Notice for TAIYO YUDEN products

Please read this notice before using the TAIYO YUDEN products.

⚠ REMINDERS

- Product information in this catalog is as of October 2016. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or use of our products.

  Please note that TAIYO YUDEN shall not be in any way responsible for any damages and defects in products or equipment incorporating our products, which are caused under the conditions other than those specified in this catalog or individual specification.

- Please contact TAIYO YUDEN for further details of product specifications as the individual specification is available.

- Please conduct validation and verification of our products in actual condition of mounting and operating environment before using our products.

- The products listed in this catalog are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment including, without limitation, mobile phone, and PC). Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, disaster prevention equipment, medical equipment, highly public information network equipment including, without limitation, telephone exchange, and base station).

  Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment, nuclear control equipment, undersea equipment, military equipment).

  When our products are used even for high safety and/or reliability-required devices or circuits of general electronic equipment, it is strongly recommended to perform a thorough safety evaluation prior to use of our products and to install a protection circuit as necessary.

  Please note that unless you obtain prior written consent of TAIYO YUDEN, TAIYO YUDEN shall not be in any way responsible for any damages incurred by you or third parties arising from use of the products listed in this catalog for any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

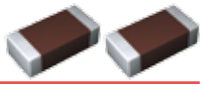
- Please note that TAIYO YUDEN shall have no responsibility for any controversies or disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from use of our products. TAIYO YUDEN grants no license for such rights.

- Please note that unless otherwise agreed in writing, the scope of warranty for our products is limited to the delivered our products themselves and TAIYO YUDEN shall not be in any way responsible for any damages resulting from a fault or defect in our products.

- The contents of this catalog are applicable to our products which are purchased from our sales offices or authorized distributors (hereinafter "TAIYO YUDEN's official sales channel"). Please note that the contents of this catalog are not applicable to our products purchased from any seller other than TAIYO YUDEN's official sales channel.

- Caution for Export
  Some of our products listed in this catalog may require specific procedures for export according to "U.S. Export Administration Regulations", "Foreign Exchange and Foreign Trade Control Law" of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales staff.

MULTILAYER CERAMIC CAPACITORS



WAVE REFLOW

■PARTS NUMBER

J	M	K	3 1 6	△	B J	1 0 6	M	L	—	T	△
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫

△=Blank space

①Rated voltage

Code	Rated voltage[VDC]
P	2.5
A	4
J	6.3
L	10
E	16
T	25
G	35
U	50
H	100
Q	250
S	630

②Series name

Code	Series name
M	Multilayer ceramic capacitor
V	Multilayer ceramic capacitor for high frequency
W	LW reverse type multilayer capacitor

③End termination

Code	End termination
K	Plated
S	Cu Internal Electrodes

④Dimension(L×W)

Type	Dimensions (L×W)[mm]	EIA(inch)
021	0.25× 0.125	008004
042	0.4 × 0.2	01005
063	0.6 × 0.3	0201
105	1.0 × 0.5	0402
	0.52× 1.0 ※	0204
107	1.6 × 0.8	0603
	0.8 × 1.6 ※	0306
212	2.0 × 1.25	0805
	1.25× 2.0 ※	0508
316	3.2 × 1.6	1206
325	3.2 × 2.5	1210
432	4.5 × 3.2	1812

Note : ※LW reverse type(□WK) only

⑤Dimension tolerance

Code	Type	L[mm]	W[mm]	T[mm]
△	ALL	Standard	Standard	Standard
A	063	0.6±0.05	0.3±0.05	0.3±0.05
	105	1.0±0.10	0.5±0.10	0.5±0.10
	107	1.6+0.15/−0.05	0.8+0.15/−0.05	0.8+0.15/−0.05
	212	2.0+0.15/−0.05	1.25+0.15/−0.05	0.45±0.05
				0.85±0.10
				1.25+0.15/−0.05
	316	3.2±0.20	1.6±0.20	0.85±0.10
				1.6±0.20
	325	3.2±0.30	2.5±0.30	2.5±0.30
B	063	0.6±0.09	0.3±0.09	0.3±0.09
	105	1.0+0.15/−0.05	0.5+0.15/−0.05	0.5+0.15/−0.05
	107	1.6+0.20/−0	0.8+0.20/−0	0.45±0.05
				0.8+0.20/−0
	212	2.0+0.20/−0	1.25+0.20/−0	0.45±0.05
				0.85±0.10
				1.25+0.20/−0
	316	3.2±0.30	1.6±0.30	1.6±0.30
C	105	1.0+0.20/−0	0.5+0.20/−0	0.5+0.20/−0

Note: P.6 Standard external dimensions △= Blank space

⑥Temperature characteristics code

■High dielectric type(Excluding Super low distortion multilayer ceramic capacitor)

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	Capacitance change	Capacitance tolerance	Tolerance code
BJ	JIS	B	−25～+ 85	20	±10%	±10%	K
						±20%	M
	EIA	X5R	−55～+ 85	25	±15%	±10%	K
						±20%	M
B7	EIA	X7R	−55～+125	25	±15%	±10%	K
						±20%	M
C6	EIA	X6S	−55～+105	25	±22%	±10%	K
						±20%	M
C7	EIA	X7S	−55～+125	25	±22%	±10%	K
						±20%	M
LD(※)	EIA	X5R	−55～+ 85	25	±15%	±10%	K
						±20%	M

Note : ※.LD Low distortion high value multilayer ceramic capacitor △= Blank space

▶This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our website (http://www.ty-top.com/) .

■Temperature compensating type

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	Capacitance change	Capacitance tolerance	Tolerance code
CG	EIA	C0G	−55～+125	25	0±30ppm/℃	±0.05pF	A
						±0.1pF	B
						±0.25pF	C
						±0.5pF	D
						±5%	J
UJ	JIS	UJ	−55～+125	20	−750±120ppm/℃	±0.25pF	C
						±0.5pF	D
	EIA	U2J		25		±5%	J
UK	JIS	UK	−55～+125	20	−750±250ppm/℃	±0.25pF	C
	EIA	U2K	−55～+125	25			
SL	JIS	SL	−55～+125	20	+350～−1000ppm/℃	±5%	J

⑥Series code

・Super low distortion multilayer ceramic capacitor

Code	Series code
SD	Standard

・Medium-High Voltage Multilayer Ceramic Capacitor

Code	Series code
SD	Standard

⑦Nominal capacitance

Code (example)	Nominal capacitance
0R5	0.5pF
010	1pF
100	10pF
101	100pF
102	1,000pF
103	10,000pF
104	0.1μF
105	1.0μF
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
F	±1pF
G	±2%
J	±5%
K	±10%
M	±20%
Z	+80/−20%

⑨Thickness

Code	Thickness[mm]
K	0.125
H	0.13
E	0.18
C	0.2
D	
P	0.3
T	
K	0.45(107type or more)
V	0.5
W	
A	0.8
D	0.85(212type or more)
F	1.15
G	1.25
L	1.6
N	1.9
Y	2.0 max
M	2.5

⑩Special code

Code	Special code
—	Standard

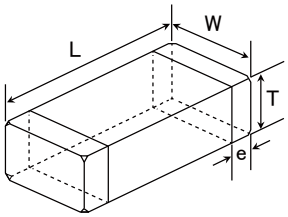
⑪Packaging

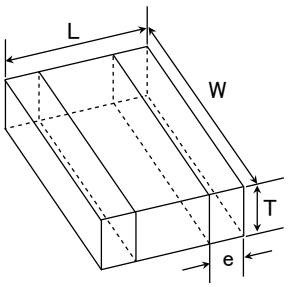
Code	Packaging
F	φ178mm Taping (2mm pitch)
T	φ178mm Taping (4mm pitch)
P	φ178mm Taping (4mm pitch, 1000 pcs/reel) 325 type(Thickness code M)
R	φ178mm Taping (2mm pitch)105type only (Thickness code E,H)
W	φ178mm Taping(1mm pitch)021/042type only

