SPDT Absorptive Switch
DC - 67 GHz

MASW-011152
Rev. V2

Features

- Ultra Wideband: 9 kHz to 67 GHz
- Insertion Loss:
  - 1.9 dB @ 40 GHz
  - 2.2 dB @ 50 GHz
  - 3.3 dB @ 67 GHz
- 48 dB Isolation:
  - 48 dB @ 40 GHz
  - 42 dB @ 50 GHz
  - 38 dB @ 67 GHz
- Input P1dB: 28 dBm
- Input IP3: 52 dBm
- Return Loss at Each RF Port:16 dB
- Power Handling including Hot Switching: 26 dBm
- No Low Frequency Spurious
- Compatible with 1.8, 2.5, and 3.3 V CMOS Logic
- 3 mm, 20 Pin Laminate Package
- RoHS* Compliant

Applications

- Multi Market
- ISM

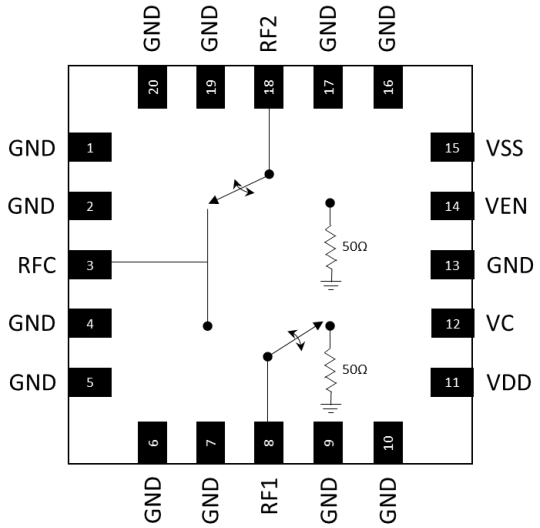
Description

The MASW-011152 is an absorptive, ultra wideband single pole double throw (SPDT) switch with 2.2 dB of insertion loss at 50 GHz. The RF output ports are terminated in 50 Ω in the isolated path. The power handling capability is 26 dBm. The input and output return losses in the thru path are typically 16 dB. The logic levels are compatible with standard 1.8, 2.5, or 3.3 V CMOS. Required bias supplies are +3.3 V and -3.3 V.

The MASW-011152 is designed for wideband applications such as Test and Measurement, Aerospace and Defense, Cellular infrastructure (5G millimeter-wave), military radios, radars, microwave radios and very small aperture terminals (VSATs).

The MASW-011152 is manufactured on a Silicon-on -Insulator process. The 3 mm laminate package is lead free and RoHS compliant.

Functional Schematic



Pin Configuration[1]

Pin #	Pin Name	Description
1,2,4-7,9,10,13 16,17,19,20	GND	Ground
3	RFC[4]	Common RF Input/Output
8	RF1[4]	RF Input/Output 1
11	VDD	+3.3 V
12	VC	Control Voltage
14	VEN	Enable Voltage
15	VSS	-3.3 V
18	RF2[2]	RF Input/Output 2

1. The exposed pad centered on the package bottom must be connected to RF, DC, and thermal ground.
2. RF ports are dc-coupled to GND. There are no internal DC blocking capacitors.

Ordering Information[3,4]

Part Number	Package
MASW-011152-TR0500	500 Piece Reel
MASW-011152-SMB	Sample Board

