Features

- Suitable for Large Signal Broadband Applications
- Power Handling: 100 W @ 85°C
- Insertion Loss: 0.5 dB @ 4 GHz
- Isolation: 35 dB @ 4 GHz
- Lead-Free 4 mm HQFN-20LD Package
- RoHS* Compliant

Applications

- ISM / MM

Description

The MASW-011060 is a high power PIN diode SP2T switch in a common anode configuration, operating from 0.5 to 6.0 GHz. It features low insertion loss and excellent linearity. This device is capable of handling 100 Watts CW of incident power at a base plate temperature of 85ºC.

This high power switch is ideal for use on broadband, MIL-COM, IED, and cellular applications that require higher CW and pulsed power operation.

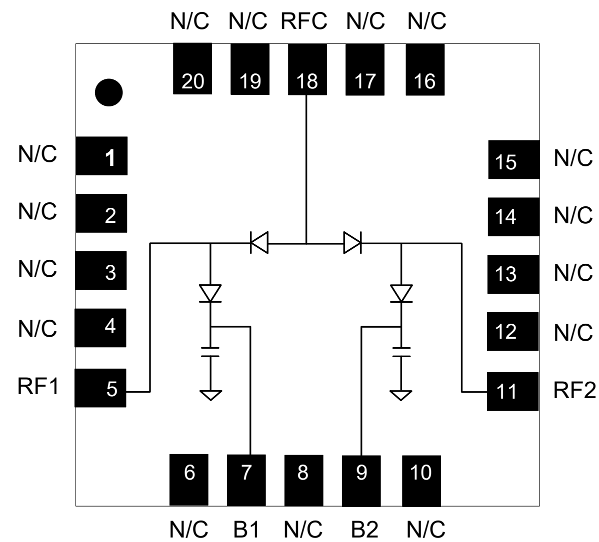
The MASW-011060 is manufactured using MACOM's hybrid manufacturing process featuring high voltage PIN diodes and passive devices integrated in a 4 mm HQFN 20-lead plastic package.

Ordering Information[1,2]

Part Number	Package
MASW-011060-TR0500	500 piece reel
MASW-011060-SMB	Sample Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration[3]

Pin #	Function
1 - 4, 6, 8, 10, 12 - 17, 19, 20	No Connection
5	RF1 / V1 Bias
7	B1 Bias
9	B2 Bias
11	RF2 / V2 Bias
18	RFC / V3 Bias
Paddle[4]	Ground

3. MACOM recommends connecting unused package pins to ground.
4. 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, Bias = 0 / +5 V[5], 50 mA / 100 mA

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss P_{IN} = 0 dBm	0.5 GHz 1.0 GHz 2.0 GHz 3.0 GHz 4.0 GHz 5.0 GHz 6.0 GHz	dB	—	0.15 0.25 0.30 0.35 0.50 0.75 0.80	— — 0.45 — — — —
Isolation P_{IN} = 0 dBm	0.5 GHz 1.0 GHz 2.0 GHz 3.0 GHz 4.0 GHz 5.0 GHz 6.0 GHz	dB	— — 40 — — — —	47 47 44 40 35 32 28	—
Input Return Loss	P_{IN} = 0 dBm	dB	—	>15	—
CW Input Power[6]	25°C Base plate, 2 GHz V_{DC} = 0 V / 28 V	dBm W	—	52 158	—
CW Input Power[6]	85°C Base plate, 2 GHz V_{DC} = 0 V / 28 V	dBm W	—	50 100	—
P0.1dB[6]	25°C Base plate, 2 GHz V_{DC} = 0 V / 28 V	dBm	—	52	—
Input IP3	F1 = 3000 MHz, F2 = 3010 MHz P_{IN} = 40 dBm/Tone, V_{DC} = 0 V / 28 V	dBm	—	75	—
T_{ON}, T_{OFF}	50% control to 90% RF, 50% control to 10% RF	µs	—	1.5	—
T_{RISE}, T_{FALL}	10% to 90% RF, 90% to 10% RF	µs	—	1.1	—

5. See Bias table and Application Schematic.
6. DC reverse bias of a PIN Diode operating at a high power is dependent on RF Frequency, Incident Power, and VSWR. See Minimum Reverse DC Voltage table for high power operation.

Absolute Maximum Ratings[7,8]

Parameter	Absolute Maximum
Forward Current	150 mA
Reverse DC Voltage	150 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C
Junction Temperature	+175°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.

