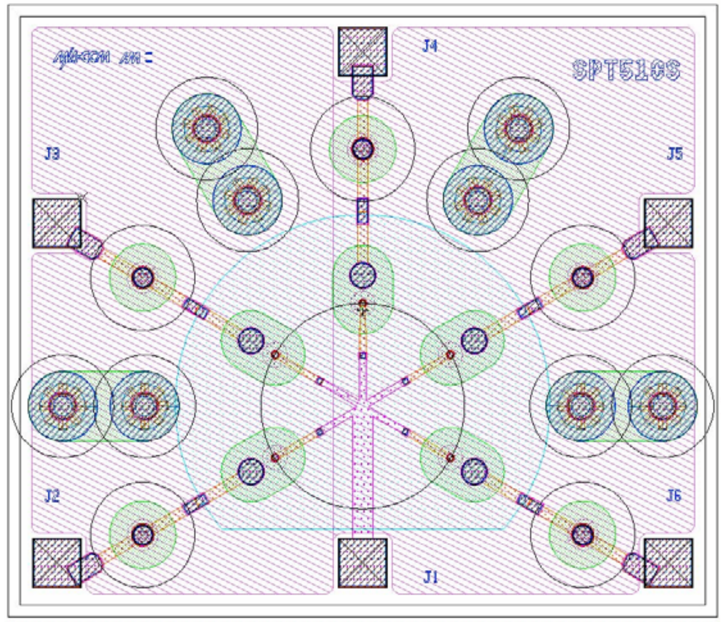
Monolithic PIN SP5T Diode Switch MASW-005100-1194

Rev 1

FEATURES

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

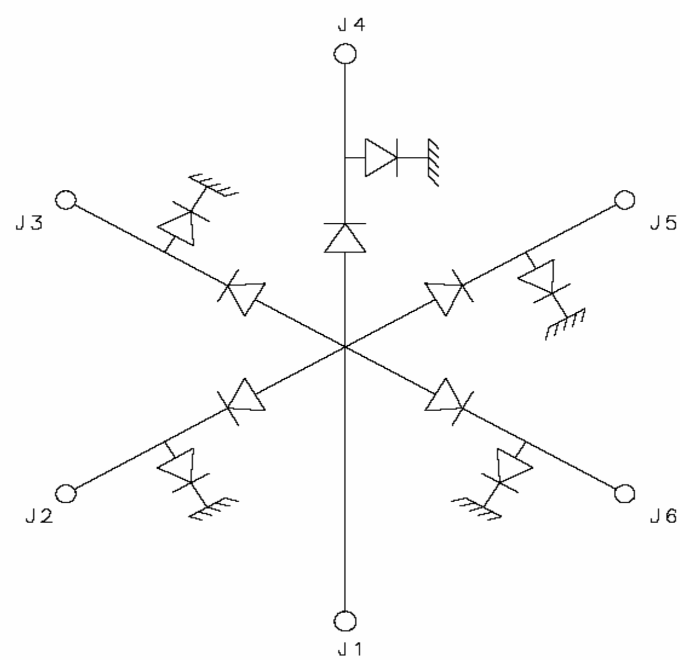


DESCRIPTION

The MASW-005100-1194 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, 50ns switching speeds are achieved.



ABSOLUTE MAXIMUM RATINGS

T_{AMB} = +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)	+33dBm
BIAS CURRENT (FORWARD)	± 20mA
APPLIED VOLTAGE (REVERSE)	- 25V

Note:
Exceeding any of these values may result in permanent damage.
Maximum operating conditions for combination of RF power, D.C. bias and temperature: +30dBm C.W., 15mA per diode @+85°C

