Ver.1.01

SPECIFICATION

SMD INDUCTOR

NRS4012 TYPE

Magnetic Shielded Type

TAIYO YUDEN

(1 / 1 3)	Specifications	
	NRS4012 TYPE	

1. Range of application

This specifications are applied to SMD Inductor, NRS4012.

2. Ordering code

Example : NRS (1) 4012 (2) T (3) 100 (4) M (5) □□□ (6)

(1) Type
(2) External dimensions
(3) Packing style (T: Tape & Reel)
(4) Inductance
(5) Inductance tolerance
(6) Internal Code

3. Standard measuring method

Inductance	:	LCR meter	(HP 4285A or equivalent, 100kHz, 1V)
Self-resonant frequency	:	Impedance/Material Analyzer	(HP 4291A or equivalent)
DC resistance	:	DC Ohmmeter	(HIOKI 3227 or equivalent)

Standard test conditions for electrical characteristics
Unless otherwise specified, temperature is at 20±15 deg C and humidity is at 65±20 %.
Should any doubt arise about the test results, further test shall be conducted at a temperature 20±2 deg C and humidity 65±5 %.
For inductance, our measured values shall be standard.

4. Operating temperature range

-25 deg C to +125 deg C (Including self-heating)

5. Storage temperature range

-40 deg C to + 85 deg C (For products in unopened tape package, -5 to 40 deg C)

6. Electrical characteristics

Refer to table 1.

7. External dimensions and structural drawing

Refer to Table 2.

8. Mechanical performance

Refer to Table 3.

9. Environment test performance specifications

Refer to Table 3.

10. Tape and Reel packaging dimensions

Refer to Table 4.

11. Packing form

Refer to Table 5.

12. Reflow profile chart

Refer to Table 6.

Table 1

ELECTRICAL CHARACTERISTICS

Ordering Code	Inductance Symbol	Nominal Inductance [μH]	Inductance Tolerance [%]	D.C. Resistance ±20% [Ω]	Rated Current [mA]		Self-resonant Frequency Min [MHz]
					Saturation Current Idc1	Temperature Rise current Idc2	
NRS4012T 1R0NDGG	A	1.0	±30	0.042	2800	2200	100
NRS4012T 2R2MDGJ	C	2.2	±20	0.060	1650	1900	70
NRS4012T 3R3MDGJ	E	3.3	±20	0.070	1400	1700	60
NRS4012T 4R7MDGJ	H	4.7	±20	0.095	1200	1500	45
NRS4012T 6R8MDGJ	I	6.8	±20	0.125	900	1300	35
NRS4012T 100MDGJ	K	10	±20	0.170	800	1100	30
NRS4012T 150MDGJ	M	15	±20	0.260	650	750	24
NRS4012T 220MDGJ	N	22	±20	0.400	500	620	18

*) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20 deg C)

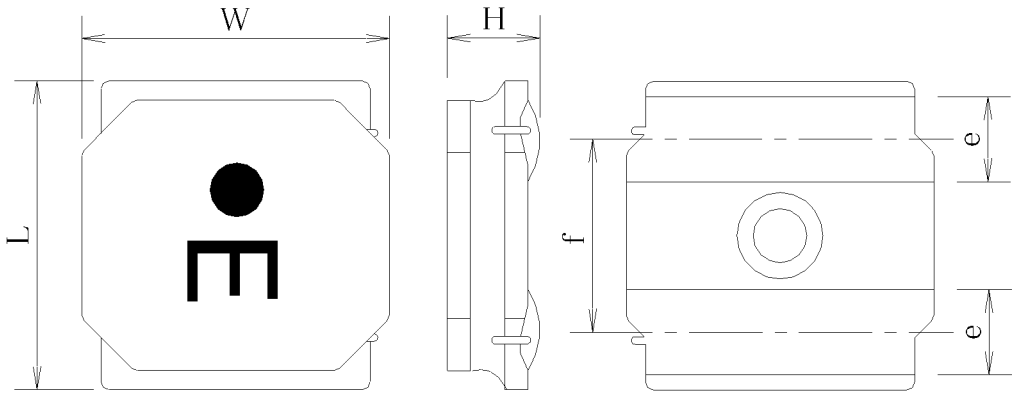
*) The temperature rise current value (Idc2) is the DC current value having temperature increase up to 40℃.(at 20 deg C)

*) The rated current is the DC current value that satisfies both of current saturation current value and temperature rise current value.