3. Reference Application Note M513 for reel size information.
4. All sample boards include 3 loose parts.

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

Electrical Specifications[5]:
V_{DD} = +3.3 V, V_{SS} = -3.3 V, VC = 0 V or 1.8 V, T_{PADDLE} = 25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	DC to 18 GHz 26 GHz 40 GHz 50 GHz 67 GHz	dB	—	1.25 1.43 1.91 2.20 3.30	1.6 1.9 2.6 3.6 —
Isolation, Between RF1 to RF2	DC to 18 GHz 26 GHz 40 GHz 50 GHz 67 GHz	dB	—	67 64 48 42 38	—
Isolation, RFC to RF1 / RF2	DC to 18 GHz 26 GHz 40 GHz 50 GHz 67 GHz	dB	55 50 40 40 —	58 58 45 45 38	—
RFC Return Loss	DC - 67 GHz	dB	—	16	—
RF1/RF2 Return Loss, Thru Port	DC - 67 GHz	dB	—	16	—
RF1/RF2 Return Loss, Isolated Port	DC - 67 GHz	dB	—	16	—
Input P0.1dB	10 MHz - 67 GHz	dBm	—	27.5	—
Input P1dB	10 MHz - 67 GHz	dBm	—	28	—
Input IP3	Two tone, P_{IN}/tone = +14 dBm 10 MHz - 67 GHz	dBm	—	52	—
T_{ON}	50% control to 90% RF	µs	—	0.9	—
T_{RISE}	10% to 90% RF	µs	—	0.35	—
T_{OFF}	50% control to 10% RF	µs	—	0.2	—
T_{FALL}	90% to 10% RF	µs	—	0.04	—
Voltage Supply, VDD	—	V	3.15	3.3	3.45
Voltage Supply, VSS	—	V	-3.45	-3.3	-3.15
Logic Voltage, Input Low (V_{IL})	—	V	0.0	—	0.8
Logic Voltage, Input High (V_{IH})	—	V	1.2	—	VDD
Supply Current, VDD	—	mA	—	0.3	0.5
Supply Current, VSS	—	mA	—	0.65	1.0
Logic Pin Current (VC)	Pulled down to GND with 100 kΩ resistor internally	µA	—	VC*10	—

5. Parameters are measured on a test board that includes impedance matching. Impedance match included in measurements.

Maximum Operating Ratings

Parameter	Maximum
Input Power, 300 MHz to 40 GHz, RFC Port[6] RF1 / RF2 Port Thru Path[6] RF1 / RF2 Port Terminated Path[6]	 26 dBm 26 dBm 24 dBm
VDD	-0.3 to +3.45 V
VSS	-3.45 to +0.3 V
VC / VEN	-0.3 to 3.45 V
Operating Temperature[7]	-40 to +105°C

6. T_{PADDLE} = 105 ºC. See power derating curves for details.
7. Guarantees 10 years lifetime.

Absolute Maximum Ratings[8,9,10]

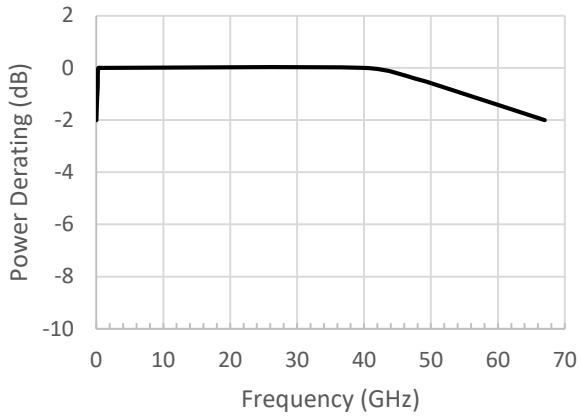
Parameter	Maximum
Input Power, 300 MHz to 67 GHz, RFC Port[6] RF1 / RF2 Port Thru Path[6] RF1 / RF2 Port Terminated Path[6]	 27 dBm 27 dBm 25 dBm
VDD	-0.3 to +3.6 V
VSS	-3.6 to +0.3 V
VC / VEN	-0.3 to 3.6 V
Junction Temperature[7]	+135°C

8. Exceeding any one or combination of these limits may cause permanent damage to this device.
9. MACOM does not recommend sustained operation near these survivability limits.
10. Based on testing with input power applied for 30 seconds.

