Features

- 200 W CW Incident Power @ +85°C
- Low Insertion Loss: 0.30 dB @ 500 MHz
- High Isolation: 48 dB @ 500 MHz
- Harmonics: -85 dBc @ 500 MHz
- Positive DC Bias
- Lead-Free 12 mm XHQFN 28-lead Package
- RoHS* Compliant

Applications

- Mil-Com/PS

Description

The MASW-011077 is a high power PIN diode SP4T switch in a common anode configuration, operating from 50 to 1000 MHz. It features low insertion loss and excellent linearity. It includes two high power ports (RF1 and RF4) capable of handling up to 200 W CW, and two lower power ports (RF2 and RF3) capable of handling up to 100 W CW of incident power at a base plate temperature of +85ºC.

This high power switch is ideal for use on land mobile radio and MIL-COM applications that require higher CW and pulsed power operation. This device operates with positive-only DC bias, making it suitable for switch-filter and power amplifier control circuits.

The MASW-011077 is manufactured using MACOM's hybrid manufacturing process featuring high voltage PIN diodes and passive devices integrated in a 12 mm XHQFN 28-lead plastic package.

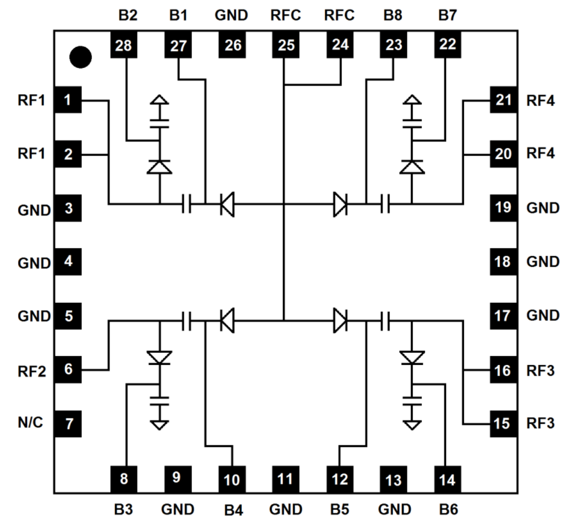
The MASW-011077 is compatible with MACOM's MADR-011021 PIN diode Driver.

Ordering Information[1]

Part #	Package
MASW-011077-TR0500	500 Piece Reel
MASW-011077-SMB	Sample Test Board

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Configuration[2]

Pin	Function	Pin	Function
1, 2[3]	RF1 Input / V1 Bias	14	B6 Bias
3 - 5	No Connection	15,16[3]	RF3 Input / V3 Bias
6[3]	RF2 Input / V2 Bias	17 - 19	No Connection
7	No Connection	20, 21[3]	RF4 Input / V4 Bias
8	B3 Bias	22	B7 Bias
9	No Connection	23	B8 Bias
10	B4 Bias	24, 25	RFC Input / V5 Bias
11	No Connection	26	No Connection
12	B5 Bias	27	B1 Bias
13	No Connection	28	B2 Bias
		Paddle[4]	Ground