Table 2

EXTERNAL DIMENSIONS AND STRUCTURAL DRAWING

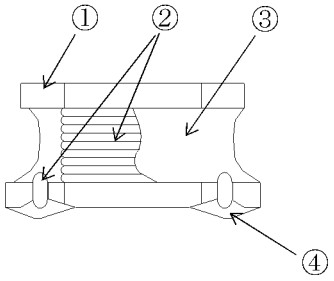
1. External dimensions



Description	Mark	Dimensions
Length	L	4.0±0.2
Width	W	4.0±0.2
Height	H	1.2Max.
Width of Electrode	e	1.1±0.2
Space between electrodes	f	2.5±0.2

(Unit: mm)

2. Structural drawing



(Magnetic Shielded Type)

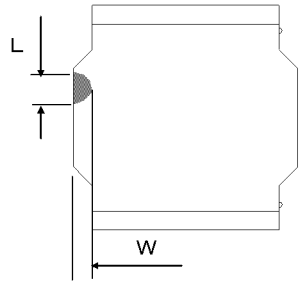
① Ferrite core	Ni－Zn ferrite	
② Winding wire	Polyurethane-copper wire	
③ Over-coating resin	Epoxy resin, containing ferrite powder	
④ Electrode	External electrode (substrate)	Ag
	External electrode (base plating)	Ni－Sn
	External electrode (top surface solder coating)	Sn－Ag－Cu

Table 2

APPEARACE TOLERANCE LIMIT AND PRODUCT MARKING

3. Core chipping

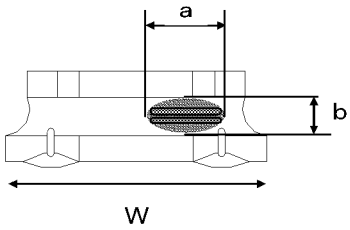
The appearance standard of the chipping size in top side, of bottom side ferrite core is following dimension.



L	W
1.0mmMax.	1.0mmMax.

4. Exposed wire tolerance limit of coating resin part on product side

Size of exposed wire occurring to coating resin is specified below.



① Width direction(dimension a) : Acceptable when a<=w/2
Nonconforming when a>w/2

② Length direction (dimension b) : Dimension b is not specified.

③ When total area of exposed wire occurring to each sides is not greater than 50% of coating resin area, that is acceptable.

5. External appearance criterion for exposed wire

Exposed end of the winding wire at the secondary side should be 2mm and below.

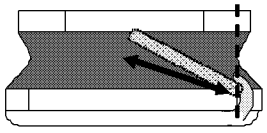
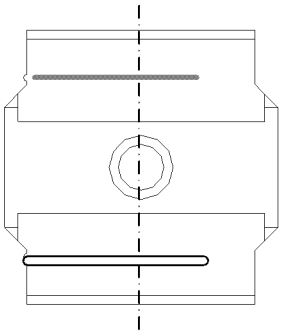


Table 2

APPEARACE TOLERANCE LIMIT AND PRODUCT MARKING

6. Electrode appearance criterion for exposed wire



<Cross section of wire joint part>

Only top side of wire is exposed.
(Regardless of whole tope side of wire exposed)

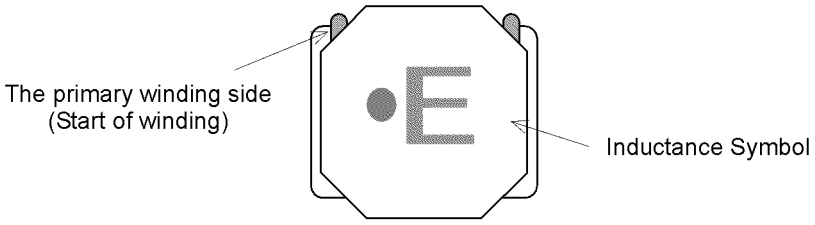
<Appearance judgment>

Conforming

Wire is soldered insufficiently and less than half of outer diameter is covered with solder.

Less than 1/2 of joint side length.
(More than 1/2 is selected as defect

7. Product Marking



The left side of the position of the marking is the primary winding side (start of winding).

