

High Power GaAs SPDT Switch DC - 7.0 GHz

Rev. V1

Features

- Ideal for high power SPDT switch applications including WiMAX, WLAN, Mesh Networks, and Fixed Wireless Access
- Broadband Performance: DC - 7.0 GHz
- Low Insertion Loss:
 - 0.65 dB @ 3.5 GHz, RFC to T_X
 - 0.70 dB @ 3.5 GHz, RFC to R_X
- High P0.1dB Compression:
 - 40 dBm @ 3V, 3.5 GHz, RFC to T_X
- Fast Settling for Low Gate Lag requirements
- Lead-Free 2 mm 8-Lead PDFN Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible
- Asymmetrical Design for optimized performance

Description

M/A-COM's MASW-007921 is a broadband GaAs pHEMT MMIC SPDT switch available in a lead-free 2 mm 8-lead PDFN package. The MASW-007921 is ideally suited for applications where very small size and high linearity are required.

Typical applications include WiMAX, WLAN, Mesh networks, fixed wireless access, and other higher power systems. This switch has a very high initial compression point, ideal for complex modulations such as OFDM, with large peak average power levels.

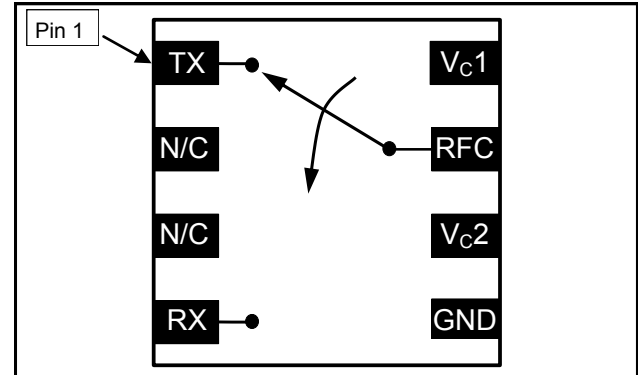
The MASW-007921 is fabricated using a 0.5 micron gate length GaAs pHEMT process. The process features full passivation for performance and reliability.

Ordering Information ^{1,2}

| Part Number | Package |
|--------------------|---------------------------------------|
| MASW-007921-TR3000 | 3000 piece reel |
| MASW-007921-001SMB | Sample Board 2.0 - 6.0 GHz Tuning |
| MASW-007921-002SMB | Sample Board 0.05 - 2.0 GHz Tuning |

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration ³

| Pin No. | Pin Name | Description |
|---------|---------------------|-------------------|
| 1 | T _X | RF Output 1 |
| 2 | N/C | No Connection |
| 3 | N/C | No Connection |
| 4 | R _X | RF Output 2 |
| 5 | GND | RF and DC Ground |
| 6 | V _{C2} | Voltage Control 2 |
| 7 | RFC | RF Common |
| 8 | V _{C1} | Voltage Control 1 |
| 9 | Paddle ⁴ | RF and DC Ground |

3. M/A-COM recommends connecting unused pins to ground.
4. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Absolute Maximum Ratings ^{5,6,7}

| Parameter | Absolute Maximum |
|--|------------------|
| Input Power @ 5 V Control (RFC to R _X Path) | +38 dBm |
| Input Power @ 5 V Control (RFC to T _X Path) | +40 dBm |
| Voltage | ≤ 8.5 volts |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -65°C to +150°C |

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. M/A-COM does not recommend sustained operation near these survivability limits.
7. Maximum Input Power applies for 0.5 to 7.0 GHz range.

