SPECIFICATIONS

Customer	
Product Name	Thin Film RF Inductor
Sunlord Part Number	HQ0201Q-P01 Series
Customer Part Number	

[☒New Released, ☐Revised] **SPEC No.: HQ0410210000**

【This SPEC is total 12 pages including specifications and appendix. 】

【ROHS, Halogen-Free and SVHC Compliant Parts】

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Qualification Status: ☐ Full ☐ Restricted ☐ Rejected

Approved By	Verified By	Re-checked By	Checked By

Comments:

_____

【Version change history】

Rev.	Effective Date	Changed Contents	Change reasons	Approved By
01	/	New release	/	Xiangdong Zeng

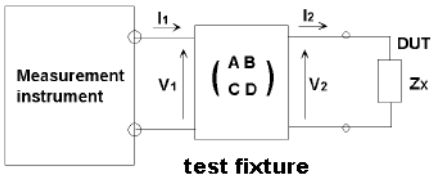
Caution

All products listed in this specification are developed, designed and intended for use in general electronics equipment. The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require especially high reliability, or whose failure, malfunction or trouble might directly cause damage to society, person, or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below. Please contact us for more details if you intend to use our products in the following applications.

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

Measuring Method of Inductance

a. *Residual elements and stray elements of test fixture can be described by F-parameter as shown in the following:*



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

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} AV_2 + BI_2 \\ CV_2 + DI_2 \end{bmatrix}$$

Measured open impedance: $Zom = \frac{A}{C}$

Measured short impedance: $Zsm = \frac{B}{D} \approx -Zsc$ *(when uses short chip to short)*

Measured short ship impedance: $Zsc = \frac{B}{D}$

Measured value: $Zxm = V_1/I_1$

Impedance of DUT: $Zx = V_2/I_2$

b. *The relation between Zx and Zom, Zsm, Zxm is shown in the following:*

$$Zx = \frac{V_2}{I_2} = \frac{D}{A} * \frac{\frac{V_1}{I_1} - \frac{B}{D}}{1 - \frac{V_1}{I_1} * \frac{C}{A}} = \frac{D}{A} * \frac{Zxm - \frac{B}{D}}{1 - Zxm * \frac{C}{A}} = \frac{D}{A} * \frac{Zxm - Zsm}{1 - Zxm / Zom}$$

c. *Lx should be calculated with the following equation:*

$$Lx = \frac{\mathrm{Im}(Zx)}{2\pi f} = \frac{\mathrm{Im}(Zxm + Zsc)}{2\pi f} = \frac{\mathrm{Im}(Zxm)}{2\pi f} + \frac{\mathrm{Im}(Zsc)}{2\pi f} = Lxm + Lsc$$

Lxm：Measured chip inductor inductance
Lsc：Measured short chip inductance
Lx：Nominal Inductance of chip inductor

Compensation Value（Lsc）of Short Chip

Series	*Compensation Value*
HQ0201Q-P01	*0.19nH*

1. Scope

This specification applies to HQ0201Q-P01 series of thin film radio frequency inductor.

2. Product Description and Identification (Part Number)

1) Description

HQ0201Q-P01 series of thin film radio frequency inductor.

2) Product Identification (Part Number)

HQ	0201	Q	XXX	□	◎	01
①	②	③	④	⑤	⑥	⑦

① Type	
HQ	High Q Ceramic Chip Inductor

② External Dimensions (L X W) (mm)	
0201 [008004]	0.25 X 0.125

③ Applications and Characteristics Code

④ Nominal Inductance	
Example	Example
0N3	0N3
3N9	3N9
6N8	6N8
10N	10N

⑤ Inductance Tolerance	
B、C、S	±0.1、±0.2、±0.3nH
G、H、J	±2%、±3%、±5%
Q	Super Q

⑥ Packing	
P	Plastic Tape Carrier Package

⑦ Serial Code
01

3. Electrical Characteristics

Please refer to **Appendix A** (Page9-10).

1) Operating and storage temperature range (individual chip without packing): -55℃~ +125℃,

2) Storage temperature range (packaging conditions): -10℃~+40℃ and RH 70% (Max.)

4. Shape and Dimensions

1) Dimensions and recommended PCB pattern for reflow soldering: See **Fig.4-1**, **Fig.4-2** and **Table 4-1**.

2) Structure: See **Fig. 4-3** and **Fig. 4-4**.

