SPECIFICATIONS

Customer	
Product Name	Thin Film RF Inductor
Sunlord Part Number	SDCL0402H-01 Series
Customer Part Number	

[☒New Released, ☐Revised] **SPEC No.: SDCL0405200000**

【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

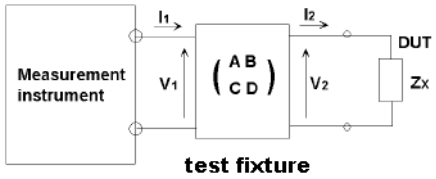
Caution

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 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
SDCL0402H-T01	0.11nH

1. **Scope**

This specification applies to SDCL0402H-01 series of thin film radio frequency inductor.

2. Product Description and Identification (Part Number)

1) Description

SDCL0402H-01 series of thin film radio frequency inductor.

2) Product Identification (Part Number)

SDCL	0402	H	XXX	□	◎	01
①	②	③	④	⑤	⑥	⑦

① Type	
SDCL	Ceramic Chip Inductor

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

③ Applications and Characteristics Code	
H	Standard Q

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

⑤ Inductance Tolerance	
B、C、S	B、C、S
G、H、J	G、H、J

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**.

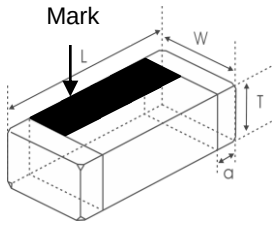


Fig. 4-1

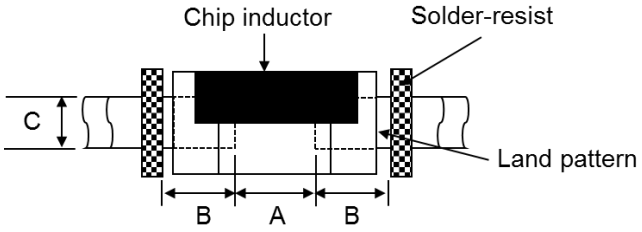


Fig. 4-2

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

Type	L	W	T	a	A	B	C
0402 [01005]	0.4±0.02 [.016±.0008]	0.2±0.02 [.008±.0008]	0.2±0.02 [.008±.0008]	0.095±0.025 [.00375±.0010]	0.15~0.19	0.18~0.22	0.18~0.22

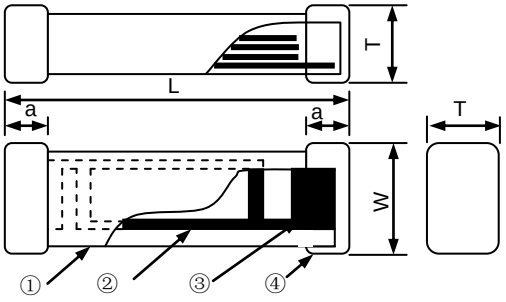
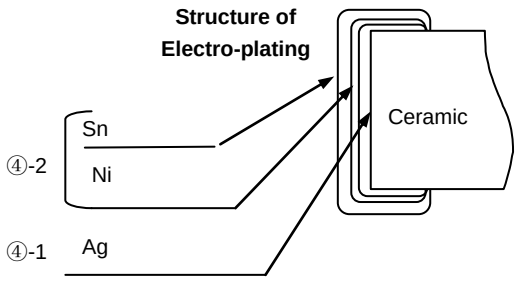


Fig. 4-3



① Ceramic for SDCL Series

② Internal electrode (Ag)

③ Pull out electrode(Ag)

④-1 Terminal electrode: Inside (Ag)

④-2 Outside (Electro-plating Ni-Sn)

Fig. 4-4

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	Termination Silver Composition
④-2	Electro-Plating: Ni/Sn plating	Plating Chemicals

4) Soldering Notice: The surface with the mark should be on the top side when soldering, but it is not necessary to identify the mark's direction towards left or right.

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-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: High 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**).

