Wire Bonding Mount Multilayer Microchip Capacitors for General Purpose
GMA05XC80J473ME12_(0505M(0202), X6S(EIA), 47000pF, DC 6.3V)
_:Package

■ Scope

This product specification is applied to Wire Bonding Mount Multilayer Microchip Capacitors used for General Electronic equipment.

■ MURATA Part No. System

(Ex.)	GMA	05	X	C8	0J	473	M	E12	T
	①Series	②Dimension (L×W)	③Dimension (T)	④Temperature Characteristics	⑤Rated Voltage	⑥Capacitance	⑦Capacitance Tolerance	⑧Individual Specification	⑨Package

■ Type & Dimension

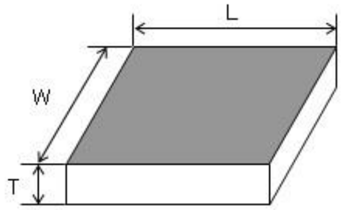


image:Dimension

Size Code : 0505M(0202) (in mm)

② L	② W	③ T
0.5+/-0.05	0.5+/-0.05	0.35+/-0.05

■ Rated Value

④Temperature Characteristics [C8] (Public STD Code : [X6S(EIA)])			⑤Rated Voltage	⑥ Capacitance	⑦ Capacitance Tolerance	Operating Temp. Range	Mounting Method
Temp. coeff. or Cap. Change	Temp. Range	Ref.Temp.					
-22 to 22 %	-55 to 105℃	25℃	DC 6.3V	47000pF	+/-20%	-55 to 105℃	Bonding

⑧Individual Specification : This denotes Murata control code.

■ Package

⑨Package	Packaging	Standard Packing Quantity
T	Bulk Tray	400 pcs./Tray

■ Specifications and Test Methods

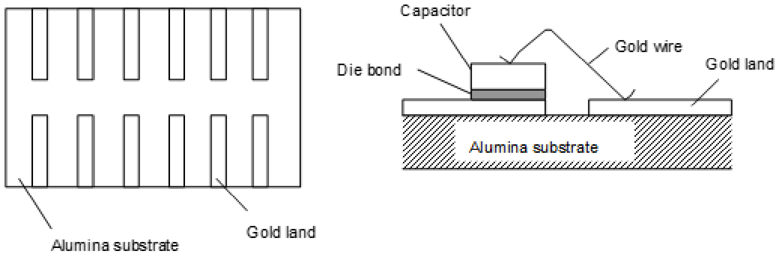
No	Item	Specification	Test Method(Ref. Standard:JIS C 5101, IEC60384)
1	Rated Voltage	Shown in Rated value.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V(peak to peak) or V(zero to peak), whichever is larger, should be maintained within the rated voltage range.
2	Appearance	No defects or abnormalities.	Visual inspection
3	Dimension	Shown in Dimension.	Using Measuring instrument of dimension.
4	Voltage proof	No defects or abnormalities.	Measurement Point: Between the terminations Test Voltage: 250% of the rated voltage Applied Time: 1s to 5s Charge/discharge current: 50mA max.
5	Insulation Resistance(I.R.) (Room Temperature)	More than 50Ω・F	Measurement Temperature: Room Temperature Measurement Point: Between the terminations Measurement Voltage: Rated Voltage Charging Time: 1min Charge/discharge current: 50mA max.
6	Capacitance	Shown in Rated value.	Measurement Temperature: Room Temperature Measurement Frequency: 1.0+/-0.1kHz Measurement Voltage: 0.5+/-0.1Vrms
7	Q or Dissipation Factor (D.F.)	DF≦0.1	Measurement Temperature: Room Temperature Measurement Frequency: 1.0+/-0.1kHz Measurement Voltage: 0.5+/-0.1Vrms
8	Temperature Characteristics of Capacitance	No bias: Shown in Rated value.	The capacitance change should be measured after 5 min at each specified temp. stage. Capacitance value as a reference is the value in "*" marked step. Measurement Voltage: Less than 1.0Vrms (Refer to the individual data sheet) Pre-treatment: Heat treatment:Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure. Temperature Step < No bias > Step / Temperature(°C) 1 / Reference Temp. +/-2 2 / Min. Operating Temp. +/-3 3 * / Reference Temp. +/-2 4 / Max. Operating Temp. +/-3 5 / Reference Temp. +/-2
9	Adhesive Strength (Wire Bonding)	Pull force : 0.03N min.	MIL-STD-883 Method 2011 Condition D Mount the capacitor on a gold metalized alumina substrate with Au-20Sn and bond a φ25μm(φ0.001 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.
10	Adhesive Strength (Die Bonding)	Die Shear force : 2N min.	MIL-STD-883 Method 2019 Mount the capacitor on a gold metalized alumina substrate with Au-20Sn. Apply the force parallel to the substrate.

