

# CHIP COIL (CHIP INDUCTORS) LQP02HQ□□□□02□ Reference Specification

## 1.Scope

This reference specification applies to LQP02HQ series, Chip coil (Chip Inductors).

## 2.Part Numbering

(ex)	LQ	P	02	H	Q	0N4	W	0	2	L
	Product ID	Structure	Dimension	Applications	Category	Inductance	Tolerance	Features	Electrode	Packaging
			(L × W)	and					L:4mm-wide / plastic tape	
									E:8mm-wide / plastic tape	
				Characteristics						*B: Bulk

\*Bulk packing also available. (A product is put in the plastic bag under the taping conditions.)

## 3.Rating

• Operating Temperature. -55°C to +125°C

• Storage Temperature. -55°C to +125°C

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (GHz)		Rated Current (mA)		
		(nH)	Tolerance			*Typ.	Min.			
	LQP02HQ0N4W02L	0.4	W:±0.05nH B:±0.1nH C:±0.2nH	14	0.03	>20	17.0	1000		
	LQP02HQ0N4W02E									
	LQP02HQ0N4B02L									
	LQP02HQ0N4B02E									
	LQP02HQ0N4C02L									
	LQP02HQ0N4C02E									
	LQP02HQ0N5W02L	0.5			0.04				0.04	17.0
	LQP02HQ0N5W02E									
	LQP02HQ0N5B02L									
	LQP02HQ0N5B02E									
	LQP02HQ0N5C02L									
	LQP02HQ0N5C02E									
	LQP02HQ0N6W02L	0.6			0.05			0.05	15.5	950
	LQP02HQ0N6W02E									
	LQP02HQ0N6B02L									
	LQP02HQ0N6B02E									
	LQP02HQ0N6C02L									
	LQP02HQ0N6C02E									
	LQP02HQ0N7W02L	0.7			0.05	0.05	19	900		
	LQP02HQ0N7W02E									
	LQP02HQ0N7B02L									
	LQP02HQ0N7B02E									
	LQP02HQ0N7C02L									
	LQP02HQ0N7C02E									
	LQP02HQ0N8W02L	0.8			0.05	0.05	19		14.6	
	LQP02HQ0N8W02E									
	LQP02HQ0N8B02L									
	LQP02HQ0N8B02E									
	LQP02HQ0N8C02L									
	LQP02HQ0N8C02E									
	LQP02HQ0N9W02L	0.9			0.05	0.05	19	13.2		
	LQP02HQ0N9W02E									
	LQP02HQ0N9B02L									
	LQP02HQ0N9B02E									
	LQP02HQ0N9C02L									
	LQP02HQ0N9C02E									
	LQP02HQ1N0W02L	1.0			0.05	0.05	18	13.2		
	LQP02HQ1N0W02E									
	LQP02HQ1N0B02L									
	LQP02HQ1N0B02E									

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (GHz)		Rated Current (mA)									
		(nH)	Tolerance			*Typ.	Min.										
	LQP02HQ1N0C02L	1.0	W:±0.05nH B:±0.1nH C:±0.2nH	14	0.05	18	13.2	900									
	LQP02HQ1N0C02E																
	LQP02HQ1N1W02L	1.1			0.06	16	12.8	850									
	LQP02HQ1N1W02E																
	LQP02HQ1N1B02L																
	LQP02HQ1N1B02E																
	LQP02HQ1N1C02L																
	LQP02HQ1N1C02E	1.2			0.06	15	12.7	800									
	LQP02HQ1N2W02L																
	LQP02HQ1N2W02E																
	LQP02HQ1N2B02L																
	LQP02HQ1N2B02E																
	LQP02HQ1N2C02L	1.3			0.08	14	10.7	700									
	LQP02HQ1N2C02E																
	LQP02HQ1N3W02L																
	LQP02HQ1N3W02E																
	LQP02HQ1N3B02L																
	LQP02HQ1N3B02E	1.4			0.08	14.5	12.7	700									
	LQP02HQ1N3C02L																
	LQP02HQ1N3C02E																
	LQP02HQ1N4W02L																
	LQP02HQ1N4W02E																
	LQP02HQ1N4B02L	1.5			0.08	14	10.7	700									
	LQP02HQ1N4B02E																
	LQP02HQ1N4C02L																
	LQP02HQ1N4C02E																
	LQP02HQ1N5W02L																
	LQP02HQ1N5W02E	1.6			0.1	11.5	10.1	650									
	LQP02HQ1N5B02L																
	LQP02HQ1N5B02E																
	LQP02HQ1N5C02L																
	LQP02HQ1N5C02E																
	LQP02HQ1N6B02L	1.6	B:±0.1nH C:±0.2nH	0.1	14	10.7	700										
	LQP02HQ1N6B02E																
	LQP02HQ1N6C02L																
	LQP02HQ1N6C02E																
	LQP02HQ1N7B02L	1.7			B:±0.1nH C:±0.2nH	0.1	13.5	10.2	700								
	LQP02HQ1N7B02E																
	LQP02HQ1N7C02L																
	LQP02HQ1N7C02E																
	LQP02HQ1N8B02L	1.8					B:±0.1nH C:±0.2nH	0.1	12.5	10.1	650						
	LQP02HQ1N8B02E																
	LQP02HQ1N8C02L																
	LQP02HQ1N8C02E																
	LQP02HQ1N9B02L	1.9							B:±0.1nH C:±0.2nH	0.1	11.5	10.1	650				
	LQP02HQ1N9B02E																
	LQP02HQ1N9C02L																
	LQP02HQ1N9C02E																
	LQP02HQ2N0B02L	2.0									B:±0.1nH C:±0.2nH	0.1	11.5	10.1	650		
	LQP02HQ2N0B02E																
	LQP02HQ2N0C02L																
	LQP02HQ2N0C02E																
	LQP02HQ2N1B02L	2.1											B:±0.1nH C:±0.2nH	0.1	11.5	10.1	650
	LQP02HQ2N1B02E																
	LQP02HQ2N1C02L																
	LQP02HQ2N1C02E																

