



## **MSW2T-2040XL-198**

# **SP2T High Power VHF & UHF PIN Diode Switch**

### **Features:**

- Wide Operating Frequency Band: 20 MHz to 512 MHz
- Peak Power: +60 dBm
- Average Power: +56 dBm
- Low Insertion Loss: <0.25 dB
- High IIP3: 65 dBm
- Surface Mount SP2T Switch: 10.1mm x 6.2mm x 2.5mm
- High Linearity
- RoHS Compliant

### **Description:**

The MSW2T-2040XL-198 SP2T surface mount Extra High Power, Low Frequency PIN Diode switch operates across the frequency band from 20 MHz to 512 MHz. The MSW2T-2040XL-198 Extra High Power, Low Frequency Switch leverages high reliability hybrid manufacturing processes which yield both superior RF and thermal characteristics performance compared to MMIC or Glass Carrier based technologies. The hybrid design approach permits precise PIN Diode selection to optimize RF performance while maintaining competitive cost targets. The small form factor (10.1mm x 6.2mm x 2.5mm) offers world class power handling, low insertion loss, and superior intermodulation performance exceeding all competitive technologies. The MSW2040XL-198 symmetrical switch is tailored to minimize Transmit-to-Antenna loss while maximizing Transmit-to-Receive isolation and to enable maximum flexibility as the designer can assign either port as Transmit Port and the other as the Receive Port. The extremely low thermal resistance of the hybrid assembly permits reliably handling up to +56 dBm CW power and up to +60 dBm peak RF incident power while operating at the  $T_{amb (MAX)} = +55^{\circ}C$ .

### **Typical Applications:**

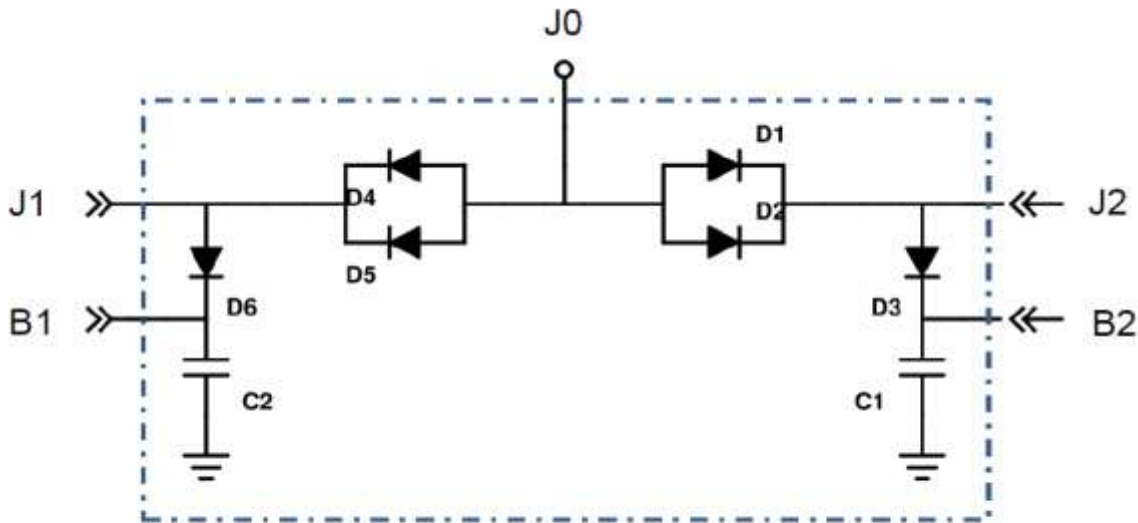
- MRI High Power Switching (Packaging: Non-Magnetic)
- Radar T/R Modules
- High Power Transmit/Receive Switching
- Switch Bank Filters
- Mil-Com Radios

The MSW2T-2040XL-198 Extra High Power, Low Frequency SP2T switch is intended for use in high power, high reliability, mission critical applications from 20 MHz to 512 MHz. The manufacturing process has been proven through decades of extensive use in high reliability application and is capable of being screened to industry HIREL standards.

**ESD and Moisture Sensitivity Level Rating:**

The MSW2T-2040XL-198 SP2T switch is fully RoHS compliant and carries an ESD rating of Class 1C, Human Body Model (HBM) with a moisture sensitivity rating of MSL 1.

