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 March 2023. 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 for consumer (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, or the equipment approved separately by TAIYO YUDEN.
TAIYO YUDEN has the product series intended for use in the following equipment. 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.

Application	Product Series		Quality Grade *3
	Equipment *1	Category (Part Number Code *2)	
Automotive	Automotive Electronic Equipment (POWERTRAIN, SAFETY)	A	1
	Automotive Electronic Equipment (BODY & CHASSIS, INFOTAINMENT)	C	2
Industrial	Telecommunications Infrastructure and Industrial Equipment	B	2
Medical	Medical Devices classified as GHTF Class C (Japan Class III)	M	2
	Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)	L	3
Consumer	General Electronic Equipment	S	3
	Only for Mobile Devices *4	E	4

*Notes: 1. Based on the general specifications required for electronic components for such equipment, which are recognized by TAIYO YUDEN, the use of each product series for the equipment is recommended. Please be sure to contact TAIYO YUDEN before using our products for equipment other than those covered by the product series.
2. On each of our part number, the 2nd code from the left is a code indicating the “Category” as shown in the above table. For details, please check the explanatory materials regarding the part numbering system of each of our products.
3. Each product series is assigned a “Quality Grade” from 1 to 4 in order of higher quality. Please do not incorporate a product into any equipment with a higher Quality Grade than the Quality Grade of such product without the prior written consent of TAIYO YUDEN.
4. The applications covered by this product series are limited to mobile devices (smartphone, tablet PC, smartwatch, handheld game console, etc.) among general electronic equipment for consumer. The design, specifications and operating environment, etc. differ from those of the product series for "General Electronic Equipment" (Category: S), so please check the individual product specification sheets for details. The product series for "General Electronic Equipment" (Category: S) can also be used for mobile devices.

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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, 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 conforming to the product specifications specified in the individual product specification sheets, 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, provided, however, that our products shall be used for general-purpose and standard use in the equipment specified in this catalog or the individual product specification sheets.

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.

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Medical Application Guide

According to the medical devices classified as GHTF Classes A to C (Japan Classes I to III), we have the corresponding product series (the 2nd code from the left side of the part number is “M” or “L”) intended for use in the medical devices. Therefore, when using our products for the medical devices, please be sure to check the classification based on the GHTF Rules and use the corresponding product series.
On the other hand, we don’t have the product series intended for use in (i) all medical devices classified as GHTF Class D (Japan Class IV) and (ii) 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, please do not incorporate our products into these medical devices. 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
Corresponding TAIYO YUDEN Product Series		**Product Series for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)** (The 2nd Code from the Left Side of the Part Number: “L”)		**Product Series for Medical Devices classified as GHTF Class C (Japan Class III)** (The 2nd Code from the Left Side of the Part Number: “M”) (See the Note below.)	N / A

* 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).

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Multilayer Ceramic Capacitors
for Medical Devices classified as GHTF Class C (Japan Class III)

REFLOW

■PART NUMBER

M	M	A	S	T	3	1	L	S	B	5	1	0	6	K	T	N	A	0	1
①				②	③		④	⑤	⑥		⑦			⑧	⑨	⑩			

①Series

Code (1)(2)(3)(4)	
MMAS	Multilayer Ceramic Capacitor (High dielectric type) for Medical Devices classified as GHTF Class C (Japan Class III) Multilayer Ceramic Capacitor (Temperature compensating type) for Medical Devices classified as GHTF Class C (Japan Class III)
MMAR	High frequency/Low loss Medium-High Voltage Multilayer Ceramic Capacitor for Medical Devices classified as GHTF Class C (Japan Class III)
MMJC	Soft Termination Multilayer Ceramic Capacitor for Medical Devices classified as GHTF Class C (Japan Class III)
MMRL	LW Reversal Decoupling Low ESL Capacitor (LWDC™) for Medical Devices classified as GHTF Class C (Japan Class III)

(1) Product Group

Code	
M	Multilayer Ceramic Capacitor

(2) Category

Code	Recommended equipment	Quality Grade
M	Medical Devices classified as GHTF Class C (Japan Class III)	2

(3) Type

Code	
A	2 terminals
J	Soft Termination
R	LW reversal

(4) Features, Characteristics

Code	
S	Standard/General
R	High frequency/Low loss
C	Internal code (Soft Termination)
L	Low ESL

②Rated 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

③Dimension(L×W)

Code	L×W [mm]	JIS(mm)	EIA(inch)
06	0.6 × 0.3	0603	0201
10	1.0 × 0.5	1005	0402
	0.52× 1.0 ※	0510	0204
16	1.6 × 0.8	1608	0603
	0.8 × 1.6 ※	0816	0306
21	2.0 × 1.25	2012	0805
	1.25× 2.0 ※	1220	0508
31	3.2 × 1.6	3216	1206
32	3.2 × 2.5	3225	1210
45	4.5 × 3.2	4532	1812

Note : ※LW reverse type(MMRL)

④Thickness

Code	Thickness[mm]
3	0.3
5	0.5
7	0.7
8	0.8
9	0.85
Q	1.15
G	1.25
L	1.6
N	1.9 (0.088 max ※)
M	2.5

Note : ※LW reverse type(MMRL)

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⑤Dimension tolerance

Code	Dimension code	L[mm]	W[mm]	T[mm]	Thickness code
A	10	1.0±0.10	0.5±0.10	0.5±0.10	5
	16	1.6+0.15/−0.05	0.8+0.15/−0.05	0.8+0.15/−0.05	8
	21	2.0+0.15/−0.05	1.25+0.15/−0.05	1.25+0.15/−0.05	G
	31	3.2±0.20	1.6±0.20	1.15±0.20	Q
				1.6±0.20	L
	32	3.2±0.30	2.5±0.30	2.5±0.30	M
B	10	1.0+0.15/−0.05	0.5+0.15/−0.05	0.5+0.15/−0.05	5
	16	1.6+0.20/−0	0.8+0.20/−0	0.8+0.20/−0	8
	21	2.0+0.20/−0	1.25+0.20/−0	1.25+0.20/−0	G
	31	3.2±0.30	1.6±0.30	1.6±0.30	L
C	10	1.0+0.20/−0	0.5+0.20/−0	0.5+0.20/−0	5
	16	1.6+0.25/−0	0.8+0.25/−0	0.8+0.25/−0	8
	21	2.0+0.25/−0	1.25+0.25/−0	1.25+0.25/−0	G
D	21	2.0+0.30/−0	1.25+0.30/−0	1.25+0.30/−0	G
H	31	3.2±0.15	1.6±0.15	1.15±0.10	Q
J	21	2.0+0.15/−0.05	1.25+0.15/−0.05	0.85±0.10	9
L	21	2.0+0.20/−0	1.25+0.20/−0	0.85±0.10	9
	32	3.2±0.50	2.5±0.30	2.5±0.30	M
N	21	2.0±0.15	1.25±0.15	0.85±0.15	9
S	06	0.6±0.03	0.3±0.03	0.3±0.03	3
	10	1.0±0.05	0.5±0.05	0.5±0.05	5
		0.52±0.05 ※	1.0±0.05	0.3±0.05	3
	16	1.6±0.10	0.8±0.10	0.7±0.10	7
				0.8±0.10	8
		0.8±0.10 ※	1.6±0.10	0.5±0.05	5
	21	2.0±0.10	1.25±0.10	0.85±0.10	9
				1.25±0.10	G
		1.25±0.15 ※	2.0±0.15	0.85±0.10	9
	31	3.2±0.15	1.6±0.15	1.6±0.20	L
	32	3.2±0.30	2.5±0.20	1.9±0.20	N
				2.5±0.20	M
	45	4.5±0.40	3.2±0.30	2.5±0.20	M

