

SPECIFICATIONS

MULTILAYER CHIP INDUCTOR
FOR HIGH FREQUENCY

HK1608 TYPE SERIES

TAIYO YUDEN CO., LTD.
TAIYO YUDEN (GUANG DONG) CO., LTD.

DATE : 3. Feb. 2006

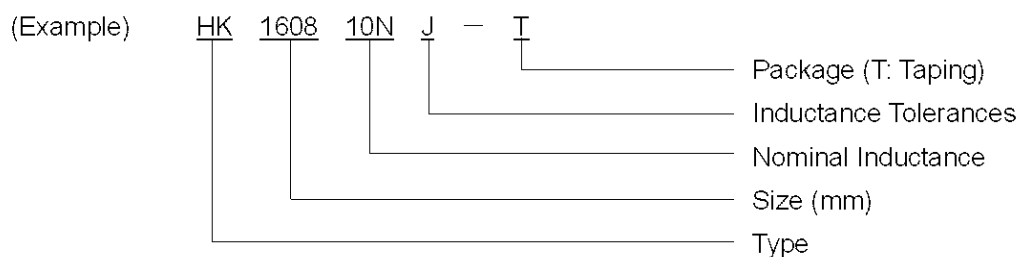
1. Scope

This specification applies to MULTILAYER CHIP INDUCTORS FOR HIGH FREQUENCY Taiyo Yuden Co., Ltd. delivers.

2. Ordering Codes and Product Name Format

2-1 The ordering codes of the products specified hereof shall be as shown in page 5.

2-2 Product Name Format



3. Appearance, Size and Dimensions

3-1 Appearance : No defects for practical use

3-2 Size and Dimensions : Conforms to Table 1 shown in page 2

4. Electrical Characteristics

Conforms to page 5. The measuring conditions for the characteristics shall conform to pages 3 to 4.

5. Tests

Conforms to Item 5.1 to Item 5.12 of pages 6 to 7.

6. Packaging and Marking

The products shall be packaged to be free from water absorption and damages and the following information shall be marked on each of packages.

6-1 Ordering codes or names shall conform to page 5.

6-2 Control No.

6-3 Manufacturer Name

7. Packaging

Taping specification shall conform to pages 8 to 9.

8. Testing Conditions

Unless otherwise specified, the temperature shall be 5°C to 35°C, the relative humidity shall be 45% to 85%, and the air pressure shall be 86kPa to 106kPa. If a question arises, the temperature shall be 20°C±2°C, the relative humidity shall be 60% to 70%, and the air pressure shall be 86kPa to 106kPa.

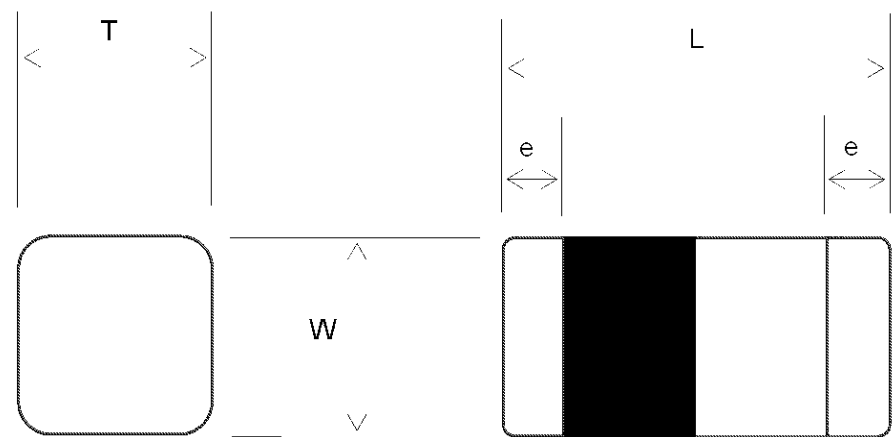
9. Cautions in Handling and in storage

Conforms to page 10.

※RoHS compliance

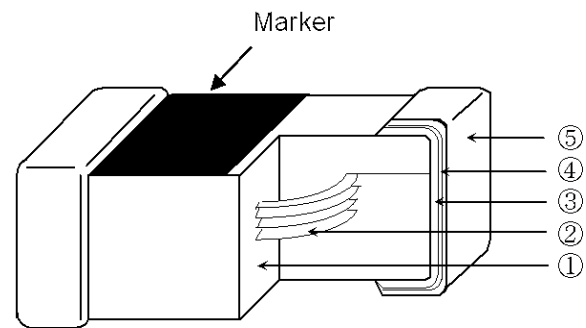
- This product conform to "RoHS compliance".
- "RoHS compliance" means that the product does not contain lead, cadmium, mercury, hexavalent chromium, PBB or PBDE referring to EU Directive 2002/95/EC, except other non-restricted substances or impurities which could not be technically removed at the refining process.

[1] Size, Dimensions and Materials



《Table 1》

Type	Dimensions and Tolerance (mm)			
	Length L	Width W	Thickness T	Electrode Width e
HK1608	1.6 ± 0.15	0.8 ± 0.15	0.8 ± 0.15	0.3 ± 0.2



《Table 2》

Name		Material
①	Ceramics	Dielectric glass ceramic
②	Internal Conductors	Ag
③	Terminal Electrodes (Base)	Ag
④	Terminal Electrodes (Plating)	Ni
⑤	Terminal Electrodes (Surface)	Sn

[2] Operating Temperature Range

-40℃ to +85℃

[3] Electrical Characteristics Measuring Method

3-1 Inductance and Q values

Equipment to be used : HP4195A

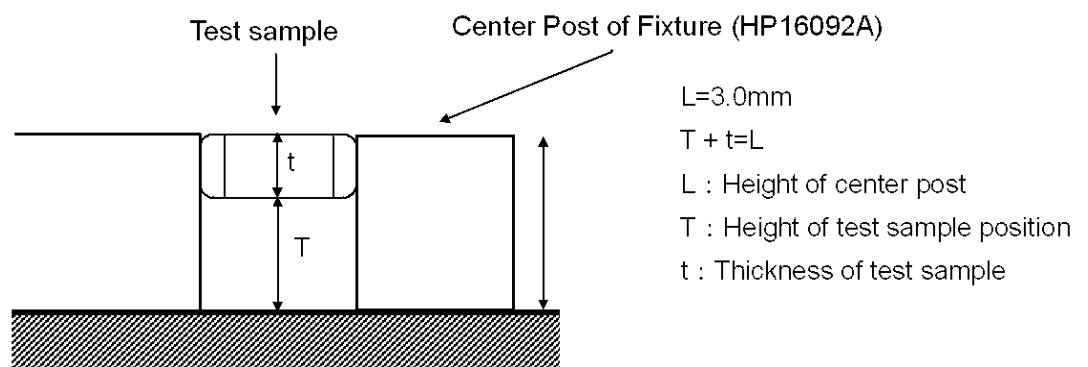
Test fixtures : HP16092A

Measuring method :

Measuring frequency shall be set as shown in table 3.