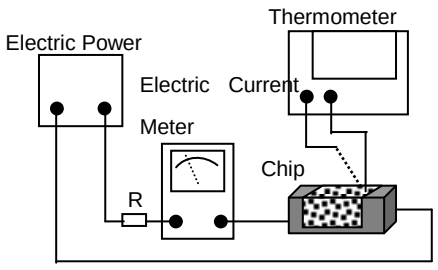


Fig. 5.3.5-1

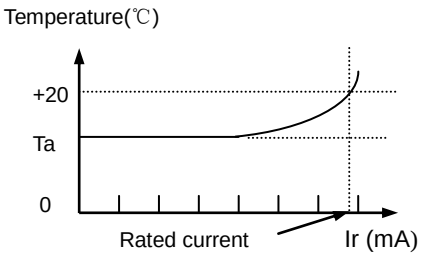
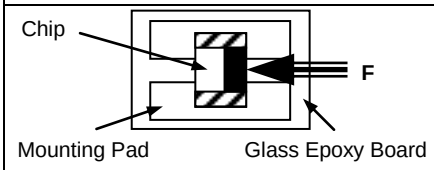
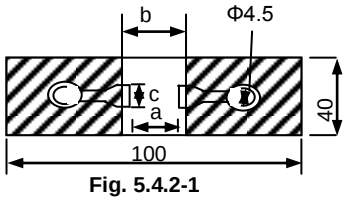
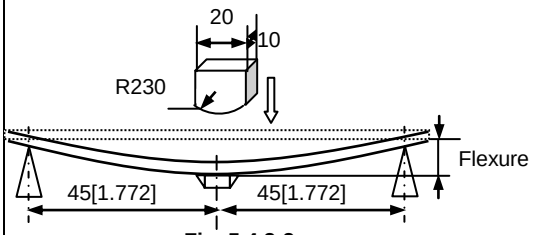
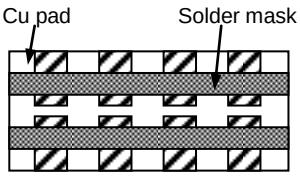
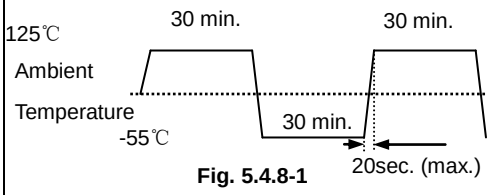


Fig. 5.3.5-2

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 SDCL0402H-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]  **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: SDCL0402H-01: -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**) SDCL0402H-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 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	0402[01005]
Thickness (mm)	0.2±0.02
Tape	Paper Tape
Quantity	20K

(1) Taping Drawings (Unit: mm)

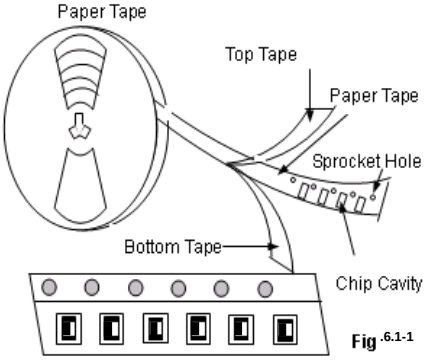


Fig .6.1-1

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

(2) Taping Dimensions

Paper Tape

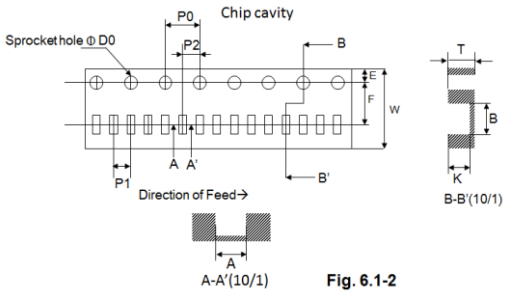


Fig. 6.1-2

Unit：mm

Type	A	B	K	P0	P1	P2	D0	T max	E	F	W
0402	0.24±0.02	0.44±0.02	0.24±0.02	4.0±0.1	2.0±0.05	2.0±0.05	1.5±0.1	0.35	1.75±0.1	3.5±0.05	8.0±0.3

(3) Reel Dimensions (Unit: mm)

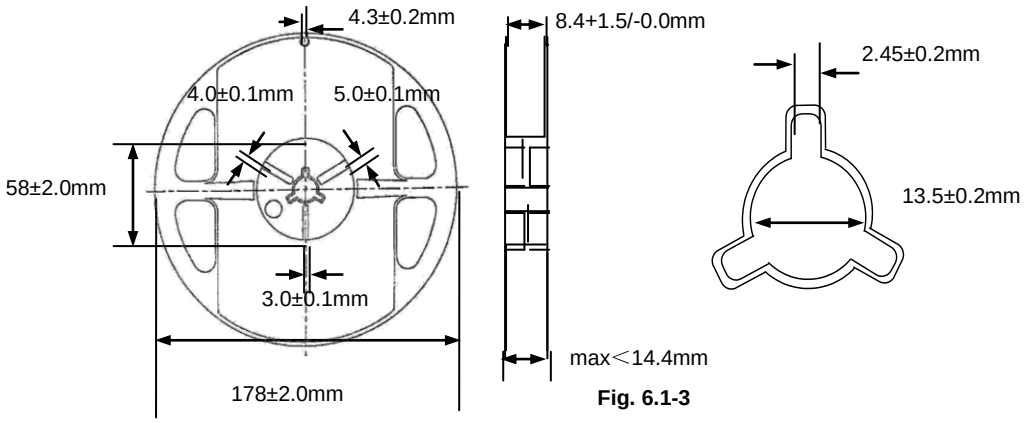


Fig. 6.1-3

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.