Note :※LW reverse type(MMRL)

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⑥Temperature characteristics code

■High dielectric type

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	Capacitance change	Capacitance tolerance	Tolerance code
B5	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

■Temperature compensating type

Code	Applicable standard		Temperature range[℃]	Ref. Temp.[℃]	Capacitance change	Capacitance tolerance	Tolerance code
CG	JIS	CG	−55～＋125	20	0±30ppm/℃	±0.05pF	A
						±0.1pF	B
						±0.25pF	C
	EIA	C0G		25		±0.5pF	D
						±2%	G
						±5%	J
CH	JIS	CH	−55～＋125	20	0±60ppm/℃	±0.25pF	C
						±0.5pF	D
	EIA	C0H		25		±5%	J
CJ	JIS	CJ	−55～＋125	20	0±120ppm/℃	±0.25pF	C
	EIA	C0J		25			
CK	JIS	CK	−55～＋125	20	0±250ppm/℃	±0.25pF	C
	EIA	C0K		25			

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	1μF
106	10μF
107	100μF

Note : R＝Decimal point

⑧Capacitance tolerance

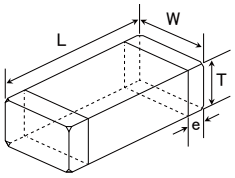
Code	Capacitance tolerance
A	±0.05pF
B	±0.1pF
C	±0.25pF
D	±0.5pF
G	±2%
J	±5%
K	±10%
M	±20%

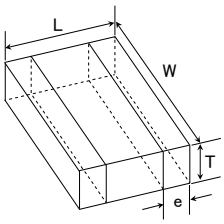
⑨Packaging

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) 3225 type(Thickness code M)

⑩Internal code

■STANDARD EXTERNAL DIMENSIONS





※LW reverse type

Type	JIS (mm)	EIA (inch)	Dimension [mm] (inch)				
			L	W	T	*1	e
MMAS□06	0603	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)	3	0.15±0.05 (0.006±0.002)
MMAR□10 MMAS□10	1005	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)	5	0.25±0.10 (0.010±0.004)
MMRL□10 ※	0510	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)	3	0.18±0.08 (0.007±0.003)
MMAS□16 MMAR□16	1608	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)	7	0.35±0.25 (0.014±0.010)
					0.8±0.10 (0.031±0.004)	8	
MMJC□16	1608	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)	8	0.35+0.3/−0.25 (0.014+0.012/−0.010)
MMRL□16 ※	0816	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)	5	0.25±0.15 (0.010±0.006)
MMAS□21 MMAR□21	2012	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)	9	0.5±0.25 (0.020±0.010)
					1.25±0.10 (0.049±0.004)	G	
MMJC□21	2012	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)	9	0.5+0.35/−0.25 (0.020+0.014/−0.010)
					1.25±0.10 (0.049±0.004)	G	
MMRL□21 ※	1220	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)	9	0.3±0.2 (0.012±0.008)
MMAS□31	3216	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)	Q	0.5+0.35/−0.25 (0.020+0.014/−0.010)
					1.6±0.20 (0.063±0.008)	L	
MMJC□31	3216	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)	Q	0.6+0.4/−0.3 (0.024+0.016/−0.012)
					1.6±0.20 (0.063±0.008)	L	
MMAS□32	3225	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±0.3 (0.024±0.012)
					2.5±0.20 (0.098±0.008)	M	
MMJC□32	3225	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	
MMAS□45	4532	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(MMRL), *1.Thickness code

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■STANDARD QUANTITY

Type			Thickness		Standard quantity[pcs]	
Code	JIS(mm)	EIA(inch)	[mm]	Code	Paper tape	Embossed tape
06	0603	0201	0.3	3	15000	—
10	1005	0402	0.5	5	10000	—
	0510 ※	0204 ※	0.3	3		
16	1608	0603	0.7	7	4000	—
			0.8	8		
			0.8	8	3000 (Soft Termination)	3000 (Soft Termination)
	0816 ※	0306 ※	0.5	5	—	4000
21	2012	0805	0.85	9	4000	—
			1.25	G	—	3000
			1.25	G	—	2000 (Soft Termination)
	1220 ※	0508 ※	0.85	9	4000	—
31	3216	1206	1.15	Q	—	3000
			1.6	L	—	2000
32	3225	1210	1.9	N	—	2000
			2.5	M	—	500(T), 1000(P)
45	4532	1812	2.5	M	—	500

Note : ※.LW Reverse type(MMRL)

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■PART NUMBER

Soft Termination Multilayer Ceramic Capacitors for Medical Devices classified as GHTF Class C (Japan Class III)

●1608TYPE

【Temperature Characteristic B7 : X7R(−55～+125℃)】 0.8mm Thickness

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MMJCT168BB7473□TPA01	TMJ107BB7473□AHT	25		X7R	0.047 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCT168BB7104□TPA01	TMJ107BB7104□AHT			X7R	0.1 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCT168BB7224□TPA01	TMJ107BB7224□AHT			X7R	0.22 μ	±10, ±20	10	150	0.8+0.20/−0	
MMJCT168BB7474□TPA01	TMJ107BB7474□AHT			X7R	0.47 μ	±10, ±20	10	150	0.8+0.20/−0	
MMJCT168CB7105□RPA01	TMJ107CB7105□AHR			X7R	1 μ	±10, ±20	10	150	0.8+0.25/−0	
MMJCG168BB7473□TPA01	GMJ107BB7473□AHT	35		X7R	0.047 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCG168BB7104□TPA01	GMJ107BB7104□AHT			X7R	0.1 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCG168BB7224□TPA01	GMJ107BB7224□AHT			X7R	0.22 μ	±10, ±20	10	150	0.8+0.20/−0	
MMJCG168BB7474□TPA01	GMJ107BB7474□AHT			X7R	0.47 μ	±10, ±20	10	150	0.8+0.20/−0	
MMJCG168CB7105□RPA01	GMJ107CB7105□AHR			X7R	1 μ	±10, ±20	10	150	0.8+0.25/−0	
MMJCU168AB7102□TPA01	UMJ107AB7102□AHT	50		X7R	1000 p	±10, ±20	3.5	200	0.8+0.15/−0.05	
MMJCU168AB7222□TPA01	UMJ107AB7222□AHT			X7R	2200 p	±10, ±20	3.5	200	0.8+0.15/−0.05	
MMJCU168BB7472□TPA01	UMJ107BB7472□AHT			X7R	4700 p	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCU168BB7103□TPA01	UMJ107BB7103□AHT			X7R	0.01 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCU168BB7223□TPA01	UMJ107BB7223□AHT			X7R	0.022 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCU168BB7473□TPA01	UMJ107BB7473□AHT			X7R	0.047 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCU168BB7104□TPA01	UMJ107BB7104□AHT			X7R	0.1 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCH168AB7102□TPA01	HMJ107AB7102□AHT	100		X7R	1000 p	±10, ±20	3.5	200	0.8+0.15/−0.05	
MMJCH168AB7222□TPA01	HMJ107AB7222□AHT			X7R	2200 p	±10, ±20	3.5	200	0.8+0.15/−0.05	
MMJCH168BB7472□TPA01	HMJ107BB7472□AHT			X7R	4700 p	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCH168BB7103□TPA01	HMJ107BB7103□AHT			X7R	0.01 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCH168BB7223□TPA01	HMJ107BB7223□AHT			X7R	0.022 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCH168BB7473□TPA01	HMJ107BB7473□AHT			X7R	0.047 μ	±10, ±20	3.5	200	0.8+0.20/−0	
MMJCH168BB7104□TPA01	HMJ107BB7104□AHT			X7R	0.1 μ	±10, ±20	3.5	200	0.8+0.20/−0	

