Reference Only

CHIP COIL (CHIP INDUCTORS) LQP03TN□□□□Z2D

Murata Standard Reference Specification 【AEC-Q200】

1.Scope

This reference specification applies to Chip coil (Chip Inductors) LQP03TN_Z2 Series for automotive Electronics based on AEC-Q200 except for Power train and Safety.

2.Part Numbering

(ex) LQ | P | 03 | T | N | 68N | J | Z | 2 | D

Product ID	Structure	Dimension (L×W)	Applications and Characteristics	Category	Inductance	Tolerance	Features	Electrode	Packaging
									D:Taping

3.Rating

・Operating Temperature Range. –55°C to +125°C
(Ambient temperature: Rated current can be handled in this temperature range.)

・Storage Temperature Range. –55°C to +125°C

Customer Part Number	MURATA Part Number	Inductance (nH)	Inductance Tolerance	Q (min)	DC Resistance (Ωmax)	Self Resonant Frequency (MHz) Min.	Self Resonant Frequency (MHz) *Typ.	Rated Current (mA)	ESD Rank 1C: 1kV
	LQP03TN0N6BZ2D	0.6	B:±0.1nH C:±0.2nH	14	0.07	20000	20000	850	1C
	LQP03TN0N6CZ2D								
	LQP03TN0N7BZ2D	0.7			0.08			800	
	LQP03TN0N7CZ2D					18000			
	LQP03TN0N8BZ2D	0.8							
	LQP03TN0N8CZ2D								
	LQP03TN0N9BZ2D	0.9			0.10			750	
	LQP03TN0N9CZ2D					17000			
	LQP03TN1N0BZ2D	1.0							
	LQP03TN1N0CZ2D								
	LQP03TN1N1BZ2D	1.1							
	LQP03TN1N1CZ2D								
	LQP03TN1N2BZ2D	1.2							
	LQP03TN1N2CZ2D								
	LQP03TN1N3BZ2D	1.3			0.15			600	
	LQP03TN1N3CZ2D								
	LQP03TN1N4BZ2D	1.4				16000	19600		
	LQP03TN1N4CZ2D								
	LQP03TN1N5BZ2D	1.5				15000	17900		
	LQP03TN1N5CZ2D								
	LQP03TN1N6BZ2D	1.6					20000		
	LQP03TN1N6CZ2D								
	LQP03TN1N7BZ2D	1.7					19100		
	LQP03TN1N7CZ2D								
	LQP03TN1N8BZ2D	1.8					17700		
	LQP03TN1N8CZ2D								
	LQP03TN1N9BZ2D	1.9				12500	15100		
	LQP03TN1N9CZ2D								
	LQP03TN2N0BZ2D	2.0					14800		
	LQP03TN2N0CZ2D								
	LQP03TN2N1BZ2D	2.1				11000	13900		
	LQP03TN2N1CZ2D								
	LQP03TN2N2BZ2D	2.2					13400		
	LQP03TN2N2CZ2D								
	LQP03TN2N3BZ2D	2.3			0.20	10000	12900	500	
	LQP03TN2N3CZ2D								
	LQP03TN2N4BZ2D	2.4					12200		
	LQP03TN2N4CZ2D								

