



## MSW2T-2020-191

# SP2T Surface Mount High Power Series PIN Diode Switch

### Features:

- Surface Mount SP2T Switch: 5mm x 8mm x 2.5mm
- Industry Leading Average Power Handling: +52 dBm (CW)
- Frequency Range: 50 MHz to 1 GHz
- Support High RF Peak Power: Handling: +57 dBm
- Low Insertion Loss: < 0.20 dB
- High IP3: >65 dBm
- Operates for Positive Voltage Only: (+5V & -200V)
- RoHS Compliant

### Description:

The MSW2T-2020-191 surface mount asymmetrical SP2T High Power PIN Diode switch will safely handle up to +52 dBm (CW) and +57 dBm Peak Power. The MSW2T-2020-191 SP2T leverages high reliability hybrid manufacturing processes which yield proven superior performance to both MMIC and Glass Carrier based technologies. The hybrid design approach permits precise PIN Diode selection to optimize RF performance while maintaining competitive cost targets. The MSW2T-2020-191 is an asymmetrical SP2T which was designed to maximize the Tx-Rx Isolation while minimizing the Tx-ANT loss. The MSW2T-2020-191 can safely handle CW powers of up to +52 dBm and peak power levels up to +57 dBm while being operated at an ambient temperature of +85°C. The small form factor (8mm x 5mm x 2.5mm) offers world class power handling, low insertion loss, and superior intermodulation performance while exceeding all competitive technologies.

### Typical Applications:

- Radar T/R Modules
- Switch Bank Filters
- Mil-Com Radios

The MSW2T-2020-191 series of High Power SP2T switches are intended for use in high power, high reliability, mission critical applications across the 50 MHz to 1.0 GHz Band frequency ranges. The manufacturing process has been proven through years of extensive use in high reliability applications.

The MSW2T-2020-191 SP2T switches are fully RoHS compliant.

**ESD and Moisture Sensitivity Level Rating:**

The MSW2T-2020-191 carries an ESD rating of Class 1C, Human Body Model (HBM) and a moisture sensitivity rating of MSL 1.

**MSW2T-2020-191 Specifications @  $Z_0 = 50\Omega$ ;  $T_a = +25^\circ\text{C}$** 

Parameter	Symbol	Unit	Test Conditions	Min Value	Typical Value	Max Value
Frequency	F	MHz		50		1,000
Tx-Ant IL	IL(Tx)	dB	+5V @ 100 mA (Tx) -200V @ 25 mA (Rx)		0.20	0.30
Ant-Rx IL	IL(Rx)	dB	+5V @ 100 mA (Rx) -200V @ 0 mA (Tx)		0.30	0.40
Tx-Ant RL	RL(Tx)	dB	+5V @ 100 mA (Tx) -200V @ 25 mA (Rx)	18	20	
Ant-Rx RL	RL(Rx)	dB	+5V @ 100 mA (Rx) -200V @ 0 mA (Tx)	18	20	
Tx-Rx Isolation	ISO(Rx)	dB	+5V @ 100 mA (Tx) -200V @ 25 mA (Rx)	40	45	
Rx-Tx Isolation	ISO(Tx)	dB	+5V @ 100 mA (Rx) -200V @ 0 mA (Tx)	20	23	
CW Incident Power, Ant-Tx Low Loss State (Note 2)	$P_{inc}(CW)$	dBm	+5V @ 100 mA (Tx) -200V @ 25 mA (Rx) 1.5:1 source & load VSWR			52
CW Incident Power, Ant-Rx Low Loss State (Note 2)	$P_{inc}(CW)$	dBm	+5V @ 100 mA (Rx) -200V @ 0 mA (Tx) 1.5:1 source & load VSWR			40
Peak Incident Power Ant-Tx Low Loss State	$P_{inc}(PK)$	dBm	+5V @ 100 mA (Tx) -200V @ 25 mA (Rx) 1.5:1 source & load VSWR, 10us PW, 1% DC			57
Switching Speed	$T_{SW}$	usec	10% to 90% RF voltage		1.5	2.0
Input 3 <sup>rd</sup> Order Intercept Point	IIP3		F1= 500 MHz, F2= 510 MHz P1=P2=0 dBm	60	65	

