SPDT Absorptive Switch 100 MHz - 67 GHz



MASW-011241

Rev. V1

Features

- Ultra Wideband: 100 MHz to 67 GHz
- Insertion Loss:

1.8 dB @ 40 GHz 2.2 dB @ 50 GHz

3.8 dB @ 67 GHz

48 dB Isolation:

48 dB @ 40 GHz 42 dB @ 50 GHz 38 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 105°C
- T_{ON}/T_{OFF}: 13 ns
- 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

- Test & Measurement
- ISM. Multi Market

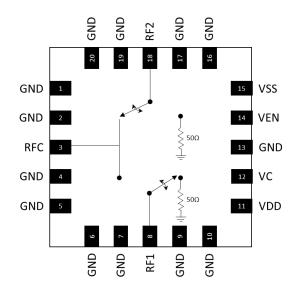
Description

The MASW-011241 is a fast switching, 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 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 and -3.3 V.

The MASW-011241 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-011241 is manufactured on a Silicon-on -Insulator process. The 3 mm laminate package is lead free and RoHS compliant.

Functional Schematic



Pin Configuration¹

Pin#	Pin Name	Description	
1,2,4-7,9,10,13 16,17,19,20	GND	Ground	
3	RFC ²	Common RF Input/Output	
8	RF1 ²	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	

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

Ordering Information^{3,4}

Part Number	Package
MASW-011241-TR0500	500 Piece reel
MASW-011241-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.

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Electrical Specifications⁵: 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.	Тур.	Max.
Insertion Loss	100 MHz to 18 GHz 26 GHz 40 GHz 50 GHz	dB	_	1.3 1.5 1.8 2.2	1.6 2.1 2.8 3.8
Isolation, Between RF1 to RF2	100 MHz to 18 GHz 26 GHz 40 GHz 50 GHz	dB	_	66 64 50 42	_
Isolation, RFC to RF1 / RF2	100 MHz to 18 GHz 26 GHz 40 GHz 50 GHz	dB	55 50 45 40	70 61 47 48	_
RFC Return Loss	100 MHz - 67 GHz	dB	_	16	_
RF1/RF2 Return Loss, Thru Port	100 MHz - 67 GHz	dB	_	16	_
RF1/RF2 Return Loss, Isolated Port	100 MHz - 67 GHz	dB	_	16	_
Input P0.1dB	100 MHz - 67 GHz	dBm	_	29	_
Input P0.5dB	100 MHz - 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	_	3.5	_
T _{ON/OFF}	10% control to 90% RF	ns	_	13	_
T _{SETTLING}	50% control to 0.1dB of settled RF 50% control to 0.05B of settled RF	ns	_	25 33	_
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, 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.



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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	29 dBm 29 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		

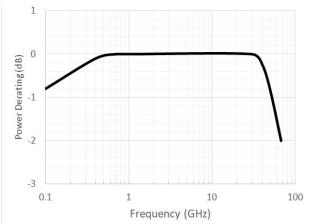
^{6.} T_{PADDLE} = 105 °C. See power derating curves for details.

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	30 dBm 30 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		

Exceeding any one or combination of these limits may cause permanent damage to this device.

Power Derating Curve⁶



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

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	

^{7.} Guarantees 10 years lifetime.

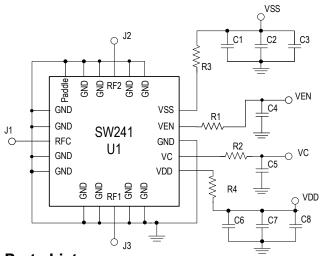
MACOM does not recommend sustained operation near these survivability limits.

^{10.}Based on testing with input power applied for 30 seconds.



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Application Schematic



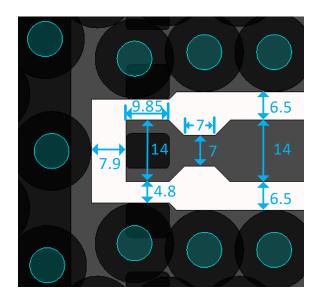
Parts List

Part	Value	Case Style
U1	MASW-011241	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
C4, C5	Capacitor, 5 pF, 50 V	0402
R1 - R4	Resistor, 0 Ω	0402
J1 - J3	Southwest 1492-04A-6	End Launch