⑫Internal code

Code	Internal code
△	Standard

■STANDARD EXTERNAL DIMENSIONS





※ LW reverse type

Type(EIA)	Dimension [mm]				
	L	W	T	*1	e
□MK021(008004)	0.25±0.013	0.125±0.013	0.125±0.013	K	0.0675±0.0275
□MK042(01005)	0.4±0.02	0.2±0.02	0.2±0.02	C	0.1±0.03
				D	
□VS042(01005)	0.4±0.02	0.2±0.02	0.2±0.02	C	0.1±0.03
□MK063(0201)	0.6±0.03	0.3±0.03	0.3±0.03	P	0.15±0.05
				T	
□MK105(0402)	1.0±0.05	0.5±0.05	0.13±0.02	H	0.25±0.10
			0.18±0.02	E	
			0.2±0.02	C	
			0.3±0.03	P	
			0.5±0.05	V	
□VK105(0402)	1.0±0.05	0.5±0.05	0.5±0.05	W	0.25±0.10
□WK105(0204)※	0.52±0.05	1.0±0.05	0.3±0.05	P	0.18±0.08
□MK107(0603)	1.6±0.10	0.8±0.10	0.45±0.05	K	0.35±0.25
			0.8±0.10	A	
□WK107(0306)※	0.8±0.10	1.6±0.10	0.5±0.05	V	0.25±0.15
□MK212(0805)	2.0±0.10	1.25±0.10	0.45±0.05	K	0.5±0.25
			0.85±0.10	D	
			1.25±0.10	G	
□WK212(0508)※	1.25±0.15	2.0±0.15	0.85±0.10	D	0.3±0.2
□MK316(1206)	3.2±0.15	1.6±0.15	0.85±0.10	D	0.5+0.35/−0.25
			1.15±0.10	F	
			1.6±0.20	L	
□MK325(1210)	3.2±0.30	2.5±0.20	0.85±0.10	D	0.6±0.3
			1.15±0.10	F	
			1.9±0.20	N	
			1.9+0.1/−0.2	Y	
			2.5±0.20	M	
□MK432(1812)	4.5±0.40	3.2±0.30	2.5±0.20	M	0.9±0.6

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

■STANDARD QUANTITY

Type	EIA(inch)	Dimension		Standard quantity[pcs]	
		[mm]	Code	Paper tape	Embossed tape
021	008004	0.125	K	—	50000
042	01005	0.2	C	—	40000
			D		
063	0201	0.3	P	15000	—
			T		
105	0402	0.13	H	—	20000
		0.18	E	—	15000
		0.2	C	20000	—
		0.3	P	15000	—
		0.5	V	10000	—
			W		
	0204 ※	0.30	P		
107	0603	0.45	K	4000	—
		0.8	A		
	0306 ※	0.50	V	—	4000
212	0805	0.45	K	4000	—
		0.85	D		
		1.25	G	—	3000
	0508 ※	0.85	D	4000	—
316	1206	0.85	D	4000	—
		1.15	F	—	3000
		1.6	L	—	2000
325	1210	0.85	D	—	2000
		1.15	F		
		1.9	N		
		2.0 max	Y		
		2.5	M	—	1000
432	1812	2.5	M	—	500

Note : ※.LW Reverse type(□WK)

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Multilayer Ceramic Capacitors for High Frequency Applications (1GHz+)