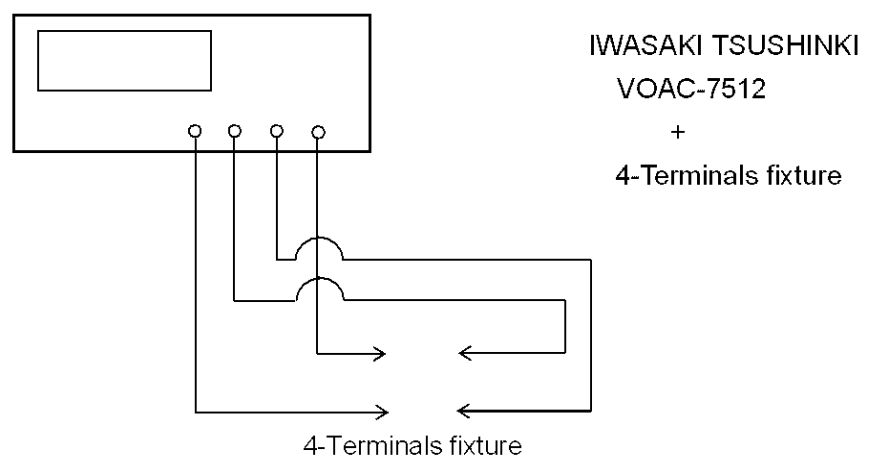
Test sample shall be set at the same height of center post and inductance and Q values shall be read.

Position of test sample



3-2 DC resistance

Circuits of equipment and instruments to be used.



Measuring method :

Test sample shall be set on 4-Terminals fixture.

The resistance value shall be read.

3-3 SRF (Self-resonant Frequency)

Equipment to be used : HP8719C

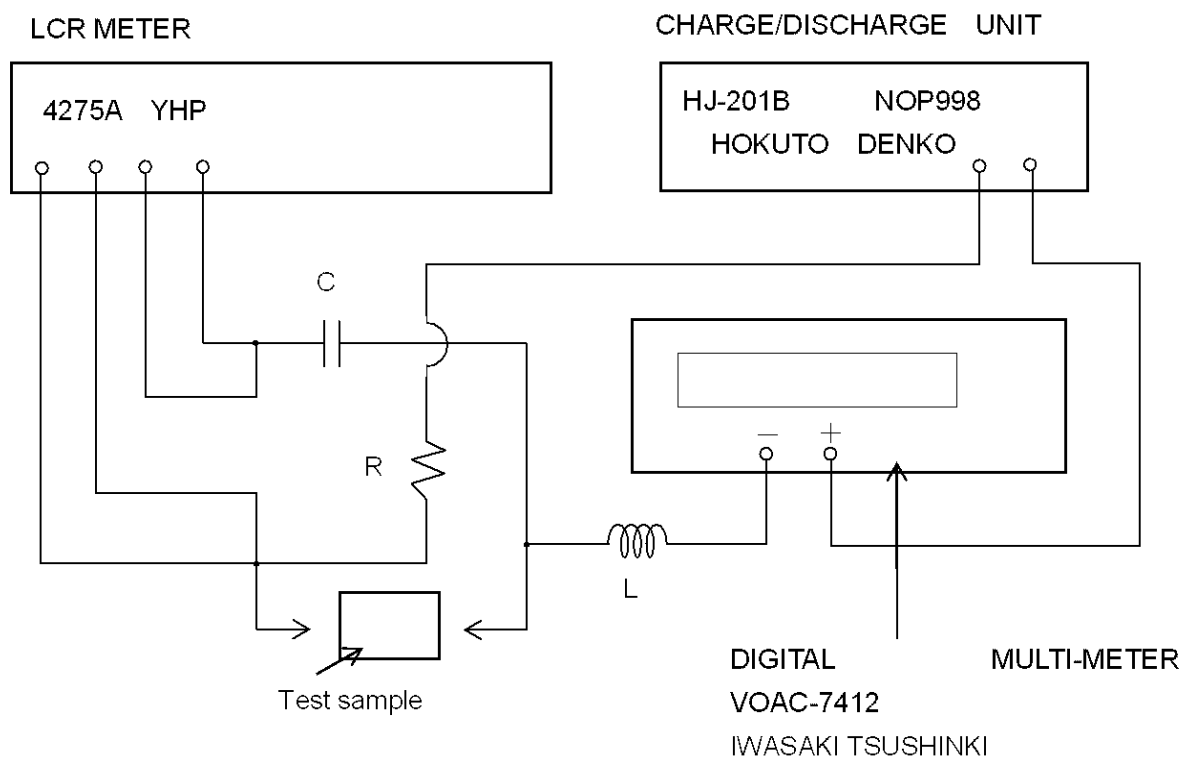
Measuring method :

S.R.F. shall be read from the impedance characteristics data measured by a network analyzer.

S.R.F. shall be the frequency indicated on this data where the difference between the inductive reactance and the capacitive reactance is zero.

3-4 IDC

Measuring circuit



Measuring method :

Measuring frequency 10MHz

The initial L value shall be measured under the above condition.

After the voltage of the DC power supply has been increased, the L (nH) value at respective currents at this time shall be "IDC".

Definition of IDC

The direct current is specified when the L (nH) value is reduced 5% in comparison to the initial L (nH) value or temperature rise of 20°C by application of direct current, whichever comes first.

