

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 2009. 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. Should you have any question or inquiry on this matter, please contact our sales staff.

SUPER LOW DISTORTION MULTILAYER CERAMIC CAPACITORS(CFCAP™)



REFLOW

FEATURES

- Newly developed dielectric material and the use of nickel for internal electrodes provide superior temperature characteristics with high capacitance, small case size and low cost.
- Low distortion and low shock noise make these capacitors appropriate for use in analog or digital mobile devices.
- Superior heat-resistance, high breakdown voltage, and mechanical strength make these capacitors appropriate for replacing film capacitors.

APPLICATIONS

- Signal line for AV products
- Analog signal coupling applications
- PLL circuit of mobile phones
- Good temperature characteristics for time constant circuits, oscillation circuits and filters

ORDERING CODE

T M K 3 1 6 S D 1 0 4 K L - T △

1 Rated voltage [VDC]

U	50
G	35
T	25
E	16
L	10
J	6.3

2 Series name

M	Multilayer ceramic capacitor
---	------------------------------

3 End termination

K	Plated
---	--------

4 Dimensions (EIA) (L×W) (mm)

105 (0402)	1.0×0.5
107 (0603)	1.6×0.8
212 (0805)	2.0×1.25
316 (1206)	3.2×1.6

5 Series symbol

SD	Standard
----	----------

6 Nominal capacitance [μF]

example	
223	0.022
104	0.1

7 Capacitance tolerance

K	±10%
---	------

8 Thickness [mm]

P	0.3
V	0.5
A	0.8
D	0.85
F	1.15
G	1.25
L	1.6

9 Special code

-	Standard Product
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10 Packaging

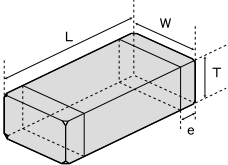
T	φ178mm Taping (4mm pitch) 107, 212, 316 Type
F	φ178mm Taping (2mm pitch) 105 Type

11 Internal code

△	Standard Product
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△=Blank space

EXTERNAL DIMENSIONS/STANDARD QUANTITY



Type (EIA)	L	W	T	e	Standard quantity [pcs]		
					Paper tape	Embossed tape	
□MK105 (0402)	1.0±0.05 (0.039±0.002)	0.5±0.05 (0.020±0.002)	0.3±0.03 (0.012±0.001)	P	0.25±0.10 (0.010±0.004)	10000	-
			0.5±0.05 (0.020±0.002)				
□MK107 (0603)	1.6±0.10 (0.063±0.004)	0.8±0.10 (0.031±0.004)	0.8±0.10 (0.031±0.004)	A	0.35±0.25 (0.014±0.010)	4000	-
			0.85±0.10 (0.033±0.004)				
□MK212 (0805)	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	1.25±0.10 (0.049±0.004)	D	0.5±0.25 (0.020±0.010)	4000	-
			1.15±0.10 (0.045±0.004)				
□MK316 (1206)	3.2±0.15 (0.126±0.006)	1.6±0.15 (0.063±0.006)	1.6±0.20 (0.063±0.008)	F	0.5 ^{+0.35} _{-0.25} (0.020 ^{+0.014} _{-0.010})	-	3000
			1.6±0.20 (0.063±0.008)				
				L			2000

Unit : mm (inch)

AVAILABLE CAPACITANCE RANGE

Cap [μF]	Type Temp.Char VDC [pF:3digits]	105 SD					107 SD				212 SD				316 SD	
		50V	25V	16V	10V	6.3V	50V	25V	16V	10V	50V	35V	16V	10V	35V	25V
		0.00039	391	V												
0.00047	471	V														
0.00056	561	V														
0.00068	681		V													
0.00082	821		V													
0.001	102		V				A									
0.0012	122		V				A									
0.0015	152			V	P		A									
0.0018	182			V			A									
0.0022	222			V			A									
0.0027	272			V		P	A									
0.0033	332				V		A									
0.0039	392				V			A			D					
0.0047	472				V			A			D					
0.0056	562								A		D					
0.0068	682								A		D					
0.0082	822								A		D					
0.01	103								A		D					
0.012	123									A		D				
0.015	153									A		D				
0.018	183									A		G				
0.022	223									A		G				
0.027	273										G					
0.033	333											G				
0.039	393												D		F	
0.047	473														F	F
0.056	563														F	F
0.068	683													G	F	F
0.082	823													G	L	L
0.1	104													G	L	L

*Letters in the table indicate thickness.

