SP3T AlGaAs PIN Diode Switch
50 MHz - 60 GHz

MASW-011185
Rev. V1

Features

- Broadband Performance, 50 MHz to 60 GHz
- Low Loss: 1.7 dB @ 47 GHz
- High Isolation: 31 dB @ 47 GHz
- Switching Speed: 20 ns
- Lead Free 5 mm 4-Lead QFN Package
- RoHS* Compliant

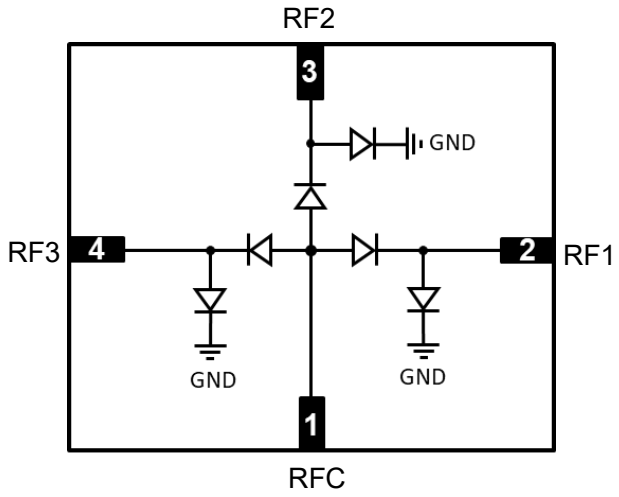
Applications

- Test & Measurement
- 5G
- Point to Point Communications
- Radar Systems
- Radiometers
- High Frequency Applications

Description

The MASW-011185 is an extremely broadband reflective SP3T PIN diode switch in a 5 mm laminate QFN package. The SP3T MMIC utilizes MACOM's proven AlGaAs PIN diode technology. External bias tees are required.

Functional Schematic



Pin Configuration

Pin #	Function
1	RFC
2	RF1
3	RF2
4	RF3
5 - Paddle	GND[2]

2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information[1]

Part Number	Package
MASW-011185-TR0500	500 piece reel
MASW-011185-SMB	Sample Board

1. Reference Application Note M513 for reel size information.

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

Electrical Specifications: Freq. = 50 MHz - 60 GHz, T_A = 25°C, I_{CC} = +/-10 mA, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	RFC to RF1 - RF5 (ON State) 17 GHz 27 GHz 37 GHz 47 GHz	dB	—	0.8 1.2 1.6 1.7	1.5 2.0 2.2 —
Isolation[3] RFC to RF_{OUT}[4]	RFC to RF1 - RF5 (OFF State) 17 GHz 27 GHz 37 GHz 47 GHz	dB	27 24 26 —	32 28 32 31	—
Return Loss Input RFC Output RF_{OUT}	RFC to RF1 - RF5 (ON State), ≤60 GHz	dB	—	10 10	—
Switching Speed[5]	+/- 5 V TTL Compatible PIN Diode Driver, 10 GHz, RFC to RF_{OUT}	ns	—	20	—
Diode Forward Voltage	10 mA	V	—	1.32	—
Input RF CW Power	RFC to RF_{OUT}, 10 mA, +85°C, 32 GHz	dBm	—	30	—
Output IP3	RFC to RF_{OUT}, 26 - 34 GHz, 1 GHz step	dBm	—	40	—
Input IP3	RFC to RF_{OUT}, 26 - 34 GHz, 1 GHz step	dBm	—	44	—

3. Isolation is measured from the common port RFC (input) to selected output port RF_{OUT} with an adjacent RF_{OUT} port in the ON state (low loss state). Isolation values shown in the table are the lowest isolation values below 57 GHz.
4. RF_{OUT} - Output Port RF1, RF2, & RF3.
5. Typical switching speed is measured from 10% to 90% of the detected RF voltage driven by a +/- 5 V TTL compatible driver. Driver output parallel RC network uses a capacitor between 390 - 560 pF and a resistor between 150 - 220 Ω ohms to achieve 15 ns rise and fall times.

