

DATA SHEET

SMP1307 Series: Very Low Distortion Attenuator Plastic Packaged PIN Diodes

Applications

- Very low distortion PI and TEE attenuators
- Cable TV AGC
- High-volume wireless systems

Features

- Low distortion design
- Frequency range from 5 MHz to > 2 GHz
- Packages rated MSL1 @ 260 °C per JEDEC J-STD-020

NEW

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



Description

The SMP1307 series of plastic packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diodes is designed for attenuator applications from 5 MHz to beyond 2 GHz.

The thick 175 μm I region width of these PIN diodes makes them very attractive for use in very low distortion PI and TEE attenuators commonly found in TV distribution applications. The 1.5 μs carrier lifetime of these diodes results in resistance of 100 Ω maximum at 1 mA and 10 Ω maximum at 10 mA.

The SMP1307 series is 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. Also available in an SOT-5 package (SMP1307-027) is a four-diode array designed for insertion in commonly used four-diode PI attenuator circuits. Table 1 describes the various packages and marking of the SMP1307 series.

Table 1. SMP1307 Series Packaging and Marking

Single	Common Anode	Common Cathode	Series Pair	Reverse Series Pair	Single	PI
SOT-23	SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-5
◆ SMP1307-001 Marking: PJ1		SMP1307-004 Marking: PJ3	SMP1307-005 Marking: PJ2			SMP1307-027 Marking: PJM
◆ SMP1307-001LF Marking: RJ1	SMP1307-003LF Marking: RJ9	SMP1307-004LF Marking: RJ3	SMP1307-005LF Marking: RJ2	SMP1307-006LF Marking: RJ8	SMP1307-011LF Marking: RJ	SMP1307-027LF Marking: RJM
$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	



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



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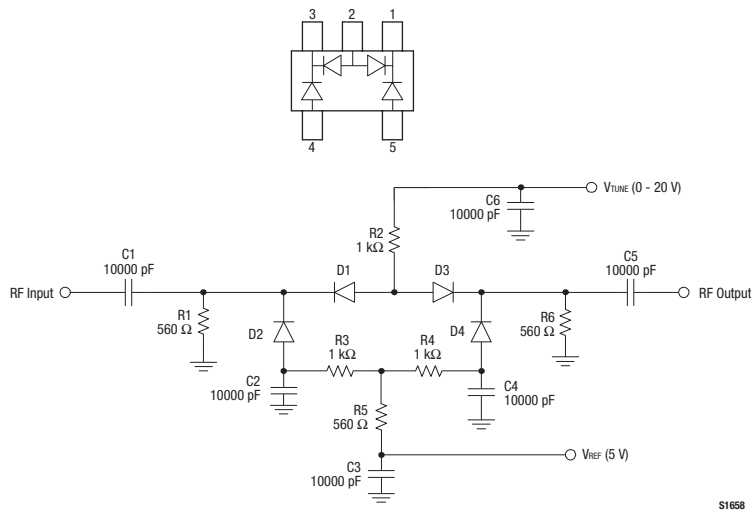


Figure 1. SMP1307-027 Block Diagram and Schematic

SMP1307-027 Four-Diode PI Attenuator

The SMP1307-027 uses four PIN diode junctions in a five-lead SOT package. It is configured for ease of insertion in the PI attenuator circuit commonly used for broadband TV distribution systems, covering a frequency range from 5 MHz to over 1 GHz.

A broadband attenuator was designed using the SMP1307-027 that shows good performance up to 2 GHz. The attenuator was evaluated with a 50 Ω source and load impedance. Figure 1 shows a block diagram and circuit diagram for this device (the typical performance of the SMP1307-027 is shown in Figure 2).

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMP1307 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 SMP1307 series are illustrated in Figures 2 to 6. Package dimensions are shown in Figures 7 to 9.

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 SMP1307 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. For packaging details, refer to the Skyworks Application Note *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation*, document number 200083.

Table 2. SMP1307 Series Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Reverse voltage	V_R		200	V
Power dissipation @ 25 °C lead temperature	P_D		250	mW
Storage temperature	T_{STG}	-65	+150	°C
Operating temperature	T_A	-65	+150	°C

Note: 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.

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 should be used at all times. The SMP1307 series PIN diodes are Class 1C ESD devices.

Table 3. SMP1307 Series Electrical Specifications (Note 1)
($T_A = +25\text{ °C}$, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse current	I_R	$V_R = 200\text{ V}$			10	μA
Capacitance (Note 2)	C_T	$f = 1\text{ MHz}, V = 30\text{ V}$			0.3	pF
Resistance	R_S	$f = 100\text{ MHz}$ $I = 1\text{ mA}$ $I = 10\text{ mA}$ $I = 100\text{ mA}$		75	100 15 3	Ω Ω Ω
Forward voltage	V_F	$I_F = 10\text{ mA}$		0.85		V
Carrier lifetime	T_I	$I_F = 10\text{ mA}$		1.5		μs
I region width				175		μm

Note 1: Performance is guaranteed only under the conditions listed in this Table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

Note 2: The SMP1307-027 maximum capacitance is 0.45 pF.