●2012TYPE

【Temperature Characteristic B7 : X7R(−55～+125℃), C7 : X7S(−55～+125℃)】 0.85mm Thickness(D)、1.25mm Thickness(G)

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MMJCJ21GCB7106□TPA01	JMJ212CB7106□GHT	6.3		X7R	10 μ	±10, ±20	10	150	1.25+0.25/−0	
MMJCE21GCB7225□TPA01	EMJ212CB7225□GHT	16		X7R	2.2 μ	±10, ±20	10	150	1.25+0.25/−0	
MMJCE21GCB7475□TPA01	EMJ212CB7475□GHT			X7R	4.7 μ	±10, ±20	10	150	1.25+0.25/−0	
MMJCT21GCB7225□TPA01	TMJ212CB7225□GHT	25		X7R	2.2 μ	±10, ±20	10	150	1.25+0.25/−0	
MMJCG21GCB7105□TPA01	GMJ212CB7105□GHT	35		X7R	1 μ	±10, ±20	10	150	1.25+0.25/−0	
MMJCU21GBB7103□TPA01	UMJ212BB7103□GHT	50		X7R	0.01 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCU21GBB7223□TPA01	UMJ212BB7223□GHT			X7R	0.022 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCU21GBB7473□TPA01	UMJ212BB7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCU21GBB7104□TPA01	UMJ212BB7104□GHT			X7R	0.1 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCU21GBB7224□TPA01	UMJ212BB7224□GHT			X7R	0.22 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCU21GCC7474□TDA01	UMJ212CC7474□GHTE			X7S	0.47 μ	±10, ±20	3.5	150	1.25+0.25/−0	
MMJCU21GCB7105□TPA01	UMJ212CB7105□GHT			X7R	1 μ	±10, ±20	10	150	1.25+0.25/−0	
MMJCH219NB7102□TPA01	HMJ212KB7102□DHT	100		X7R	1000 p	±10, ±20	3.5	200	0.85±0.15	
MMJCH219NB7222□TPA01	HMJ212KB7222□DHT			X7R	2200 p	±10, ±20	3.5	200	0.85±0.15	
MMJCH21GBB7472□TPA01	HMJ212BB7472□GHT			X7R	4700 p	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCH21GBB7103□TPA01	HMJ212BB7103□GHT			X7R	0.01 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCH21GBB7223□TPA01	HMJ212BB7223□GHT			X7R	0.022 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCH21GBB7473□TPA01	HMJ212BB7473□GHT			X7R	0.047 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCH21GBB7104□TPA01	HMJ212BB7104□GHT			X7R	0.1 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCH21GBB7224□TPA01	HMJ212BB7224□GHT			X7R	0.22 μ	±10, ±20	3.5	200	1.25+0.20/−0	
MMJCH21GCC7474□TDA01	HMJ212CC7474□GHTE			X7S	0.47 μ	±10, ±20	3.5	150	1.25+0.25/−0	
MMJCH21GDC7105□TDA01	HMJ212DC7105□GHTE			X7S	1 μ	±10, ±20	3.5	150	1.25+0.30/−0	
MMJCQ219NB7102□TPA01	QMJ212KB7102□DHT	250		X7R	1000 p	±10, ±20	2.5	150	0.85±0.15	
MMJCQ219NB7222□TPA01	QMJ212KB7222□DHT			X7R	2200 p	±10, ±20	2.5	150	0.85±0.15	
MMJCQ21GBB7472□TPA01	QMJ212BB7472□GHT			X7R	4700 p	±10, ±20	2.5	150	1.25+0.20/−0	
MMJCQ21GBB7103□TPA01	QMJ212BB7103□GHT			X7R	0.01 μ	±10, ±20	2.5	150	1.25+0.20/−0	
MMJCQ21GBB7223□TPA01	QMJ212BB7223□GHT			X7R	0.022 μ	±10, ±20	2.5	150	1.25+0.20/−0	

■PART NUMBER

●3216TYPE

【Temperature Characteristic B7 : X7R(−55～+125℃), C7 : X7S(−55～+125℃)】 1.15mm Thickness、1.6mm Thickness

