

W-Band, 75 - 100 GHz, AlGaAs SP3T  
PIN Diode Switch with integrated bias circuits

Rev. V1a

Features

- 60-110GHz Broadband Operating Frequency
- 1.3dB Insertion Loss
- 33dB Isolation
- Silicon Nitride Passivation
- BCB Scratch Protection
- Lead-Free GaAs MMIC Chip
- RoHS\* Compliant and 260°C Reflow Compatible

Description

The MASW-011029 is a W-Band SP3T Switch manufactured using MACOM’s patented AlGaAs PIN Diode MMIC process, on a semi-insulating GaAs substrate. The device is fully passivated with silicon nitride and has an additional layer of BCB for scratch protection. This protective coating prevents damage to the circuit during automated or manual handling. These devices are suitable for pick and place insertion.

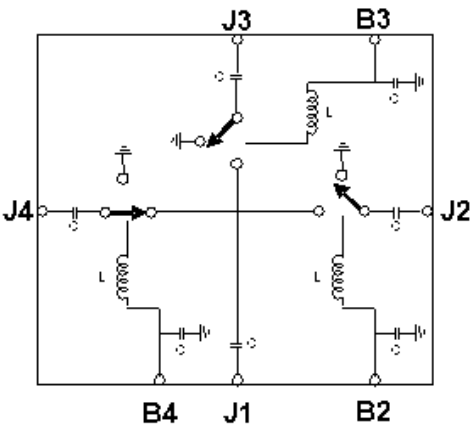
Each RF port contains DC blocking capacitors and a DC bias circuit consisting of high impedance lines and RF bypass capacitors. This device has 100 um gold plated bonding pads at all RF and DC ports. RF and DC ground backside gold plating allows conventional chip bonding techniques using 80Au/20Sn solder, Indalloy solder, or electrically conductive silver epoxy.

Applications include satellite communications, millimeter-wave radar, 77GHz automotive cruise control radar, and 94GHz imaging in astronomy, defense, and security applications.

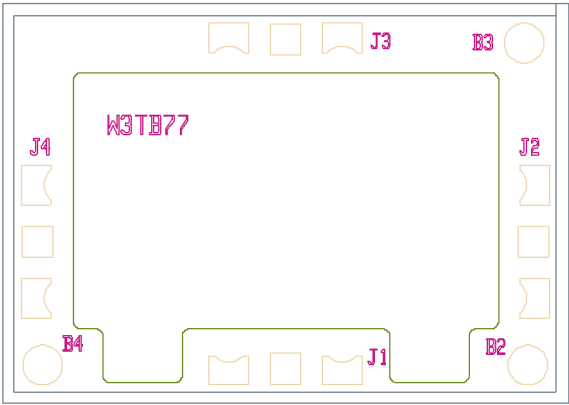
Ordering Information

Part Number	Package
MASW-011029-14140W	Waffle Pak

Functional Schematic



Outline



Bondpad Configuration<sup>3, 4</sup>

Bondpad No.	Function
J1	Common, RF1 (GSG)
J2	Output, RF2 (GSG)
B2	J2 Bias Control
J3	Output, RF3 (GSG)
B3	J3 Bias Control
J4	Output, RF4 (GSG)
B4	J4 Bias Control

3. Bondpad Metal is gold and Backside Metal is gold.  
4. The backside metal must be connected to RF and DC ground.

1      \* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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**Electrical Specifications: Freq. = 75 - 100 GHz,  $T_A = 25^\circ\text{C}$ , +10 mA / -25 V,  $Z_0 = 50\ \Omega$**

Parameter	Units	Min.	Typ.	Max.
Insertion Loss	dB	—	1.3	—
Isolation	dB	—	33	—
Forward Bias, 10 mA	V	1.15	—	1.40
Blocking Capacitor Leakage Current, -25 V	nA	—	—	50
Diode Leakage Current, -32 V	nA	—	—	50
Switching Speed, 10% - 90% RF Voltage	ns	—	2	—

### Absolute Maximum Ratings<sup>5,6</sup>

Parameter	Absolute Maximum
Input Power	+23 dBm
DC Current, per diode	15 mA
DC Voltage	-25 V
Junction Temperature <sup>7</sup>	+150°C
Operating Temperature	-25°C to +85°C
Storage Temperature	-65°C to +150°C

