

# 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.

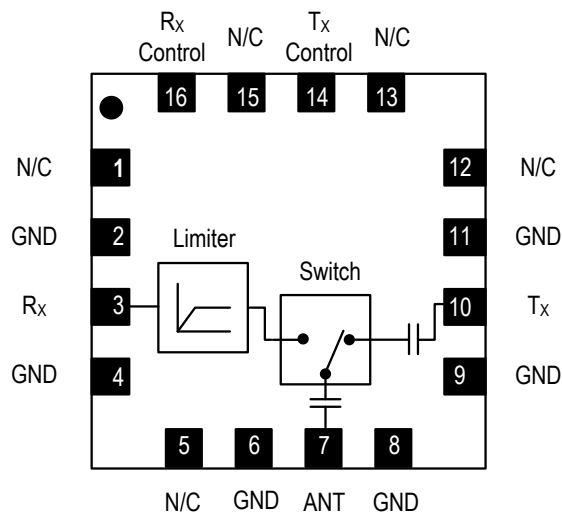
MASW-010370 can be used in conjunction with MACOM's MADL-011008 diode limiter, which would be located after the receive filter to fully protect the  $R_x$  LNA.

## Ordering Information<sup>1,2</sup>

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	$R_x$ <sup>2</sup>
7	Antenna
10	$T_x$
14	$T_x$ Control
16	$R_x$ Control
17	Pad <sup>3</sup>

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.

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**Electrical Specifications:  $P_{IN} = 0$  dBm,  $T_A = 25^\circ\text{C}$ ,  $Z_0 = 50 \Omega$**

<b>T<sub>X</sub> Mode (T<sub>X</sub> Control = -5 V, R<sub>X</sub> Control = +5 V)</b>					
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 <sub>X</sub> to R <sub>X</sub> 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 <sub>ON</sub>	50% control to 90% RF @ 3 GHz	ns	—	56	—
T <sub>RISE</sub>	10% to 90% RF @ 3 GHz	ns	—	56	—
T <sub>OFF</sub>	50% control to 10% RF @ 3 GHz	ns	—	22	—
T <sub>FALL</sub>	90% to 10% RF @ 3 GHz	ns	—	19	—
T <sub>X</sub> Control	-5 V Current	mA	-50	—	-10
R <sub>X</sub> Control	+5 V Current	mA	10	—	50

<b>R<sub>X</sub> Mode (T<sub>X</sub> Control = +5 V, R<sub>X</sub> Control = -5 V)</b>					
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 <sub>X</sub> 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 <sub>ON</sub>	50% control to 90% RF @ 3 GHz	ns	—	167	—
T <sub>RISE</sub>	10% to 90% RF @ 3 GHz	ns	—	48	—
T <sub>OFF</sub>	50% control to 10% RF @ 3 GHz	ns	—	53	—
T <sub>FALL</sub>	90% to 10% RF @ 3 GHz	ns	—	43	—
T <sub>X</sub> Control	+5 V Current	mA	0	—	1
R <sub>X</sub> Control	-5 V Current	mA	-50	—	-10
R <sub>X</sub> Limiter Peak P <sub>OUT</sub>	10 W Pulsed P <sub>IN</sub> @ 3 GHz 10 $\mu$ s, 10% duty cycle	dBm	—	26	—

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Rev. V2

## Bias Table

Mode	T <sub>X</sub> Control	R <sub>X</sub> Control
T <sub>X</sub>	-5 V	+5 V
R <sub>X</sub>	+5 V	-5 V

## Absolute Maximum Ratings<sup>4,5</sup>

Parameter	Absolute Maximum
T <sub>X</sub> Control Voltage	-6 V ≤ T <sub>X</sub> Control ≤ +6 V
R <sub>X</sub> Control Voltage	-6 V ≤ R <sub>X</sub> Control ≤ +6 V
T <sub>X</sub> Peak Incident Power	20 W, 10 μs pulse width, 10% duty cycle
R <sub>X</sub> 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.