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (MHz)		Rated Current (mA)	ESD Rank 1C: 1kV
		(nH)	Tolerance			Min.	*Typ.		
	LQP03TN2N5BZ2D	2.5	B:±0.1nH C:±0.2nH	14	0.20	10000	12200	500	1C
	LQP03TN2N5CZ2D						13300		
	LQP03TN2N6BZ2D	2.6					13000		
	LQP03TN2N6CZ2D						11800		
	LQP03TN2N7BZ2D	2.7				9500	12400		
	LQP03TN2N7CZ2D						11900		
	LQP03TN2N8BZ2D	2.8			0.25		11300	450	
	LQP03TN2N8CZ2D					8000	10600		
	LQP03TN2N9BZ2D	2.9					10900		
	LQP03TN2N9CZ2D						9400		
	LQP03TN3N0BZ2D	3.0				7000	9600		
	LQP03TN3N0CZ2D						9500		
	LQP03TN3N1BZ2D	3.1			0.30	6000	8200	400	
	LQP03TN3N1CZ2D						8100		
	LQP03TN3N2BZ2D	3.2					7900		
	LQP03TN3N2CZ2D					5700	8600		
	LQP03TN3N3BZ2D	3.3			0.40	5300	8400	350	
	LQP03TN3N3CZ2D						8600		
	LQP03TN3N4BZ2D	3.4					9800		
	LQP03TN3N4CZ2D					4400	8800		
	LQP03TN3N5BZ2D	3.5				4200	8600		
	LQP03TN3N5CZ2D					4000	8000		
	LQP03TN3N6BZ2D	3.6			0.60		7900	300	
	LQP03TN3N6CZ2D					3900	8000		
	LQP03TN3N7BZ2D	3.7				3700	6700		
	LQP03TN3N7CZ2D				0.70	3600	6600	250	
	LQP03TN3N8BZ2D	3.8				3300	5900		
	LQP03TN3N8CZ2D								
	LQP03TN3N9BZ2D	3.9							
	LQP03TN3N9CZ2D								
	LQP03TN4N0BZ2D	4.0							
	LQP03TN4N0CZ2D								
	LQP03TN4N1BZ2D	4.1							
	LQP03TN4N1CZ2D								
	LQP03TN4N2BZ2D	4.2							
	LQP03TN4N2CZ2D								
	LQP03TN4N3HZ2D	4.3	H:±3% J:±5%						
	LQP03TN4N3JZ2D								
	LQP03TN4N7HZ2D	4.7							
	LQP03TN4N7JZ2D								
	LQP03TN5N1HZ2D	5.1							
	LQP03TN5N1JZ2D								
	LQP03TN5N6HZ2D	5.6							
	LQP03TN5N6JZ2D								
	LQP03TN6N2HZ2D	6.2							
	LQP03TN6N2JZ2D								
	LQP03TN6N8HZ2D	6.8							
	LQP03TN6N8JZ2D								
	LQP03TN7N5HZ2D	7.5							
	LQP03TN7N5JZ2D								
	LQP03TN8N2HZ2D	8.2							
	LQP03TN8N2JZ2D								
	LQP03TN9N1HZ2D	9.1							
	LQP03TN9N1JZ2D								

