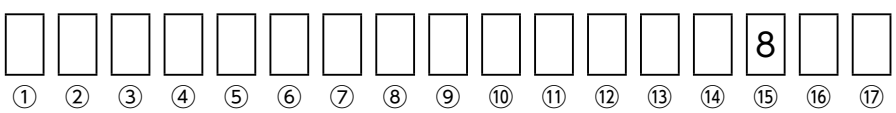
Industrial Application Guide

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	・Base Station ・Optical Transceiver ・Router/Switch (Carrier-Grade) ・UPS (Uninterruptible Power Supply), etc.
Factory Automation	・PLC (Programmable Logic Controller) ・Servomotor/Servo Driver ・Industry Robot, etc.
Measurement	・Gas Meter ・Water Meter ・Flow Meter ・Pressure Gauge Meter ・Magnetometer ・Thermometer, etc.
Electric Power Apparatus	・Power Conditioner (Solar Power System) ・Smart Meter ・GFCI (Ground Fault Circuit Interrupter) ・Electric Vehicle Charging Station, etc.

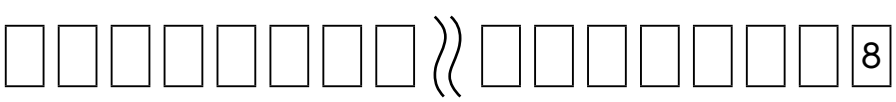
Part Numbering System

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.

▶ 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/) .

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		Low → High			
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	Medical devices with relatively low risk to the human body in case of problems	Medical devices with relatively high risk to the human body in case of problems	Medical devices highly invasive to patients and with life-threatening risk 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.	[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.	[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.	[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
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

①Rated 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

②Series name

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

③End termination

Code	End termination
K	Plated
J	Soft Termination
S	Cu Internal Electrodes (For High Frequency)
F	High Reliability Application
R	High Reliability Application (Cu External Electrodes)

④Dimension(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

⑤Dimension tolerance

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

⑥Temperature characteristics code

■High dielectric type

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	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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■Temperature compensating type

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

⑦Nominal capacitance

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

Note : R=Decimal point

⑧Capacitance tolerance

Code	Capacitance tolerance
A	±0.05pF
B	±0.1pF
C	±0.25pF
D	±0.5pF
G	±2%
J	±5%
K	±10%
M	±20%

⑨Thickness

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

⑩Special code

Code	Special code
–	Standard
H	MLCC for Automotive
8	MLCC for Telecommunications infrastructure and Industrial equipment / Medical devices

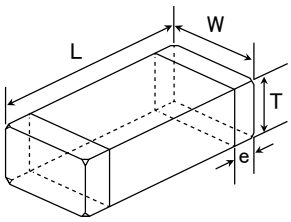
⑪Packaging

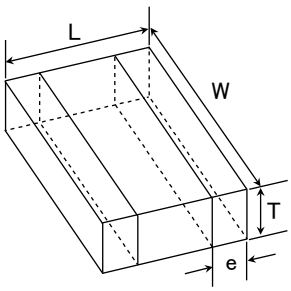
Code	Packaging
F	φ178mm Taping (2mm pitch)
R	φ178mm Embossed Taping (4mm pitch)
T	φ178mm Taping (4mm pitch)
P	φ178mm Taping (4mm pitch, 1000 pcs/reel) 325 type(Thickness code M)

⑫Internal code

Code	Internal code
△	Standard

■STANDARD EXTERNAL DIMENSIONS





※ LW reverse type

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

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

■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

- 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.
- The products are for Telecommunications infrastructure and Industrial equipment and for Medical devices.
  Please consult with TAIYO YUDEN's official sales channel for the details of the product specifications, etc.,
  and please review and approve the product specifications before ordering.
  Please be sure to contact us for further information in advance when the products are used for automotive electronic equipment.
- *1: For standard case size, please kindly refer to ④Dimension, ⑤Dimension tolerance, ⑨Thickness and STANDARD EXTERNAL DIMENSIONS.

Multilayer Ceramic Capacitors (High dielectric type)

●063TYPE (Demension:0.6×0.3mm JIS:1005 EIA:0402)
【Temperature Characteristic B7 : X7R(−55～+125℃)】 0.3mm thickness(P)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
TMK063 B7101□P8FE		25		X7R	100 p	±10, ±20	3.5	200	0.3±0.03	
TMK063 B7151□P8FE				X7R	150 p	±10, ±20	3.5	200	0.3±0.03	
TMK063 B7221□P8FE				X7R	220 p	±10, ±20	3.5	200	0.3±0.03	
TMK063 B7331□P8FE				X7R	330 p	±10, ±20	3.5	200	0.3±0.03	
TMK063 B7471□P8FE				X7R	470 p	±10, ±20	3.5	200	0.3±0.03	
TMK063 B7102□P8FE				X7R	1000 p	±10, ±20	5	200	0.3±0.03	
TMK063 B7152□P8FE				X7R	1500 p	±10, ±20	5	200	0.3±0.03	
TMK063 B7222□P8FE				X7R	2200 p	±10, ±20	5	200	0.3±0.03	
TMK063 B7332□P8FE				X7R	3300 p	±10, ±20	5	200	0.3±0.03	
EMK063 B7101□P8FE		16		X7R	100 p	±10, ±20	3.5	200	0.3±0.03	
EMK063 B7151□P8FE				X7R	150 p	±10, ±20	3.5	200	0.3±0.03	
EMK063 B7221□P8FE				X7R	220 p	±10, ±20	3.5	200	0.3±0.03	
EMK063 B7331□P8FE				X7R	330 p	±10, ±20	3.5	200	0.3±0.03	
EMK063 B7471□P8FE				X7R	470 p	±10, ±20	3.5	200	0.3±0.03	
EMK063 B7102□P8FE				X7R	1000 p	±10, ±20	5	200	0.3±0.03	
EMK063 B7152□P8FE				X7R	1500 p	±10, ±20	5	200	0.3±0.03	
EMK063 B7222□P8FE				X7R	2200 p	±10, ±20	5	200	0.3±0.03	
EMK063 B7332□P8FE				X7R	3300 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7101□P8FE		10		X7R	100 p	±10, ±20	3.5	200	0.3±0.03	
LMK063 B7151□P8FE				X7R	150 p	±10, ±20	3.5	200	0.3±0.03	
LMK063 B7221□P8FE				X7R	220 p	±10, ±20	3.5	200	0.3±0.03	
LMK063 B7331□P8FE				X7R	330 p	±10, ±20	3.5	200	0.3±0.03	
LMK063 B7471□P8FE				X7R	470 p	±10, ±20	3.5	200	0.3±0.03	
LMK063 B7102□P8FE				X7R	1000 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7152□P8FE				X7R	1500 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7222□P8FE				X7R	2200 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7332□P8FE				X7R	3300 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7472□P8FE				X7R	4700 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7682□P8FE				X7R	6800 p	±10, ±20	5	200	0.3±0.03	
LMK063 B7103□P8FE				X7R	10000 p	±10, ±20	5	200	0.3±0.03	

