

DATA SHEET

# SMP1321 Series: Low Capacitance Plastic Packaged PIN Diodes

## Features

- Designed for high performance wireless switch applications
- 0.25 pF capacitance specified
- Available lead (Pb)-free MSL-1 @ 250 °C per JEDEC J-STD-020
- Available in tape and reel packaging

## Description

The SMP1321 series of plastic packaged, surface mountable PIN diodes are designed for high volume switch applications from 10 MHz to beyond 2 GHz. The low capacitance of these diodes (0.25 pF) combined with its low resistance (2.0 Ω maximum at 10 mA) make the SMP1321 series particularly suited to high isolation series connected PIN diode switches in 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 (SMP1321-007), the small footprint SC-79 and the miniature SC-70. The SMP1321-508 has been specifically designed for WLAN 802.11 a, b, and g applications.

**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 ( $V_R$ )	100 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	Single	Anti-Parallel
SOT-23	SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SC-79	LGA
<b>SMP1321-001</b>	<b>SMP1321-003</b>	<b>SMP1321-004</b>	<b>SMP1321-005</b>	<b>SMP1321-007</b>	<b>SMP1321-011</b>	<b>SMP1321-079</b>	<b>SMP1321-508</b> Lead (Pb)-Free
Marking: PM1	Marking: PM9	Marking: PM3	Marking: PM2	Marking: PMB	Marking: PM		Marking: H
	<b>SMP1321-003LF</b>	<b>SMP1321-004LF</b>	<b>SMP1321-005LF</b>		<b>SMP1321-011LF</b>	<b>SMP1321-079LF</b>	
	Marking: RM9	Marking: RM3	Marking: RM2		Marking: RM		
$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 0.4 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 0.7 \text{ nH}$	$L_S = 0.6 \text{ nH}$
	SC-70		SC-70	SC-70			
	<b>SMP1321-073</b>		<b>SMP1321-074</b>	<b>SMP1321-075</b>			
	Marking: PM9		Marking: PM2	Marking: PMB			
	$L_S = 1.4 \text{ nH}$		$L_S = 1.4 \text{ nH}$	$L_S = 1.4 \text{ nH}$			

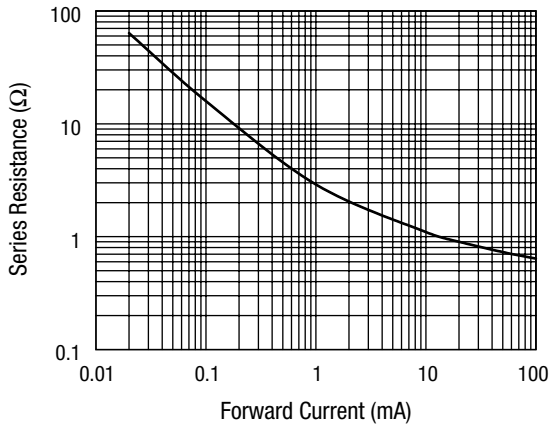
LF denotes lead (Pb)-free packaging option as an alternative to our standard tin/lead (Sn/Pb) packaging.