**MSW2T-2040XL-198 Schematic**



**MSW2T-2040XL-198 Electrical Specifications @ Zo = 50Ω; Ta = +25°C**

Parameter	Symbol	Test Condition	Min Value	Typ Value	Max Value	Units
Frequency	F		20		512	MHz
Insertion Loss	IL	Bias State 1: port J0 to J1 Bias State 2: port J0 to J2		0.15	0.25	dB
Return Loss	RL	Bias State 1: port J0 to J1 Bias State 2: port J0 to J2	13	15		dB
Isolation	ISO	Bias State 1: port J0 to J1 Bias State 2: port J0 to J2	40	45		dB
CW Incident Power (Note 2)	P <sub>inc</sub> (CW)	Source & Load VSWR = 1.5:1			+56	dBm
Peak Incident Power (Note 2)	P <sub>inc</sub> (PK)	Source & Load VSWR = 1.5:1 Pulse width = 10 us, Duty Cycle = 1%			+60	dB
Switching Time	t <sub>sw</sub>	10% to 90% RF Voltage, TTL rep rate = 100 kHz		2		usec
Input 3 <sup>rd</sup> Order Intercept Point	IIP3	F <sub>1</sub> =500 MHz, F <sub>2</sub> =510 MHz, P <sub>1</sub> =P <sub>2</sub> =10dBm Measured on path biased to low loss state	60	65		dBm

### MSW2T-2040XL-198 Absolute Maximum Ratings @ T<sub>A</sub> = +25 °C (unless otherwise denoted)

Parameters	Conditions	Absolute Maximum Value
Forward Current – Ant, Tx or Rx Port		250mA
Forward Current – DC Bias Port		100mA
Reverse Voltage – Tx or Rx Port		125V
Reverse Voltage – DC Bias Port		125V
Forward Diode Voltage	I <sub>F</sub> = 250mA	1.2V
Operating Temperature		-65°C to + 125°C
Storage Temperature		-65°C to + 150°C
Junction Temperature		+175°C
Assembly Temperature		260°C for 10 sec
CW Incident Power Handling – J0-J1 or J0-J2 ( Note 1)	Source & Load VSWR = 1.5:1, T <sub>CASE</sub> = +55°C, cold switching	+56 dBm
Peak Incident Power Handling – J0-J1 or J0-J2 (Note 1)	Source & Load VSWR = 1.5:1, T <sub>CASE</sub> = +55°C, cold switching, Pulse Width = 10 us, Duty Cycle = 1%	+60 dBm

## Notes:

- 1) Backside RF, DC and Thermal Ground area of device must be completely soldered attached to RF circuit board vias for proper electrical and thermal circuit grounding.

### Control Truth Table for MSW2T-2040XL-198

+V<sub>cc1</sub> = 5V and +V<sub>cc2</sub> = 28V ( unless otherwise noted)

Ant – Tx Path	Ant – Rx Path	Bias J1 (notes 1 & 2)	Bias J2 (notes 1 & 2)	B1 Bias (notes 1 & 2)	B2 Bias (notes 1 & 2)	J0 (notes 1 & 2)
Low Loss	Isolation	V = 0 V, I = -150 mA	V = V <sub>HIGH</sub> , I = +100 mA	V = V <sub>HIGH</sub> I = 0 mA	V = 0V I = -25 mA	V ~ 0.9V I = +100mA
Isolation	Low Loss	V = V <sub>HIGH</sub> , I = +25 mA	V = 0 V, I = -150 mA	V = 0 V, I = -25 mA	V <sub>HIGH</sub> +28 V I = 0 mA	V ~ 0.9V I = +100mA

## Notes:

- 1) 28 V ≤ V<sub>HIGH</sub> ≤ 125V
- 2) PIN diode min reverse DC voltage (V<sub>HIGH</sub>) to maintain high resistance state in the OFF PIN diode is determined by RF frequency. Incident power, duty cycle, characteristic impedance and VSWR as well as by characteristics of the diode. The recommended min reverse bias voltage (V<sub>HIGH</sub>) values are provided in the Min Reverse Bias Voltage Table of this data sheet.