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (MHz)		Rated Current (mA)	ESD Rank 1C: 1kV
		(nH)	Tolerance			Min.	*Typ.		
	LQP03TN10NHZ2D	10	H:±3% J:±5%	14	0.70	3200	5800	250	1C
	LQP03TN10NJZ2D								
	LQP03TN11NHZ2D	11			0.80	2900	5400		
	LQP03TN11NJZ2D								
	LQP03TN12NHZ2D	12		12	0.70		4300		
	LQP03TN12NJZ2D								
	LQP03TN13NHZ2D	13			0.80	2600			
	LQP03TN13NJZ2D								
	LQP03TN15NHZ2D	15			0.70		3800		
	LQP03TN15NJZ2D								
	LQP03TN16NHZ2D	16			0.95	2200	3700	200	
	LQP03TN16NJZ2D								
	LQP03TN18NHZ2D	18			0.80		3400		
	LQP03TN18NJZ2D								
	LQP03TN20NHZ2D	20			2.30		3600	150	
	LQP03TN20NJZ2D								
	LQP03TN22NHZ2D	22			1.90		3300		
	LQP03TN22NJZ2D								
	LQP03TN24NHZ2D	24			2.30	2000	3200	140	
	LQP03TN24NJZ2D								
	LQP03TN27NHZ2D	27					2900		
	LQP03TN27NJZ2D								
	LQP03TN30NHZ2D	30		9	2.95	1700	2700	120	
	LQP03TN30NJZ2D								
	LQP03TN33NHZ2D	33					2600		
	LQP03TN33NJZ2D								
	LQP03TN36NHZ2D	36			3.00	1500	2400		
	LQP03TN36NJZ2D								
	LQP03TN39NHZ2D	39					2200		
	LQP03TN39NJZ2D								
	LQP03TN43NHZ2D	43			3.60	1300		100	
	LQP03TN43NJZ2D								
	LQP03TN47NHZ2D	47					2000		
	LQP03TN47NJZ2D								
	LQP03TN51NHZ2D	51			3.90	1200			
	LQP03TN51NJZ2D								
	LQP03TN56NHZ2D	56							
	LQP03TN56NJZ2D								
	LQP03TN62NHZ2D	62		8	8	1100	1800		
	LQP03TN62NJZ2D								
	LQP03TN68NHZ2D	68					1500		
	LQP03TN68NJZ2D								
	LQP03TN75NJZ2D	75			10	1000	1400		
	LQP03TN75NHZ2D								
	LQP03TN82NHZ2D	82							
	LQP03TN82NJZ2D								
	LQP03TN91NHZ2D	91				900	1300	80	
	LQP03TN91NJZ2D								
	LQP03TNR10HZ2D	100							
	LQP03TNR10JZ2D								
	LQP03TNR11HZ2D	110			12	800	1100		
	LQP03TNR11JZ2D								
	LQP03TNR12HZ2D	120							
	LQP03TNR12JZ2D								

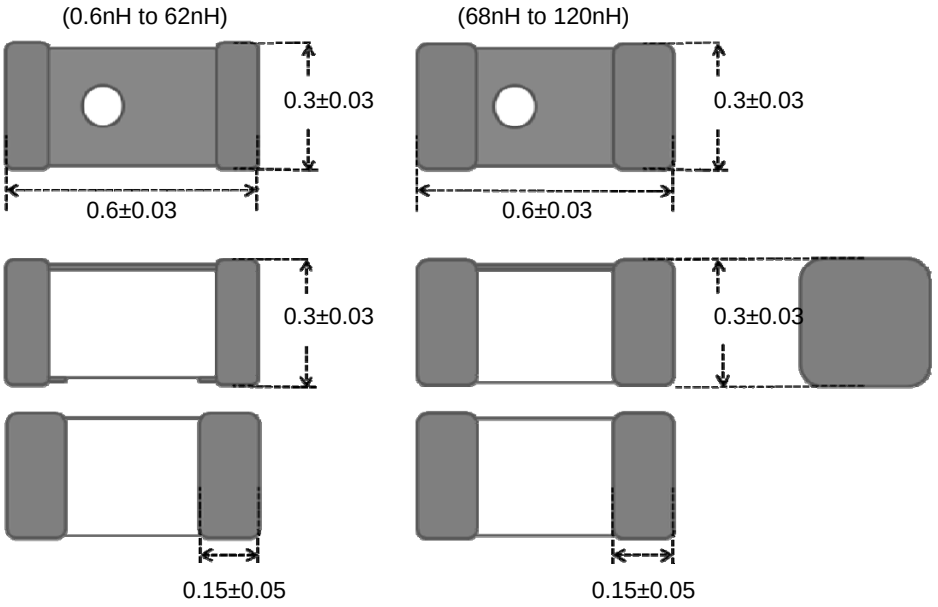
✱ Typical value is actual performance.