Minimum Reverse DC Voltage[9]

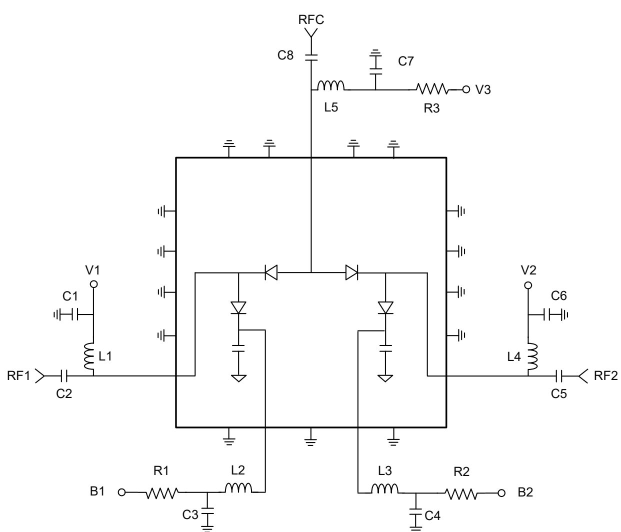
Frequency (MHz)	Minimum Reverse DC Voltage
500	41 V
1000	22 V
2000	11 V
3000	8 V
4000	6 V

9. Required to maintain low loss under 100 W of incident power with 1.5:1 VSWR.

Bias Table for Small Signal Operation: Positive Only DC Bias 0 / +5 V

RF State	V1 Bias (V)	V2 Bias (V)	V3 Bias (V)	B1 Bias (V)	B2 Bias (V)
Pin #	Pin 5	Pin 11	Pin 18	Pin 7	Pin 9
RFC – RF1 Insertion Loss RFC – RF2 Isolation	0 V @ -100 mA	+5 V @ 50 mA	+5 V @ 100 mA	+5 V @ 0 mA	0 V @ -50 mA
RFC – RF2 Insertion Loss RFC – RF1 Isolation	+5 V @ 50 mA	0 V @ -100 mA	+5 V @ 100 mA	0 V @ -50 mA	+5 V @ 0 mA

Application Schematic



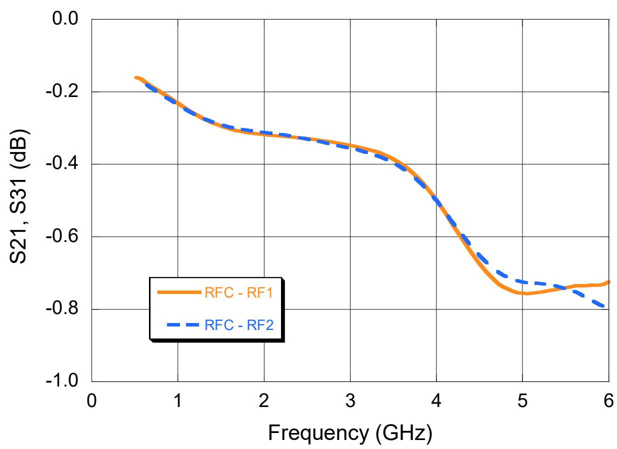
Off-Chip Component Values[10]

Component	Value	Size
C1, C3, C4, C6, C7	47 pF	0402
C2, C5, C8	18 pF	0402
L1 - L5	47 nH	0402
R1 - R2	82 Ω[11]	1210
R3	39 Ω	1210

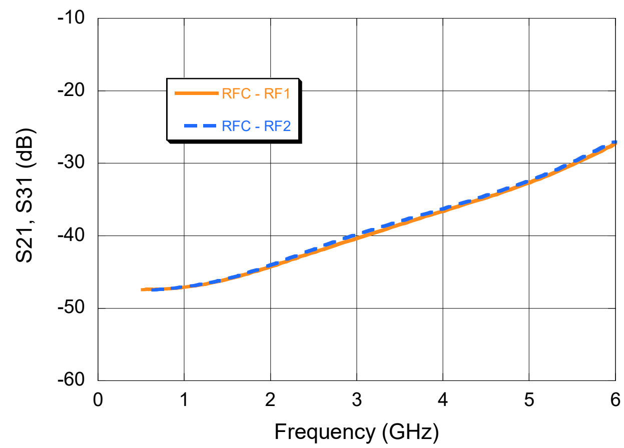
10. Off-chip component values are used for small signal testing under +5 / 0 V bias conditions. These must be rated appropriately to ensure safe performance under high power operation.
11. Shunt resistor (R1, R2) values can be adjusted using the following formula: $R = (V-1) / I_{SHUNT}$ where R is the shunt resistor value, V is the DC voltage applied to the reverse-biased series PIN diode, and I_{SHUNT} is the current through the forward-biased shunt PIN diode.