¹ * Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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Rev. V1

Electrical Specifications: $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$, $V_C = 0 \text{ V} / 3 \text{ V}$, 4.7 pF Capacitor^{8,9}

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-----------------------------|---|---------------|------|------|------|
| Insertion Loss RFC to R_x | 0.05 - 2 GHz ¹⁰ | dB | — | 0.5 | — |
| | 2.4 GHz | dB | — | 0.6 | 0.85 |
| | 3.5 GHz | dB | — | 0.70 | — |
| | 5.8 GHz | dB | — | 0.8 | — |
| Insertion Loss RFC to T_x | 0.05 - 2 GHz ¹⁰ | dB | — | 0.5 | — |
| | 2.4 GHz | dB | — | 0.65 | 0.85 |
| | 3.5 GHz | dB | — | 0.65 | — |
| | 5.8 GHz | dB | — | 1.2 | — |
| Isolation | 0.05 - 2 GHz ¹⁰ | dB | — | 27 | — |
| | 2.4 GHz | dB | 21 | 25 | — |
| | 3.5 GHz | dB | — | 26 | — |
| | 5.8 GHz | dB | — | 30 | — |
| Return Loss | DC - 6.0 GHz | dB | — | 15 | — |
| Input IP2 R_x | 10 MHz Spacing, +20 dBm | | | | |
| | 2.4 GHz | dBm | — | 102 | — |
| | 3.5 GHz | dBm | — | 99 | — |
| | 5.8 GHz | dBm | — | 84 | — |
| Input IP2 T_x | 10 MHz Spacing, +20 dBm | | | | |
| | 2.4 GHz | dBm | — | 104 | — |
| | 3.5 GHz | dBm | — | 101 | — |
| | 5.8 GHz | dBm | — | 88 | — |
| Input IP3 R_x | 10 MHz Spacing, +20 dBm | | | | |
| | 2.4 GHz | dBm | — | 59 | — |
| | 3.5 GHz | dBm | — | 57 | — |
| | 5.8 GHz | dBm | — | 51 | — |
| Input IP3 T_x | 10 MHz Spacing, +20 dBm | | | | |
| | 2.4 GHz | dBm | — | 62 | — |
| | 3.5 GHz | dBm | — | 58 | — |
| | 5.8 GHz | dBm | — | 52 | — |
| Input P0.1dB R_x | 2.4 GHz | dBm | — | 38 | — |
| | 3.5 GHz | dBm | — | 37 | — |
| | 5.8 GHz | dBm | — | 39 | — |
| Input P0.1dB T_x | 2.4 GHz | dBm | — | 38 | — |
| | 3.5 GHz | dBm | — | 40 | — |
| | 5.8 GHz | dBm | — | 39 | — |
| Trise, Tfall | 10% to 90% RF | nS | — | 21 | — |
| | 90% to 10% RF | nS | — | 18 | — |
| Ton, Toff | 50% control to 90% and 50% control to 10% RF | nS | — | 40 | — |
| Transients | | mV | — | 100 | — |
| Control Current | | μA | — | 2.0 | 10.0 |

8. For positive voltage control, external DC blocking capacitors are required on all RF ports.

9. Performance can be optimized by varying the DC blocking capacitor value. See application schematic for details.

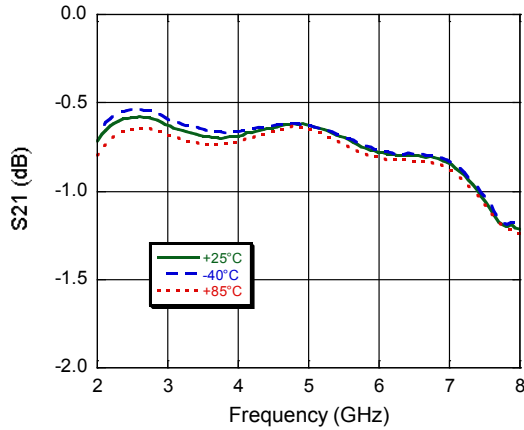
10. 0.05 - 2.0 GHz specifications apply with 1000 pF blocking capacitors. See applications section for typical data.

