SPECIFICATIONS

Customer	
Product Name	Multi-layer Chip Ceramic Inductors
Sunlord Part Number	HQ0603Q_T01 Series
Customer Part Number	

[☒New Released, ☐Revised] **SPEC No.:HQ0307200000**

【This SPEC is total 11 pages including specifications and appendix. 】

【ROHS, Halogen-Free and SVHC Compliant Parts】

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

Approved By	Checked By	Issued By

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【For Customer approval Only】 Date:_____

Qualification Status: Full Restricted Rejected

Approved By	Verified By	Re-checked By	Checked By

Comments:

_____

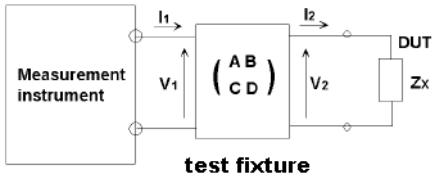
Caution

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:



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
HQ0603Q_T01	0.48nH

1. Scope

This specification applies to HQ0603Q_T01 series of multi-layer ceramic chip inductors.

2. Product Description and Identification (Part Number)

1) Description

HQ0603Q_T01 series of multi-layer ceramic chip inductors.

2) Product Identification (Part Number)

HQ 0603 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)	
0603 [0201]	0.6 X 0.3

③ Applications and Characteristics Code	
Q	Super Q

④ Nominal Inductance	
Example	Nominal Value
3N9	3.9nH
10N	10nH

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

⑥ Packing	
T	Tape Carrier Package

⑦ Serial Code
01

3. Electrical Characteristics

Please refer to **Appendix A** (Page9-12).

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**.

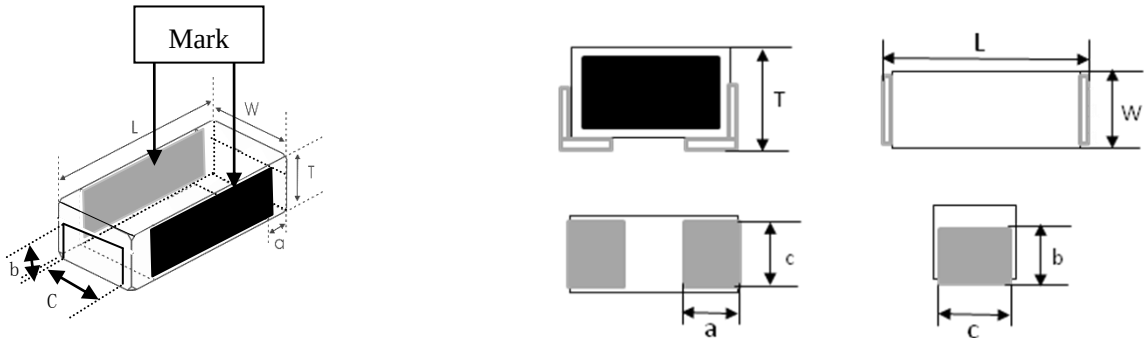


Fig. 4-1

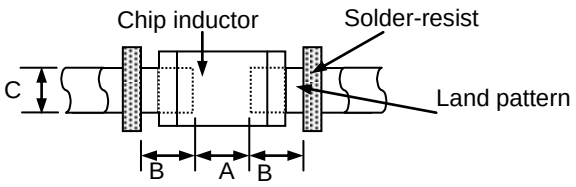
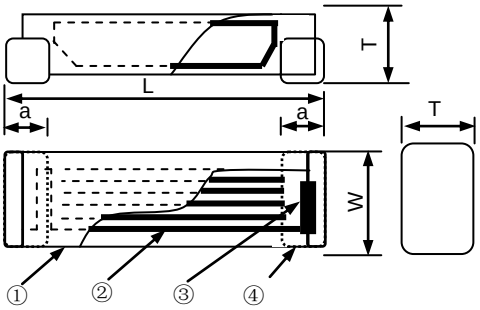


Fig. 4-2

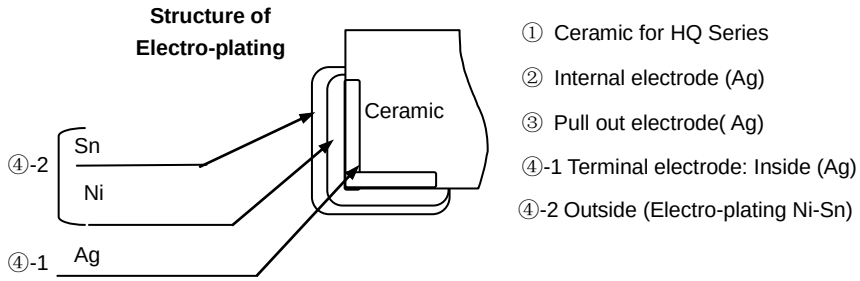
[Table 4-1]

