

MSW2022-202 SP2T Switch Datasheet Rev 00

Features

- Surface Mount SP2T Switch in Compact Outline: 8mm L x 5mm W x 2.5 mm H
- Higher Average Power Handling than Plastic (158 W C.W.)
- Higher Voltage > 800 Volts for Higher RF Peak Power (500 W)
- Lower Insertion Loss (0.3 dB) & Higher IIP3 (60 dBm)
- Operates with +5V & +200V for Linear Frequency Operation
- RoHS Compliant



Description

The MSW2022-202 Silicon PIN Diode, Surface Mount SP2T T-R Switch is manufactured using Aeroflex/Metelics proven hybrid manufacturing process incorporating High Voltage PIN Diodes and passive devices integrated within a ceramic substrate. This low profile, compact, surface mount component (8mm L x 5mm W x 2.5 mm H) offers superior low and high signal performance to comparable MMIC devices in QFN packages. The SP2T switches are designed in an asymmetrical Series & Series-Shunt topology to optimize Tx & Rx performance. The MSW2022-202 operates from 10 – 1,200 MHz to provide broadband performance for low and high signal superior operation.

Using PIN Diodes with lower thermal resistance (< 8 °C/W), RF C.W. incident power levels of + 52 dBm and RF peak incident power levels of + 57 dBm are very achievable in higher power cold and hot switching applications @ + 85 ° C. The lower PIN Diode series resistance (< 1.0 Ω), coupled with the longer minority carrier lifetime, (> 4 μ S), provides better IIP3 distortion values > + 60 dBm .

Applications

These MSW2022-202 SP2T Switches are designed to be used in higher power switch applications, operating from 10 MHz to 1200 MHz, requiring high volume, surface mount, solder re-flow manufacturing. These products are durable, reliable, and capable of meeting all military, commercial, and industrial environments. The devices are fully RoHS compliant.

Environmental Capabilities

The MSW2022-202 SP2T Switches are capable of meeting the environmental requirements of MIL-STD-202, and MIL-STD-750.

ESD and Moisture Sensitivity Level Rating

PIN Diode Switches are susceptible to ESD conditions as with all semiconductors.

The ESD rating for this device is Class 1C, HBM. The moisture sensitivity level rating for this device is MSL 2.

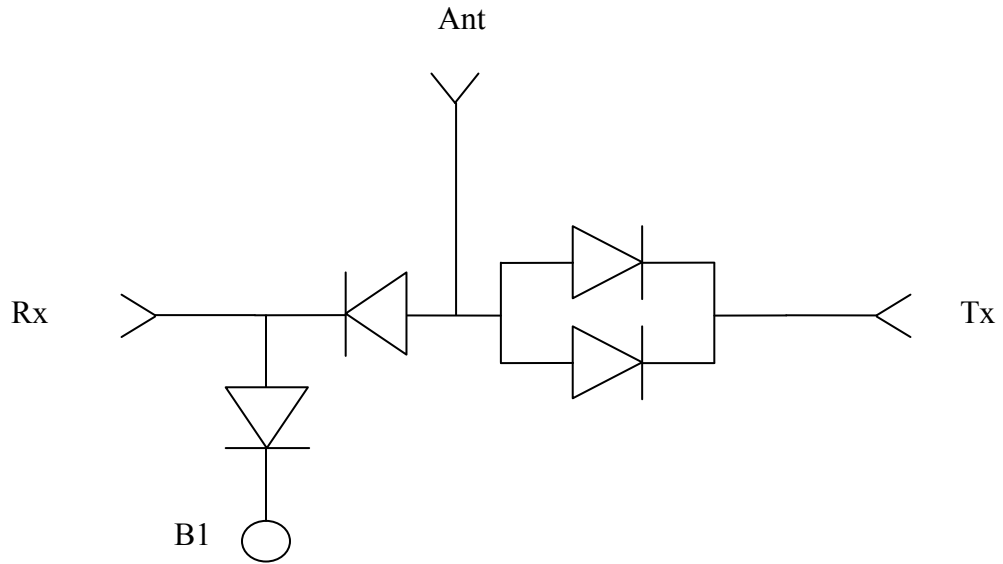
Electrical Specifications @ $Z_0 = 50 \Omega$, $T_A = +25^\circ\text{C}$ (Unless Otherwise Defined)