### MSW2T-2040XL-198 Minimum Reverse Bias Voltage Table

Part Number	Frequency of Operation (MHz)				
	20	100	200	300	512
MSW2T-2040XL-198	TBD	TBD	TBD	TBD	TBD

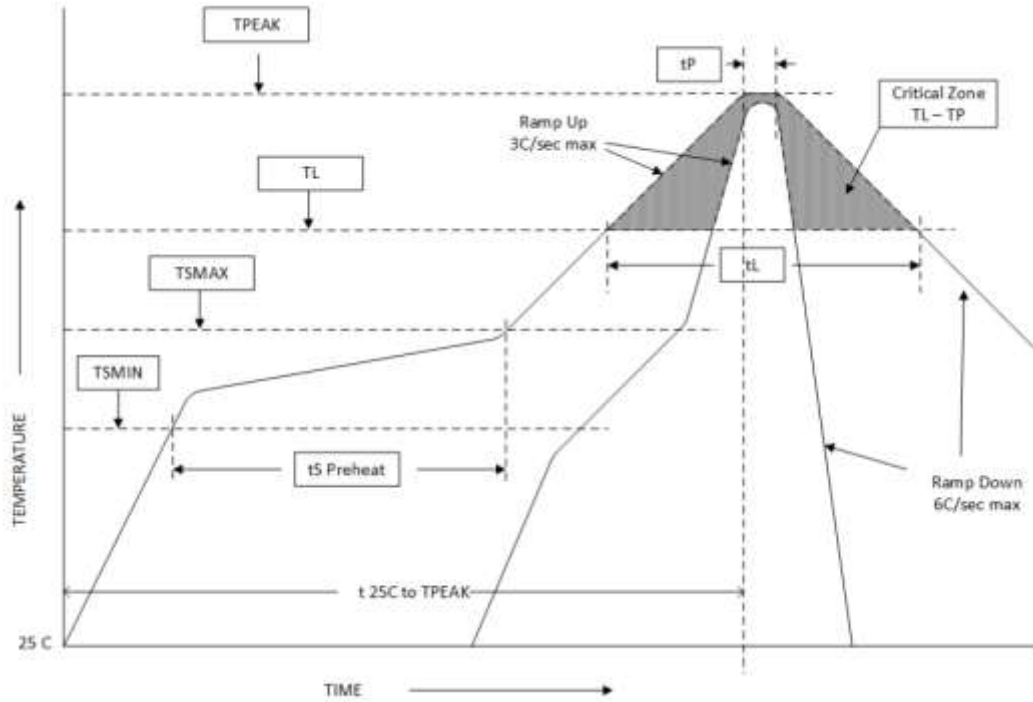
Note: N/A denotes an operating frequency outside the normal switch operating frequency range.

## Assembly Instructions

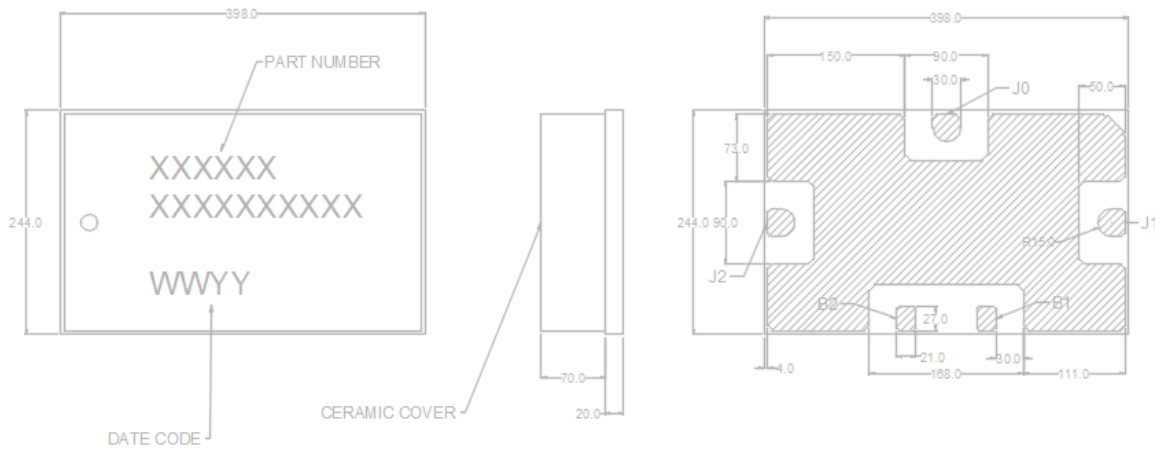
The MSW2T-2040XL-198 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

