

## Notice for TAIYO YUDEN Products

[ For High Quality and/or Reliability Equipment  
(Automotive / Industrial Equipment) ]

Please read this notice before using the TAIYO YUDEN products.

### REMINDERS

- Product information in this catalog is as of October 2017. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or use of our products.

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

- Please contact TAIYO YUDEN for further details of product specifications as the individual product specification sheets are available.
- Please conduct validation and verification of our products in actual condition of mounting and operating environment before using our products.
- The products listed in this catalog are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment), medical equipment classified as Class I or II by IMDRF, industrial equipment, and automotive interior applications, etc. Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, medical equipment classified as Class III by IMDRF).

Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment\*, medical equipment classified as Class IV by IMDRF, nuclear control equipment, undersea equipment, military equipment).

\*Note: There is a possibility that our products can be used only for aviation equipment that does not directly affect the safe operation of aircraft (e.g., in-flight entertainment, cabin light, electric seat, cooking equipment) if such use meets requirements specified separately by TAIYO YUDEN. Please be sure to contact TAIYO YUDEN for further information before using our products for such aviation equipment.

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

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

- Information contained in this catalog is intended to convey examples of typical performances and/or applications of our products and is not intended to make any warranty with respect to the intellectual property rights or any other related rights of TAIYO YUDEN or any third parties nor grant any license under such rights.
- Please note that the scope of warranty for our products is limited to the delivered our products themselves and TAIYO YUDEN shall not be in any way responsible for any damages resulting from a fault or defect in our products. Notwithstanding the foregoing, if there is a written agreement (e.g., supply and purchase agreement, quality assurance agreement) signed by TAIYO YUDEN and your company, TAIYO YUDEN will warrant our products in accordance with such agreement.
- The contents of this catalog are applicable to our products which are purchased from our sales offices or authorized distributors (hereinafter "TAIYO YUDEN's official sales channel"). Please note that the contents of this catalog are not applicable to our products purchased from any seller other than TAIYO YUDEN's official sales channel.

#### ■ Caution for Export

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



REFLOW  
AEC-Q200

# MULTILAYER CERAMIC CAPACITORS

■ PART NUMBER

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

△=Blank space

① Rated voltage

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

③ End termination

Code	End termination
K	Plated
J	Soft Termination
S	Cu Internal Electrodes
F	High Reliability Application

② Series name

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

④ Dimension (L × W)

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

Note : ※LW reverse type (□WK) only

⑤ Dimension tolerance

Code	Type	L [mm]	W [mm]	T [mm]
△	ALL	Standard	Standard	Standard
A	063	0.6±0.05	0.3±0.05	0.3±0.05
	105	1.0±0.10	0.5±0.10	0.5±0.10
	107	1.6+0.15/-0.05	0.8+0.15/-0.05	0.8+0.15/-0.05
	212	2.0+0.15/-0.05	1.25+0.15/-0.05	0.85±0.10 1.25+0.15/-0.05
	316	3.2±0.20	1.6±0.20	1.6±0.20
	325	3.2±0.30	2.5±0.30	2.5±0.30
B	105	1.0+0.15/-0.05	0.5+0.15/-0.05	0.5+0.15/-0.05
	107	1.6+0.20/-0	0.8+0.20/-0	0.8+0.20/-0
	212	2.0+0.20/-0	1.25+0.20/-0	0.85±0.10 1.25+0.20/-0
C	105	1.0+0.20/-0	0.5+0.20/-0	0.5+0.20/-0
	107	1.6+0.25/-0	0.8+0.25/-0	0.8+0.25/-0
	212	2.0+0.25/-0	1.25+0.25/-0	1.25+0.25/-0
K	212	2.0±0.15	1.25±0.15	0.85±0.15 1.15±0.20 1.6±0.20
	316	3.2±0.20	1.6±0.20	1.6±0.20
	325	3.2±0.50	2.5±0.30	2.5±0.30

Note: cf. STANDARD EXTERNAL DIMENSIONS

△= Blank space

⑥ Temperature characteristics code

■ High dielectric type

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

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## ■ Temperature compensating type

Code	Applicable standard		Temperature range [°C]	Ref. Temp. [°C]	Capacitance change	Capacitance tolerance	Tolerance code
CG	JIS	CG	-55 ~ +125	20	0 ± 30ppm/°C	± 0.1pF	B
						± 0.25pF	C
						± 0.5pF	D
	EIA	C0G		25		± 1pF	F
						± 2%	G
						± 5%	J

## ⑦ Nominal capacitance

Code (example)	Nominal capacitance
0R5	0.5pF
010	1pF
100	10pF
101	100pF
102	1,000pF
103	0.01 $\mu$ F
104	0.1 $\mu$ F
105	1.0 $\mu$ F
106	10 $\mu$ F
107	100 $\mu$ F

Note : R=Decimal point

## ⑧ Capacitance tolerance

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

## ⑨ Thickness

Code	Thickness [mm]
P	0.3
T	
V	0.5
C	0.7 (107type or more)
A	0.8
D	0.85 (212type or more)
F	1.15
G	1.25
L	1.6
N	1.9
M	2.5

## ⑩ Special code

Code	Special code
H	MLCC for Industrial and Automotive

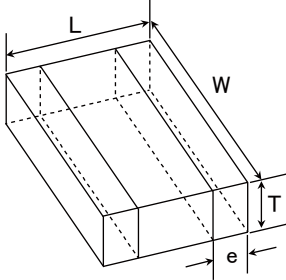
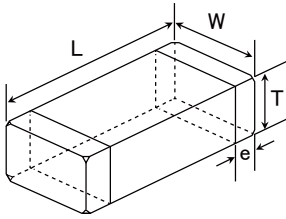
## ⑪ Packaging

Code	Packaging
F	$\phi$ 178mm Taping (2mm pitch)
R	$\phi$ 178mm Embossed Taping (4mm pitch)
T	$\phi$ 178mm Taping (4mm pitch)
P	$\phi$ 178mm Taping (4mm pitch, 1000 pcs/reel) 325 type (Thickness code M)

