

GaAs SP6T 2.5 V High Power Switch Dual- / Tri- / Quad-Band GSM Applications

Rev. V1

Features

- Dual- / tri- / quad-band GSM / GPRS / EDGE
- 2.5V Operation
- Harmonics: -70 dBc @ +34.5 dBm & 1 GHz
- Insertion Loss: 0.5 dB @ 1 GHz
- T_x - R_x Isolation: 41 dB @ 2 GHz
- Lead-Free 4 mm 20-Lead PQFN Package
- RoHS Compliant* and 260°C Reflow Compatible

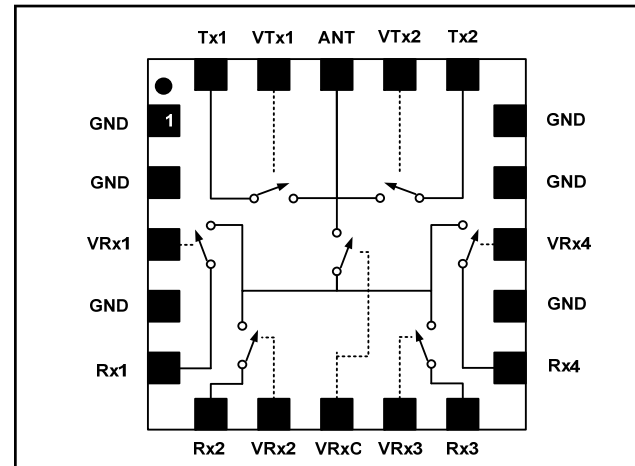
Description

M/A-COM's MASW-000105 is a GaAs PHEMT MMIC single pole six throw (SP6T) high power switch in a 4 mm PQFN package. Designed for dual-, tri-, or quad-band GSM/GPRS/EDGE mobile devices, the MASW-000105 is ideally suited for applications where high power, low control voltage, low insertion loss, high isolation, small size and low cost are required. This part can be used in all systems operating up to 2.5 GHz requiring high power at low control voltage.

The MASW-000105 is fabricated using a 0.5 micron gate length GaAs PHEMT process. The process features full passivation for performance and reliability.

The MASW-000105 can also be purchased in die form as the MASWSS0091.

Functional Block Diagram



Pin Configuration

| Pin No. | Function | Description |
|---------|---------------------|-------------------|
| 1 | GND | Ground |
| 2 | GND | Ground |
| 3 | VRx1 | Rx1 Control |
| 4 | GND | Ground |
| 5 | Rx1 | Rx1 Port |
| 6 | Rx2 | Rx2 Port |
| 7 | VRx2 | Rx2 Control |
| 8 | VRxC | Rx Common Control |
| 9 | VRx3 | Rx3 Control |
| 10 | Rx3 | Rx3 Port |
| 11 | Rx4 | Rx4 Port |
| 12 | GND | Ground |
| 13 | VRx4 | Rx4 Control |
| 14 | GND | Ground |
| 15 | GND | Ground |
| 16 | Tx2 | Tx2 Port |
| 17 | VTx2 | Tx2 Control |
| 18 | ANT | ANT Pad |
| 19 | VTx1 | Tx1 Control |
| 20 | Tx1 | Tx1 Port |
| 21 | Paddle ³ | RF and DC Ground |

3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Ordering Information ^{1,2}

| Part Number | Package |
|--------------------|-------------------|
| MASW-000105-TR3000 | 3000 piece reel |
| MASW-000105-001SMB | Sample Test Board |

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

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

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

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Electrical Specifications: $T_A = 25^\circ\text{C}$, $V_C = 0\text{V}/2.5\text{V}$, $Z_0 = 50 \Omega$ ⁴