4. Testing Conditions

《Unless otherwise specified》
Temperature : Ordinary Temperature / 15°C to 35°C
Humidity: Ordinary Humidity / 25%(RH) to 85 %(RH)

《In case of doubt》
Temperature : 20°C ± 2°C
Humidity : 60%(RH) to 70 %(RH)
Atmospheric Pressure : 86kPa to 106 kPa

5. Appearance and Dimensions



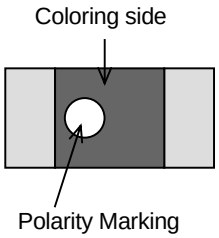
■Unit Mass (Typical value)

0.0002g

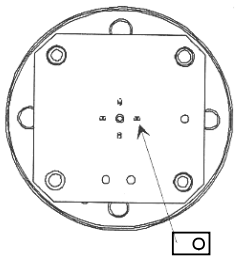
(in mm)

6. Marking

Polarity Marking :white



7.Electrical Performance

No.	Item	Specification	Test Method
7.1	Inductance	Inductance shall meet item 3.	Measuring Equipment: KEYSIGHT E4991A or equivalent Measuring Frequency: (0.6nH～30nH) 500MHz (33nH～120nH) 300MHz Measuring Condition: Test signal level / about 0dBm Electrical length / 10mm Weight / about 1N to 5N Measuring Fixture: KEYSIGHT 16197A Position coil under test as shown in below and contact coil with each terminal by adding weight. Coloring side should be a topside, and should be in the direction of the fixture for position of chip coil.  ↑ Polarity Marking Measuring Method:See the endnote. <Electrical Performance:Measuring Method of Inductance/Q>
7.2	Q	Q shall meet item 3.	
7.3	DC Resistance	DC Resistance shall meet item 3.	Measuring Equipment:Digital multi meter
7.4	Self Resonant Frequency(S.R.F)	S.R.F shall meet item 3.	Measuring Equipment: KEYSIGHT N5230A or equivalent
7.5	Rated Current	Self temperature rise shall be limited to 25°C max.	The rated current is applied.

8.Q200 Requirement

8.1.Performance (based on Table 5 for Magnetics(Inductors / Transformer)

