

Notice for TAIYO YUDEN products

Please read this notice before using the TAIYO YUDEN products.

⚠️ REMINDERS

■ Product Information in this Catalog

Product information in this catalog is as of October 2019. All of the contents specified herein and production status of the products listed in this catalog are subject to change without notice due to technical improvement of our products, 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.

■ Approval of Product Specifications

Please contact TAIYO YUDEN for further details of product specifications as the individual product specification sheets are available. When using our products, please be sure to approve our product specifications or make a written agreement on the product specification with TAIYO YUDEN in advance.

■ Pre-Evaluation in the Actual Equipment and Conditions

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

■ Limited Application

1. Equipment Intended for Use

The products listed in this catalog are intended for general-purpose and standard use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment including, without limitation, mobile phone, and PC) and other equipment specified in this catalog or the individual product specification sheets.

TAIYO YUDEN has the line-up of the products intended for use in automotive electronic equipment, telecommunications infrastructure and industrial equipment, or medical devices classified as GHTF Classes A to C (Japan Classes I to III). Therefore, when using our products for these equipment, please check available applications specified in this catalog or the individual product specification sheets and use the corresponding products.

2. Equipment Requiring Inquiry

Please be sure to contact TAIYO YUDEN for further information before using the products listed in this catalog for the following equipment (excluding intended equipment as specified in this catalog or the individual product specification sheets) which may cause loss of human life, bodily injury, serious property damage and/or serious public impact due to a failure or defect of the products and/or malfunction attributed thereto.

- (1) Transportation equipment (automotive powertrain control system, train control system, and ship control system, etc.)
- (2) Traffic signal equipment
- (3) Disaster prevention equipment, crime prevention equipment
- (4) Medical devices classified as GHTF Class C (Japan Class III)
- (5) Highly public information network equipment, data-processing equipment (telephone exchange, and base station, etc.)
- (6) Any other equipment requiring high levels of quality and/or reliability equal to the equipment listed above

3. Equipment Prohibited for Use

Please do not incorporate our products into the following equipment requiring extremely high levels of safety and/or reliability.

- (1) Aerospace equipment (artificial satellite, rocket, etc.)
- (2) Aviation equipment *¹
- (3) Medical devices classified as GHTF Class D (Japan Class IV), implantable medical devices *²

- (4) Power generation control equipment (nuclear power, hydroelectric power, thermal power plant control system, etc.)
- (5) Undersea equipment (submarine repeating equipment, underwater work equipment, etc.)
- (6) Military equipment
- (7) Any other equipment requiring extremely high levels of safety and/or reliability equal to the equipment listed above

*Notes:

1. 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.
2. Implantable medical devices contain not only internal unit which is implanted in a body, but also external unit which is connected to the internal unit.

4. Limitation of Liability

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 that is not intended for use by TAIYO YUDEN, or any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

■ Safety Design

When using our products for high safety and/or reliability-required equipment or circuits, please fully perform safety and/or reliability evaluation. In addition, please install (i) systems equipped with a protection circuit and a protection device and/or (ii) systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault for a failsafe design to ensure safety.

■ Intellectual Property Rights

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.

■ Limited Warranty

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 failure 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.

■ TAIYO YUDEN's Official Sales Channel

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

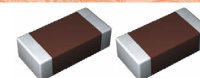
Some of our products listed in this catalog may require specific procedures for export according to "U.S. Export Administration Regulations", "Foreign Exchange and Foreign Trade Control Law" of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales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

Automotive Application Guide

We classify automotive electronic equipment into the following four application categories and set usable application categories for each of our products. When using our products for automotive electronic equipment, please be sure to check such application categories and use our products accordingly. Should you have any questions on this matter, please contact us.