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**

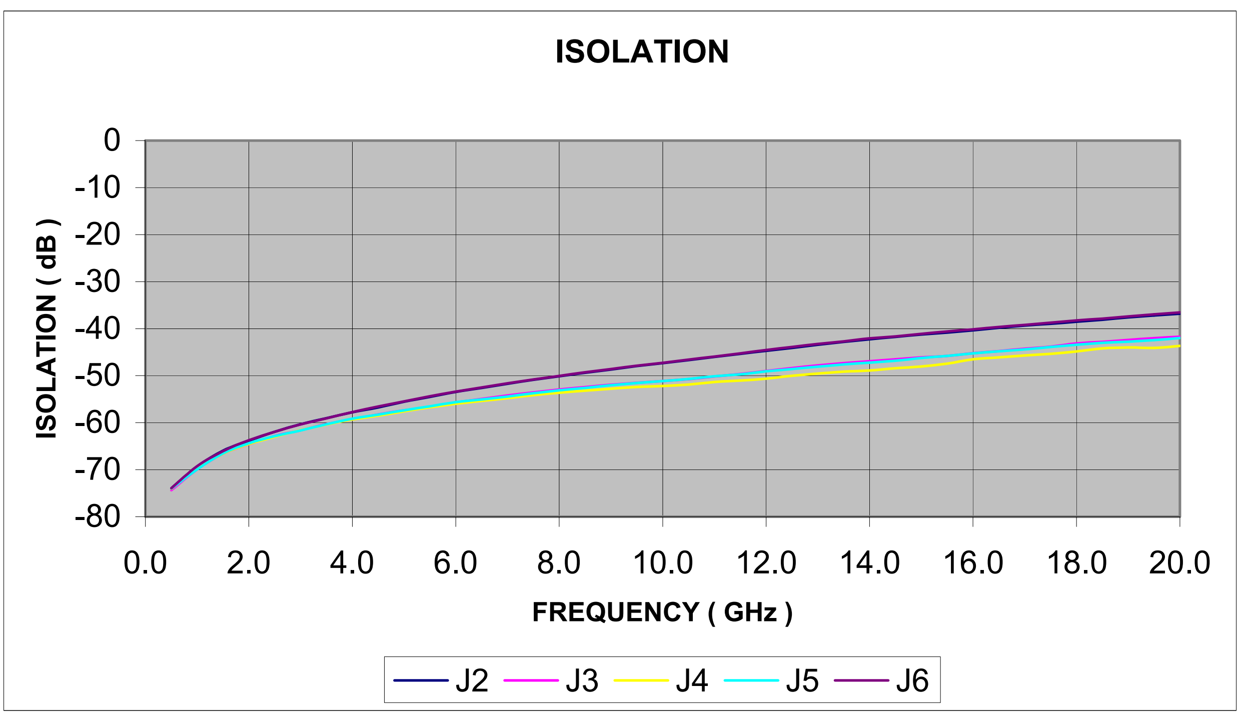
Electrical Specifications @ T_{AMB} = 25°C, ± 20 mA bias current
(on-wafer measurements)

RF SPECIFICATIONS					
PARAMETER	**FREQUENCY**	**MIN**	**TYP**	**MAX**	**UNITS**
INSERTION LOSS	**20GHz**		**0.9**	**1.4**	**dB**
ISOLATION	**20GHz**	**28**	**38**		**dB**
INPUT RETURN LOSS	**20GHz**		**22**		**dB**
OUTPUT RETURN LOSS	**20GHz**		**23**		**dB**
SWITCHING SPEED	**10GHz [1]**		**50**		**nS**