[4] Electrical Characteristics

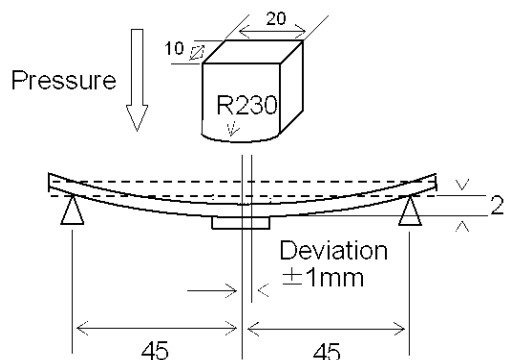
Table 3

Ordering Code	Thickness t (mm)	Inductance L (nH)	Tolerance	Q MIN	LQ Measuring Frequency (MHz)	Self-resonant Frequency SRF (MHz)	DC Resistance Rdc (Ω).	Rated current IDC (mA) max.
HK1608 1N0S-T	0.8+/-0.15	1.0	S	8	100	10000MIN	0.05MAX	300
HK1608 1N2S-T	0.8+/-0.15	1.2	S	8	100	10000MIN	0.05MAX	300
HK1608 1N5S-T	0.8+/-0.15	1.5	S	8	100	6000MIN	0.10MAX	300
HK1608 1N8S-T	0.8+/-0.15	1.8	S	8	100	6000MIN	0.10MAX	300
HK1608 2N2S-T	0.8+/-0.15	2.2	S	8	100	6000MIN	0.10MAX	300
HK1608 2N7S-T	0.8+/-0.15	2.7	S	10	100	6000MIN	0.10MAX	300
HK1608 3N3S-T	0.8+/-0.15	3.3	S	10	100	6000MIN	0.12MAX	300
HK1608 3N9S-T	0.8+/-0.15	3.9	S	10	100	6000MIN	0.14MAX	300
HK1608 4N7S-T	0.8+/-0.15	4.7	S	10	100	4000MIN	0.16MAX	300
HK1608 5N6S-T	0.8+/-0.15	5.6	S	10	100	4000MIN	0.18MAX	300
HK1608 6N8J-T	0.8+/-0.15	6.8	J	10	100	4000MIN	0.22MAX	300
HK1608 8N2J-T	0.8+/-0.15	8.2	J	10	100	3500MIN	0.24MAX	300
HK1608 10NJ-T	0.8+/-0.15	10.0	J	12	100	3400MIN	0.26MAX	300
HK1608 12NJ-T	0.8+/-0.15	12.0	J	12	100	2600MIN	0.28MAX	300
HK1608 15NJ-T	0.8+/-0.15	15.0	J	12	100	2300MIN	0.32MAX	300
HK1608 18NJ-T	0.8+/-0.15	18.0	J	12	100	2000MIN	0.35MAX	300
HK1608 22NJ-T	0.8+/-0.15	22.0	J	12	100	1600MIN	0.40MAX	300
HK1608 27NJ-T	0.8+/-0.15	27.0	J	12	100	1400MIN	0.45MAX	300
HK1608 33NJ-T	0.8+/-0.15	33.0	J	12	100	1200MIN	0.55MAX	300
HK1608 39NJ-T	0.8+/-0.15	39.0	J	12	100	1100MIN	0.60MAX	300
HK1608 47NJ-T	0.8+/-0.15	47.0	J	12	100	900MIN	0.70MAX	300
HK1608 56NJ-T	0.8+/-0.15	56.0	J	12	100	900MIN	0.75MAX	300
HK1608 68NJ-T	0.8+/-0.15	68.0	J	12	100	700MIN	0.85MAX	300
HK1608 82NJ-T	0.8+/-0.15	82.0	J	12	100	600MIN	0.95MAX	300
HK1608 R10J-T	0.8+/-0.15	100.0	J	12	100	600MIN	1.00MAX	300
HK1608 R12J-T	0.8+/-0.15	120.0	J	8	50	500MIN	1.20MAX	300
HK1608 R15J-T	0.8+/-0.15	150.0	J	8	50	500MIN	1.20MAX	300
HK1608 R18J-T	0.8+/-0.15	180.0	J	8	50	400MIN	1.30MAX	300
HK1608 R22J-T	0.8+/-0.15	220.0	J	8	50	400MIN	1.50MAX	300
HK1608 R27J-T	0.8+/-0.15	270.0	J	8	50	400MIN	1.90MAX	150
HK1608 R33J-T	0.8+/-0.15	330.0	J	8	50	350MIN	2.10MAX	150
HK1608 R39J-T	0.8+/-0.15	390.0	J	8	50	350MIN	2.30MAX	150
HK1608 R47J-T	0.8+/-0.15	470.0	J	8	50	300MIN	2.60MAX	150

※ Tolerance: J=±5%, S=±0.3nH

PACKING T (For taping)