●042TYPE

【Temperature Characteristic CG : CG/C0G】 0.2mm thickness(C)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q (at 1GHz) (min)	HTLT Rated voltage x %	Thickness*3 [mm]	Soldering R:Reflow W:Wave
TVS042 CG0R2□C-W			CG	C0G	0.2 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R3□C-W			CG	C0G	0.3 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R4□C-W			CG	C0G	0.4 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R5□C-W			CG	C0G	0.5 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R6□C-W			CG	C0G	0.6 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R7□C-W			CG	C0G	0.7 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CGR75□C-W			CG	C0G	0.75 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R8□C-W			CG	C0G	0.8 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG0R9□C-W			CG	C0G	0.9 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG010□C-W			CG	C0G	1 p	±0.05pF, ±0.1pF, ±0.25pF	300	200	0.2±0.02	R
TVS042 CG1R1□C-W			CG	C0G	1.1 p	±0.05pF, ±0.1pF, ±0.25pF	280	200	0.2±0.02	R
TVS042 CG1R2□C-W			CG	C0G	1.2 p	±0.05pF, ±0.1pF, ±0.25pF	270	200	0.2±0.02	R
TVS042 CG1R3□C-W			CG	C0G	1.3 p	±0.05pF, ±0.1pF, ±0.25pF	260	200	0.2±0.02	R
TVS042 CG1R4□C-W			CG	C0G	1.4 p	±0.05pF, ±0.1pF, ±0.25pF	250	200	0.2±0.02	R
TVS042 CG1R5□C-W			CG	C0G	1.5 p	±0.05pF, ±0.1pF, ±0.25pF	240	200	0.2±0.02	R
TVS042 CG1R6□C-W			CG	C0G	1.6 p	±0.05pF, ±0.1pF, ±0.25pF	230	200	0.2±0.02	R
TVS042 CG1R7□C-W			CG	C0G	1.7 p	±0.05pF, ±0.1pF, ±0.25pF	220	200	0.2±0.02	R
TVS042 CG1R8□C-W			CG	C0G	1.8 p	±0.05pF, ±0.1pF, ±0.25pF	210	200	0.2±0.02	R
TVS042 CG1R9□C-W			CG	C0G	1.9 p	±0.05pF, ±0.1pF, ±0.25pF	200	200	0.2±0.02	R
TVS042 CG020□C-W			CG	C0G	2 p	±0.05pF, ±0.1pF, ±0.25pF	190	200	0.2±0.02	R
TVS042 CG2R1□C-W			CG	C0G	2.1 p	±0.05pF, ±0.1pF, ±0.25pF	185	200	0.2±0.02	R
TVS042 CG2R2□C-W			CG	C0G	2.2 p	±0.05pF, ±0.1pF, ±0.25pF	180	200	0.2±0.02	R
TVS042 CG2R3□C-W			CG	C0G	2.3 p	±0.05pF, ±0.1pF, ±0.25pF	175	200	0.2±0.02	R
TVS042 CG2R4□C-W			CG	C0G	2.4 p	±0.05pF, ±0.1pF, ±0.25pF	170	200	0.2±0.02	R
TVS042 CG2R5□C-W			CG	C0G	2.5 p	±0.05pF, ±0.1pF, ±0.25pF	160	200	0.2±0.02	R
TVS042 CG2R6□C-W			CG	C0G	2.6 p	±0.05pF, ±0.1pF, ±0.25pF	155	200	0.2±0.02	R
TVS042 CG2R7□C-W			CG	C0G	2.7 p	±0.05pF, ±0.1pF, ±0.25pF	150	200	0.2±0.02	R
TVS042 CG2R8□C-W			CG	C0G	2.8 p	±0.05pF, ±0.1pF, ±0.25pF	140	200	0.2±0.02	R
TVS042 CG2R9□C-W			CG	C0G	2.9 p	±0.05pF, ±0.1pF, ±0.25pF	135	200	0.2±0.02	R
TVS042 CG030□C-W			CG	C0G	3 p	±0.05pF, ±0.1pF, ±0.25pF	130	200	0.2±0.02	R
TVS042 CG3R1□C-W			CG	C0G	3.1 p	±0.1pF, ±0.25pF	125	200	0.2±0.02	R
TVS042 CG3R2□C-W			CG	C0G	3.2 p	±0.1pF, ±0.25pF	125	200	0.2±0.02	R
TVS042 CG3R3□C-W			CG	C0G	3.3 p	±0.1pF, ±0.25pF	120	200	0.2±0.02	R
TVS042 CG3R4□C-W			CG	C0G	3.4 p	±0.1pF, ±0.25pF	120	200	0.2±0.02	R
TVS042 CG3R5□C-W			CG	C0G	3.5 p	±0.1pF, ±0.25pF	110	200	0.2±0.02	R
TVS042 CG3R6□C-W			CG	C0G	3.6 p	±0.1pF, ±0.25pF	110	200	0.2±0.02	R
TVS042 CG3R7□C-W			CG	C0G	3.7 p	±0.1pF, ±0.25pF	110	200	0.2±0.02	R
TVS042 CG3R8□C-W			CG	C0G	3.8 p	±0.1pF, ±0.25pF	100	200	0.2±0.02	R
TVS042 CG3R9□C-W			CG	C0G	3.9 p	±0.1pF, ±0.25pF	100	200	0.2±0.02	R
TVS042 CG040□C-W			CG	C0G	4 p	±0.1pF, ±0.25pF	90	200	0.2±0.02	R
TVS042 CG4R1□C-W			CG	C0G	4.1 p	±0.1pF, ±0.25pF	90	200	0.2±0.02	R
TVS042 CG4R2□C-W			CG	C0G	4.2 p	±0.1pF, ±0.25pF	85	200	0.2±0.02	R
TVS042 CG4R3□C-W		25	CG	C0G	4.3 p	±0.1pF, ±0.25pF	85	200	0.2±0.02	R
TVS042 CG4R4□C-W			CG	C0G	4.4 p	±0.1pF, ±0.25pF	85	200	0.2±0.02	R
TVS042 CG4R5□C-W			CG	C0G	4.5 p	±0.1pF, ±0.25pF	85	200	0.2±0.02	R
TVS042 CG4R6□C-W			CG	C0G	4.6 p	±0.1pF, ±0.25pF	85	200	0.2±0.02	R
TVS042 CG4R7□C-W			CG	C0G	4.7 p	±0.1pF, ±0.25pF	85	200	0.2±0.02	R
TVS042 CG4R8□C-W			CG	C0G	4.8 p	±0.1pF, ±0.25pF	80	200	0.2±0.02	R
TVS042 CG4R9□C-W			CG	C0G	4.9 p	±0.1pF, ±0.25pF	80	200	0.2±0.02	R
TVS042 CG050□C-W			CG	C0G	5 p	±0.1pF, ±0.25pF	80	200	0.2±0.02	R
TVS042 CG5R1□C-W			CG	C0G	5.1 p	±0.1pF, ±0.25pF, ±0.5pF	75	200	0.2±0.02	R
TVS042 CG5R2□C-W			CG	C0G	5.2 p	±0.1pF, ±0.25pF, ±0.5pF	75	200	0.2±0.02	R
TVS042 CG5R3□C-W			CG	C0G	5.3 p	±0.1pF, ±0.25pF, ±0.5pF	75	200	0.2±0.02	R
TVS042 CG5R4□C-W			CG	C0G	5.4 p	±0.1pF, ±0.25pF, ±0.5pF	70	200	0.2±0.02	R
TVS042 CG5R5□C-W			CG	C0G	5.5 p	±0.1pF, ±0.25pF, ±0.5pF	70	200	0.2±0.02	R
TVS042 CG5R6□C-W			CG	C0G	5.6 p	±0.1pF, ±0.25pF, ±0.5pF	70	200	0.2±0.02	R
TVS042 CG5R7□C-W			CG	C0G	5.7 p	±0.1pF, ±0.25pF, ±0.5pF	70	200	0.2±0.02	R
TVS042 CG5R8□C-W			CG	C0G	5.8 p	±0.1pF, ±0.25pF, ±0.5pF	70	200	0.2±0.02	R
TVS042 CG5R9□C-W			CG	C0G	5.9 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG060□C-W			CG	C0G	6 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG6R1□C-W			CG	C0G	6.1 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG6R2□C-W			CG	C0G	6.2 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG6R3□C-W			CG	C0G	6.3 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG6R4□C-W			CG	C0G	6.4 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG6R5□C-W			CG	C0G	6.5 p	±0.1pF, ±0.25pF, ±0.5pF	65	200	0.2±0.02	R
TVS042 CG6R6□C-W			CG	C0G	6.6 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG6R7□C-W			CG	C0G	6.7 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG6R8□C-W			CG	C0G	6.8 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG6R9□C-W			CG	C0G	6.9 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG070□C-W			CG	C0G	7 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG7R1□C-W			CG	C0G	7.1 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG7R2□C-W			CG	C0G	7.2 p	±0.1pF, ±0.25pF, ±0.5pF	60	200	0.2±0.02	R
TVS042 CG7R3□C-W			CG	C0G	7.3 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG7R4□C-W			CG	C0G	7.4 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG7R5□C-W			CG	C0G	7.5 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG7R6□C-W			CG	C0G	7.6 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG7R7□C-W			CG	C0G	7.7 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG7R8□C-W			CG	C0G	7.8 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG7R9□C-W			CG	C0G	7.9 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG080□C-W			CG	C0G	8 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG8R1□C-W			CG	C0G	8.1 p	±0.1pF, ±0.25pF, ±0.5pF	55	200	0.2±0.02	R
TVS042 CG8R2□C-W			CG	C0G	8.2 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG8R3□C-W			CG	C0G	8.3 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG8R4□C-W			CG	C0G	8.4 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG8R5□C-W			CG	C0G	8.5 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R

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■PARTS NUMBER

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q (at 1GHz) (min)	HTLT Rated voltage x %	Thickness*3 [mm]	Soldering R:Reflow W:Wave
TVS042 CG8R6□C-W		25	CG	C0G	8.6 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG8R7□C-W			CG	C0G	8.7 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG8R8□C-W			CG	C0G	8.8 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG8R9□C-W			CG	C0G	8.9 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG090□C-W			CG	C0G	9 p	±0.1pF, ±0.25pF, ±0.5pF	50	200	0.2±0.02	R
TVS042 CG9R1□C-W			CG	C0G	9.1 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R2□C-W			CG	C0G	9.2 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R3□C-W			CG	C0G	9.3 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R4□C-W			CG	C0G	9.4 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R5□C-W			CG	C0G	9.5 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R6□C-W			CG	C0G	9.6 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R7□C-W			CG	C0G	9.7 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R8□C-W			CG	C0G	9.8 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG9R9□C-W			CG	C0G	9.9 p	±0.1pF, ±0.25pF, ±0.5pF	45	200	0.2±0.02	R
TVS042 CG100□C-W			CG	C0G	10 p	±2%, ±5%	45	200	0.2±0.02	R
TVS042 CG110JC-W			CG	C0G	11 p	±5%	40	200	0.2±0.02	R
TVS042 CG120JC-W			CG	C0G	12 p	±5%	40	200	0.2±0.02	R
TVS042 CG130JC-W			CG	C0G	13 p	±5%	40	200	0.2±0.02	R
TVS042 CG150JC-W			CG	C0G	15 p	±5%	40	200	0.2±0.02	R
TVS042 CG160JC-W			CG	C0G	16 p	±5%	40	200	0.2±0.02	R
TVS042 CG180JC-W			CG	C0G	18 p	±5%	40	200	0.2±0.02	R
TVS042 CG220JC-W			CG	C0G	22 p	±5%	30	200	0.2±0.02	R