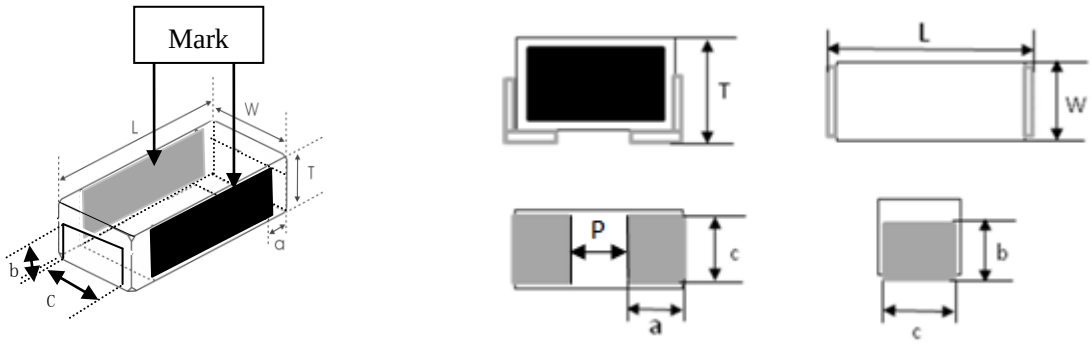


Fig. 4-1

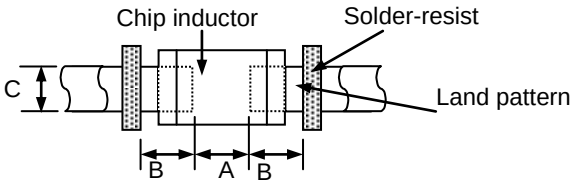
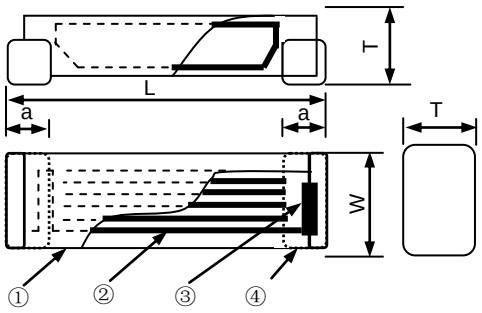


Fig. 4-2

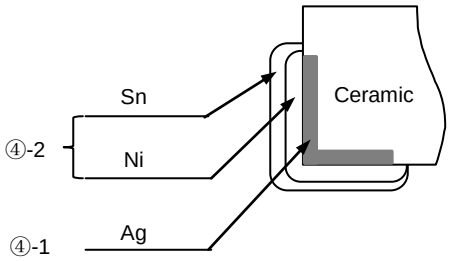
[Table 4-1] Unit: mm [inch]

Type	L	W	T	a	b	c	P	A	B	C
0201 [008004]	0.25±0.013 [.010±0005]	0.125±0.008 [.005±0003]	0.2±0.013 [.008±0005]	0.075±0.025 [.003±0010]	0.115±0.025 [.004±0010]	0.085±0.025 [.003±0010]	0.07~0.1	0.09~0.13	0.09~0.13	0.105~0.145



[Fig 4-3]

Structure of Electro-plating



[Fig 4-4]

① Ceramic for HQ Series
② Internal electrode (Ag)
③ Pull out electrode(Ag)
④-1 Terminal electrode: Inside (Ag)
④-2 Outside (Electro-plating Ni-Sn)

3) Material Information: See **Table 4-2**

Code	Part Name	Material Name
①	Ceramic Body	Ceramic Powder
②	Inner Coils	Silver Paste
③	Pull-out Electrode (Ag)	Silver Paste
④-1	Terminal Electrode: Inside Ag	Silver Paste
④-2	Electro-Plating: Ni/Sn plating	Plating Chemicals

4) Soldering Notice: The surface with the mark should be on the two beside when soldering

5. Test and Measurement Procedures

5.1 Test Conditions

Unless otherwise specified, the standard atmospheric conditions for measurement/test as:

a. Ambient Temperature: 20±15℃
b. Relative Humidity: 65±20%
c. Air Pressure: 86 KPa to 106 KPa

If any doubt on the results, measurements/tests should be made within the following limits:

a. Ambient Temperature: 20±2℃
b. Relative Humidity: 65±5%
c. Air Pressure: 86KPa to 106 KPa

5.2 Visual Examination

a. Inspection Equipment: 60 X magnifier

5.3 Electrical Test

5.3.1 DC Resistance (DCR)

a. Refer to **Appendix A**.
b. Test equipment (Analyzer): High Accuracy Milliohmmeter-HP4338B or equivalent.

5.3.2 Inductance (L)

a. Refer to **Appendix A**.
b. Test equipment: High Accuracy RF Impedance /Material Analyzer-E4991B+16198A or equivalent.
c. Test signal: -20dBm or 50mV
d. Test frequency refers to Appendix A.
e. Short bar residual inductance=0.19nH

5.3.3 Q Factor (Q)

a. Refer to **Appendix A**.
b. Test equipment: High Accuracy RF Impedance /Material Analyzer- E4991B+16198A or equivalent.
c. Test signal: -20dBm or 50mV
d. Test frequency refers to Appendix A.

