10 W Antenna Switch with Receive Limiter 1.5 - 4.0 GHz

MASW-010370

Rev. V2

Features

- 0.5 dB T_X Path Insertion Loss @ 3 GHz
- 10 W Peak Power Handling @ 3 GHz
- 37 dB T_X to R_X Isolation @ 3 GHz
- 0.85 dB R_X Path Insertion Loss @ 3 GHz
- Integrated Limiter Diode for R_X Protection
- Integrated Bias Circuit for Easy Control
- Lead-Free 3 mm 16-lead PQFN Package
- RoHS* Compliant and 260°C Reflow Compatible

Applications

- Aviation and Weather Radar

Description

The MASW-010370 is a fully integrated 10 W PIN diode antenna switch assembled in a lead-free 3 mm 16-lead PQFN plastic package.

This module is designed to handle 10 W pulsed signals at both the T_X and Antenna ports. Low loss on the transmit side improves the overall efficiency of the transmit chain. The receive section soft limits the receive signal prior to the receive filter, which would reflect out-of-band interfering signals.

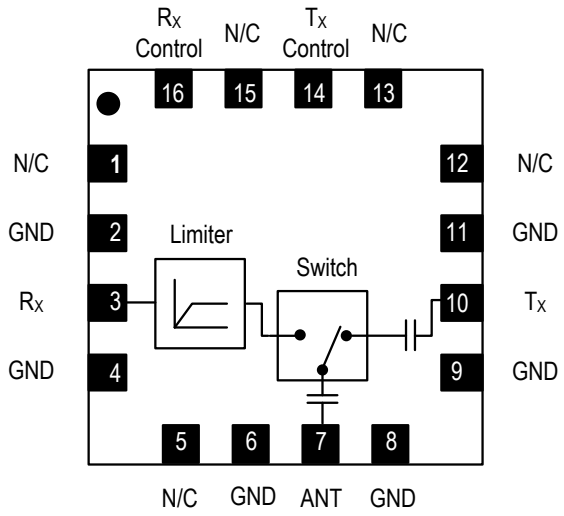
MASW-010370 can be used in conjunction with MACOM's MADL-011008 diode limiter, which would be located after the receive filter to fully protect the R_X LNA.

Ordering Information[1,2]

Part Number	Package
MASW-010370	bulk
MASW-010370-TR0500	500 piece reel
MASW-010370-001SMB	Sample Test Board

1. Reference Application Note M513 for reel size information.

Functional Block Diagram



Pin Designations

Pin #	Function
1, 5, 12, 13, 15	No Connection
2, 4, 6, 8, 9, 11	Ground
3	R_X[2]
7	Antenna
10	T_X
14	T_X Control
16	R_X Control
17	Pad[3]

2. An external DC block is required at the R_X pin.
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: P_{IN} = 0 dBm, T_A = 25°C, Z_0 = 50 Ω

T_X Mode (T_X Control = -5 V, R_X Control = +5 V)					
Parameter	**Test Conditions**	**Units**	**Min.**	**Typ.**	**Max.**
Insertion Loss	1.5 - 4.0 GHz 2.7 GHz 2.3 - 3.0 GHz	dB	—	0.6 — 0.5	— 0.6 —
T_X to R_X Isolation	1.5 - 4.0 GHz 3.0 GHz 2.3 - 3.0 GHz	dB	— 35 —	39 — 38	—
Input Return Loss	1.5 - 4.0 GHz 2.3 - 3.0 GHz	dB	—	25 29	—
Output Return Loss	1.5 - 4.0 GHz 2.3 - 3.0 GHz	dB	—	24 25	—
T_{ON}	50% control to 90% RF @ 3 GHz	ns	—	56	—
T_{RISE}	10% to 90% RF @ 3 GHz	ns	—	56	—
T_{OFF}	50% control to 10% RF @ 3 GHz	ns	—	22	—
T_{FALL}	90% to 10% RF @ 3 GHz	ns	—	19	—
T_X Control	-5 V Current	mA	-50	—	-10
R_X Control	+5 V Current	mA	10	—	50

