SPECIFICATIONS

Customer	
Product Name	**Thin Film RF Inductor**
Sunlord Part Number	**UHQ0402H-P01 Series**
Customer Part Number	

[☒New Released, ☐Revised] **SPEC No.: UHQ030920000**

【This SPEC is total 12 pages including specifications and appendix. 】
【ROHS, Halogen-Free and SVHC Compliant Parts】

Approved By	Checked By	Issued By

Shenzhen Sunlord Electronics Co., Ltd.

Address: Sunlord Industrial Park, Dafuyuan Industrial Zone, Baoan, Shenzhen, China 518110
Tel: 0086-755-29832333 Fax: 0086-755-82269029 E-Mail: sunlord@sunlordinc.com

【For Customer approval Only】 Date:_____

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

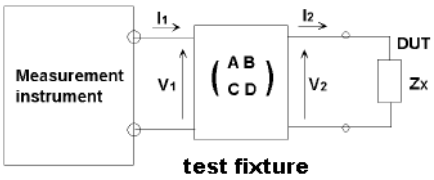
Caution

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 Super 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:



test fixture

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

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

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

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
UHQ0402H-P01	0.11nH

1. Scope

This specification applies to UHQ0402H-P01 series of thin film radio frequency inductor.

2. Product Description and Identification (Part Number)

1) Description

UHQ0402H-P01 series of thin film radio frequency inductor.

2) Product Identification (Part Number)

UHQ	0402	H	XXX	□	◎	01
①	②	③	④	⑤	⑥	⑦

①	Type
UHQ	Super Q Ceramic Chip Inductor

②	External Dimensions (L X W) (mm)
0402 [01005]	0.4 X 0.2

③	Applications and Characteristics Code
H	Chip Thickness=0.20mm

④	Nominal Inductance
Example	Example
3N9	3N9
10N	10N

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

⑥	Packing
P	Plastic Tape Carrier Package

⑦	Serial Code
01	Internal code

3. Electrical Characteristics

Please refer to **Appendix A** (Page10-12).

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**.

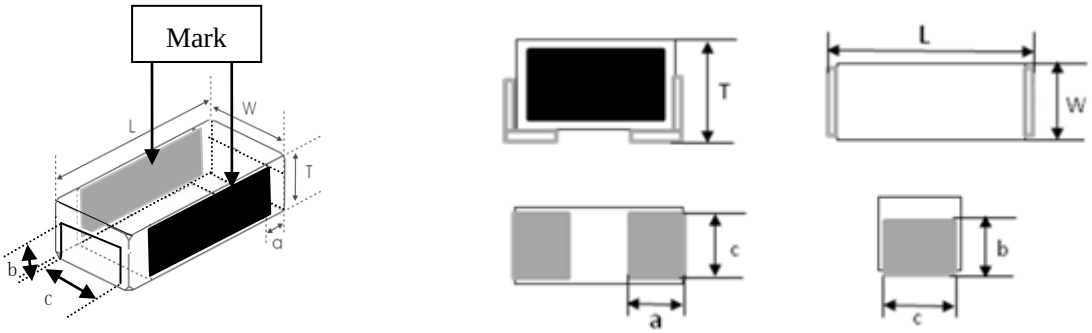


Fig. 4-1

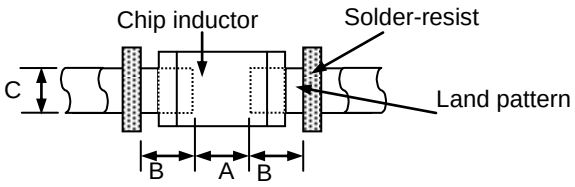
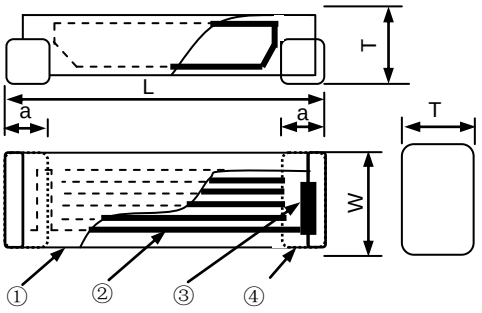


