

# 4 W Ka-band Absorptive SPDT Switch 27 - 31 GHz



MASW-011145

Rev. V5

## Features

- Insertion Loss: 1.3 dB
- Isolation: 45 dB
- Maximum Input Power: 4 W
- P0.1dB: 35 dBm
- P1dB: 37 dBm
- Return Loss: 18 dB
- All RF Ports are Internal DC Grounded
- Compatible with 1.8, 2.5, and 3.3 V CMOS Logic
- Internal Negative Voltage Generator
- 3 mm, 20 Lead Laminate Package
- RoHS\* Compliant

## Applications

- Satellite Communications

## Description

The MASW-011145 is a high power single pole double throw (SPDT) Ka-band switch with 1.4 dB of insertion loss. The power handling capability is 35 dBm. The input and output return losses in the thru path are typically greater than 18 dB over most of the specified frequency band. The isolated path also has 18 dB typical return loss. The logic levels may be standard 1.8, 2.5, or 3.3 V CMOS. The required bias supply is 3.3 V.

The MASW-011145 is designed for high power Ka-band satellite communications between 27 and 31 GHz. The 3 mm, 20 lead laminate package is lead free and RoHS compliant.

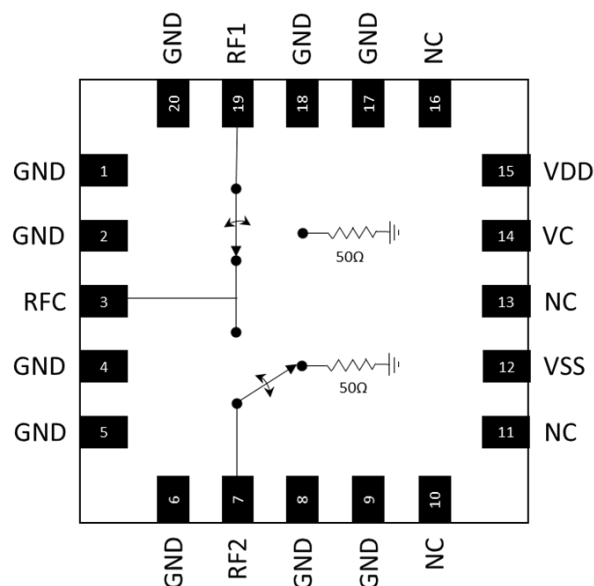
The MASW-011145 includes a negative voltage generator. If VSS (pin 12) is connected to ground, the negative voltage generator will be used to internally supply -3.3 V. If -3.3 V is applied to the VSS pin, the negative voltage generator will be disabled.

## Ordering Information<sup>1,2</sup>

Part Number	Package
MASW-011145-TR0500	500 piece reel
MASW-011145-SMB	Sample Board

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

## Functional Schematic



## Pin Configuration<sup>3</sup>

Pin #	Pin Name	Description
1,2,4,5,6,8,9,17,18,20	GND	Ground
3	RFC	Common RF Input/Output
7	RF2	RF Input/Output 2
10,11,13,16	NC	No Connection
12	VSS	-3.3 V or Ground
14	VC	Control Voltage
15	VDD	+3.3 V
19	RF1	RF Input/Output 1

3. The exposed pad centered on the package bottom must be connected to RF, DC, and thermal ground. MACOM recommends connecting all GND and NC pins to ground.