■PART NUMBER

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

【Temperature Characteristic BJ : X5R(−55～+85℃)】 0.5mm thickness(V)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK105 BJ471□V8F		50	X5R	470 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 BJ102□V8F			X5R	1000 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 BJ152□V8F			X5R	1500 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 BJ222□V8F			X5R	2200 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 BJ332□V8F			X5R	3300 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 BJ472□V8F			X5R	4700 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 BJ682□V8F			X5R	6800 p	±10, ±20	2.5	150	0.5±0.05	
UMK105 BJ103□V8F			X5R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
UMK105 BJ223□V8F			X5R	0.022 μ	±10, ±20	5	200	0.5±0.05	
UMK105 BJ473□V8F			X5R	0.047 μ	±10, ±20	5	200	0.5±0.05	
UMK105 BJ104□V8F			X5R	0.1 μ	±10, ±20	10	150	0.5±0.05	
TMK105 BJ472□V8F		25	X5R	4700 p	±10, ±20	2.5	200	0.5±0.05	
TMK105 BJ682□V8F			X5R	6800 p	±10, ±20	2.5	200	0.5±0.05	
TMK105 BJ103□V8F			X5R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
TMK105 BJ153□V8F			X5R	0.015 μ	±10, ±20	3.5	200	0.5±0.05	
TMK105 BJ223□V8F			X5R	0.022 μ	±10, ±20	3.5	200	0.5±0.05	
TMK105 BJ333□V8F			X5R	0.033 μ	±10, ±20	3.5	150	0.5±0.05	
TMK105 BJ473□V8F			X5R	0.047 μ	±10, ±20	3.5	150	0.5±0.05	
TMK105 BJ104□V8F			X5R	0.1 μ	±10, ±20	5	150	0.5±0.05	
TMK105 BJ224□V8F			X5R	0.22 μ	±10, ±20	10	150	0.5±0.05	
TMK105ABJ474□V8F			X5R	0.47 μ	±10, ±20	10	150	0.5±0.10	
EMK105 BJ104□V8F		16	X5R	0.1 μ	±10, ±20	5	150	0.5±0.05	
EMK105 BJ224□V8F			X5R	0.22 μ	±10, ±20	10	150	0.5±0.05	
EMK105ABJ474□V8F			X5R	0.47 μ	±10, ±20	10	150	0.5±0.10	
EMK105 BJ105□V8F			X5R	1 μ	±10, ±20	10	150	0.5±0.05	
LMK105 BJ224□V8F		10	X5R	0.22 μ	±10, ±20	5	150	0.5±0.05	
LMK105ABJ474□V8F			X5R	0.47 μ	±10, ±20	10	150	0.5±0.10	
LMK105 BJ105□V8F			X5R	1 μ	±10, ±20	10	150	0.5±0.05	
LMK105ABJ225□V8F			X5R	2.2 μ	±10, ±20	10	150	0.5±0.10	
JMK105 BJ474□V8F		6.3	X5R	0.47 μ	±10, ±20	10	150	0.5±0.05	
JMK105 BJ105□V8F			X5R	1 μ	±10, ±20	10	150	0.5±0.05	
JMK105 BJ225□V8F			X5R	2.2 μ	±10, ±20	10	150	0.5±0.05	
JMK105BBJ475MV8F			X5R	4.7 μ	±20	10	150	0.5+0.15/−0.05	
AMK105 BJ225□V8F		4	X5R	2.2 μ	±10, ±20	10	150	0.5±0.05	
AMK105BBJ475MV8F			X5R	4.7 μ	±20	10	150	0.5+0.15/−0.05	

【Temperature Characteristic B7 : X7R(−55～+125℃), D7 : X7T(−55～+125℃)】 0.5mm thickness(V)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK105 B7221□V8F		50	X7R	220 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7331□V8F			X7R	330 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7471□V8F			X7R	470 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7681□V8F			X7R	680 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7102□V8F			X7R	1000 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7152□V8F			X7R	1500 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7222□V8F			X7R	2200 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7332□V8F			X7R	3300 p	±10, ±20	2.5	200	0.5±0.05	
UMK105 B7472□V8F			X7R	4700 p	±10, ±20	2.5	150	0.5±0.05	
UMK105 B7682□V8F			X7R	6800 p	±10, ±20	2.5	150	0.5±0.05	
UMK105 B7103□V8F			X7R	0.01 μ	±10, ±20	3.5	150	0.5±0.05	
UMK105 B7153□V8FE			X7R	0.015 μ	±10, ±20	3.5	200	0.5±0.05	
UMK105 B7223□V8F			X7R	0.022 μ	±10, ±20	10	200	0.5±0.05	
UMK105 B7333□V8FE			X7R	0.033 μ	±10, ±20	3.5	150	0.5±0.05	
UMK105 B7473□V8F			X7R	0.047 μ	±10, ±20	10	200	0.5±0.05	
UMK105 B7104□V8F			X7R	0.1 μ	±10, ±20	10	150	0.5±0.05	
TMK105 B7472□V8F		25	X7R	4700 p	±10, ±20	2.5	200	0.5±0.05	
TMK105 B7682□V8F			X7R	6800 p	±10, ±20	2.5	200	0.5±0.05	
TMK105 B7103□V8F			X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
TMK105 B7153□V8F			X7R	0.015 μ	±10, ±20	3.5	150	0.5±0.05	
TMK105 B7223□V8F			X7R	0.022 μ	±10, ±20	3.5	150	0.5±0.05	
TMK105 B7333□V8F			X7R	0.033 μ	±10, ±20	3.5	150	0.5±0.05	
TMK105 B7473□V8F			X7R	0.047 μ	±10, ±20	3.5	150	0.5±0.05	
TMK105 B7104□V8F			X7R	0.1 μ	±10, ±20	10	150	0.5±0.05	
EMK105 B7103□V8F		16	X7R	0.01 μ	±10, ±20	3.5	200	0.5±0.05	
EMK105 B7153□V8F			X7R	0.015 μ	±10, ±20	3.5	150	0.5±0.05	
EMK105 B7223□V8F			X7R	0.022 μ	±10, ±20	3.5	150	0.5±0.05	
EMK105 B7333□V8F			X7R	0.033 μ	±10, ±20	3.5	150	0.5±0.05	
EMK105 B7473□V8F			X7R	0.047 μ	±10, ±20	3.5	150	0.5±0.05	
EMK105 B7104□V8F			X7R	0.1 μ	±10, ±20	5	150	0.5±0.05	
EMK105 B7224□V8F			X7R	0.22 μ	±10, ±20	10	150	0.5±0.05	
LMK105 B7473□V8F		10	X7R	0.047 μ	±10, ±20	3.5	150	0.5±0.05	
LMK105 B7104□V8F			X7R	0.1 μ	±10, ±20	5	150	0.5±0.05	
LMK105 B7224□V8F			X7R	0.22 μ	±10, ±20	10	150	0.5±0.05	
JMK105 B7104□V8F		6.3	X7R	0.1 μ	±10, ±20	5	150	0.5±0.05	
JMK105 B7224□V8F			X7R	0.22 μ	±10, ±20	10	150	0.5±0.05	
JMK105 B7474□V8F			X7R	0.47 μ	±10, ±20	10	150	0.5±0.05	
JMK105CD7105□V8F			X7T	1 μ	±10, ±20	10	150	0.5+0.2/−0	
AMK105 B7474□V8F		4	X7R	0.47 μ	±10, ±20	10	150	0.5±0.05	

