

RELEASED



RFuW Engineering Ltd.

MSW3T-3200-150

SP3T Surface Mount High Power PIN Diode Switch

Features:

- Surface Mount SP3T Switch: 9mm x 6mm x 2.5mm
- Frequency Range: 50 MHz to 3.0 GHz
- Industry Leading Average Power Handling: +50 dBm (CW)
- High RF Peak Power: +53 dBm (Peak)
- Low Insertion Loss: < 0.5 dB
- High IP3: > 65 dBm
- High Bias Voltage supports High Linearity
- RoHS Compliant

Description:

The MSW3T-3200-150 SP3T surface mount High Power PIN Diode switch 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 small form factor (9mm x 6mm x 2.5mm) offers world class power handling, low insertion loss, and superior intermodulation performance exceeding all competitive technologies.

Typical Applications:

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

The MSW3T-3200-150 High Power SP3T switch are intended for use in high power, high reliability, mission critical applications across the 50 MHz to 3 GHz frequency ranges. The manufacturing process has been proven through years of extensive use in high reliability applications.

The MSW3T-3200-150 SP3T switch is fully RoHS compliant.

ESD and Moisture Sensitivity Level Rating:

The MSW3T-3200-150 carries an ESD ratings of Class 1C, Human Body Model (HBM) and a moisture sensitivity rating of MSL 1.

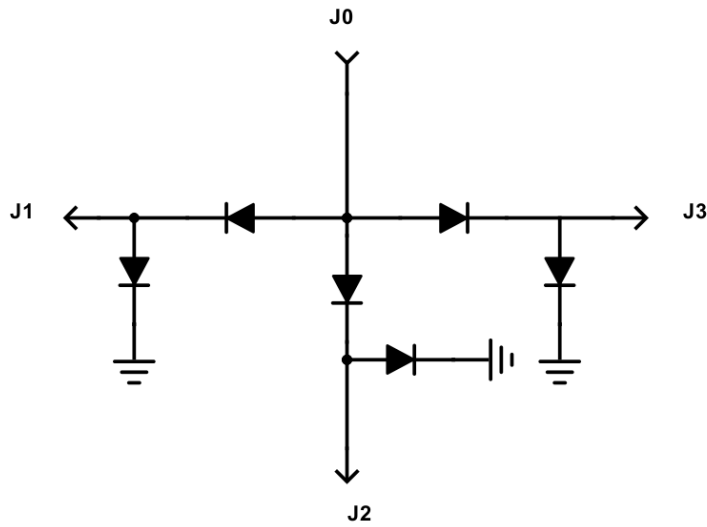
MSW3T-3200-150 Specifications@ Zo = 50Ω; Ta = +25°C

Parameter	Symbol	Units	Test Conditions	Min Value	Typical Value	Max Value
Frequency	F	MHz		50		3,000
J0-J1, J0-J2 or J0-J3 Insertion Loss (Note 1)	IL	dB	-20V @ 100mA (ON) +10V @ 50 mA (OFF)		0.4	0.6
J0-J1, J0-J2 or J0-J3 Return Loss (Note 1)	RL	dB	-20V @ 100mA (ON) +10V @ 50 mA (OFF)	12	> 15	
J0-J1, J0-J2 or J0-J3 Isolation (Note 1)	ISO	dB	-20V @ 100mA (ON) +10V @ 50 mA (OFF)	25	> 30	
CW Incident Power (Note 2)	P _{inc} (CW)	dBm	-30V @ 150mA (ON) +180V @ 100 mA (OFF) 1.5:1 Source & Load VSWR		50	
Peak Incident Power (Note 2)	P _{inc} (Pk)	dBm	-30V @ 150mA (ON) +180V @ 100 mA (OFF) 1.5:1 Source & Load VSWR		53 @ 20 uS Pulse, 12% Duty	
Switching Speed	Ts	us	(10%-90%) RF Voltage TTL rep rate = 100 kHz		3	
Input 3 rd Order Intercept Point	IIP3	dBm	F1 = 500 MHz F2 = 510 MHz P1 = P2 = +40 dBm -180V @ -50 mA (ON) +1V @ +50 mA (OFF)	60	65	

