K- & Ka-Band High Power Reflective SPDT PIN Switch Die 20 - 40 GHz

Features

- Broadband Performance, 20 - 40 GHz
- Low Loss: <1 dB, 30 - 40 GHz
- High Isolation: >30 dB, 20 - 40 GHz
- 40 dBm CW Power @ 35 GHz
- Die with G-S-G RF Pads and DC Bias Pads
- Includes DC blocking Capacitor at each RF input and Bias Low Pass filters with Series Resistor
- RoHS* Compliant

Applications

- K- and Ka-Band applications, including point-to-point radio and military products.

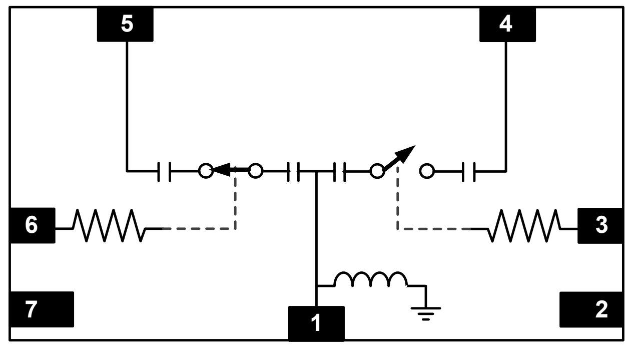
Description

The MASW-011144-DIE is a high power SPDT, reflective, broadband, high linearity, Aluminum Gallium Arsenide (AlGaAs) PIN diode switch for K- and Ka-Band applications, including point-to-point radio and military products.

The switch utilizes one shunt PIN diode per RF channel. The diode is controlled through an on-chip bias network that includes a current limiting resistor. These bias networks simplify the control of the switch; no external components are required.

The SPDT MMIC utilizes MACOM's proven AlGaAs PIN diode technology. The switch is fully passivated with silicon nitride and has an added polymer layer for scratch protection. The protective coating prevents damage to the junctions and the anode air-bridges during handling and assembly. The die has backside metallization to facilitate an epoxy die attach process.

Functional Schematic



Pad Configuration[1]

Pad #	Function
1	RF Common
2	No Connection
3	BIAS1
4	RF1
5	RF2
6	BIAS2
7	No Connection

1. The die backside must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MASW-011144-DIE	Die in Gel Pack

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications: T_A = +25°C, Z_0 = 50 Ω, V_F = 4.5 V / V_R = -9 V, P_{IN} = 0 dBm

Parameter	Conditions	Units	Min.	Typ.	Max.
Insertion Loss	26 GHz 32 GHz 34 GHz 38 GHz	dB	—	0.90 0.65 0.65 0.75	— 1.0 0.9 1.1
Insertion Loss	34 GHz, P_{IN} = 30 dBm	dB	—	0.65	—
Isolation	26 GHz 32 GHz 34 GHz 38 GHz	dB	— — 25 —	30	—
Input Return Loss	34 GHz	dB	14.5	22	—
Output Return Loss	34 GHz	dB	14.0	20	—
CW Input Power[2]	-9 V @ 85°C, 29 GHz -25 V @ 85°C, 29 GHz	dBm	—	39.0 41.2	—
Switching Speed	10 dBm, 10 - 90% RF, 500 µs pulse, 26.5 GHz	ns	—	40	—
0.1 dB Compression Point	-9 V @ 85°C, 29 GHz -25 V @ 85°C, 29 GHz	dBm	—	34 40	—
Forward Current	V_F = 4.5 V	mA	6.0	8.5	11.0

2. Reverse bias voltage should be determined based on working conditions. For example, -25 V @ 40 dBm input power. For lower power applications, a less negative voltage can be used.

Absolute Maximum Ratings

Parameter	Absolute Maximum
T_x Incident CW Power	42 dBm @ 29 GHz
Reverse DC Bias Voltage	-50 V
Forward Bias Current	15 mA
Junction Temperature	+150°C
Operating Temperature	-55°C to +85°C
Storage Temperature	-65°C to +150°C

Handling Procedures

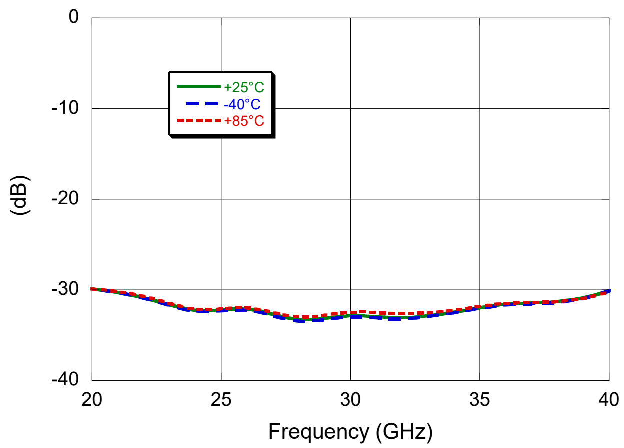
Please observe the following precautions to avoid damage:

Static Sensitivity

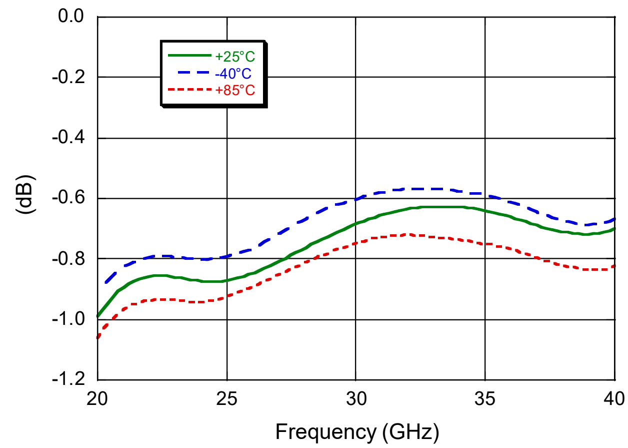
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM class 1A devices.

Typical Performance Curves: V_R = -9 V

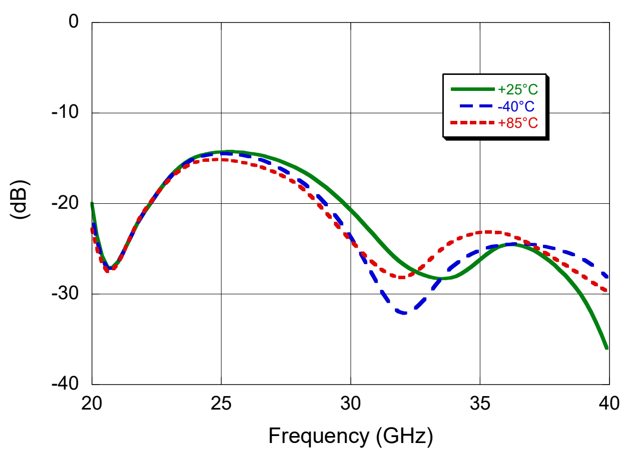
Isolation over Temperature



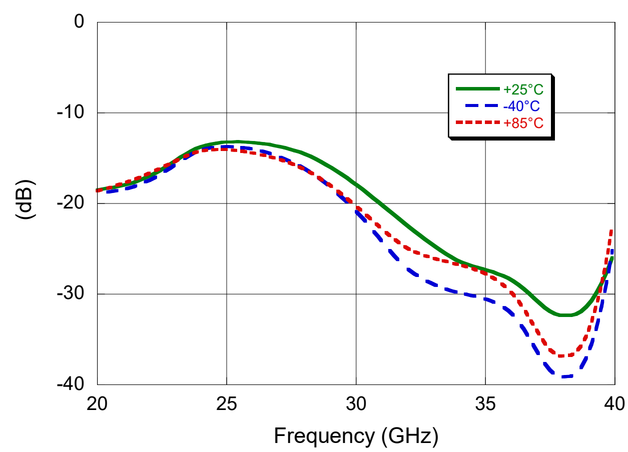
Insertion Loss over Temperature



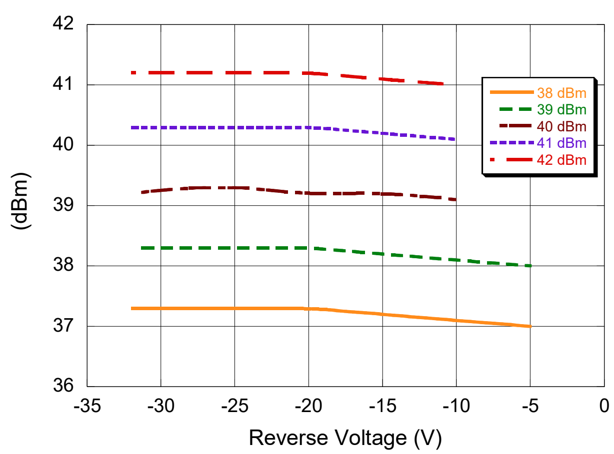
RF1, RF2 Return Loss over Temperature



Common Return Loss over Temperature



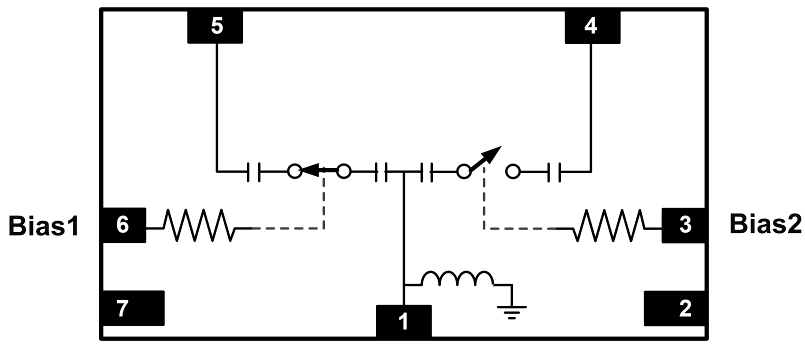
Output Power over Reverse Bias Voltage @ +85°C, 29 GHz