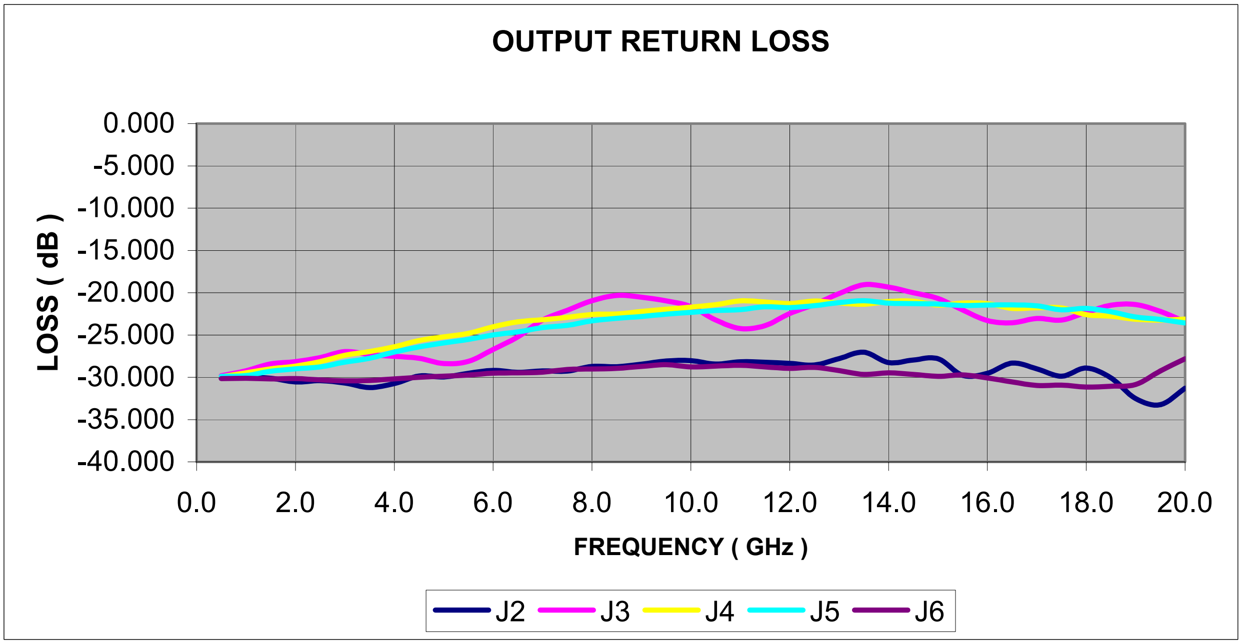
Note:

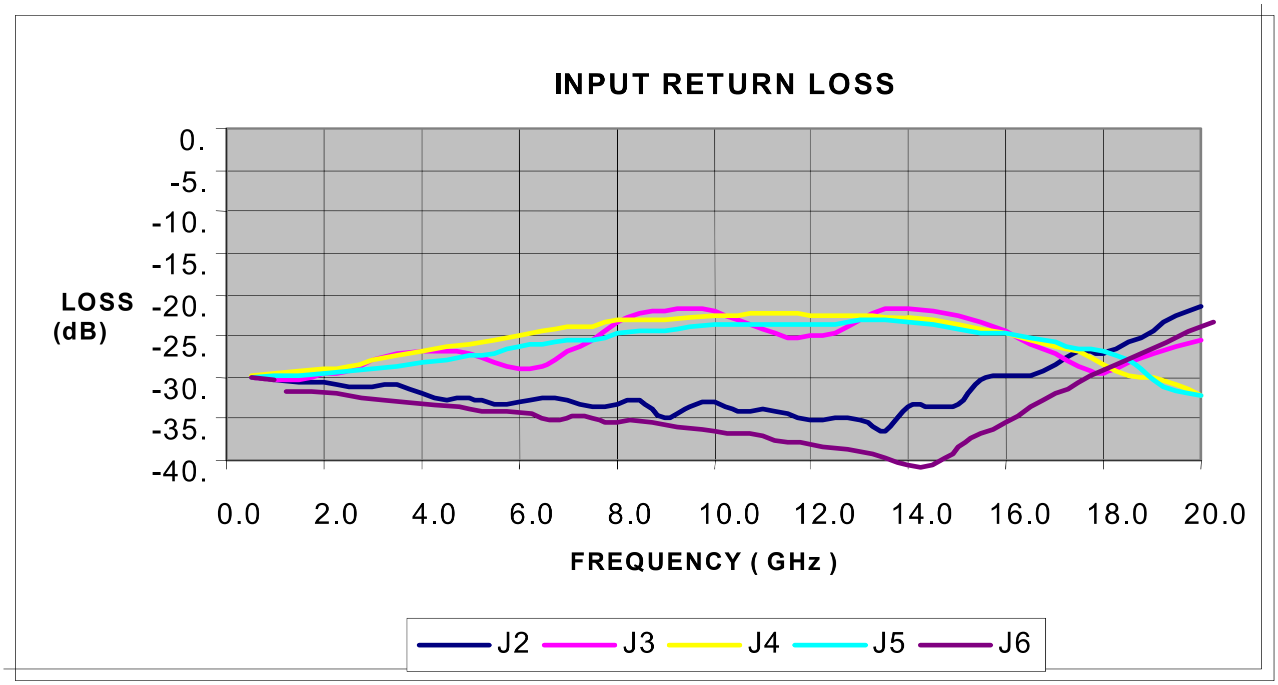
1.) Typical switching speed is measured from 10% to 90% of the detected RF voltage driven by a TTL compatible driver. Driver output parallel RC network uses a capacitor between 390pF - 560pF and a resistor between 150Ω - 220Ω to achieve 50ns rise and fall times.