## ⑫ Internal code

Code	Internal code
$\Delta$	Standard

STANDARD EXTERNAL DIMENSIONS



※ LW reverse type

Type( EIA )	Dimension [mm] (inch)				
	L	W	T	*1	e
□MK063(0201)	0.6±0.03 (0.024±0.001)	0.3±0.03 (0.012±0.001)	0.3±0.03 (0.012±0.001)	T	0.15±0.05 (0.006±0.002)
□MK105(0402) □MF105(0402)	1.0±0.05 (0.039±0.002)	0.5±0.05 (0.020±0.002)	0.5±0.05 (0.020±0.002)	V	0.25±0.10 (0.010±0.004)
□WK105(0204) ※	0.52±0.05 (0.020±0.002)	1.0±0.05 (0.039±0.002)	0.3±0.05 (0.012±0.002)	P	0.18±0.08 (0.007±0.003)
□MK107(0603) □MF107(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)
□MJ107(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+0.3/-0.25 (0.014+0.012/-0.010)
□VS107(0603)	1.6±0.10 (0.063±0.004)	0.8±0.10 (0.031±0.004)	0.7±0.10 (0.028±0.004)	C	0.35±0.25 (0.014±0.010)
□WK107(0306) ※	0.8±0.10 (0.031±0.004)	1.6±0.10 (0.063±0.004)	0.5±0.05 (0.020±0.002)	V	0.25±0.15 (0.010±0.006)
□MK212(0805) □MF212(0805)	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	0.85±0.10 (0.033±0.004)	D	0.5±0.25 (0.020±0.010)
1.25±0.10 (0.049±0.004)			G		
□MJ212(0805)	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	0.85±0.10 (0.033±0.004)	D	0.5+0.35/-0.25 (0.020+0.014/-0.010)
1.25±0.10 (0.049±0.004)			G		
□VS212(0805)	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	0.85±0.10 (0.033±0.004)	D	0.5±0.25 (0.020±0.010)
□WK212(0508) ※	1.25±0.15 (0.049±0.006)	2.0±0.15 (0.079±0.006)	0.85±0.10 (0.033±0.004)	D	0.3±0.2 (0.012±0.008)
□MK316(1206) □MF316(1206)	3.2±0.15 (0.126±0.006)	1.6±0.15 (0.063±0.006)	1.15±0.10 (0.045±0.004)	F	0.5+0.35/-0.25 (0.020+0.014/-0.010)
1.6±0.20 (0.063±0.008)			L		
□MJ316(1206)	3.2±0.15 (0.126±0.006)	1.6±0.15 (0.063±0.006)	1.15±0.10 (0.045±0.004)	F	0.6+0.4/-0.3 (0.024+0.016/-0.012)
1.6±0.20 (0.063±0.008)			L		
□MK325(1210) □MF325(1210)	3.2±0.30 (0.126±0.012)	2.5±0.20 (0.098±0.008)	1.15±0.10 (0.045±0.004)	F	0.6±0.3 (0.024±0.012)
1.9±0.20 (0.075±0.008)			N		
2.5±0.20 (0.098±0.008)			M		
□MJ325(1210)	3.2±0.30 (0.126±0.012)	2.5±0.20 (0.098±0.008)	1.9±0.20 (0.075±0.008)	N	0.6+0.4/-0.3 (0.024+0.016/-0.012)
2.5±0.20 (0.098±0.008)			M		
□MK432(1812)	4.5±0.40 (0.177±0.016)	3.2±0.30 (0.126±0.012)	2.5±0.20 (0.098±0.008)	M	0.9±0.6 (0.035±0.024)

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

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## ■ STANDARD QUANTITY

Type	EIA (inch)	Dimension		Standard quantity [pcs]	
		[mm]	Code	Paper tape	Embossed tape
063	0201	0.3	T	15000	—
105	0402	0.5	V	10000	—
	0204 ※	0.30	P		
107	0603	0.7	C	4000	—
		0.8	A		
		0.8	A	3000 (Soft Termination)	—
		0.8	A	—	3000 (Soft Termination)
	0306 ※	0.50	V	—	4000
212	0805	0.85	D	4000	—
		1.25	G	—	3000
		1.25	G	—	2000 (Soft Termination)
	0508 ※	0.85	D	4000	—
316	1206	1.15	F	—	3000
		1.6	L	—	2000
325	1210	1.15	F	—	2000
		1.9	N		
		2.5	M	—	500 (T), 1000 (P)
432	1812	2.5	M	—	500

Note : ※: LW Reverse type (□WK)

• All the Multilayer Ceramic Capacitors of the catalog lineup are RoHS compliant.  
 • Capacitance tolerance code is applied to □ of part number.  
 • All the Multilayer Ceramic Capacitors in the catalog lineup are applicable for reflow-soldering.

Note)

• The exchange of individual specifications is necessary depending on the application and circuit condition. Please contact Taiyo Yuden sales channels.  
 • \*1: Automotive (AEC-Q200 Qualified) products  
 < **AEC-Q200** :AEC-Q200 qualified>  
 All the Multilayer Ceramic Capacitors of \*1 marks are tested based on the test conditions and methods defined in AEC-Q200 family item.  
 125°C products: AEC-Q200 Grade1 (we conduct the evaluation at the test condition of Grade1.)  
 Please consult with TAIYO YUDEN's official sales channel for the details of the product specification and AEC-Q200 test results, etc.,  
 and please review and approve TAIYO YUDEN's product specification before ordering.  
 • \*3: For standard case size, please kindly refer to ④Dimension, ⑤Dimension tolerance, ⑨Thickness and STANDARD EXTERNAL DIMENSIONS.

**High Reliability Application Multilayer Ceramic Capacitors**

● **105TYPE (Dimension:1.0×0.5mm JIS:1005 EIA:0402)**

[Temperature Characteristic B7 : X7R] 0.5mm thickness (V)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*3 [mm]	Note
							Rated voltage x %			
UMF105 B7102□VHF		50	X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	*1	
UMF105 B7472□VHF			X7R	4700 p	±10, ±20	2.5	150	0.5±0.05	*1	
UMF105 B7103□VHF			X7R	0.01 μ	±10, ±20	3.5	150	0.5±0.05	*1	
TMF105 B7102□VHF		25	X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	*1	
TMF105 B7472□VHF			X7R	4700 p	±10, ±20	2.5	150	0.5±0.05	*1	
TMF105 B7103□VHF			X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	*1	
TMF105 B7223□VHF		16	X7R	0.022 μ	±10, ±20	3.5	150	0.5±0.05	*1	
EMF105 B7102□VHF			X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	*1	
EMF105 B7472□VHF			X7R	4700 p	±10, ±20	2.5	150	0.5±0.05	*1	
EMF105 B7103□VHF		10	X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	*1	
EMF105 B7223□VHF			X7R	0.022 μ	±10, ±20	3.5	150	0.5±0.05	*1	
EMF105 B7104□VHF			X7R	0.1 μ	±10, ±20	5	150	0.5±0.05	*1	
LMF105 B7102□VHF		10	X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	*1	
LMF105 B7472□VHF			X7R	4700 p	±10, ±20	2.5	150	0.5±0.05	*1	
LMF105 B7103□VHF			X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	*1	
LMF105 B7223□VHF		10	X7R	0.022 μ	±10, ±20	3.5	150	0.5±0.05	*1	
LMF105 B7104□VHF			X7R	0.1 μ	±10, ±20	5	200	0.5±0.05	*1	