■ Specifications and Test Methods

No	Item	Specification		Test Method(Ref. Standard:JIS C 5101, IEC60384)	
11	Vibration	Appearance Capacitance Q or D.F.	No defects or abnormalities. Within the specified initial value. Within the specified initial value.	Mounting method Kind of Vibration Vibration Time Total amplitude Vibration directions and time	Mount the capacitor on the substrate using die bonding and wire bonding. A simple harmonic motion 10Hz to 55Hz to 10Hz 1min 1.5mm This motion should be applied for a period of 2hours in each 3 mutually perpendicular directions(total of 6hours).
12	Temperature Sudden Change	Appearance Capacitance Change Q or D.F. I.R. Voltage proof	No defects or abnormalities. Within +/-7.5% Within the specified initial value. Within the specified initial value. No defects or abnormalities.	Mounting method Pre-treatment Cycles Temperature Cycling	Mount the capacitor on the substrate using die bonding and wire bonding. Heat treatment:Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure. 5cycles
					Step / Temp. (℃) / Time(min): 1 / Min.Operating Temp.+0/-3 / 30+/-3 2 / Room Temp. / 2 to 3 3 / Max.Operating Temp.+3/-0 / 30+/-3 4 / Room Temp. / 2 to 3
				Post-treatment	Non treatment:Let sit for 24+/-2hours at room temperature, then measure.
13	High Temperature High Humidity (Steady)	Appearance Capacitance Change Q or D.F. I.R.	No defects or abnormalities. Within +/-12.5% DF≦0.2 More than 12.5Ω・F	Mounting method Pre-treatment Test Temperature Test Humidity Test Time Test Voltage Charge/discharge current Post-treatment	Mount the capacitor on the substrate using die bonding and wire bonding. Heat treatment:Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure. 40+/-2℃ 90%RH to 95%RH 500+/-12h Rated Voltage 50mA max. Heat treatment:Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure.
14	Durability	Appearance Capacitance Change Q or D.F. I.R.	No defects or abnormalities. Within +/-12.5% DF≦0.2 More than 25Ω・F	Mounting method Pre-treatment Test Temperature Test Time Test Voltage Charge/discharge current Post-treatment	Mount the capacitor on the substrate using die bonding and wire bonding. Heat treatment:Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure. Maximum Operating Temperature +/-3℃ 1000+/-12h 150% of the rated voltage 50mA max. Heat treatment:Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure.

Mounting method

・Mounting Diagram



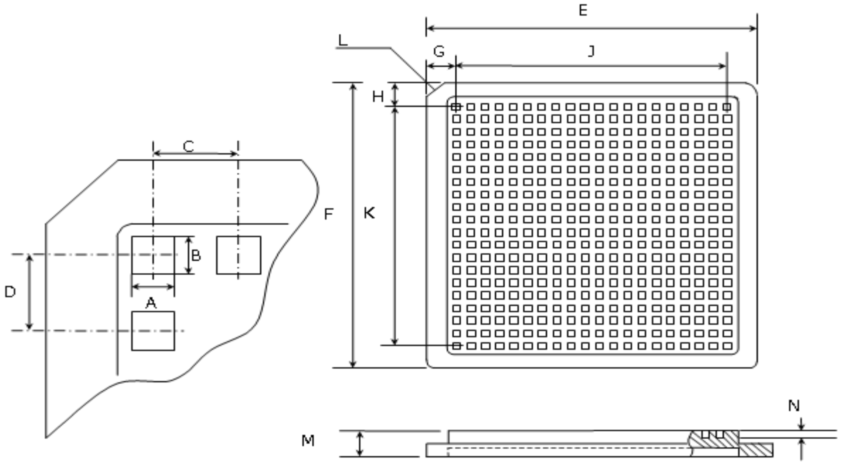
■ **Package**

1. Tray Packaging

Packaging unit：(pcs/Tray)

Type		Code：T
GMA05	X	400

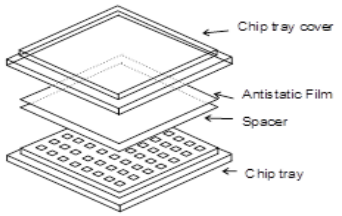
2. Dimensions of Tray (in mm)

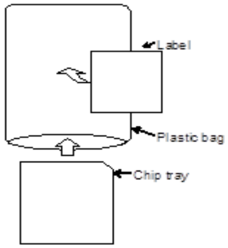


Type		A	B	C	D	E	F	G	H	J	K	L	M	N
GMA05	X	0.57+/-0.05	0.57+/-0.05	2.2+/-0.05	2.2+/-0.05	50.8+/-0.05	50.8+/-0.05	4.5+/-0.08	4.5+/-0.08	19×2.2= 41.8+/-0.05	19×2.2= 41.8+/-0.05	C2.5	3.96+0.03/-0.05	0.45+/-0.05

■ **Package**

3. Individual packaging
   3.1 Place the tray filled with product into a plastic bag.





   3.2 In individual boxes, place Maximum up to 3 trays in which each are covered in plastic bags.

   LF Mark : We print ROHS-Y<*> on the packing label and stick it on the reels.
   The mark * will be changed to A→B→C…. due to the revise of the ROHS directive.
   Please refer to the document, “The Marking for the law on the restriction of the hazardous substanes’ use, “to check the objective law corresponding to alphabets in *.

Caution

■ Limitation of Applications

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

①Aircraft equipment ②Aerospace equipment ③Undersea equipment ④Power plant control equipment ⑤Medical equipment ⑥Transportation equipment(vehicles,trains,ships,etc.) ⑦Traffic signal equipment
⑧Disaster prevention / crime prevention equipment ⑨Data-processing equipment ⑩Application of similar complexity and/or reliability requirements to the applications listed in the above.

■ Storage and Operation condition

1. The performance of chip multilayer ceramic capacitors (henceforth just "capacitors") may be affected by the storage conditions. Please use them promptly after delivery.

1-1. Please maintain an appropriate storage condition for capacitors using the following conditions.
- A temperature is +5°C to +40°C and a relative humidity is 20% to 70% as a standard condition.
- The temperature recommendation is less than 30°C.

High temperature and humidity conditions and/or prolonged storage may cause deterioration of the packaging materials. If more than six months have elapsed since delivery, check packaging, mounting, etc. before use.
In addition, this may cause oxidation of the electrodes. Also please check the mountability before use.

1-2. Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor mountability.
Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g.,hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.).