Parameter	Symbol	Units	Test Conditions	Minimum Value	Typical Value	Maximum Value
Frequency	F	MHz		10	30 – 1000	1200
Tx-Ant Insertion Loss	IL(Tx)	dB	+5V @ 150 mA (Tx) +200V @ +20 mA (Rx)		-0.20	-0.30
Ant-Rx Insertion Loss	IL(Rx)	dB	+5V @ 150 mA (Rx) +200V @ 0mA (Tx)		-0.30	-0.40
Tx-Ant Return Loss	RL(Tx)	dB	+5V @ 150 mA (Tx) +200V @ +20 mA (Rx)	-20	-22	
Ant-Rx Return Loss	RL(Tx)	dB	+5V @ 150 mA (Rx) +200V @ 0mA (Tx)	-20	-22	
Tx-Rx Isolation	Isol(Rx)	dB	+5V @ 150 mA (Tx) +200V @ +20 mA (Rx)	-40	-45	
Rx-Tx Isolation	Isol(Tx)	dB	+5V @ 150 mA (Rx) +200V @ 0mA (Tx)	-20	-23	
C.W. Incident Power (Tx)	Pinc(CW) (Tx)	dBm	+5V @ 150 mA (Tx) +200V @ +20 mA (Rx) 1.5:1 Circuit VSWR		+ 52	+ 52
C.W. Incident Power (Rx)	Pinc(CW) (Rx)	dBm	+5V @ 150 mA (Rx) +200V @ 0mA (Tx) 1.5:1 Circuit VSWR		+ 40	+ 40
Peak. Incident Power (Tx)	Pinc(Pk)	dBm	+5V @ 150 mA (Tx) +200V @ +20 mA (Rx) 1.5:1 Circuit VSWR		+ 57 @ 10 μS Pulse, 1 % Duty	+ 58 @ 10 μS Pulse, 1 % Duty
Switching Speed	Ts	μS	(10% -90% RF Voltage)		1.5	2
Input 3 rd Order Intercept Point	IIP3	dBm	F1 = 500 MHz F2 = 510 MHz P1 = P2 = + 40 dBm	60	65	

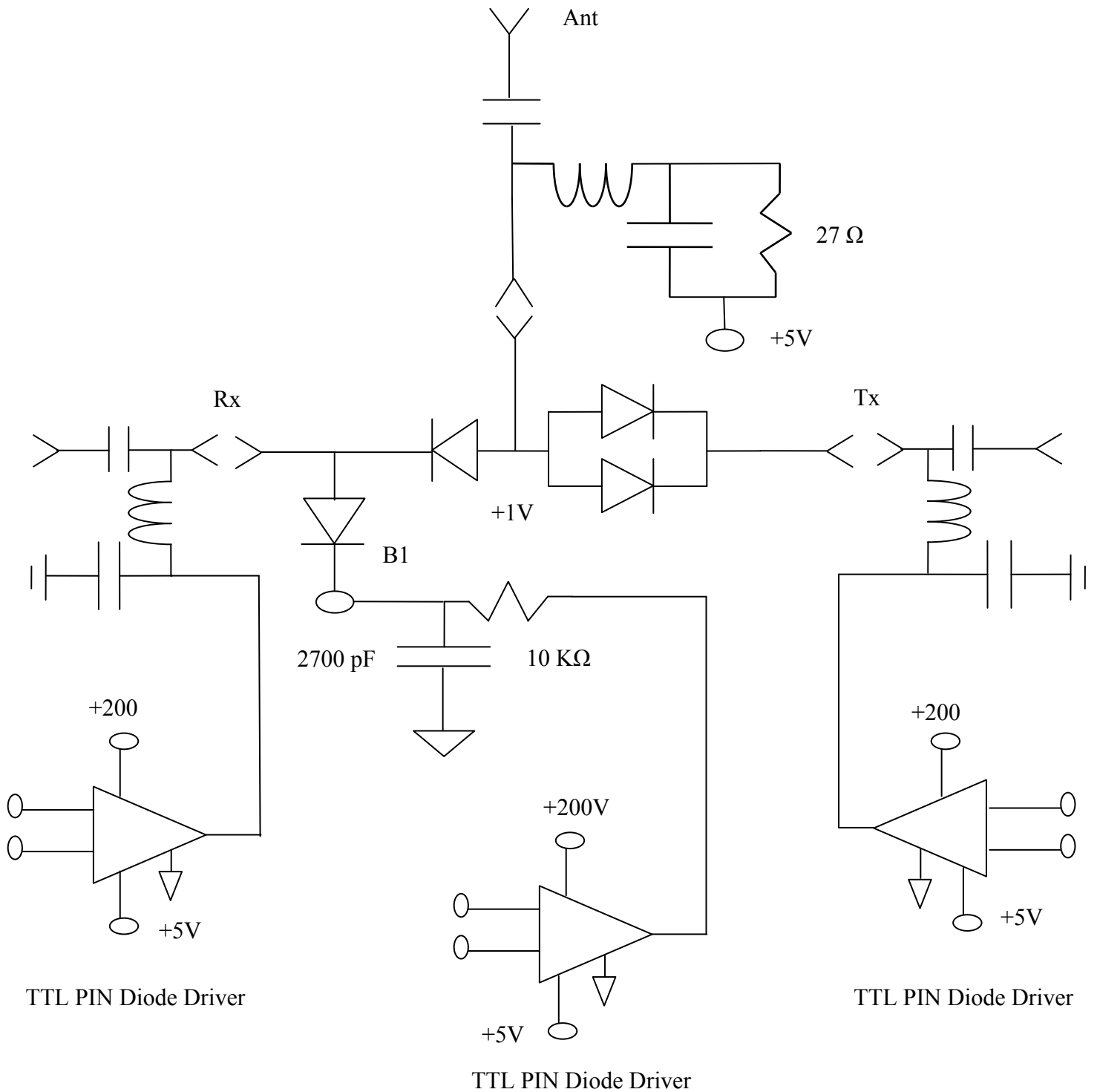
Notes:

1. **Switching Speed (50 % TTL – 10/90 % RF Voltage) is a Function of the PIN Diode Driver Performance. A RC “ Current Spiking Network” is used on the Driver Output to provide a $I_c = C \text{ dV/dt}$ transient current to move Stored charge through the PIN Diode, typical values are: $R = 50 - 220 \Omega$ and $C = 470 - 1,000 \text{ pF}$.**

MSW2022-202 SP2T Schematic



SP2T Switch Schematic with RF Bias Network



Note: 2700 pF RF bypass capacitor, 8.2KΩ current limiting resistor, and RF bias network are external to SP2T.

D.C. Bias to RF Truth Table

RF State	Tx Bias	Rx Bias	B1 Bias
Tx-Ant Low Loss & Tx-Rx Isolation	0V @ + 150 mA	+200V @ +20 mA	+199V @ 20 mA
Ant-Rx Low Loss & Rx-Tx Isolation	+200V @ 0 mA	0V @ + 150 mA	+200V @ 0 mA

RF Typical Bias Network Values

P/N	F (MHz)	DC Blocking Capacitors	Inductors	RF Bypass Capacitors
MSW2020-202	20 – 1,000	0.1 μ F	4.7 μ H	0.1 μ F

Absolute Maximum Ratings @ $T_A = + 25\text{ }^\circ\text{C}$ (Unless Otherwise Defined)

Parameter	Absolute Maximum Value
Forward Current @ Tx or Rx	300 mA
Reverse Voltage @ Tx, Rx, or B1	 -300 V
Forward Diode Voltage	1.2 V @ 500 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
C.W. Incident Power Handling Source & Load VSWR = 1.5 :1 (Cold Switching & Hot Switching) Notes 1,2	+ 52 dBm @ + 85 °C Case Temperature
Peak Incident Power Handling Source & Load VSWR = 1.5 :1 (Cold Switching & Hot Switching) Notes 1,2	+ 57 @ 10 μS Pulse, 1 % Duty @ + 85 °C Case Temperature
Total Dissipated RF & D.C. Power (Cold Switching) Notes 1,2	9.0 W @ + 85 °C Case Temperature

Notes:

1. For Hot Switching, PIN Diode Driver must Transition from Forward Bias to Reverse Bias and Reverse Bias to Forward Bias within 100 ns with a parallel RC spiking network at the Driver Output.
2. Backside RF and D.C. Grounding Area of Switch must be Completely Solder Attached to RF Circuit Board Vias for Proper Electrical and Thermal RF Circuit Grounding.