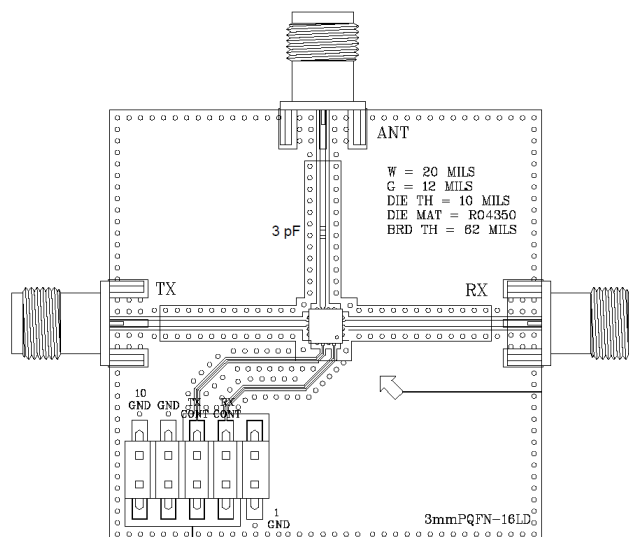
## Handling Procedures

Please observe the following precautions to avoid damage:

## Static Sensitivity

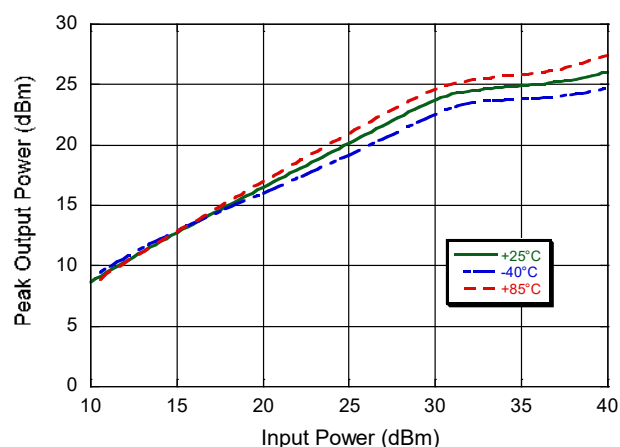
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 1A (HBM) & Class C4 (CDM) devices.

## Sample Board



## Typical Performance Curve

### Limiter Diode Power Limiting Curve<sup>6,7</sup>



6. Frequency = 3 GHz, 10 μs pulse width, 10% duty cycle, Z<sub>0</sub> = 50 Ω.

7. For improved limiting, add MADL-011008 after R<sub>X</sub> port.

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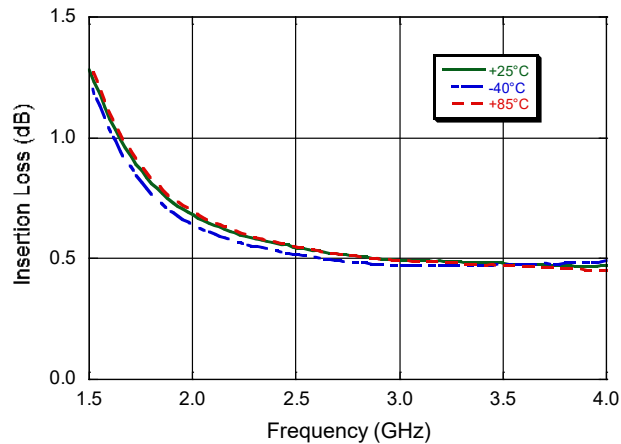


