



MSW2T-206X-195

SP2T Surface Mount High Power PIN Diode Switch

Features:

- Frequency Band: 50 MHz to 6.0 GHz
- Surface Mount SP2T Switch: 8mm x 5mm x 2.5mm
- Peak Power: +57 dBm
- Average Power: +50 dBm
- Insertion Loss: 0.25 dB
- Isolation: 53 dB
- RoHS Compliant

Description:

The MSW2T-206X-195 series of surface mount High Power PIN Diode switches leverage 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 (8mm x 5mm 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 MSW2T206X-195 series of High Power SP2T switches are intended for use in high power, high reliability, mission critical applications across the HF to C Band frequency ranges. The manufacturing process has been proven through years of extensive use in high reliability applications.

The MSW2T-206X-195 family of SP2T switches are fully RoHS compliant.

ESD and Moisture Sensitivity Level Rating:

The MSW2T-206X-195 carries an ESD ratings of Class 1C, Human Body Model (HBM) and a moisture sensitivity rating of MSL 1.

MSW2T-206X-195 Absolute Maximum Ratings @ $T_A = +25\text{ }^\circ\text{C}$ (unless otherwise denoted)

| Parameter | Absolute Maximum Value |
|--|--|
| Forward Current @ J1 or J2 | +/- 250 mA |
| Reverse Voltage @ J1 or J2 | -300 V |
| 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 and Hot Switching) See Notes below: 1 & 2 | +50 dBm @ +85 °C Case Temp |
| Peak Incident Power Handling Source & Load VSWR = 1.5 : 1 (Cold and Hot Switching) See Notes below: 1 & 2 | +57 dBm @ 10 usec pulse, 1% duty cycle @ +85 °C Case Temp |
| Total Dissipated RF & DC Power (Cold Switching) See Notes below: 1 & 2 | 12 W @ +85 °C Case Temp |

Notes:

- 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.
- Backside RF and DC grounding area of the MSW2T-206X-195 must be completely solder attached to the RF Circuit board for proper electrical and thermal circuit grounding.

MSW2T-2060-195 Specifications @ $Z_o = 50\Omega$; $T_a = +25\text{ }^\circ\text{C}$

| Parameter | Symbol | Units | Test Conditions | Min Value | Typical Value | Max Value |
|--|---------------|-------|--|-----------|---------------------------------|-----------|
| Frequency | F | MHz | | 20 | | 1,200 |
| J0-J1 or J0-J2 Insertion Loss (Note 1) | IL | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | | 0.25 | 0.35 |
| J0-J1 or J0-J2 Return Loss (Note 1) | RL | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | 20 | 23 | |
| J0-J1 or J0-J2 Isolation (Note 1) | ISO | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | 49 | 53 | |
| CW Incident Power (Note 1) | P inc (CW) | dBm | -180V @ -50mA (ON) +1V @ +25 mA (OFF) 1.5:1 Source & Load VSWR | | 50 | |
| Peak Incident Power (Note 1) | P inc (Pk) | dBm | -180V @ -50mA (ON) +1V @ +25 mA (OFF) 1.5:1 Source & Load VSWR | | 57 @ 10 uS Pulse, 1% Duty | |
| Switching Speed | Ts | ns | (10%-90%) RF Voltage TTL rep rate = 100 kHz | | 750 | 1,000 |
| Input 3 rd Order Intercept Point | IIP3 | dBm | F1 = 2,000 MHz F2 = 2,010 MHz P1 = P2 = +40 dBm -180V @ -50 mA (ON) +1V @ +25 mA (OFF) | 60 | 65 | |

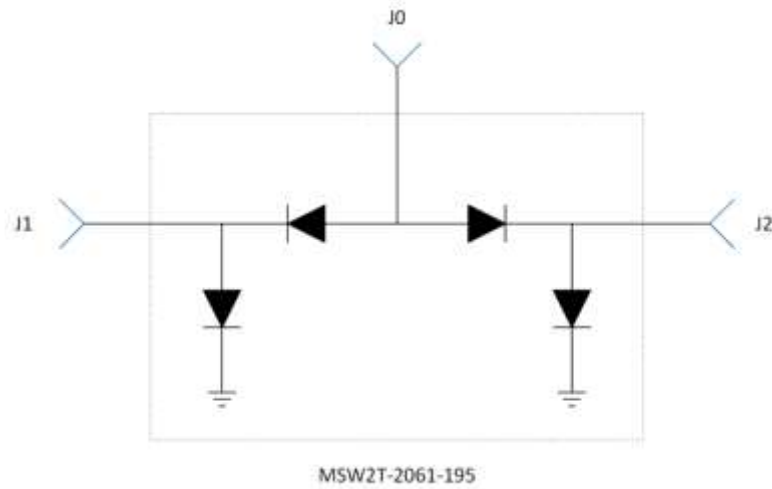
MSW2T-2061-195 Specifications @ $Z_o = 50\Omega$; $T_a = +25^\circ\text{C}$

| Parameter | Symbol | Units | Test Conditions | Min Value | Typical Value | Max Value |
|---|------------|-------|--|-----------|---|-----------|
| Frequency | F | MHz | | 200 | | 2,500 |
| J0-J1 or J0-J2 Insertion Loss (Note 1) | IL | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | | 0.5 | 0.7 |
| J0-J1 or J0-J2 Return Loss (Note 1) | RL | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | 14 | 16 | |
| J0-J1 or J0-J2 Isolation (Note 1) | ISO | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | 32 | 35 | |
| CW Incident Power (Note 1) | P inc (CW) | dBm | -180V @ -50mA (ON) +1V @ +25 mA (OFF) 1.5:1 Source & Load VSWR | | 50 | |
| Peak Incident Power (Note 1) | P inc (Pk) | dBm | -180V @ -50mA (ON) +1V @ +25 mA (OFF) 1.5:1 Source & Load VSWR | | +57 dBm @ 10 μS Pulse, 1% Duty | |
| Switching Speed | Ts | ns | (10%-90%) RF Voltage TTL rep rate = 100 kHz | | 750 | 1,000 |
| Input 3 rd Order Intercept Point | IIP3 | dBm | F1 = 2,000 MHz F2 = 2,010 MHz P1 = P2 = +40 dBm -180V @ -50 mA (ON) +1V @ +25 mA (OFF) | 60 | 65 | |