Table 4. Resistance vs Temperature @ 100 MHz

I_F (mA)	$R_S @ -55\text{ °C}$ (Ω)	$R_S @ -15\text{ °C}$ (Ω)	$R_S @ +25\text{ °C}$ (Ω)	$R_S @ +65\text{ °C}$ (Ω)	$R_S @ +100\text{ °C}$ (Ω)
0.02	2386	2360	2546	2520	2440
0.10	560	598	632	633	639
0.3	203	219	236	239	242
1.0	66.1	71.2	79.3	83.6	85.4
10	9.1	10.0	10.9	12.2	12.9
20	5.6	6.0	6.6	7.4	7.8
100	2.2	2.4	2.6	3.0	3.2

Typical Performance Characteristics

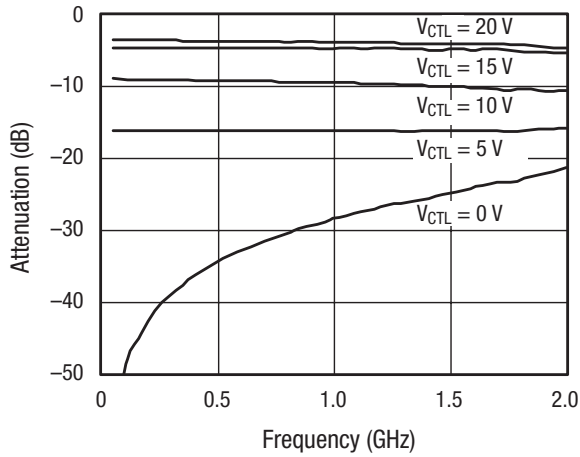


Figure 2. SMP1307-027 Attenuation vs Frequency

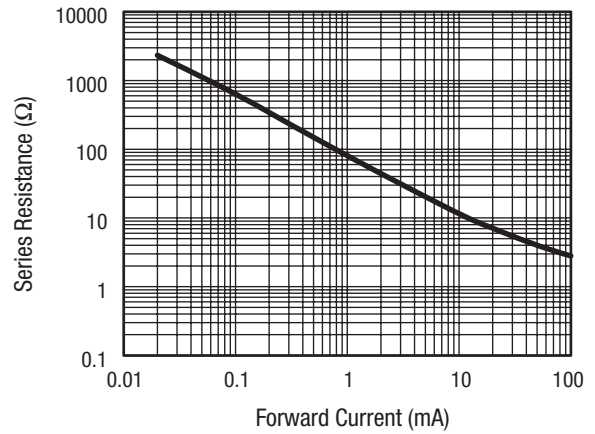


Figure 3. Series Resistance vs Current @ 100 MHz

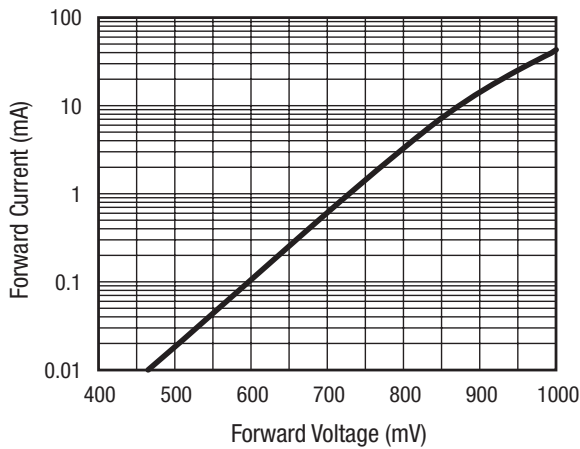


Figure 4. DC Characteristic

