MA4AGSW8-2

SP8T AlGaAs PIN Diode Switch

Rev. V2

FEATURES

- Specified Performance : 50 MHz to 40 GHz
- Operational Performance: 50 MHz to 50 GHz
- 2.0 dB Typical Insertion Loss at 40 GHz
- 30 dB Typical Isolation at 40 GHz thru 3 Diodes
- 22 dB Typical Isolation at 40 GHz thru 2 Diodes
- Low Current Consumption
  - 10 mA for low loss state
  - 0 Volts for Isolation state
- M/A-COM's Patented AlGaAs Hetero-Junction Anode Technology.
- Silicon Nitride Passivation
- BCB Impact Protection
- RoHS Compliant

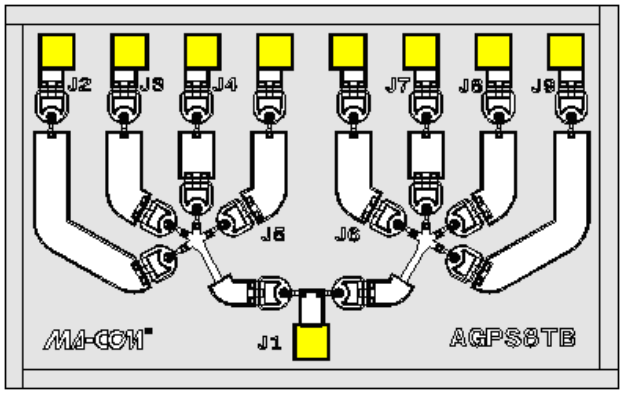
DESCRIPTION

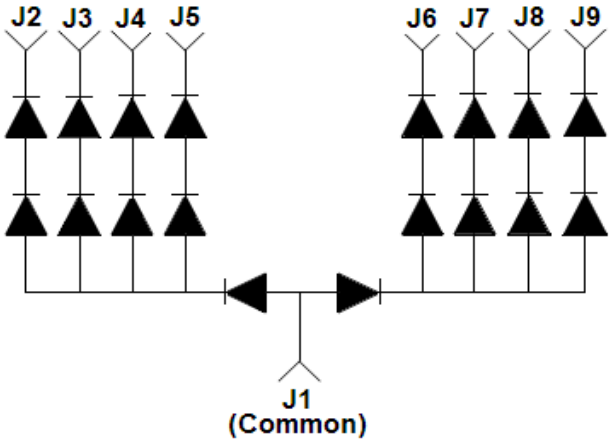
M/A-COM's MA4AGSW8-2 is an Aluminum-Gallium-Arsenide (AlGaAs) anode enhanced, SP8T, PIN diode series switch. Operation is accomplished with 10 mA applied to the low loss port and 0V for the isolated ports. M/A-COM's Technology Solutions AlGaAs process utilizes a patented hetero-junction technology which produces lower insertion loss than conventional GaAs devices. These devices are fabricated on an OMCVD epitaxial wafer using a process designed for high device uniformity and extremely low parasitics. The diodes used have low series resistance, (3 Ω) , low capacitance (20 fF) , and fast switching speed (20 nS). The MA4AGSW8-2 device is fully passivated with silicon nitride, and has an extra layer of polyamide for added scratch and impact protection. This protective coating prevents damage to the diode junction and anode air bridges during handling and assembly. External RF to DC bias networks which are optimized for the particular operating band of interest are required.

APPLICATIONS

The low capacitance of the internal PIN diodes makes this switch ideal for use in many microwave multi-throw switch designs. The low series resistance of the diodes reduces the insertion loss at microwave millimeter-wave frequencies. These AlGaAs PIN switches can be used as switching arrays on radar systems, optical switching networks, instrumentation, and other wideband multi-throw switch assemblies.

CHIP LAYOUT





Absolute Maximum Ratings

T_{AMB} = +25°C (Unless Otherwise Noted) [1]

Parameter	Absolute Maximum
D.C. Reverse Voltage	25V
Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Bias Current	±30mA

Note:

1. Operation of this device above any one of these parameters may cause permanent damage.

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Visit www.macomtech.com for additional data sheets and product information.