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■PART NUMBER

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

【Temperature Characteristic BJ : X5R(−55～+85℃)】 0.8mm thickness(A)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK107 BJ224□A8T		50		X5R	0.22 μ	±10, ±20	10	150	0.8±0.10	
UMK107 BJ474□A8T				X5R	0.47 μ	±10, ±20	10	150	0.8±0.10	
UMK107ABJ105□A8T				X5R	1 μ	±10, ±20	10	150	0.8+0.15/−0.05	
GMK107 BJ224□A8T		35		X5R	0.22 μ	±10, ±20	10	150	0.8±0.10	
GMK107ABJ474□A8T				X5R	0.47 μ	±10, ±20	10	150	0.8+0.15/−0.05	
GMK107 BJ105□A8T				X5R	1 μ	±10, ±20	10	150	0.8±0.10	
TMK107 BJ224□A8T		25		X5R	0.22 μ	±10, ±20	5	150	0.8±0.10	
TMK107 BJ474□A8T				X5R	0.47 μ	±10, ±20	3.5	150	0.8±0.10	
TMK107 BJ105□A8T				X5R	1 μ	±10, ±20	10	150	0.8±0.10	
TMK107BBJ225□A8T				X5R	2.2 μ	±10, ±20	10	150	0.8+0.20/−0	
EMK107 BJ105□A8T		16		X5R	1 μ	±10, ±20	5	150	0.8±0.10	
EMK107ABJ225□A8T				X5R	2.2 μ	±10, ±20	10	150	0.8+0.15/−0.05	
EMK107BBJ475□A8T				X5R	4.7 μ	±10, ±20	10	150	0.8+0.20/−0	
LMK107 BJ225□A8T		10		X5R	2.2 μ	±10, ±20	10	150	0.8±0.10	
LMK107 BJ475□A8T				X5R	4.7 μ	±10, ±20	10	150	0.8±0.10	
LMK107BBJ106MA8T				X5R	10 μ	±20	10	150	0.8+0.20/−0	
JMK107 BJ475□A8T		6.3		X5R	4.7 μ	±10, ±20	10	150	0.8±0.10	
JMK107ABJ106□A8T				X5R	10 μ	±10, ±20	10	150	0.8+0.15/−0.05	
AMK107ABJ106□A8T		4		X5R	10 μ	±10, ±20	10	150	0.8+0.15/−0.05	
AMK107BBJ226MA8T				X5R	22 μ	±20	10	150	0.8+0.20/−0	

【Temperature Characteristic B7 : X7R(−55～+125℃), C7 : X7S(−55～+125℃), D7 : X7T(−55～+125℃)】 0.8mm thickness(A)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK107AC7154□A8TE		50		X7S	0.15 μ	±10, ±20	3.5	150	0.8+0.15/−0.05	
UMK107 C7224□A8TE				X7S	0.22 μ	±10, ±20	3.5	150	0.8±0.10	
GMK107 B7224□A8T		35		X7R	0.22 μ	±10, ±20	10	150	0.8±0.10	
GMK107 B7474□A8T				X7R	0.47 μ	±10, ±20	10	150	0.8±0.10	
GMK107AB7105□A8T				X7R	1 μ	±10, ±20	10	150	0.8+0.15/−0.05	
TMK107 B7224□A8T		25		X7R	0.22 μ	±10, ±20	10	150	0.8±0.10	
TMK107 B7474□A8T				X7R	0.47 μ	±10, ±20	10	150	0.8±0.10	
TMK107AB7105□A8T				X7R	1 μ	±10, ±20	10	150	0.8+0.15/−0.05	
EMK107 B7224□A8T		16		X7R	0.22 μ	±10, ±20	5	150	0.8±0.10	
EMK107 B7474□A8T				X7R	0.47 μ	±10, ±20	10	150	0.8±0.10	
EMK107 B7105□A8T				X7R	1 μ	±10, ±20	10	150	0.8±0.10	
LMK107 B7474□A8T		10		X7R	0.47 μ	±10, ±20	3.5	150	0.8±0.10	
LMK107 B7105□A8T				X7R	1 μ	±10, ±20	10	150	0.8±0.10	
LMK107BD7225□A8T				X7T	2.2 μ	±10, ±20	10	200	0.8+0.20/−0	
JMK107 B7105□A8T		6.3		X7R	1 μ	±10, ±20	10	150	0.8±0.10	
JMK107 B7225□A8TR				X7R	2.2 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 BJ : X5R(−55～+85℃)】 1.25mm thickness(G)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK212 BJ474□G8T		50	X5R	0.47 μ	±10, ±20	3.5	150	1.25±0.10	
UMK212 BJ105□G8T			X5R	1 μ	±10, ±20	5	150	1.25±0.10	
GMK212 BJ105□G8T		35	X5R	1 μ	±10, ±20	5	150	1.25±0.10	
GMK212BBJ225□G8T			X5R	2.2 μ	±10, ±20	10	150	1.25+0.20/−0	
TMK212 BJ225□G8T		25	X5R	2.2 μ	±10, ±20	5	150	1.25±0.10	
TMK212BBJ475□G8T			X5R	4.7 μ	±10, ±20	10	150	1.25+0.20/−0	
TMK212BBJ106□G8T			X5R	10 μ	±10, ±20	10	150	1.25+0.20/−0	
EMK212 BJ225□G8T		16	X5R	2.2 μ	±10, ±20	5	150	1.25±0.10	
EMK212ABJ475□G8T			X5R	4.7 μ	±10, ±20	10	150	1.25+0.15/−0.05	
EMK212BBJ106□G8T			X5R	10 μ	±10, ±20	10	150	1.25+0.20/−0	
LMK212ABJ475□G8T		10	X5R	4.7 μ	±10, ±20	10	150	1.25+0.15/−0.05	
LMK212ABJ106□G8T			X5R	10 μ	±10, ±20	10	150	1.25+0.15/−0.05	
JMK212ABJ106□G8T		6.3	X5R	10 μ	±10, ±20	10	150	1.25+0.15/−0.05	
JMK212BBJ226MG8T			X5R	22 μ	±20	10	150	1.25+0.20/−0	
AMK212BBJ476MG8T		4	X5R	47 μ	±20	10	150	1.25+0.20/−0	

【Temperature Characteristic BJ : X5R(−55～+85℃)】 0.85mm thickness(D)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
EMK212ABJ225□D8T		16	X5R	2.2 μ	±10, ±20	5	150	0.85±0.10	
EMK212BBJ475□D8T			X5R	4.7 μ	±10, ±20	10	150	0.85±0.10	

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

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics	Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK212 B7473□G8T		50	X7R	0.047 μ	±10, ±20	3.5	200	1.25±0.10	
UMK212 B7683□G8T			X7R	0.068 μ	±10, ±20	3.5	200	1.25±0.10	
UMK212 B7104□G8T			X7R	0.1 μ	±10, ±20	3.5	200	1.25±0.10	
UMK212BB7154□G8TE			X7R	0.15 μ	±10, ±20	3.5	200	1.25+0.20/−0	
UMK212 B7224□G8T			X7R	0.22 μ	±10, ±20	3.5	150	1.25±0.10	
UMK212BC7334□G8TE			X7S	0.33 μ	±10, ±20	3.5	150	1.25+0.20/−0	
UMK212 C7474□G8TE			X7S	0.47 μ	±10, ±20	3.5	150	1.25±0.10	
UMK212CC7684□G8TE			X7S	0.68 μ	±10, ±20	3.5	150	1.25+0.25/−0	
UMK212 B7105□G8T			X7R	1 μ	±10, ±20	10	150	1.25±0.10	
GMK212 B7105□G8T		35	X7R	1 μ	±10, ±20	10	150	1.25±0.10	
TMK212 B7474□G8T		25	X7R	0.47 μ	±10, ±20	3.5	150	1.25±0.10	
TMK212 B7105□G8TR			X7R	1 μ	±10, ±20	10	150	1.25±0.10	
TMK212 B7225□G8T			X7R	2.2 μ	±10, ±20	10	150	1.25±0.10	
EMK212 B7105□G8TR		16	X7R	1 μ	±10, ±20	10	150	1.25±0.10	
EMK212 B7225□G8T			X7R	2.2 μ	±10, ±20	10	150	1.25±0.10	
EMK212AB7475□G8T			X7R	4.7 μ	±10, ±20	10	150	1.25+0.15/−0.05	
LMK212 B7225□G8T		10	X7R	2.2 μ	±10, ±20	10	150	1.25±0.10	
LMK212 B7475□G8T			X7R	4.7 μ	±10, ±20	10	150	1.25±0.10	
JMK212 B7475□G8T		6.3	X7R	4.7 μ	±10, ±20	10	150	1.25±0.10	
JMK212AB7106□G8T			X7R	10 μ	±10, ±20	10	150	1.25+0.15/−0.05	