Category	Automotive Electronic Equipment (Typical Example)
POWERTRAIN	<ul style="list-style-type: none"> • Engine ECU (Electronically Controlled Fuel Injector) • Cruise Control Unit • 4WS (4 Wheel Steering) • Transmission • Power Steering • HEV/PHV/EV Core Control (Battery, Inverter, DC-DC) • Automotive Locator (Car location information providing device), etc.
SAFETY	<ul style="list-style-type: none"> • ABS (Anti-Lock Brake System) • ESC (Electronic Stability Control) • Airbag • ADAS (Equipment that directly controls running, turning and stopping), etc.
BODY & CHASSIS	<ul style="list-style-type: none"> • Wiper • Automatic Door • Power Window • Keyless Entry System • Electric Door Mirror • Automobile Digital Mirror • Interior Lighting • Automobile Air Conditioning System • LED Headlight • TPMS (Tire Pressure Monitoring System) • Anti-Theft Device (Immobilizer), etc.
INFOTAINMENT	<ul style="list-style-type: none"> • Car Infotainment System • ITS/Telematics System • Instrument Cluster • ADAS (Sensor, Equipment that is not interlocked with safety equipment or powertrain) • Dashcam (genuine products for automotive manufacturer), etc.

MULTILAYER CERAMIC CAPACITORS



REFLOW
AEC-Q200

■ 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 (For High Frequency)
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
	316	3.2±0.20	1.6±0.20	1.25+0.15/-0.05
	325	3.2±0.30	2.5±0.30	1.6±0.20
B	105	1.0+0.15/-0.05	0.5+0.15/-0.05	2.5±0.30
	107	1.6+0.20/-0	0.8+0.20/-0	0.5+0.15/-0.05
	212	2.0+0.20/-0	1.25+0.20/-0	0.8+0.20/-0
C	316	3.2±0.30	1.6±0.30	0.85±0.10
	105	1.0+0.20/-0	0.5+0.20/-0	1.25+0.20/-0
	107	1.6+0.25/-0	0.8+0.25/-0	1.6±0.30
K	212	2.0±0.15	1.25±0.15	0.5+0.20/-0
	316	3.2±0.20	1.6±0.20	0.8+0.25/-0
K	212	2.0±0.15	1.25±0.15	0.8+0.25/-0
	325	3.2±0.50	2.5±0.30	1.25+0.25/-0
K	316	3.2±0.20	1.6±0.20	0.85±0.15
	325	3.2±0.50	2.5±0.30	1.15±0.20
K	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%	K
					±20%	M
C6	EIA X6S	-55 ~ +105	25	±22%	±10%	K
					±20%	M
B7	EIA X7R	-55 ~ +125	25	±15%	±10%	K
					±20%	M
C7	EIA X7S	-55 ~ +125	25	±22%	±10%	K
					±20%	M
D7	EIA X7T	-55 ~ +125	25	+22% / -33%	±10%	K
					±20%	M

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

CERAMIC CAPACITORS
 AUTO
 For Automotive Electronic Equipment
 MULTILAYER CERAMIC CAPACITORS

■ 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 μF
104	0.1 μF
105	1.0 μF
106	10 μF
107	100 μF

Note : R=Decimal point

⑧ Capacitance tolerance

Code	Capacitance tolerance
A	± 0.05pF
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 (107 type or more)
A	0.8
D	0.85 (212 type 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 Automotive
8	MLCC for Telecommunications infrastructure and Industrial equipment / Medical devices

⑪ Packaging

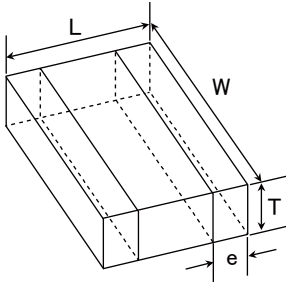
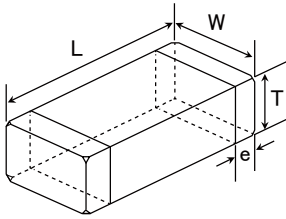
Code	Packaging
F	φ 178mm Taping (2mm pitch)
R	φ 178mm Embossed Taping (4mm pitch)
T	φ 178mm Taping (4mm pitch)
P	φ 178mm Taping (4mm pitch, 1000 pcs/reel) 325 type (Thickness code M)

⑫ Internal code

Code	Internal code
Δ	Standard

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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)	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)	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)
□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±0.3/-0.25 (0.014±0.012/-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±0.25 (0.014±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)	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)
□MF212(0805)			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)	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)
□MF316(1206)			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)	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)
□MF325(1210)			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

CERAMIC CAPACITORS

AUTO

For Automotive Electronic Equipment
MULTILAYER CERAMIC CAPACITORS

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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.