MASW-010370

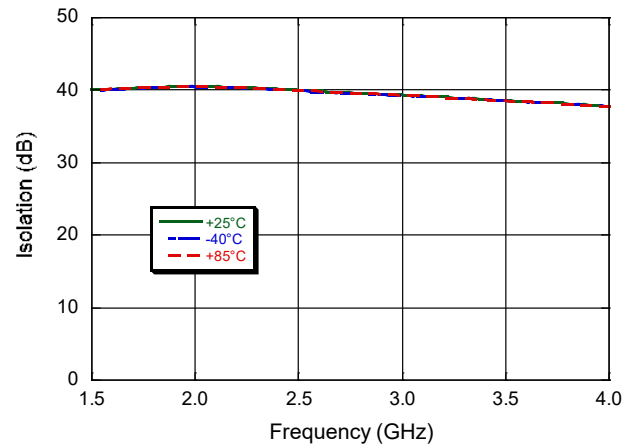
Rev. V2

## Typical Performance Curves $T_x$ Mode

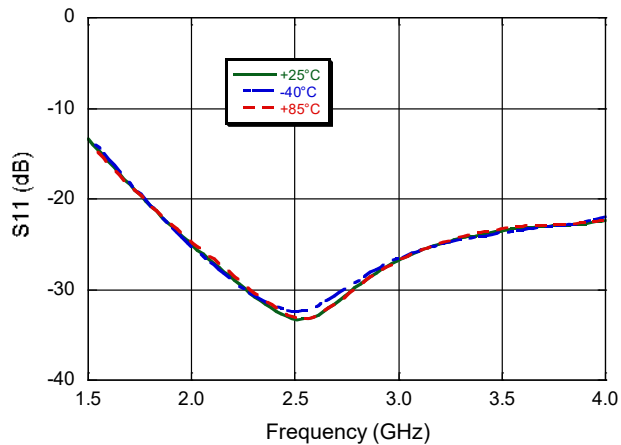
*Insertion Loss vs. Frequency*



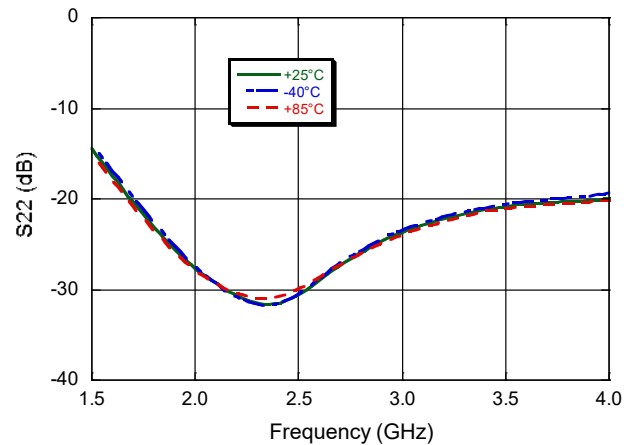
*$T_x$  to  $R_x$  Isolation vs. Frequency*



*Input Return Loss vs. Frequency*



*Output Return Loss vs. Frequency*



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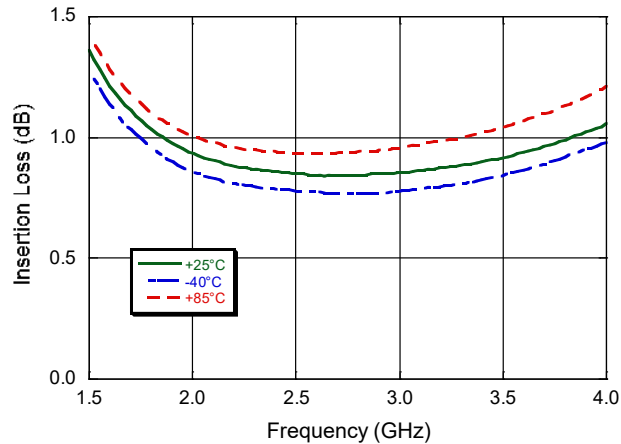


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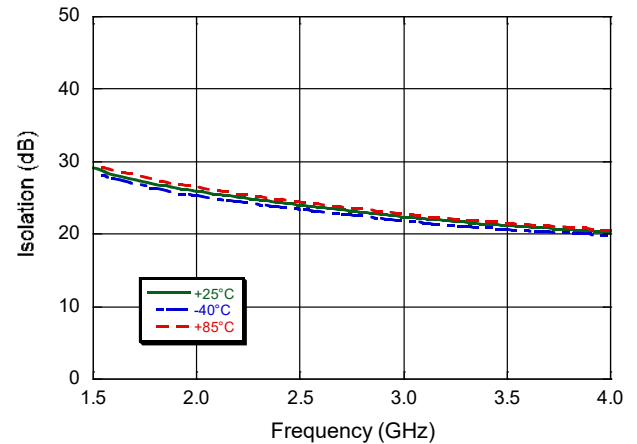
Rev. V2