●105TYPE

【Temperature Characteristic CG : CG/C0G】 0.5mm thickness (W)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q (at 1GHz) (min)	HTLT Rated voltage x %	Thickness*3 [mm]	Soldering R:Reflow W:Wave
EVK105 CG0R3BW-F		16	CG	C0G	0.3 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG0R4BW-F			CG	C0G	0.4 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG0R5BW-F			CG	C0G	0.5 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG0R6BW-F			CG	C0G	0.6 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG0R7BW-F			CG	C0G	0.7 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG0R8BW-F			CG	C0G	0.8 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG0R9BW-F			CG	C0G	0.9 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG010BW-F			CG	C0G	1 p	±0.1pF	300	200	0.5±0.05	R
EVK105 CG1R1BW-F			CG	C0G	1.1 p	±0.1pF	280	200	0.5±0.05	R
EVK105 CG1R2BW-F			CG	C0G	1.2 p	±0.1pF	270	200	0.5±0.05	R
EVK105 CG1R3BW-F			CG	C0G	1.3 p	±0.1pF	260	200	0.5±0.05	R
EVK105 CG1R5BW-F			CG	C0G	1.5 p	±0.1pF	240	200	0.5±0.05	R
EVK105 CG1R6BW-F			CG	C0G	1.6 p	±0.1pF	230	200	0.5±0.05	R
EVK105 CG1R8BW-F			CG	C0G	1.8 p	±0.1pF	210	200	0.5±0.05	R
EVK105 CG020BW-F			CG	C0G	2 p	±0.1pF	190	200	0.5±0.05	R
EVK105 CG2R2JW-F			CG	C0G	2.2 p	±5%	180	200	0.5±0.05	R
EVK105 CG2R4JW-F			CG	C0G	2.4 p	±5%	170	200	0.5±0.05	R
EVK105 CG2R7JW-F			CG	C0G	2.7 p	±5%	150	200	0.5±0.05	R
EVK105 CG030JW-F			CG	C0G	3 p	±5%	130	200	0.5±0.05	R
EVK105 CG3R3JW-F			CG	C0G	3.3 p	±5%	120	200	0.5±0.05	R
EVK105 CG3R6JW-F			CG	C0G	3.6 p	±5%	110	200	0.5±0.05	R
EVK105 CG3R9JW-F			CG	C0G	3.9 p	±5%	99	200	0.5±0.05	R
EVK105 CG4R3JW-F			CG	C0G	4.3 p	±5%	84	200	0.5±0.05	R
EVK105 CG4R7JW-F			CG	C0G	4.7 p	±5%	84	200	0.5±0.05	R
EVK105 CG5R1JW-F			CG	C0G	5.1 p	±5%	84	200	0.5±0.05	R

【Temperature Characteristic CG : CG/C0G】 0.5mm thickness (W)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q (at 1GHz) (min)	HTLT Rated voltage x %	Thickness*3 [mm]	Soldering R:Reflow W:Wave
UVK105 CG0R3BW-F		50	CG	C0G	0.3 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG0R4BW-F			CG	C0G	0.4 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG0R5BW-F			CG	C0G	0.5 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG0R6BW-F			CG	C0G	0.6 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG0R7BW-F			CG	C0G	0.7 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG0R8BW-F			CG	C0G	0.8 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG0R9BW-F			CG	C0G	0.9 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG010BW-F			CG	C0G	1 p	±0.1pF	300	200	0.5±0.05	R
UVK105 CG1R1BW-F			CG	C0G	1.1 p	±0.1pF	280	200	0.5±0.05	R
UVK105 CG1R2BW-F			CG	C0G	1.2 p	±0.1pF	270	200	0.5±0.05	R
UVK105 CG1R3BW-F			CG	C0G	1.3 p	±0.1pF	260	200	0.5±0.05	R
UVK105 CG1R5BW-F			CG	C0G	1.5 p	±0.1pF	240	200	0.5±0.05	R
UVK105 CG1R6BW-F			CG	C0G	1.6 p	±0.1pF	230	200	0.5±0.05	R
UVK105 CG1R8BW-F			CG	C0G	1.8 p	±0.1pF	210	200	0.5±0.05	R
UVK105 CG020BW-F			CG	C0G	2 p	±0.1pF	190	200	0.5±0.05	R
UVK105 CG2R2JW-F			CG	C0G	2.2 p	±5%	180	200	0.5±0.05	R
UVK105 CG2R4JW-F			CG	C0G	2.4 p	±5%	170	200	0.5±0.05	R
UVK105 CG2R7JW-F			CG	C0G	2.7 p	±5%	150	200	0.5±0.05	R
UVK105 CG030JW-F			CG	C0G	3 p	±5%	130	200	0.5±0.05	R
UVK105 CG3R3JW-F			CG	C0G	3.3 p	±5%	120	200	0.5±0.05	R
UVK105 CG3R6JW-F			CG	C0G	3.6 p	±5%	110	200	0.5±0.05	R
UVK105 CG3R9JW-F			CG	C0G	3.9 p	±5%	99	200	0.5±0.05	R
UVK105 CG4R3JW-F			CG	C0G	4.3 p	±5%	84	200	0.5±0.05	R
UVK105 CG4R7JW-F			CG	C0G	4.7 p	±5%	84	200	0.5±0.05	R
UVK105 CG5R1JW-F			CG	C0G	5.1 p	±5%	84	200	0.5±0.05	R

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■PACKAGING

①Minimum Quantity

●Taped package

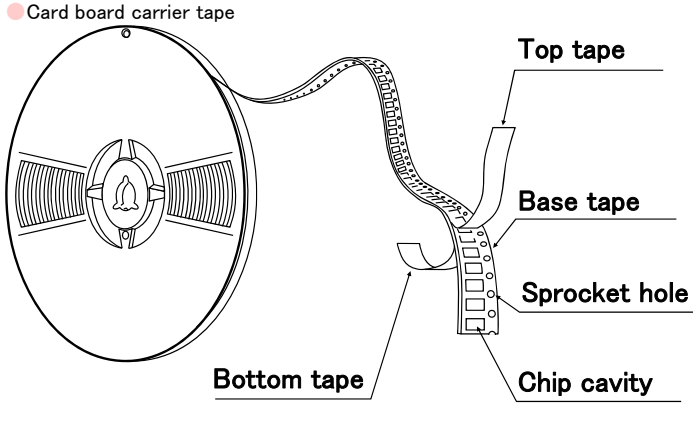
Type(EIA)	Thickness		Standard quantity [pcs]	
	mm	code	Paper tape	Embossed tape
□MK021(008004)	0.125	K	—	50000
□MK042(01005)	0.2	C, D	—	40000
□VS042(01005)	0.2	C		
□MK063(0201)	0.3	P,T	15000	—
□WK105(0204) ※	0.3	P	10000	—
□MK105(0402)	0.13	H	—	20000
	0.18	E	—	15000
	0.2	C	20000	—
	0.3	P	15000	—
	0.5	V	10000	—
□VK105(0402)	0.5	W	10000	—
□MK107(0603)	0.45	K	4000	—
□WK107(0306) ※	0.5	V	—	4000
□MR107(0603)	0.8	A	4000	—
□VS107(0603)	0.7	C	4000	—
□MJ107(0603)	0.8	A	3000	3000
□MK212(0805)	0.45	K	4000	—
□WK212(0508) ※	0.85	D		
□MR212(0805)	1.25	G	—	3000
□VS212(0805)	0.85	D	4000	—
□MJ212(0805)	0.85	D	4000	—
	1.25	G	—	2000
□MK316(1206)	0.85	D	4000	—
□MR316(1206)	1.15	F	—	3000
	1.6	L	—	2000
□MJ316(1206)	1.15	F	—	3000
	1.6	L	—	2000
□MK325(1210)	0.85	D	—	2000
□MR325(1210)	1.15	F		
	1.9	N		
	2.0max.	Y		
	2.5	M	—	1000
□MJ325(1210)	1.9	N	—	2000
	2.5	M	—	500(T), 1000(P)
□MK432(1812)	2.5	M	—	500

Note : ※ LW Reverse type.