2. MACOM recommends connecting unused package pins to ground.
3. RF1 and RF4 are high power ports (200 W); RF2 is a receive port; RF3 is a low power port (100 W),
4. The exposed paddle 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, P_{IN} = 0 dBm, Z_0 = 50 Ω, Bias[5] = 8 V / 500 mA, 8 V / 75 mA, 150 V (unless otherwise defined)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss RFC - RF1 & RFC - RF4	170 MHz 500 MHz 870 MHz	dB	—	0.25 0.30 0.35	0.40 — 0.55
Insertion Loss RFC - RF2 & RFC - RF3	170 MHz 500 MHz 870 MHz	dB	—	0.30 0.35 0.40	0.45 — 0.60
Isolation RFC - RF1 & RFC - RF4	170 MHz 500 MHz 870 MHz	dB	50 — 37	55 48 41	—
Isolation RFC - RF2 & RFC - RF3	170 MHz 500 MHz 870 MHz	dB	53 — 42	58 52 47	—
Input Return Loss RFC - All Ports	50 - 1000 MHz	dB	—	>14	—
CW Input Power RFC - RF1 & RFC - RF4	85°C base plate, 500 MHz	dBm W	—	53 200	—
CW Input Power RFC - RF2 & RFC - RF3	85°C base plate, 870 MHz	dBm W	—	50 100	—
P0.1dB RFC - RF1 & RFC - RF4	85°C base plate, 500 MHz	dBm W	—	53 200	—
P0.1dB RFC - RF2 & RFC - RF3	85°C base plate, 870 MHz	dBm W	—	51 125	—
2nd Harmonics	P_{IN} = 51 dBm, F_O = 150 MHz P_{IN} = 51 dBm, F_O = 500 MHz P_{IN} = 51 dBm, F_O = 870 MHz	dBc	—	-85 -85 -80	—
3rd Harmonics	P_{IN} = 51 dBm, F_O = 150 MHz P_{IN} = 51 dBm, F_O = 500 MHz P_{IN} = 51 dBm, F_O = 870 MHz	dBc	—	-85 -90 -90	—
T_{ON}, T_{OFF}	50% Control - 90% RF and 10% RF 100 Hz Rep. Rate in Commutating Mode	µs	—	10	—
T_{RISE}, T_{FALL}	10 - 90% RF Voltage 100 Hz Rep. Rate in Commutating Mode	µs	—	4	—
Reverse Bias Leakage Current	Vr =150 V	µA	—	0.3	1.0

5. See Bias table.

Bias Tables[6]

RF State	V1	V2	V3	V4	V5
RFC - RF1 Insertion Loss RFC - RF2 Isolation RFC - RF3 Isolation RFC - RF4 Isolation	8 V @ <1.0 µA	8 V @ 75 mA	8 V @ 75 mA	8 V @ 75 mA	8 V @ 500 mA
RFC - RF2 Insertion Loss RFC - RF1 Isolation RFC - RF3 Isolation RFC - RF4 Isolation	8 V @ 75 mA	8 V @ <1.0 µA	8 V @ 75 mA	8 V @ 75 mA	8 V @ 500 mA
RFC - RF3 Insertion Loss RFC - RF1 Isolation RFC - RF2 Isolation RFC - RF4 Isolation	8 V @ 75 mA	8 V @ 75 mA	8 V @ <1.0 µA	8 V @ 75 mA	8 V @ 500 mA
RFC - RF4 Insertion Loss RFC - RF1 Isolation RFC - RF2 Isolation RFC - RF3 Isolation	8 V @ 75 mA	8 V @ 75 mA	8 V @ 75 mA	8 V @ <1.0 µA	8 V @ 500 mA

RF State	B1	B2	B3	B4	B5	B6	B7	B8
RFC - RF1 Insertion Loss RFC - RF2 Isolation RFC - RF3 Isolation RFC - RF4 Isolation	0 V @ 500 mA	150 V @ <1.0 µA	0 V @ 75 mA	150 V @ <1.0 µA	150 V @ <1.0 µA	0 V @ 75 mA	0 V @ 75 mA	150 V @ <1.0 µA
RFC - RF2 Insertion Loss RFC - RF1 Isolation RFC - RF3 Isolation RFC - RF4 Isolation	150 V @ <1.0 µA	0 V @ 75 mA	150 V @ <1.0 µA	0 V @ 500 mA	150 V @ <1.0 µA	0 V @ 75 mA	0 V @ 75 mA	150 V @ <1.0 µA
RFC - RF3 Insertion Loss RFC - RF1 Isolation RFC - RF2 Isolation RFC - RF4 Isolation	150 V @ <1.0 µA	0 V @ 75 mA	0 V @ 75 mA	150 V @ <1.0 µA	0 V @ 500 mA	150 V @ <1.0 µA	0 V @ 75 mA	150 V @ <1.0 µA
RFC - RF4 Insertion Loss RFC - RF1 Isolation RFC - RF2 Isolation RFC - RF3 Isolation	150 V @ <1.0 µA	0 V @ 75 mA	0 V @ 75 mA	150 V @ <1.0 µA	150 V @ <1.0 µA	0 V @ 75 mA	150 V @ <1.0 µA	0 V @ 500 mA