(6 / 1 3)	Table 3 MECHANICAL PERFORMANCE / ENVIRONMENTAL TEST PERFORMANCE SPECIFICEATIONS	

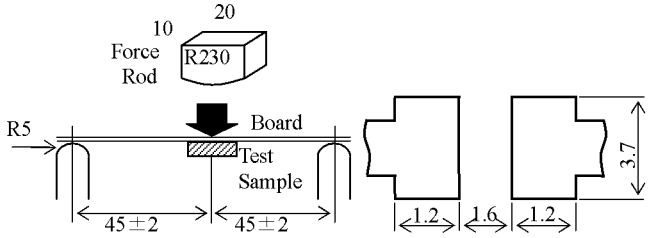
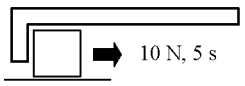
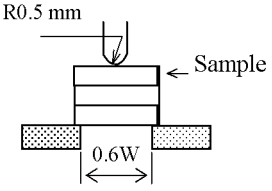
	Test Item	Standard	Test method
ELECTRICAL CHARACTERISTICS	Inductance	Refer to Table 1.	LCR meter (HP4285A or equivalent)
	DC resistance	Refer to Table 1.	DC ohm meter (HIOKI3227 or equivalent)
	Rated current	Refer to Table 1.	Maximum DC value that does not cause inductance to decrease more than 30% with DC bias and does not cause temperature to increase by more than 40 deg C.
	Self resonant frequency	Refer to Table 1.	Impedance/material analyzer (HP4291A or equivalent)
MECHANICAL CHARACTERISTICS	Resistance to deflection	No damage.	The test samples shall be soldered to the test board by the reflow soldering conditions show in Table 6. As illustrated below, apply force in the direction of the arrow indicating until deflection of the test board reaches to 2 mm.  Land dimensions Test board size : 100×40×1.0 Test board material: glass epoxy-resin Solder cream thickness: 0.15 Unit: mm
	Adhesion of Terminal electrode	Shall not come off PC board	The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6.  Applied force: 10 N to X and Y directions. Duration: 5 s. Solder cream thickness: 0.15 mm (Refer to recommended Land Pattern Dimensions defined in "Precaution")
	Body strength	No damage.	Applied force: 30 N Duration: 10 s 

Table 3

MECHANICAL PERFORMANCE / ENVIRONMENTAL TEST PERFORMANCE SPECIFICEATIONS

<table>
<tr><th></th><th>Test Item</th><th>Standard</th><th>Test method</th></tr>
<tr><td rowspan="6">ENVIRONMENT TESTS</td><td>Resistance to vibration</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. Then it shall be submitted to below test conditions.
<table>
<tr><td>Frequency range</td><td>10Hz ～55 Hz</td></tr>
<tr><td>Total Amplitude</td><td>1.5 mm （May not exceed acceleration 196 m/S^2）</td></tr>
<tr><td>Sweeping Method</td><td>10Hz to 55Hz to 10 Hz for 1 min.</td></tr>
<tr><td>Time</td><td>For 2 hours on each X, Y, and Z axis.</td></tr>
</table></td></tr>
<tr><td>Resistance to soldering heat (Reflow)</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test sample shall be exposed to reflow oven at 230±5 deg C for 40 seconds, with peak temperature at 260±5 deg C for 5 seconds, 2 times.

Test board thickness: 1.0 mm
Test board material: glass epoxy-resin</td></tr>
<tr><td>Solderability</td><td>At least 90 % of surface of terminal electrode is covered by new solder.</td><td>The test samples shall be dipped in flux, and then immersed in molten solder as shown in below table.
Flux: Methanol solution containing rosin 25 %.
<table>
<tr><td>Solder Temperature</td><td>245±5 deg C</td></tr>
<tr><td>Time</td><td>5±1.0 s.</td></tr>
<tr><td>Immersing Speed</td><td>25 mm/s</td></tr>
</table></td></tr>
<tr><td>Temperature characteristics</td><td>ΔL/L : within±20 %
No abnormality observed in appearance.</td><td>Measurement of inductance shall be taken at temperature range within -25 deg C to +85 deg.
With reference to inductance value at +20 deg, change rate shall be calculated.</td></tr>
<tr><td>Thermal shock</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6.
The test samples shall be placed at specified temperature for specified time by step 1 to step 4 as shown in below table in sequence.
The temperature cycle shall be repeated 100 cycles.

