Multilayer Ceramic Capacitors for Automotive Body & Chassis and Infotainment

REFLOW
AEC-Q200

■PART NUMBER

M	C	A	S	J	3	1	L	S	B	5	1	0	6	K	T	N	A	0	1
①				②	③		④	⑤	⑥		⑦			⑧	⑨	⑩			

①Series

Code (1)(2)(3)(4)	
MCAS	Multilayer Ceramic Capacitor (High dielectric type) for Automotive Body & Chassis and Infotainment Multilayer Ceramic Capacitor (Temperature compensating type) for Automotive Body & Chassis and Infotainment Medium-High voltage Multilayer Ceramic Capacitor for Automotive Body & Chassis and Infotainment
MCAR	High frequency/Low loss Medium-High Voltage Multilayer Ceramic Capacitor for Automotive Body & Chassis and Infotainment
MCJC	Soft Termination Multilayer Ceramic Capacitor for Automotive Body & Chassis and Infotainment
MCRL	LW Reversal Decoupling Low ESL Capacitor (LWDC™) for Automotive Body & Chassis and Infotainment

(1) Product Group

Code	
M	Multilayer Ceramic Capacitor

(2) Category

Code	Recommended equipment	Quality Grade
C	Automotive Electronic Equipment (Body & Chassis, Infotainment)	2

(3) Type

Code	
A	2 terminals
J	Soft Termination
R	LW reversal

(4) Features, Characteristics

Code	
S	Standard/General
R	High frequency/Low loss
C	Internal code (Soft Termination)
L	Low ESL

②Rated voltage

Code	Rated voltage[VDC]
A	4
J	6.3
L	10
E	16
T	25
G	35
U	50
H	100
Q	250
S	630

③Dimension(L×W)

Code	L×W [mm]	JIS(mm)	EIA(inch)
06	0.6 × 0.3	0603	0201
10	1.0 × 0.5	1005	0402
	0.52× 1.0 ※	0510	0204
16	1.6 × 0.8	1608	0603
	0.8 × 1.6 ※	0816	0306
21	2.0 × 1.25	2012	0805
	1.25× 2.0 ※	1220	0508
31	3.2 × 1.6	3216	1206
32	3.2 × 2.5	3225	1210
45	4.5 × 3.2	4532	1812

Note : ※LW reverse type(MCRL)

④Thickness

Code	Thickness[mm]
3	0.3
5	0.5
7	0.7
8	0.8
9	0.85
Q	1.15
G	1.25
L	1.6
N	1.9 (0.088 max ※)
M	2.5

Note : ※LW reverse type(MCRL)

⑤Dimension tolerance

Code	Dimension code	L[mm]	W[mm]	T[mm]	Thickness code
A	10	1.0±0.10	0.5±0.10	0.5±0.10	5
	16	1.6+0.15/−0.05	0.8+0.15/−0.05	0.8+0.15/−0.05	8
	21	2.0+0.15/−0.05	1.25+0.15/−0.05	1.25+0.15/−0.05	G
	31	3.2±0.20	1.6±0.20	1.15±0.20	Q
				1.6±0.20	L
	32	3.2±0.30	2.5±0.30	2.5±0.30	M
B	10	1.0+0.15/−0.05	0.5+0.15/−0.05	0.5+0.15/−0.05	5
	16	1.6+0.20/−0	0.8+0.20/−0	0.8+0.20/−0	8
	21	2.0+0.20/−0	1.25+0.20/−0	1.25+0.20/−0	G
	31	3.2±0.30	1.6±0.30	1.6±0.30	L
C	10	1.0+0.20/−0	0.5+0.20/−0	0.5+0.20/−0	5
	16	1.6+0.25/−0	0.8+0.25/−0	0.8+0.25/−0	8
	21	2.0+0.25/−0	1.25+0.25/−0	1.25+0.25/−0	G
D	21	2.0+0.30/−0	1.25+0.30/−0	1.25+0.30/−0	G
H	31	3.2±0.15	1.6±0.15	1.15±0.10	Q
J	21	2.0+0.15/−0.05	1.25+0.15/−0.05	0.85±0.10	9
L	21	2.0+0.20/−0	1.25+0.20/−0	0.85±0.10	9
	32	3.2±0.50	2.5±0.30	2.5±0.30	M
N	21	2.0±0.15	1.25±0.15	0.85±0.15	9
S	06	0.6±0.03	0.3±0.03	0.3±0.03	3
	10	1.0±0.05	0.5±0.05	0.5±0.05	5
		0.52±0.05 ※	1.0±0.05	0.3±0.05	3
	16	1.6±0.10	0.8±0.10	0.7±0.10	7
				0.8±0.10	8
		0.8±0.10 ※	1.6±0.10	0.5±0.05	5
	21	2.0±0.10	1.25±0.10	0.85±0.10	9
				1.25±0.10	G
		1.25±0.15 ※	2.0±0.15	0.85±0.10	9
	31	3.2±0.15	1.6±0.15	1.6±0.20	L
	32	3.2±0.30	2.5±0.20	1.9±0.20	N
				2.5±0.20	M
	45	4.5±0.40	3.2±0.30	2.5±0.20	M

Note :※LW reverse type(MCRL)

⑥Temperature characteristics code

■High dielectric type

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	Capacitance change	Capacitance tolerance	Tolerance code
B5	EIA	X5R	−55～＋ 85	25	±15%	±10%	K
						±20%	M
C6	EIA	X6S	−55～＋105	25	±22%	±10%	K
						±20%	M
B7	EIA	X7R	−55～＋125	25	±15%	±10%	K
						±20%	M
C7	EIA	X7S	−55～＋125	25	±22%	±10%	K
						±20%	M
D7	EIA	X7T	−55～＋125	25	＋22%/−33%	±10%	K
						±20%	M

■Temperature compensating type

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	Capacitance change	Capacitance tolerance	Tolerance code
CG	JIS	CG	−55～＋125	20	0±30ppm/℃	±0.05pF	A
						±0.1pF	B
						±0.25pF	C
	EIA	C0G		25		±0.5pF	D
						±2%	G
						±5%	J
CH	JIS	CH	−55～＋125	20	0±60ppm/℃	±0.25pF	C
						±0.5pF	D
	EIA	C0H		25		±5%	J
CJ	JIS	CJ	−55～＋125	20	0±120ppm/℃	±0.25pF	C
	EIA	C0J		25			
CK	JIS	CK	−55～＋125	20	0±250ppm/℃	±0.25pF	C
	EIA	C0K		25			

⑦Nominal capacitance

Code (example)	Nominal capacitance
0R5	0.5pF
010	1pF
100	10pF
101	100pF
102	1,000pF
103	0.01μF
104	0.1μF
105	1μF
106	10μF
107	100μF

Note : R＝Decimal point

⑧Capacitance tolerance

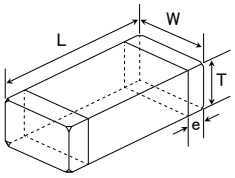
Code	Capacitance tolerance
A	±0.05pF
B	±0.1pF
C	±0.25pF
D	±0.5pF
G	±2%
J	±5%
K	±10%
M	±20%

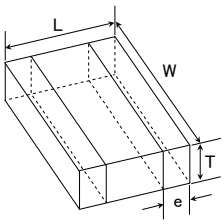
⑨Packaging

Code	Packaging
F	φ178mm Taping (2mm pitch)
R	φ178mm Embossed Taping (4mm pitch)
T	φ178mm Taping (4mm pitch)
P	φ178mm Taping (4mm pitch, 1000 pcs/reel) 3225 type(Thickness code M)

⑩Internal code

■STANDARD EXTERNAL DIMENSIONS





※LW reverse type

Type	JIS (mm)	EIA (inch)	Dimension [mm] (inch)				
			L	W	T	*1	e
MCAS□06	0603	0201	0.6±0.03 (0.024±0.001)	0.3±0.03 (0.012±0.001)	0.3±0.03 (0.012±0.001)	3	0.15±0.05 (0.006±0.002)
MCAR□10 MCAS□10	1005	0402	1.0±0.05 (0.039±0.002)	0.5±0.05 (0.020±0.002)	0.5±0.05 (0.020±0.002)	5	0.25±0.10 (0.010±0.004)
MCRL□10 ※	0510	0204	0.52±0.05 (0.020±0.002)	1.0±0.05 (0.039±0.002)	0.3±0.05 (0.012±0.002)	3	0.18±0.08 (0.007±0.003)
MCAS□16 MCAR□16	1608	0603	1.6±0.10 (0.063±0.004)	0.8±0.10 (0.031±0.004)	0.7±0.10 (0.028±0.004)	7	0.35±0.25 (0.014±0.010)
					0.8±0.10 (0.031±0.004)	8	
MCJC□16	1608	0603	1.6±0.10 (0.063±0.004)	0.8±0.10 (0.031±0.004)	0.8±0.10 (0.031±0.004)	8	0.35+0.3/−0.25 (0.014+0.012/−0.010)
MCRL□16 ※	0816	0306	0.8±0.10 (0.031±0.004)	1.6±0.10 (0.063±0.004)	0.5±0.05 (0.020±0.002)	5	0.25±0.15 (0.010±0.006)
MCAS□21 MCAR□21	2012	0805	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	0.85±0.10 (0.033±0.004)	9	0.5±0.25 (0.020±0.010)
					1.25±0.10 (0.049±0.004)	G	
MCJC□21	2012	0805	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	0.85±0.10 (0.033±0.004)	9	0.5+0.35/−0.25 (0.020+0.014/−0.010)
					1.25±0.10 (0.049±0.004)	G	
MCRL□21 ※	1220	0508	1.25±0.15 (0.049±0.006)	2.0±0.15 (0.079±0.006)	0.85±0.10 (0.033±0.004)	9	0.3±0.2 (0.012±0.008)
MCAS□31	3216	1206	3.2±0.15 (0.126±0.006)	1.6±0.15 (0.063±0.006)	1.15±0.10 (0.045±0.004)	Q	0.5+0.35/−0.25 (0.020+0.014/−0.010)
					1.6±0.20 (0.063±0.008)	L	
MCJC□31	3216	1206	3.2±0.15 (0.126±0.006)	1.6±0.15 (0.063±0.006)	1.15±0.10 (0.045±0.004)	Q	0.6+0.4/−0.3 (0.024+0.016/−0.012)
					1.6±0.20 (0.063±0.008)	L	
MCAS□32	3225	1210	3.2±0.30 (0.126±0.012)	2.5±0.20 (0.098±0.008)	1.9±0.20 (0.075±0.008)	N	0.6±0.3 (0.024±0.012)
					2.5±0.20 (0.098±0.008)	M	
MCJC□32	3225	1210	3.2±0.30 (0.126±0.012)	2.5±0.20 (0.098±0.008)	1.9±0.20 (0.075±0.008)	N	0.6+0.4/−0.3 (0.024+0.016/−0.012)
					2.5±0.20 (0.098±0.008)	M	
MCAS□45	4532	1812	4.5±0.40 (0.177±0.016)	3.2±0.30 (0.126±0.012)	2.5±0.20 (0.098±0.008)	M	0.9±0.6 (0.035±0.024)

