

# High Power Reflective SP2T Surface Mount Switch, 30 MHz - 5 GHz



MASW-011209

Rev. V1

## Features

- Higher Power SMT Switch
- Operating Frequency: 30 MHz - 5 GHz
- CW Power Handling:  
53 dBm @ +25°C, 3.5 GHz
- Peak Power Handling:  
62 dBm @ +25°C, 3.5 GHz
- Insertion Loss: 0.5 dB
- Return Loss: 13 dB
- Isolation: 40 dB
- T<sub>ON</sub> Switching Speed: 6 μs
- Input IP3: 70 dBm
- RoHS\* Compliant
- Higher Reliability Compared to Electromechanical Switches

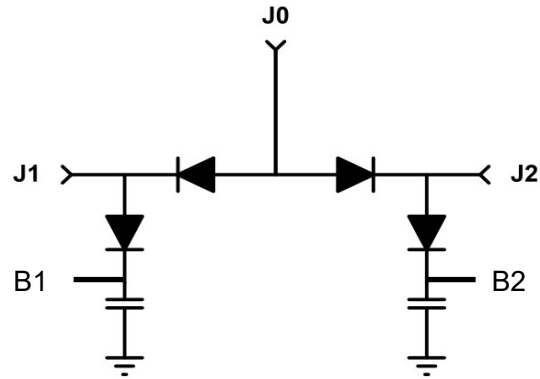
## Applications

- Aerospace and Defense
- Space

## Description

The MASW-011209 is a 30 MHz - 5 GHz reflective surface mount SP2T switch that uses 5 V VDC and 200 V VDC positive voltage only for successful high RF power operation. This product provides an exceptional isolation to insertion loss ratio of 40 dB to 0.7 dB at 5 GHz, with 6 μs switching speed in a 20 x 10 x 3 mm ceramic housing. It is ideally suited for applications requiring higher RF power surface mount switching applications.

## Functional Schematic



## Port Configuration <sup>1</sup>

Port Description	Function
J0	RF Input
J1	RF Output 1
J2	RF Output 2
B1	DC Bias for J1 Shunt Diode
B2	DC Bias for J2 Shunt Diode
GND	RF & DC Voltage Ground Return

1. The backside of the SP2T substrate must be directly connected to thermal, DC, and RF Ground for proper and successful operation.

## Ordering Information

Part Number	Package
MASW-011209	Parts in Gel-Pak
MASW-011209-SMB	Sample Test Board

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

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**Electrical Specifications:  $T_A = 25^\circ\text{C}$ ,  $P_{IN} = 0 \text{ dBm}$ ,  $Z_0 = 50 \Omega$ ,  
DC Power = 5 V @ 200 mA (Insertion Loss ), 200 V @ 25 mA (Isolation)**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss, J0-J1 and J0-J2	1.0 GHz	dB	—	0.2	0.6
	2.5 GHz			0.5	0.9
	4.0 GHz			0.4	0.9
	5.0 GHz			0.3	0.8
Return Loss, J0-J1 and J0-J2	1.0 GHz	dB	—	22	—
	2.5 GHz			15	
	4.0 GHz			18	
	5.0 GHz			18	
Isolation, J0-J1 and J0-J2	1.0 GHz	dB	52	65	—
	2.5 GHz		33	45	
	4.0 GHz		35	44	
	5.0 GHz		29	38	
Switching Speed ( $T_{ON}$ ) <sup>3</sup>	3.5 GHz, 10 kHz TTL repetition rate (50% Control Voltage - 90% RF Voltage)	$\mu\text{s}$	—	6	—
Switching Speed ( $T_{OFF}$ ) <sup>3</sup>	3.5 GHz, 10 kHz TTL repetition rate (50% Control Voltage - 10% RF Voltage)	$\mu\text{s}$	—	3	—
CW Incident Power <sup>2</sup>	3.5 GHz	dBm	—	53	—
Peak Incident Power <sup>2</sup>	3.5 GHz, RF pulse width = 100 $\mu\text{s}$ , 5% duty cycle		—	62	—
Input IP3	F1 = 2.000 GHz, F2 = 2.010 GHz 39 dBm per tone power	dbm	—	71	—