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PART NUMBERS

105TYPE (0402 case size)

Rated Voltage	Ordering code		EHS (Environmental Hazardous Substances)	Capacitance [μF]	Temperature characteristics	Dissipation factor [%] Max.	Soldering method R:Reflow soldering W:Wave soldering	Capacitance tolerance	Thickness [mm] (inch)
50V	UMK105 SD391KV		RoHS	0.00039	Standard type	0.1	R	±10%*	0.5±0.05 (0.020±0.002)
	UMK105 SD471KV		RoHS	0.00047					
	UMK105 SD561KV		RoHS	0.00056					
25V	TMK105 SD681KV		RoHS	0.00068					
	TMK105 SD821KV		RoHS	0.00082					
	TMK105 SD102KV		RoHS	0.0010					
16V	TMK105 SD122KV		RoHS	0.0012					
	EMK105 SD152KV		RoHS	0.0015					
	EMK105 SD182KV		RoHS	0.0018					
	EMK105 SD222KV		RoHS	0.0022					
10V	EMK105 SD272KV		RoHS	0.0027					
	LМК105 SD152KP		RoHS	0.0015					
	LМК105 SD332KV		RoHS	0.0033					
	LМК105 SD392KV		RoHS	0.0039					
6.3V	LМК105 SD472KV		RoHS	0.0047					
	JMK105 SD272KP		RoHS	0.0027					

*: Capacitance tolerance J (±5%) is also available. Please contact Taiyo Yuden sales channels.

107TYPE (0603 case size)

Rated Voltage	Ordering code		EHS (Environmental Hazardous Substances)	Capacitance [μF]	Temperature characteristics	Dissipation factor [%] Max.	Soldering method R:Reflow soldering W:Wave soldering	Capacitance tolerance	Thickness [mm] (inch)
50V	UMK107 SD102KA		RoHS	0.0010	Standard type	0.1	R	±10%*	0.8±0.1 (0.031±0.004)
	UMK107 SD122KA		RoHS	0.0012					
	UMK107 SD152KA		RoHS	0.0015					
	UMK107 SD182KA		RoHS	0.0018					
	UMK107 SD222KA		RoHS	0.0022					
	UMK107 SD272KA		RoHS	0.0027					
25V	UMK107 SD332KA		RoHS	0.0033					
	TMK107 SD392KA		RoHS	0.0039					
16V	TMK107 SD472KA		RoHS	0.0047					
	EMK107 SD562KA		RoHS	0.0056					
	EMK107 SD682KA		RoHS	0.0068					
	EMK107 SD822KA		RoHS	0.0082					
10V	EMK107 SD103KA		RoHS	0.010					
	LМК107 SD123KA		RoHS	0.012					
	LМК107 SD153KA		RoHS	0.015					
	LМК107 SD183KA		RoHS	0.018					
	LМК107 SD223KA		RoHS	0.022					

*: Capacitance tolerance J (±5%) is also available. Please contact Taiyo Yuden sales channels.

212TYPE (0805 case size)

Rated Voltage	Ordering code		EHS (Environmental Hazardous Substances)	Capacitance [μF]	Temperature characteristics	Dissipation factor [%] Max.	Soldering method R:Reflow soldering W:Wave soldering	Capacitance tolerance	Thickness [mm] (inch)
50V	UMK212 SD392KD		RoHS	0.0039	Standard type	0.1	R	±10%*	0.85±0.1 (0.033±0.004)
	UMK212 SD472KD		RoHS	0.0047					
	UMK212 SD562KD		RoHS	0.0056					
	UMK212 SD682KD		RoHS	0.0068					
	UMK212 SD822KD		RoHS	0.0082					
35V	UMK212 SD103KD		RoHS	0.01					
	GМК212 SD123KD		RoHS	0.012					
	GМК212 SD153KD		RoHS	0.015					
	GМК212 SD183KG		RoHS	0.018					
	GМК212 SD223KG		RoHS	0.022					
	GМК212 SD273KG		RoHS	0.027					
16V	GМК212 SD333KD		RoHS	0.033					
10V	EMK212 SD333KD		RoHS	0.033					
	LМК212 SD473KD		RoHS	0.047					
	LМК212 SD683KG		RoHS	0.068					
	LМК212 SD823KG		RoHS	0.082					
	LМК212 SD104KG		RoHS	0.1					

*: Capacitance tolerance J (±5%) is also available. Please contact Taiyo Yuden sales channels.

