MA4AGSW4

SP4T AlGaAs PIN Diode Switch

V3

FEATURES

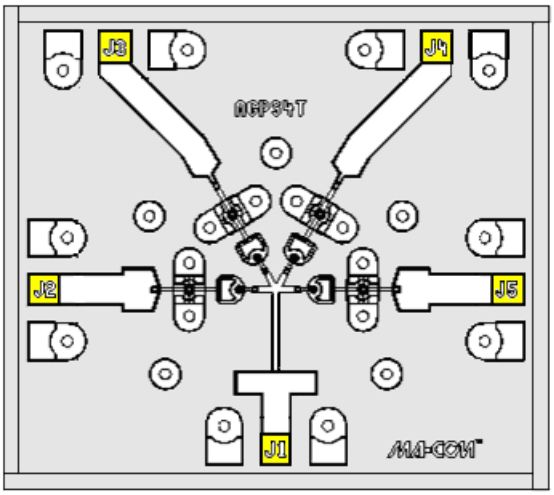
- Ultra Broad Bandwidth: 50 MHz to 50 GHz
- Functional Bandwidth : 50 MHz to 70 GHz
- 0.7 dB Insertion Loss,
- 32 dB Isolation at 50 GHz
- Low Current consumption.
  - -10mA for low loss state
  - +10mA for Isolation state
- M/A-COM's unique AlGaAs hetero-junction anode technology.
- Silicon Nitride Passivation
- Polymer Scratch protection
- RoHS Compliant

DESCRIPTION

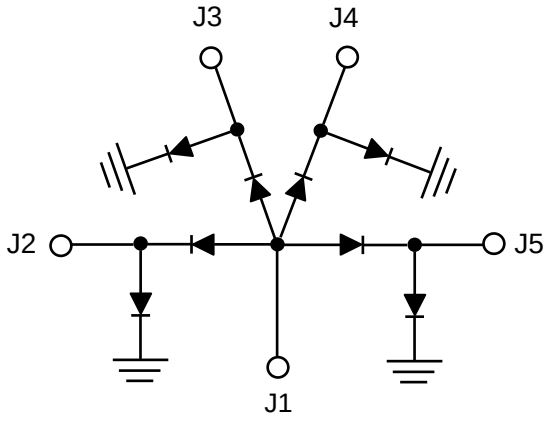
M/A-COM's MA4AGSW4 is an Aluminum-Gallium-Arsenide, single pole, four throw (SP4T), PIN diode switch. The switch features enhanced AlGaAs anodes which are formed using M/A-COM's patented hetero-junction technology. AlGaAs technology produces a switch with less loss than a device fabricated using conventional GaAs processes. As much as a 0.3 dB reduction in insertion loss can be realized at 50 GHz. This device is fabricated on an OMCVD epitaxial wafer using a process designed for high device uniformity and extremely low parasitics. The diodes within the chip exhibit low series resistance, low capacitance, and fast switching speed. They are fully passivated with silicon nitride and have an additional polymer layer for scratch protection. The protective coating prevents damage during handling and assembly to the diode junction and the chip anode air-bridges. Off chip bias circuitry is required.

APPLICATIONS

The high electron mobility of AlGaAs and the low capacitance of the PIN diodes used makes this switch ideal for fast response, high frequency, multi-throw switch designs where the series capacitance in each off-arm will load the input. AlGaAs PIN diode switches are an ideal choice for switching arrays in radar systems, radiometers, test equipment and other multi-assembly components.



Yellow areas indicate bond pads



Absolute Maximum Ratings @ T_{AMB} = +25°C

Parameter	Maximum Rating
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +150°C
Incident C.W. RF Power	+23dBm C.W.
Breakdown Voltage	25V
Bias Current	± 25mA
Assembly Temperature	+300°C < 10 sec
Junction Temperature	+175°C

Maximum combined operating conditions for RF Power, D.C. bias, and temperature: +23 dBm C.W. @ 10 mA (per diode) @ +85°C.