● **107TYPE (Dimension:1.6×0.8mm JIS:1608 EIA:0603)**

[Temperature Characteristic B7 : X7R] 0.8mm thickness (A)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*3 [mm]	Note
							Rated voltage x %			
UMF107 B7104□AHT		50	X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	*1	
TMF107 B7104□AHT		25	X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	*1	
EMF107 B7104□AHT		16	X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	*1	
EMF107 B7105□AHT			X7R	1 μ	±10, ±20	10	150	0.8±0.10	*1	
LMF107 B7104□AHT		10	X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	*1	
LMF107 B7105□AHT			X7R	1 μ	±10, ±20	10	150	0.8±0.10	*1	

● **212TYPE (Dimension:2.0×1.25mm JIS:2012 EIA:0805)**

[Temperature Characteristic B7 : X7R] 1.25mm thickness (G)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*3 [mm]	Note
							Rated voltage x %			
UMF212 B7473□GHT		50	X7R	0.047 μ	±10, ±20	3.5	200	1.25±0.10	*1	
TMF212 B7473□GHT		25	X7R	0.047 μ	±10, ±20	3.5	200	1.25±0.10	*1	
EMF212 B7473□GHT		16	X7R	0.047 μ	±10, ±20	3.5	200	1.25±0.10	*1	
EMF212AB7475□GHT			X7R	4.7 μ	±10, ±20	10	150	1.25+0.15/-0.05	*1	
LMF212 B7473□GHT		10	X7R	0.047 μ	±10, ±20	3.5	200	1.25±0.10	*1	
LMF212 B7475□GHT			X7R	4.7 μ	±10, ±20	10	150	1.25±0.10	*1	

● **316TYPE (Dimension:3.2×1.6mm JIS:3216 EIA:1206)**

[Temperature Characteristic B7 : X7R] 1.6mm thickness (L)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*3 [mm]	Note
							Rated voltage x %			
LMF316AB7106□LHT		10	X7R	10 μ	±10, ±20	10	150	1.6±0.20	*1	
JMF316AB7106□LHT		6.3	X7R	10 μ	±10, ±20	10	150	1.6±0.20	*1	

● **325TYPE (Dimension:3.2×2.5mm JIS:3225 EIA:1210)**

[Temperature Characteristic B7 : X7R] 2.5mm thickness (M)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*3 [mm]	Note
							Rated voltage x %			
UMF325 B7475□MHP		50	X7R	4.7 μ	±10, ±20	5	150	2.5±0.20	*1	
TMF325 B7475□MHP		25	X7R	4.7 μ	±10, ±20	5	150	2.5±0.20	*1	
EMF325 B7475□MHP		16	X7R	4.7 μ	±10, ±20	5	150	2.5±0.20	*1	
LMF325 B7475□MHP		10	X7R	4.7 μ	±10, ±20	5	150	2.5±0.20	*1	

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# Multilayer Ceramic Capacitors

## PACKAGING

### ① Minimum Quantity

#### ● Taped package

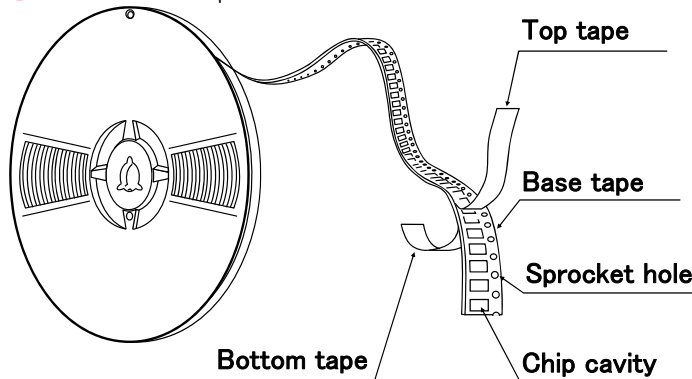
Type(EIA)	Thickness		Standard quantity [pcs]	
	mm	code	Paper tape	Embossed tape
<input type="checkbox"/> MK021(008004)	0.125	K	—	50000
<input type="checkbox"/> VS021(008004)				
<input type="checkbox"/> MK042(01005)	0.2	C, D	—	40000
<input type="checkbox"/> VS042(01005)				
<input type="checkbox"/> MK063(0201)	0.3	P, T	15000	—
<input type="checkbox"/> WK105(0204) ※	0.3	P	10000	—
<input type="checkbox"/> MK105(0402) <input type="checkbox"/> MF105(0402)	0.13	H	—	20000
	0.18	E	—	15000
	0.2	C	20000	—
	0.3	P	15000	—
	0.5	V	10000	—
<input type="checkbox"/> VK105(0402)	0.5	W	10000	—
<input type="checkbox"/> MK107(0603)	0.45	K	4000	—
<input type="checkbox"/> WK107(0306) ※				
<input type="checkbox"/> MF107(0603)	0.5	V	—	4000
<input type="checkbox"/> VS107(0603)	0.8	A	4000	—
<input type="checkbox"/> MJ107(0603)	0.7	C	4000	—
<input type="checkbox"/> MK212(0805)	0.85	D	4000	—
<input type="checkbox"/> WK212(0508) ※				
<input type="checkbox"/> MF212(0805)				
<input type="checkbox"/> VS212(0805)	1.25	G	—	3000
<input type="checkbox"/> MJ212(0805)	0.85	D	4000	—
	1.25	G	—	2000
<input type="checkbox"/> MK316(1206) <input type="checkbox"/> MF316(1206)	0.85	D	4000	—
	1.15	F	—	3000
	1.6	L	—	2000
<input type="checkbox"/> MJ316(1206)	1.15	F	—	3000
	1.6	L	—	2000
<input type="checkbox"/> MK325(1210) <input type="checkbox"/> MF325(1210)	0.85	D	—	2000
	1.15	F		
	1.9	N		
	2.0max.	Y		
<input type="checkbox"/> MJ325(1210)	2.5	M	—	1000
	1.9	N	—	2000
<input type="checkbox"/> MK432(1812)	2.5	M	—	500(T), 1000(P)
	2.5	M	—	500

Note : ※ LW Reverse type.

