SP5T PIN Diode Reflective Switch

V 1.00

MA4SW510

Features

- Ultra Broad Bandwidth: 50 MHz to 26 GHz
- 1.0 dB Insertion Loss, 30 dB Isolation at 20 GHz
- Reliable. Fully Monolithic, Glass Encapsulated Construction

Description

The MA4SW510 is a SP5T Series-Shunt broad band switch made with M/A-COM's HMIC ™ (Heterolithic Microwave Integrated Circuit) process, US Patent 5,268,310. This process allows the incorporation of silicon pedestals that form series and shunt diodes or vias by imbedding them in a low loss, low dispersion glass. This hybrid combination of Silicon and Glass gives HMIC Switches exceptional low loss and remarkable high isolation through low millimeter-wave frequencies.

Applications

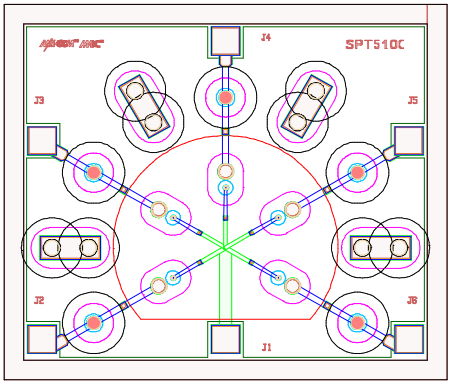
These high performance switches are suitable for the use in multi-band ECM, Radar, and instrumentation control circuits where high isolation to insertion loss ratios are required. With a standard +5 V/-5 V, TTL controlled PIN diode driver, 50 ns switching speeds are achieved.

Absolute Maximum Ratings[1] @ TA = +25 °C (unless otherwise specified)

Parameter	Value
Operating Temperature	-65 °C to +150 °C
Storage Temperature	65 °C to +175 °C
RF C.W. Incident Power (+/-20 mA)	+ 30 dBm
DC Bias Current (Forward)	+/-50 mA
Applied Voltage (Reverse)	25 V

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

MA4SW510 Layout



Nominal Chip Dimensions

Chip Dimensions (µm)		
	X	Y
Chip	1810	1650.0
Pad Dimensions (µm)		
	X	Y
RF	120	120
Pad Locations (µm)		
	X	Y
J1	0	0
J2	-750	0
J3	-750	+825
J4	0	+1240
J5	-750	+825
J6	+750	0
Pad Locations Relative to J1		

Electrical Specifications @ T_A = 25 °C, +/- 20 mA Bias Current (On-Wafer Measurements)

Parameters	Frequency	Minimum	Typical	Maximum	Units
Insertion Loss	20 GHz	-	0.9	1.4	dB
Isolation	20 GHz	28	38	-	dB
Input Return Loss	20 GHz	-	22	-	dB
Output Return Loss	20 GHz	-	23	-	dB
Switching Speed[1]	10 GHz	-	50	-	nS

1. 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 50 ns rise and fall times.