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Electrical Specifications @ T_A = 25°C, +/-10mA bias current (On-wafer measurements)

RF SPECIFICATIONS					
PARAMETER	**FREQUENCY BAND**	**MIN**	**TYP**	**MAX**	**UNITS**
INSERTION LOSS	0.05 - 18 GHz		0.7	0.8	dB
	18 - 50 GHz		1.0	1.4	dB
ISOLATION	0.05 - 18 GHz	25	41		dB
	18 - 50 GHz	25	32		dB
INPUT RETURN LOSS	0.05 - 18 GHz	10	21		dB
	18 - 50 GHz	10	22		dB
OUTPUT RETURN LOSS	0.05 - 18 GHz	10	26		dB
	18 - 50 GHz	10	17		dB
SWITCHING SPEED	10 GHz		20		nS

***Note:**

Typical switching speed is measured from 10% to 90% of the detected RF voltage driven by a TTL compatible driver. Driver output parallel RC network uses a capacitor between 390 pF - 560 pF and a resistor between 150 - 220 Ohms to achieve 20 ns rise and fall times.

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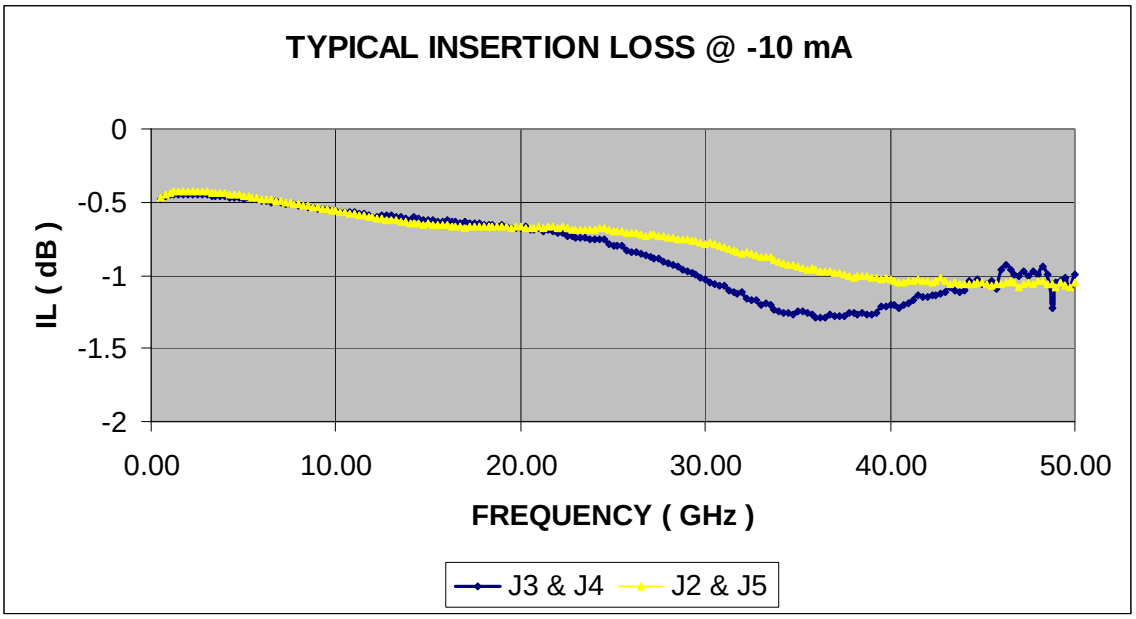
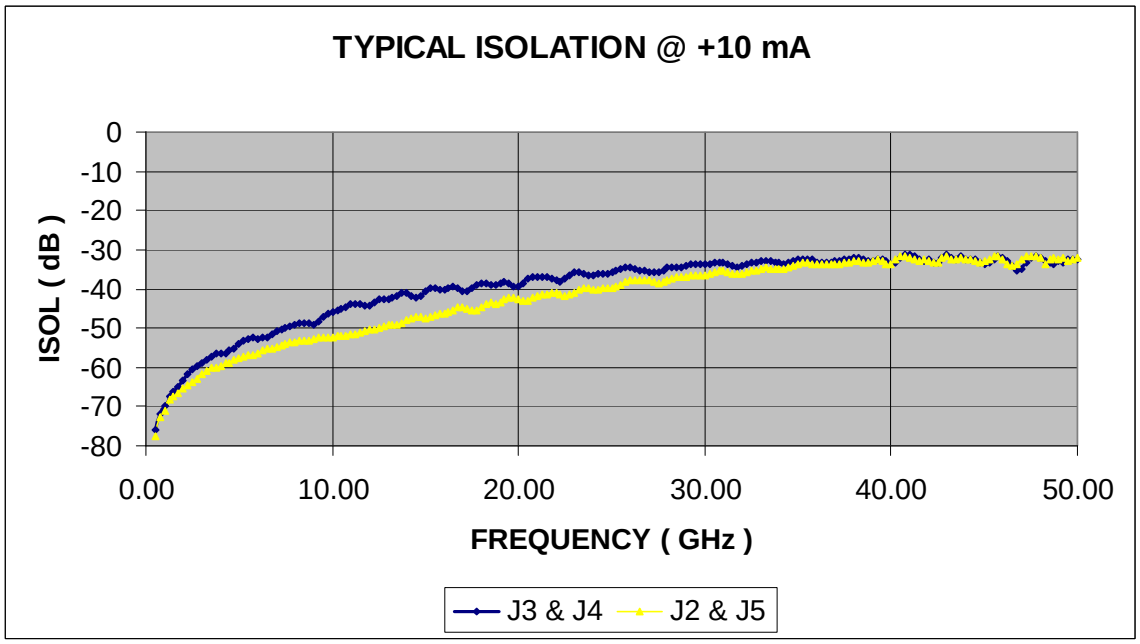
Typical R.F. Performance (Probed on Wafer) @ +25°C





