List of publications

1. B. C. Das and N. S. Bhattacharyya, A Wideband Circularly Polarized Patch Antenna for Active Array Radar Applications in X Band. *IEEE Access*, 2022, pp. 1535-1540.
   doi: 10.1109/MAPCON56011.2022.10047804.
2. Das, B. C., & Bhattacharyya, N. S. (2025). A novel fluidic-based phase reconfiguration technique using embedded slot-coupled transmission lines for X-band applications. *APL Electronic Devices* , *1*(3).
   https://doi.org/10.1063/5.0277391
3. Bidhan C Das, Nidhi S Bhattacharyya, Sreejith C A, Beenamole K S, A Low-Profile, Wideband Substrate Integrated Waveguide (SIW) Cavity Backed Antenna Array with Coplanar Calibration Lines. Defense Science Journal (Revision communicated)
4. Bidhan C Das, Nidhi S Bhattacharyya, Mitigation of Mutual Coupling in Linear Array Systems Incorporating Metasurface Superstrate. *Journal of Electromagnetic Waves and Applications* (Revision communicated)

List of conferences attended

1. Presented poster entitled “A Single Layered, angular stable, modified FSS structure for RADAR applications in X-band” at the DST-SERB Sponsored International Conference on Devices, Sensors and Systems (CoDSS) 2024 organized by the Department of Electronics and Communication Engineering, Tezpur University, Assam during 10-11 February 2024.
2. Presented poster titled “A Wideband Circularly Polarized Patch Antenna for Active Array Radar Applications in X Band” at 1st IEEE International Conference Microwave, Antennas and Propagation Conference (MAPCON) Dec 12-15 organized by IEEE MTT/AP society Bangalore Jt Chapter.

List of workshops and training attended

1. Completed 06 months training program on design and development of Active Phased Array Antennas and worked on the project title "A wideband, low profile 8X8 phased array and a technique for mutual coupling reduction in linear arrays“ under the guidance of Mr. Srecjith CA, Scicntist ‘D’, at Electronics and Radar Development Establishment (LRDE), Defence Rescarch & Development Organisation (DRD0), from July 2023 to Dccember2023.
2. Participated in Seven Day Training Program on “State of Art Electronics System and Design” organized by Department of Electronics and Communication Engineering (ECE), Gauhati University in association with Project Management Unit, NIT Agartala under Synergistic Training Program Utilizing Scientific and Technological Infrastructure (STUTI) during 22nd Sept to 28th Sept, 2022.

List of book chapters

1. Bidhan Chandra Das and Nidhi S. Bhattacharyya, “Angular stable, modified FSS structure for RADAR applications in X band”, in the book Current Trends in Electronic Devices, Sensors and Systems, Cambridge Scholars Publishing. (Accepted).
2. Bidhan Ch Das, Subham Das and Nidhi S Bhattacharyya, “A 1-Bit Meta Structure based Transmission Line Phase Shifter for X-Band Applications”, in the book Advances in Physical Sciences: Theories, Applications and Innovations. (Accepted)
3. Bidhan Ch Das and Nidhi S Bhattacharyya, “Design and Analysis of Patch Antenna Array for High Gain Applications in X-band”, in the book Frontiers in Natural Sciences (Vol. I). (Under review)

Appendix I

Datasheet of RF PIN diode

DATA SHEET

SMP1320 Series: Low Resistance, Low Capacitance, Plastic Packaged PIN Diodes

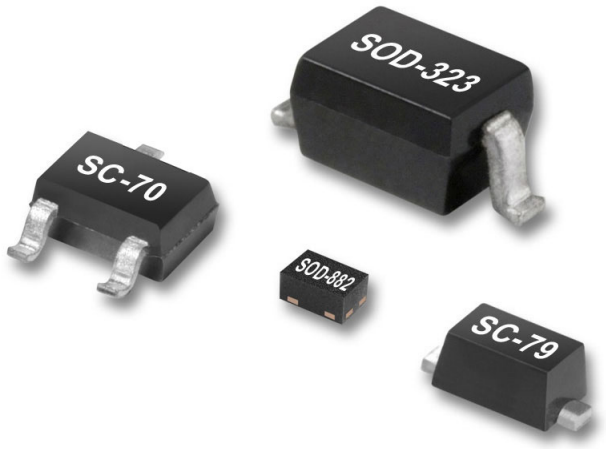
Applications

- High-volume wireless applications

Features

- Resistance: 0.75 Ω typical @ 10 mA
- Capacitance: 0.23 pF typical @ 30 V
- Packages rated MSL1, 260 °C per JEDEC J-STD-020)

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04–0074.



Description

The SMP1320 series of plastic packaged, surface mountable PIN diodes is designed for use in high volume switch applications from 10 MHz to more than 10 GHz. The low capacitance of these diodes (0.3 pF maximum at 30 V), combined with a low resistance (0.9 Ω maximum at 10 mA), makes the SMP1320 series particularly suited for high-isolation, series-connected PIN diode switches in battery-operated circuits.

The SMP1320 series is available in a selection of plastic packages and a variety of configurations that include an SC-70, a small footprint SC-79, and a miniature SOD-882. Table 1 describes the various packages and markings of the SMP1320 series.

Table 1. SMP1320 Series Packaging and Marking

				
Series Pair	Low Inductance	Single	Single	Single
SC-70	SC-70	SOD-323 Green™	SC-79 Green™	SOD-882 Green™
SMP1320-075LF Green™ Marking: RL2	**SMP1320-077LF** Green™ Marking: RLB	**SMP1320-011LF** Marking: RL	**♦SMP1320-079LF** Marking: Cathode and C5	**SMP1320-040LF** Marking: N
L_S = 1.4 nH	L_S = 0.4 nH	L_S = 1.5 nH	L_S = 0.7 nH	L_S = 0.45 nH

The Pb-free symbol or "LF" in the part number denotes a lead-free, RoHS-compliant package unless otherwise noted as Green™. Tin/lead (Sn/Pb) packaging is not recommended for new designs.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMP1320 series are provided in Table 2. Electrical specifications are provided in Table 3. Resistance versus temperature measurements are provided in Table 4.