Absolute Maximum Ratings[6,7]

Parameter	Absolute Maximum
DC Reverse Bias Voltage + RF Peak Voltage	80 V
Forward Bias Current	+/- 15 mA
CW Incident RF Power	31 dBm @ +85°C, 32 GHz
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

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

Handling Procedures

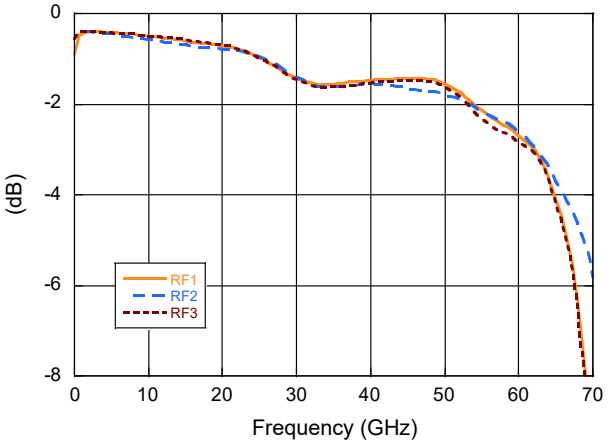
Please observe the following precautions to avoid damage:

Static Sensitivity

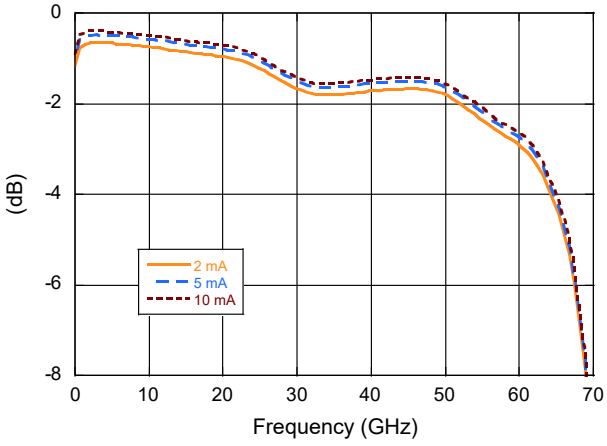
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 0 devices.

Typical Performance Curves (Probed Data on a Sample Board), I_{CC} = +/-10 mA

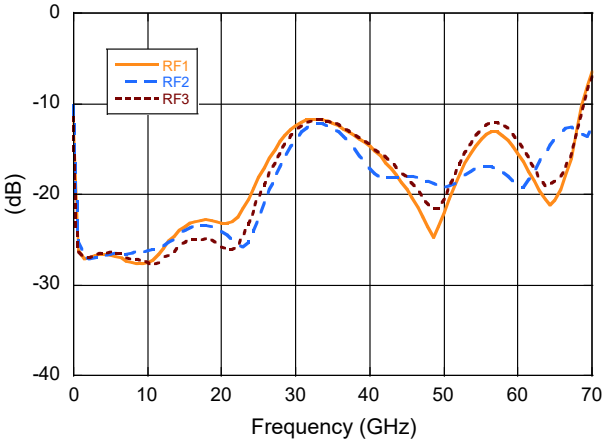
Insertion Loss RF1, RF2, and RF3



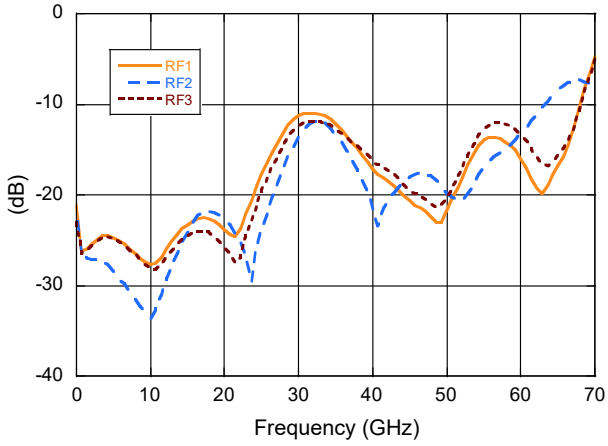
Insertion Loss RF1 over Forward Bias Current