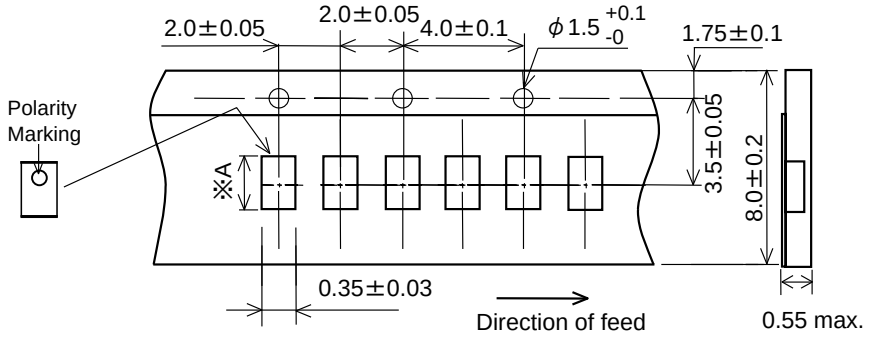
AEC-Q200 Rev.D issued June 1. 2010

<table>
<tr><th colspan="3">AEC-Q200</th><th rowspan="2">Murata Specification / Deviation</th></tr>
<tr><th>No</th><th>Stress</th><th>Test Method</th></tr>
<tr><td>3</td><td>High
Temperature
Exposure</td><td>1000hours at 125 deg C
Set for 24hours at room
temperature, then measured.</td><td>Meet Table A after testing.
Table A
<table><tr><td>Appearance</td><td>No damage</td></tr><tr><td>Inductance
0.6nH～30nH (at 500MHz)
33nH～120nH (at 300MHz)</td><td>Within ±10%</td></tr></table>Substrate；6-layers FR-4</td></tr>
<tr><td>4</td><td>Temperature
Cycling</td><td>1000cycles
-40 deg C to +125 deg C
Set for 24hours at room
temperature,then measured.</td><td>Meet Table A after testing.
Substrate；6-layers FR-4</td></tr>
<tr><td>7</td><td>Biased Humidity</td><td>1000hours at 85 deg C, 85%RH
unpowered.</td><td>Meet Table A after testing.
Substrate；6-layers FR-4</td></tr>
<tr><td>8</td><td>Operational Life</td><td>Apply 125 deg C 1000hours
Set for 24hours at room
temperature, then measured</td><td>Meet Table A after testing.
Substrate；6-layers FR-4</td></tr>
<tr><td>9</td><td>External Visual</td><td>Visual inspection</td><td>No abnormalities</td></tr>
<tr><td>10</td><td>Physical Dimension</td><td>Meet ITEM 4
（Style and Dimensions）</td><td>No defects</td></tr>
<tr><td>12</td><td>Resistance
to Solvents</td><td>Per
MIL-STD-202
Method 215</td><td>Not Applicable</td></tr>
<tr><td>13</td><td>Mechanical Shock</td><td>Per MIL-STD-202 Method 213
Condition F:
1500g's(14.7N)/0.5ms/Half sine</td><td>Meet Table A after testing.
Substrate；6-layers FR-4</td></tr>
<tr><td>14</td><td>Vibration</td><td>5g's(0.049N) for 20 minutes,
12cycles each of 3 oritentations
Test from 10-2000Hz.</td><td>Meet Table A after testing.
Substrate；6-layers FR-4</td></tr>
</table>

AEC-Q200			Murata Specification / Deviation
No	Stress	Test Method	
15	Resistance to Soldering Heat	No-heating Solder temperature 260C+/-5 deg C Immersion time 10s	Meet Table A after testing. Pre-heating 150C +/-10 deg C, 60s to 90s
17	ESD	Per AEC-Q200-002	ESD Rank: 1C（1KV~2KV） Substrate；6-layers FR-4
18	Solderbility	Per J-STD-002	Method b : Not Applicable Pre-heating 150C +/-10 deg C, 60s to 90s 90% of the terminations is to be soldered.
19	Electrical Characterization	Measured : Inductance	No defects
20	Flammability	Per UL-94	Not Applicable
21	Board Flex	Epoxy-PCB(1.6mm_thickness) Deflection 2mm(min) Holding time 60s	Meet Table B after testing. Murata deviation request: Substrate；Substrate；FR-4(0.8mm_thickness) Holding time 30s Table B Appearance: No damage DC resistance: Within ±10%
22	Terminal Strength	Per AEC-Q200-006 A force of 17.7N for 60s	Murata Deviation Request: 2N/5s No defect Substrate；Substrate；6-layers FR-4

9.Specification of Packaging

9.1 Appearance and Dimensions of paper tape (8mm-wide)



(in mm)

※A 0N6～62N； 0.67±0.03
68N～R12； 0.65±0.03

9.2 Specification of Taping

(1) Packing quantity (standard quantity)
15,000 pcs. / reel

(2) Packing Method
Products shall be packed in the cavity of the base tape and sealed by cover tape.

(3) Sprocket hole
The sprocket holes are to the right as the tape is pulled toward the user.

(4) Spliced point
Base tape and Cover tape has no spliced point.

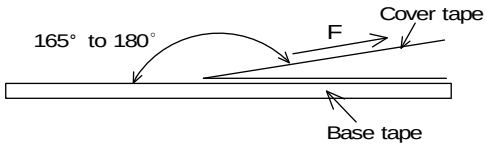
(5) Missing components number
Missing components number within 0.1 % of the number per reel or 1 pc. , whichever is greater, and are not continuous. The Specified quantity per reel is kept.