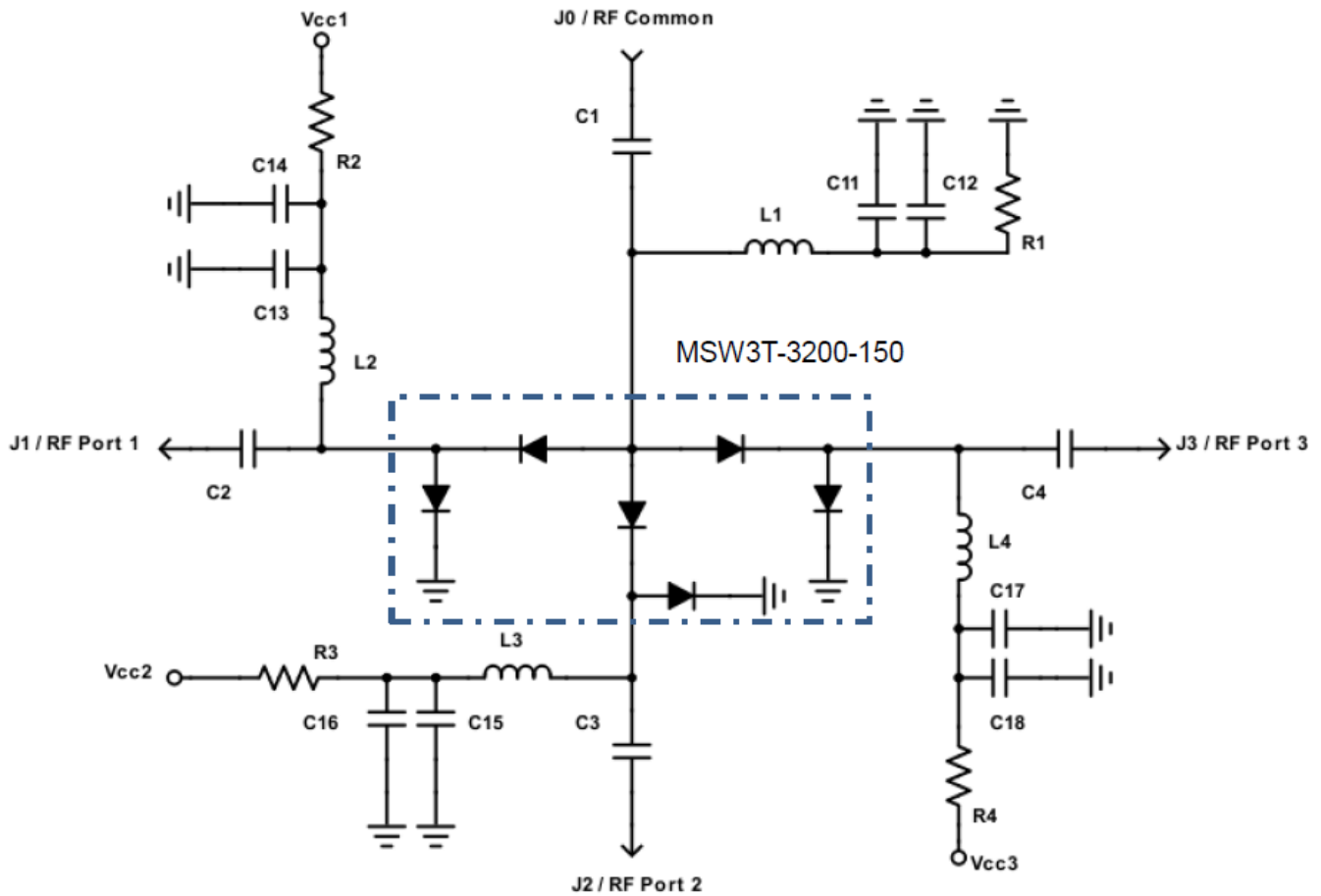
Note 1: Low signal test. For higher power and bias setting, see section on Minimum Reverse Bias Voltage.

