DATA SHEET

SMP1334-084LF: 100 W High-Power Silicon PIN Diode

Applications

- Low-loss, high-power switches
- Low-distortion attenuators

Features

- High RF power handling: 100 W
- Low thermal resistance: 10 °C/W
- Low series resistance: 0.45 Ω typical @ 100 mA
- Low total capacitance: 0.45 pF maximum @ 30 V
- Small QFN (2 x 2 mm) package
  (MSL1, 260 °C per JEDEC J-STD-020)

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

Description

The SMP1334-084LF is a surface-mountable, low-capacitance silicon PIN diode designed as a series-connected PIN diode for high-power, high-volume switch and attenuator applications from 10 MHz to beyond 6 GHz.

Typical resistance at 100 mA is 0.45 Ω and maximum capacitance at 30 V is 0.45 pF. The combination of low capacitance, low parasitic inductance, and nominal 50 µm I-region width, makes the SMP1334-084LF useful in large signal switches and attenuator applications.

The device has a 1 W dissipation power rating, which makes it capable of handling up to 100 W @ 25 °C Continuous Wave (CW) in a series-connected transmit/receive (T/R) switch.

Design information for high power switches may be found in the Skyworks Application Note, *Design With PIN Diodes* (document number 200312).

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMP1334-084LF are provided in Table 1. Electrical specifications are provided in Table 2. Typical DC performance characteristics of the SMP1334-084LF are illustrated in Figures 1, 2, and 3.

The SMP1334-084LF Evaluation Board is used to test the performance of the SMP1334-084LF PIN Diode. Figure 4 shows a bias schematic, and Table 3 lists the Evaluation Board Bill of Materials. Typical RF performance of the SMP1334-084LF using the schematic shown in Figure 4 is summarized in Table 4 and illustrated in Figures 5, 6, and 7.

An assembly drawing for the Evaluation Board is shown in Figure 8. The layer detail physical characteristics are provided in Figure 9.

Table 1. SMP1334-084LF Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Forward current	I_F		200	mA
Reverse voltage	V_R		200	V
Dissipated power @ 85 °C	P_D		1	W
Peak pulse power dissipation @ 85 °C (10% duty cycle)			10	W
Operating temperature	T_A	–55	+85	°C
Storage temperature	T_{STG}	–55	+200	°C
Junction temperature	T_J	–55	+175	°C
Electrostatic discharge: Charged-Device Model (CDM), Class 4 Human Body Model (HBM), Class 3A Machine Model (MM), Class C	ESD		 1100 5000 400	 V V V

1 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.

ESD HANDLING: *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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

Table 2. SMP1334-084LF Electrical Specifications[1]
(T_A = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Forward voltage	V_F	I_F = 10 mA		0.75		V
Reverse leakage current	I_R	V_R = 200 V			10	µA
Series resistance	R_{S1}	I_F = 1 mA, f = 100 MHz		16.5	20	Ω
	R_{S10}	I_F = 10 mA, f = 100 MHz		2.0	2.5	Ω
	R_{S100}	I_F = 100 mA, f = 100 MHz		0.45		Ω
Total capacitance	C_{T30}	V_R = 30 V, f = 1 MHz		0.40	0.45	pF
Series inductance	L_S			0.37		nH
Minority carrier lifetime	T_L	I_F = 10 mA		700		ns
I region width	W			50		µm
Thermal resistance (Note 2)	Θ_{JC}	Junction-to-case		10		°C/W
Peak thermal resistance	Θ_P	Single, 1 µs pulse width, junction-to-case (10% duty cycle)		1		°C/W

1 Performance is guaranteed only under the conditions listed in this table.
2 Assume a thermal resistance of 90 °C/W for the junction-to-bottom of the circuit board.

Typical DC Performance Characteristics
(T_A = 25 °C, Unless Otherwise Noted)

