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 2011. 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 usage of the Products.

  Please note that Taiyo Yuden Co., Ltd. shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this catalog or individual specification.

- Please contact Taiyo Yuden Co., Ltd. for further details of product specifications as the individual specification is available.

- Please conduct validation and verification of products in actual condition of mounting and operating environment before commercial shipment of the equipment.

- All electronic components or functional modules listed in this catalog are developed, designed and intended for use in general electronics equipment.(for AV, office automation, household, office supply, information service, telecommunications, (such as mobile phone or PC) etc.). Before incorporating the components or devices into any equipment in the field such as transportation,(automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network (telephone exchange, base station) etc. which may have direct influence to harm or injure a human body, please contact Taiyo Yuden Co., Ltd. for more detail in advance.
  Do not incorporate the products into any equipment in fields such as aerospace, aviation, nuclear control, submarine system, military, etc. where higher safety and reliability are especially required.

  In addition, even electronic components or functional modules that are used for the general electronic equipment, if the equipment or the electric circuit require high safety or reliability function or performances, a sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage.

- The contents of this catalog are applicable to the products which are purchased from our sales offices or distributors (so called "TAIYO YUDEN's official sales channel").
  It is only applicable to the products purchased from any of TAIYO YUDEN's official sales channel.

- Please note that Taiyo Yuden Co., Ltd. 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 your usage of products in this catalog. Taiyo Yuden Co., Ltd. grants no license for such rights.

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

ARRAY TYPE MULTILAYER CERAMIC CAPACITORS

REFLOW

FEATURES

- High density and high efficiency mounting.
- Internal electrodes are composed of nickel for improved cost performance and reliability.

APPLICATIONS

- General electronic equipment
- Communication equipment (cellular phone, wireless applications, etc.)

PART NUMBER

E 4 K 2 1 2 △ B J 1 0 4 M D — T △

❶Rated voltage〔VDC〕

A	4
J	6.3
L	10
E	16
T	25
U	50

❷Series name

2	2 circuits multilayer capacitor
4	4 circuits multilayer capacitor

❸End termination

K	Plated

❹Dimension

Type	(inch)	L×W〔mm〕
096	(0302)	0.9×0.6
110	(0504)	1.37×1.0
212	(0805)	2.0×1.25

❺Dimension tolerance

△	Standard

△=Blank space

❻Temperature characteristics code

BJ	B
	X5R
B7	X7R
CH	CH
	C0H

❼Nominal capacitance〔pF〕

example	
104	100,000
105	1,000,000

❽Capacitance tolerance

F	±1pF
K	±10%
M	±20%

❾Thickness〔mm〕

P	0.3
K	0.45
V	0.5
B	0.6
A	0.8
D	0.85

❿Special code

—	Standard

⓫Packaging

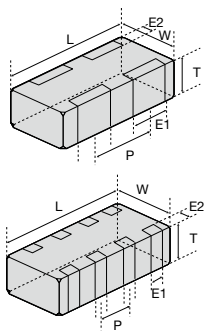
T	ϕ178mm Taping (4mm pitch) 0504, 0805 Type
F	ϕ178mm Taping (2mm pitch) 0302 Type

⓬Internal code

△	Standard

△=Blank space

STANDARD EXTERNAL DIMENSIONS/STANDARD QUANTITY



Type	Dimension [mm]							Standard quantity [pcs]	
	L	W	E1	E2	P	T		Paper tape	Embossed tape
□2K096 (0302 inch)	0.9±0.05	0.6±0.05	0.23±0.10	0.125±0.075	0.45±0.05	P	0.30±0.03	10000	—
						K	0.45±0.05		
□2K110 (0504 inch)	1.37±0.07	1.00±0.08	0.36±0.10	0.2±0.10	0.64±0.10	V	0.50±0.05	4000	—
						B	0.60±0.06		
						A	0.80±0.08		
□2K212 (0805 inch)	2.00±0.10	1.25±0.10	0.50±0.20	0.25±0.15	1.00±0.10	D	0.85±0.10	4000	—
□4K212 (0805 inch)	2.00±0.10	1.25±0.10	0.25±0.10	0.25±0.15	0.50±0.10	D	0.85±0.10	4000	—

AVAILABLE CAPACITANCE RANGE

BJ/B7

Cap [μF]	Type	096 2 circuits □2K096			110 2 circuits □2K110										212 2 circuits □2K212		212 4circuits □4K212				
		B/X5R	X5R		X7R			B/X5R				X5R			B/X5R	X5R	X7R	B/X5R			X5R
	VDC	10V	6.3V	4V	50V	25V	16V	50V	25V	16V	10V	16V	10V	6.3V	25V	10V	16V	25V	16V	10V	10V
	[3-digit]																				
0.001	102				B			B													
0.0022	222				B			B													
0.0047	472				B			B													
0.01	103	P				B			B												
0.022	223					B			B												
0.047	473		K				B			B											
0.1	104		K				B		B	B							D	D	D		
0.22	224		K								B									D	
0.47	474		K								A									D	
1.0	105			K								A	A,V	V	D						D
2.2	225													A		D					

※Letters in the table indicate thickness.

CH

Cap [pF]	Type	096 2 circuits □2K096	110 2 circuits □2K110
		CH	CH
	VDC	25V	50V
	[3-digit]		
10	100	P	B
12	120	P	B
15	150	P	B
18	180	P	B
22	220	P	B
27	270	P	B
33	330	P	B
39	390	P	B
47	470	P	B
56	560	P	B
68	680	P	B
82	820	P	B
100	101	P	B

※Letters in the table indicate thickness.