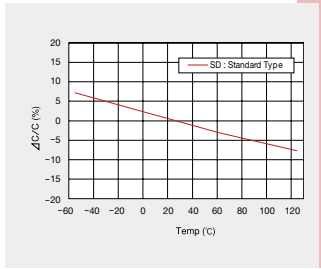
316TYPE (1206 case size)

Rated Voltage	Ordering code		EHS (Environmental Hazardous Substances)	Capacitance [μF]	Temperature characteristics	Dissipation factor [%] Max.	Soldering method R:Reflow soldering W:Wave soldering	Capacitance tolerance	Thickness [mm] (inch)
35V	GМК316 SD333KF		RoHS	0.033	Standard type	0.1	R	±10%*	1.15±0.1 (0.045±0.004)
	GМК316 SD393KF		RoHS	0.039					
25V	TMK316 SD473KF		RoHS	0.047					
	TMK316 SD563KF		RoHS	0.056					
	TMK316 SD683KF		RoHS	0.068					
	TMK316 SD823KL		RoHS	0.082					
	TMK316 SD104KL		RoHS	0.1					

*: Capacitance tolerance J (±5%) is also available. Please contact Taiyo Yuden sales channels.

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Capacitance-temperature characteristics



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PACKAGING

① Minimum Quantity

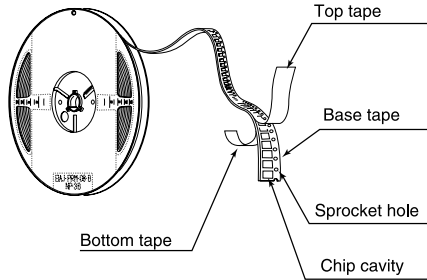
● Taped packaging

Type (EIA)	Thickness		Standard quantity [pcs]		
	mm (inch)	code	Paper tape	Embossed tape	
□MK042(01005)	0.2(0.008)	C	20000	—	
□MK063(0201)	0.3(0.012)	P,T	15000		
□2K096(0302)	0.3(0.012)	P	10000		
□WK105(0204)	0.45(0.018)	K			
	0.3(0.012)	P			
	0.5(0.020)	V			
□MK105(0402)	0.5(0.020)	V, W	4000		
□VK105(0402)	0.5(0.020)	W			
□MK107(0603)	0.45(0.018)	K	—		4000
□WK107(0306)	0.5(0.020)	V			
	0.8(0.031)	A	4000		
	0.5(0.020)	V			
□2K110(0504)	0.6(0.024)	B			
	0.8(0.031)	A			
□MK212(0805)	0.45(0.018)	K	—	3000	
□WK212(0508)	0.85(0.033)	D			
	1.25(0.049)	G	4000		
□4K212(0805)	0.85(0.033)	D			
□2K212(0805)	0.85(0.033)	D	—	3000	
	1.15(0.045)	F			
	1.25(0.049)	G			
□MK316(1206)	1.6(0.063)	L	—	2000	
	0.85(0.033)	D			
	1.15(0.045)	F	—	500(T), 1000(P)	
□MK325(1210)	1.9(0.075)	N			
	2.0max(0.079)	Y			
	2.5(0.098)	M	—	500	
□MK432(1812)	2.5(0.098)	M			

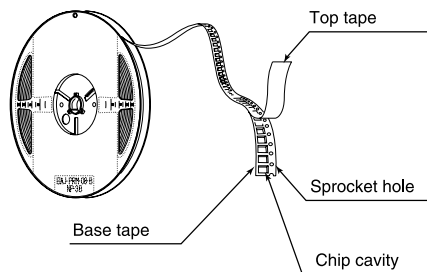
② Taping material

※ No bottom tape for pressed carrier tape

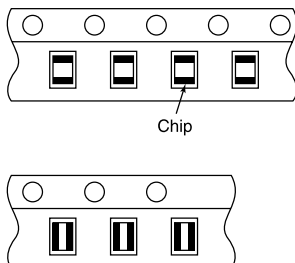
● Paper tape



● Embossed tape



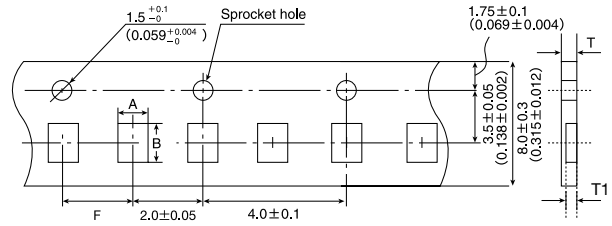
● Chip filled



③ Taping dimensions

● Paper Tape (0.315 inches wide)