Notes)

- The exchange of individual specifications is necessary depending on your application and/or circuit condition. Please contact TAIYO YUDEN's official sales channel.
- For Automotive (AEC-Q200 Qualified) products for POWERTRAIN, and SAFETY. Please check "Automotive Application Guide" for further details before using the products.
 - < AEC-Q200 : AEC-Q200 qualified >
- All the Multilayer Ceramic Capacitors for Automotive products 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 specifications and AEC-Q200 test results, etc., and please review and approve the product specifications before ordering.
- *1: 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(−55~+125°C)】 0.5mm thickness (V)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT	Thickness*1 [mm]	Note
							Rated voltage x %		
UMF105 B7102[VHF]		50	X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	
UMF105 B7222[VHF]			X7R	2200 p	±10, ±20	2.5	200	0.5±0.05	
UMF105 B7472[VHF]			X7R	4700 p	±10, ±20	2.5	150	0.5±0.05	
UMF105 B7103[VHF]			X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
TMF105 B7102[VHF]		25	X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	
TMF105 B7222[VHF]			X7R	2200 p	±10, ±20	2.5	200	0.5±0.05	
TMF105 B7472[VHF]			X7R	4700 p	±10, ±20	2.5	200	0.5±0.05	
TMF105 B7103[VHF]			X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
TMF105 B7223[VHF]		16	X7R	0.022 μ	±10, ±20	3.5	150	0.5±0.05	
TMF105 B7473[VHF]			X7R	0.047 μ	±10, ±20	3.5	150	0.5±0.05	
EMF105 B7102[VHF]			X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	
EMF105 B7222[VHF]			X7R	2200 p	±10, ±20	2.5	200	0.5±0.05	
EMF105 B7472[VHF]		10	X7R	4700 p	±10, ±20	2.5	200	0.5±0.05	
EMF105 B7103[VHF]			X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
EMF105 B7223[VHF]			X7R	0.022 μ	±10, ±20	3.5	200	0.5±0.05	
EMF105 B7473[VHF]			X7R	0.047 μ	±10, ±20	3.5	200	0.5±0.05	
EMF105 B7104[VHF]		10	X7R	0.1 μ	±10, ±20	5	150	0.5±0.05	
LMF105 B7102[VHF]			X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	
LMF105 B7222[VHF]			X7R	2200 p	±10, ±20	2.5	200	0.5±0.05	
LMF105 B7472[VHF]			X7R	4700 p	±10, ±20	2.5	200	0.5±0.05	
LMF105 B7103[VHF]		10	X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
LMF105 B7223[VHF]			X7R	0.022 μ	±10, ±20	3.5	200	0.5±0.05	
LMF105 B7473[VHF]			X7R	0.047 μ	±10, ±20	3.5	200	0.5±0.05	
LMF105 B7104[VHF]			X7R	0.1 μ	±10, ±20	5	200	0.5±0.05	

