

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.

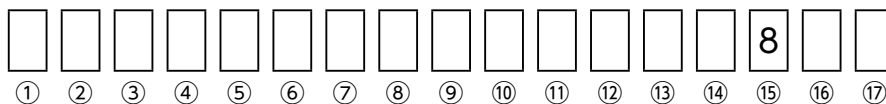
Industrial Application Guide

The products described as “For Telecommunications Infrastructure and Industrial Equipment” in this catalog are intended for use in the equipment shown in the below table as its typical example. Therefore, when using our products for these equipment, please check it carefully by referring to the part number or the individual product specification sheets and use the corresponding products. Should you have any questions on this matter, please contact us.

Category	Telecommunications Infrastructure and Industrial Equipment (Typical Example)
Telecommunications Infrastructure	<ul style="list-style-type: none"> • Base Station • Optical Transceiver • Router/Switch (Carrier-Grade) • UPS (Uninterruptible Power Supply), etc.
Factory Automation	<ul style="list-style-type: none"> • PLC (Programmable Logic Controller) • Servomotor/Servo Driver • Industry Robot, etc.
Measurement	<ul style="list-style-type: none"> • Gas Meter • Water Meter • Flow Meter • Pressure Gauge Meter • Magnetometer • Thermometer, etc.
Electric Power Apparatus	<ul style="list-style-type: none"> • Power Conditioner (Solar Power System) • Smart Meter • GFCI (Ground Fault Circuit Interrupter) • Electric Vehicle Charging Station, etc.

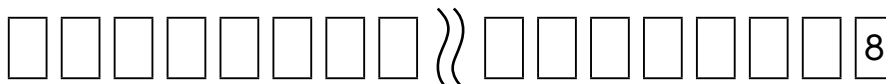
Part Numbering System

Multilayer Ceramic Capacitors:



If the 15th code from the left is “8”, it indicates “For Telecommunications Infrastructure and Industrial Equipment” or “For Medical Devices”.

Inductors:



If the 1st code from the right is “8” regardless of the total digit number, it indicates “For Telecommunications Infrastructure and Industrial Equipment” or “For Medical Devices”.

Because there are some exceptions, for details please refer to each page of this catalog where the part numbering system of each product is described.

Medical Application Guide

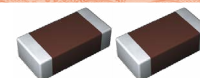
The products described as “For Medical Devices” in this catalog are intended for use in the medical devices classified as GHTF Classes A to C (Japan Classes I to III) except for all medical devices classified as GHTF Class D (Japan Class IV) and implantable medical devices (bone-anchored hearing aid, artificial retina system, and external unit which is connected to internal unit which is implanted in a body, etc.). Therefore, when using our products for these medical devices, please check it carefully by referring to the part number or the individual product specification sheets and use the corresponding products. Should you have any questions on this matter, please contact us.

Risk Level					
Japan	Classification according to the PMD Act of Japan (based on the GHTF Rules)	Class I General Medical Devices (GHTF Class A)	Class II Controlled Medical Devices (GHTF Class B)	Class III Specially-controlled Medical Devices (GHTF Class C)	Class IV Specially-controlled Medical Devices (GHTF Class D)
		Medical devices with extremely low risk to the human body in case of problems [Ex.] • In Vitro Diagnostic Devices • Nebulizer • Blood Gas Analyzer • Plethysmographs • Breathing Sensor • AC-powered Operating Table • Surgical Light • Cholesterol Analysis Device • Blood Type Analysis Device, etc.	Medical devices with relatively low risk to the human body in case of problems [Ex.] • Electronic Thermometer • Electronic Blood Pressure Gauge • Electronic Endoscope • Hearing Aid • Electrocardiograph • MRI • Ultrasonic Diagnostic System • Diagnostic Imaging Equipment • X-ray Diagnostic Equipment • Central Monitor • Pulse Oximeter, etc.	Medical devices with relatively high risk to the human body in case of problems [Ex.] • Dialysis Machine • Radiation Therapy Equipment • Infusion Pump • Respirator • Glucose Monitoring System • AED (Automated External Defibrillator) • Skin Laser Scanner • Electric Surgical Unit • Insulin Pump, etc.	Medical devices highly invasive to patients and with life-threatening risk in case of problems [Ex.] • Cardiac Pacemaker • Video Flexible Angioscope • Implantable Infusion Pump • Cardiac Electrosurgical Unit • Inspection Device with Cardiac Catheter • Defibrillator, etc.
U.S.A.	FDA Classification	Class I General Controls	Class II General Controls and Special Controls	Class III General Controls and Premarket Approval	
		Medical devices without the possibility of causing serious injury or harm to the patient or user even if there is a defect or malfunction in such medical devices	Medical devices with the possibility of causing injury or harm to the patient or user if there is a defect or malfunction in such medical devices	Medical devices with the possibility of causing serious injury, disability or death to the patient or user if a defect or malfunction occurs in such medical devices	

Coverage of those Classes by TAIYO YUDEN Products	Product Series for Medical Devices *Note: It is prohibited that our products are used in some medical devices such as implantable medical devices even if such medical devices are classified as GHTF Class C (Japan Class III).	N/A
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MULTILAYER CERAMIC CAPACITORS



REFLOW

■ 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+0.25/-0	1.25+0.25/-0	0.5+0.20/-0
	212	2.0±0.15	1.25±0.15	0.8+0.25/-0
	316	3.2±0.20	1.6±0.20	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
				1.6±0.20
				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

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CERAMIC CAPACITORS
 INDL
 For Telecommunications Infrastructure and Industrial Equipment / Medical Devices
 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	COG		25		± 1pF	F
						± 2%	G
						± 5%	J

⑦ Nominal capacitance

Code (example)	Nominal capacitance
OR5	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

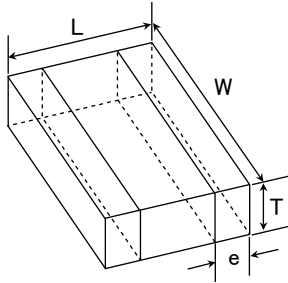
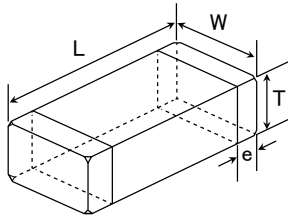
Code	Packaging
F	φ 178mm Taping (2mm pitch)
R	φ 178mm Embossed Taping (4mm pitch)
T	φ 178mm Taping (4mm pitch)
P	φ 178mm Taping (4mm pitch, 1000 pcs/reel) 325 type (Thickness code M)

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

INDL

For Telecommunications Infrastructure and Industrial Equipment / Medical Devices
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)

■ PART NUMBER

Multilayer Ceramic Capacitors (Temperature compensating type)

● 063TYPE (Dimension:0.6×0.3mm JIS:0603 EIA:0201)