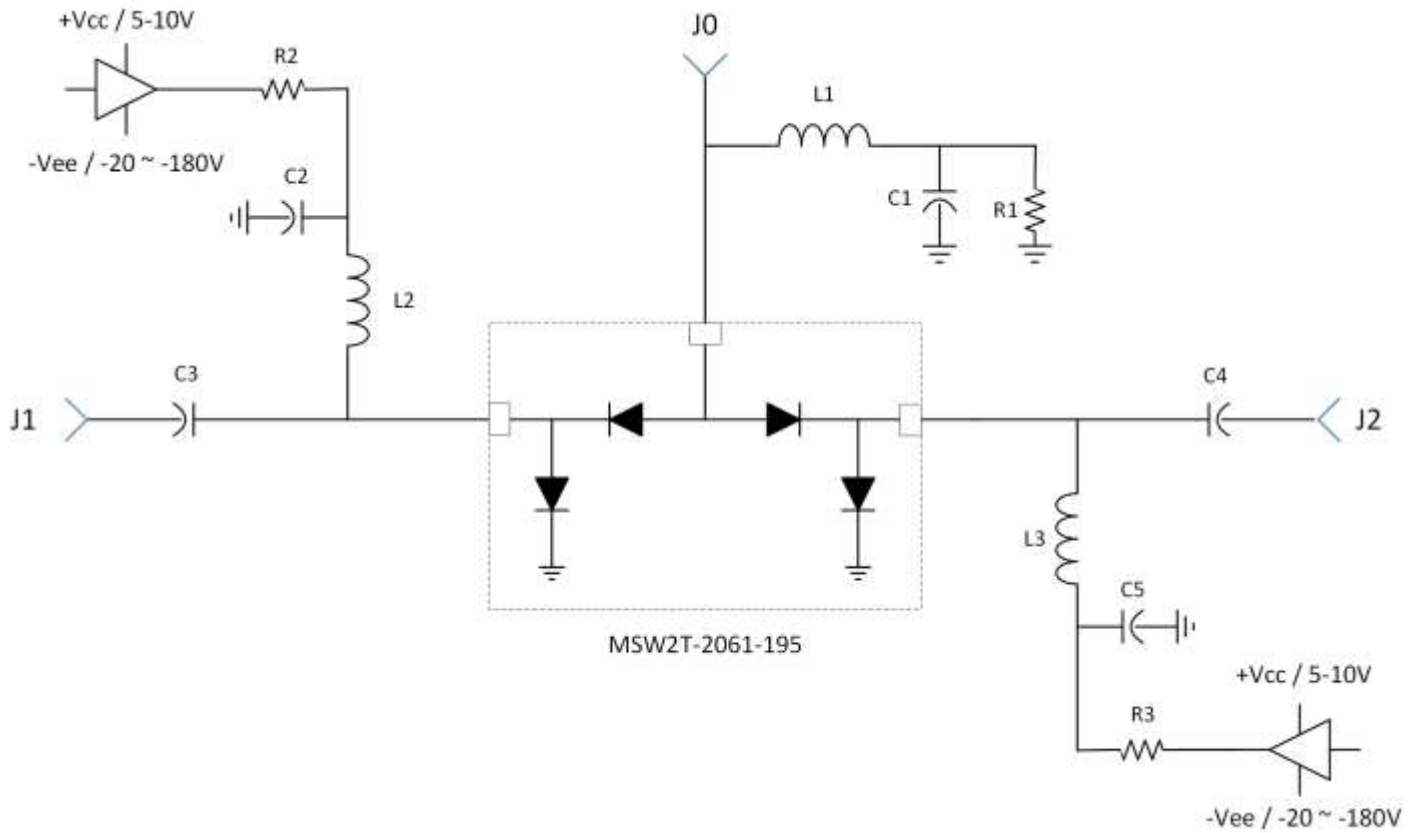
MSW2T-2062-195 Specifications @ $Z_o = 50\Omega$; $T_a = +25^\circ\text{C}$

| Parameter | Symbol | Units | Test Conditions | Min Value | Typical Value | Max Value |
|---|------------|-------|--|-----------|---------------------------------------|-----------|
| Frequency | F | MHz | | 1,500 | | 6,500 |
| J0-J1 or J0-J2 Insertion Loss (Note 1) | IL | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | | 0.7 | 0.9 |
| J0-J1 or J0-J2 Return Loss (Note 1) | RL | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | 11 | 13 | |
| J0-J1 or J0-J2 Isolation (Note 1) | ISO | dB | -180V @ -50mA (ON) +1V @ +25 mA (OFF) | 31 | 34 | |
| CW Incident Power (Note 1) | P inc (CW) | dBm | -180V @ -50mA (ON) +1V @ +25 mA (OFF) 1.5:1 Source & Load VSWR | | +50 | |
| Peak Incident Power (Note 1) | P inc (Pk) | dBm | -180V @ -50mA (ON) +1V @ +25 mA (OFF) 1.5:1 Source & Load VSWR | | +57 @ 10 μS Pulse, 1% Duty | |
| Switching Speed | Ts | ns | (10%-90%) RF Voltage TTL rep rate = 100 kHz | | 750 | 1,000 |
| Input 3 rd Order Intercept Point | IIP3 | dBm | F1 = 2,000 MHz F2 = 2,010 MHz P1 = P2 = +40 dBm -180V @ -50 mA (ON) +1V @ +25 mA (OFF) | 60 | 65 | |

MSW2T-206X-195 SP2T Schematic



MSW2T-206X-195 Driver Interface Schematic and Associated Truth Table



RF Biasing Network Values

| Part | F (MHz) | DC Blocking Caps | Inductors | RF Bypass Caps |
|----------------|---------------|------------------|-----------|----------------|
| MSW2T-2060-195 | 50 – 1,000 | 0.1 uF | 4.7 uH | 0.1 uF |
| MSW2T-2061-195 | 400 – 4,000 | 27 pF | 82 nH | 270 pF |
| MSW2T-2062-195 | 2,000 – 6,000 | 22 pF | 33 nH | 33 pF |

RF Truth Table

| RF State | J1 Bias | J2 Bias |
|--------------------------|-----------------|-----------------|
| J1-J0 "ON" & J2-J0 "OFF" | -180 V @ -50 mA | +1 V @ +25 mA |
| J1-J0 "OFF" & J2-J0 "ON" | +1 V @ +25 mA | -180 V @ -50 mA |