- 107TYPE (Dimension:1.6×0.8mm JIS:1608 EIA:0603)
 【Temperature Characteristic B7 : X7R(−55~+125°C)】 0.8mm thickness (A)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT	Thickness*1 [mm]	Note
							Rated voltage x %		
UMF107 B7223[AHT]		50	X7R	0.022 μ	±10, ±20	3.5	200	0.8±0.10	
UMF107 B7473[AHT]			X7R	0.047 μ	±10, ±20	3.5	200	0.8±0.10	
UMF107 B7104[AHT]			X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	
TMF107 B7223[AHT]			X7R	0.022 μ	±10, ±20	3.5	200	0.8±0.10	
TMF107 B7473[AHT]		25	X7R	0.047 μ	±10, ±20	3.5	200	0.8±0.10	
TMF107 B7104[AHT]			X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	
EMF107 B7223[AHT]			X7R	0.022 μ	±10, ±20	3.5	200	0.8±0.10	
EMF107 B7473[AHT]			X7R	0.047 μ	±10, ±20	3.5	200	0.8±0.10	
EMF107 B7104[AHT]		16	X7R	0.1 μ	±10, ±20	3.5	200	0.8±0.10	
EMF107 B7224[AHT]			X7R	0.22 μ	±10, ±20	5	200	0.8±0.10	
EMF107 B7105[AHT]			X7R	1 μ	±10, ±20	10	150	0.8±0.10	
LMF107 B7223[AHT]			10	X7R	0.022 μ	±10, ±20	3.5	200	0.8±0.10
LMF107 B7473[AHT]		X7R		0.047 μ	±10, ±20	3.5	200	0.8±0.10	
LMF107 B7104[AHT]		X7R		0.1 μ	±10, ±20	3.5	200	0.8±0.10	
LMF107 B7224[AHT]		X7R		0.22 μ	±10, ±20	5	200	0.8±0.10	
LMF107 B7105[AHT]		10	X7R	1 μ	±10, ±20	10	150	0.8±0.10	

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■ PART NUMBER

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

【Temperature Characteristic B7 : X7R(−55~+125°C)】 1.25mm thickness(G)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*1 [mm]	Note
							Rated voltage x %			
HMF212 B7103□GHT		100	X7R	0.01 μ	±10, ±20	3.5	200		1.25±0.10	
HMF212 B7223□GHT			X7R	0.022 μ	±10, ±20	3.5	200		1.25±0.10	
HMF212 B7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200		1.25±0.10	
HMF212 B7104□GHT			X7R	0.1 μ	±10, ±20	3.5	200		1.25±0.10	
HMF212 B7224□GHT			X7R	0.22 μ	±10, ±20	3.5	200		1.25±0.10	
UMF212 B7103□GHT		50	X7R	0.01 μ	±10, ±20	3.5	200		1.25±0.10	
UMF212 B7223□GHT			X7R	0.022 μ	±10, ±20	3.5	200		1.25±0.10	
UMF212 B7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200		1.25±0.10	
UMF212 B7104□GHT			X7R	0.1 μ	±10, ±20	3.5	200		1.25±0.10	
UMF212 B7224□GHT			X7R	0.22 μ	±10, ±20	3.5	200		1.25±0.10	
UMF212 B7105□GHT		25	X7R	1 μ	±10, ±20	10	150		1.25±0.10	
TMF212 B7103□GHT			X7R	0.01 μ	±10, ±20	3.5	200		1.25±0.10	
TMF212 B7223□GHT			X7R	0.022 μ	±10, ±20	3.5	200		1.25±0.10	
TMF212 B7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200		1.25±0.10	
TMF212 B7104□GHT			X7R	0.1 μ	±10, ±20	3.5	200		1.25±0.10	
TMF212 B7224□GHT		16	X7R	0.22 μ	±10, ±20	3.5	200		1.25±0.10	
TMF212 B7474□GHT			X7R	0.47 μ	±10, ±20	3.5	200		1.25±0.10	
TMF212 B7105□GHT			X7R	1 μ	±10, ±20	10	200		1.25±0.10	
TMF212 B7225□GHT			X7R	2.2 μ	±10, ±20	10	150		1.25±0.10	
EMF212 B7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200		1.25±0.10	
EMF212 B7104□GHT		10	X7R	0.1 μ	±10, ±20	3.5	200		1.25±0.10	
EMF212 B7224□GHT			X7R	0.22 μ	±10, ±20	3.5	200		1.25±0.10	
EMF212 B7474□GHT			X7R	0.47 μ	±10, ±20	3.5	200		1.25±0.10	
EMF212 B7105□GHT			X7R	1 μ	±10, ±20	10	200		1.25±0.10	
EMF212 B7225□GHT			X7R	2.2 μ	±10, ±20	10	200		1.25±0.10	
EMF212AB7475□GHT		6.3	X7R	4.7 μ	±10, ±20	10	150		1.25±0.15/-0.05	
LMF212 B7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200		1.25±0.10	
LMF212 B7104□GHT			X7R	0.1 μ	±10, ±20	3.5	200		1.25±0.10	
LMF212 B7224□GHT			X7R	0.22 μ	±10, ±20	3.5	200		1.25±0.10	
LMF212 B7474□GHT			X7R	0.47 μ	±10, ±20	3.5	200		1.25±0.10	
LMF212 B7105□GHT		10	X7R	1 μ	±10, ±20	10	200		1.25±0.10	
LMF212 B7225□GHT			X7R	2.2 μ	±10, ±20	10	200		1.25±0.10	
LMF212 B7475□GHT			X7R	4.7 μ	±10, ±20	10	150		1.25±0.10	
JMF212AB7106□GHT			X7R	10 μ	±10, ±20	10	150		1.25±0.15/-0.05	