Input Return Loss RF1, RF2, and RF3

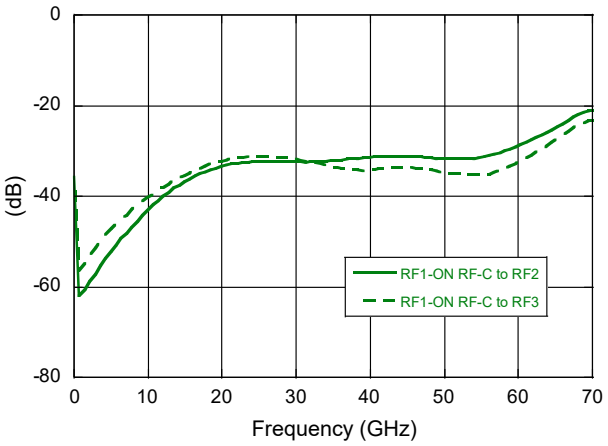


Output Return Loss RF1, RF2, and RF3

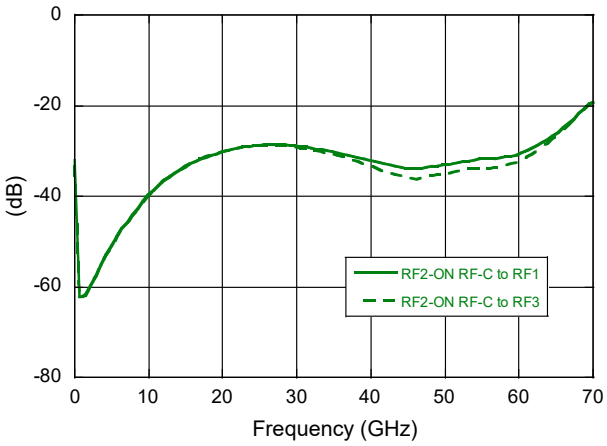


Typical Performance Curves (Probed Data on a Sample Board), I_{CC} = +/-10 mA

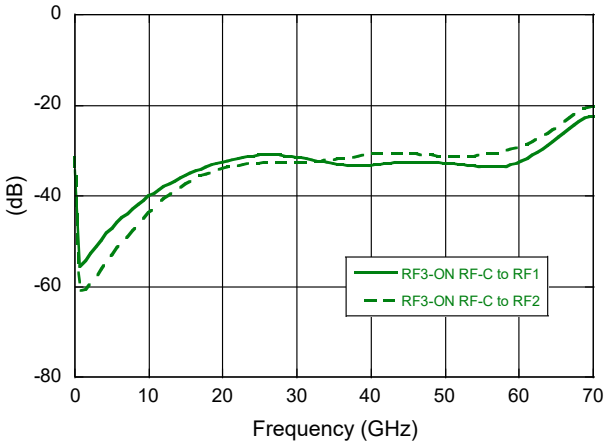
Isolation RF1-ON, RF-C to RF2 & RF3



Isolation RF2-ON, RF-C to RF1 & RF3

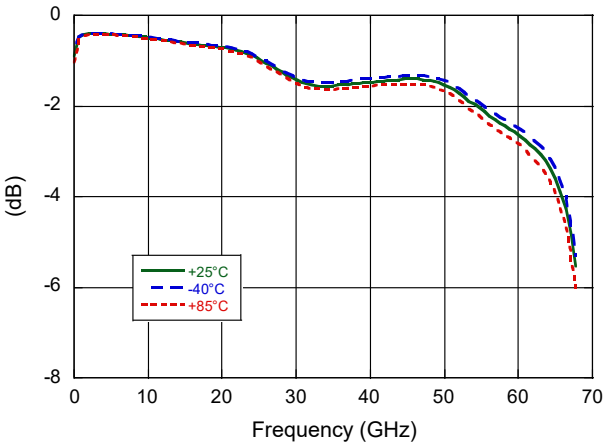


Isolation RF3-ON, RF-C to RF1 & RF2