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■PART NUMBER

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

【Temperature Characteristic BJ : X5R(−55～+85℃)】 1.6mm thickness(L)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK316 BJ225□L8T		50		X5R	2.2 μ	±10, ±20	10	150	1.6±0.20	
UMK316ABJ475□L8T				X5R	4.7 μ	±10, ±20	10	150	1.6±0.20	
GMK316 BJ225□L8T		35		X5R	2.2 μ	±10, ±20	10	150	1.6±0.20	
GMK316 BJ475□L8T				X5R	4.7 μ	±10, ±20	10	150	1.6±0.20	
GMK316BBJ106□L8T				X5R	10 μ	±10, ±20	10	150	1.6±0.30	
TMK316 BJ475□L8T		25		X5R	4.7 μ	±10, ±20	5	150	1.6±0.20	
TMK316 BJ106□L8T				X5R	10 μ	±10, ±20	5	150	1.6±0.20	
EMK316 BJ475□L8T		16		X5R	4.7 μ	±10, ±20	5	150	1.6±0.20	
EMK316 BJ106□L8T				X5R	10 μ	±10, ±20	5	150	1.6±0.20	
EMK316BBJ226ML8T				X5R	22 μ	±20	10	150	1.6±0.30	
LMK316ABJ226□L8T		10		X5R	22 μ	±10, ±20	10	150	1.6±0.20	
JMK316ABJ476ML8T		6.3		X5R	47 μ	±20	10	150	1.6±0.20	
JMK316BBJ107ML8T				X5R	100 μ	±20	10	150	1.6±0.30	
AMK316ABJ107ML8T		4		X5R	100 μ	±20	10	150	1.6±0.20	

【Temperature Characteristic B7 : X7R(−55～+125℃), C7 : X7S(−55～+125℃)】 1.6mm thickness(L)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK316 B7105□L8T		50		X7R	1 μ	±10, ±20	3.5	200	1.6±0.20	
UMK316BC7155□L8TE				X7S	1.5 μ	±10, ±20	3.5	150	1.6±0.30	
UMK316 B7225□L8T				X7R	2.2 μ	±10, ±20	10	150	1.6±0.20	
UMK316AC7475□L8TE				X7S	4.7 μ	±10, ±20	2.5	150	1.6±0.20	
GMK316 B7225□L8T		35		X7R	2.2 μ	±10, ±20	10	150	1.6±0.20	
GMK316AB7475□L8T				X7R	4.7 μ	±10, ±20	10	150	1.6±0.20	
TMK316AB7475□L8T		25		X7R	4.7 μ	±10, ±20	10	150	1.6±0.20	
TMK316AB7106□L8T				X7R	10 μ	±10, ±20	10	150	1.6±0.20	
EMK316AB7475□L8T		16		X7R	4.7 μ	±10, ±20	10	150	1.6±0.20	
EMK316AB7106□L8T				X7R	10 μ	±10, ±20	10	150	1.6±0.20	
LMK316AB7106□L8T		10		X7R	10 μ	±10, ±20	10	150	1.6±0.20	
JMK316AB7226□L8T		6.3		X7R	22 μ	±10, ±20	10	150	1.6±0.20	
AMK316AB7226□L8T		4		X7R	22 μ	±10, ±20	10	150	1.6±0.20	
AMK316AC7476ML8T				X7S	47 μ	±20	10	150	1.6±0.20	

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

【Temperature Characteristic BJ : X5R(−55～+85℃)】 2.5mm thickness(M)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK325 BJ106□M8P		50		X5R	10 μ	±10, ±20	5	150	2.5±0.20	
EMK325ABJ476□M8P		16		X5R	47 μ	±10, ±20	10	150	2.5±0.30	
LMK325 BJ476□M8P		10		X5R	47 μ	±10, ±20	10	150	2.5±0.20	
LMK325ABJ107MM8P				X5R	100 μ	±20	10	150	2.5±0.30	
AMK325ABJ227MM8P		4		X5R	220 μ	±20	10	150	2.5±0.30	

【Temperature Characteristic C6 : X6S(−55～+105℃)】 2.5mm thickness(M)

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
JMK325AC6107MM8P		6.3		X6S	100 μ	±20	10	150	2.5±0.30	

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

Part number 1	Part number 2	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
UMK325 B7475□M8P		50		X7R	4.7 μ	±10, ±20	5	150	2.5±0.20	
UMK325AB7106□M8P				X7R	10 μ	±10, ±20	10	150	2.5±0.30	
GMK325AB7106□M8P		35		X7R	10 μ	±10, ±20	10	150	2.5±0.30	
TMK325AB7106□M8PR		25		X7R	10 μ	±10, ±20	10	150	2.5±0.30	
TMK325 B7226□M8P				X7R	22 μ	±10, ±20	10	150	2.5±0.20	
EMK325 B7226□M8P		16		X7R	22 μ	±10, ±20	10	150	2.5±0.20	
LMK325 B7226□M8P		10		X7R	22 μ	±10, ±20	10	150	2.5±0.20	
JMK325 B7476□M8PR		6.3		X7R	47 μ	±10, ±20	10	150	2.5±0.20	

▶ 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/) .

■PACKAGING

①Minimum Quantity

●Taped package

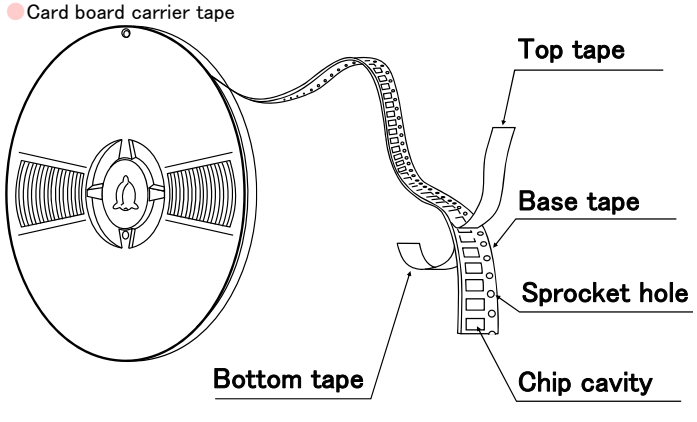
Type(EIA)	Thickness		Standard quantity [pcs]	
	mm	code	Paper tape	Embossed tape
□MK021(008004)	0.125	K	—	50000
□VS021(008004)				
□MK042(01005)	0.2	C, D	—	40000
□VS042(01005)	0.2	C		
□MK063(0201)	0.3	P,T	15000	—
□WK105(0204) ※	0.3	P	10000	—
□MK105(0402) □MF105(0402)	0.13	H	—	20000
	0.18	E	—	15000
	0.2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

Note : ※ LW Reverse type.