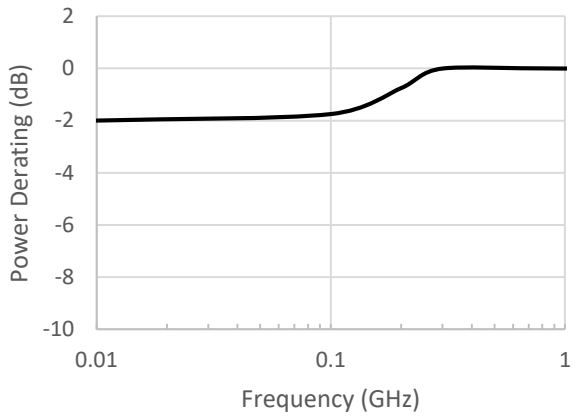
Truth Table

Enable	Control	Condition of Switch	
VEN	VC	RF1	RF2
V_{IL}	V_{IL}	Off	On
V_{IL}	V_{IH}	On	Off
V_{IH}	V_{IL}	Off	Off
V_{IH}	V_{IH}	Off	Off

Power Derating Curve[6]



Low Frequency Power Derating Detail[6]



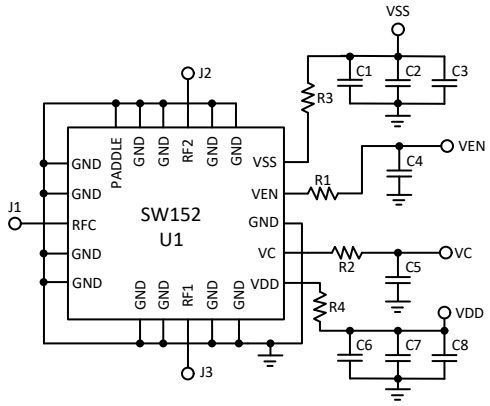
Handling Procedures

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 HBM Class 1C devices.

Application Schematic



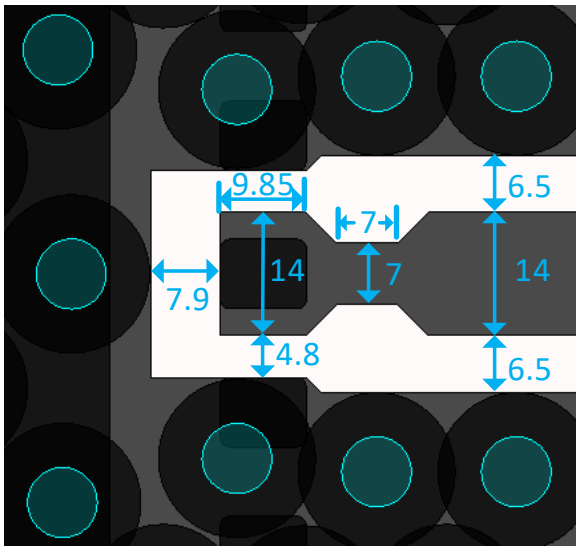
Parts List

Part	Value	Case Style
U1	MASW-011152	3 mm, 20 Lead
C1, C6	Capacitor, 10 pF, 50 V	0402
C2,C7	Capacitor, 1000 pF, 25 V	0402
C3, C8	Capacitor, 1 µF, 10 V	0402
R1 - R4	Resistor, 0 Ω	0402
J1 - J3	Southwest 1892-04A-6	End Launch