2. Maximum source and load VSWR = 1.2:1 each.

3. Switching speed measured in commutating mode.

## Nominal Operating Conditions<sup>4,5</sup>

Parameter	Nominal Value
CW Incident Power <sup>2</sup>	53 dBm @ +25°C 52 dBm @ +55°C 51 dBm @ +85°C
Peak Incident Power <sup>2</sup>	100 $\mu\text{s}$ , 5% duty 62.0 dBm @ +25°C 61.5 dBm @ +85°C
DC Operating Voltage & Current Bias +V <sub>CC</sub> +V <sub>DD</sub>	5 $\pm$ 3% V @ 200 mA 200 $\pm$ 3% V @ 25 mA
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C

4. Operating at nominal conditions with  $T_J \leq +175^\circ\text{C}$  will ensure MTBF > 1 x 10<sup>6</sup> hours.

5. Maximum Source VSWR = 1.2 :1 and Load VSWR = 1.2:1

## Maximum Survivability Ratings<sup>6,7</sup>

Parameter	Absolute Maximum
CW Incident Power <sup>2</sup>	53.5 dBm @ +25°C 52.5 dBm @ +55°C 51.5 dBm @ +85°C
Peak Incident Power <sup>2</sup>	100 $\mu\text{s}$ , 5% duty 62.5 dBm @ +25°C 62.0 dBm @ +85°C
DC Operating Voltage & Current Bias +V <sub>CC</sub> +V <sub>DD</sub>	5 $\pm$ 5% V @ 250 mA 200 $\pm$ 5% V @ 40 mA
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C

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

7. MACOM does not recommend sustained operation near ANY of these maximum survivability limits.

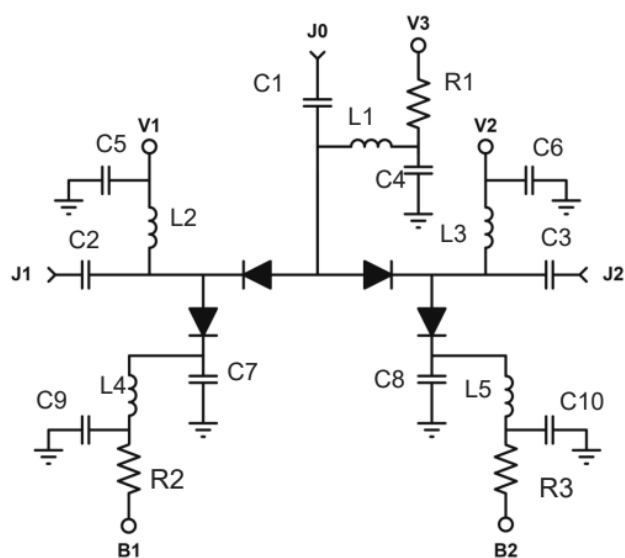
## DC Bias to RF Truth Table<sup>8</sup>

Insertion Loss Typical Bias State = 5 V @ 200 mA, Isolation Bias Typical State = 200 V @ 25 mA

RF State	J0 Bias (V3)	J1 Bias (V1)	B1 Bias	J2 Bias (V2)	B2 Bias
J0-J1 Insertion Loss & J0-J2 Isolation	5 V @ 200 mA	0 V @ 200 mA	200 V @ 0 mA	200 V @ 25 mA	0 V @ 25 mA
J0-J2 Insertion Loss & J0-J1 Isolation	5 V @ 200 mA	200 V @ 25 mA	0 V @ 25 mA	0 V @ 200 mA	200 V @ 0 mA
J0-J1 & J0-J2 Isolation	0 V @ 0 mA	200 V @ 25 mA	0 V @ 25 mA	200 V @ 25 mA	0 V @ 25 mA

8. Current limiting resistors are required for proper DC bias operation and are shown in the switch applications schematic.