R_X Mode (T_X Control = +5 V, R_X Control = -5 V)					
Parameter	**Test Conditions**	**Units**	**Min.**	**Typ.**	**Max.**
Insertion Loss	1.5 - 4.0 GHz 2.7 GHz 2.3 - 3.0 GHz	dB	—	0.90 — 0.85	— 1.0 —
ANT to T_X Isolation	1.5 - 4.0 GHz 3.0 GHz 2.3 - 3.0 GHz	dB	— 22 —	24 — 23	—
Input Return Loss	1.5 - 4.0 GHz 2.3 - 3.0 GHz	dB	—	20 22	—
Output Return Loss	1.5 - 4.0 GHz 2.3 - 3.0 GHz	dB	—	26 26	—
T_{ON}	50% control to 90% RF @ 3 GHz	ns	—	167	—
T_{RISE}	10% to 90% RF @ 3 GHz	ns	—	48	—
T_{OFF}	50% control to 10% RF @ 3 GHz	ns	—	53	—
T_{FALL}	90% to 10% RF @ 3 GHz	ns	—	43	—
T_X Control	+5 V Current	mA	0	—	1
R_X Control	-5 V Current	mA	-50	—	-10
R_X Limiter Peak P_{OUT}	10 W Pulsed P_{IN} @ 3 GHz 10 µs, 10% duty cycle	dBm	—	26	—

Bias Table

Mode	T_X Control	R_X Control
T_X	-5 V	+5 V
R_X	+5 V	-5 V

Absolute Maximum Ratings[4,5]

Parameter	Absolute Maximum
T_X Control Voltage	-6 V ≤ T_X Control ≤ +6 V
R_X Control Voltage	-6 V ≤ R_X Control ≤ +6 V
T_X Peak Incident Power	20 W, 10 µs pulse width, 10% duty cycle
R_X Peak Incident Power	12 W, 10 µs pulse width, 10% duty cycle
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

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

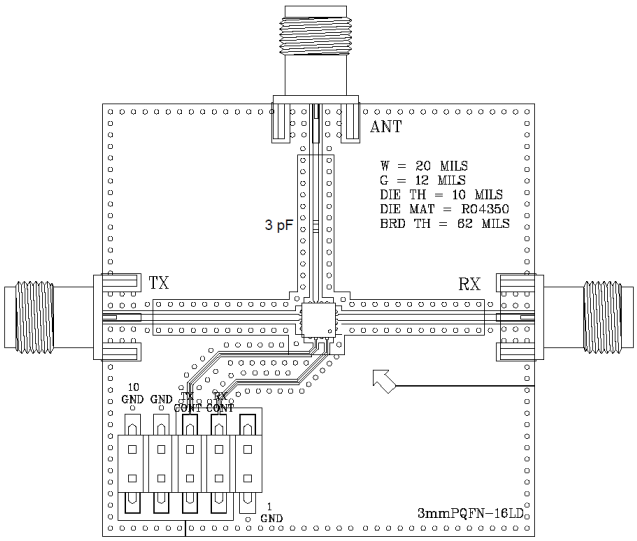
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

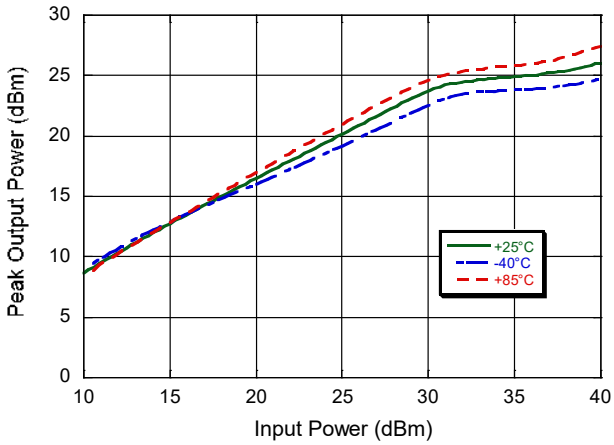
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 1A (HBM) & Class C4 (CDM) devices.

