# Millimeter Wave Reflective SP4T with TTL Driver 0.5 - 30 GHz

**MASW-011137**
**Rev. V1**

## Features

- Hermetic SP4T Reflective Switch
- 2.4 mm Field Replaceable RF Connectors
- Unique All RF Ports Isolation State
- +5 V, -20 V, TTL Driver
- 3.8 dB Insertion Loss @ 30 GHz
- 30 dB Isolation @ 30 GHz
- 2:1 VSWR @ 30 GHz
- 70 ns $T_{ON}$ Switching Speed
- Non-RoHS* Part

## Applications

- Aerospace and Defense
- Space

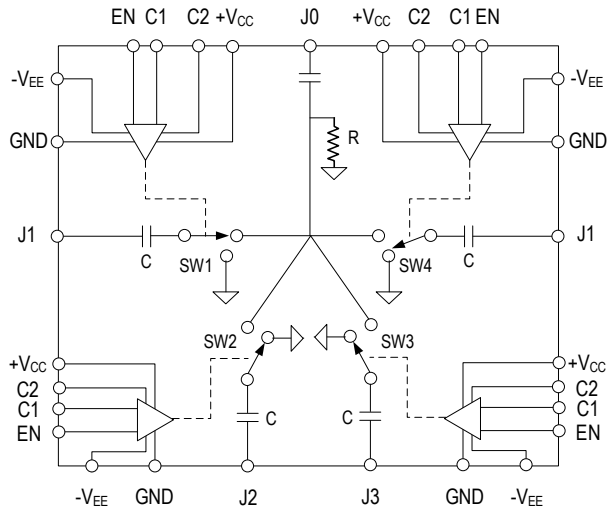
## Description

The MASW-011137 is a 0.5 – 30 GHz hermetic reflective SP4T that uses 2.4 mm RF replaceable connectors with an integrated TTL driver operating with +5 VDC and -20 VDC. The additional enable logic control provides for a unique state where all RF ports can be placed into simultaneous isolation. This product provides an exceptional isolation to insertion loss ratio, with 70 ns switching speed in a compact,1.3” x 1.3” x 0.7” metal housing. It is ideally suited for applications requiring hermetic hardware enclosures.

## Ordering Information

| Part Number | Package |
|---|---|
| MASW-011137-CS0240 | Bulk |

## Functional Schematic




## Port Configuration[1]

| Port Description | Function |
|---|---|
| J0 | RF Input |
| J1 | RF Output 1 |
| J2 | RF Output 2 |
| J3 | RF Output 3 |
| J4 | RF Output 4 |
| C1 | TTL Logic Control 1 |
| C2 | TTL Logic Control 2 |
| EN | TTL Enable Logic Control |
| $V_{CC}$ | Positive Bias |
| $V_{EE}$ | Negative Bias |
| GND | RF & DC Voltage Ground Return |

1. The RF ground is provided through the RF connectors and the metal housing. The driver ground is provided through the DC feedthrus and the metal housing.

## Electrical Specifications: $T_A$ = 25 °C, $P_{IN}$ = 0 dBm (unless otherwise defined), $Z_0$ = 50 Ω, DC Power = +5 V @ +90 mA, -20 V @ -30 mA

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Insertion Loss | 0.5 - 30 GHz<br>2GHz<br>18GHz<br>30GHz | dB | — | 3.0<br>0.9<br>2.1<br>4.0 | 5.4<br>1.0<br>2.6<br>5.4 |
| Return Loss | 0.5 - 30 GHz | dB | — | 14 | — |
| Input to Output Isolation | One Port in Insertion Loss<br>0.5 - 30 GHz<br>2GHz<br>18GHz<br>30GHz | dB | 26<br>61<br>39<br>26 | 40<br>65<br>40<br>30 | — |
| Input to Output Isolation | All Ports in Isolation<br>0.5 - 30 GHz | dB | — | 35 | — |
| Switching Speed<br>$T_{ON}$<br>$T_{OFF}$ | F=10 GHz, 100 kHz TTL repetition rate<br>( 50% Control Voltage - 90% RF Voltage )<br>( 50% Control Voltage - 10% RF Voltage ) | ns | — | 70<br>40 | — |
| CW Incident Power[2] | 10 GHz | dBm | — | 30 | — |
| Input IP2 | 2 Tone, 5 dBm/Tone<br>10 MHz spacing at 10 GHz | dBm | — | 74 | |
| Input IP3 | 2 Tone, 5 dBm/Tone<br>10 MHz spacing at 10 GHz | dbm | — | 45 | — |