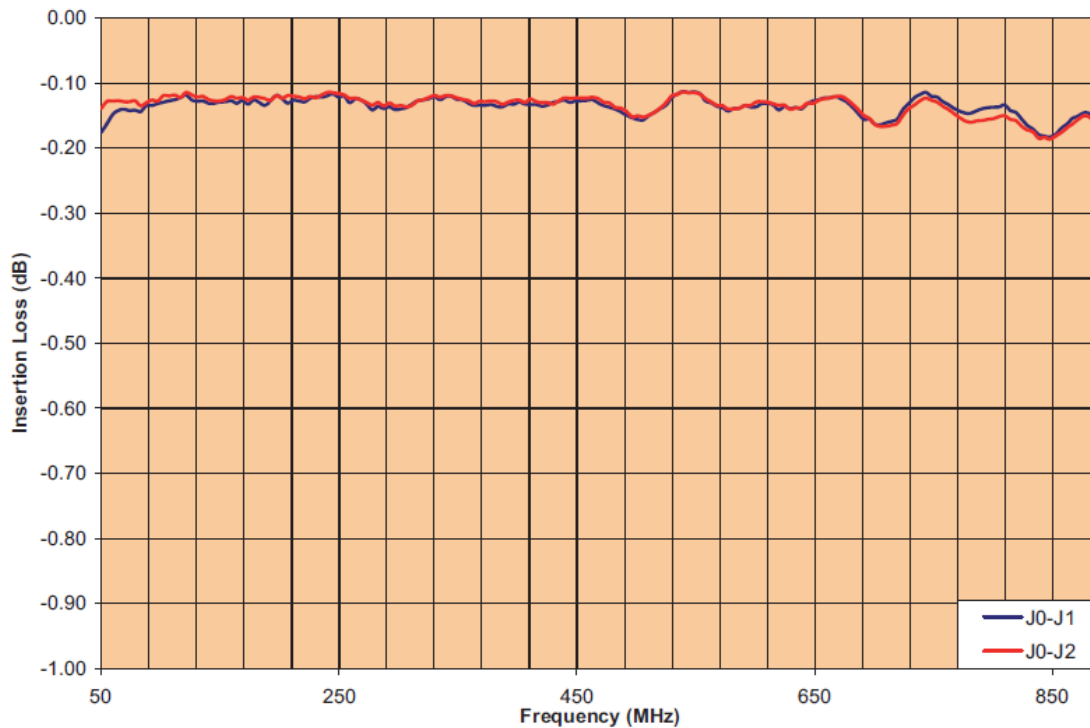
MIN Reverse Bias Voltage @ J1, J2 Ports vs Frequency for 100W CW:

| Part | F (MHz) & V _{DC} | F (MHz) & V _{DC} | F (MHz) & V _{DC} | F (MHz) & V _{DC} | F (MHz) & V _{DC} | F (MHz) & V _{DC} |
|----------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| MSW2T-2060-195 | 20 MHz -180 V | 100 MHz -150 V | 200 MHz -75 V | 400 MHz -55 V | 1,000 MHz -35 V | 4,000 MHz N/A |
| MSW2T-2061-195 | 20 MHz N/A | 100 MHz N/A | 200 MHz -150 V | 400 MHz -110 V | 1,000 MHz -55 V | 4,000 MHz -25 V |
| MSW2T-2062-195 | 1,000 MHz -55 V | 2,000 MHz -28 V | 3,000 MHz -28 V | 4,000 MHz -28 V | 5,000 MHz -28 V | 6,000 MHz -28 V |

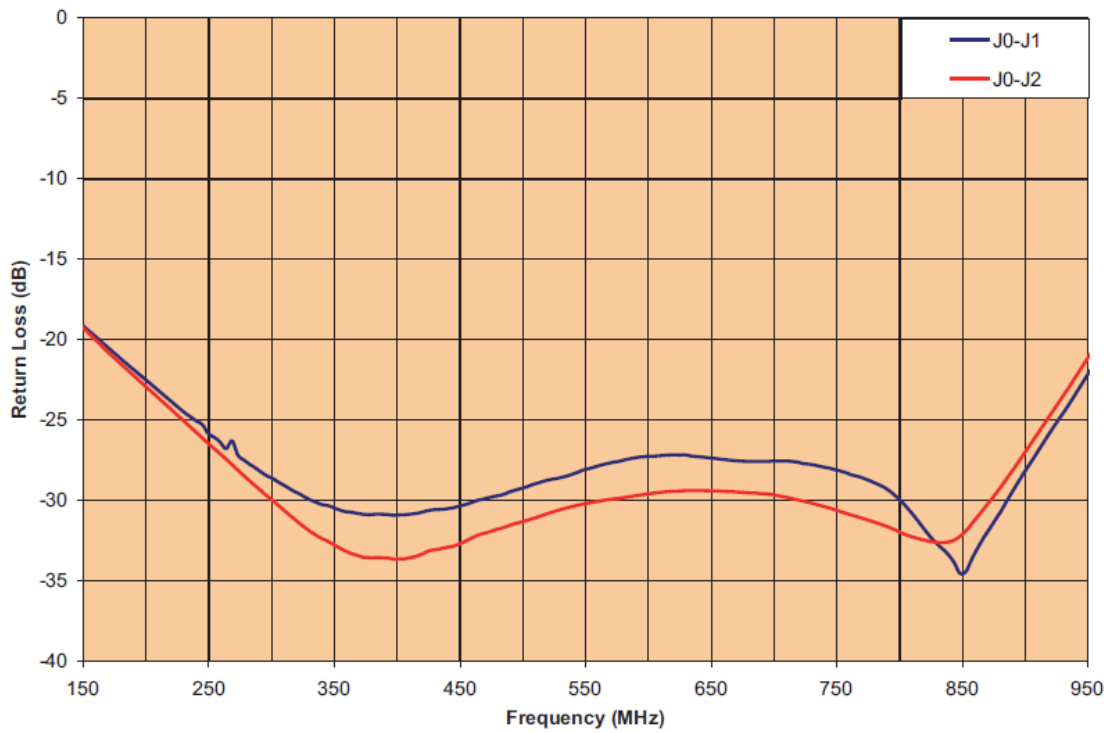
Note: N/A denotes that the condition is outside of the normal operating frequency range.