Conditions of steps for 1 cycle
<table>
<tr><th>Step</th><th>Temperature</th><th>Time (min)</th></tr>
<tr><td>1</td><td>-40±3 de C</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp.</td><td>3 maximum</td></tr>
<tr><td>3</td><td>85±2 deg C</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp</td><td>3 maximum</td></tr>
</table></td></tr>
<tr><td>Low temperature life test</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6.
After that, the test samples shall be placed at test conditions as shown in below table.
<table>
<tr><td>Temperature</td><td>-40±2 deg C</td></tr>
<tr><td>Time</td><td>500 +24/-0 h</td></tr>
</table></td></tr>
</table>

Table 3

MECHANICAL PERFORMANCE / ENVIRONMENTAL TEST PERFORMANCE SPECIFICEATIONS

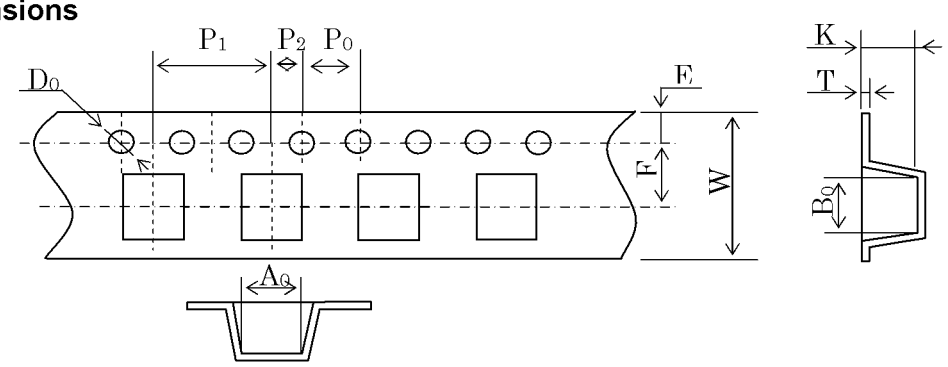
<table>
<tr><th></th><th>Test Item</th><th>Standard</th><th>Test method</th></tr>
<tr><td rowspan="3">ENVIRONMENT TESTS</td><td>Loading at high temperature life test</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6.
The test samples shall be placed in thermostatic oven set at specified temperature and applied the rated current continuously as shown in below table.
<table><tr><td>Temperature</td><td>85±2 deg C</td></tr><tr><td>Applied current</td><td>Rated current
(Refer to Table 1)</td></tr><tr><td>Time</td><td>500 +24/-0 h</td></tr></table></td></tr>
<tr><td>Damp heat life test</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6.
The test samples shall be placed in thermostatic oven set at specified temperature and humidity as shown in below table.
<table><tr><td>Temperature</td><td>60±2 deg C</td></tr><tr><td>Humidity</td><td>90～95 %RH</td></tr><tr><td>Time</td><td>500 +24/-0 h</td></tr></table></td></tr>
<tr><td>Loading under damp heat life test</td><td>ΔL/L : within±10 %
No abnormality observed in appearance.</td><td>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6.
The test samples shall be placed in thermostatic oven set at specified temperature and humidity and applied the rated current continuously as shown in below table.
<table><tr><td>Temperature</td><td>60±2 deg C</td></tr><tr><td>Humidity</td><td>90～95 %RH</td></tr><tr><td>Applied current</td><td>Rated current
(Refer to Table 1)</td></tr><tr><td>Time</td><td>500 +24/-0 h</td></tr></table></td></tr>
</table>

Standard measuring condition	Unless otherwise specified, the test samples are placed at room temperature and humidity and measured within 48 hours after exposure to test conditions.