5.3.4 Self-Resonant Frequency (SRF)

a. Refer to **Appendix A**.
b. Test equipment: Agilent 8719ES or equivalent.
c. Test signal: -20 dBm or 50 mV

5.3.5 Rated Current

a. Refer to **Appendix A**.
b. Test equipment (see **Fig. 5.3.5-1**): Electric Power, Electric current meter, Thermometer.
c. Measurement method (see **Fig. 5.3.5-1**):
   1. Set test current to be 0 mA.
   2. Measure initial temperature of chip surface.
   3. Gradually increase voltage and measure chip temperature for corresponding current.
d. Definition of Rated Current(Ir): Ir is direct electric current as chip surface temperature rose just 20℃ against chip initial surface temperature(Ta) (see **Fig. 5.3.5-2**).

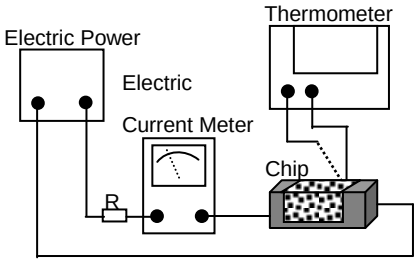


Fig. 5.3.5-1

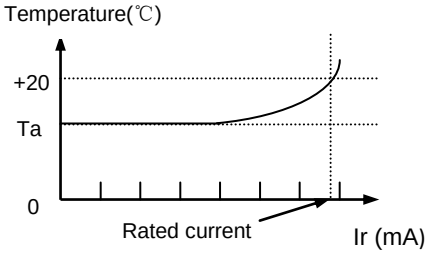
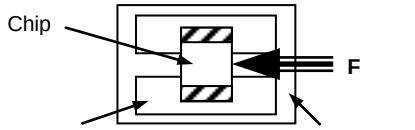
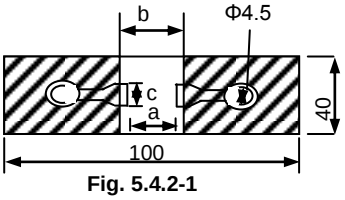
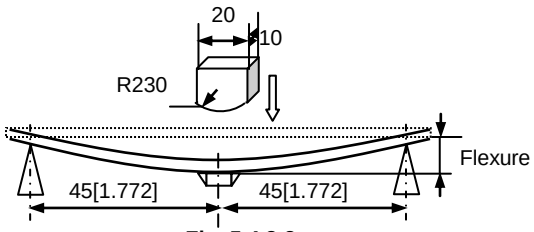
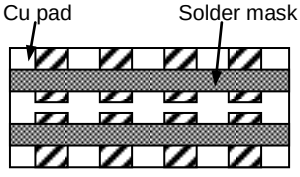
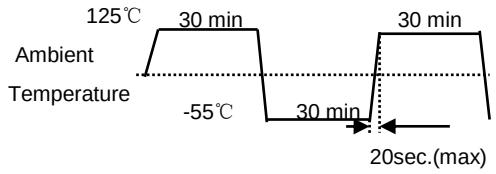


Fig. 5.3.5-2

5.4 Reliability Test

Items	Requirements	Test Methods and Remarks
5.4.1 Terminal Strength	No removal or split of the termination or other defects shall occur.  **Fig.5.4.1-1**	1）Solder the inductor to the testing jig (glass epoxy board shown in Fig. 5.4.1-1) using leadfree solder. Then apply a force in the direction of the arrow. 2）0.5N force for HQ0201Q-01 series. 3）Keep time: 10±1s 4）Speed: 1.0mm/s.
5.4.2 Resistance to Flexure	No visible mechanical damage. Unit: mm [inch] Type / a / b / c 0201[008004] / 0.11 / 0.33 / 0.125  **Fig. 5.4.2-1**	1）Solder the inductor to the test jig (glass epoxy board shown in Fig. 5.4.2-1) Using a leadfree solder. Then apply a force in the direction shown Fig. 5.4.2-2. 2）Flexure: 2mm. 3）Pressurizing Speed: 0.5mm/sec. 4）Keep time: 60 sec.  **Fig. 5.4.2-2**
5.4.3 Temperature Characteristics	Inductance change should be within ±10% of initial value measuring at 25℃.	Temperature range: HQ0201Q-01: -55℃ to +85℃, Reference temperature: +25℃
5.4.4 Resistance to Soldering Heat	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	1）Solder temperature: 260±5℃ 2）Duration: 10 sec. 3）Solder: Sn/3.0Ag/0.5Cu. 4）Flux: 25% Resin and 75% ethanol in weight. 5）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.5 Dropping	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	Mounting the components on afixture, dropped from a height of 100cm onto concrete floor for 10times.
5.4.6 Vibration	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.  **Fig. 5.4.3-1**	1）Solder the inductor to the testing jig (glass epoxy board shown in Fig. 5.4.3-1) using leadfree solder. 2）The inductor shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the 3 approximate limits of 10 and 2000 Hz. 3）The frequency range from 10 to 2000 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 4 hours in each 3mutually perpendicular directions (total of 12 hours).