R.F. Specifications @ T_{AMB} = +25°C, -15 mA bias current, and 0 Volts

(On-wafer measurements)

PARAMETER	FREQUENCY BAND	MIN	TYP	MAX	UNITS
Insertion Loss	.05 - 18 GHz	-	1.5	2.0	dB
	18 - 26 GHz	-	1.8	2.1	dB
	26 - 40 GHz	-	2.0	2.3	dB
Isolation	.05 - 18 GHz	40	45	-	dB
	18 - 26 GHz	35	42	-	dB
	26 - 40 GHz	30	35	-	dB
Input/Output Return Loss	.05 - 18 GHz	10	15	-	dB
	18 - 26 GHz	13	15	-	dB
	26 - 40 GHz	17	20	-	dB
Switching Speed [2]	10 GHz	-	20	-	nS

Notes:

1. Isolation is measured through (3) diodes from common port (Input) to selected output port with (1) opposite port in low loss. Isolation for (2) diodes from common port (input) to selected output with (1) adjacent port in low loss = 22 dB Typical.
2. Typical switching speed is measured from 10% to 90% of the detected RF voltage driven by a ± 5V 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.

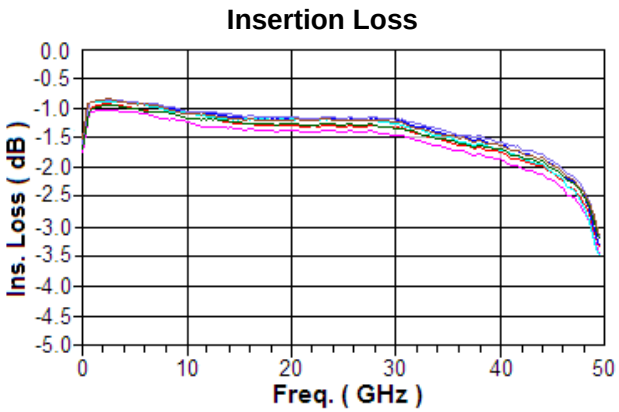
D.C. Bias to RF Truth Table

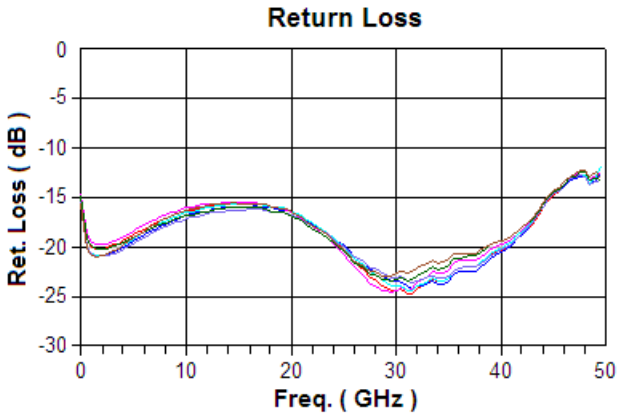
Input Port	Output Ports							
	@ J2	@ J3	@ J4	@ J5	@ J6	@ J7	@ J8	@ J9
J1	**Low Loss**	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation
J1	Isolation	**Low Loss**	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation
J1	Isolation	Isolation	**Low Loss**	Isolation	Isolation	Isolation	Isolation	Isolation
J1	Isolation	Isolation	Isolation	**Low Loss**	Isolation	Isolation	Isolation	Isolation
J1	Isolation	Isolation	Isolation	Isolation	**Low Loss**	Isolation	Isolation	Isolation
J1	Isolation	Isolation	Isolation	Isolation	Isolation	**Low Loss**	Isolation	Isolation
J1	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation	**Low Loss**	Isolation
J1	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation	**Low Loss**