Note :※LW reverse type(MCRL), *1.Thickness code

■STANDARD QUANTITY

Type			Thickness		Standard quantity[pcs]	
Code	JIS(mm)	EIA(inch)	[mm]	Code	Paper tape	Embossed tape
06	0603	0201	0.3	3	15000	—
10	1005	0402	0.5	5	10000	—
	0510 ※	0204 ※	0.3	3		
16	1608	0603	0.7	7	4000	—
			0.8	8		
			0.8	8	3000 (Soft Termination)	3000 (Soft Termination)
	0816 ※	0306 ※	0.5	5	—	4000
21	2012	0805	0.85	9	4000	—
			1.25	G	—	3000
			1.25	G	—	2000 (Soft Termination)
	1220 ※	0508 ※	0.85	9	4000	—
31	3216	1206	1.15	Q	—	3000
			1.6	L	—	2000
32	3225	1210	1.9	N	—	2000
			2.5	M	—	500(T), 1000(P)
45	4532	1812	2.5	M	—	500

Note : ※.LW Reverse type(MCRL)

■PART NUMBER

High frequency/Low loss Medium-High Voltage Multilayer Ceramic Capacitors for Automotive Body & Chassis and Infotainment

●1005TYPE

【Temperature Characteristic CG : CG/C0G(－55～＋125℃)】 0.5mm Thickness

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q [at 1MHz] (Min)	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MCARQ105SCG0R5□FRA01	QVS105 CG0R5□VHF	250	CG	C0G	0.5 p	±0.1pF, ±0.25pF	810	200	0.5±0.05	
MCARQ105SCG0R6□FRA01	QVS105 CG0R6□VHF	250	CG	C0G	0.6 p	±0.1pF, ±0.25pF	812	200	0.5±0.05	
MCARQ105SCG0R7□FRA01	QVS105 CG0R7□VHF	250	CG	C0G	0.7 p	±0.1pF, ±0.25pF	814	200	0.5±0.05	
MCARQ105SCGR75□FRA01	QVS105 CGR75□VHF	250	CG	C0G	0.75 p	±0.1pF, ±0.25pF	815	200	0.5±0.05	
MCARQ105SCG0R8□FRA01	QVS105 CG0R8□VHF	250	CG	C0G	0.8 p	±0.1pF, ±0.25pF	816	200	0.5±0.05	
MCARQ105SCG0R9□FRA01	QVS105 CG0R9□VHF	250	CG	C0G	0.9 p	±0.1pF, ±0.25pF	818	200	0.5±0.05	
MCARQ105SCG010□FRA01	QVS105 CG010□VHF	250	CG	C0G	1 p	±0.1pF, ±0.25pF	820	200	0.5±0.05	
MCARQ105SCG1R1□FRA01	QVS105 CG1R1□VHF	250	CG	C0G	1.1 p	±0.1pF, ±0.25pF	822	200	0.5±0.05	
MCARQ105SCG1R2□FRA01	QVS105 CG1R2□VHF	250	CG	C0G	1.2 p	±0.1pF, ±0.25pF	824	200	0.5±0.05	
MCARQ105SCG1R3□FRA01	QVS105 CG1R3□VHF	250	CG	C0G	1.3 p	±0.1pF, ±0.25pF	826	200	0.5±0.05	
MCARQ105SCG1R5□FRA01	QVS105 CG1R5□VHF	250	CG	C0G	1.5 p	±0.1pF, ±0.25pF	830	200	0.5±0.05	
MCARQ105SCG1R6□FRA01	QVS105 CG1R6□VHF	250	CG	C0G	1.6 p	±0.1pF, ±0.25pF	832	200	0.5±0.05	
MCARQ105SCG1R8□FRA01	QVS105 CG1R8□VHF	250	CG	C0G	1.8 p	±0.1pF, ±0.25pF	836	200	0.5±0.05	
MCARQ105SCG020□FRA01	QVS105 CG020□VHF	250	CG	C0G	2 p	±0.1pF, ±0.25pF	840	200	0.5±0.05	
MCARQ105SCG2R2□FRA01	QVS105 CG2R2□VHF	250	CG	C0G	2.2 p	±0.1pF, ±0.25pF	844	200	0.5±0.05	
MCARQ105SCG2R4□FRA01	QVS105 CG2R4□VHF	250	CG	C0G	2.4 p	±0.1pF, ±0.25pF	848	200	0.5±0.05	
MCARQ105SCG2R7□FRA01	QVS105 CG2R7□VHF	250	CG	C0G	2.7 p	±0.1pF, ±0.25pF	854	200	0.5±0.05	
MCARQ105SCG030□FRA01	QVS105 CG030□VHF	250	CG	C0G	3 p	±0.1pF, ±0.25pF	860	200	0.5±0.05	
MCARQ105SCG3R3□FRA01	QVS105 CG3R3□VHF	250	CG	C0G	3.3 p	±0.1pF, ±0.25pF	866	200	0.5±0.05	
MCARQ105SCG3R6□FRA01	QVS105 CG3R6□VHF	250	CG	C0G	3.6 p	±0.1pF, ±0.25pF	872	200	0.5±0.05	
MCARQ105SCG3R9□FRA01	QVS105 CG3R9□VHF	250	CG	C0G	3.9 p	±0.1pF, ±0.25pF	878	200	0.5±0.05	
MCARQ105SCG4R3□FRA01	QVS105 CG4R3□VHF	250	CG	C0G	4.3 p	±0.1pF, ±0.25pF	886	200	0.5±0.05	
MCARQ105SCG4R7□FRA01	QVS105 CG4R7□VHF	250	CG	C0G	4.7 p	±0.1pF, ±0.25pF	894	200	0.5±0.05	
MCARQ105SCG5R1□FRA01	QVS105 CG5R1□VHF	250	CG	C0G	5.1 p	±0.25pF, ±0.5pF	902	200	0.5±0.05	
MCARQ105SCG5R6□FRA01	QVS105 CG5R6□VHF	250	CG	C0G	5.6 p	±0.25pF, ±0.5pF	912	200	0.5±0.05	
MCARQ105SCG6R2□FRA01	QVS105 CG6R2□VHF	250	CG	C0G	6.2 p	±0.25pF, ±0.5pF	924	200	0.5±0.05	
MCARQ105SCG6R8□FRA01	QVS105 CG6R8□VHF	250	CG	C0G	6.8 p	±0.25pF, ±0.5pF	936	200	0.5±0.05	
MCARQ105SCG7R5□FRA01	QVS105 CG7R5□VHF	250	CG	C0G	7.5 p	±0.25pF, ±0.5pF	950	200	0.5±0.05	
MCARQ105SCG8R2□FRA01	QVS105 CG8R2□VHF	250	CG	C0G	8.2 p	±0.25pF, ±0.5pF	964	200	0.5±0.05	
MCARQ105SCG9R1□FRA01	QVS105 CG9R1□VHF	250	CG	C0G	9.1 p	±0.25pF, ±0.5pF	982	200	0.5±0.05	
MCARQ105SCG100JFRA01	QVS105 CG100JVHF	250	CG	C0G	10 p	±5%	1000	200	0.5±0.05	
MCARQ105SCG110JFRA01	QVS105 CG110JVHF	250	CG	C0G	11 p	±5%	1020	200	0.5±0.05	
MCARQ105SCG120JFRA01	QVS105 CG120JVHF	250	CG	C0G	12 p	±5%	1040	200	0.5±0.05	
MCARQ105SCG130JFRA01	QVS105 CG130JVHF	250	CG	C0G	13 p	±5%	1060	200	0.5±0.05	
MCARQ105SCG150JFRA01	QVS105 CG150JVHF	250	CG	C0G	15 p	±5%	1100	200	0.5±0.05	
MCARQ105SCG160JFRA01	QVS105 CG160JVHF	250	CG	C0G	16 p	±5%	1120	200	0.5±0.05	
MCARQ105SCG180JFRA01	QVS105 CG180JVHF	250	CG	C0G	18 p	±5%	1160	200	0.5±0.05	
MCARQ105SCG200JFRA01	QVS105 CG200JVHF	250	CG	C0G	20 p	±5%	1200	200	0.5±0.05	
MCARQ105SCG220JFRA01	QVS105 CG220JVHF	250	CG	C0G	22 p	±5%	1240	200	0.5±0.05	
MCARQ105SCG240JFRA01	QVS105 CG240JVHF	250	CG	C0G	24 p	±5%	1280	200	0.5±0.05	
MCARQ105SCG270JFRA01	QVS105 CG270JVHF	250	CG	C0G	27 p	±5%	1340	200	0.5±0.05	
MCARQ105SCG300JFRA01	QVS105 CG300JVHF	250	CG	C0G	30 p	±5%	1400	200	0.5±0.05	
MCARQ105SCG330JFRA01	QVS105 CG330JVHF	250	CG	C0G	33 p	±5%	1400	200	0.5±0.05	

