



# **MSW2T-020522-232**

## **SP2T SMT 1KW PIN Diode Series Switch**

### **Features:**

- Wide Operating Frequency Band: 20 MHz to 520 MHz
- Industry Leading Average Power (CW) Handling: +60 dBm
- Low Insertion Loss: <0.5 dB
- Isolation: >40 dB
- High IIP3: 65 dBm
- Surface Mount SP2T Switch: 8mm x 5mm x 2.5mm
- High Linearity
- RoHS Compliant

### **Description:**

The MSW2T-020522-232 symmetrical SP2T surface mount High Power Series PIN Diode switch offers an exceptionally high power handling of 1KW (+60 dBm) average power over the over the operating frequency operating from 20 MHz to 520 MHz. The MSW2T-020522-232 high power switches leverage 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 (8mm x 5mm x 2.5mm) offers world class power handling, low insertion loss, and superior intermodulation performance exceeding all competitive technologies. The MSW2T-020522-232 symmetrical switches 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 +60 dBm CW power while operating at the  $T_{amb (MAX)} = +55^{\circ}C$ .

### **Typical Applications:**

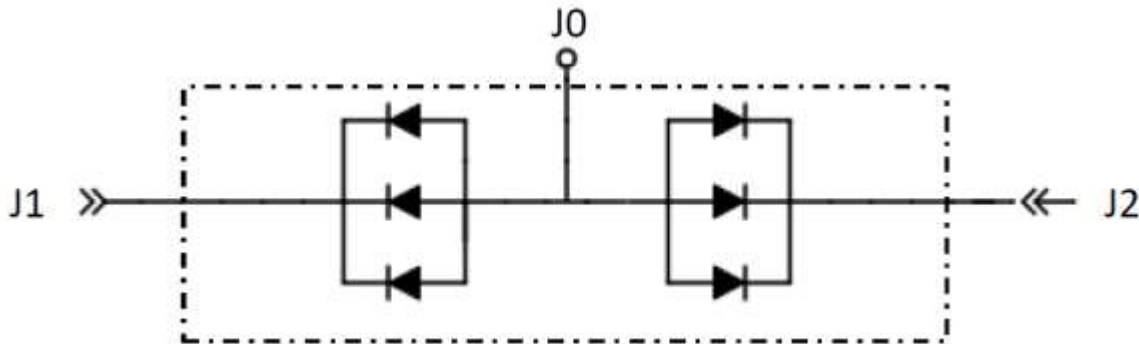
- High Power Transmit/Receive Switching
- EW Systems
- Switch Bank Filters
- Mil-Com Radios

The MSW2T-020522-232 series of High Power SP2T switches are intended for use in high power, high reliability, mission critical applications from 20 MHz to 520 MHz. The manufacturing process has been proven through decades of extensive use in high reliability applications.

### **ESD and Moisture Sensitivity Level Rating:**

The MSW2T-020522-232 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-020522-232 Schematic**



#### **MSW2T-020522-232 Electrical Specifications @ $Z_o = 50\Omega$ ; $T_a = +25^\circ\text{C}$**

Parameter	Symbol	Test Condition	Min Value	Typ Value	Max Value	Units
Frequency	F		20		520	MHz
Insertion Loss	IL	State 1: J0 to J1 & State 2: J0 to J2			0.5	dB
Return Loss	RL	50 MHz to 1 GHz	15			dB
Isolation	ISO	State 1: J0 to J1 & State 2: J0 to J2 50 MHz to 1 GHz	40			dB
CW Incident Power (Note 2)	$P_{inc}(CW)$	Source & Load VSWR = 1:1.25			+60	dBm
Switching Time	$t_{sw}$	10% to 90% RF Voltage, TTL rep rate = 100 kHz			5	usec
Input 3 <sup>rd</sup> Order Intercept Point	IIP3	$F_1=500$ MHz, $F_2=510$ MHz, $P_1=P_2=10$ dBm Measured on path biased to low loss state	60	65		dBm

**MSW2T-020522-232 Absolute Maximum Ratings @  $T_A = +25\text{ }^\circ\text{C}$  (unless otherwise denoted)**

Parameters	Conditions	Absolute Maximum Value
Forward Current – Port		1,200mA
Reverse Voltage – Tx or Rx Port		195V
Forward Diode Voltage	$I_F = 400\text{mA}$	1.2V
Operating Temperature		$-65^\circ\text{C}$ to $+125^\circ\text{C}$
Storage Temperature		$-65^\circ\text{C}$ to $+150^\circ\text{C}$
Junction Temperature		$+175^\circ\text{C}$
Assembly Temperature		$260^\circ\text{C}$ for 10 sec
CW Incident Power Handling – J0-J1 or J0-J2 ( Note 1)	Source & Load VSWR = 1:1.25, $T_{\text{CASE}} = 55^\circ\text{C}$ , cold switching	+60 dBm

Notes:

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

**Control Truth Table for MSW2T-020522-232** $+V_{cc1} = 5\text{V}$  and  $+V_{cc2} = 28\text{V}$  ( unless otherwise noted)