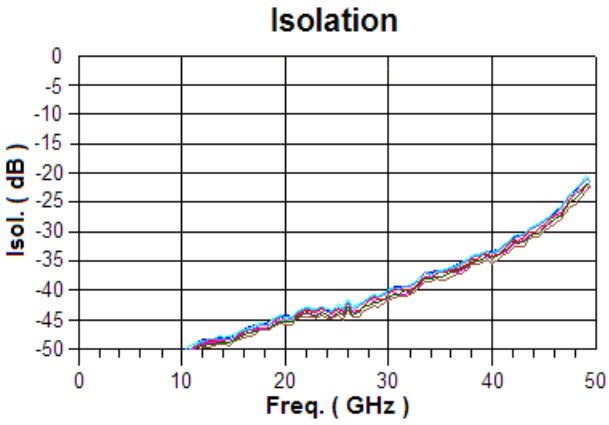
Notes:

1. **Low Loss = -15 mA** applied at the specified output port. A DC ground return at port J1 must be provided
2. **Isolation = 0 volts** applied at the specified output ports.

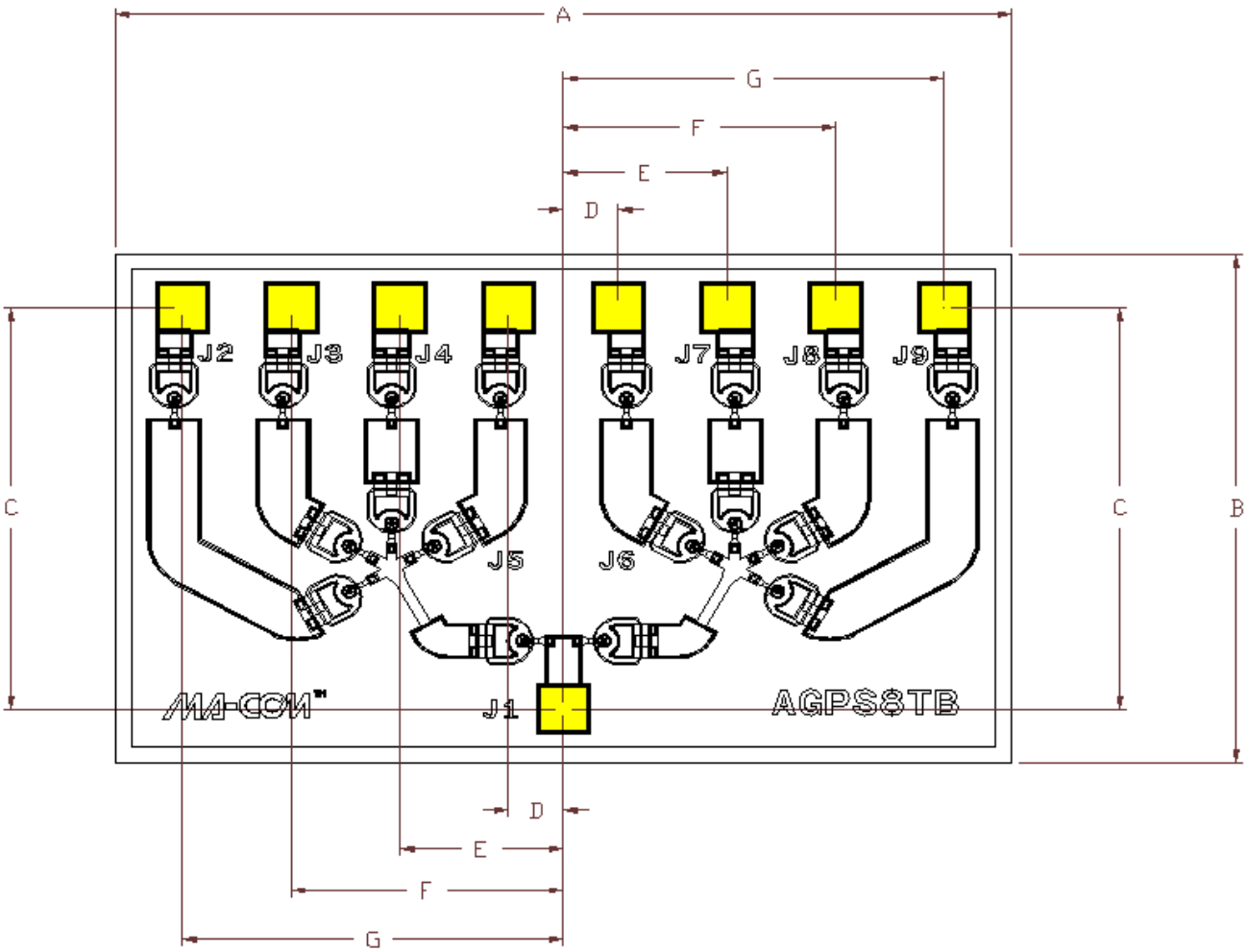
Typical RF Performance @ T_{AMB} = +25°C