5.4.7 Mechanical Shock	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	1）Half sine shock pulse 2）6 shocks in each 3 mutually perpendicular directions(total of 18 shocks).
5.4.8 Thermal Shock	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.  Fig. 5.4.8-1	1）Temperature, Time: (See Fig. 5.4.8-1) HQ0201Q-01: -55℃for 30±3 min→125℃ for 30±3min, 2）Transforming interval: Max. 20 sec. 3）Tested cycle: 1000 cycles. 4）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.9 Resistance to Low Temperature	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	1）Temperature: -55±2℃, 2）Duration: 1000^{+24} hours. 3）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.10 Resistance to High Temperature	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	1）Temperature: 150±2℃, 2）Duration: 1000^{+24} hours. 3）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.11 Loading Under Damp Heat	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%. 4）RDC: Satisfy electrical characteristic	1）Temperature: 60±2℃ 2）Humidity: 90% to 95% RH. 3）Duration: 1000^{+24} hours. 4）Applied current: Rated current. 5）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.12 Life Test	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%. 4）RDC: Satisfy electrical characteristic	1）Temperature: 125±2℃, 2）Duration: 1000^{+24} hours. 3）Applied current: Rated current. 4）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.13 Biased Humidity	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	1）Temperature: 85±2℃ 2）Humidity: 85% RH. 3）Duration: 1000^{+24} hours. 4）The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.14 Moisture Resistance	1）No visible mechanical damage. 2）Inductance change: Within ±10%. 3）Q factor change: Within ±20%.	1）25±2℃→65±2℃, 90%~100% RH, 2.5h ; 2）65±2℃,90%~100%RH,3h ; 3）65℃→25 (+10,-2)℃,80%~100%RH,2.5h; 4）25℃→65±2℃,90%~100%RH,2.5h; 5）65±2℃,90%~100%RH,3h ; 6）65℃→25±2℃,80%~100%RH,2.5h; 7）25±2℃,90%~100%RH,8h,24 hours of 1cycle(total of 240 hours)
5.4.15 Solderability	1）No visible mechanical damage. 2）Wetting shall exceed 95% coverage.	1）Solder temperture:245±2℃ 2）Duration: 3 sec. 3）Solder: Sn/3.0Ag/0.5Cu. 4）Flux: 25% Resin and 75% ethanol in weight.

6. Packaging and Storage

6.1 Packaging

Tape Carrier Packaging:

Packaging code: P

a. Tape carrier packaging are specified in attached figure **Fig.6.1-1~3**

b. Plastic tape and Cover tape has no spliced point.

c. Missing components number within 0.01% of the number per reel or 1 pcs. whichever is greater, and are not continuous. The Specified quantity per reel is kept

d. Tape carrier packaging quantity please see the following table:

Type	0201[008004]
Thickness (mm)	0.2±0.13
Tape	Plastic Tape
Quantity	40K

(1) Taping Drawings (Unit: mm)

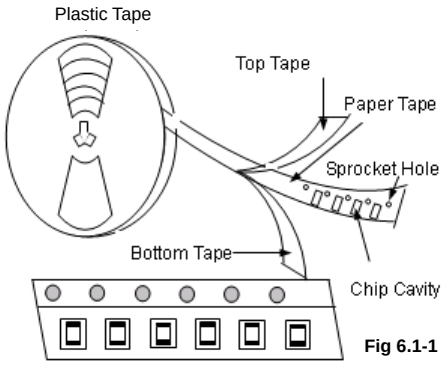


Fig 6.1-1

Remark: The sprocket holes are to the right as the tape is pulled toward the user.