9.3 Pull Strength

Cover tape	5N min

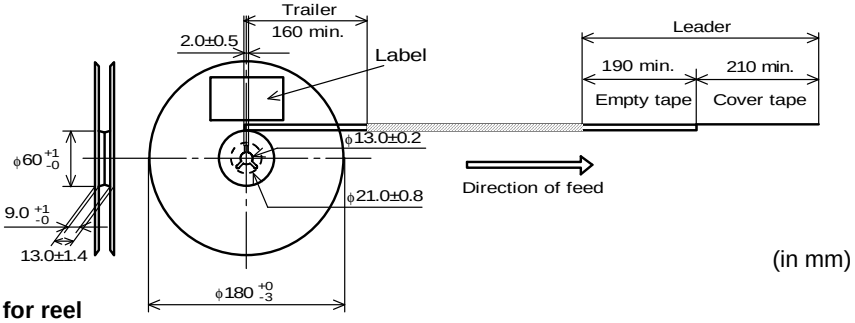
9.4 Peeling off force of cover tape

Speed of Peeling off	300mm/min
Peeling off force	0.1N to 0.6N (minimum value is typical)



9.5 Dimensions of Leader-tape, Trailer and Reel

There shall be leader-tape (top tape and empty tape) and trailer-tape (empty tape) as follows.



(in mm)

9.6 Marking for reel

Customer part number, MURATA part number, Inspection number(∗1) , RoHS Marking (∗2), Quantity etc ・・・

∗1) <Expression of Inspection No.> □□ OOOO ××× (1) (2) (3)

(1) Factory Code
(2) Date First digit : Year / Last digit of year
Second digit : Month / Jan. to Sep. → 1 to 9, Oct. to Dec. → O,N,D
Third, Fourth digit : Day
(3) Serial No.

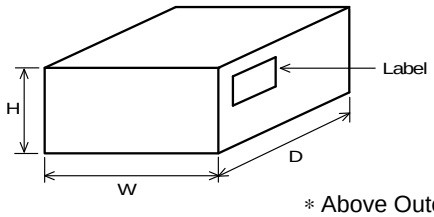
∗2) <Expression of RoHS Marking> ROHS – Y (△) (1) (2)

(1) RoHS regulation conformity parts.
(2) MURATA classification number

9.7 Marking for Outside package (corrugated paper box)

Customer name, Purchasing order number, Customer part number, MURATA part number, RoHS Marking (∗2) ,Quantity, etc ・・・

9.8 Specification of Outer Case



Outer Case Dimensions (mm)			Standard Reel Quantity in Outer Case (Reel)
W	D	H	
186	186	93	5

∗ Above Outer Case size is typical. It depends on a quantity of an order.

10. ⚠ 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.

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

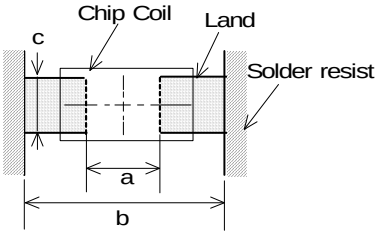
11. Notice

Products can only be soldered with reflow.

This product is designed for solder mounting.

Please consult us in advance for applying other mounting method such as conductive adhesive.

11.1 Land pattern designing



a	0.2~0.3
b	0.8~0.9
c	0.2~0.3

(in mm)

11.2 Flux, Solder

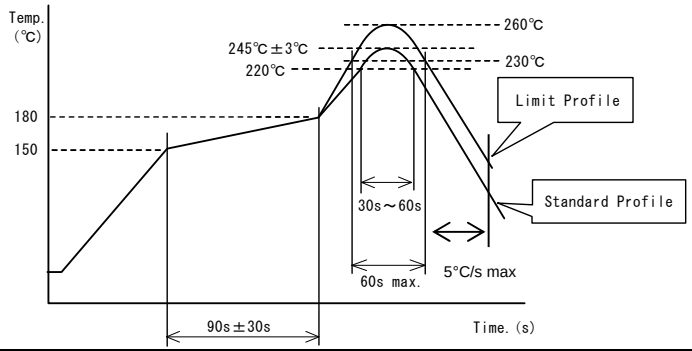
- Use rosin-based flux.
  Don't use highly acidic flux with halide content exceeding 0.2(wt)% (chlorine conversion value).
  Don't use water-soluble flux.
- Use Sn-3.0Ag-0.5Cu solder.
- Standard thickness of solder paste :60 μm~100 μm.