Unit: mm [inch]

Type	L	W	T	a	b	c	A	B	C
0603 [0201]	0.6±0.03 [.024±.0012]	0.3±0.03 [.012±.0012]	0.4±0.02 [.016±.0008]	0.15±0.03 [.006±.0012]	0.2±0.03 [.008±.0012]	0.25±0.03 [.01±.0012]	0.2~0.3	0.25~0.35	0.25~0.35



[Fig 4-3]



[Fig 4-4]

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: 86KPa to 106KPa

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 106KPa

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-E4991A+16197A or equivalent.
c. Test signal: -20dBm or 50mV
d. Test frequency refers to Appendix A.
e. Short bar residual inductance=0.48nH

5.3.3 Q Factor (Q)

a. Refer to **Appendix A**.
b. Test equipment: High Accuracy RF Impedance /Material Analyzer-E4991A+16197A 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**).

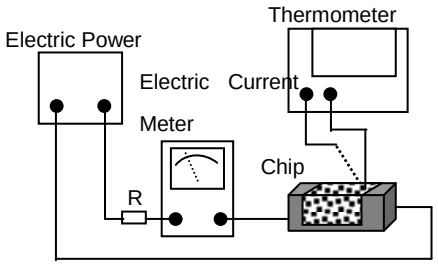


Fig. 5.3.5-1

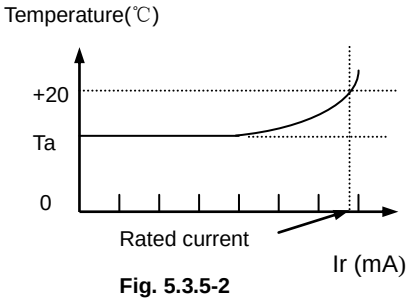
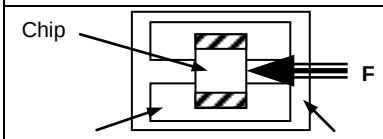
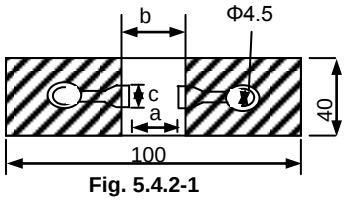
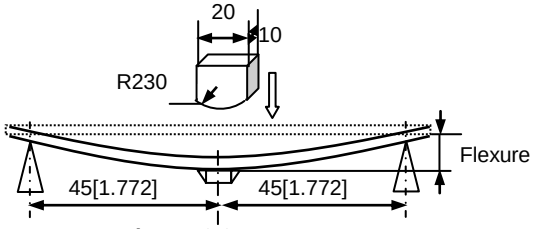
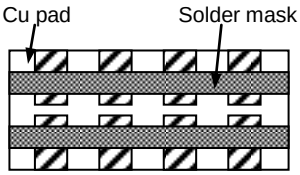
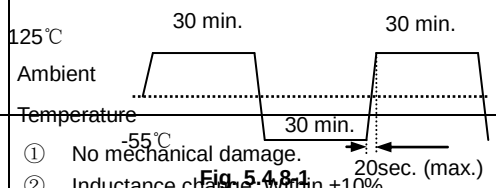


Fig. 5.3.5-2

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 2N force for HQ0603Q_T01 series. ③ Keep time: 10±1s ④ Speed: 1.0mm/s.
5.4.2 Resistance to Flexure	No visible mechanical damage. Type | a | b | c 0603[0201] | 0.25 | 0.8 | 0.3 Unit: mm [inch]  **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%.  Glass Epoxy Board **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: HQ0603Q_T01: -55℃ to +125℃, Reference temperature: +20℃
5.4.6 Solderability	① No visible mechanical damage. ② Wetting shall exceed 75% 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**) HQ0603Q_T01: -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 High 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 High 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: T

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	0603[0201]
Thickness (mm)	0.5±0.02
Tape	Paper Tape
Quantity	15K

(1) Taping Drawings (Unit: mm)

