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_{ON} Switching Speed: 6 µs
- Input IP3: 70 dBm
- RoHS* Compliant
- Higher Reliability Compared to Electromechanical Switches

Applications

- Aerospace and Defense
- Space

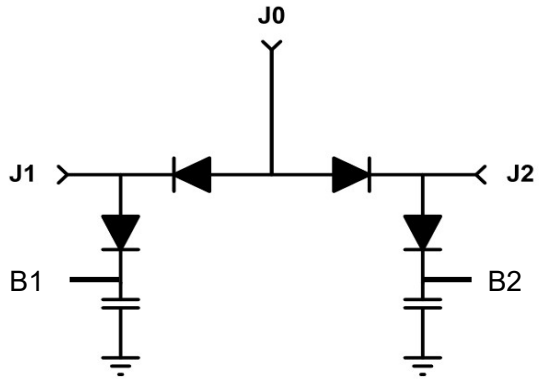
Description

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.

Ordering Information

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

Functional Schematic



Port Configuration [1]

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.

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

Electrical Specifications: T_A = 25°C, P_{IN} = 0 dBm, Z_0 = 50 Ω, 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 2.5 GHz 4.0 GHz 5.0 GHz	dB	—	0.2 0.5 0.4 0.3	0.6 0.9 0.9 0.8
Return Loss, J0-J1 and J0-J2	1.0 GHz 2.5 GHz 4.0 GHz 5.0 GHz	dB	—	22 15 18 18	—
Isolation, J0-J1 and J0-J2	1.0 GHz 2.5 GHz 4.0 GHz 5.0 GHz	dB	52 33 35 29	65 45 44 38	—
Switching Speed (T_{ON})[3]	3.5 GHz, 10 kHz TTL repetition rate (50% Control Voltage - 90% RF Voltage)	µs	—	6	—
Switching Speed (T_{OFF})[3]	3.5 GHz, 10 kHz TTL repetition rate (50% Control Voltage - 10% RF Voltage)	µs	—	3	—
CW Incident Power[2]	3.5 GHz	dBm	—	53	—
Peak Incident Power [2]	3.5 GHz, RF pulse width = 100 µs, 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[4,5]

Parameter	Nominal Value
CW Incident Power[2]	53 dBm @ +25°C 52 dBm @ +55°C 51 dBm @ +85°C
Peak Incident Power[2]	100 µs, 5% duty 62.0 dBm @ +25°C 61.5 dBm @ +85°C
DC Operating Voltage & Current Bias $+V_{CC}$ $+V_{DD}$	 5 ± 3% V @ 200 mA 200 ± 3% V @ 25 mA
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C

4. Operating at nominal conditions with $T_J \leq +175°C$ will ensure MTBF > 1 x 10^6 hours.
5. Maximum Source VSWR = 1.2 :1 and Load VSWR = 1.2:1

Maximum Survivability Ratings[6,7]

Parameter	Absolute Maximum
CW Incident Power[2]	53.5 dBm @ +25°C 52.5 dBm @ +55°C 51.5 dBm @ +85°C
Peak Incident Power[2]	100 µs, 5% duty 62.5 dBm @ +25°C 62.0 dBm @ +85°C
DC Operating Voltage & Current Bias $+V_{CC}$ $+V_{DD}$	 5 ± 5% V @ 250 mA 200 ± 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.

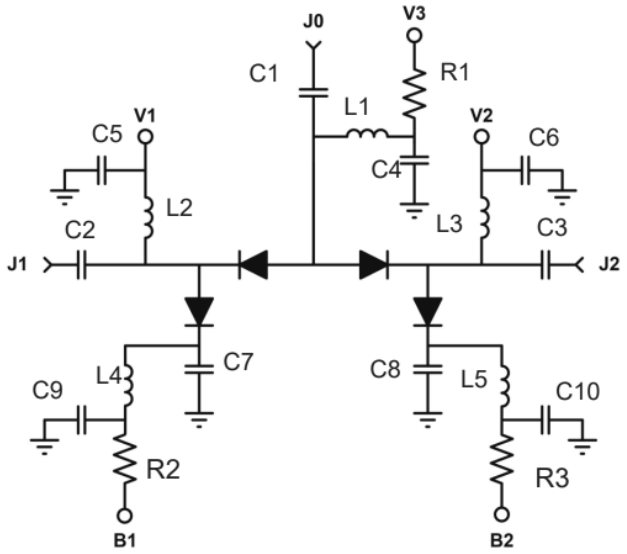
DC Bias to RF Truth Table[8]

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

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.

