Ka-Band High Power Reflective SPDT PIN Switch 26 - 40 GHz

MASW-011098
Rev. V3

Features

- Low Loss: 1.1 dB @ 40 GHz
- High Isolation: 39 dB @ 40 GHz
- Up to 13 W CW Power Handling, +85°C
- Switching Speed <30 ns
- Integrated DC Blocks and RF Bias Networks
- 5 mm 20-lead Laminate Package
- RoHS* Compliant

Applications

- 5G Wireless Infrastructure

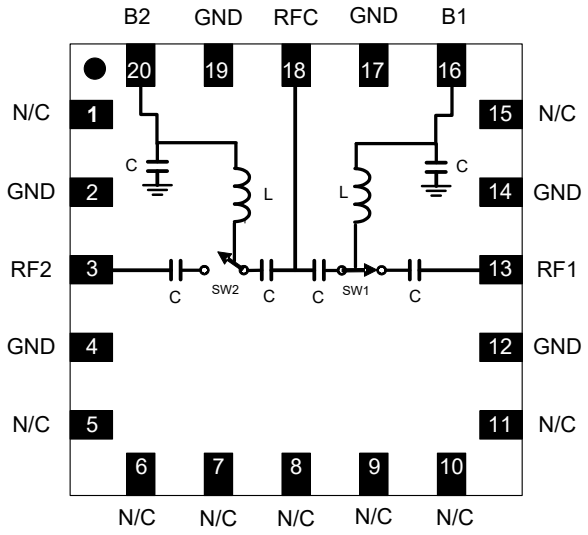
Description

The MASW-011098 is a high power SPDT PIN diode switch in a 5 mm laminate package. This broadband, reflective, high linearity, switch was developed for 26 - 40 GHz applications that require up to 13 W of power handling while maintaining low insertion loss and high isolation.

The SPDT MMIC utilizes MACOM's proven AlGaAs PIN diode technology.

This switch is ideally suited for 5G, Point-to-Point communications systems, radar systems, radiometers, test and instrumentation equipment and other high frequency applications.

Functional Diagram



Ordering Information[1]

Part Number	Package
MASW-011098	Bulk Packaged part
MASW-011098-TR0500	500 Part Reel
MASW-011098-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Pin Configuration[2, 3]

Pin #	Pin Name	Function
1, 5 - 11, 15	N/C	No Connection
2, 4, 12, 14, 17, 19	GND	Ground
3	RF2	RF2
13	RF1	RF1
16	B1	Bias 1
18	RFC	RF_{COMMON}
20	B2	Bias 2

2. MACOM recommends connecting all no connection pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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

Electrical Specifications: T_A = +25°C, I_F[4] = 20 mA, V_R[5] = -15 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (RF_{COMMON} to RFx ON state)	26.0 GHz 30.0 GHz 38.5 GHz 40.0 GHz	dB	—	0.85 0.85 1.05 1.15	1.3 1.5 1.7 1.8
Isolation (RF_{COMMON} to RFx OFF state)[6]	26.0 GHz 30.0 GHz 38.5 GHz 40.0 GHz	dB	30 29 29 27	43 40 38 39	—
Return Loss (RF_{COMMON})	26.0 GHz 30.0 GHz 38.5 GHz 40.0 GHz	dB	—	20 21 23 19	—
Return Loss (RFx ON state)	26.0 GHz 30.0 GHz 38.5 GHz 40.0 GHz	dB	—	24 24 27 25	—
CW Power Handling (ON state)[5]	26.5 GHz, V_R = -25 V, +85°C	dBm W	—	41.2 13	—
Switching Speed T_{ON} / T_{OFF} T_{RISE} / T_{FALL}	26.5 GHz 50% DC to 90% RF / 50% DC to 10% RF 10% to 90% RF / 90% to 10% RF	ns	—	30 / 21 10 / 8	—
Reverse Bias Current	-15 V	nA	—	25	—

4. Forward bias current (I_F) is set using external bias resistors (R_{BIAS}) placed at pins B1 and B2, where R_{BIAS} = (V_{CC} - 1.32 V) / I_F.
5. Reverse bias voltage should be determined based on working conditions. For example, -25 V @ 41.2 dBm input power. For lower power applications, a less negative voltage can be used. R. Caverly and G. Hiller, "Establishing the Minimum Reverse Bias for a PIN Diode in a High Power Switch," IEEE Transactions on Microwave Theory and Techniques, Vol.38, No.12, December 1990.
6. Isolation defined with 1 port in low loss state.