Temp.char.Code	Temperature characteristics					Capacitance tolerance〔%〕
	Applicable standard		Temperature range〔℃〕	Ref. Temp.〔℃〕	Capacitance change	
BJ	JIS	B	−25～+85	20	±10 [%]	±10 (K) ±20 (M)
	EIA	X5R	−55～+85	25	±15 [%]	
B7	EIA	X7R	−55～+125	25	±15 [%]	
CH	JIS	CH	−55～+125	20	±60 [ppm/℃]	±10 (K)
	EIA	C0H	−55～+125	25	±60 [ppm/℃]	

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REPRESENTATIVE PART NUMBERS

●096TYPE 2 circuits type

【Temperature Characteristic BJ : B/X5R】

・0.45mm thickness(K)

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance 〔μF〕	Capacitance tolerance	tanδ 〔%〕	Thickness 〔mm〕	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
6.3V	J2K096 BJ473□K		X5R	0.047	±10, ±20	5	0.45±0.05	R	150%		
	J2K096 BJ104□K		X5R	0.1	±10, ±20	5	0.45±0.05	R	150%		
	J2K096 BJ224MK		X5R	0.22	±20	10	0.45±0.05	R	150%		
	J2K096 BJ474MK		X5R	0.47	±20	10	0.45±0.05	R	150%		
4V	A2K096 BJ105MK		X5R	1	±20	10	0.45±0.05	R	150%		

・0.3mm thickness(P)

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance 〔μF〕	Capacitance tolerance	tanδ 〔%〕	Thickness 〔mm〕	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
10V	L2K096 BJ103□P		B/X5R	0.01	±10, ±20	5	0.3±0.03	R	200%		

Capacitance tolerance code is applied to □ of part number.

【Temperature Characteristic CH : CH/C0H】

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance 〔pF〕	Capacitance tolerance	Q	Thickness 〔mm〕	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
25V	T2K096 CH100FP		CH/C0H	10	±1pF	600	0.3±0.03	R	200%		
	T2K096 CH120KP		CH/C0H	12	±10%	640	0.3±0.03	R	200%		
	T2K096 CH150KP		CH/C0H	15	±10%	700	0.3±0.03	R	200%		
	T2K096 CH180KP		CH/C0H	18	±10%	760	0.3±0.03	R	200%		
	T2K096 CH220KP		CH/C0H	22	±10%	840	0.3±0.03	R	200%		
	T2K096 CH270KP		CH/C0H	27	±10%	940	0.3±0.03	R	200%		
	T2K096 CH330KP		CH/C0H	33	±10%	1000	0.3±0.03	R	200%		
	T2K096 CH390KP		CH/C0H	39	±10%	1000	0.3±0.03	R	200%		
	T2K096 CH470KP		CH/C0H	47	±10%	1000	0.3±0.03	R	200%		
	T2K096 CH560KP		CH/C0H	56	±10%	1000	0.3±0.03	R	200%		
	T2K096 CH680KP		CH/C0H	68	±10%	1000	0.3±0.03	R	200%		
	T2K096 CH820KP		CH/C0H	82	±10%	1000	0.3±0.03	R	200%		
	T2K096 CH101KP		CH/C0H	100	±10%	1000	0.3±0.03	R	200%		

Capacitance tolerance code is applied to □ of part number.

●110TYPE 2 circuits type

【Temperature Characteristic BJ : B/X5R】

・0.8mm thickness(A)

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance 〔μF〕	Capacitance tolerance	tanδ 〔%〕	Thickness 〔mm〕	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
16V	E2K110 BJ105□A		X5R	1	±10, ±20	10	0.8±0.08	R	150%		
10V	L2K110 BJ474□A		B/X5R	0.47	±10, ±20	5	0.8±0.08	R	200%		
	L2K110 BJ105□A		X5R	1	±10, ±20	10	0.8±0.08	R	150%		
6.3V	J2K110 BJ225□A		X5R	2.2	±10, ±20	10	0.8±0.08	R	150%		

・0.6mm thickness(B)

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance 〔μF〕	Capacitance tolerance	tanδ 〔%〕	Thickness 〔mm〕	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
50V	U2K110 BJ102□B		B/X5R*1	0.001	±10, ±20	3.5	0.6±0.06	R	200%		
	U2K110 BJ222□B		B/X5R*1	0.0022	±10, ±20	3.5	0.6±0.06	R	200%		
	U2K110 BJ472□B		B/X5R*1	0.0047	±10, ±20	3.5	0.6±0.06	R	200%		
25V	T2K110 BJ103□B		B/X5R*1	0.01	±10, ±20	3.5	0.6±0.06	R	200%		
	T2K110 BJ223□B		B/X5R*1	0.022	±10, ±20	3.5	0.6±0.06	R	200%		
	T2K110 BJ104□B		B/X5R	0.1	±10, ±20	5	0.6±0.06	R	200%		
16V	E2K110 BJ473□B		B/X5R*1	0.047	±10, ±20	3.5	0.6±0.06	R	200%		
	E2K110 BJ104□B		B/X5R*1	0.1	±10, ±20	5	0.6±0.06	R	200%		
10V	L2K110 BJ224□B		B/X5R	0.22	±10, ±20	5	0.6±0.06	R	200%		

・0.5mm thickness(V)

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance 〔μF〕	Capacitance tolerance	tanδ 〔%〕	Thickness 〔mm〕	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
10V	L2K110 BJ105MV		X5R	1	±20	10	0.5±0.05	R	150%		
6.3V	J2K110 BJ105□V		X5R	1	±10, ±20	10	0.5±0.05	R	150%		

Capacitance tolerance code is applied to □ of part number.

*1 We may provide X7R for some itemes according to the individual specification.