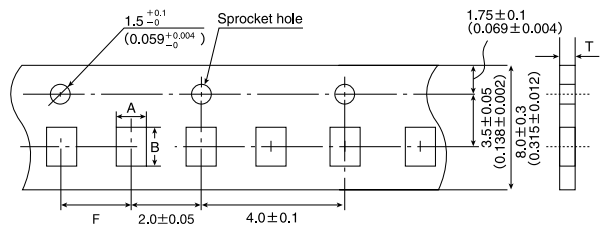
● Pressed carrier tape (2mm pitch)



Type (EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness	
	A	B		T	T1
□MK042(01005)	0.25 (0.010)	0.45 (0.018)	2.0±0.05 (0.079±0.002)	0.36max. (0.014)	0.27max. (0.011)
□MK063(0201)	0.37 (0.016)	0.67 (0.027)		0.45max. (0.018)	0.42max. (0.017)
□WK105(0204)	0.65 (0.026)	1.15 (0.045)		0.45max. (0.018max.)	0.42max. (0.017max.)

Unit: mm (inch)

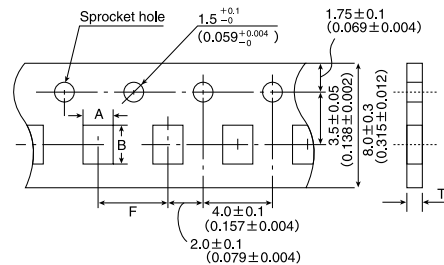
● Punched carrier tape (2mm pitch)



Type (EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness
	A	B		T
□2K096(0302)	0.72 (0.028)	1.02 (0.040)	2.0±0.05 (0.079±0.002)	0.45max.(0.018max.) 0.6max.(0.024max.)
□MK105(0402)	0.65 (0.026)	1.15 (0.045)		0.8max. (0.031max.)

Unit: mm (inch)

● Punched carrier tape (4mm pitch)



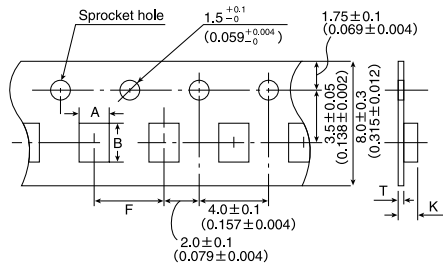
Type (EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness
	A	B		T
□MK107(0603)	1.0 (0.039)	1.8 (0.071)	4.0±0.1 (0.157±0.004)	1.1max. (0.043max.)
□WK107(0306)	1.15 (0.045)	1.55 (0.061)		1.0max. (0.039max.)
□2K110(0504)	1.65 (0.065)	2.4 (0.094)		1.1max. (0.043max.)
□4K212(0805)	2.0 (0.079)	3.6 (0.142)		

Unit: mm (inch)

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PACKAGING

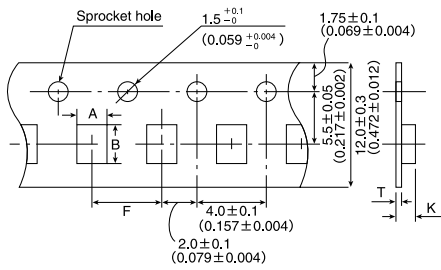
● Embossed tape (0.315 inches wide)



Type(EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness	
	A	B		K	T
□WK107 (0306)	1.0 (0.039)	1.8 (0.071)	4.0 ± 0.1 (0.157 ± 0.004)	1.3max. (0.051max.)	0.25 ± 0.1 (0.01 ± 0.004)
□MK212 (0805)	1.65 (0.065)	2.4 (0.094)		3.4max. (0.134max.)	0.6max. (0.024max.)
□MK316 (1206)	2.0 (0.079)	3.6 (0.142)			
□MK325 (1210)	2.8 (0.110)	3.6 (0.142)			

Unit : mm (inch)