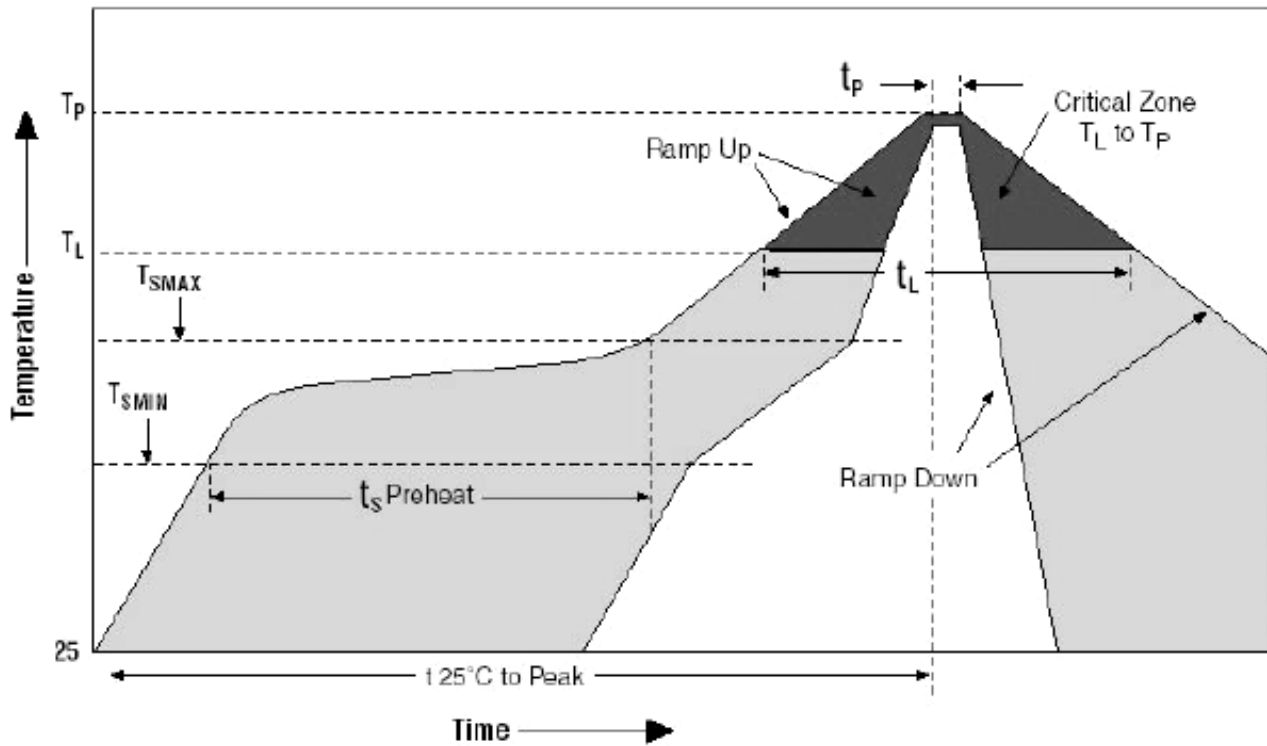
Assembly Instructions

The MSW2022-202 Switches are capable of being placed onto circuit boards with pick and place manufacturing equipment from tube or tape-reel dispensing. The devices are attached to the circuit board using conventional solder re-flow or wave soldering procedures with RoHS type or Sn 63 / Pb 37 type solders per Table I and Graph I Time-Temperature recommended profile.

Table 1: Time-Temperature Profile for Sn 60/Pb40 or RoHS Type Solders

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_p)	3°C/second max.	3°C/second max.
Preheat – Temperature Min (T_{SMIN}) – Temperature Max (T_{SMAX}) – Time (min to max) (t_s)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
T_{SMAX} to T_L – Ramp-up Rate		3°C/second max
Time maintained above: – Temperature (T_L) – Time (t_l)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature (T_p)	225 +0/-5°C	245 +0/-5°C
Time within 5°C of actual Peak Temperature (t_p)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