■PART NUMBER

●1608TYPE

【Temperature Characteristic CG : CG/C0G(－55～＋125℃)】 0.7mm Thickness

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q [at 1MHz] (Min)	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MCARQ167SCG0R2□TRA01	QVS107 CG0R2□CHT	250	CG	C0G	0.2 p	±0.05pF, ±0.1pF	804	200	0.7±0.10	
MCARQ167SCG0R3□TRA01	QVS107 CG0R3□CHT	250	CG	C0G	0.3 p	±0.05pF, ±0.1pF	806	200	0.7±0.10	
MCARQ167SCG0R4□TRA01	QVS107 CG0R4□CHT	250	CG	C0G	0.4 p	±0.05pF, ±0.1pF	808	200	0.7±0.10	
MCARQ167SCG0R5□TRA01	QVS107 CG0R5□CHT	250	CG	C0G	0.5 p	±0.1pF, ±0.25pF	810	200	0.7±0.10	
MCARQ167SCG0R6□TRA01	QVS107 CG0R6□CHT	250	CG	C0G	0.6 p	±0.1pF, ±0.25pF	812	200	0.7±0.10	
MCARQ167SCG0R7□TRA01	QVS107 CG0R7□CHT	250	CG	C0G	0.7 p	±0.1pF, ±0.25pF	814	200	0.7±0.10	
MCARQ167SCGR75□TRA01	QVS107 CGR75□CHT	250	CG	C0G	0.75 p	±0.1pF, ±0.25pF	815	200	0.7±0.10	
MCARQ167SCG0R8□TRA01	QVS107 CG0R8□CHT	250	CG	C0G	0.8 p	±0.1pF, ±0.25pF	816	200	0.7±0.10	
MCARQ167SCG0R9□TRA01	QVS107 CG0R9□CHT	250	CG	C0G	0.9 p	±0.1pF, ±0.25pF	818	200	0.7±0.10	
MCARQ167SCG010□TRA01	QVS107 CG010□CHT	250	CG	C0G	1 p	±0.1pF, ±0.25pF	820	200	0.7±0.10	
MCARQ167SCG1R1□TRA01	QVS107 CG1R1□CHT	250	CG	C0G	1.1 p	±0.1pF, ±0.25pF	822	200	0.7±0.10	
MCARQ167SCG1R2□TRA01	QVS107 CG1R2□CHT	250	CG	C0G	1.2 p	±0.1pF, ±0.25pF	824	200	0.7±0.10	
MCARQ167SCG1R3□TRA01	QVS107 CG1R3□CHT	250	CG	C0G	1.3 p	±0.1pF, ±0.25pF	826	200	0.7±0.10	
MCARQ167SCG1R5□TRA01	QVS107 CG1R5□CHT	250	CG	C0G	1.5 p	±0.1pF, ±0.25pF	830	200	0.7±0.10	
MCARQ167SCG1R6□TRA01	QVS107 CG1R6□CHT	250	CG	C0G	1.6 p	±0.1pF, ±0.25pF	832	200	0.7±0.10	
MCARQ167SCG1R8□TRA01	QVS107 CG1R8□CHT	250	CG	C0G	1.8 p	±0.1pF, ±0.25pF	836	200	0.7±0.10	
MCARQ167SCG020□TRA01	QVS107 CG020□CHT	250	CG	C0G	2 p	±0.1pF, ±0.25pF	840	200	0.7±0.10	
MCARQ167SCG2R2□TRA01	QVS107 CG2R2□CHT	250	CG	C0G	2.2 p	±0.1pF, ±0.25pF	844	200	0.7±0.10	
MCARQ167SCG2R4□TRA01	QVS107 CG2R4□CHT	250	CG	C0G	2.4 p	±0.1pF, ±0.25pF	848	200	0.7±0.10	
MCARQ167SCG2R7□TRA01	QVS107 CG2R7□CHT	250	CG	C0G	2.7 p	±0.1pF, ±0.25pF	854	200	0.7±0.10	
MCARQ167SCG030□TRA01	QVS107 CG030□CHT	250	CG	C0G	3 p	±0.1pF, ±0.25pF	860	200	0.7±0.10	
MCARQ167SCG3R3□TRA01	QVS107 CG3R3□CHT	250	CG	C0G	3.3 p	±0.1pF, ±0.25pF	866	200	0.7±0.10	
MCARQ167SCG3R6□TRA01	QVS107 CG3R6□CHT	250	CG	C0G	3.6 p	±0.1pF, ±0.25pF	872	200	0.7±0.10	
MCARQ167SCG3R9□TRA01	QVS107 CG3R9□CHT	250	CG	C0G	3.9 p	±0.1pF, ±0.25pF	878	200	0.7±0.10	
MCARQ167SCG4R3□TRA01	QVS107 CG4R3□CHT	250	CG	C0G	4.3 p	±0.1pF, ±0.25pF	886	200	0.7±0.10	
MCARQ167SCG4R7□TRA01	QVS107 CG4R7□CHT	250	CG	C0G	4.7 p	±0.1pF, ±0.25pF	894	200	0.7±0.10	
MCARQ167SCG5R1□TRA01	QVS107 CG5R1□CHT	250	CG	C0G	5.1 p	±0.25pF,±0.5pF	902	200	0.7±0.10	
MCARQ167SCG5R6□TRA01	QVS107 CG5R6□CHT	250	CG	C0G	5.6 p	±0.25pF,±0.5pF	912	200	0.7±0.10	
MCARQ167SCG6R2□TRA01	QVS107 CG6R2□CHT	250	CG	C0G	6.2 p	±0.25pF,±0.5pF	924	200	0.7±0.10	
MCARQ167SCG6R8□TRA01	QVS107 CG6R8□CHT	250	CG	C0G	6.8 p	±0.25pF,±0.5pF	936	200	0.7±0.10	
MCARQ167SCG7R5□TRA01	QVS107 CG7R5□CHT	250	CG	C0G	7.5 p	±0.25pF,±0.5pF	950	200	0.7±0.10	
MCARQ167SCG8R2□TRA01	QVS107 CG8R2□CHT	250	CG	C0G	8.2 p	±0.25pF,±0.5pF	964	200	0.7±0.10	
MCARQ167SCG9R1□TRA01	QVS107 CG9R1□CHT	250	CG	C0G	9.1 p	±0.25pF,±0.5pF	982	200	0.7±0.10	
MCARQ167SCG100□TRA01	QVS107 CG100□CHT	250	CG	C0G	10 p	±2%, ±5%	1000	200	0.7±0.10	
MCARQ167SCG110JTRA01	QVS107 CG110JCHT	250	CG	C0G	11 p	±5%	1020	200	0.7±0.10	
MCARQ167SCG120JTRA01	QVS107 CG120JCHT	250	CG	C0G	12 p	±5%	1040	200	0.7±0.10	
MCARQ167SCG130JTRA01	QVS107 CG130JCHT	250	CG	C0G	13 p	±5%	1060	200	0.7±0.10	
MCARQ167SCG150JTRA01	QVS107 CG150JCHT	250	CG	C0G	15 p	±5%	1100	200	0.7±0.10	
MCARQ167SCG160JTRA01	QVS107 CG160JCHT	250	CG	C0G	16 p	±5%	1120	200	0.7±0.10	
MCARQ167SCG180JTRA01	QVS107 CG180JCHT	250	CG	C0G	18 p	±5%	1160	200	0.7±0.10	
MCARQ167SCG200JTRA01	QVS107 CG200JCHT	250	CG	C0G	20 p	±5%	1200	200	0.7±0.10	
MCARQ167SCG220JTRA01	QVS107 CG220JCHT	250	CG	C0G	22 p	±5%	1240	200	0.7±0.10	
MCARQ167SCG240JTRA01	QVS107 CG240JCHT	250	CG	C0G	24 p	±5%	1280	200	0.7±0.10	
MCARQ167SCG270JTRA01	QVS107 CG270JCHT	250	CG	C0G	27 p	±5%	1340	200	0.7±0.10	
MCARQ167SCG300JTRA01	QVS107 CG300JCHT	250	CG	C0G	30 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG330JTRA01	QVS107 CG330JCHT	250	CG	C0G	33 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG360JTRA01	QVS107 CG360JCHT	250	CG	C0G	36 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG390JTRA01	QVS107 CG390JCHT	250	CG	C0G	39 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG430JTRA01	QVS107 CG430JCHT	250	CG	C0G	43 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG470JTRA01	QVS107 CG470JCHT	250	CG	C0G	47 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG510JTRA01	QVS107 CG510JCHT	250	CG	C0G	51 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG560JTRA01	QVS107 CG560JCHT	250	CG	C0G	56 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG620JTRA01	QVS107 CG620JCHT	250	CG	C0G	62 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG680JTRA01	QVS107 CG680JCHT	250	CG	C0G	68 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG750JTRA01	QVS107 CG750JCHT	250	CG	C0G	75 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG820JTRA01	QVS107 CG820JCHT	250	CG	C0G	82 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG910JTRA01	QVS107 CG910JCHT	250	CG	C0G	91 p	±5%	1400	200	0.7±0.10	
MCARQ167SCG101JTRA01	QVS107 CG101JCHT	250	CG	C0G	100 p	±5%	1400	200	0.7±0.10	