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MMJCL31LBB7226□TPA01	LMJ316BB7226□LHT	10		X7R	22 μ	±10, ±20	10	150	1.6±0.30	
MMJCE31LBB7475□TPA01	EMJ316BB7475□LHT	16		X7R	4.7 μ	±10, ±20	10	150	1.6±0.30	
MMJCE31LBB7106□TPA01	EMJ316BB7106□LHT			X7R	10 μ	±10, ±20	10	150	1.6±0.30	
MMJCT31LBB7474□TPA01	TMJ316BB7474□LHT	25		X7R	0.47 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCT31LBB7475□TPA01	TMJ316BB7475□LHT			X7R	4.7 μ	±10, ±20	10	150	1.6±0.30	
MMJCT31LBB7106□TPA01	TMJ316BB7106□LHT			X7R	10 μ	±10, ±20	10	150	1.6±0.30	
MMJCG31LBB7474□TPA01	GMJ316BB7474□LHT	35		X7R	0.47 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCG31LAB7225□TPA01	GMJ316AB7225□LHT			X7R	2.2 μ	±10, ±20	10	150	1.6±0.20	
MMJCG31LBB7475□TPA01	GMJ316BB7475□LHT			X7R	4.7 μ	±10, ±20	10	150	1.6±0.30	
MMJCG31LBB7106□TPA01	GMJ316BB7106□LHT			X7R	10 μ	±10, ±20	10	150	1.6±0.30	
MMJCU31LBB7473□TPA01	UMJ316BB7473□LHT	50		X7R	0.047 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCU31LBB7104□TPA01	UMJ316BB7104□LHT			X7R	0.1 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCU31LBB7224□TPA01	UMJ316BB7224□LHT			X7R	0.22 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCU31LBB7474□TPA01	UMJ316BB7474□LHT			X7R	0.47 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCU31LBB7105□TPA01	UMJ316BB7105□LHT			X7R	1 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCU31LAB7225□TPA01	UMJ316AB7225□LHT			X7R	2.2 μ	±10, ±20	10	150	1.6±0.20	
MMJCU31LBC7475□TDA01	UMJ316BC7475□LHTE			X7S	4.7 μ	±10, ±20	2.5	150	1.6±0.30	
MMJCH31QHB7102□TPA01	HMJ316 B7102□FHT	100		X7R	1000 p	±10, ±20	3.5	200	1.15±0.10	
MMJCH31QHB7222□TPA01	HMJ316 B7222□FHT			X7R	2200 p	±10, ±20	3.5	200	1.15±0.10	
MMJCH31QHB7472□TPA01	HMJ316 B7472□FHT			X7R	4700 p	±10, ±20	3.5	200	1.15±0.10	
MMJCH31QAB7103□TPA01	HMJ316KB7103□FHT			X7R	0.01 μ	±10, ±20	3.5	200	1.15±0.20	
MMJCH31LBB7223□TPA01	HMJ316BB7223□LHT			X7R	0.022 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCH31LBB7473□TPA01	HMJ316BB7473□LHT			X7R	0.047 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCH31LBB7104□TPA01	HMJ316BB7104□LHT			X7R	0.1 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCH31LBB7224□TPA01	HMJ316BB7224□LHT			X7R	0.22 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCH31LBB7474□TPA01	HMJ316BB7474□LHT			X7R	0.47 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCH31LBB7105□TPA01	HMJ316BB7105□LHT			X7R	1 μ	±10, ±20	3.5	200	1.6±0.30	
MMJCH31LBC7225□TDA01	HMJ316BC7225□LHTE			X7S	2.2 μ	±10, ±20	3.5	150	1.6±0.30	
MMJCQ31QHB7102□TPA01	QMJ316 B7102□FHT	250		X7R	1000 p	±10, ±20	2.5	150	1.15±0.10	
MMJCQ31QHB7222□TPA01	QMJ316 B7222□FHT			X7R	2200 p	±10, ±20	2.5	150	1.15±0.10	
MMJCQ31QHB7472□TPA01	QMJ316 B7472□FHT			X7R	4700 p	±10, ±20	2.5	150	1.15±0.10	
MMJCQ31QAB7103□TPA01	QMJ316KB7103□FHT			X7R	0.01 μ	±10, ±20	2.5	150	1.15±0.20	
MMJCQ31LBB7223□TPA01	QMJ316BB7223□LHT			X7R	0.022 μ	±10, ±20	2.5	150	1.6±0.30	
MMJCQ31LBB7473□TPA01	QMJ316BB7473□LHT			X7R	0.047 μ	±10, ±20	2.5	150	1.6±0.30	
MMJCQ31LBB7104□TPA01	QMJ316BB7104□LHT			X7R	0.1 μ	±10, ±20	2.5	150	1.6±0.30	
MMJCS31QHB7102□TPA01	SMJ316 B7102□FHT	630		X7R	1000 p	±10, ±20	2.5	120	1.15±0.10	
MMJCS31QHB7222□TPA01	SMJ316 B7222□FHT			X7R	2200 p	±10, ±20	2.5	120	1.15±0.10	
MMJCS31QHB7472□TPA01	SMJ316 B7472□FHT			X7R	4700 p	±10, ±20	2.5	120	1.15±0.10	
MMJCS31QAB7103□TPA01	SMJ316KB7103□FHT			X7R	0.01 μ	±10, ±20	2.5	120	1.15±0.20	
MMJCS31LBB7223□TPA01	SMJ316BB7223□LHT			X7R	0.022 μ	±10, ±20	2.5	120	1.6±0.30	

●3225TYPE

【Temperature Characteristic B7 : X7R(−55～+125℃), C7 : X7S(−55～+125℃)】 1.9mm Thickness、2.5mm Thickness

New part number	Old part number (for reference)	Rated voltage [V]	Temperature characteristics		Capacitance [F]	Capacitance tolerance [%]	tan δ [%]	HTLT Rated voltage x %	Thickness*1 [mm]	Note
MMJCJ32MLB7476□PPDT1	JMJ325KB7476□MHP	6.3		X7R	47 μ	±10, ±20	10	150	2.5±0.30	
MMJCE32MLB7226□PPDT1	EMJ325KB7226□MHP	16		X7R	22 μ	±10, ±20	10	150	2.5±0.30	
MMJCT32MKB7475□PPA01	TMJ325AB7475□MHP	25		X7R	4.7 μ	±10, ±20	5	150	2.5±0.30	
MMJCT32MLB7106□PPDT1	TMJ325KB7106□MHP			X7R	10 μ	±10, ±20	10	150	2.5±0.30	
MMJCG32MKB7475□PPA01	GMJ325AB7475□MHP	35		X7R	4.7 μ	±10, ±20	5	150	2.5±0.30	
MMJCG32MLB7106□PPDT1	GMJ325KB7106□MHP			X7R	10 μ	±10, ±20	10	150	2.5±0.30	
MMJCU32MKB7225□PPA01	UMJ325AB7225□MHP	50		X7R	2.2 μ	±10, ±20	3.5	200	2.5±0.30	
MMJCU32MKB7475□PPA01	UMJ325AB7475□MHP			X7R	4.7 μ	±10, ±20	5	150	2.5±0.30	
MMJCU32MLB7106□PPDT1	UMJ325KB7106□MHP			X7R	10 μ	±10, ±20	10	150	2.5±0.30	
MMJCH32NSB7223□TPA01	HMJ325 B7223□NHT	100		X7R	0.022 μ	±10, ±20	3.5	200	1.9±0.20	
MMJCH32NSB7473□TPA01	HMJ325 B7473□NHT			X7R	0.047 μ	±10, ±20	3.5	200	1.9±0.20	
MMJCH32NSB7104□TPA01	HMJ325 B7104□NHT			X7R	0.1 μ	±10, ±20	3.5	200	1.9±0.20	
MMJCH32NSB7224□TPA01	HMJ325 B7224□NHT			X7R	0.22 μ	±10, ±20	3.5	200	1.9±0.20	
MMJCH32NSB7474□TPA01	HMJ325 B7474□NHT			X7R	0.47 μ	±10, ±20	3.5	200	1.9±0.20	
MMJCH32NSB7105□TPA01	HMJ325 B7105□NHT			X7R	1 μ	±10, ±20	3.5	200	1.9±0.20	
MMJCH32MKB7225□PPA01	HMJ325AB7225□MHP			X7R	2.2 μ	±10, ±20	3.5	200	2.5±0.30	
MMJCH32MLC7475□PDDT1	HMJ325KC7475□MHPE			X7S	4.7 μ	±10, ±20	3.5	150	2.5±0.30	
MMJCQ32NSB7223□TPA01	QMJ325 B7223□NHT	250		X7R	0.022 μ	±10, ±20	2.5	150	1.9±0.20	
MMJCQ32NSB7473□TPA01	QMJ325 B7473□NHT			X7R	0.047 μ	±10, ±20	2.5	150	1.9±0.20	
MMJCQ32NSB7104□TPA01	QMJ325 B7104□NHT			X7R	0.1 μ	±10, ±20	2.5	150	1.9±0.20	
MMJCQ32NSB7224□TPA01	QMJ325 B7224□NHT			X7R	0.22 μ	±10, ±20	2.5	150	1.9±0.20	
MMJCS32NSB7223□TPA01	SMJ325 B7223□NHT	630		X7R	0.022 μ	±10, ±20	2.5	120	1.9±0.20	
MMJCS32NSB7473□TPA01	SMJ325 B7473□NHT			X7R	0.047 μ	±10, ±20	2.5	120	1.9±0.20	