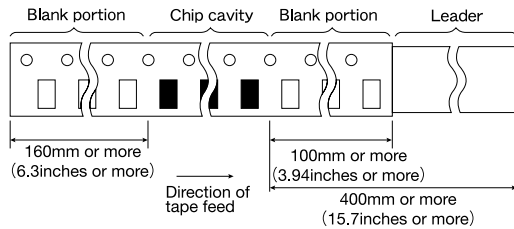
● Embossed tape (0.472 inches wide)



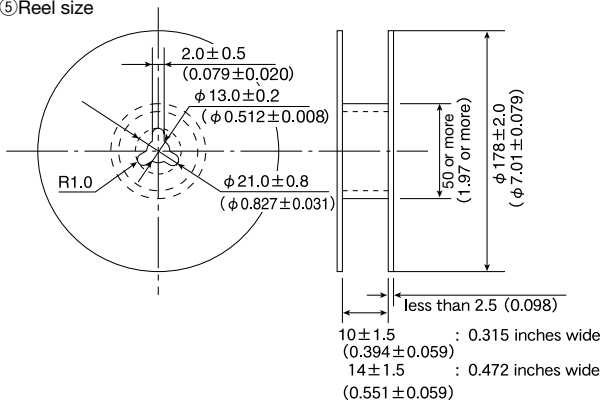
Type(EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness	
	A	B		K	T
□MK432 (1812)	3.7 (0.146)	4.9 (0.193)	8.0 ± 0.1 (0.315 ± 0.004)	4.0max. (0.157max.)	0.6max. (0.024max.)

Unit : mm (inch)

④ Leader and Blank portion



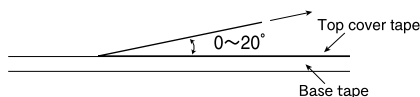
⑤ Reel size



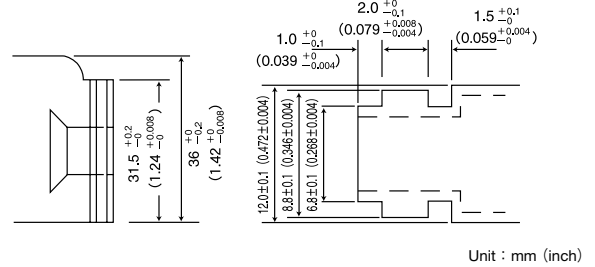
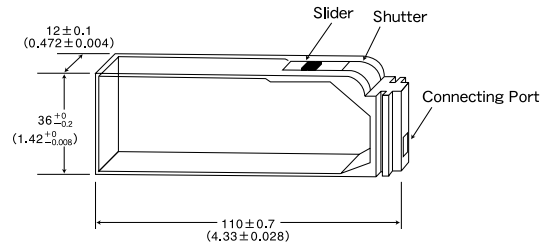
⑥ Top Tape Strength

Unit : mm (inch)

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



⑦ Bulk Cassette

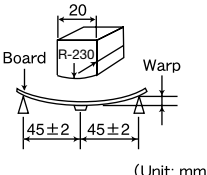
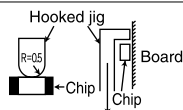


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Multilayer Ceramic Capacitors and Medium-High Voltage Multilayer Ceramic Capacitors are noted separately.

Super Low Distortion Multilayer Ceramic Capacitors (CFCAP)

1. Operating Temperature Range												
Specified Value	-55 to +125°C											
2. Storage Temperature Range												
Specified Value	-55 to +125°C											
3. Rated Voltage												
Specified Value	6.3VDC, 10VDC, 16VDC, 25VDC, 35VDC, 50VDC											
4. Withstanding Voltage (Between terminals)												
Specified Value	No breakdown or damage											
[Test Methods and Remarks] Applied voltage: Rated voltage×3 Duration: 1 to 5 sec. Charge/discharge current: 50mA max.												
5. Insulation Resistance												
Specified Value	10000 MΩ or 500MΩ μF, whichever is smaller											
[Test Methods and Remarks] Applied voltage: Rated voltage Duration: 60±5 sec. Charge/discharge current: 50mA max.												
6. Capacitance (Tolerance)												
Specified Value	±10%											
[Test Methods and Remarks] Measuring frequency : 1kHz±10% Measuring voltage : 1±0.2Vrms Bias application: None												
7. Dissipation Factor												
Specified Value	0.1%max											
[Test Methods and Remarks] Measuring frequency : 1kHz±10% Measuring voltage : 1±0.2Vrms Bias application: None												
8. Deflection												
Specified Value	Appearance: No abnormality Capacitance change: ±5%											
[Test Methods and Remarks] Warp: 1mm Speed: 0.5mm/second Duration: 10 seconds Test board: glass epoxy resin substrate Thickness: 1.6mm Capacitance measurement shall be conducted with the board bent.												
												