■PART NUMBER

●2012TYPE

【Temperature Characteristic CG : CG/C0G(－55～＋125℃)】 0.85mm Thickness

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q [at 1MHz] (Min)	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MCARQ219SCG0R3□TRA01	QVS212 CG0R3□DHT	250	CG	C0G	0.3 p	±0.05pF, ±0.1pF, ±0.25pF	806	200	0.85±0.10	
MCARQ219SCG0R4□TRA01	QVS212 CG0R4□DHT	250	CG	C0G	0.4 p	±0.05pF, ±0.1pF, ±0.25pF	808	200	0.85±0.10	
MCARQ219SCG0R5□TRA01	QVS212 CG0R5□DHT	250	CG	C0G	0.5 p	±0.1pF, ±0.25pF	810	200	0.85±0.10	
MCARQ219SCG0R6□TRA01	QVS212 CG0R6□DHT	250	CG	C0G	0.6 p	±0.1pF, ±0.25pF	812	200	0.85±0.10	
MCARQ219SCG0R7□TRA01	QVS212 CG0R7□DHT	250	CG	C0G	0.7 p	±0.1pF, ±0.25pF	814	200	0.85±0.10	
MCARQ219SCGR75□TRA01	QVS212 CGR75□DHT	250	CG	C0G	0.75 p	±0.1pF, ±0.25pF	815	200	0.85±0.10	
MCARQ219SCG0R8□TRA01	QVS212 CG0R8□DHT	250	CG	C0G	0.8 p	±0.1pF, ±0.25pF	816	200	0.85±0.10	
MCARQ219SCG0R9□TRA01	QVS212 CG0R9□DHT	250	CG	C0G	0.9 p	±0.1pF, ±0.25pF	818	200	0.85±0.10	
MCARQ219SCG010□TRA01	QVS212 CG010□DHT	250	CG	C0G	1 p	±0.1pF, ±0.25pF	820	200	0.85±0.10	
MCARQ219SCG1R1□TRA01	QVS212 CG1R1□DHT	250	CG	C0G	1.1 p	±0.1pF, ±0.25pF	822	200	0.85±0.10	
MCARQ219SCG1R2□TRA01	QVS212 CG1R2□DHT	250	CG	C0G	1.2 p	±0.1pF, ±0.25pF	824	200	0.85±0.10	
MCARQ219SCG1R3□TRA01	QVS212 CG1R3□DHT	250	CG	C0G	1.3 p	±0.1pF, ±0.25pF	826	200	0.85±0.10	
MCARQ219SCG1R5□TRA01	QVS212 CG1R5□DHT	250	CG	C0G	1.5 p	±0.1pF, ±0.25pF	830	200	0.85±0.10	
MCARQ219SCG1R6□TRA01	QVS212 CG1R6□DHT	250	CG	C0G	1.6 p	±0.1pF, ±0.25pF	832	200	0.85±0.10	
MCARQ219SCG1R8□TRA01	QVS212 CG1R8□DHT	250	CG	C0G	1.8 p	±0.1pF, ±0.25pF	836	200	0.85±0.10	
MCARQ219SCG020□TRA01	QVS212 CG020□DHT	250	CG	C0G	2 p	±0.1pF, ±0.25pF	840	200	0.85±0.10	
MCARQ219SCG2R2□TRA01	QVS212 CG2R2□DHT	250	CG	C0G	2.2 p	±0.1pF, ±0.25pF	844	200	0.85±0.10	
MCARQ219SCG2R4□TRA01	QVS212 CG2R4□DHT	250	CG	C0G	2.4 p	±0.1pF, ±0.25pF	848	200	0.85±0.10	
MCARQ219SCG2R7□TRA01	QVS212 CG2R7□DHT	250	CG	C0G	2.7 p	±0.1pF, ±0.25pF	854	200	0.85±0.10	
MCARQ219SCG030□TRA01	QVS212 CG030□DHT	250	CG	C0G	3 p	±0.1pF, ±0.25pF	860	200	0.85±0.10	
MCARQ219SCG3R3□TRA01	QVS212 CG3R3□DHT	250	CG	C0G	3.3 p	±0.1pF, ±0.25pF	866	200	0.85±0.10	
MCARQ219SCG3R6□TRA01	QVS212 CG3R6□DHT	250	CG	C0G	3.6 p	±0.1pF, ±0.25pF	872	200	0.85±0.10	
MCARQ219SCG3R9□TRA01	QVS212 CG3R9□DHT	250	CG	C0G	3.9 p	±0.1pF, ±0.25pF	878	200	0.85±0.10	
MCARQ219SCG4R3□TRA01	QVS212 CG4R3□DHT	250	CG	C0G	4.3 p	±0.1pF, ±0.25pF	886	200	0.85±0.10	
MCARQ219SCG4R7□TRA01	QVS212 CG4R7□DHT	250	CG	C0G	4.7 p	±0.1pF, ±0.25pF	894	200	0.85±0.10	
MCARQ219SCG5R1□TRA01	QVS212 CG5R1□DHT	250	CG	C0G	5.1 p	±0.25pF, ±0.5pF	902	200	0.85±0.10	
MCARQ219SCG5R6□TRA01	QVS212 CG5R6□DHT	250	CG	C0G	5.6 p	±0.25pF, ±0.5pF	912	200	0.85±0.10	
MCARQ219SCG6R2□TRA01	QVS212 CG6R2□DHT	250	CG	C0G	6.2 p	±0.25pF, ±0.5pF	924	200	0.85±0.10	
MCARQ219SCG6R8□TRA01	QVS212 CG6R8□DHT	250	CG	C0G	6.8 p	±0.25pF, ±0.5pF	936	200	0.85±0.10	
MCARQ219SCG7R5□TRA01	QVS212 CG7R5□DHT	250	CG	C0G	7.5 p	±0.25pF, ±0.5pF	950	200	0.85±0.10	
MCARQ219SCG8R2□TRA01	QVS212 CG8R2□DHT	250	CG	C0G	8.2 p	±0.25pF, ±0.5pF	964	200	0.85±0.10	
MCARQ219SCG9R1□TRA01	QVS212 CG9R1□DHT	250	CG	C0G	9.1 p	±0.25pF, ±0.5pF	982	200	0.85±0.10	
MCARQ219SCG100JTRA01	QVS212 CG100JDHT	250	CG	C0G	10 p	±5%	1000	200	0.85±0.10	
MCARQ219SCG110JTRA01	QVS212 CG110JDHT	250	CG	C0G	11 p	±5%	1020	200	0.85±0.10	
MCARQ219SCG120JTRA01	QVS212 CG120JDHT	250	CG	C0G	12 p	±5%	1040	200	0.85±0.10	
MCARQ219SCG130JTRA01	QVS212 CG130JDHT	250	CG	C0G	13 p	±5%	1060	200	0.85±0.10	
MCARQ219SCG150JTRA01	QVS212 CG150JDHT	250	CG	C0G	15 p	±5%	1100	200	0.85±0.10	
MCARQ219SCG160JTRA01	QVS212 CG160JDHT	250	CG	C0G	16 p	±5%	1120	200	0.85±0.10	
MCARQ219SCG180JTRA01	QVS212 CG180JDHT	250	CG	C0G	18 p	±5%	1160	200	0.85±0.10	
MCARQ219SCG200JTRA01	QVS212 CG200JDHT	250	CG	C0G	20 p	±5%	1200	200	0.85±0.10	
MCARQ219SCG220JTRA01	QVS212 CG220JDHT	250	CG	C0G	22 p	±5%	1240	200	0.85±0.10	
MCARQ219SCG240JTRA01	QVS212 CG240JDHT	250	CG	C0G	24 p	±5%	1280	200	0.85±0.10	
MCARQ219SCG270JTRA01	QVS212 CG270JDHT	250	CG	C0G	27 p	±5%	1340	200	0.85±0.10	
MCARQ219SCG300JTRA01	QVS212 CG300JDHT	250	CG	C0G	30 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG330JTRA01	QVS212 CG330JDHT	250	CG	C0G	33 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG360JTRA01	QVS212 CG360JDHT	250	CG	C0G	36 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG390JTRA01	QVS212 CG390JDHT	250	CG	C0G	39 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG430JTRA01	QVS212 CG430JDHT	250	CG	C0G	43 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG470JTRA01	QVS212 CG470JDHT	250	CG	C0G	47 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG510JTRA01	QVS212 CG510JDHT	250	CG	C0G	51 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG560JTRA01	QVS212 CG560JDHT	250	CG	C0G	56 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG620JTRA01	QVS212 CG620JDHT	250	CG	C0G	62 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG680JTRA01	QVS212 CG680JDHT	250	CG	C0G	68 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG750JTRA01	QVS212 CG750JDHT	250	CG	C0G	75 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG820JTRA01	QVS212 CG820JDHT	250	CG	C0G	82 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG910JTRA01	QVS212 CG910JDHT	250	CG	C0G	91 p	±5%	1400	200	0.85±0.10	
MCARQ219SCG101JTRA01	QVS212 CG101JDHT	250	CG	C0G	100 p	±5%	1400	200	0.85±0.10	

■PACKAGING

①Minimum Quantity

●Taped package

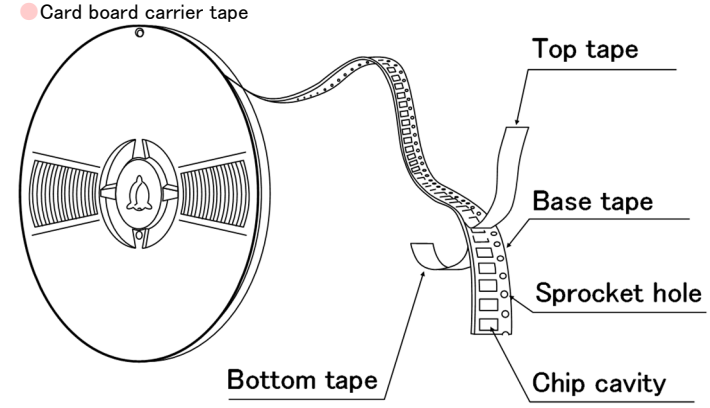
Type			Thickness		Standard Quantity[pcs]	
Code	JIS(mm)	EIA(inch)	[mm]	Code	Paper tape	Embossed tape
02	0201	008004	0.125	1	—	50000
04	0402	01005	0.2	2	—	40000
06	0603	0201	0.3	3	15000	—
1L	1005	0402	0.13	H	—	20000
			0.18	E	—	15000
			0.2	2	20000	—
			0.3	3	15000	—
10	1005	0402	0.5	5	10000	—
	0510 ※	0204	0.3	3	10000	—
16	1608	0603	0.45	K	4000	—
			0.7	7		
			0.8	8		
			0.8	8	3000 (Soft Termination)	3000 (Soft Termination)
	0816 ※	0306	0.5	5	—	4000
21	2012	0805	0.85	9	4000	—
			1.25	G	—	3000
			1.25	G	—	2000 (Soft Termination)
	1220 ※	0508	0.85	9	4000	—
31	3216	1206	0.85	9	4000	—
			1.15	Q	—	3000
			1.6	L	—	2000
32	3225	1210	0.85	9	—	2000
			1.15	Q		
			1.9	N		
			2.0 max	Y		
			2.5	M	—	500(T), 1000(P)
45	4532	1812	2.0 max	Y	—	1000
			2.5	M	—	500

注:※LW Reverse type (MSRL, MCRL, MBRL, MLRL, MMRL)

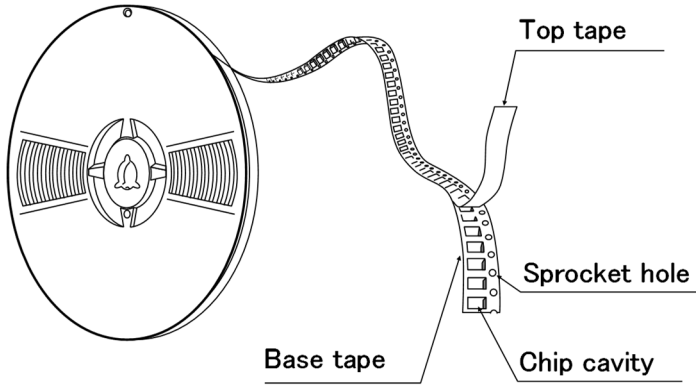
②Taping material

※No bottom tape for pressed carrier tape

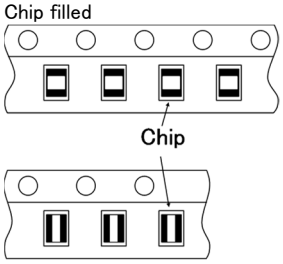
Card board carrier tape



Embossed tape



Chip filled



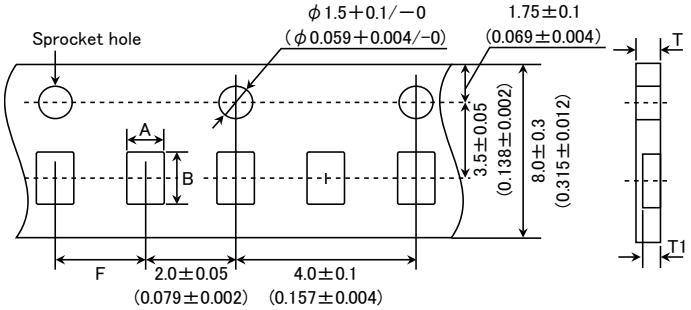
※ LW Reverse type.

