

DATA SHEET

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

## Features

- Designed for high performance wireless switch applications
- 0.9  $\Omega$  resistance, 0.3 pF capacitance
- Available lead (Pb)-free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in lead (Pb)-free packaging

## Description

The SMP1320 series of plastic packaged, surface mountable PIN diodes is designed for high volume switch applications from 10 MHz to beyond 2 GHz. The low current performance of these diodes (0.9  $\Omega$  maximum at 10 mA and 2  $\Omega$  typical at 1 mA) make the SMP1320 series particularly suited to battery operated circuits. Available in a selection of plastic packages and in a variety of configurations including a low inductance (0.4 nH) SOT-23 (SMP1320-007), the small footprint SC-79 and the miniature SC-70.

**NEW** Skyworks offers lead (Pb)-free “environmentally friendly” packaging that is RoHS compliant (European Parliament for the Restriction of Hazardous Substances).



## Absolute Maximum Ratings

Characteristic	Value
Reverse voltage ( $V_R$ )	50 V
Power dissipation @ 25 °C lead temperature ( $P_D$ )	250 mW
Storage temperature ( $T_{ST}$ )	-65 °C to +150 °C
Operating temperature ( $T_{OP}$ )	-65 °C to +150 °C
ESD human body model	Class 1B

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

**CAUTION:** 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. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions must be employed at all times.

Single	Common Anode	Common Cathode	Series Pair	Low Inductance	Single	Ultra Low Inductance	Single
SOT-23	SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-143	SC-79
<b>SMP1320-001</b>	<b>SMP1320-003</b>	<b>SMP1320-004</b>	<b>SMP1320-005</b>	<b>SMP1320-007</b>	<b>SMP1320-011</b>	<b>SMP1320-017</b>	<b>SMP1320-079</b>
Marking: PL1	Marking: PL9	Marking: PL3	Marking: PL2	Marking: PLB	Marking: PL	Marking: PLF	
<b>SMP1320-001LF</b>				<b>SMP1320-007LF</b>	<b>SMP1320-011LF</b>		<b>SMP1320-079LF</b>
Marking: RL1				Marking: RLB	Marking: RL		
$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 0.4 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 0.2 \text{ nH}$	$L_S = 0.7 \text{ nH}$
		SC-70	SC-70	SC-70			
		<b>SMP1320-074</b>	<b>SMP1320-075</b>	<b>SMP1320-077</b>			
		$L_S = 1.4 \text{ nH}$	$L_S = 1.4 \text{ nH}$	$L_S = 0.4 \text{ nH}$			

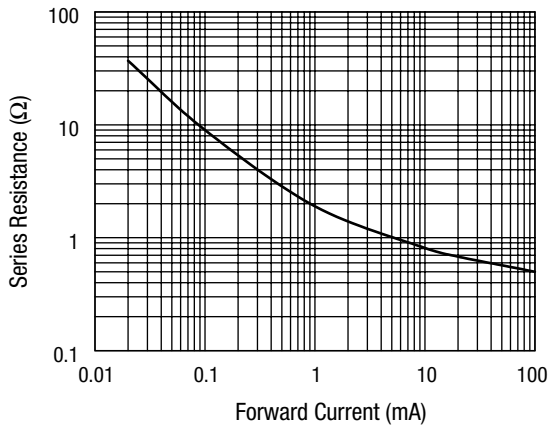
LF denotes lead (Pb)-free packaging option as an alternative to our standard tin/lead (Sn/Pb) packaging.

### Electrical Specifications at 25 °C

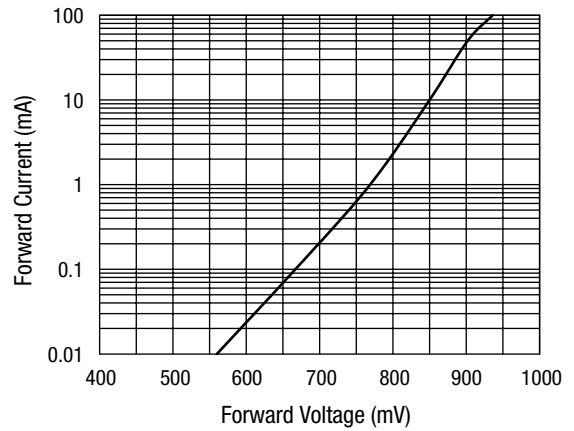
Parameter	Condition	Typ.	Max.	Unit
Reverse current ( $I_R$ )	$V_R = 50 \text{ V}$		10	$\mu\text{A}$
Capacitance ( $C_T$ ) <sup>(1)</sup>	$F = 1 \text{ MHz}, V = 30 \text{ V}$		0.30	pF
Resistance ( $R_S$ )	$F = 100 \text{ MHz}, I = 1 \text{ mA}$	2.0		$\Omega$
Resistance ( $R_S$ )	$F = 100 \text{ MHz}, I = 10 \text{ mA}$		0.9	$\Omega$
Forward voltage ( $V_F$ )	$I_F = 10 \text{ mA}$	0.85		V
Carrier lifetime (TI)	$I_F = 10 \text{ mA}$	0.4		$\mu\text{s}$
I region width		8		$\mu\text{m}$