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

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**Electrical Specifications:  $V_{DD} = +3.3\text{ V}$ ,  $V_{SS} = -3.3\text{ V}^4$ ,  $T_{BASE} = 25^\circ\text{C}$ ,  $Z_0 = 50\ \Omega$**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	27 - 31 GHz	dB	—	1.3	1.8
Isolation	27 - 31 GHz	dB	40	45	—
Input P0.1 dB	27 - 31 GHz	dBm	—	35	—
Input P1dB	27 - 31 GHz	dBm	—	>37	—
Input IP3	27 - 31 GHz	dBm	—	60	—
Common Port Return Loss	27 - 31 GHz	dB	—	18	—
RF1/RF2 Return Loss	ON State, 27 - 31 GHz	dB	—	20	—
RF1/RF2 Return Loss	OFF State, 27 - 31 GHz	dB	—	18	—
Max. Input Power @ RF1/RF2	OFF State, 27 - 31 GHz	dBm	—	24	—
$T_{RISE}$ , $T_{FALL}$	10% to 90% RF and 90% to 10% RF	ns	—	20	—
$T_{ON}$ , $T_{OFF}$	50% control to 90% RF and 50% control to 10% RF	ns	—	135	—
Logic Voltage, Input High ( $V_{IH}$ )	—	V	1.17	—	3.6
Logic Pin Current (VC)	Pin pulled down to GND with 100 k $\Omega$ resistor	$\mu\text{A}$	—	-33	—
Logic Voltage, Input Low ( $V_{IL}$ )	—	V	0.0	—	0.8
Voltage Supply, VDD	—	V	3.135	3.3	3.465
Voltage Supply, VSS <sup>5</sup>	When applied	V	-3.465	-3.3	-3.135
Supply Current, VDD	No VSS applied	mA	—	0.2	—
Supply Current, VSS	When applied	$\mu\text{A}$	—	3	—
Spurious	1 to 10 MHz, when VSS grounded	dBm	—	—	-90
Switching Frequency <sup>6</sup>	—	kHz	—	—	100

4. Apply VDD and VSS before RF signal.

5. If a negative supply is not used, VSS should be connected to ground in order to activate the internal negative voltage generator.

6. Switching frequency is the inverse of the time interval between switching transitions.

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## Maximum Operating Conditions

Parameter	Maximum Rating
Input Power	36 dBm
VDD	0 to +3.465 V
VSS	-3.465 to 0 V
VC	0 to +3.6 V
Operating Temperature	-40°C to +105°C
Junction Temperature	+125°C

## Absolute Maximum Ratings<sup>7,8</sup>

Parameter	Absolute Maximum
Input Power <sup>9</sup>	37 dBm
VDD	-0.3 to +3.8 V
VSS	-3.8 to +0.3 V
VC	-0.5 to +3.9 V
Storage Temperature	-65°C to +125°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.  
9. Based on testing with input power applied for 30 seconds.

## Truth Table

Control Input	Condition of Switch	
	RF1	RF2
VC		
V <sub>IH</sub>	On	Off
V <sub>IL</sub>	Off	On

## 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.

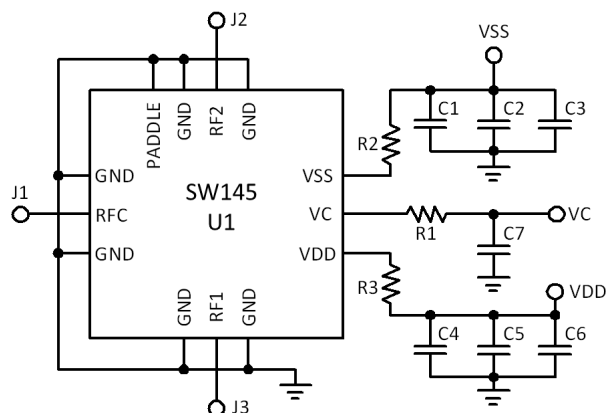
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## Application Schematic

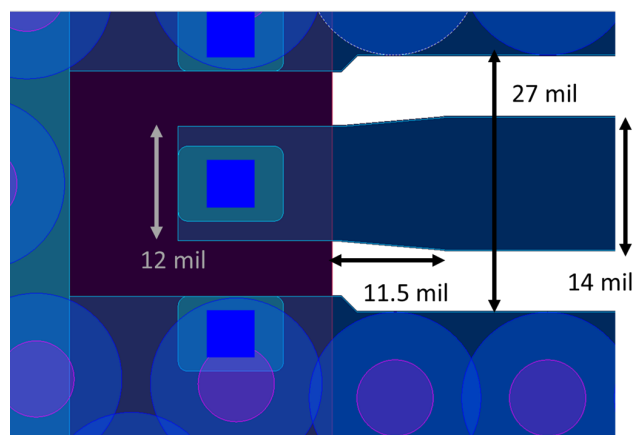


## Evaluation Board

The MASW-011145 SMB is a 2-layer evaluation board. The top and bottom copper layer are 1 oz thick and separated by 8 mil RO4003.

