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

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 4 diode PI attenuator circuit.

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)	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, 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 Cathode	Series Pair	Low Inductance	Single	PI	PI
SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-143	SOT-5
SMP1304-001	**SMP1304-004**	**SMP1304-005**	**SMP1304-007**	**SMP1304-011**	**SMP1304-019**	**SMP1304-027**
Marking: PG1	Marking: PG3	Marking: PG2	Marking: PGB	Marking: PG	Marking: PGJ	Marking: PGM
			SMP1304-007LF	**SMP1304-011LF**		
			Marking: RGB	Marking: RG		
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.4 nH	L_S = 1.5 nH		

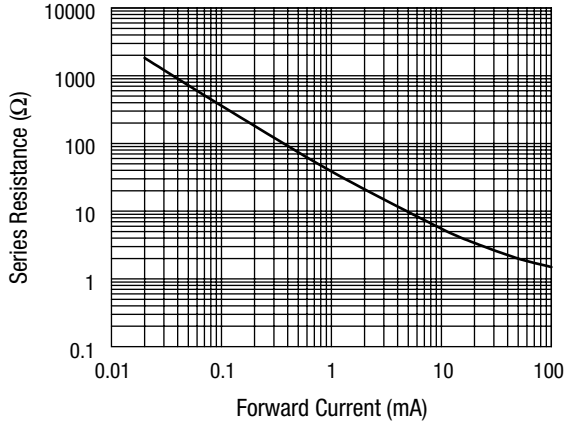
LF denotes lead (Pb)-free packaging option as an alternative to our standard tin/lead (Sn/Pb) packaging.

Electrical Specifications at 25 °C

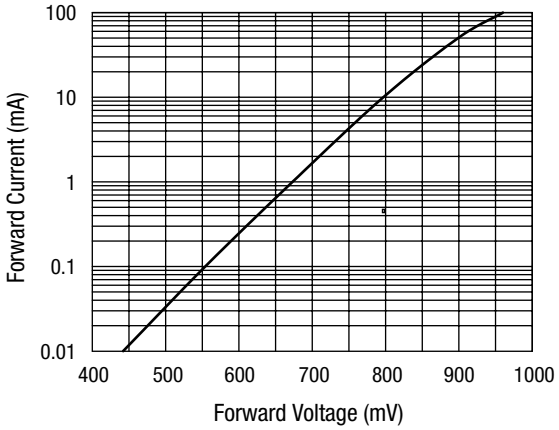
Parameter	Condition	Typ.	Max.	Unit
Reverse current (I_R)	V_R = 200 V		10	µA
Capacitance (C_T)[1]	F = 1 MHz, V = 30 V		0.30	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	40	50	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA		7.0	Ω
Resistance (R_S)	F = 100 MHz, I = 100 mA		2.0	Ω
Forward voltage (V_F)	I_F = 10 mA	0.8		V
Carrier lifetime (TI)	I_F = 10 mA	1.0		µs
I region width		100		µm

