AlGaAs SP2T Reflective PIN Diode Switch
20 - 55 GHz

MASW-011173-DIE
Rev. V2

Features

- Low Loss: 1 dB, 22 to 45 GHz
- 30 dBm CW Power Handling @ +85°C, 40 GHz
- Switching Speed <30 ns
- Integrated DC Blocks and Bias Networks
- Die with GSG RF Pads and DC Bias Pads
- RoHS* Compliant

Applications

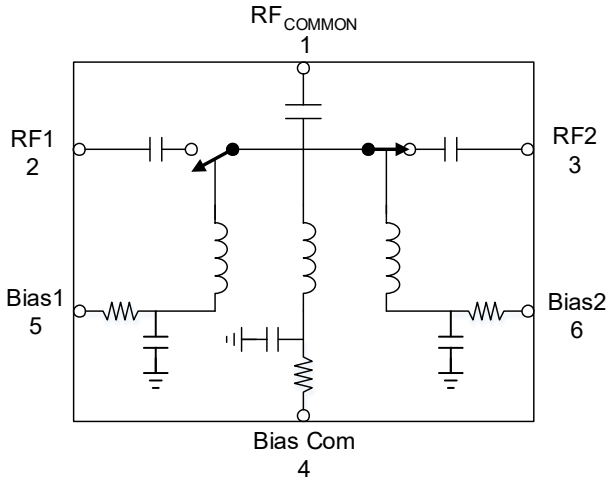
- Test Equipment
- Switching Arrays of Radar Systems
- Point-to-Point Communications
- Multi-Assembly Components

Description

The MASW-011173-DIE is a high power SP2T switch with integrated bias networks. This broadband, reflective switch was developed for 20 - 55 GHz applications that require up to 30 dBm (1 W) power handling while maintaining low insertion loss, high isolation, and fast switching speed. These switches are suitable for multiple applications.

This SP2T 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 air-bridges during handling and assembly. The die has backside metallization designed to facilitate an epoxy die attach process.

Functional Schematic



Pin Configuration[1]

Pin #	Function
1	RF Common
2	RF 1
3	RF 2
4	Bias Common
5	Bias 1
6	Bias 2
Backside	Ground[1]

1. The entire exposed pad on the die bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MASW-011173-DIE	Gel-Pak
MASW-011173-DIEW	Waffle Pack
MASW-011173-SMB	Sample Board

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

Electrical Specifications: T_A = +25 °C, I_{ON} = -5 mA, I_{OFF} = +5 mA, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion loss (RF_{COMMON} to RF_X ON state)	20 GHz 40 GHz 50 GHz 55 GHz	dB	—	1.3 0.8 1.1 1.5	1.7 1.2 1.5 —
Isolation (RF_{COMMON} to RF_X OFF state)	20 GHz 40 GHz 50 GHz 55 GHz	dB	35 25 23 —	40 30 28 28	—
Return loss (RF_{COMMON})	20 GHz 40 GHz 50 GHz 55 GHz	dB	—	10 20 18 14	—
Return loss (RF_X)	20 GHz 40 GHz 50 GHz 55 GHz	dB	—	10 20 16 13	—
CW Power Handling (ON state)	40 GHz, +85°C	dBm	—	30	—
P0.1dB	40 GHz	dB	—	>30	—
Switching Speed	T_{RISE} / T_{FALL} (10% - 90% RF) T_{ON} / T_{OFF} (50% control to 90% RF)	ns	—	<30	—
IIP3	30 GHz 40 GHz	dBm	—	>55 >48	—

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Incident Power (ON path) @ Baseplate, 40 GHz +85°C +25°C	 31 dBm 33 dBm
I_{ON}	10 mA
I_{OFF}	10 mA
V_R	50 V
Junction Temperature[4]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55 °C to +150 °C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with $T_J \leq +150°C$ will ensure MTTF > 1 x 10^6 hours.