All RF, DC, and Control traces are on the top copper layer. The RF lines are CPW (coplanar waveguide) line. The trace width is 14 mil and space to ground is 6.5 mil. The evaluation board layout is shown on right side of this page and the RF trace layout details around DUT are shown as following:

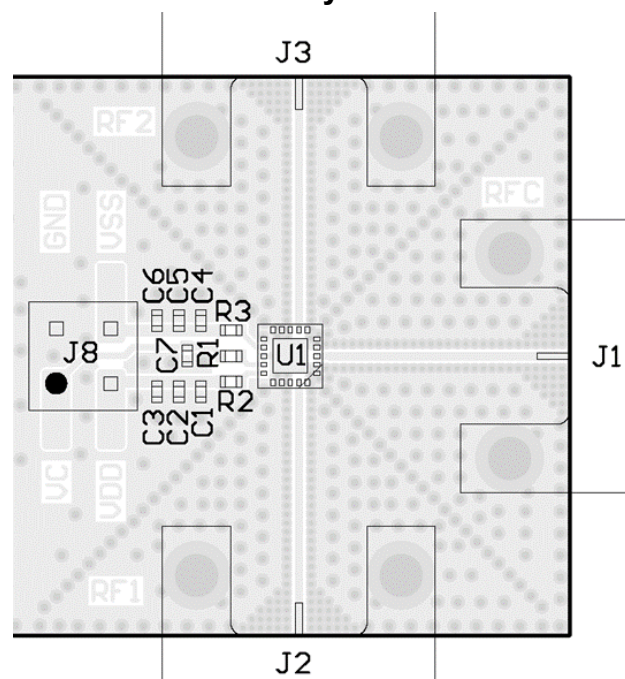
## RF Trace Detail



## Parts List

Part	Value	Case Style
U1	MASW-011145	3 mm, 20 Lead
C1, C4	Capacitor, 10 pF, 50 V	0402
C2, C5	Capacitor, 1000 pF, 25 V	0402
C3, C6	Capacitor, 1 $\mu$ F, 10 V	0402
R1 - R3	Resistor, 0 $\Omega$	0402
J1 - J3	Southwest 1492-04A-6	End Launch 2.4mm Female
J8	DC Connector	Tyco Electronics 5-146130-1

## Evaluation Board Layout



# 4 W Ka-band Absorptive SPDT Switch 27 - 31 GHz

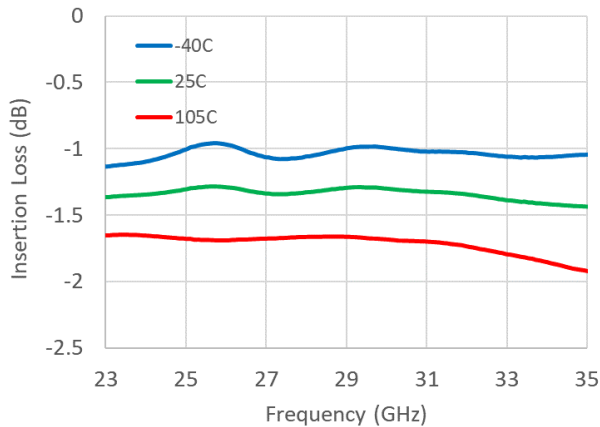


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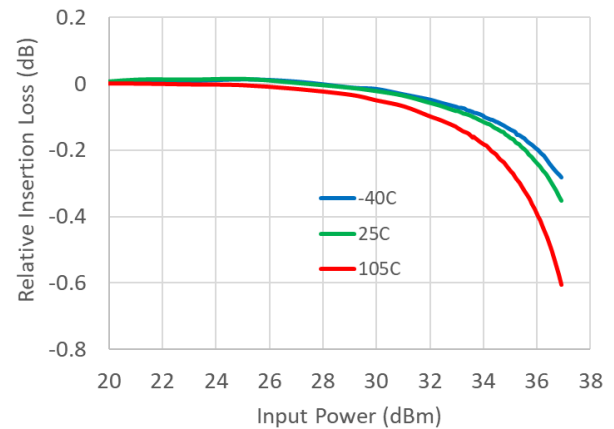
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## Typical Performance Curves

