

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



MASW-011145

Rev. V3

Features

- 1.3 dB Insertion Loss
- 45 dB Isolation
- 4W Maximum Input Power
- 35 dBm P0.1dB
- 37 dBm P1dB
- 18 dB Return Losses
- All RF ports are internal DC grounded
- Compatible with 1.8, 2.5, and 3.3V 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.

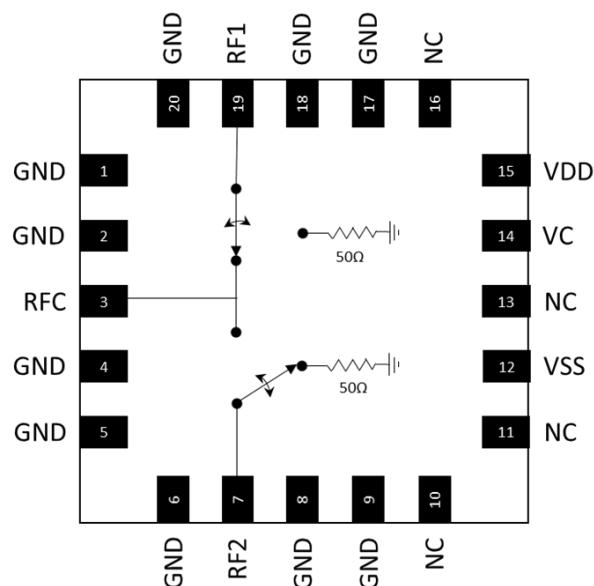
The MASW-011145 includes a negative voltage generator. If VSS (pin 12) is connected to ground, the negative voltage generator will be used to internally supply -3.3 V. If -3.3 V is applied to the VSS pin, the negative voltage generator will be disabled.

Ordering Information^{1,2}

| 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 Configuration³

| Pin # | Pin Name | Description |
|-------------------------|----------|------------------------|
| 10,11, 13,16 | NC | No Connection |
| 1,2,4,5,6,8,9, 17,18,20 | GND | Ground |
| 3 | RFC | Common RF Input/Output |
| 7 | RF2 | RF Input/Output 2 |
| 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.

¹ * 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 Ω resistor | μA | — | -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 ⁵ | When applied | V | -3.465 | -3.3 | -3.135 |
| Supply Current, VDD | No VSS applied | mA | — | 0.2 | — |
| Supply Current, VSS | When applied | μA | — | 3 | — |
| Spurious | 1 to 10 MHz, when VSS grounded | dBm | — | — | -90 |
| Switching Frequency ⁶ | — | 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^{7,8}

| Parameter | Absolute Maximum |
|--------------------------|------------------|
| Input Power ⁹ | 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 _{IH} | On | Off |
| V _{IL} | Off | On |

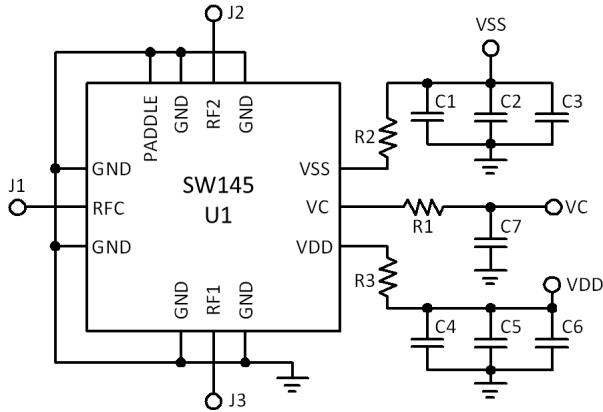
Handling Procedures

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.