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REPRESENTATIVE PART NUMBERS

【Temperature Characteristic B7 : X7R】

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance (μF)	Capacitance tolerance	tanδ (%)	Thickness (mm)	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
50V	U2K110 B7102□B		X7R	0.001	±10, ±20	3.5	0.6±0.06	R	200%		
	U2K110 B7222□B		X7R	0.0022	±10, ±20	3.5	0.6±0.06	R	200%		
	U2K110 B7472□B		X7R	0.0047	±10, ±20	3.5	0.6±0.06	R	200%		
25V	T2K110 B7103□B		X7R	0.01	±10, ±20	3.5	0.6±0.06	R	200%		
	T2K110 B7223□B		X7R	0.022	±10, ±20	3.5	0.6±0.06	R	200%		
16V	E2K110 B7473□B		X7R	0.047	±10, ±20	3.5	0.6±0.06	R	200%		
	E2K110 B7104□B		X7R	0.1	±10, ±20	5	0.6±0.06	R	200%		

Capacitance tolerance code is applied to □ of part number.

【Temperature Characteristic CH : CH/C0H】

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance (pF)	Capacitance tolerance	Q	Thickness (mm)	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
50V	U2K110 CH100FB		CH/C0H	10	±1pF	600	0.6±0.06	R	200%		
	U2K110 CH120KB		CH/C0H	12	±10%	640	0.6±0.06	R	200%		
	U2K110 CH150KB		CH/C0H	15	±10%	700	0.6±0.06	R	200%		
	U2K110 CH180KB		CH/C0H	18	±10%	760	0.6±0.06	R	200%		
	U2K110 CH220KB		CH/C0H	22	±10%	840	0.6±0.06	R	200%		
	U2K110 CH270KB		CH/C0H	27	±10%	940	0.6±0.06	R	200%		
	U2K110 CH330KB		CH/C0H	33	±10%	1000	0.6±0.06	R	200%		
	U2K110 CH390KB		CH/C0H	39	±10%	1000	0.6±0.06	R	200%		
	U2K110 CH470KB		CH/C0H	47	±10%	1000	0.6±0.06	R	200%		
	U2K110 CH560KB		CH/C0H	56	±10%	1000	0.6±0.06	R	200%		
	U2K110 CH680KB		CH/C0H	68	±10%	1000	0.6±0.06	R	200%		
	U2K110 CH820KB		CH/C0H	82	±10%	1000	0.6±0.06	R	200%		
	U2K110 CH101KB		CH/C0H	100	±10%	1000	0.6±0.06	R	200%		

●212TYPE 2 circuits type

【Temperature Characteristic BJ : B/X5R】

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance (μF)	Capacitance tolerance	tanδ (%)	Thickness (mm)	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
25V	T2K212 BJ105□D		B/X5R	1	±10, ±20	5	0.85±0.1	R	200%		
10V	L2K212 BJ225MD		X5R	2.2	±20	10	0.85±0.1	R	150%		

Capacitance tolerance code is applied to □ of part number.

●212TYPE 4 circuits type

【Temperature Characteristic BJ : B/X5R】

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance (μF)	Capacitance tolerance	tanδ (%)	Thickness (mm)	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
25V	T4K212 BJ104□D		B/X5R	0.1	±10, ±20	5	0.85±0.1	R	200%		
16V	E4K212 BJ104□D		B/X5R*1	0.1	±10, ±20	5	0.85±0.1	R	200%		
10V	L4K212 BJ224□D		B/X5R	0.22	±10, ±20	5	0.85±0.1	R	200%		
	L4K212 BJ474□D		B/X5R	0.47	±10, ±20	5	0.85±0.1	R	200%		
	L4K212 BJ105□D		X5R	1	±10, ±20	10	0.85±0.1	R	150%		

Capacitance tolerance code is applied to □ of part number.
*1 We may provide X7R for some itemes according to the individual specification.

【Temperature Characteristic B7 : X7R】

Rated voltage	Part number 1	Part number 2	Temp. char.	Capacitance (μF)	Capacitance tolerance	tanδ (%)	Thickness (mm)	Soldering R:Reflow W:Wave	HALT % Rated voltage	Internal code (P/N 1)	Note
16V	E4K212 B7104□D		X7R	0.1	±10, ±20	5	0.85±0.1	R	200%		

Capacitance tolerance code is applied to □ of part number.

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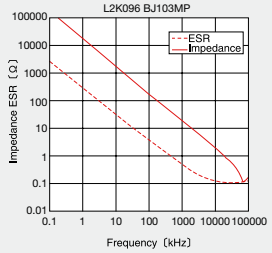
ELECTRICAL CHARACTERISTICS

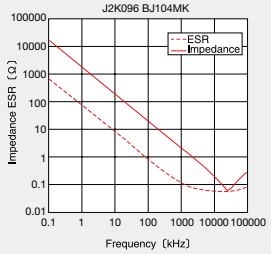
Example of Impedance ESR vs. Frequency characteristics