Sample Board



Typical Performance Curve

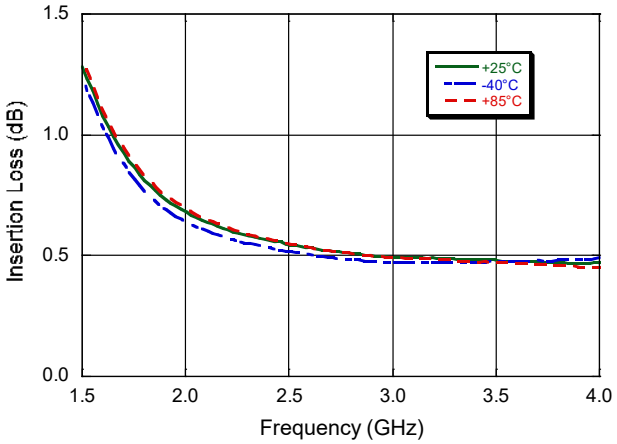
Limiter Diode Power Limiting Curve[6,7]



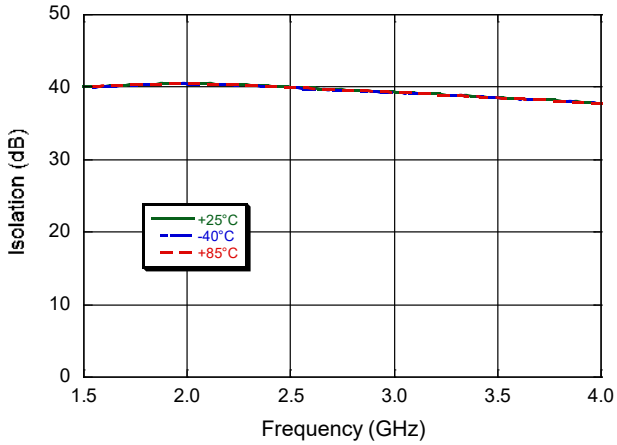
6. Frequency = 3 GHz, 10 µs pulse width, 10% duty cycle, Z_0 = 50 Ω.
7. For improved limiting, add MADL-011008 after R_X port.