1-3. Due to moisture condensation caused by rapid humidity changes, or the photochemical change caused by direct sunlight on the terminal electrodes, the mountability and electrical performance may deteriorate.
Do not store capacitors under direct sunlight or in high huimidity conditions.

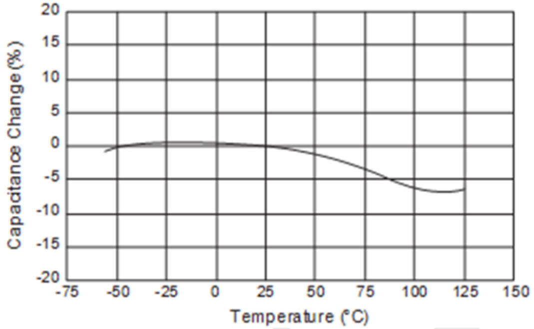
■ Rating

1. Temperature Dependent Characteristics

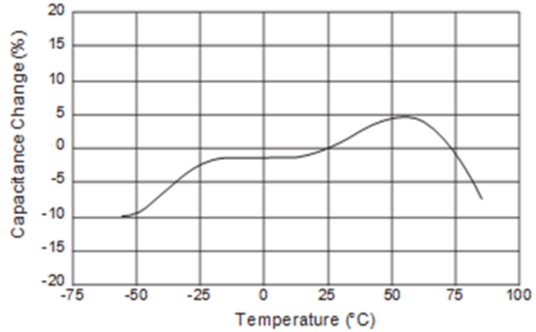
1. The electrical characteristics of the capacitor can change with temperature.

1-1. For capacitors having larger temperature dependency, the capacitance may change with temperature changes. The following actions are recommended in order to ensure suitable capacitance values.
(1) Select a suitable capacitance for the operating temperature range.
(2) The capacitance may change within the rated temperature. When you use a high dielectric constant type capacitor in a circuit that needs a tight (narrow) capacitance tolerance (e.g., a time-constant circuit), please carefully consider the temperature characteristics, and carefully confirm the various characteristics in actual use conditions and the actual system.

[Example of Temperature Caracteristics X7R(R7)]
Sample: 0.1μF, Rated Voltage 50VDC



[Example of Temperature Characteristics X5R(R6)]
Sample: 22μF, Rated Voltage 4VDC



2. Measurement of Capacitance

1. Measure capacitance with the voltage and frequency specified in the product specifications.

1-1. The output voltage of the measuring equipment may decrease occasionally when capacitance is high. Please confirm whether a prescribed measured voltage is impressed to the capacitor.

1-2. The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied. Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.

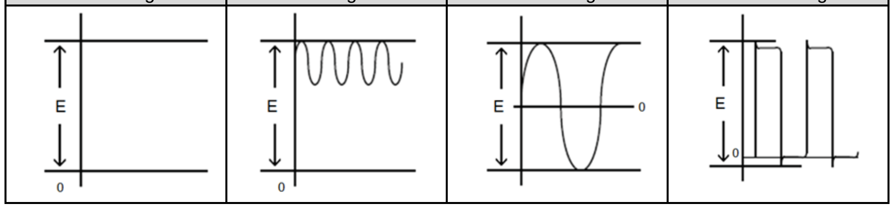
3. Applied Voltage

1. Do not apply a voltage to the capacitor that exceeds the rated voltage as called out in the specifications.

1-1. Applied voltage between the terminals of a capacitor shall be less than or equal to the rated voltage.
(1) When AC voltage is superimposed on DC voltage, the zero-to-peak voltage shall not exceed the rated DC voltage. When AC voltage or pulse voltage is applied, the peak-to-peak voltage shall not exceed the rated DC voltage.
(2) Abnormal voltages (surge voltage, static electricity, pulse voltage, etc.) shall not exceed the rated DC voltage.

Typical Voltage Applied to the DC capacitor

DC Voltage	DC Voltage+AC	AC Voltage	Pulse Voltage



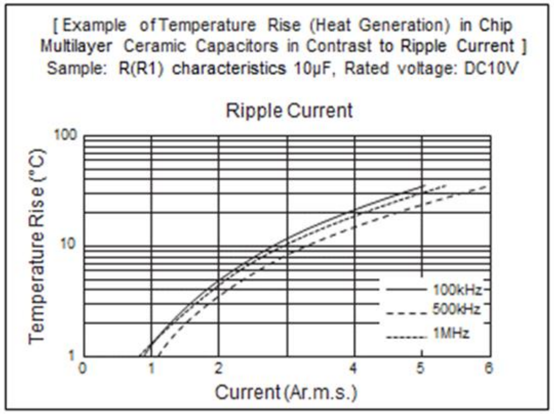
(E：Maximum possible applied voltage.)

1-2. Influence of over voltage
Over voltage that is applied to the capacitor may result in an electrical short circuit caused by the breakdown of the internal dielectric layers. The time duration until breakdown depends on the applied voltage and the ambient temperature.

4. Type of Applied Voltage and Self-heating Temperature

1. Confirm the operating conditions to make sure that no large current is flowing into the capacitor due to the continuous application of an AC voltage or pulse voltage.
When a DC rated voltage product is used in an AC voltage circuit or a pulse voltage circuit, the AC current or pulse current will flow into the capacitor; therefore check the self-heating condition.
Please confirm the surface temperature of the capacitor so that the temperature remains within the upper limits of the operating temperature, including the rise in temperature due to self-heating.
When the capacitor is used with a high-frequency voltage or pulse voltage, heat may be generated by dielectric loss.

< Applicable to Rated Voltage of less than 100VDC >
The load should be contained so that the self-heating of the capacitor body remains below 20°C, when measuring at an ambient temperature of 25°C.