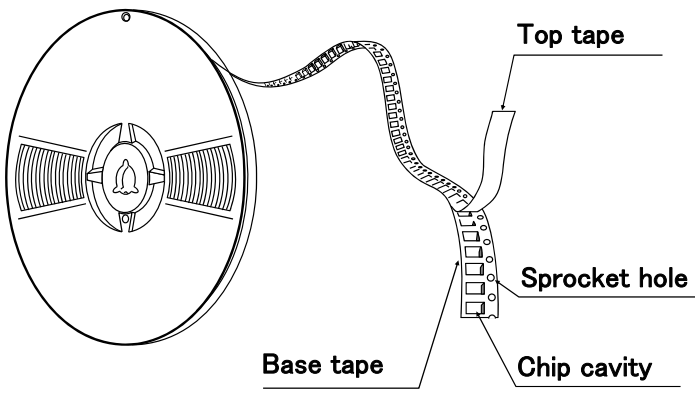
②Taping material

※No bottom tape for pressed carrier tape

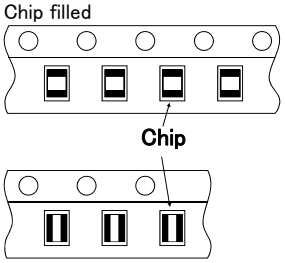
●Card board carrier tape



●Embossed tape



Chip filled



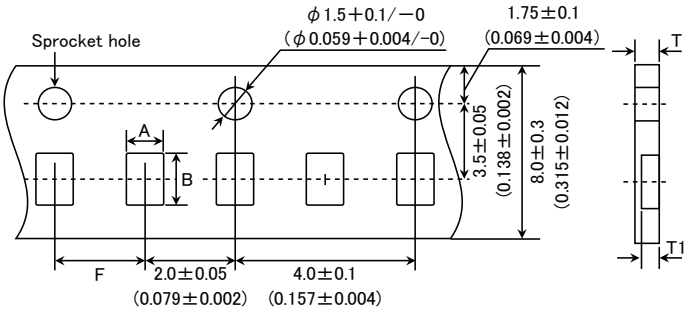
※ LW Reverse type.

③Representative taping dimensions

Paper Tape (8mm wide)

●Pressed carrier tape (2mm pitch)

Unit : mm (inch)



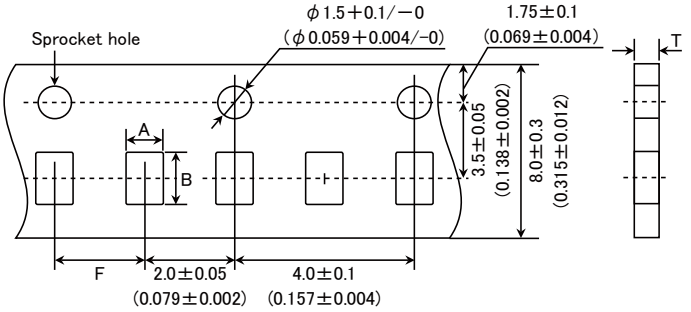
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	T	T1
□MK063(0201)	0.37	0.67	2.0±0.05	0.45max.	0.42max.
□WK105(0204) ※	0.65	1.15			
□MK105(0402) (*1 C)				0.4max.	0.3max.
□MK105(0402) (*1 P)				0.45max.	0.42max.

Note *1 Thickness, C : 0.2mm ,P : 0.3mm. ※ LW Reverse type.

Unit : mm

●Punched carrier tape (2mm pitch)

Unit : mm (inch)

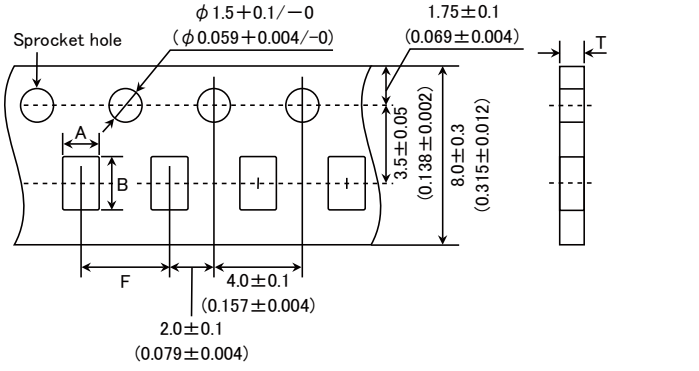


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
□MK105 (0402) □VK105 (0402)	0.65	1.15	2.0±0.05	0.8max.

Unit : mm

●Punched carrier tape (4mm pitch)

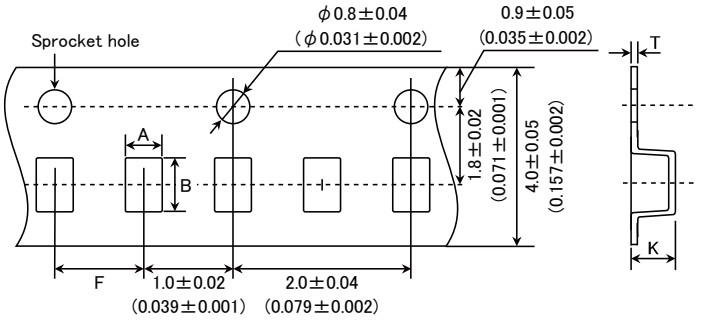
Unit : mm (inch)



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
☐MK107(0603) ☐WK107(0306) ※ ☐MR107(0603)	1.0	1.8	4.0±0.1	1.1max.
☐MK212(0805) ☐WK212(0508) ※	1.65	2.4		1.1max.
☐MK316(1206)	2.0	3.6		

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

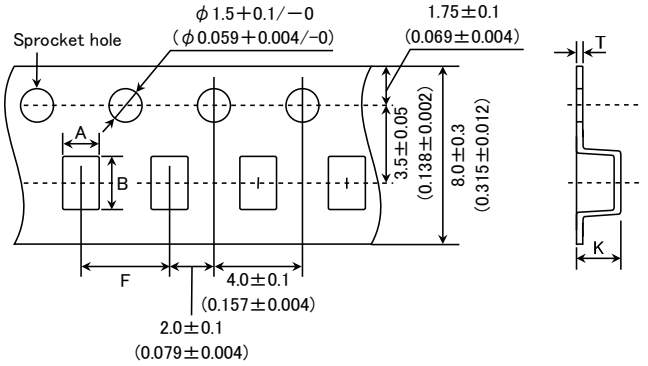
● Embossed tape (4mm wide) Unit : mm (inch)



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
☐MK021(008004)	0.135	0.27	1.0±0.02	0.5max.	0.25max.
☐MK042(01005)	0.23	0.43			
☐VS042(01005)					

Unit : mm

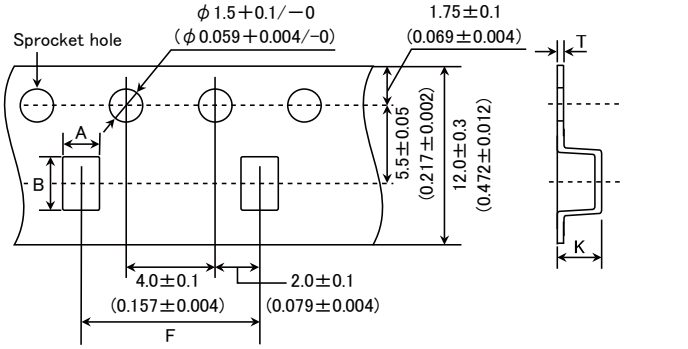
● Embossed tape (8mm wide) Unit : mm (inch)



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
☐MK105(0402)	0.6	1.1	2.0±0.1	0.6max	0.2±0.1
☐WK107(0306) ※	1.0	1.8	4.0±0.1	1.3max.	0.25±0.1
☐MK212(0805) ☐MR212(0805)	1.65	2.4		3.4max.	0.6max.
☐MK316(1206) ☐MR316(1206)	2.0	3.6			
☐MK325(1210) ☐MR325(1210)	2.8	3.6			