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

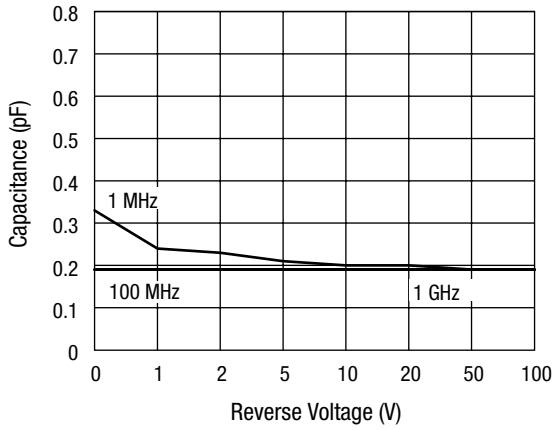
Typical Performance Data



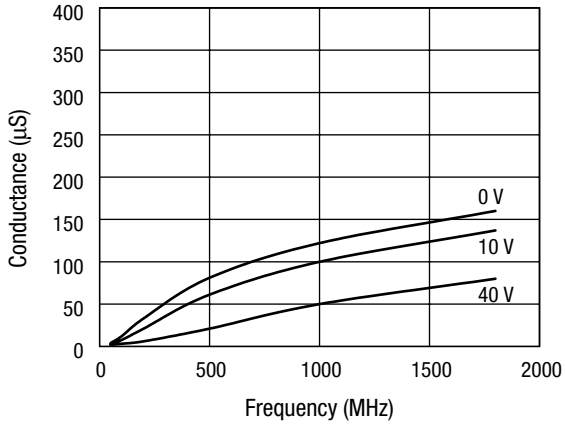
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



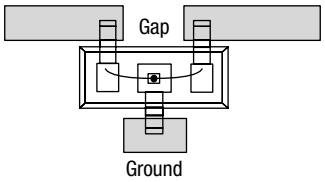
Conductance vs. Frequency and Reverse Voltage

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	1590.0	1660.0	1752.0	1770.0	1760.0
0.10	315.0	340.0	367.0	396.0	409.0
0.30	108.0	118.0	128.0	141.0	147.0
1.00	34.5	37.9	41.6	46.3	48.8
10.00	4.8	5.3	5.8	6.6	7.0
20.00	3.0	3.3	3.6	4.1	4.3
100.00	1.3	1.4	1.5	1.7	1.8

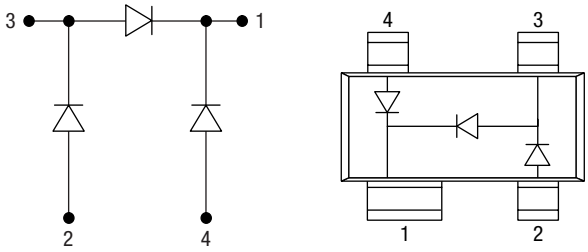
SMP1304-007

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 only realizable 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.