Typical performance characteristics of the SMP1320 series are illustrated in Figures 1 to 4. Package dimensions are shown in Figures 5 to 11 (odd numbers), and tape and reel dimensions are provided in Figures 6 to 12 (even numbers).

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SMP1320 series is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

Table 2. SMP1320 Series Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Reverse voltage	V_R		50	V
Power dissipation @ 25 °C lead temperature	P_D		400	mW
Storage temperature	T_{STG}	–65	+150	°C
Operating temperature	T_A	–65	+150	°C
Electrostatic discharge:	ESD			
Charged Device Model (CDM), Class 4			1000	V
Human Body Model (HBM), Class 2			2000	V
Machine Model (MM), Class B			200	V

1 Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

***ESD HANDLING**: Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

Table 3. SMP1320 Series Electrical Specifications[1] (T_A = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse current	I_R	V_R = 50 V			10	µA
Capacitance[2]	C_T	F = 1 MHz, V = 30 V		0.23	0.30	pF
Resistance	R_S	F = 100 MHz				
		I = 1 mA		2.00		Ω
		I = 10 mA		0.75	0.90	Ω
Forward voltage	V_F	I_F = 10 mA		0.85		V
Carrier lifetime	TI	I_F = 10 mA		0.4		µs
I region width				7		µm

1 Performance is guaranteed only under the conditions listed in this table.

2 C_T @ 30 V is 0.45 pF maximum for the SMP1320-077LF.

Table 4. Resistance vs Temperature @ 500 MHz

I_F (mA)	R_S @ –55 °C (Ω)	R_S @ –15 °C (Ω)	R_S @ +25 °C (Ω)	R_S @ +65 °C (Ω)	R_S @ +100 °C (Ω)
0.02	29.6	29.2	30.8	32.0	32.7
0.10	7.2	7.7	8.3	8.8	8.8
0.3	3.4	3.6	3.8	4.0	4.1
0.5	2.5	2.7	2.8	2.9	3.0
1.0	1.7	1.8	1.9	2.0	1.9
10	0.84	0.85	0.76	0.76	0.67
20	0.73	0.73	0.64	0.64	0.56
100	0.59	0.57	0.47	0.48	0.40

Typical Performance Characteristics

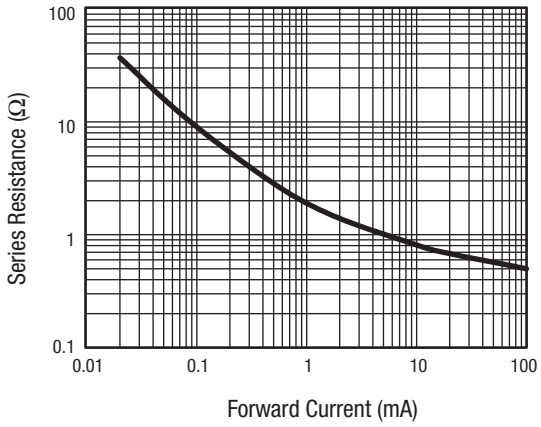


Figure 1. Series Resistance vs Current @ 100 MHz

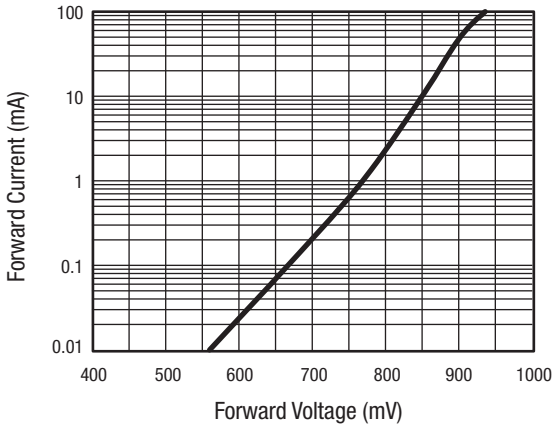


Figure 2. Forward Current vs Voltage

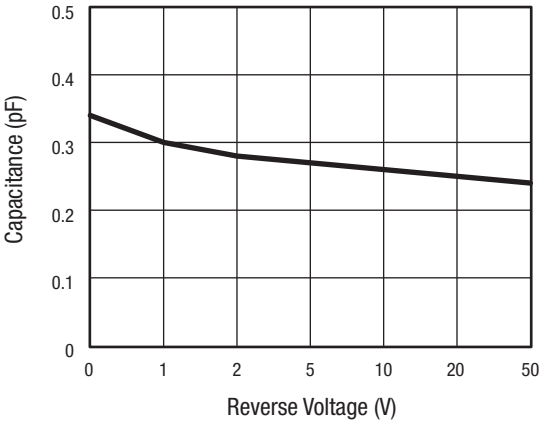


Figure 3. Capacitance vs Reverse Voltage (1 MHz to 1 GHz)