2. Maximum source and load VSWR = 1.2:1

## Recommended Operating Conditions

| Parameter | Test Conditions | Units | Min | Typ. | Max |
|---|---|---|---|---|---|
| CW Input Power | 10 GHz, +25 °C | dBm | — | — | 30 |
| $V_{CC}$ | — | V | — | +5.0 | — |
| $V_{EE}$ | — | V | — | -20.0 | — |
| $I_{CC}$ | One Port in Insertion Loss<br>All Ports in Isolation | mA | +79<br>+105 | +82<br>+108 | +85<br>+111 |
| $I_{EE}$ | One Port in Insertion Loss<br>All Ports in Isolation | mA | -29<br>-3 | -26<br>0 | -23<br>0 |
| C1, C2, EN | Logic “0”<br>Logic “1” | V | 0.0<br>2.0 | 0.0<br>+5.0 | +0.8<br>+5.0 |
| Operating Temperature | — | °C | -40 | +25 | +85 |
| Storage Temperature | — | °C | -65 | +25 | +150 |

## Maximum Survivability Ratings[3,4,5,6]

| Parameter | Absolute Maximum |
|---|---|
| CW Input Power | 31 dBm @ +25 °C |
| $V_{CC}$[6] | +4.5 V ≤ $V_{CC}$ ≤ +5.5 V |
| $V_{EE}$[6] | -22 V ≤ $V_{EE}$ ≤ to -10 V |
| C1, C2, EN | -0.5 V ≤ $V_{CC}$ ≤ +7.0 V |
| Junction Temperature | +175 °C |
| Operating Temperature | -55 °C to +95 °C |
| Storage Temperature | -65 °C to +150 °C |

3. Operating at recommended conditions with $T_J$ ≤ +175°C will ensure MTTF > 1 x $10^6$ hours.
4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near ANY of these maximum survivability limits.
6. Important: The TTL driver in the MASW-011137 SP4T does NOT use reverse polarity protection for the $V_{CC}$ and $V_{EE}$ voltage inputs. The MASW-011137 can be damaged if $V_{CC}$ and $V_{EE}$ voltage inputs are reversed.

## Handling Procedures

Please observe the following precautions to avoid damage:

## Static Sensitivity

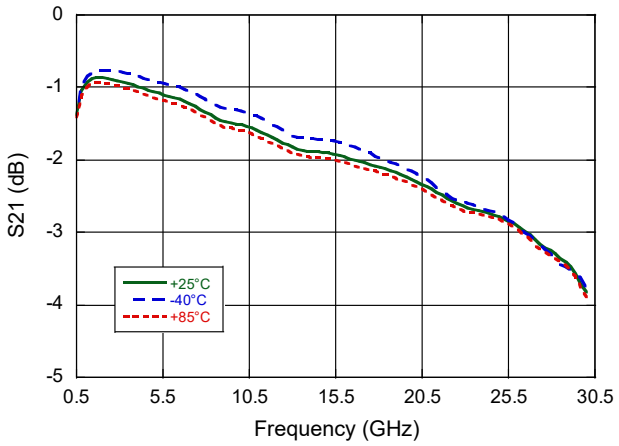
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.This device is ESD defined as HBM Class 1A.