[5] Chip Inductor Reliability Test

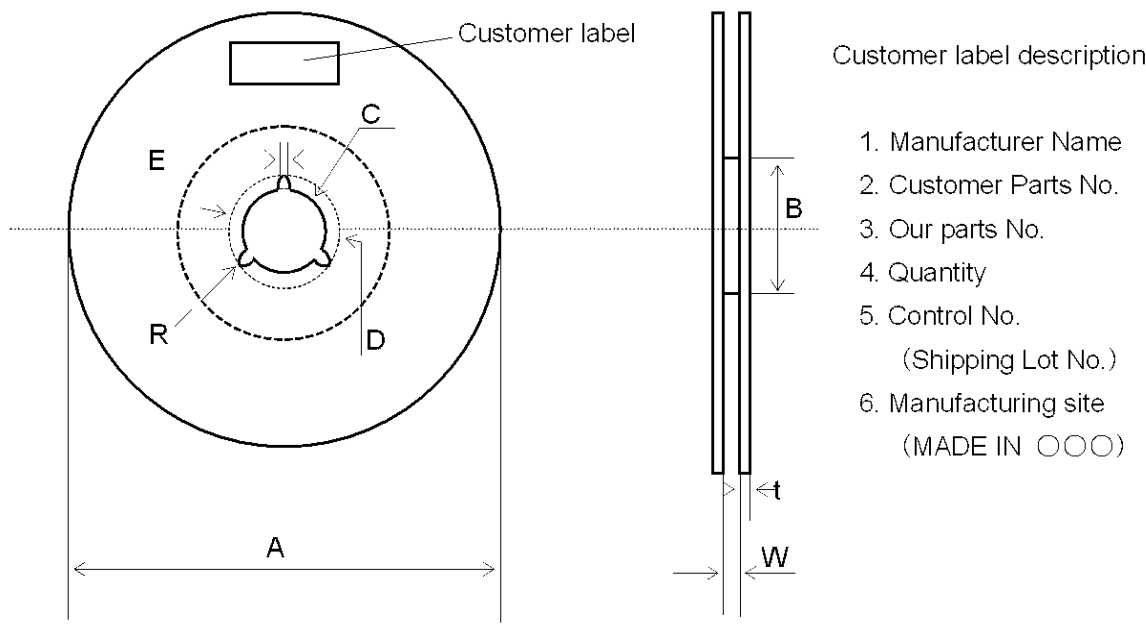
No.	Item	Specified Value	Testing Method
5.1	Bending Strength	No mechanical damage.	<p>Test sample shall be soldered to the printed circuit board shown in attached drawing 1 and a load is applied in the arrow direction until amount of deflection reaches to 2mm.</p>  <p style="text-align: right;">Unit [mm]</p>
5.2	Vibration Test	<p>No mechanical damage.</p> <p>Inductance change rate : Within $\pm 10\%$</p> <p>Q change rate : Within $\pm 20\%$</p>	<p>Test sample shall be soldered to the jig shown in Fig 2.</p> <p>Test conditions :</p> <p>Vibration frequency range : 10Hz to 55Hz</p> <p>Overall amplitude : 1.5mm</p> <p>Sweeping method : 10Hz to 55Hz to 10Hz for 1 min</p> <p>Each two hours in X, Y, Z direction : 6 hours in total</p>
5.3	Falling Test	<p>No mechanical damage.</p> <p>Inductance change rate : Within $\pm 10\%$</p> <p>Q change rate : Within $\pm 20\%$</p>	<p>Test sample shall be fallen spontaneously 10 times from a 1 meter high position onto a concrete floor.</p>
5.4	Resistance to Humidity	<p>No mechanical damage.</p> <p>Inductance change rate : Within $\pm 10\%$</p> <p>Q change rate : Within $\pm 20\%$</p>	<p>Test sample shall be kept in an atmosphere with temperature of $60^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and relative humidity of 90% to 95% for 500 ± 12 hours.</p> <p>After the test, test sample shall be kept at normal temperature with normal humidity for 2 to 3 hours. Then measurement shall be conducted.</p>
5.5	Heat Resistance Test	<p>No mechanical damage.</p> <p>Inductance change rate : Within $\pm 10\%$</p> <p>Q change rate : Within $\pm 20\%$</p>	<p>Test sample shall be kept in an atmosphere with temperature of $85^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 500 ± 12 hours.</p> <p>After the test, test sample shall be kept at normal temperature with normal humidity for 2 to 3 hours. Then measurement shall be conducted.</p>
5.6	Humidity Resistance Load Life Test	<p>No mechanical damage.</p> <p>Inductance change rate : Within $\pm 10\%$</p> <p>Q change rate : Within $\pm 20\%$</p>	<p>Test sample shall be soldered to the printed circuit board shown in attached drawing 2 and kept in atmosphere with temperature of $60^{\circ}\text{C} \pm 2^{\circ}\text{C}$ with relative humidity of 90% to 95% for 500 ± 12 hours while supplying the rated current.</p> <p>After the test, test sample shall be kept at normal temperature with normal humidity for 2 to 3 hours. Then measurement shall be conducted.</p>

[5] Chip Inductor Reliability Test

Chip Inductor Reliability Test																		
No.	Item	Specified Value	Testing Method															
5.7	High Temperature Load Life Test	No mechanical damage. Inductance change rate : Within±10% Q change rate : Within±20%	Test sample shall be soldered to the printed circuit board shown in attached drawing 2 and kept in atmosphere with temperature of 85℃±2℃ for 500±12 hours while supplying the rated current. After the test, test sample shall be kept at normal temperature with normal humidity for 2 to 3 hours. Then measurement shall be conducted.															
5.8	Coldness Resistance Test	No mechanical damage. Inductance change rate : Within±10% Q change rate : Within±20%	Test sample shall be kept in atmosphere with temperature of -40℃±2℃ for 500±12 hours. After the test, test sample shall be kept at normal temperature with normal humidity for 2 to 3 hours. Then measurement shall be conducted.															
5.9	Thermal Shock	No mechanical damage. Inductance change rate : Within±10% Q change rate : Within±20%	Test sample shall be soldered to the printed circuit board shown in attached drawing 2 and 5 cycles of test shall be conducted under the conditions shown below. After the test, test sample shall be kept at normal temperature with normal humidity for 2 to 3 hours. Then measurement shall be conducted. <table><tr><td>Step</td><td>Temperature</td><td>Time</td></tr><tr><td>1</td><td>-40℃±$\frac{0}{3}$℃</td><td>30min.±3min.</td></tr><tr><td>2</td><td>Normal temp</td><td>2min.~3min.</td></tr><tr><td>3</td><td>+85℃±$\frac{3}{0}$℃</td><td>30min.±3min.</td></tr><tr><td>4</td><td>Normal temp</td><td>2min.~3min.</td></tr></table>	Step	Temperature	Time	1	-40℃± $\frac{0}{3}$ ℃	30min.±3min.	2	Normal temp	2min.~3min.	3	+85℃± $\frac{3}{0}$ ℃	30min.±3min.	4	Normal temp	2min.~3min.
Step	Temperature	Time																
1	-40℃± $\frac{0}{3}$ ℃	30min.±3min.																
2	Normal temp	2min.~3min.																
3	+85℃± $\frac{3}{0}$ ℃	30min.±3min.																
4	Normal temp	2min.~3min.																
5.10	Resistance to Soldering Heat	No mechanical damage. Remaining terminal electrode : 70% min. Inductance change rate : Within±5%	Test sample shall be immersed in a methanol (JIS K1501) solution containing rosin (JIS K5902) (weight ratio 25%), preheated at 150℃ to 180℃ for 2 to 3 minutes and immersed into a solder hot melt (H60A or H63A specified in JIS Z3282) of 260℃±5℃ for 10±0.5 seconds.															
5.11	Solderability	More than 75% of terminal electrode shall be covered with fresh solder.	Flux: Methanol solution containing rosin (JIS K5902) (weight ratio 25%) Preheating: 150 to 180℃, 2 to 3 minutes [Eutectic solder] (JIS Z 3282 H60A or H63A) 230℃±5℃, 4±1 seconds [Pb-free solder] (Sn/3.0Ag/0.5Cu) 245℃±3℃, 4±1 seconds															
5.12	Temperature Characteristic	Inductance change rate : Within±10%	Measurement were taken in a temperature range of -30℃ to +85℃ and the value at +20℃ was the reference value.															