Application Schematic



Parts List

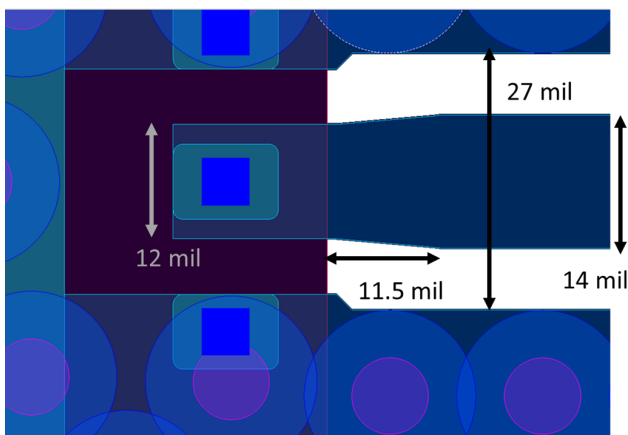
| Part | Value | Case Style |
|---------|----------------------------|--------------------------------|
| U1 | MASW-011145 | 3 mm, 20 Lead |
| C1, C4 | Capacitor, 10 pF, 50 V | 0402 |
| C2, C5 | Capacitor, 1000 pF, 25 V | 0402 |
| C3, C6 | Capacitor, 1 μ F, 10 V | 0402 |
| R1 - R3 | Resistor, 0 Ω | 0402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

Evaluation Board

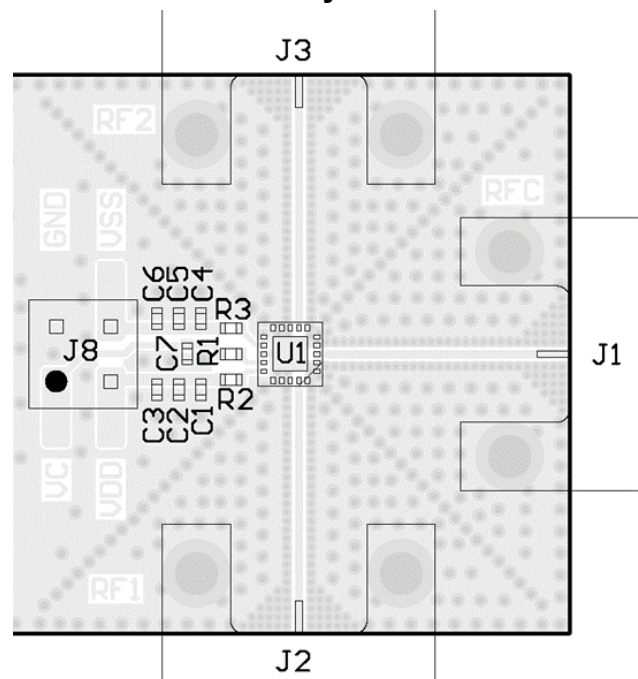
The MASW-011145 SMB is a 2-layer evaluation board. The top and bottom copper layer are 1 oz thick and separated by 8 mil RO4003.

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



Evaluation Board Layout



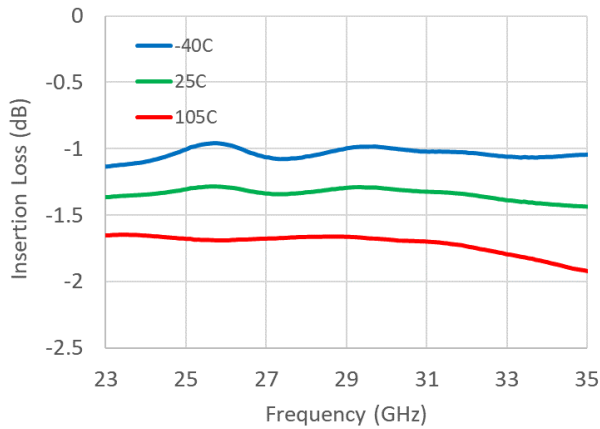
4W Ka-band Absorptive SPDT Switch 27 - 31 GHz



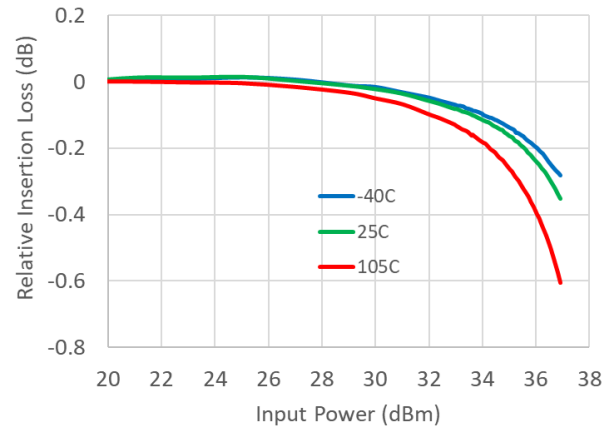
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Typical Performance Curves