## Truth Table

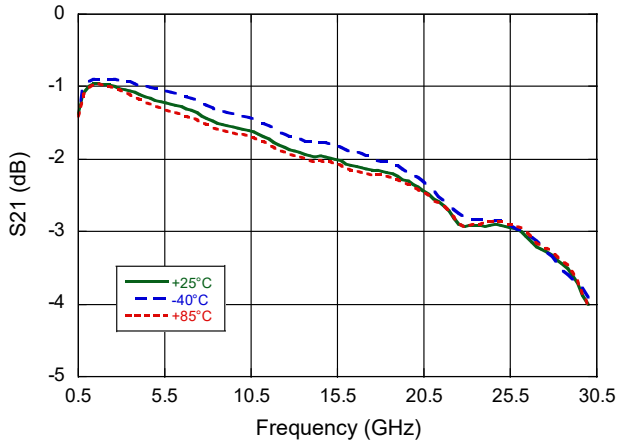
| Inputs | | | Outputs | | | |
|---|---|---|---|---|---|---|
| C1 | C2 | EN | J0-J1 | J0-J2 | J0-J3 | J0-J4 |
| 1 | 1 | 0 | Insertion Loss | Isolation | Isolation | Isolation |
| 0 | 1 | 0 | Isolation | Insertion Loss | Isolation | Isolation |
| 1 | 0 | 0 | Isolation | Isolation | Insertion Loss | Isolation |
| 0 | 0 | 0 | Isolation | Isolation | Isolation | Insertion Loss |
| X | X | 1 | Isolation | Isolation | Isolation | Isolation |