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (GHz)		Rated Current (mA)									
		(nH)	Tolerance			*Typ.	Min.										
	LQP02HQ2N2B02L	2.2	B:±0.1nH C:±0.2nH	14	0.2	11.5	9.8	500									
	LQP02HQ2N2B02E																
	LQP02HQ2N2C02L																
	LQP02HQ2N2C02E																
	LQP02HQ2N3B02L	2.3				11	9.5	450									
	LQP02HQ2N3B02E																
	LQP02HQ2N3C02L																
	LQP02HQ2N3C02E																
	LQP02HQ2N4B02L	2.4							9.5	450							
	LQP02HQ2N4B02E																
	LQP02HQ2N4C02L																
	LQP02HQ2N4C02E																
	LQP02HQ2N5B02L	2.5									10.5	8.8	450				
	LQP02HQ2N5B02E																
	LQP02HQ2N5C02L																
	LQP02HQ2N5C02E																
	LQP02HQ2N6B02L	2.6												10	8.5	400	
	LQP02HQ2N6B02E																
	LQP02HQ2N6C02L																
	LQP02HQ2N6C02E																
	LQP02HQ2N7B02L	2.7			0.25	10	8.2	350									
	LQP02HQ2N7B02E																
	LQP02HQ2N7C02L																
	LQP02HQ2N7C02E																
	LQP02HQ2N8B02L	2.8							0.3	8.2							350
	LQP02HQ2N8B02E																
	LQP02HQ2N8C02L																
	LQP02HQ2N8C02E																
	LQP02HQ2N9B02L	2.9									0.3	8.2	350				
	LQP02HQ2N9B02E																
	LQP02HQ2N9C02L																
	LQP02HQ2N9C02E																
	LQP02HQ3N0B02L	3.0												0.3	8.2	350	
	LQP02HQ3N0B02E																
	LQP02HQ3N0C02L																
	LQP02HQ3N0C02E																
	LQP02HQ3N1B02L	3.1			0.3	8.2	350										
	LQP02HQ3N1B02E																
	LQP02HQ3N1C02L																
	LQP02HQ3N1C02E																
	LQP02HQ3N2B02L	3.2						0.3	8.2	350							
	LQP02HQ3N2B02E																
	LQP02HQ3N2C02L																
	LQP02HQ3N2C02E																
	LQP02HQ3N3B02L	3.3									0.3	8.2	350				
	LQP02HQ3N3B02E																
	LQP02HQ3N3C02L																
	LQP02HQ3N3C02E																
	LQP02HQ3N4B02L	3.4												0.3	8.2	350	
	LQP02HQ3N4B02E																
	LQP02HQ3N4C02L																
	LQP02HQ3N4C02E																
	LQP02HQ3N5B02L	3.5			0.3	8.2	350										
	LQP02HQ3N5B02E																
	LQP02HQ3N5C02L																
	LQP02HQ3N5C02E																

