

DATA SHEET

SMP1304 Series: Low-Distortion Attenuator Plastic Packaged PIN Diodes

Features

- Low-distortion design
- Frequency range from HF to > 2 GHz
- Designed for base station applications
- Configured for PI and TEE attenuators
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C⁽¹⁾ per JEDEC J-STD-020

Description

The SMP1304 series of plastic packaged, surface mountable, low capacitance (0.3 pF), silicon PIN diodes is designed for use in attenuator applications from 5 MHz to beyond 2 GHz. The thick 100 μm I region of these PIN diodes makes them very attractive for use in low-distortion PI and TEE attenuators commonly used in TV distribution applications. The 1 μs typical carrier lifetime of these diodes results in resistance of 20 Ω maximum at 1 mA and 7 Ω maximum at 10 mA. Available in a selection of plastic packages: as a single diode in the small footprint SOD-323 package and in a variety of configurations in the SOT-23 package, including a low inductance (0.4 nH) SMP1304-007 package. Also available in the SOT-143 package are three diode junctions designed for insertion in TEE attenuators (SMP1304-018) and PI attenuators (SMP1304-019). Also available in a SOT-5 (SMP1304-027) package as a four-diode array designed for insertion in the commonly used four-diode PI attenuator circuit.

NEW Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.



Absolute Maximum Ratings

Characteristic	Value
Reverse voltage (V_R)	200 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 1C

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, ESD (Electrostatic Discharge) 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.

1. SOT-5 (-027) MSL to be defined.

Single	Common Cathode	Series Pair	Low Inductance	Single	PI	PI
SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-143	SOT-5
SMP1304-001 Marking: PG1	SMP1304-004 Marking: PG3	SMP1304-005 Marking: PG2	SMP1304-007 Marking: PGB	◆SMP1304-011 Marking: PG	SMP1304-019 Marking: PGJ	SMP1304-027 Marking: PGM
SMP1304-001LF Marking: RG1	SMP1304-004LF Marking: RG3	SMP1304-005LF Marking: RG2	SMP1304-007LF Marking: RGB	◆SMP1304-011LF Marking: RG	SMP1304-019LF Marking: RGJ	SMP1304-027LF Marking: RGM
$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 0.4 \text{ nH}$	$L_S = 1.5 \text{ nH}$		

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

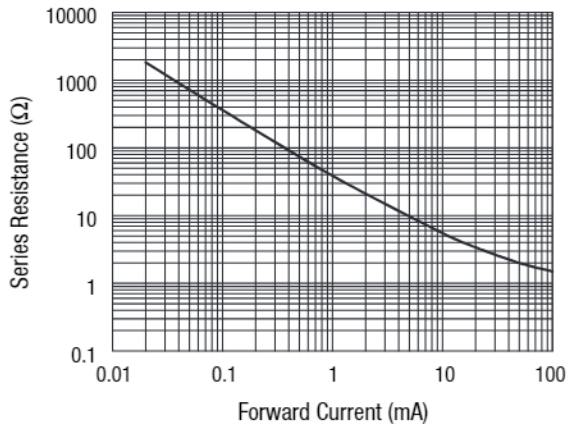
Innovation to Go™
Select Linear Products (indicated by ◆) now available for purchase online.

Electrical Specifications at 25 °C

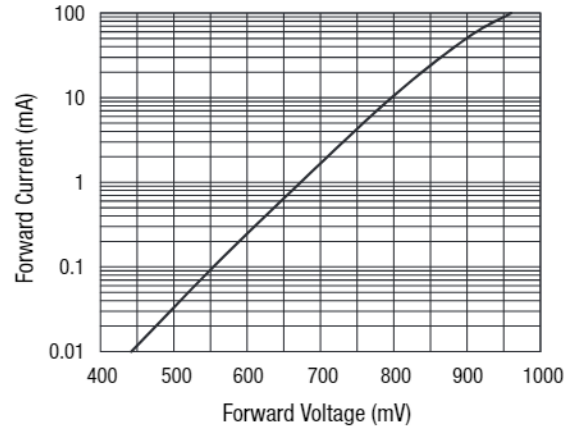
Parameter	Condition	Typ.	Max.	Unit
Reverse current (I_R)	$V_R = 200 \text{ V}$		10	μA
Capacitance (C_T) ⁽¹⁾	$F = 1 \text{ MHz}, V = 30 \text{ V}$		0.3	pF
Resistance (R_S)	$F = 100 \text{ MHz}, I = 1 \text{ mA}$	40	50	Ω
Resistance (R_S)	$F = 100 \text{ MHz}, I = 10 \text{ mA}$		7	Ω
Resistance (R_S)	$F = 100 \text{ MHz}, I = 100 \text{ mA}$		2	Ω
Forward voltage (V_F)	$I_F = 10 \text{ mA}$	0.8		V
Carrier lifetime (T_I)	$I_F = 10 \text{ mA}$	1		μs
I region width		100		μm