## Applications Bias Network Schematic



## Off-Chip Component Values (1 - 5 GHz)

Component	Value
C1 - C3	6.8 nF
C4 - C10	33 pF
L1 - L3	18.7 nH
L4, L5	1.8 nH
R1	12 Ω
R2, R3	7.5 kΩ

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near ANY of these maximum survivability limits.

## 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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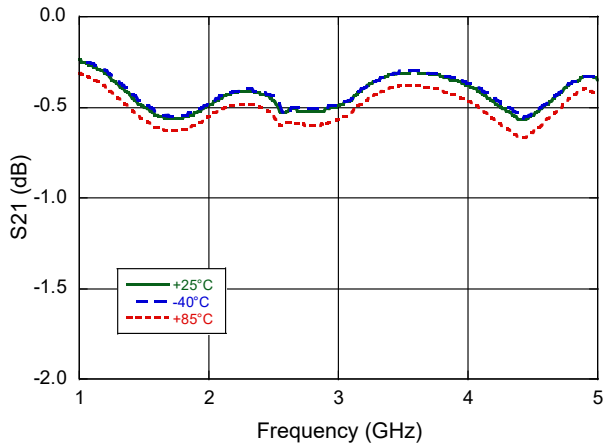
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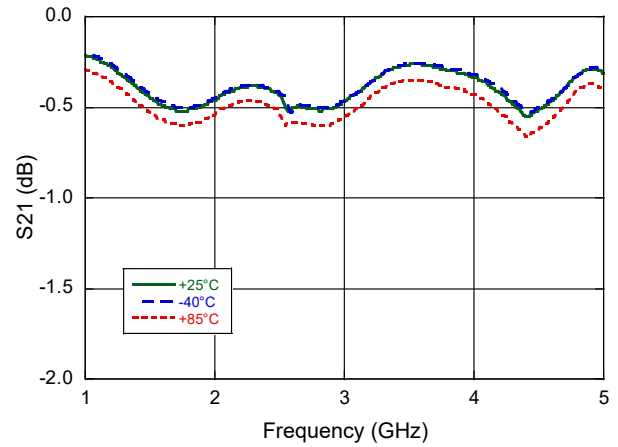
## Typical Performance Curves:

S-Parameter measurements are made on switches soldered to RF evaluation boards with high power components in the band shown.