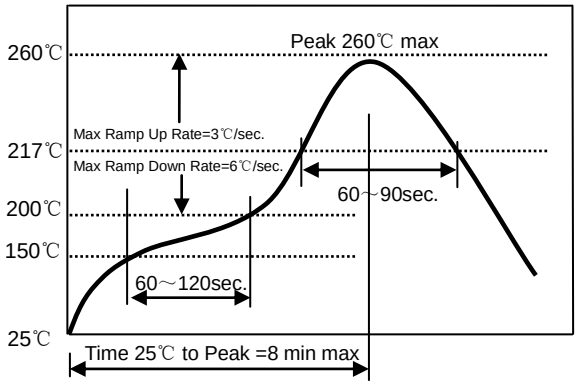
d. Solderability specified in **Clause 5.4.6** shall be guaranteed for 12 months from the date of delivery on condition that they are stored at the environment specified in **Clause 3**. For those parts, which passed more than 12 months shall be checked solder-ability before use.

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

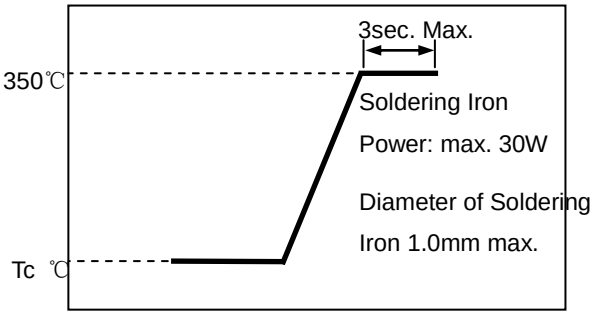
[Note: The reflow profile in the above table is only for qualification and is not meant to specify board assembly profiles. Actual board assembly profiles must be based on the customer's specific board design, solder paste and process, and should not exceed the parameters as the Reflow profile shows.]



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 (SDCL0402H-01 Series of Inductors)