Taiyo Yuden multilayer ceramic capacitor

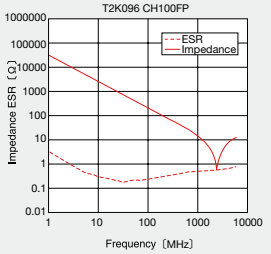
L2K096 BJ103MP



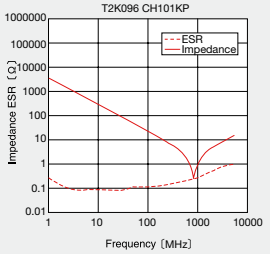
J2K096 BJ104MK



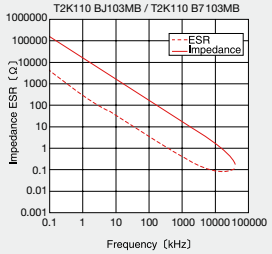
T2K096 CH100FP



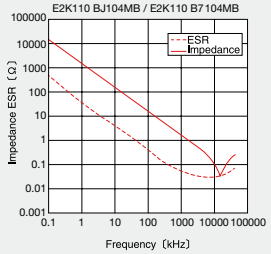
T2K096 CH101KP



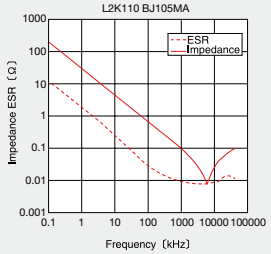
T2K110 BJ103MB / T2K110 B7103MB



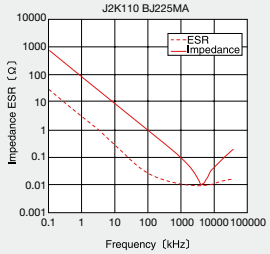
E2K110 BJ104MB / E2K110 B7104MB



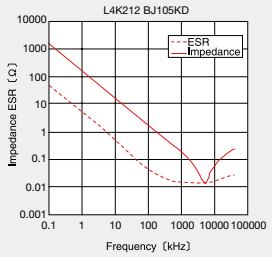
L2K110 BJ105MA



J2K110 BJ225MA



L4K212 BJ105KD



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PACKAGING

①Minimum Quantity

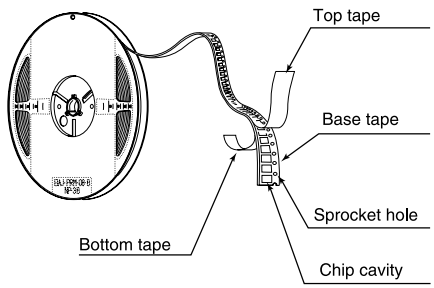
● Taped package

Type	Thickness		Standard quantity [pcs]	
	mm	code	Paper tape	Embossed tape
□MK042	0.2	C,D	—	40000
□MK063	0.3	P,T	15000	
□2K096	0.3	P	10000	
	0.45	K		
□WK105	0.3	P		
□MK105	0.2	C	20000	—
	0.3	P	15000	
	0.5	V, W	10000	
□VK105	0.5	W		
□MK107 □WK107	0.45	K	4000	
	0.5	V	—	4000
□2K110	0.8	A	4000	—
	0.5	V		
	0.6	B		
	0.8	A		
□MK212 □WK212	0.45	K		
	0.85	D		
	1.25	G	—	3000
□4K212	0.85	D	4000	—
□2K212	0.85	D		
□MK316	0.85	D		
	1.15	F	—	3000
	1.25	G		
	1.6	L		2000
□MK325	0.85	D	—	
	1.15	F		
	1.9	N		
	2.0max	Y		
	2.5	M		500(T), 1000(P)
□MK432	2.5	M	—	500

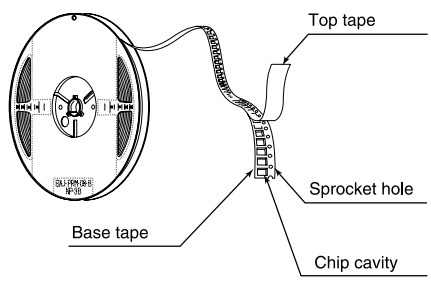
②Taping material

※No bottom tape for pressed carrier tape

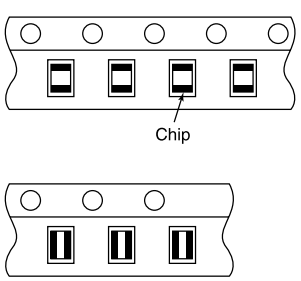
● Paper tape



● Embossed tape



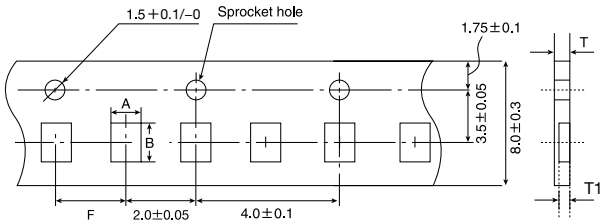
● Chip filled



③Representative taping dimensions

● Paper Tape (8mm wide)

● Pressed carrier tape (2mm pitch)

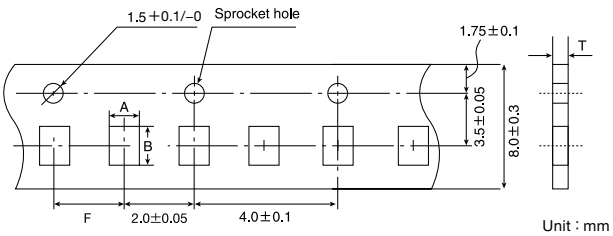


Unit : mm

Type	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	T	T1
□MK063	0.37	0.67	2.0±0.05	0.45max.	0.42max.
□2K096	0.65	1.02			
□WK105	0.65	1.15			
MK105(*1C)				0.4max.	0.3max.
MK105(*1P)				0.45max.	0.42max.

*1 Thickness, C : 0.2mm、P : 0.3mm

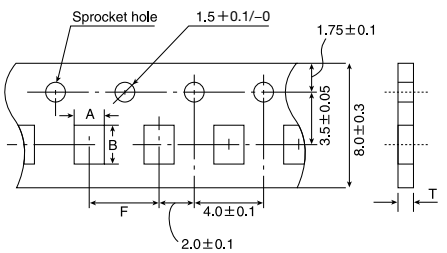
● Punched carrier tape (2mm pitch)



Unit : mm

Type	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
□2K096	0.72	1.02	2.0±0.05	0.6max.
□MK105 □VK105	0.65	1.15		0.8max.