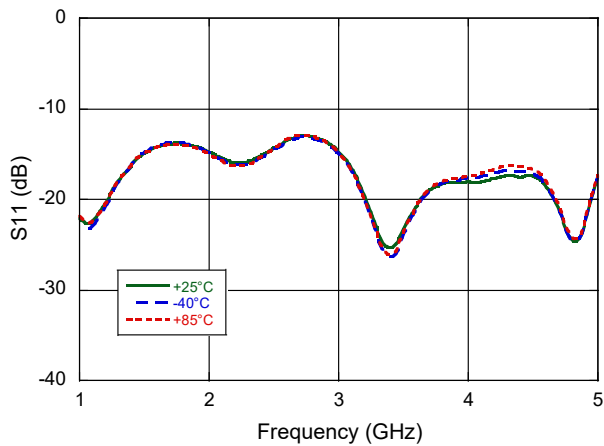
**J0-J1 Insertion Loss**



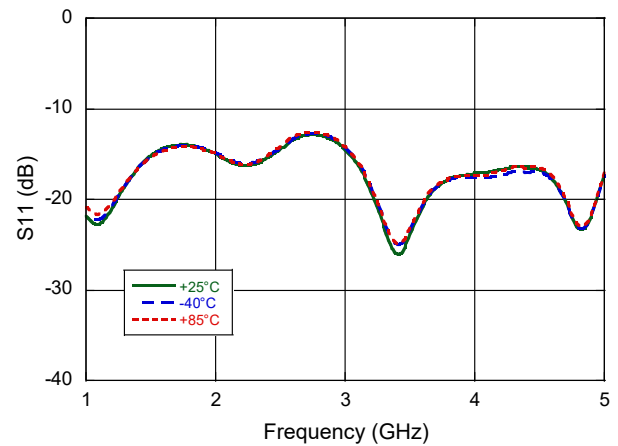
**J0-J2 Insertion Loss**



**J0-J1 Input Return Loss**



**J0-J2 Input Return Loss**



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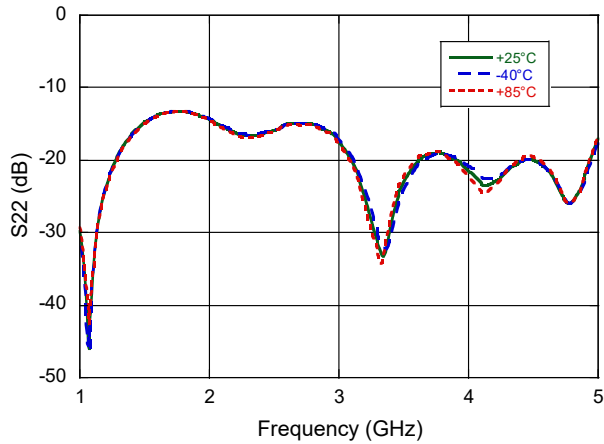


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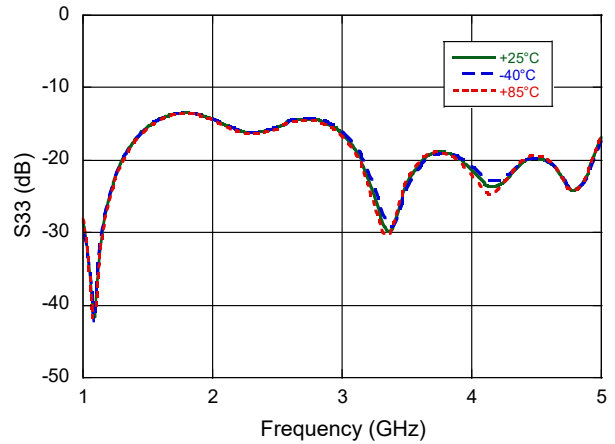
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## Typical Performance Curves: $T_A = +25^\circ\text{C}$