Handling Procedures

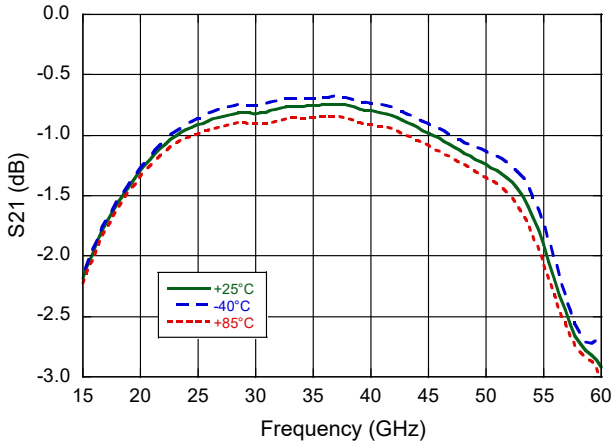
Please observe the following precautions to avoid damage:

Static Sensitivity

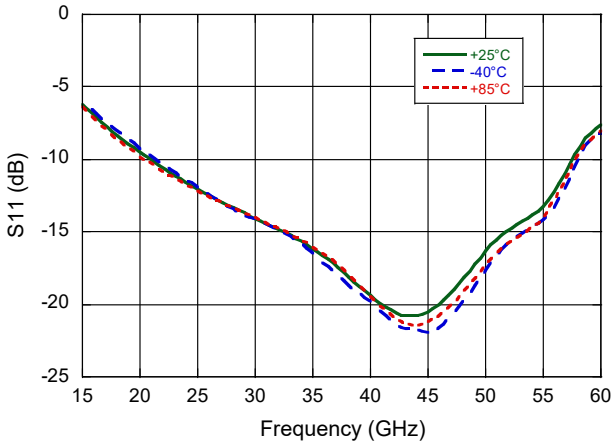
These HBM Class 1A electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance: On-Wafer Probe, I_{ON} = -5 mA, I_{OFF} = +5 mA, Z_0 = 50 Ω