③Representative taping dimensions

Paper Tape (8mm wide)

●Pressed carrier tape (2mm pitch)

Unit : mm (inch)



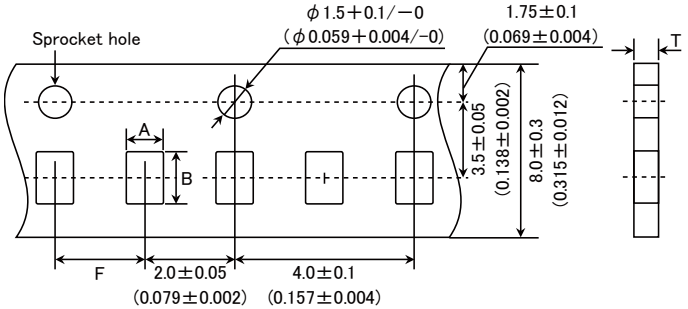
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	T	T1
0603 (0201)	0.37	0.67	2.0±0.05	0.45max.	0.42max.
0510 (0204) ※	0.65	1.15			
1005 (0402) (*1 2)				0.4max.	0.3max.
1005 (0402) (*1 3)				0.45max.	0.42max.

Note *1 Thickness, 2 : 0.2mm , 3 : 0.3mm. ※ LW Reverse type.

Unit : mm

●Punched carrier tape (2mm pitch)

Unit : mm (inch)

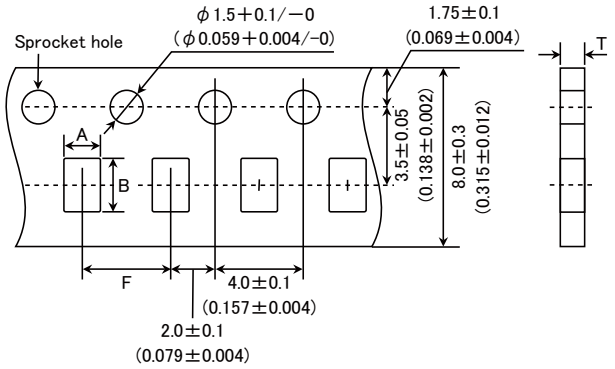


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
1005 (0402)	0.65	1.15	2.0±0.05	0.8max.

Unit : mm

●Punched carrier tape (4mm pitch)

Unit : mm (inch)

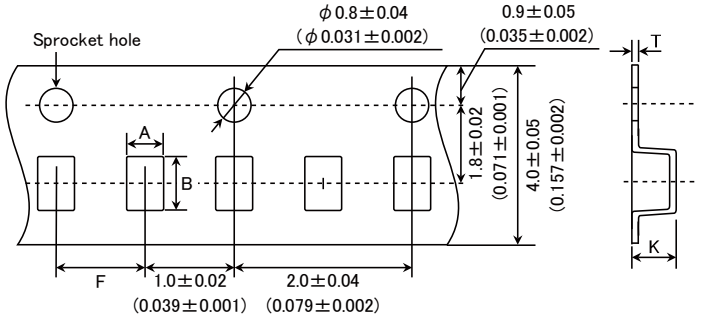


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
1608 (0603) 0816 (0306) ※	1.0	1.8	4.0±0.1	1.1max.
2012 (0805) 1220 (0508) ※	1.65	2.4		1.1max.
3216 (1206)	2.0	3.6		

Note : Taping size might be different depending on the size of the product. ※ LW Reverse type. Unit : mm

●Embossed tape (4mm wide)

Unit : mm (inch)

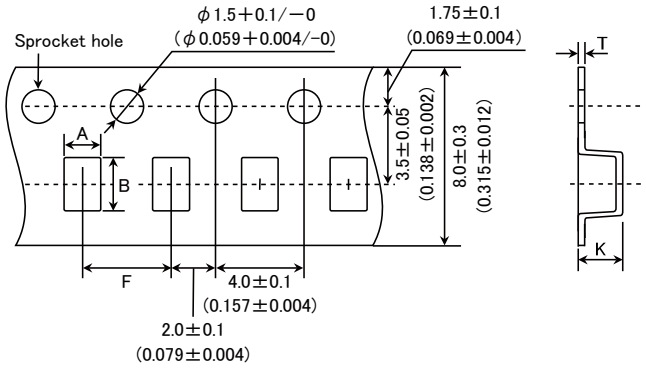


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
0201 (008004)	0.135	0.27	1.0±0.02	0.5max.	0.25max.
0402 (01005)	0.23	0.43			

Unit : mm

●Embossed tape (8mm wide)

Unit : mm (inch)

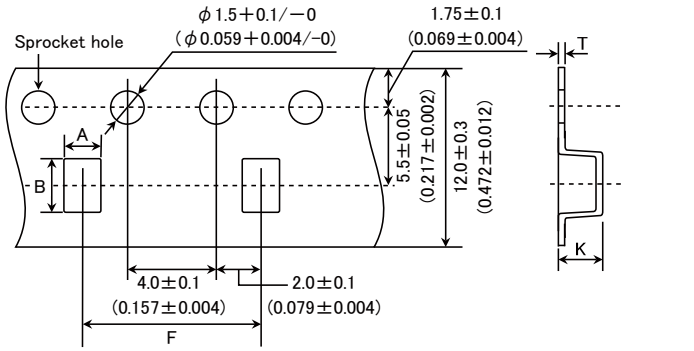


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
1005 (0402)	0.6	1.1	2.0±0.1	0.6max	0.2±0.1
0816 (0306) ※	1.0	1.8	4.0±0.1	1.3max.	0.25±0.1
2012 (0805)	1.65	2.4		3.4max.	0.6max.
3216 (1206)	2.0	3.6			
3225 (1210)	2.8	3.6			

Note : ※ LW Reverse type. Unit : mm

Embossed tape (12mm wide)

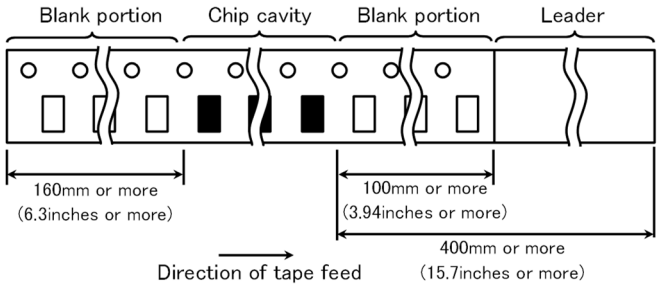
Unit : mm (inch)



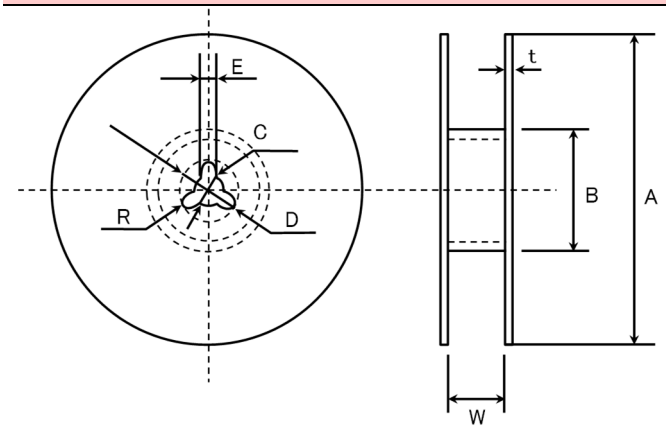
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
3225 (1210)	3.1	4.0	8.0±0.1	4.0max.	0.6max.
4532 (1812)	3.7	4.9	8.0±0.1	4.0max.	0.6max.

Unit : mm

④Trailer and Leader



⑤Reel size



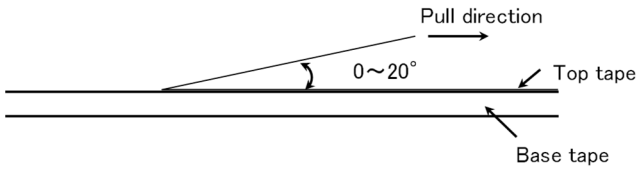
A	B	C	D	E	R
φ178±2.0	φ50min.	φ13.0±0.2	φ21.0±0.8	2.0±0.5	1.0

	T	W
4mm wide tape	1.5max.	5±1.0
8mm wide tape	2.5max.	10±1.5
12mm wide tape	2.5max.	14±1.5

Unit : mm

⑥Top Tape Strength

The top tape requires a peel-off force of 0.1 to 0.7N in the direction of the arrow as illustrated below.