Ant – Tx Path	Ant – Rx Path	J1 (notes 1 & 2)	J2 (notes 1 & 2)	J0 (notes 1 & 2)
Low Loss	Isolation	$V = 0\text{ V}$ , $I = -150\text{ mA}$	$V = V_{\text{HIGH}}$ , $I = +100\text{ mA}$	$V \sim +5\text{V}$ $I = +100\text{mA}$
Isolation	Low Loss	$V = V_{\text{HIGH}}$ , $I = +25\text{ mA}$	$V = 0\text{ V}$ , $I = -150\text{ mA}$	$V \sim +5\text{V}$ $I = +100\text{mA}$

Notes:

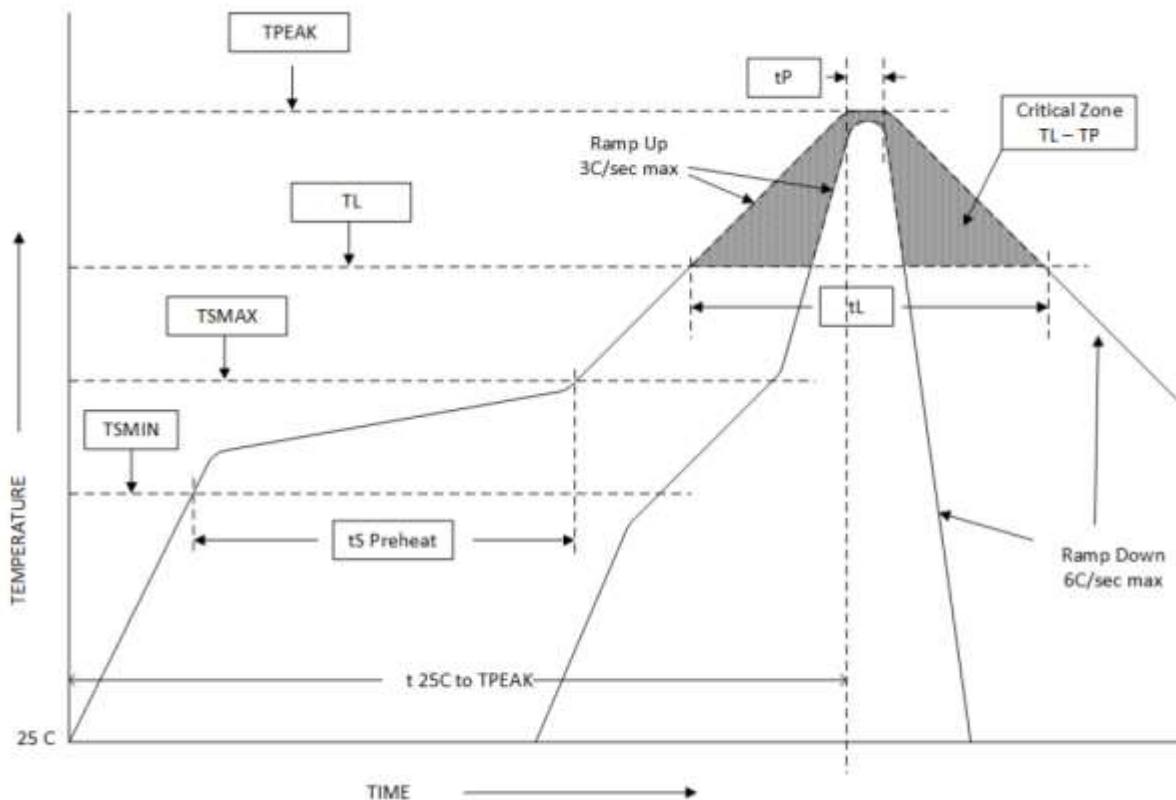
- 1)  $28\text{ V} \leq V_{\text{HIGH}} \leq 125\text{V}$
- 2) PIN diode min reverse DC voltage ( $V_{\text{HIGH}}$ ) to maintain high resistance state in the OFF PIN diode is determined by RF frequency. Incident power, duty cycle, characteristic impedance and VSWR as well as by characteristics of the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

## Assembly Instructions

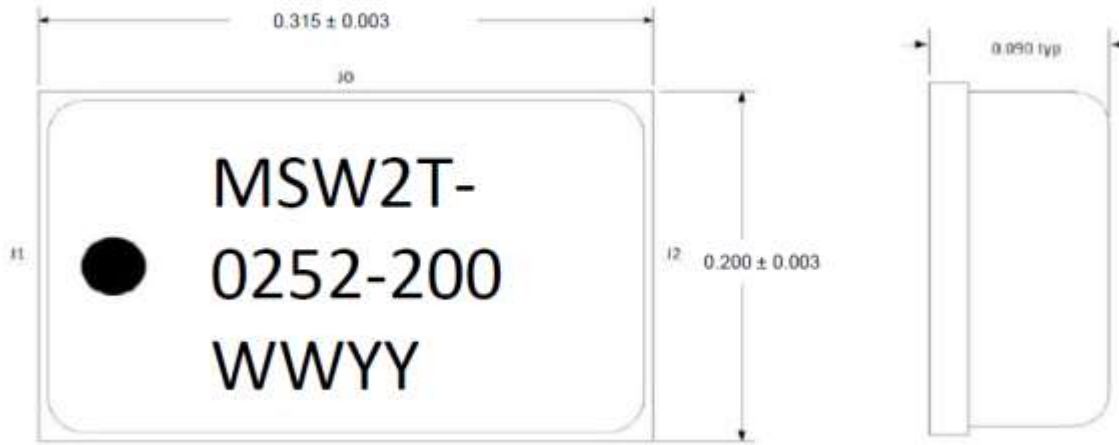
The MSW2T-204X-193 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