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (GHz)		Rated Current (mA)	
		(nH)	Tolerance			*Typ.	Min.		
	LQP02HQ3N6B02L	3.6	B:±0.1nH C:±0.2nH	14	0.3	9.5	8.2	350	
	LQP02HQ3N6B02E								
	LQP02HQ3N6C02L								
	LQP02HQ3N6C02E								
	LQP02HQ3N7B02L	3.7			0.35				
	LQP02HQ3N7B02E								
	LQP02HQ3N7C02L								
	LQP02HQ3N7C02E								
	LQP02HQ3N8B02L	3.8							
	LQP02HQ3N8B02E								
	LQP02HQ3N8C02L								
	LQP02HQ3N8C02E								
	LQP02HQ3N9B02L	3.9							
	LQP02HQ3N9B02E								
	LQP02HQ3N9C02L								
	LQP02HQ3N9C02E								
	LQP02HQ4N0B02L	4.0							
	LQP02HQ4N0B02E								
	LQP02HQ4N0C02L								
	LQP02HQ4N0C02E								
	LQP02HQ4N1B02L	4.1							
	LQP02HQ4N1B02E								
	LQP02HQ4N1C02L								
	LQP02HQ4N1C02E								
	LQP02HQ4N2B02L	4.2							
	LQP02HQ4N2B02E								
	LQP02HQ4N2C02L								
	LQP02HQ4N2C02E								
	LQP02HQ4N3H02L	4.3	H:±3% J:±5%	13	0.35	8	6.9		
	LQP02HQ4N3H02E								
	LQP02HQ4N3J02L								
	LQP02HQ4N3J02E								
	LQP02HQ4N7H02L	4.7							
	LQP02HQ4N7H02E								
	LQP02HQ4N7J02L								
	LQP02HQ4N7J02E								
	LQP02HQ5N1H02L	5.1							
	LQP02HQ5N1H02E								
	LQP02HQ5N1J02L								
	LQP02HQ5N1J02E								
	LQP02HQ5N6H02L	5.6							
	LQP02HQ5N6H02E								
	LQP02HQ5N6J02L								
	LQP02HQ5N6J02E								
	LQP02HQ6N2H02L	6.2							
	LQP02HQ6N2H02E								
	LQP02HQ6N2J02L								
	LQP02HQ6N2J02E								
	LQP02HQ6N8H02L	6.8							
	LQP02HQ6N8H02E								
	LQP02HQ6N8J02L								
	LQP02HQ6N8J02E								

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω max)	Self Resonant Frequency (GHz)		Rated Current (mA)						
		(nH)	Tolerance			*Typ.	Min.							
	LQP02HQ7N5H02L	7.5	H:±3% J:±5%	13	0.5	6.5	5.6	300						
	LQP02HQ7N5H02E						5.1							
	LQP02HQ7N5J02L													
	LQP02HQ7N5J02E													
	LQP02HQ8N2H02L	8.2												
	LQP02HQ8N2H02E													
	LQP02HQ8N2J02L													
	LQP02HQ8N2J02E													
	LQP02HQ9N1H02L	9.1			6.0	4.9								
	LQP02HQ9N1H02E													
	LQP02HQ9N1J02L													
	LQP02HQ9N1J02E													
	LQP02HQ10NH02L	10				5.8	250							
	LQP02HQ10NH02E													
	LQP02HQ10NJ02L													
	LQP02HQ10NJ02E													
	LQP02HQ11NH02L	11			5.6	4.0								
	LQP02HQ11NH02E													
	LQP02HQ11NJ02L													
	LQP02HQ11NJ02E													
	LQP02HQ12NH02L	12			0.82			230						
	LQP02HQ12NH02E													
	LQP02HQ12NJ02L													
	LQP02HQ12NJ02E													
	LQP02HQ13NH02L	13			0.99	4.0	210							
	LQP02HQ13NH02E													
	LQP02HQ13NJ02L													
	LQP02HQ13NJ02E													
	LQP02HQ15NH02L	15			1.53		4.8	170						
	LQP02HQ15NH02E													
	LQP02HQ15NJ02L													
	LQP02HQ15NJ02E													
	LQP02HQ16NH02L	16			4.4	4.2			3.7					
	LQP02HQ16NH02E													
	LQP02HQ16NJ02L													
	LQP02HQ16NJ02E													
	LQP02HQ18NH02L	18			1.63		3.9	3.0		160				
	LQP02HQ18NH02E													
	LQP02HQ18NJ02L													
	LQP02HQ18NJ02E													
	LQP02HQ20NH02L	20		12	2.26	3.9			3.0		140			
	LQP02HQ20NH02E													
	LQP02HQ20NJ02L													
	LQP02HQ20NJ02E													
	LQP02HQ22NH02L	22					12	2.26		3.9		3.0	140	
	LQP02HQ22NH02E													
	LQP02HQ22NJ02L													
	LQP02HQ22NJ02E													