9. Adhesive Strength of Terminal Electrodes												
Specified Value	No terminal separation or its indication.											
[Test Methods and Remarks] Applied force: 5N Duration: 30 ±5 seconds												
												
10. Solderability												
Specified Value	At least 95% of terminal electrode is covered by new solder.											
[Test Methods and Remarks]												
	<table border="1"> <thead> <tr> <th></th> <th>Solder type</th> <th>Solder temperature</th> <th>Duration</th> </tr> </thead> <tbody> <tr> <td>Eutectic solder</td> <td>H60A or H63A</td> <td>230±5°C</td> <td rowspan="2">4±1 sec.</td> </tr> <tr> <td>Lead-free solder</td> <td>Sn-3.0Ag-0.5Cu</td> <td>245±3°C</td> </tr> </tbody> </table>		Solder type	Solder temperature	Duration	Eutectic solder	H60A or H63A	230±5°C	4±1 sec.	Lead-free solder	Sn-3.0Ag-0.5Cu	245±3°C
	Solder type	Solder temperature	Duration									
Eutectic solder	H60A or H63A	230±5°C	4±1 sec.									
Lead-free solder	Sn-3.0Ag-0.5Cu	245±3°C										
11. Resistance to Soldering												
Specified Value	Appearance: No abnormality Capacitance change: ±2.5% max. Dissipation factor : Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality											
[Test Methods and Remarks] Solder temp.: 270 ±5°C Duration: 3 ±0.5 sec. Preheating conditions : 80 to 100°C, 2 to 5 min. or 5 to 10 min. 150 to 200°C, 2 to 5 min. or 5 to 10 min. Recovery : 24±2hrs under the standard condition Note1												

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RELIABILITY DATA

12. Temperature Cycle (Thermal Shock)

Specified Value	Appearance: No abnormality Capacitance change: $\pm 2.5\%$ max Dissipation factor : Initial value Insulation resistance: Initial value Withstanding voltage (between terminals) : No abnormality
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[Test Methods and Remarks]

Conditions for 1 cycle / Step 1: Minimum operating temperature $\pm 0_{-3}^0$ °C 30 \pm 3 min.
Step 2: Room temperature 2 to 3 min.
Step 3: Maximum operating temperature $\pm 0_{-3}^0$ °C 30 \pm 3 min.
Step 4: Room temperature 2 to 3 min.

Number of cycles: 5 times
Recovery : 24 \pm 2hrs under the standard condition Note1

13. Humidity (Steady state)

Specified Value	Appearance: No abnormality Capacitance change: $\pm 5\%$ max Dissipation factor : 0.5% max Insulation resistance 50M Ω μ F or 1000M Ω , whichever is smaller
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[Test Methods and Remarks]

Temperature: 40 \pm 2°C
Humidity: 90 to 95% RH
Duration: 500 $\pm 24_{-0}^0$ hrs
Recovery: 24 ± 2 hrs under the standard condition Note1

14. Humidity Loading

Specified Value	Appearance: No abnormality Capacitance change: $\pm 7.5\%$ max Dissipation factor : 0.5% max Insulation resistance: 25M Ω μ F or 500M Ω , whichever is smaller
-----------------	---

[Test Methods and Remarks]

According to JIS C 5102 clause 9.9.
Temperature: 40 \pm 2°C Humidity: 90 to 95% RH
Duration: 500 $\pm 0_{-0}^0$ hrs
Applied voltage: Rated voltage
Charge/discharge current: 50mA max
Recovery: 24 ± 2 hrs under the standard condition Note1

15. High Temperature Loading

Specified Value	Appearance: No abnormality Capacitance change: $\pm 3\%$ max Dissipation factor : 0.35% max Insulation resistance: 50M Ω μ F or 1000M Ω , whichever is smaller
-----------------	---

[Test Methods and Remarks]

According to JIS C 5102 clause 9.10.
Temperature: 125 \pm 3°C
Duration: 1000 $\pm 0_{-0}^0$ hrs
Applied voltage: Rated voltage x 2
Charge/discharge current: 50mA max
Recovery: 24 ± 2 hrs under the standard condition Note1

Note1 Standard condition: Temperature: 5 to 35°C, 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 \pm 2°C, 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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PRECAUTIONS

Precautions on the use of Multilayer Ceramic Capacitors

1. Circuit Design

- ◆ 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

- ◆ 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.