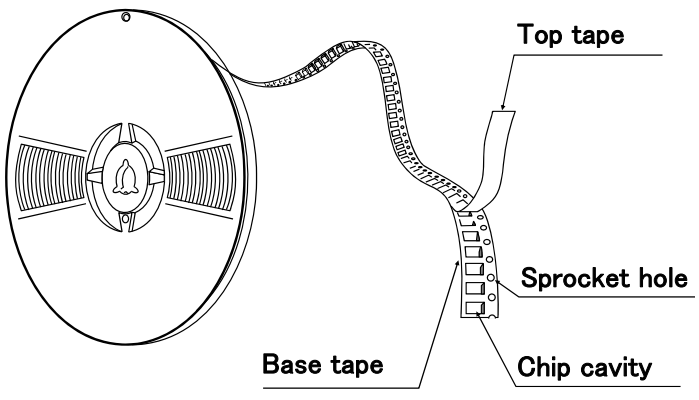
②Taping material

※No bottom tape for pressed carrier tape

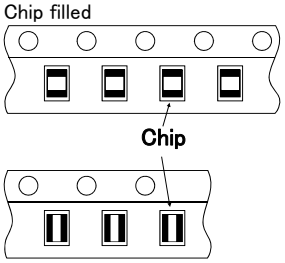
●Card board carrier tape



●Embossed tape



Chip filled



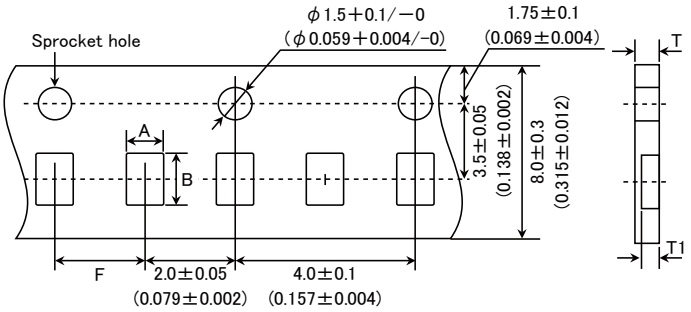
※ LW Reverse type.

③Representative taping dimensions

●Paper Tape(8mm wide)

●Pressed carrier tape(2mm pitch)

Unit:mm(inch)



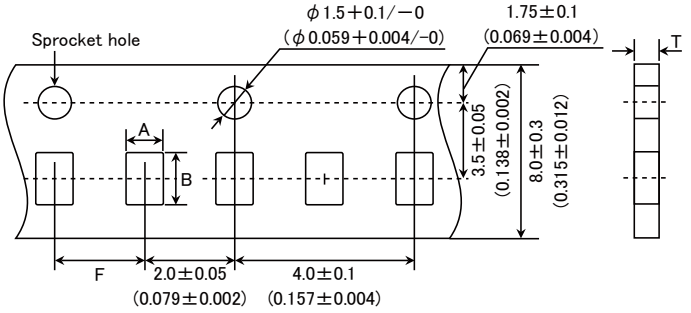
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	T	T1
□MK063(0201)	0.37	0.67	2.0±0.05	0.45max.	0.42max.
□WK105(0204) ※	0.65	1.15			
□MK105(0402) (*1 C)				0.4max.	0.3max.
□MK105(0402) (*1 P)				0.45max.	0.42max.

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

Unit:mm

●Punched carrier tape (2mm pitch)

Unit:mm(inch)

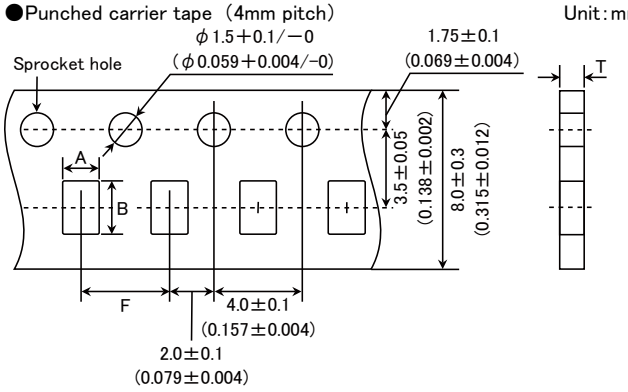


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
□MK105 (0402) □MF105 (0402) □VK105 (0402)	0.65	1.15	2.0±0.05	0.8max.

Unit:mm

●Punched carrier tape (4mm pitch)

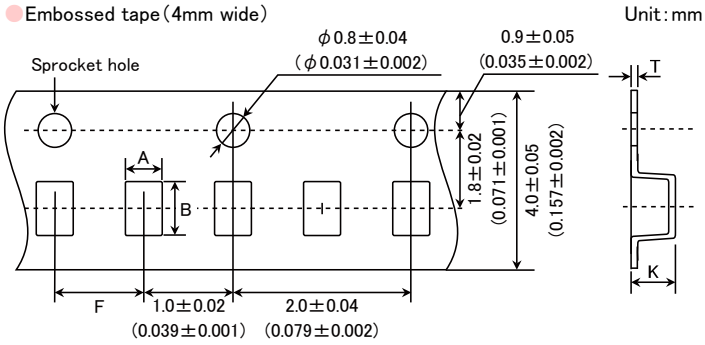
Unit:mm(inch)



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

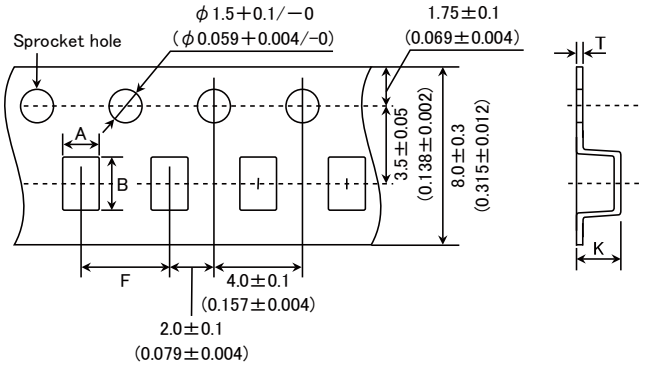
● Embossed tape (4mm wide) Unit : mm (inch)



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK021(008004)	0.135	0.27	1.0±0.02	0.5max.	0.25max.
□VS021(008004)					
□MK042(01005)	0.23	0.43			
□VS042(01005)					

Unit : mm

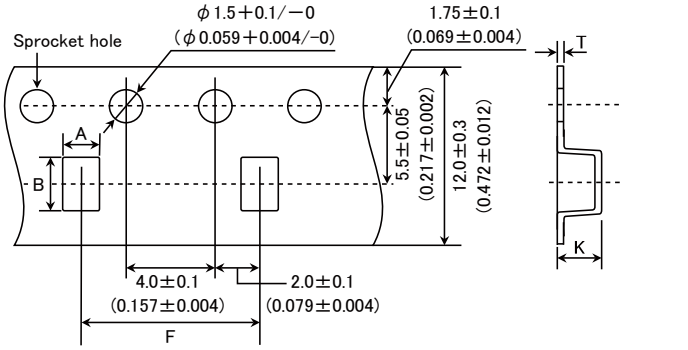
● Embossed tape (8mm wide) Unit : mm (inch)



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK105(0402)	0.6	1.1	2.0±0.1	0.6max	0.2±0.1
□WK107(0306) ※	1.0	1.8	4.0±0.1	1.3max.	0.25±0.1
□MK212(0805) □MF212(0805)	1.65	2.4		3.4max.	0.6max.
□MK316(1206) □MF316(1206)	2.0	3.6			
□MK325(1210) □MF325(1210)	2.8	3.6			