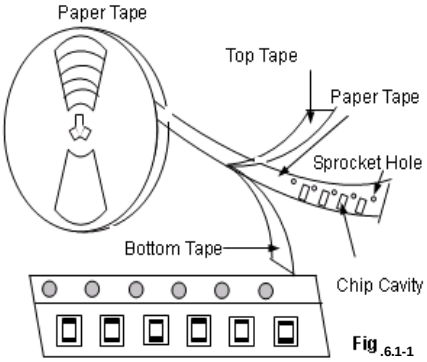


Fig.6.1-1

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

(2) Taping Dimensions (Unit: mm)

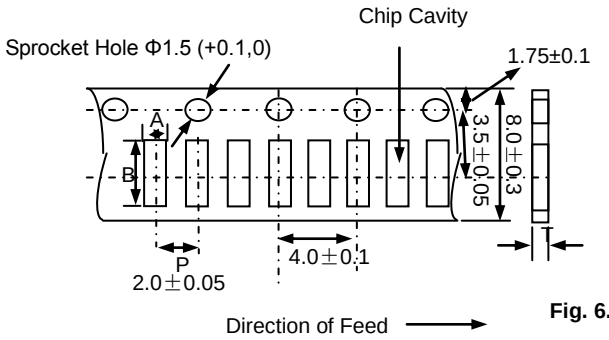


Fig. 6.1-2

Paper Tape

Type	A	B	P	T max
0603[0201]	0.36±0.02	0.68±0.02	2.0±0.05	0.5

(3) Reel Dimensions (Unit: mm)

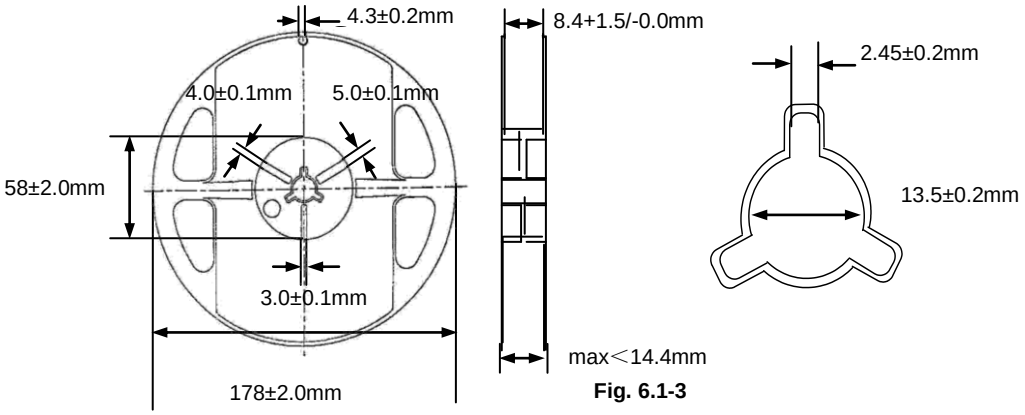


Fig. 6.1-3

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.

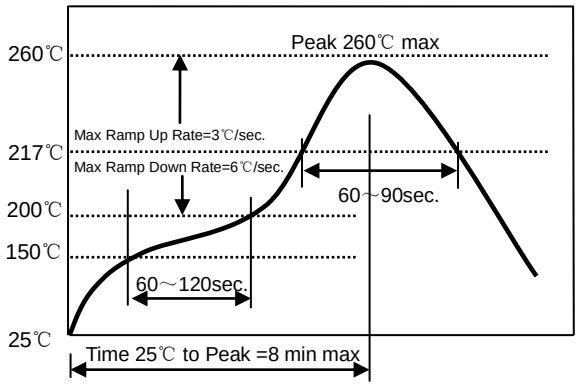
d. Solderability specified in **Clause 5.4.6** shall be guaranteed for 12 months from the date of delivery on condition that they are stored at the environment specified in **Clause 3**. For those parts, which passed more than 12 months shall be checked solder-ability before use.

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

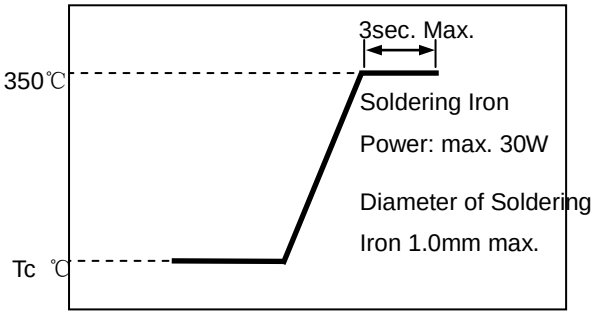
[Note: The reflow profile in the above table is only for qualification and is not meant to specify board assembly profiles. Actual board assembly profiles must be based on the customer's specific board design, solder paste and process, and should not exceed the parameters as the Reflow profile shows.]