6. This device requires positive DC voltage to operate the PIN diodes under both the forward and reverse bias conditions. For safe operation of a reverse biased PIN diode at high power, the minimum DC bias voltage, applied to B1 - B8, is dependent on RF frequency, incident power, and VSWR. See the High Power DC Bias Voltage table for high power operation.

Maximum Operating / Storage Ratings[7]

Parameter	Maximum
RF Input Power 1:1 VSWR Load @ +85°C RFC-RF1, RFC-RF4 RFC-RF2, RFC-RF3	 53.5 dBm, 500 MHz 51.0 dBm, 870 MHz
Forward Current	600 mA
Reverse DC Voltage	200 V
Junction Temperature	+175°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

7. Operating at nominal conditions with $T_J \leq +175°C$ will ensure MTBF > 1 x 10^6 hours.

Absolute Maximum Ratings[8,9,10]

Parameter	Absolute Maximum
RF Input Power 1:1 VSWR Load @ +85°C RFC-RF1, RFC-RF4 RFC-RF2, RFC-RF3	 54.5 dBm, 500 MHz 52.0 dBm, 870 MHz
Forward Current	750 mA
Reverse DC Voltage	400 V
Junction Temperature	+250°C

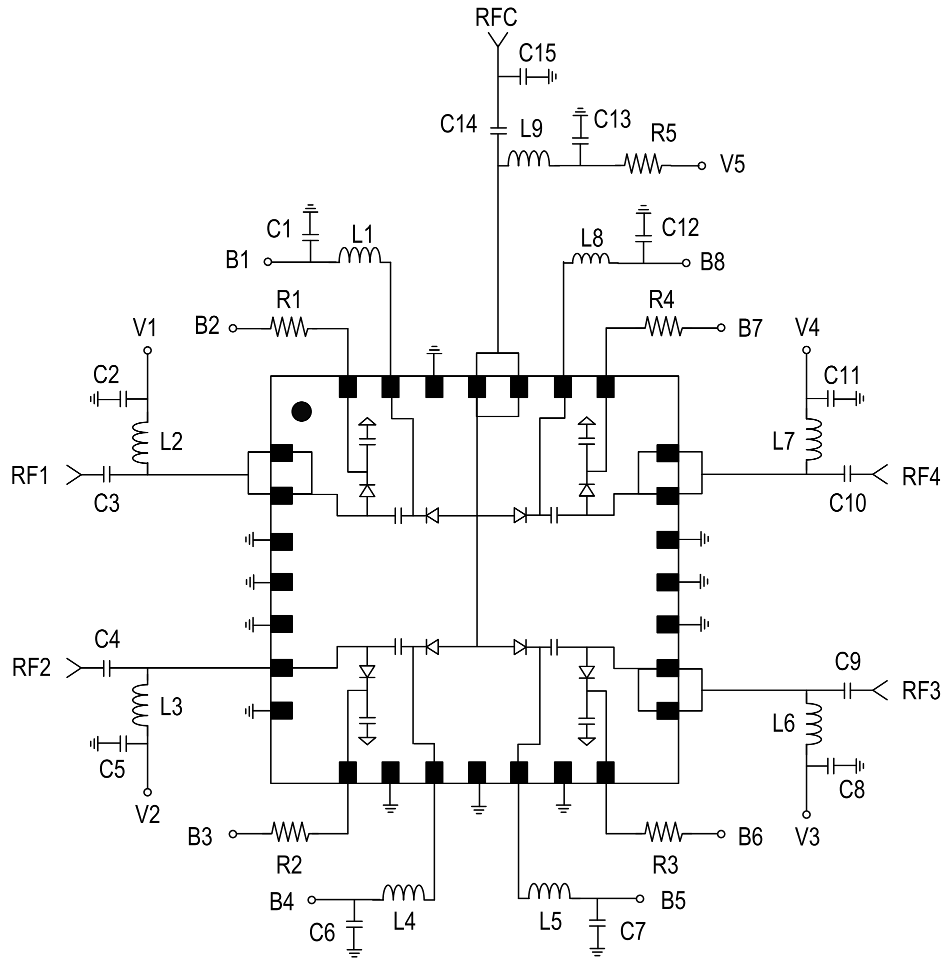
8. Operating at nominal conditions with $T_J \leq +250°C$ will ensure MTBF > 3 x 10^4 hours.
9. MACOM does not recommend sustained operation near these survivability limits.
10. Exceeding any one or combination of these limits may cause permanent damage to this device.