【Temperature Characteristic CG : CG/COG(-55~+125°C)】 0.3mm thickness(T)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q [at 1MHz] (Min)	HTLT	Thickness*1 [mm]	Note
								Rated voltage x %		
UMK063 CG0R2CT8F		50	CG	COG	0.2 p	±0.25pF	404	200	0.3±0.03	
UMK063 CG0R3CT8F			CG	COG	0.3 p	±0.25pF	406	200	0.3±0.03	
UMK063 CG0R4CT8F			CG	COG	0.4 p	±0.25pF	408	200	0.3±0.03	
UMK063 CG0R5CT8F			CG	COG	0.5 p	±0.25pF	410	200	0.3±0.03	
UMK063 CG0R6CT8F			CG	COG	0.6 p	±0.25pF	412	200	0.3±0.03	
UMK063 CG0R7CT8F			CG	COG	0.7 p	±0.25pF	414	200	0.3±0.03	
UMK063 CGR75CT8F			CG	COG	0.75 p	±0.25pF	415	200	0.3±0.03	
UMK063 CG0R8CT8F			CG	COG	0.8 p	±0.25pF	416	200	0.3±0.03	
UMK063 CG0R9CT8F			CG	COG	0.9 p	±0.25pF	418	200	0.3±0.03	
UMK063 CG010CT8F			CG	COG	1 p	±0.25pF	420	200	0.3±0.03	
UMK063 CG1R1CT8F			CG	COG	1.1 p	±0.25pF	422	200	0.3±0.03	
UMK063 CG1R2CT8F			CG	COG	1.2 p	±0.25pF	424	200	0.3±0.03	
UMK063 CG1R3CT8F			CG	COG	1.3 p	±0.25pF	426	200	0.3±0.03	
UMK063 CG1R4CT8F			CG	COG	1.4 p	±0.25pF	428	200	0.3±0.03	
UMK063 CG1R5CT8F			CG	COG	1.5 p	±0.25pF	430	200	0.3±0.03	
UMK063 CG1R6CT8F			CG	COG	1.6 p	±0.25pF	432	200	0.3±0.03	
UMK063 CG1R7CT8F			CG	COG	1.7 p	±0.25pF	434	200	0.3±0.03	
UMK063 CG1R8CT8F			CG	COG	1.8 p	±0.25pF	436	200	0.3±0.03	
UMK063 CG1R9CT8F			CG	COG	1.9 p	±0.25pF	438	200	0.3±0.03	
UMK063 CG020CT8F			CG	COG	2 p	±0.25pF	440	200	0.3±0.03	
UMK063 CG2R1CT8F			CG	COG	2.1 p	±0.25pF	442	200	0.3±0.03	
UMK063 CG2R2CT8F			CG	COG	2.2 p	±0.25pF	444	200	0.3±0.03	
UMK063 CG2R3CT8F			CG	COG	2.3 p	±0.25pF	446	200	0.3±0.03	
UMK063 CG2R4CT8F			CG	COG	2.4 p	±0.25pF	448	200	0.3±0.03	
UMK063 CG2R5CT8F			CG	COG	2.5 p	±0.25pF	450	200	0.3±0.03	
UMK063 CG2R6CT8F			CG	COG	2.6 p	±0.25pF	452	200	0.3±0.03	
UMK063 CG2R7CT8F			CG	COG	2.7 p	±0.25pF	454	200	0.3±0.03	
UMK063 CG2R8CT8F			CG	COG	2.8 p	±0.25pF	456	200	0.3±0.03	
UMK063 CG2R9CT8F			CG	COG	2.9 p	±0.25pF	458	200	0.3±0.03	
UMK063 CG030CT8F			CG	COG	3 p	±0.25pF	460	200	0.3±0.03	
UMK063 CG3R1CT8F			CG	COG	3.1 p	±0.25pF	462	200	0.3±0.03	
UMK063 CG3R2CT8F			CG	COG	3.2 p	±0.25pF	464	200	0.3±0.03	
UMK063 CG3R3CT8F			CG	COG	3.3 p	±0.25pF	466	200	0.3±0.03	
UMK063 CG3R4CT8F			CG	COG	3.4 p	±0.25pF	468	200	0.3±0.03	
UMK063 CG3R5CT8F			CG	COG	3.5 p	±0.25pF	470	200	0.3±0.03	
UMK063 CG3R6CT8F			CG	COG	3.6 p	±0.25pF	472	200	0.3±0.03	
UMK063 CG3R7CT8F			CG	COG	3.7 p	±0.25pF	474	200	0.3±0.03	
UMK063 CG3R8CT8F			CG	COG	3.8 p	±0.25pF	476	200	0.3±0.03	
UMK063 CG3R9CT8F			CG	COG	3.9 p	±0.25pF	478	200	0.3±0.03	
UMK063 CG040CT8F			CG	COG	4 p	±0.25pF	480	200	0.3±0.03	
UMK063 CG4R1CT8F			CG	COG	4.1 p	±0.25pF	482	200	0.3±0.03	
UMK063 CG4R2CT8F			CG	COG	4.2 p	±0.25pF	484	200	0.3±0.03	
UMK063 CG4R3CT8F			CG	COG	4.3 p	±0.25pF	486	200	0.3±0.03	
UMK063 CG4R4CT8F			CG	COG	4.4 p	±0.25pF	488	200	0.3±0.03	
UMK063 CG4R5CT8F			CG	COG	4.5 p	±0.25pF	490	200	0.3±0.03	
UMK063 CG4R6CT8F			CG	COG	4.6 p	±0.25pF	492	200	0.3±0.03	
UMK063 CG4R7CT8F			CG	COG	4.7 p	±0.25pF	494	200	0.3±0.03	
UMK063 CG4R8CT8F			CG	COG	4.8 p	±0.25pF	496	200	0.3±0.03	
UMK063 CG4R9CT8F			CG	COG	4.9 p	±0.25pF	498	200	0.3±0.03	
UMK063 CG050CT8F			CG	COG	5 p	±0.25pF	500	200	0.3±0.03	
UMK063 CG5R1DT8F		CG	COG	5.1 p	±0.5pF	502	200	0.3±0.03		
UMK063 CG5R2DT8F		CG	COG	5.2 p	±0.5pF	504	200	0.3±0.03		
UMK063 CG5R3DT8F		CG	COG	5.3 p	±0.5pF	506	200	0.3±0.03		
UMK063 CG5R4DT8F		CG	COG	5.4 p	±0.5pF	508	200	0.3±0.03		
UMK063 CG5R5DT8F		CG	COG	5.5 p	±0.5pF	510	200	0.3±0.03		
UMK063 CG5R6DT8F		CG	COG	5.6 p	±0.5pF	512	200	0.3±0.03		
UMK063 CG5R7DT8F		CG	COG	5.7 p	±0.5pF	514	200	0.3±0.03		
UMK063 CG5R8DT8F		CG	COG	5.8 p	±0.5pF	516	200	0.3±0.03		
UMK063 CG5R9DT8F		CG	COG	5.9 p	±0.5pF	518	200	0.3±0.03		
UMK063 CG060DT8F		CG	COG	6 p	±0.5pF	520	200	0.3±0.03		
UMK063 CG6R1DT8F		CG	COG	6.1 p	±0.5pF	522	200	0.3±0.03		
UMK063 CG6R2DT8F		CG	COG	6.2 p	±0.5pF	524	200	0.3±0.03		
UMK063 CG6R3DT8F		CG	COG	6.3 p	±0.5pF	526	200	0.3±0.03		
UMK063 CG6R4DT8F		CG	COG	6.4 p	±0.5pF	528	200	0.3±0.03		
UMK063 CG6R5DT8F		CG	COG	6.5 p	±0.5pF	530	200	0.3±0.03		
UMK063 CG6R6DT8F		CG	COG	6.6 p	±0.5pF	532	200	0.3±0.03		
UMK063 CG6R7DT8F		CG	COG	6.7 p	±0.5pF	534	200	0.3±0.03		
UMK063 CG6R8DT8F		CG	COG	6.8 p	±0.5pF	536	200	0.3±0.03		
UMK063 CG6R9DT8F		CG	COG	6.9 p	±0.5pF	538	200	0.3±0.03		
UMK063 CG070DT8F		CG	COG	7 p	±0.5pF	540	200	0.3±0.03		
UMK063 CG7R1DT8F		CG	COG	7.1 p	±0.5pF	542	200	0.3±0.03		
UMK063 CG7R2DT8F		CG	COG	7.2 p	±0.5pF	544	200	0.3±0.03		
UMK063 CG7R3DT8F		CG	COG	7.3 p	±0.5pF	546	200	0.3±0.03		
UMK063 CG7R4DT8F		CG	COG	7.4 p	±0.5pF	548	200	0.3±0.03		
UMK063 CG7R5DT8F		CG	COG	7.5 p	±0.5pF	550	200	0.3±0.03		
UMK063 CG7R6DT8F		CG	COG	7.6 p	±0.5pF	552	200	0.3±0.03		
UMK063 CG7R7DT8F		CG	COG	7.7 p	±0.5pF	554	200	0.3±0.03		
UMK063 CG7R8DT8F		CG	COG	7.8 p	±0.5pF	556	200	0.3±0.03		
UMK063 CG7R9DT8F		CG	COG	7.9 p	±0.5pF	558	200	0.3±0.03		
UMK063 CG080DT8F		CG	COG	8 p	±0.5pF	560	200	0.3±0.03		
UMK063 CG8R1DT8F		CG	COG	8.1 p	±0.5pF	562	200	0.3±0.03		
UMK063 CG8R2DT8F		CG	COG	8.2 p	±0.5pF	564	200	0.3±0.03		
UMK063 CG8R3DT8F		CG	COG	8.3 p	±0.5pF	566	200	0.3±0.03		
UMK063 CG8R4DT8F		CG	COG	8.4 p	±0.5pF	568	200	0.3±0.03		
UMK063 CG8R5DT8F		CG	COG	8.5 p	±0.5pF	570	200	0.3±0.03		

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CERAMIC CAPACITORS
 INDL

For Telecommunications Infrastructure and Industrial Equipment / Medical Devices
 MULTILAYER CERAMIC CAPACITORS (TEMPERATURE COMPENSATING TYPE)