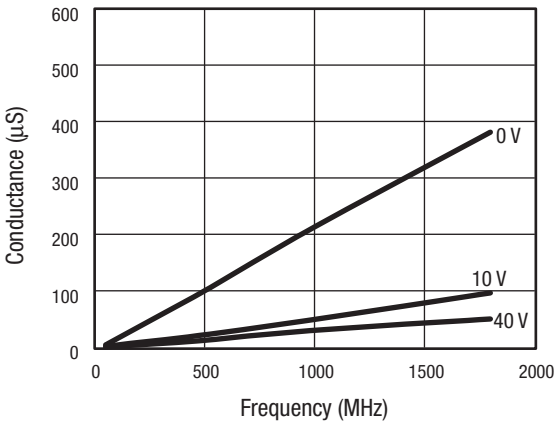
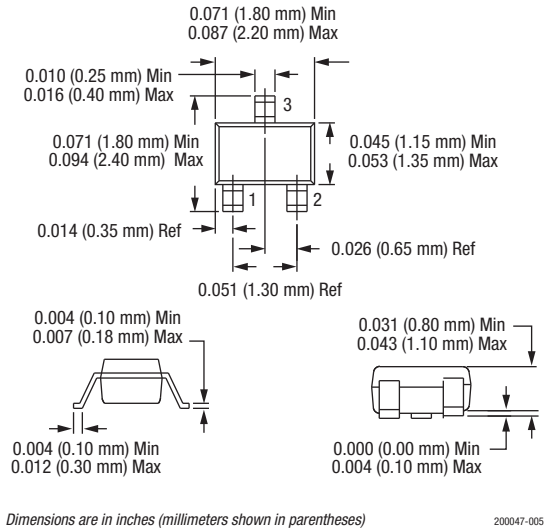
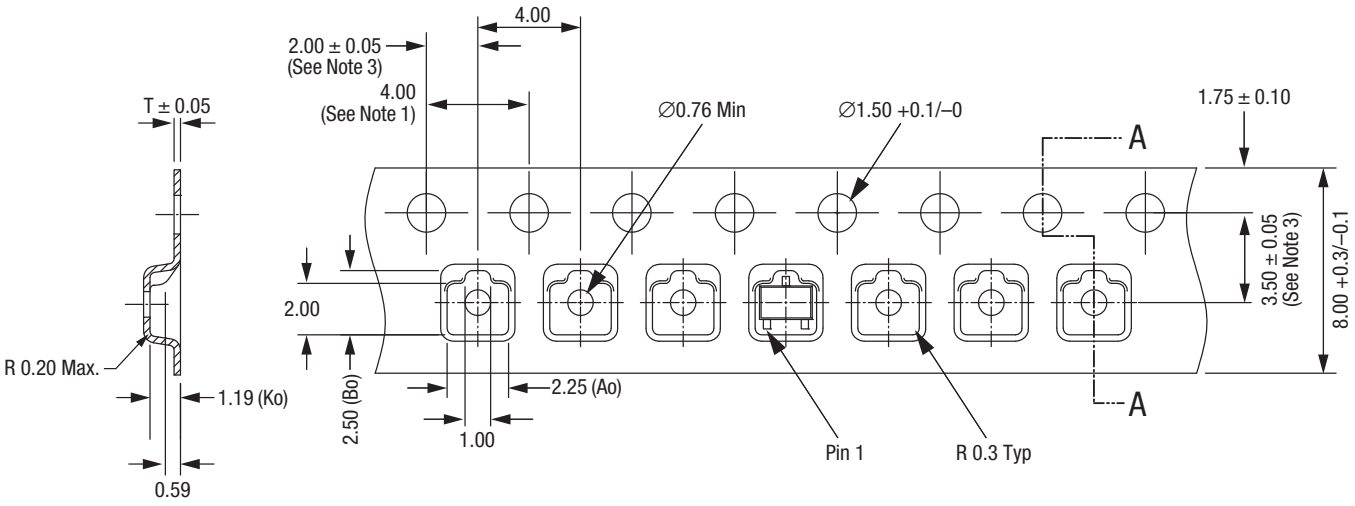


Figure 4. Conductance vs Frequency and Reverse Voltage



Dimensions are in inches (millimeters shown in parentheses) 200047-005

Figure 5. SC-70 Package Dimension Drawing

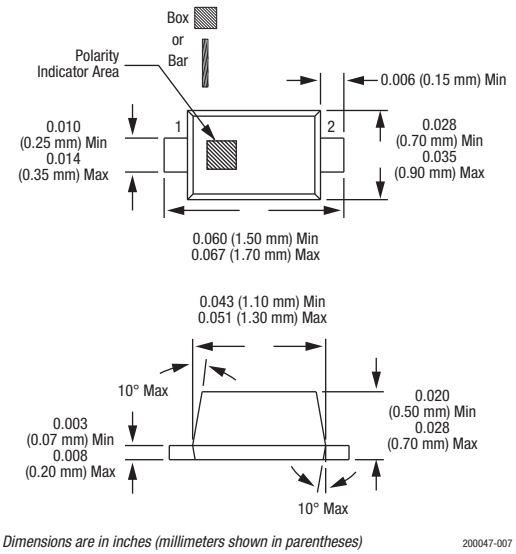


Notes:

1. *Sprocket hole pitch cumulative tolerance ±0.2 mm.*
2. *Carrier tape: black conductive polystyrene.*
3. *Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.*
4. *Cover tape material: transparent and conductive material.*
5. *All measurements are in millimeters.*