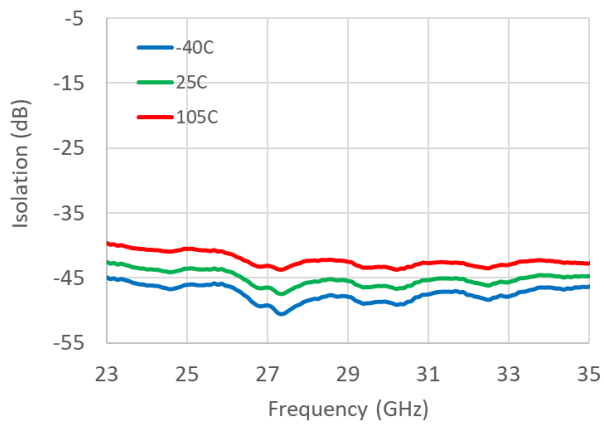
Insertion Loss



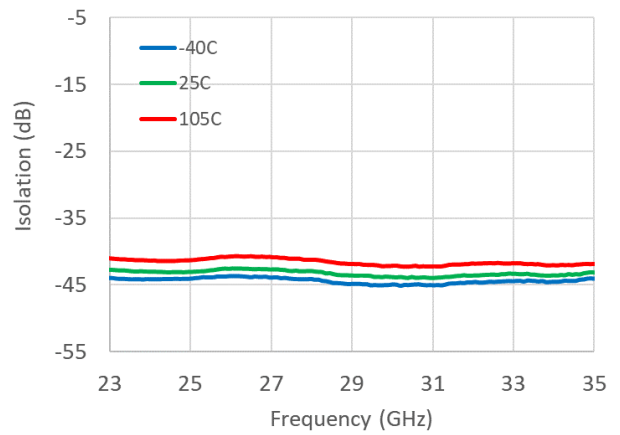
Relative Insertion Loss Compression @ 30 GHz



RF1 to RF2 Isolation



RF1 to RF2 Isolation



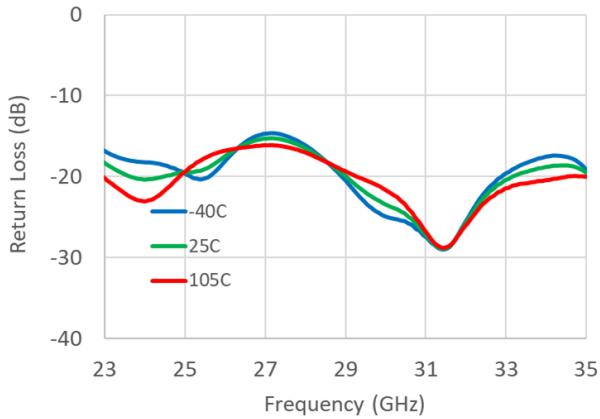
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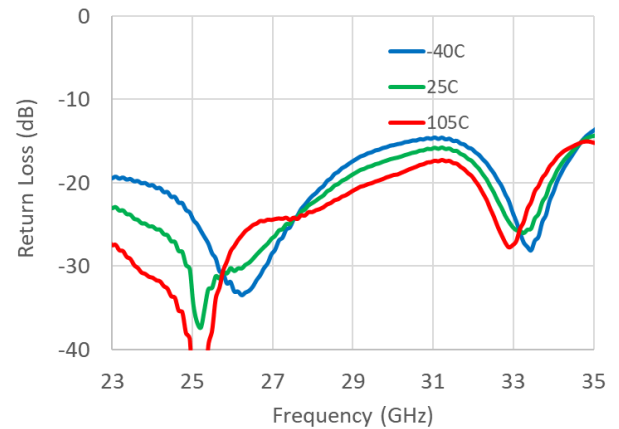
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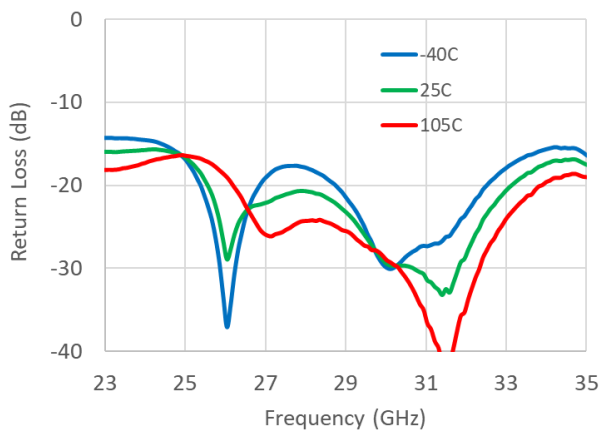
Return loss: RFC