SDCL0402H-01 **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	2.4				
Units 单位	nH	-	MHz	-					MHz	Ω	mA	mm [inch]
Symbol 符号	L	Q	Freq	Q					S.R.F	DCR	Ir	T
SDCL0402H0N2□T01	0.2	-	500	12	16	22	26	38	13000	0.4	320	0.2±0.02 [.008±.0008]
SDCL0402H0N3□T01	0.3	-	500	12	15	22	25	36	13000	0.4.	320	
SDCL0402H0N4□T01	0.4	8	500	11	14	21	22	24	13000	0.4	320	
SDCL0402H0N5□T01	0.5	8	500	10	13	21	23	25	13000	0.4	320	
SDCL0402H0N6□T01	0.6	8	500	12	14	20	23	25	13000	0.4	320	
SDCL0402H0N7□T01	0.7	8	500	11	13	21	22	24	13000	0.4	320	
SDCL0402H0N8□T01	0.8	8	500	10	12	20	21	23	13000	0.4	320	
SDCL0402H0N9□T01	0.9	8	500	11	13	20	22	24	13000	0.4	320	
SDCL0402H1N0□T01	1	8	500	10	12	19	21	23	11500	0.4	220	
SDCL0402H1N1□T01	1.1	8	500	11	13	19	22	24	11500	0.4	220	
SDCL0402H1N2□T01	1.2	8	500	10	12	20	21	23	11500	0.4	220	
SDCL0402H1N3□T01	1.3	8	500	10	12	19	21	23	11500	0.4	220	
SDCL0402H1N4□T01	1.4	8	500	11	13	20	21	23	11500	0.4	220	
SDCL0402H1N5□T01	1.5	8	500	10	13	19	21	24	11500	0.4	220	
SDCL0402H1N6□T01	1.6	8	500	10	12	19	21	23	11500	0.4	220	
SDCL0402H1N7□T01	1.7	8	500	11	13	20	21	24	9500	0.5	200	
SDCL0402H1N8□T01	1.8	8	500	10	12	19	21	23	9000	0.5	200	
SDCL0402H1N9□T01	1.9	8	500	10	12	20	21	23	9000	0.5	200	
SDCL0402H2N0□T01	2	8	500	11	12	19	21	23	9000	0.5	200	
SDCL0402H2N1□T01	2.1	8	500	10	12	19	22	24	9000	0.5	200	
SDCL0402H2N2□T01	2.2	8	500	9.5	11	18	20	22	7500	0.55	200	
SDCL0402H2N3□T01	2.3	8	500	10	12	19	21	23	7500	0.55	200	
SDCL0402H2N4□T01	2.4	8	500	10	12	19	21	23	7500	0.55	200	
SDCL0402H2N5□T01	2.5	8	500	9.5	11	18	20	22	7500	0.6	200	
SDCL0402H2N6□T01	2.6	8	500	11	12	19	21	23	7500	0.6	200	
SDCL0402H2N7□T01	2.7	8	500	10	12	19	22	24	7500	0.6	200	
SDCL0402H2N8□T01	2.8	8	500	10	12	19	21	23	7500	0.8	200	
SDCL0402H2N9□T01	2.9	8	500	10	12	19	21	23	7500	0.8	200	
SDCL0402H3N0□T01	3	8	500	10	12	19	20	23	7500	0.9	200	
SDCL0402H3N1□T01	3.1	8	500	10	13	19	20	22	7500	0.9	200	
SDCL0402H3N2□T01	3.2	8	500	9	11	19	20	22	7500	0.9	180	
SDCL0402H3N3□T01	3.3	8	500	10	13	19	20	23	7500	0.9	180	
SDCL0402H3N4□T01	3.4	8	500	10	12	19	21	23	7500	1	180	
SDCL0402H3N5□T01	3.5	8	500	10	13	19	21	24	7500	1	180	
SDCL0402H3N6□T01	3.6	8	500	11	12	19	21	23	7500	1	180	
SDCL0402H3N7□T01	3.7	8	500	10	12	19	21	23	7500	1	180	
SDCL0402H3N8□T01	3.8	8	500	10	12	19	21	23	7500	1	180	
SDCL0402H3N9□T01	3.9	8	500	9	11	19	20	22	7500	1	180	
SDCL0402H4N0□T01	4	8	500	10	12	19	21	23	7500	1.1	180	
SDCL0402H4N1□T01	4.1	8	500	11	12	19	21	24	7500	1.1	180	
SDCL0402H4N2□T01	4.2	8	500	10	12	18	20	22	7500	1.1	180	
SDCL0402H4N3□T01	4.3	8	500	10	13	19	21	24	7500	1.1	180	
SDCL0402H4N7□T01	4.7	8	500	9	11	19	20	22	6500	1.2	160	
SDCL0402H5N1□T01	5.1	8	500	10	12	18	19	22	6500	1.3	160	
SDCL0402H5N6□T01	5.6	8	500	10	12	17	22	24	6000	1.5	140	
SDCL0402H6N2□T01	6.2	8	500	10	11	18	20	23	5500	1.6	140	

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	2.4				
Units 单位	nH	-	MHz	-					MHz	Ω	mA	mm [inch]
Symbol 符号	L	Q	Freq	Q					S.R.F	DCR	Ir	T
SDCL0402H6N8□T01	6.8	8	500	10	11	17	20	23	5500	1.8	140	0.2±0.02 [.008±.0008]
SDCL0402H7N5□T01	7.5	8	500	10	13	17	22	24	4500	1.8	140	
SDCL0402H8N2□T01	8.2	8	500	10	12	18	20	22	4500	2	140	
SDCL0402H9N1□T01	9.1	8	500	10	13	17	21	23	4000	2	140	
SDCL0402H10N□T01	10	8	500	9	12	18	20	21	4000	2.2	140	
SDCL0402H11N□T01	11	8	500	9	12	18	19	20	4000	2.4	140	
SDCL0402H12N□T01	12	8	500	9	12	17	18	18	4000	2.4	140	
SDCL0402H13N□T01	13	7	500	8	12	17	18	18	3500	3	140	
SDCL0402H15N□T01	15	7	500	8	12	16	15	14	3000	3	140	
SDCL0402H16N□T01	16	7	500	8	11	13	12	11	2500	3.2	140	
SDCL0402H18N□T01	18	7	500	7.5	10	12	10	9	2500	3.2	140	
SDCL0402H20N□T01	20	6	500	7	9	11	9	7	2500	4.5	120	
SDCL0402H22N□T01	22	6	500	7	10	10	9	7	2300	5	120	
SDCL0402H24N□T01	24	6	500	8	11	10	9	6	2000	5.5	120	
SDCL0402H27N□T01	27	6	500	8	10	8	7	-	2000	5.5	120	
SDCL0402H30N□T01	30	6	500	7	9	7	-	-	1800	6.5	90	
SDCL0402H33N□T01	33	6	300	8	9	7	-	-	1800	6.5	90	