High Power DC Bias Voltage[11]

Frequency (MHz)	DC Voltage (V)
50	80
100	50
200	30
500	20
1000	15

11. Minimum DC bias voltage, applied to B1 - B8 as shown on the Bias Table, to maintain low loss under 200 W of incident power with 1.5:1 VSWR.

Application Schematic



Off-Chip Component Values[12]

Component	Value
C1, C2, C5, C6, C7 C8, C11, C12, C13	1000 pF
C3,C4,C9,C10,C14	270 pF
C15	1 pF
L1 - L9[13]	520 nH
R1 - R4	100 Ω
R5	10 Ω

12. Off-chip components must be rated appropriately to ensure safe performance under DC and high RF power operation.
13. Air core inductors supplied by Microwave Components, Inc. part # 22-6042-CCPAS-27-42-48.

Handling Procedures

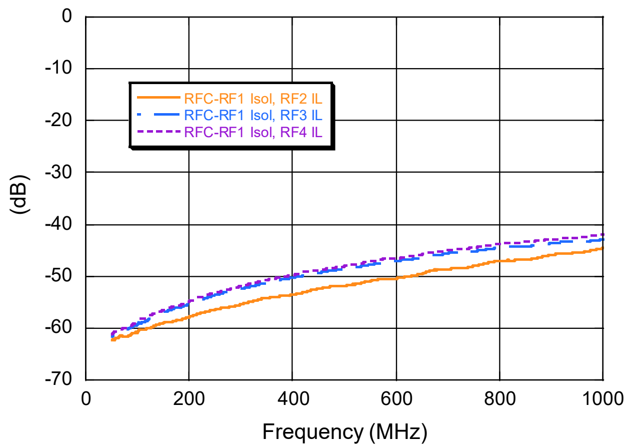
Please observe the following precautions to avoid damage:

Static Sensitivity

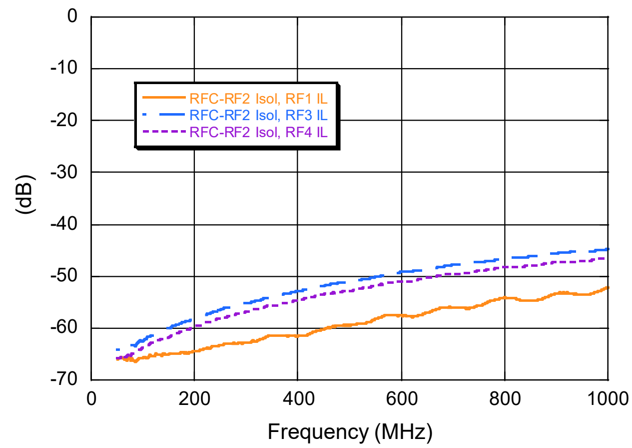
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices. The device has an ESD rating for HBM Class 1C (1000 V), and CDM Class C3 (1000 V).