■PACKAGING

①Minimum Quantity

●Taped package

Type			Thickness		Standard Quantity[pcs]	
Code	JIS(mm)	EIA(inch)	[mm]	Code	Paper tape	Embossed tape
02	0201	008004	0.125	1	—	50000
04	0402	01005	0.2	2	—	40000
06	0603	0201	0.3	3	15000	—
1L	1005	0402	0.13	H	—	20000
			0.18	E	—	15000
			0.2	2	20000	—
			0.3	3	15000	—
10	1005	0402	0.5	5	10000	—
	0510 ※	0204	0.3	3	10000	—
16	1608	0603	0.45	K	4000	—
			0.7	7		
			0.8	8		
			0.8	8	3000 (Soft Termination)	3000 (Soft Termination)
	0816 ※	0306	0.5	5	—	4000
21	2012	0805	0.85	9	4000	—
			1.25	G	—	3000
			1.25	G	—	2000 (Soft Termination)
	1220 ※	0508	0.85	9	4000	—
31	3216	1206	0.85	9	4000	—
			1.15	Q	—	3000
			1.6	L	—	2000
32	3225	1210	0.85	9	—	2000
			1.15	Q		
			1.9	N		
			2.0 max	Y		
			2.5	M	—	500(T), 1000(P)
45	4532	1812	2.0 max	Y	—	1000
			2.5	M	—	500

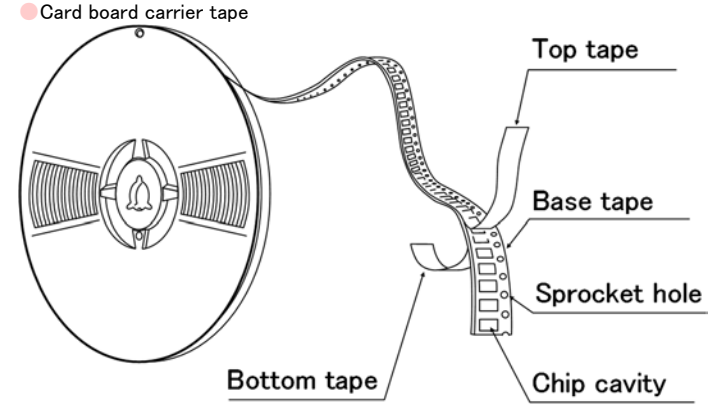
注:※LW Reverse type (MSRL, MCRL, MBRL, MLRL, MMRL)

▸ 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/) .

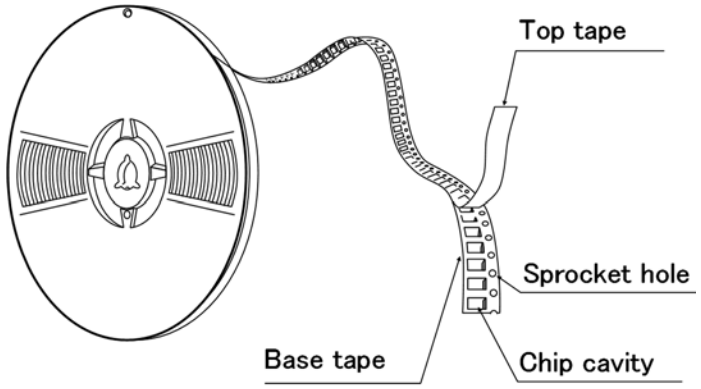
②Taping material

※No bottom tape for pressed carrier tape

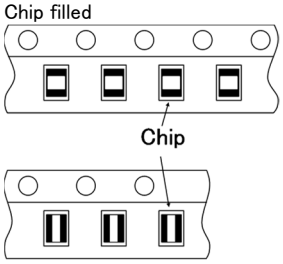
Card board carrier tape



Embossed tape



Chip filled



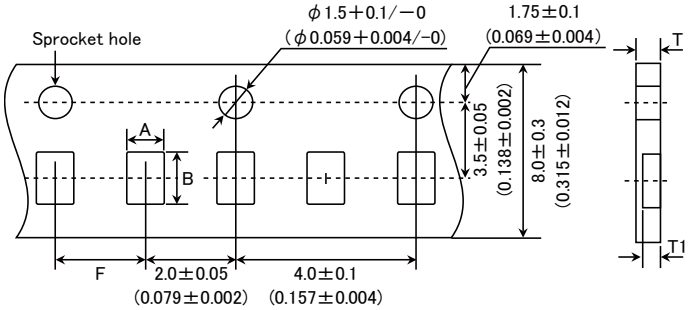
※ LW Reverse type.

③Representative taping dimensions

Paper Tape(8mm wide)

●Pressed carrier tape(2mm pitch)

Unit:mm(inch)

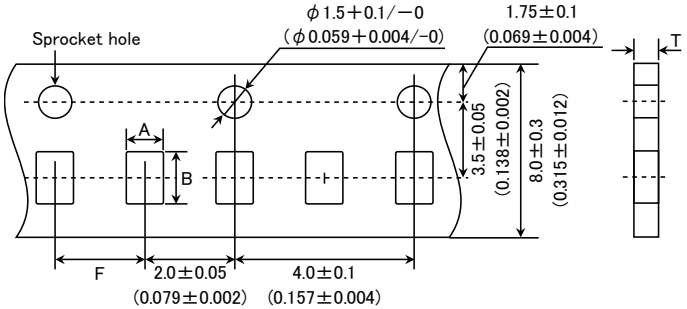


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	T	T1
0603 (0201)	0.37	0.67	2.0±0.05	0.45max.	0.42max.
0510 (0204) ※	0.65	1.15			
1005 (0402) (*1 2)				0.4max.	0.3max.
1005 (0402) (*1 3)				0.45max.	0.42max.

Note *1 Thickness, 2:0.2mm , 3:0.3mm. ※ LW Reverse type. Unit:mm

●Punched carrier tape (2mm pitch)

Unit:mm(inch)



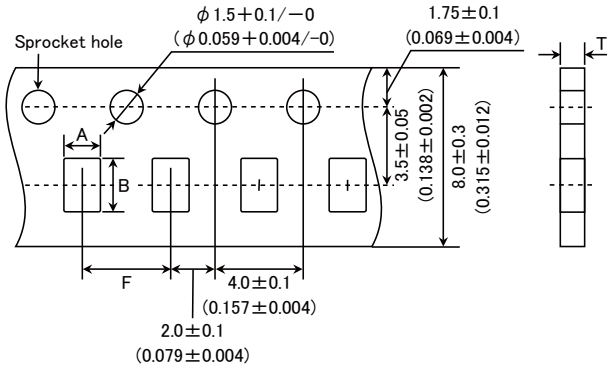
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
1005 (0402)	0.65	1.15	2.0±0.05	0.8max.