● Punched carrier tape (4mm pitch)



Unit : mm

Type	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
□MK107 □WK107	1.0	1.8	4.0±0.1	1.1max.
□2K110	1.15	1.55		1.0max.
□MK212 □WK212	1.65	2.4		1.1max.
□4K212 □2K212				
□MK316	2.0	3.6		

Note : Taping size might be different depending on the size of the product.

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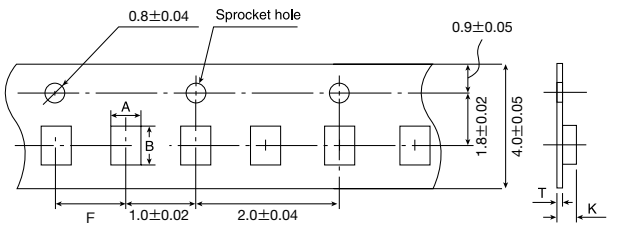
PACKAGING

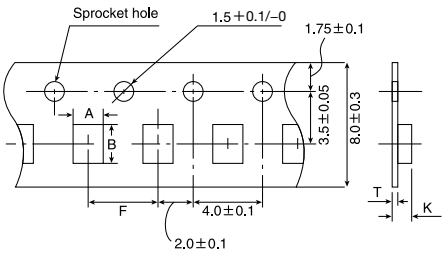
● Embossed tape (4mm wide)



Unit : mm

Type	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK042	0.23	0.43	1.0±0.02	0.5max.	0.25max.

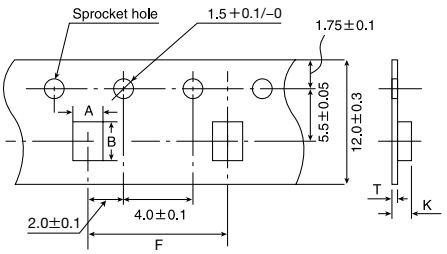
● Embossed tape (8mm wide)



Unit : mm

Type	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□WK107	1.0	1.8	4.0±0.1	1.3max	0.25±0.1
□MK212	1.65	2.4		3.4max.	0.6max.
□MK316	2.0	3.6			
□MK325	2.8	3.6			

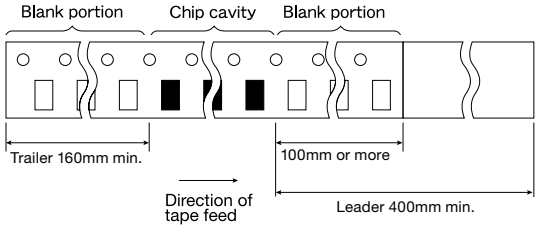
● Embossed tape (12mm wide)



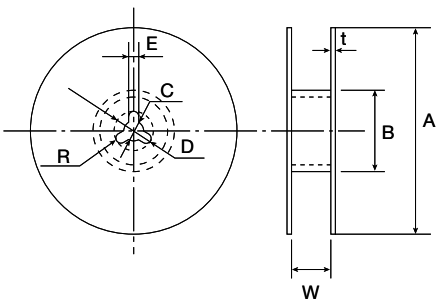
Unit : mm

Type	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK432	3.7	4.9	8.0±0.1	4.0max.	0.6max.

④Trailer and Leader



⑤Reel size



Unit : mm

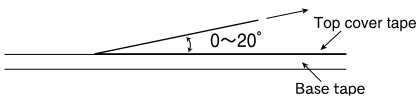
A	B	C
ϕ178±2.0	ϕ50min.	ϕ13.0±0.2

D	E	R
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

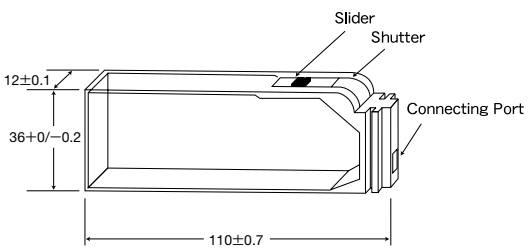
⑥Top Tape Strength

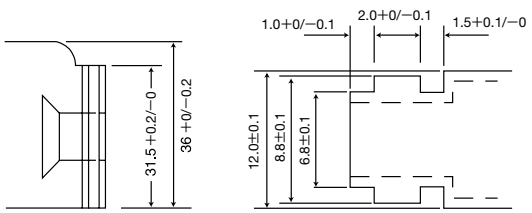
The top tape requires a peel-off force of 0.1 to 0.7N in the direction of the arrow as illustrated below.



⑦Bulk Cassette

The exchange of individual specification is necessary.
Please contact Taiyo Yuden sales channels.





Unit : mm

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RELIABILITY DATA

Super Low Distortion Multilayer Ceramic Capacitors and Medium-High Voltage Multilayer Ceramic Capacitors are noted separately.