[6] Taping Specification

6-1 Marking and Dimensions of Reel

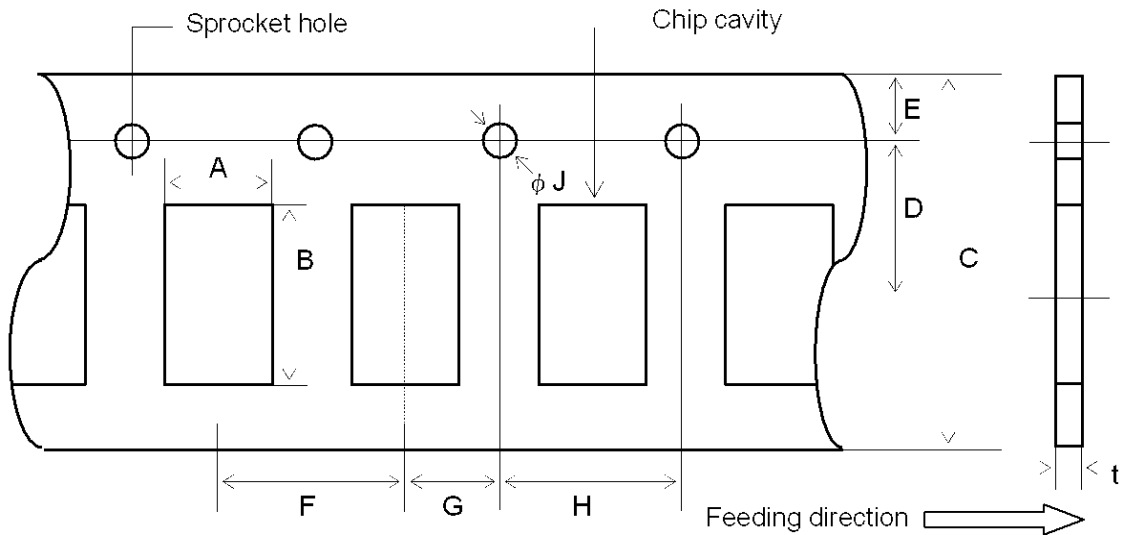


Code	ϕA	ϕB	ϕC	ϕD
Dimension	178 ± 2.0	50 min	13 ± 0.2	21 ± 0.8

Code	E	W	t	R
Dimension	2.0 ± 0.5	10 ± 1.5	2.5 max	1.0

Unit 【mm】

6-2 External Dimension of Paper Tape



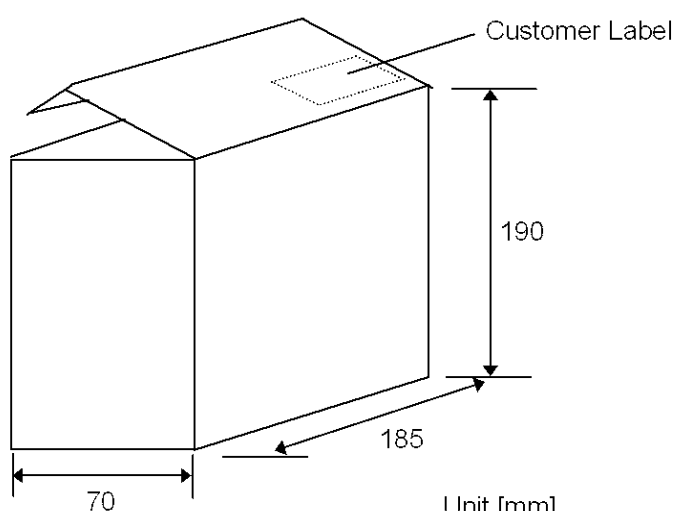
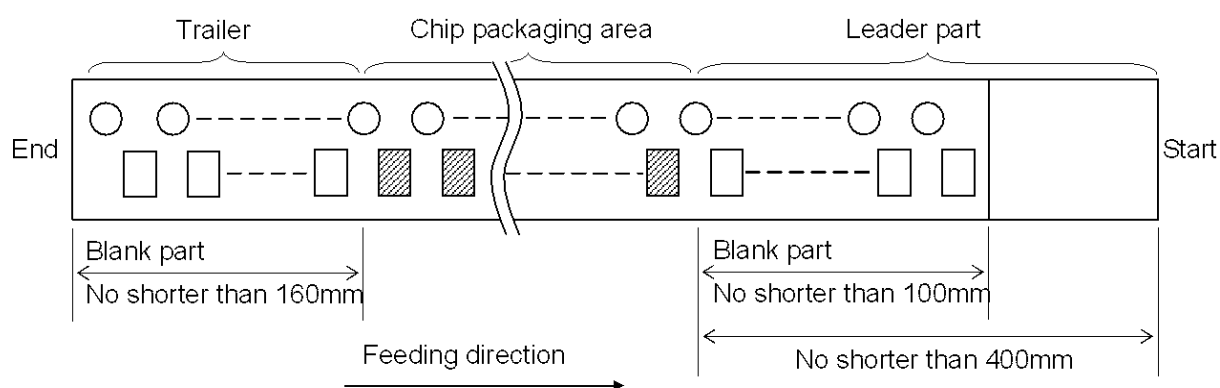
Code	A	B	C	D	E
Dimension	1.0 ± 0.2	1.8 ± 0.2	8.0 ± 0.3	3.5 ± 0.05	1.75 ± 0.1

Code	F	G	H	ϕJ	t
Dimension	4.0 ± 0.1	2.0 ± 0.05	4.0 ± 0.1	$1.5 \begin{smallmatrix} +0.1 \\ -0 \end{smallmatrix}$	1.1 max

※A, B, t : Sufficient clearance.