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

【Temperature Characteristic B7 : X7R(−55~+125°C)】 1.15mm thickness(F)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*1 [mm]	Note
							Rated voltage x %			
HMF316 B7102□FHT		100	X7R	1000 p	±10, ±20	2.5	200		1.15±0.10	
HMF316 B7222□FHT			X7R	2200 p	±10, ±20	2.5	200		1.15±0.10	
HMF316 B7472□FHT			X7R	4700 p	±10, ±20	2.5	200		1.15±0.10	
HMF316 B7103□FHT			X7R	0.01 μ	±10, ±20	2.5	200		1.15±0.10	
UMF316 B7102□FHT		50	X7R	1000 p	±10, ±20	2.5	200		1.15±0.10	
UMF316 B7222□FHT			X7R	2200 p	±10, ±20	2.5	200		1.15±0.10	
UMF316 B7472□FHT			X7R	4700 p	±10, ±20	2.5	200		1.15±0.10	
UMF316 B7103□FHT			X7R	0.01 μ	±10, ±20	2.5	200		1.15±0.10	

【Temperature Characteristic B7 : X7R(−55~+125°C)】 1.6mm thickness(L)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*1 [mm]	Note
							Rated voltage x %			
HMF316 B7104□LHT		100	X7R	0.1 μ	±10, ±20	3.5	200		1.6±0.20	
HMF316 B7224□LHT			X7R	0.22 μ	±10, ±20	3.5	150		1.6±0.20	
HMF316 B7474□LHT			X7R	0.47 μ	±10, ±20	3.5	150		1.6±0.20	
UMF316 B7104□LHT			X7R	0.1 μ	±10, ±20	3.5	200		1.6±0.20	
UMF316 B7224□LHT		50	X7R	0.22 μ	±10, ±20	3.5	200		1.6±0.20	
UMF316 B7474□LHT			X7R	0.47 μ	±10, ±20	3.5	200		1.6±0.20	
UMF316 B7105□LHT			X7R	1 μ	±10, ±20	3.5	150		1.6±0.20	
TMF316 B7104□LHT			X7R	0.1 μ	±10, ±20	3.5	200		1.6±0.20	
TMF316 B7224□LHT		25	X7R	0.22 μ	±10, ±20	3.5	200		1.6±0.20	
TMF316 B7474□LHT			X7R	0.47 μ	±10, ±20	3.5	200		1.6±0.20	
TMF316 B7105□LHT			X7R	1 μ	±10, ±20	3.5	200		1.6±0.20	
TMF316 B7225□LHT			X7R	2.2 μ	±10, ±20	3.5	200		1.6±0.20	
TMF316AB7475□LHT		16	X7R	4.7 μ	±10, ±20	10	150		1.6±0.20	
EMF316 B7224□LHT			X7R	0.22 μ	±10, ±20	3.5	200		1.6±0.20	
EMF316 B7474□LHT			X7R	0.47 μ	±10, ±20	3.5	200		1.6±0.20	
EMF316 B7105□LHT			X7R	1 μ	±10, ±20	3.5	200		1.6±0.20	
EMF316 B7225□LHT			X7R	2.2 μ	±10, ±20	3.5	200		1.6±0.20	
EMF316AB7475□LHT		10	X7R	4.7 μ	±10, ±20	10	200		1.6±0.20	
EMF316AB7106□LHT			X7R	10 μ	±10, ±20	10	150		1.6±0.20	
LMF316 B7224□LHT			X7R	0.22 μ	±10, ±20	3.5	200		1.6±0.20	
LMF316 B7474□LHT			X7R	0.47 μ	±10, ±20	3.5	200		1.6±0.20	
LMF316 B7105□LHT			X7R	1 μ	±10, ±20	3.5	200		1.6±0.20	
LMF316 B7225□LHT		6.3	X7R	2.2 μ	±10, ±20	3.5	200		1.6±0.20	
LMF316AB7475□LHT			X7R	4.7 μ	±10, ±20	10	200		1.6±0.20	
LMF316AB7106□LHT			X7R	10 μ	±10, ±20	10	150		1.6±0.20	
JMF316AB7106□LHT		X7R	10 μ	±10, ±20	10	200		1.6±0.20		