Typical Performance Curves: T_A = 25°C, Bias = +5 / -5 V[5], 50 mA / 100 mA

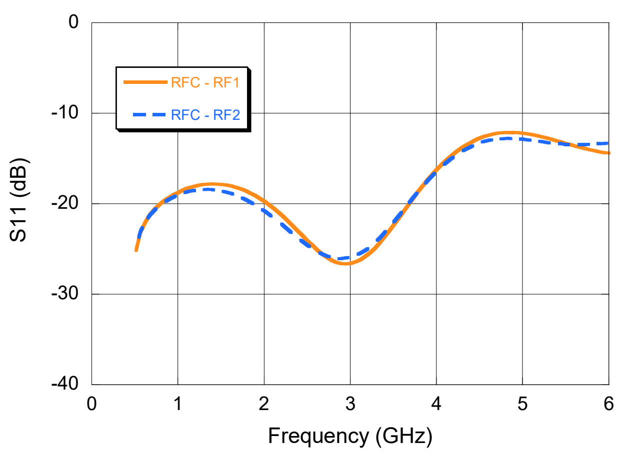
Insertion Loss



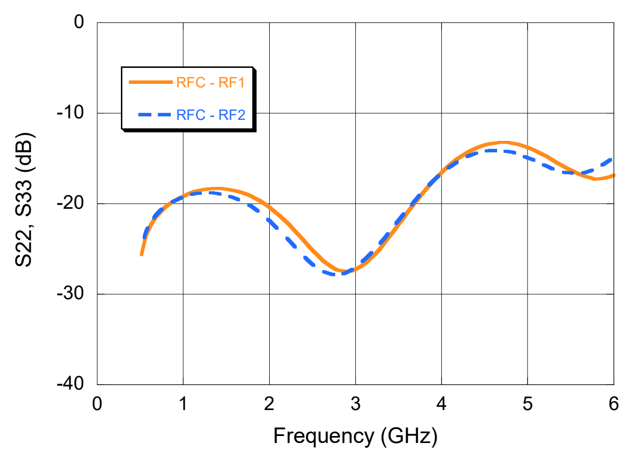
Isolation



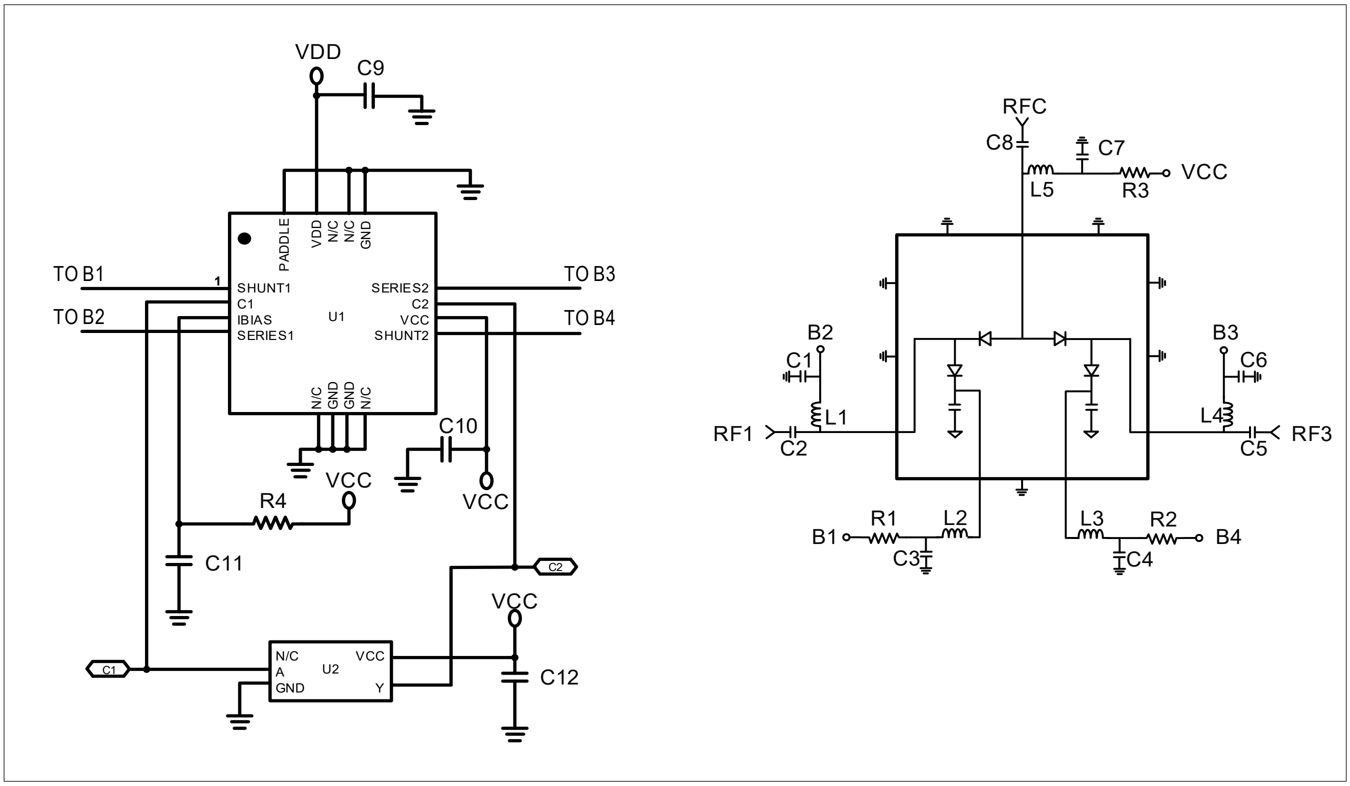
Input Return Loss



Output Return Loss



MASW-011060 with MADR-010574 Driver Application Schematic[12]



12.See page 3 for R3, L1 - L5 and C1 - C8 values.

Parts List

Part	Value
C9	0.01 µF
C10 - C12	0.1 µF
R1,R2[13]	5 kΩ
R4	499 kΩ
U2	SN74AHC1G

13. Resistor values calculated to provide ~10 mA of shunt diode bias current given V_{CC} = 5 V and V_{DD} = 50 V.

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 1B HMB devices.