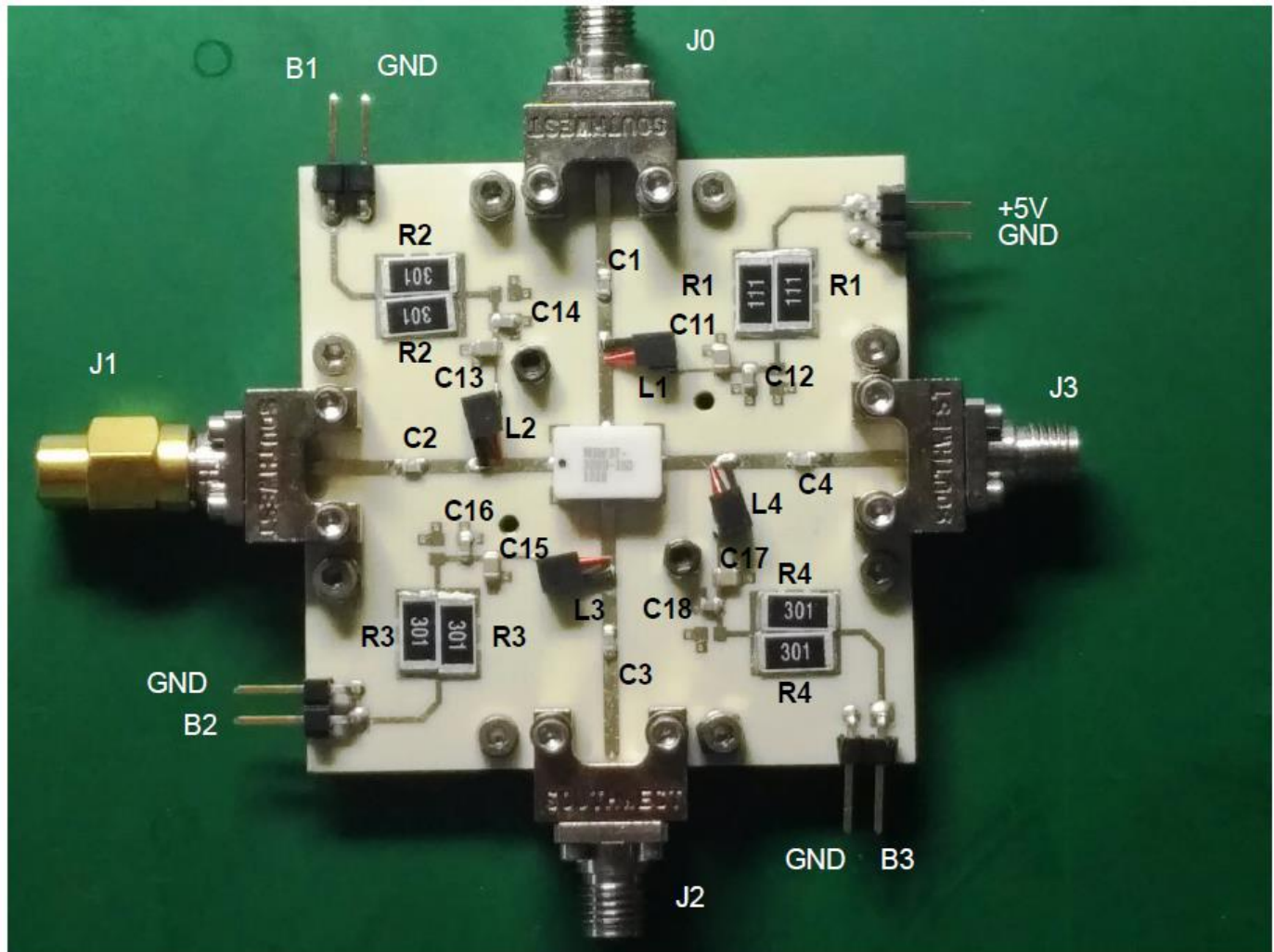
Note 2: The bias setting for high power is frequency and RF power dependent. See section on Minimum Reverse Bias Voltage.