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 (HQ0603Q_T01 Series of Inductors)

HQ0603Q_T01 **Series of Inductor**

Part Number 型号	Inductance 电感量	Min. Quality Factor 品质因子	L, Q Test Freq. L/Q 测试频率	Typical Q @ Freq. (GHz)					Min. Self-resonant Frequency 自谐频率	Max. DC Resistance 直流电阻	Max. Rated Current 额定电流	Thickness 厚度
				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	I r	T
HQ0603Q0N6□T01	0.6	20	500	-	-	-	-	-	20000	0.04	1100	
HQ0603Q0N7□T01	0.7	20	500	-	-	-	-	-	20000	0.04	1100	
HQ0603Q0N8□T01	0.8	20	500	-	-	-	-	-	18000	0.04	1100	
HQ0603Q0N9□T01	0.9	20	500	-	-	-	-	-	18000	0.04	1100	
HQ0603Q1N0□T01	1.0	20	500	47	60	92	99	110	16000	0.04	1100	
HQ0603Q1N1□T01	1.1	20	500	46	58	90	95	104	14000	0.04	1100	
HQ0603Q1N2□T01	1.2	20	500	45	56	88	92	100	13000	0.04	1100	
HQ0603Q1N3□T01	1.3	20	500	45	56	88	93	102	13000	0.04	1100	
HQ0603Q1N4□T01	1.4	20	500	42	55	89	95	103	12000	0.04	1100	
HQ0603Q1N5□T01	1.5	20	500	42	54	86	90	100	12000	0.05	1000	
HQ0603Q1N6□T01	1.6	20	500	41	52	80	83	92	10000	0.05	1000	
HQ0603Q1N7□T01	1.7	20	500	39	49	75	79	86	10000	0.07	800	
HQ0603Q1N8□T01	1.8	20	500	38	45	72	75	81	10000	0.08	800	
HQ0603Q1N9□T01	1.9	20	500	36	46	71	74	81	10000	0.12	600	
HQ0603Q2N0□T01	2.0	20	500	36	45	68	70	77	9000	0.12	600	
HQ0603Q2N1□T01	2.1	20	500	36	45	67	71	76	9000	0.12	600	
HQ0603Q2N2□T01	2.2	20	500	36	45	67	69	76	9000	0.12	600	
HQ0603Q2N3□T01	2.3	20	500	37	46	68	71	76	9000	0.12	600	
HQ0603Q2N4□T01	2.4	20	500	39	48	72	75	82	9000	0.12	600	
HQ0603Q2N5□T01	2.5	20	500	38	47	70	73	80	9000	0.12	600	0.4±0.02 [.016±.0008]
HQ0603Q2N6□T01	2.6	20	500	35	43	64	66	72	9000	0.12	600	
HQ0603Q2N7□T01	2.7	20	500	36	44	65	68	73	9000	0.12	600	
HQ0603Q2N8□T01	2.8	20	500	34	43	63	65	70	8000	0.12	600	
HQ0603Q2N9□T01	2.9	20	500	36	45	65	66	72	8000	0.12	600	
HQ0603Q3N0□T01	3.0	20	500	36	44	65	66	72	8000	0.12	600	
HQ0603Q3N1□T01	3.1	20	500	34	42	62	64	69	7500	0.17	500	
HQ0603Q3N2□T01	3.2	20	500	33	42	63	66	72	7000	0.17	500	
HQ0603Q3N3□T01	3.3	20	500	34	45	73	77	89	7000	0.17	500	
HQ0603Q3N4□T01	3.4	20	500	33	41	59	61	66	7000	0.17	500	
HQ0603Q3N5□T01	3.5	20	500	33	41	59	61	65	7000	0.17	500	
HQ0603Q3N6□T01	3.6	20	500	32	42	59	61	65	7000	0.17	500	
HQ0603Q3N7□T01	3.7	20	500	32	40	59	60	65	7000	0.17	500	
HQ0603Q3N8□T01	3.8	20	500	31	38	60	62	70	7000	0.17	500	
HQ0603Q3N9□T01	3.9	20	500	30	39	61	64	72	7000	0.17	500	
HQ0603Q4N0□T01	4.0	20	500	33	41	59	61	66	7000	0.17	500	
HQ0603Q4N1□T01	4.1	20	500	30	38	56	58	62	7000	0.17	500	
HQ0603Q4N2□T01	4.2	20	500	31	39	57	59	63	7000	0.17	500	
HQ0603Q4N3□T01	4.3	20	500	32	40	58	59	64	7000	0.17	500	
HQ0603Q4N7□T01	4.7	20	500	31	39	58	58	63	7000	0.25	400	
HQ0603Q5N1□T01	5.1	20	500	32	39	55	56	59	5500	0.25	400	