1.  $C_T$  @ 30 V is 0.45 pF maximum for the SMP1320-007, SMP1320-007LF, and SMP1320-077.  $C_T$  @ 30 V is 0.5 pF maximum for the SMP1320-017.

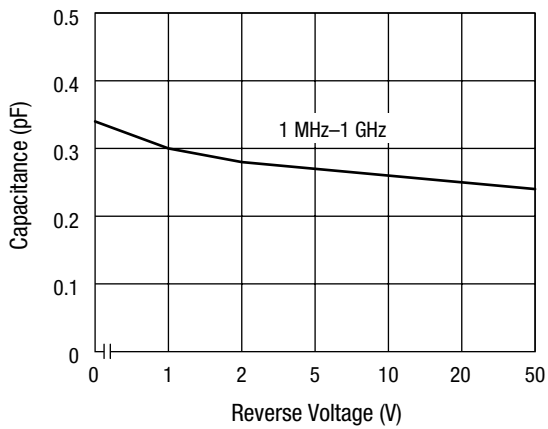
**Typical Performance Data**



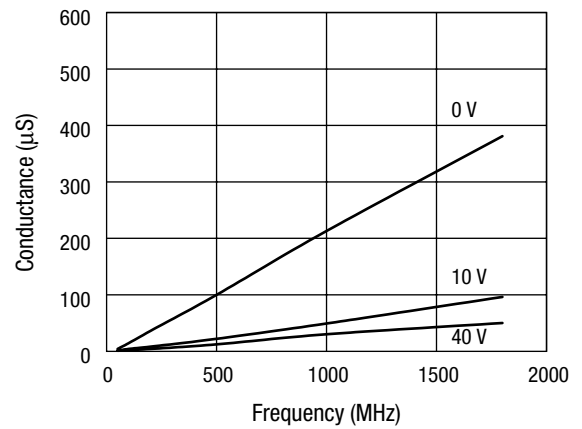
**Series Resistance vs. Current @ 100 MHz**



**DC Characteristic**



**Capacitance vs. Reverse Voltage**



**Conductance vs. Frequency and Reverse Voltage**

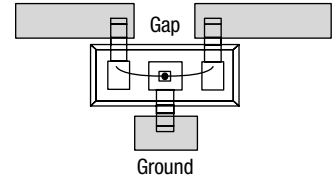
### Resistance vs. Temperature @ 500 MHz

$I_F$ (mA)	$R_S$ -55 °C ( $\Omega$ )	$R_S$ -15 °C ( $\Omega$ )	$R_S$ +25 °C ( $\Omega$ )	$R_S$ +65 °C ( $\Omega$ )	$R_S$ +100 °C ( $\Omega$ )
0.02	29.60	29.20	30.80	32.00	32.70
0.10	7.20	7.70	8.30	8.80	8.80
0.30	3.40	3.60	3.80	4.00	4.10
0.50	2.50	2.70	2.80	2.90	3.00
1.00	1.70	1.80	1.90	2.00	1.90
10.00	0.84	0.85	0.76	0.76	0.67
20.00	0.73	0.73	0.64	0.64	0.56
100.00	0.59	0.57	0.47	0.48	0.40