Note : ※ LW Reverse type. Unit : mm

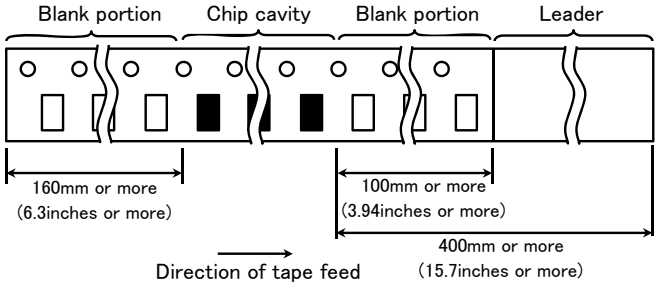
● Embossed tape (12mm wide)　　Unit : mm (inch)



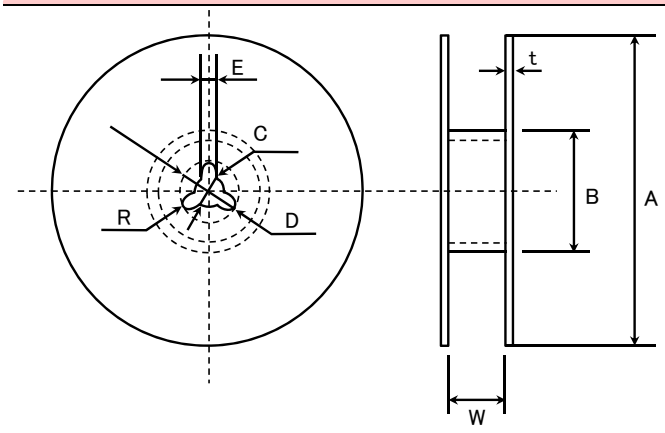
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
□MK325(1210)	3.1	4.0	8.0±0.1	4.0max.	0.6max.
□MK432(1812)	3.7	4.9	8.0±0.1	4.0max.	0.6max.

Unit : mm

④Trailer and Leader



⑤Reel size



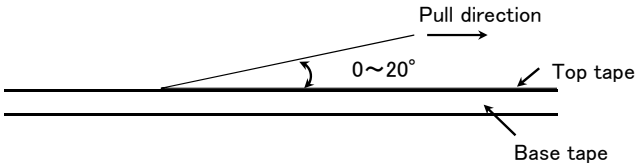
A	B	C	D	E	R
φ178±2.0	φ50min.	φ13.0±0.2	φ21.0±0.8	2.0±0.5	1.0

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

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.



■RELIABILITY DATA

1.Operating Temperature Range

Specified Value	Temperature Compensating(Class1)	Standard / High Frequency Type	−55 to +125℃
	High Permittivity (Class2)		

	Specification	Temperature Range
BJ	B	−25 to +85℃
	X5R	−55 to +85℃
B7	X7R	−55 to +125℃
C6	X6S	−55 to +105℃
C7	X7S	−55 to +125℃
D7	X7T	−55 to +125℃
LD(※)	X5R	−55 to +85℃

Note: ※LD Low distortion high value multilayer ceramic capacitor

2. Storage Conditions

Specified Value	Temperature Compensating(Class1)	Standard / High Frequency Type	−55 to +125℃
	High Permittivity (Class2)		

	Specification	Temperature Range
BJ	B	−25 to +85℃
	X5R	−55 to +85℃
B7	X7R	−55 to +125℃
C6	X6S	−55 to +105℃
C7	X7S	−55 to +125℃
D7	X7T	−55 to +125℃
LD(※)	X5R	−55 to +85℃

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 / High Frequency Type	No breakdown or damage
	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 / High Frequency Type	10000 MΩ min.
	High Permittivity (Class2) Note 1		C≦0.047μF : 10000 MΩ min. C＞0.047μF : 500MΩ・μF
Test Methods and Remarks	Applied voltage : Rated voltage Duration : 60±5 sec. Charge/discharge current : 50mA max.		

6. Capacitance (Tolerance)

Specified Value

Temperature Compensating(Class1)	Standard	C□ / U□ / SL: 0.2pF≦C≦5pF : ±0.25pF; 0.2pF≦C≦10pF : ±0.5pF; C＞10pF : ±5% or ±10%
	High Frequency Type	CH: 0.3pF≦C≦2pF : ±0.1pF; C＞2pF : ±5%
High Permittivity (Class2)		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≦10μF	C＞10μF
Preconditioning	None		Thermal treatment (at 150℃ for 1hr) Note 2	
Measuring frequency	1MHz±10%		1kHz±10%	120±10Hz
Measuring voltage Note	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1rms
Bias application	None			

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≦10μF	C＞10μF
Preconditioning	None		Thermal treatment (at 150℃ for 1hr) Note 2	
Measuring frequey	1MHz±10%	1GHz	1kHz±10%	120±10Hz
Measuring voltage Note 1	0.5 to 5Vrms		1±0.2Vrms	0.5±0.1Vrms
Bias application	None			

High Frequency Type
Measuring equipment : HP4291A
Measuring jig : HP16192A

8. Temperature Characteristic (Without voltage application)

Specified Value

Temperature Compensating(Class1)	Standard	C□ : 0 — CG,CH, CJ, CK; U□ : −750 — UJ, UK; Tolerance [ppm/℃] G : ±30, H : ±60, J : ±120, K : ±250 SL : +350 to −1000
	High Frequency Type	Temperature Characteristic [ppm/℃]: C□ : 0 — CH; Tolerance [ppm/℃]: H : ±60

High Permittivity (Class2)

	Specification	Capacitance change	Reference temperature	Temperature Range
BJ	B	±10%	20℃	−25 to +85℃
	X5R	±15%	25℃	−55 to +85℃
B7	X7R	±15%	25℃	−55 to +125℃
C6	X6S	±22%	25℃	−55 to +105℃
C7	X7S	±22%	25℃	−55 to +125℃
D7	X7S	+22/−33%	25℃	−55 to +125℃
LD(※)	X5R	±15%	25℃	−55 to +85℃

Note : ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks

Class 1 : Capacitance at 20℃ and 85℃ shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.

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

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℃	25℃
3	Maximum operating temperature	

$$\frac{(C-C_2)}{C_2}\times 100(\%)$$

C : Capacitance in Step 1 or Step 3
C2 : Capacitance in Step 2

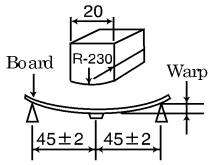
9. Deflection

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

Test Methods and Remarks

	Multilayer Ceramic Capacitors	
	042, 063, ※1105 Type	The other types
Board	Glass epoxy-resin substrate	
Thickness	0.8mm	1.6mm
Warp	1mm (Soft Termination type:3mm)	
Duration	10 sec.	

※1:105 Type thickness, C: 0.2mm ,P: 0.3mm.



(Unit: mm)

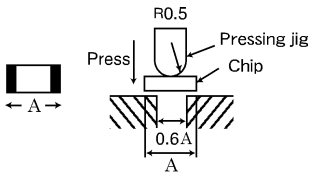
Capacitance measurement shall be conducted with the board bent

10. Body Strength

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

Test Methods and Remarks

High Frequency Type
Applied force : 5N
Duration : 10 sec.



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℃	245±3℃
Duration	4±1 sec.	