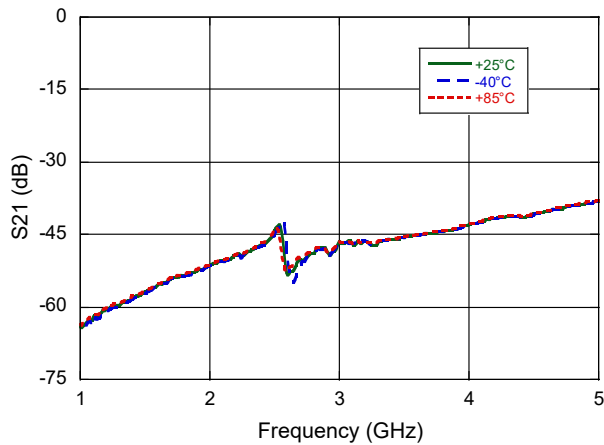
**J1-J0 Output Return Loss**



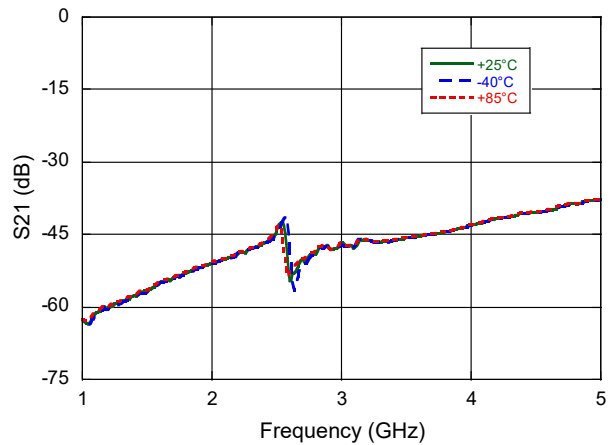
**J2-J0 Output Return Loss**



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



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



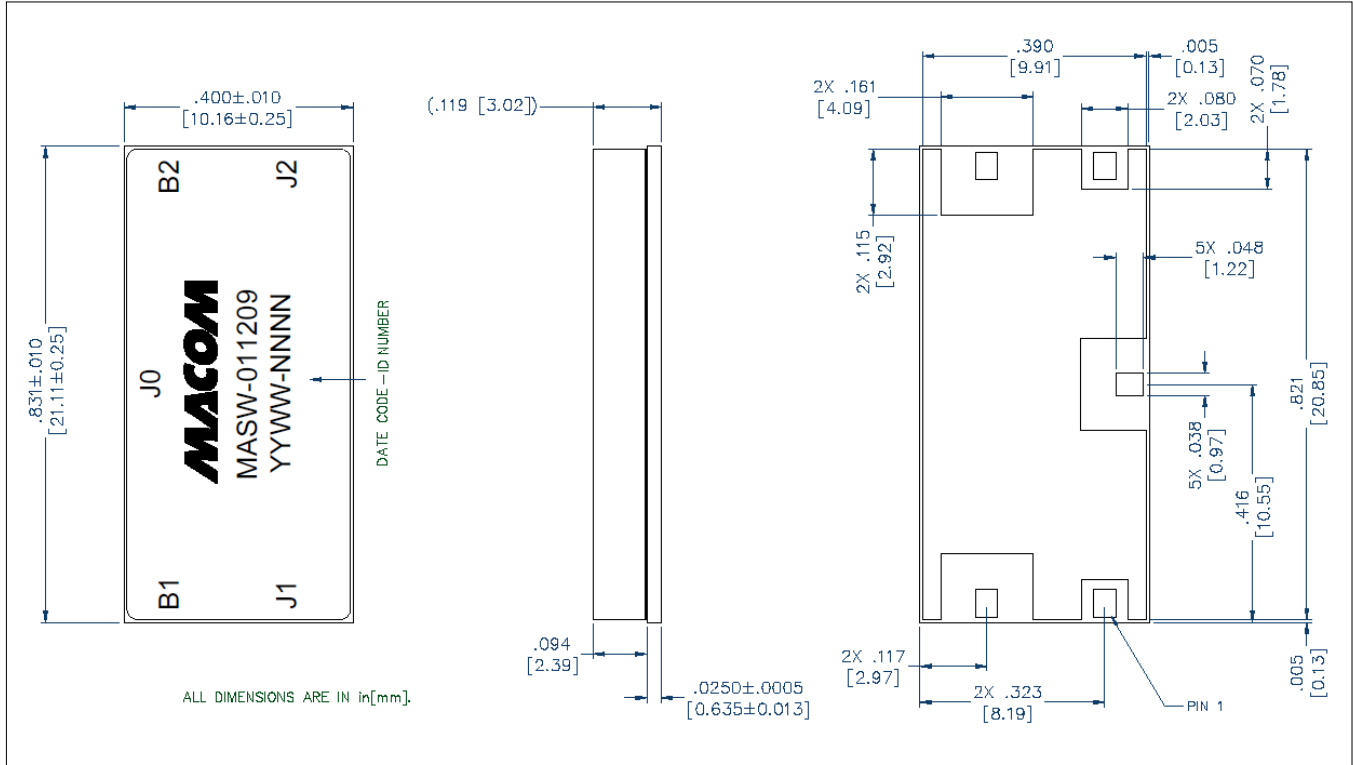
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## Outline Drawing



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