Unit:mm

▸ 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/) .

●Punched carrier tape (4mm pitch)

Unit:mm(inch)

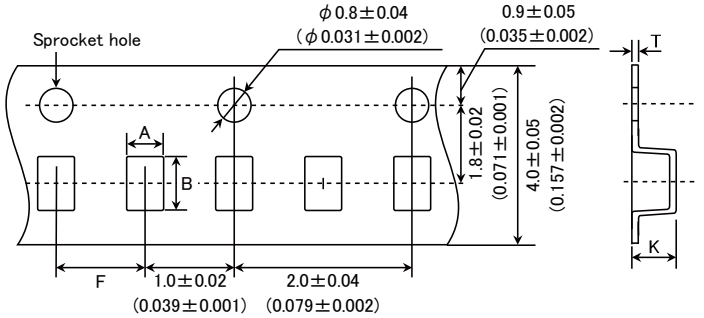


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness
	A	B	F	T
1608 (0603) 0816 (0306) ※	1.0	1.8	4.0±0.1	1.1max.
2012 (0805) 1220 (0508) ※	1.65	2.4		1.1max.
3216 (1206)	2.0	3.6		

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)

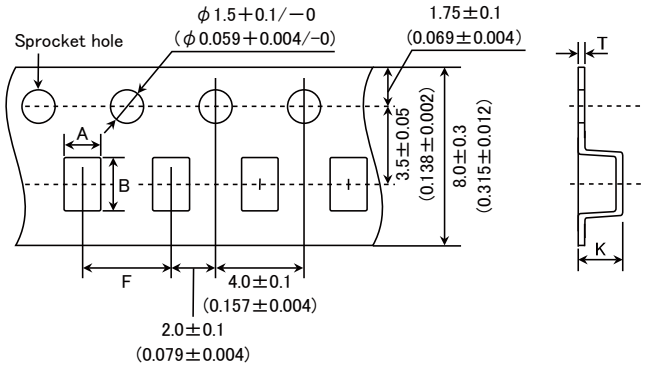


Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
0201 (008004)	0.135	0.27	1.0±0.02	0.5max.	0.25max.
0402 (01005)	0.23	0.43			

Unit:mm

●Embossed tape(8mm wide)

Unit:mm(inch)



Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
1005 (0402)	0.6	1.1	2.0±0.1	0.6max	0.2±0.1
0816 (0306) ※	1.0	1.8	4.0±0.1	1.3max.	0.25±0.1
2012 (0805)	1.65	2.4		3.4max.	0.6max.
3216 (1206)	2.0	3.6			
3225 (1210)	2.8	3.6			

Note: ※ LW Reverse type. Unit:mm

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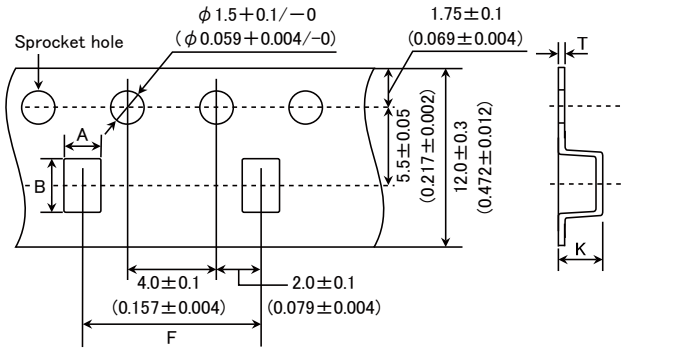
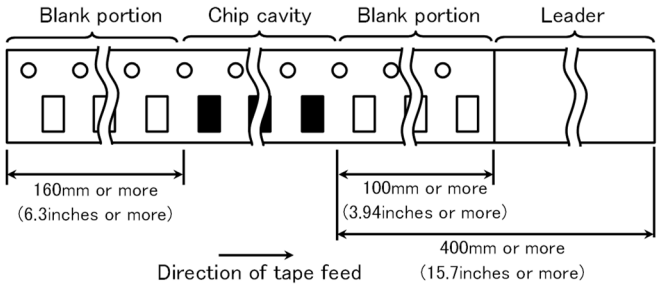
Embossed tape (12mm wide)　　Unit : mm (inch)



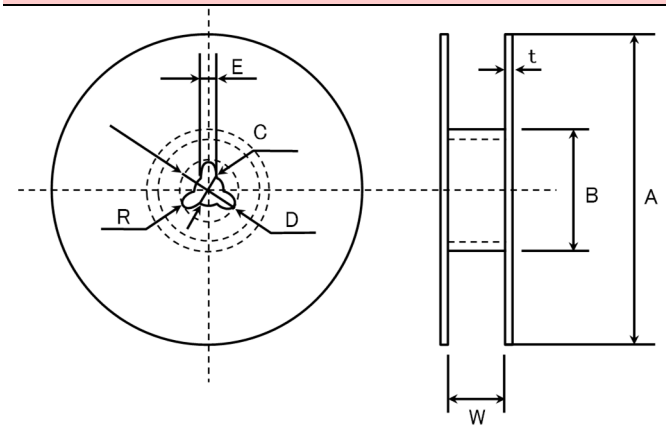
Type(EIA)	Chip Cavity		Insertion Pitch	Tape Thickness	
	A	B	F	K	T
3225 (1210)	3.1	4.0	8.0±0.1	4.0max.	0.6max.
4532 (1812)	3.7	4.9	8.0±0.1	4.0max.	0.6max.

Unit : mm

④Trailer and Leader



⑤Reel size



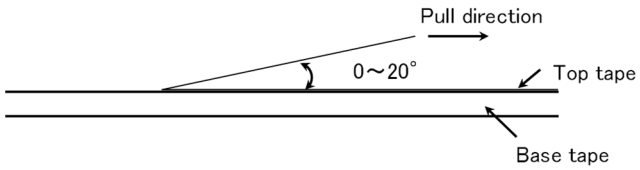
A	B	C	D	E	R
φ178±2.0	φ50min.	φ13.0±0.2	φ21.0±0.8	2.0±0.5	1.0

	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)	−55 to +125℃
	High Permittivity (Class2)	

	Specification	Temperature Range
B5	X5R	−55 to +85℃
B7	X7R	−55 to +125℃
C6	X6S	−55 to +105℃
C7	X7S	−55 to +125℃
D7	X7T	−55 to +125℃

2. Storage Conditions

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

	Specification	Temperature Range
B5	X5R	−55 to +85℃
B7	X7R	−55 to +125℃
C6	X6S	−55 to +105℃
C7	X7S	−55 to +125℃
D7	X7T	−55 to +125℃

3. Rated Voltage

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

4. Withstanding Voltage (Between terminals)

Specified Value	Temperature Compensating(Class1)	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)	10000 MΩ min.
	High Permittivity (Class2) Note 1	C≦0.047μF : 10000 MΩ min. C＞0.047μF : 500MΩ・μF (C:Nominal capacitance)
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)	C≦5pF : ±0.25pF 5pF＜C≦10pF : ±0.5pF C＞10pF : ±5% (C:Nominal capacitance)
	High Permittivity (Class2)	±10% or ±20%

Test Methods and Remarks

	Class 1	Class 2	
		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 1	0.5 to 5Vrms	1±0.2Vrms	0.5±0.1rms
Bias application	None		

7. Q or Dissipation Factor

Specified Value

Temperature Compensating(Class1)	C＜30pF : Q≧400＋20C C≧30pF : Q≧1000　（C:Nominal capacitance）
High Permittivity （Class2） Note 1	2.5% max.