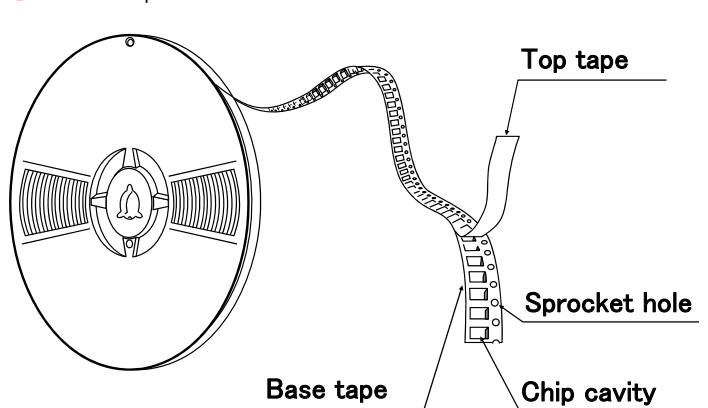
### ② Taping material

※No bottom tape for pressed carrier tape

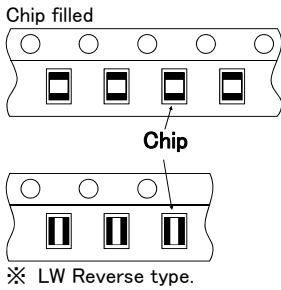
#### ● Card board carrier tape



#### ● Embossed tape



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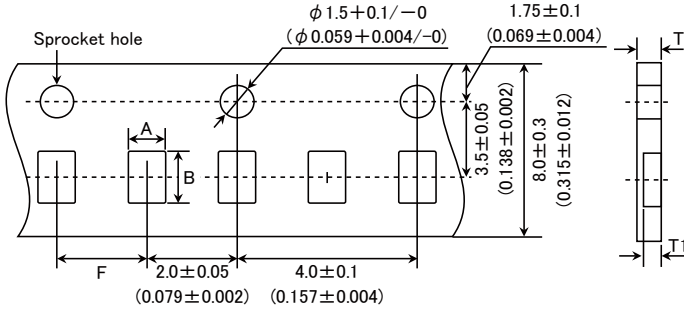


### ③ Representative taping dimensions

● Paper Tape (8mm wide)

● Pressed carrier tape ( 2mm pitch)

Unit: mm (inch)



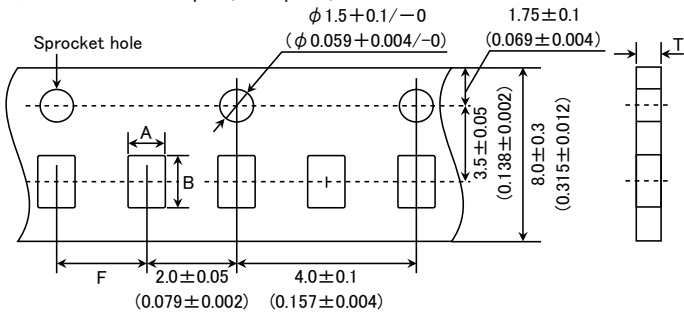
Type(EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness	
	A	B		T	T1
□MK063(0201)	0.37	0.67	2.0±0.05	0.45max.	0.42max.
□WK105(0204) ※	0.65	1.15		0.4max.	0.3max.
□MK105(0402) (*1 C)				0.45max.	0.42max.
□MK105(0402) (*1 P)					

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

Unit: mm

● Punched carrier tape (2mm pitch)

Unit: mm (inch)

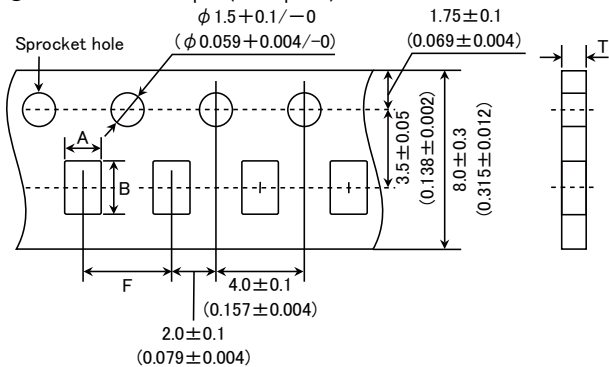


Type(EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness
	A	B		T
□MK105 (0402)	0.65	1.15	2.0±0.05	0.8max.
□MF105 (0402)				
□VK105 (0402)				

Unit: mm

● Punched carrier tape (4mm pitch)

Unit: mm (inch)



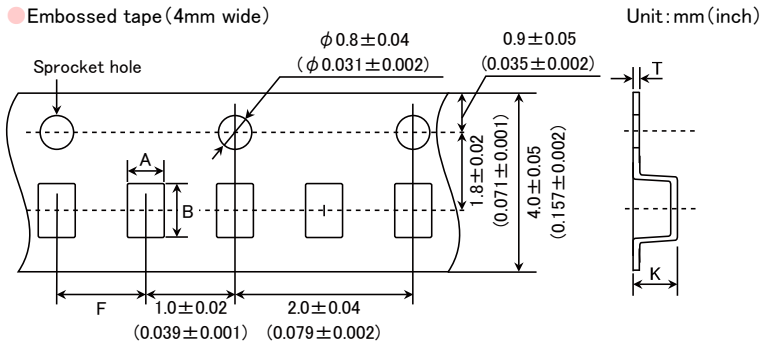
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Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
□MK107(0603) □WK107(0306) ※ □MF107(0603)	1.0	1.8	4.0±0.1	1.1max.
□MK212(0805) □WK212(0508) ※ □MK316(1206)	1.65	2.4		1.1max.
	2.0	3.6		

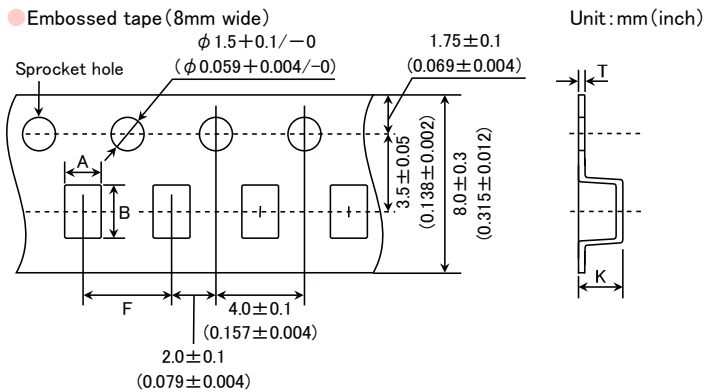
Note: Taping size might be different depending on the size of the product. ※ LW Reverse type.