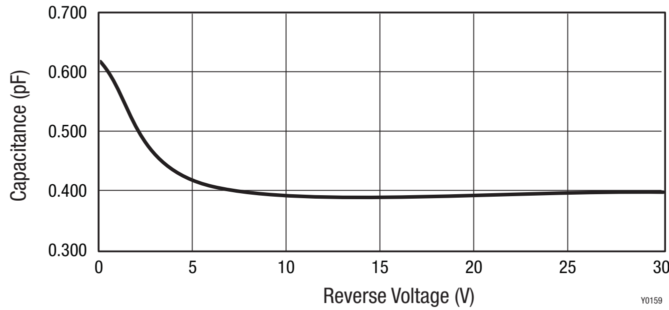

Figure 1. Capacitance vs Reverse Voltage @ 1 MHz

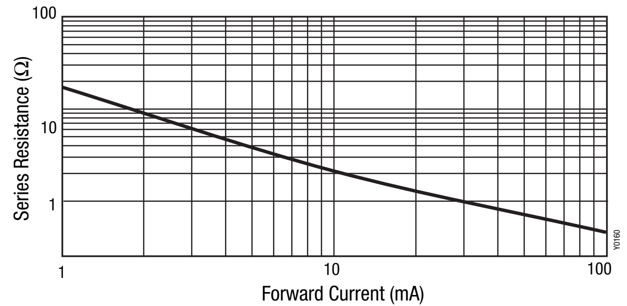

Figure 2. Series Resistance vs Forward Current @ 100 MHz

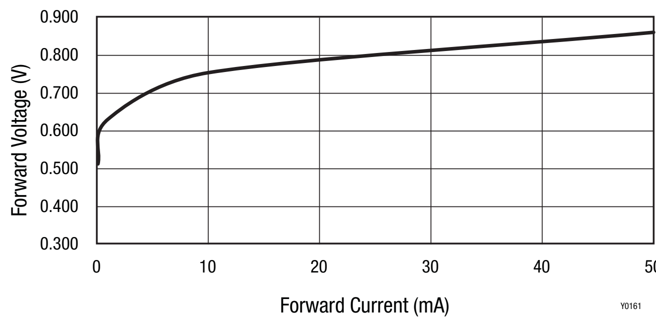

Figure 3. Forward Voltage vs Forward Current

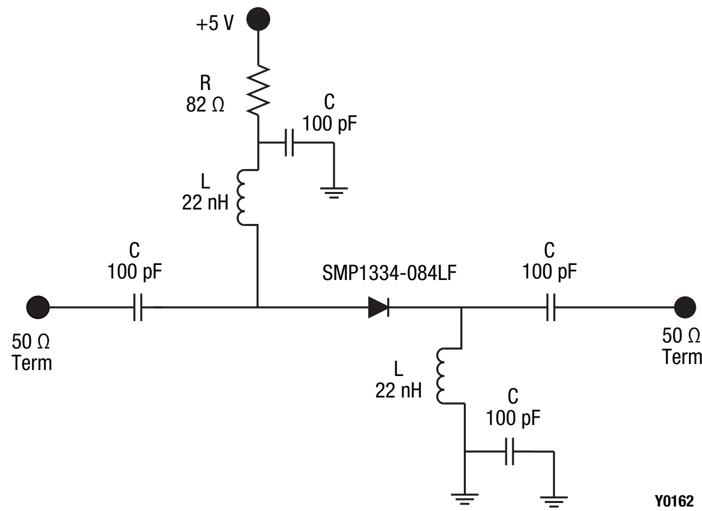

Figure 4. SMP1334-084LF Bias Schematic

Table 3. Evaluation Board Bill of Materials for EN33-D515-01_V3 (Tuned Circuit)

Component	Value	Size	QTY	Manufacturer	Mfg. Part Number	Characteristics
C	100 pF	0402	4	Murata	GRM1555C1H101JZ01	5% C0G 50 V
L	22 nH	0402	2	Murata	HK100522NJ-T	5%
R	82 Ω	0402	1	Panasonic	ERJ2GEJ820X	5%, 0.1 W

Table 4. Typical RF Performance @ 25 °C, f = 2.6 GHz

Parameter	Typical	Units
Un-tuned		
Insertion loss	0.22	dB
Return loss	15	dB
Isolation	–6.4	dB
With 22 nH Bias Circuit		
Insertion loss	0.5	dB
Return loss	11.7	dB
Isolation	–8.2	dB
Max power	+50	dBm

Typical RF Performance Characteristics

(TOP = +25 °C, Characteristic Impedance [Z0] = 50 Ω, EVB Optimized with Bias Circuit, Unless Otherwise Noted)

