Ka-Band High Power Reflective SPDT PIN Switch Die 26 - 40 GHz

MASW-010646

Rev. V6

Features

- Broadband Performance, 26 to 40 GHz
- Low Loss: 0.6 dB
- High Isolation: 32 dB
- Up to 13 W CW Power, +85°C
- Die with G-S-G RF Pads and DC Bias Pads
- Includes DC Blocks and RF Bias Networks
- RoHS* Compliant

Applications

- Aerospace & Defense

Description

The MASW-010646 is a high power, broadband, reflective, high linearity, SPDT switch die. This switch was developed for Ka–Band applications that require up to 13 W of power handling while maintaining low insertion loss and high isolation.

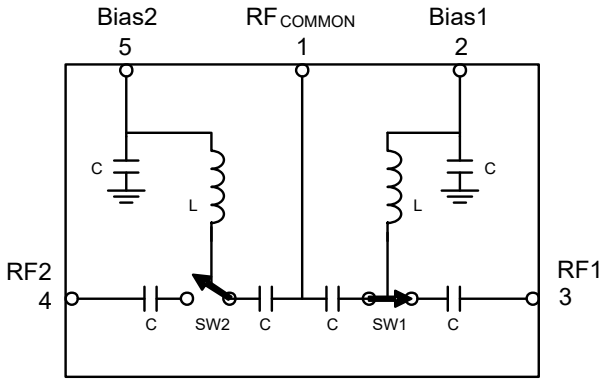
The SPDT MMIC utilizes MACOM's proven AlGaAs PIN diode technology. The switch is fully passivated with silicon nitride and has an added polymer layer for scratch protection. The protective coating prevents damage to the junction and the anode air-bridge during handling and assembly. The die has backside metallization to facilitate an epoxy die attach process.

Ordering Information[1]

Part Number	Package
MASW-010646-13940G	Die in Gel Pack
MASW-010646-13940W	Die in Waffle Pack

1. Die quantity varies.

Functional Diagram



Pad Configuration:

(Back Metal is RF, DC, and Thermal Ground)

Pad #	Function
1	RF_{COMMON}
2	BIAS 1
3	RF1
4	RF2
5	BIAS 2

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

Electrical Specifications:
Freq. = 28 - 38 GHz, T_A = +25°C, I_F[2] = +25 mA, V_R[3] = -15 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (RF_{COMMON} to RFx ON state)	26 GHz 28 GHz 35 GHz 38 GHz 40 GHz	dB	—	0.60 0.60 0.60 0.60 0.70	— 0.90 0.90 0.90 —
Isolation (RF_{COMMON} to RFx OFF state)[4]	26 GHz 28 GHz 35 GHz 38 GHz 40 GHz	dB	— 29 33 35 —	34 35 39 41 42	—
Return Loss (RF_{COMMON})	26 GHz 28 GHz 35 GHz 38 GHz 40 GHz	dB	—	16 18 16 16 16	—
Return Loss (RFx ON state)	26 GHz 28 GHz 35 GHz 38 GHz 40 GHz	dB	—	16 18 16 16 16	—
CW Power Handling (ON state)[3]	-25 V, +85°C	dBm	—	41.2	—
Switching Speed T_{ON} / T_{OFF} T_{RISE} / T_{FALL}	 50% DC to 90% RF / 50% DC to 10% RF 10% to 90% RF / 90% to 10% RF	ns	—	 25 / 23 9 / 9	—
Reverse Bias Voltage[3]	—	V	-32	-15	-5
Reverse Bias Current[3]	-15 V	nA	—	25	—

2. Forward bias current (I_F) is set using external bias resistors (R_{BIAS}) placed at pins Bias1 and Bias2, where R_{BIAS} = (V_{CC} - 1.32 V) / I_F.
3. Reverse bias voltage should be determined based on working conditions. For example, -25 V @ 41.2 dBm input power. For lower power applications, a less negative voltage can be used. R. Caverly and G. Hiller, "Establishing the Minimum Reverse Bias for a PIN Diode in a High Power Switch," IEEE Transactions on Microwave Theory and Techniques, Vol.38, No.12, December 1990.
4. Isolation defined with 1 port in low loss state.