\* 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)

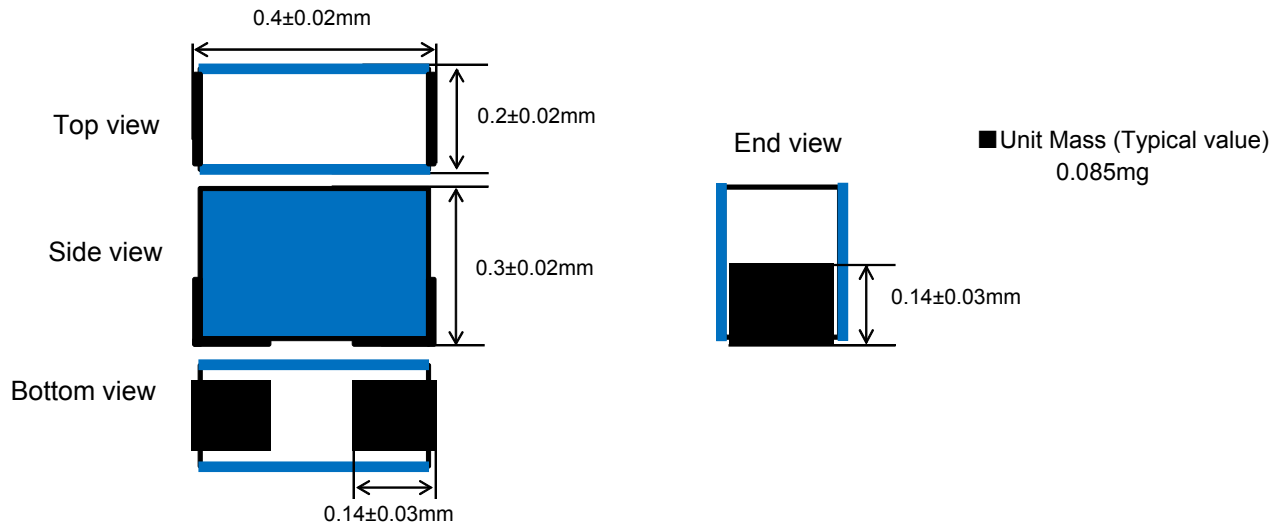
《In case of doubt》

Temperature : 20°C ± 2°C

Humidity : 60%(RH) to 70 %(RH)

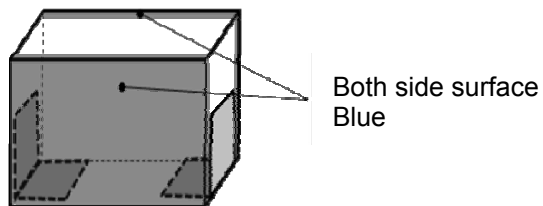
Atmospheric Pressure : 86kPa to 106 kPa

#### 5. Appearance and Dimensions

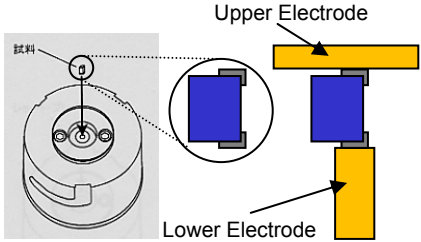


#### 6. Marking

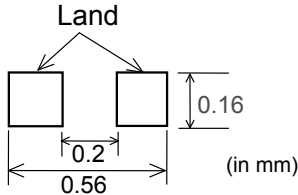
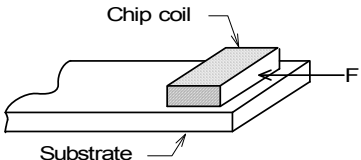
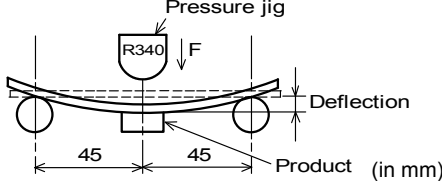
Side surface identification marking :Blue