### Electrical Specifications at 25 °C

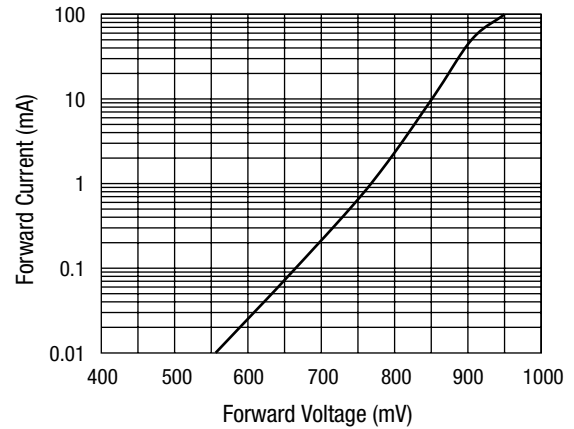
Parameter	Condition	Typ.	Max.	Unit
Reverse current ( $I_R$ )	$V_R = 100 \text{ V}$		10	$\mu\text{A}$
Capacitance ( $C_T$ ) <sup>(1)</sup>	$F = 1 \text{ MHz}, V = 30 \text{ V}$		0.25	$\text{pF}$
Resistance ( $R_S$ )	$F = 100 \text{ MHz}, I = 1 \text{ mA}$	3.00		$\Omega$
Resistance ( $R_S$ )	$F = 100 \text{ MHz}, I = 10 \text{ mA}$		2.00	$\Omega$
Forward voltage ( $V_F$ )	$I_F = 10 \text{ mA}$	0.85		V
Carrier lifetime (TI)	$I_F = 10 \text{ mA}$	0.40		$\mu\text{s}$
I region width		15		$\mu\text{m}$

1. The SMP1321-007 maximum capacitance is 0.40 pF.

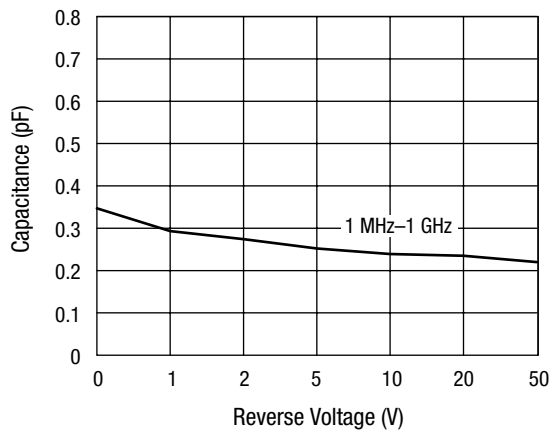
**Typical Performance Data**



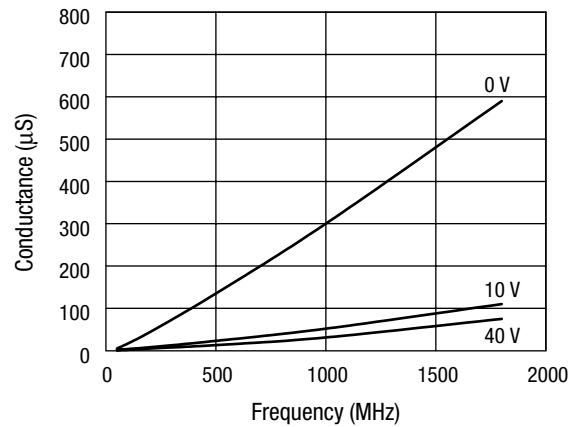
**Series Resistance vs. Current @ 100 MHz**



**DC Characteristic**



**Capacitance vs. Reverse Voltage**



**Conductance vs. Frequency and Reverse Voltage**

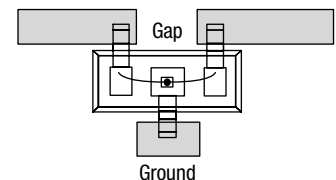
**Resistance vs. Temperature @ 500 MHz**

$I_F$ (mA)	R -55 °C (Ω)	R -15 °C (Ω)	R +25 °C (Ω)	R +65 °C (Ω)	R +100 °C (Ω)
0.02	47.400	50.000	56.300	61.500	65.100
0.10	12.000	12.600	13.900	15.400	16.400
0.30	5.200	5.400	5.800	6.400	6.900
0.50	3.600	3.800	4.100	4.500	4.800
1.00	2.400	2.500	2.600	2.800	3.100
10.00	1.030	1.040	1.040	1.070	1.150
20.00	0.871	0.888	0.873	0.889	0.956
100.00	0.669	0.659	0.642	0.645	0.695