1. The SMP1304-019 and SMP1304-027 maximum capacitance is 0.45 pF.

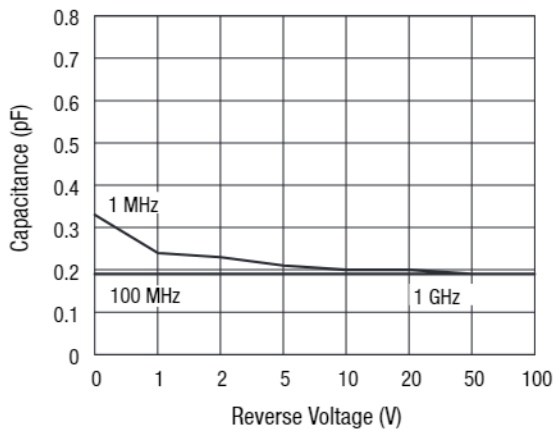
Typical Performance Data



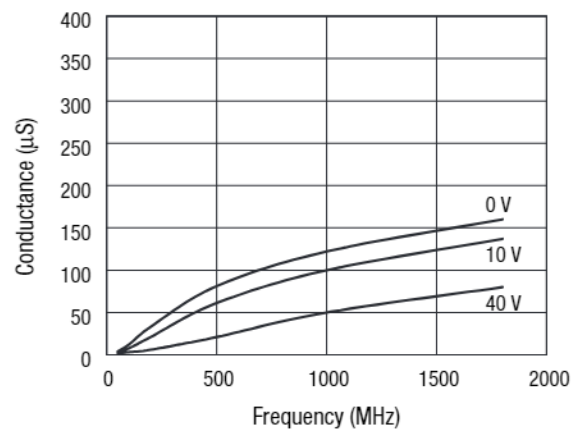
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



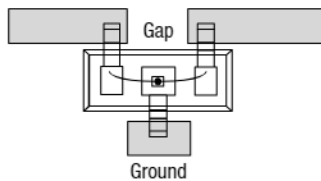
Conductance vs. Frequency and Reverse Voltage

Resistance vs. Temperature @ 100 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	1590	1660	1752	1770	1760
0.1	315	340	367	396	409
0.3	108	118	128	141	147
1	34.5	37.9	41.6	46.3	48.8
10	4.8	5.3	5.8	6.6	7
20	3	3.3	3.6	4.1	4.3
100	1.3	1.4	1.5	1.7	1.8

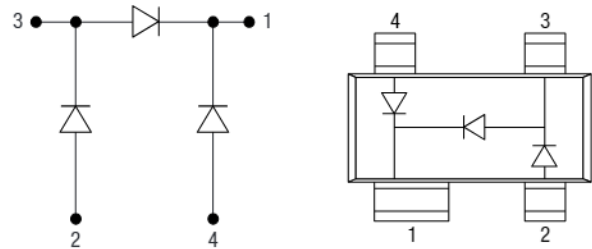
SMP1304-007

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 realizable only with the cathode connected to ground.



SMP1304-019 PI Attenuator PIN Diodes

The SMP1304-019 employs three PIN diode junctions in a SOT-143 package. They are configured for ease of insertion in PI attenuator circuits commonly used from 10 MHz to beyond 1 GHz. The SMP1304 PIN diode junction was designed for low capacitance, wide resistance dynamic range, and low distortion performance.