Bias Diagrams & Tables

Functional Diagram

The Functional Diagram shows the switch in following state:
RF1 - Low Loss
RF2 - Isolation



Truth Table

Pin	Bias 1	Bias 2
	Pin 3	Pin 6
RF1 - Low Loss RF2 - Isolation	V_R = -9 V	V_F = 4.5 V[3]
RF2 - Low Loss RF1 - Isolation	V_F = 4.5 V[3]	V_R = -9 V

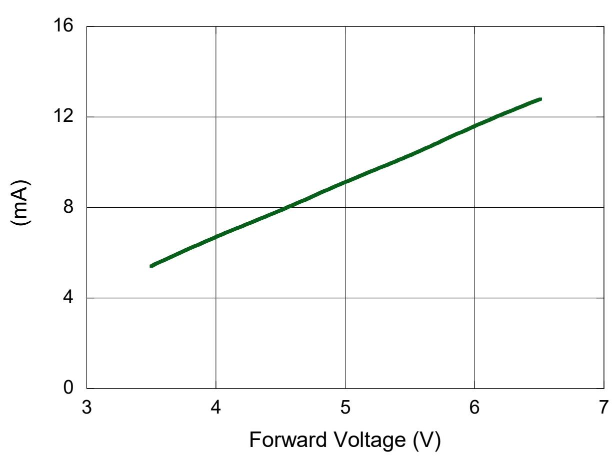
3. Internal bias resistors (400 Ω) control the forward bias current (I_F).

Bias Control

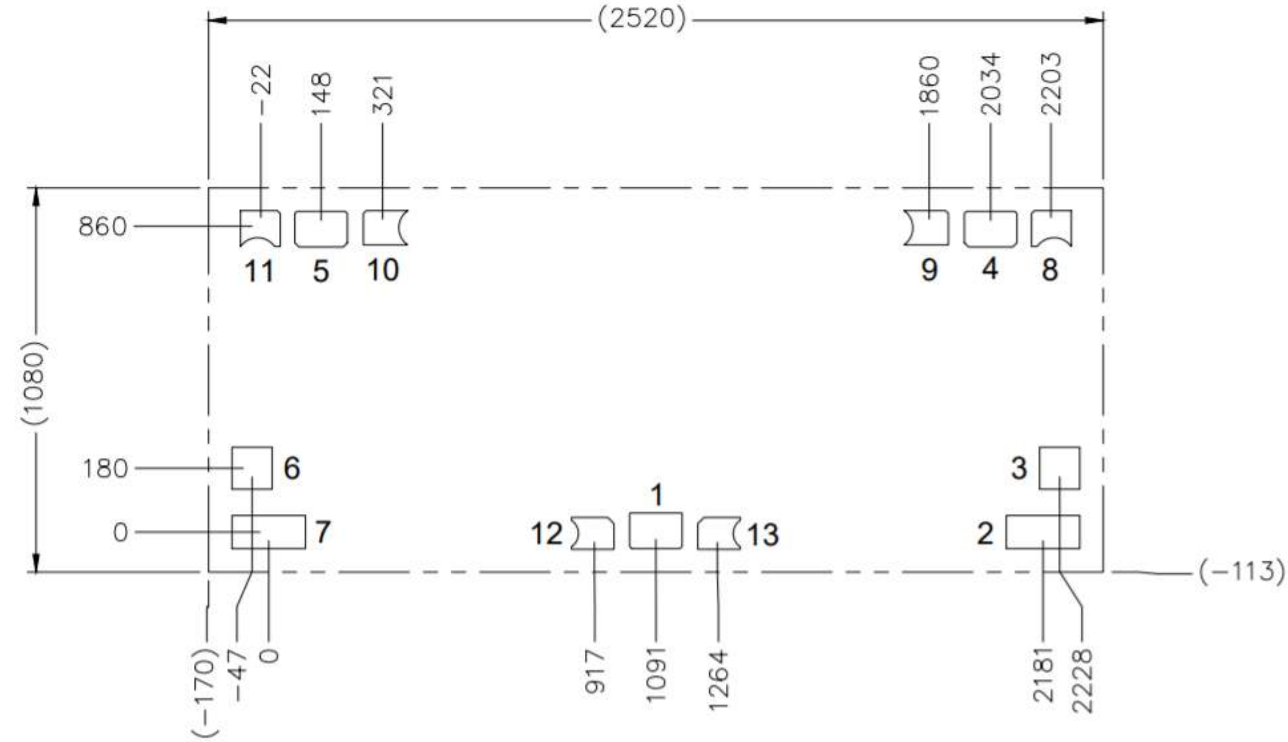
Optimal operation is achieved by simultaneous application of negative V_R voltage to the low loss switch path and positive V_F voltage to the isolating switch path.

In the low loss path, the diodes are reverse biased. In the isolating path, the diodes are forward biased.

Forward Bias Current over Forward Bias Voltage



Outline Drawing



Dimensions indicated in µm.
Chip Thickness: 100 µm
RF Pads (1,4,5): 110 x 148 µm
DC Bias Pads (3 & 6): 113 x 118 µm
DC Pads (2 & 7): 93 x 207 µm