Table 4

TAPE & REEL PACKAGING DIMENSIONS

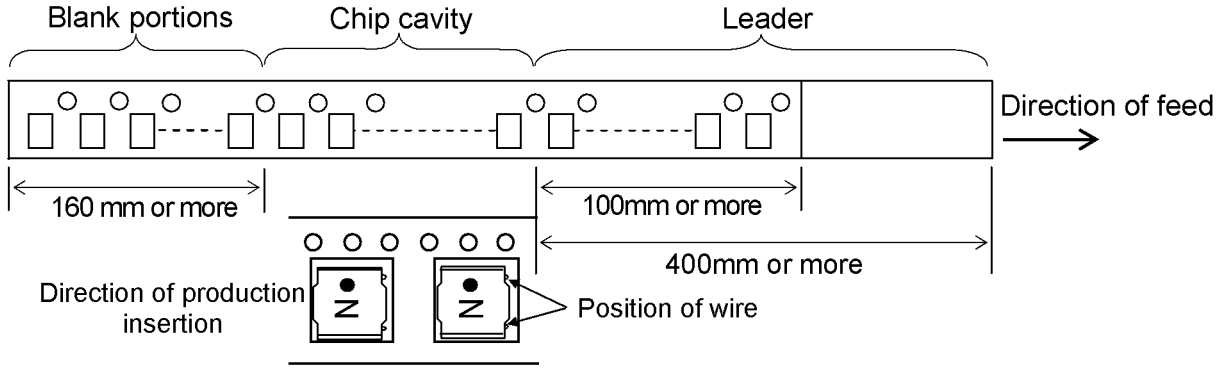
1. Dimensions



Unit: mm

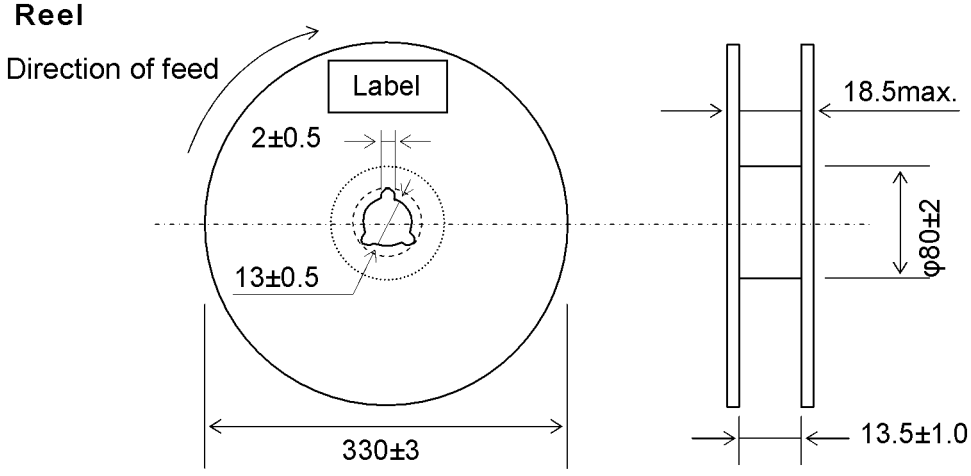
A_0	B_0	W	F	E	P_1	P_2	P_0	D_0	T	K
4.3 ±0.1	4.3 ±0.1	12.0 ±0.3	5.5 ±0.1	1.75 ±0.1	8.0 ±0.1	2.0 ±±0.1	4.0 ±0.1	φ1.5 +0.1 −0	0.3 ±0.05	1.6 ±0.1

2. Direction of rolling



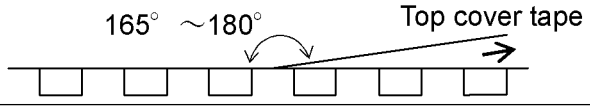
3. Reel

Unit: mm



Label position: On the opposite side of sprocket holes side of reel

4. Top tape strength



Peel-off strength : 0.1 N～1.3 N
Peel-off angle : 165° ～180°
Peel-off speed : 300 mm/min

(10 / 13)	Table 5	
	PACKING FORM	

1. The number of components

A tape & reel package contains 4500 inductors.

2. Tape and Reel

Emboss carrier tape: 12mm-width and 8 mm-pitch
Reel: 330 mm-diameter

3. The allowable number of empty chip cavities

Maximum two (2) chip cavities missing product may exist in a reel but they may not be consecutive two cavities.