## Typical Performance Curves

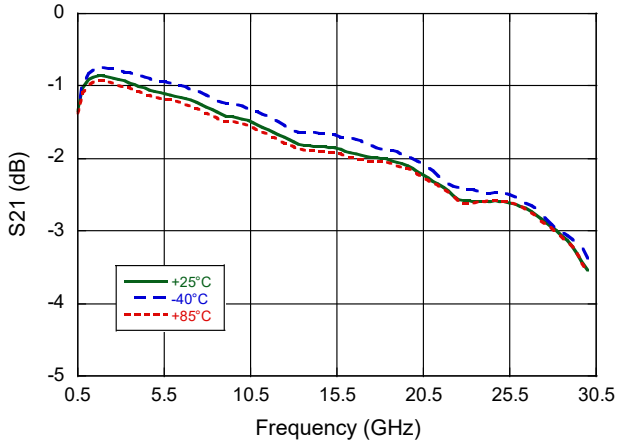
***J0 -J1 Insertion Loss***



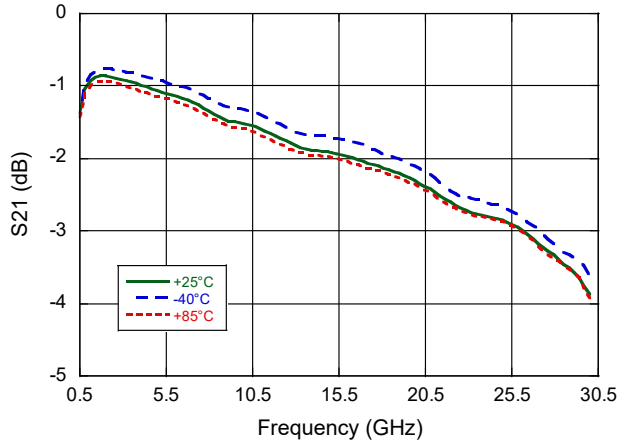

***J0 -J2 Insertion Loss***




***J0 -J3 Insertion Loss***

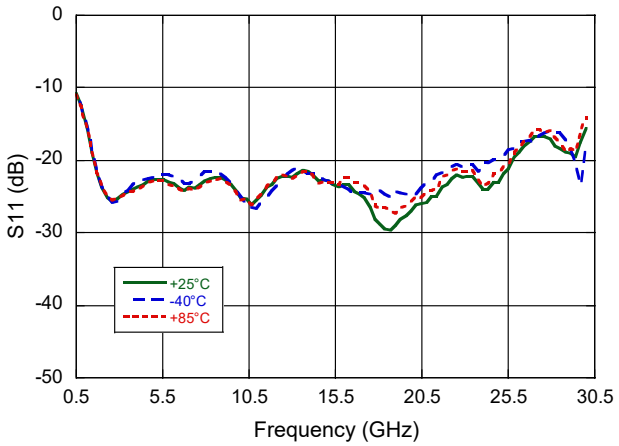



***J0 -J4 Insertion Loss***

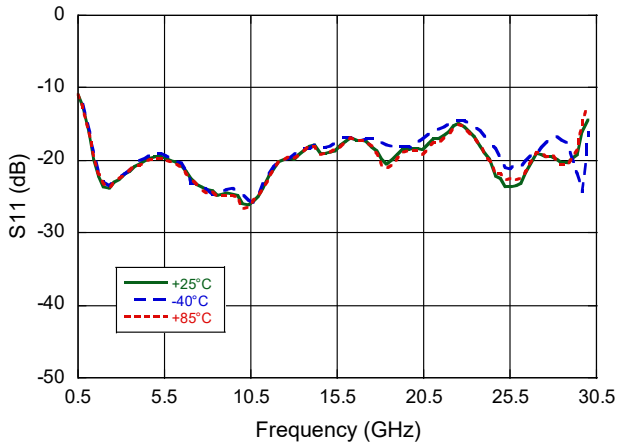


## Typical Performance Curves

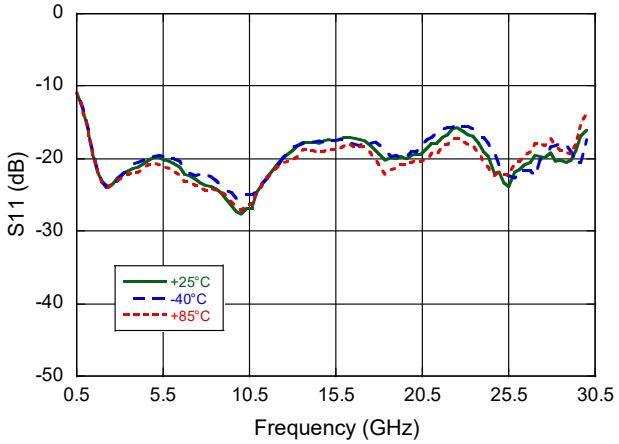