MSW2T-2060-195 Small Signal Parametric Performance:

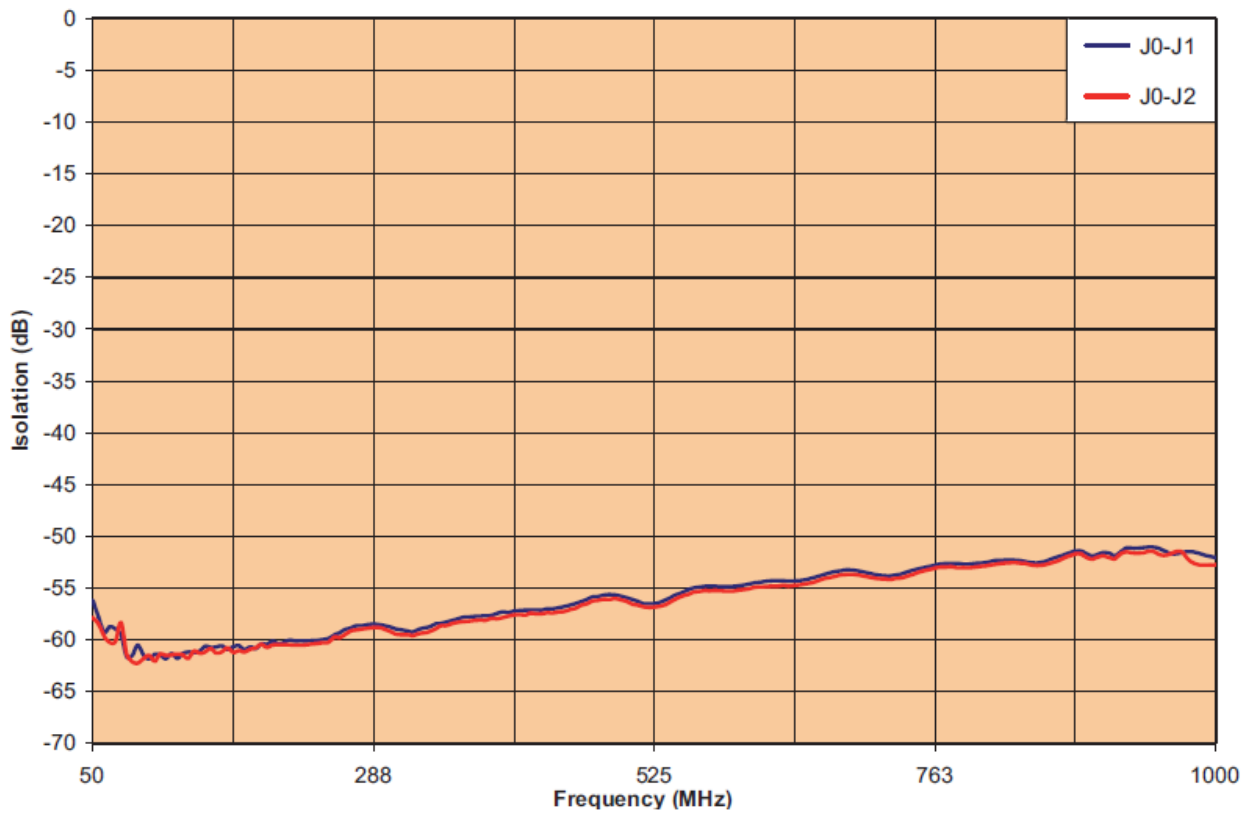
MSW2T-2060-195 Insertion Loss vs. Frequency



