SPDT Reflective Switch
100 MHz - 67 GHz

MASW-011240
Rev. V1

Features

- Ultra Wideband: 100 MHz to 67 GHz
- Insertion Loss:
  - 1.3 dB @ 40 GHz
  - 1.6 dB @ 55 GHz
  - 2.6 dB @ 67 GHz
- Isolation:
  - 46 dB @ 40 GHz
  - 39 dB @ 55 GHz
  - 36 dB @ 67 GHz
- Input P0.5dB: 30 dBm
- Input IP3: 52 dBm
- Return Loss at Each RF Port: 16 dB
- Power Handling: 30 dBm at 105ºC
- T_{ON}/T_{OFF}: 12 ns
- No Low Frequency Spurious
- Compatible with 1.8, 2.5, and 3.3 V CMOS Logic
- 2.25 mm, 12 Lead Laminate Package
- RoHS* Compliant

Applications

- Test & Measurement
- ISM, Multi Market

Description

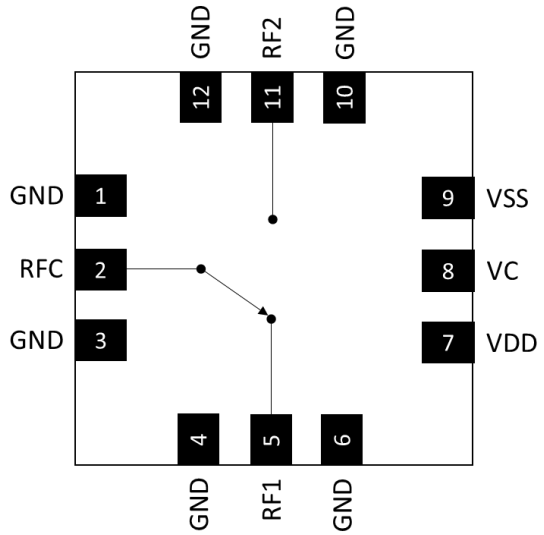
The MASW-011240 is a fast switching, reflective, ultra wideband single pole double throw (SPDT) switch with 1.6 dB of insertion loss at 55 GHz. The power handling capability is 30 dBm. The input and output return losses in the thru path are typically 16 dB. The logic levels are compatible with standard 1.8, 2.5, or 3.3 V CMOS. Required bias supplies are +3.3 V & -3.3 V.

For ultra wideband applications, impedance matching on the RF transmission lines can further optimize high frequency insertion loss and return loss performance.

The MASW-011240 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-011240 is manufactured on a Silicon-on-Insulator process. The 2.25 mm laminate package is lead free and RoHS compliant.

Functional Schematic



Pin Configuration[1]

Pin #	Pin Name	Description
1,3,4,6,10,12	GND	Ground
2	RFC[2]	Common RF Input/Output
5	RF1[2]	RF Input/Output 1
7	VDD	+3.3 V
8	VC	Control Voltage
9	VSS	-3.3 V
11	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-011240-TR0500	500 Piece reel
MASW-011240-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]:
VDD = +3.3 V, VSS = -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	100 MHz to 18 GHz 19 GHz 26 GHz 38 GHz 52 GHz 67 GHz	dB	—	0.8 0.9 1.0 1.3 1.6 2.6	- 1.5 - 2.0 2.5 -
Isolation, Between RF1 to RF2	100 MHz to 18 GHz 19 GHz 26 GHz 38 GHz 52 GHz 67 GHz	dB	—	50 49 47 48 41 36	—
Isolation, RFC to RF1 / RF2	100 MHz to 18 GHz 19 GHz 26 GHz 38 GHz 52 GHz 67 GHz	dB	- 44 - 41 33 -	47 47 47 46 39 36	—
RFC Port Return Loss	100 MHz to 67 GHz	dB	—	16	—
RF1 / RF2 Port Return Losses	100 MHz to 67 GHz	dB	—	16	—
Input P0.1dB	100 MHz to 67 GHz	dBm	—	29	—
Input P0.5dB	100 MHz to 67 GHz	dBm	—	30	—
Input IP3	Two tone, P_{IN}/tone = +12 dBm 100 MHz - 67 GHz	dBm	—	52	—
$T_{RISE/FALL}$	10% to 90% RF	ns	—	3	—
$T_{ON/OFF}$	50% control to 90% RF	ns	—	12	—
$T_{SETTLING}$	50% control to 0.1 dB of settled RF 50% control to 0.05 dB of settled RF	ns	—	20 24	—
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	—	0.8
Logic Voltage, Input High (V_{IH})	—	V	1.2	—	VDD
Supply Current, IDD	—	mA	—	0.1	0.25
Supply Current, ISS	—	mA	-0.25	-0.1	—
Logic Pin Current (VC)	Internal 100 kΩ pull down resistor	µA	—	VC*10	—

5. Parameters are measured on a test board that includes impedance matching. Device needs to be aligned to recommended PCB footprint +/- 1 mil for optimum performance.