MSW3T-3200-150 SP3T Schematic



MSW3T-3200-150 Switch Schematic with RF Bias Network and Truth Table





RF Biasing Components Values Used on Evaluation Board (small signal)

Component Type	Value	Part Number	Manufacturer
R1	110Ω, 1W, 5%, 2512	ERJ-1TYJ111U	Panasonic
R2, R3, R4	300Ω, 1W, % 2512	ERJ-1TYJ301U	Panasonic
Inductor L1, L2, L3, L4	3.3uH	506WLSN3R30KT350T	ATC
Capacitor (Coupling) C1, C2, C3, C4	270pF, 250V, 5%, 0805	C1608COG2E271J080AA	TDK
Capacitor C11, C13, C15, C17	220pF, 250V, 5%, 0603	251R15S221JV4S	Johanson Technology
Capacitor C12, C14, C16, C18	47pF, 250V, 5%, 0603	251R14S470JV4S	Johanson Technology
J0, J1, J2, J3	N/A	292-04A-5	Southwest

RF Truth Table (Low Signal)

RF State	Vcc1 Bias	Vcc2 Bias	Vcc3 Bias
J1-J0 "ON" J2-J0 "OFF" J3--J0 "OFF"	-20V @ 100 mA	+10 V @ 25 mA	+10 V @ +25 mA
J1-J0 "OFF" J2-J0 "ON" J3--J0 "OFF"	+10 V @ 25 mA	-20V @ 100 mA	+10 V @ 25 mA
J1-J0 "OFF" J2-J0 "OFF" J3--J0 "ON"	+10 V @ 25 mA	+10 V @ 25 mA	-20V @ 100 mA

Current Limiting Resistors (R1, R2, R3, R4) power rating must be considered; heat sinking must be provided, based on bias conditions chosen. For the small signal test, R1 = 50 ohms typ, R2 = R3 = R4 = 300 ohms typ. Resistor Power Dissipation is < 1 watt in this scenario.

Minimum Reverse Bias Voltage @ J1, J2, J3 vs. Frequency

@ 100W (CW) VSWR: 1.5:1

Part Number	Frequency & Min Bias Voltage	Frequency & Min Bias Voltage	Frequency & Min Bias Voltage	Frequency & Min Bias Voltage	Frequency & Min Bias Voltage	Frequency & Min Bias Voltage
Frequency	50 MHz	100 MHz	200 MHz	400 MHz	1 GHz	3 GHz
MSW3T-3200-150	200V	190V	160V	110V	55V	25V