Absolute Maximum Ratings[7,8]

Parameter	Absolute Maximum
Reverse Bias Voltage	-50 V
Forward Bias Current	25 mA
CW Incident Power	43 dBm @ 85°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

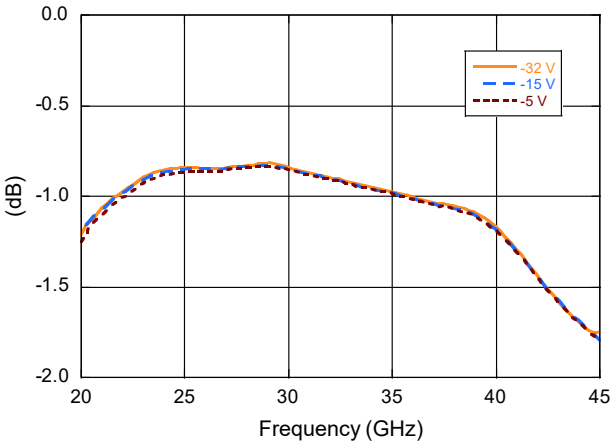
7. Exceeding any one or combination of these limits may cause permanent damage to this device.
8. MACOM does not recommend sustained operation near these survivability limits.

Truth Table

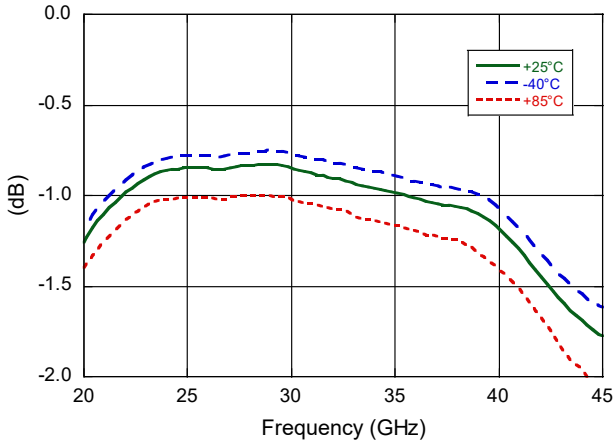
RF_{COMMOM} Path	Bias 1	Bias 2
RF1 Insertion Loss RF2 Isolation	-15 V	20 mA
RF2 Insertion Loss RF1 Isolation	20 mA	-15 V

Typical Performance Curves

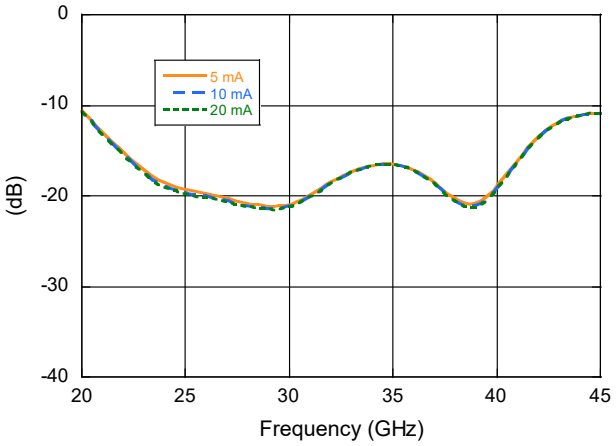
Insertion Loss over Reverse Bias Voltage