■ PART NUMBER

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q [at 1MHz] (Min)	HTLT	Thickness*1 [mm]	Note	
								Rated voltage x %			
UMK063 CG8R6DT8F		50	CG	C0G	8.6 p	±0.5pF	572	200	0.3±0.03		
UMK063 CG8R7DT8F			CG	C0G	8.7 p	±0.5pF	574	200	0.3±0.03		
UMK063 CG8R8DT8F			CG	C0G	8.8 p	±0.5pF	576	200	0.3±0.03		
UMK063 CG8R9DT8F			CG	C0G	8.9 p	±0.5pF	578	200	0.3±0.03		
UMK063 CG900DT8F			CG	C0G	9 p	±0.5pF	580	200	0.3±0.03		
UMK063 CG9R1DT8F			CG	C0G	9.1 p	±0.5pF	582	200	0.3±0.03		
UMK063 CG9R2DT8F			CG	C0G	9.2 p	±0.5pF	584	200	0.3±0.03		
UMK063 CG9R3DT8F			CG	C0G	9.3 p	±0.5pF	586	200	0.3±0.03		
UMK063 CG9R4DT8F			CG	C0G	9.4 p	±0.5pF	588	200	0.3±0.03		
UMK063 CG9R5DT8F			CG	C0G	9.5 p	±0.5pF	590	200	0.3±0.03		
UMK063 CG9R6DT8F			CG	C0G	9.6 p	±0.5pF	592	200	0.3±0.03		
UMK063 CG9R7DT8F			CG	C0G	9.7 p	±0.5pF	594	200	0.3±0.03		
UMK063 CG9R8DT8F			CG	C0G	9.8 p	±0.5pF	596	200	0.3±0.03		
UMK063 CG9R9DT8F			CG	C0G	9.9 p	±0.5pF	598	200	0.3±0.03		
UMK063 CG100DT8F			CG	C0G	10 p	±0.5pF	600	200	0.3±0.03		
UMK063 CG110JT8F			CG	C0G	11 p	±5%	620	200	0.3±0.03		
UMK063 CG120JT8F			CG	C0G	12 p	±5%	640	200	0.3±0.03		
UMK063 CG130JT8F			CG	C0G	13 p	±5%	660	200	0.3±0.03		
UMK063 CG150JT8F			CG	C0G	15 p	±5%	700	200	0.3±0.03		
UMK063 CG160JT8F			CG	C0G	16 p	±5%	720	200	0.3±0.03		
UMK063 CG180JT8F			CG	C0G	18 p	±5%	760	200	0.3±0.03		
UMK063 CG200JT8F			CG	C0G	20 p	±5%	800	200	0.3±0.03		
UMK063 CG220JT8F			CG	C0G	22 p	±5%	840	200	0.3±0.03		
UMK063 CG240JT8F			CG	C0G	24 p	±5%	880	200	0.3±0.03		
UMK063 CG270JT8F			CG	C0G	27 p	±5%	940	200	0.3±0.03		
UMK063 CG300JT8F			CG	C0G	30 p	±5%	1000	200	0.3±0.03		
UMK063 CG330JT8F			CG	C0G	33 p	±5%	1000	200	0.3±0.03		
UMK063 CG360JT8F			CG	C0G	36 p	±5%	1000	200	0.3±0.03		
UMK063 CG390JT8F			CG	C0G	39 p	±5%	1000	200	0.3±0.03		
UMK063 CG430JT8F			CG	C0G	43 p	±5%	1000	200	0.3±0.03		
UMK063 CG470JT8F			CG	C0G	47 p	±5%	1000	200	0.3±0.03		
UMK063 CG510JT8F			CG	C0G	51 p	±5%	1000	200	0.3±0.03		
UMK063 CG560JT8F			CG	C0G	56 p	±5%	1000	200	0.3±0.03		
UMK063 CG620JT8F			CG	C0G	62 p	±5%	1000	200	0.3±0.03		
UMK063 CG680JT8F			CG	C0G	68 p	±5%	1000	200	0.3±0.03		
UMK063 CG750JT8F			CG	C0G	75 p	±5%	1000	200	0.3±0.03		
UMK063 CG820JT8F			CG	C0G	82 p	±5%	1000	200	0.3±0.03		
UMK063 CG910JT8F			CG	C0G	91 p	±5%	1000	200	0.3±0.03		
UMK063 CG101JT8F			CG	C0G	100 p	±5%	1000	200	0.3±0.03		
UMK063 CG111JT8F			CG	C0G	110 p	±5%	1000	200	0.3±0.03		
UMK063 CG121JT8F			CG	C0G	120 p	±5%	1000	200	0.3±0.03		
UMK063 CG131JT8F			CG	C0G	130 p	±5%	1000	200	0.3±0.03		
UMK063 CG151JT8F			CG	C0G	150 p	±5%	1000	200	0.3±0.03		
UMK063 CG181JT8F			CG	C0G	180 p	±5%	1000	200	0.3±0.03		
UMK063 CG201JT8F			CG	C0G	200 p	±5%	1000	200	0.3±0.03		
UMK063 CG221JT8F			CG	C0G	220 p	±5%	1000	200	0.3±0.03		
TMK063 CG111JT8F			25	CG	C0G	110 p	±5%	1000	200	0.3±0.03	
TMK063 CG121JT8F				CG	C0G	120 p	±5%	1000	200	0.3±0.03	
TMK063 CG131JT8F		CG		C0G	130 p	±5%	1000	200	0.3±0.03		
TMK063 CG151JT8F		CG		C0G	150 p	±5%	1000	200	0.3±0.03		
TMK063 CG181JT8F		CG		C0G	180 p	±5%	1000	200	0.3±0.03		
TMK063 CG201JT8F		CG		C0G	200 p	±5%	1000	200	0.3±0.03		
TMK063 CG221JT8F		CG	C0G	220 p	±5%	1000	200	0.3±0.03			

CERAMIC CAPACITORS

INDL

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MULTILAYER CERAMIC CAPACITORS (TEMPERATURE COMPENSATING TYPE)

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■ PART NUMBER

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

【Temperature Characteristic CG : CG/COG(−55~+125°C)】 0.5mm thickness(V)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance	Q [at 1MHz] (Min)	HTLT	Thickness*1 [mm]	Note
			CG	COG				Rated voltage x %		
UMK105 CG0R5CV8F		50	CG	COG	0.5 p	±0.25pF	410	200	0.5±0.05	
UMK105 CG010CV8F			CG	COG	1 p	±0.25pF	420	200	0.5±0.05	
UMK105 CG1R5CV8F			CG	COG	1.5 p	±0.25pF	430	200	0.5±0.05	
UMK105 CG020CV8F			CG	COG	2 p	±0.25pF	440	200	0.5±0.05	
UMK105 CG030CV8F			CG	COG	3 p	±0.25pF	460	200	0.5±0.05	
UMK105 CG040CV8F			CG	COG	4 p	±0.25pF	480	200	0.5±0.05	
UMK105 CG050CV8F			CG	COG	5 p	±0.25pF	500	200	0.5±0.05	
UMK105 CG060DV8F			CG	COG	6 p	±0.5pF	520	200	0.5±0.05	
UMK105 CG070DV8F			CG	COG	7 p	±0.5pF	540	200	0.5±0.05	
UMK105 CG080DV8F			CG	COG	8 p	±0.5pF	560	200	0.5±0.05	
UMK105 CG090DV8F			CG	COG	9 p	±0.5pF	580	200	0.5±0.05	
UMK105 CG100DV8F			CG	COG	10 p	±0.5pF	600	200	0.5±0.05	
UMK105 CG120JV8F			CG	COG	12 p	±5%	640	200	0.5±0.05	
UMK105 CG150JV8F			CG	COG	15 p	±5%	700	200	0.5±0.05	
UMK105 CG180JV8F			CG	COG	18 p	±5%	760	200	0.5±0.05	
UMK105 CG220JV8F			CG	COG	22 p	±5%	840	200	0.5±0.05	
UMK105 CG270JV8F			CG	COG	27 p	±5%	940	200	0.5±0.05	
UMK105 CG330JV8F			CG	COG	33 p	±5%	1000	200	0.5±0.05	
UMK105 CG390JV8F			CG	COG	39 p	±5%	1000	200	0.5±0.05	
UMK105 CG470JV8F			CG	COG	47 p	±5%	1000	200	0.5±0.05	
UMK105 CG560JV8F			CG	COG	56 p	±5%	1000	200	0.5±0.05	
UMK105 CG680JV8F			CG	COG	68 p	±5%	1000	200	0.5±0.05	
UMK105 CG820JV8F			CG	COG	82 p	±5%	1000	200	0.5±0.05	
UMK105 CG101JV8F			CG	COG	100 p	±5%	1000	200	0.5±0.05	
UMK105 CG121JV8F			CG	COG	120 p	±5%	1000	200	0.5±0.05	
UMK105 CG151JV8F			CG	COG	150 p	±5%	1000	200	0.5±0.05	
UMK105 CG181JV8F			CG	COG	180 p	±5%	1000	200	0.5±0.05	
UMK105 CG221JV8F			CG	COG	220 p	±5%	1000	200	0.5±0.05	
UMK105 CG271JV8F			CG	COG	270 p	±5%	1000	200	0.5±0.05	
UMK105 CG331JV8F			CG	COG	330 p	±5%	1000	200	0.5±0.05	
UMK105 CG391JV8F			CG	COG	390 p	±5%	1000	200	0.5±0.05	
UMK105 CG471JV8F			CG	COG	470 p	±5%	1000	200	0.5±0.05	
UMK105 CG561JV8F		CG	COG	560 p	±5%	1000	200	0.5±0.05		
UMK105 CG681JV8F		CG	COG	680 p	±5%	1000	200	0.5±0.05		
UMK105 CG821JV8F		CG	COG	820 p	±5%	1000	200	0.5±0.05		
UMK105 CG102JV8F		CG	COG	1000 p	±5%	1000	200	0.5±0.05		