SMP1304-019 (PI)

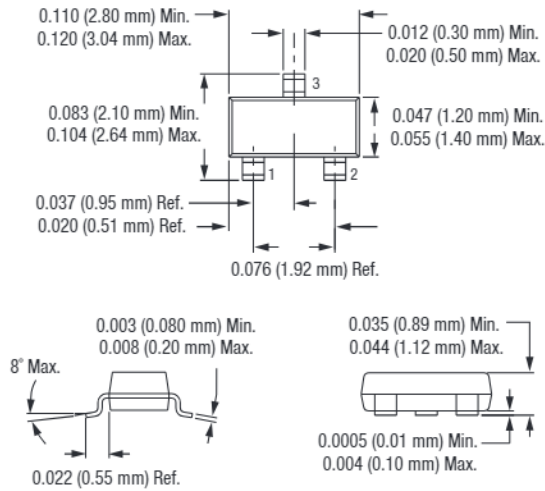
Recommended Solder Reflow Profiles

Refer to the [“Recommended Solder Reflow Profile”](#) Application Note.

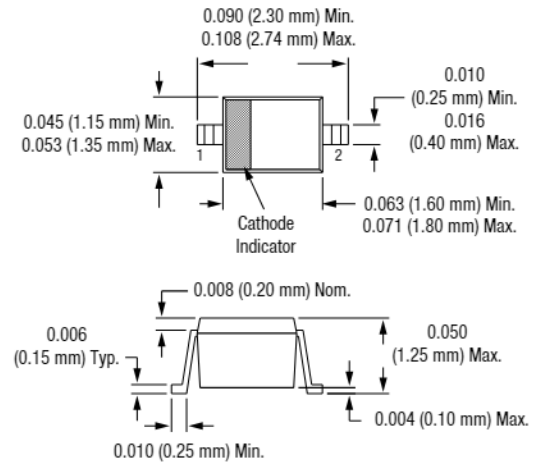
Tape and Reel Information

Refer to the [“Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation”](#) Application Note.

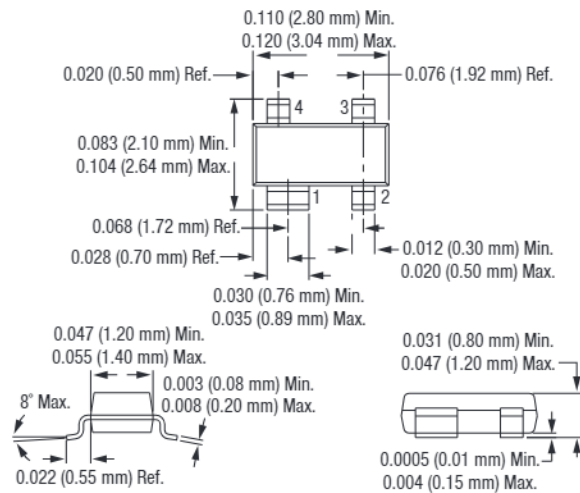
SOT-23



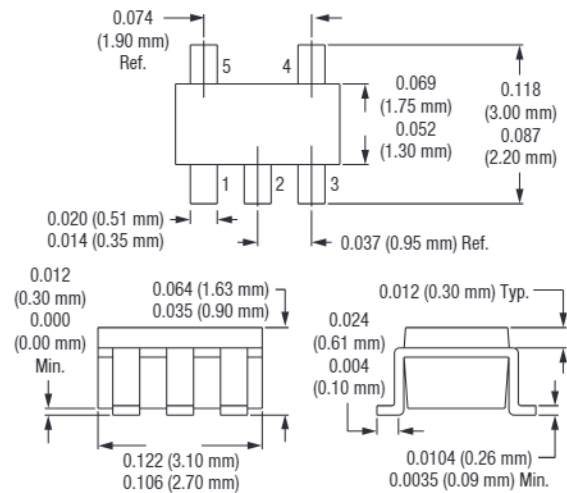
SOD-323



SOT-143



SOT-5



Copyright © 2002, 2003, 2004, 2005, Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, 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 or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS 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 BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, 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, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. 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.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks, the Skyworks symbol, "Breakthrough Simplicity" and "Innovation to Go" are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at www.skyworksinc.com, are incorporated by reference.