Typical Microwave Performance



Typical Microwave Performance





ASSEMBLY INSTRUCTIONS

Cleanliness
These chips should be handled in a clean environment free of organic contamination.

Electro-Static Sensitivity
The MASW-00 Series PIN switches are ESD, Class 1A sensitive (HBM). The proper ESD handling procedures must be used.

Wire Bonding
Thermosonic wedge wire bonding using 0.003” x 0.00025” ribbon or 0.001” diameter gold wire is recommended. A stage temperature of 150°C and a force of 18 to 22 grams should be used. Ultrasonic energy should be adjusted to the minimum required. RF bonds should be kept as short as possible to minimize inductance.

Mounting
These chips have Ti-Pt-Au back metal. They can be die mounted with a 80Au/20Sn or electrically conductive Ag epoxy. Mounting surface must be flat and clean of oils and contaminants.

Eu Eutectic Die Attachment
An 80/20 gold-tin eutectic solder preform is recommended with a work surface temperature of 255°C and a tool tip temperature of 265°C. When hot gas is applied, the tool tip temperature should be 290°C. The chip should not be exposed to temperatures greater than 320°C for more than 10 seconds. No more than three seconds should be required for the die attachment.

Epoxy Die Attachment
Assembly should be preheated to 125°C-150°C. A Controlled thickness of 2 mils is recommended for best electrical and thermal conductivity. A thin epoxy fillet should be visible around the perimeter of the chip after placement to ensure complete coverage. Cure epoxy per manufacturer’s recommended schedule.

Operation of the MASW-005100-1194 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 MASW-005100-1194 diode switch. 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 voltages at these points will not exceed ± 1.5 volts (1.2 volts typical) for supply currents up to ± 20 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 are 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 , 65V TTL controlled PIN diode driver. A typical DC bias schematic for 2-18 GHz operation is shown in Figure 1.