Multilayer Ceramic Capacitors

1.Operating Temperature Range

Specified Value	Temperature Compensating (Class 1)	Standard / High Frequency Type	−55 to +125℃
	High Permittivity (Class 2)		

	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℃
F	F	−25 to +85℃
	Y5V	−30 to +85℃

2. Storage Conditions

Specified Value	Temperature Compensating (Class 1)	Standard / High Frequency Type	−55 to +125℃
	High Permittivity (Class 2)		

	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℃
F	F	−25 to +85℃
	Y5V	−30 to +85℃

3. Rated Voltage

Specified Value	Temperature Compensating (Class 1)	Standard	50VDC, 25VDC, 16VDC
		High Frequency Type	50VDC, 16VDC
	High Permittivity (Class 2)		50VDC, 35VDC, 25VDC, 16VDC, 10VDC, 6.3VDC, 4VDC

4. Withstanding Voltage (Between terminals)

Specified Value	Temperature Compensating (Class 1)	Standard / High Frequency Type	No breakdown or damage
	High Permittivity (Class 2)		

【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 (Class 1)	Standard / High Frequency Type	10000 MΩ min.
	High Permittivity (Class 2) Note 1		C≦0.047μF : 10000 MΩ min. C>0.047μF : 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 (Class 1)	Standard	
		High Frequency Type	
	High Permittivity (Class 2)		BJ, B7, C6,C7 : ±10% or ±20%, F : −20%／+80%

C△ U△	0.5pF≦C≦5pF : ±0.25pF	
	0.5pF<C≦10pF : ±0.5pF	
	C>10pF : ±5%	
RH S△ T△	0.5pF≦C≦2pF : ±0.1pF	
	C>2pF : ±5%	

CH RH	0.5pF≦C≦2pF : ±0.1pF
	C>2pF : ±5%

【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 Note 1	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1Vrms
Bias application	None			

7. Q or Dissipation Factor

Specified Value	Temperature Compensating (Class 1)	Standard	C<30 pF : Q≧400+20C、C≧30 pF : Q≧1000 (C : Nominal capacitance)
		High Frequency Type	Refer to detailed specification
	High Permittivity (Class 2) Note 1		BJ, B7, C6,C7 : 2.5% max., F : 7% 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

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RELIABILITY DATA

8. Temperature Characteristic (Without voltage application)

Specified Value

Temperature Compensating (Class 1)	Standard	
	High Frequency Type	

Temperature Characteristic [ppm/℃]		Tolerance
C□ : 0	CH, CJ, CK	H±60 J±120 K±250
R□ : −220	RH	
S□ : −330	SH, SJ, SK	
T□ : −470	TJ, TK	
U□ : −750	UJ, UK	
SL : +350 to −1000		

High Permittivity (Class 2)

	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	X6S	±22%	25℃	−55 to +105℃
C7	X7S	±22%	25℃	−55 to +125℃
F	F	+30/−80%	20℃	−25 to +85℃
	Y5V	+22/−82%	25℃	−30 to +85℃

【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.

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

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、F	X5R、X7R、X6S、X7S、Y5V
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

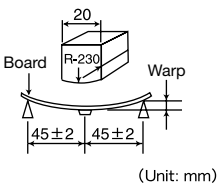
Temperature Compensating (Class 1)	Standard	Appearance : No abnormality Capacitance change : Within ±5% or ±0.5 pF, whichever is larger.
	High Frequency Type	Appearance : No abnormality Capacitance change : Within±0.5 pF
High Permittivity (Class 2)		Appearance : No abnormality Capacitance change : Within ±12.5% (BJ, B7, C6, C7), Within ±30% (F)

【Test Methods and Remarks】
Multilayer Ceramic Capacitors

	Board	Thickness	Warp	Duration
042、063 Type	glass epoxy-resin substrate	0.8mm	1mm	10 sec.
The other types		1.6mm		

Array Type

	Board	Thickness	Warp	Duration
096、110、212 Type	glass epoxy-resin substrate	1.6mm	1mm	10 sec.



(Unit: mm)

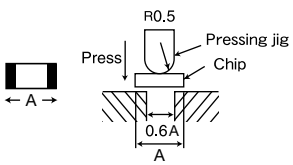
Capacitance measurement shall be conducted with the board bent

10. Body Strength

Specified Value

Temperature Compensating (Class 1)	Standard	—
	High Frequency Type	No mechanical damage.
High Permittivity (Class 2)		—

【Test Methods and Remarks】
High Frequency Type
Applied force: 5N
Duration: 10 sec.



11. Adhesive Strength of Terminal Electrodes

Specified Value

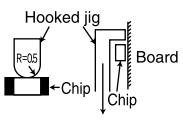
Temperature Compensating (Class 1)	Standard	No terminal separation or its indication.
	High Frequency Type	
High Permittivity (Class 2)		

【Test Methods and Remarks】
Multilayer Ceramic Capacitors

	Applied force	Duration
042、063 Type	2N	30±5 sec.
105 Type or more	5N	

Array Type

	Applied force	Duration
096 Type	2N	30±5 sec.
110、212 Type	5N	



12. Solderability

Specified Value

Temperature Compensating (Class 1)	Standard	At least 95% of terminal electrode is covered by new solder.
	High Frequency Type	
High Permittivity (Class 2)		

【Test Methods and Remarks】

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

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13. Resistance to Soldering

Specified Value	Temperature Compensating (Class 1)	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 (Class 2) Note 1		Appearance: No abnormality Capacitance change: Within ±7.5% (BJ, B7, C6, C7) Within ±20% (F) Dissipation factor: Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality

【Test Methods and Remarks】

Class 1

	042, 063 Type	105 Type Array (096, 110 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

	042、063 Type	105, 107, 212 Type Array (096, 110,212 Type)	316, 325 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 (Class 1)	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 (Class 2) Note 1		Appearance: No abnormality Capacitance change: Within ±7.5% (BJ, B7, C6, C7) Within ±20% (F) 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: Temperature (℃) Lowest operating temperature +0/−3, Time (min.) 30±3 Step 2: Normal temperature, 2 to 3 Step 3: Highest operating temperature +0/−3, 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 (Class 1)	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 (Class 2) Note 1		Appearance: No abnormality Capacitance change: Within ±12.5% (BJ, B7, C6, C7) Within ±30% (F) Dissipation factor: 5.0% max. (BJ, B7, C6, C7) 11.0% max. (F) Insulation resistance: 50 MΩμF or 1000 MΩ whichever is smaller.