Unit: mm



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK021(008004) □VS021(008004)	0.135	0.27	1.0±0.02	0.5max.	0.25max.
□MK042(01005) □VS042(01005)					

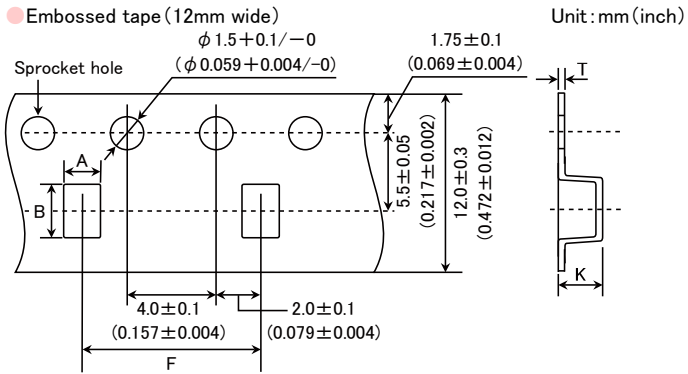
Unit: mm



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK105(0402)	0.6	1.1	2.0±0.1	0.6max.	0.2±0.1
□WK107(0306) ※ □MK212(0805) □MF212(0805)	1.0	1.8	4.0±0.1	1.3max.	0.25±0.1
□MK316(1206) □MF316(1206)	2.0	3.6		3.4max.	0.6max.
□MK325(1210) □MF325(1210)	2.8	3.6			

Note: ※ LW Reverse type.

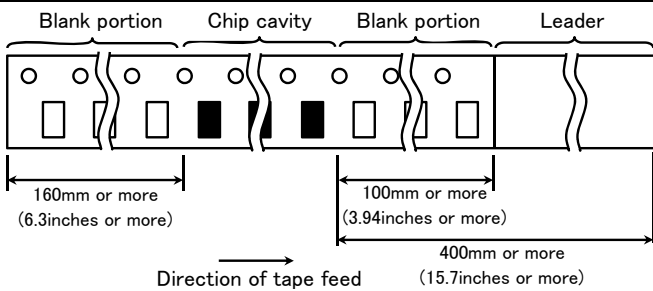
Unit: mm



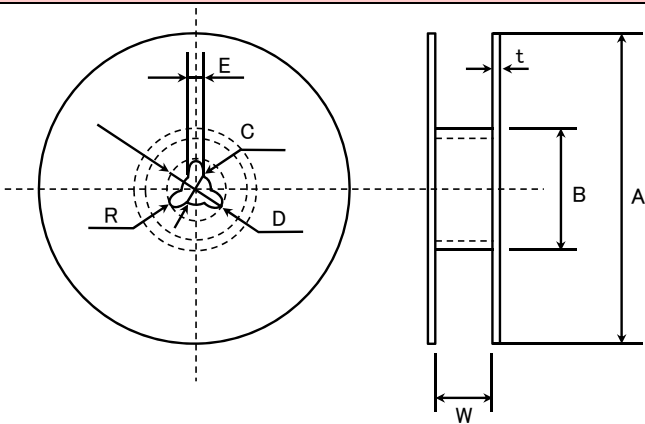
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK325(1210)	3.1	4.0	$8.0\pm 0.1$	4.0max.	0.6max.
□MK432(1812)	3.7	4.9	$8.0\pm 0.1$	4.0max.	0.6max.

Unit: mm

#### ④Trailer and Leader



#### ⑤Reel size



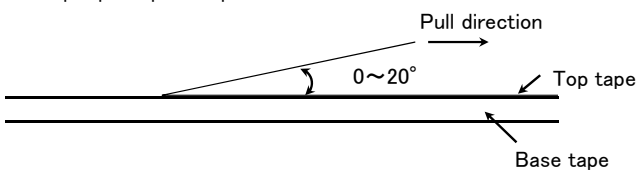
A	B	C	D	E	R
$\phi 178\pm 2.0$	$\phi 50$ min.	$\phi 13.0\pm 0.2$	$\phi 21.0\pm 0.8$	$2.0\pm 0.5$	1.0

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

Unit: mm

#### ⑥Top Tape Strength

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



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# High Reliability Application Multilayer Ceramic Capacitors

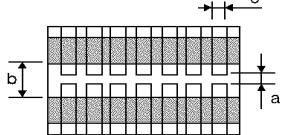
## RELIABILITY DATA

1. Operating Temperature Range	
Specified Value	X7R(−55°C to +125°C)
Test Methods and Remarks	Continuous use is available in this range. (reference temperature : 25°C)
2.Highest Operating temperature Range	
Specified Value	X7R(−55°C to +125°C)
Test Methods and Remarks	Maximum ambient temperature at which capacitors can be continuously used with rated voltage applied.
3. Rated Voltage	
Specified Value	Please refer to the page of the "PART NUMBERS".
Test Methods and Remarks	Continuous maximum applied voltage. If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages should be lower than the rated voltage of the capacitor.
4. Shape and Dimensions	
Specified Value	Please refer to the page of the "EXTERNAL DIMENSIONS".
5. Heat Treatment (Class II)	
Test Methods and Remarks	Initial value shall be measured after test sample is heat-treated at 150+0/−10°C for an hour and kept at room temperature for 24 ± 2 hours.
6. Voltage Treatment (Class II)	
Test Methods and Remarks	Initial value shall be measured after test sample is voltage-treated for an hour at temperature and voltage which are specified as test conditions, and kept at room temperature for 24 ± 2 hours.
7. Dielectric Withstanding Voltage (between terminals)	
Specified Value	No abnormality.
Test Methods and Remarks	Applied voltage : Rated voltage × 2.5 Duration : 1 to 5 seconds. Charging and discharging current shall be 50mA max.
8. Insulation Resistance	
Specified Value	Larger than whichever smaller of 500 MΩ·μF or 10 <sup>4</sup> MΩ
Test Methods and Remarks	Applied voltage : Rated voltage Duration : 60±5 seconds. Charging and discharging current shall be 50mA max.
9. Capacitance and Tolerance	
Specified Value	Please refer to the page of the "PART NUMBERS".
Test Methods and Remarks	Measurement frequency : 1kHz±10% (C≤10 μF) Measurement voltage : 1±0.2Vrms (C≤10 μF) 0.5±0.1V (6.3V rated voltage) Heat treatment specified in No.5 of the specification shall be conducted prior to measurement.
10. Q or Dissipation factor (tan δ)	
Specified Value	Please refer to the page of the "PART NUMBERS".
Test Methods and Remarks	Measurement frequency : 1kHz±10% (C≤10 μF) Measurement voltage : 1±0.2Vrms (C≤10 μF) 0.5±0.1V (6.3V rated voltage) Heat treatment specified in No.5 of the specification shall be conducted prior to measurement. NO DC bias is applied.

