MASW-002103-1363

HMIC™ Silicon PIN Diode SPDT Switch 50 MHz - 20 GHz

M/A-COM Products
Preliminary- Rev. V5P

Features

- Broad Bandwidth
- Specified from 50 MHz to 20 GHz
- Low Insertion Loss
- High Isolation
- Rugged Silicon Glass Construction
- Low Parasitic Capacitance and Inductance
- Lead-Free Surmount™ Package
- Rugged, Fully Monolithic
- Glass Encapsulated Construction
- Up to +37 dBm C.W. Power Handling[3] @ +25°C
- Silicon Nitride Passivation
- Polymer Scratch Protection

Description

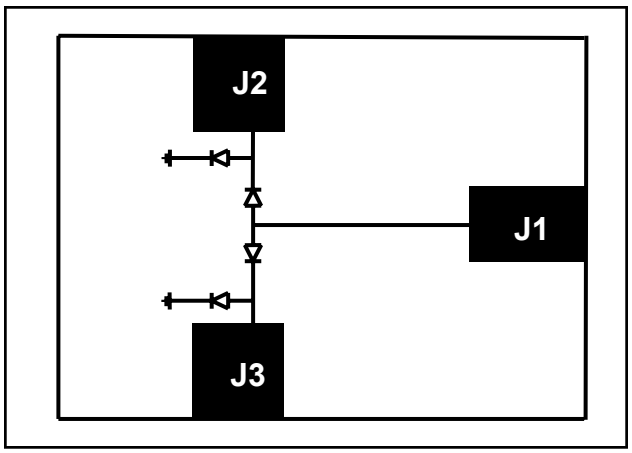
MA-COM's MASW-002103-1363 is a Surmount™ broadband monolithic switch using series and shunt connected silicon PIN diodes. This part is designed for use as a moderate signal, high performance switch in applications up to 20 GHz. This *Sur*face *Mount* chipscale configuration is optimized for broadband performance with minimal associated parasitics usually associated with hybrid MIC designs incorporating beam lead and PIN diodes that require chip and wire assembly.

The MASW-002103-1363 is fabricated using M/A-COM's patented 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 low loss, low dispersion glass. By using small spacing between elements, this combination of silicon and glass gives HMIC devices low loss and high isolation performance through low millimeter frequencies.

Selective backside metalization is applied producing a Surface Mount device. The topside is fully encapsulated with silicon nitride and has an additional polymer layer for scratch and impact protection. These protective coatings prevent damage to the junction and the anode airbridge during handling and assembly.

3. Power Handling Testing performed @ 2GHz

Functional Schematic



Pin Configuration [1]

Pin	Function
J1	RFC
J2	RF1
J3	RF2

1. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Ordering Information [2]

Part Number	Package
MASW-002103-1363OG	GEL PACK
MASW-002103-1363OP	POCKET TAPE

2. Reference Application Note M513 for reel size information.

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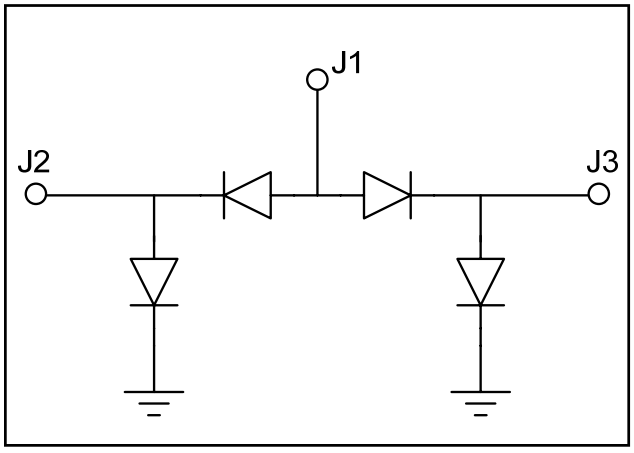
Electrical Specifications: T_A = 25°C, P_{IN} = 0 dBm, Z_0 = 50 Ω, 20mA/-10V

Parameter	Conditions	Units	Min.	Typ.	Max.
Insertion Loss	6 GHz 13 GHz 20 GHz	dB	— — —	0.55 0.80 1.05	— — —
Isolation	6 GHz 13 GHz 20 GHz	dB	— — —	52 38 27	— — —
Return Loss	6 GHz 13 GHz 20 GHz	dB	— — —	25 23 23	— — —
Switching Speed[3]	—	ns	—	20	—
Voltage Rating[4]	—	V	—	—	50
Input 0.1dB Compression Point	2 GHz	dBm	—	36	—

3. Typical Switching Speed measured fro 10% to 90 % of detected RF signal driven by TTL compatible drivers.
4. Maximum reverse leakage current in either the shunt or series PIN diodes shall be 10 mA maximum @ -50 volts.