Fig. 4-2

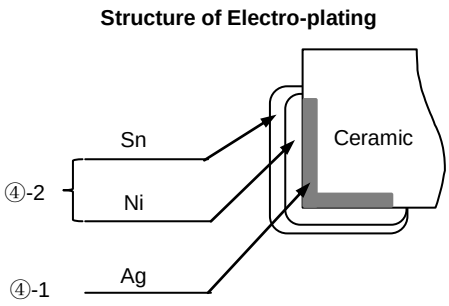
[Table 4-1]

Unit: mm [inch]

Type	L	W	T	a	b	c	A	B	C
0402 [01005]	0.4±0.02 [.016±.0008]	0.2±0.02 [.008±.0008]	0.2±0.02 [.008±.0008]	0.14±0.03 [.005±.0010]	0.14±0.03 [.005±.0010]	0.17±0.03 [.006±.0010]	0.15~0.19	0.18~0.22	0.18~0.22



[Fig 4-3]



[Fig 4-4]

① Ceramic for UHQ 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**

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

5.1.1 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

5.1.2 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): Super Accuracy Milliohmmeter-HP4338B or equivalent.

5.3.2 Inductance (L)

a. Refer to **Appendix A**.
b. Test equipment: Super Accuracy RF Impedance /Material Analyzer-E4991A+16196D or equivalent.
c. Test signal: -20dBm or 50mV
d. Test frequency refers to Appendix A.
e. Short bar residual inductance=0.11nH

5.3.3 Q Factor (Q)

a. Refer to **Appendix A**.
b. Test equipment: Super Accuracy RF Impedance /Material Analyzer-E4991A+16196D 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**).

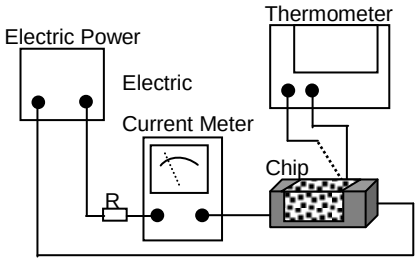


Fig. 5.3.5-1

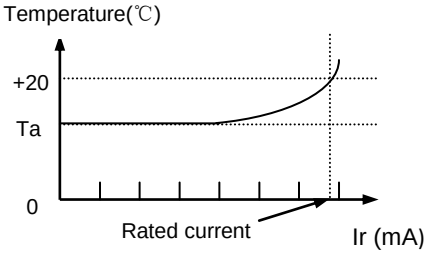
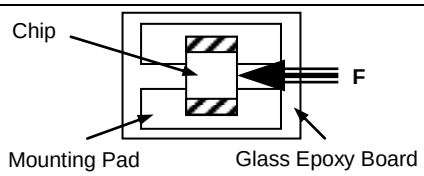
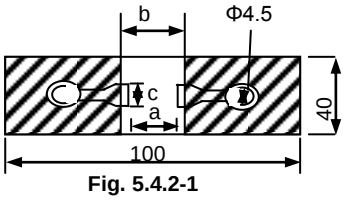
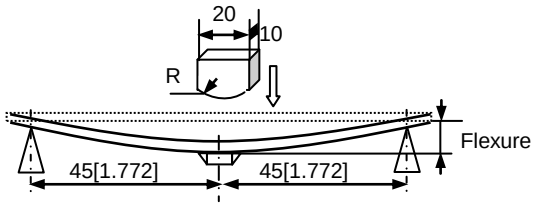
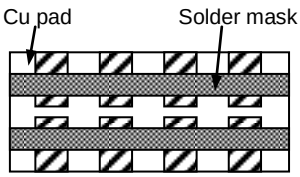
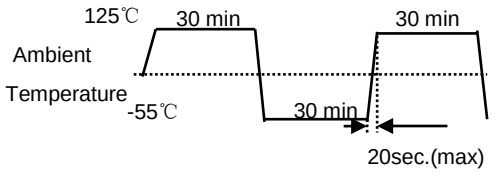