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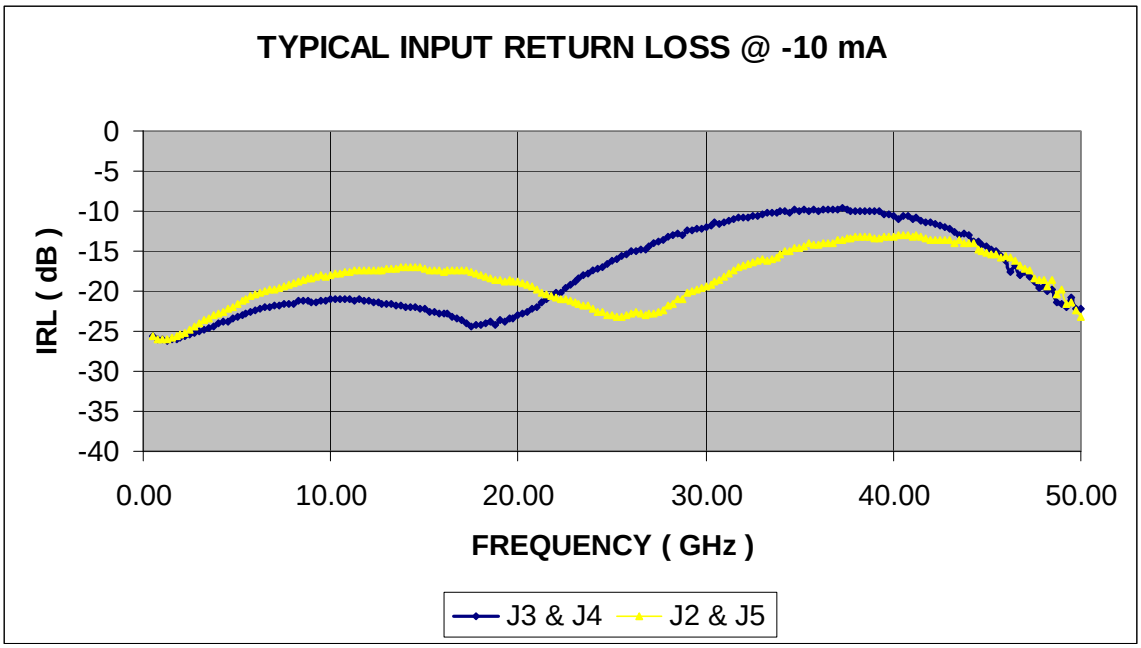
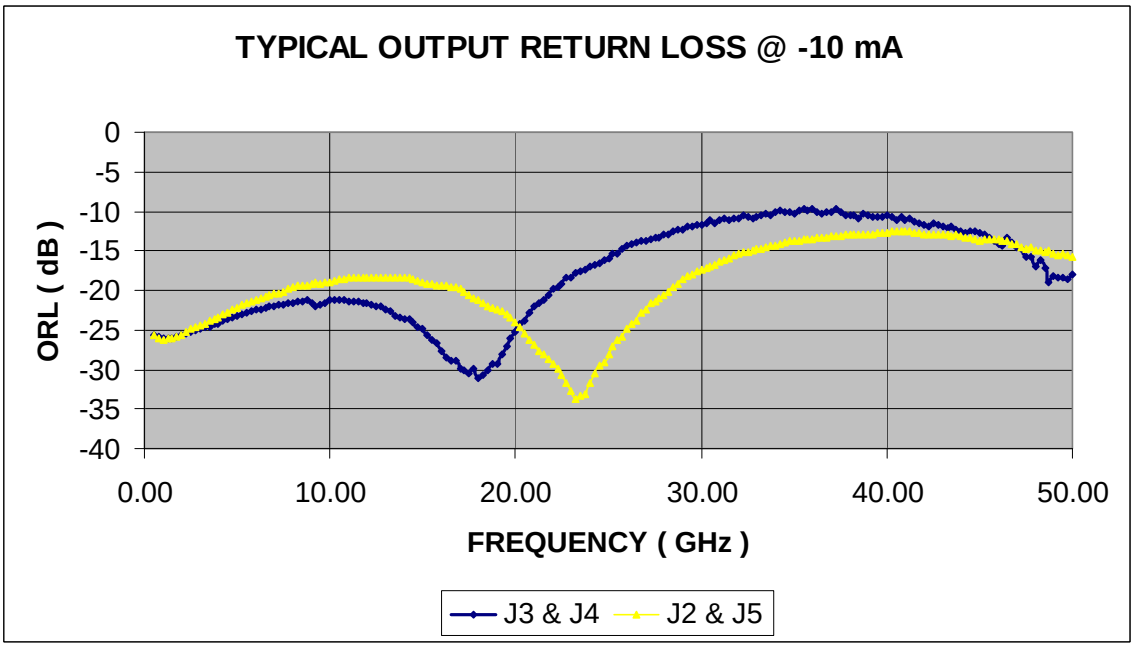
Typical RF Performance (Probed on wafer) @ +25°C