MA4AGSW8-2 OUTLINE



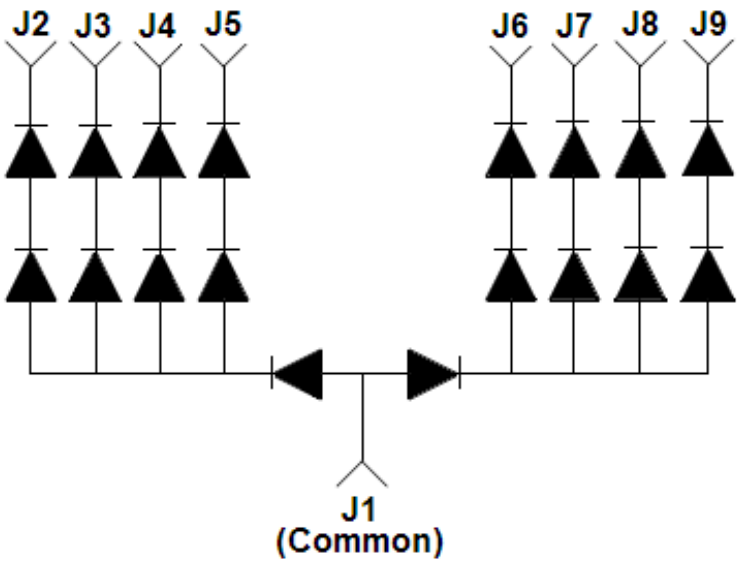
Dimension	mils		mm	
	min	max	min	max
A	64.4	65.6	1.64	1.67
B	39.2	40.4	1.00	1.03
C	30.9	31.7	0.78	0.80
D	3.8	4.2	0.10	0.11
E	11.7	12.0	0.30	0.31
F	19.5	19.9	0.50	0.51
G	27.4	27.8	0.70	0.71
Thickness	3.7	4.3	0.09	0.11
Bonding Pads (shown in yellow) 100um X 100um X 5um (thick gold)				

OPERATION OF THE MA4AGSW8-2

The MA4AGSW8-2 switch is designed to operate in systems where lower D.C. current consumption and D.C. operating voltages are required. The application of either +10 mA or –10 mA DC bias current to the selected port will provide the low insertion loss state. Typically this low loss, " ON " bias voltage through (3) series diodes is | 4.5 Volts | maximum. All Isolated Ports can be set to 0V at 0 mA, or the application of | 5 V | back bias at 0 mA will improve the isolation and switching speed. RF to DC bias networks, (such as the MA4BN18-40) are required on all RF Ports.

A simple single supply, +5V, PIN Diode TTL Gate Driver can be used to supply current for loss or 0V back bias for isolation to switch the individual RF Ports. In this bias scheme, +5 V through a current limiting resistor would be applied at the common port and each RF port would be connected to a TTL Gate. Low loss would occur when the Selected Gate Voltage is 0.5 V @ + 10 mA , " TTL 0 " and Isolation would occur when the Selected Gate Voltage is +5V @ 0mA (0 V Back Bias), " TTL 1 ".

For faster switching speeds (< 20 nS) , a +/- 5V , PIN Diode TTL Driver should be employed to help remove the diode stored charge with back bias. In this case, the common port is connected to D.C. Ground. Insertion Loss is achieved with –10 mA @ – 4.5 V and Isolation is accomplished by applying +5V @ 0mA to the selected RF ports respectively.



HANDLING

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 MA4AGSW8-2, AlGaAs switch 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 low temperature solders which do not scavenge gold, such as Indalloy #2, are 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.macomtech.com.**