（Continued）

Part Number 型号	Inductance 电感量	Min. Quality Factor 品质因子	L, Q Test Freq. L/Q 测试频率	Typical Q @ Freq. (GHz)					Min. Self-resonant Frequency 自谐频率	Max. DC Resistance 直流电阻	Max. Rated Current 额定电流	Thickness 厚度
				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	I r	T
HQ0603Q5N6□T01	5.6	20	500	32	40	56	57	57	5500	0.25	400	0.4±0.02 [.016±.0008]
HQ0603Q6N2□T01	6.2	20	500	29	36	51	52	55	5500	0.25	400	
HQ0603Q6N8□T01	6.8	20	500	29	36	50	51	53	5500	0.3	400	
HQ0603Q7N5□T01	7.5	20	500	28	36	50	52	53	4500	0.3	400	
HQ0603Q8N2□T01	8.2	20	500	29	37	51	51	52	4500	0.4	300	
HQ0603Q9N1□T01	9.1	20	500	27	35	48	50	51	4500	0.4	300	
HQ0603Q10N□T01	10	20	500	28	36	48	49	47	4500	0.4	300	
HQ0603Q11N□T01	11	20	500	28	36	48	49	47	4000	0.5	300	
HQ0603Q12N□T01	12	20	500	29	36	48	49	48	4000	0.5	300	
HQ0603Q13N□T01	13	20	500	28	35	45	46	43	4000	0.5	300	
HQ0603Q15N□T01	15	20	500	27	34	41	40	37	3500	0.7	300	
HQ0603Q16N□T01	16	20	500	27	34	41	40	36	3500	0.8	250	
HQ0603Q18N□T01	18	20	500	28	35	41	39	35	3500	0.8	250	
HQ0603Q20N□T01	20	20	500	26	33	38	37	30	3000	0.8	250	
HQ0603Q22N□T01	22	20	500	25	31	35	33	29	3000	0.82	250	
HQ0603Q24N□T01	24	15	500	27	32	32	29	22	2000	1.6	170	
HQ0603Q27N□T01	27	15	500	25	30	29	25	17	2000	1.6	170	
HQ0603Q30N□T01	30	12	500	27	31	26	21	11	1700	2.0	150	
HQ0603Q33N□T01	33	12	300	26	31	23	19	8	1700	2.0	150	
HQ0603Q36N□T01	36	12	300	24	28	20	13	-	1500	2.0	150	
HQ0603Q39N□T01	39	12	300	25	29	17	11	-	1500	2.0	150	
HQ0603Q43N□T01	43	12	300	25	28	15	10	-	1300	2.5	130	
HQ0603Q47N□T01	47	12	300	25	28	14	7	-	1300	2.5	130	
HQ0603Q51N□T01	51	12	300	25	29	12	6	-	1200	2.5	130	
HQ0603Q56N□T01	56	12	300	24	27	10	2	-	1200	2.5	130	
HQ0603Q62N□T01	62	12	300	22	25	7	1	-	1100	5	100	
HQ0603Q68N□T01	68	12	300	21	24	2	-	-	1100	5	100	
HQ0603Q75N□T01	75	10	300	22	24	1	-	-	1100	5	100	
HQ0603Q82N□T01	82	10	300	20	20	-	-	-	1000	5	100	
HQ0603Q91N□T01	91	10	300	19	19	-	-	-	1000	7	80	
HQ0603QR10□T01	100	10	300	18	17	-	-	-	900	7	80	
HQ0603QR11□T01	110	10	300	19	18	-	-	-	900	8	80	
HQ0603QR12□T01	120	10	300	18	17	-	-	-	800	8	80	
HQ0603QR13□T01	130	7	100	16	14	-	-	-	700	8	80	
HQ0603QR15□T01	150	7	100	17	13	-	-	-	700	8	80	