4. Marking

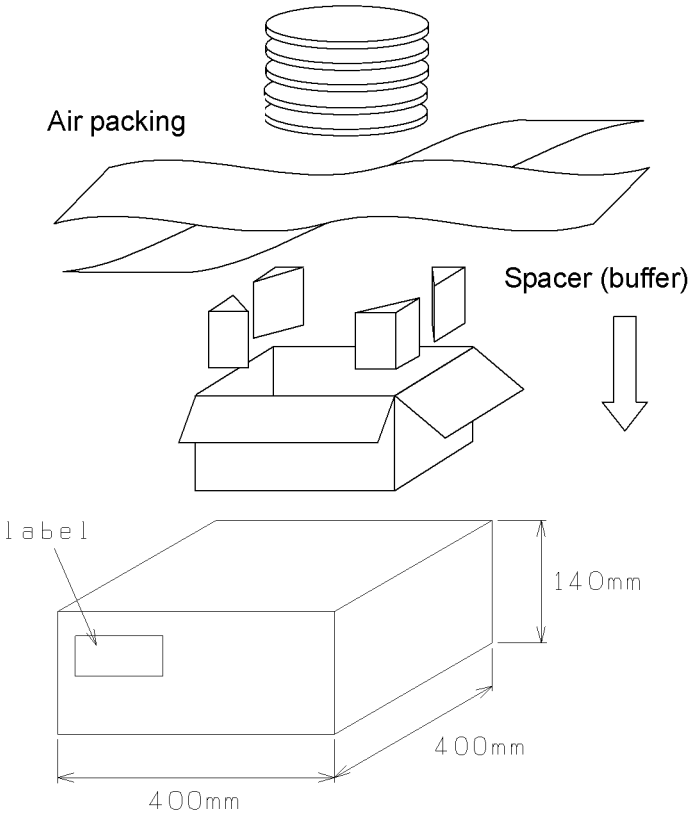
The following items shall be marked legibly on per tape & reel package.

(1) Customer part No.
(2) Our part No.
(3) Supplier name (Taiyo Yuden Co., Ltd.)
(4) Control No.
(5) Date (stamp)
(6) Quantity
(7) Country of the origin

5. Dimensions of packing box (for Tape & Reel package)

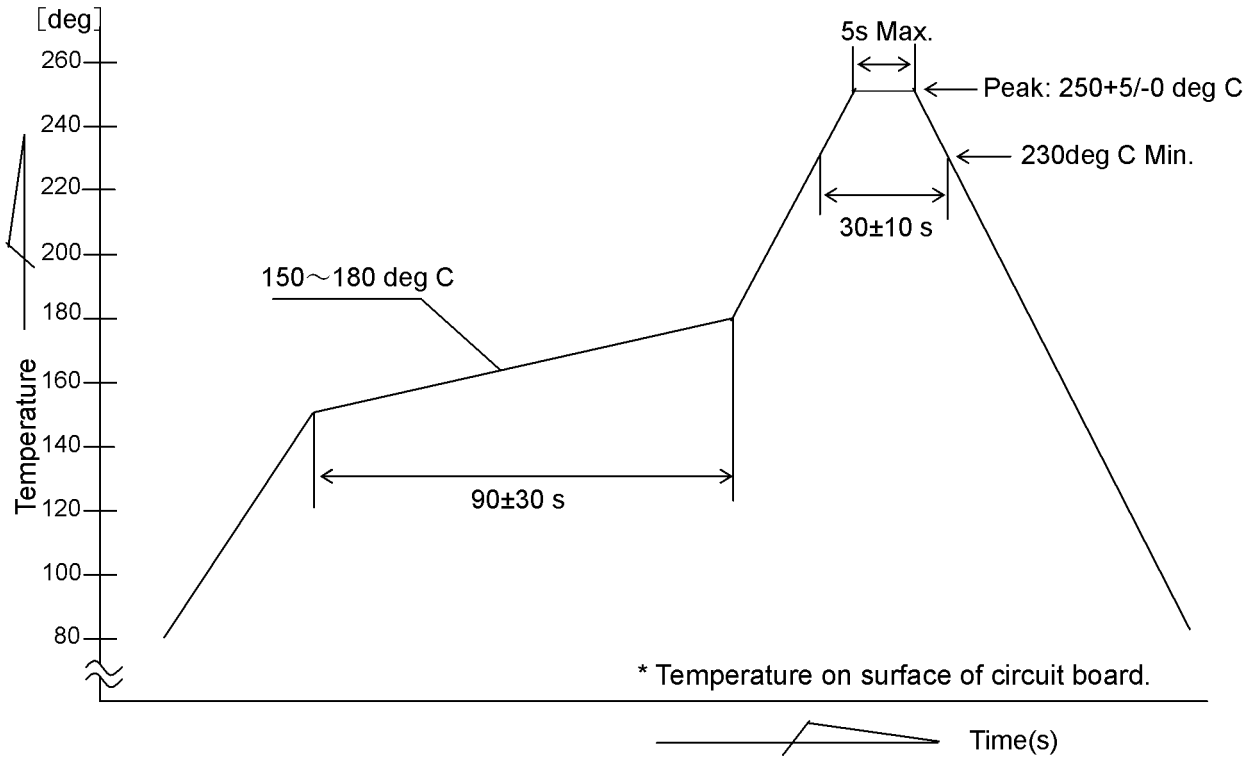
Standard Quantity: 22500 pcs.