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■ PART NUMBER

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

【Temperature Characteristic B7 : X7R(−55~+125°C)】 2.5mm thickness (M)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*1 [mm]	Note
							Rated voltage x %			
HMF325 B7225□MHP		100	X7R	2.2 μ	±10, ±20	3.5	150		2.5±0.20	
UMF325 B7225□MHP		50	X7R	2.2 μ	±10, ±20	3.5	200		2.5±0.20	
UMF325 B7475□MHP			X7R	4.7 μ	±10, ±20	5	150		2.5±0.20	
TMF325 B7225□MHP		25	X7R	2.2 μ	±10, ±20	3.5	200		2.5±0.20	
TMF325 B7475□MHP			X7R	4.7 μ	±10, ±20	5	200		2.5±0.20	
EMF325 B7225□MHP		16	X7R	2.2 μ	±10, ±20	3.5	200		2.5±0.20	
EMF325 B7475□MHP			X7R	4.7 μ	±10, ±20	5	200		2.5±0.20	
LMF325 B7225□MHP		10	X7R	2.2 μ	±10, ±20	3.5	200		2.5±0.20	
LMF325 B7475□MHP			X7R	4.7 μ	±10, ±20	5	200		2.5±0.20	

【Temperature Characteristic B7 : X7R(−55~+125°C)】 1.9mm thickness (N)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT		Thickness*1 [mm]	Note
							Rated voltage x %			
HMF325 B7223□NHHT		100	X7R	0.022 μ	±10, ±20	2.5	200		1.9±0.20	
HMF325 B7473□NHHT			X7R	0.047 μ	±10, ±20	2.5	200		1.9±0.20	
HMF325 B7224□NHHT			X7R	0.22 μ	±10, ±20	3.5	200		1.9±0.20	
UMF325 B7223□NHHT		50	X7R	0.022 μ	±10, ±20	2.5	200		1.9±0.20	
UMF325 B7473□NHHT			X7R	0.047 μ	±10, ±20	2.5	200		1.9±0.20	
UMF325 B7104□NHHT			X7R	0.1 μ	±10, ±20	3.5	200		1.9±0.20	
UMF325 B7224□NHHT			X7R	0.22 μ	±10, ±20	3.5	200		1.9±0.20	
UMF325 B7474□NHHT			X7R	0.47 μ	±10, ±20	3.5	200		1.9±0.20	
UMF325 B7105□NHHT			X7R	1 μ	±10, ±20	3.5	200		1.9±0.20	
TMF325 B7224□NHHT		25	X7R	0.22 μ	±10, ±20	3.5	200		1.9±0.20	
TMF325 B7474□NHHT			X7R	0.47 μ	±10, ±20	3.5	200		1.9±0.20	
TMF325 B7105□NHHT			X7R	1 μ	±10, ±20	3.5	200		1.9±0.20	
EMF325 B7224□NHHT		16	X7R	0.22 μ	±10, ±20	3.5	200		1.9±0.20	
EMF325 B7474□NHHT			X7R	0.47 μ	±10, ±20	3.5	200		1.9±0.20	
EMF325 B7105□NHHT			X7R	1 μ	±10, ±20	3.5	200		1.9±0.20	
LMF325 B7224□NHHT		10	X7R	0.22 μ	±10, ±20	3.5	200		1.9±0.20	
LMF325 B7474□NHHT			X7R	0.47 μ	±10, ±20	3.5	200		1.9±0.20	
LMF325 B7105□NHHT			X7R	1 μ	±10, ±20	3.5	200		1.9±0.20	