Typical Performance Curves T_X Mode

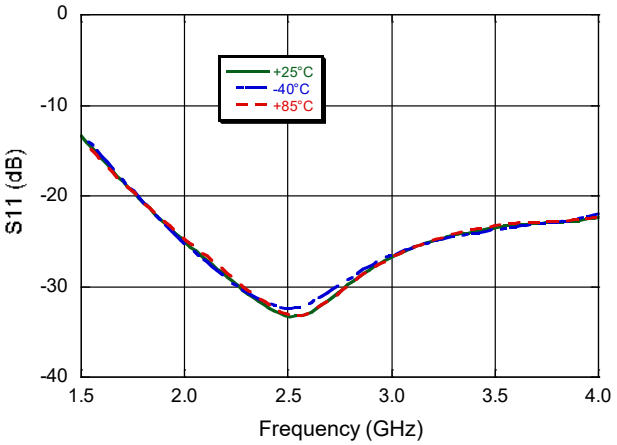
Insertion Loss vs. Frequency



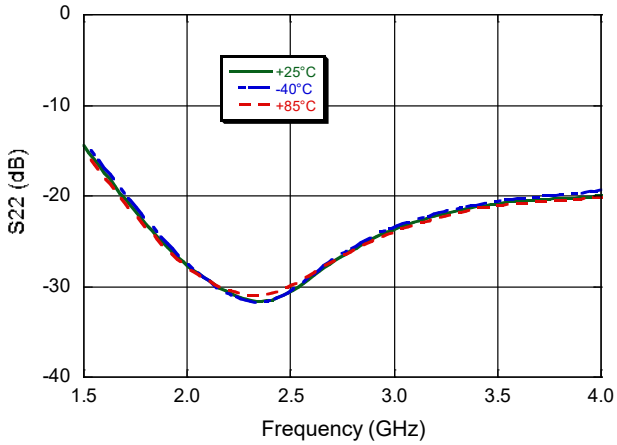
T_X to R_X Isolation vs. Frequency



Input Return Loss vs. Frequency

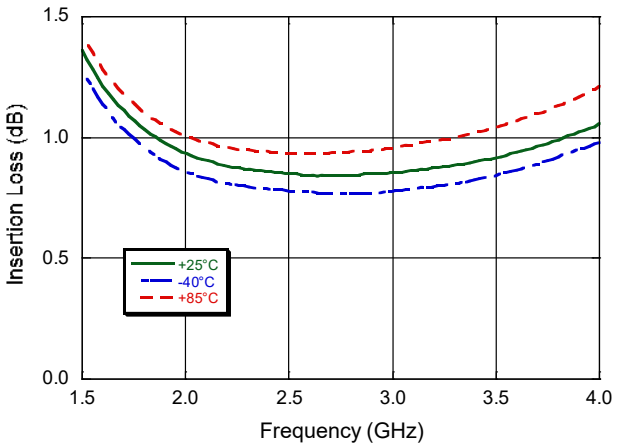


Output Return Loss vs. Frequency

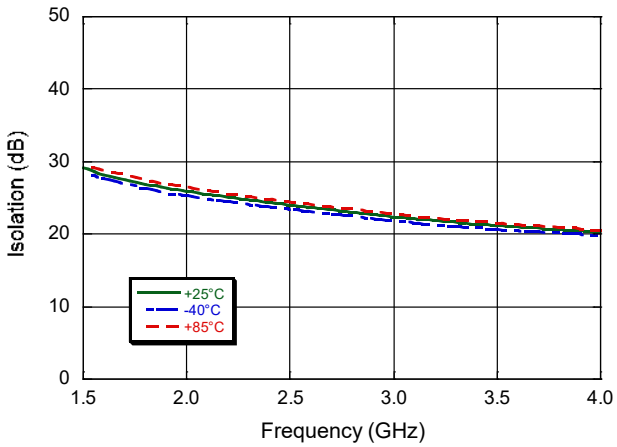


Typical Performance Curves R_X Mode