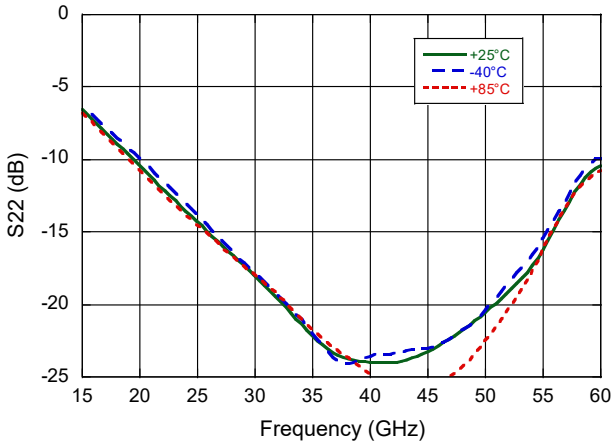
Insertion Loss



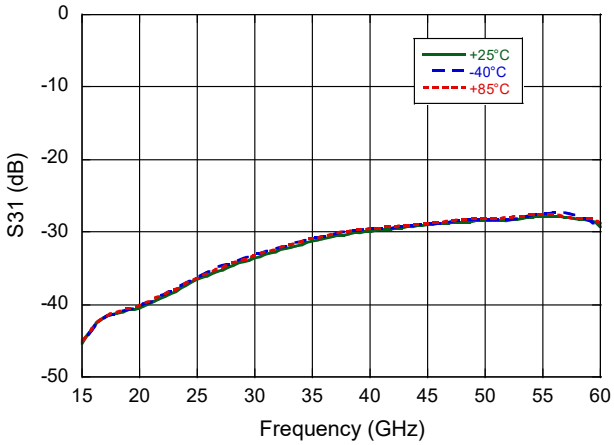
RF_{COMMON} Return Loss



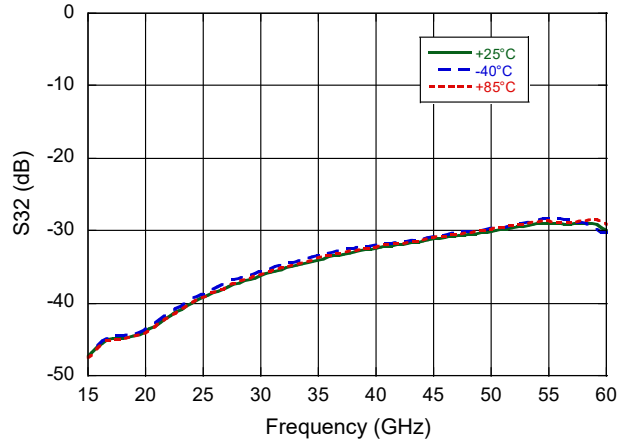
RF1, RF2 Return Loss



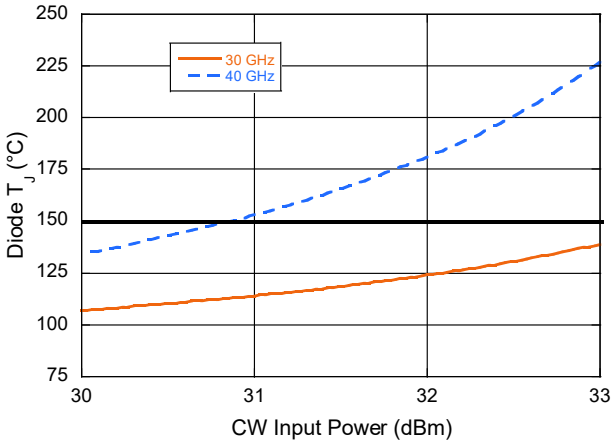
Isolation RF_{COM} to RF1, RF2



Isolation RF1 to RF2



Diode Junction Temperature with +85°C Baseplate[5,6]

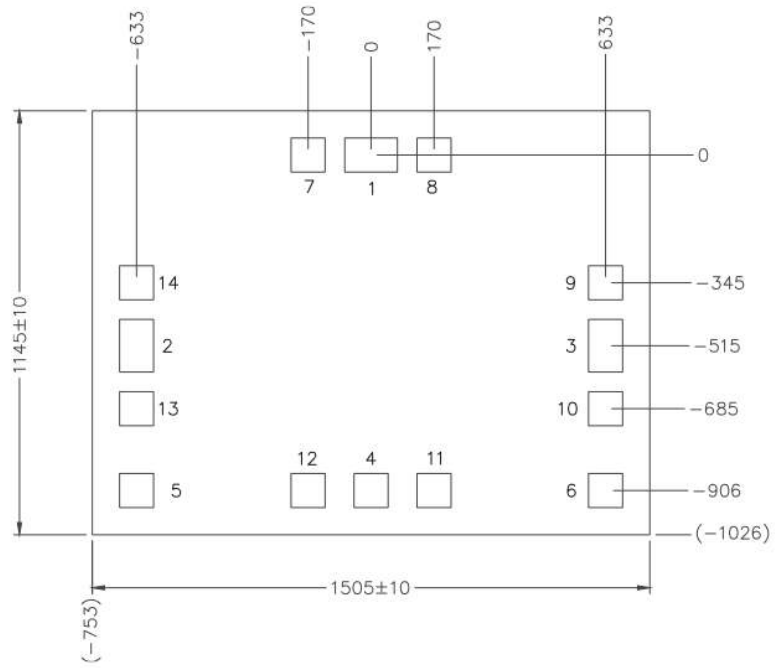


5. The die is mounted to the SMB with high thermal conductivity epoxy.
6. Operating with Diode Junction Temperature ≤ +150°C will ensure MTTF > 1 x 10^6 hours.

Truth Table

State	R_{COMMON}	B1	B2
RF_{COM} to RF1 ON	≥ 1.6 kΩ to Ground	-5 mA	+5 mA
RF_{COM} to RF2 ON		+5 mA	-5 mA

Outline Drawing



BOND PAD DIM. (μm)			
PAD	X	Y	PIN LABEL
1	142	92	RF_{COM}
2	92	142	RF1
3	92	142	RF2
4	92	92	B_{COM}
5	92	92	B1
6	92	92	B2
7–14	92	92	GND

NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHOWN ARE μm WITH A TOLERANCE OF ±5μm.
2. DIE THICKNESS IS 100 ±10μm
3. BOND PAD/BACKSIDE METALLIZATION: GOLD.

Solder Die Attach

All die attach and bonding methods should be compatible with gold metal. Solder which does not scavenge gold, such as 80 Au/20 Sn or Indalloy #2, is recommended. Do not expose die to a temperature greater than 300°C for more than 10 seconds.