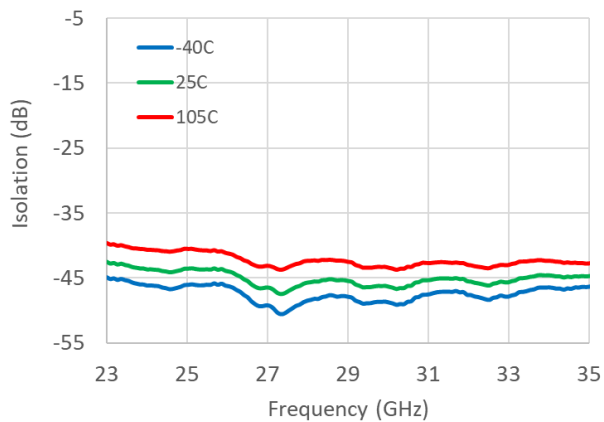
**Insertion Loss**



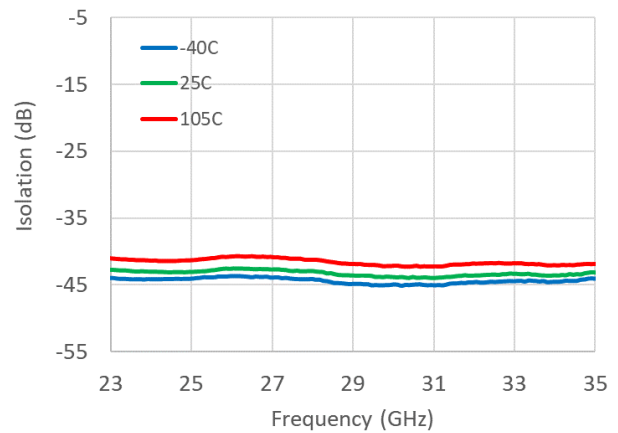
**Relative Insertion Loss Compression @ 30 GHz**



**RF1 to RF2 isolation**



**RF1 to RF2 Isolation**



# 4 W Ka-band Absorptive SPDT Switch 27 - 31 GHz

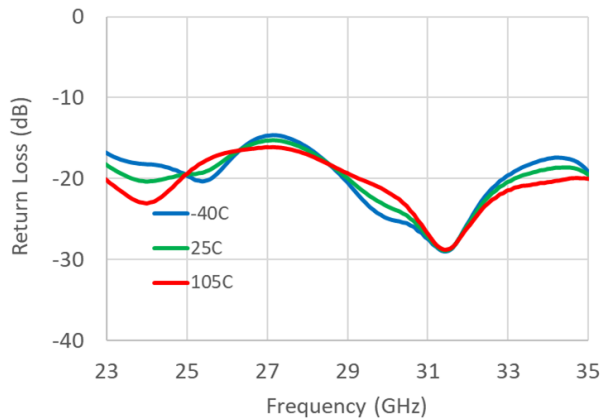


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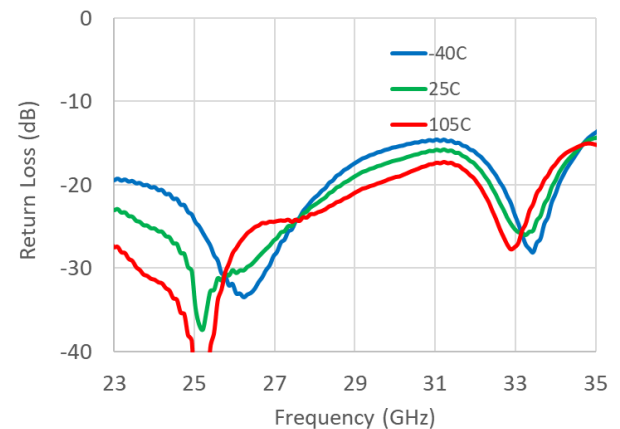
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## Typical Performance Curves