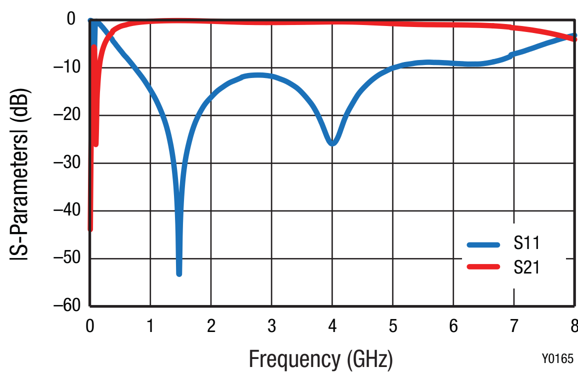

Figure 5. S-Parameter Magnitude vs Frequency If = 50 mA

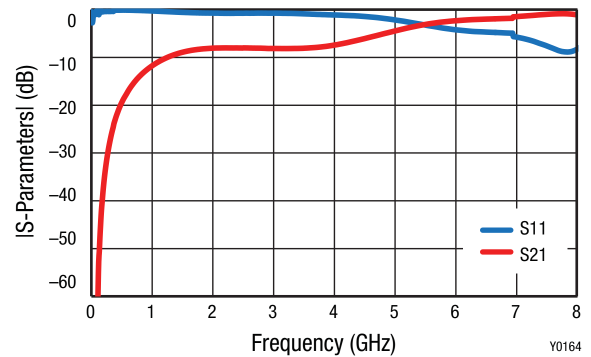

Figure 6. S-Parameter Magnitude vs Frequency VREV = –30 V

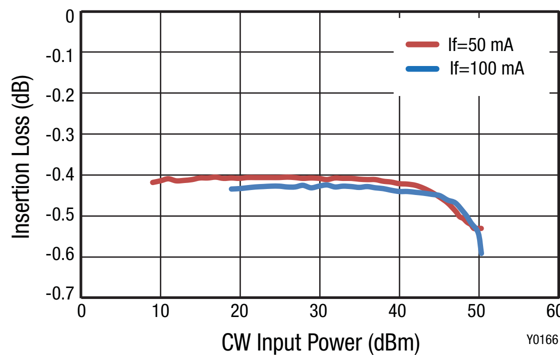

Figure 7. Insertion Loss vs CW Input Power f=2.6 GHz

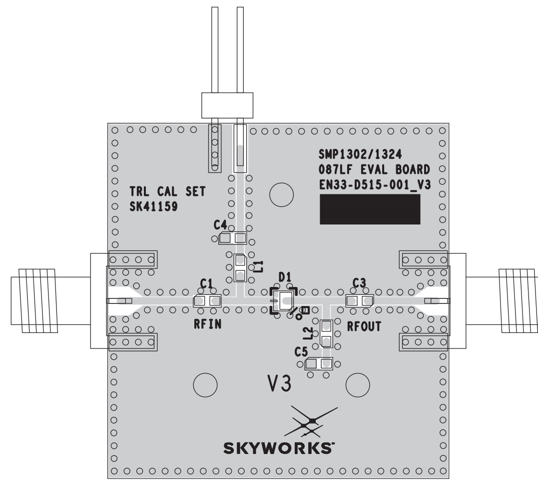

Figure 8. SMP1334-084LF Evaluation Board

Cross Section	Name	Thickness (in)	Material
	Top Soldermask		
	L1	(0.0028)	Cu foil
	Laminate	0.012 ± 0.0006	Rogers RO4003C Core
	L2	(0.0014)	Cu foil
	Laminate	(Note 1)	FR4 Prepreg
	L3	(0.0014)	Cu foil
	Laminate	0.010 ± 0.0006	FR4 Core
	L4	(0.0028)	Cu foil
	Bottom Soldermask		

Note 1: Adjust this thickness to meet total thickness goal of 0.062 ± 0.005 inches.

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Figure 9. Board Layer Detail Physical Characteristics

Package Dimensions

The PCB layout footprint for the SMP1334-084LF is provided in Figure 10. Typical part markings are shown in Figure 11. Package dimensions for the SMP1334-084LF are provided in Figure 12, and tape and reel dimensions are provided in Figure 13.

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 SMP1334-084LF 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.

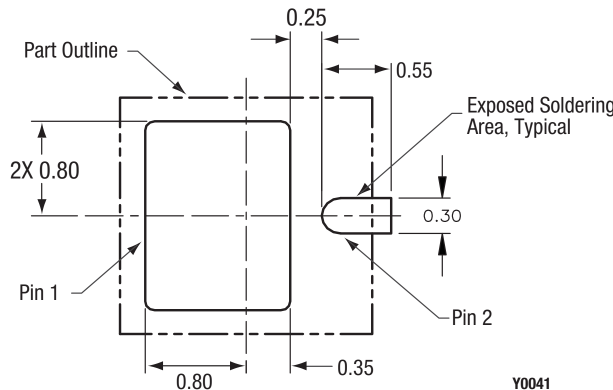

Figure 10. SMP1334-084LF PCB Layout Footprint (Top View)

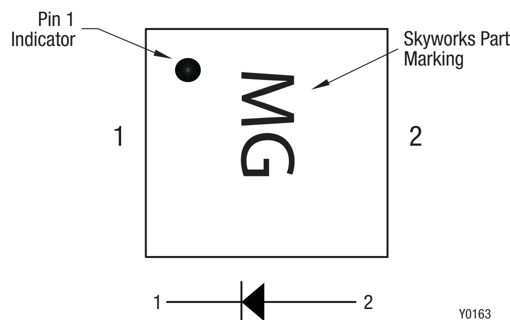

Figure 11. Typical Part Markings (Top View)

Figure 12. SMP1334-084LF Package Dimensions

Figure 13. SMP1334-084LF Tape and Reel Dimensions