Absolute Maximum Ratings[5,6]

Parameter	Absolute Maximum
DC Reverse Bias Voltage	50 V
Forward Bias Current	40 mA
CW Incident Power	43 dBm @ 85°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

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

Truth Table

RF_{COMMOM} Path	Bias 1	Bias 2
RF1 Insertion Loss RF2 Isolation	-15 V	25 mA
RF2 Insertion Loss RF1 Isolation	25 mA	-15 V

Minimum Reverse Bias Voltage[7]

Frequency (GHz)	DC Voltage (V)
26	16
30	14
35	12
40	11

7. Minimum DC bias voltage to maintain low loss under 41.2 dBm of power with 1.5:1 VSWR.

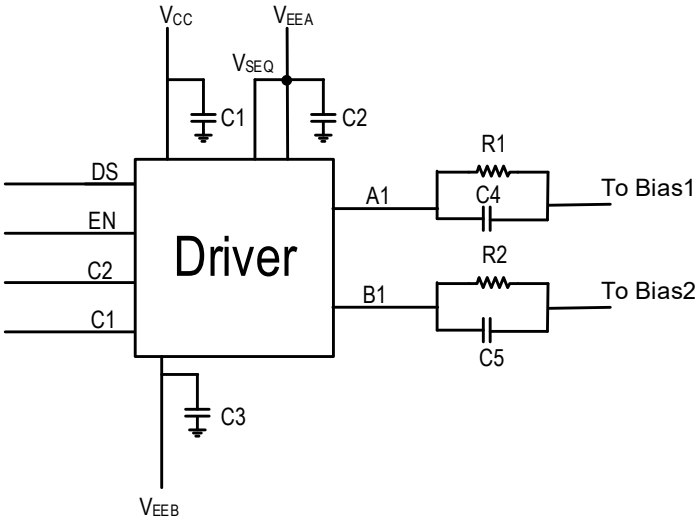
Handling Procedures

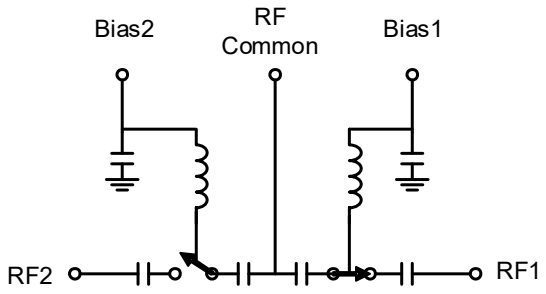
Please observe the following precautions to avoid damage:

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 HBM Class 1A devices.

MASW-010646 with MADR-011020 Driver Application Schematic





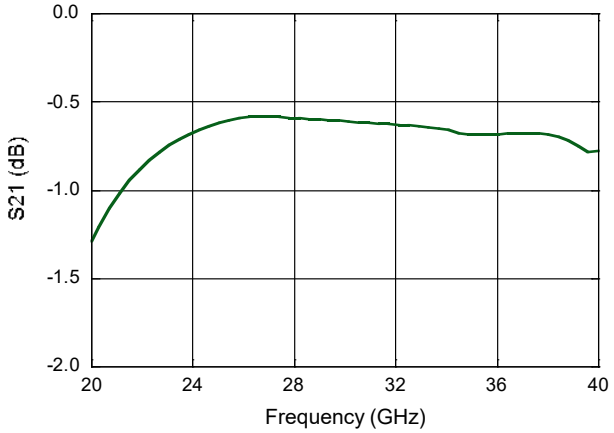
Parts List[8]

Part	Value
C1, C3	0.1 µF
C2	47 pF
C4, C5	470 pF
R1, R2	150 Ω

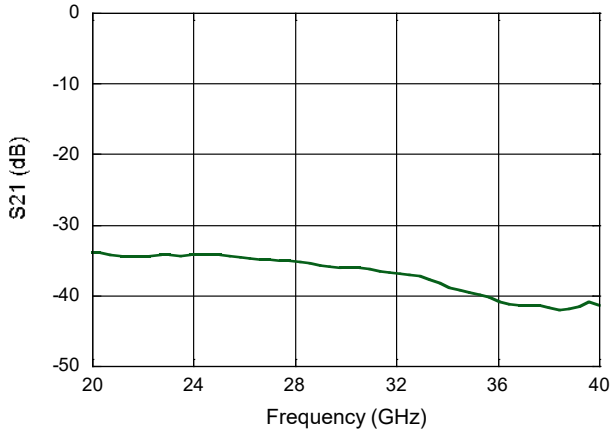
8. Resistor values calculated to provide 25 mA of bias current given V_{CC} = 5 V.