- ◆ 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
	W	0.8	1.25	1.6
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

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	4.5
	W	0.2	0.3	0.5	0.8	1.25	1.6	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

- LWDC: Recommended land dimensions for reflow-soldering (unit: mm)

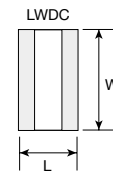
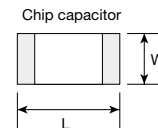
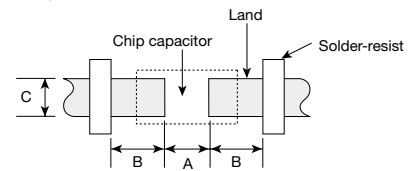
Type	105	107	212
Size	L	0.52	0.8
	W	1.0	1.6
A	0.18 to 0.22	0.25 to 0.3	0.5 to 0.7
B	0.2 to 0.25	0.3 to 0.4	0.4 to 0.5
C	0.9 to 1.1	1.5 to 1.7	1.9 to 2.1

(unit: mm)

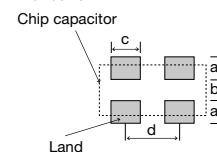
- Array type: Recommended land dimensions for reflow-soldering (unit: mm)

Type	096 (2 circuits)	110 (2 circuits)	212 (2 circuits)	212 (4 circuits)
Size	L	0.9	1.37	2.0
	W	0.6	1.0	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

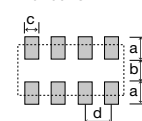
Land patterns for PCBs



2 circuits



4 circuits



Technical considerations

(2) Examples of good and bad solder application

Items	Not recommended	Recommended
Mixed mounting of SMD and leaded components	Lead wire of component	Solder-resist
Component placement close to the chassis	Chassis Solder (for grounding)	Solder-resist
Hand-soldering of leaded components near mounted components	Lead wire of component Soldering iron	Solder-resist
Horizontal component placement		Solder-resist

To next page

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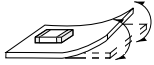
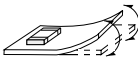
PRECAUTIONS

Precautions on the use of Multilayer Ceramic Capacitors

2. PCB Design

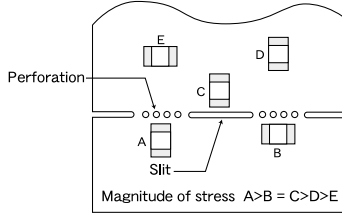
◆Pattern configurations (Capacitor layout on PCBs)

1-1. The following are 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

◆Adjustment of mounting machine

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

Precautions

◆Selection of Adhesives

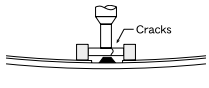
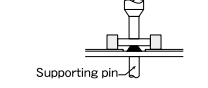
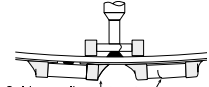
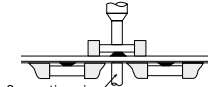
1. When chips are attached on PCBs with adhesives prior to soldering, it may cause capacitor characteristics degradation unless the following factors are appropriately checked : size of land patterns, type of adhesive, amount applied, hardening temperature and hardening period. Therefore, please contact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

◆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.

- The bottom dead center of the pick-up nozzle shall be adjusted to the surface level of PCB without the board deflection.
- 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

Technical considerations

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.

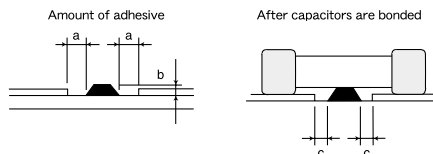
(1) Required adhesive characteristics

- The adhesive shall be strong enough to hold parts on the board during the mounting & solder process.
- The adhesive shall have sufficient strength at high temperatures.
- The adhesive shall have good coating and thickness consistency.
- The adhesive shall be used during its prescribed shelf life.
- The adhesive shall harden rapidly.
- The adhesive shall have corrosion resistance.
- The adhesive shall have excellent insulation characteristics.
- 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 μ m
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.

◆ 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.