Fig. 5.3.5-2

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 1N force for UHQ0402H-P01 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 0402[01005] / 0.18 / 0.8 / 0.2  **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: 30 sec.  **Fig. 5.4.2-2**
5.4.3 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 approximate limits of 10 and 55 Hz. ③ The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions (total of 6 hours).
5.4.4 Dropping	① No visible mechanical damage. ② Inductance change: Within ±10%. ③ Q factor change: Within ±20%.	Drop chip inductor 10 times on a concrete floor from a height of 100 cm.
5.4.5 Temperature	Inductance change should be within ±10% of initial value measuring at 20℃.	Temperature range: UHQ0402H-P01: -55℃ to +125℃, Reference temperature: +20℃
5.4.6 Solderability	① No visible mechanical damage. ② Wetting shall exceed 95% coverage.	① Solder temperture:240±2℃ ② Duration: 3 sec. ③ Solder: Sn/3.0Ag/0.5Cu. ④ Flux: 25% Resin and 75% ethanol in weight.
5.4.7 Resistance to Soldering Heat	① No visible mechanical damage. ② Wetting shall exceed 75% coverage. ③ Inductance change: Within ±10%. ④ Q factor change: Within ±20%.	① Solder temperature: 260±3℃ ② Duration: 5 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.

5.4.8 Thermal Shock	① No 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**) UHQ0402H-01: -55℃for 30±3 min→125℃ for 30±3min, ② Transforming interval: Max. 20 sec. ③ Tested cycle: 100 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 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 Super Temperature	① No mechanical damage. ② Inductance change: Within ±10%. ③ Q factor change: Within ±20%.	① Temperature: 125±2℃, ② Duration: 1000^{+24} hours. ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.11 Damp Heat (Steady States)	① No visible mechanical damage. ② Inductance change: Within ±10%. ③ Q factor change: Within ±20%.	① Temperature: 60±2℃ ② Humidity: 90% to 95% RH. ③ Duration: 1000^{+24} hours. ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.12 Loading Under Damp Heat	① No visible mechanical damage. ② Inductance change: Within ±10%. ③ Q factor change: Within ±20%.	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.
5.4.13 Loading at Super Temperature (Life Test)	① No visible mechanical damage. ② Inductance change: Within ±10%. ③ Q factor change: Within ±20%.	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.

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. Tape carrier packaging quantity please see the following table:

Type	0402[01005]
Thickness (mm)	0.2±0.02
Tape	Plastic Tape
Quantity	40K

(1) Taping Drawings (Unit: mm)

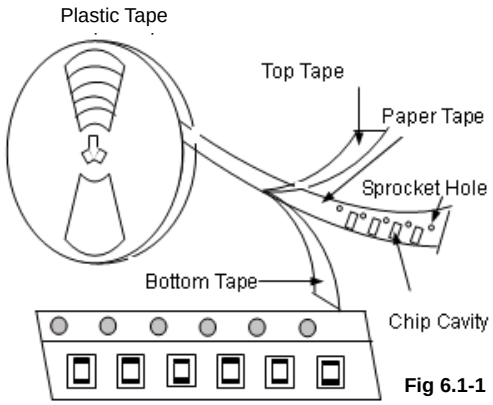


Fig 6.1-1

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

(2) Taping Dimensions (Unit: mm)