MSW2T-2060-195 Return Loss vs. Frequency

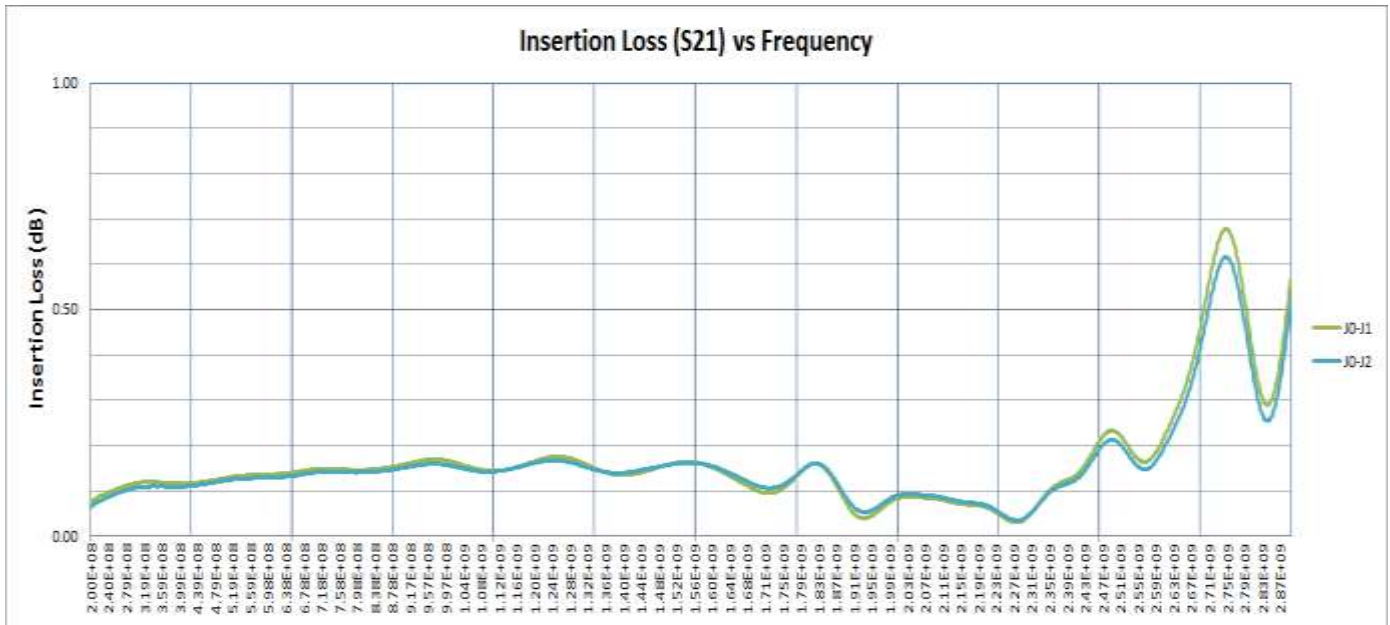


MSW2T-2060-195 Isolation vs. Frequency

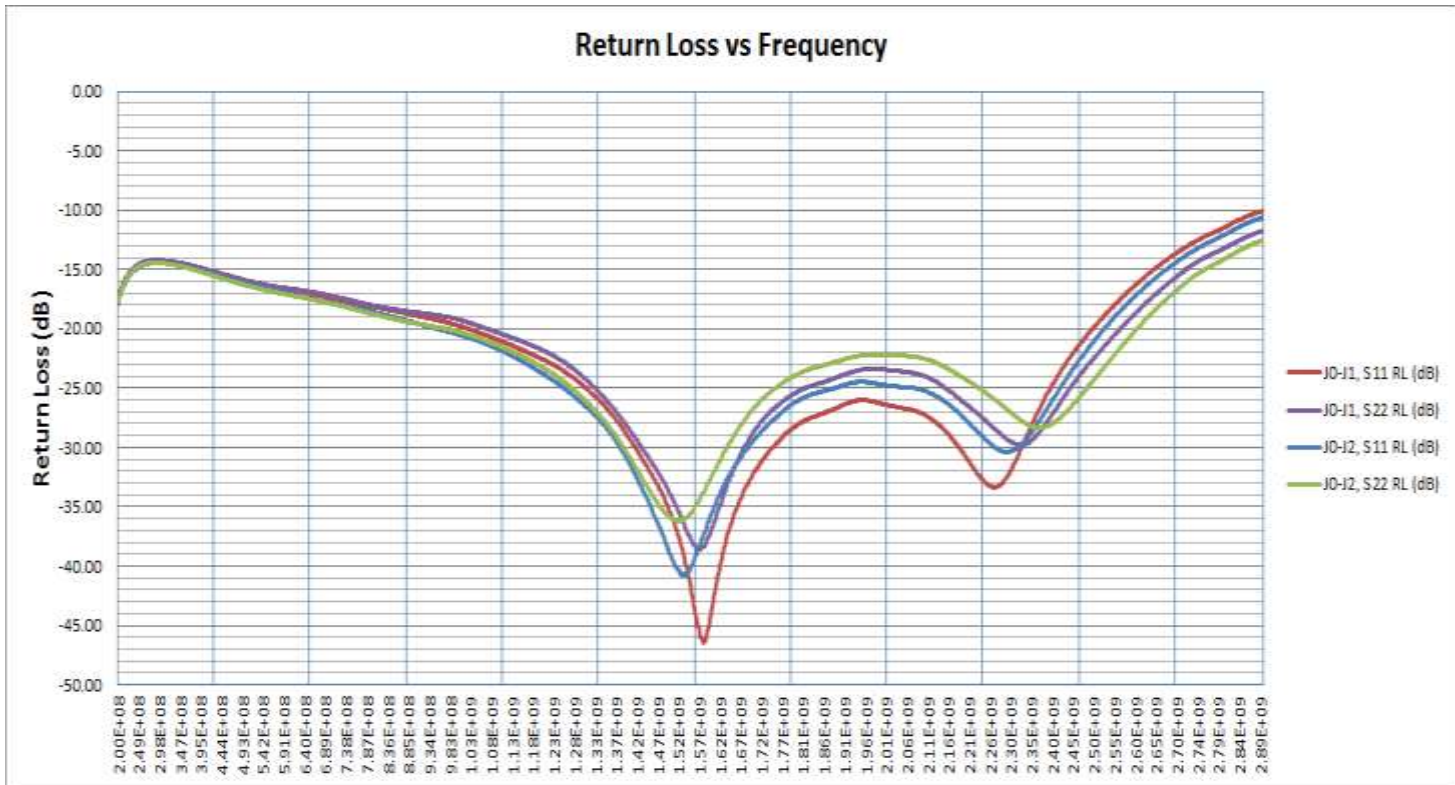


MSW2T-2061-195 Small Signal Parametric Performance:

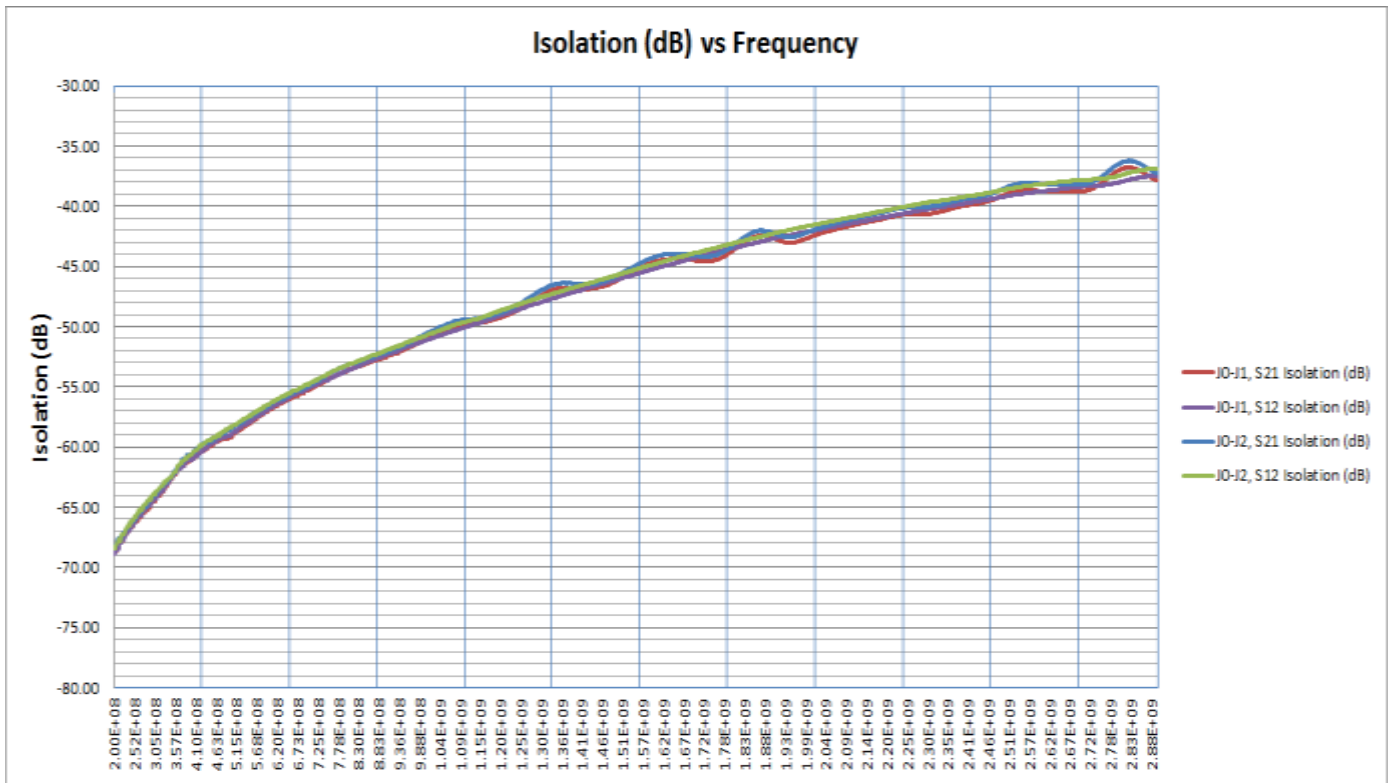
MSW2T-2061-195 Insertion Loss vs. Frequency