(Unit: mm)



A packing box contains 5 reels maximum.

	Table 6	
(11 / 13)	REFLOW PROFILE CHART (REFERENCE)	

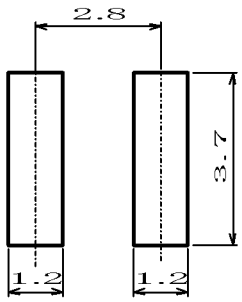


The products may be exposed to reflow soldering process of above profile up to two times.

Precautions

1. Surface Mounting

- Mounting and soldering conditions should be checked beforehand.
- Applicable soldering process to this products is reflow soldering only.
- Recommended Land-Pattern :



(Unit: mm)

2. Handling

- Keep the products away from all magnets and magnetic objects.
- Be careful not to subject the products to excessive mechanical shocks.
- Please avoid applying impact to the products after mounted on pc board.
- Avoid ultrasonic cleaning.

3. Storage

To prevent deterioration of the solderability of terminal electrodes and/or the packing materials of the products, please store the products under following storage conditions.

Ambient temperature range	0 deg C to 40 deg C
Humidity	70 % RH maximum

Even under the ideal storage conditions, solderability of inductor's electrode deteriorates as time passes, so inductors should be used within 6 months after the delivery time.

4. Regarding Regulations

- Any Class－Ⅰ or Class－Ⅱ ozone-depleting substance (ODS) listed in the Clean Air Act in US for regulation is not included in the products or applied to the products at any stage of whose manufacturing processes.
- Certain brominated flame retardants (PBBs, PBDEs) are not used at all.
- The products of this specifications are not subject to the Export Trade Control Order in Japan or the Export Administration Regulations in US.

5. RoHS compliance

This product conforms to "RoHS compliance".

6. Production Sites and country of origin

TAIYO YUDEN (PHILIPPINES) INC.

7. Guarantee

The guaranteed operating conditions of the products are in accordance with the conditions specified in this specifications.
Please note that Taiyo Yuden Co., Ltd. takes no responsibility for any failure and/or abnormality which is caused by use under other than the aforesaid operating conditions.

SPECIAL NOTICE

■ All of the contents specified here are subject to change without notice due to technical improvements, etc. Therefore, please check latest version of the components specifications carefully before practical application or usage of the components. Please note that Taiyo Yuden Co,.Ltd. shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification or individual specification.

■Please conduct validation and verification of products in actual condition of mounting and operating environment before commercial shipment of the equipment.

■All electronic components in this specification are developed, designed and intended for use in general electronics equipment. (for Av, office automation, household, office supply, information service, telecommunications, (such as mobile phone or PC) etc.).

Before incorporating the components or devices into any equipment in the field such as transportation, (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network (telephone exchange, base station) etc. which may have direct influence to harm or injure a human body, please contact Taiyo Yuden Co., Ltd. for more detail in advance.

Do not incorporate the products into any equipment in fields such as aerospace, aviation, unclear control, submarine system, military, etc. where higher safety and reliability are especially required.

In addition, even electronic components or functional modules that are used for the general electronic equipment, if the equipment or the electric circuit require high safety or reliability function or performances, a sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage.

■The contents of this specification are applicable to the products which are purchased from our sales offices or distributors (so called "TAIYO YUDEN's official sales channel").

It is only applicable to the products purchased from any of TAIYO YUDEN's official sales channel.

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