Handling Procedures

Please observe the following precautions to avoid damage:

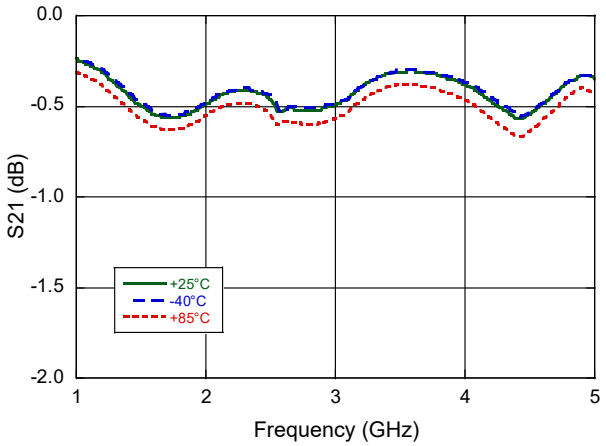
Static Sensitivity

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.

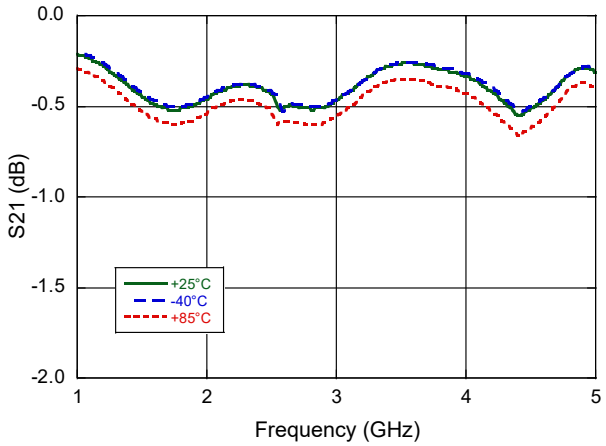
Typical Performance Curves:

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

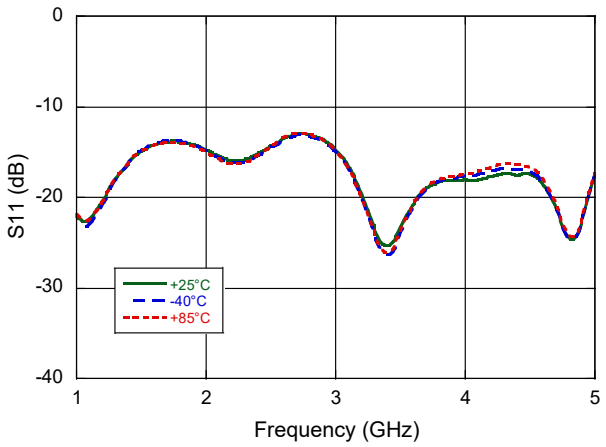
J0-J1 Insertion Loss



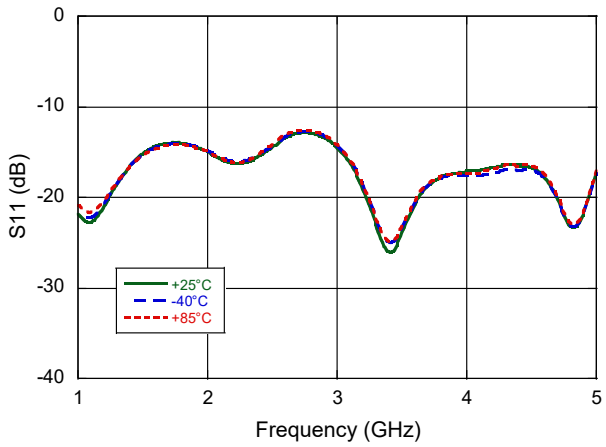
J0-J2 Insertion Loss



J0-J1 Input Return Loss

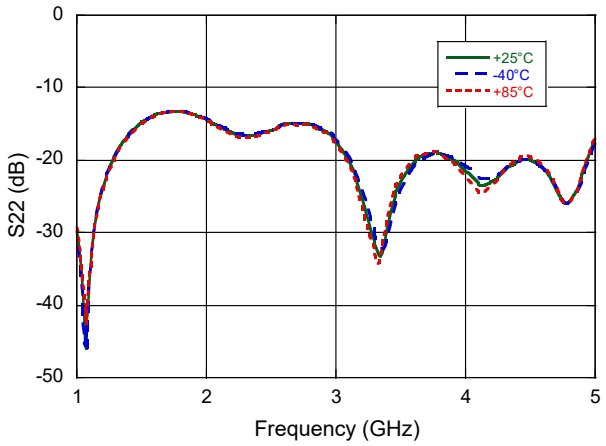


J0-J2 Input Return Loss

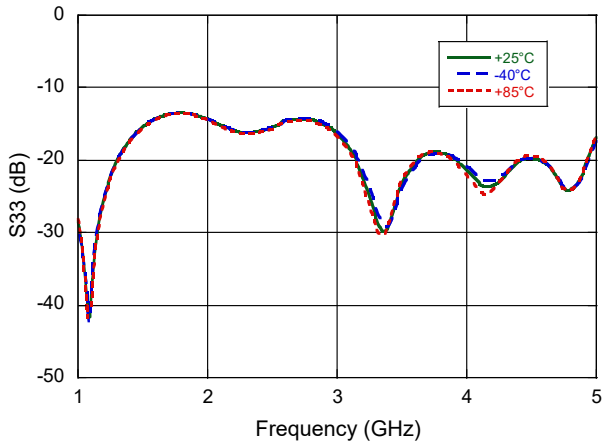


Typical Performance Curves: T_A = +25°C

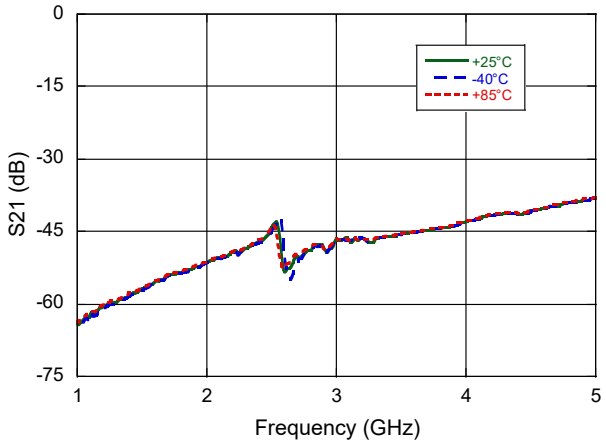
J1-J0 Output Return Loss



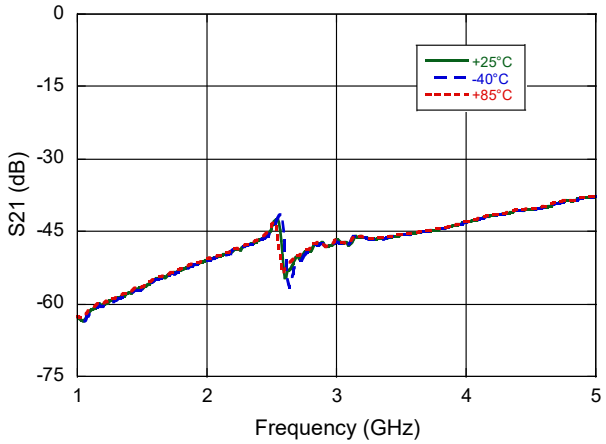
J2-J0 Output Return Loss



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



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



Outline Drawing