(2) Taping Dimensions (Unit: mm)

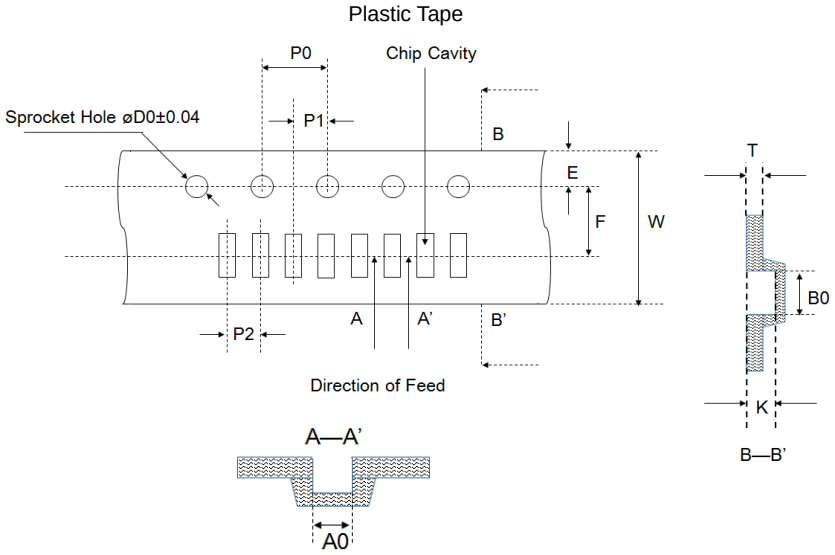


Fig. 6.1-2

Table 6.1-1 Unit:mm

Type	A0	B0	T	W	K	P0	P1	P2	D0	F	E
0201	0.16±0.02	0.29±0.02	0.2±0.02	4.0±0.05	0.24±0.02	2.0±0.04	1.0±0.02	1.0±0.02	0.78±0.04	1.8±0.02	0.9±0.05

(2) Reel Dimensions (Unit: mm)

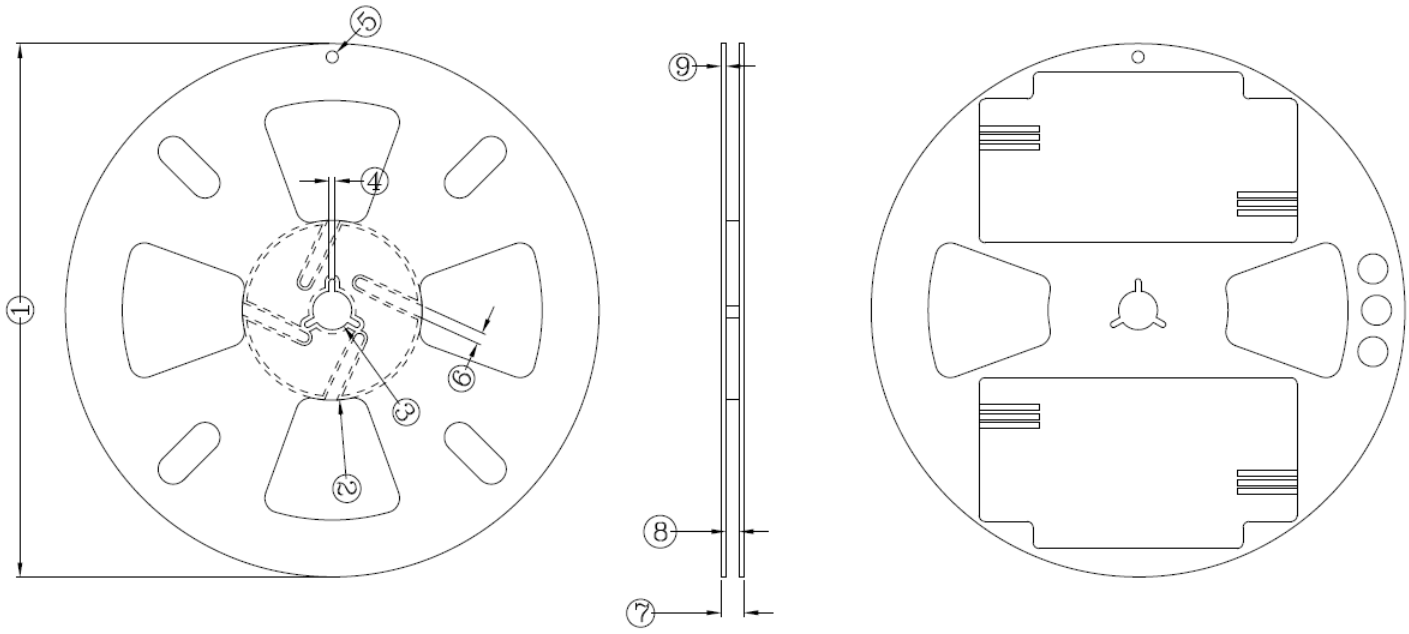


Fig. 6.1-3

Table 6.1-2 Unit:mm

①	②	③	④	⑤	⑥	⑦	⑧	⑨
178±1.0	60±1.0	13±0.3	2.0±0.5	4±0.2	4±0.5	7.5±1	4.5±0.5	1.5±0.3

6.2 Storage

a. The solderability of the external electrode may be deteriorated if packages are stored where they are exposed to high humidity. Package must be stored at 40℃ or less and 70% RH or less.

b. The solderability of the external electrode may be deteriorated if packages are stored where they are exposed to dust of harmful gas (e.g. HCl, sulfurous gas of H_2S).

c. Packaging material may be deformed if package are stored where they are exposed to heat of direct sunlight.