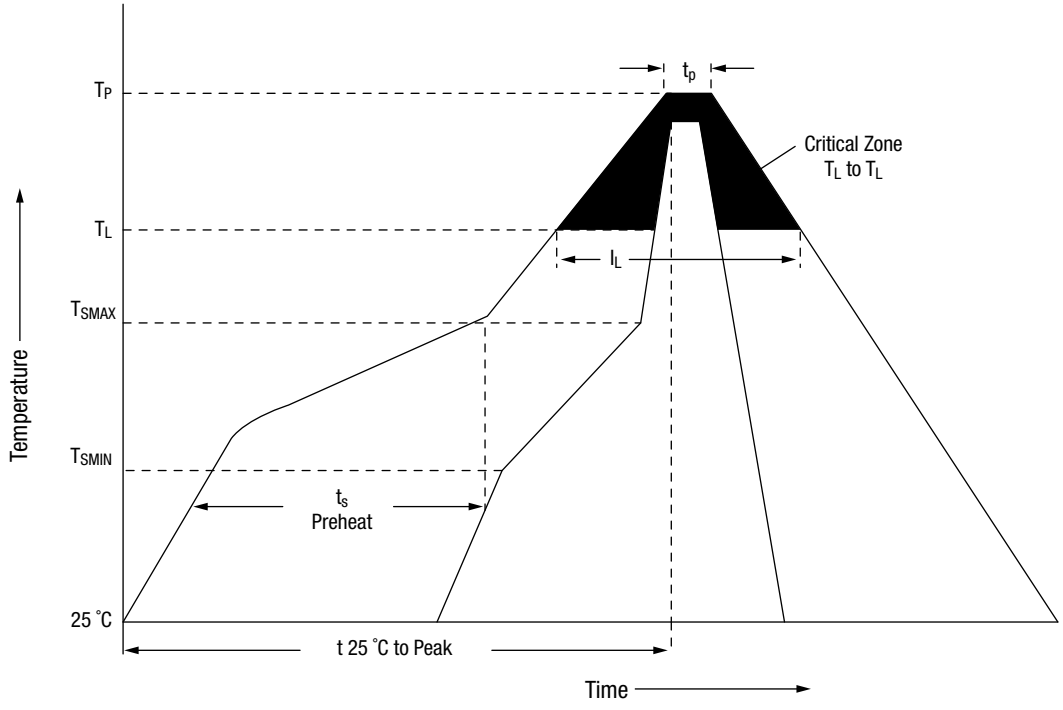


SMP1304-019 (PI)

Recommended Solder Reflow Profiles

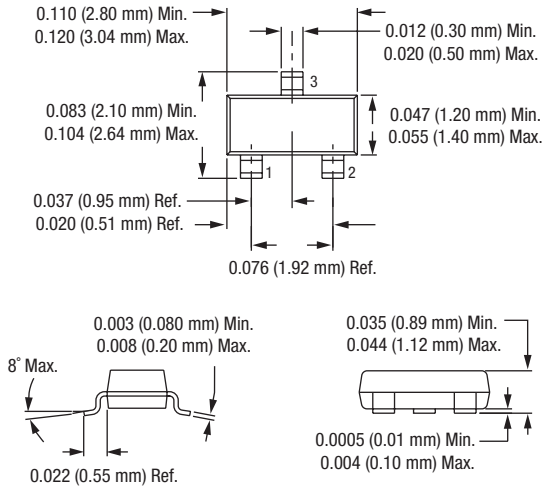
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average ramp-up rate (T_L to T_P)	3 °C/second max.	3 °C/second max.
Preheat Temperature min. (T_{SMIN}) Temperature max. (T_{SMAX}) Time (min. to max.) (ts)	 100 °C 150 °C 60–120 seconds	 150 °C 200 °C 60–80 seconds
T_{SMAX} to T_L 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 (tp)	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.

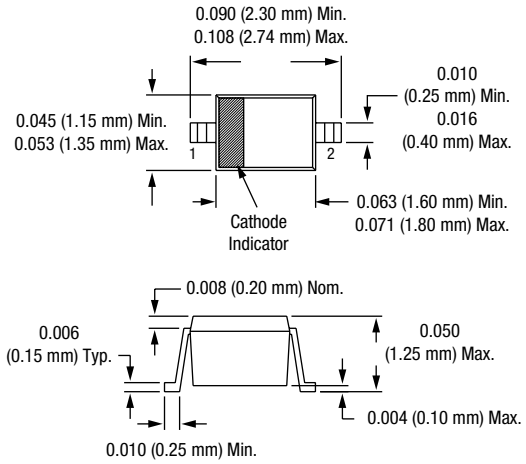


Reference JEDEC J-STD-020

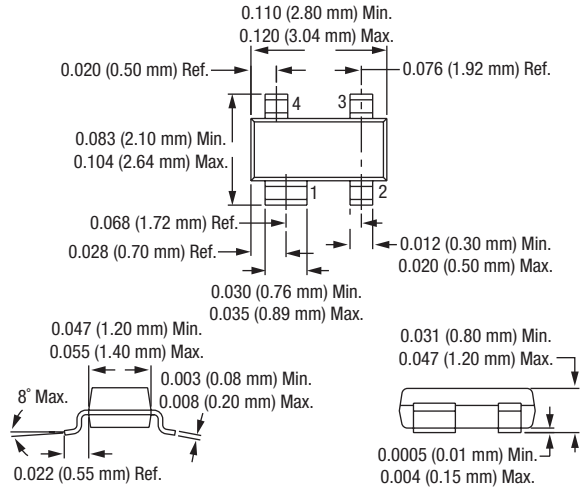
SOT-23



SOD-323



SOT-143



SOT-5