Maximum Operating Ratings

Parameter	Absolute Maximum
Input Power, 300 MHz to 40 GHz, RFC Port[6]	29 dBm
Input Power, 300 MHz to 40 GHz, RF1 / RF2 Port[6]	29 dBm
VDD	0 to +3.45 V
VSS	-3.45 to 0 V
VC	0 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]

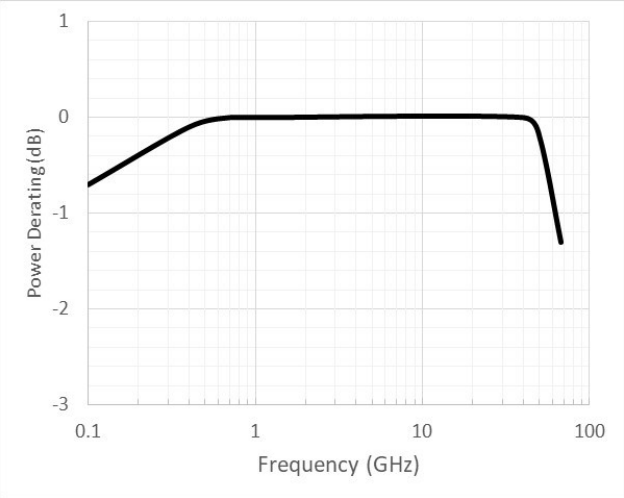
Parameter	Absolute Maximum
Input Power, 300 MHz to 40 GHz, RFC Port[6]	30 dBm
Input Power, 300 MHz to 40 GHz, RF1 / RF2 Port[6]	30 dBm
VDD	-0.3 to +3.6 V
VSS	-3.6 to +0.3 V
VC	-0.3 to 3.6 V
Junction Temperature	+135°C

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

Control Input	Condition of Switch	
VC	RFC - RF1 Path	RFC - RF2 Path
V_{IH}	On	Off
V_{IL}	Off	On

Power Derating Curve[6]



Handling Procedures

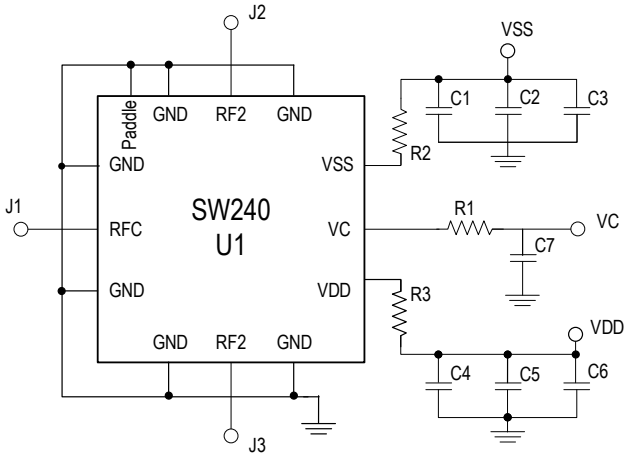
Please observe the following precautions to avoid damage:

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 devices.

Parameter	Rating	Standard
Human Body Model (HBM)	Class 1C	ESDA/JEDEC JS-001
Charged Device Model (CDM)	Class C3	ESDA/JEDEC JS-002

Application Schematic



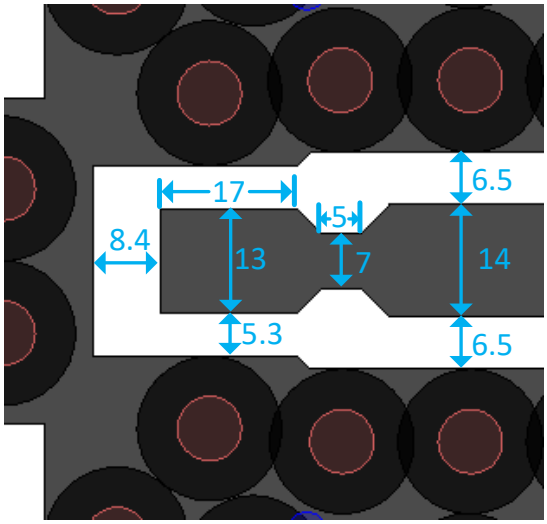
Parts List

Part	Value	Case Style
U1	MASW-011240	2.25 mm, 12 lead
C1, C4	Capacitor, 10 pF, 50 V	0402
C2, C5	Capacitor, 1000 pF, 25 V	0402
C3, C6	Capacitor, 1 µF, 10 V	0402
C7	Capacitor, 5 pF, 50 V	0402
R1 - R3	Resistor, 0 Ω	0402
J1 - J3	Southwest 1492-04A-6	End Launch
J8	DC Connector	Tyco Electronics 5-146130-1