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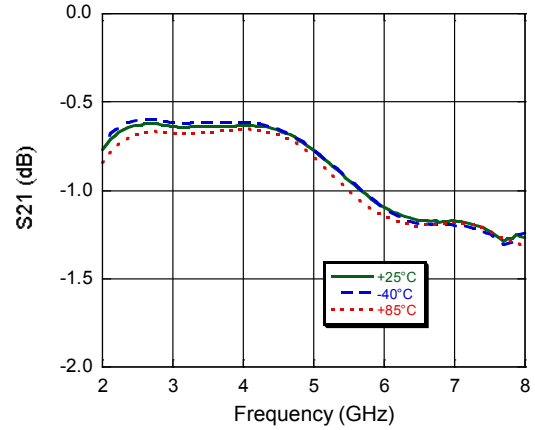
Rev. V1

Typical Performance Curves Over Temp.: $Z_0 = 50 \Omega$, 4.7 pF Blocking Caps on all RF Ports

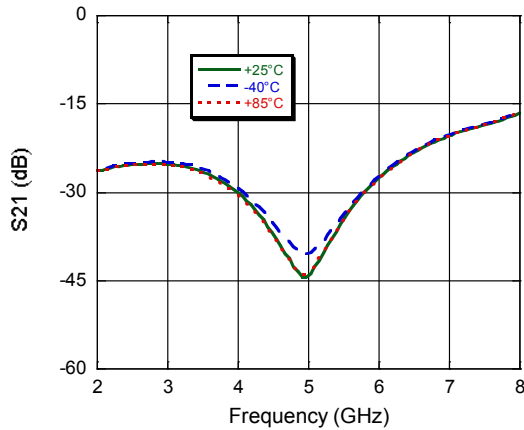
RFC to Rx Insertion Loss



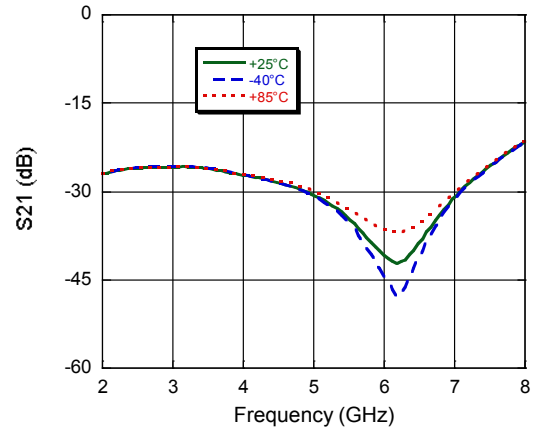
RFC to Tx Insertion Loss



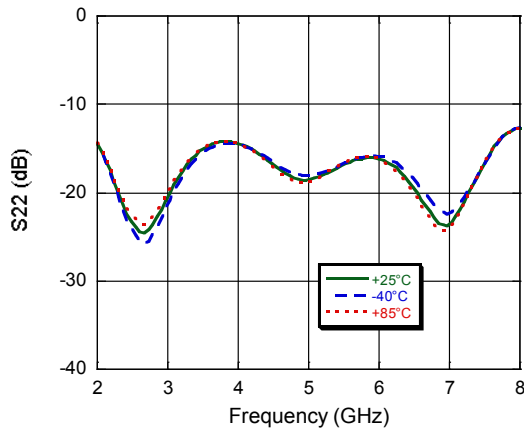
RFC to Rx Isolation



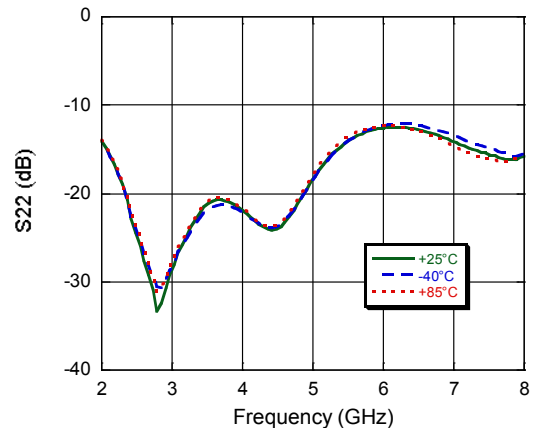
RFC to Tx Isolation



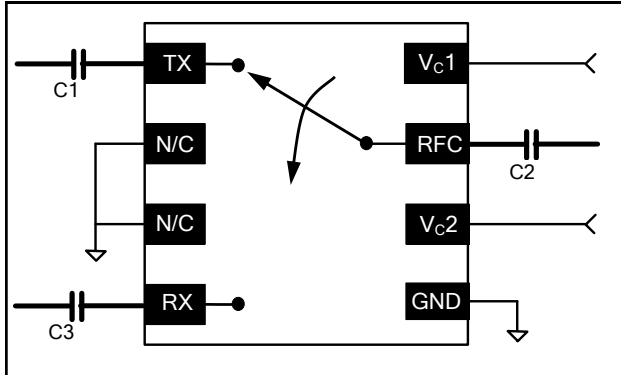
Rx Return Loss



Tx Return Loss



Application Schematic ¹¹



| Frequency | Recommended Value C1 - C3 |
|----------------|------------------------------|
| 0.05 - 2.0 GHz | 1000 pF |
| 2.4 - 2.5 GHz | 8 pF |
| 2.0 - 6.0 GHz | 4.7 pF |
| 4.9 - 7.0 GHz | 1.5 pF |

11. M/A-COM recommends connecting unused package pins (N/C) to ground as shown.

Truth Table ^{12,13}

| Control V _{c1} | Control V _{c2} | RFC - TX | RFC - RX |
|----------------------------|----------------------------|----------|----------|
| 1 | 0 | On | Off |
| 0 | 1 | Off | On |

12. Differential voltage, V (state 1) - V (state 0), must be +2.7 V minimum and must not exceed 8.0 V.
 13. Positive Control: 1 = +2.9 V to +8 V, 0 = 0 V \pm 0.2 V.
 Negative Control: 1 = 0 V \pm 0.2 V, 0 = -2.9V to -8.0 V.

Qualification

Qualified to M/A-COM specification REL-201, Process Flow -1.