Unit 【mm】

6-3 Packaging



Customer label description

1. Manufacturer Name
2. Customer Parts No.
3. Our parts No.
4. Quantity
5. Control No.
- ※ (Shipping Lot No.)
6. Manufacturing site
(MADE IN ○○○)

Unit [mm]
(The size is only for reference.)

- To attach labels means that all products are passed.

※Control No.

We control our products by control number and shipping lot number is not marked on customer label.
Shipping lot number is marked on our control label.
Shipping lot number is traceable from our Control number marked on customer label.

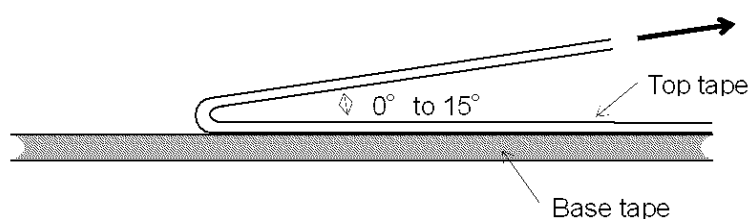
6-4 Quantity of taping package

TYPE	Thickness T	1 reel	1 carton box
HK1608	0.80mm	4,000 / reel	20,000 / 5 reels

6-5 The tensile strength of the tape is 5N or over.

6-6 Top tape strength

Top tape requires peeling strength of 0.1N to 0.7N in the arrow direction as shown below.



[7] Cautions in Handling for Mounting

Before soldering, preheating shall be conducted.

When installing a printed circuit board on the set after inductors are mounted, these inductors shall be free from a residual stress due to overall deflection of the printed circuit board or partial deflection resulting from tightening of screws.

At soldering, please take care the solder is not excessively put on the electrode of the inductor.

In case solder is too much put on the electrode, excessive stress is applied to the inductor, and it may damage the inductor.

Rosin-type flux shall be used and highly acidic flux (any containing a minimum of 0.2wt% chlorine) shall not be used.

[8] Cautions in Handling

- Sets of tweezers made of non-magnetic material such as titanium shall be used.
- Soldering irons and measuring equipments shall be grounded.
- The electrodes of inductors or the conductive parts which conduct to these electrodes shall be protected from direct touch of bare hands or ambient metallic items (steel desk or the like).
- The inductors shall be kept away from the objects such as speakers, coils, etc. which generate a magnetic field.
- Note that the inductor should not be exposed to static electricity.

[9] Cautions for storage

To maintain the solderability of terminal electrodes and to keep the packaging material in good condition, care must be taken to control temperature and humidity in the storage area.

Humidity should especially be kept as low as possible.

Recommended conditions

Ambient temperature Below 40°C

Humidity Below 70%RH

The ambient temperature must be kept below 30°C. Even under ideal storage conditions inductor electrode solderability decreases as time passes, so inductors should be used within 6 months from the time of delivery.

If exceeding the above period, please check solderability before using the inductors.

The packaging material should be kept where no chlorine or sulfur exists in the air.

[10] Cautions on cleaning

Freon, Chlorosen, Triclen, Alcohol, etc. are used as solvent of cleaning process.

However, some of them are restricted due to negative influence to human body and/or destruction of the environment.

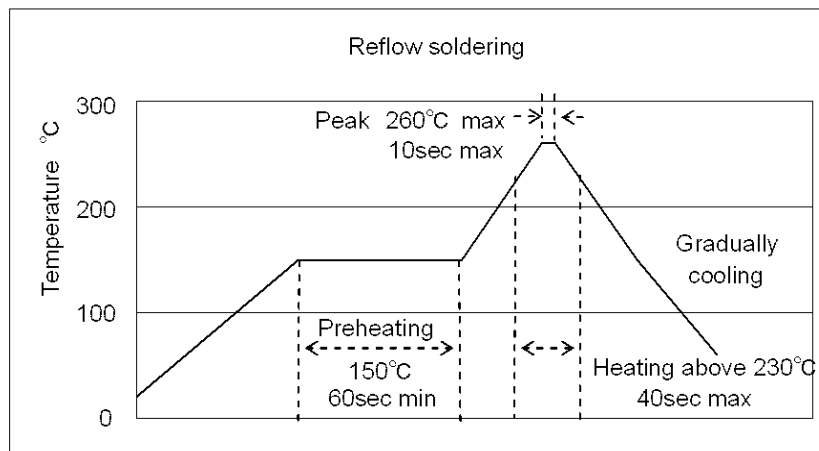
Solvent shall be selected with care. Effect to the other parts shall be considered at cleaning.

[11] Manufacturing factory

TAIYO YUDEN CO., LTD. / JAPAN

TAIYO YUDEN (GUANG DONG) CO., LTD. / CHINA

Recommended Soldering Profiles for Lead-free Solder Paste



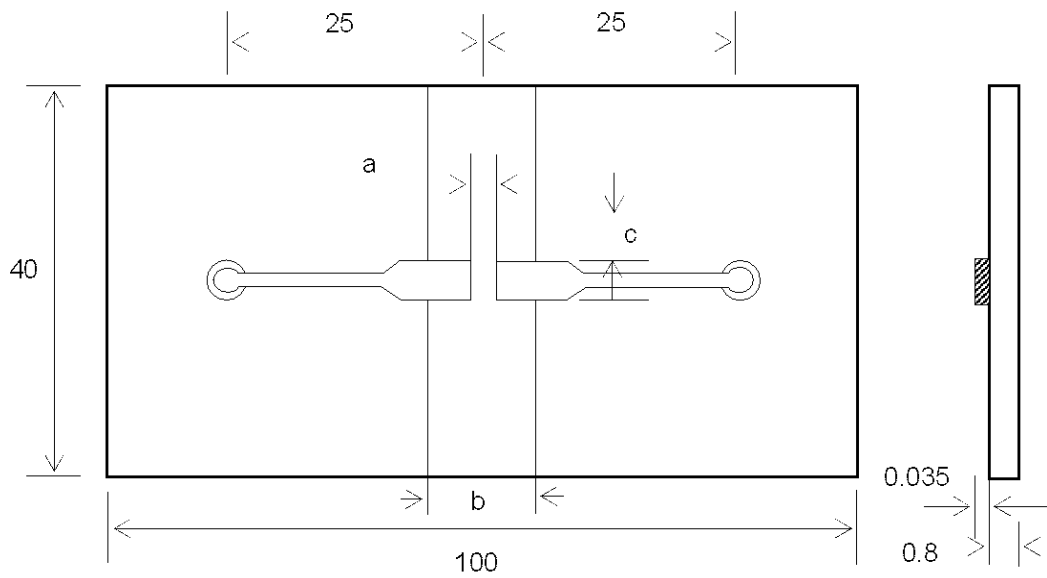
※Components should be preheated to within 100 to 130°C from soldering temperature.

