M/A-COM

77 GHz GaAs SP2T PIN Diode Switch

V 2.00

MA4GC6773

Features

- 77 Ghz Frequency Response
- 1.2 dB Insertion Loss
- 24 dB Isolation
- 2nS Switching Speed
- Silicon Nitride Passivation
- Polyimide Scratch Protection
- Designed for Automated Pick and Place Insertion
- Qualified for Automotive Environments

Applications

This highly reliable, very low parasitic SP2T is useable through higher millimeter frequencies for exceptional loss to isolation ratio and 2nS switching speed performance. Typical Applications include Transceivers, Automotive Cruise Control Systems, and Radiometry Switch Functions.

Description

The MA4CG6773 is a 77 GHz SP2T Switch made from Gallium Arsenide PIN Diodes, and semi-insulating GaAs Substrate designed for Automotive Applications. These diodes are fabricated on OMCVD epitaxial wafers using a process designed for repeatable electrical characteristics and extremely low parasitics. These Diodes are fully passivated with Silicon Nitride and have an additional layer of Polymide for scratch protection. This protective coating prevents damage to the junction during automated or manual handling. These devices are suitable for pick and place insertion.

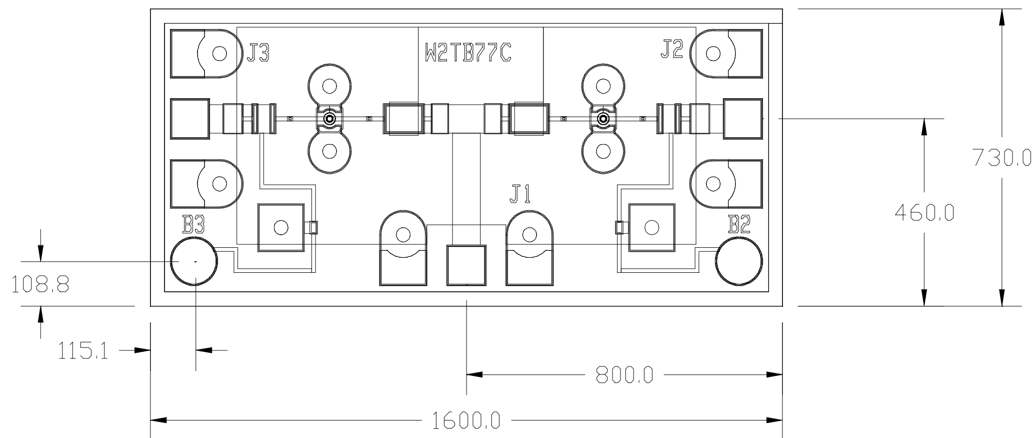
Each RF Port contains DC blocking Capacitors and a D.C. Bias Network consisting of High Impedance Lines and RF bypass capacitors. This device has 100 um square gold plated bonding pads at all RF and DC ports. RF and DC Ground Backside Gold Plating allows conventional chip bonding techniques using 80Au/20Sn Solder, Indalloy Solder, or Electrically Conductive Silver Epoxy.

Absolute Maximum Ratings[1]

Parameter	Value
Operating Temperature	-25 °C to +85 °C
Storage Temperature	-65 °C to +150 °C
D.C. Bias Current	+15 mA per Diode
D. C. Reverse Bias Voltage	-15 Volts @ -10 µA
RF C.W. Incident Power	+ 23 dBm C.W.
Mounting Temperature	+300 °C for 10 seconds

1. Exceeding any of these values may result in permanent damage

Outline Drawing



Dim. Are in µm

Electrical Specifications, T_A = + 25 °C

Parameters	Units	Minimum Specification	Typical Specification	Maximum Specification	Bias Conditions
Forward Voltage, +Vf	V	1.15	1.25	1.40	+10 mA per Diode
Leakage Current, -Ir	nA	-200	-20		-15 V per Diode
DC Slope Resistance	Ω		4.8	6.4	+10 mA & +11 mA per Diode

Reference Millimeter Wave Data @ F = 77 GHz, T_A = + 25 °C

MA4GC6773					
Parameters	Conditions	Avg.	Bias Condition		Comments
			-5 V	+10 mA	
Insertion Loss	(J1-J2) (J1-J3)	-1.2 dB -1.2 dB	B2 B3	B3 B2	RF Input Power = 0 dBm
Isolation	(J1-J2) (J1-J3)	-24 dB -24 dB	B3 B2	B2 B3	RF Input Power = 0 dBm
VSWR	(J1-J2) (J1-J3)	-15 dB -15 dB	B2 B3	B3 B2	RF Input Power = 0 dBm Low Loss Condition Only (Reflective in Isolation Mode)
Switching Speed	10% - 90% RF Voltage	2 nS	0 to 5 V TTL	0 to 5 V TTL	Switching Speed is Driver Dependent

DC to Millimeter Wave State Truth Table for the MA4GC6773

DC Bias Conditions		Millimeter Wave State	
B2	B3	J1-J2	J1-J3
-5 Volts	+10 mA	Low Loss	Isolation
+10 mA	-5 Volts	Isolation	Low Loss

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Assembly Considerations

The following precautions should be observed for successful assembly of the die.

Cleanliness

These chips should be handled in a clean environment. Do not attempt to clean die after installation.

Electro-Static Sensitivity

The MA4GC Series of GaAs PIN Diode Switches are ESD, Class 1 Sensitive. The proper ESD handling procedures must be used.

General Handling

The protective polymer coating on the active areas of these die provides scratch and impact protection, particularly for the metal airbridge which contacts the diode's anode. Die should primarily be handled with vacuum pickups, or alternatively with plastic tweezers.

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 Expoxy 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.

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