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Multilayer Ceramic Capacitors

PACKAGING

① Minimum Quantity

● Taped package

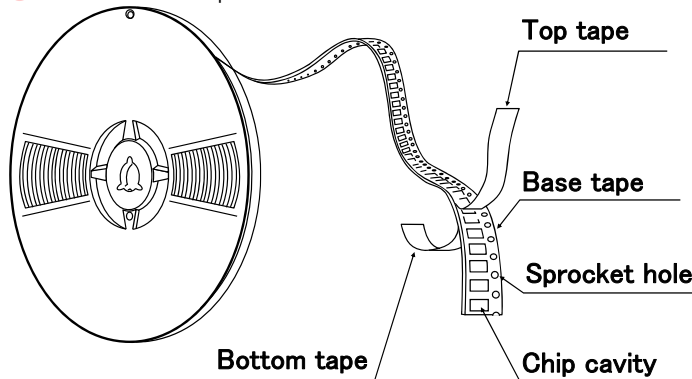
Type(EIA)	Thickness		Standard quantity [pcs]	
	mm	code	Paper tape	Embossed tape
<input type="checkbox"/> MK021(008004)	0.125	K	—	50000
<input type="checkbox"/> VS021(008004)				
<input type="checkbox"/> MK042(01005)	0.2	C, D	—	40000
<input type="checkbox"/> VS042(01005)				
<input type="checkbox"/> MK063(0201)	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.

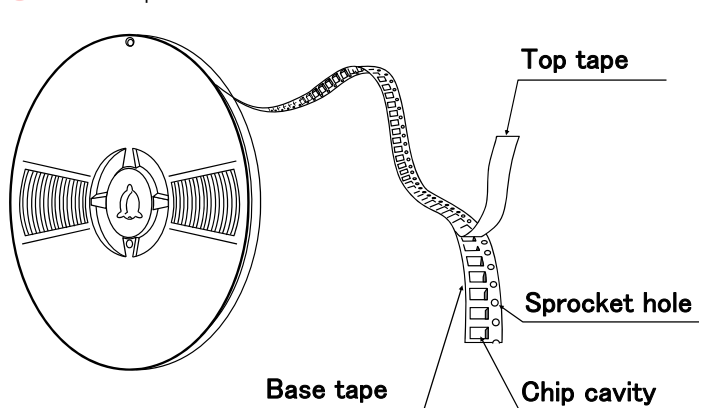
② Taping material

※No bottom tape for pressed carrier tape

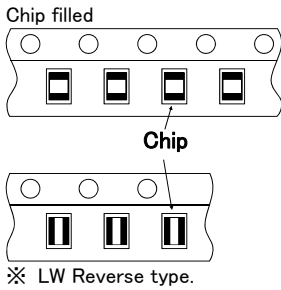
● Card board carrier tape



● Embossed tape



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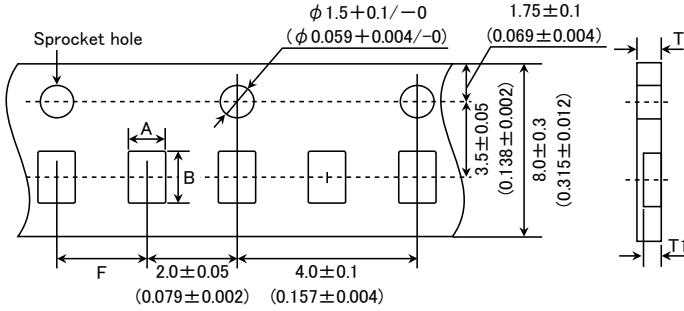


③ Representative taping dimensions

● Paper Tape (8mm wide)

● Pressed carrier tape (2mm pitch)

Unit: mm (inch)



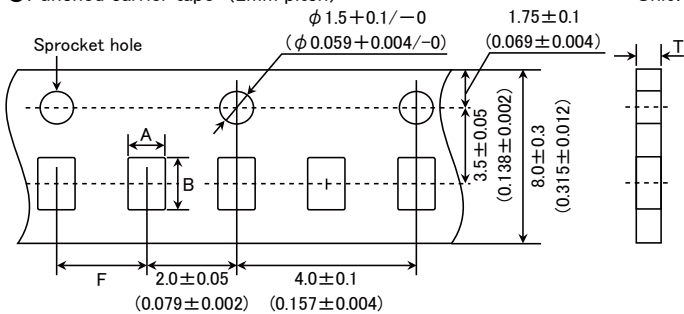
Type(EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness	
	A	B		T	T1
□MK063(0201)	0.37	0.67	2.0±0.05	0.45max.	0.42max.
□WK105(0204) ※	0.65	1.15		0.4max.	0.3max.
□MK105(0402) (*1 C)				0.45max.	0.42max.
□MK105(0402) (*1 P)					

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

Unit: mm

● Punched carrier tape (2mm pitch)

Unit: mm (inch)

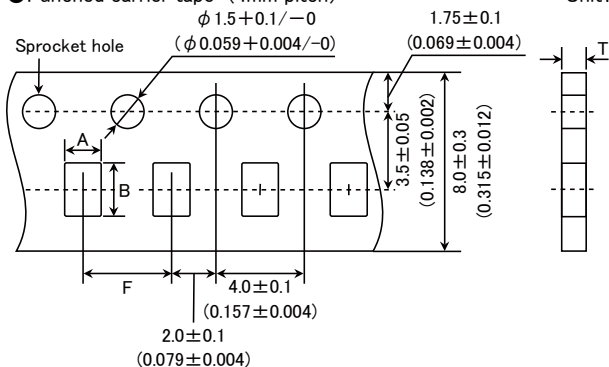


Type(EIA)	Chip Cavity		Insertion Pitch F	Tape Thickness
	A	B		T
□MK105 (0402)	0.65	1.15	2.0±0.05	0.8max.
□MF105 (0402)				
□VK105 (0402)				

Unit: mm

● Punched carrier tape (4mm pitch)

Unit: mm (inch)

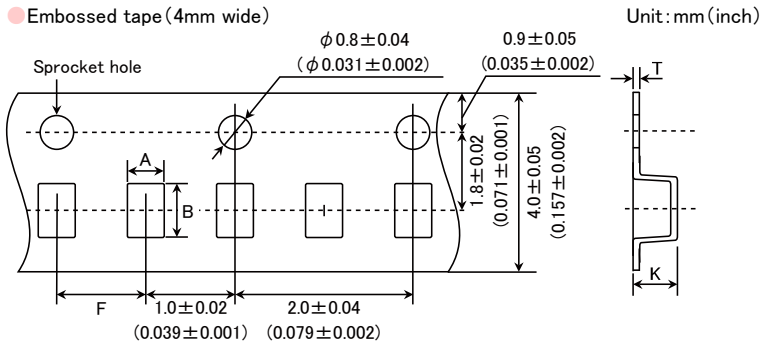


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Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B		F	T
□MK107(0603) □WK107(0306) ※ □MF107(0603)	1.0	1.8	4.0±0.1	1.1max.	
□MK212(0805) □WK212(0508) ※	1.65	2.4		1.1max.	
□MK316(1206)	2.0	3.6			

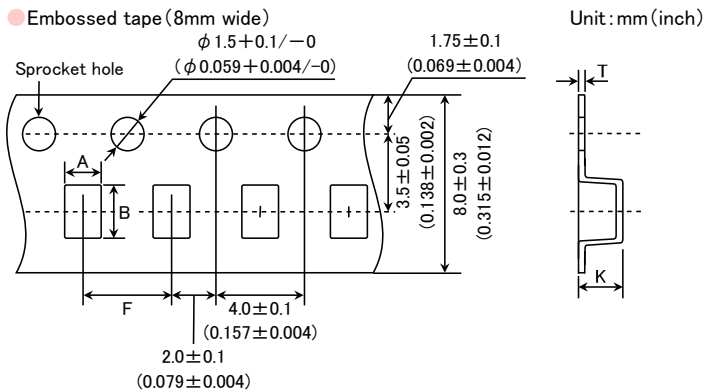
Note: Taping size might be different depending on the size of the product. ※ LW Reverse type.