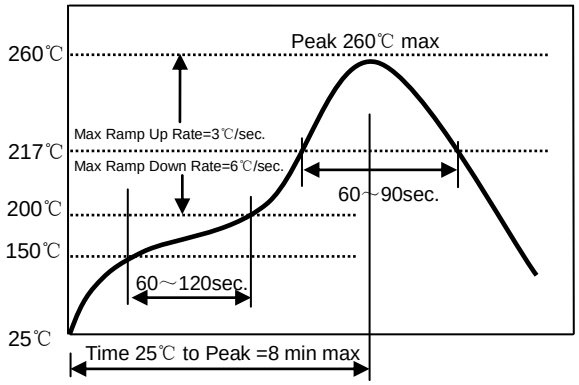
d. Solderability specified in **Clause 5.4.6** shall be guaranteed for *12* months from the date of delivery on condition that they are stored at the environment specified in **Clause 3**. For those parts, which passed more than *12* months shall be checked solder-ability before use.

7. Recommended Soldering Technologies

7.1 Reflow Profile

△ Preheat condition: 150 ~200℃/60~120sec.
△ Allowed time above 217℃: 60~90sec.
△ Max temp: 260℃
△ Max time at max temp: 10sec.
△ Solder paste: Sn/3.0Ag/0.5Cu
△ Allowed Reflow time: 2x max

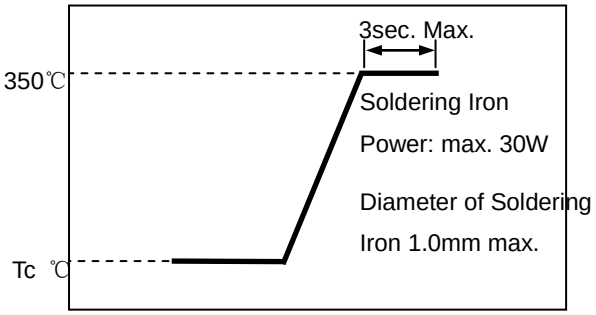
[Note: The reflow profile in the above table is only for qualification and is not meant to specify board assembly profiles. Actual board assembly profiles must be based on the customer's specific board design, solder paste and process, and should not exceed the parameters as the Reflow profile shows.]



7.2 Iron Soldering Profile

△ Iron soldering power: Max. 30W
△ Pre-heating: 150℃/60sec.
△ Soldering Tip temperature: 350℃ Max.
△ Soldering time: 3sec. Max.
△ Solder paste: Sn/3.0Ag/0.5Cu
△ Max.1 times for iron soldering

[Note: Take care not to apply the tip of the soldering iron to the terminal electrodes.]



Appendix A: Electrical Characteristics (HQ0201Q-P01 Series of Inductors)