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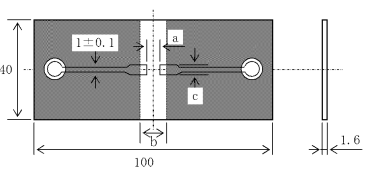
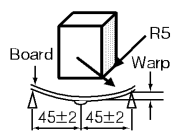
11. Temperature Characteristic (without DC bias)																									
Specified Value	X7R(−55°C to +125°C) : ±15%																								
Test Methods and Remarks	Confirming to EIA RS-198-D (1991) Heat treatment specified in No.5 of the specification shall be conducted prior to measurement. Change of the maximum capacitance deviation in step 1 to 5.																								
	<table border="1"> <thead> <tr> <th>step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>+25</td> </tr> <tr> <td>2</td> <td>Minimum operating temperature</td> </tr> <tr> <td>3</td> <td>+25</td> </tr> <tr> <td>4</td> <td>Maximum operating temperature</td> </tr> <tr> <td>5</td> <td>+25</td> </tr> </tbody> </table>	step	Temperature(°C)	1	+25	2	Minimum operating temperature	3	+25	4	Maximum operating temperature	5	+25												
	step	Temperature(°C)																							
	1	+25																							
	2	Minimum operating temperature																							
	3	+25																							
4	Maximum operating temperature																								
5	+25																								
12. Adhesive Force of Terminal Electrodes																									
Specified Value	Appearance: Terminal electrodes shall be no exfoliation or a sign of exfoliation.																								
Test Methods and Remarks	Solder lands refer to fig.1.																								
	<table border="1"> <thead> <tr> <th></th> <th>1608 size</th> <th>larger than 2012 size</th> </tr> </thead> <tbody> <tr> <td>Applying force</td> <td>5N</td> <td>10N</td> </tr> <tr> <td>Duration</td> <td colspan="2">30±5 seconds.</td> </tr> <tr> <td>Board</td> <td colspan="2">Glass epoxy-resin substrate</td> </tr> <tr> <td>Thickness</td> <td colspan="2">1.6mm</td> </tr> </tbody> </table>		1608 size	larger than 2012 size	Applying force	5N	10N	Duration	30±5 seconds.		Board	Glass epoxy-resin substrate		Thickness	1.6mm										
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	<table border="1"> <thead> <tr> <th rowspan="2">Dimension</th> <th colspan="4">Case size</th> </tr> <tr> <th>1608</th> <th>2012</th> <th>3216</th> <th>3225</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>1.0</td> <td>1.2</td> <td>2.2</td> <td>2.2</td> </tr> <tr> <td>b</td> <td>3.0</td> <td>4.0</td> <td>5.0</td> <td>5.0</td> </tr> <tr> <td>c</td> <td>1.2</td> <td>1.65</td> <td>2.0</td> <td>2.9</td> </tr> </tbody> </table>	Dimension	Case size				1608	2012	3216	3225	a	1.0	1.2	2.2	2.2	b	3.0	4.0	5.0	5.0	c	1.2	1.65	2.0	2.9
Dimension	Case size																								
	1608	2012	3216	3225																					
a	1.0	1.2	2.2	2.2																					
b	3.0	4.0	5.0	5.0																					
c	1.2	1.65	2.0	2.9																					
Fig.1																									
13. Vibration																									
Specified Value	Appearance : No abnormality																								
	Capacitance change : Initial value shall be satisfied.																								
	Dissipation factor : Initial value shall be satisfied.																								
	Insulation resistance : Initial value shall be satisfied.																								
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test. Measurement shall be conducted after test sample is heat treated as specified in No.5.																								
	Solder lands refer to figure 1.																								
	Direction of the vibration test : X, Y, Z each of 3 orientations for 2 hours respectively (total 6 hours)																								
	Vibration frequency : 10 to 55 to 10Hz (1 minutes each)																								
	Total amplitude : 1.5 mm																								
	Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.																								
14. Resistance to Soldering Heat																									
Specified Value	Appearance : No abnormality																								
	Capacitance change : ≤ ±7.5%																								
	Dissipation factor : Initial value shall be satisfied.																								
	Insulation resistance : Initial value shall be satisfied.																								
	Dielectric withstanding voltage (between terminals) : No abnormality																								
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test.																								
	Immerse test sample in an solder solution (Sn-3Ag-0.5Cu).																								
	Soldering temperature : 270°C±5°C																								
	Duration : 3±0.5 seconds																								
	Soaking position : Test sample is soaked until the terminal electrode is covered in solder solution.																								
	Preheating condition : 3216 size or smaller size: 120 to 150°C for 1 minute, 3225 size: 100 to 120°C for 1 minute, 170 to 200°C for 1 minute.																								
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.																									
15. Solderability																									
Specified Value	More than 95% of terminal electrode shall be covered with fresh solder.																								
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test.																								
	Immerse test sample in an solder solution(Sn-3Ag-0.5Cu).																								
	Soldering temperature : 245°C±5°C																								
	Duration : 4±1 seconds																								
	Dipping position : Test sample is immersed until the terminal electrode is covered in solder solution.																								