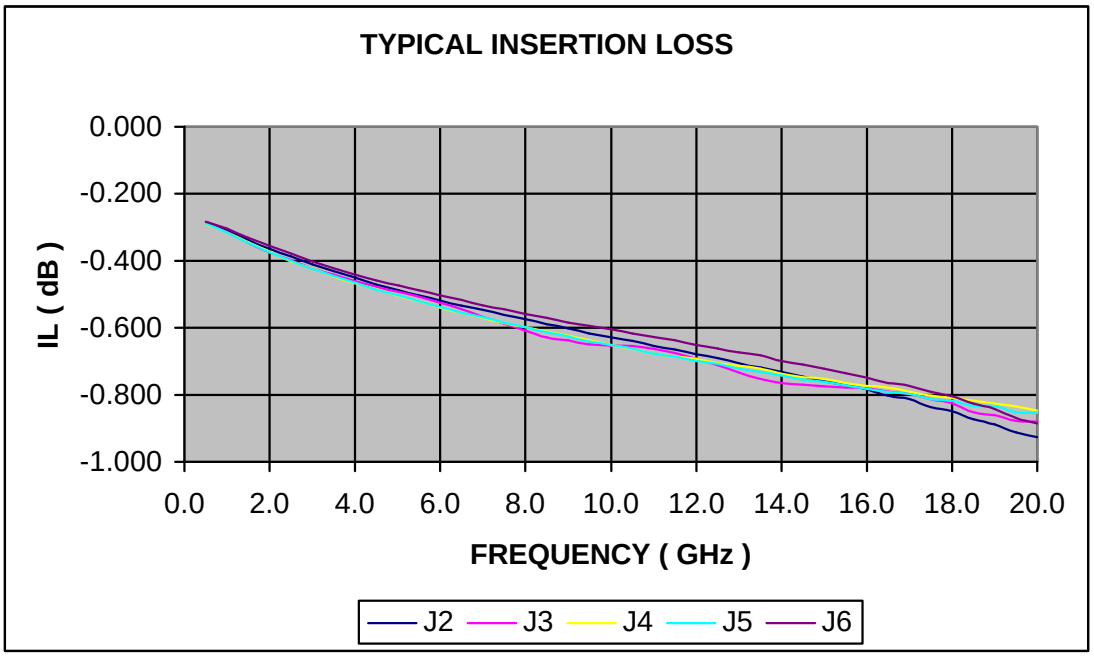
Typical Driver Connections

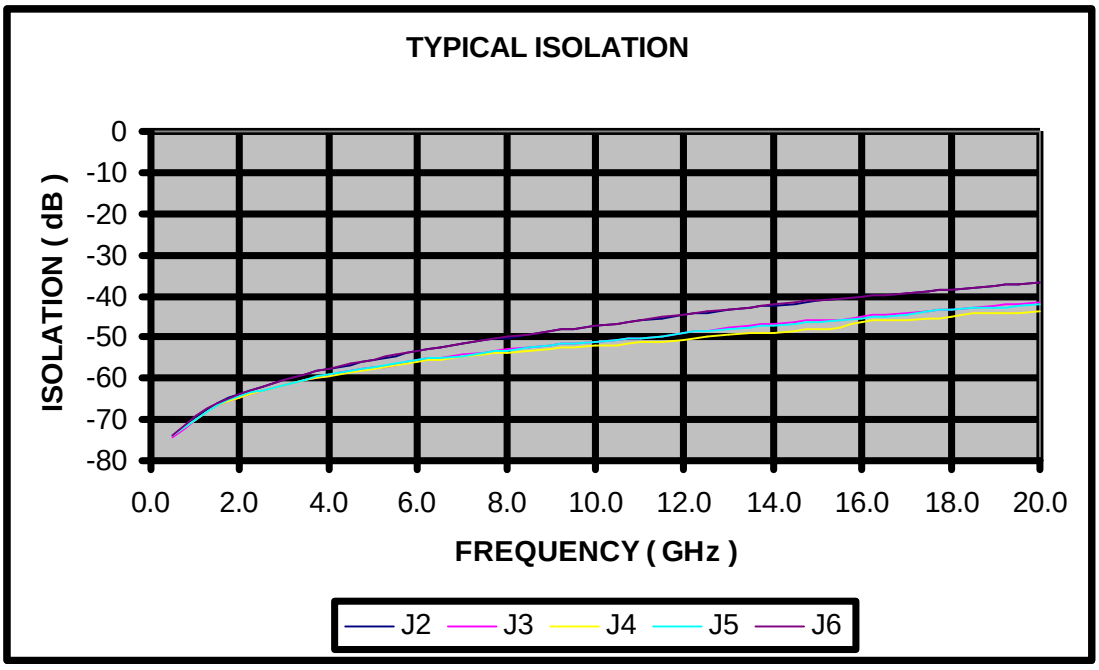
Control Level (DC Current)					Condition of RF Output				
J2	J3	J4	J5	J6	J2-J1	J3-J1	J4-J1	J5-J1	J6-J1
-20 mA	+20 mA	+20 mA	+20 mA	+20 mA	**Low Loss**	Isolation	Isolation	Isolation	Isolation
+20 mA	**-20 mA**	+20 mA	+20 mA	+20 mA	Isolation	**Low Loss**	Isolation	Isolation	Isolation
+20 mA	+20 mA	**-20 mA**	+20 mA	+20 mA	Isolation	Isolation	**Low Loss**	Isolation	Isolation
+20 mA	+20 mA	+20 mA	**-20 mA**	-20 mA	Isolation	Isolation	Isolation	**Low Loss**	Isolation
+20 mA	+20 mA	+20 mA	+20 mA	**-20 mA**	Isolation	Isolation	Isolation	Isolation	**Low Loss**

Note: Typical Switching Speed measured from 10 % to 90 % of detected RF signal driven by a TTL compatible driver.