Note : ※ LW Reverse type. Unit : mm

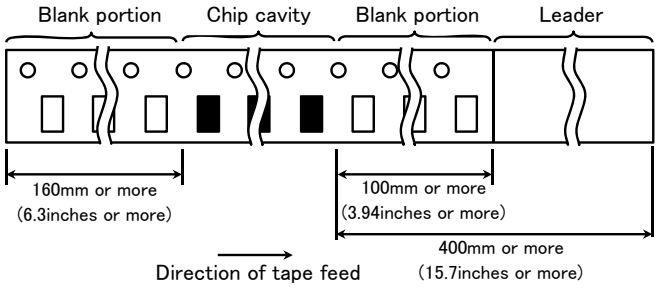
Embossed tape (12mm wide)　　Unit : mm (inch)



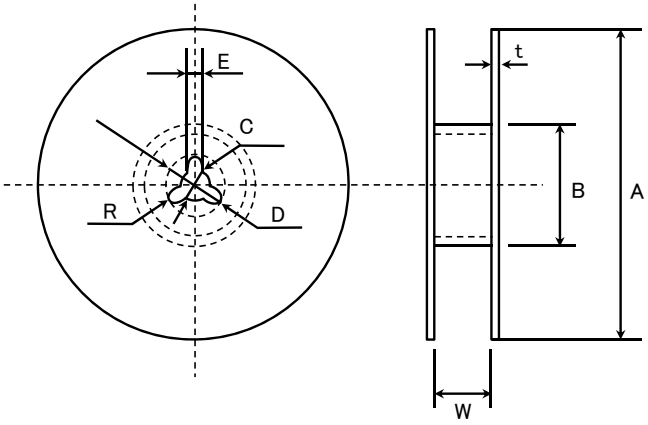
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK325(1210)	3.1	4.0	8.0±0.1	4.0max.	0.6max.
□MK432(1812)	3.7	4.9	8.0±0.1	4.0max.	0.6max.

Unit : mm

④Trailer and Leader



⑤Reel size



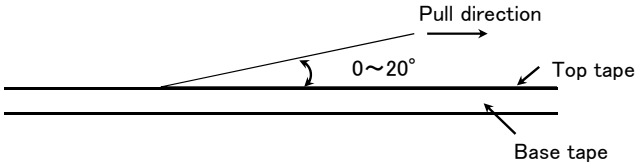
A	B	C	D	E	R
φ178±2.0	φ50min.	φ13.0±0.2	φ21.0±0.8	2.0±0.5	1.0

	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.



Multilayer Ceramic Capacitors

■RELIABILITY DATA

1.Operating Temperature Range

Specified Value	Temperature Compensating(Class1)	Standard / High Frequency Type	−55 to +125℃
	High Permittivity (Class2)		See table below

	Specification	Temperature Range
BJ	B	−25 to +85℃
	X5R	−55 to +85℃
B7	X7R	−55 to +125℃
C6	X6S	−55 to +105℃
C7	X7S	−55 to +125℃
LD(※)	X5R	−55 to +85℃

Note: ※LD Low distortion high value multilayer ceramic capacitor

2. Storage Conditions

Specified Value	Temperature Compensating(Class1)	Standard / High Frequency Type	−55 to +125℃
	High Permittivity (Class2)		See table below

	Specification	Temperature Range
BJ	B	−25 to +85℃
	X5R	−55 to +85℃
B7	X7R	−55 to +125℃
C6	X6S	−55 to +105℃
C7	X7S	−55 to +125℃
LD(※)	X5R	−55 to +85℃

Note: ※LD Low distortion high value multilayer ceramic capacitor

3. Rated Voltage

Specified Value	Temperature Compensating(Class1)	Standard	50VDC, 25VDC, 16VDC
		High Frequency Type	50VDC, 25VDC, 16VDC
	High Permittivity (Class2)		50VDC, 35VDC, 25VDC, 16VDC, 10VDC, 6.3VDC, 4VDC, 2.5VDC

4. Withstanding Voltage (Between terminals)

Specified Value	Temperature Compensating(Class1)	Standard / High Frequency Type	No breakdown or damage
	High Permittivity (Class2)		

Test Methods and Remarks

	Class 1	Class 2
Applied voltage	Rated voltage × 3	Rated voltage × 2.5
Duration	1 to 5 sec.	
Charge/discharge current	50mA max.	

5. Insulation Resistance

Specified Value	Temperature Compensating(Class1)	Standard / High Frequency Type	10000 MΩ min.
	High Permittivity (Class2) Note 1		C≦0.047 μF : 10000 MΩ min. C＞0.047 μF : 500MΩ・μF
Test Methods and Remarks	Applied voltage	: Rated voltage	
	Duration	: 60±5 sec.	
	Charge/discharge current	: 50mA max.	

6. Capacitance (Tolerance)

Specified Value

Temperature Compensating(Class1)	Standard	C□ 0.2pF≦C≦5pF : ±0.25pF U□ 0.2pF≦C≦10pF : ±0.5pF SL C>10pF : ±5% or ±10%
	High Frequency Type	CG 0.2pF≦C≦2pF : ±0.1pF C>2pF : ±5%
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) Note 2	
Measuring frequency	1MHz±10%		1kHz±10%	120±10Hz
Measuring voltage Nte	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1Vrms
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		BJ, B7, C6, C7:2.5% 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) Note 2	
Measuring frequency	1MHz±10%	1GHz	1kHz±10%	120±10Hz
Measuring voltage Note 1	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1Vrms
Bias application	None			

High Frequency Type
Measuring equipment : HP4291A
Measuring jig : HP16192A

8. Temperature Characteristic (Without voltage application)

Specified Value

Temperature Compensating(Class1) — Standard

Temperature Characteristic [ppm/℃]		Tolerance [ppm/℃]
C□ : 0	CG	G : ±30
U□ : −750	UJ, UK	J : ±120 K : ±250
SL : +350 to −1000		

Temperature Compensating(Class1) — High Frequency Type

Temperature Characteristic [ppm/℃]		Tolerance [ppm/℃]
C□ : 0	CG	G : ±30

High Permittivity (Class2)

	Specification	Capacitance change	Reference temperature	Temperature Range
BJ	B	±10%	20℃	−25 to +85℃
	X5R	±15%	25℃	−55 to +85℃
B7	X7R	±15%	25℃	−55 to +125℃
C6	XS	±22%	25℃	−55 to +105℃
C7	X7S	±22%	25℃	−55 to +125℃
LD(※)	X5R	±15%	25℃	−55 to +85℃

Note : ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks

Class 1
Capacitance at 20℃ and 85℃ shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.

$$\frac{(C_{85}-C_{20})}{C_{20}\times\Delta T}\times 10^{6}(\text{ppm/℃}) \qquad \Delta T=65$$

Class 2
Capacitance at each step shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.

Step	B	X5R、X7R、X6S、X7S
1	Minimum operating temperature	
2	20℃	25℃
3	Maximum operating temperature	

$$\frac{(C-C_2)}{C_2}\times 100(\%)$$

C : Capacitance in Step 1 or Step 3
C_2 : Capacitance in Step 2

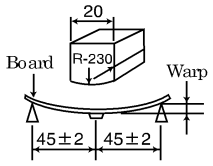
9. Deflection

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±5% or ±0.5 pF, whichever is larger.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within±0.5 pF
	High Permittivity (Class2)		Appearance : No abnormality Capacitance change : Within ±12.5%

Test Methods and Remarks

	Multilayer Ceramic Capacitors	
	021, 042, 063, ※105 Type	The other types
Board	Glass epoxy-resin substrate	
Thickness	0.8mm	1.6mm
Warp	1mm	
Duration	10 sec.	

※105 Type thickness, C: 0.2mm ,P: 0.3mm.