■RELIABILITY DATA

1.Operating Temperature Range

Specified Value	Temperature Compensating(Class1)	−55 to ＋125℃
	High Permittivity （Class2）	

	Specification	Temperature Range
B5	X5R	−55 to ＋85℃
B7	X7R	−55 to ＋125℃
C6	X6S	−55 to ＋105℃
C7	X7S	−55 to ＋125℃
D7	X7T	−55 to ＋125℃

2. Storage Conditions

Specified Value	Temperature Compensating(Class1)	−55 to ＋125℃
	High Permittivity （Class2）	

	Specification	Temperature Range
B5	X5R	−55 to ＋85℃
B7	X7R	−55 to ＋125℃
C6	X6S	−55 to ＋105℃
C7	X7S	−55 to ＋125℃
D7	X7T	−55 to ＋125℃

3. Rated Voltage

Specified Value	Temperature Compensating (Class1)	Standard	50VDC, 25VDC
		High Frequency Type	250VDC
	High Permittivity （Class2）		630VDC, 250VDC, 100VDC 50VDC, 35VDC, 25VDC, 16VDC, 10VDC, 6.3VDC, 4VDC

4. Withstanding Voltage （Between terminals）

Specified Value	Temperature Compensating(Class1)	No breakdown or damage
	High Permittivity （Class2）	

Test Methods and Remarks

	Class 1	Class 2
Applied voltage	Rated voltage×3 Rated voltage(Code Q)×2	Rated voltage×2.5 Rated voltage(Code Q)×2、Rated voltage(Code S)×1.2
Duration	1 to 5 sec.	
Charge/discharge current	50mA max.	

5. Insulation Resistance

Specified Value	Temperature Compensating(Class1)	10000 MΩ min.
	High Permittivity （Class2） Note 1	C≦0.047μF : 10000 MΩ min. C＞0.047μF : 500MΩ・μF （C:Nominal capacitance）

Test Methods and Remarks

Applied voltage : Rated voltage, 500V(Code S)
Duration : 60±5 sec.
Charge/discharge current : 50mA max.

6. Capacitance (Tolerance)

Specified Value	Temperature Compensating (Class1)	Standard	C≦5pF: ±0.25pF 5pF＜C≦10pF: ±0.5pF C＞10pF: ±5% (C:Nominal capacitance)
		High Frequency Type	Refer to detailed specification
	High Permittivity (Class2)		±10% or ±20%

Test Methods and Remarks	Class 1		Class 2	
	Standard	High Frequency Type	C≦10μF	C＞10μF
Preconditioning	None		Thermal treatment (at 150℃ for 1hr) No.9	
Measuring frequency	1MHz±10%		1kHz±10%	120±10Hz
Measuring voltage Note 1	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1rms
Bias application	None			

7. Q or Dissipation Factor

Specified Value	Temperature Compensating (Class1)	Standard	C＜30pF : Q≧400+20C C≧30pF : Q≧1000 (C:Nominal capacitance)
		High Frequency Type	Refer to detailed specification
	High Permittivity (Class2) Note 1		2.5% max.

Test Methods and Remarks	Class 1		Class 2	
	Standard	High Frequency Type	C≦10μF	C＞10μF
Preconditioning	None		Thermal treatment (at 150℃ for 1hr) No.9	
Measuring frequey	1MHz±10%		1kHz±10%	120±10Hz
Measuring voltage Note 1	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1Vrms
Bias application	None			

8. Pre- and Post-Stress Electrical test

Measurement at 25±5℃

9. Heat treatment

Value shall be measured after test sample is heat treated at 150 +0/−10℃ for an hour and kept at room temperature for 24±2hrs.
※ Heat treatment is applicable to High dielectric type.

10. High Temperature Exposure (Storage)

Specified Value	Temperature Compensating (Class1)	Standard	Appearance : No abnormality Cap. Change : Within ±3% or ±0.3pF, whichever is larger. Q : C＜10pF : Q≧200+10C 10≦ C＜30pF : Q≧275+2.5C C≧ 30pF : Q≧350 (C:Nominal capacitance) IR : 1000MΩ min
		High Frequency Type	Appearance : No abnormality Cap. Change : Within ±3% or ±0.3pF, whichever is larger. IR : 1000MΩ min
	High Permittivity (Class2) Note 1		Appearance : No abnormality Cap. Change : Within ±12.5% tan δ : 5% max IR : Within 50MΩμF or 100MΩ whichever is smaller.
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Temperature: The maximum operating temperature shall be used. Duration: Unpowered 1000 hrs. Measurement shall be performed after test sample following the test is heated at 150+0/−10℃ for an hour and kept at room temperature for 24±2 hrs. No.9		

11. Temperature Cycling			
Specified Value	Temperature Compensating (Class1)	Standard	Appearance : No abnormality Cap. Change : Within ±2.5% or ±0.25pF, whichever is larger. Q : Initial value IR : Initial value
		High Frequency Type	Appearance : No abnormality Cap. Change : Within ±2.5% or ±0.25pF, whichever is larger. IR : Initial value
	High Permittivity (Class2)		Appearance : No abnormality Cap. Change : Within ±7.5% tan δ : Initial value IR : Initial value
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Temperature: Minimum operating temperature to Maximum operating temperature Number of cycles: 1000 cycles Maximum dwell time at each temperature extreme: 30 min Maximum transition time: Within 1 min Measurement shall be performed after test sample following the test is heated at 150+0/−10° C for an hour and kept at room temperature for 24±2 hours. No.9		

12. Destructive Physical Analysis	
Specified Value	No abnormality
Test Methods and Remarks	Per EIA-469

13. Biased Humidity			
Specified Value	Temperature Compensating (Class1)	Standard	Appearance : No abnormality Cap. Change : Within ±7.5% or ±0.75pF, whichever is larger. Q : C＜30pF : Q≧100＋10C/3 C≧30pF : Q≧200 (C:Nominal capacitance) IR : 500MΩ min
		High Frequency Type	Appearance : No abnormality Cap. Change : C≦2.0pF : ±0.4pF 2.0pF＜C＜10pF : ±0.75pF C≧10pF : ±7.5% (C:Nominal capacitance) IR : 500MΩ min
	High Permittivity (Class2) Note 1		Appearance : No abnormality Cap. Change : Within ±12.5% tan δ : 5% max IR : Within 25MΩμF or 500MΩ whichever is smaller.
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Temperature: 85℃ Humidity: 85%RH Duration: 1000hrs Applied voltage: Rated voltage and 1.3 to 1.5V. Measurement shall be performed after test sample following the test is heated at 150+0/−10℃ for an hour and kept at room temperature for 24±2 hours. No.9		

14. Temperature Cycle (Thermal Shock)			
Specified Value	Temperature Compensating (Class1)	Standard	Appearance : No abnormality Cap. Change : Within ±3.0% or ±0.3pF, whichever is larger. Q : C＜10pF : Q≧200＋10C 10≦ C＜30pF : Q≧275＋2.5C C≧ 30pF : Q≧350 (C:Nominal capacitance) IR : 1000MΩ min
		High Frequency Type	Appearance : No abnormality Cap. Change : Within ±3.0% or ±0.3pF, whichever is larger. IR : 1000MΩ min
	High Permittivity (Class2) Note 1		Appearance : No abnormality Cap. Change : Within ±12.5% tan δ : 5% max IR : Within 50MΩμF or 1000MΩ, whichever is smaller.
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Temperature: Maximum operating temperature Duration: 1000hrs Applied voltage: Rated voltage Measurement shall be performed after test sample following the test is heated at 150+0/−10℃ for an hour and kept at room temperature for 24±2 hours. No.9		

15. External Visual	
Specified Value	No abnormality
Test Methods and Remarks	Visual inspection shall be performed.

16. Physical Dimension	
Specified Value	Refer to detailed specification
Test Methods and Remarks	Verify physical dimensions to the applicable device specification.

17. Resistance to Solvents	
Specified Value	Appearance : No abnormality Cap. Change : Initial value Q or tan δ : Initial value IR : Initial value
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Add Aqueous wash chemical OKEMCLEAN (A 6% concentrated Oakite cleaner) or equivalent.

18. Mechanical Shock	
Specified Value	Appearance : No abnormality Cap. Change : Initial value Q or tan δ : Initial value IR : Initial value
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). Peak value: 1500g Duration: 0.5ms Test pulse: Half-sine Velocity change: 4.7m/s.

19. Vibration	
Specified Value	Appearance : No abnormality Cap. Change : Initial value Q or tan δ : Initial value IR : Initial value
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 5g's for 20 min., 12 cycles each of 3 orientations. (Total: 36 cycles) Frequency range: 10Hz～2000Hz

20. Resistance to Soldering Heat

Specified Value	Temperature Compensating (Class1)	Standard	Appearance : No abnormality Cap. Change : Within ±2.5% or ±0.25pF, whichever is larger. Q : Initial value IR : Initial value
		High Frequency Type	Appearance : No abnormality Cap. Change : Within ±2.5% or ±0.25pF, whichever is larger. IR : Initial value
	High Permittivity (Class2) Note 1		Appearance : No abnormality Cap. Change : Within ±7.5% tan δ : Initial value IR : Initial value
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Dipping Solder: 260±5℃ Time: 10±1 sec. Measurement shall be performed after test sample following the test kept at room temperature for 24±2hours.		

21. ESC

Specified Value	Appearance: No abnormality IR: Initial value
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Per AEC-Q200-002

22. Solderability

Specified Value	More than 95% of terminal electrode shall be covered with fresh solder.
Test Methods and Remarks	(a) Pb Free Solder Solder at 235±5℃ for 5sec. (b) SnPb Solder Solder at 215±5℃ for 5sec. (c) Wave Soldering (Pb Free Solder) Solder at 260±5℃ for 7sec.

23. Temperature Characteristic

Specified Value

Temperature Compensating (Class1)

Temp. chara. [ppm/℃]		Tolerance[ppm/℃]
C□:0	CG、CH、CJ、CK	G:±30 H:±60 J:±120 K:±250

High Permittivity (Class2)

		Capacitance change rate	Reference temperature	Temperature range
B5	X5R	±15%	25℃	−55～+85℃
B7	X7R	±15%	25℃	−55～+125℃
C6	X6S	±22%	25℃	−55～+105℃
C7	X7S	±22%	25℃	−55～+125℃
D7	X7T	+22/−33%	25℃	−55～+125℃

Test Methods and Remarks: Heat treatment specified in this specification shall be conducted prior to test. No.9
Capacitance shall be measured at room temperature as well as minimum and maximum operating temperatures.