MSW2T-2061-195 Return Loss vs. Frequency

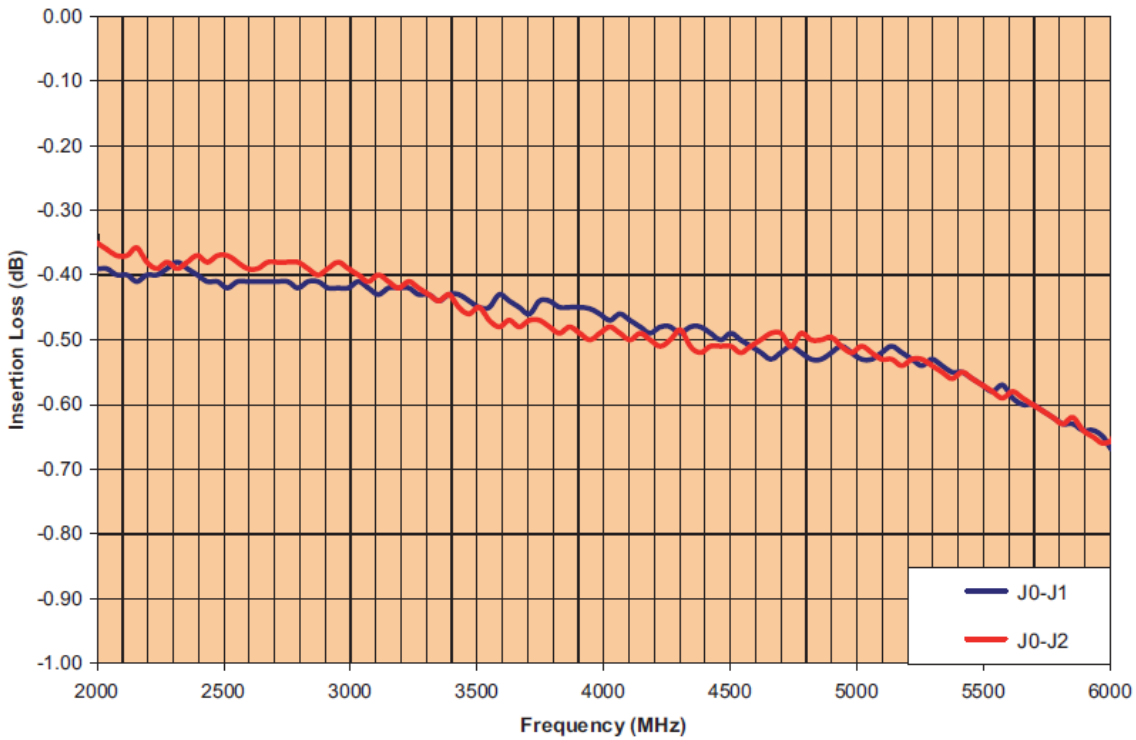


MSW2T-2061-195 Isolation vs. Frequency

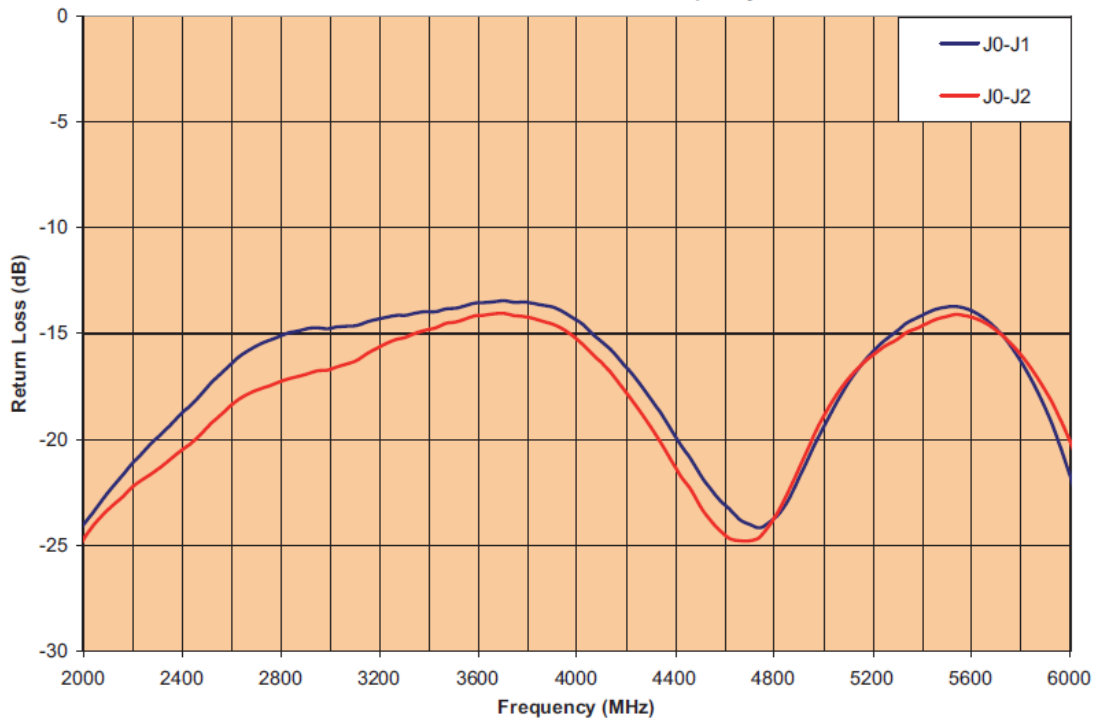


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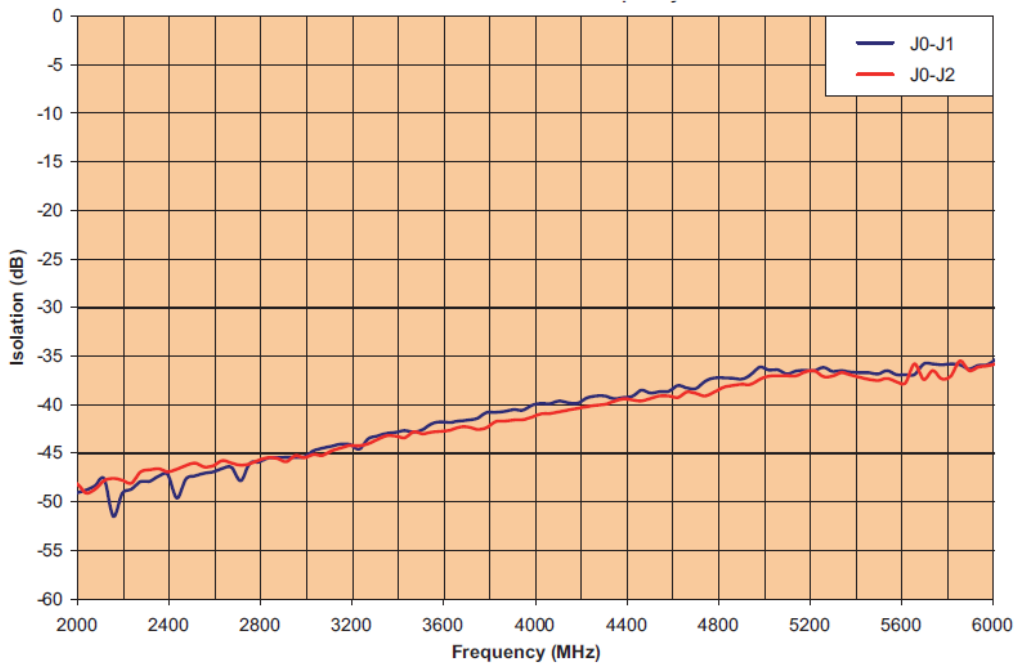
MSW2T-2062-195 Insertion Loss vs. Frequency