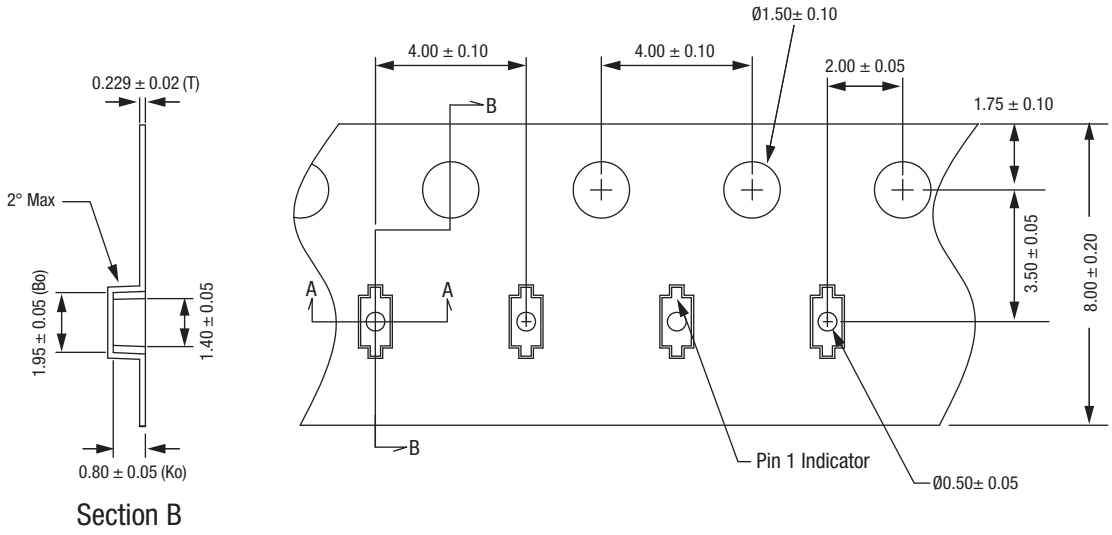
200047-006

Figure 6. SC-70 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses) 200047-007

Figure 7. SC-79 Package Dimension Drawing

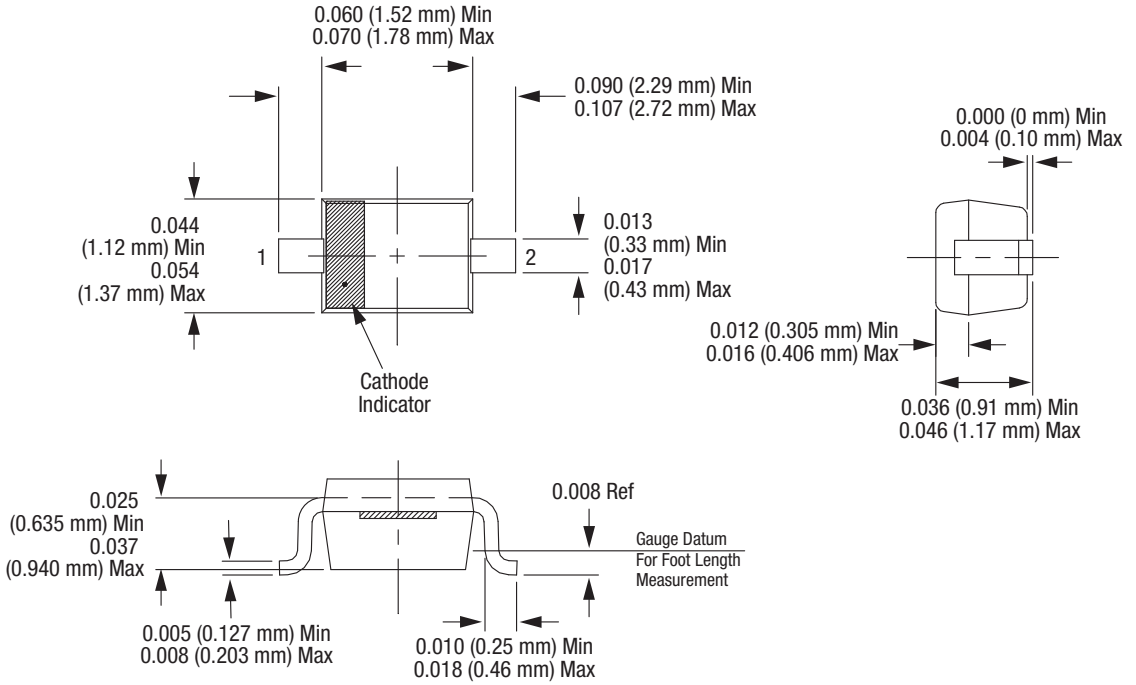


Notes:

1. *Carrier tape: black conductive polycarbonate or polystyrene.*
2. *Cover tape material: transparent conductive PSA.*
3. *Cover tape size: 5.4 mm width.*
4. *ESD-surface resistivity is ≤1 x 10^8 Ohms/square per EIA, JEDEC TNR Specification.*
5. *All measurements are in millimeters.*

200047-008

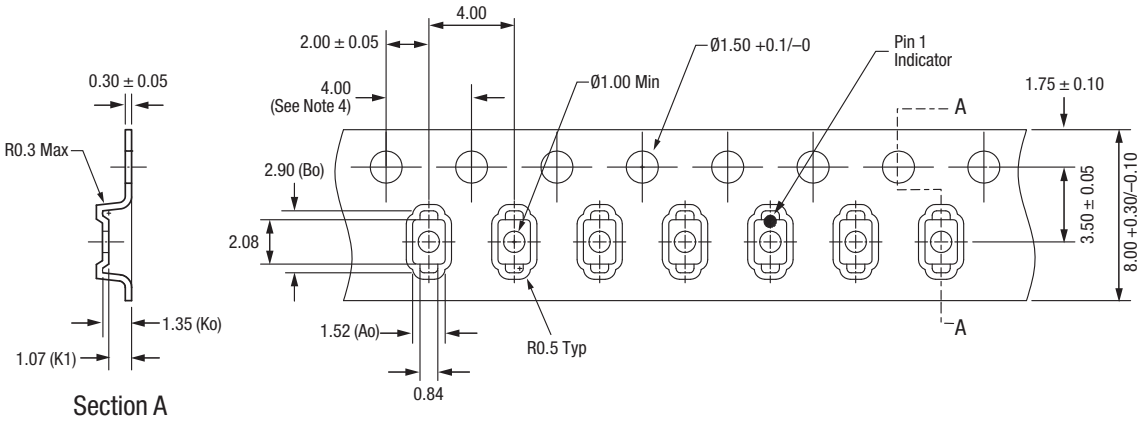
Figure 8. SC-79 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses)