Typical Performance Curves

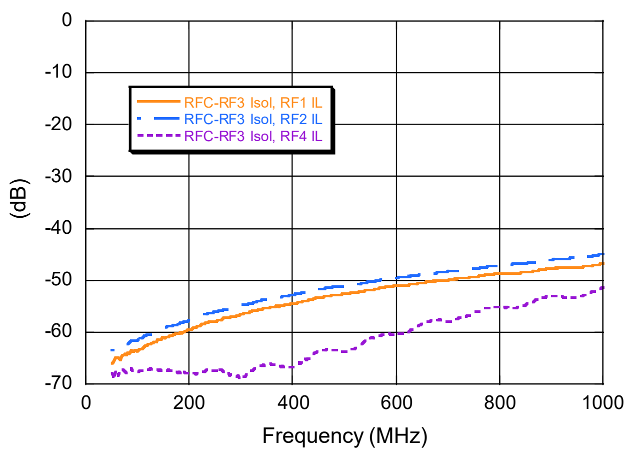
Isolation RFC - RF1



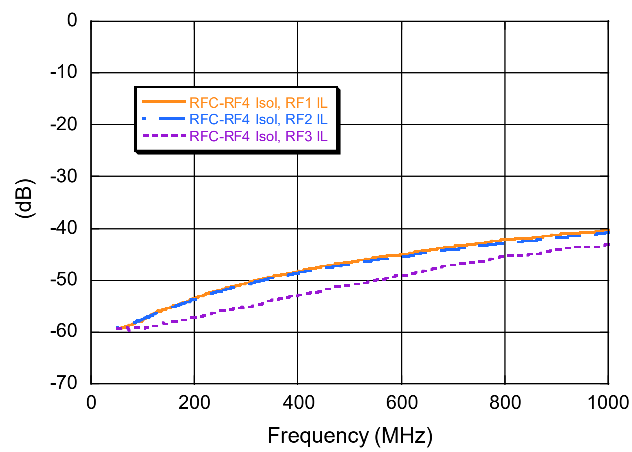
Isolation RFC - RF2



Isolation RFC - RF3

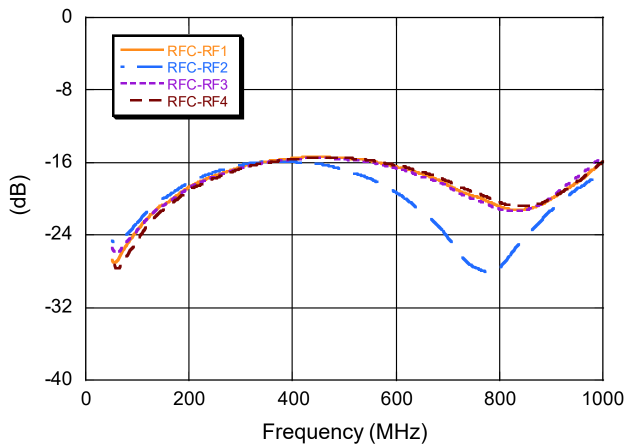


Isolation RFC - RF4

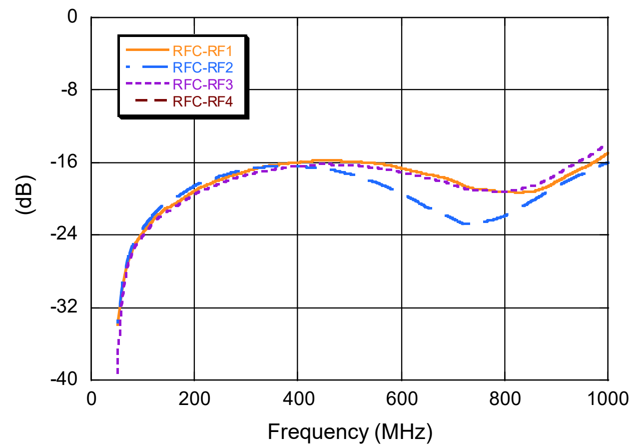