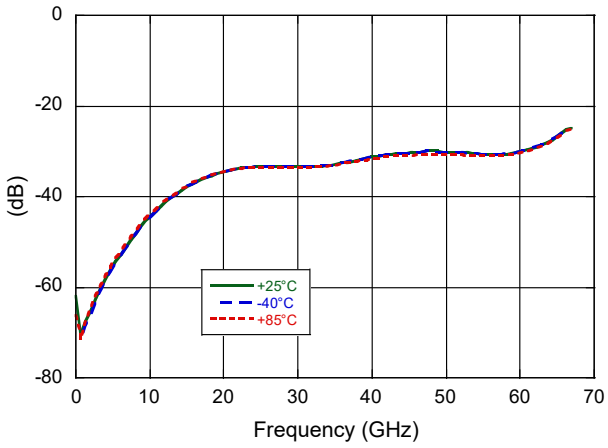


Typical Performance Curves (Probed Data on a Sample Board), I_{CC} = +/-10 mA

Insertion Loss RF1 over Temp

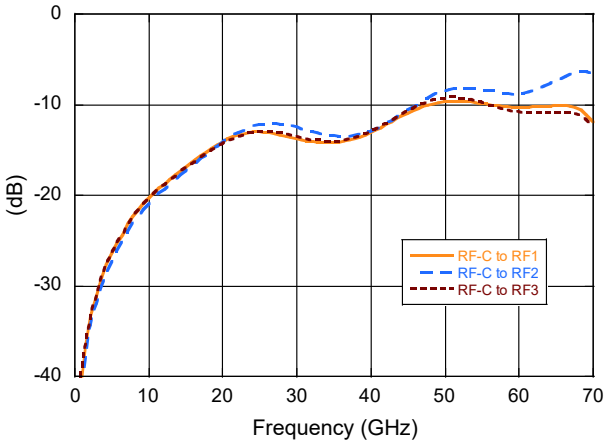


Isolation RF1 over Temp

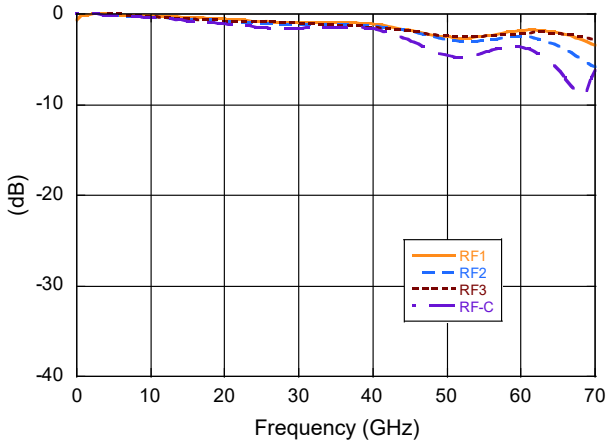


Typical Performance Curves in Unbiased Condition @ +25°C, I_{CC} = 0 mA (Probed Data on a Sample Board)

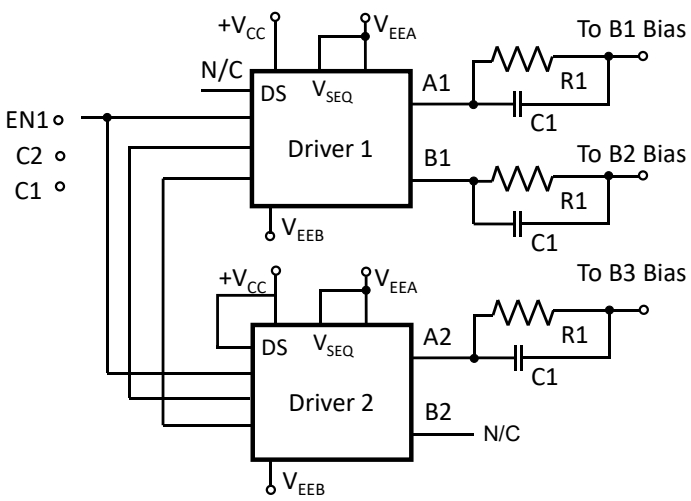
Unbiased Insertion Loss RFC to RF1, RF2, RF3