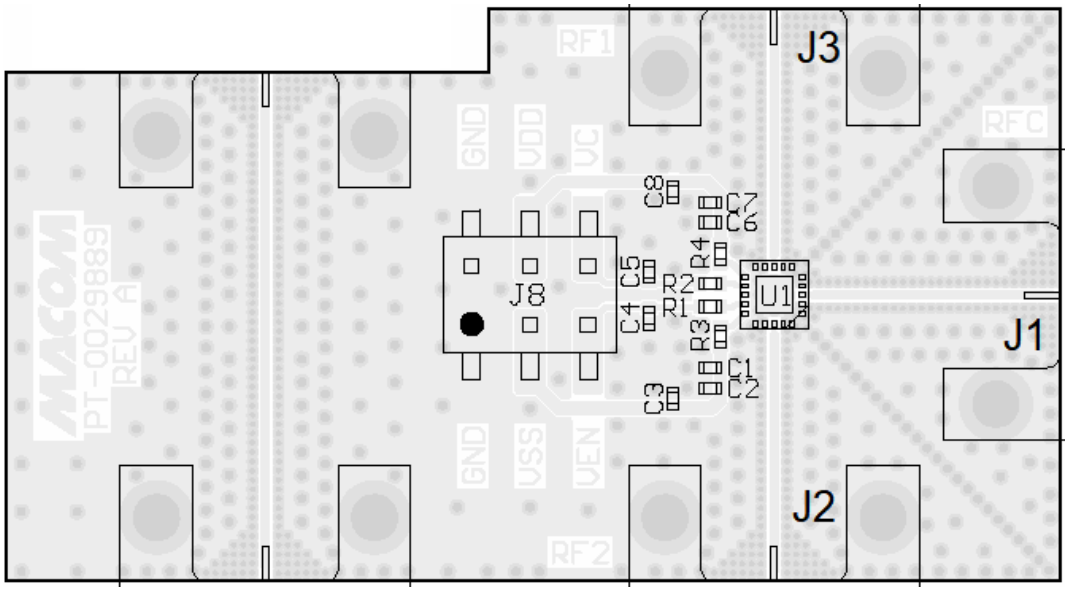
Impedance Match

MASW-011152-SMB is a 2-layer board with 8 mil Rogers RO4003 dielectric material and 1 oz copper on top and bottom layers. For this stack-up, 7 mil traces with 7 mil width are used for all RF port matching, as shown below.

The 50Ω RF transmission lines are CPWG of 14 mil width with 6.5 mil gap.

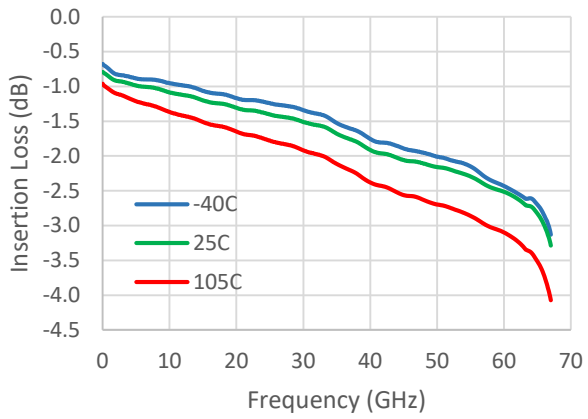


Evaluation Board Layout

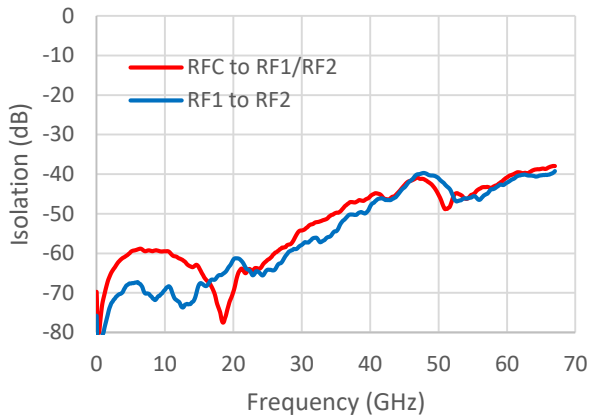


Typical Performance Curves

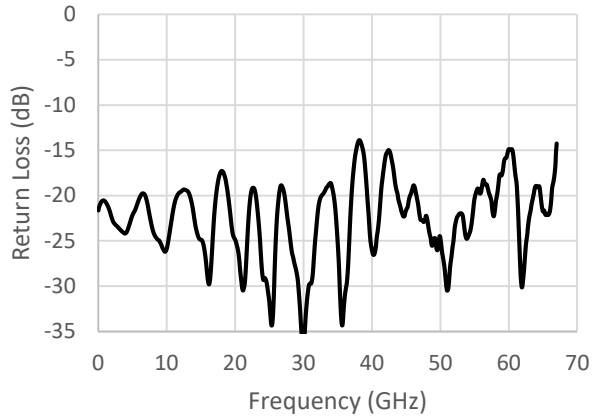
Insertion Loss with Impedance Match[11]