13. Resistance to Soldering

Specified Value

Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±2.5% or ±0.25pF, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Frequency Type	Appearance : No abnormality Capacitancecange : Within ±2.5% Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
High Permittivity (Class2) Note 1		Appearance : No abormality Capactace change : Within ±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℃, 1 to 2 min.	80 to 100℃, 2 to 5 min. 150 to 200℃, 2 to 5 min.
Solder temp.	270±5℃	
Duration	3±0.5 sec.	
Recovery	6 to 24 hrs (Standard condition) Noe 5	

	Class 2		
	042、063 Type	105, 107, 212 Type	316, 325 Type
Preconditioning	Thermal treatment (at 150℃ for 1 hr) Note 2		
Preheating	150℃, 1 to 2 min.	80 to 100℃, 2 to 5 min. 150 to 200℃, 2 to 5 min.	80 to 100℃, 5 to 10 min. 150 to 200℃, 5 to 10 min.
Solder temp.	270±5℃		
Duration	3±0.5 sec.		
Recovery	24±2 hrs (Standard condition) Note 5		

14. Temperature Cycle (Thermal Shock)

Specified Value

Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±2.5% or ±0.25pF, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Frequency Type	Appearance : No abnormality Capacitance change : Within ±0.25pF Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±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
Preconditioning	None	Thermal treatment (at 150℃ for 1 hr) Note 2
1 cycle	(see table below)	
Number of cycles	5 times	
Recovery	6 to 24 hrs (Standard condition) Note 5	24±2 hrs (Standard condition) Note 5

Step	Temperature(℃)	Time(min.)
1	Minimum operating temperature	30±3
2	Normal temperature	2 to 3
3	Maximum operating temperature	30±3
4	Normal temperature	2 to 3

15. Humidity (Steady State)

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±5% or ±0.5pF, whichever is larger. Q : C＜10pF : Q≧200＋10C 10≦C＜30pF : Q≧275＋2.5C C≧30pF:Q≧350(C:Nominal capacitance) Insulation resistance : 1000 MΩ min.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within ±0.5pF, Insulation resistance : 1000 MΩ min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±12.5% (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : 5.0% max.(BJ, B7, C6, C7, D7, LD(※)) Insulation resistance : 50 MΩ μF or 1000 MΩ 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℃ for 1 hr) Note 2
Temperature	40±2℃	60±2℃	40±2℃
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±2 hrs (Standard condition) Note 5

16. Humidity Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±7.5% or ±0.75pF, whichever is larger. Q : C＜30pF:Q≧100＋10C/3 C≧30pF:Q≧200 (C:Nominal capacitance) Insulation resistance : 500 MΩ min.
		High Frequency Type	Appearance : No abnormality Capacitance change : C≦2pF:Within ±0.4 pF C＞2pF:Within ±0.75 pF (C:Nominal capacitance) Insulation resistance : 500 MΩ min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±12.5% (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : 5.0% max. (BJ, B7, C6, C7, D7, LD(※)) Insulation resistance : 25 MΩ μF or 500 MΩ, 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℃) Note 3
Temperature	40±2℃	60±2℃	40±2℃
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±2 hrs(Standard condition) Note 5

17. High Temperature Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within ±3% or ±0.3pF, whichever is larger. Q : C＜10pF: Q≧200＋10C 10≦C＜30pF:Q≧275＋2.5C C≧30pF: Q≧350(C:Nominal capacitance) Insulation resistance : 1000 MΩ min.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within ±3% or ±0.3pF, whichever is larger. Insulation resistance : 1000 MΩ min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within ±12.5% (BJ, B7, C6, C7, D7, LD(※)) Dissipation factor : 5.0% max.(BJ, B7, C6, C7, D7, LD(※)) Insulation resistance : 50 MΩ μF or 1000 MΩ, 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℃, 105℃ or 125℃) Note 3, 4		
Temperature	Maximum operating temperature		Maximum operating temperature		
Duration	1000＋48/－0 hrs		1000＋48/－0 hrs		
Applied voltage	Rated voltage × 2		Rated voltage × 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℃ for an hour and kept at room temperature for 24±2hours.

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

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

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

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

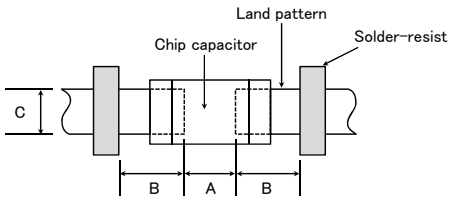
●Multilayer Ceramic Capacitors : Recommended land dimensions

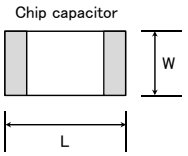
(unit: mm)

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

Land patterns for PCBs





Reflow-soldering

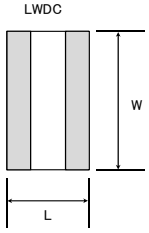
Type		042	063	105	107	212	316	325	432
Size	L	0.4	0.6	1.0	1.6	2.0	3.2	3.2	4.5
	W	0.2	0.3	0.5	0.8	1.25	1.6	2.5	3.2
A		0.15 to 0.25	0.20 to 0.30	0.45 to 0.55	0.8 to 1.0	0.8 to 1.2	1.8 to 2.5	1.8 to 2.5	2.5 to 3.5
B		0.15 to 0.20	0.20 to 0.30	0.40 to 0.50	0.6 to 0.8	0.8 to 1.2	1.0 to 1.5	1.0 to 1.5	1.5 to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

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

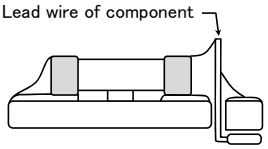
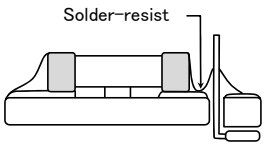
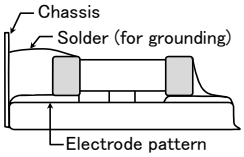
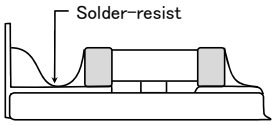
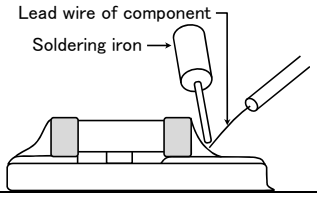
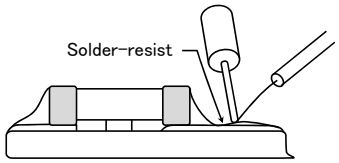
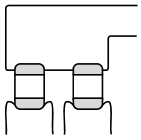
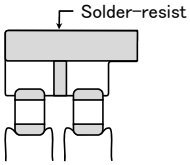
●LWDC: Recommended land dimensions for reflow-soldering

(unit: mm)

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

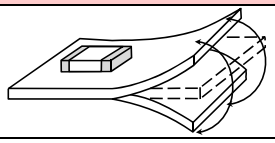
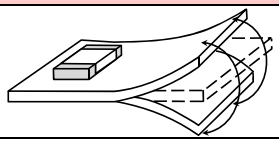


(2)Examples of good and bad solder application

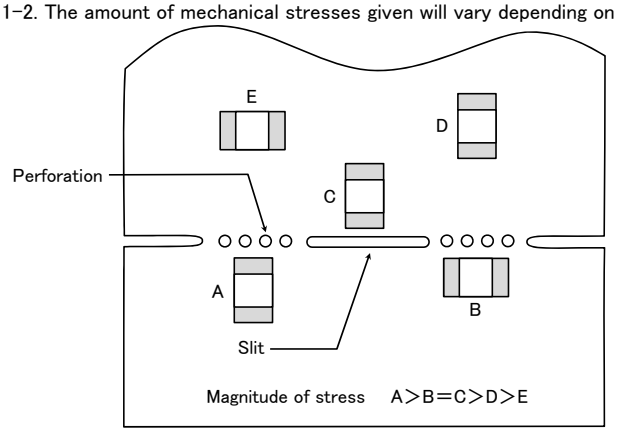
Items	Not eommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded Components near mounted components		
Horizontal component placement		

◆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

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

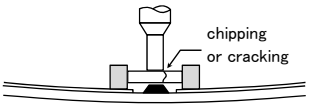
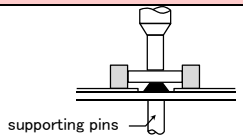
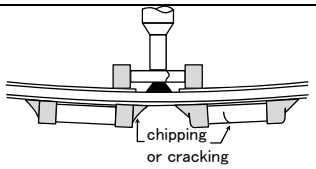
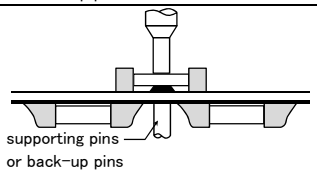
◆Selection of Adhesives

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

Technical considerations

◆Adjustment of mounting machine

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

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

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.