Functional Schematic



Absolute Maximum Ratings [5,6]

Parameter	Absolute Maximum
Operating Temperature	-65 °C to +125 °C
Storage Temperature	-65 °C to +150 °C
Junction Temperature	+175 °C
Applied Reverse Voltage	|-50 V|
RF CW Incident Power	+34dBm CW
Bias Current +25°C	± 20 mA

Max Operating Conditions for combination RF Pwr, DC Bias, & Temp: 33dBm CW @ 20mA per Diode @ 85ºC

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. M/A-COM does not recommend sustained operation near these survivability limits.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These devices are rated at Class 1A Human Body. Proper ESD control techniques should be used when handling these devices.

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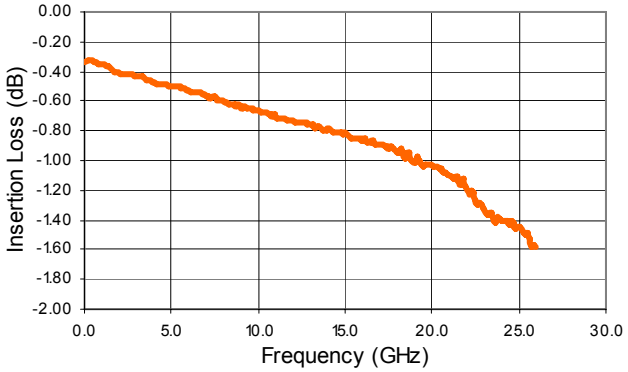
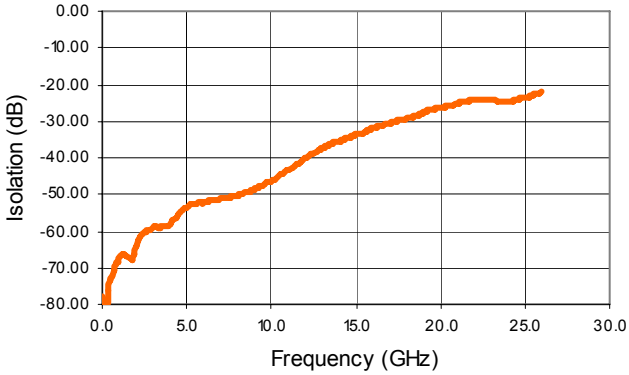
Typical Small Signal Performance at +25°C

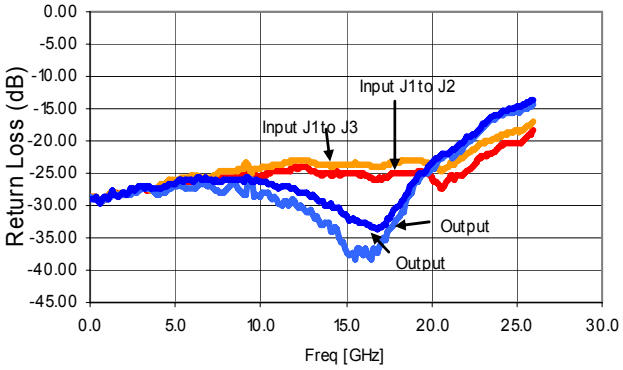
MASW-002103-1363 Insertion Loss, 25degC
Forward Bias (On-arm): -20mA, Reverse Bias (Off-arm): +10V



MASW-002103-1363 Isolation, 25degC
Forward Bias (On-arm): -20mA, Reverse Bias (Off-arm): +10V

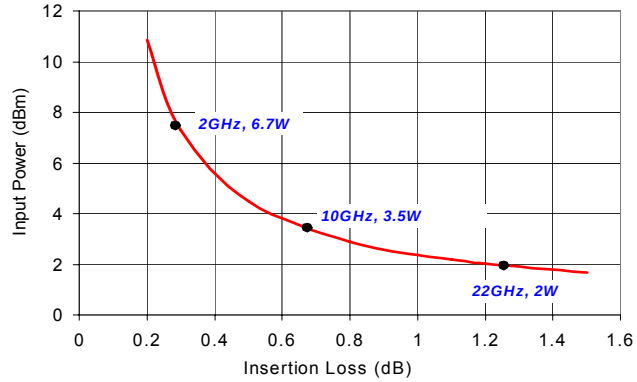


MASW-002103-1363 Return Loss, 25degC
Forward Bias (On-arm): -20mA, Reverse Bias (Off-arm): +10V