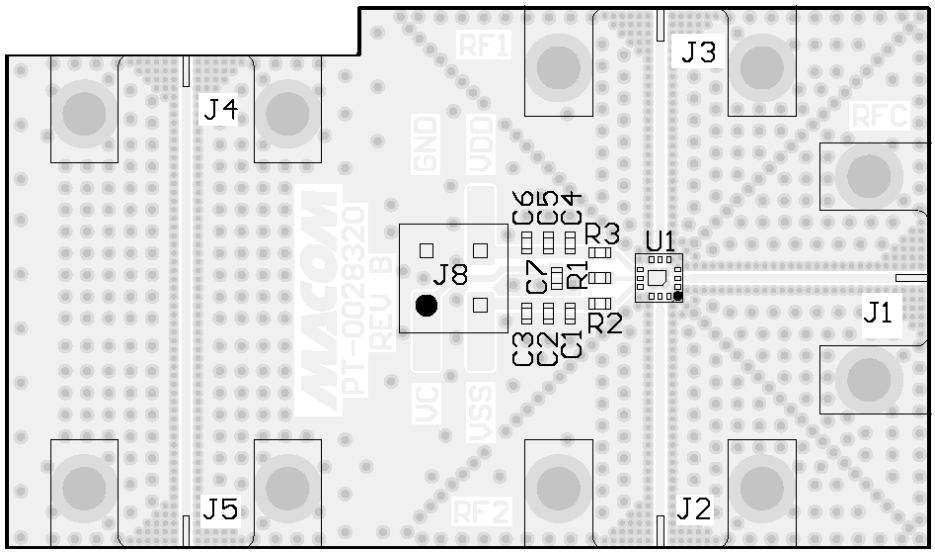
Impedance Match

MASW-011240-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, 5 mil traces with 7 mil width are used for all RF port matching, as shown below.

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

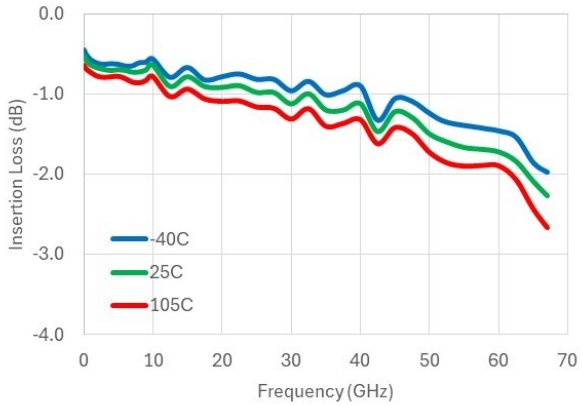


Evaluation Board Layout

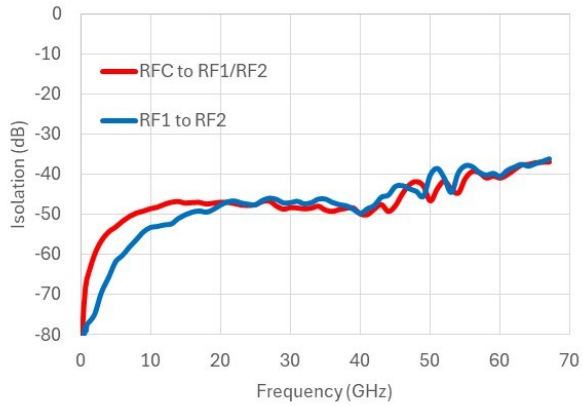


Typical Performance Curves

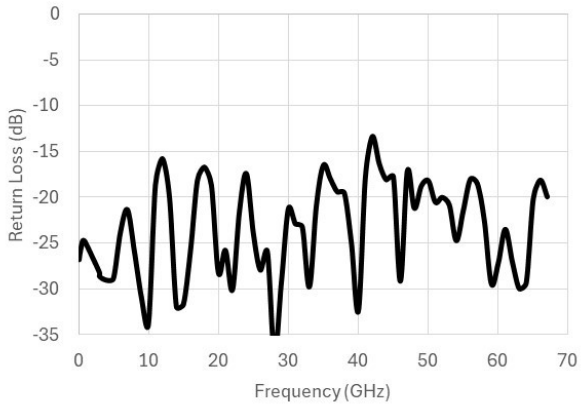
Insertion Loss with Impedance Match[11]