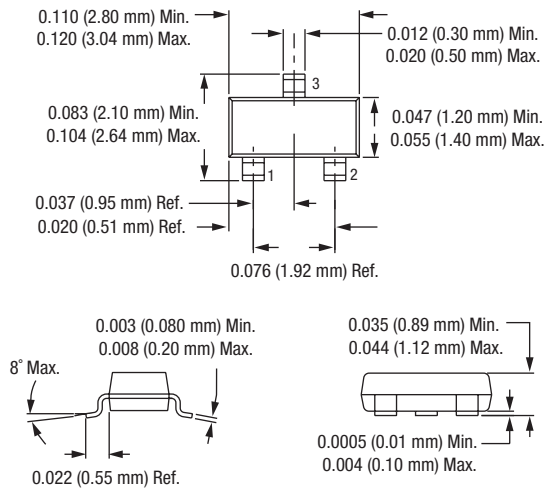
### SMP1320-007

In the -007 configuration of the SOT-23 package, the package inductance is effectively reduced to 0.4 nH, in comparison to the 1.5 nH value of the standard configuration. This lower inductance will be particularly beneficial when the diodes are used as shunt connected switches at frequencies higher than 500 MHz, where inductance is the primary limitation on maximum switch isolation.

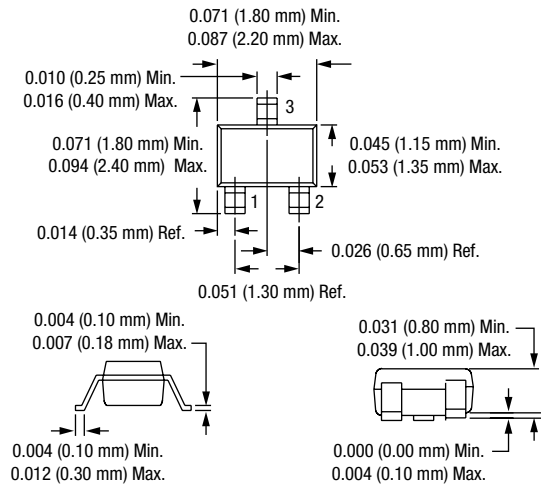
To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in the figure. Because of the polarity of the diode junction, this low inductance feature is only realizable with the cathode connected to ground.