Large Signal Operation @ 1 GHz

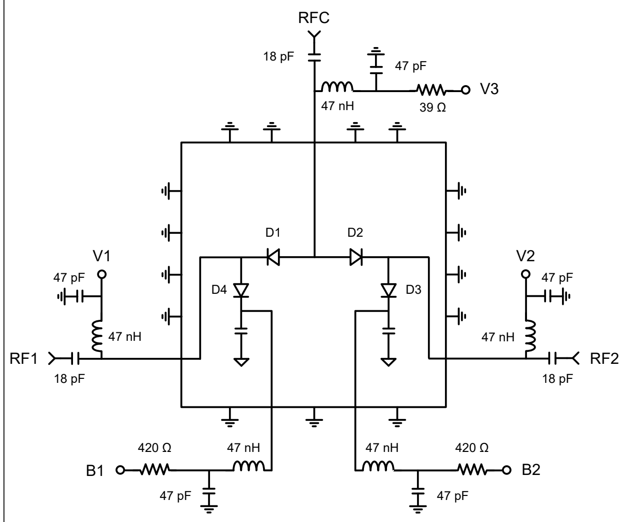
Operation of the MASW-011060 high power switch requires four complementary DC control signals. Bias voltages are applied to DC ports B1 and V1 (corresponding to RF port RF1), B2 and V2 (corresponding to RF port RF2), and static V3.

For positive-only DC bias at 1 GHz, 5 V and 22 V are required. A constant 5 V is applied at the V3 DC port at all times. To set the switch to a RFC-RF1 low loss state and RFC-RF2 in Isolation, D1 PIN diode must be forward biased, D2 PIN diode must be reversed biased, D3 PIN diode must be forward biased, and D4 PIN diode must be reversed biased.