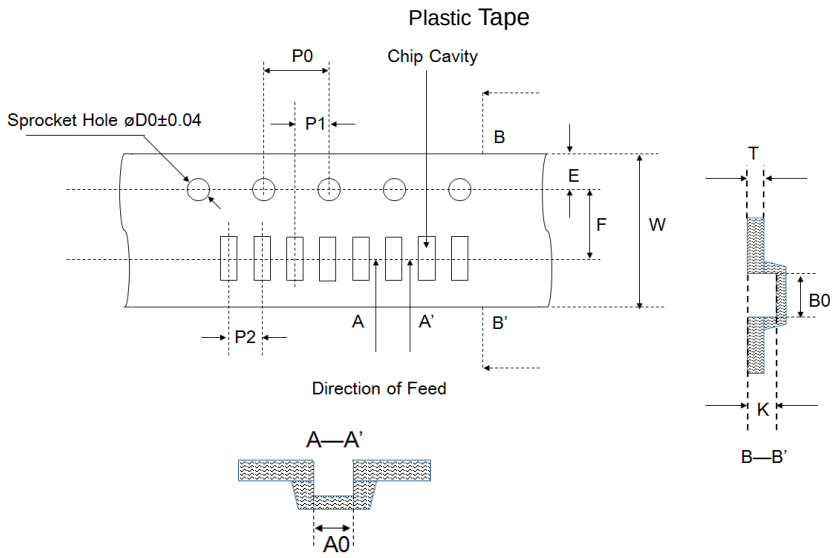


Fig. 6.1-2

Table 6.1-1 Unit:mm

Type	A0	B0	T	W	K	P0	P1	P2	D0	F	E
0402	0.24±0.02	0.44±0.02	2.0±0.05	4.0±0.05	0.24±0.02	2.0±0.04	1.0±0.02	1.0±0.02	0.80±0.04	1.8±0.02	0.9±0.05

(2) Reel Dimensions (Unit: mm)