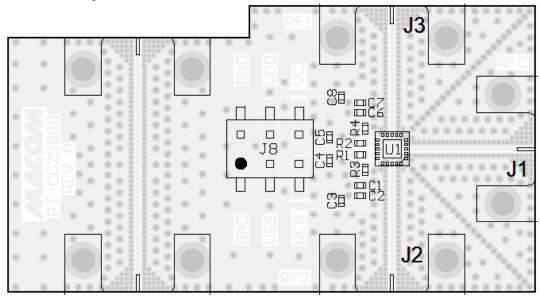
Impedance Match

MASW-011241-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



1

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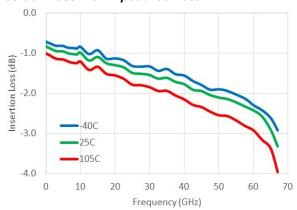
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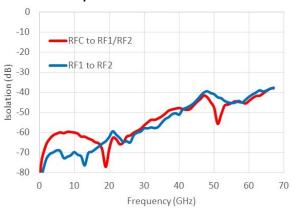
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Typical Performance Curves

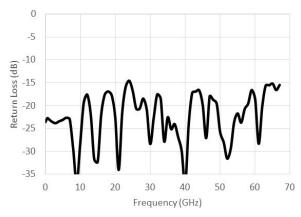
Insertion Loss with Impedance Match¹¹



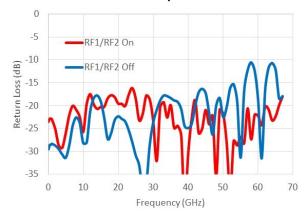
Isolation with Impedance Match¹¹



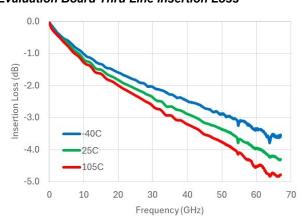
RFC Return Loss with Impedance Match¹²



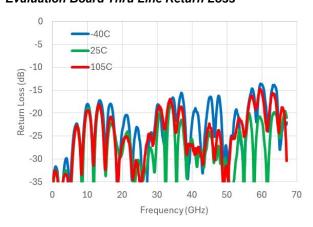
RF1/RF2 Return Loss with Impedance Match¹²



Evaluation Board Thru Line Insertion Loss



Evaluation Board Thru Line Return Loss



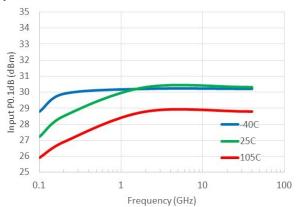
- 11.Insertion Loss and Isolation with impedance match were measured using connectorized evaluation board, and normalized using the insertion loss of the 50Ω thru line.
- 12. Return Loss with impedance match were measured using connectorized evaluation board.



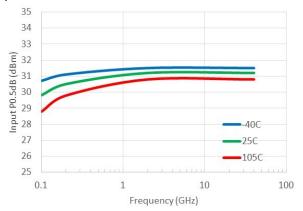
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Typical Performance Curves

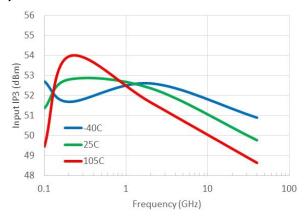
Input P0.1dB



Input P0.5dB



Input IP3¹³

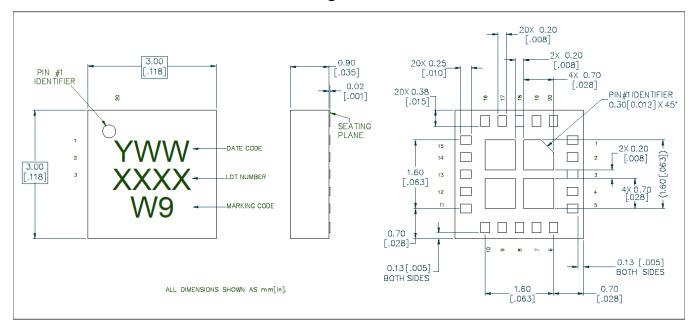


13.Input IP3 were measured using connectorized evaluation board with impedance matching. The RF input power was 14 dBm per tone with spacing of 1 MHz. The IP3 rolloff below 150 MHz is due to rolloff of test system IP3.



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Lead Free 3 mm 20-Lead Laminate Package †



[†] Reference Application Note S2083 for lead-free solder reflow recommendations. Meets JEDEC moisture sensitivity level 1 requirements. Plating is NiPdAu (ENEPIG) finish

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