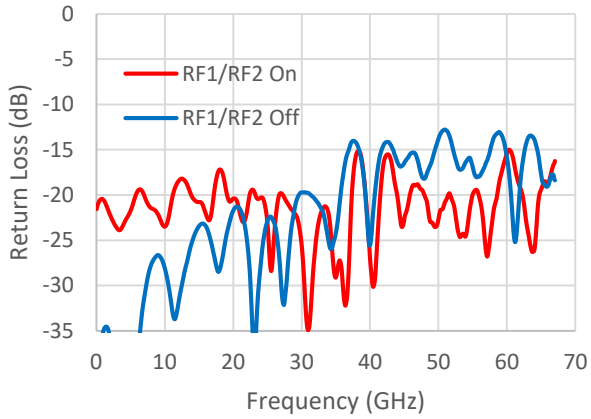
Isolation with Impedance Match[11]



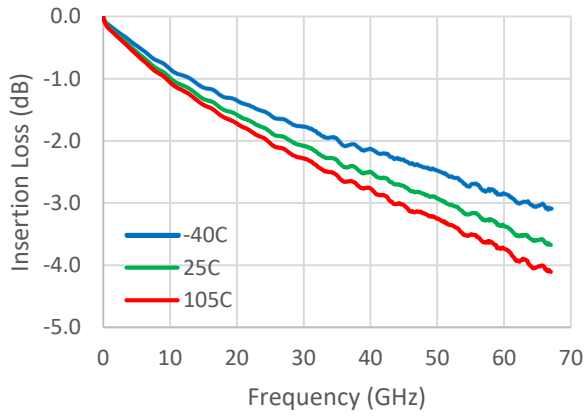
RFC Return Loss with Impedance Match[12]



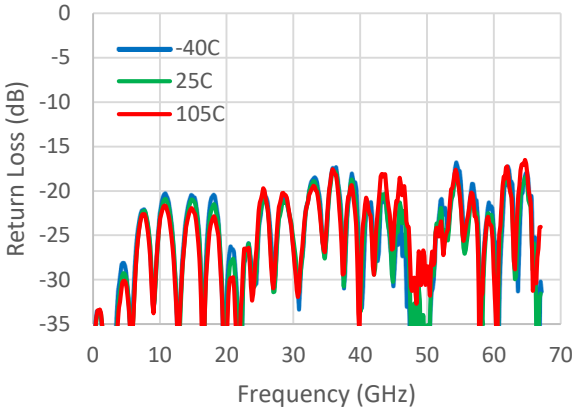
RF1/RF2 Return Loss with Impedance Match[12]



Evaluation Board Thru Line Insertion Loss



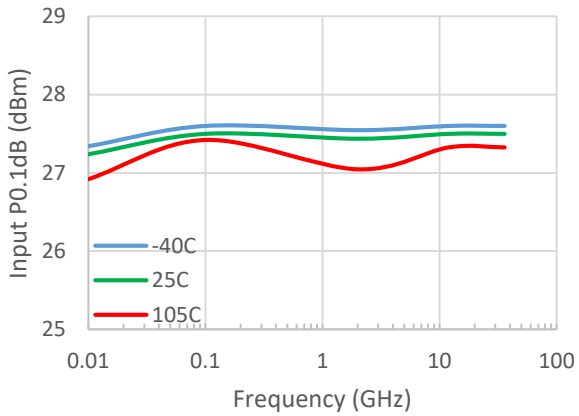
Evaluation Board Thru Line Return Loss



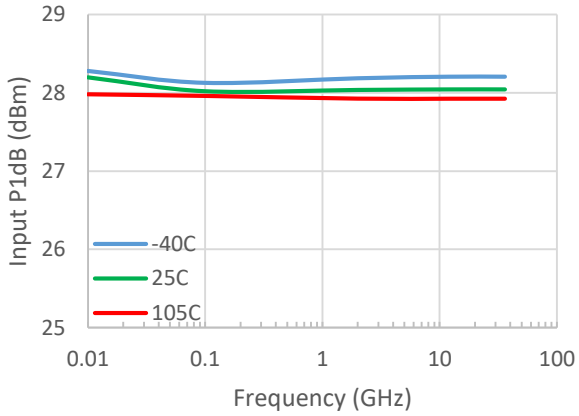
11. Insertion Loss and Isolation with impedance match were measured using connectorized evaluation board, and normalized using the insertion loss of the 50Ω thru line.
12. Return Loss with impedance match were measured using connectorized evaluation board.