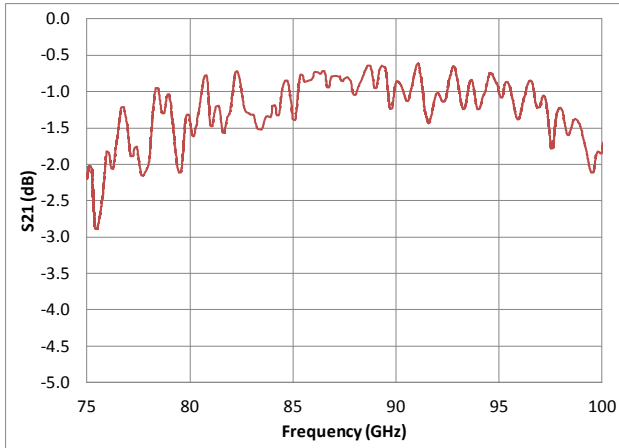
5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with  $T_J \leq +150^\circ\text{C}$  will ensure MTBF >  $1 \times 10^6$  hours.

## W-Band, 75 - 100 GHz, AlGaAs SP3T PIN Diode Switch with integrated bias circuits

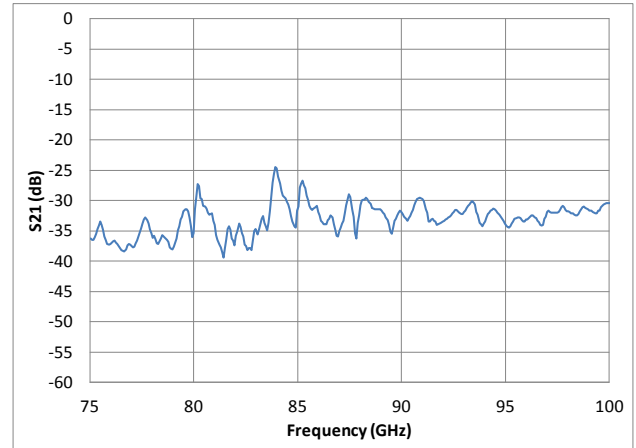
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### MASW-011029 Typical Performance Curves, 75 - 100 GHz<sup>8</sup>