MSW3T-320X-150 Absolute Maximum Ratings @ T_A = +25 °C

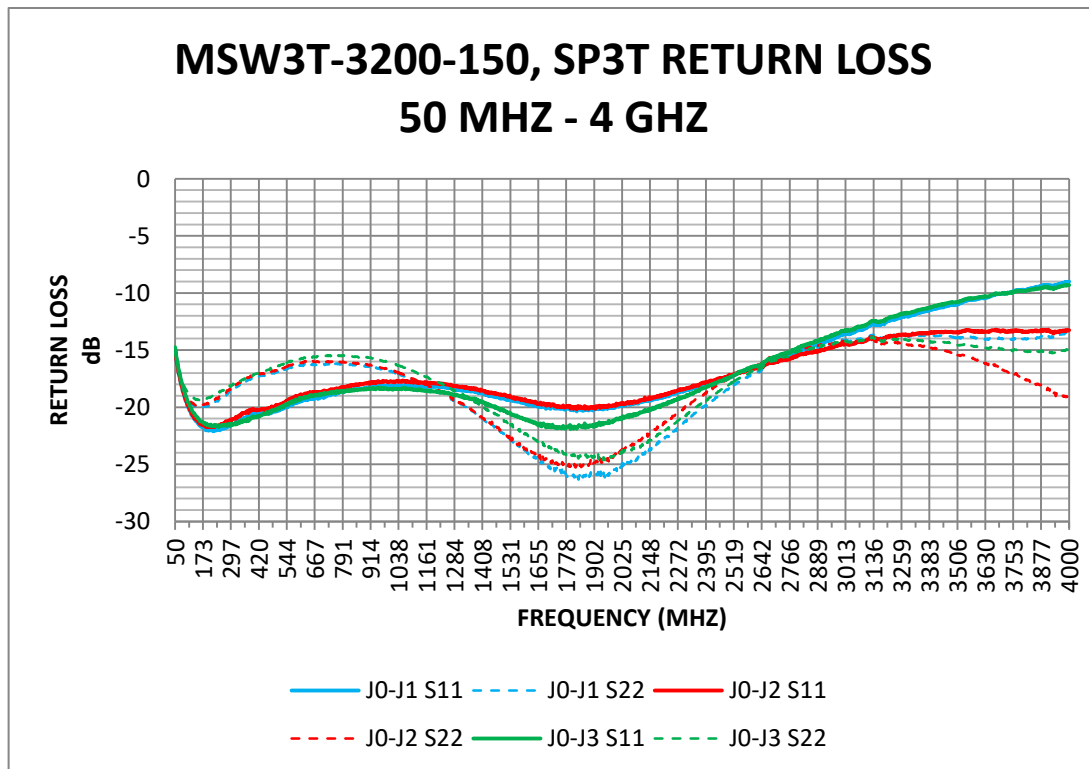
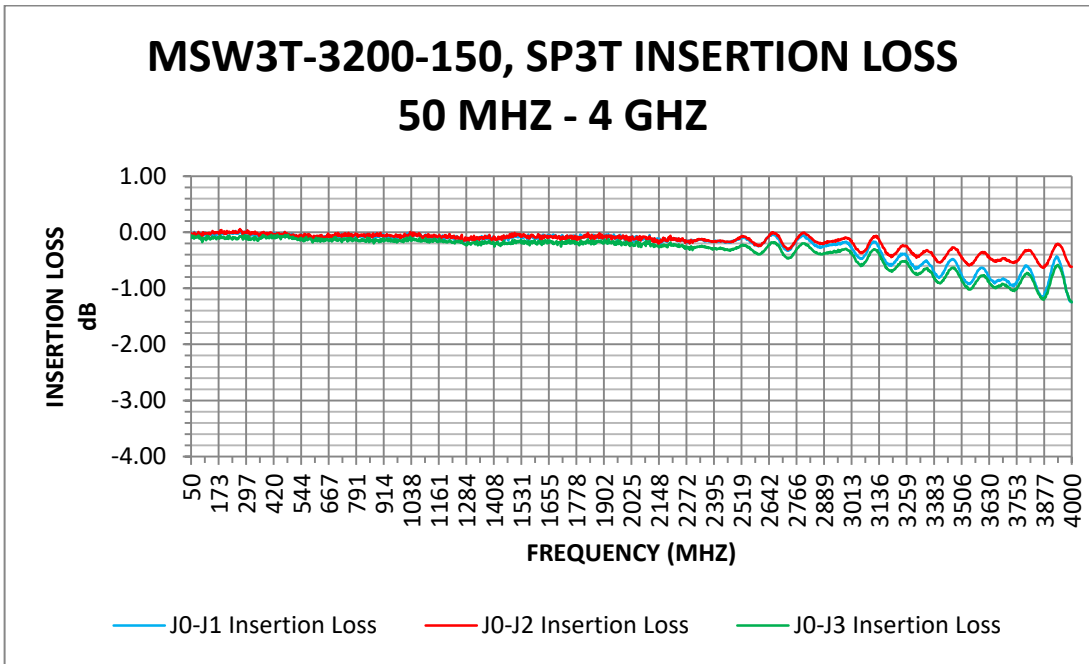
(unless otherwise denoted)