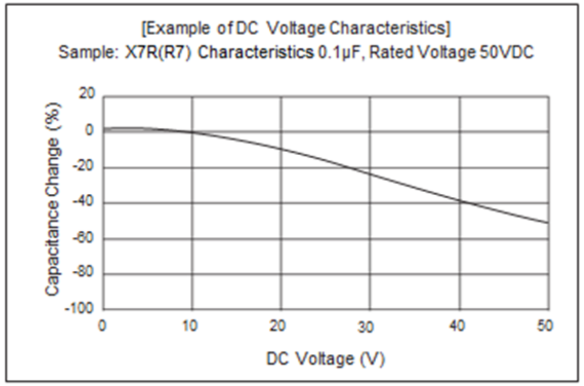


5. DC Voltage and AC Voltage Characteristic

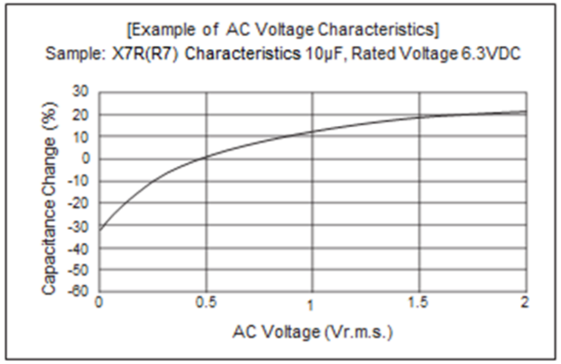
1. The capacitance value of a high dielectric constant type capacitor changes depending on the DC voltage applied.
Please consider the DC voltage characteristics when a capacitor is selected for use in a DC circuit.

1-1. The capacitance of ceramic capacitors may change sharply depending on the applied voltage. (See figure)
Please confirm the following in order to secure the capacitance.

(1) Determine whether the capacitance change caused by the applied voltage is within the allowed range.
(2) In the DC voltage characteristics, the rate of capacitance change becomes larger as voltage increases, even if the applied voltage is below the rated voltage.
When a high dielectric constant type capacitor is used in a circuit that requires a tight (narrow) capacitance tolerance (e.g., a time constant circuit), please carefully consider the voltage characteristics, and confirm the various characteristics in the actual operating conditions of the system.

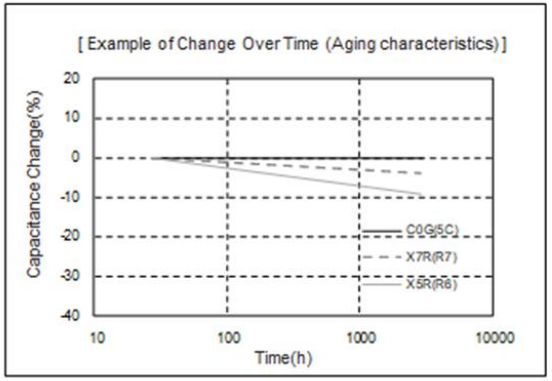


2. The capacitance values of high dielectric constant type capacitors changes depending on the AC voltage applied.
Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.



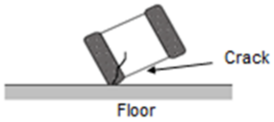
6. Capacitance Aging

1. The high dielectric constant type capacitors have an Aging characteristic in which the capacitance value decreases with the passage of time.
   When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance (e.g., a time-constant circuit), please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics.
   In addition, check capacitors using your actual appliances at the intended environment and operating conditions.



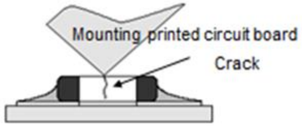
7. Vibration and Shock

1. Please confirm the kind of vibration and/or shock, its condition, and any generation of resonance.
   Please mount the capacitor so as not to generate resonance, and do not allow any impact on the terminals.



2. Mechanical shock due to being dropped may cause damage or a crack in the dielectric material of the capacitor.
   Do not use a dropped capacitor because the quality and reliability may be deteriorated.

3. When printed circuit boards are piled up or handled, the corner of another printed circuit board
   should not be allowed to hit the capacitor in order to avoid a crack or other damage to the capacitor.



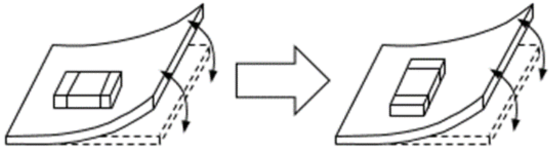
■Mounting

1. Mounting Position

1. Confirm the best mounting position and direction that minimizes the stress imposed on the capacitor during flexing or bending the printed circuit board.

1-1. Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



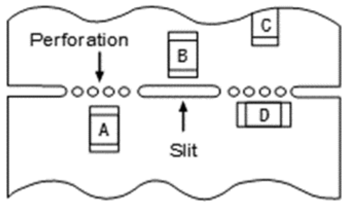
(Bad Example) (Good Example)

Locate chip horizontal to the direction in which stress acts.

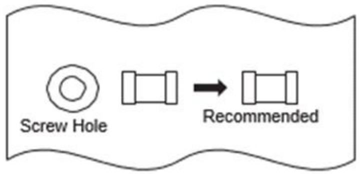
[Chip Mounting Close to Board Separation Point]
It is effective to implement the following measures, to reduce stress in separating the board.
It is best to implement all of the following three measures; however, implement as many measures as possible to reduce stress.