HQ0201Q-P01 **Series of Inductor**

Part Number	Inductance	Min. Quality Factor	L, Q Test Freq. L/Q	Typical Q @ Freq. (GHz)					Min. Self-resonant Frequency	Max. DC Resistance	Max. Rated Current	Thickness
				0.5	0.8	1.8	2.0	2.4				
Units	nH	-	MHz	-					MHz	Ω	mA	mm [inch]
Symbol	L	Q	Freq	Q					S.R.F	DCR	Ir	T
HQ0201Q0N3□P01	0.3	8	500	/	/	/	/	/	14000	0.02	650	0.2±0.013 [.008±.0005]
HQ0201Q0N4□P01	0.4	8	500	/	/	/	/	/	14000	0.04	560	
HQ0201Q0N5□P01	0.5	8	500	/	/	/	/	/	14000	0.06	560	
HQ0201Q0N6□P01	0.6	8	500	/	/	/	/	/	14000	0.10	560	
HQ0201Q0N7□P01	0.7	8	500	/	/	/	/	/	13000	0.15	360	
HQ0201Q0N8□P01	0.8	8	500	12	16	21	22	23	13000	0.15	360	
HQ0201Q0N9□P01	0.9	8	500	12	16	20	21	23	13000	0.15	360	
HQ0201Q1N0□P01	1.0	8	500	12	15	19	20	22	12000	0.18	340	
HQ0201Q1N1□P01	1.1	8	500	12	15	20	21	23	12500	0.18	340	
HQ0201Q1N2□P01	1.2	8	500	12	15	19	20	22	12500	0.18	340	
HQ0201Q1N3□P01	1.3	8	500	12	15	20	21	22	12000	0.29	330	
HQ0201Q1N4□P01	1.4	8	500	12	15	19	20	22	12000	0.32	330	
HQ0201Q1N5□P01	1.5	8	500	12	15	19	20	22	12000	0.32	330	
HQ0201Q1N6□P01	1.6	8	500	12	14	19	20	21	11000	0.32	330	
HQ0201Q1N7□P01	1.7	8	500	12	14	19	20	21	11000	0.32	330	
HQ0201Q1N8□P01	1.8	8	500	12	14	19	20	21	10000	0.32	330	
HQ0201Q1N9□P01	1.9	8	500	12	15	19	20	22	10000	0.32	330	
HQ0201Q2N0□P01	2.0	8	500	12	14	19	20	22	10000	0.32	330	
HQ0201Q2N1□P01	2.1	8	500	12	15	19	20	22	9500	0.42	260	
HQ0201Q2N2□P01	2.2	8	500	12	14	19	20	21	9000	0.43	260	
HQ0201Q2N3□P01	2.3	8	500	12	14	19	20	22	9000	0.45	260	
HQ0201Q2N4□P01	2.4	8	500	12	14	19	20	21	9000	0.46	260	
HQ0201Q2N5□P01	2.5	8	500	12	14	19	20	21	9000	0.46	260	
HQ0201Q2N6□P01	2.6	8	500	12	15	19	20	22	8500	0.46	260	
HQ0201Q2N7□P01	2.7	8	500	12	14	19	20	21	8500	0.46	260	
HQ0201Q2N8□P01	2.8	8	500	12	14	19	20	22	8500	0.46	260	
HQ0201Q2N9□P01	2.9	8	500	12	15	19	20	21	8000	0.60	240	
HQ0201Q3N0□P01	3.0	8	500	12	15	19	20	21	8000	0.60	240	
HQ0201Q3N1□P01	3.1	8	500	12	15	19	20	21	7500	0.60	240	
HQ0201Q3N2□P01	3.2	8	500	12	14	18	19	21	7500	0.60	240	
HQ0201Q3N3□P01	3.3	8	500	12	14	18	19	21	6700	0.60	240	
HQ0201Q3N4□P01	3.4	8	500	12	14	18	19	20	6700	0.70	220	
HQ0201Q3N5□P01	3.5	8	500	11	14	18	19	20	6700	0.70	220	
HQ0201Q3N6□P01	3.6	8	500	11	14	18	19	20	6700	0.85	200	
HQ0201Q3N7□P01	3.7	8	500	11	14	18	19	20	6000	0.85	200	
HQ0201Q3N8□P01	3.8	8	500	11	14	18	19	20	5500	0.88	200	
HQ0201Q3N9□P01	3.9	8	500	11	14	18	19	20	5500	0.88	200	
HQ0201Q4N0□P01	4.0	8	500	11	14	18	20	20	5500	0.88	200	
HQ0201Q4N1□P01	4.1	8	500	11	14	18	19	20	5200	0.90	180	
HQ0201Q4N2□P01	4.2	8	500	11	14	18	19	20	5200	0.90	180	
HQ0201Q4N3□P01	4.3	8	500	11	14	18	19	21	5200	0.90	180	

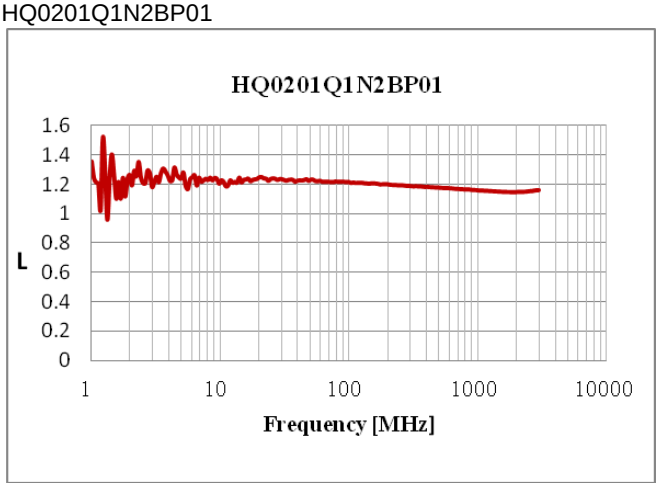
Part Number	Inductance	Min. Quality Factor	L, Q Test Freq. L/Q	Typical Q @ Freq. (GHz)					Min. Self-resonant Frequency	Max. DC Resistance	Max. Rated Current	Thickness
				0.5	0.8	1.8	2.0	2.4				
Units	nH	-	MHz	-					MHz	Ω	mA	mm [inch]
Symbol	L	Q	Freq	Q					S.R.F	DCR	Ir	T
HQ0201Q4N7□P01	4.7	8	500	11	14	18	19	21	4000	1.20	170	0.2±0.013 [.008±0005]
HQ0201Q5N1□P01	5.1	8	500	11	14	18	19	20	4000	1.20	160	
HQ0201Q5N6□P01	5.6	8	500	10	13	14	18	19	4000	1.20	160	
HQ0201Q6N2□P01	6.2	8	500	10	13	14	18	20	4000	1.30	150	
HQ0201Q6N8□P01	6.8	8	500	10	13	14	19	20	3900	1.50	140	
HQ0201Q7N5□P01	7.5	8	500	10	13	17	19	21	3900	1.50	140	
HQ0201Q8N2□P01	8.2	8	500	10	13	17	19	20	3900	1.50	140	
HQ0201Q9N1□P01	9.1	7	500	10	13	17	18	20	3700	2.00	130	
HQ0201Q10N□P01	10	7	500	10	13	17	18	19	3700	2.00	130	