Typical Performance Curves

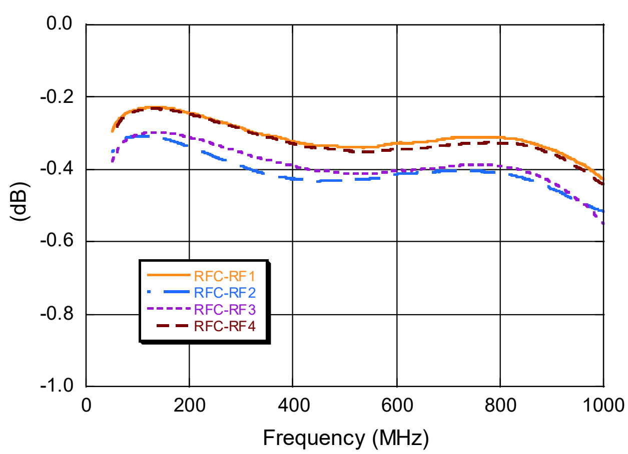
Input Return Loss



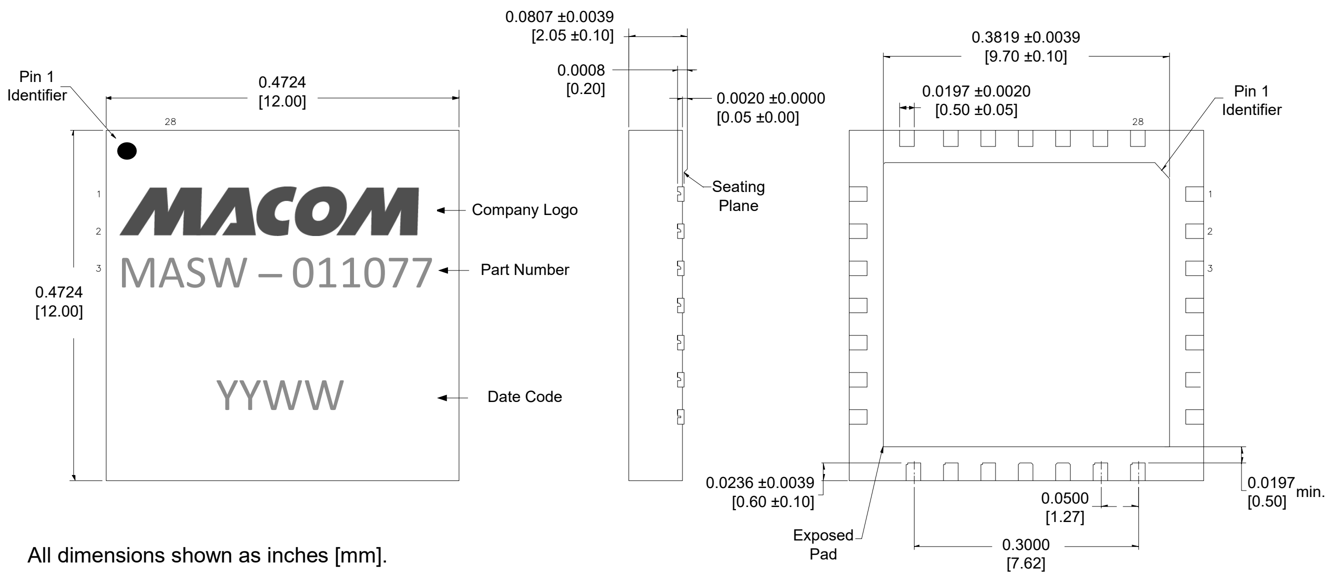
Output Return Loss



Insertion Loss



Lead Free 12 mm XHQFN 28-Lead†



All dimensions shown as inches [mm].

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is NiPdAuAg.