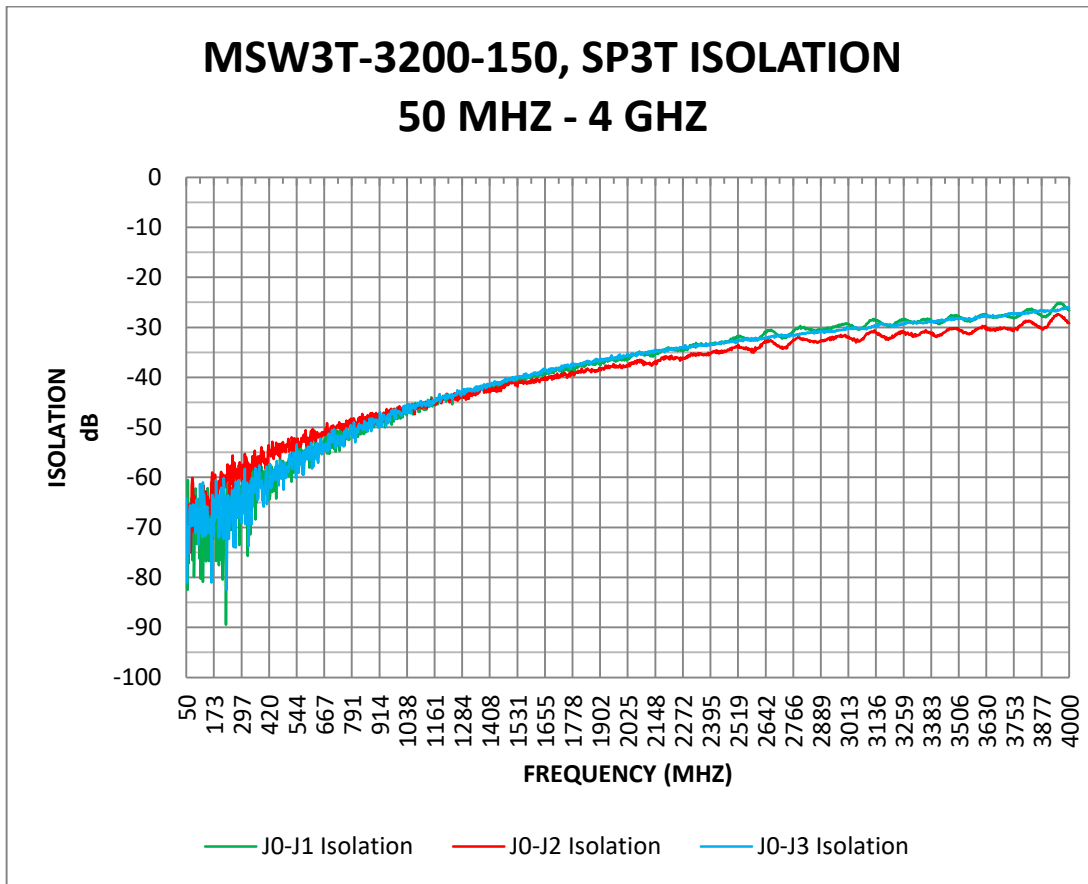
Parameter	Absolute Maximum Value
Forward Current @ J1, J2 or J3	250 mA
Reverse Voltage @ J1, J2 or J3	300 V
Forward Diode Voltage	1.2 V @ 10 mA
Operating Temperature	-65 °C to +125 °C
Storage Temperature	-65 °C to +150°C
Junction Temperature	+175 °C
Assembly Temperature	+260 °C for 10 seconds
CW Incident Power Handling Source & Load VSWR = 1.5 : 1 (Cold Switching) See Notes below: 1 & 2	+50 dBm @ +85 °C Case Temp
Peak Incident Power Handling Source & Load VSWR = 1.5 : 1 (Cold Switching) See Notes below: 1 & 2	+53 dBm @ 20 usec pulse, 12% duty cycle @ +85 °C Case Temp

Notes:

- 1) For Hot Switching, PIN Diode Drivers must transition between states in less than 100 nsec with a parallel RC spiking network at the Driver Output.
- 2) Backside RF and DC grounding area of the MSW3T-3200-150 must be completely solder attached to the RF Circuit board for proper electrical and thermal circuit grounding.