D1 PIN diode is forward biased by setting V1 port to 0 V. A 39 Ω resistor sets the forward current to a nominal of 100 mA. D2 PIN diode is reverse biased by applying 22 V at V2 port. This is the minimum reverse bias voltage that is required to maintain the PIN diode in its non-conducting, high impedance state under 100 W incident power with a 1.5:1 VSWR. D3 PIN diode is forward biased by setting B2 to 0 V. To determine the forward current of the shunt PIN diode, equation listed on note 10 can be used. The resultant resistance is 420 Ω to achieve 50 mA nominal forward current. D4 PIN diode is reverse biased by applying 22 V to B1 port.

To set the switch to a RFC-RF2 low loss state and RFC-RF1 in isolation, reverse 0 V and 22 V.

Large Signal Operation @ 1 GHz, DC Bias 0 / +22 V

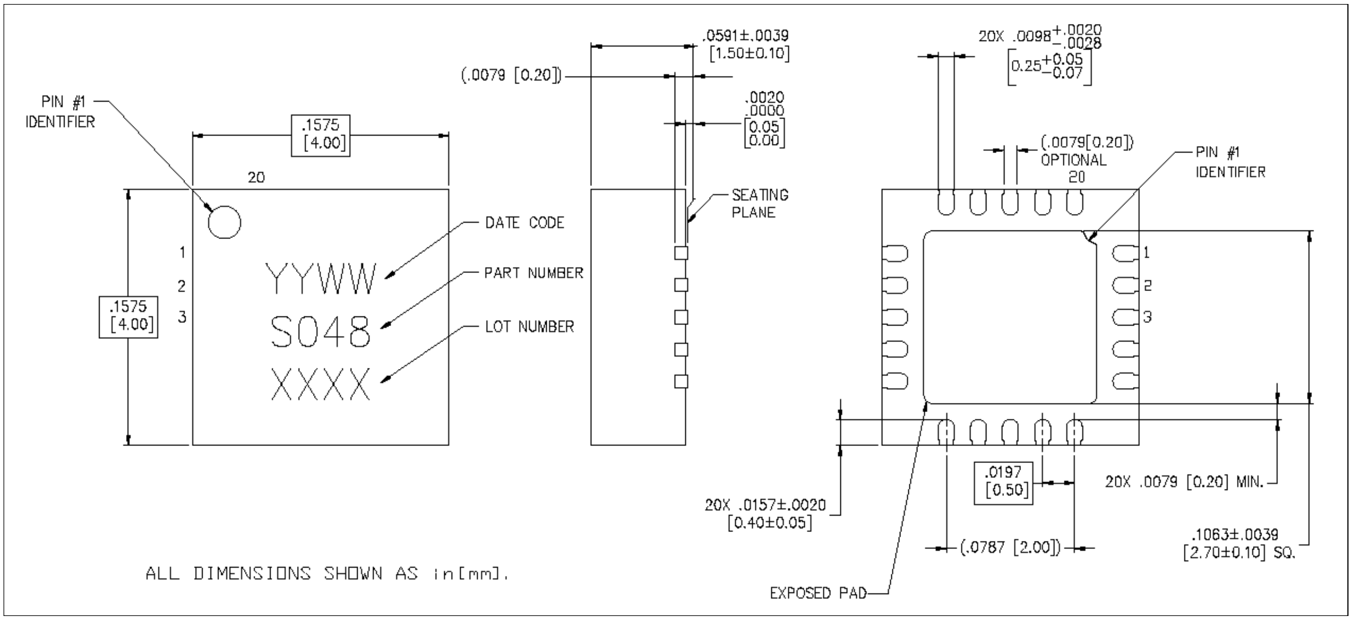


In order to safely operate at 100 W incident power, the values of the reactive components that make up the bias decoupling networks and DC blocking must be rated appropriately. Proper heat sinking is essential to safe operation under high incident power.

Bias 0 / +22 V (Large Signal Operation @ 1 GHz)

RF State	V1 Bias (V)	V2 Bias (V)	V3 Bias (V)	B1 Bias (V)	B2 Bias (V)
Pin #	Pin 5	Pin 11	Pin 18	Pin 7	Pin 9
RFC - RF1 Insertion Loss RFC - RF2 Isolation	0 V @ -100 mA	+22 V @ 50 mA	+5 V @ 100 mA	+22 V @ 0 mA	0 V @ -50 mA
RFC - RF2 Insertion Loss RFC - RF1 Isolation	+22 V @ 50 mA	0 V @ -100 mA	+5 V @ 100 mA	0 V @ -50 mA	+22 V @ 0 mA

Lead Free 4 mm 20-Lead HQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is NiPdAuAg.