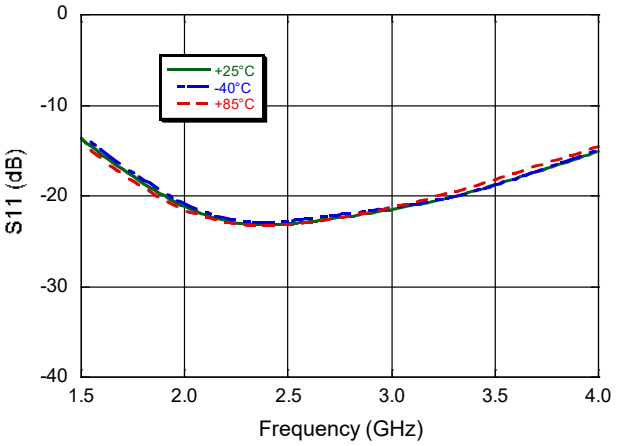
Insertion Loss vs. Frequency



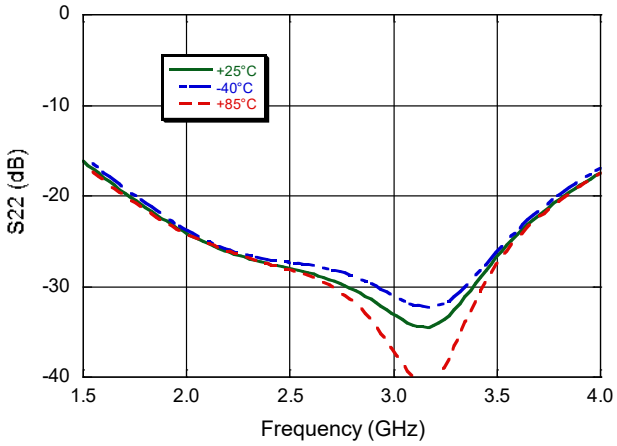
ANT to T_X Isolation vs. Frequency



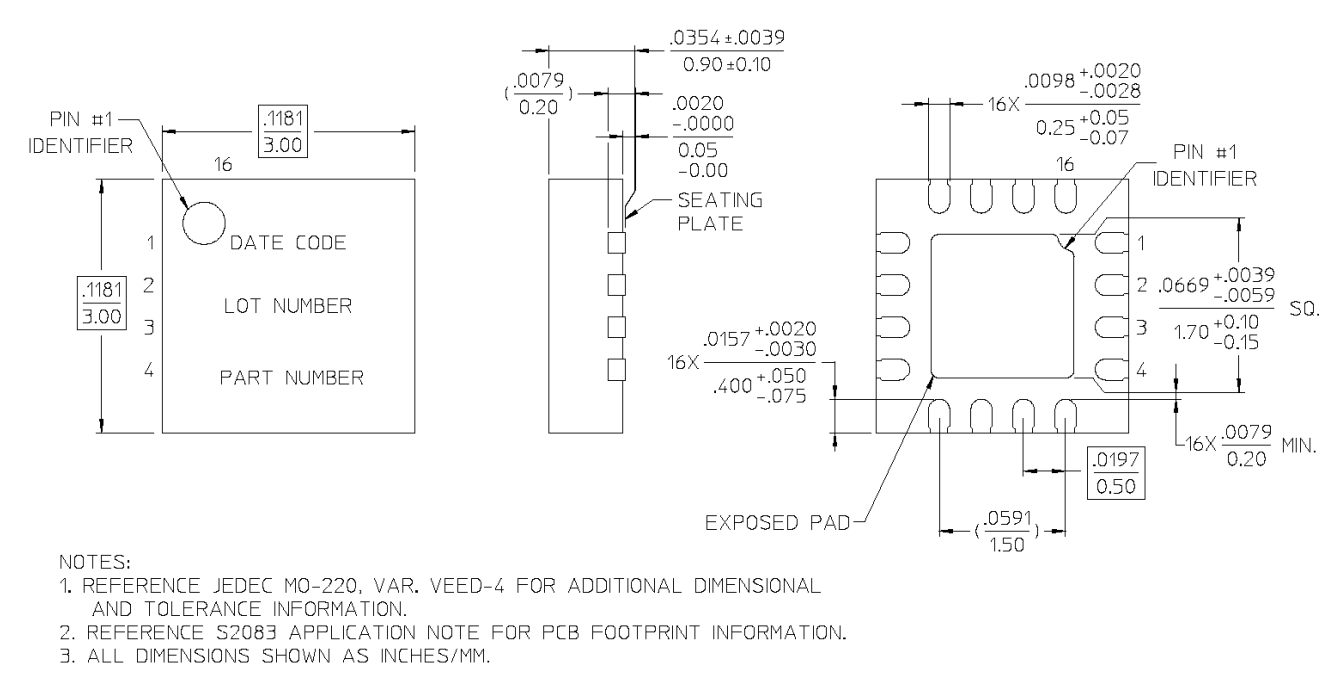
Input Return Loss vs. Frequency



Output Return Loss vs. Frequency



Lead-Free 3 mm 16-Lead PQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% tin over copper.