CERAMIC CAPACITORS

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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) ※	0.5	V	—	4000
<input type="checkbox"/> MF107(0603)	0.8	A	4000	—
<input type="checkbox"/> VS107(0603)	0.7	C	4000	—
<input type="checkbox"/> MJ107(0603)	0.8	A	3000	3000
<input type="checkbox"/> MK212(0805)	0.45	K	4000	—
<input type="checkbox"/> WK212(0508) ※	0.85	D		
<input type="checkbox"/> MF212(0805)	1.25	G	—	3000
<input type="checkbox"/> VS212(0805)	0.85	D	4000	—
<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
	2.5	M	—	500(T), 1000(P)
<input type="checkbox"/> MK432(1812)	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 T
	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		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		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

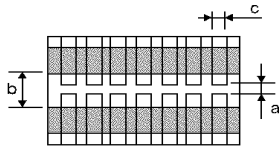
High Reliability Application Multilayer Ceramic Capacitors

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 ⁴ 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.

▶ 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/>).

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												

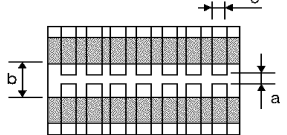
12. Adhesive Force of Terminal Electrodes																									
Specified Value	Appearance: Terminal electrodes shall be no exfoliation or a sign of exfoliation.																								
Test Methods and Remarks	Solder lands refer to fig.1.																								
	<table border="1"> <thead> <tr> <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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Dimension	Case size																								
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b	3.0	4.0	5.0	5.0																					
c	1.2	1.65	2.0	2.9																					

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.

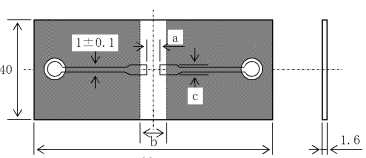
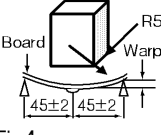
15. Solderability	
Specified Value	More than 95% of terminal electrode shall be covered with fresh solder.
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test.
	Immerse test sample in an solder solution(Sn-3Ag-0.5Cu).
	Soldering temperature : 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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For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

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="width: 100%; border-collapse: collapse;"> <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 ± 2 hours. <div style="display: flex; align-items: center;">  <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <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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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 ± 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 ± 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;">  <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <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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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 $10000M\Omega$
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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.
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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
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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)
	1	Minimum usage temperature
	2	+25
	3	Maximum usage temperature
	4	+25
		Time (min.)
		30 ± 3
		2 to 3
		30 ± 3
		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

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.

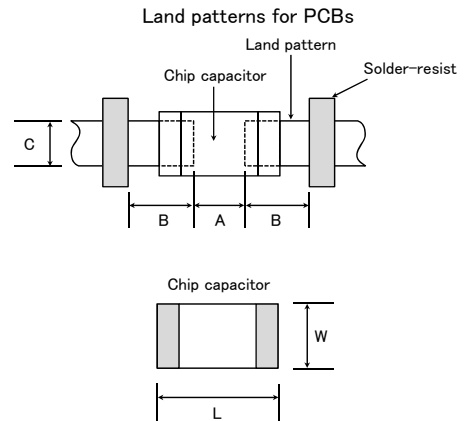
2. PCB Design

- 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.