***J0 -J1 Return Loss***



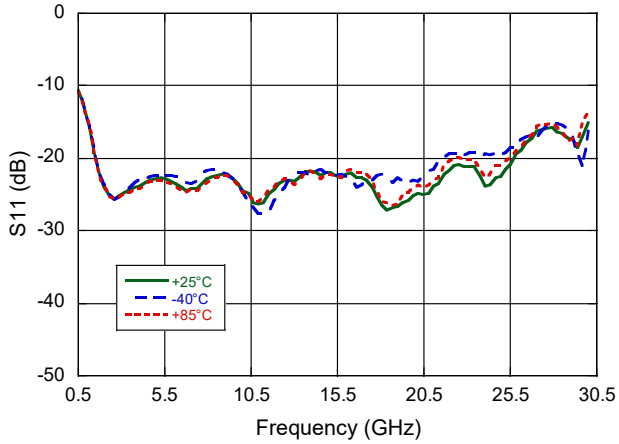

***J0 -J2 Return Loss***




***J0 -J3 Return Loss***

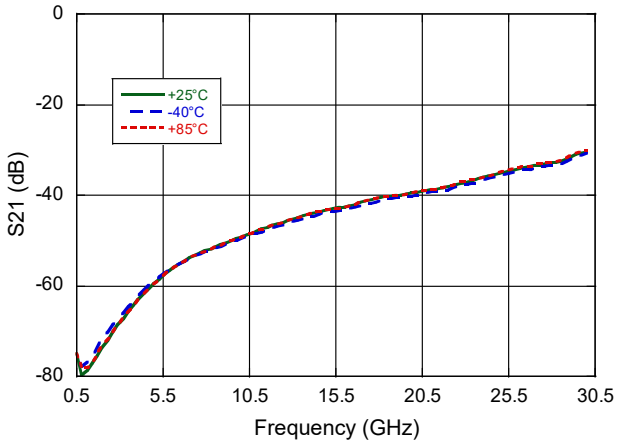



***J0 -J4 Return Loss***

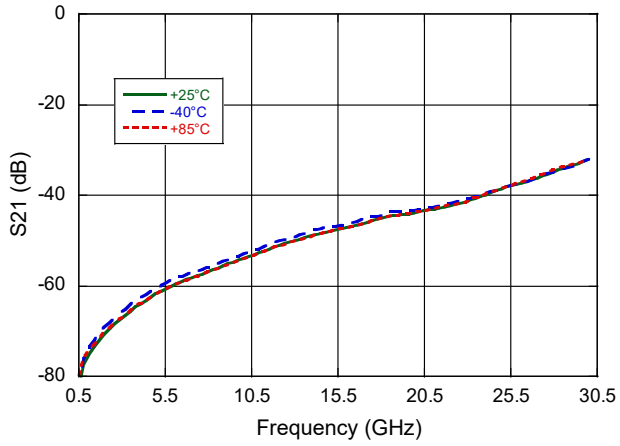


## Typical Performance Curves

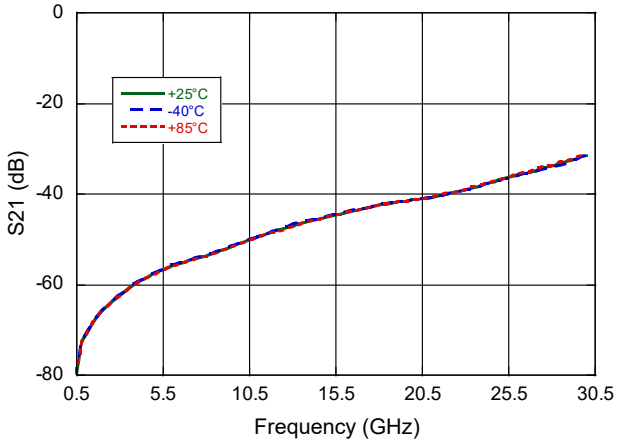
***J0 -J1 Isolation ( J0 -J2 in Insertion Loss )***