(Unit: mm)

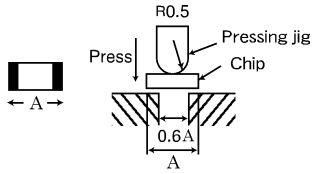
Capacitance measurement shall be conducted with the board bent

10. Body Strength

Specified Value	Temperature Compensating(Class1)	Standard	—
		High Frequency Type	No mechanical damage.
	High Permittivity (Class2)		—

Test Methods and Remarks

High Frequency Type
Applied force : 5N
Duraton : 10 sec.

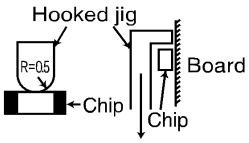


11. Adhesive Strength of Terminal Electrodes

Specified Value	Temperature Compensating(Class1)	Standard	No terminal separation or its indication.
		High Frequency Type	
	High Permittivity (Class2)		

Test Methods and Remarks

	Multilayer Ceramic Capacitors	
	021, 042, 063 Type	105 Type or more
Applied force	2N	5N
Duration	30±5 sec.	



12. Solderability

Specified Value	Temperature Compensating(Class1)	Standard	At least 95% of terminal electrode is covered by new solder.
		High Frequency Type	
	High Permittivity (Class2)		

Test Methods and Remarks

	Eutectic solder	Lead-free solder
Solder type	H60A or H63A	Sn-3.0Ag-0.5Cu
Solder temperature	230±5℃	245±3℃
Duration	4±1 sec.	

13. Resistance to Soldering

Specified Value

Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±2.5% or ±0.25pF, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Frequency Type	Appearance : No abnormality Capacitance change : Within ±2.5% Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±7.5% Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals): No abnormality

Test Methods and Remarks

	Class 1	
	021, 042, 063 Type	105 Type
Preconditioning	None	
Preheating	150℃, 1 to 2 min.	80 to 100℃, 2 to 5 min. 150 to 200℃, 2 to 5 min.
Solder temp.	270±5℃	
Duration	3±0.5 sec.	
Recovery	6 to 24 hrs (Standard condition) Note 5	

	Class 2		
	021, 042、063 Type	105, 107, 212 Type	316, 325, 432 Type
Preconditioning	Thermal treatment (at 150℃ for 1 hr) Note 2		
Preheating	150℃, 1 to 2 min.	80 to 100℃, 2 to 5 min. 150 to 200℃, 2 to 5 min.	80 to 100℃, 5 to 10 min. 150 to 200℃, 5 to 10 min.
Solder temp.	270±5℃		
Duration	3±0.5 sec.		
Recovery	24±2 hrs (Standard condition) Note 5		

14. Temperature Cycle (Thermal Shock)

Specified Value

Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±2.5% or ±0.25pF, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Frequency Type	Appearance : No abnormality Capacitance change : Within ±0.25pF Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±7.5% Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality

Test Methods and Remarks

	Class 1	Class 2
Preconditioning	None	Thermal treatment (at 150℃ for 1 hr) Note 2
1 cycle	Step 1: Minimum operating temperature, 30±3 Step 2: Normal temperature, 2 to 3 Step 3: Maximum operating temperature, 30±3 Step 4: Normal temperature, 2 to 3	
Number of cycles	5 times	
Recovery	6 to 24 hrs (Standard condition) Note 5	24±2 hrs (Standard condition) Note 5

15. Humidity (Steady State)

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±5% or ±0.5pF, whichever is larger. Q : C＜10pF : Q≧200＋10C 10≦C＜30pF : Q≧275＋2.5C C≧30pF:Q≧350(C:Nominal capacitance) Insulation resistance : 1000 MΩ min.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within ±0.5pF, Insulation resistance : 1000 MΩ min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±12.5% Dissipation factor : 5.0% max. Insulation resistance : 50 MΩ*μF* or 1000 MΩ whichever is smaller.

Test Methods and Remarks	Class 1		Class 2
	Standard	High Frequency Type	All items
Preconditioning	None		Thermal treatment(at 150℃ for 1 hr) Note 2
Temperature	40±2℃	60±2℃	40±2℃
Humidity	90 to 95%RH		90 to 95%RH
Duration	500＋24/－0 hrs		500＋24/－0 hrs
Recovery	6 to 24 hrs (Standard condition) Note 5		24±2 hrs (Standard condition) Note 5

16. Humidity Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±7.5% or ±0.75pF, whichever is larger. Q : C＜30pF:Q≧100＋10C/3 C≧30pF:Q≧200 (C:Nominal capacitance) Insulation resistance : 500 MΩ min.
		High Frequency Type	Appearance : No abnormality Capacitance change : C≦2pF:Within ±0.4 pF C＞2pF:Within ±0.75 pF (C:Nominal capacitance) Insulation resistance : 500 MΩ min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±12.5% Dissipation factor : 5.0% max. Insulation resistance : 25 MΩ*μF* or 500 MΩ whichever is smaller.

Test Methods and Remarks	Class 1		Class 2
	Standard	High Frequency Type	All items
Preconditioning	None		Voltage treatment (Rated voltage are applied for 1 hour at 40℃) Note 3
Temperature	40±2℃	60±2℃	40±2℃
Humidity	90 to 95%RH		90 to 95%RH
Duration	500＋24/－0 hrs		500＋24/－0 hrs
Applied voltage	Rated voltage		Rated voltage
Charge/discharge current	50mA max.		50mA max.
Recovery	6 to 24 hrs (Standard condition) Note 5		24±2 hrs(Standard condition) Note 5

17. High Temperature Loading

Specified Value

Temperature Compensating(Class1)	Standard	Appearance	: No abnormality
		Capacitance 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)
		Insulation resistance	: 1000 MΩ min.
	High Frequency Type	Appearance	: No abnormality
		Capacitance change	: Within ±3% or ±0.3pF, whichever is larger.
		Insulation resistance	: 1000 MΩ min.
High Permittivity (Class2) Note 1		Appearance	: No abnormality
		Capacitance change	: Within ±12.5%
		Dissipation factor	: 5.0% max.
		Insulation resistance	: 50 MΩ*μF* or 1000 MΩ whichever is smaller.

Test Methods and Remarks

	Class 1		Class 2		
	Standard	High Frequency Type	BJ, LD(※)	C6	B7, C7
Preconditioning	None		Voltage treatment(Twice the rated voltage shall be applied for 1 hour at 85℃, 105℃ or 125℃) Note 3, 4		
Temperature	Maximum operating temperature		Maximum operating temperature		
Duration	1000＋48/－0 hrs		1000＋48/－0 hrs		
Applied voltage	Rated voltage×2 Note 4		Rated voltage×2 Note 4		
Charge/discharge current	50mA max.		50mA max.		
Recovery	6 to 24hr (Standard condition) Note 5		24±2 hrs (Standard condition) Note 5		

Note: ※LD Low distortion high value multilayer ceramic capacitor

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

Note 2 Thermal treatment : Initial value shall be measured after test sample is heat-treated at 150＋0/－10℃ for an hour and kept at room temperature for 24±2hours.

Note 3 Voltage treatment : Initial value shall be measured after test sample is voltage-treated for an hour at both the temperature and voltage specified in the test conditions, and kept at room temperature for 24±2hours.

Note 4 150% of rated voltage is applicable to some items. Please refer to their specifications for further information.

Note 5 Standard condition: Temperature: 5 to 35℃, Relative humidity: 45 to 85 % RH, Air pressure: 86 to 106kPa When there are questions concerning measurement results, in order to provide correlation data, the test shall be conducted under the following condition.
Temperature: 20±2℃, Relative humidity: 60 to 70 % RH, Air pressure: 86 to 106kPa Unless otherwise specified, all the tests are conducted under the "standard condition".