Test Methods and Remarks

	Class 1	Class 2	
		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 1	0.5 to 5Vrms	1±0.2Vrms	0.5±0.1Vrms
Bias application	None		

8. Temperature Characteristic （Without voltage application）

Specified Value

Temperature Compensating(Class1)

Temperature Characteristic [ppm/℃]		Tolerance [ppm/℃]
C□: 0	CG, CH, CJ, CK	G : ±30 H : ±60 J : ±120 K : ±250

High Permittivity （Class2）

	Specification	Capacitance change	Reference temperature	Temperature Range
B5	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	X7T	＋22/−33%	25℃	−55 to ＋125℃

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	Temperature
1	Minimum operating temperature
2	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
※Measuring Frequency, Measuring Voltage: Refer to detailed specification

9. Deflection

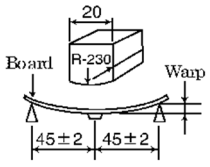
Specified Value

Temperature Compensating(Class1)	Appearance　: No abnormality Capacitance change　: Within ±5% or ±0.5 pF, whichever is larger.
High Permittivity （Class2）	Appearance　: No abnormality Capacitance change　: Within ±12.5%

Test Methods and Remarks

	Multilayer Ceramic Capacitors	
	0603, ※1 1005 Type	The other types
Board	Glass epoxy-resin substrate	
Thickness	0.8mm	1.6mm
Warp	1mm （Soft Termination type:3mm）	
Duration	10 sec.	

※1 : 1005 Type thickness, ,3 : 0.3mm.



(Unit: mm)

Capacitance measurement shall be conducted with the board bent

10. Adhesive Strength of Terminal Electrodes

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

Test Methods and Remarks

	0603 Type	1005 Type or more
Applied force	2N	5N
Duration	10±1 sec.	30±5 sec. (Soft Termination type: 10±1 sec.)

11. Vibration

Specified Value	Temperature Compensating(Class1) High Permittivity (Class2)	Initial performance shall be satisfied.

Test Methods and Remarks

Preconditioning : Thermal treatment(at 150℃ for 1hr) Note2 (Only High permittivity)
Frequency range : 10 to 55 Hz
Overall amplitude : 1.5 mm
Sweeping method : 10 to 55 to 10 Hz for 1 min
Two hours each in X, Y, Z directions: 6 hrs in total

12. Solderability

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

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)	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 Permittivity (Class2) Note 1	Appearance : No abnormality Capacitance change : Within ±7.5% Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals): No abnormality

Test Methods and Remarks

	Class 1	
	0603 Type	1005 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	24±2hrs (Standard condition) Noe 5	

	Class 2		
	0603 Type	1005, 1608, 2012 Type	3216, 3225 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)	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 Permittivity (Class2) Note 1	Appearance : No abnormality Capacitance change : Within ±7.5% Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality

Test Methods and Remarks

	Class 1	Class 2
Preconditioning	None	Thermal treatment (at 150℃ for 1 hr) Note 2
1 cycle		
Number of cycles	50 times	
Recovery	24±2hrs (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)	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 Permittivity (Class2) Note 1	Appearance : No abnormality Capacitance change : Within ±12.5% Dissipation factor : 5.0% max. Insulation resistance : 50 MΩ μF or 1000 MΩ whichever is smaller.

Test Methods and Remarks

Preconditioning :Thermal treatment(at 150℃ for 1 hr) Note 2 (Only High permittivity)
Temperature : 40±2℃
Humidity : 90 to 95%RH
Duration : 500＋24/－0 hrs
Recovery : 24±2 hrs (Standard condition) Note 1,5

16. Humidity Loading

Specified Value

Temperature Compensating(Class1)	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 Permittivity (Class2) Note 1	Appearance : No abnormality Capacitance change : Within ±12.5% Dissipation factor : 5.0% max. Insulation resistance : 25 MΩ μF or 500 MΩ, whichever is smaller.

Test Methods and Remarks

Preconditioning : Voltage treatment (Rated voltage are applied for 1 hour at 40℃) Note 1,3 (Only High permittivity)
Temperature : 60±2℃
Humidity : 90 to 95%RH
Duration : 500＋24/－0 hrs
Applied voltage : Rated voltage
Charge/discharge current : 50mA max.
Recovery : 24±2 hrs(Standard condition) Note 1,5

17. High Temperature Loading		
Specified Value	Temperature Compensating(Class1)	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 Permittivity (Class2) Note 1	Appearance : No abnormality Capacitance change : Within ±12.5% Dissipation factor : 5.0% max. Insulation resistance : 50 MΩ μF or 1000 MΩ, whichever is smaller.
Test Methods and Remarks	Preconditioning	:Voltage treatment(Twice the rated voltage shall be applied for 1 hour at 85℃, 105℃ or 125℃) Note 1,3,4 (Only High permittivity)
	Temperature	:Maximum operating temperature
	Duration	:1000＋24/－0 hrs
	Applied voltage	: Rated voltage×2 Note 4
	Charge/discharge current	: 50mA max.
	Recovery	: 24±2 hrs (Standard condition) Note 1,5

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

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

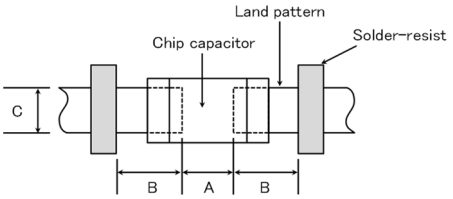
●Multilayer Ceramic Capacitors : Recommended land dimensions

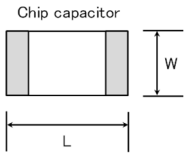
(unit: mm)

Wave-soldering

Type		1608	2012	3216	3225
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

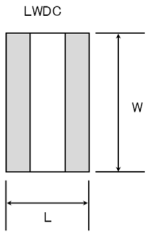
Type		0201	0402	0603	1005	1608	2012	3216	3225	4532
Size	L	0.25	0.4	0.6	1.0	1.6	2.0	3.2	3.2	4.5
	W	0.125	0.2	0.3	0.5	0.8	1.25	1.6	2.5	3.2
A		0.095～0.135	0.15～0.25	0.20～0.30	0.45～0.55	0.6～0.8	0.8～1.2	1.8～2.5	1.8～2.5	2.5～3.5
B		0.085～0.125	0.10～0.20	0.20～0.30	0.40～0.50	0.6～0.8	0.8～1.2	1.0～1.5	1.0～1.5	1.5～1.8
C		0.110～0.150	0.15～0.30	0.25～0.40	0.45～0.55	0.6～0.8	0.9～1.6	1.2～2.0	1.8～3.2	2.3～3.5