Return Loss: RF1/RF2 (Off State)



Return Loss: RF1/RF2 (On State)



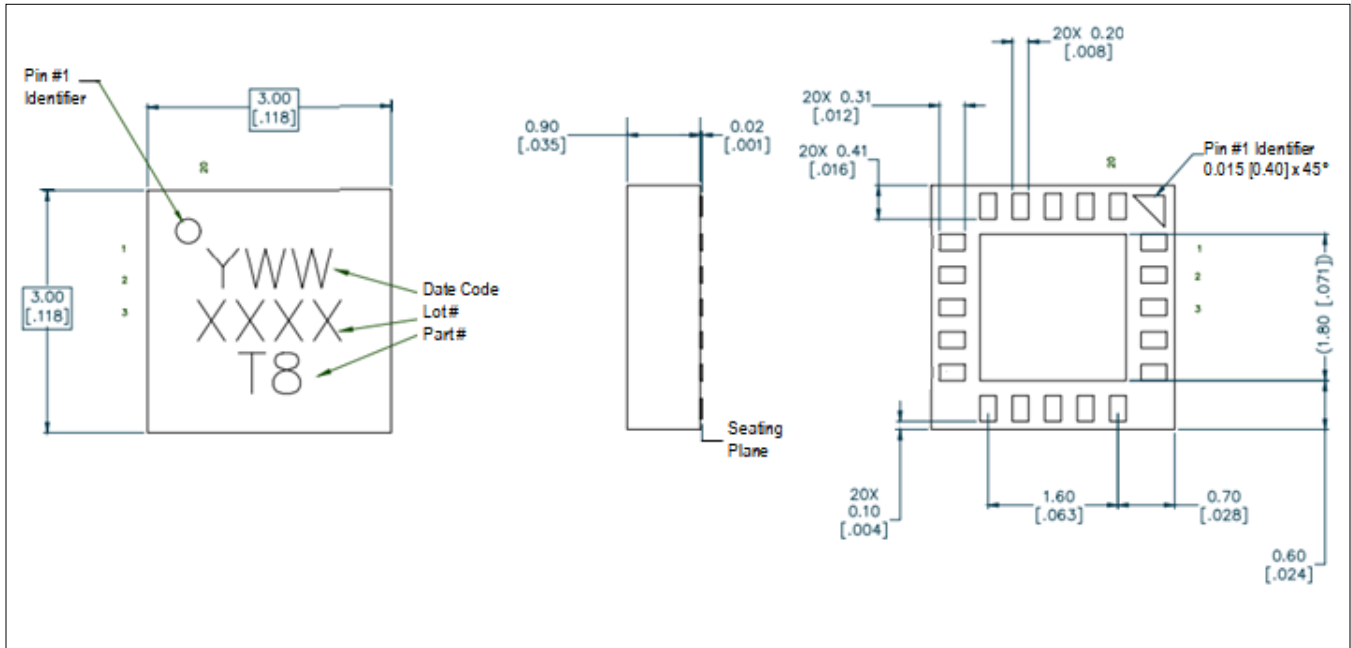
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Lead-Free 3 mm, 20-Lead Laminate Package⁹



10. Outline drawing based on new package design.

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