Precautions on the use of Multilayer Ceramic Capacitors

■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

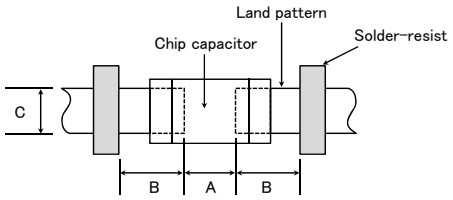
●Multilayer Ceramic Capacitors : Recommended land dimensions

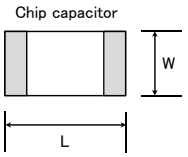
(unit: mm)

Wave-soldering

Type		107	212	316	325
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

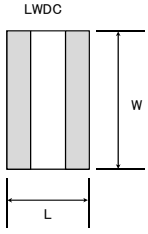
Type		021	042	063	105	107	212	316	325	432
Size	L	0.25	0.4	0.6	1.0	1.6	2.0	3.2	3.2	4.5
	W	0.125	0.2	0.3	0.5	0.8	1.25	1.6	2.5	3.2
A		0.095～0.135	0.15～0.25	0.20～0.30	0.45～0.55	0.8～1.0	0.8～1.2	1.8～2.5	1.8～2.5	2.5～3.5
B		0.085～0.125	0.15～0.20	0.20～0.30	0.40～0.50	0.6～0.8	0.8～1.2	1.0～1.5	1.0～1.5	1.5～1.8
C		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.

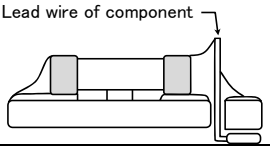
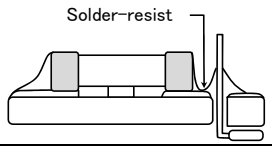
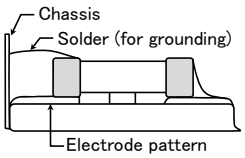
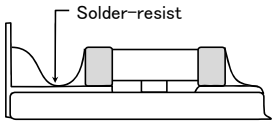
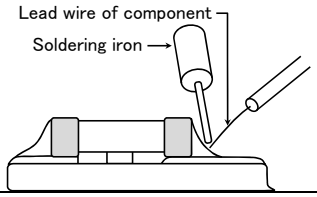
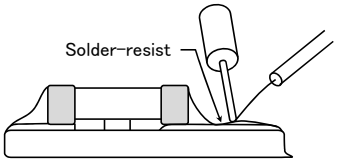
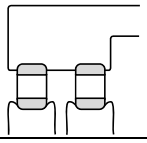
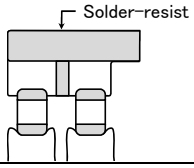
●LWDC: Recommended land dimensions for reflow-soldering

(unit: mm)

Type		105	107	212
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

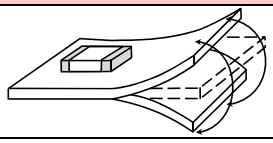
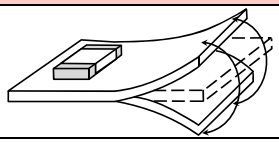


(2)Examples of good and bad solder application

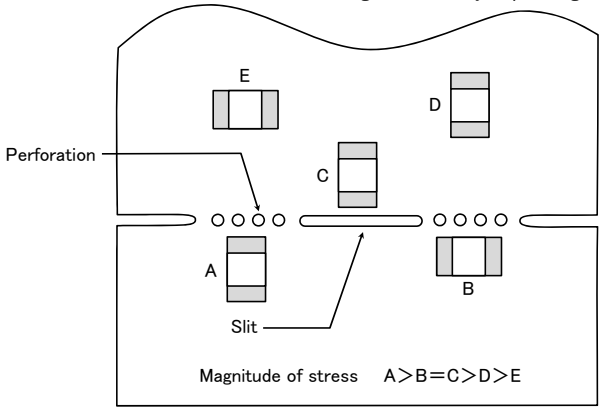
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆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.

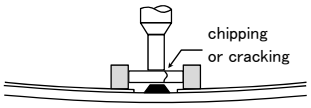
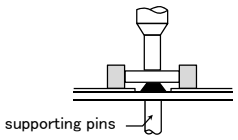
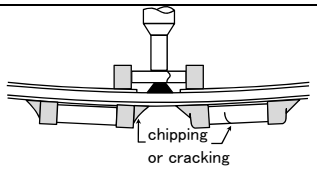
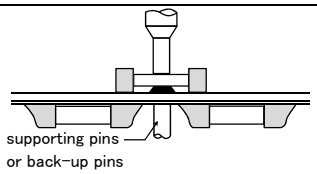
◆Selection of Adhesives

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

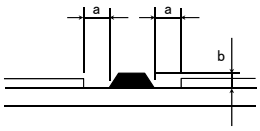
Some adhesives may cause IR deterioration. The different shrinkage percentage of between the adhesive and the capacitors may result in stresses on the capacitors and lead to cracking. Moreover, too little or too much adhesive applied to the board may adversely affect components. Therefore, the following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

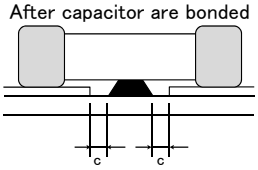
(2) The recommended amount of adhesives is as follows;
   [Recommended condition]

Figure	212/316 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

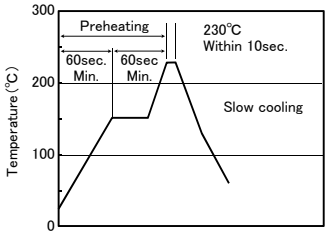
1-1. When too much halogenated substance(Chlorine, etc.) content is used to activate flux, or highly acidic flux is used, it may lead to corrosion of terminal electrodes or degradation of insulation resistance on the surfaces of the capacitors.
1-2. Flux is used to increase solderability in wave soldering. 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

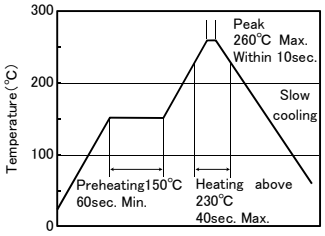
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated 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】



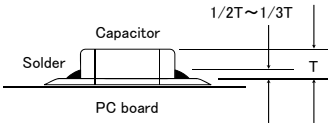
【Recommended condition for Pb-free soldering】



Caution

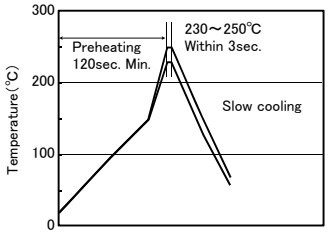
①The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of a capacitor.

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

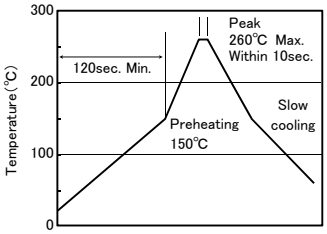


[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】

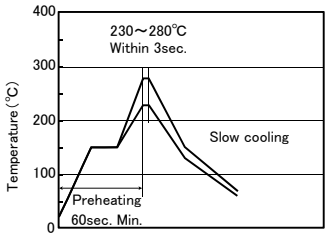


Caution

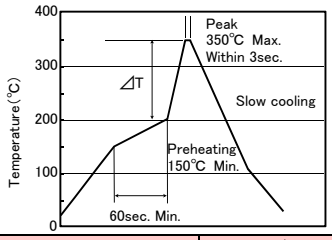
①Wave soldering must not be applied to capacitors designated as for reflow soldering only. soldering for 1 times.

[Hand soldering]

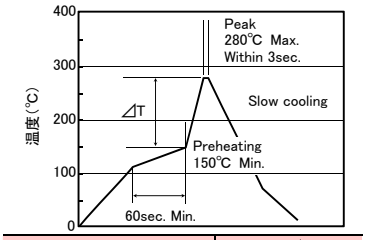
【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



	⊿T
316type or less	⊿T≦150℃



	⊿T
325type 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.