## Typical Performance Curves $R_x$ Mode

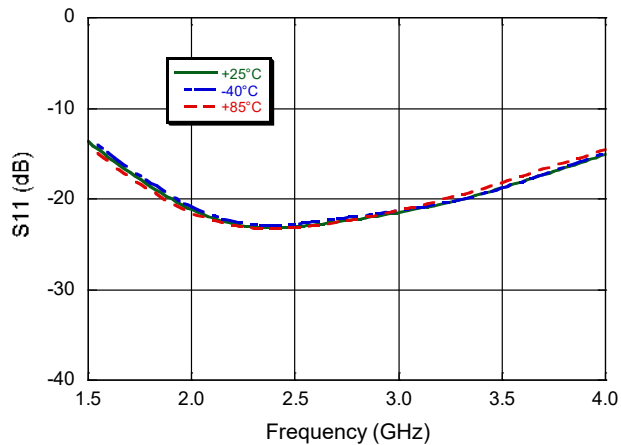
**Insertion Loss vs. Frequency**



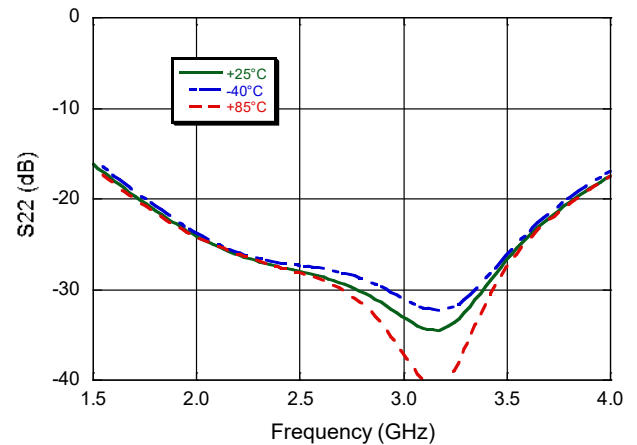
**ANT to  $T_x$  Isolation vs. Frequency**



**Input Return Loss vs. Frequency**



**Output Return Loss vs. Frequency**



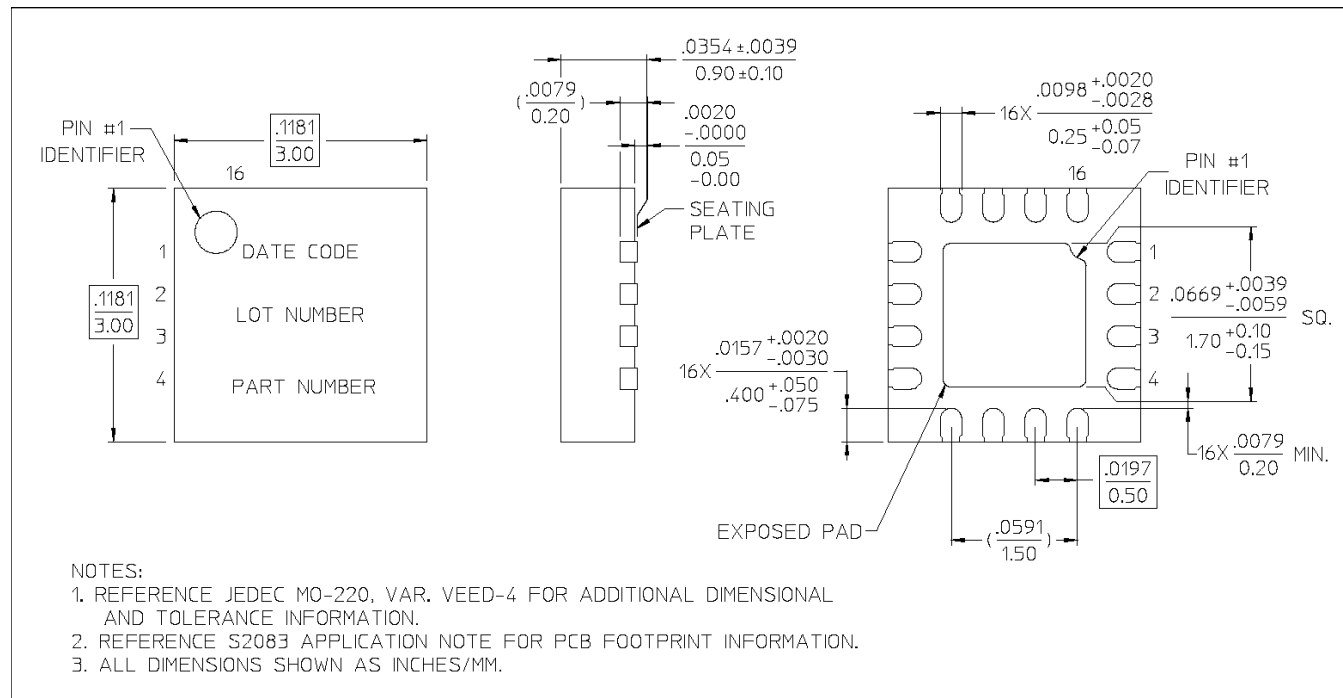
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Rev. V2

## 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.

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**MASW-010370**

Rev. V2

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