## 7. Electrical Performance

No.	Item	Specification	Test Method
7.1	Inductance	Inductance shall meet item 3.	<p>Measuring Equipment: KEYSIGHT E4991A or equivalent Measuring Frequency: 500MHz Measuring Condition: Test signal level / about 0dBm Electrical length / 27.3mm Measuring Fixture: KEYSIGHT 16196D Insert Chip coil in the hole in order that the polarity marking is at the top of the side surface. Contact coil with each terminal by adding the weigh cover. See diagram below.</p> 
7.2	Q	Q shall meet item 3.	<p>Make close contact of the outer electrode of a product with the lower electrode like above to avoid dispersion of measurement.</p> <p>Chip coil placement hole: <math>\phi 0.36\text{mm}</math> Measuring Method: See P.16. &lt;Electrical Performance: Measuring Method of Inductance/Q&gt;</p>
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.Mechanical Performance

No.	Item	Specification	Test Method
8.1	Shear Test	Chip coil shall not be damaged after tested as test method.	<p>Substrate:Glass-epoxy substrate</p>  <p>Force:1N Hold Duration:5 s<math>\pm</math>1 s Applied Direction: Parallel to PCB</p> 
8.2	Bending Test		<p>Substrate:Glass-epoxy substrate (100mm <math>\times</math> 40mm <math>\times</math> 0.8mm) Speed of Applying Force:1mm /s Deflection:1mm Hold Duration:30 s</p> 
8.3	Vibration	Appearance:No damage Inductance Change: within $\pm$ 10%	<p>Substrate: Glass-epoxy substrate Oscillation Frequency: 10Hz to 2000Hz to 10Hz for 20 min Total amplitude 1.5 mm or Acceleration amplitude 196 m/s<sup>2</sup> whichever is smaller. Testing Time:A period of 2h in each of 3 mutually perpendicular directions.</p>
8.4	Solderability	The electrode shall be at least 90% covered with new solder coating.	<p>Flux: Ethanol solution of rosin 25(wt)% (Immersed for 5s to 10s) Solder:Sn-3.0Ag-0.5Cu Pre-Heating:150°C<math>\pm</math>10°C / 60s to 90s Solder Temperature:240°C<math>\pm</math>5°C Immersion Time:3s<math>\pm</math>1s</p>
8.5	Resistance to Soldering Heat	Appearance:No damage Inductance Change: within $\pm$ 10%	<p>Flux: Ethanol solution of rosin 25(wt)% (Immersed for 5s to 10s) Solder:Sn-3.0Ag-0.5Cu Pre-Heating:150°C<math>\pm</math>10°C / 60s to 90s Solder Temperature:260°C<math>\pm</math>5°C Immersion Time:5s<math>\pm</math>1s Then measured after exposure in the room condition for 24h<math>\pm</math>2h.</p>



## 9.Environmental Performance

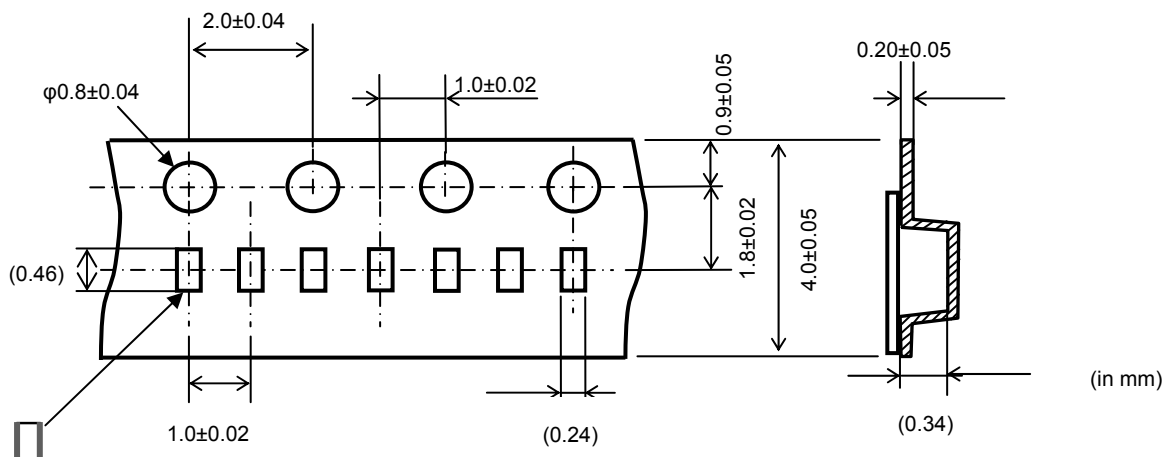
It shall be soldered on the substrate.