MSW2T-2062-195 Return Loss vs. Frequency



MSW2T-2062-195 Isolation vs. Frequency

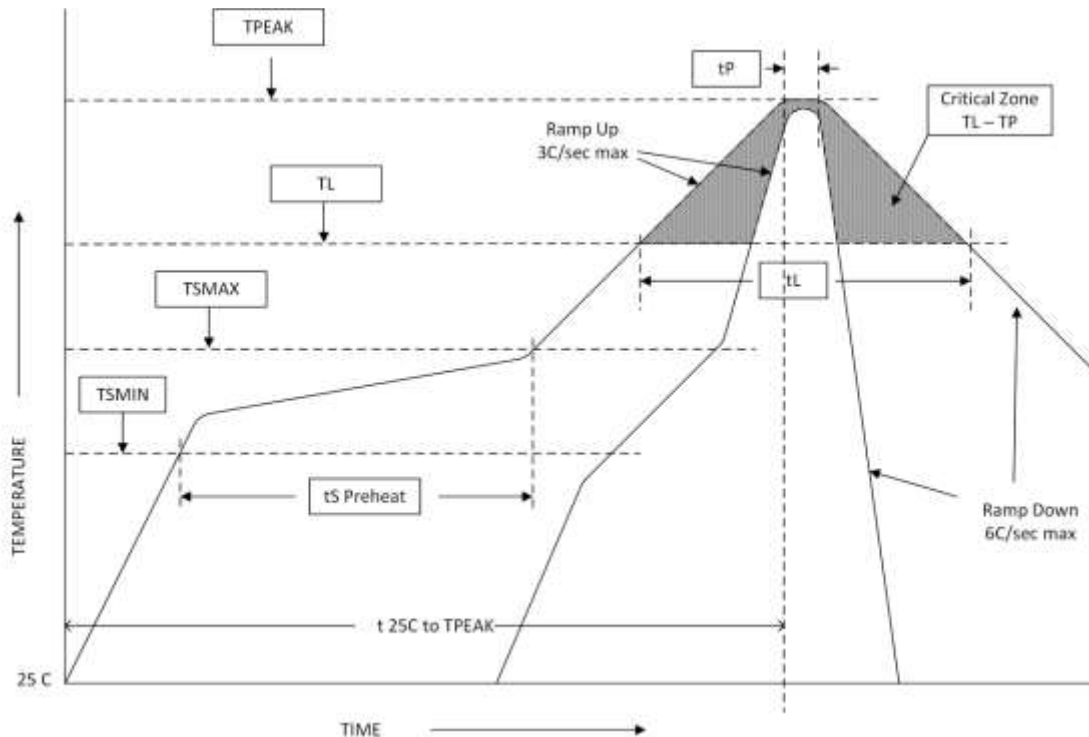


Assembly Instructions

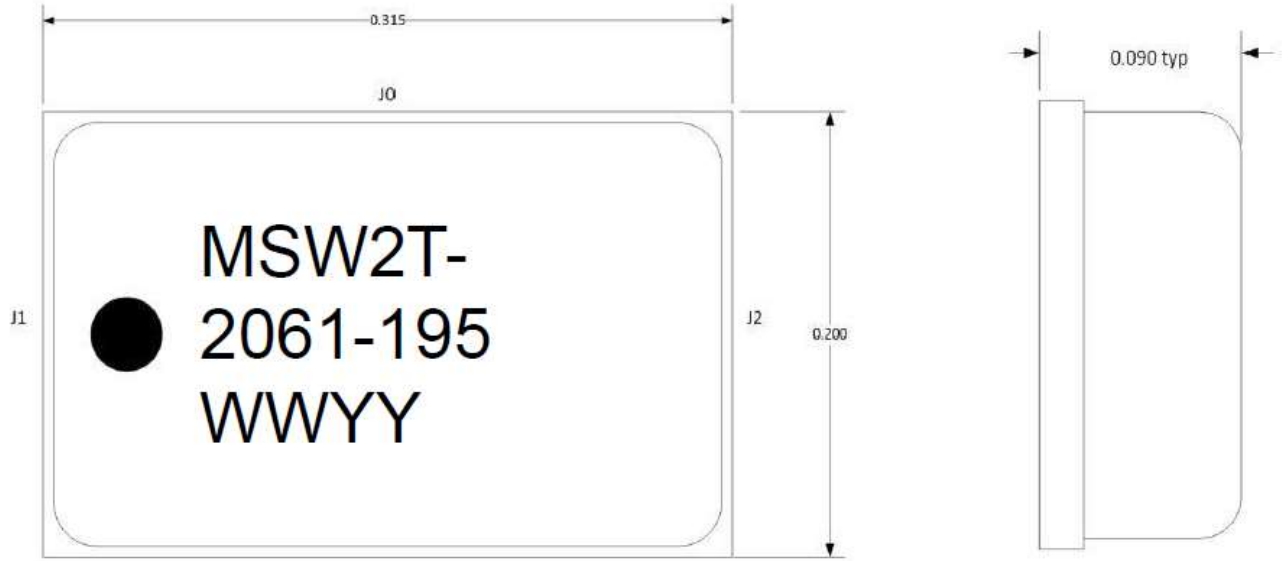
The MSW2T-206X-195 family of High Power Switches are available in either tube or Tape & Reel format. The MSW2T-206X-195 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