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16. Thermal shock																																					
Specified Value	Appearance : No abnormality Capacitance change : $\leq \pm 7.5\%$ Dissipation factor : Initial value shall be satisfied. Insulation resistance : Initial value shall be satisfied. Dielectric withstanding voltage (between terminals) : No abnormality																																				
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test. Measurement shall be conducted after test sample is heat treated as specified in No.5. condition of the one cycle (Air—Air) <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Time (min.)</th> <th>Transfer time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Minimum usage temperature</td> <td>15</td> <td>within 20 seconds</td> </tr> <tr> <td>2</td> <td>Maximum usage temperature</td> <td>15</td> <td>within 20 seconds</td> </tr> </tbody> </table> Test cycles: 100 times. Measurement after the test shall be made after test sample is kept at room temperature for $24 \pm 2$ hours. <div style="display: flex; align-items: center; margin-top: 10px;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th rowspan="2">Dimension</th> <th colspan="4">Case size</th> </tr> <tr> <th>1608</th> <th>2012</th> <th>3216</th> <th>3225</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>0.6</td> <td>0.8</td> <td>2.0</td> <td>2.0</td> </tr> <tr> <td>b</td> <td>2.2</td> <td>3.0</td> <td>4.4</td> <td>4.4</td> </tr> <tr> <td>c</td> <td>0.9</td> <td>1.3</td> <td>1.7</td> <td>2.6</td> </tr> </tbody> </table> </div>	Step	Temperature (°C)	Time (min.)	Transfer time	1	Minimum usage temperature	15	within 20 seconds	2	Maximum usage temperature	15	within 20 seconds	Dimension	Case size				1608	2012	3216	3225	a	0.6	0.8	2.0	2.0	b	2.2	3.0	4.4	4.4	c	0.9	1.3	1.7	2.6
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c	0.9	1.3	1.7	2.6																																	

17. Humidity Loading	
Specified Value Note1	Appearance : No abnormality Capacitance change : $\pm 12.5\%$ Dissipation factor : 5.0%max. Insulation resistance : Larger than whichever smaller of $25M\Omega \cdot \mu F$ or $500M\Omega$
Test Methods and Remarks	Test condition : $85^\circ C/85\%RH$ . Duration : $1000 +48/-0$ hours. DC bias : Applied rated voltage. Voltage treatment specified in No.6 of the specification shall be conducted prior to test. Measurement after the test shall be made after test sample is kept at room temperature for $24 \pm 2$ hours.

18. High Temperature Loading	
Specified Value Note1	Appearance : No abnormality Capacitance change : $\leq \pm 12.5\%$ Dissipation factor : 5.0%max. Insulation resistance : Larger than whichever smaller of $25M\Omega \cdot \mu F$ or $500M\Omega$
Test Methods and Remarks	Voltage treatment specified in No.6 of the specification shall be conducted prior to test. Test sample shall be put in thermostatic oven with maximum temperature. Applied voltage : Rated voltage x 2 Duration : $1000 +48/-0$ hours. Charging and discharging current shall be 50mA or less. Measurement after the test shall be made after test sample is kept at room temperature for $24 \pm 2$ hours.

19. Resistance to Flexure of substrate																									
Specified Value	Appearance : No abnormality Capacitance change : $\leq \pm 12.5\%$ Dissipation factor : 5.0%max. Insulation resistance : Initial value shall be satisfied.																								
Test Methods and Remarks	Warp : 1mm Testing board : Grass epoxy - resin substrate Thickness : 1.6mm Test board and solder lands : Refer to fig. 3. <div style="display: flex; align-items: center; margin-top: 10px;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th rowspan="2">Dimension</th> <th colspan="4">Case size</th> </tr> <tr> <th>1608</th> <th>2012</th> <th>3216</th> <th>3225</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>0.6</td> <td>0.8</td> <td>2.0</td> <td>2.0</td> </tr> <tr> <td>b</td> <td>2.2</td> <td>3.0</td> <td>4.4</td> <td>4.4</td> </tr> <tr> <td>c</td> <td>0.9</td> <td>1.3</td> <td>1.7</td> <td>2.6</td> </tr> </tbody> </table>  </div>	Dimension	Case size				1608	2012	3216	3225	a	0.6	0.8	2.0	2.0	b	2.2	3.0	4.4	4.4	c	0.9	1.3	1.7	2.6
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a	0.6	0.8	2.0	2.0																					
b	2.2	3.0	4.4	4.4																					
c	0.9	1.3	1.7	2.6																					

Measurement shall be made with board in the bent position. (fig.4)

**20. High Temperature Exposure**

Specified Value Note1	Appearance	: No abnormality
	Capacitance change	: $\leq \pm 12.5\%$
	Dissipation factor	: 5.0%max.
	Insulation resistance	: Larger than whichever smaller of $500M\Omega \cdot \mu F$ or $10000M\Omega$

Test Methods and Remarks  
 Heat treatment specified in No.5 of the specification shall be conducted prior to test.  
 Test sample shall be put in thermostatic oven with maximum temperature.  
 Duration : 1000 +48/−0 hours.  
 Initial value shall be measured after test sample is heat-treated specified No.5.  
 Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

**21. Temperature Cycling**

Specified Value Note1	Appearance	: No abnormality
	Capacitance change	: $\leq \pm 7.5\%$
	Dissipation factor	: Initial value shall be satisfied
	Insulation resistance	: Initial value shall be satisfied

Test Methods and Remarks  
 Heat treatment specified in No.5 of the specification shall be conducted prior to test.  
 Measurement shall be conducted after test sample is heat treated as specified in No.5.  
 condition of the one cycle

Step	Temperature (°C)	Time (min.)
1	Minimum usage temperature	30 ± 3
2	+25	2 to 3
3	Maximum usage temperature	30 ± 3
4	+25	2 to 3

Test cycles: 200 times  
 Solder lands refer to fig. 2.  
 Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

**22. Body strength**

Specified Value	No mechanical damage
-----------------	----------------------

Test Methods and Remarks

Applying force : 10N  
 Applying time : 10 seconds

The diagram illustrates the body strength test setup. On the left, a 3D perspective view of a rectangular chip is shown with length L and width W, where L is greater than or equal to W. On the right, a cross-sectional view shows the chip being pressed by a hemispherical pressing jig with a radius R=0.5. The contact width between the jig and the chip is 0.6L. The entire assembly is supported by a substrate.

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

# Precautions on the use of High Reliability Application Multilayer Ceramic Capacitors

## ■ PRECAUTIONS

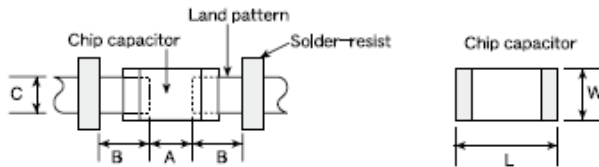
### 1. Circuit Design

- Precautions**
- ◆ Verification of operating environment, electrical rating and performance
    1. A malfunction in medical equipment, spacecraft, nuclear reactors, etc. may cause serious harm to human life or have severe social ramifications.  
As such, any capacitors to be used in such equipment may require higher safety and/or reliability considerations and should be clearly differentiated from components used in general purpose applications.
  - ◆ Operating Voltage (Verification of Rated voltage)
    1. The operating voltage for capacitors must always be lower than their rated values.  
If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages should be lower than the rated value of the capacitor chosen. For a circuit where both an AC and a pulse voltage may be present, the sum of their peak voltages should also be lower than the capacitor's rated voltage.
    2. Even if the applied voltage is lower than the rated value, the reliability of capacitors might be reduced if either a high frequency AC voltage or a pulse voltage having rapid rise time is present in the circuit.