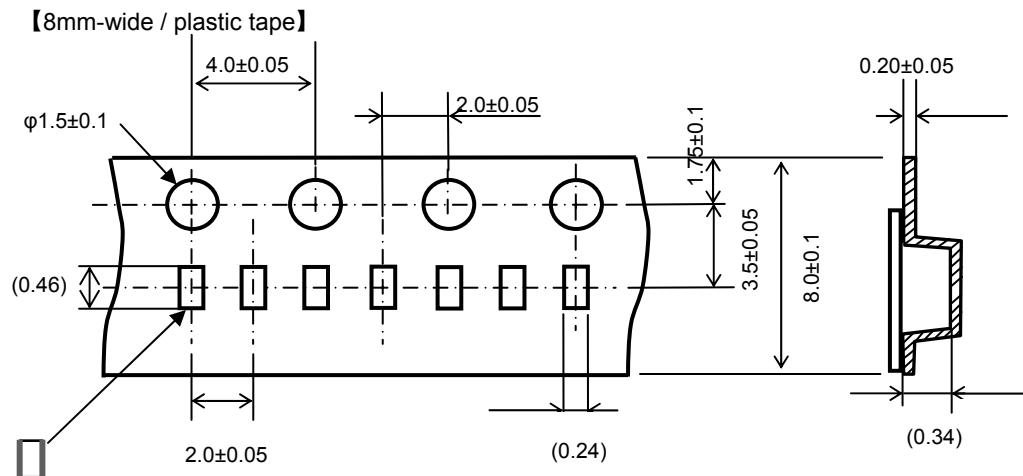
No.	Item	Specification	Test Method
9.1	Heat Resistance	Appearance:No damage Inductance Change: within $\pm 10\%$	Substrate: Glass-epoxy substrate Temperature: $125^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Time: 1000h (+48h, -0h) Then measured after exposure in the room condition for 24h $\pm$ 2h.
9.2	Cold Resistance		Substrate: Glass-epoxy substrate Temperature: $-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Time: 1000 h (+48h, -0h) Then measured after exposure in the room condition for 24h $\pm$ 2h.
9.3	Humidity		Substrate: Glass-epoxy substrate Temperature: $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Humidity: 90%(RH) to 95%(RH) Time: 1000 h(+48h, -0h) Then measured after exposure in the room condition for 24h $\pm$ 2h.
9.4	Temperature Cycle		Substrate: Glass-epoxy substrate 1 cycle: 1 step: $-55^{\circ}\text{C} \pm 2^{\circ}\text{C}$ / 30min $\pm$ 3 min 2 step: Ordinary temp. / 10~15 min 3 step: $125^{\circ}\text{C} \pm 2^{\circ}\text{C}$ / 30 $\pm$ 3 min 4 step: Ordinary temp. / 10~15 min Total of 10 cycles Then measured after exposure in the room condition for 24h $\pm$ 2h.

## 10.Specification of Packaging

## 10.1 Appearance and Dimensions

【4mm-wide / plastic tape】





Dimension of the Cavity is measured at the bottom side.

## 10.2 Specification of Taping

### 【4mm-wide / plastic tape】

- (1) Packing quantity (standard quantity)  
30,000 pcs. / reel
- (2) Packing Method  
Products shall be packed in the each embossed cavity of plastic 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  
Plastic 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.

### 【 8 mm-wide / plastic tape】

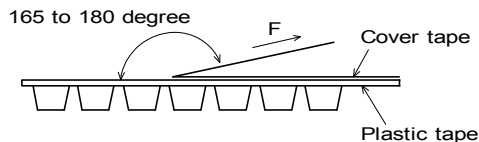
- (1) Packing quantity (standard quantity)  
15,000 pcs. / reel
- (2) Packing Method  
Products shall be packed in the each embossed cavity of plastic tape and sealed by cover tape.
- (3) Sprocket hole  
The sprocket holes are to the right as the tape is pulled toward the user.
- (4) Spliced point  
Plastic 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.

**10.3 Pull Strength**

Cover tape	5N min
------------	--------

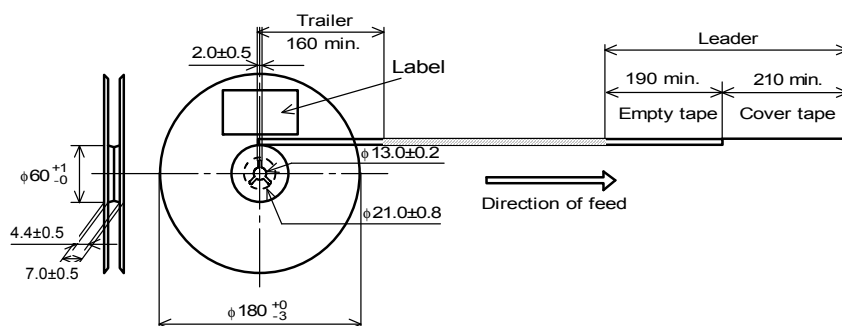
**10.4 Peeling off force of cover tape**