**Condition 1:**

Tx: +5V; +100mA  
 ANT: -200V; -25mA  
 Rx: -200V; -25mA  
 B1: 0V, -25mA

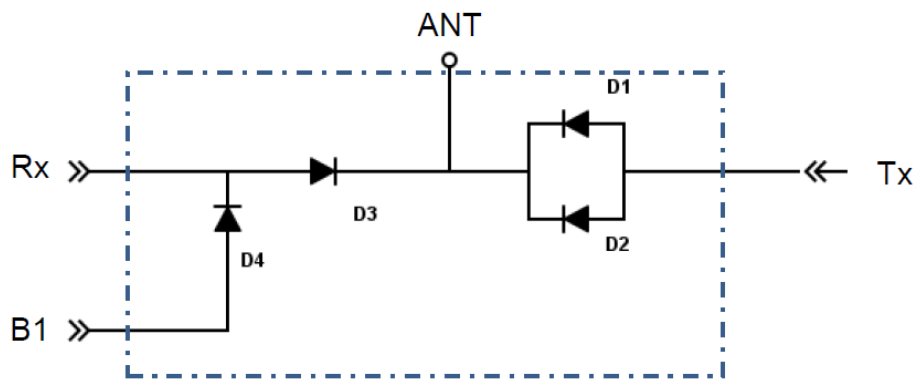
**Condition 2:**

Tx: -200V; 0mA  
 ANT: -200V; 0mA  
 Rx: +5V; +100mA  
 B1: -200V; 0mA

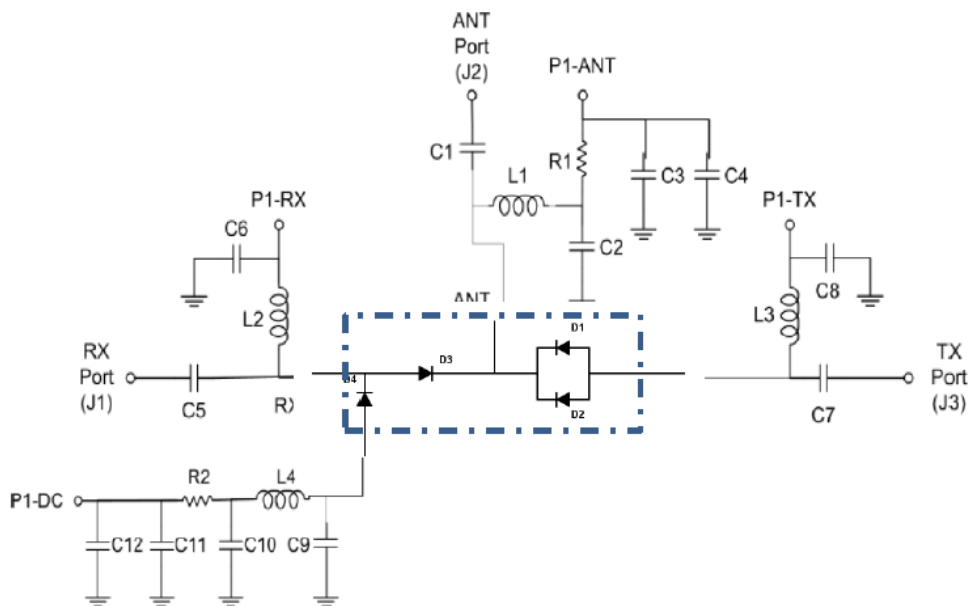
Notes:

- 1) Switching speed (50% TTL – 10% to 90% RF Voltage) is a function of the driver circuit. An RC current spike network is employed on the driver output to provide the transient current spike to remove the I region stored charge. Typical values are: R = 50 to 220Ω and C = 470 to 1,000 pF.
- 2) The minimum DC reverse bias voltage to maintain high resistance in the OFF state is determined by the RF frequency, incident power and VSWR. The minimum DC reverse voltage values are provided in the Minimum Reverse Voltage Table below.