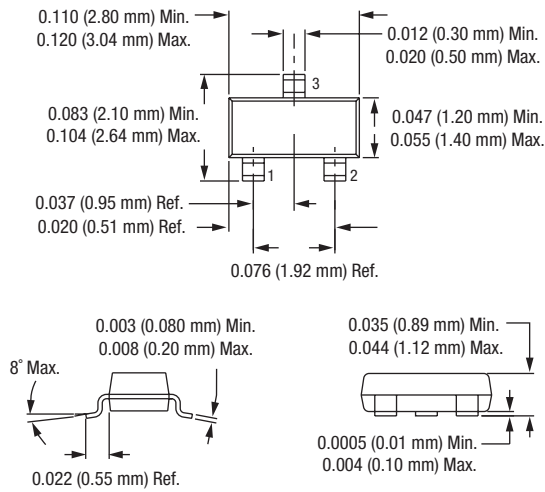
**SMP1321-007**

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.

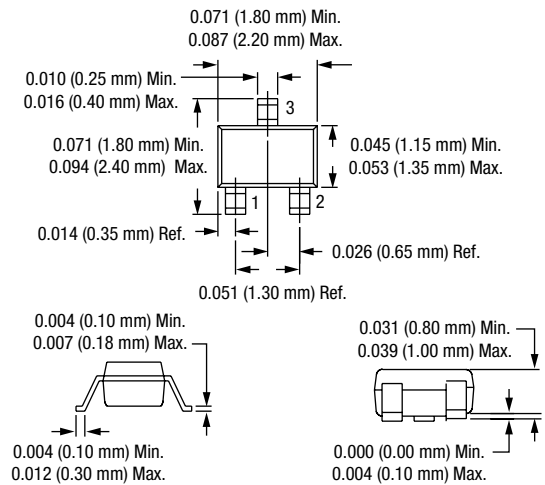
To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in the figure. Because of the polarity of the diode junction, this low inductance feature is only realizable with the cathode connected to ground.