24. Board Flex

Specified Value	Appearance: No abnormality Cap. Change: ±12.5%
Test Methods and Remarks	Heat treatment specified in this specification shall be conducted prior to test. No.9 Test sample is soldered onto the test board shown in Fig 1. The board is bent 2.0mm for 60 seconds as shown in Fig 2. Measurement shall be conducted as the board is bent 2.0mm.

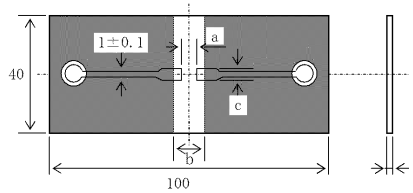


Fig 1

Dimension	Case size[mm]						
	0603	1005	1608	2012	3216	3225	4532
a	0.3	0.4	1.0	1.2	2.2	2.2	3.5
b	0.9	1.5	3.0	4.0	5.0	5.0	7.0
c	0.3	0.5	1.2	1.65	2.0	2.9	3.7
Thickness	0.8	1.6					

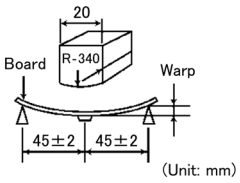


Fig 2

25. Terminal Strength

Specified Value	Appearance: No abnormality
Test Methods and Remarks	Per AEC-Q200-006 Test sample is soldered onto the test board shown in Fig 3. 0603 or greater (case size): 17.7N for 60±5 sec 0402 (case size): 5N for 30±5 sec. 0201 (case size): 2N for 30±5 sec.

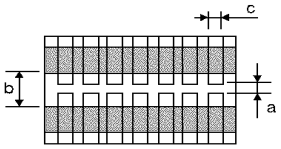
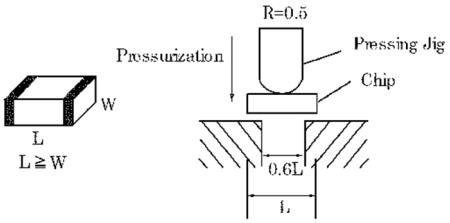


Fig 3

Dimension	Case size[mm]						
	0603	1005	1608	2012	3216	3225	4532
a	0.3	0.4	1.0	1.2	2.2	2.2	3.5
b	0.9	1.5	3.0	4.0	5.0	5.0	7.0
c	0.3	0.5	1.2	1.65	2.0	2.9	3.7

26. Beam Load Test

Specified Value	Destruction value should exceed 5N.
Test Methods and Remarks	Per AEC-Q200-003



Note 1 The figures indicate typical specifications. Please refer to individual specifications in detail.

■PRECAUTIONS

1. Circuit Design

Precautions

◆Verification of operating environment, electrical rating and performance

1. A malfunction of equipment in fields such as medical, aerospace, nuclear control, etc. may cause serious harm to human life or have severe social ramifications.
   Therefore, any capacitors to be used in such equipment may require higher safety and reliability, and shall be clearly differentiated from them used in general purpose applications.

◆Operating Voltage (Verification of Rated voltage)

1. The operating voltage for capacitors must always be their rated voltage or less.
   If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages shall be the rated voltage or less.
   For a circuit where an AC or a pulse voltage may be used, the sum of their peak voltages shall also be the rated voltage or less.
2. Even if an applied voltage is the rated voltage or less reliability of capacitors may be deteriorated in case that either a high frequency AC voltage or a pulse voltage having rapid rise time is used in a circuit.

2. PCB Design

Precautions

◆Pattern configurations (Design of Land-patterns)

1. When capacitors are mounted on PCBs, the amount of solder used (size of fillet) can directly affect the capacitor performance. Therefore, the following items must be carefully considered in the design of land patterns:
   (1) Excessive solder applied can cause mechanical stresses which lead to chip breaking or cracking. Therefore, please consider appropriate land-patterns for proper amount of solder.
   (2) When more than one component are jointly soldered onto the same land, each component's soldering point shall be separated by solder-resist.

◆Pattern configurations (Capacitor layout on PCBs)

After capacitors are mounted on boards, they can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering of the boards, etc.). For this reason, land pattern configurations and positions of capacitors shall be carefully considered to minimize stresses.

Technical considerations

◆Pattern configurations (Design of Land-patterns)

The following diagrams and tables show some examples of recommended land patterns to prevent excessive solder amounts.

(1) Recommended land dimensions for typical chip capacitors

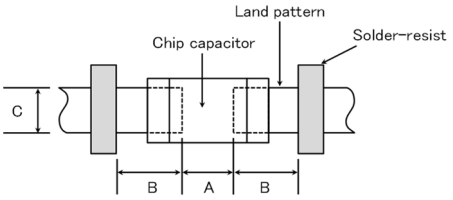
●Multilayer Ceramic Capacitors : Recommended land dimensions

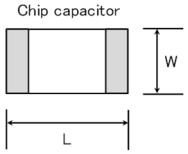
(unit: mm)

Wave-soldering

Type		1608	2012	3216	3225
Size	L	1.6	2.0	3.2	3.2
	W	0.8	1.25	1.6	2.5
A		0.8 to 1.0	1.0 to 1.4	1.8 to 2.5	1.8 to 2.5
B		0.5 to 0.8	0.8 to 1.5	0.8 to 1.7	0.8 to 1.7
C		0.6 to 0.8	0.9 to 1.2	1.2 to 1.6	1.8 to 2.5

Land patterns for PCBs





Reflow-soldering

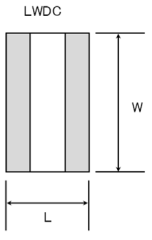
Type		0201	0402	0603	1005	1608	2012	3216	3225	4532
Size	L	0.25	0.4	0.6	1.0	1.6	2.0	3.2	3.2	4.5
	W	0.125	0.2	0.3	0.5	0.8	1.25	1.6	2.5	3.2
A		0.095～0.135	0.15～0.25	0.20～0.30	0.45～0.55	0.6～0.8	0.8～1.2	1.8～2.5	1.8～2.5	2.5～3.5
B		0.085～0.125	0.10～0.20	0.20～0.30	0.40～0.50	0.6～0.8	0.8～1.2	1.0～1.5	1.0～1.5	1.5～1.8
C		0.110～0.150	0.15～0.30	0.25～0.40	0.45～0.55	0.6～0.8	0.9～1.6	1.2～2.0	1.8～3.2	2.3～3.5

Note : Recommended land size might be different according to the allowance of the size of the product.

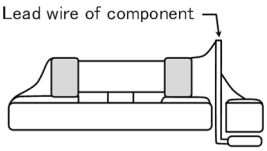
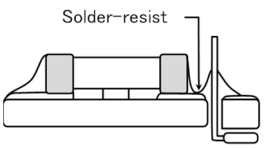
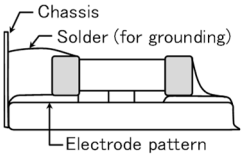
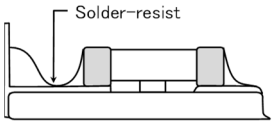
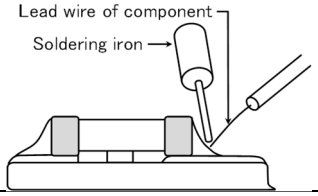
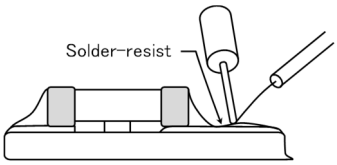
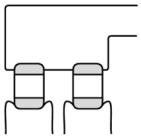
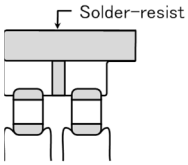
●LWDC: Recommended land dimensions for reflow-soldering

(unit: mm)

Type		0510	0816	1220
Size	L	0.52	0.8	1.25
	W	1.0	1.6	2.0
A		0.18～0.22	0.25～0.3	0.5～0.7
B		0.2～0.25	0.3～0.4	0.4～0.5
C		0.9～1.1	1.5～1.7	1.9～2.1

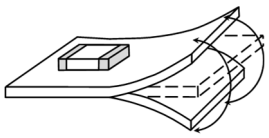
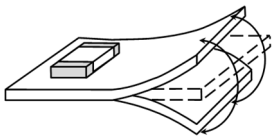


(2) Examples of good and bad solder application

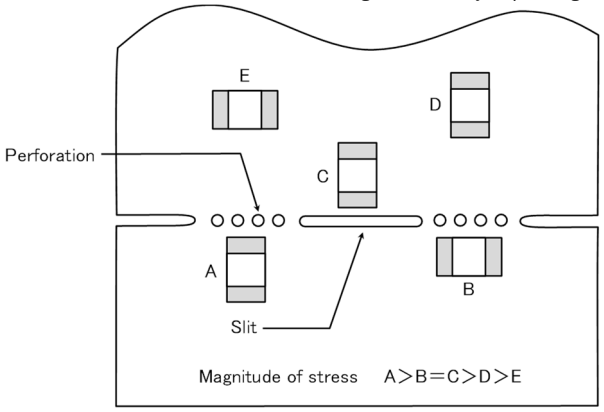
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆Pattern configurations (Capacitor layout on PCBs)

1-1. The following is examples of good and bad capacitor layouts ; capacitors shall be located to minimize any possible mechanical stresses from board warp or deflection.

Items	Not recommended	Recommended
Deflection of board		 Place the product at a right angle to the direction of the anticipated mechanical stress.

1-2. The amount of mechanical stresses given will vary depending on capacitor layout. Please refer to diagram below.



1-3. When PCB is split, the amount of mechanical stress on the capacitors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, slit, V-grooving, and perforation. Thus, please consider the PCB, split methods as well as chip location.

3. Mounting

Precautions

◆Adjustment of mounting machine

1. When capacitors are mounted on PCB, excessive impact load shall not be imposed on them.
2. Maintenance and inspection of mounting machines shall be conducted periodically.

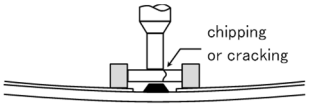
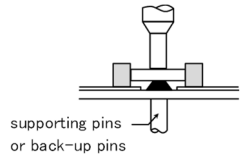
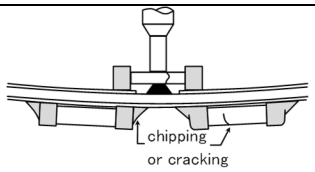
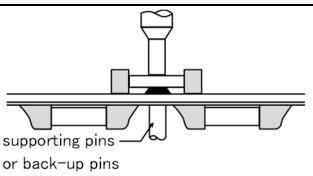
◆Selection of Adhesives

1. When chips are attached on PCBs with adhesives prior to soldering, it may cause capacitor characteristics degradation unless the following factors are appropriately checked : size of land patterns, type of adhesive, amount applied, hardening temperature and hardening period. Therefore, please contact us for further information.