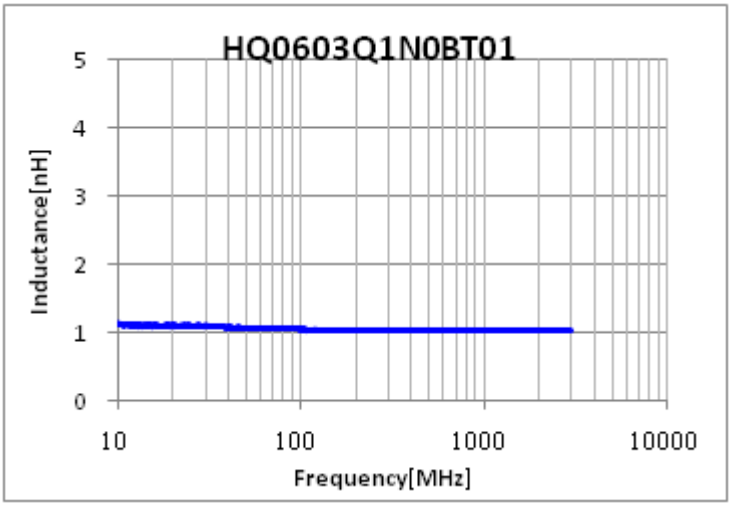
Note: □: Please specify the inductance tolerance. For L≤4.2nH, choose B=±0.1nH, C=±0.2nH or S=±0.3nH; For L＞4.2nH choose, H=±3%, J=±5%.

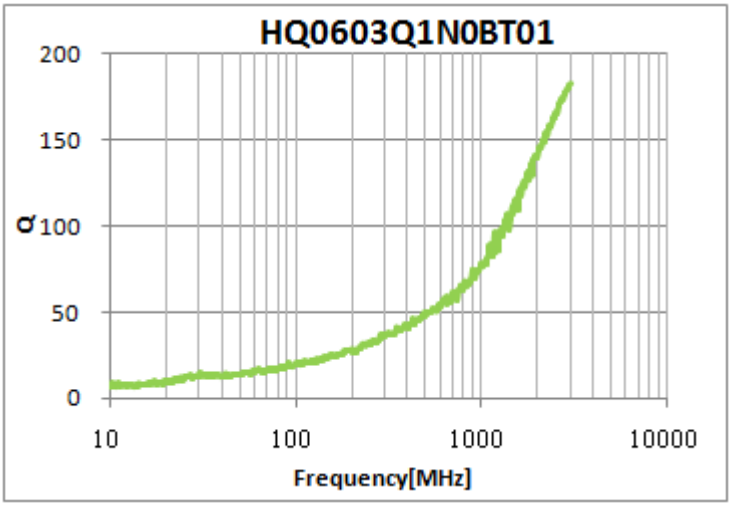
TYPICAL ELECTRICAL CHARACTERISTICS

Inductance-Frequency Characteristics(Typ.)

Q-Frequency Characteristics(Typ.)

HQ0603Q1N0BT01





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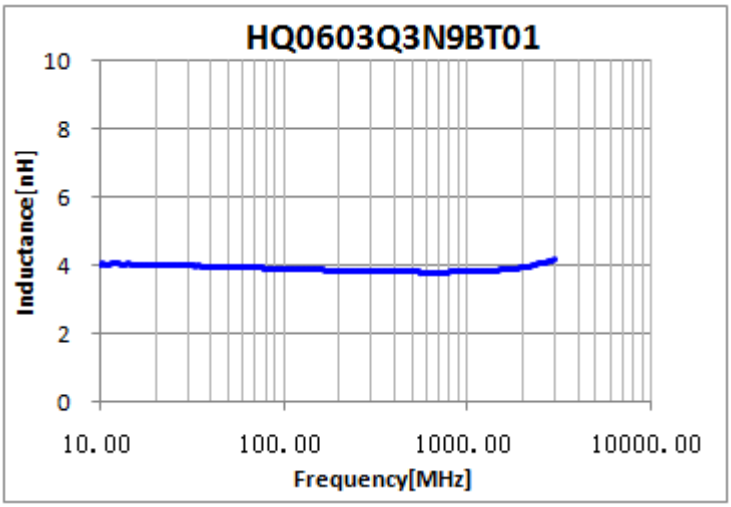