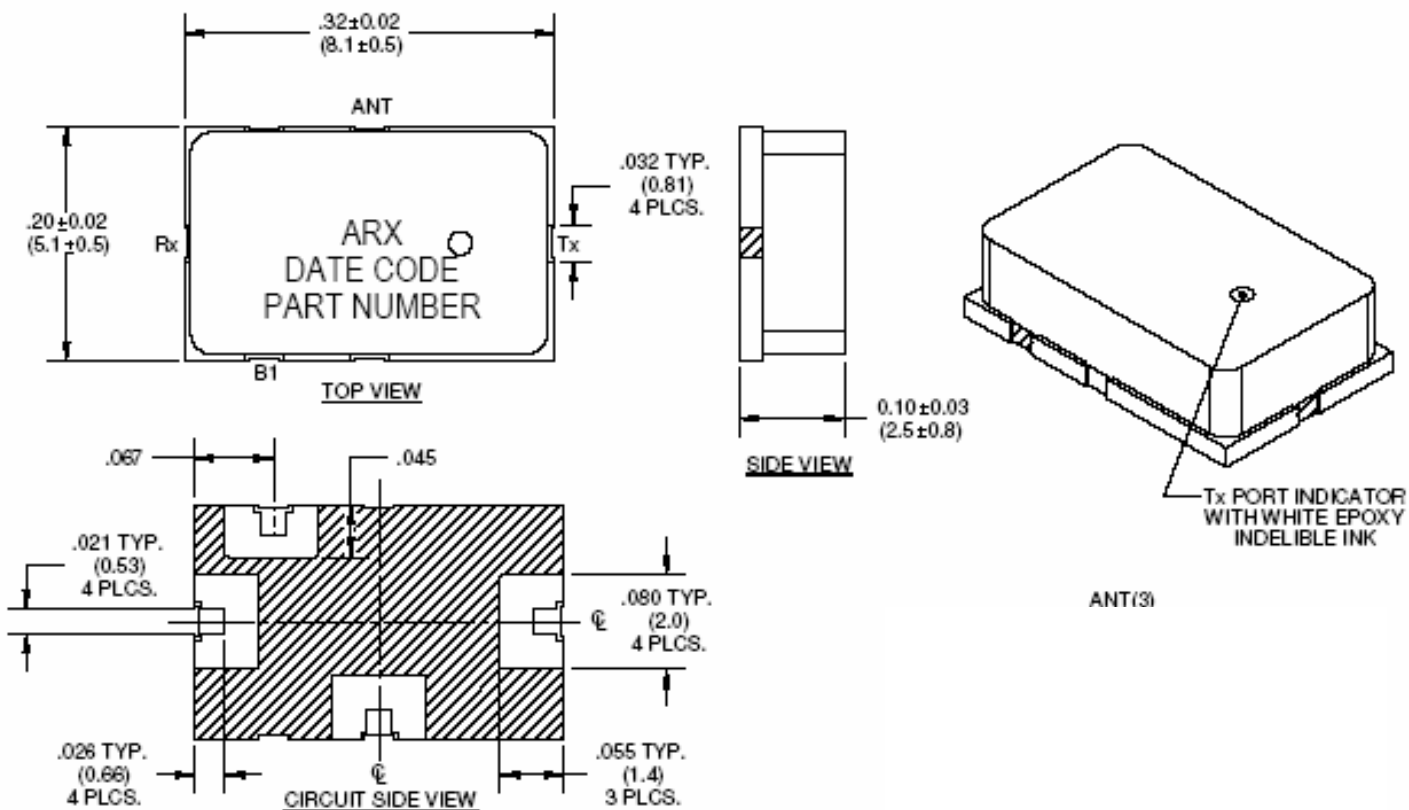
Graph1: Solder Re-Flow Time-Temperature Function



Part Number Ordering Information:

Part Number	Packaging
MSW2022-202-T	Tube
MSW2022-202-R	Tape-Reel
MSW2022-202-EVAL	RF Evaluation Board

MSW2022-202 High Power SP2T Switch Outline (Case Style 202)



NOTES:

1. SUBSTRATE MATERIAL: 20 MIL THICK ALUMINA NITRIDE (ALN)
RF COVER: BLACK CERAMIC
2. TOP SIDE AND BACKSIDE METALLIZATION: 100μ IN. TYPICAL PLATED Au OVER Ti-Pd.

Notes:

1. Thatched Metal Area on Circuit Side of Device is RF, D.C. , and Thermal Ground.