200047-009

Figure 9. SOD-323 Package Dimension Drawing

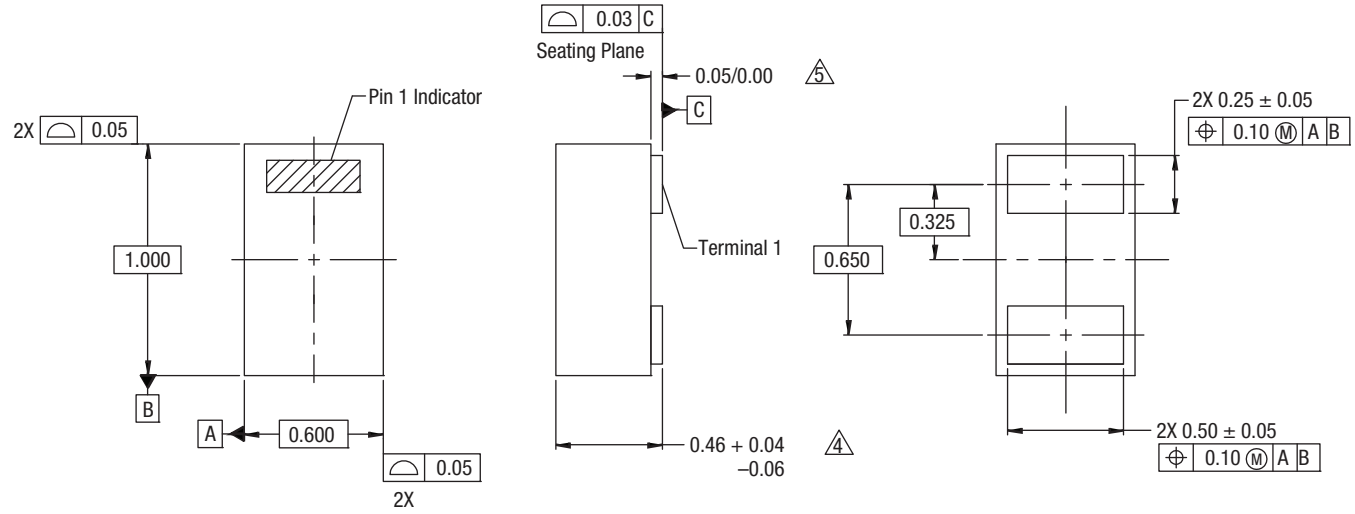


Notes:

1. *Carrier tape: black conductive polystyrene.*
2. *Cover tape: transparent conductive PSA.*
3. *Cover tape size: 5.4 mm width.*
4. *10 sprocket hole pitch cumulative tolerance: ±0.20 mm.*
5. *All measurements are in millimeters.*

200047-010

Figure 10. SOD-323 Tape and Reel Dimensions

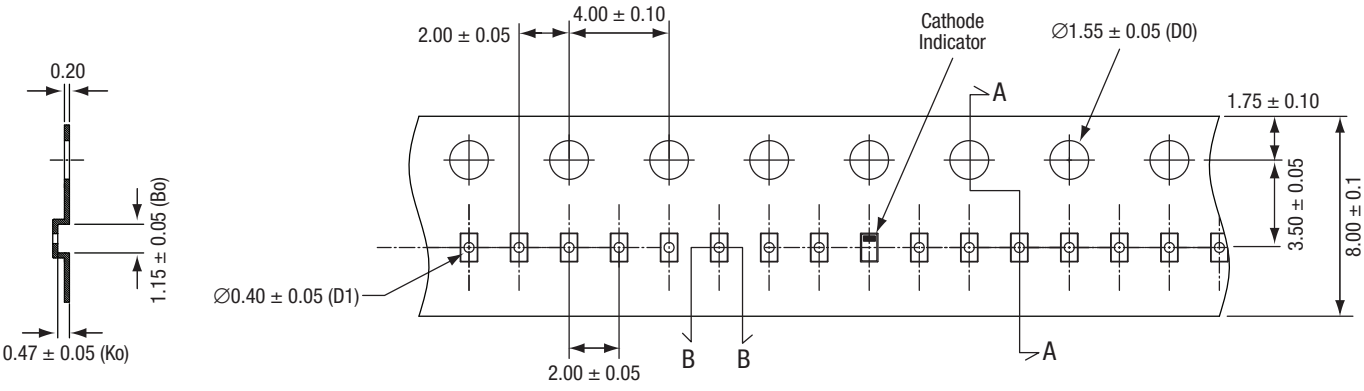


Notes:

1. *All measurements are in millimeters.*
2. *Dimensions and tolerances according to ASME Y14.5M-1994.*
3. *These packages are used principally for discrete devices.*
4. *This dimension includes stand-off height and package body thickness, but does not include attached features, e.g., external heatsink or chip capacitors. An integral heatslug is not considered an attached feature.*
5. *This dimension is primarily terminal plating, but does not include small metal protrusion.*

200047-011

Figure 11. SOD-882 Package Dimension Drawing



Notes:

1. *Carrier tape: black conductive polycarbonate.*
2. *Cover tape: transparent conductive material.*
3. *Cover tape size: 5.4 mm width.*
4. *ESD surface resistivity is ≥1 x 10^4 ~ ≤ 1 x 10^8 Ohms/square.*
5. *All dimensions are in millimeters.*

200047-012

Figure 12. SOD-882 Tape and Reel Dimensions

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Skyworks:

SMP1320-040LF SMP1320-075LF SMP1320-079LF SMP1320-011LF

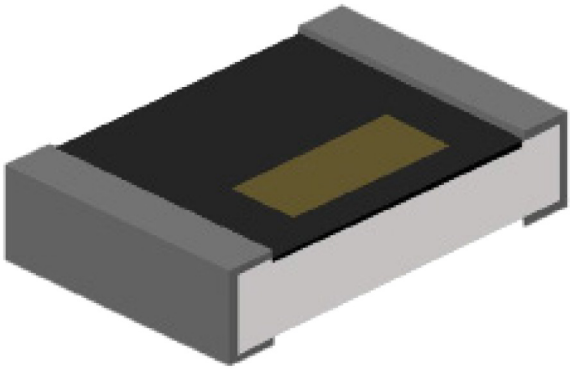
Appendix II

Datasheet of RF inductor

Thin Film Chip Inductor

multicomp PRO

RoHS Compliant



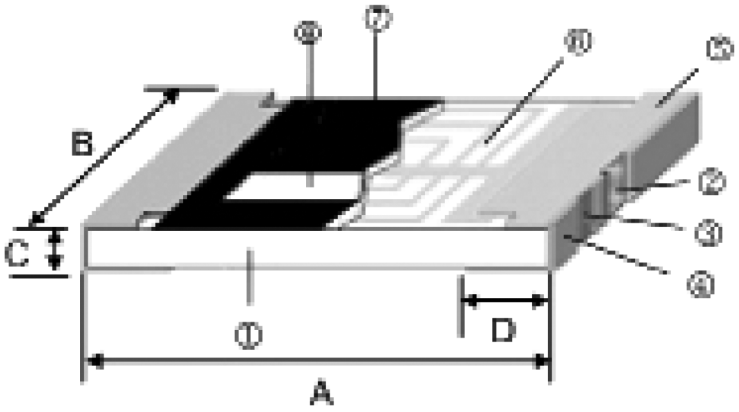
Features

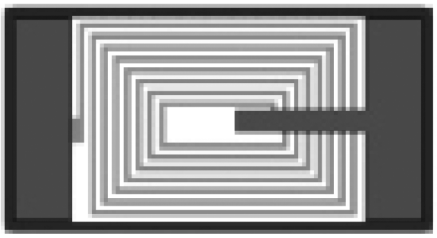
- Photolithographic single layer ceramic chip
- High SRF, excellent Q, superior temperature stability
- Tight tolerance of ± 1% or ± 0.1nH
- Self resonant frequency controlled within 10%
- Stable inductance in high frequency circuit
- Highly stable design for critical needs

Applications

- Cellular Telephone, Pagers and GPS Products
- VCO, TCXO Circuit and RF Transceiver Module
- Wireless LAN, Bluetooth Module, Communication Appliances

Construction





①	Alumina Substrate	⑤	Edge Electrode
②	Inner Electrode (Ni-Cr)	⑥	Cu Circuits
③	Barrier Layer (Ni)	⑦	Overcoat
④	External Electrode (Sn)	⑧	Marking

Dimensions

Size (Inch)	A	B	C	D	Weight (g) (1,000pcs)
0201	0.6 ± 0.05	0.3 ± 0.05	0.23 ± 0.05	0.15 ± 0.05	0.3
0402	1 ± 0.05	0.5 ± 0.05	0.32 ± 0.05	0.2 ± 0.1	0.9

Dimensions: mm

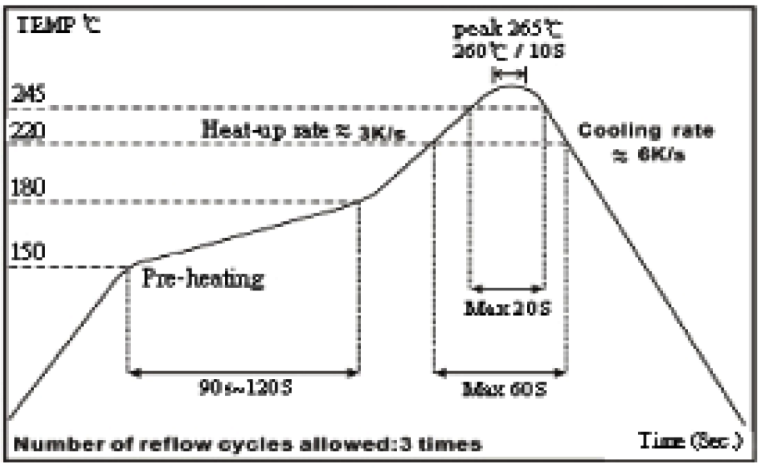
Standard Electrical Specifications

Chip Inductors / High Current Type					
Inductance (nH)	**Inductance Tolerance (nH or %)**	**Quality Factor min.**	**SRF (GHz) min.**	**DCR (Ω) max.**	**IDC (mA) max.**
0.1	±0.1, 0.2, 0.3nH	10 / 500MHz	6	0.05	600
0.2					
0.3					
0.4					
0.5				0.1	
0.6					
0.7					
0.8					
0.9					
1				0.15	
1.1					
1.2					
1.3				0.20	
1.4					
1.5				0.25	
1.6					
1.7				0.30	500
1.8					
1.9					
2					
2.1					
2.2				0.35	
2.3					
2.4					450
2.5					
2.6					
2.7					
2.8				0.50	
2.9					
3					400
3.1					
3.2					
3.3					

Inductance (nH)	Inductance Tolerance (nH or %)	Quality Factor min.	SRF (GHz) min.	DCR (Ω) max.	IDC (mA) max.
3.4	±0.1, 0.2, 0.3nH	10 / 500MHz	6	0.80	350
3.5					
3.6					
3.7					
3.8					
3.9					
4					
Chip Inductors / Standard Type					
0.2	±0.1, 0.2, 0.3nH	13 / 500MHz	14	0.1	800
0.3					
0.4					
0.5				0.15	700
0.8					
0.9					
1.1			12		
1.2					
1.3			10	0.25	
1.4					
1.6					560
1.7					
1.8					
1.9			8	0.35	
2.0					
2.1					440
2.3					
2.4					
2.5					
2.6					
2.7					
2.8			6	0.45	380
2.9					
3.0					
3.1					
3.2					
3.4				0.55	
3.5					
3.6					