Contents of Measures	Stress Level
(1) Turn the mounting direction of the component parallel to the board separation surface.	A > D *1
(2) Add slits in the board separation part.	A > B
(3) Keep the mounting position of the component away from the board separation surface.	A > C

*1 A > D is valid when stress is added vertically to the perforation as with Hand Separation.
If a Cutting Disc is used, stress will be diagonal to the PCB, therefore A > D is invalid.



[Mounting Capacitors Near Screw Holes]
When a capacitor is mounted near a screw hole, it may be affected by the board deflection that occurs during the tightening of the screw.
Mount the capacitor in a position as far away from the screw holes as possible.



2. Information before Mounting

1. Do not re-use capacitors that were removed from the equipment.
2. Confirm capacitance characteristics under actual applied voltage.
3. Confirm the mechanical stress under actual process and equipment use.
4. Confirm the rated capacitance, rated voltage and other electrical characteristics before assembly.
5. Prior to measuring capacitance, carry out a heat treatment for capacitors that were in long-term storage.

3. Maintenance of the Mounting (pick and place) Machine

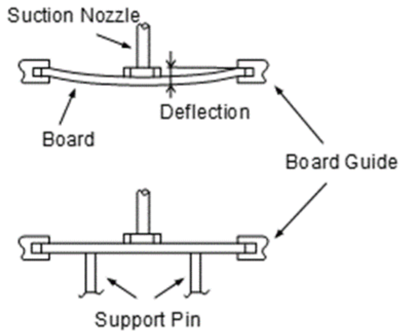
1. Make sure that the following excessive forces are not applied to the capacitors. Check the mounting in the actual device under actual use conditions ahead of time.

1-1. In mounting the capacitors on the printed circuit board, any bending force against them shall be kept to a minimum to prevent them from any damage or cracking.
Please take into account the following precautions and recommendations for use in your process.

(1) Adjust the lowest position of the pickup nozzle so as not to bend the printed circuit board.

[Incorrect]

[Correct]



2. Dirt particles and dust accumulated in the suction nozzle and suction mechanism prevent the nozzle from moving smoothly. This creates excessive force on the capacitor during mounting, causing cracked chips.
Also, the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically.

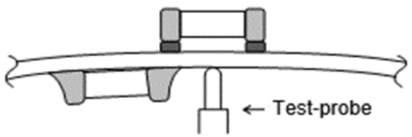
4. Electrical Test on Printed Circuit Board

1. Confirm position of the support pin or specific jig, when inspecting the electrical performance of a capacitor after mounting on the printed circuit board.

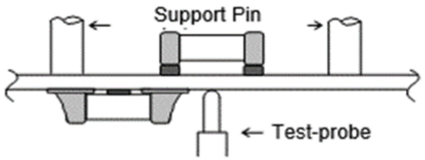
1-1. Avoid bending the printed circuit board by the pressure of a test-probe, etc. The thrusting force of the test probe can flex the PCB, resulting in cracked chips. Provide support pins on the back side of the PCB to prevent warping or flexing. Install support pins as close to the test-probe as possible.

1-2. Avoid vibration of the board by shock when a test -probe contacts a printed circuit board.

[Not Recommended]



[Recommended]

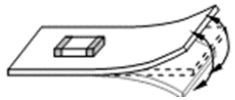


5. Printed Circuit Board Cropping

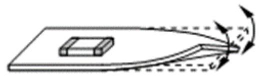
1. After mounting a capacitor on a printed circuit board, do not apply any stress to the capacitor that caused bending or twisting the board.

1-1. In cropping the board, the stress as shown may cause the capacitor to crack. Cracked capacitors may cause deterioration of the insulation resistance, and result in a short.
Avoid this type of stress to a capacitor.

[Bending]



[Twisting]



2. Check the cropping method for the printed circuit board in advance.

2-1. Printed circuit board cropping shall be carried out by using a jig or an apparatus (Disc separator, router type separator, etc.) to prevent the mechanical stress that can occur to the board.

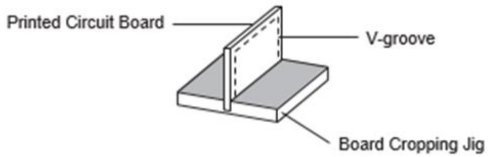
Board Separation Method	Hand Separation Nipper Separation	(1) Board Separation Jig	Board Separation Apparatus	
			(2) Disc Separator	(3) Router Type Separator
Level of stress on board	High	Medium	Medium	Low
Recommended	×	△*	△*	○
Notes	Hand and nipper separation apply a high level of stress. Use another method.	· Board handling · Board bending direction · Layout of capacitors	· Board handling · Layout of slits · Design of V groove · Arrangement of blades · Controlling blade life	Board handling

* When a board separation jig or disc separator is used, if the following precautions are not observed, a large board deflection stress will occur and the capacitors may crack.
Use router type separator if at all possible.

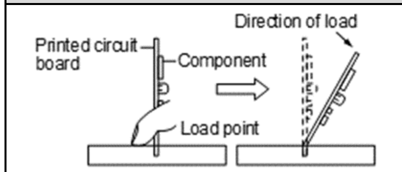
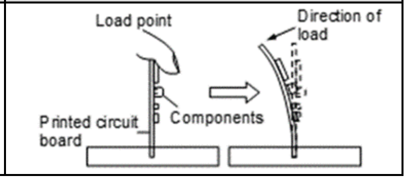
(1) Example of a suitable jig

[In the case of Single-side Mounting]
An outline of the board separation jig is shown as follows.
Recommended example:
Stress on the component mounting position can be minimized by holding the portion close to the jig, and bend in the direction towards the side where the capacitors are mounted.
Not recommended example: The risk of cracks occurring in the capacitors increases due to large stress being applied to the component mounting position,
direction opposite the side where the capacitors are mounted.