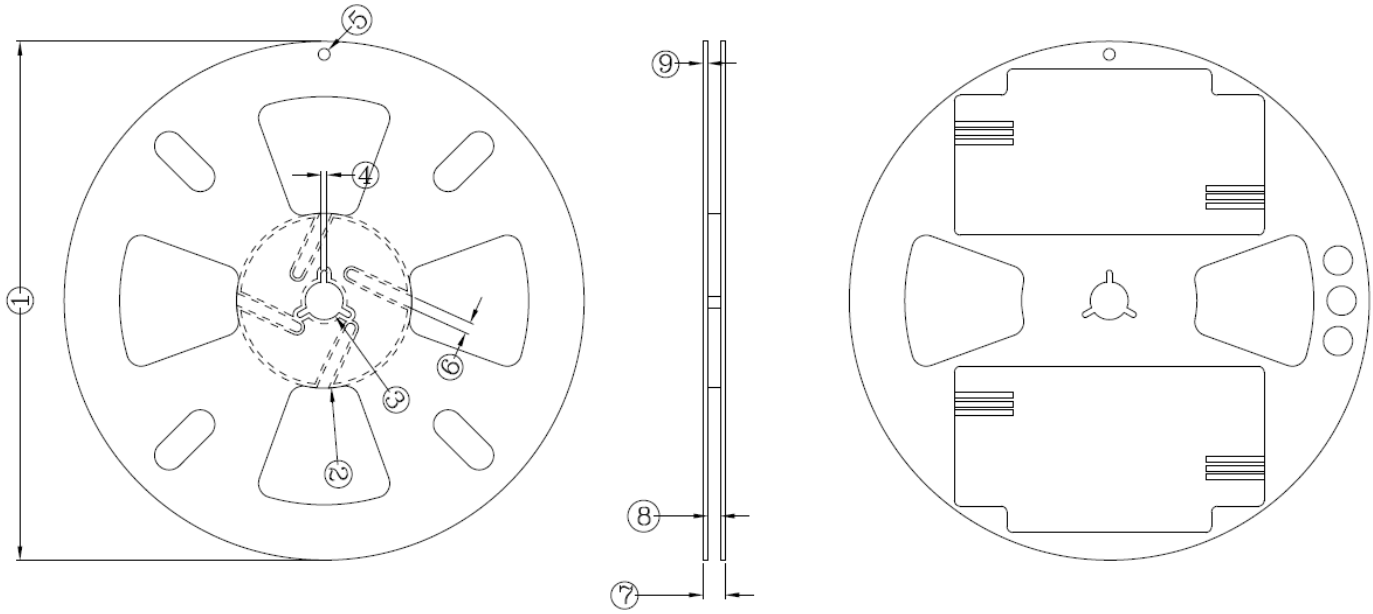


Fig. 6.1-3

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 Super 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.

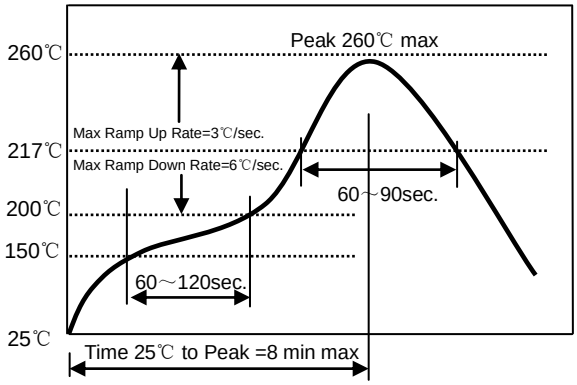
d. Solderability specified in **Clause 5.4.6** shall be guaranteed for *12* months from the date of delivery on condition that they are stored at the environment specified in **Clause 3**. For those parts, which passed more than *12* months shall be checked solder-ability before use.

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

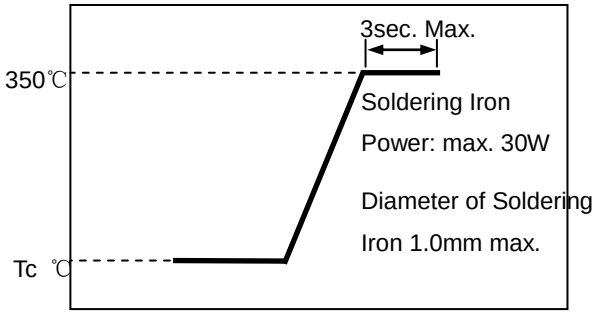
[Note: The reflow profile in the above table is only for qualification and is not meant to specify board assembly profiles. Actual board assembly profiles must be based on the customer's specific board design, solder paste and process, and should not exceed the parameters as the Reflow profile shows.]



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 (UHQ0402H-P01 Series of Inductors)