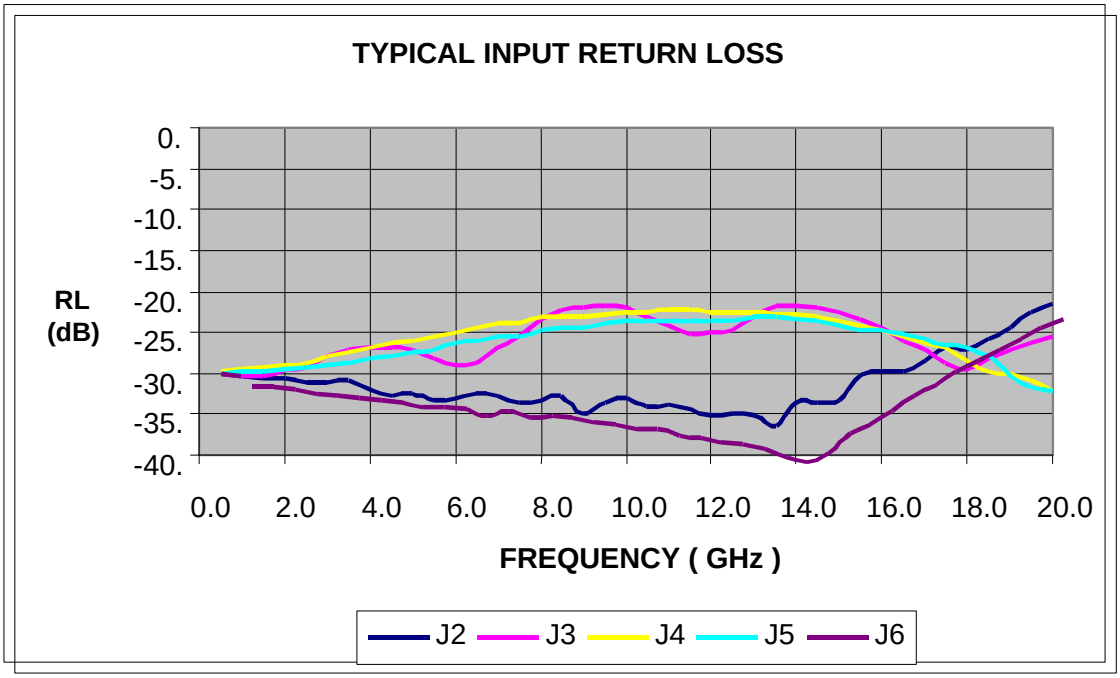
- **North America:** Tel. (800) 366-2266
- **Asia/Pacific:** Tel.+81-44-844-8296, Fax +81-44-844-8298
- **Europe:** Tel. +44 (1344) 869 595, Fax+44 (1344) 300 020