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

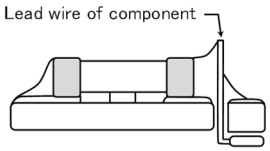
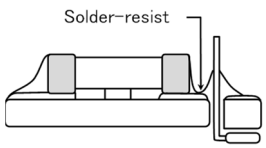
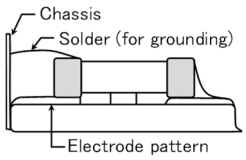
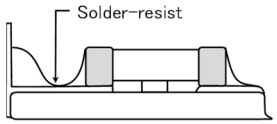
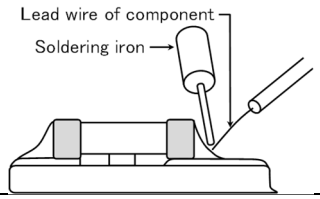
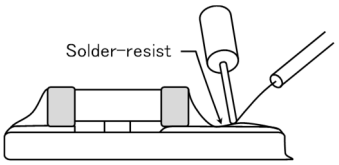
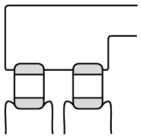
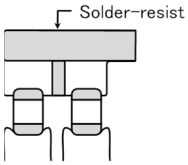
●LWDC: Recommended land dimensions for reflow-soldering

(unit: mm)

Type		0510	0816	1220
Size	L	0.52	0.8	1.25
	W	1.0	1.6	2.0
A		0.18～0.22	0.25～0.3	0.5～0.7
B		0.2～0.25	0.3～0.4	0.4～0.5
C		0.9～1.1	1.5～1.7	1.9～2.1

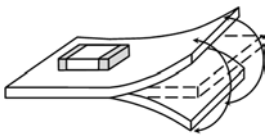
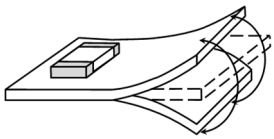


(2) Examples of good and bad solder application

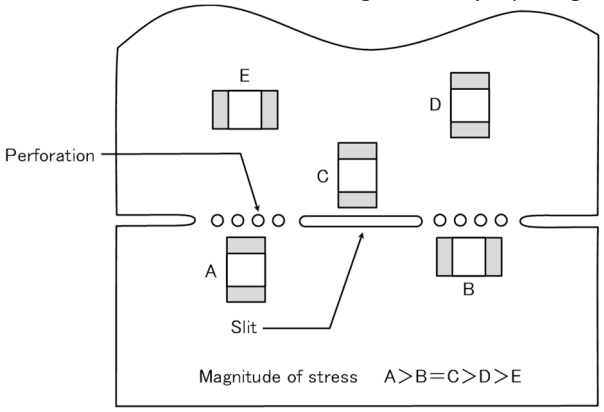
Item	Not recommended	Recommended
Mixed mounting of SMD and leaded components		
Component placement close to the chassis		
Hand-soldering of leaded components near mounted components		
Horizontal component placement		

◆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

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.

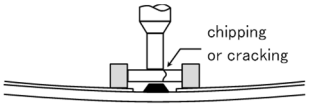
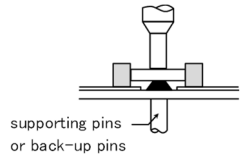
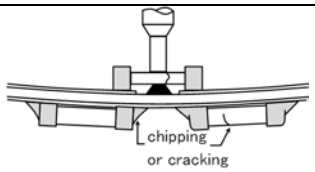
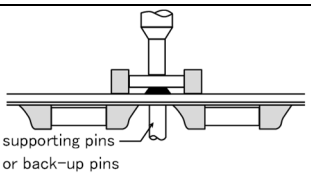
◆Selection of Adhesives

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:

Item	Improper method	Proper method
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.

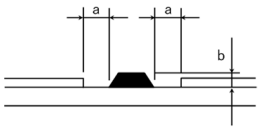
(1) Required adhesive characteristics
   a. The adhesive shall be strong enough to hold parts on the board during the mounting & solder process.
   b. The adhesive shall have sufficient strength at high temperatures.
   c. The adhesive shall have good coating and thickness consistency.
   d. The adhesive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

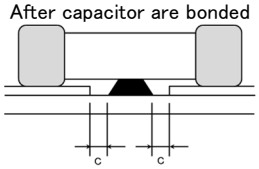
[Recommended condition]

Figure	2012/3216 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

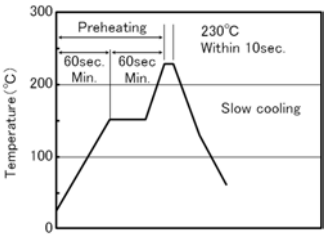
and the capability of the machines used shall also be considered carefully when water-soluble flux is used.

◆Soldering

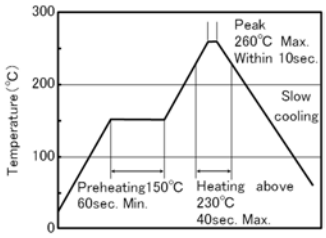
- Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling.
- Therefore, the soldering must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.
- Preheating : Capacitors shall be preheated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

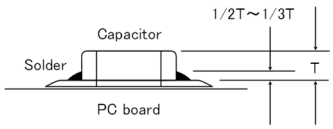
[Reflow soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】





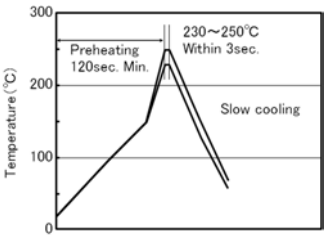
Caution

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

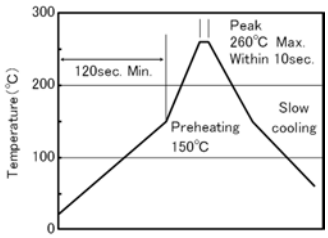
②Because excessive dwell times can adversely affect solderability, soldering duration shall be kept as close to recommended times as possible. soldering for 2 times.

[Wave soldering]

【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】

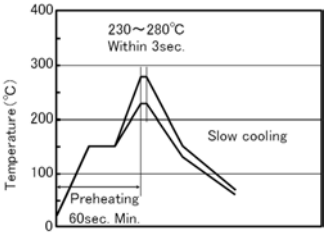


Caution

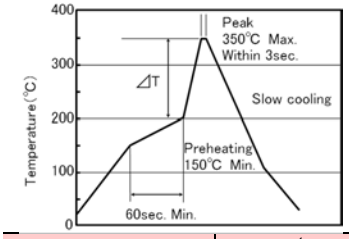
①Wave soldering must not be applied to capacitors designated as for reflow soldering only. soldering for 1 times.

[Hand soldering]

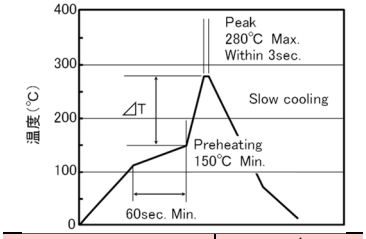
【Recommended conditions for eutectic soldering】



【Recommended condition for Pb-free soldering】



	⊿T
3216type or less	⊿T≦150℃



	⊿T
3225type 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. soldering for 1 times.

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 les 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.