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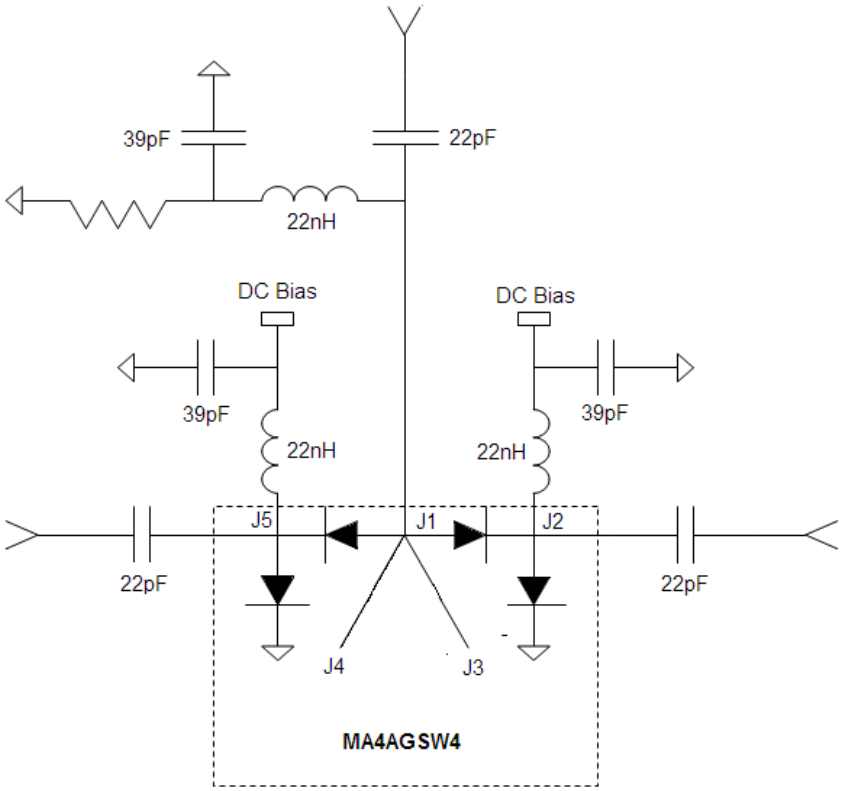
Operation of the MA4AGSW4 Switch