[Outline of jig]



[Hand Separation]

<table>
<tr><th>Recommended</th><th>Not recommended</th></tr>
<tr><td>
</td><td>
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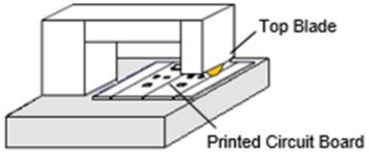
[In the case of Double-sided Mounting]
Since components are mounted on both sides of the board, the risk of cracks occurring can not be avoided with the above method. Therefore, implement the following measures to prevent stress from being applied to the components.
(Measures)
(1) Consider introducing a router type separator. If it is difficult to introduce a router type separator, implement the following measures. (Refer to item 1. Mounting Position)
(2) Mount the components parallel to the board separation surface.
(3) When mounting components near the board separation point, add slits in the separation position near the component.
(4) Keep the mounting position of the components away from the board separation point.

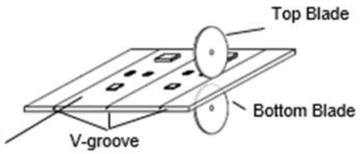
(2) Example of a Disc Separator

An outline of a disc separator is shown as follows. As shown in the Principle of Operation, the top blade and bottom blade are aligned with the V-grooves on the printed circuit board to separate the board.
In the following case, board deflection stress will be applied and cause cracks in the capacitors.
(1) When the adjustment of the top and bottom blades are misaligned, such as deviating in the top-bottom, left-right or front-rear directions
(2) The angle of the V groove is too low, depth of the V groove is too shallow, or the V groove is misaligned top-bottom
If V groove is too deep, it is possible to brake when you handle and carry it. Carefully design depth of the V groove with consideration about strength of material of the printed circuit board.

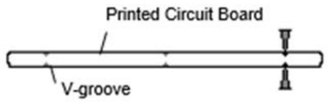
[Outline of Machine]



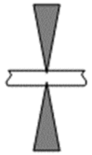
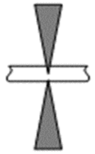
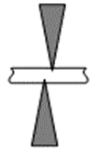
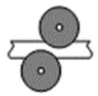
[Principle of Operation]



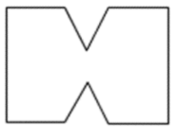
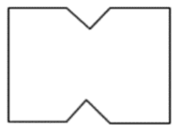
[Cross-section Diagram]



[Disc Separator]

Recommended	Not recommended		
	Top-bottom Misalignment	Left-right Misalignment	Front-rear Misalignment
Top Blade  Bottom Blade	Top Blade  Bottom Blade	Top Blade  Bottom Blade	Top Blade  Bottom Blade

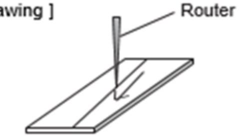
[V-groove Design]

Example of Recommended V-groove Design	Not Recommended			
	Left-right Misalignment	Low-Angle	Depth too Shallow	Depth too Deep
				

(3) Example of Router Type Separator

The router type separator performs cutting by a router rotating at a high speed. Since the board does not bend in the cutting process, stress on the board can be suppressed during board separation.
When attaching or removing boards to/from the router type separator, carefully handle the boards to prevent bending.

[Outline Drawing]



6. Assembly

1. Handling

If a board mounted with capacitors is held with one hand, the board may bend. Firmly hold the edges of the board with both hands when handling.

If a board mounted with capacitors is dropped, cracks may occur in the capacitors. Do not use dropped boards, as there is a possibility that the quality of the capacitors may be impaired.

2. Attachment of Other Components

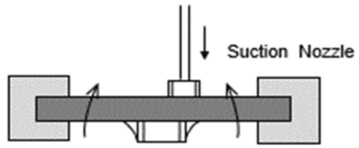
2-1. Mounting of Other Components

Pay attention to the following items, when mounting other components on the back side of the board after capacitors have been mounted on the opposite side.

When the bottom dead point of the suction nozzle is set too low, board deflection stress may be applied to the capacitors on the back side (bottom side), and cracks may occur in the capacitors.

・After the board is straightened, set the bottom dead point of the nozzle on the upper surface of the board.

・Periodically check and adjust the bottom dead point.



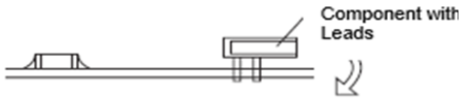
2-2. Inserting Components with Leads into Boards

When inserting components (transformers, IC, etc.) into boards, bending the board may cause cracks in the capacitors. Pay attention to the following.

・Increase the size of the holes to insert the leads, to reduce the stress on the board during insertion.

・Fix the board with support pins or a dedicated jig before insertion.

・Support below the board so that the board does not bend. When using support pins on the board, periodically confirm that there is no difference in the height of each support pin.



2-3. Attaching/Removing Sockets and/or Connectors

Insertion and removal of sockets and connectors, etc., might cause the board to bend.

Please insure that the board does not warp during insertion and removal of sockets and connectors, etc., or the bending may damage mounted components on the board.

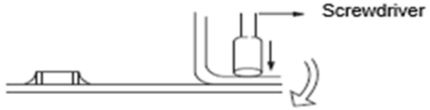
2-4. Tightening Screws

The board may be bent, when tightening screws, etc. during the attachment of the board to a shield or chassis. Pay attention to the following items before performing the work.

・Plan the work to prevent the board from bending.

・Use a torque screwdriver, to prevent over-tightening of the screws.

・The board may bend after mounting by reflow soldering, etc. Please note, as stress may be applied to the chips by forcibly flattening the board when tightening the screws.