Inductance (nH)	Inductance Tolerance (nH or %)	Quality Factor min.	SRF (GHz) min.	DCR (Ω) max.	IDC (mA) max.
3.7	±0.1, 0.2, 0.3nH	13 / 500MHz	6	0.55	340
3.8					
3.9					
4.3				0.65	320
5.4				0.85	280
5.6					
5.9					
6.5				1.05	260
7.2					
8.0			5.5	1.25	220
8.1					
9.1					
10.8	±1, 2, 3, 5%		4.5	1.35	200
12.0			3.7	1.55	180
13.8				1.75	
17.0			3.1	1.95	100
18.0				2.15	
20.8			2.8	2.55	90
27.0			2.5	3.25	75

Reflow



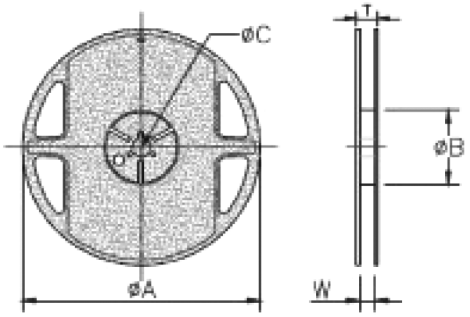
Environmental Characteristics

Item	Requirement	Test Method
Inductance	As Spec.	Measuring equipment and fixture: 0201: HP4287 + Agilent 16196C 0402: HP4287 + Agilent 16196B
Insulation Resistance	> 1,000MΩ	Apply 100V DC for 1minute
Damp Heat with Load	ΔL ≦ 10%	40 ± 2°C, 90 ~ 95% R.H. Max. working voltage for 1,000 hrs with 1.5 hrs “ON” and 0.5 hrs “OFF”
Bending Strength	As Spec.	Bending Amplitude 3mm for 10 seconds
Solderability	95% min. coverage	245 ± 5°C for 3 seconds
Resistance to Soldering Heat	ΔL ≦ 10%	260 ± 5°C for 10 seconds
Dielectric Withstand Voltage	> 100V	Apply 100VA (rms) for 1minute
High Temperature Exposure	ΔL ≦ 10%	85 ± 2°C, 1,000 +48/-0 hours
Low Temperature Storage		-40 ± 3°C, 1,000 +48/-0 hours
Temperature Cycle		-40 / RT / 85 / RT, 10 cycles

Reference Standards: MIL-STD-202F, JIS-C 5201-1
Storage Temperature : 25 ± 3°C; Humidity < 80%RH

Packaging

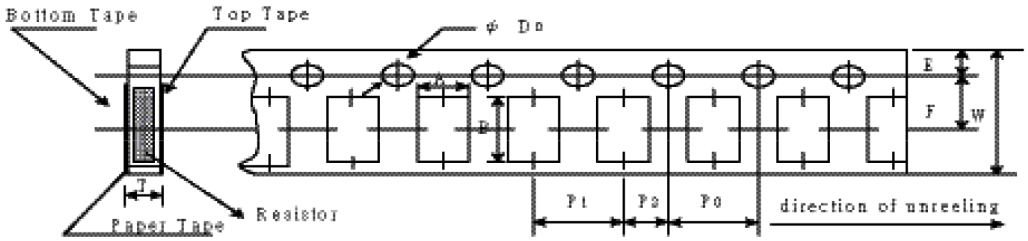
Reel Specifications & Packaging Quantity



Size (Inch)	ψA	ψB	ψC	W	T	Quantity (EA)
0201	178 ± 1.0	60 + 1	13.5 ± 0.7	9.5 ± 1	11.5 ± 1	10,000
0402						

Dimensions: mm

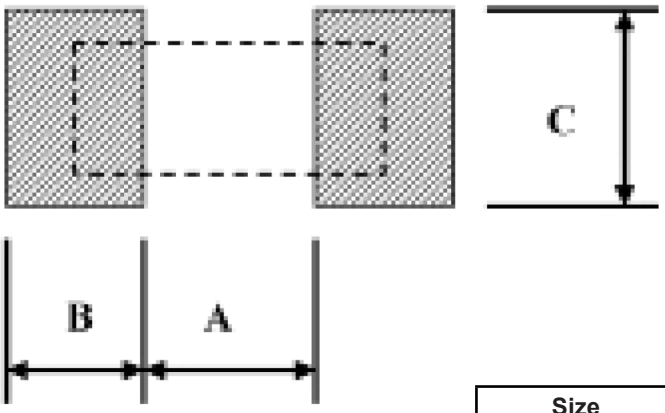
Paper Tape Specifications



Size (Inch)	A	B	W	E	F	P0	P1	P2	ψD0	T
0201	0.4 ± 0.05	0.7 ± 0.05	8 ± 0.1	1.75 ± 0.05	3.5 ± 0.05	4 ± 0.1	2 ± 0.05	2 ± 0.05	1.55 ± 0.03	0.42 ± 0.02
0402	0.7 ± 0.05	1.16 ± 0.05							1.55 ± 0.05	0.4 ± 0.03