**MSW2T-2020-191 SP2T Schematic**



**MSW2T-2020-191 Driver Interface Schematic and Associated Truth Table**



## RF Biasing Network Values

Part	F (MHz)	DC Blocking Caps	Inductors	Current Limiting Resistors
MSW2T-2020-191	50 – 1,000	0.1 uF	4.7 uH	R1=43Ω, R2=180Ω

R1 and R2 = Bias Current Setting Resistors. Recommended minimum forward bias current is 100mA to assure that low insertion loss is achieved.

## RF Truth Table

Tx-Ant Path	Rx-ANT Path	Tx Bias	Rx Bias	ANT Bias	B1 Bias
Low Loss	Isolation	+5V @ +100mA	-200V @ -25mA	-200V @ -25 mA	0V @ -25mA
Isolation	Low Loss	+200V @ 0mA	+5V @ +100mA	-200V @ 0mA	-200V @ 0mA

## MSW2T-2020-191 Absolute Maximum Ratings @ T<sub>A</sub> = +25 °C (unless otherwise denoted)

Parameter	Absolute Maximum Value
Forward Current @ Tx or Rx	250mA
Forward Current @ Bias Port	150 mA
Reverse Voltage @ Tx or Rx	300V
Reverse Voltage @ DC	300V
Forward Diode Voltage	1.2 V @ 250 mA
Operating Temperature	-65 °C to +125 °C
Storage Temperature	-65 °C to +150 °C
Junction Temperature	+175 °C
Assembly Temperature	+260 °C for 10 seconds
CW Incident Power Handling Source & Load VSWR = 1.5 : 1 (Cold Switching)	+52 dBm @ +85 °C Case Temp
Peak Incident Power Handling Source & Load VSWR = 1.5 : 1 (Cold Switching)	+57 dBm @ 10 usec pulse, 1% duty cycle @ +85 °C Case Temp
Total Dissipated RF & DC Power (Cold Switching)	5W @ +85 °C Case Temp

Notes:.