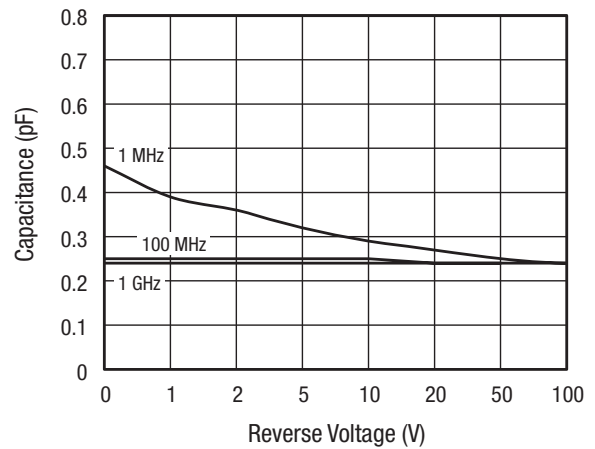


Figure 5. Capacitance vs Reverse Voltage

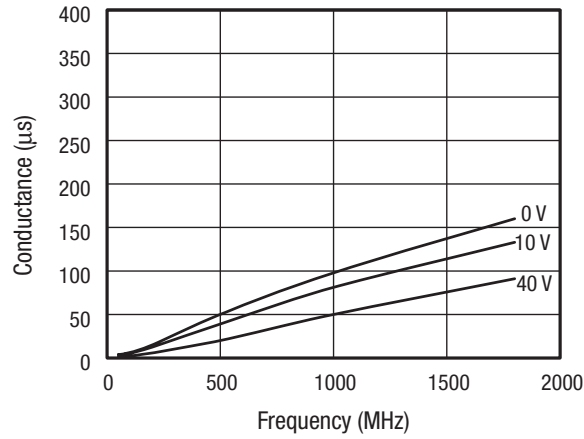
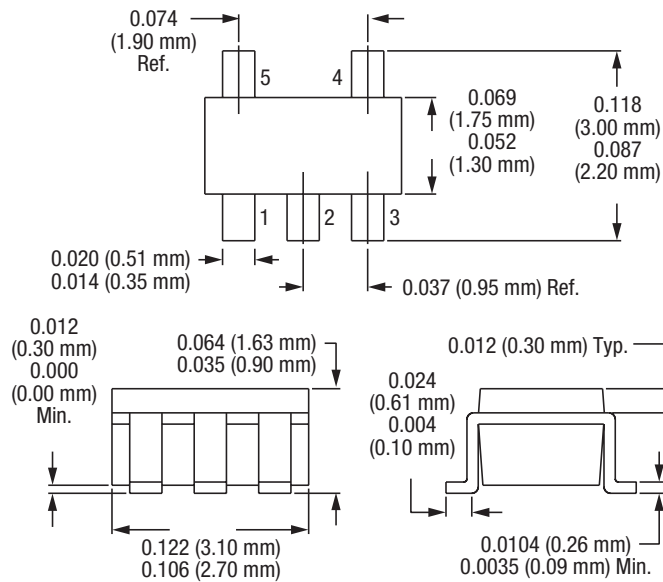


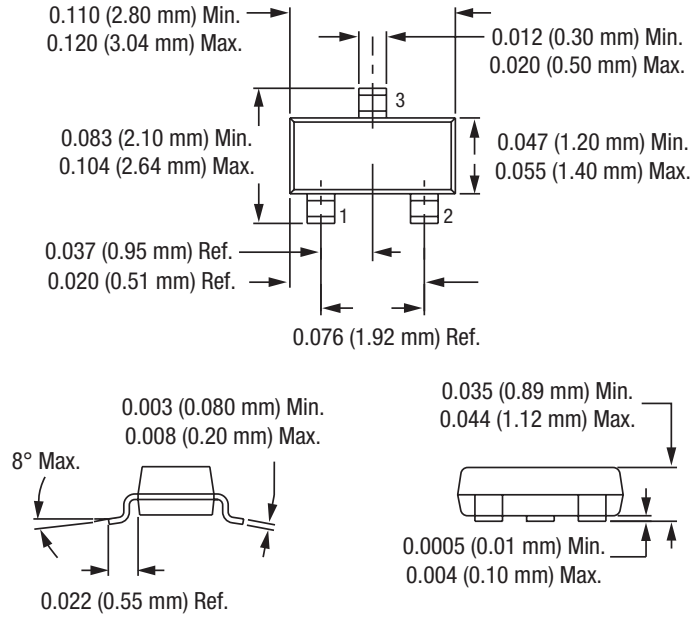
Figure 6. Conductance vs Frequency and Reverse Voltage



Dimensions are in inches (millimeters shown in parentheses)

S1657

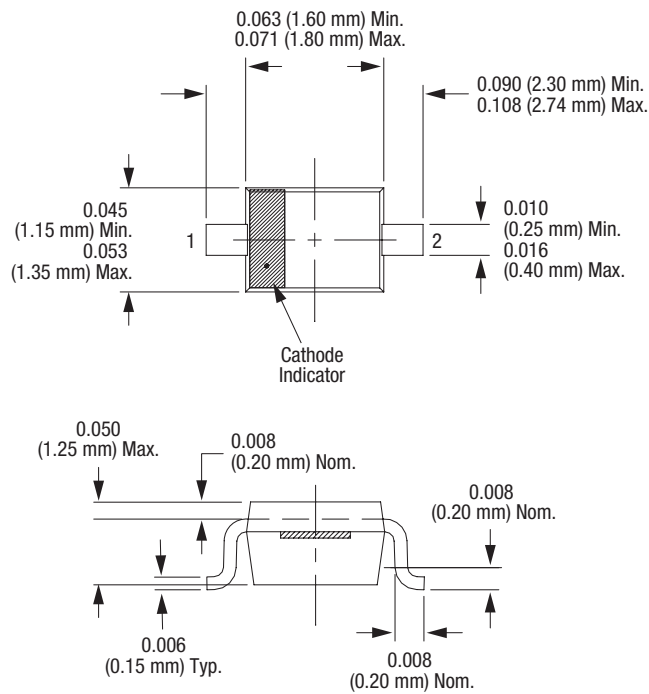
Figure 7. SOT-5 Package Dimension Drawing



Dimensions are in inches (millimeters shown in parentheses)

S1389

Figure 8. SOT-23 Package Dimension Drawing



Dimensions are in inches (millimeters shown in parentheses)

S1619

Figure 9. SOD-323 Package Dimension Drawing

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