Handling Procedures

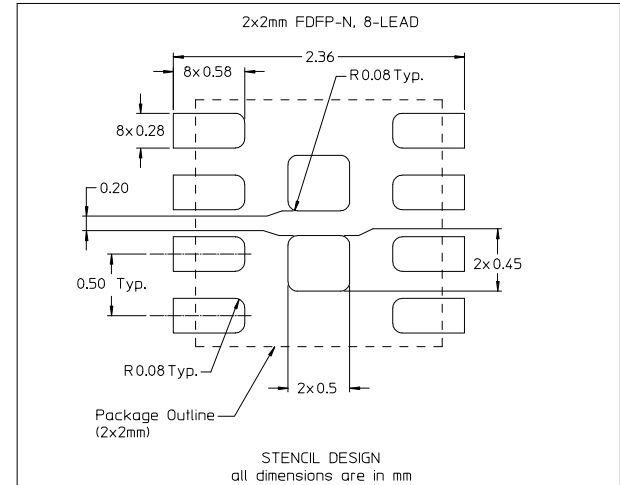
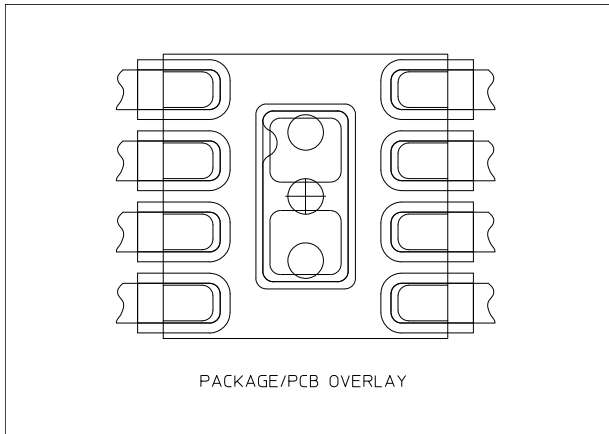
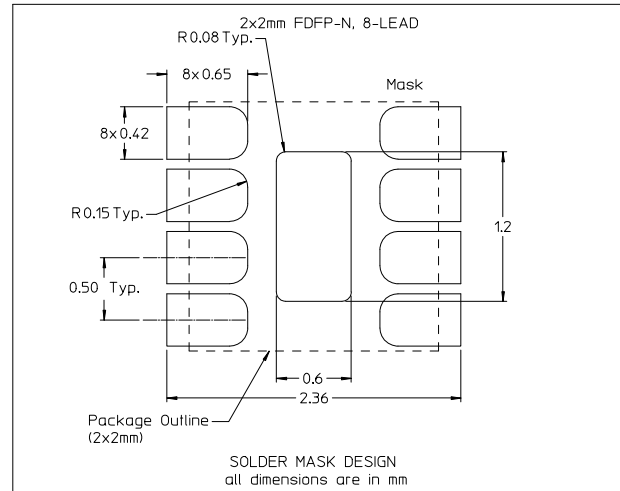
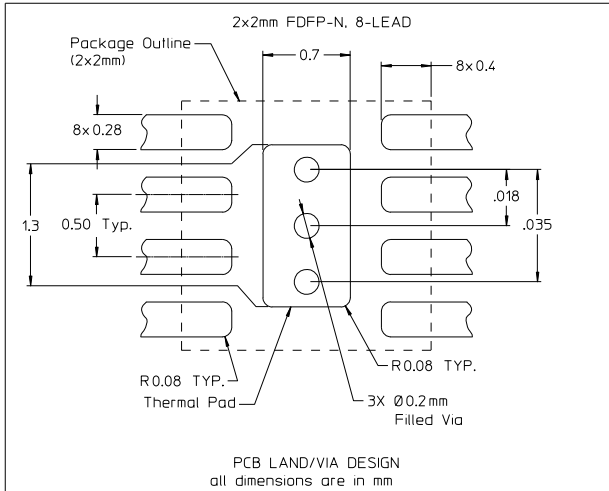
Please observe the following precautions to avoid damage:

Static Sensitivity

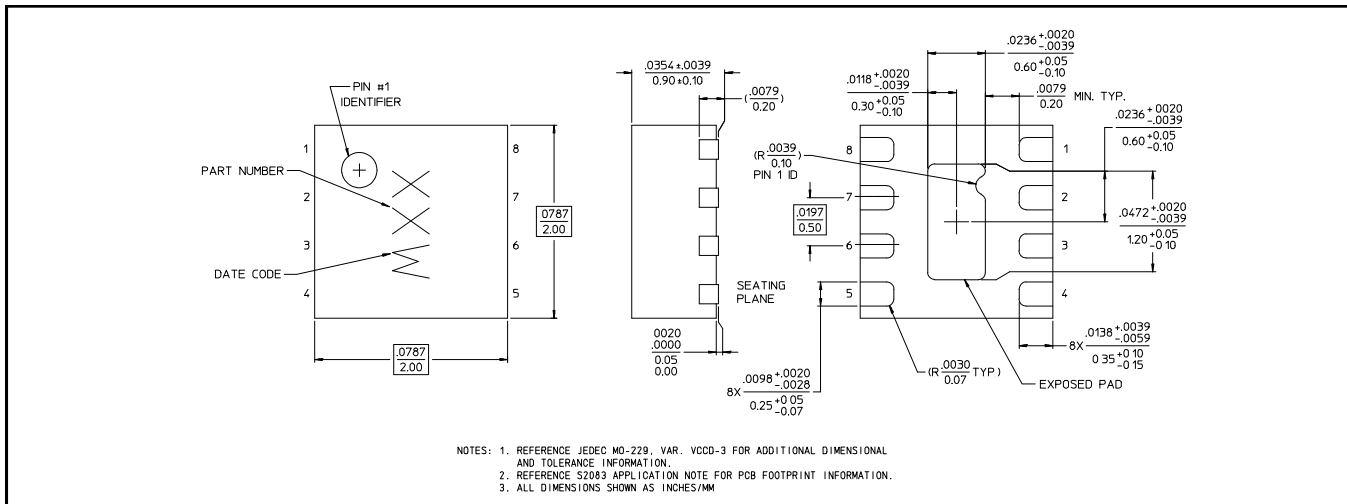
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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Lead Free 2 mm 8-lead PDFN †