| 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) |

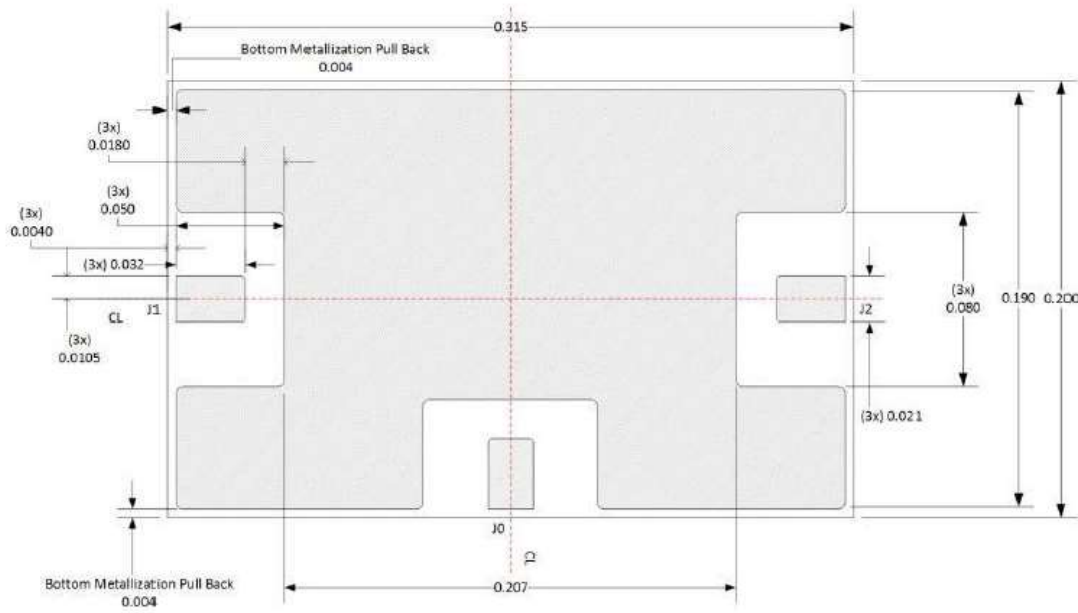
Solder Re-Flow Time-Temperature Profile



MSW2T-206X-195 SP2T Package Outline Drawing



Side View

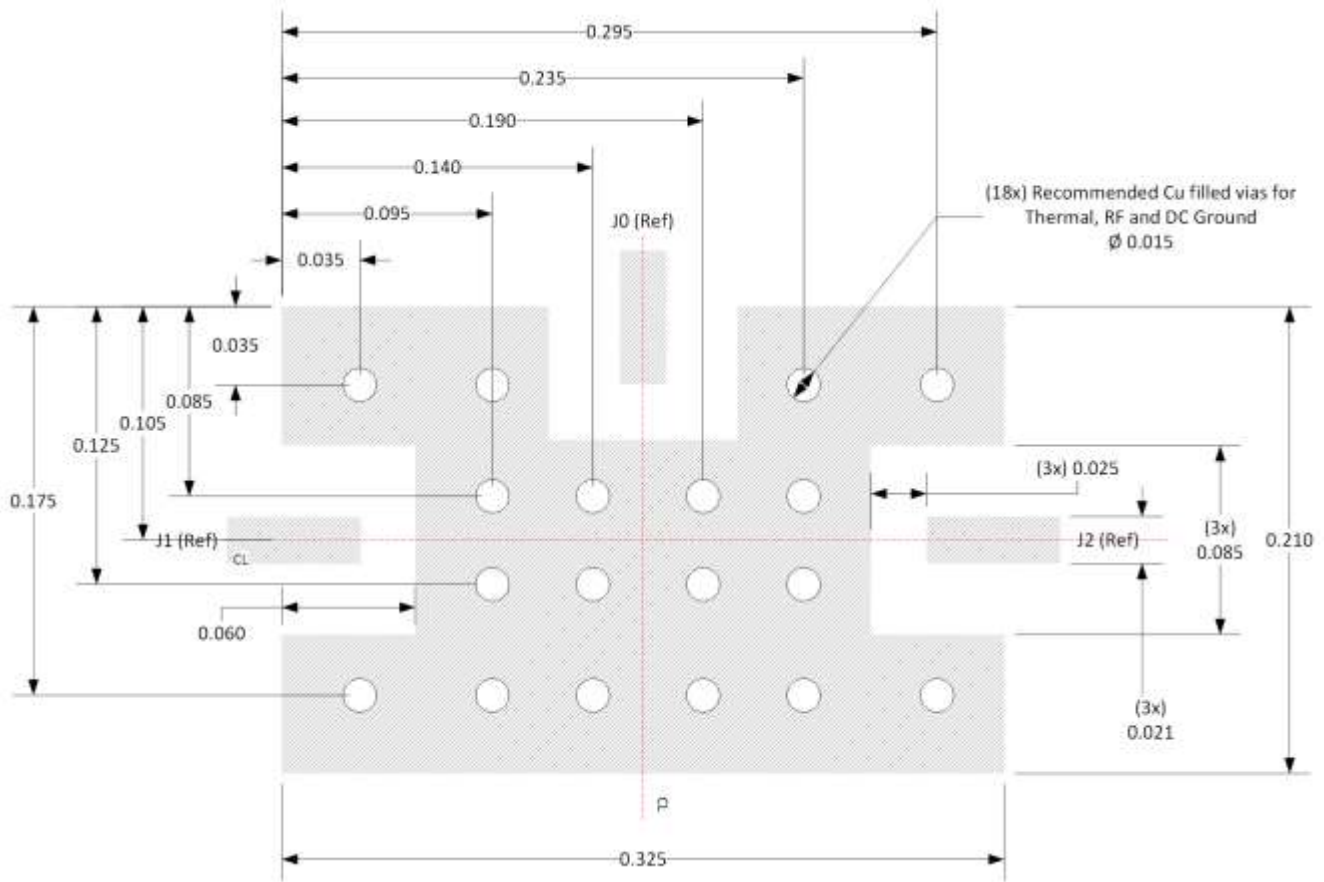


Note: Metallized area on backside is the RF, DC and Thermal ground. In user's end application this surface temperature must be managed to meet the power handling requirements.

Thermal Design Considerations:

The design of the MWT-206X-195 family of 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-206X-195



Part Number Ordering Details:

| Part Number | Packaging |
|---------------------------------|-----------|
| MSW2T-2060-195 | Gel Pack |
| MSW2T-2060-195 Small Signal EVB | Box |
| MSW2T-2061-195 | Gel Pack |
| MSW2T-2061-195 Small Signal EVB | Box |
| MSW2T-2062-195 | Gel Pack |
| MSW2T-2062-195 Small Signal EVB | Box |