Typical Performance Curves

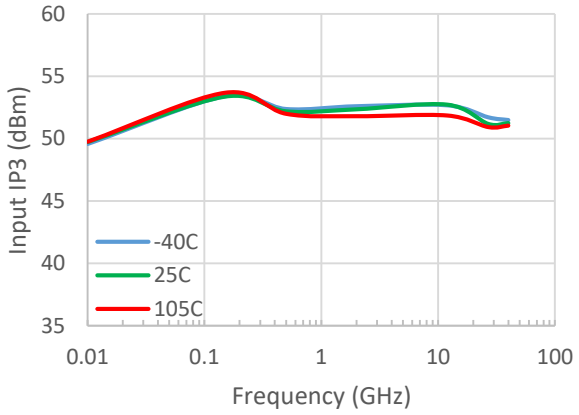
Input P0.1dB



Input P1dB

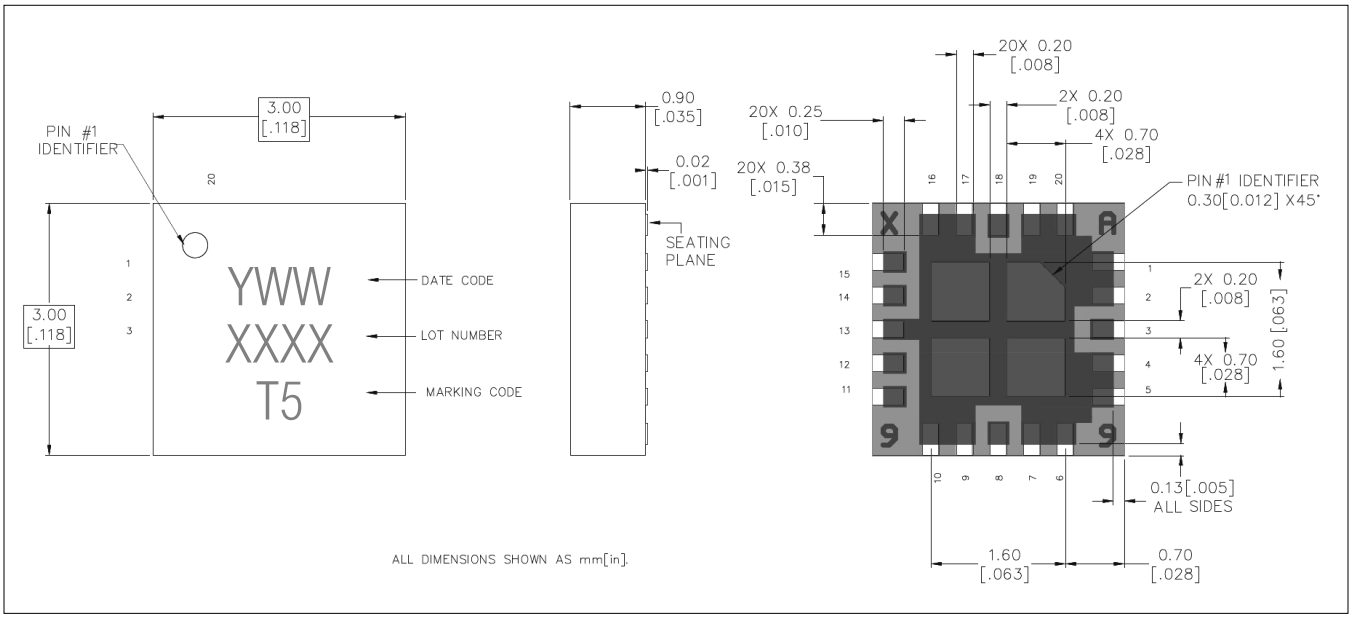


Input IP3[13]



13. Input IP3 were measured using connectorized evaluation board with impedance matching. The RF input power was 14 dBm per tone with spacing of 1 MHz. The IP3 rolloff below 150 MHz is due to rolloff of test system IP3.

Lead-Free 3 mm, 20-Lead Laminate Package†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is NiPdAu (ENEPIG) finish.