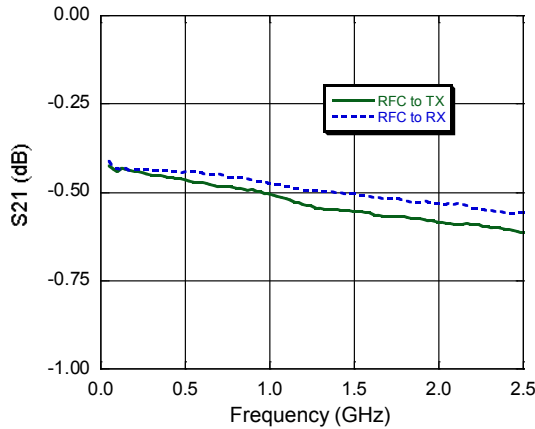


† Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.

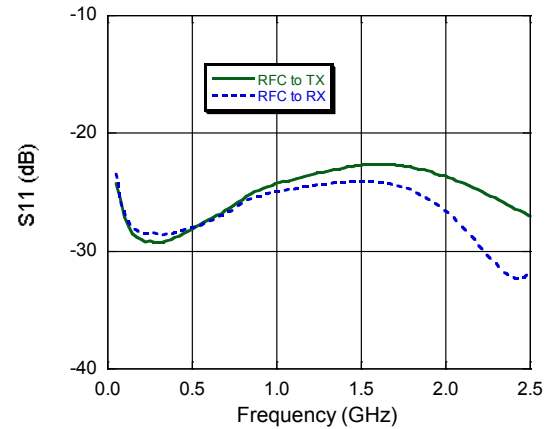
Applications Section

Typical Low Frequency Performance Curves: $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$, 1000 pF Blocking Caps on all RF Ports

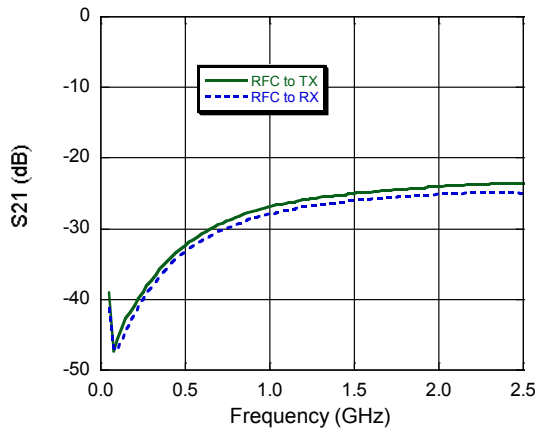
Insertion Loss



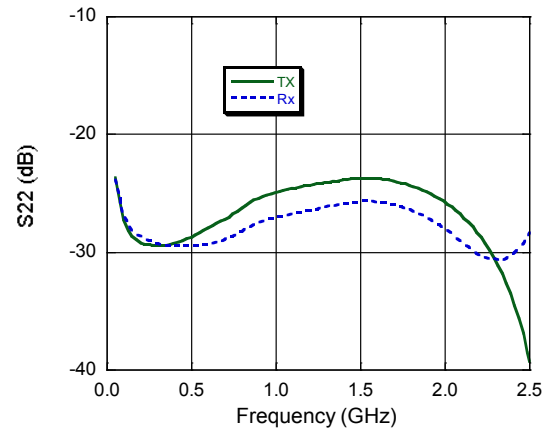
RFC Return Loss



Isolation



Tx and Rx Return Loss



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