11.3 Reflow soldering conditions

- Pre-heating should be in such a way that the temperature difference between solder and product surface is limited to 150°C max.

  Insufficient pre-heating may cause cracks on the product, resulting in the deterioration of products quality.
- Standard soldering profile and the limit soldering profile is as follows.
  The excessive limit soldering conditions may cause leaching of the electrode and / or resulting in the deterioration of product quality.

・Reflow soldering profile



	Standard Profile	Limit Profile
Pre-heating	150°C～180°C 、90s±30s	
Heating	above 220°C、30s～60s	above 230°C、60s max.
Peak temperature	245°C±3°C	260°C,10s
Cycle of reflow	2 times	2 times
Cooling rate	5°C/s max	

11.4 Reworking with soldering iron

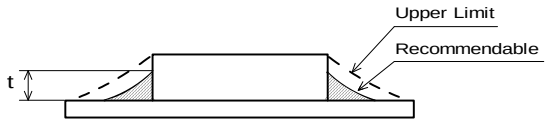
The following conditions must be strictly followed when using a soldering iron.

Pre-heating	150°C,1 min
Tip temperature	350°C max.
Soldering iron output	80W max.
Tip diameter	φ3mm max.
Soldering time	3(+1,-0)s
Time	2 times

Note : Do not directly touch the products with the tip of the soldering iron in order to prevent the crack on the products due to the thermal shock.

11.5 Solder Volume

・ Solder shall be used not to be exceeded the upper limits as shown below.



1/3T≦t≦T
T : thickness of product

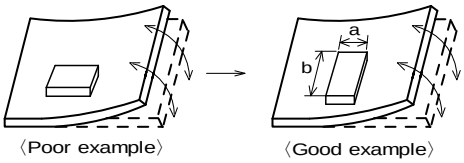
Accordingly increasing the solder volume, the mechanical stress to Chip is also increased. Exceeding solder volume may cause the failure of mechanical or electrical performance.

11.6 Attention regarding P.C.B. bending

The following shall be considered when designing and laying out P.C.B.'s.

(1) P.C.B. shall be designed so that products are not subject to the mechanical stress due to warping the board.

［Products direction］



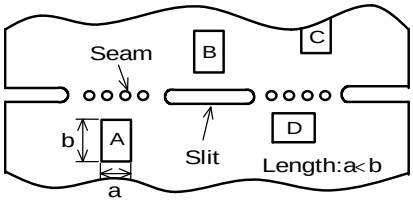
Products shall be located in the sideways direction (Length:a＜b) to the mechanical stress.

(2) Components location on P.C.B. separation.

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.

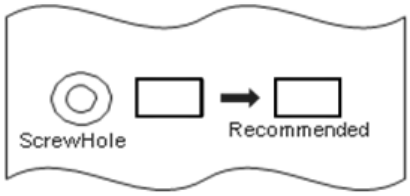
Contents of Measures	Stress Level
(1) Turn the mounting direction of the component parallel to the board separation surface.	A > D *1
(2) Add slits in the board separation part.	A > B
(3) Keep the mounting position of the component away from the board separation surface.	A > C



*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.

(3) Mounting Components Near Screw Holes

When a component 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.



11.7 Cleaning Conditions

Products shall be cleaned on the following conditions.

(1) Cleaning temperature shall be limited to 60°C max.(40°C max for IPA)
(2) Ultrasonic cleaning shall comply with the following conditions with avoiding the resonance phenomenon at the mounted products and P.C.B.
Power : 20 W / l max. Frequency : 28kHz to 40kHz Time : 5 min max.
(3) Cleaner
1. Alcohol type cleaner
Isopropyl alcohol (IPA)
2. Aqueous agent
PINE ALPHA ST-100S
(4) There shall be no residual flux and residual cleaner after cleaning.
In the case of using aqueous agent, products shall be dried completely after rinse with de-ionized water in order to remove the cleaner.
(5) Other cleaning Please contact us.