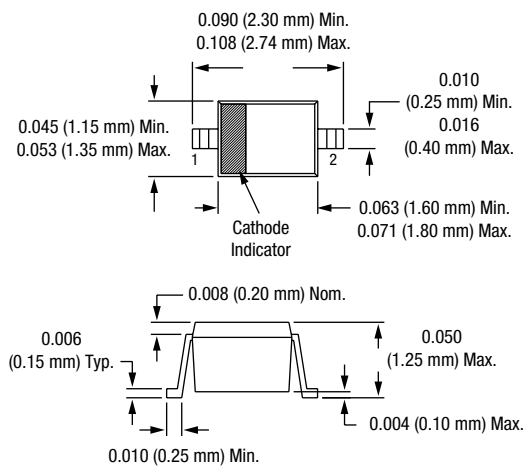
### SOT-23



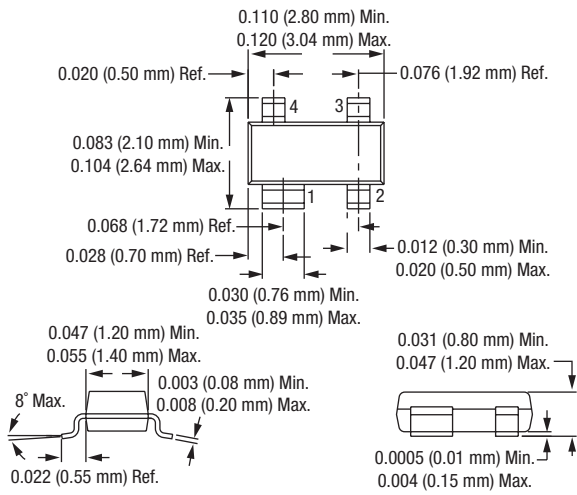
### SC-70



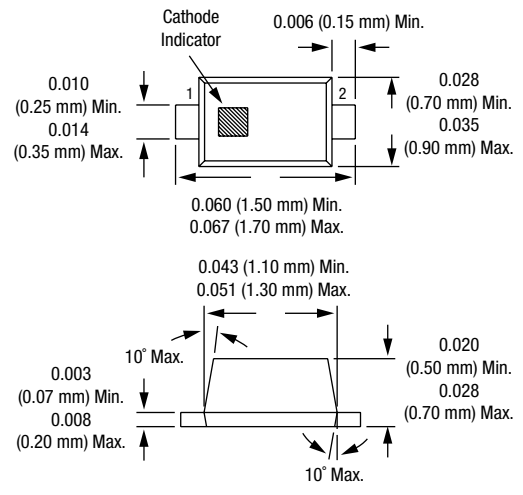
### SOD-323



**SOT-143**



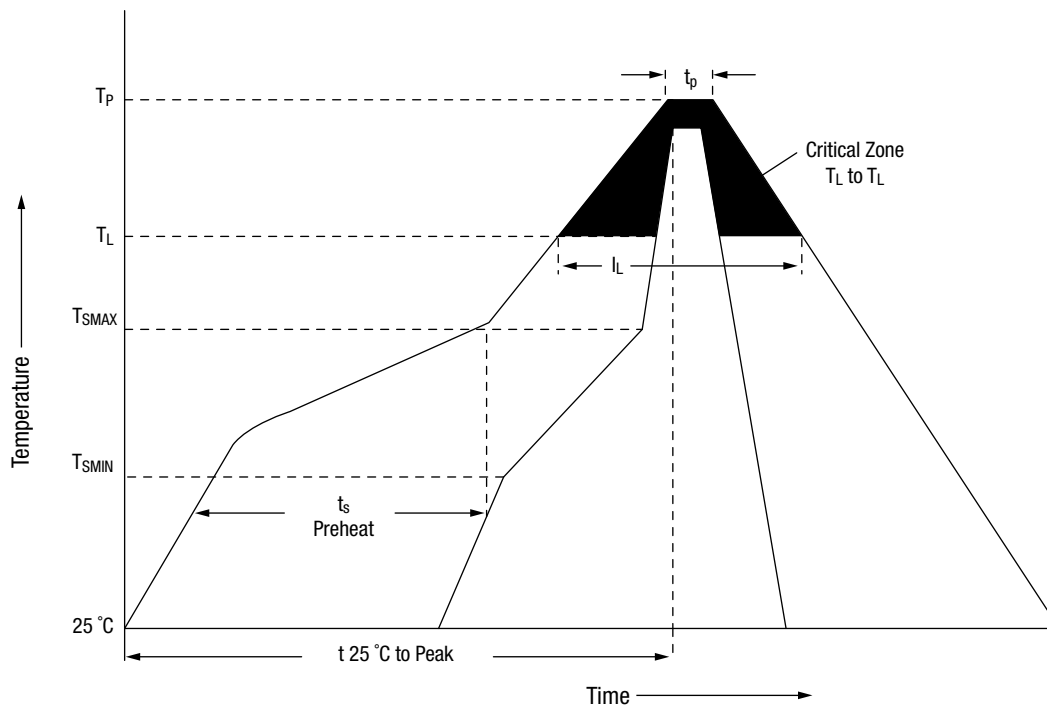
**SC-79**



### Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average ramp-up rate ( $T_L$ to $T_P$ )	3 °C/second max.	3 °C/second max.
Preheat Temperature min. ( $T_{SMIN}$ ) Temperature max. ( $T_{SMAX}$ ) Time (min. to max.) ( $t_s$ )	100 °C 150 °C 60–120 seconds	150 °C 200 °C 60–80 seconds
$T_{SMAX}$ to $T_L$ Ramp-up rate	—	3 °C/second max.
Time maintained above: Temperature ( $T_L$ ) Time ( $t_L$ )	183 °C 60–150 seconds	217 °C 60–150 seconds
Peak temperature ( $T_P$ )	240 +0/-5 °C	250 +0/-5 °C
Time within 5 °C of actual peak temperature ( $t_p$ )	10–30 seconds	20–40 seconds
Ramp-down rate	6 °C/second max.	6 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

All temperatures refer to the top side of the package, measured on the package body surface.  
Reference JEDEC J-STD-020B.



Reference JEDEC J-STD-020

Copyright © 2002, 2003, 2004, Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products. These materials are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials. Skyworks may make changes to its documentation, products, specifications and product descriptions at any time, without notice. Skyworks makes no commitment to update the information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from future changes to its documentation, products, specifications and product descriptions.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by or under this document. Except as may be provided in Skyworks Terms and Conditions of Sale for such products, Skyworks assumes no liability whatsoever in association with its documentation, products, specifications and product descriptions.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED OR OTHERWISE, RELATING TO SALE AND/OR USE OF SKYWORKS PRODUCTS INCLUDING WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. SKYWORKS FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THESE MATERIALS WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

The following are trademarks of Skyworks Solutions, Inc.: Skyworks™, the Skyworks logo, and Breakthrough Simplicity™. Product names or services listed in this publication are for identification purposes only, and may be trademarks of Skyworks or other third parties. Third-party brands and names are the property of their respective owners. Additional information, posted at [www.skyworksinc.com](http://www.skyworksinc.com), is incorporated by reference.