UHQ0402H-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
UHQ0402H0N2□P01	0.2	-	500	-	-	-	-	-	16600	0.08	990	0.2±0.02 [.008±.0008]
UHQ0402H0N3□P01	0.3	-	500	-	-	-	-	-	16600	0.08	990	
UHQ0402H0N4□P01	0.4	-	500	-	-	-	-	-	16600	0.08	990	
UHQ0402H0N5□P01	0.5	-	500	-	-	-	-	-	16600	0.08	730	
UHQ0402H0N6□P01	0.6	13	500	18	23	40	42	51	16600	0.08	730	
UHQ0402H0N7□P01	0.7	13	500	18	23	39	41	49	16600	0.08	730	
UHQ0402H0N8□P01	0.8	13	500	18	23	38	41	48	16600	0.11	630	
UHQ0402H0N9□P01	0.9	13	500	18	23	38	40	48	16600	0.11	580	
UHQ0402H1N0□P01	1	13	500	17	22	37	40	48	16600	0.11	580	
UHQ0402H1N1□P01	1.1	13	500	17	22	37	39	41	16600	0.11	580	
UHQ0402H1N2□P01	1.2	13	500	17	22	36	38	40	16600	0.17	550	
UHQ0402H1N3□P01	1.3	13	500	17	22	35	37	39	16000	0.17	400	
UHQ0402H1N4□P01	1.4	13	500	17	22	35	36	43	15000	0.17	400	
UHQ0402H1N5□P01	1.5	13	500	17	22	35	36	37	15000	0.17	390	
UHQ0402H1N6□P01	1.6	13	500	17	22	35	37	40	15000	0.23	390	
UHQ0402H1N7□P01	1.7	13	500	17	20	35	37	40	15000	0.23	380	
UHQ0402H1N8□P01	1.8	13	500	17	21	34	36	39	15000	0.23	380	
UHQ0402H1N9□P01	1.9	13	500	17	20	34	36	40	13000	0.23	380	
UHQ0402H2N0□P01	2	13	500	17	21	35	37	40	13000	0.24	380	
UHQ0402H2N1□P01	2.1	13	500	17	20	33	36	40	13000	0.24	380	
UHQ0402H2N2□P01	2.2	13	500	17	23	36	39	39	13000	0.24	380	
UHQ0402H2N3□P01	2.3	13	500	17	21	34	36	43	13000	0.29	370	
UHQ0402H2N4□P01	2.4	13	500	17	23	35	37	40	13000	0.29	370	
UHQ0402H2N5□P01	2.5	13	500	17	21	34	36	40	11500	0.3	370	
UHQ0402H2N6□P01	2.6	13	500	17	20	34	36	40	11500	0.3	370	
UHQ0402H2N7□P01	2.7	13	500	17	21	34	36	39	11500	0.32	370	
UHQ0402H2N8□P01	2.8	13	500	17	20	33	35	40	10000	0.32	360	
UHQ0402H2N9□P01	2.9	13	500	17	20	32	35	40	10000	0.35	360	
UHQ0402H3N0□P01	3.0	13	500	17	19	32	34	39	10000	0.35	360	
UHQ0402H3N1□P01	3.1	13	500	17	20	32	35	40	10000	0.4	290	
UHQ0402H3N2□P01	3.2	13	500	17	20	32	35	40	10000	0.4	290	
UHQ0402H3N3□P01	3.3	13	500	17	20	33	35	37	10000	0.4	290	
UHQ0402H3N4□P01	3.4	13	500	17	19	31	33	37	9700	0.4	280	
UHQ0402H3N5□P01	3.5	13	500	17	19	32	34	36	9700	0.4	280	
UHQ0402H3N6□P01	3.6	13	500	17	19	31	33	35	9700	0.4	280	
UHQ0402H3N7□P01	3.7	13	500	17	19	31	33	37	9700	0.4	270	
UHQ0402H3N8□P01	3.8	13	500	17	19	31	33	36	9700	0.48	270	
UHQ0402H3N9□P01	3.9	13	500	17	19	28	29	34	9700	0.48	270	
UHQ0402H4N0□P01	4	13	500	17	18	29	32	34	9000	0.48	270	
UHQ0402H4N1□P01	4.1	13	500	17	19	29	32	35	9000	0.6	270	