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-----------------------------|----------------------------------------------------------------------------------------|-------|---------|------------|----------|
| Insertion Loss ⁵ | Ant - T _X 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | - - | 0.5 0.7 | 0.7 - |
| | Ant - R _X 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | - - | 1.0 1.3 | 1.2 - |
| Isolation | T _X to R _X , T _X On 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | 40 - | 47 41 | - - |
| | T _X to T _X , T _X On 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | 20 - | 27 21 | - - |
| | R _X to T _X , R _X On 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | - - | 26 21 | - - |
| | R _X to R _X , R _X On 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | - - | 37 33 | - - |
| Return Loss | 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dB | - - | 18 16 | - - |
| T _X P0.1dB | $V_C = 0 \text{ V} / 2.5 \text{ V}$ | dBm | - | 36 | - |
| R _X P1dB | $V_C = 0 \text{ V} / 2.5 \text{ V}$ | dBm | - | 24 | - |
| IP3 | T _X to ANT | dBm | - | 60 | - |
| | ANT to R _X | dBm | - | 50 | - |
| 2nd Harmonic | 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dBc | - - | 71 70 | - - |
| 3rd Harmonic | 0.5 - 1.0 GHz 1.0 - 2.0 GHz | dBc | - - | 74 66 | - - |
| Trise, Tfall | 10% to 90% RF, 90% to 10% RF | μs | - | 0.5 | - |
| Ton, Toff | 50% control to 90% RF, 50% control to 10% RF | μs | - | 0.9 | - |
| Transients | In Band | mV | - | 30 | - |
| Control Current | $ V_C = 2.5 \text{ V}$ | μA | - | 20 | 50 |

4. External DC blocking capacitors are required on all RF ports.

5. Insertion loss can be optimized by varying the DC blocking capacitor value, e.g. 100 pF for 0.5 GHz - 2.0 GHz.

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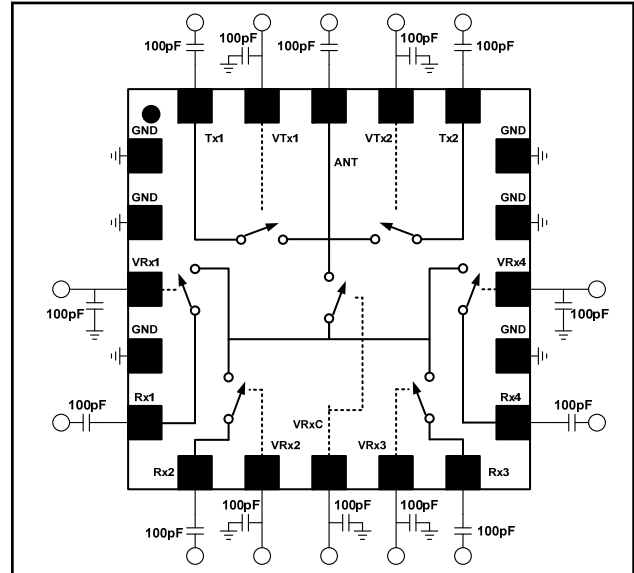
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Absolute Maximum Ratings ^{6,7}

| Parameter | Absolute Maximum |
|----------------------------------------------|------------------|
| Input Power (0.5 - 2.5 GHz, 2.5V Control) | +38 dBm |
| Voltage | +8.5 volts |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -65°C to +150°C |

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM does not recommend sustained operation near these survivability limits.

Functional Schematic



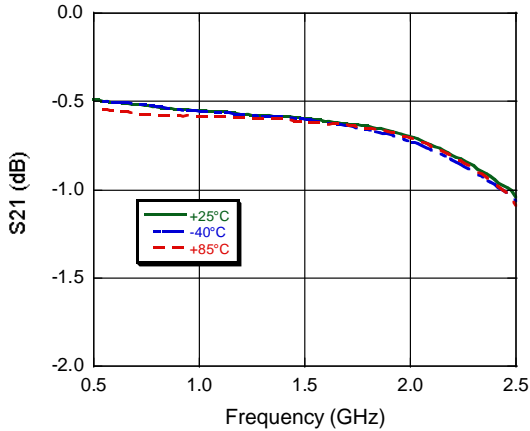
Truth Table ^{8,9}

| VTx1 | VTx2 | VRxC | VRx1 | VRx2 | VRx3 | VRx4 | ANT-Tx1 | ANT-Tx2 | ANT-Rx1 | ANT-Rx2 | ANT-Rx3 | ANT-Rx4 |
|------|------|------|------|------|------|------|---------|---------|---------|---------|---------|---------|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | On | Off | Off | Off | Off | Off |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | Off | On | Off | Off | Off | Off |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | Off | Off | On | Off | Off | Off |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | Off | Off | Off | On | Off | Off |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | Off | Off | Off | Off | On | Off |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | Off | Off | Off | Off | Off | On |