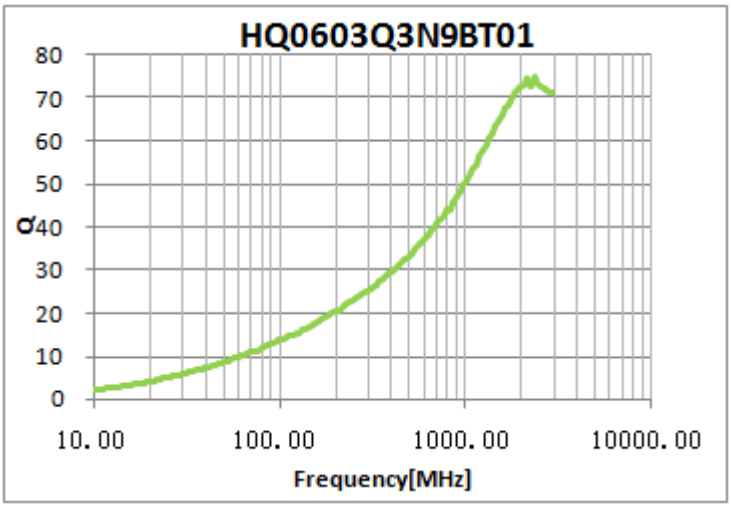

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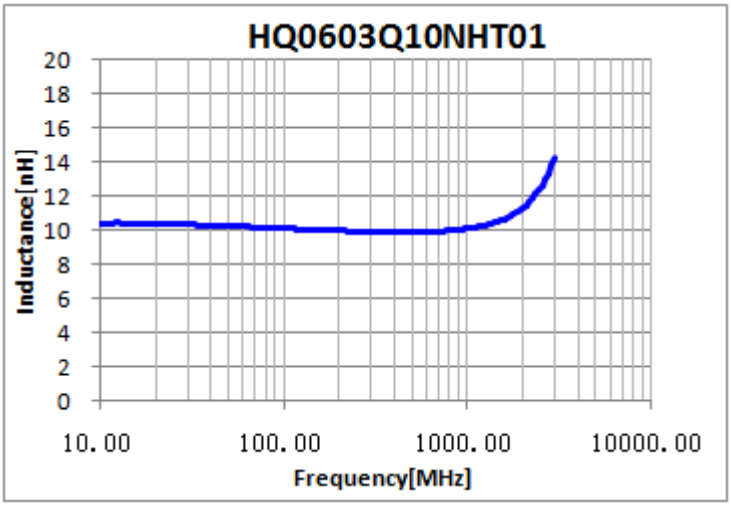

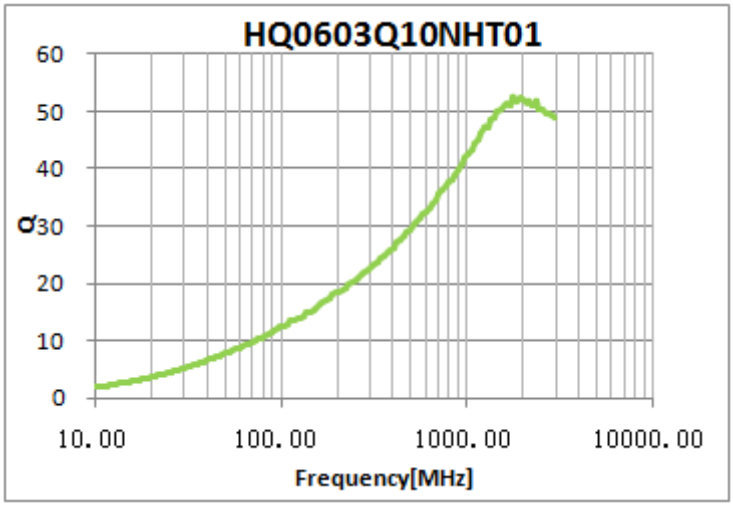

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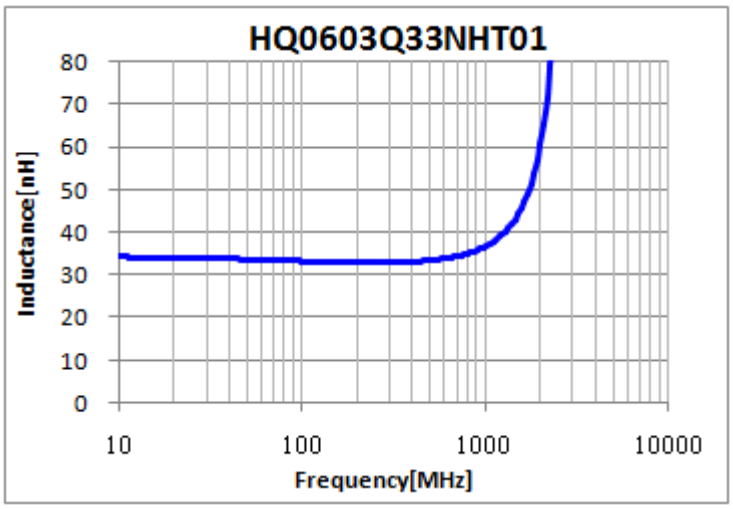