Unit: mm



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)					

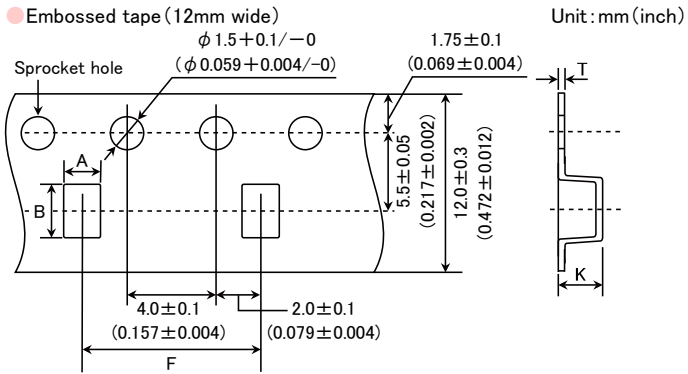
Unit: mm



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.

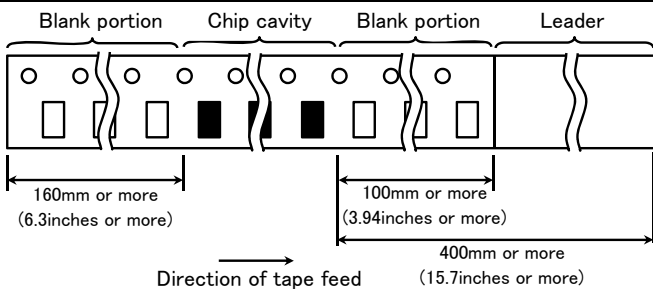
Unit: mm



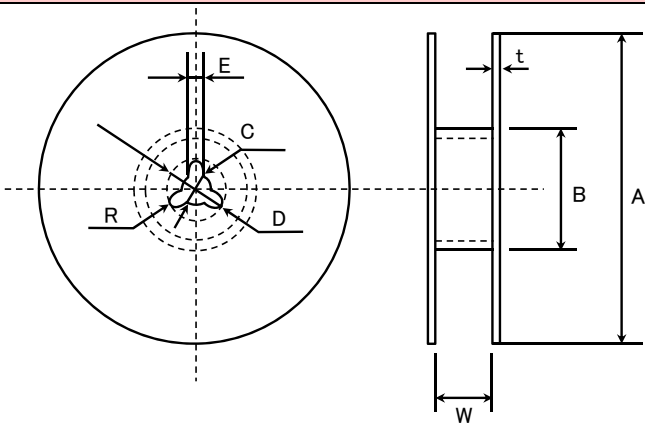
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK325(1210)	3.1	4.0	8.0 ± 0.1	4.0max.	0.6max.
□MK432(1812)	3.7	4.9	8.0 ± 0.1	4.0max.	0.6max.

Unit: mm

④Trailer and Leader



⑤Reel size

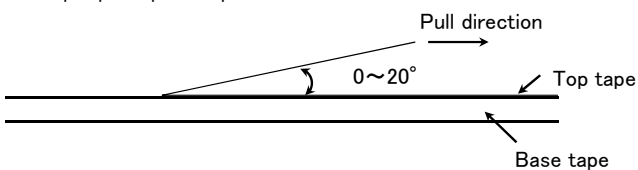


A	B	C	D	E	R
$\phi 178 \pm 2.0$	$\phi 50 \text{min.}$	$\phi 13.0 \pm 0.2$	$\phi 21.0 \pm 0.8$	2.0 ± 0.5	1.0
	T	W			
4mm wide tape	1.5max.	5 ± 1.0			
8mm wide tape	2.5max.	10 ± 1.5			
12mm wide tape	2.5max.	14 ± 1.5			

Unit: mm

⑥Top Tape Strength

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



Multilayer Ceramic Capacitors

RELIABILITY DATA

1. Operating Temperature Range

Specified Value	Temperature Compensating(Class1)	Standard	-55 to +125°C																							
		High Frequency Type																								
	High Permittivity (Class2)																									
			<table border="1"> <thead> <tr> <th></th> <th>Specification</th> <th>Temperature Range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">BJ</td> <td>B</td> <td>-25 to +85°C</td> </tr> <tr> <td>X5R</td> <td>-55 to +85°C</td> </tr> <tr> <td>B7</td> <td>X7R</td> <td>-55 to +125°C</td> </tr> <tr> <td>C6</td> <td>X6S</td> <td>-55 to +105°C</td> </tr> <tr> <td>C7</td> <td>X7S</td> <td>-55 to +125°C</td> </tr> <tr> <td>D7</td> <td>X7T</td> <td>-55 to +125°C</td> </tr> <tr> <td>LD(※)</td> <td>X5R</td> <td>-55 to +85°C</td> </tr> </tbody> </table>		Specification	Temperature Range	BJ	B	-25 to +85°C	X5R	-55 to +85°C	B7	X7R	-55 to +125°C	C6	X6S	-55 to +105°C	C7	X7S	-55 to +125°C	D7	X7T	-55 to +125°C	LD(※)	X5R	-55 to +85°C
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LD(※)	X5R	-55 to +85°C																								
			Note: ※LD Low distortion high value multilayer ceramic capacitor																							

2. Storage Conditions

Specified Value	Temperature Compensating(Class1)	Standard	-55 to +125°C																							
		High Frequency Type																								
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D7	X7T	-55 to +125°C																								
LD(※)	X5R	-55 to +85°C																								
			Note: ※LD Low distortion high value multilayer ceramic capacitor																							

3. Rated Voltage

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

4. Withstanding Voltage (Between terminals)

Specified Value	Temperature Compensating(Class1)	Standard	No breakdown or damage
		High Frequency Type	
	High Permittivity (Class2)		
Test Methods and Remarks		Class 1	Class 2
	Applied voltage	Rated volta × 3	Rated voltage × 2.5
	Duration	1 to 5 sec.	
	Charge/discharge current	50mA max.	

5. Insulation Resistance

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

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6. Capacitance (Tolerance)					
Specified Value	Temperature Compensating(Class1)	Standard	C□	0.2pF ≤ C ≤ 5pF : ±0.25pF	
			U□	0.2pF ≤ C ≤ 10pF : ±0.5pF	
	SL	C > 10pF : ±5% or ±10%			
High Permittivity (Class2)	High Frequency Type	CH	0.3pF ≤ C ≤ 2pF : ±0.1pF	C > 2pF : ±5%	
	BJ, B7, C6, C7, D7, LD(※) : ±10% or ±20% Note: ※LD Low distortion high value multilayer ceramic capacitor				
Test Methods and Remarks	Class 1		Class 2		
	Standard		High Frequency Type	C ≤ 10 μF	C > 10 μF
	Preconditioning		None		
	Measuring frequency		Thermal treatment (at 150°C for 1hr) Note 2		
	Measuring voltage Note		1MHz ± 10%	1kHz ± 10%	120 ± 10Hz
Bias application		0.5 to 5Vrms	1 ± 0.2Vrms	0.5 ± 0.1rms	
		one			

7. Q or Dissipation Factor					
Specified Value	Temperature Compensating(Class1)	Standard	C < 30pF : Q ≥ 400 + 20C		
			C ≥ 30pF : Q ≥ 1000 (C : Nominal capacitance)		
	High Frequency Type	Refer to detailed specification			
High Permittivity (Class2) Note 1		BJ, B7, C6, C7, D7: 2.5% max.			
Test Methods and Remarks	Class 1		Class 2		
	Standard		High Frequency Type	C ≤ 10 μF	C > 10 μF
	Preconditioning		None		
	Measuring frequency		Thermal treatment (at 150°C for 1hr) Note 2		
	Measuring voltage Note 1		1MHz ± 10%	1GHz	1kHz ± 10%
Bias application		0.5 to 5Vrms	1 ± 0.2Vrms	0.5 ± 0.1Vrms	
High Frequency Type		None			
Measuring equipment		: HP4291A			
Measuring jig		: HP16192A			