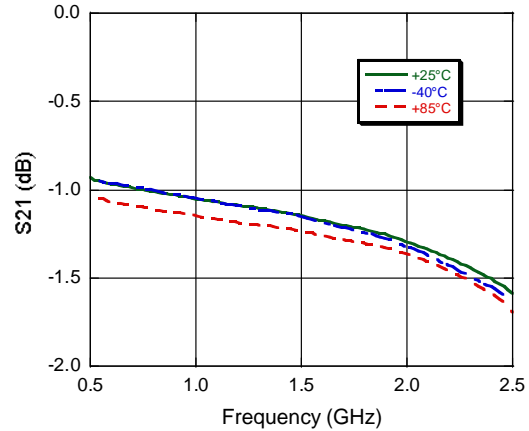
- Differential voltage, V (state 1) - V (state 0), must be 2.5 V minimum.
- State 0 = 0 V to +0.2 V, State 1 = 2.5 V to 5 V.

Typical Performance Curves

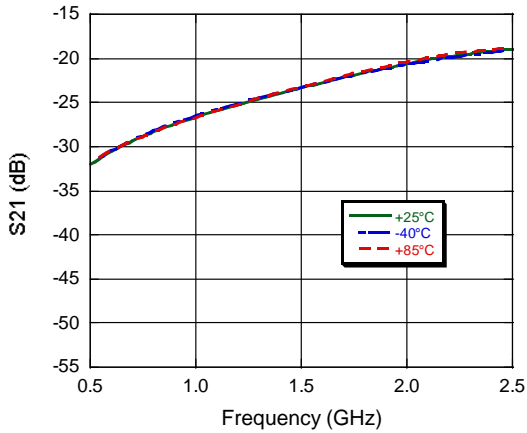
T_X Insertion Loss



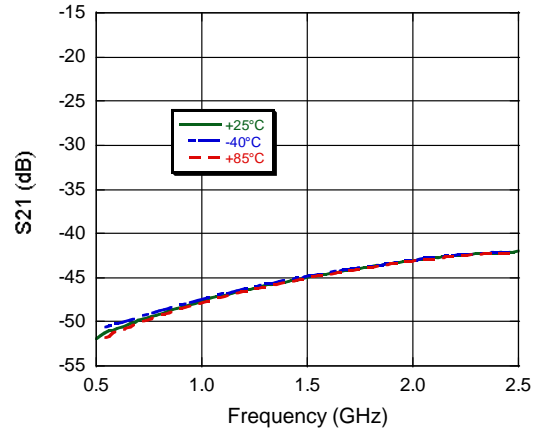
R_X Insertion Loss



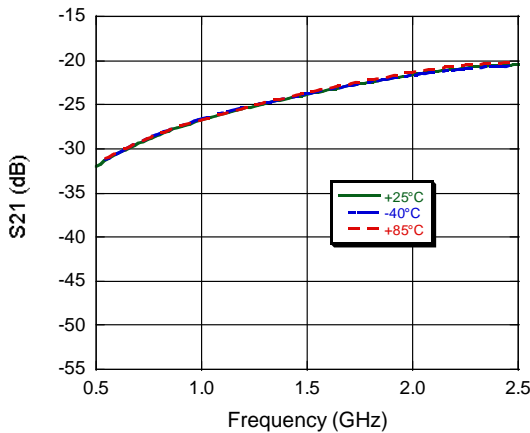
$T_X - T_X$ Isolation



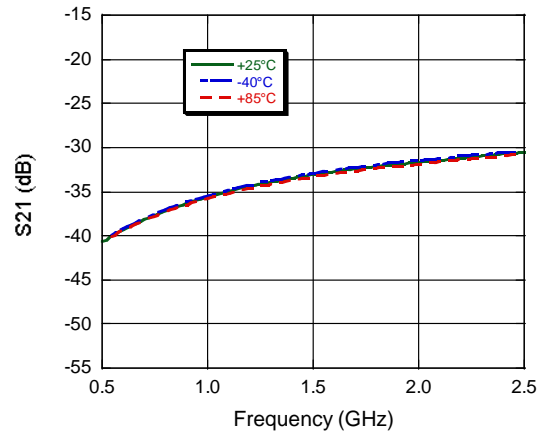
$T_X - R_X$ Isolation