7.Die Bonding/Wire Bonding

1. Die bonding

1-1. Bonding material

Au-20Sn solder

1-2. Die bonding method

(1)Melt the solder by heating the die pad where the Au-20Sn solder is placed to 300 °C to 320 °C in a non-oxidizing atmosphere.

(2)Place the capacitor on the molten solder and lightly press and solder the capacitor while scrubbing.

(3)Soldering(excluding preheating) in 30s to 180s, then slowly cool.

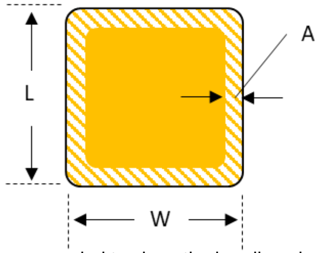
2. Wire Bonding

2-1. Bonding material and Bonding method

Ball bonding with Au wire

2-2. Caution

(1)Do not wire-bond to an area 10% around the electrodes of the capacitor.(See the image below)



A
GMA0D:38μm
GMA05：50μm
GMA08：80μm

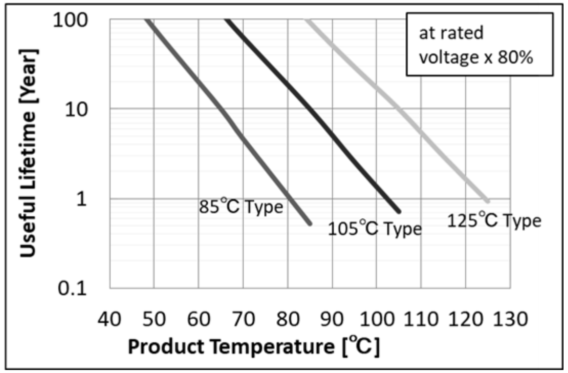
(2)It is recommended to clean the bonding plane by plasma processing before wire bonding.

(3)In stitch bonding(tail bonding, 2nd bonding), it is not recommended to wire-bond directly to electrodes of the capacitor.
When stitch bonding, form a ball bump(stud bump) and wire-bond on the bump.

■Others

1. Useful Life time of MLCC

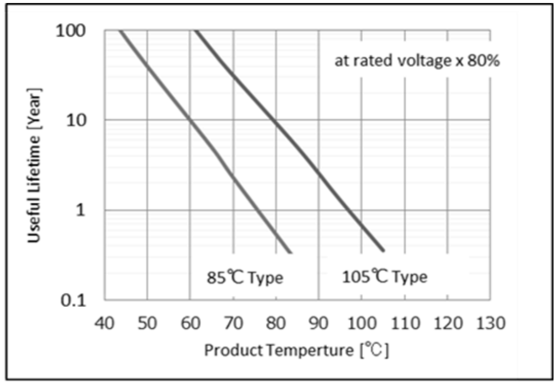
[For general application use]



Murata's General MLCC products are designed for use in devices with a typical lifetime around 10 years.
Murata's general MLCC products are designed so that the useful lifetime can be extended longer than 10 years under the following conditions:
「80% of the rated voltage or less, Maximum operating temperature -20 degree C or less」
Extended useful lifetime, under specific operating conditions, can be estimated from the chart.

※The useful lifetime is the time when cumulative failure rate becomes 1%.
※Please note that the useful lifetime data is for reference only and not guaranteed.

[For mobile application specific]



These MLCC products are designed for use in devices with a typical lifetime of less than 5 years.
(Examples: Cellular phone, Smartphone, Tablet PC, Digital camera, Watch,
Electronics dictionary,Small-scale server, IPC-9592B class1 equipment, etc.)
These MLCC products are designed so that the useful lifetime can be extended longer than 5 years under the following conditions:
「80% of the rated voltage or less, Maximum operating temperature -20 degree C or less」
Extended useful lifetime, under specific operating conditions, can be estimated from the chart.

※The useful lifetime is the time when cumulative failure rate becomes 1%.
※Please note that the useful lifetime data is for reference only and not guaranteed.

2. Under Operation of Equipment

2-1. Do not touch a capacitor directly with bare hands during operation in order to avoid the danger of an electric shock.

2-2. Do not allow the terminals of a capacitor to come in contact with any conductive objects (short-circuit).
Do not expose a capacitor to a conductive liquid, inducing any acid or alkali solutions.

2-3. Confirm the environment in which the equipment will operate is under the specified conditions.
Do not use the equipment under the following environments.
(1) Being spattered with water or oil.
(2) Being exposed to direct sunlight.
(3) Being exposed to ozone, ultraviolet rays, or radiation.
(4) Being exposed to toxic gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
(5) Any vibrations or mechanical shocks exceeding the specified limits.
(6) Moisture condensing environments.

2-4. Use damp proof countermeasures if using under any conditions that can cause condensation.

3. Others

3-1. In an Emergency
(1) If the equipment should generate smoke, fire, or smell, immediately turn off or unplug the equipment. If the equipment is not turned off or unplugged, the hazards may be worsened by supplying continuous power.
(2) In this type of situation, do not allow face and hands to come in contact with the capacitor or burns may be caused by the capacitor's high temperature.

3-2. Disposal of waste
When capacitors are disposed of, they must be burned or buried by an industrial waste vendor with the appropriate licenses.

3-3. Circuit Design
(1) Addition of Fail Safe Function
Capacitors that are cracked by dropping or bending of the board may cause deterioration of the insulation resistance, and result in a short.
If the circuit being used may cause an electrical shock, smoke or fire when a capacitor is shorted, be sure to install fail-safe functions, such as a fuse, to prevent secondary accidents.
(2) This series are not safety standard certified products.