8. Temperature Characteristic (Without voltage application)					
Specified Value	Temperature Compensating(Class1)	Standard	Temperature Characteristic [ppm/°C]		Tolerance [ppm/°C]
			C□ : 0	CG, CH, C, J, CK	G : ±30
			U□ : -750	UJ, UK	H : ±60
		SL : +350 to -1000		J : ±120	K : ±250
High Permittivity (Class2)	High Frequency Type	Temperature Characteristic [ppm/°C]		Tolerance [ppm/°C]	
		C□ : 0	CH	H : ±60	
		Specification	Capacitance change	Reference temperature	Temperature Range
		B	±10%	20°C	-25 to +85°C
		X5R	±15%	25°C	-55 to +85°C
		X7R	±15%	25°C	-55 to +125°C
		X6S	±22%	25°C	-55 to +105°C
		X7S	±22%	25°C	-55 to +125°C
		X7S	+22/-33%	25°C	-55 to +125°C
		LD(※)	±15%	25°C	-55 to +85°C
Note : ※LD Low distortion high value multilayer ceramic capacitor					
Test Methods and Remarks	Class 1				
	Capacitance at 20°C and 85°C shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.				
	$\frac{(C_{85} - C_{20})}{C_{20} \times \Delta T} \times 10^6 (\text{ppm}/^\circ\text{C}) \quad \Delta T = 65$				
	Class 2				
	Capacitance at each step shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.				
Step	B	X5R, X7R, X6S, X7S, X7T			
1	Minimum operating temperature				
2	20°C	25°C			
3	Maximum operating temperature				

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	$\frac{(C - C_2)}{C_2} \times 100(\%)$ <p>C : Capacitance in Step 1 or Step 3 C2 : Capacitance in Step 2</p>
--	--

9. Deflection

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 5\%$ or ± 0.5 pF, whichever is larger.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within ± 0.5 pF
	High Permittivity (Class2)		Appearance : No abnormality Capacitance change : Within $\pm 12.5\%$ (BJ, B7, C6, C7, D7, LD(※)) Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks	<table border="1"> <tr> <th colspan="2">Multilayer Ceramic Capacitors</th> </tr> <tr> <td>042, 063, ※1105 Type</td> <td>The other types</td> </tr> <tr> <th colspan="2">Glass epoxy-resin substrate</th> </tr> <tr> <td>Thickness</td> <td>0.8mm 1.6mm</td> </tr> <tr> <td>Warp</td> <td>1mm (Soft Termination type:3mm)</td> </tr> <tr> <td>Duration</td> <td>10 sec.</td> </tr> </table> <p>※1:105 Type thickness, C: 0.2mm, P: 0.3mm.</p>	Multilayer Ceramic Capacitors		042, 063, ※1105 Type	The other types	Glass epoxy-resin substrate		Thickness	0.8mm 1.6mm	Warp	1mm (Soft Termination type:3mm)	Duration	10 sec.	<p>(Unit: mm)</p> <p>Capacitance measurement shall be conducted with the board bent</p>
	Multilayer Ceramic Capacitors													
042, 063, ※1105 Type	The other types													
Glass epoxy-resin substrate														
Thickness	0.8mm 1.6mm													
Warp	1mm (Soft Termination type:3mm)													
Duration	10 sec.													

10. Body Strength

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

Test Methods and Remarks	<p>High Frequency Type Applied force : 5N Duration : 10 sec.</p>
--------------------------	--

11. Adhesive Strength of Terminal Electrodes

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

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

12. Solderability

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

Test Methods and Remarks		Eutectic solder	Lead-free solder
	Solder type	H60A or H63A	Sn-3.0Ag-0.5Cu
	Solder temperature	230 ± 5°C	245 ± 3°C
	Duration	4 ± 1 sec.	

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13. Resistance to Soldering

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 2.5\%$ Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 7.5\%$ (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals): No abnormality Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks	Class 1	
	042, 063 Type	105 Type
	Preconditioning	None
	Preheating	150°C, 1 to 2 min. 80 to 100°C, 2 to 5 min. 150 to 200°C, 2 to 5 min.
	Solder temp.	270 \pm 5°C
	Duration	3 \pm 0.5 sec.
	Recovery	6 to 24 hrs (Standard condition) Note 5
	Class 2	
	042, 063 Type	105, 107, 212 Type 316, 325 Type
	Preconditioning	Thermal treatment (at 150°C for 1 hr) Note 2
	Preheating	150°C, 1 to 2 min. 80 to 100°C, 2 to 5 min. 80 to 100°C, 5 to 10 min. 150 to 200°C, 2 to 5 min. 150 to 200°C, 5 to 10 min.
	Solder temp.	270 \pm 5°C
	Duration	3 \pm 0.5 sec.
	Recovery	24 \pm 2 hrs (Standard condition) Note 5

14. Temperature Cycle (Thermal Shock)

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 0.25\text{pF}$ Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 7.5\%$ (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks	Class 1		Class 2	
	None		Thermal treatment (at 150°C for 1 hr) Note 2	
	1 cycle	Step	Temperature (°C)	Time (min.)
		1	Minimum operating temperature	30 \pm 3
		2	Normal temperature	2 to 3
		3	Maximum operating temperature	30 \pm 3
4	Normal temperature	2 to 3		
Number of cycles	5 times			
Recovery	6 to 24 hrs (Standard condition) Note 5	24 \pm 2 hrs (Standard condition) Note 5		

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15. Humidity (Steady State)

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever is larger. Q : $C < 10\text{pF} : Q \geq 200 + 10C$ $10 \leq C < 30\text{pF} : Q \geq 275 + 2.5C$ $C \geq 30\text{pF} : Q \geq 350$ (C: Nominal capacitance) Insulation resistance : 1000 M Ω min.		
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 0.5\text{pF}$, Insulation resistance : 1000 M Ω min.		
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 12.5\%$ (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : 5.0% max. (BJ, B7, C6, C7, D7, LD(※)) Insulation resistance : 50 M Ω μF or 1000 M Ω whichever is smaller. Note: ※LD Low distortion high value multilayer ceramic capacitor		
Test Methods and Remarks		Class 1		Class 2	
		Standard	High Frequency Type	All items	
	Preconditioning	None			Thermal treatment (at 150°C for 1 hr) Note 2
	Temperature	40 \pm 2°C	60 \pm 2°C	40 \pm 2°C	
	Humidity	90 to 95%RH			90 to 95%RH
	Duration	500+24/-0 hrs			500+24/-0 hrs
	Recovery	6 to 24 hrs (Standard condition) Note 5			24 \pm 2 hrs (Standard condition) Note 5

16. Humidity Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 7.5\%$ or $\pm 0.75\text{pF}$, whichever is larger. Q : $C < 30\text{pF} : Q \geq 100 + 10C/3$ $C \geq 30\text{pF} : Q \geq 200$ (C: Nominal capacitance) Insulation resistance : 500 M Ω min.		
		High Frequency Type	Appearance : No abnormality Capacitance change : $C \leq 2\text{pF} : \text{Within } \pm 0.4 \text{ pF}$ $C > 2\text{pF} : \text{Within } \pm 0.75 \text{ pF}$ (C: Nominal capacitance) Insulation resistance : 500 M Ω min.		
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 12.5\%$ (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : 5.0% max. (BJ, B7, C6, C7, D7, LD(※)) Insulation resistance : 25 M Ω μF or 500 M Ω , whichever is smaller. Note: ※LD Low distortion high value multilayer ceramic capacitor		
Test Methods and Remarks		Class 1		Class 2	
		Standard	High Frequency Type	All items	
	Preconditioning	None			Voltage treatment (Rated voltage are applied for 1 hour at 40°C) Note 3
	Temperature	40 \pm 2°C	60 \pm 2°C	40 \pm 2°C	
	Humidity	90 to 95%RH			90 to 95%RH
	Duration	500+24/-0 hrs			500+24/-0 hrs
	Applied voltage	Rated voltage			Rated voltage
	Charge/discharge current	50mA max.			50mA max.
Recovery	6 to 24 hrs (Standard condition) Note 5			24 \pm 2 hrs (Standard condition) Note 5	