【Test Methods and Remarks】

Class 1

	Standard	High Frequency Type
Preconditioning	None	
Temperature	40±2℃	60±2℃
Humidity	90 to 95%RH	
Duration	500+24/−0 hrs	
Recovery	6 to 24 hrs (Standard condition) Note 5	

Class 2

	All items
Preconditioning	Thermal treatment (at 150℃ for 1 hr) Note 2
Temperature	40±2℃
Humidity	90 to 95%RH
Duration	500+24/−0 hrs
Recovery	24±2 hrs (Standard condition) Note 5

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16. Humidity Loading

Specified Value	Temperature Compensating (Class 1)	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 (Class 2) Note 1		Appearance: No abnormality Capacitance change: Within ±12.5% (BJ, B7, C6, C7) Within ±30% (F) Dissipation factor : 5.0% max. (BJ, B7, C6, C7) 11.0% max. (F) Insulation resistance: 25 MΩμF or 500 MΩ, whichever is smaller.

【Test Methods and Remarks】

Class 1

	Standard	High Frequency Type
Preconditioning	None	
Temperature	40±2℃	60±2℃
Humidity	90 to 95%RH	
Duration	500+24/−0 hrs	
Applied voltage	Rated voltage	
Charge/discharge current	50mA max.	
Recovery	6 to 24 hrs (Standard condition) Note 5	

Class 2

	All items
Preconditioning	Voltage treatment (Rated voltage are applied for 1 hour at 40℃) Note 3
Temperature	40±2℃
Humidity	90 to 95%RH
Duration	500+24/−0 hrs
Applied voltage	Rated voltage
Charge/discharge current	50mA max.
Recovery	24±2 hrs (Standard condition) Note 5

17. High Temperature Loading

Specified Value	Temperature Compensating (Class 1)	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 (Class 2) Note 1		Appearance: No abnormality Capacitance change: Within ±12.5% (BJ, B7, C6, C7) Within ±30% (F) Dissipation factor : 5.0% max. (BJ, B7, C6, C7) 11.0% max. (F) Insulation resistance: 50 MΩμF or 1000 MΩ, whichever is smaller.

【Test Methods and Remarks】

Class 1

	Standard	High Frequency Type
Preconditioning	None	
Temperature	125±3℃	
Duration	1000+48/−0 hrs	
Applied voltage	Rated voltage×2	
Charge/discharge current	50mA max.	
Recovery	6 to 24hr (Standard condition) Note 5	

Class 2

	BJ, F	C6	B7, C7
Preconditioning	Voltage treatment (Twice the rated voltage shall be applied for 1 hour at 85℃, 105℃ or 125℃) Note 3, 4		
Temperature	85±2℃	105±3℃	125±3℃
Duration	1000+48/−0 hrs		
Applied voltage	Rated voltage×2 Note 4		
Charge/discharge current	50mA max.		
Recovery	24±2 hrs (Standard condition) Note 5		

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".

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For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (http://www.ty-top.com/) or CD catalogs.

PRECAUTIONS

Precautions on the use of Multilayer Ceramic Capacitors

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.

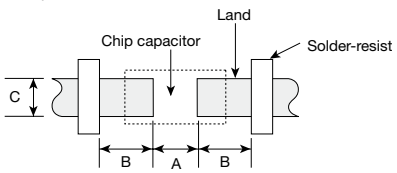
(1) Recommended land dimensions for typical chip capacitors

●Multilayer Ceramic Capacitors : Recommended land dimensions (unit: mm)

Wave-soldering

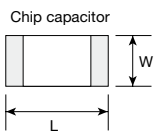
Type		107	212	316	325
Size	L	1.6	2.0	3.2	3.2
	W	0.8	1.25	1.6	2.5
A		0.8 to 1.0	1.0 to 1.4	1.8 to 2.5	1.8 to 2.5
B		0.5 to 0.8	0.8 to 1.5	0.8 to 1.7	0.8 to 1.7
C		0.6 to 0.8	0.9 to 1.2	1.2 to 1.6	1.8 to 2.5

Land patterns for PCBs



Reflow-soldering

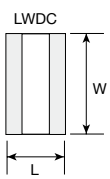
Type		042	063	105	107	212	316	325	432
Size	L	0.4	0.6	1.0	1.6	2.0	3.2	3.2	4.5
	W	0.2	0.3	0.5	0.8	1.25	1.6	2.5	3.2
A		0.15 to 0.25	0.20 to 0.30	0.45 to 0.55	0.8 to 1.0	0.8 to 1.2	1.8 to 2.5	1.8 to 2.5	2.5 to 3.5
B		0.15 to 0.20	0.20 to 0.30	0.40 to 0.50	0.6 to 0.8	0.8 to 1.2	1.0 to 1.5	1.0 to 1.5	1.5 to 1.8
C		0.15 to 0.30	0.25 to 0.40	0.45 to 0.55	0.6 to 0.8	0.9 to 1.6	1.2 to 2.0	1.8 to 3.2	2.3 to 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)

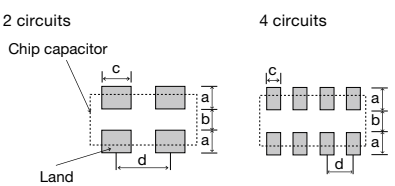
Type		105	107	212
Size	L	0.52	0.8	1.25
	W	1.0	1.6	2.0
A		0.18 to 0.22	0.25 to 0.3	0.5 to 0.7
B		0.2 to 0.25	0.3 to 0.4	0.4 to 0.5
C		0.9 to 1.1	1.5 to 1.7	1.9 to 2.1