※Assured to be reflow soldering for 2 times.

Note: The above profiles are the maximum allowable soldering condition, therefore these profiles are not always recommended.

Not recommended soldering condition	Recommended soldering condition

Attached Drawing 1
Printed circuit board for Bending Strength Test



Unit 【mm】

Specification
Glass cloth-based epoxy resin
Type GE 4 specified in JIS C6484
Thickness : 0.8mm

Chip Size	a	b	c
1.6×0.8	1.0	3.0	1.2

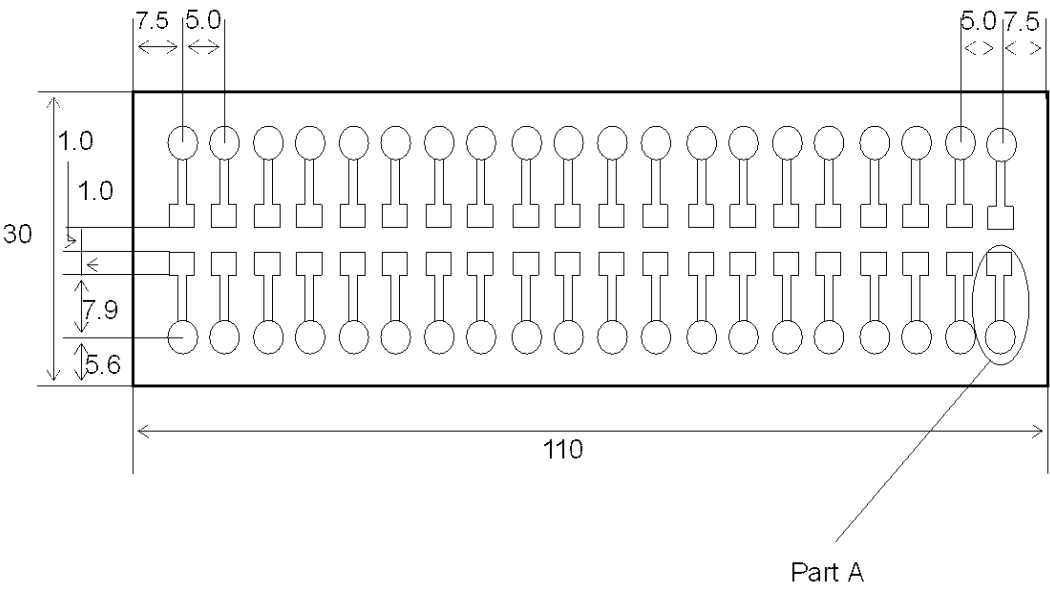
Unit 【mm】

Attached Drawing 2

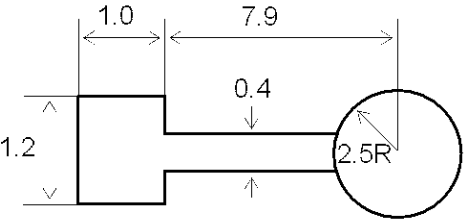
Printed circuit board for reliability test