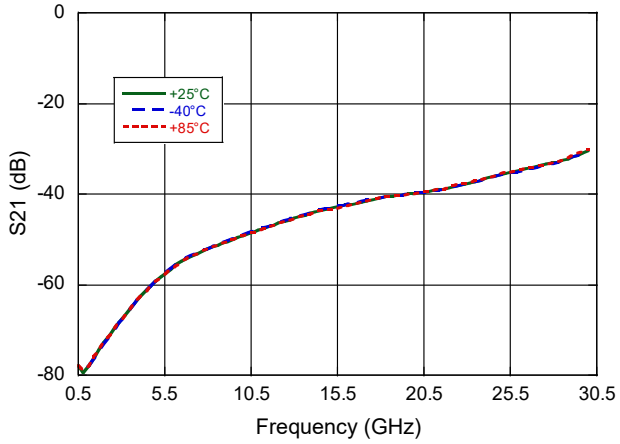

***J0 -J2 Isolation ( J0 -J3 in Insertion Loss )***



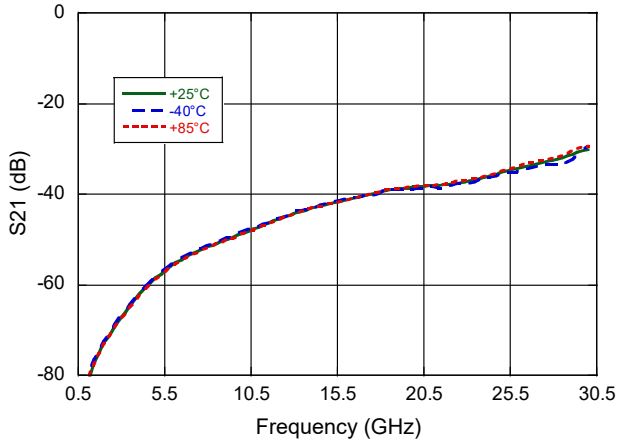

***J0 -J3 Isolation ( J0 -J4 in Insertion Loss)***



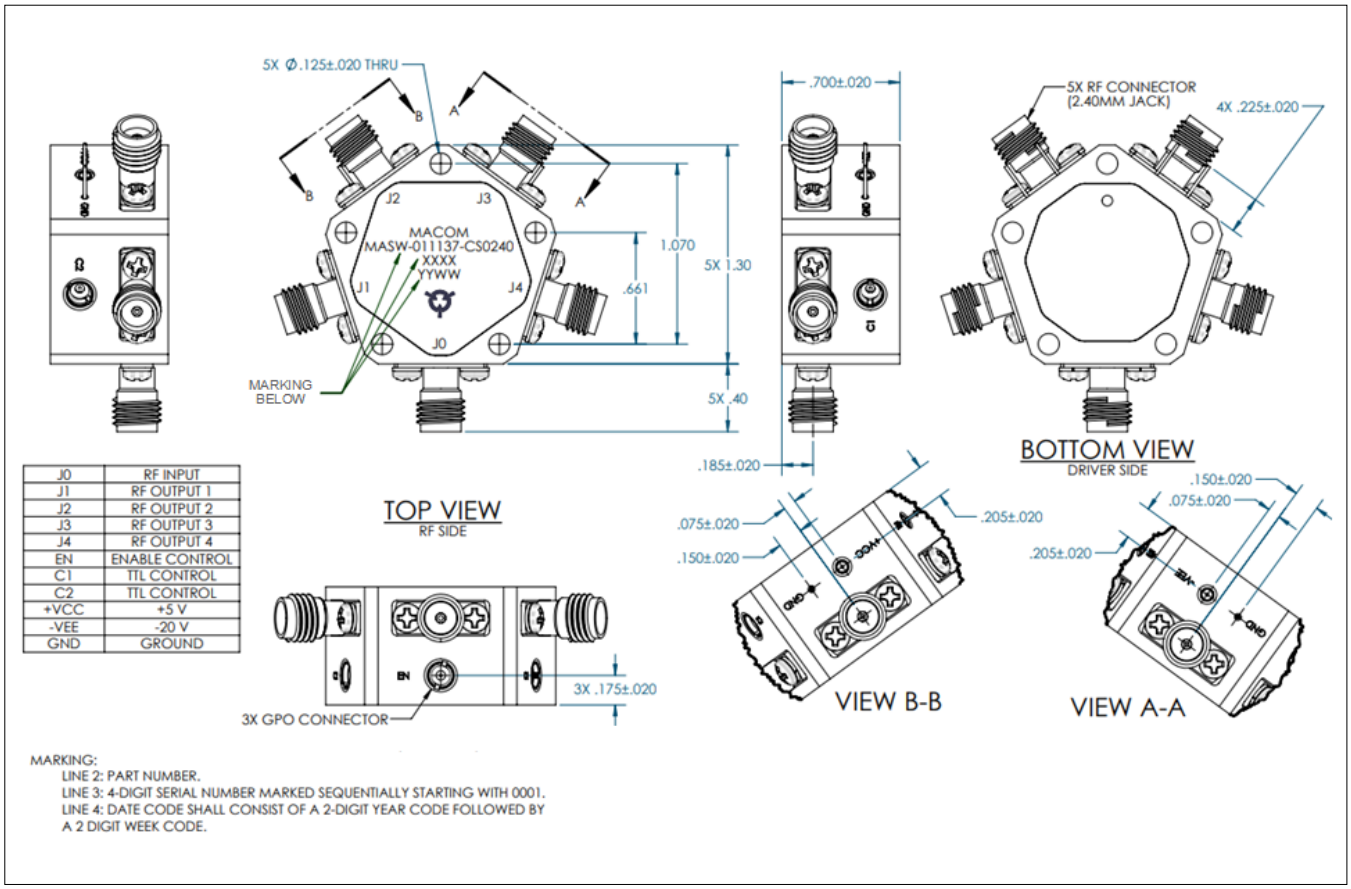

***J0 -J4 Isolation ( J0 -J3 in Insertion Loss)***




***J0 -J1 Isolation ( All Ports in Isolation )***



## Outline Drawing (dimensions shown are in inches)




| | |
|---|---|
| J0 | RF INPUT |
| J1 | RF OUTPUT 1 |
| J2 | RF OUTPUT 2 |
| J3 | RF OUTPUT 3 |
| J4 | RF OUTPUT 4 |
| EN | ENABLE CONTROL |
| C1 | TTL CONTROL |
| C2 | TTL CONTROL |
| +VCC | +5 V |
| -VEE | -20 V |
| GND | GROUND |