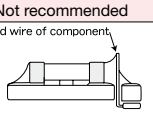
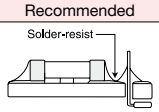
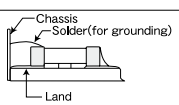
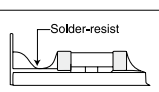
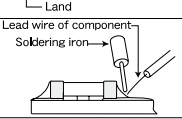
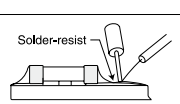
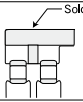
●Array type: Recommended land dimensions for reflow-soldering (unit: mm)

Type		096 (2 circuits)	110 (2 circuits)	212 (2 circuits)	212 (4 circuits)
Size	L	0.9	1.37	2.0	2.0
	W	0.6	1.0	1.25	1.25
a		0.25 to 0.35	0.35 to 0.45	0.5 to 0.6	0.5 to 0.6
b		0.15 to 0.25	0.55 to 0.65	0.5 to 0.6	0.5 to 0.6
c		0.15 to 0.25	0.3 to 0.4	0.5 to 0.6	0.2 to 0.3
d		0.45	0.64	1.0	0.5

2 circuits　　4 circuits



(2) Examples of good and bad solder application

Items	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		

To next page

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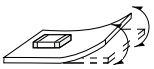
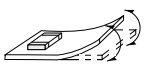
Precautions on the use of Multilayer Ceramic Capacitors

2. PCB Design

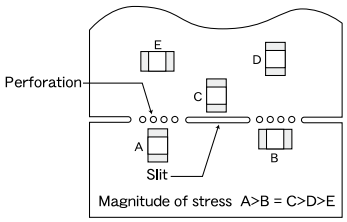
◆Pattern configurations (Capacitor layout on PCBs)

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		 Position the component at a right angle to the direction of the mechanical stresses that are anticipated.

Technical considerations

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.

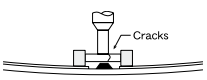
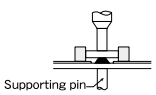
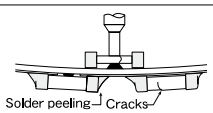
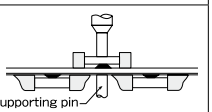
◆Selection of Adhesives

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:

Items	Not recommended	Recommended
Single-sided mounting	 Cracks	 Supporting pin
Double-sided mounting	 Solder peeling Cracks	 Supporting pin

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.

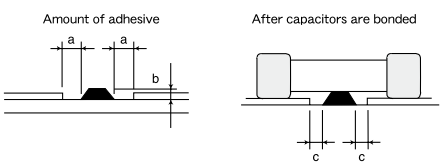
(1) Required adhesive characteristics

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



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Precautions on the use of Multilayer Ceramic Capacitors

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 consider-ations

◆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.

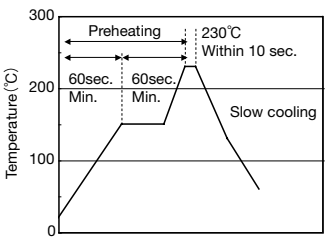
1-3. Since the residue of water-soluble flux is easily dissolved in moisture in the air, the residues on the surfaces of capacitors in high humidity conditions may cause a degradation of insulation resistance and reliability of the capacitors. Therefore, the cleaning methods and the capability of the machines used shall also be considered carefully when water-soluble flux is used.

◆Soldering

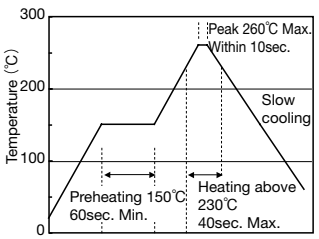
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated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

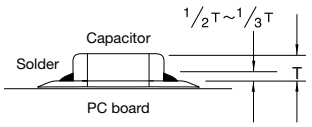
[Reflow soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】





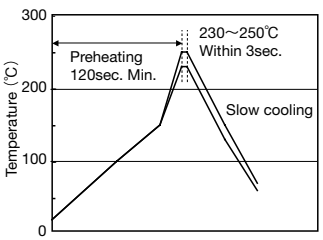
Caution

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

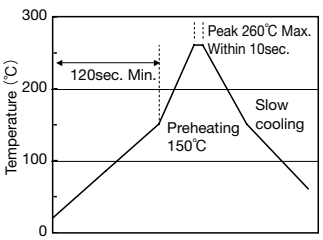
②Because excessive dwell times can adversely affect solderability, soldering duration shall be kept as close to recommended times as possible.

[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】

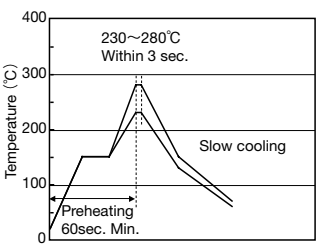


Caution

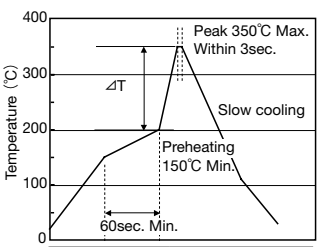
①Wave soldering must not be applied to capacitors designated as for reflow soldering only.

[Hand soldering]

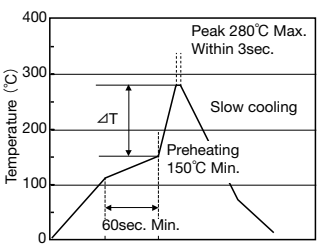
【Recommended conditions for eutectic soldering】



【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.

PRECAUTIONS

Precautions on the use of Multilayer Ceramic Capacitors

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 consider-ations	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 less 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 consider-ations	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.

* 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 Web site (http://www.ty-top.com/) or CD catalogs.