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	245°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)

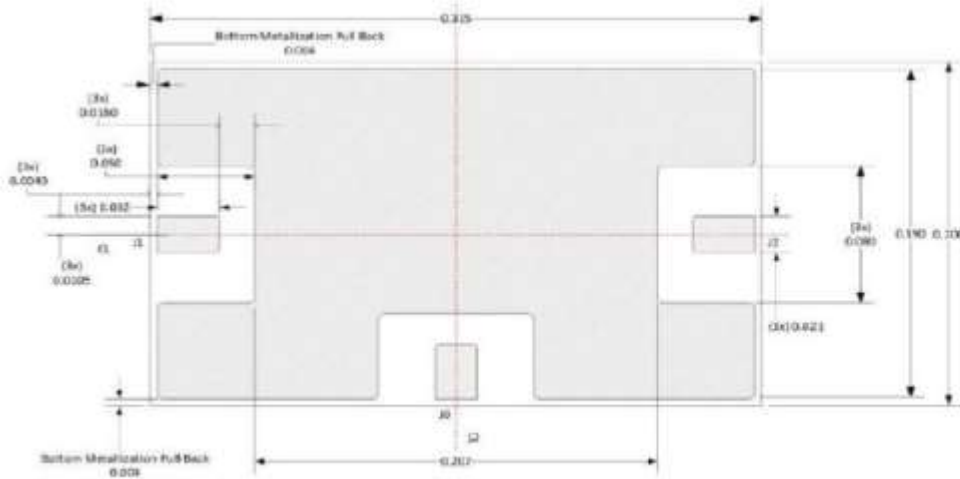
### Solder Re-Flow Time-Temperature Profile



### MSW2T-020522-232 SP2T Package Outline Drawing



Side View



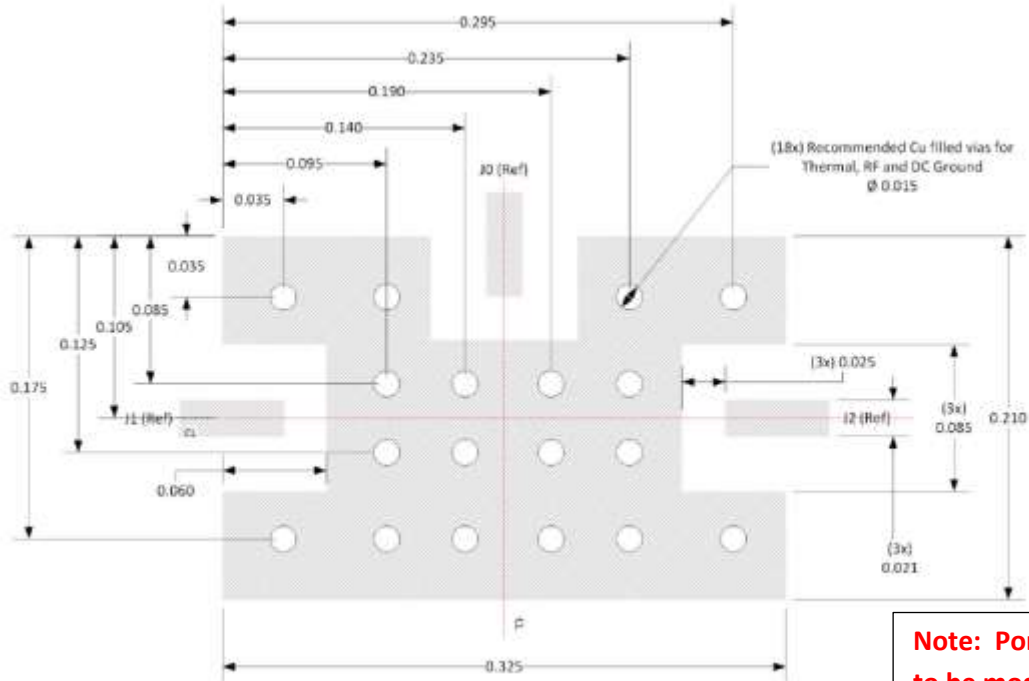
**Note: Port trace width to be modified to match customer PCB trace width to maximize power handling.**

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.

### Thermal Design Considerations:

The design of the MWT-2040-193 High Power Switches 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 85°C.

### Recommended RF Circuit Solder Footprint for the MSW2T-020522-232



**Note: Port trace width to be modified to match customer PCB trace width to maximize power handling.**

#### Part Number Ordering Details:

The MSW2T-020522-232 High Power Switch is available in the following format.

Part Number	Packaging
MSW2T-020522-232	Gel-Pack