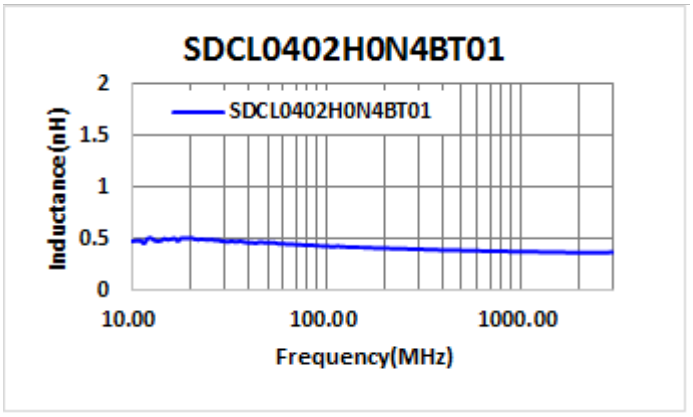
Note: □: Please specify the inductance tolerance. For L≤4.2nH, choose B=±0.1nH, C=±0.2nH or S=±0.3nH;For L≥4.3nH, choose, H=±3%, J=±5%

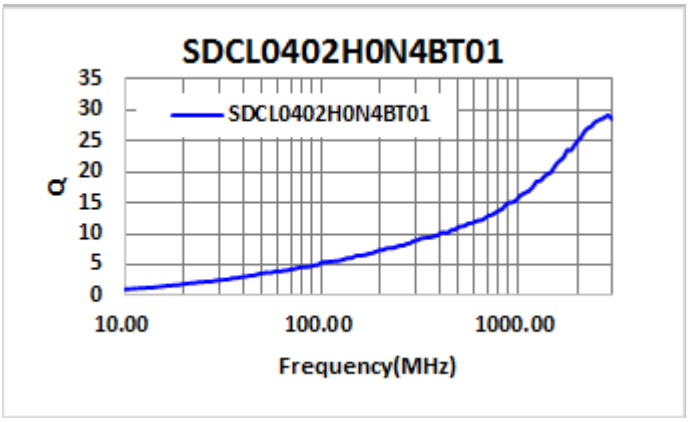
TYPICAL ELECTRICAL CHARACTERISTICS

Inductance-Frequency Characteristics(Typ.)

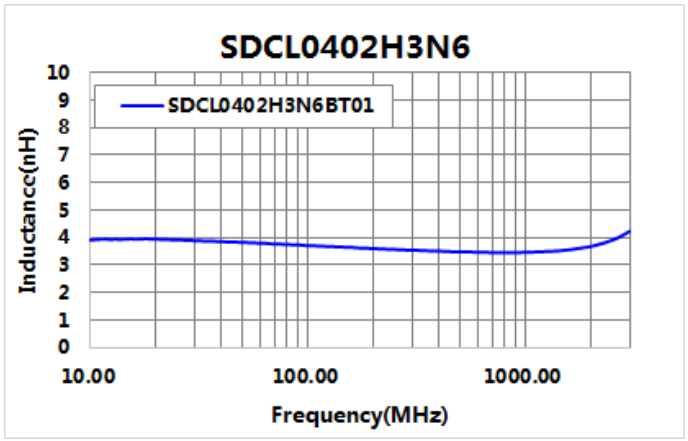
Q-Frequency Characteristics(Typ.)

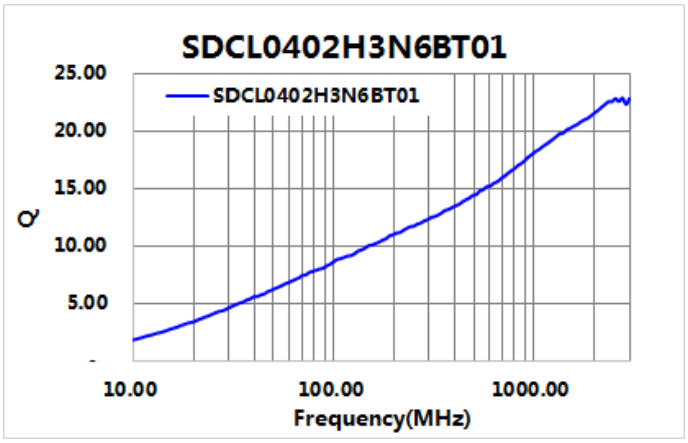
SDCL0402H0N4BT01





SDCL0402H3N6BT01





SDCL0402H20NHT01