The simultaneous application of a negative DC current to the low loss port and positive DC current to the remaining isolated switching ports is required for the operation of the MA4AGSW4, AlGaAs, PIN switch. The backside area of the die is the RF and DC return ground plane. The DC return is connected to the common port J1. The forward bias voltage at J2, J3, J4 & J5 will not exceed ±1.6 volts and is typically ± 1.4 volts with supply current of ± 30mA). In the low loss state, the series diode must be forward biased and the shunt diode reverse biased. While for the Isolated port, the shunt diode is forward biased and the series diode is reverse biased. The bias network design shown below should yield > 30 dB RF to DC Isolation.

The lowest insertion loss, P1dB, IP^3, and switching speed is achieved by using a voltage pull-up resistor in the DC return path, (J1). A minimum value of | -2V | is recommended at this return node, which is achievable with a standard, ± 5V TTL Controlled PIN Diode Driver.

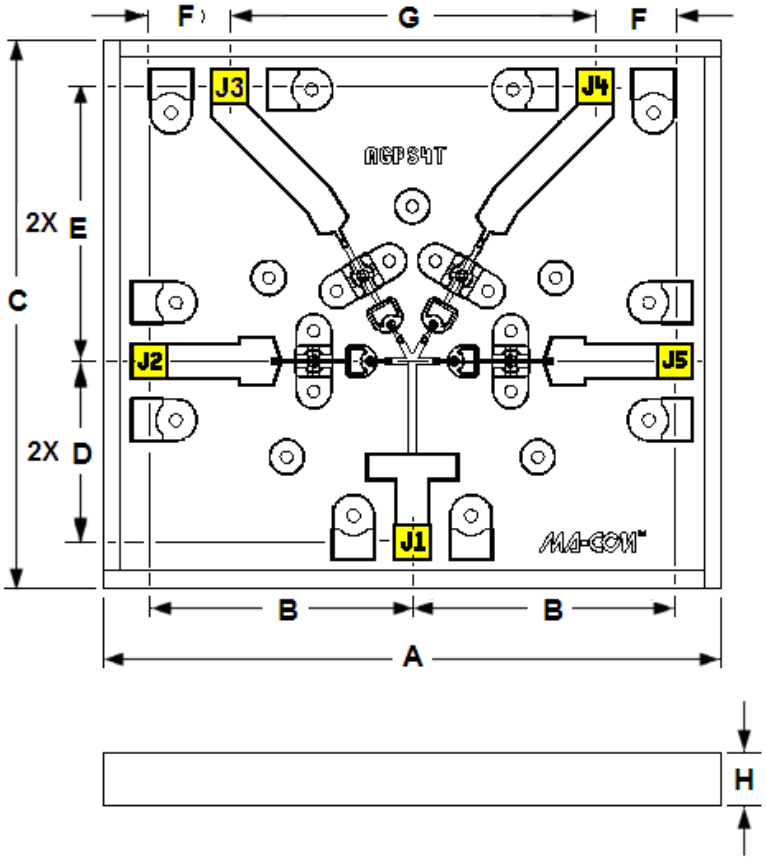
MA4AGSW4 Schematic with a Typical External 2-18 GHz Bias Network