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

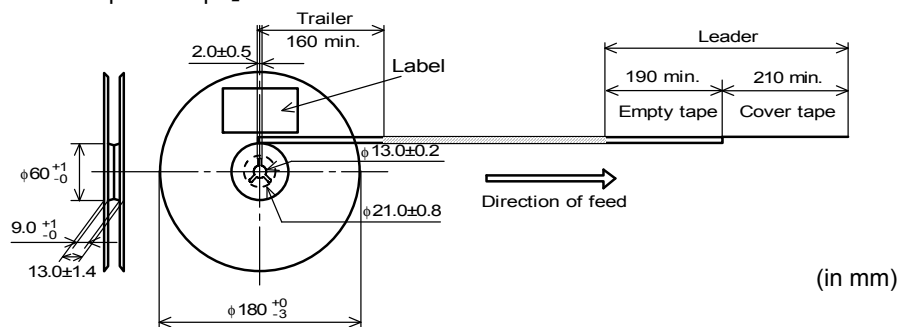
**10.5 Dimensions of Leader-tape, Trailer and Reel**

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

【4mm-wide / plastic tape】



【8mm-wide / plastic tape】

**10.6 Marking for reel**

Customer part number, MURATA part number, Inspection number(\*1), RoHS Marking(\*2), Quantity etc ...

\*1) <Expression of Inspection No.>

$\square\square$  0000 XXX  
(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 (Δ)  
(1) (2)

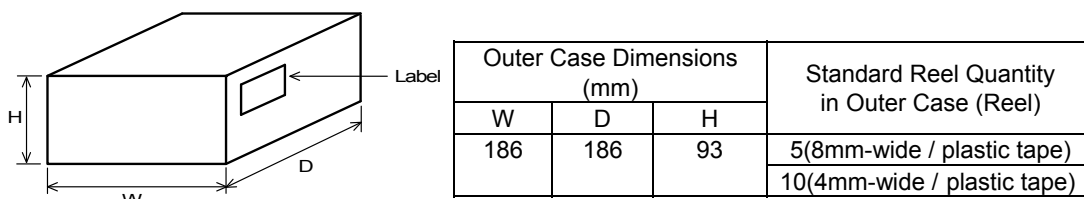
(1) RoHS regulation conformity parts.

(2) MURATA classification number

**10.7 Marking for Outside package (corrugated paper box)**

Customer name, Purchasing order number, Customer part number, MURATA part number, RoHS Marking (\*2), Quantity, etc ...

### 10.8 Specification of Outer Case



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

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

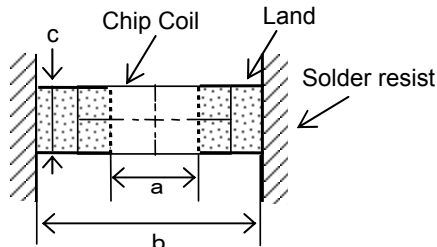
### 12. Notice

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.

#### 12.1 Land pattern designing



a	0.20
b	0.56
c	0.16

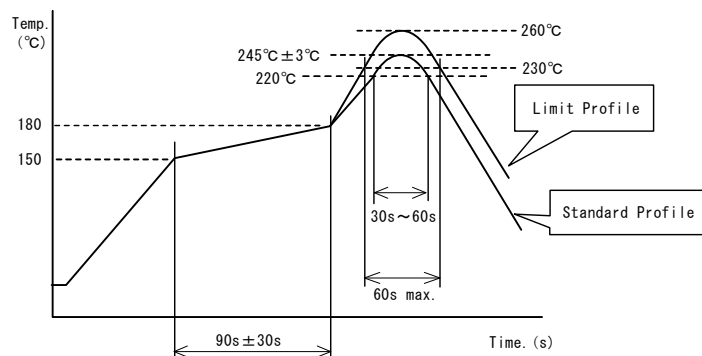
(in mm)

#### 12.2 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 : 50  $\mu$ m ~65  $\mu$ m.

**12.3 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. Cooling into solvent after soldering also should be in such a way that the temperature difference is limited to 100°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