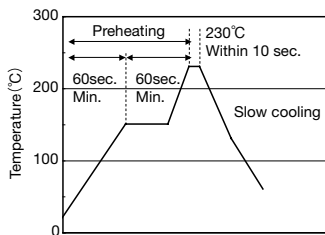
1-3. Since the residue of water-soluble flux is easily dissolved in moisture in the air, the residues on the surfaces of capacitors in high humidity conditions may cause a degradation of insulation resistance and reliability of the capacitors. Therefore, the cleaning methods and the capability of the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

◆ Soldering

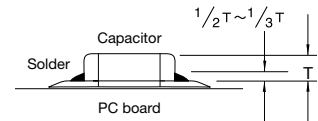
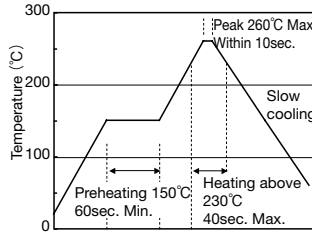
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated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

[Reflow soldering]

[Recommended conditions for eutectic soldering]



[Recommended condition for Pb-free soldering]



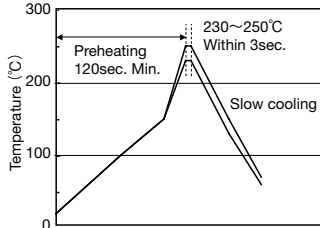
Cautions

- ① The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of a capacitor.
- ② Because excessive dwell times can adversely affect solderability, soldering duration shall be kept as close to recommended times as possible.

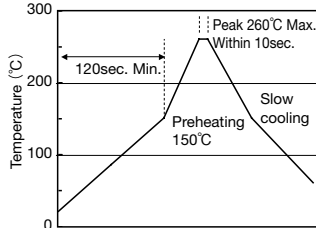
Technical considerations

[Wave soldering]

[Recommended conditions for eutectic soldering]



[Recommended condition for Pb-free soldering]

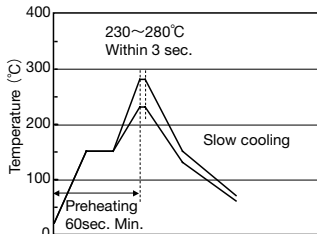


Cautions

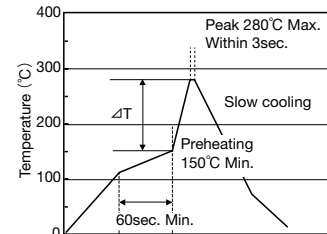
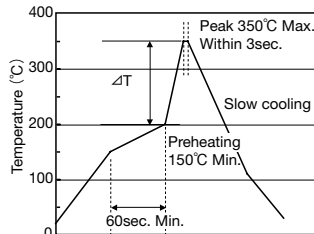
- ① Wave soldering must not be applied to capacitors designated as for reflow soldering only.

[Hand soldering]

[Recommended conditions for eutectic soldering]



[Recommended condition for Pb-free soldering]



Cautions

- ① Use a 50W soldering iron with a maximum tip diameter of 1.0 mm.
- ② The soldering iron shall not directly touch capacitors.

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■ PRECAUTIONS

Precautions on the use of Multilayer Ceramic Capacitors

5. Cleaning	
Precautions	<p>◆Cleaning conditions</p> <ol style="list-style-type: none"> 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.) 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	<ol style="list-style-type: none"> 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). 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	<ol style="list-style-type: none"> 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. 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	<p>◆Splitting of PCB</p> <ol style="list-style-type: none"> 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. Board separation shall not be done manually, but by using the appropriate devices. <p>◆Mechanical considerations</p> <p>Be careful not to subject capacitors to excessive mechanical shocks.</p> <ol style="list-style-type: none"> If ceramic capacitors are dropped onto a floor or a hard surface, they shall not be used. Please be careful that the mounted components do not come in contact with or bump against other boards or components.
8. Storage conditions	
Precautions	<p>◆Storage</p> <ol style="list-style-type: none"> 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. <ul style="list-style-type: none"> Recommended conditions <ul style="list-style-type: none"> Ambient temperature : Below 30°C Humidity : Below 70% RH <p>The ambient temperature must be kept below 40°C. 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.</p> <ul style="list-style-type: none"> Ceramic chip capacitors shall be kept where no chlorine or sulfur exists in the air. 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°C for 1hour.
Technical considerations	<p>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.</p>

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