Profile Parameter	Sn-Pb Assembly Technique	RoHS Assembly Technique
Average ramp-up rate (T <sub>L</sub> to T <sub>P</sub> )	3°C/sec (max)	3°C/sec (max)
Preheat		
Temp Min (T <sub>smin</sub> )	100°C	100°C
Temp Max (T <sub>smax</sub> )	150°C	150°C
Time (min to max) (t <sub>s</sub> )	60 – 120 sec	60 – 120 sec
T <sub>smax</sub> to T <sub>L</sub>		
Ramp up Rate		3°C/sec (max)
Peak Temp (T <sub>P</sub> )	225°C +0°C / -5°C	245°C +0°C / -5°C
Time within 5°C of Actual Peak Temp (T <sub>P</sub> )	10 to 30 sec	20 to 40 sec
Time Maintained Above:		
Temp (T <sub>L</sub> )	183°C	217°C
Time (t <sub>L</sub> )	60 to 150 sec	60 to 150 sec
Ramp Down Rate	6°C/sec (max)	6°C/sec (max)
Time 25°C to T <sub>P</sub>	6 minutes (max)	8 minutes (max)

### Solder Re-Flow Time-Temperature Profile

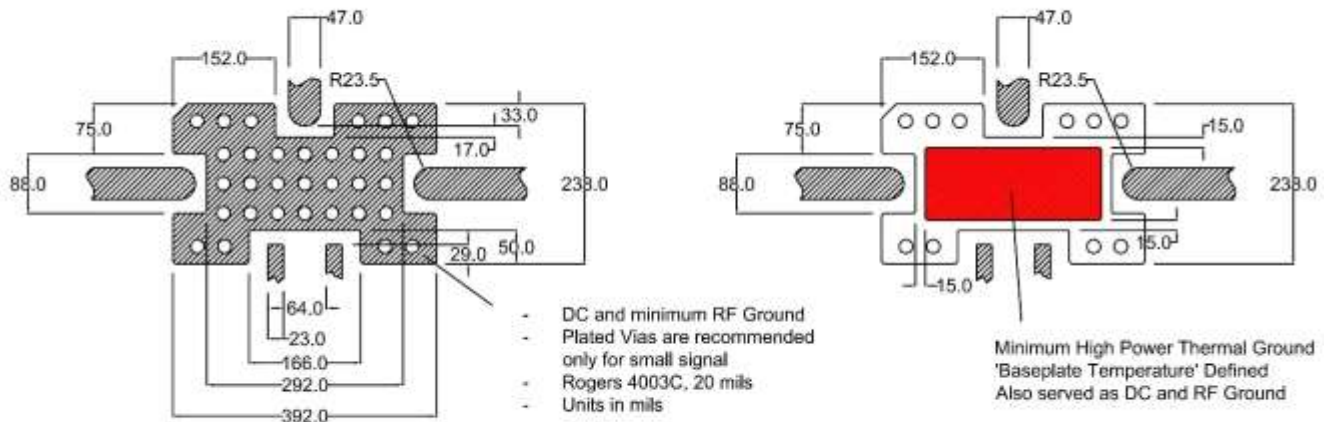


### MSW2T-2040XL-198 SP2T Package Outline Drawing



Note: Metalized area on backside is the RF, DC and Thermal ground. In user's end application this surface temperature must be managed to meet the power handling requirements.

## MSW2T-2040XL-198 Suggested Solder Foot Print



## Thermal Design Considerations

The design of the MWT-2040XL-198 High Power Switch permits the maximum efficiency in thermal management of the PIN Diodes while maintaining extremely high reliability. Optimum switch performance and reliability of the switch can be achieved by the maintaining the base ground surface temperature of less than +55°C.

## Part Number Ordering Details

The MSW2T-2040XL-198 High Power Switch is available in the following format.

Part Number	Packaging
MSW2T-2040XL-198	Gel-Pack
MSW2T-2040XL-198 SS EVB	Box
MSW2T-2040XL-198 HP EVB	Box