MSW3T-3200-150 Small Signal Parametric Performance:



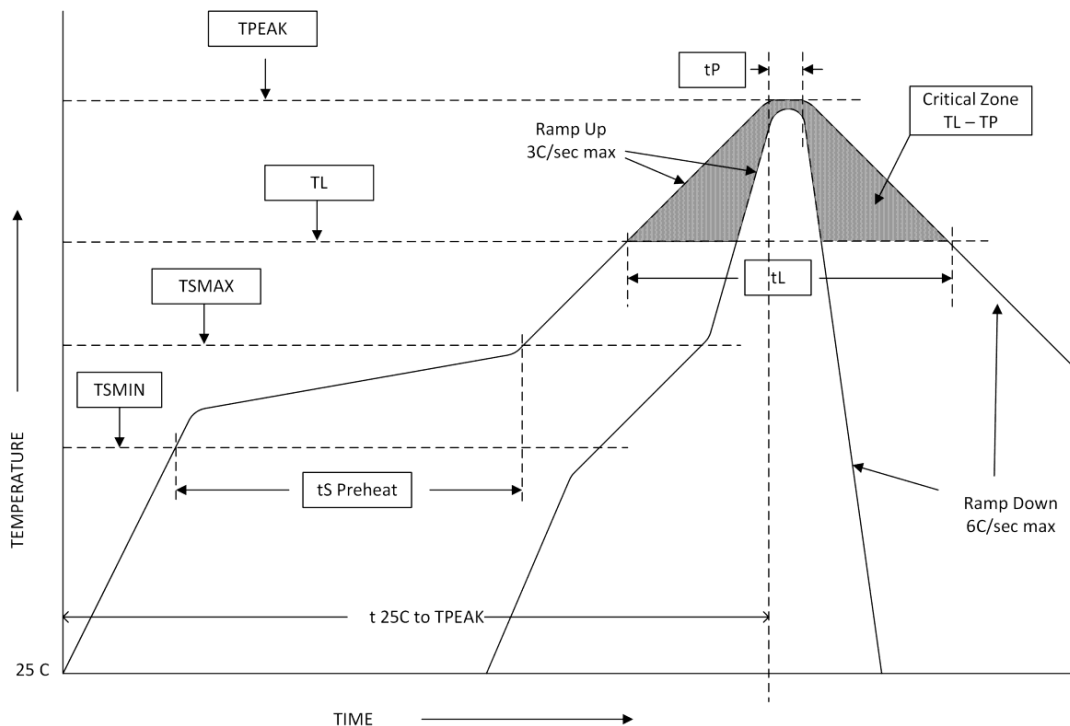


Assembly Instructions

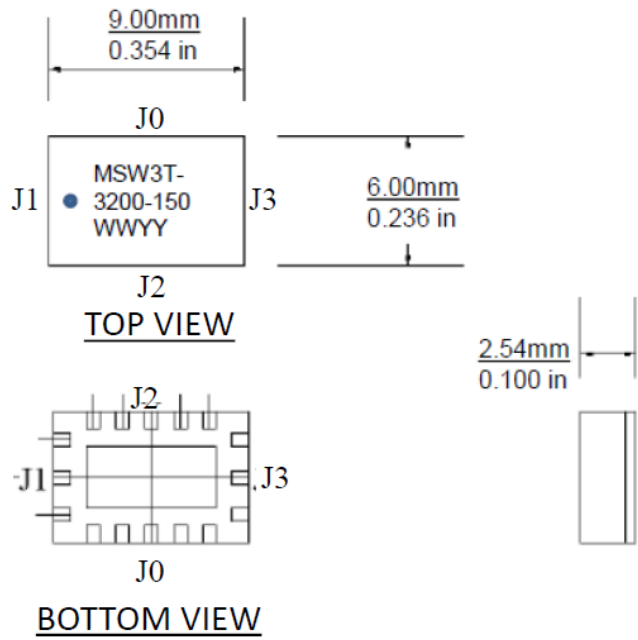
The MSW3T-3200-150 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

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}) Temp Max (T_{smax}) Time (min to max) (t_s)	100°C 150°C 60 – 120 sec	100°C 150°C 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) Time (t_L)	183°C 60 to 150 sec	217°C 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)