### 2. PCB Design

- Precautions**
- ◆ Pattern configurations (Design of Land-patterns)
    1. When capacitors are mounted on a PCB, the amount of solder used (size of fillet) can directly affect capacitor performance. Therefore, the following items must be carefully considered in the design of solder land patterns:
      - (1) The amount of solder applied can affect the ability of chips to withstand mechanical stresses which may lead to breaking or cracking. Therefore, when designing land-patterns it is necessary to consider the appropriate size and configuration of the solder pads which in turn determines the amount of solder necessary to form the fillets.
      - (2) When more than one part is jointly soldered onto the same land or pad, the pad must be designed so that each component's soldering point is separated by solder-resist.
  - ◆ Pattern configurations (Capacitor layout on panelized [breakaway] PC boards)
    1. After capacitors have been mounted on the boards, chips can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering the reflow soldered boards etc.) For this reason, planning pattern configurations and the position of SMD capacitors should be carefully performed to minimize stress.

- Technical considerations**
- ◆ Pattern configurations (Design of Land-patterns)
    1. The following diagrams and tables show some examples of recommended patterns to prevent excessive solder amounts. (larger fillets which extend above the component end terminations) Examples of improper pattern designs are also shown.
      - (1) Recommended land dimensions for a typical chip capacitor land patterns for PCBs



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

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		0.8~1.0	0.8~1.2	1.8~2.5	1.8~2.5
B		0.6~0.8	0.8~1.2	1.0~1.5	1.0~1.5
C		0.6~0.8	0.9~1.6	1.2~2.0	1.8~3.2

Excess solder can affect the ability of chips to withstand mechanical stresses. Therefore, please take proper precautions when designing land-patterns.

(2) Examples of good and bad solder application

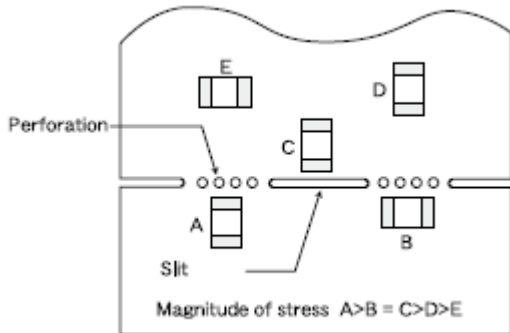
Items	Not recommended	Recommended
Mixed mounting of SMD and leaded components	Lead wire of component	Solder-resist
Component placement close to the chassis	Chassis Solder (for grounding) Electrode pattern	Solder-resist
Hand-soldering of leaded components near mounted components	Lead wire of component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

◆ Pattern configurations (Capacitor layout on panelized [breakaway] PC boards)

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

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

1-2. To layout the capacitors for the breakaway PC board, it should be noted that the amount of mechanical stresses given will vary depending on capacitor layout. The example below shows recommendations for better design.



1-3. When breaking PC boards along their perforations, 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, any ideal SMD capacitor layout must also consider the PCB splitting procedure.



Precautions

◆Selection of Flux

1. 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 should be with less than or equal to 0.1 wt% (equivalent to chlorine) of halogenated content. Flux having strong acidity content should not be applied.
  - (2) When soldering capacitors on the board, the amount of flux applied should be controlled at the optimum level.
  - (3) When using water-soluble flux, special care should be taken to properly clean the boards.

◆Soldering

1. Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions.  
Sn-Zn solder paste can affect MLCC reliability performance.  
Please contact us prior to usage.

Technical considerations

◆Selection of Flux

- 1-1. When too much halogenated substance (Chlorine, etc.) content is used to activate the flux, or highly acidic flux is used, an excessive amount of residue after soldering may lead to corrosion of the terminal electrodes or degradation of insulation resistance on the surface of the capacitors.
- 1-2. Flux is used to increase solderability in flow soldering, but if too much is applied, a large amount of flux gas may be emitted and may detrimentally affect 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 by water content in the air, the residue on the surface of capacitors in high humidity conditions may cause a degradation of insulation resistance and therefore affect the reliability of the components. The cleaning methods and the capability of the machines used should also be considered carefully when selecting water-soluble flux.

◆Soldering

1-1. Preheating when soldering

Heating: Ceramic chip components should be preheated to within 100 to 130°C of the soldering.

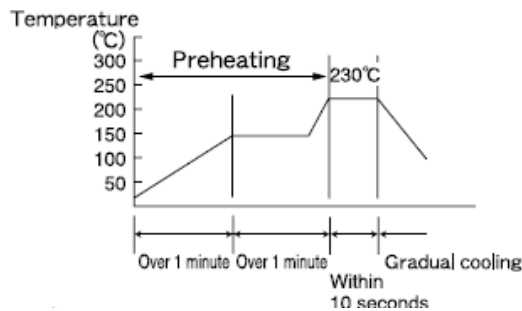
Cooling: The temperature difference between the components and cleaning process should not be greater than 100°C.

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

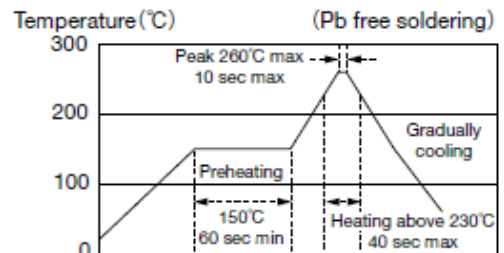
【Recommended conditions for soldering】

[Reflow soldering]

Temperature profile



【Recommended conditions for Pd Free soldering】

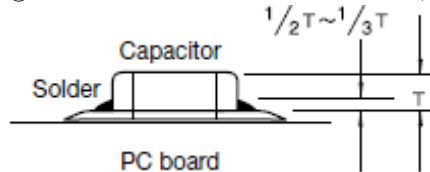


※Ceramic chip components should be preheated to within 100 to 130°C of the soldering.

※Assured to be reflow soldering for 2 times.

Caution

- ① The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of the capacitor, as shown below:



- ② Because excessive dwell times can detrimentally affect solderability, soldering duration should be kept as close to recommended times as possible.