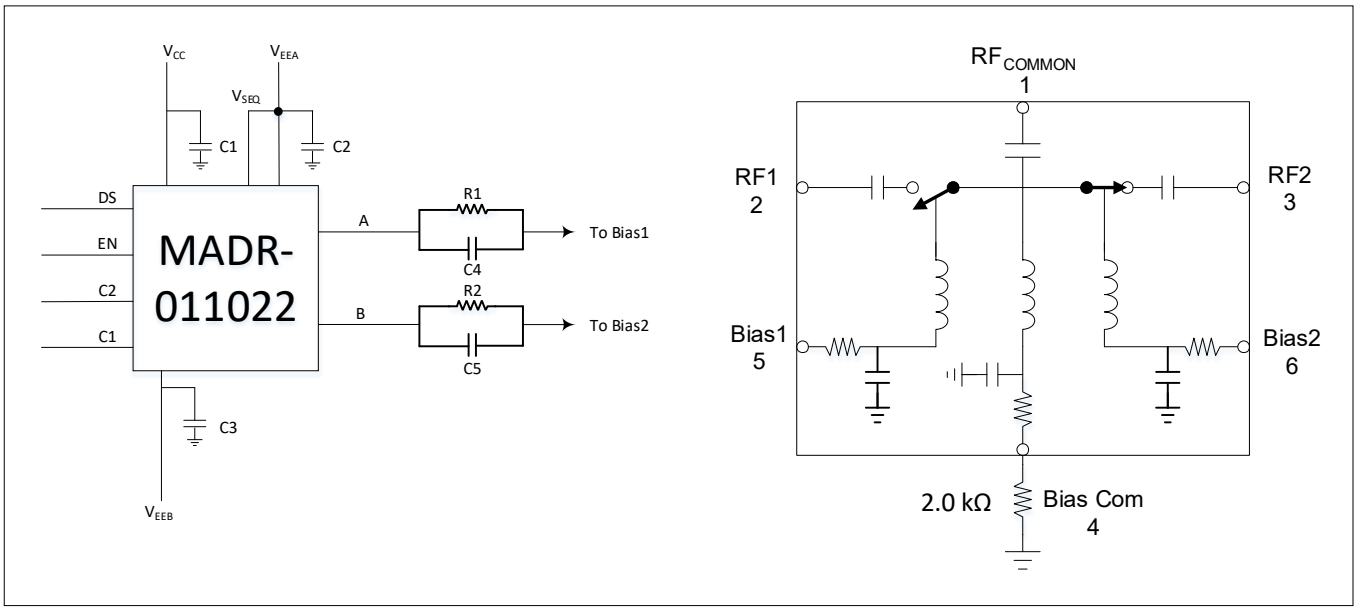
Electrically Conductive Epoxy Die Attach

Assembly can be preheated to approximately 125°C. Use a controlled thickness of approximately 1 mils for best electrical conductivity and lower thermal resistance. A thin epoxy fillet should be visible around the perimeter of the chip after placement. Cure epoxy per manufacturer's schedule. For extended cure times, temperatures should be kept below 150°C.

Wire / Ribbon Bonding

Wedge thermo compression bonding may be used to attach ribbons to the RF bonding pads. Gold ribbons should be at least 1/2 by 3 mil for lowest inductance. The same gold ribbon or 1 mil dia. gold wire is recommended for all DC pads.

MASW-011173-DIE with MADR-011022 Driver Application Schematic



Parts List

Part	Value
C1, C3	0.1 µF
C2	47 pF
C4, C5	470 pF
R1, R2	723 Ω
R_{COMMON}	2 kΩ

MADR-011022	Voltage
VCC	+5 V
VEEA and VEEB	-15 V
Logic “0”	0 V
Logic “1”	+5 V

Application Control Table

State	EN	DS	C2	C1	A Output	B Output
RFCOM to RF1	0	0	0	0	-15 V @ -5 mA	+5 V @ +5 mA
RFCOM to RF2	0	0	0	1	+5 V @ +5 mA	-15 V @ -5 mA

*Full logic truth table can be found on MADR-011022 datasheet.