11.8 Resin coating

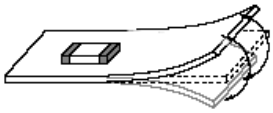
When products are coated with resin, please contact us in advance.

11.9 Handling of a substrate

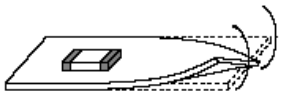
(1)There is a possibility of chip cracking caused by PCB expansion/contraction with heat, because stress on a chip is different depending on PCB material and structure.
When the thermal expansion coefficient greatly differs between the board used for mounting and the chip, it will cause cracking of the chip due to the thermal expansion and contraction.
The chip is assumed to be mounted on the PCB of glass-epoxy material, and we don't test with other PCB material which has different thermal expansion coefficient from Glass-epoxy.
When other PCB materials are considered, please be sure to evaluate by yourself.

(2)After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening screw to the substrate.
Excessive mechanical stress may cause cracking in the product.
In case of the mounting on flexible PCB, there is a possibility of chip cracking caused by mechanical stress even from small bending or twisting.
When the flexible PCB is considered, please be sure to evaluate by yourself.

Bending



Twisting



Substrate restriction

・Don't mount on FPC（Flexible printed circuits）
・When components are mounted on substrate of under 6-layers, please contact us in advance.
To mount components on FPC or substrate of under 6-layers may cause of cracking issue by stress.

11.10 Storage and Handing Requirements

(1) Storage period
Use the products within 12 months after delivered.
Solderability should be checked if this period is exceeded.

(2) Storage conditions
・Products should be stored in the warehouse on the following conditions.
Temperature : -10°C ~ 40°C
Humidity : 15% to 85% relative humidity No rapid change on temperature and humidity.
・Products should not be stored on bulk packaging condition to prevent the chipping of the core and the breaking of winding wire caused by the collision between the products.
・Products should be stored on the palette for the prevention of the influence from humidity, dust and so on.
・Products should be stored in the warehouse without heat shock, vibration, direct sunlight and so on.

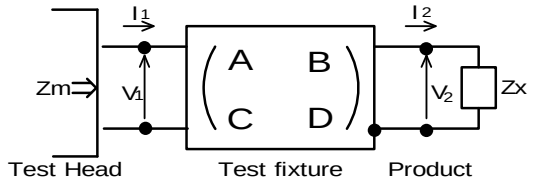
(3) Handling Condition
Care should be taken when transporting or handling product to avoid excessive vibration or mechanical shock.

12.⚠ 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)You are requested not to use our product deviating from the reference specifications.
(3)The contents of this reference specification are subject to change without advance notice.
Please approve our product specifications or transact the approval sheet for product specifications before ordering.

<Electrical Performance:Measuring Method of Inductance/Q>

(1) Residual elements and stray elements of test fixture can be described by F-parameter shown in following.



$$\begin{pmatrix} V_1 \\ I_1 \end{pmatrix} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} \begin{pmatrix} V_2 \\ I_2 \end{pmatrix}$$

(2) The impedance of chip coil Zx and measured value Zm can be described by input/output current/voltage.

$$Zm = \frac{V_1}{I_1} \quad , \quad Zx = \frac{V_2}{I_2}$$

(3) Thus,the relation between Zx and Zm is following;

$$Zx = \alpha \frac{Zm - \beta}{1 - Zm\,\Gamma}$$

where, α= D / A =1
β= B / D =Zsm-(1-Yom Zsm)Zss
Γ= C / A =Yom

Zsm:measured impedance of short chip
Zss:residual impedance of short chip (0.480nH)
Yom:measured admittance when opening the fixture

(4) Lx and Qx shall be calculated with the following equation.

$$Lx = \frac{Im(Zx)}{2\pi f} \quad , \quad Qx = \frac{Im(Zx)}{Re(Zx)}$$

Lx :Inductance of chip coil
Qx:Q of chip coil
f :Measuring frequency