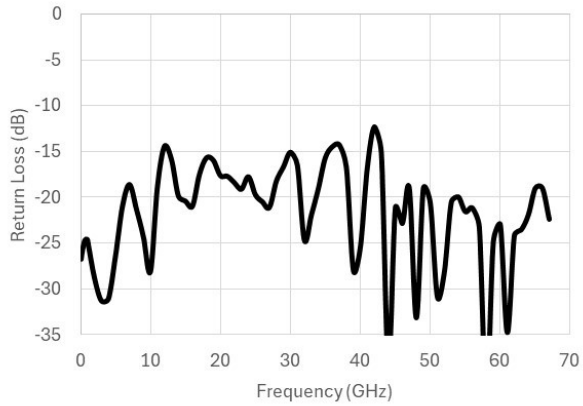
RFC to RF1 / RF2 Isolation with Impedance Match[11]



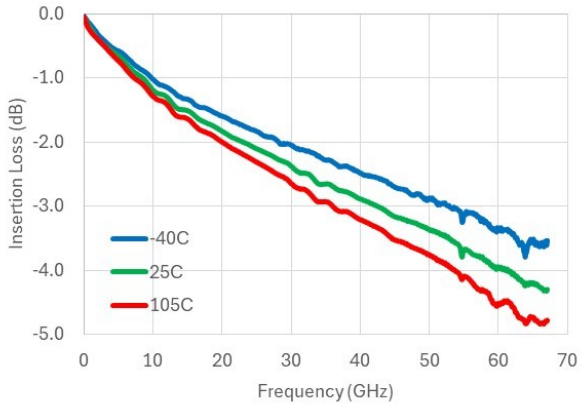
RFC Return Loss with Impedance Match[12]



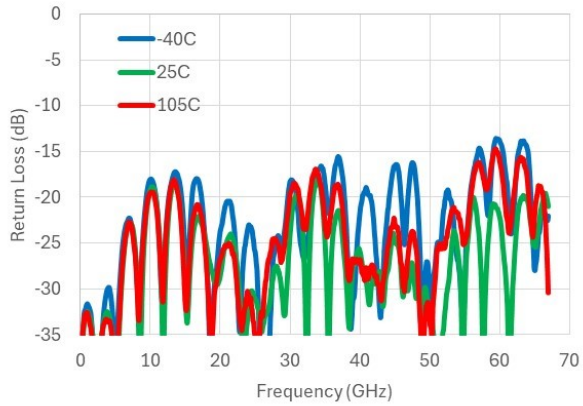
RF1 / RF2 Return Loss with Impedance Match[12]



Evaluation Board Thru Line Insertion Loss



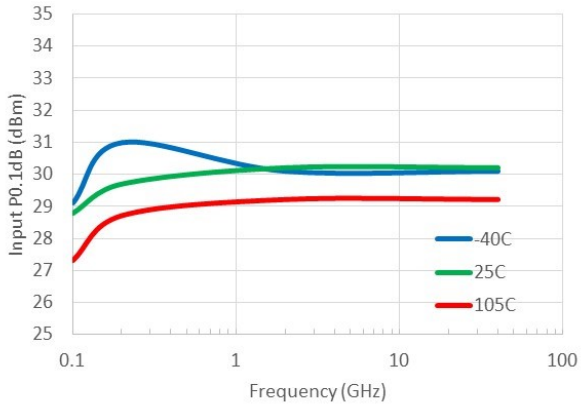
Evaluation Board Thru Line Return Loss



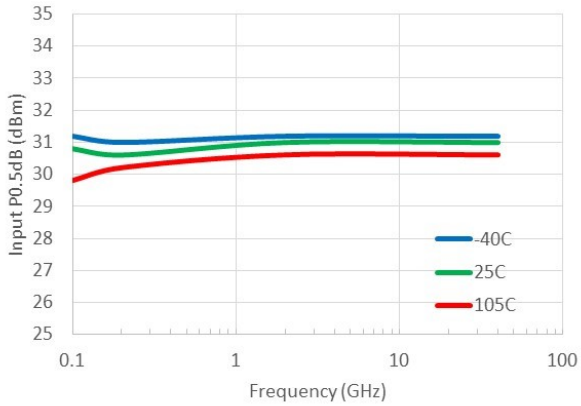
11. Insertion Loss and Isolation with impedance match were measured using connectorized evaluation board, and normalized using the insertion loss of the 50 Ω thru line.
12. Return Loss with impedance match were measured using connectorized evaluation board.