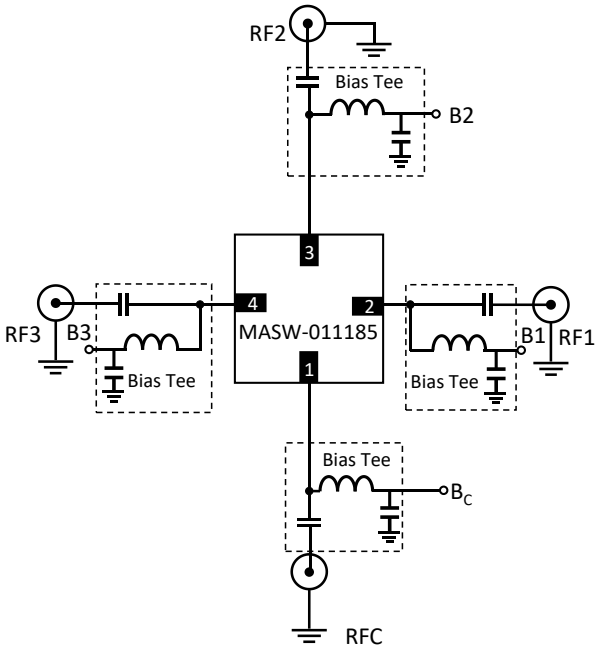


Unbiased Input Return Loss RFC, RF1, RF2, RF3



MASW-011185 with MADR-011022 / MADR-011020[9] Driver Application Schematic - One Possible Configuration Example.





Parts List

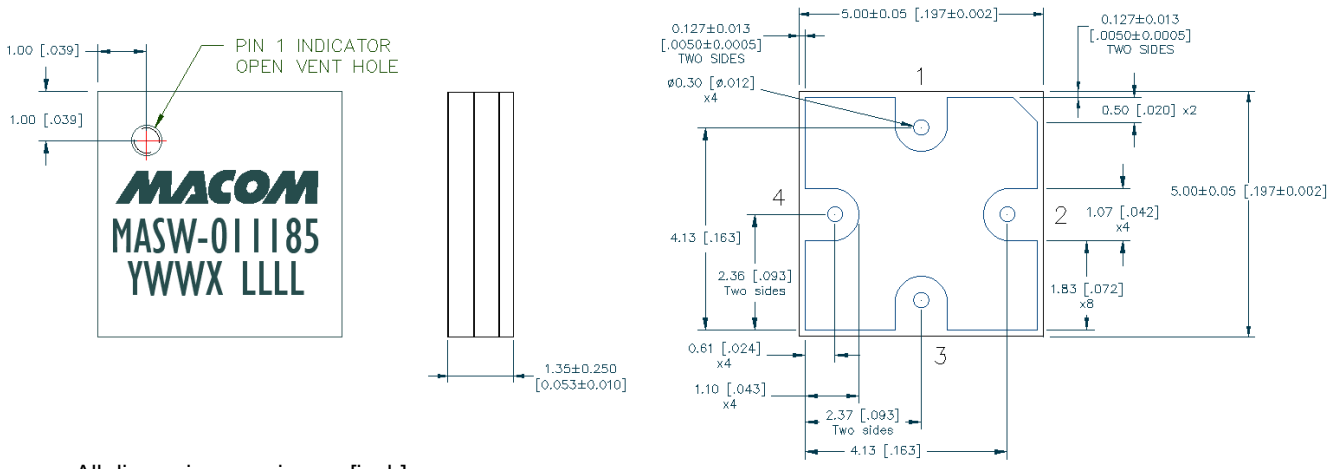
Parameter	Value	Parameter	Value
C1 [10]	520 pF	V_{CC} [12]	5 V
R1 [10]	180 Ω	V_{EEA} , V_{EEB} [13]	-10 V
B_C [11]	-5 V		

An Example of the Logic Truth Table MADR-011022 / MADR-011020

Inputs			Outputs			RF Output
EN1	C2	C1	A1	B1	A2	
1	X	X	H	H	H	ALL OFF
0	0	0	L	H	H	RF1 - ON
0	0	1	H	L	H	RF2 - ON
0	1	0	H	H	L	RF3 - ON

9. The application details of the MADR-011022 / MADR-011020 driver are in their Data Sheets.
10. C1, R1 - Exemplary values. For more option contact MACOM technical support.
11. B_C - Common Port Bias - Exemplary voltage, one of many possible option. For more option how to connect the B_C contact MACOM technical support.
12. V_{CC} at the driver should be 0.4 V higher than the required forward bias voltage V_B at the bias input A1, B1, A2.
13. V_{EEA} , V_{EEB} - Exemplary voltage. For details see Data Sheet of the used driver.

Lead-Free 5 mm 4-LD Laminate Package†



All dimensions are in mm [inch]

† This is not a JEDEC standard package
Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is ENEPIG

This device is non-hermetic, with an open vent hole. MACOM does not recommend performing aqueous cleaning processes post-assembly unless the vent hole has been filled post-reflow.