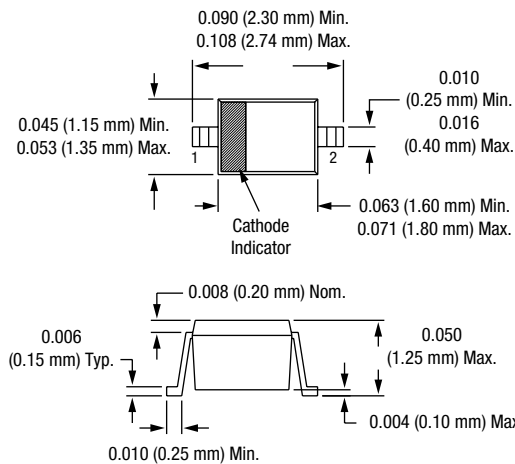
**SOT-23**



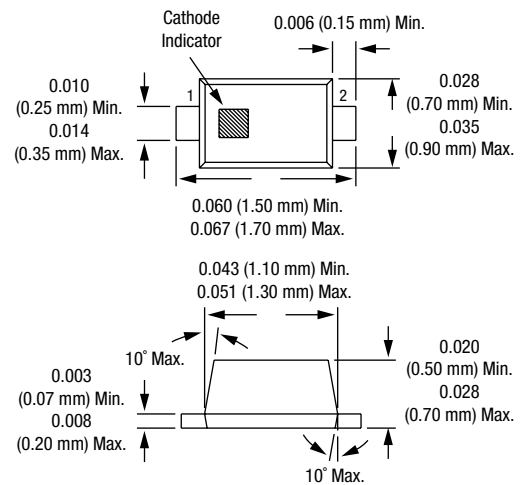
**SC-70**



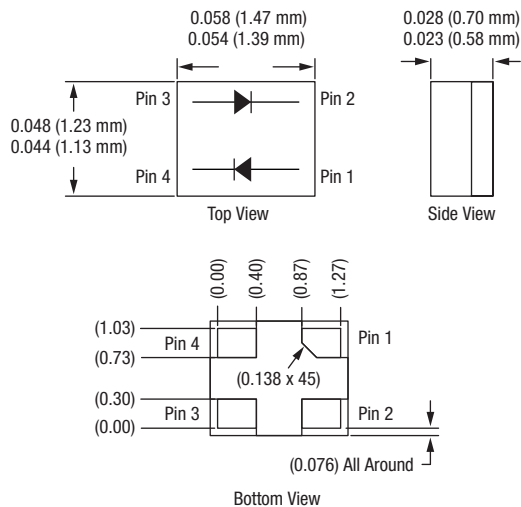
**SOD-323**



**SC-79**



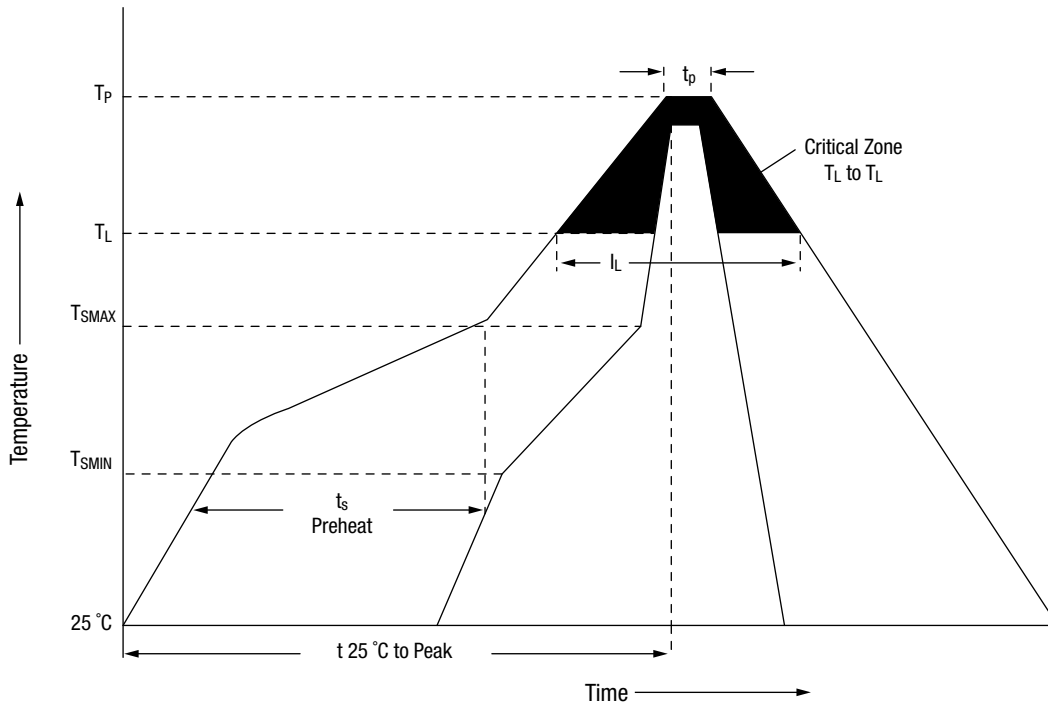
**LGA**



### 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. ( $T_{SMIN}$ )	100 °C	150 °C
Temperature max. ( $T_{SMAX}$ )	150 °C	200 °C
Time (min. to max.) ( $t_s$ )	60–120 seconds	60–80 seconds
$T_{SMAX}$ to $T_L$ Ramp-up rate	—	3 °C/second max.
Time maintained above:		
Temperature ( $T_L$ )	183 °C	217 °C
Time ( $t_L$ )	60–150 seconds	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 topside of the package, measured on the package body surface.  
Reference JEDEC J-STD-020B.



Reference JEDEC J-STD-020

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