Dimensions: mm

Recommend Land Pattern



Size (Inch)	A	B	C
0201	0.3	0.25	0.3 ± 0.2
0402	0.5	0.45	0.6 ± 0.2

Dimensions: mm

Part Number Table

Description	Part Number
Inductor, 0402, 0.2nH	MCFT0BT0N2
Inductor, 0402, 0.3nH	MCFT0BT0N3
Inductor, 0402, 0.4nH	MCFT0BT0N4
Inductor, 0402, 0.5nH	MCFT0BT0N5
Inductor, 0402, 0.8nH	MCFT0BT0N8
Inductor, 0402, 0.9nH	MCFT0BT0N9
Inductor, 0402, 1.1nH	MCFT0BT1N1
Inductor, 0402, 1.2nH	MCFT0BT1N2
Inductor, 0402, 1.3nH	MCFT0BT1N3
Inductor, 0402, 1.4nH	MCFT0BT1N4
Inductor, 0402, 1.6nH	MCFT0BT1N6
Inductor, 0402, 1.7nH	MCFT0BT1N7
Inductor, 0402, 1.8nH	MCFT0BT1N8
Inductor, 0402, 1.9nH	MCFT0BT1N9
Inductor, 0402, 2.0nH	MCFT0BT2N0
Inductor, 0402, 2.1nH	MCFT0BT2N1
Inductor, 0402, 2.3nH	MCFT0BT2N3
Inductor, 0402, 2.4nH	MCFT0BT2N4
Inductor, 0402, 2.5nH	MCFT0BT2N5
Inductor, 0402, 2.6nH	MCFT0BT2N6
Inductor, 0402, 2.7nH	MCFT0BT2N7
Inductor, 0402, 2.8nH	MCFT0BT2N8
Inductor, 0402, 2.9nH	MCFT0BT2N9
Inductor, 0402, 3.0nH	MCFT0BT3N0
Inductor, 0402, 3.1nH	MCFT0BT3N1
Inductor, 0402, 3.2nH	MCFT0BT3N2
Inductor, 0402, 3.4nH	MCFT0BT3N4
Inductor, 0402, 3.5nH	MCFT0BT3N5
Inductor, 0402, 3.6nH	MCFT0BT3N6
Inductor, 0402, 3.7nH	MCFT0BT3N7
Inductor, 0402, 3.8nH	MCFT0BT3N8
Inductor, 0402, 3.9nH	MCFT0BT3N9
Inductor, 0402, 4.3nH	MCFT0BT4N3
Inductor, 0402, 5.4nH	MCFT0BT5N4

Description	Part Number
Inductor, 0402, 5.6nH	MCFT0BT5N6
Inductor, 0402, 5.9nH	MCFT0BT5N9
Inductor, 0402, 6.5nH	MCFT0BT6N5
Inductor, 0402, 7.2nH	MCFT0BT7N2
Inductor, 0402, 8.0nH	MCFT0BT8N0
Inductor, 0402, 8.1nH	MCFT0BT8N1
Inductor, 0402, 9.1nH	MCFT0BT9N1
Inductor, 0402, 10.8nH	MCFT0FT10N8
Inductor, 0402, 12.0nH	MCFT0FT12N
Inductor, 0402, 13.8nH	MCFT0FT13N8
Inductor, 0402, 17.0nH	MCFT0FT17N
Inductor, 0402, 18.0nH	MCFT0FT18N
Inductor, 0402, 20.8nH	MCFT0FT20N8
Inductor, 0402, 27.0nH	MCFT0FT27N
High Current Inductor, 0201, 0.1nH	MCFT0BT0N101
High Current Inductor, 0201, 0.2nH	MCFT0BT0N201
High Current Inductor, 0201, 0.3nH	MCFT0BT0N301
High Current Inductor, 0201, 0.4nH	MCFT0BT0N401
High Current Inductor, 0201, 0.5nH	MCFT0BT0N501
High Current Inductor, 0201, 0.6nH	MCFT0BT0N601
High Current Inductor, 0201, 0.7nH	MCFT0BT0N701
High Current Inductor, 0201, 0.8nH	MCFT0BT0N801
High Current Inductor, 0201, 0.9nH	MCFT0BT0N901
High Current Inductor, 0201, 1.0nH	MCFT0BT1N001
High Current Inductor, 0201, 1.1nH	MCFT0BT1N001
High Current Inductor, 0201, 1.2nH	MCFT0BT1N201
High Current Inductor, 0201, 1.3nH	MCFT0BT1N301
High Current Inductor, 0201, 1.4nH	MCFT0BT1N401
High Current Inductor, 0201, 1.5nH	MCFT0BT1N501
High Current Inductor, 0201, 1.6nH	MCFT0BT1N601
High Current Inductor, 0201, 1.7nH	MCFT0BT1N701
High Current Inductor, 0201, 1.8nH	MCFT0BT1N801
High Current Inductor, 0201, 1.9nH	MCFT0BT1N901
High Current Inductor, 0201, 2.0nH	MCFT0BT2N001
High Current Inductor, 0201, 2.1nH	MCFT0BT2N101
High Current Inductor, 0201, 2.2nH	MCFT0BT2N201

Description	Part Number
High Current Inductor, 0201, 2.3nH	MCFT0BT2N301
High Current Inductor, 0201, 2.4nH	MCFT0BT2N401
High Current Inductor, 0201, 2.5nH	MCFT0BT2N501
High Current Inductor, 0201, 2.6nH	MCFT0BT2N601
High Current Inductor, 0201, 2.7nH	MCFT0BT2N701
High Current Inductor, 0201, 2.8nH	MCFT0BT2N801
High Current Inductor, 0201, 2.9nH	MCFT0BT2N901
High Current Inductor, 0201, 3.0nH	MCFT0BT3N001
High Current Inductor, 0201, 3.1nH	MCFT0BT3N101
High Current Inductor, 0201, 3.2nH	MCFT0BT3N201
High Current Inductor, 0201, 3.3nH	MCFT0BT3N301
High Current Inductor, 0201, 3.4nH	MCFT0BT3N401
High Current Inductor, 0201, 3.5nH	MCFT0BT3N501
High Current Inductor, 0201, 3.6nH	MCFT0BT3N601
High Current Inductor, 0201, 3.7nH	MCFT0BT3N701
High Current Inductor, 0201, 3.8nH	MCFT0BT3N801
High Current Inductor, 0201, 3.9nH	MCFT0BT3N901
High Current Inductor, 0201, 4.0nH	MCFT0BT4N001