Typical Power Performance at +25°C

MASW-002103-1363 Maximum Input Power Curve
Baseplate Temperature fixed @ 25degC



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Bias Control

Optimal operation of the MASW-002103-1363 is achieved by simultaneous application of negative DC voltage and current to the low loss switching arm J2 or J3, and positive DC voltage and current to the remaining switching arm as shown in the applications circuit below. DC return is achieved via J1.

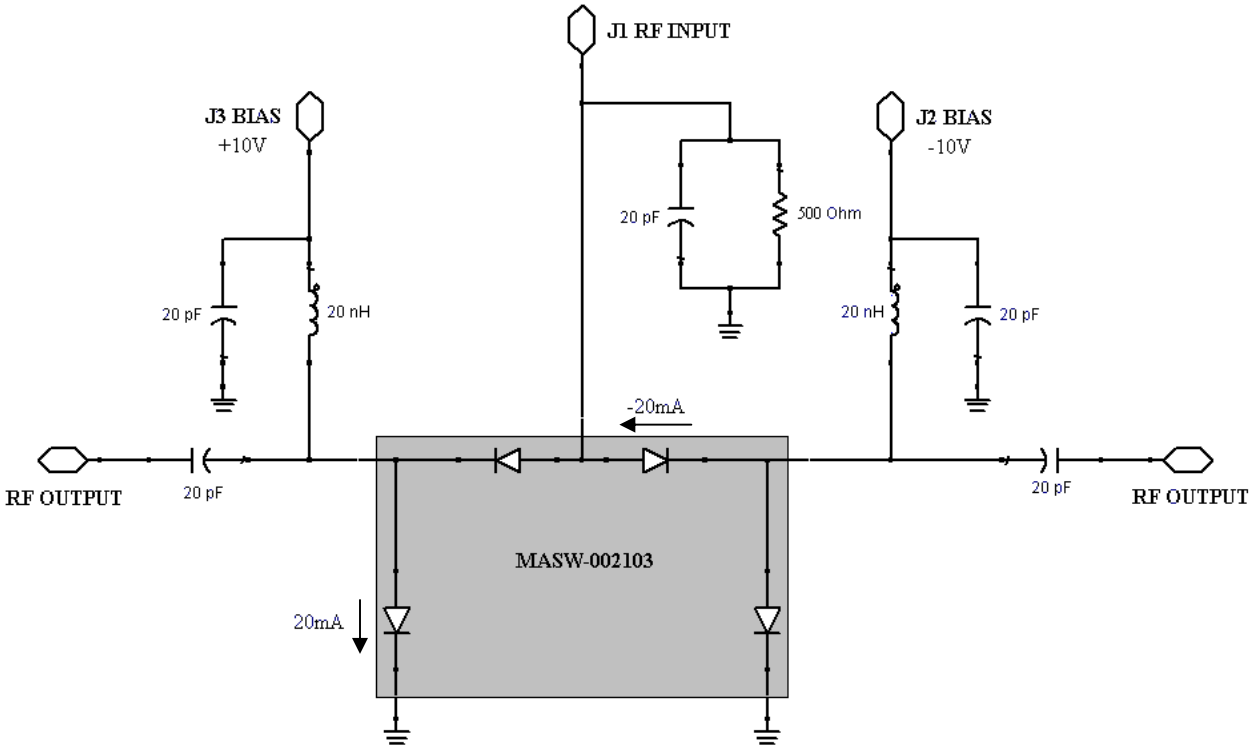
In the low loss state, the series diode must be forward biased with current and the shunt diode reverse biased with voltage. In the isolation arm, the shunt diode is forward biased with current and the series diode is reverse biased with voltage.