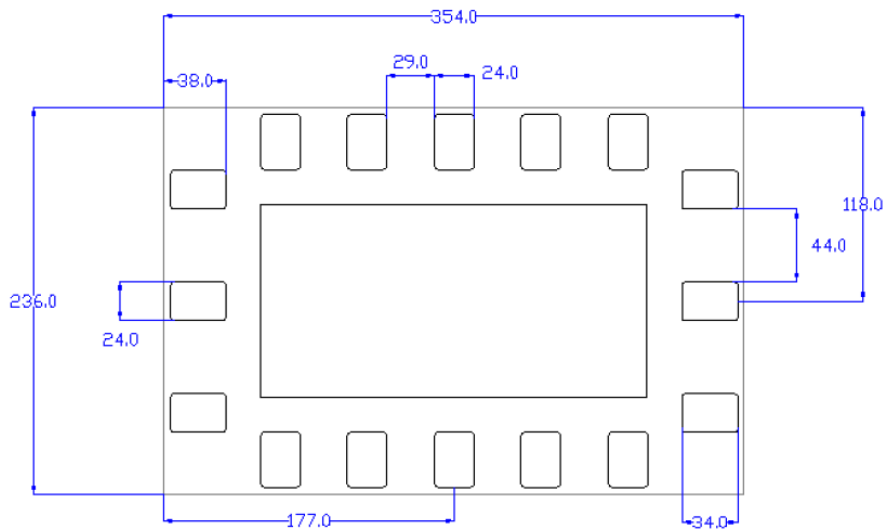
Solder Re-Flow Time-Temperature Profile



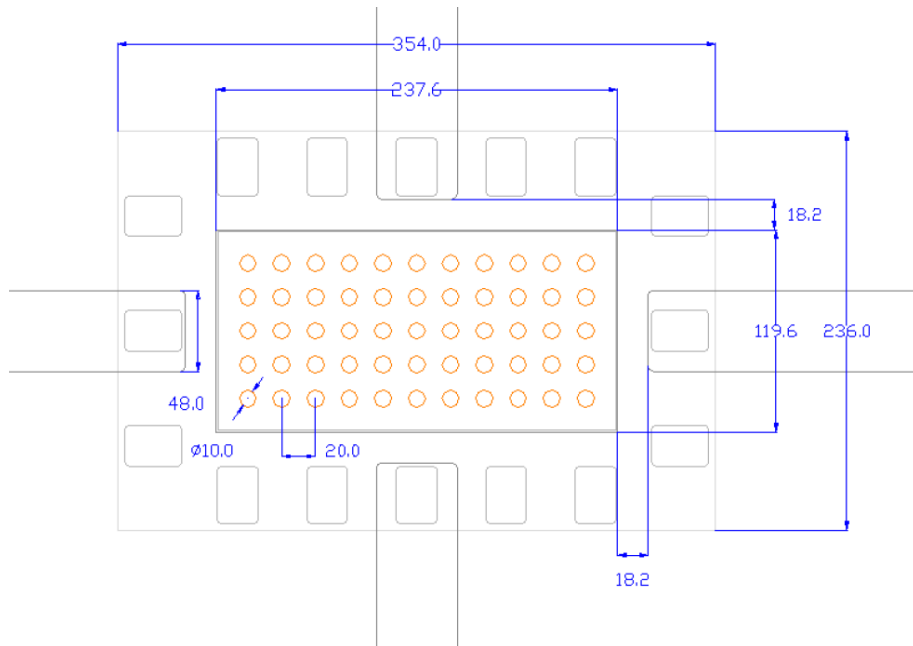
MSW3T-3200-150 SP3T Package Outline Drawing



MSW3T-3200-150 Bottom View Detail



MSW3T-3200-150 Solder Foot Print



Note:

- 1) All units in mils.
- 2) Transmission lines width (48 mils), 20 mils Rogers 4003C, 1 oz copper, 50Ω impedance.
- 3) 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.
- 4) All undefined pins should be connected to ground or mechanically supported by soldering down.

Thermal Design Considerations:

The design of the MSW3T-3200-150 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 85°C.

Part Number Ordering Details:

The MSW3T-3200-150 High Power Switch is available in the following formats:

Part Number	Packaging
MSW3T-3200-150	Gel Pack