Typical Performance: T_A = +25°C, +25 mA, -15 V, Z_0 = 50 Ω

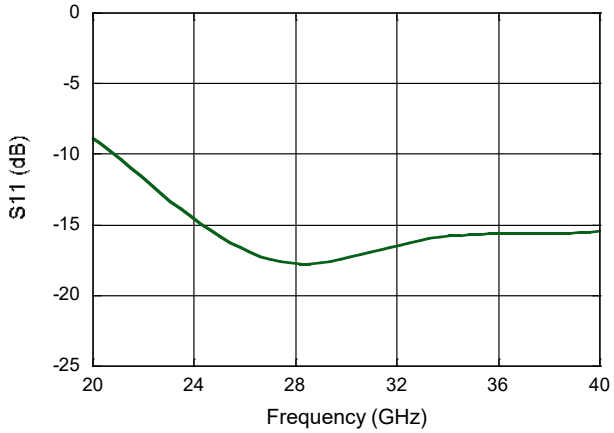
Insertion Loss (On State)



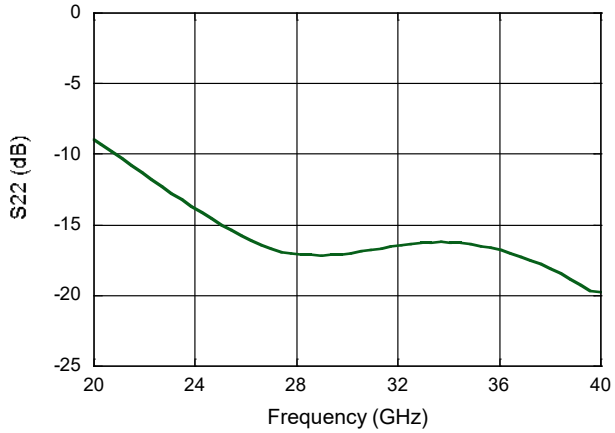
Isolation (Off State)



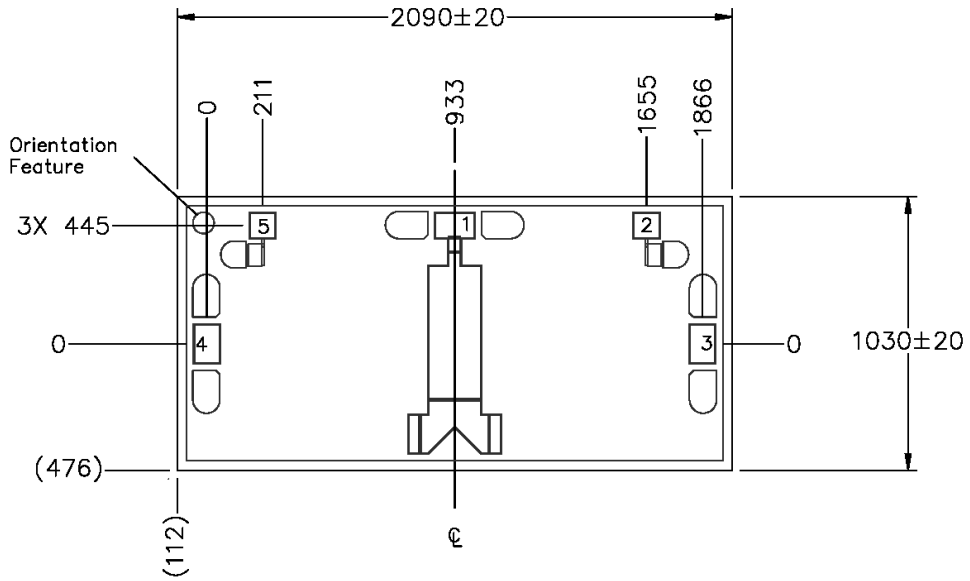
RF_{COMMON} Return Loss ((On State)



RF1, 2 Return Loss (On State)



Die Outline†



† Dimensions indicated in µm.
Die Thickness : 100 µm
RF Pads (1, 3 & 4) are 100 x 150 µm.
DC Bias Pads (2 & 5) are 100 x 100 µm.
Meets JEDEC moisture sensitivity level 1 requirements.