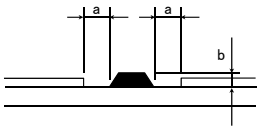
(1) Required adhesive characteristics
   a. The adhesive shall be strong enough to hold parts on the board during the mounting & solder process.
   b. The adhesive shall have sufficient strength at high temperatures.
   c. The adhesive shall have good coating and thickness consistency.
   d. The adhesive 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;

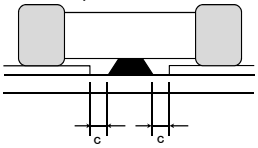
[Recommended condition]

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

Amount adhesive



After capacitor are bonded



4. Soldering

Precautions

◆Selection of Flux

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

◆Soldering

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

Technical 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.

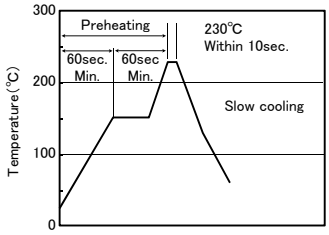
1-3. Since the residue of water-soluble flux is easily dissolved in moisture in the air, the residues on the surfaces of capacitors in high humidity conditions may cause a degradation of insulation resistance and reliability of the capacitors. Therefore, the cleaning methods and the capability of the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

◆Soldering

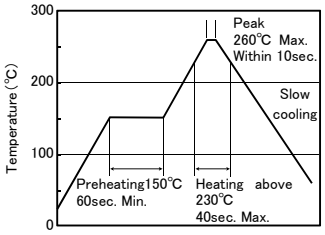
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated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

[Reflow soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】

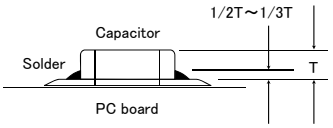


Caution

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

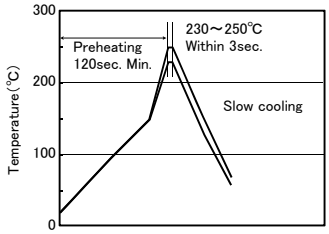
②Because excessive dwell times can adversely affect solderability, soldering duration shall be kept as close to recommended times as possible.

③Allowable number of reflow soldering : 2 times max.

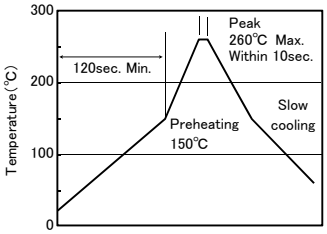


[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



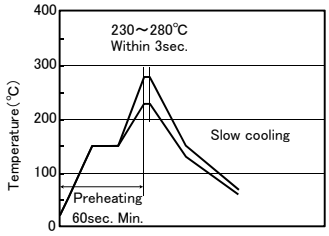
Caution

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

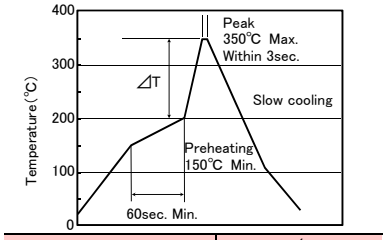
②Allowable number of wave soldering : 1 times max.

[Hand soldering]

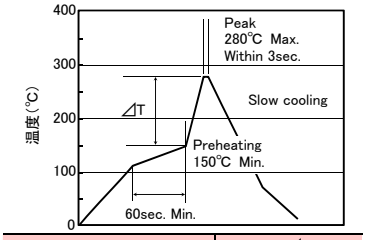
【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



	⊿T
316type or less	⊿T≦150℃



	⊿T
325type or more	⊿T≦130℃

Caution

①Use a 50W soldering iron with a maximum tip diameter of 1.0 mm.

②The soldering iron shall not directly touch capacitors.

③Allowable number of hand soldering : 1 times max.

5. Cleaning	
Precautions	◆Cleaning conditions 1. When PCBs are cleaned after capacitors mounting, please select the appropriate cleaning solution in accordance with the intended use of the cleaning. (e.g. to remove soldering flux or other materials from the production process.) 2. Cleaning condition shall be determined after it is verified by using actual cleaning machine that the cleaning process does not affect capacitor's characteristics.
Technical considerations	1. The use of inappropriate cleaning solutions can cause foreign substances such as flux residue to adhere to capacitors or deteriorate their outer coating, resulting in a degradation of the capacitor's electrical properties (especially insulation resistance). 2. Inappropriate cleaning conditions(insufficient or excessive cleaning) may adversely affect the performance of the capacitors. In the case of ultrasonic cleaning, too much power output can cause excessive vibration of PCBs which may lead to the cracking of capacitors or the soldered portion, or decrease the terminal electrodes' strength. Therefore, the following conditions shall be carefully checked; Ultrasonic output : 20 W/ℓ or less Ultrasonic frequency : 40 kHz or less Ultrasonic washing period : 5 min. or less

6. Resin coating and mold	
Precautions	1. With some type of resins, decomposition gas or chemical reaction vapor may remain inside the resin during the hardening period or while left under normal storage conditions resulting in the deterioration of the capacitor's performance. 2. When a resin's hardening temperature is higher than capacitor's operating temperature, the stresses generated by the excessive heat may lead to damage or destruction of capacitors. The use of such resins, molding materials etc. is not recommended.

7. Handling	
Precautions	◆Splitting of PCB 1. When PCBs are split after components mounting, care shall be taken so as not to give any stresses of deflection or twisting to the board. 2. Board separation shall not be done manually, but by using the appropriate devices. ◆Mechanical considerations Be careful not to subject capacitors to excessive mechanical shocks. (1)If ceramic capacitors are dropped onto a floor or a hard surface, they shall not be used. (2)Please be careful that the mounted components do not come in contact with or bump against other boards or components.

8. Storage conditions	
Precautions	◆Storage 1. To maintain the solderability of terminal electrodes and to keep packaging materials in good condition, care must be taken to control temperature and humidity in the storage area. Humidity should especially be kept as low as possible. ・Recommended conditions Ambient temperature : Below 30℃ Humidity : Below 70% RH The ambient temperature must be kept below 40℃. Even under ideal storage conditions, solderability of capacitor is deteriorated as time passes, so capacitors shall be used within 6 months from the time of delivery. ・Ceramic chip capacitors shall be kept where no chlorine or sulfur exists in the air. 2. The capacitance values of high dielectric constant capacitors will gradually decrease with the passage of time, so care shall be taken to design circuits . Even if capacitance value decreases as time passes, it will get back to the initial value by a heat treatment at 150℃ for 1hour.
Technical considerations	If capacitors are stored in a high temperature and humidity environment, it might rapidly cause poor solderability due to terminal oxidation and quality loss of taping/packaging materials. For this reason, capacitors shall be used within 6 months from the time of delivery. If exceeding the above period, please check solderability before using the capacitors.

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

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