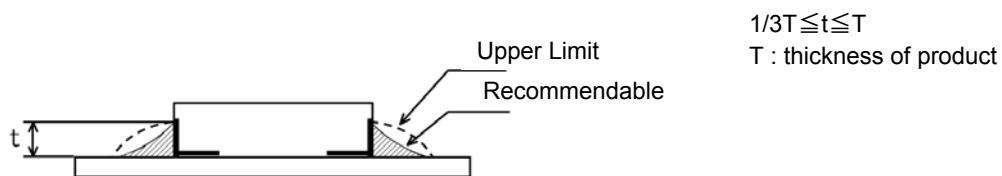
	Standard Profile	Limit Profile
Pre-heating	150°C~180°C , 90s±30s	
Heating	above 220°C, 30s~60s	above 230°C, 60s max.
Peak temperature	245°C±3°C	260°C, 10s
Cycle of reflow	2 times	2 times

**12.4 Reworking with soldering iron**

Reworking with soldering iron is disapproved.

**12.5 Solder Volume**

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



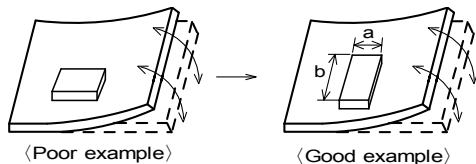
Accordingly increasing the solder volume, the mechanical stress to Chip is also increased. Exceeding solder volume may cause the failure of mechanical or electrical performance and become easy to tilt.

**12.6 Attention regarding P.C.B. bending**

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

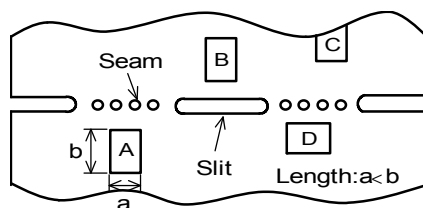
- (1) P.C.B. shall be designed so that products are not subject to the mechanical stress due to warping the board.

[Products direction]



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

- (2) Products location on P.C.B. separation



Products (A,B,C,D) shall be located carefully so that products are not subject to the mechanical stress due to warping the board. Because they may be subjected the mechanical stress in order of  $A > C > B \cong D$ .

**12.7 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.

**12.8 Resin coating**

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

**12.9 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.

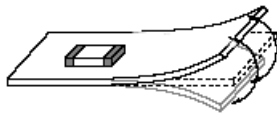
- (2) After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening screw to the substrate.

Excessive mechanical stress may cause cracking in the product.

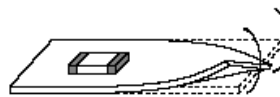
In case of the mounting on flexible PCB, there is a possibility of chip cracking caused by mechanical stress even from small bending or twisting.

When the flexible PCB is considered, please be sure to evaluate by yourself.

Bending



Twisting



## 12.10 Storage and Handling 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 : 30% to 70% 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

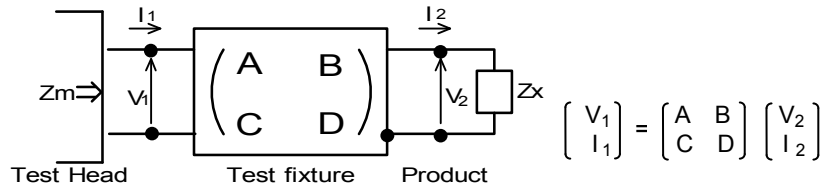
Care should be taken when transporting or handling product to avoid excessive vibration or mechanical shock.

## 13. ⚠ 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.

## &lt;Electrical Performance:Measuring Method of Inductance/Q&gt;

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



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

$$Z_m = \frac{V_1}{I_1}, \quad Z_x = \frac{V_2}{I_2}$$

(3) Thus, the relation between  $Z_x$  and  $Z_m$  is following;

$$Z_x = \alpha \frac{Z_m - \beta}{1 - Z_m \Gamma} \quad \text{where, } \alpha = D / A = 1$$

$$\beta = B / D = Z_{sm} - (1 - Y_{om} Z_{sm}) Z_{ss}$$

$$\Gamma = C / A = Y_{om}$$

$Z_{sm}$ :measured impedance of short chip  
 $Z_{ss}$ :residual impedance of short chip (0.110nH)  
 $Y_{om}$ :measured admittance when opening the fixture

(4)  $L_x$  and  $Q_x$  shall be calculated with the following equation.

$$L_x = \frac{\text{Im}(Z_x)}{2\pi f}, \quad Q_x = \frac{\text{Im}(Z_x)}{\text{Re}(Z_x)}$$

$L_x$  :Inductance of chip coil  
 $Q_x$ :Q of chip coil  
 $f$  :Measuring frequency