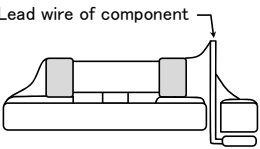
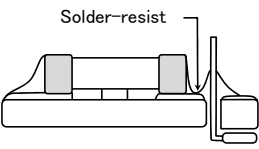
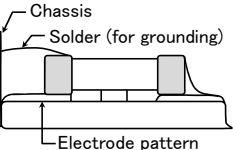
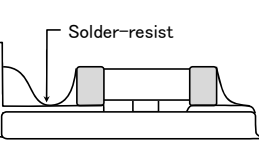
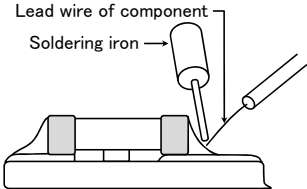
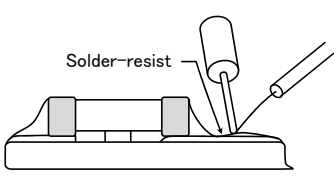
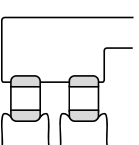
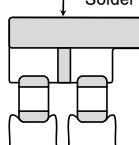
(1) Recommended land dimensions for a typical chip capacitor land patterns for PCBs
Recommended land dimensions for reflow-soldering (unit: mm)

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



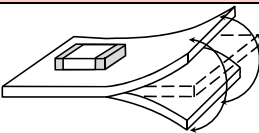
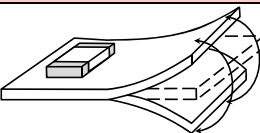
Excess solder can affect the ability of chips to withstand mechanical stresses. Therefore, please take proper precautions when designing land-patterns.

(2) Examples of good and bad solder application

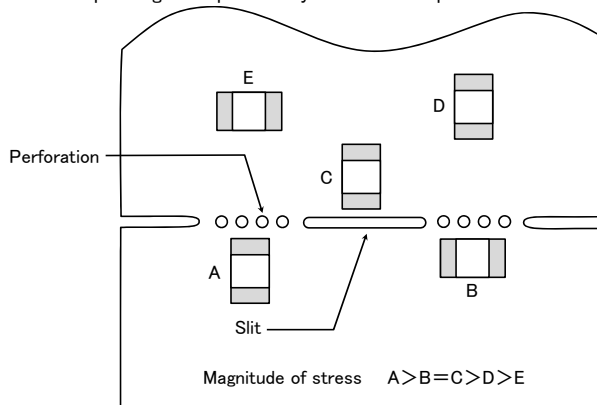
Items	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆ 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 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.

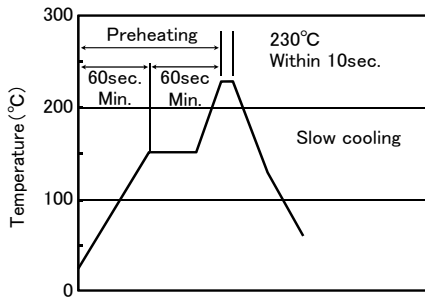
Cooling: The temperature difference between the components and cleaning process should not be greater than 100°C.

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.

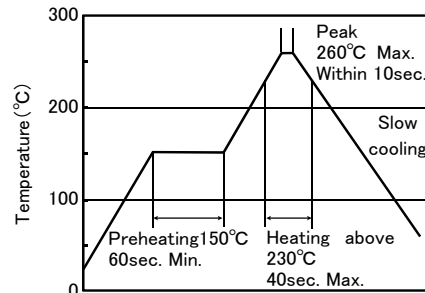
【Recommended conditions for soldering】

[Reflow soldering]

Temperature profile



【Recommended conditions for Pd Free soldering】

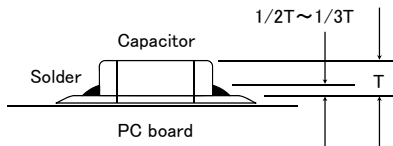


※Ceramic chip components should be preheated to within 100 to 130°C of the soldering.

※Assured to be reflow soldering for 2 times.

Caution

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



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