$R_X - T_X$ Isolation

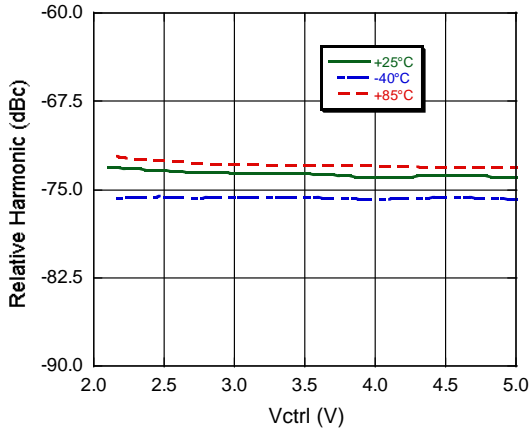


$R_X - R_X$ Isolation



Typical Performance Curves

3rd Harmonic vs. V_{ctrl} @ 1 GHz, $P_{in} = +35$ dBm, 100% Duty Cycle



Qualification

Qualified to M/A-COM specification REL-201, Process Flow -2.

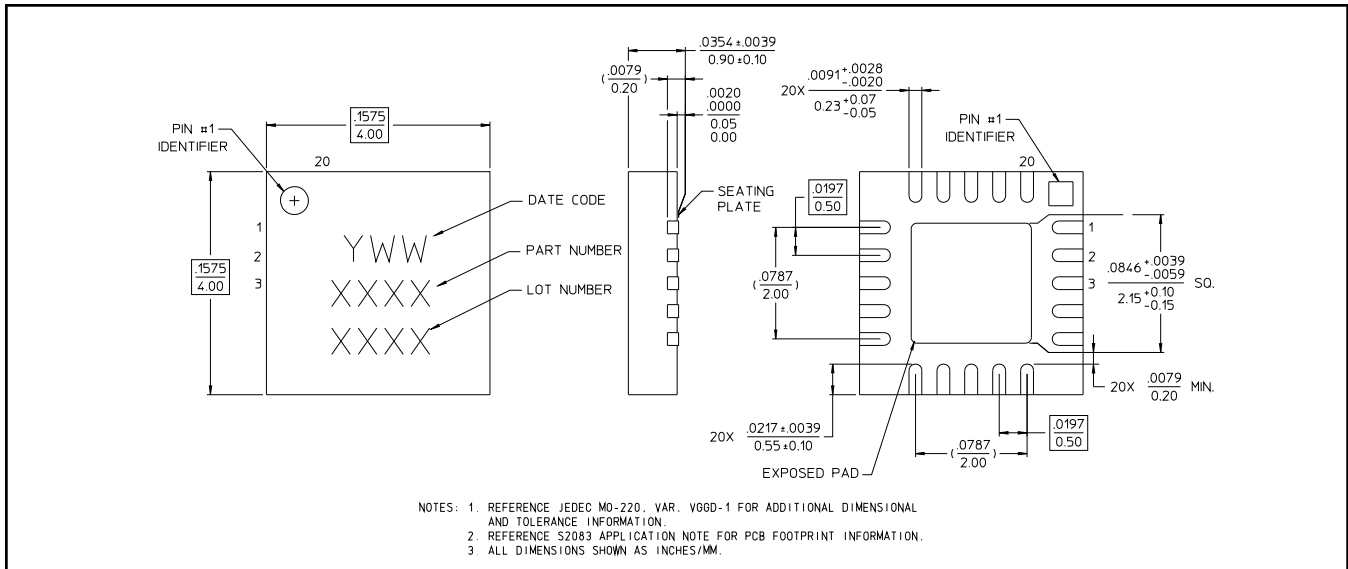
Handling Procedures

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.

Lead Free 4 mm 20-lead PQFN †



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.