Note: □: Please specify the inductance tolerance. For L≤4.2nH, choose B=±0.1nH, C=±0.2nH or S=±0.3nH; For 4.2nH＜L＜5.6nH, choose, H=±3%, J=±5%. or S=±0.3nH； For L≥5.6nH, choose, H=±3%, J=±5%.

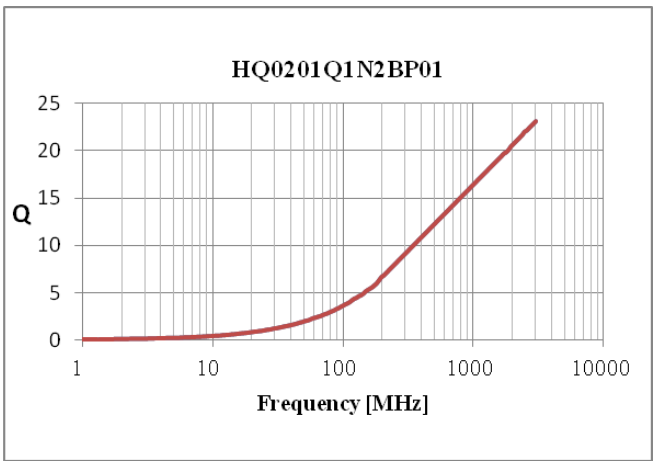
TYPICAL ELECTRICAL CHARACTERISTICS

Inductance-Frequency Characteristics(Typ.)

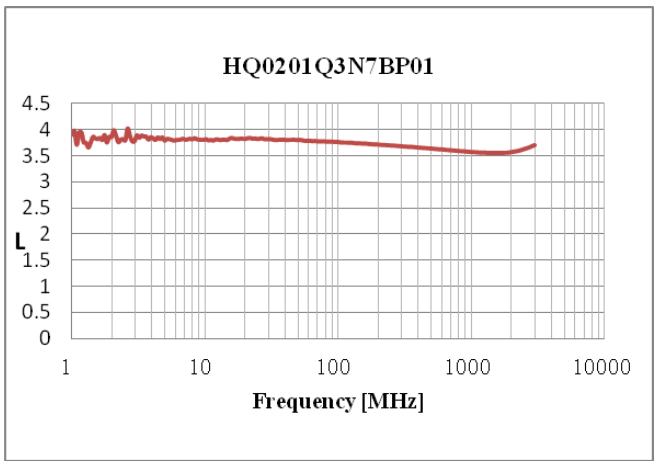
HQ0201Q1N2BP01

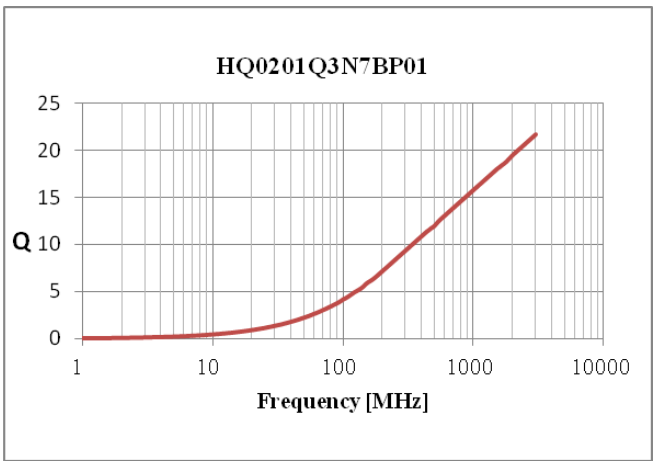


Q-Frequency Characteristics(Typ.)



HQ0201Q3N7BP01





HQ0201Q10NHP01