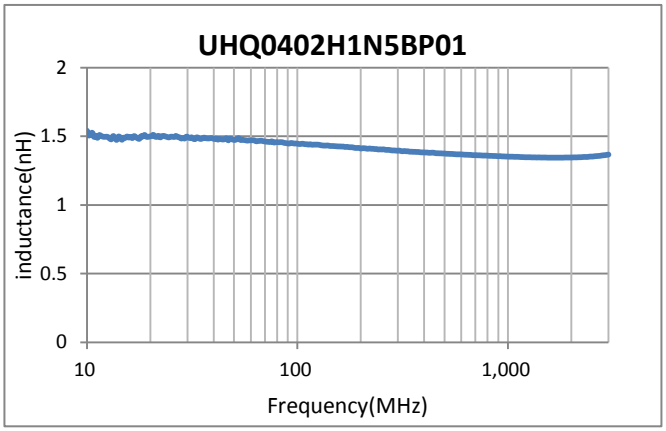
Part Number	Inductance	Min. Quality Factor	L, Q Test Freq .L/Q	Typical Q @ Freq. (GHz)					Min .Self-resonant Frequency	Max. DC Resistance	Max .Rated Current	Thickness
				0.5	0.8	1.8	2.0	2.4				
Units	nH	-	MHz	-					MHz	Ω	mA	mm [inch]
Symbol	L	Q	Freq	Q					S.R.F	DCR	Ir	T
UHQ0402H4N2□P01	4.2	13	500	17	19	31	33	35	9000	0.6	270	0.2±0.02 [.008±.0008]
UHQ0402H4N3□P01	4.3	13	500	17	19	29	32	35	9000	0.6	270	
UHQ0402H4N7□P01	4.7	13	500	17	19	28	31	34	8500	0.6	270	
UHQ0402H5N1□P01	5.1	13	500	17	19	29	32	35	7800	0.6	250	
UHQ0402H5N6□P01	5.6	13	500	17	20	34	35	37	7800	0.65	230	
UHQ0402H6N2□P01	6.2	13	500	17	20	34	35	36	7200	0.7	220	
UHQ0402H6N8□P01	6.8	13	500	17	21	33	35	37	6600	0.8	210	
UHQ0402H7N5□P01	7.5	13	500	16	21	32	35	37	6600	0.8	200	
UHQ0402H8N2□P01	8.2	13	500	17	23	33	35	37	6600	0.85	190	
UHQ0402H9N1□P01	9.1	13	500	17	23	32	35	36	5900	0.95	170	
UHQ0402H10N□P01	10	13	500	16	22	29	33	35	5900	0.95	170	
UHQ0402H11N□P01	11	13	500	16	22	28	29	32	3500	1.1	140	
UHQ0402H12N□P01	12	13	500	16	22	28	29	32	3500	1.2	140	
UHQ0402H13N□P01	13	12	500	16	22	26	28	29	3000	1.3	140	
UHQ0402H15N□P01	15	12	500	16	21	26	28	29	3000	1.4	140	
UHQ0402H16N□P01	16	12	500	16	21	26	28	29	3000	1.4	140	
UHQ0402H18N□P01	18	10	500	16	21	26	28	29	2500	1.5	140	
UHQ0402H20N□P01	20	10	500	16	19	24	25	26	2500	1.5	140	

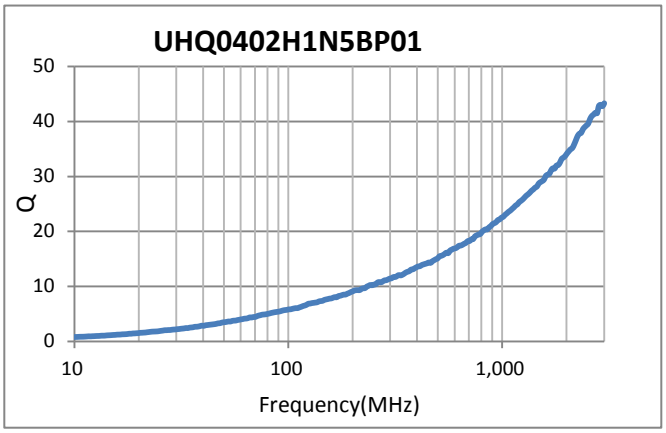
Note: □: Please specify the inductance tolerance. For L≤4.2nH, choose B=±0.1nH, C=±0.2nH or S=±0.3nH; For 4.2nH＜L＜5.6nH, choose, H=±3%, J=±5%. or S=±0.3nH； For L≥5.6nH, choose, H=±3%, J=±5%