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17. High Temperature Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever is larger. Q : $C < 10\text{pF}$: $Q \geq 200 + 10C$ $10 \leq C < 30\text{pF}$: $Q \geq 275 + 2.5C$ $C \geq 30\text{pF}$: $Q \geq 350$ (C: Nominal capacitance) Insulation resistance : 1000 M Ω min.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever is larger. Insulation resistance : 1000 M Ω min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 12.5\%$ (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : 5.0% max.(BJ, B7, C6, C7, D7, LD(※)) Insulation resistance : 50 M Ω μF or 1000 M Ω , whichever is smaller. Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks		Class 1		Class 2		
		Standard	High Frequency Type	BJ, LD(※)	C6	B7, C7, D7
	Preconditioning	None		Voltage treatment (Twice the rated voltage shall be applied for 1 hour at 85°C, 105°C or 125°C) Note 3, 4		
	Temperature	Maximum operating temperature		Maximum operating temperature		
	Duration	1000+48/-0 hrs		1000+48/-0 hrs		
	Applied voltage	Rated voltage $\times 2$		Rated voltage $\times 2$ Note 4		
	Charge/discharge current	50mA max.		50mA max.		
	Recovery	6 to 24hr (Standard condition) Note 5		24 ± 2 hrs (Standard condition) Note 5		

Note: ※LD Low distortion high value multilayer ceramic capacitor

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

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

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

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

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

Precautions on the use of Multilayer Ceramic Capacitors

PRECAUTIONS

1. Circuit Design

Precautions

- ◆ Verification of operating environment, electrical rating and performance
 1. A malfunction of equipment in fields such as medical, aerospace, nuclear control, etc. may cause serious harm to human life or have severe social ramifications. Therefore, any capacitors to be used in such equipment may require higher safety and reliability, and shall be clearly differentiated from them used in general purpose applications.
- ◆ Operating Voltage (Verification of Rated voltage)
 1. The operating voltage for capacitors must always be their rated voltage or less.
 - If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages shall be the rated voltage or less.
 - For a circuit where an AC or a pulse voltage may be used, the sum of their peak voltages shall also be the rated voltage or less.
 2. Even if an applied voltage is the rated voltage or less reliability of capacitors may be deteriorated in case that either a high frequency AC voltage or a pulse voltage having rapid rise time is used in a circuit.

2. PCB Design

Precautions

- ◆ Pattern configurations (Design of Land-patterns)
 1. When capacitors are mounted on PCBs, the amount of solder used (size of fillet) can directly affect the capacitor performance. Therefore, the following items must be carefully considered in the design of land patterns:
 - (1) Excessive solder applied can cause mechanical stresses which lead to chip breaking or cracking. Therefore, please consider appropriate land-patterns for proper amount of solder.
 - (2) When more than one component are jointly soldered onto the same land, each component's soldering point shall be separated by solder-resist.
- ◆ Pattern configurations (Capacitor layout on PCBs)

After capacitors are mounted on boards, they can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering of the boards, etc.). For this reason, land pattern configurations and positions of capacitors shall be carefully considered to minimize stresses.

Technical considerations

- ◆ Pattern configurations (Design of Land-patterns)

The following diagrams and tables show some examples of recommended land patterns to prevent excessive solder amounts.

(1) Recommended land dimensions for typical chip capacitors

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

Wave-soldering

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

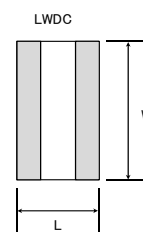
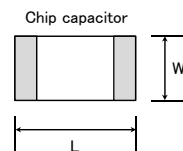
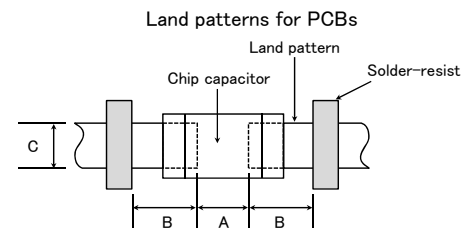
Reflow-soldering

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

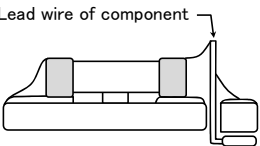
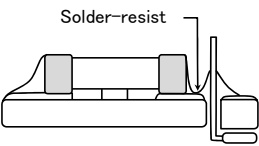
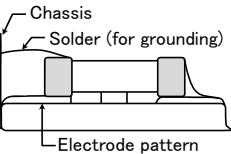
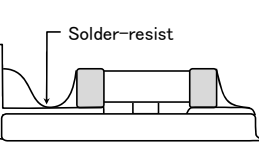
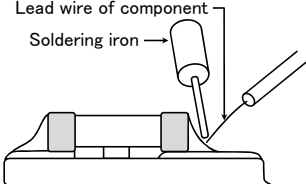
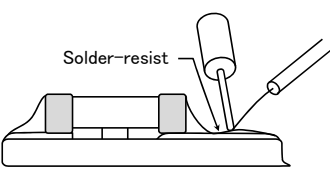
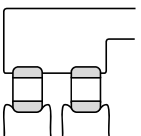
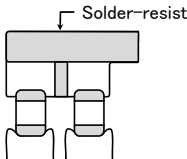
Note: Recommended land size might be different according to the allowance of the size of the product.

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

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

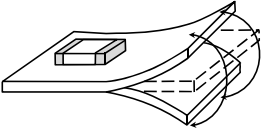
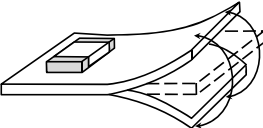


(2) Examples of good and bad solder application

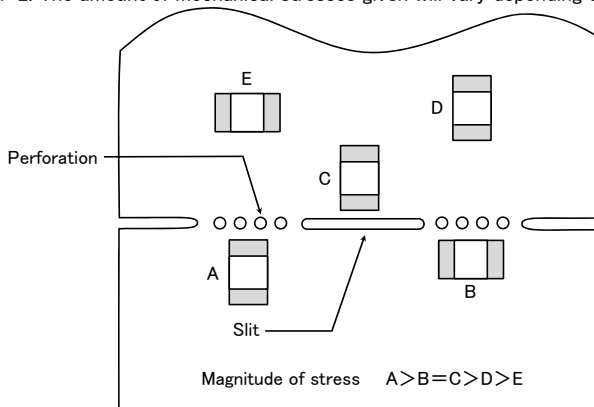
Items	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆ Pattern configurations (Capacitor layout on PCBs)

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

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

1-2. The amount of mechanical stresses given will vary depending on capacitor layout. Please refer to diagram below.



1-3. When PCB is split, the amount of mechanical stress on the capacitors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, slit, V-grooving, and perforation. Thus, please consider the PCB, split methods as well as chip location.

3. Mounting

Precautions

◆ Adjustment of mounting machine

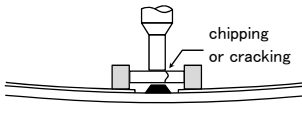
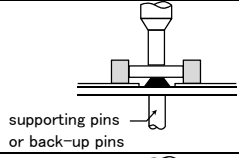
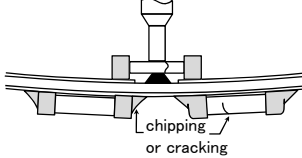
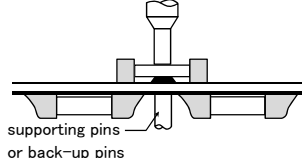
- When capacitors are mounted on PCB, excessive impact load shall not be imposed on them.
- Maintenance and inspection of mounting machines shall be conducted periodically.

◆ Selection of Adhesives

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

◆ Adjustment of mounting machine

1. When the bottom dead center of a pick-up nozzle is too low, excessive force is imposed on capacitors and causes damages. To avoid this, the following points shall be considerable.
 - (1) The bottom dead center of the pick-up nozzle shall be adjusted to the surface level of PCB without the board deflection.
 - (2) The pressure of nozzle shall be adjusted between 1 and 3 N static loads.
 - (3) To reduce the amount of deflection of the board caused by impact of the pick-up nozzle, supporting pins or back-up pins shall be used on the other side of the PCB. The following diagrams show some typical examples of good and bad pick-up nozzle placement:

Items	Not recommended	Recommended
Single-sided mounting		
Double-sided mounting		

Technical considerations

2. As the alignment pin is worn out, adjustment of the nozzle height can cause chipping or cracking of capacitors because of mechanical impact on the capacitors. To avoid this, the monitoring of the width between the alignment pins in the stopped position, maintenance, check and replacement of the pin shall be conducted periodically.