Driver Connection

Control Level (DC Current) at		Condition of RF Output	Condition of RF Output
J2	J3	J1-J2	J1-J3
-10V at -20mA	+20mA[1]	Low Loss	Isolation
20mA[1]	-10V at -20mA	Isolation	Low Loss

1. The voltage applied to the off arm can vary as long as +20mA is applied through the shunt diode on the off arm.

Applications Circuit



Note:
1. RLC values are for a typical operating frequency of 2 - 18 GHz and Bias Current of ± 20mA per diode

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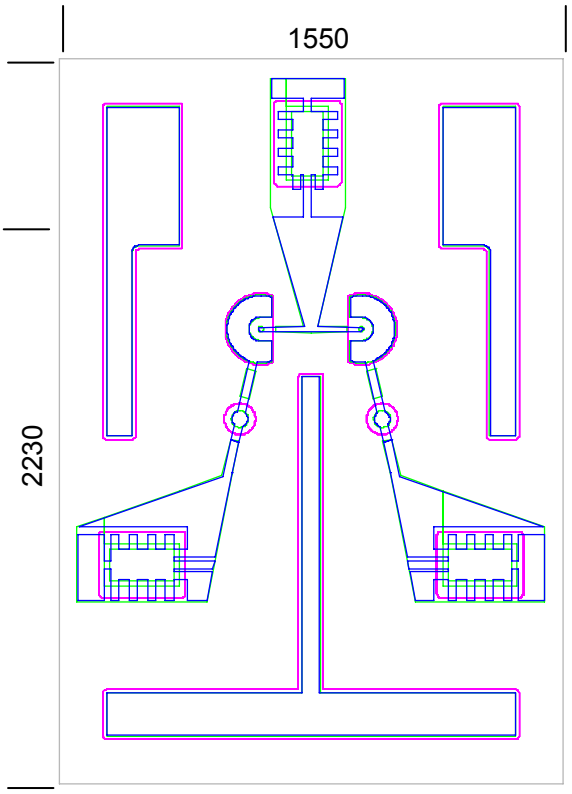
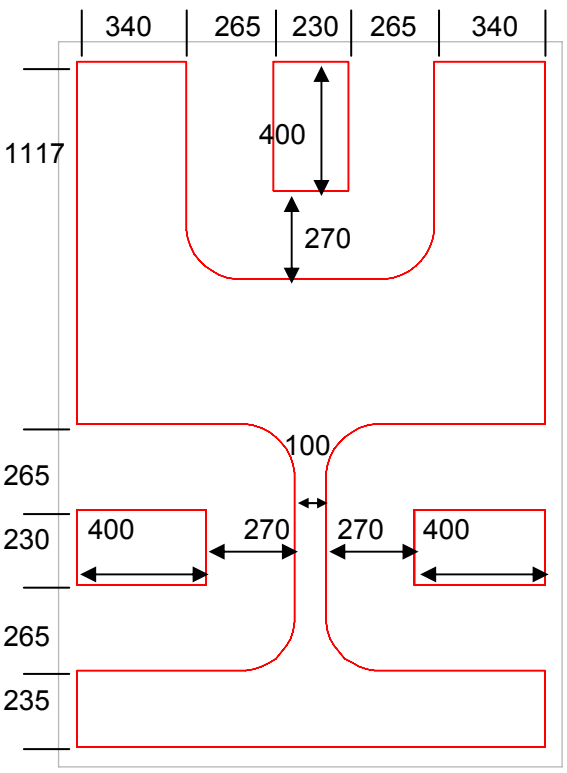
MASW-002103-1363 Outline Drawing†

Topside Footprint



Sideview

Backside Footprint



Unit um

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Handling Procedures

Attachment to a circuit board is made simple through the use of standard surface mount technology. Mounting pads are conveniently located on the bottom surface of these devices and are removed from the active junction locations. These devices are well suited for solder attachment onto hard and soft substrates. The use of 80Au/20Sn, or RoHS compliant solders is recommended. For applications where the average power is ≤ 1W, conductive silver epoxy may also be used. Cure per manufacturers recommended time and temperature. Typically 1 hour at 150°C.

When soldering these devices to a hard substrate, a solder re-flow method is preferred. A vacuum tip pick-up tool and a force of 60 to100 grams applied to the top surface of the device while placing the chip is recommended. When soldering to soft substrates, such as Duroid, it is recommended to use a soft solder at the circuit board to mounting pad interface to minimize stress due to any TCE mismatches that may exist. Position the die so that its mounting pads are aligned with the circuit board mounting pads. Solder reflow should not be performed by causing heat to flow through the top surface of the die to the back. Since the HMIC glass is transparent, the edges of the mounting pads can be visually inspected through the die after attachment is completed.

Typical re-flow profiles for Sn60/Pb40 and RoHS compliant solders is provided in Application Note M538 , “Surface Mounting Instructions“ and can viewed on the MA-COM website @ www.macom.com

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