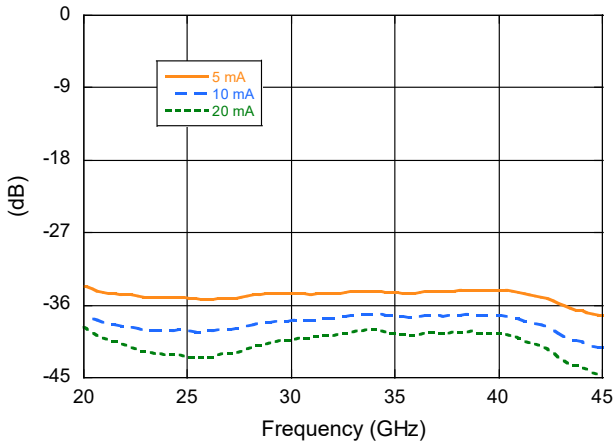
Insertion Loss over Temperature



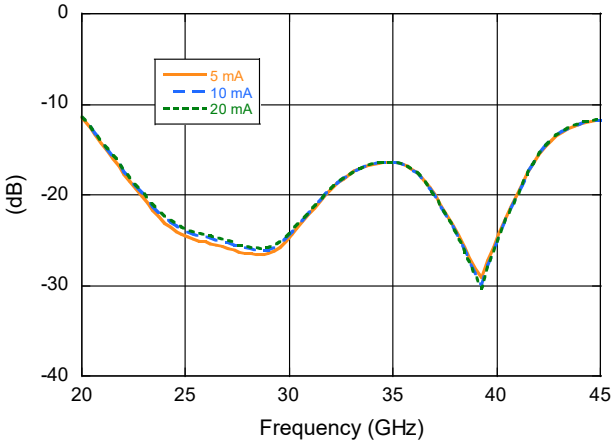
RF_{COMMON} Return Loss



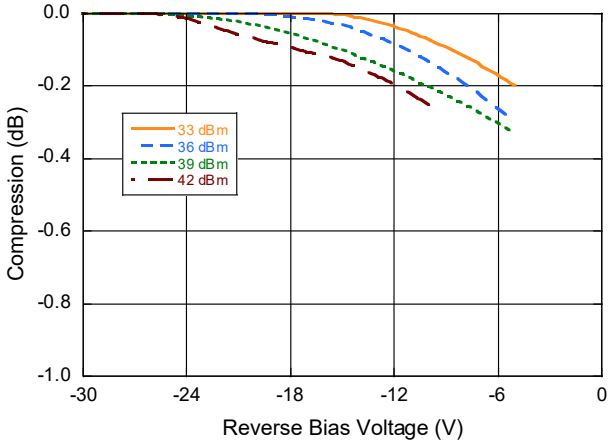
Isolation over Forward Bias Current



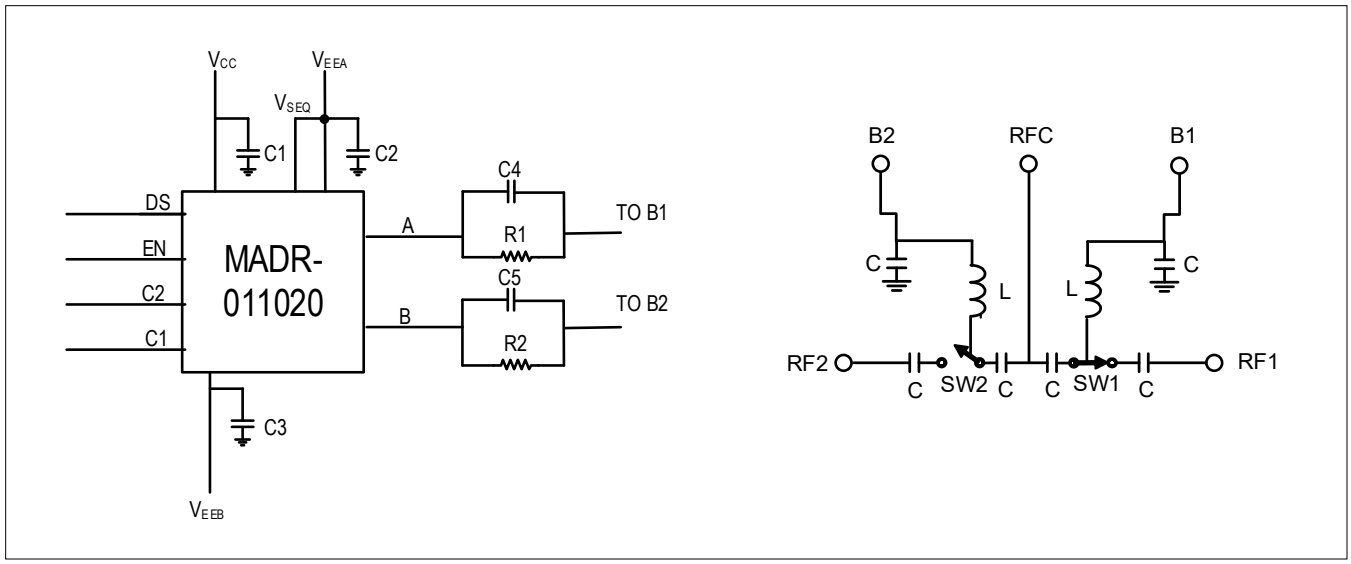
RF1, RF2 Return Loss (Insertion Loss State)