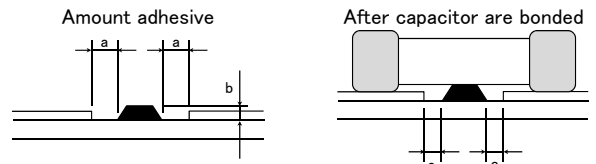
◆ Selection of Adhesives

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

- (1) Required adhesive characteristics
 - a. The adhesive shall be strong enough to hold parts on the board during the mounting & solder process.
 - b. The adhesive shall have sufficient strength at high temperatures.
 - c. The adhesive shall have good coating and thickness consistency.
 - d. The adhesive shall be used during its prescribed shelf life.
 - e. The adhesive shall harden rapidly.
 - f. The adhesive shall have corrosion resistance.
 - g. The adhesive shall have excellent insulation characteristics.
 - h. The adhesive shall have no emission of toxic gasses and no effect on the human body.
- (2) The recommended amount of adhesives is as follows;

[Recommended condition]

Figure	212/316 case sizes as examples
a	0.3mm min
b	100 to 120 μm
c	Adhesives shall not contact land



4. Soldering

◆ Selection of Flux

- Since flux may have a significant effect on the performance of capacitors, it is necessary to verify the following conditions prior to use;
- (1) Flux used shall be less than or equal to 0.1 wt% (in Cl equivalent) of halogenated content. Flux having a strong acidity content shall not be applied.
 - (2) When shall capacitors are soldered on boards, the amount of flux applied shall be controlled at the optimum level.
 - (3) When water-soluble flux is used, special care shall be taken to properly clean the boards.

Precautions

◆ Soldering

Temperature, time, amount of solder, etc. shall be set in accordance with their recommended conditions.
 Sn-Zn solder paste can adversely affect MLCC reliability.
 Please contact us prior to usage of Sn-Zn solder.

Technical considerations

◆ Selection of Flux

- 1-1. When too much halogenated substance (Chlorine, etc.) content is used to activate flux, or highly acidic flux is used, it may lead to corrosion of terminal electrodes or degradation of insulation resistance on the surfaces of the capacitors.
- 1-2. Flux is used to increase solderability in wave soldering. However if too much flux is applied, a large amount of flux gas may be emitted and may adversely affect the solderability. To minimize the amount of flux applied, it is recommended to use a flux-bubbling system.
- 1-3. Since the residue of water-soluble flux is easily dissolved in moisture in the air, the residues on the surfaces of capacitors in high humidity conditions may cause a degradation of insulation resistance and reliability of the capacitors. Therefore, the cleaning methods and the capability of the machines used shall also be considered carefully when water-soluble flux is used.

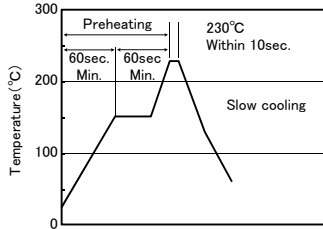
► This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

◆Soldering

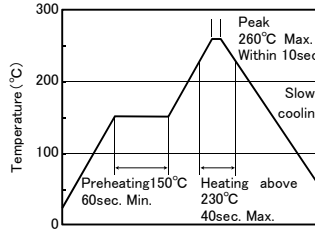
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated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

[Reflow soldering]

【Recommended conditions for eutectic soldering】

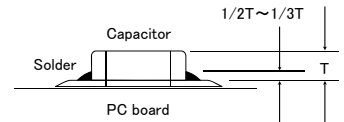


【Recommended condition for Pb-free soldering】



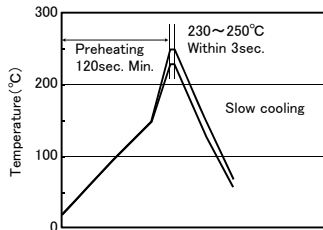
Caution

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

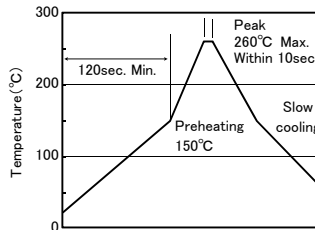


[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】

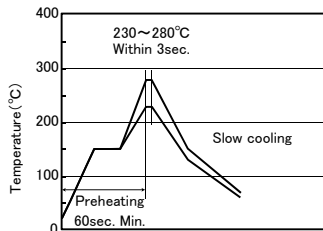


Caution

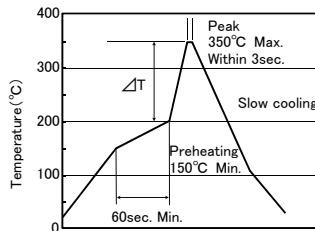
- ①Wave soldering must not be applied to capacitors designated as for reflow soldering only.
- ②Allowable number of wave soldering : 1 times max.

[Hand soldering]

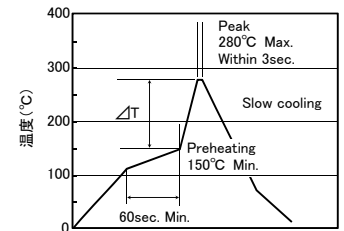
【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



	ΔT
316type or less	$\Delta T \leq 150^\circ\text{C}$



	ΔT
325type or more	$\Delta T \leq 130^\circ\text{C}$

Caution

- ①Use a 50W soldering iron with a maximum tip diameter of 1.0 mm.
- ②The soldering iron shall not directly touch capacitors.
- ③Allowable number of hand soldering : 1 times max.

5. Cleaning	
Precautions	<p>◆Cleaning conditions</p> <ol style="list-style-type: none"> When PCBs are cleaned after capacitors mounting, please select the appropriate cleaning solution in accordance with the intended use of the cleaning. (e.g. to remove soldering flux or other materials from the production process.) Cleaning condition shall be determined after it is verified by using actual cleaning machine that the cleaning process does not affect capacitor's characteristics.
Technical considerations	<ol style="list-style-type: none"> The use of inappropriate cleaning solutions can cause foreign substances such as flux residue to adhere to capacitors or deteriorate their outer coating, resulting in a degradation of the capacitor's electrical properties (especially insulation resistance). Inappropriate cleaning conditions (insufficient or excessive cleaning) may adversely affect the performance of the capacitors. In the case of ultrasonic cleaning, too much power output can cause excessive vibration of PCBs which may lead to the cracking of capacitors or the soldered portion, or decrease the terminal electrodes' strength. Therefore, the following conditions shall be carefully checked: Ultrasonic output : 20 W/l or less Ultrasonic frequency : 40 kHz or less Ultrasonic washing period : 5 min. or less

6. Resin coating and mold	
Precautions	<ol style="list-style-type: none"> With some type of resins, decomposition gas or chemical reaction vapor may remain inside the resin during the hardening period or while left under normal storage conditions resulting in the deterioration of the capacitor's performance. When a resin's hardening temperature is higher than capacitor's operating temperature, the stresses generated by the excessive heat may lead to damage or destruction of capacitors. The use of such resins, molding materials etc. is not recommended.

7. Handling	
Precautions	<p>◆Splitting of PCB</p> <ol style="list-style-type: none"> When PCBs are split after components mounting, care shall be taken so as not to give any stresses of deflection or twisting to the board. Board separation shall not be done manually, but by using the appropriate devices. <p>◆Mechanical considerations</p> <p>Be careful not to subject capacitors to excessive mechanical shocks.</p> <p>(1) If ceramic capacitors are dropped onto a floor or a hard surface, they shall not be used.</p> <p>(2) Please be careful that the mounted components do not come in contact with or bump against other boards or components.</p>

8. Storage conditions	
Precautions	<p>◆Storage</p> <ol style="list-style-type: none"> To maintain the solderability of terminal electrodes and to keep packaging materials in good condition, care must be taken to control temperature and humidity in the storage area. Humidity should especially be kept as low as possible. <ul style="list-style-type: none"> Recommended conditions <ul style="list-style-type: none"> Ambient temperature : Below 30°C Humidity : Below 70% RH The ambient temperature must be kept below 40°C. Even under ideal storage conditions, solderability of capacitor is deteriorated as time passes, so capacitors shall be used within 6 months from the time of delivery. <ul style="list-style-type: none"> Ceramic chip capacitors shall be kept where no chlorine or sulfur exists in the air. The capacitance values of high dielectric constant capacitors will gradually decrease with the passage of time, so care shall be taken to design circuits. Even if capacitance value decreases as time passes, it will get back to the initial value by a heat treatment at 150°C for 1hour.
Technical considerations	<p>If capacitors are stored in a high temperature and humidity environment, it might rapidly cause poor solderability due to terminal oxidation and quality loss of taping/packaging materials. For this reason, capacitors shall be used within 6 months from the time of delivery. If exceeding the above period, please check solderability before using the capacitors.</p>

※RCR-2335B (Safety Application Guide for fixed ceramic capacitors for use in electronic equipment) is published by JEITA.
Please check the guide regarding precautions for deflection test, soldering by spot heat, and so on.