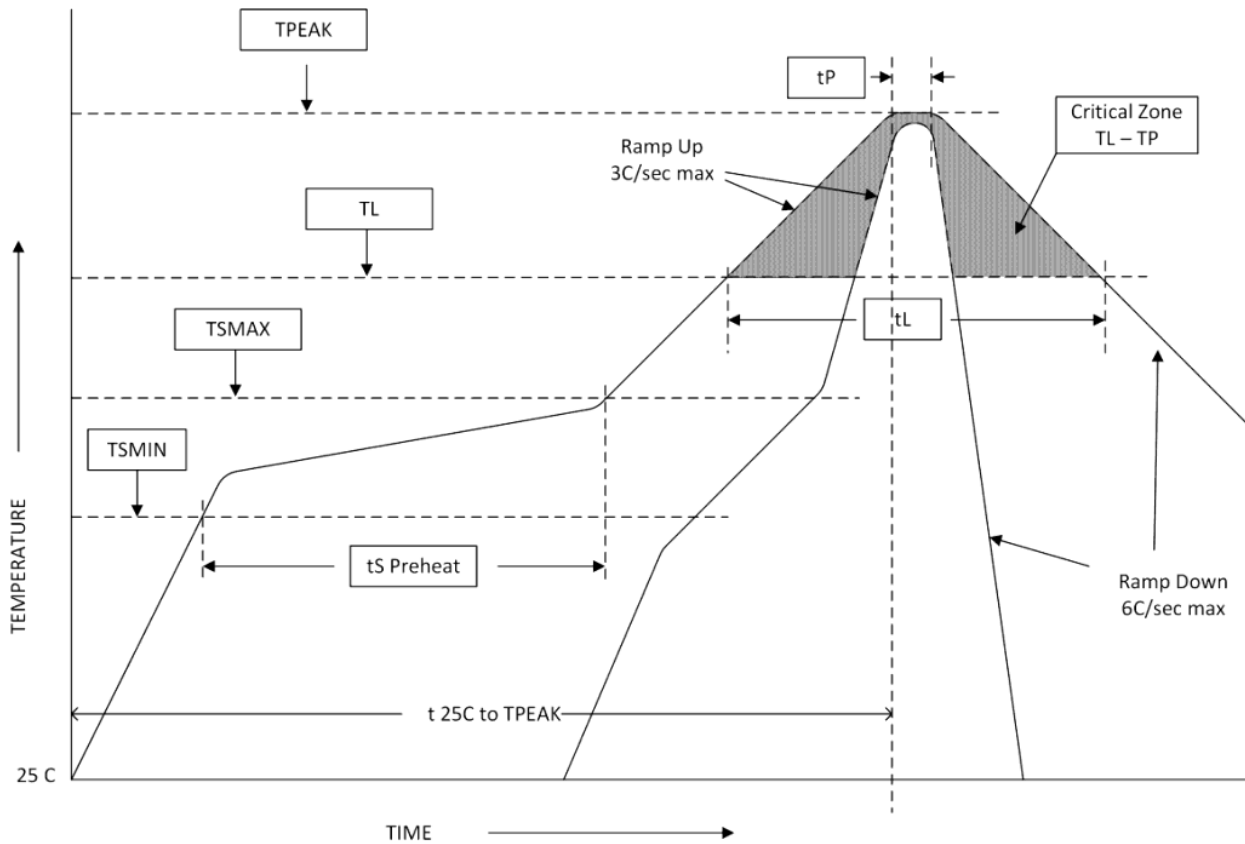
- 1) Backside RF and DC grounding area of the MSW2T-2020-191 must be completely soldered attached to the RF Circuit board for proper electrical and thermal circuit grounding.

## Assembly Instructions

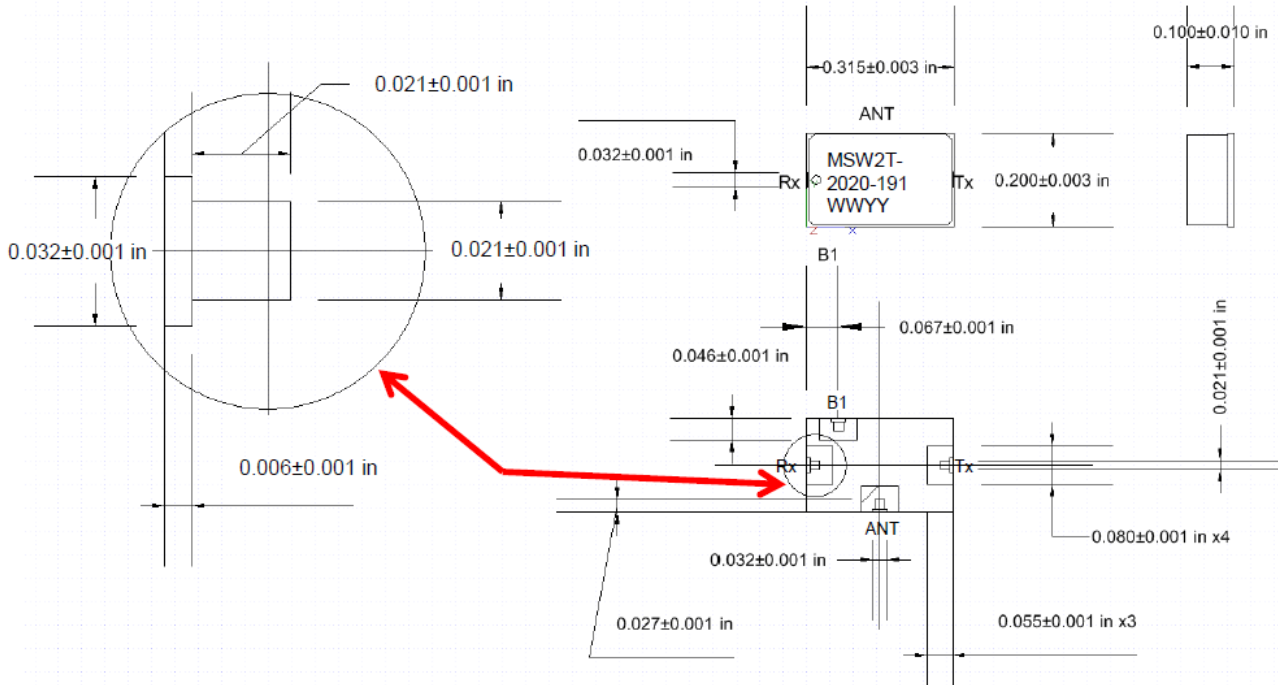
The MSW2T-2020-191 High Power Switch are available in either tube or Tape & Reel format. The MSW2T-2020-191 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/Pb37 type solders per the Table and Temperature Profile Graph shown below:

Profile Parameter	Sn-Pb Assembly Technique	RoHS Assembly Technique
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/sec (max)	3°C/sec (max)
Preheat		
Temp Min ( $T_{smin}$ )	100°C	100°C
Temp Max ( $T_{smax}$ )	150°C	150°C
Time (min to max) ( $t_s$ )	60 – 120 sec	60 – 120 sec
$T_{smax}$ to $T_L$		
Ramp up Rate		3°C/sec (max)
Peak Temp ( $T_P$ )	225°C +0°C / -5°C	260°C +0°C / -5°C
Time within 5°C of Actual Peak Temp ( $T_P$ )	10 to 30 sec	20 to 40 sec
Time Maintained Above:		
Temp ( $T_L$ )	183°C	217°C
Time ( $t_L$ )	60 to 150 sec	60 to 150 sec
Ramp Down Rate	6°C/sec (max)	6°C/sec (max)
Time 25°C to $T_P$	6 minutes (max)	8 minutes (max)

### Solder Re-Flow Time-Temperature Profile



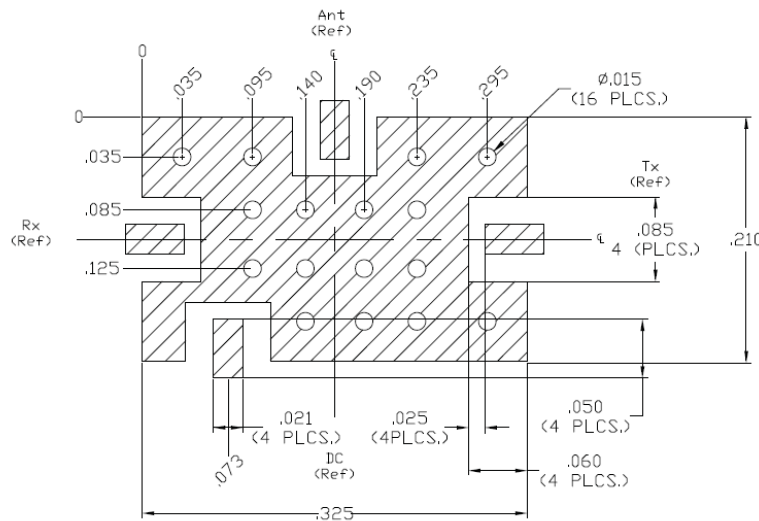
### MSW2T-2020-191 SP2T Package Outline Drawing



**Note:**

- 1) 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.
- 2) All dimensions in inches.

### MSW2T-2020-191 Recommended Solder Foot Print



**Part Number Ordering Details**

Part Number	Packaging
MSW2T-2020-191	Tube or Tray
MSW2T-2020-191TR	Tape & Reel (250 pcs)