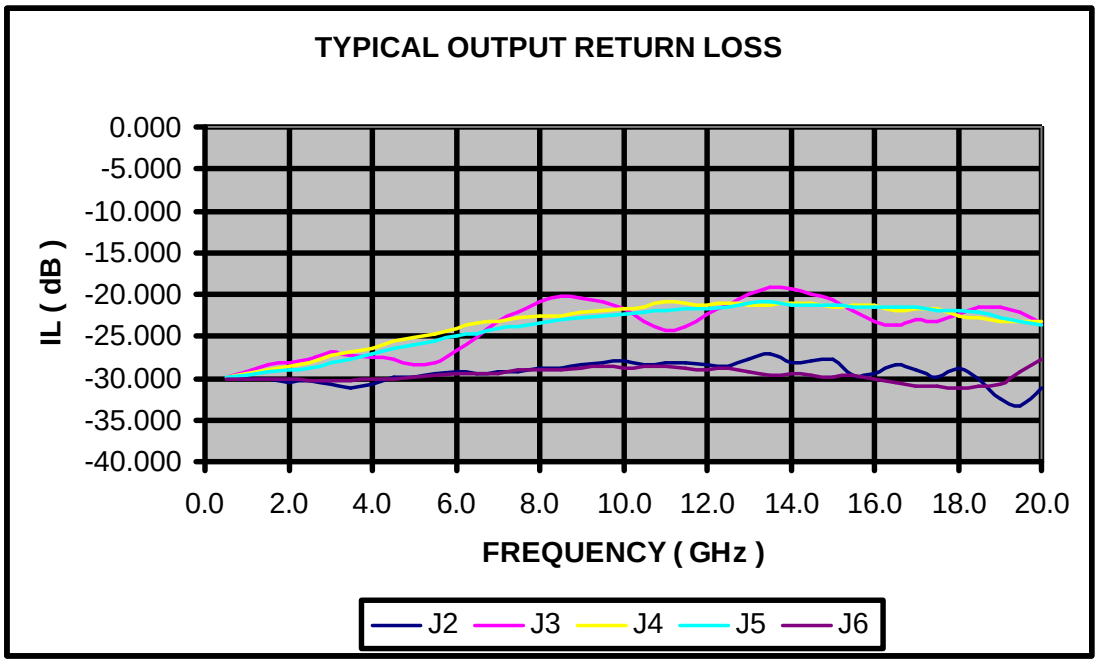
Typical Microwave Performance





Typical Microwave Performance





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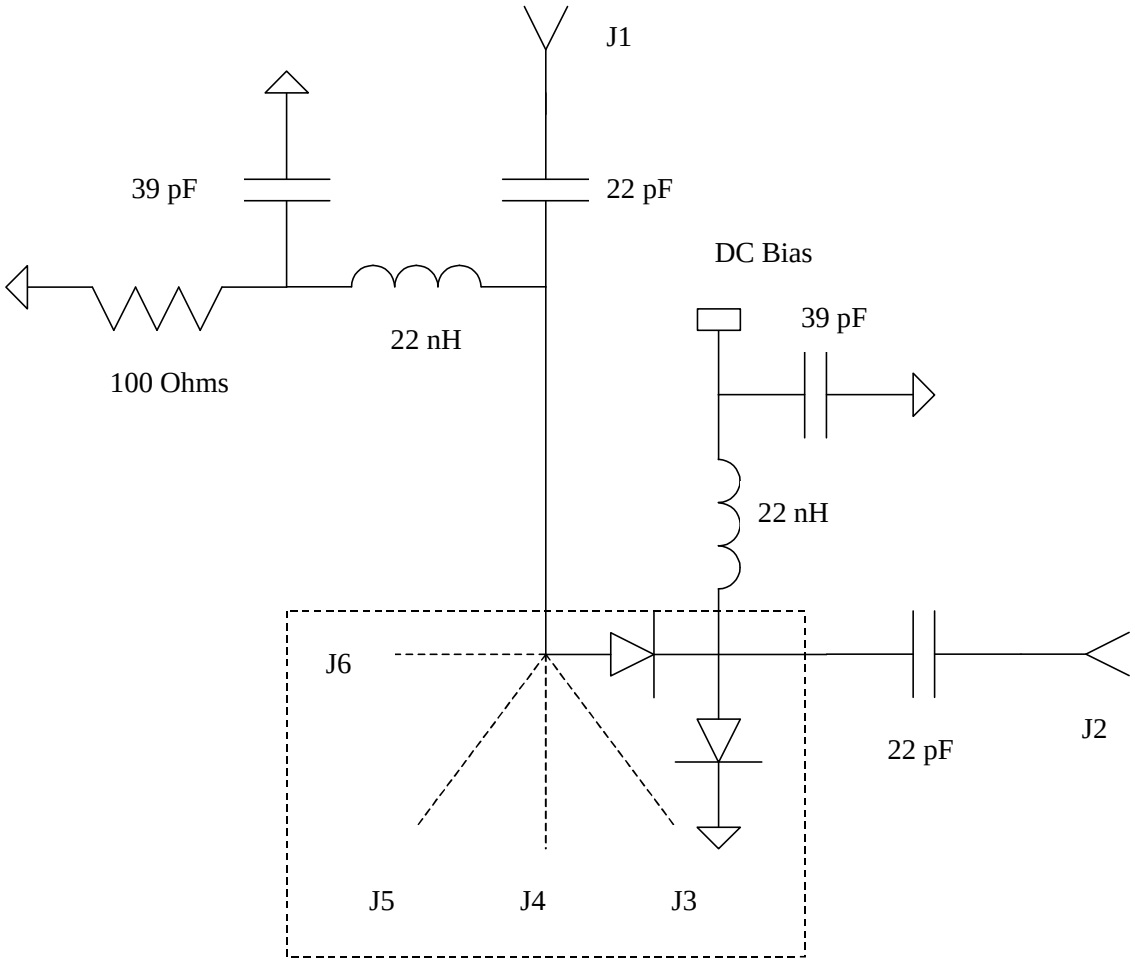
Operation of the MA4SW510 Switch

The Simultaneous Application of Negative DC Current to the Low Loss Port and Positive DC current to the Remaining Isolated Ports as shown in Figure 1 achieves operation of the MA4SW Series of PIN Diode Switches. The Backside Area of the Die is the RF and DC Return Ground Plane. The DC Return is achieved on Common Port J1. Constant Current Sources should supply the DC Control Currents. The diode voltages at these points will not exceed ± 1.5 volts (1.2 volts typical) for Supply Currents up to ± 50 mA. In the Low Loss State, the Series Diode must be Forward Biased and the Shunt Diode Reverse Biased. For All the Isolated Ports, the Shunt Diode is Forward Biased and the Series Diode is Reverse Biased. The Bias Network Design should yield > 30 dB RF to DC Isolation.

Best Insertion Loss, P1dB, IP3, 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 , +/- 5 V TTL Controlled PIN Diode Driver. A Typical DC Bias Schematic for 2-18 GHz Operation is shown in Figure 1.

Fig 1: 2—18 GHz Bias Network Schematic



HMIC Switch Die