2 – 18 GHz Bias Network Schematic

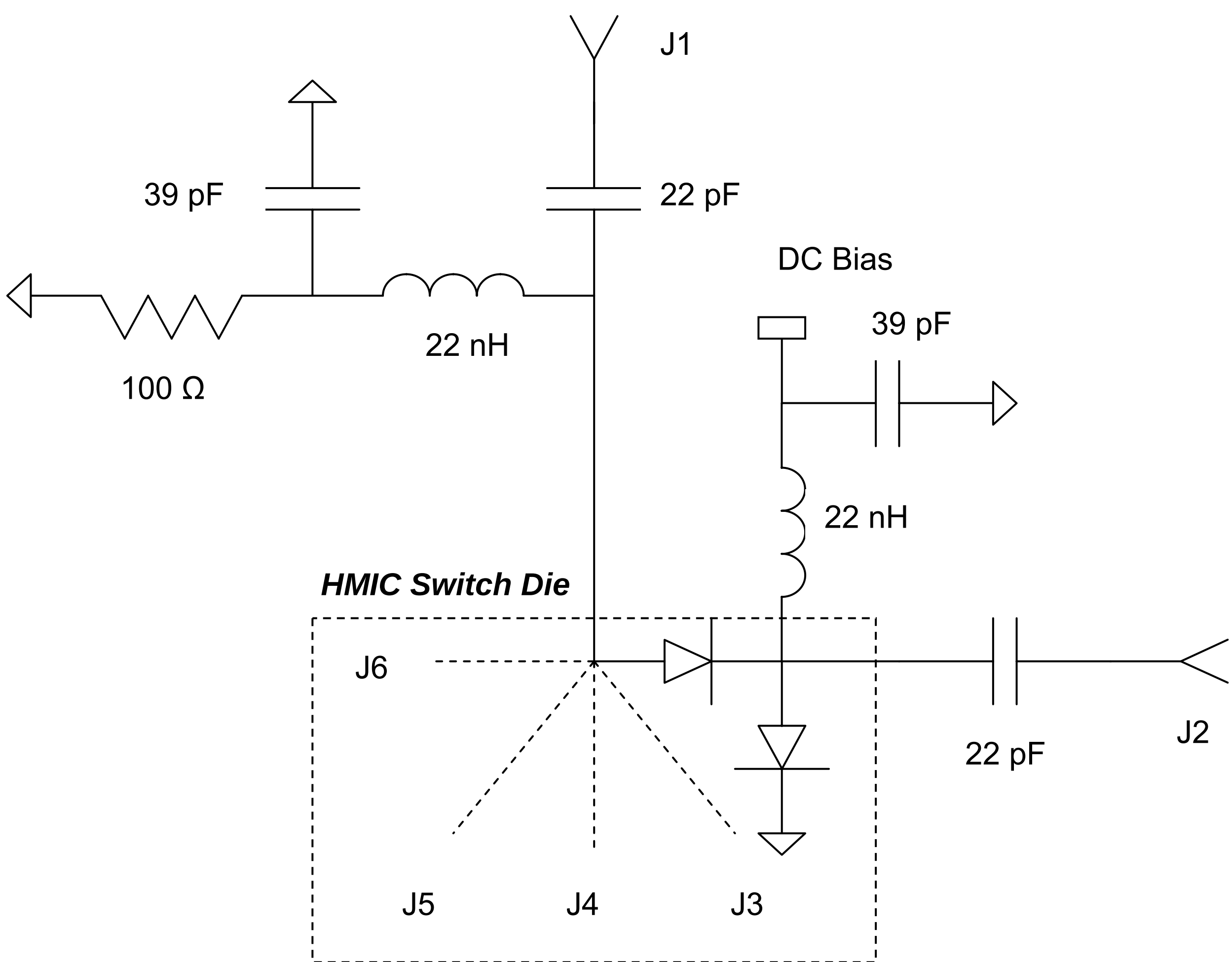
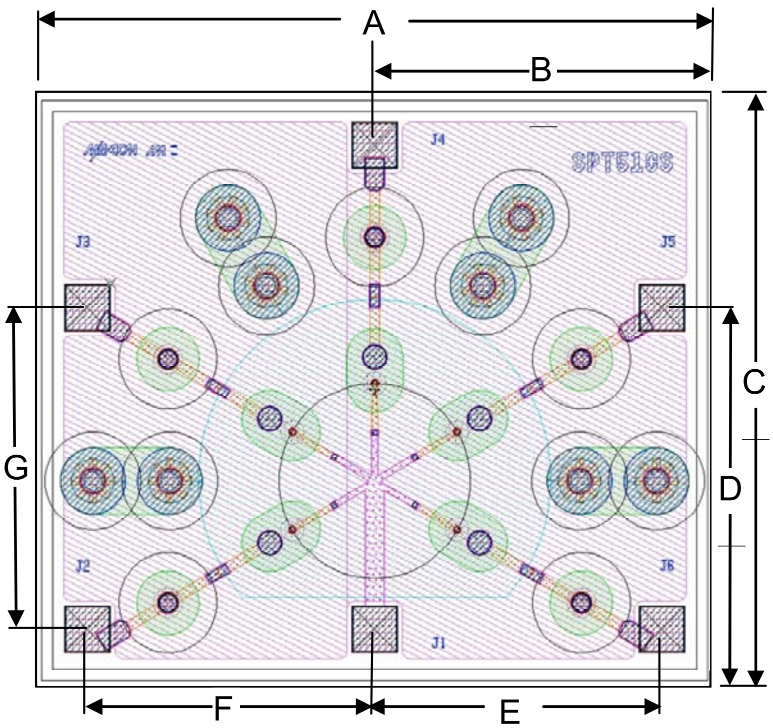


Fig. 1

MASW-005100-1194
Chip Dimensions



Nominal Chip Dimensions

DIM	INCHES	µM
A	0.068	1730
B	0.034	865
C	0.058	1480
D	0.037	945
E	0.030	750
F	0.030	750
G	0.033	825
All Pads	.005 X .005	120 X 120
Thickness	0.005	120

ORDERING INFORMATION

Part Number	Package
MASW-005100-11940W	Waffle Pack