TYPICAL DRIVER CONNECTIONS

CONTROL LEVEL (DC CURRENT)				CONDITION OF RF OUTPUT			
J2	**J3**	**J4**	**J5**	**J2-J1**	**J3-J1**	**J4-J1**	**J5-J1**
-10mA	+10mA	+10mA	+10mA	**Low Loss**	Isolation	Isolation	Isolation
+10mA	**-10mA**	+10mA	+10mA	Isolation	**Low Loss**	Isolation	Isolation
+10mA	+10mA	**-10mA**	+10mA	Isolation	Isolation	**Low Loss**	Isolation
+10mA	+10mA	+10mA	**-10mA**	Isolation	Isolation	Isolation	**Low Loss**

Chip Dimensions and Bonding Pad Locations (In Yellow)



	mils			mm		
DIM	**Minimum**	**Nominal**	**Maximum**	**Minimum**	**Nominal**	**Maximum**
A	66.0	67.0	68.0	1.676	1.702	1.727
B	28.5	29.0	29.5	0.724	0.737	0.749
C	59.0	60.0	61.0	1.499	1.524	1.549
D	19.5	20.0	20.5	0.495	0.508	0.521
E	29.5	30.0	30.5	0.749	0.762	0.775
F	8.5	9.0	9.5	0.216	0.229	0.241
G	39.5	40.0	40.5	1.003	1.016	1.029
H	3.5	4.0	4.5	0.089	0.102	0.114
PADS	3.5	4.0	4.5	0.089	0.102	0.114

ASSEMBLY INSTRUCTIONS

CLEANLINESS

These chips should be handled in a clean environment.

STATIC SENSITIVITY

These Devices are considered ESD Class 1A, HBM. Proper ESD techniques should be used when handling these devices.

GENERAL HANDLING

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

ASSEMBLY TECHNIQUES

The MA4AGSW3, AlGaAs device is designed to be mounted with electrically conductive silver epoxy or with a low temperature solder perform, which does not have a rich tin content.

SOLDER DIE ATTACH

Only solders which do not scavenge gold, such as 80/20, Au/Sn or Indalloy #2 is recommended. Do not expose die to temperatures greater than 300°C for more than 10 seconds.

ELECTRICAL CONDUCTIVE EPOXY DIE ATTACH

Use a controlled thickness of approximately 2 mils for best electrical conductivity and lowest thermal resistance. Cure epoxy per manufacturer's schedule. Typically 150°C for 1 hour.

RIBBON/WIRE BONDING

Thermo-compression wedge or ball bonding may be used to attach ribbons or wire to the gold bonding pads. A 1/4 x 3 mil gold ribbon is recommended on all RF ports and should be kept as short as possible for the lowest inductance and best microwave performance. For more detailed handling and assembly instructions, see **Application Note M541, "Bonding and Handling Procedures for Chip Diode Devices" at www.macom.com.**

Ordering Information

Part Number	Package
MA4AGSW4	Waffle Pack

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