Material : Glass epoxy

Thickness : 1.6mm

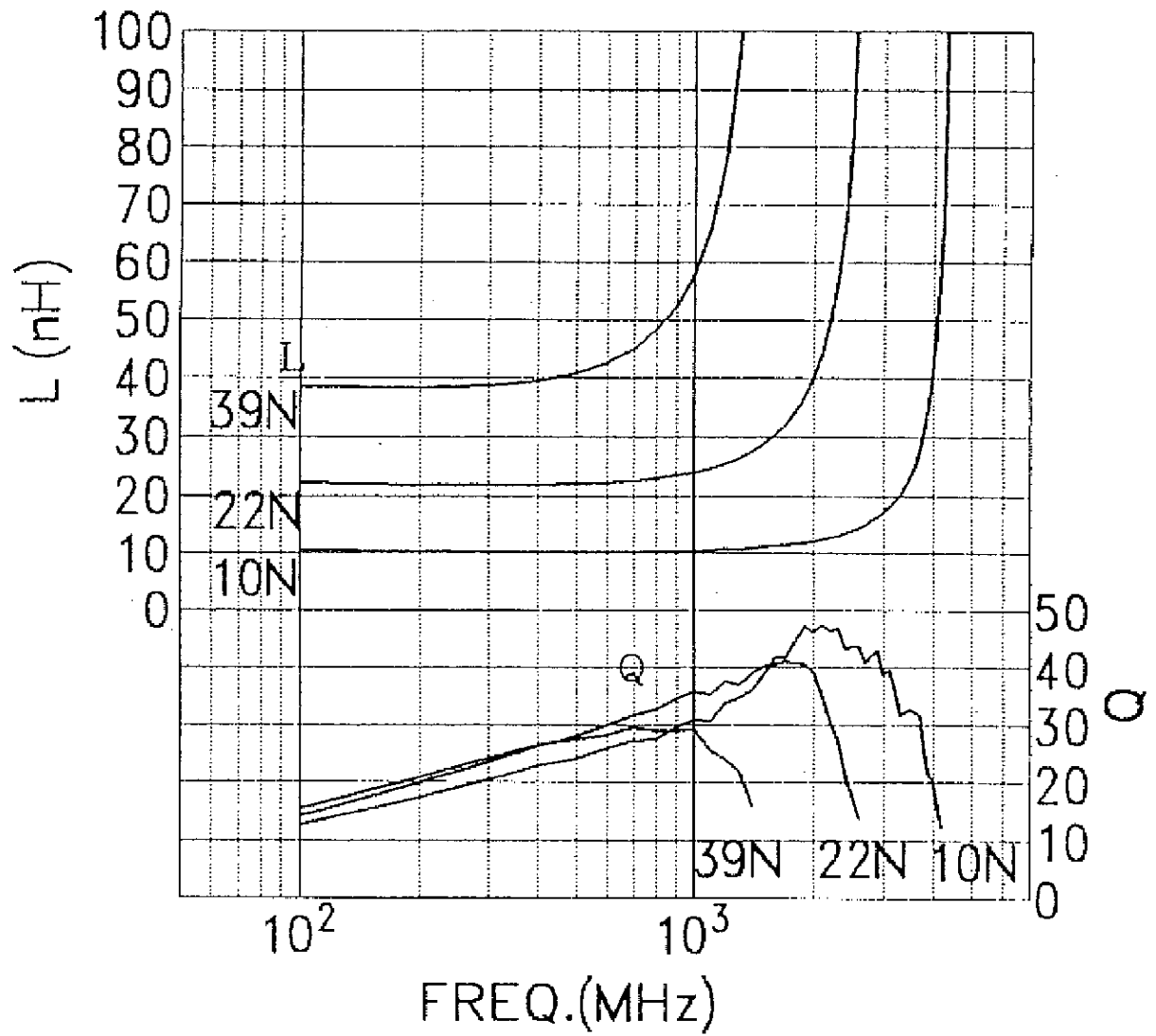


Part A

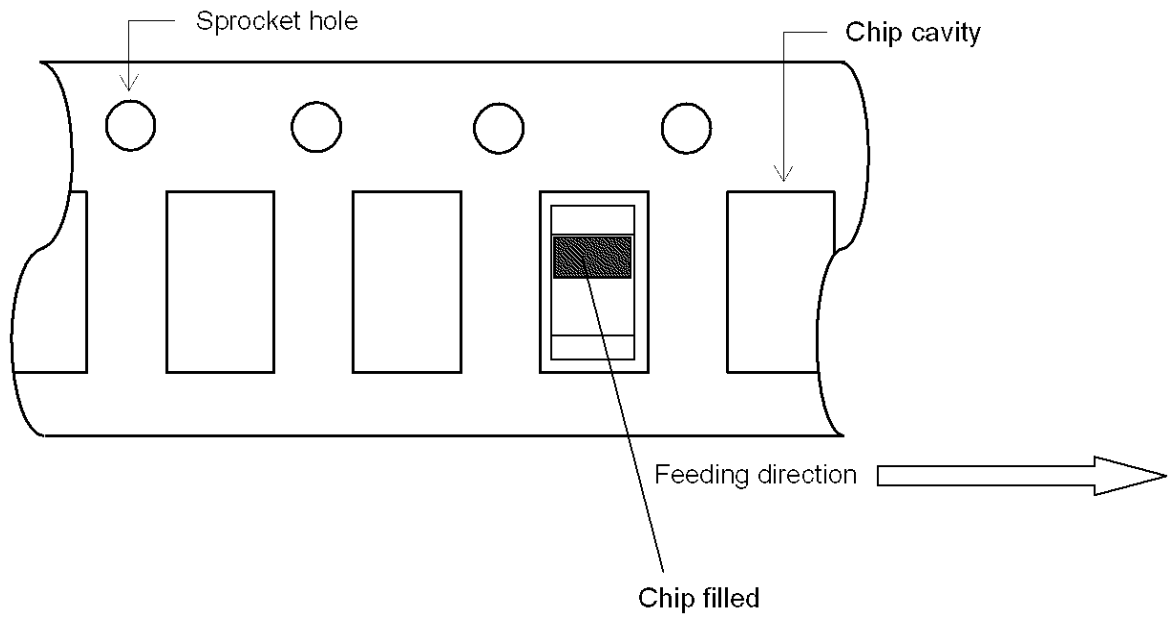


Unit 【mm】

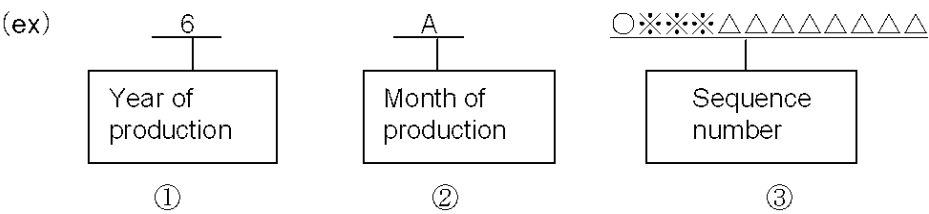
HK1608 FREQUENCY CHARACTERISTICS



All markings are in the side of sprocket holes



Composition of the shipping lot number



- ①Year of production (The last numeral of the Christian era. 2006year → 6)
- ②Month of production (It is due to the table below.)
- ③Sequence number is alphanumeric including space.

month	1	2	3	4	5	6	7	8	9	10	11	12
symbol	A	B	C	D	E	F	G	H	J	K	L	M

Operating conditions for guarantee of this product are as shown in the specification.
Please note that Taiyo Yuden Co., Ltd. shall not be responsible for a failure and/or abnormality which are caused by use under the conditions other than the aforesaid operating conditions.

This product is developed, designed and intended for use in general electronics equipments. (for AV, household, office supply, information service, telecommunications, etc.). Before incorporating the components into any equipments in the field such as aerospace, aviation, nuclear control, submarine, transportation, (automotive driving and control, passenger protection, train control, ship control), transportation signal, disaster prevention, medical, public information network etc.

where higher safety and reliability are especially required, please contact Taiyo Yuden Co., Ltd. for more detail in advance.

And before incorporating the components or devices into the equipments not mentioned in the above, if there is possibility of direct damage or injury to human body, please contact Taiyo Yuden Co., Ltd. for more detail in advance.