TYPICAL ELECTRICAL CHARACTERISTICS

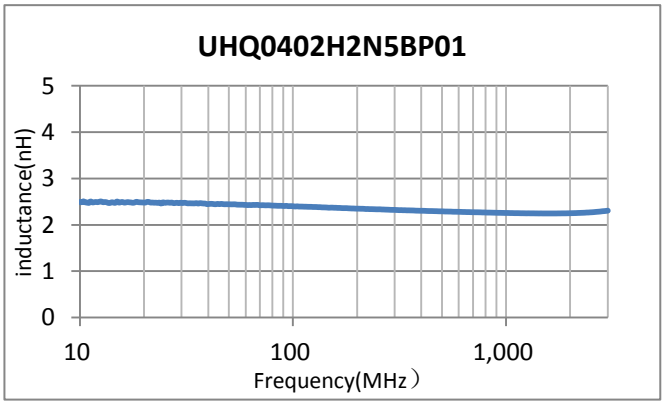
Inductance-Frequency Characteristics(Typ.) Q-Frequency Characteristics(Typ.)

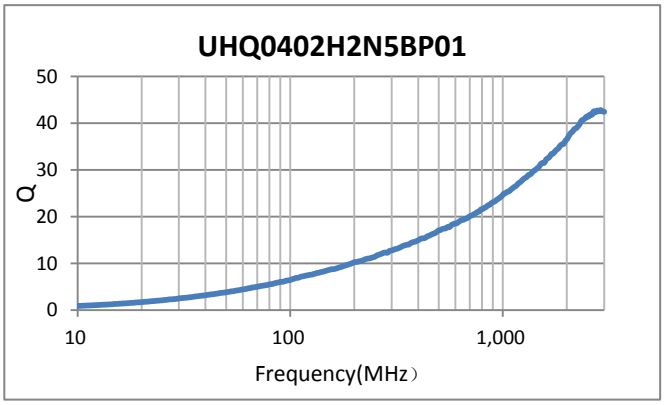
UHQ0402H1N5BP01



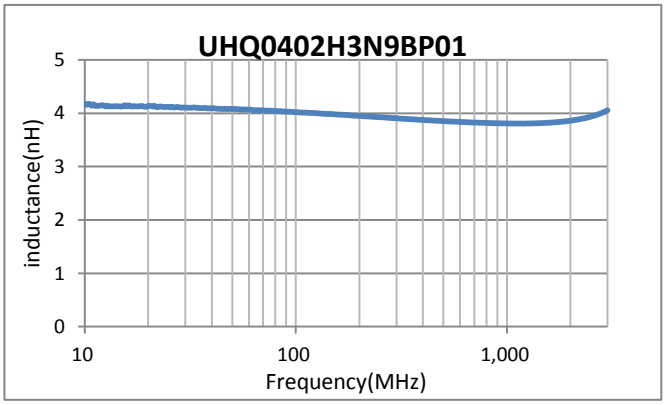


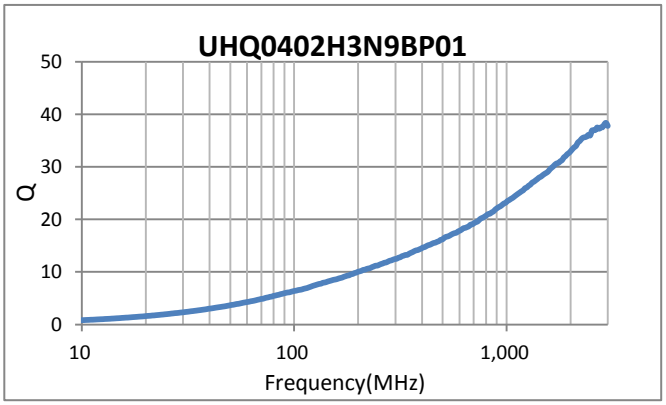
UHQ0402H2N5BP01





UHQ0402H3N9BP01





UHQ0402H15NHP01