3-4. Remarks
Failure to follow the cautions may result, worst case, in a short circuit and smoking when the product is used.
The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions.
Select optimum conditions for operation as they determine the reliability of the product after assembly.
The data herein are given in typical values, not guaranteed ratings.

Notice

■ Rating

1. Operating Temperature

1. The operating temperature limit depends on the capacitor.

1-1. Do not apply temperatures exceeding the maximum operating temperature.
It is necessary to select a capacitor with a suitable rated temperature that will cover the operating temperature range.
It is also necessary to consider the temperature distribution in equipment and the seasonal temperature variable factor.

1-2. Consider the self-heating factor of the capacitor
The surface temperature of the capacitor shall not exceed the maximum operating temperature including self-heating.

2. Atmosphere Surroundings (gaseous and liquid)

1. Restriction on the operating environment of capacitors.

1-1. The capacitor will short-circuit by water or brine. It may shorten the lifetime and may have the failure by the corrosion of terminals and the permeation of moisture into capacitor.

1-2. The same phenomenon as the above may occur when the electrodes or terminals of the capacitor are subject to moisture condensation.

1-3. The deterioration of characteristics and insulation resistance due to the oxidization or corrosion of terminal electrodes may result in breakdown
when the capacitor is exposed to corrosive or volatile gases or solvents for long periods of time.

3. Piezo-electric Phenomenon

1. When using high dielectric constant type capacitors in AC or pulse circuits, the capacitor itself vibrates at specific frequencies and noise may be generated.
Moreover, when the mechanical vibration or shock is added to capacitor, noise may occur.

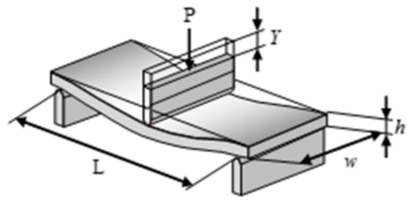
■ Mounting

1. PCB Design

When designing the board, keep in mind thatthe amount of strain which occurs will increase depending on the sizeand material of the board.

Relationship with amount of strain to the board thickness, length, width, etc.]

$$\varepsilon = \frac{3PL}{2Ewh^2}$$ Relationship between load and strain



ε : Strain on center of board (μst)
L : Distance between supporting points (mm)
w : Board width (mm)
h : Board thickness (mm)
E : Elastic modulus of board (N/m²=Pa)
Y : Deflection (mm)
P : Load (N)

When the load is constant, the following relationship can be established.
· As the distance between the supporting points (L) increases,the amount of strain also increases.
→Reduce the distance between the supporting points.
· As the elastic modulus (E) decreases, the amount of strain increases.
→Increase the elastic modulus.
· As the board width (w) decreases, the amount of strain increases.
→Increase the width of the board.
· As the board thickness (h) decreases, the amount of strain increases.
→Increase the thickness of the board.
Since the board thickness is squared, the effect on the amount of strain becomes even greater.

2. Coating

1. A crack may be caused in the capacitor due to the stress of the thermal contraction of the resin during curing process. The stress is affected by the amount of resin and curing contraction. Select a resin with low curing contraction.
   The difference in the thermal expansion coefficient between a coating resin or a molding resin and the capacitor may cause the destruction and deterioration of the capacitor such as a crack or peeling,
   and lead to the deterioration of insulation resistance or dielectric breakdown.
   Select a resin for which the thermal expansion coefficient is as close to that of the capacitor as possible. A silicone resin can be used as an under-coating to buffer against the stress.

2. Select a resin that is less hygroscopic. Using hygroscopic resins under high humidity conditions may cause the deterioration of the insulation resistance of a capacitor.
   An epoxy resin can be used as a less hygroscopic resin.

3. The halogen system substance and organic acid are included in coating material, and a chip corrodes by the kind of Coating material. Do not use strong acid type.

■ Others

1. Transportation

1. The performance of a capacitor may be affected by the conditions during transportation.

1-1. The capacitors shall be protected against excessive temperature, humidity and mechanical force during transportation.

・ Mechanical condition
Transportation shall be done in such a way that the boxes are not deformed and forces are not directly passed on to the inner packaging.

1-2. Do not apply excessive vibration, shock, or pressure to the capacitor.
(1) When excessive mechanical shock or pressure is applied to a capacitor, chipping or cracking may occur in the ceramic body of the capacitor.
(2) When the sharp edge of an air driver, a soldering iron, tweezers, a chassis, etc. impacts strongly on the surface of the capacitor, the capacitor may crack and short-circuit.

1-3. Do not use a capacitor to which excessive shock was applied by dropping etc. A capacitor dropped accidentally during processing may be damaged.

2. Characteristics Evaluation in the Actual System

1. Evaluate the capacitor in the actual system, to confirm that there is no problem with the performance and specification values in a finished product before using.

2. Since a voltage dependency and temperature dependency exists in the capacitance of high dielectric type ceramic capacitors, the capacitance may change depending on the operating conditions in the actual system.
Therefore,be sure to evaluate the various characteristics, such as the leakage current and noise absorptivity, which will affect the capacitance value of the capacitor.

3. In addition,voltages exceeding the predetermined surge may be applied to the capacitor by the inductance in the actual system.
Evaluate the surge resistance in the actual system as required.

⚠ NOTE

1. Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.

2. Your are requested not to use our product deviating from this product specification.

3. We consider it not appropriate to include any terms and conditions with regard to the business transaction in the product specifications, drawings or other technical documents.
Therefore, if your technical documents as above include such terms and conditions such as warranty clause, product liability clause, or intellectual property infringement liability clause, they will be deemed to be invalid.