Compression vs. Reverse Bias Voltage @ 26.5 GHz



MASW-011098 with MADR-011020 Driver Application Schematic



Parts List[9]

Part	Value
C1,C3	0.1 µF
C2	47 pF
C4,C5	470 pF
R1,R2	180 Ω

9. Resistor values calculated to provide ~20 mA of bias current and ~25 V reverse bias voltage given VCC = 5 V, V_{EEB} = -25 V, voltage drop at driver output ~0.4 V and Vf of switch diodes ~1.32 V.

Switch Minimum Reverse Bias Voltage[5,10]

Frequency (GHz)	DC Voltage (V) B1 & B2
26	-16
30	-14
35	-12
40	-11

10. Calculated (see note 5) minimum DC reverse bias voltage to maintain low loss under 13 W of power with 1.5:1 VSWR.

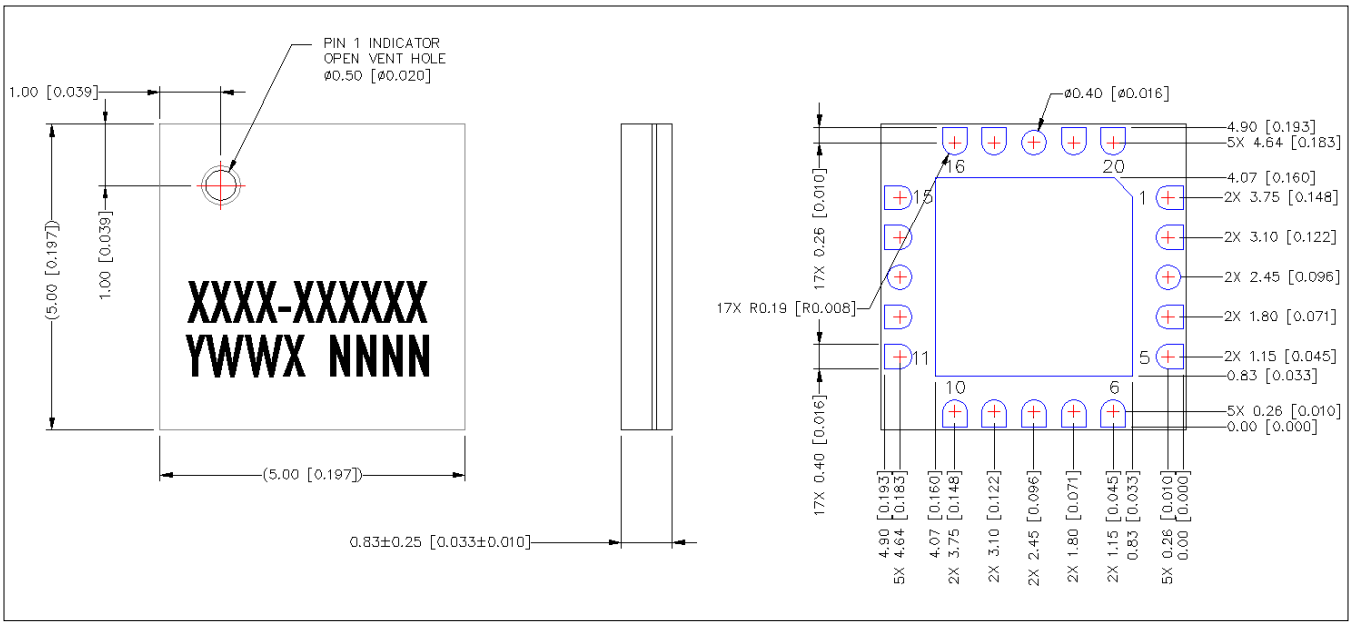
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Arsenide Integrated Circuits 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.

Lead-Free 5 mm 20-Lead Laminate Package†



† All dimensions are in millimeters [inches].
Plating is gold.
This device is non-hermetic with an open vent hole. MACOM does not recommended performing any aqueous cleaning process post-assembly unless the vent hole has been filled post-reflow.

Recommended PCB Land Pattern and PCB construction
(Material : RO4350B LoPro, Dielectric thickness 10.7 mils ,Top Metal thickness 1oz. Cu)