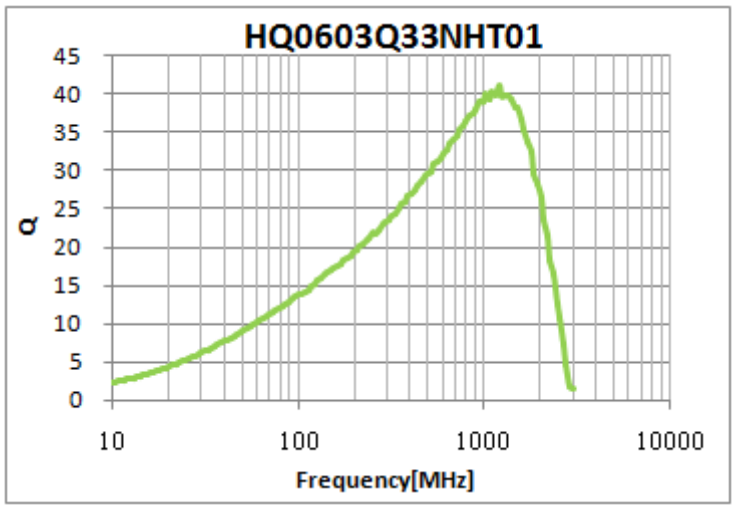

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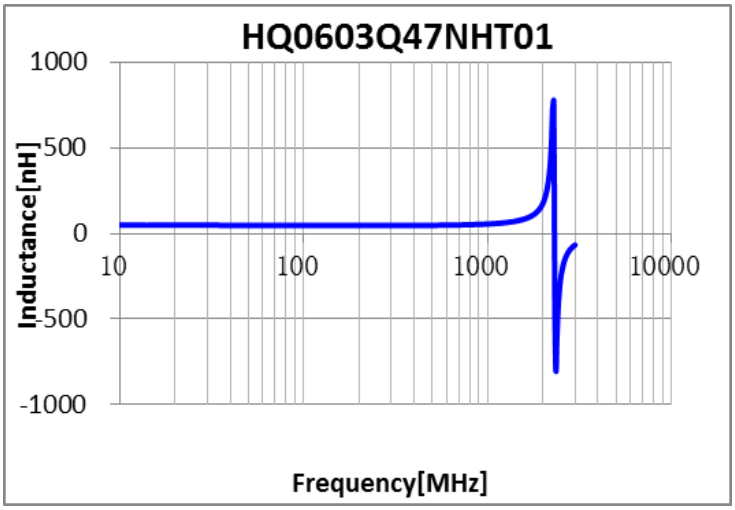

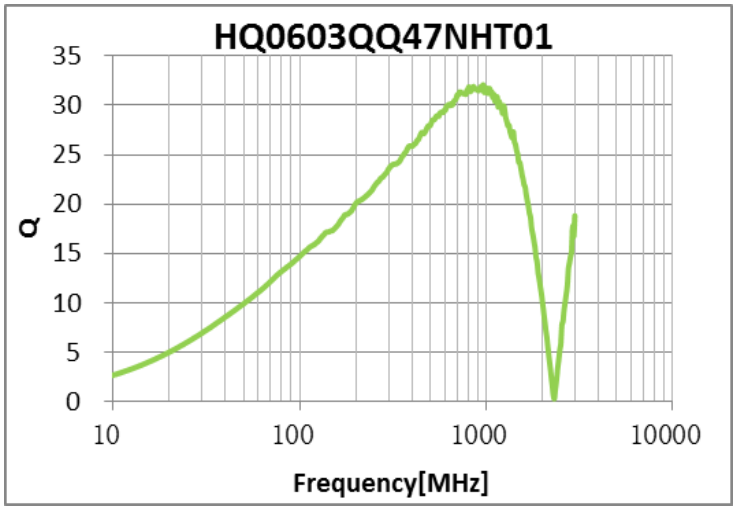

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