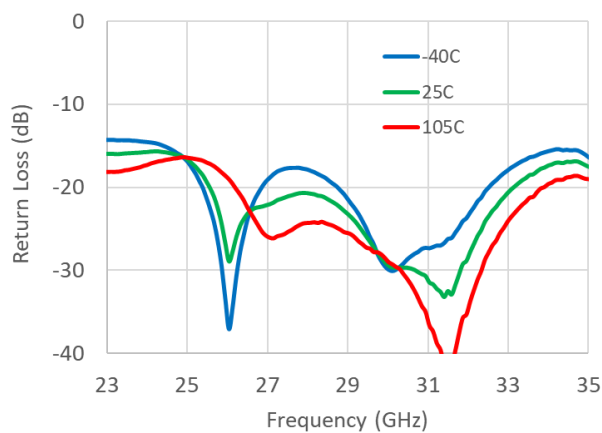
**Return loss: RFC**



**Return Loss: RF1/RF2 (Off State)**



**Return Loss: RF1/RF2 (On State)**



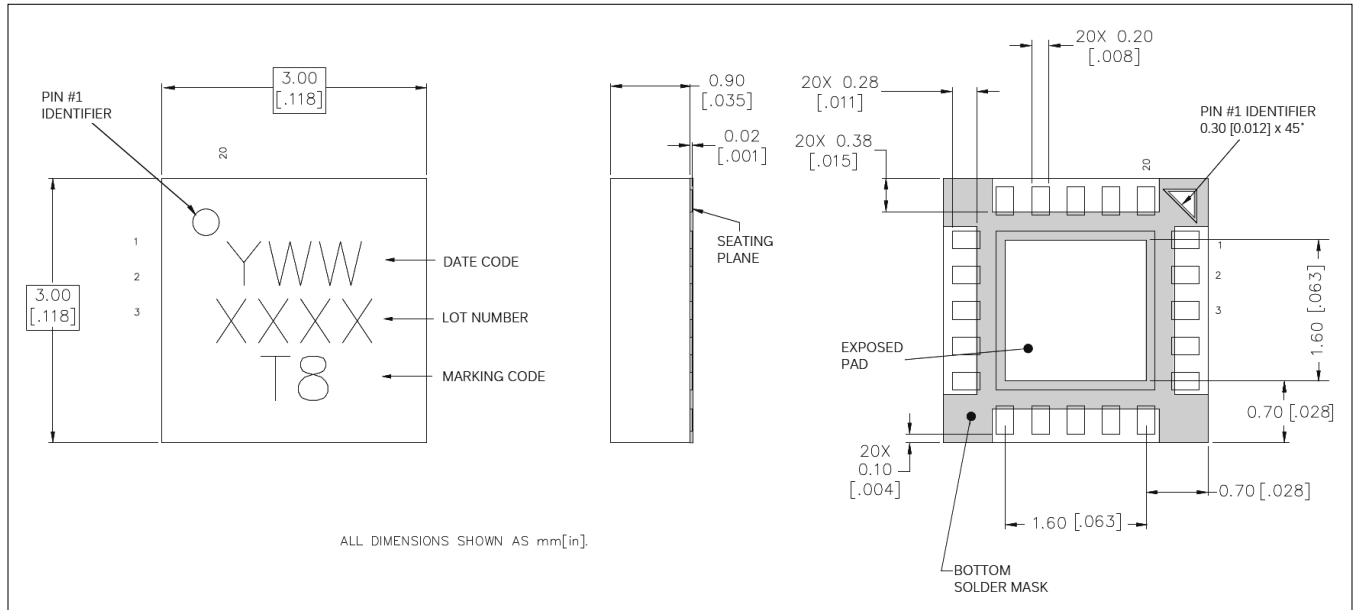
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## Lead-Free 3 mm, 20-Lead Laminate Package<sup>†</sup>



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

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