Technical considerations

◆Adjustment of mounting machine

1. When the bottom dead center of a pick-up nozzle is too low, excessive force is imposed on capacitors and causes damages. To avoid this, the following points shall be considerable.
   (1) The bottom dead center of the pick-up nozzle shall be adjusted to the surface level of PCB without the board deflection.
   (2) The pressure of nozzle shall be adjusted between 1 and 3 N static loads.
   (3) To reduce the amount of deflection of the board caused by impact of the pick-up nozzle, supporting pins or back-up pins shall be used on the other side of the PCB. The following diagrams show some typical examples of good and bad pick-up nozzle placement:

Item	Improper method	Proper method
Single-sided mounting		
Double-sided mounting		

2. As the alignment pin is worn out, adjustment of the nozzle height can cause chipping or cracking of capacitors because of mechanical impact on the capacitors.
   To avoid this, the monitoring of the width between the alignment pins in the stopped position, maintenance, check and replacement of the pin shall be conducted periodically.

◆Selection of Adhesives

Some adhesives may cause IR deterioration. The different shrinkage percentage of between the adhesive and the capacitors may result in stresses on the capacitors and lead to cracking. Moreover, too little or too much adhesive applied to the board may adversely affect components. Therefore, the following precautions shall be noted in the application of adhesives.

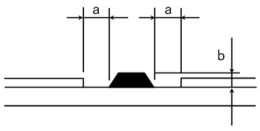
(1) Required adhesive characteristics
   a. The adhesive shall be strong enough to hold parts on the board during the mounting & solder process.
   b. The adhesive shall have sufficient strength at high temperatures.
   c. The adhesive shall have good coating and thickness consistency.
   d. The adhesive shall be used during its prescribed shelf life.
   e. The adhesive shall harden rapidly.
   f. The adhesive shall have corrosion resistance.
   g. The adhesive shall have excellent insulation characteristics.
   h. The adhesive shall have no emission of toxic gasses and no effect on the human body.

(2) The recommended amount of adhesives is as follows;

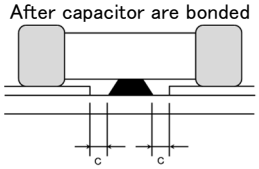
[Recommended condition]

Figure	2012/3216 case sizes as examples
a	0.3mm min
b	100 to 120 μm
c	Adhesives shall not contact land

Amount adhesive



After capacitor are bonded



4. Soldering

Precautions

◆Selection of Flux

Since flux may have a significant effect on the performance of capacitors, it is necessary to verify the following conditions prior to use;

(1) Flux used shall be less than or equal to 0.1 wt%(in Cl equivalent) of halogenated content. Flux having a strong acidity content shall not be applied.
(2) When shall capacitors are soldered on boards, the amount of flux applied shall be controlled at the optimum level.
(3) When water-soluble flux is used, special care shall be taken to properly clean the boards.

◆Soldering

Temperature, time, amount of solder, etc. shall be set in accordance with their recommended conditions.
Sn-Zn solder paste can adversely affect MLCC reliability.
Please contact us prior to usage of Sn-Zn solder.

Technical considerations

◆Selection of Flux

1-1. When too much halogenated substance(Chlorine, etc.) content is used to activate flux, or highly acidic flux is used, it may lead to corrosion of terminal electrodes or degradation of insulation resistance on the surfaces of the capacitors.
1-2. Flux is used to increase solderability in wave soldering. However if too much flux is applied, a large amount of flux gas may be emitted and may adversely affect the solderability. To minimize the amount of flux applied, it is recommended to use a flux-bubbling system.
1-3. Since the residue of water-soluble flux is easily dissolved in moisture in the air, the residues on the surfaces of capacitors in high humidity conditions may cause a degradation of insulation resistance and reliability of the capacitors. Therefore, the cleaning methods

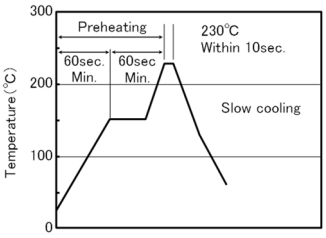
and the capability of the machines used shall also be considered carefully when water-soluble flux is used.

◆Soldering

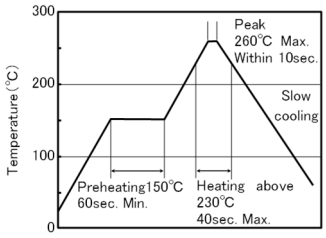
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated sufficiently, and the temperature difference between the capacitors and solder shall be within 130℃.
- Cooling : The temperature difference between the capacitors and cleaning process shall not be greater than 100℃.

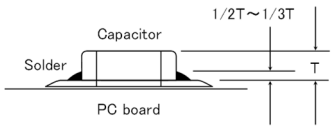
[Reflow soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】





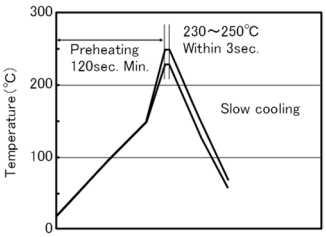
Caution

①The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of a capacitor.

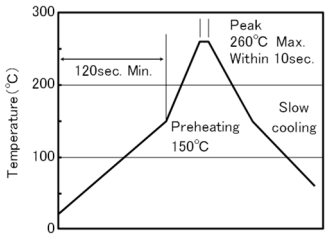
②Because excessive dwell times can adversely affect solderability, soldering duration shall be kept as close to recommended times as possible. soldering for 2 times.

[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】

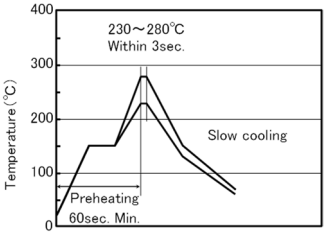


Caution

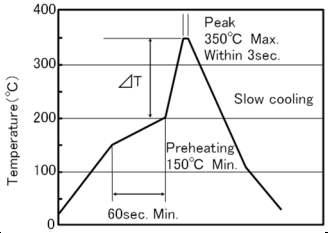
①Wave soldering must not be applied to capacitors designated as for reflow soldering only. soldering for 1 times.

[Hand soldering]

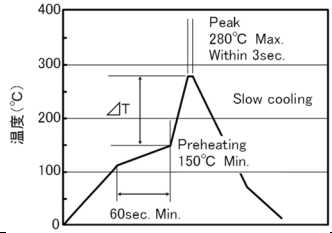
【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



	⊿T
3216type or less	⊿T≦150℃



	⊿T
3225type or more	⊿T≦130℃

Caution

①Use a 50W soldering iron with a maximum tip diameter of 1.0 mm.

②The soldering iron shall not directly touch capacitors. soldering for 1 times.

5. Cleaning	
Precautions	◆Cleaning conditions 1. When PCBs are cleaned after capacitors mounting, please select the appropriate cleaning solution in accordance with the intended use of the cleaning. (e.g. to remove soldering flux or other materials from the production process.) 2. Cleaning condition shall be determined after it is verified by using actual cleaning machine that the cleaning process does not affect capacitor's characteristics.
Technical considerations	1. The use of inappropriate cleaning solutions can cause foreign substances such as flux residue to adhere to capacitors or deteriorate their outer coating, resulting in a degradation of the capacitor's electrical properties (especially insulation resistance). 2. Inappropriate cleaning conditions(insufficient or excessive cleaning) may adversely affect the performance of the capacitors. In the case of ultrasonic cleaning, too much power output can cause excessive vibration of PCBs which may lead to the cracking of capacitors or the soldered portion, or decrease the terminal electrodes' strength. Therefore, the following conditions shall be carefully checked; Ultrasonic output : 20 W/ℓ or les Ultrasonic frequency : 40 kHz or less Ultrasonic washing period : 5 min. or less

6. Resin coating and mold	
Precautions	1. With some type of resins, decomposition gas or chemical reaction vapor may remain inside the resin during the hardening period or while left under normal storage conditions resulting in the deterioration of the capacitor's performance. 2. When a resin's hardening temperature is higher than capacitor's operating temperature, the stresses generated by the excessive heat may lead to damage or destruction of capacitors. The use of such resins, molding materials etc. is not recommended.

7. Handling	
Precautions	◆Splitting of PCB 1. When PCBs are split after components mounting, care shall be taken so as not to give any stresses of deflection or twisting to the board. 2. Board separation shall not be done manually, but by using the appropriate devices. ◆Mechanical considerations Be careful not to subject capacitors to excessive mechanical shocks. (1)If ceramic capacitors are dropped onto a floor or a hard surface, they shall not be used. (2)Please be careful that the mounted components do not come in contact with or bump against other boards or components.

8. Storage conditions	
Precautions	◆Storage 1. To maintain the solderability of terminal electrodes and to keep packaging materials in good condition, care must be taken to control temperature and humidity in the storage area. Humidity should especially be kept as low as possible. ・Recommended conditions Ambient temperature : Below 30℃ Humidity : Below 70% RH The ambient temperature must be kept below 40℃. Even under ideal storage conditions, solderability of capacitor is deteriorated as time passes, so capacitors shall be used within 6 months from the time of delivery. ・Ceramic chip capacitors shall be kept where no chlorine or sulfur exists in the air. 2. The capacitance values of high dielectric constant capacitors will gradually decrease with the passage of time, so care shall be taken to design circuits. Even if capacitance value decreases as time passes, it will get back to the initial value by a heat treatment at 150℃ for 1hour.
Technical considerations	If capacitors are stored in a high temperature and humidity environment, it might rapidly cause poor solderability due to terminal oxidation and quality loss of taping/packaging materials. For this reason, capacitors shall be used within 6 months from the time of delivery. If exceeding the above period, please check solderability before using the capacitors.

※RCR-2335B(Safety Application Guide for fixed ceramic capacitors for use in electronic equipment)is published by JEITA.
Please check the guide regarding precautions for deflection test, soldering by spot heat, and so on.