Typical Performance Curves

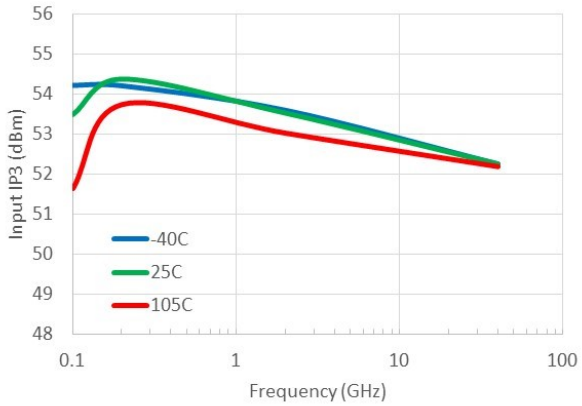
Input P0.1dB



Input P0.5dB

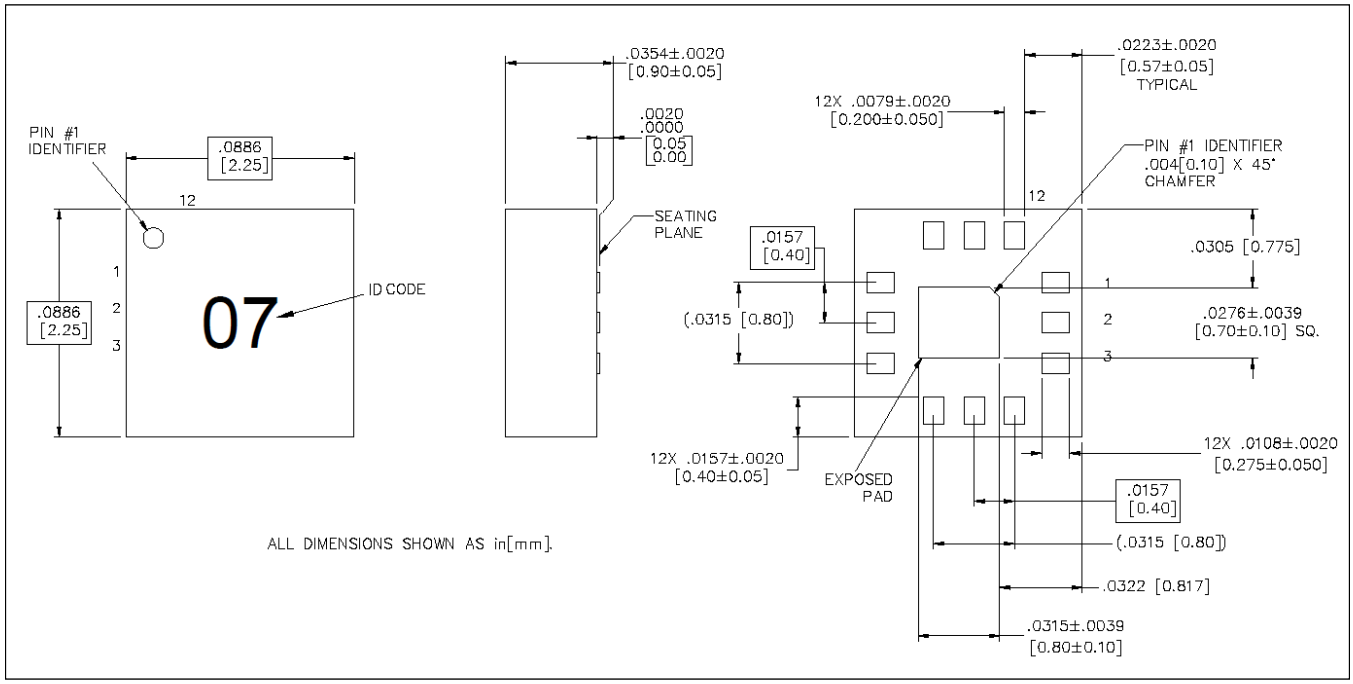


Input IP3[13]



13. Input IP3 were measured using connectorized evaluation board with impedance matching. The RF input power was 12 dBm per tone with spacing of 1 MHz.

Lead Free 2.25 mm 12-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.