**Insertion Loss**

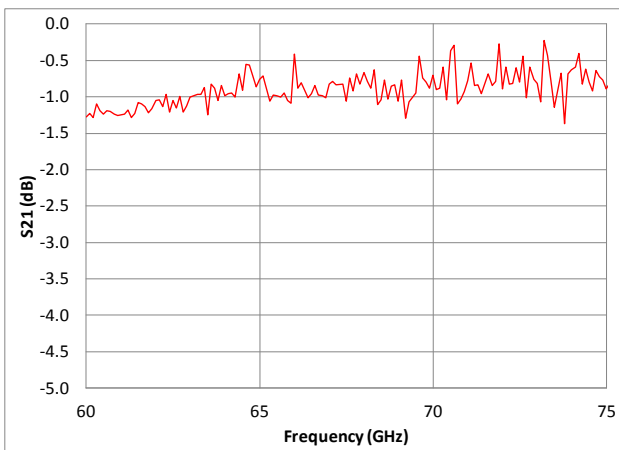


**Isolation**

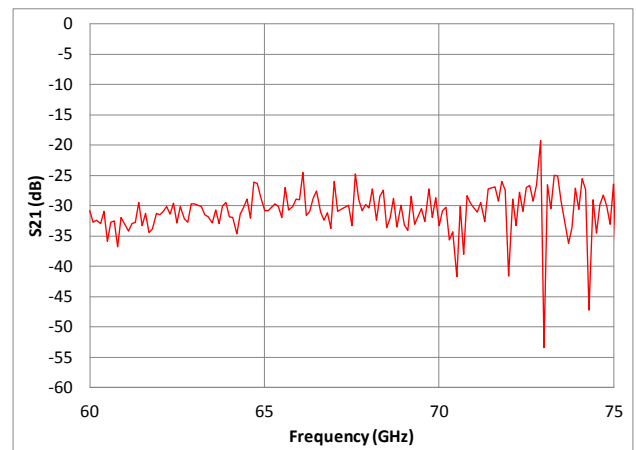


### MA4GC6774 (Former Part Number) Reference Data, 60 - 75 GHz<sup>8</sup>

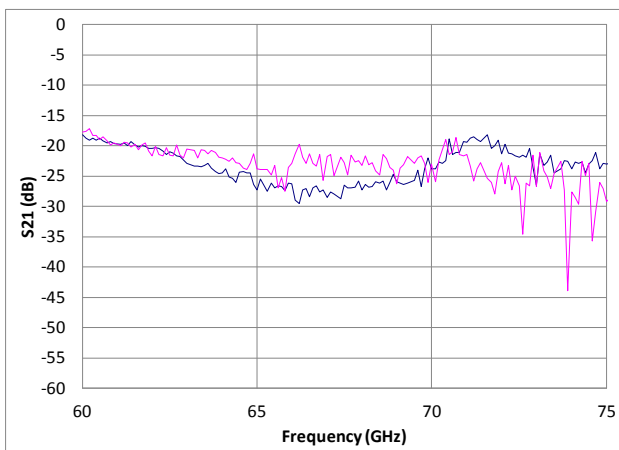
**Insertion Loss**



**Isolation**



**Return Loss, Input and Output**

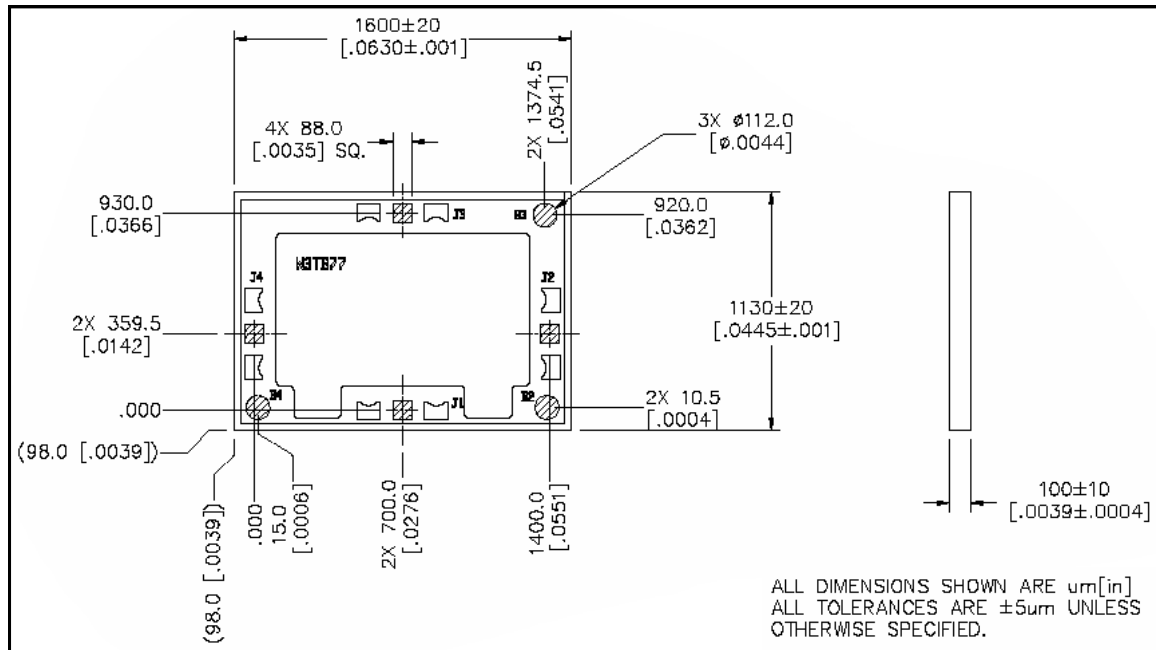


8. Measured data is highly dependent on fixturing and equipment setup.

## W-Band, 75 - 100 GHz, AlGaAs SP3T PIN Diode Switch with integrated bias circuits

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### Outline Drawing



### 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 2 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 1/4 by 3 mil sq. for lowest inductance. The same 1/4 by 3 mil sq. gold ribbon or 1 mil dia. Gold Wire is recommended for all DC pads.

### Handling Procedures

Please observe the following precautions to avoid damage:

### Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.