# GaAs SPDT Switch, Absorptive, Single Supply, DC-4.0 GHz



Rev. V4

#### Features

- Operates DC 4 GHz on Single Supply
- ASIC TTL / CMOS Driver •
- Low DC Power Consumption
- 50 Ohm Nominal Impedance
- Test Boards are Available
- Tape and Reel are Available
- Lead-Free 4 x 6 mm PQFN Package •
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible •
- RoHS\* Compliant Version of SW90-0002

#### Description

M/A-COM's MASW-007071-000100 is a SPDT absorptive pHEMT switch with integral TTL driver. This device is in an PQFN plastic surface mount package. This switch offers excellent broadband performance and repeatability from DC to 4 GHz, while maintaining low DC power dissipation. The MASW-007071-000100 is ideally suited for wireless infrastructure applications.

### **Ordering Information**

| Part Number        | Package           |
|--------------------|-------------------|
| MASW-007071-000100 | Bulk Packaging    |
| MASW-007071-0001TR | 1000 piece reel   |
| MASW-007071-0001TB | Sample Test Board |

Note: Reference Application Note M513 for reel size information.

# Pin Configuration<sup>1,2,3,4</sup>

| Pin No. | Function        | Pin No. | Function        |
|---------|-----------------|---------|-----------------|
| 1       | NC              | 17      | NC              |
| 2       | GND             | 18 C1   |                 |
| 3       | RFC             | 19 NC   |                 |
| 4       | GND             | 20      | V <sub>CC</sub> |
| 5       | NC              | 21 NC   |                 |
| 6       | NC              | 22      | NC              |
| 7       | GND             | 23 CP1  |                 |
| 8       | RF1             | 24      | CP2             |
| 9       | GND             | 25      | NC              |
| 10      | NC              | 26      | V <sub>EE</sub> |
| 11      | NC              | 27      | NC              |
| 12      | V <sub>EE</sub> | 28      | NC              |
| 13      | NC              | 29      | NC              |
| 14      | V <sub>cc</sub> | 30      | GND             |
| 15      | NC              | 31      | RF2             |
| 16      | NC              | 32      | GND             |

NC = No Connection 1

2 VEE is internally generated and must remain isolated from external power supplies. Generated noise is typical of switching DC-DC Converters.

- Connections and external components shown in functional 3. schematic are required. 0.1 µF Capacitors need to be located near pins 20 & 26.
- The exposed pad centered on the package bottom must be 4. connected to RF and DC ground. (For PQFN Packages)

### Truth Table (Switch)

| Control Input | Condition of the Switch   |     |  |
|---------------|---------------------------|-----|--|
|               | RF Common to each RF Port |     |  |
| C1            | RF1                       | RF2 |  |
| 0             | Off                       | On  |  |
| 1             | On                        | Off |  |

"0" = TTL Low "1" = TTL High

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

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# Electrical Specifications: $T_A = 25^{\circ}C$ , $Z_0 = 50\Omega$

| Parameter  | Test Conditions   | Frequency               | Units      | Min        | Тур      | Max        |
|--|---|-------------------------|------------|------------|----------|------------|
| Insertion Loss   | RFC—RF1,RF2<br>(Logic per truth table)                        | DC - 4.0 GHz            | dB         | -          | -        | 1.8        |
| Isolation  | RF1—RF2 (All Logic "0")                                       | DC - 4.0 GHz            | dB         | 30         | —        | —          |
| VSWR   | On (RFC,RF1, RF2)<br>(Logic per truth table)                  | DC - 4.0 GHz            | Ratio      | _          | —        | 2.0:1      |
| VSWR   | Off (RF1, RF2)<br>(Logic per truth table)                     | DC - 4.0 GHz            | Ratio      | _          | —        | 1.8:1      |
| 1 dB Compression   | _   | 50 MHz<br>0.5 - 4.0 GHz | dBm<br>dBm | _          | 18<br>29 | _          |
| Input IP <sub>3</sub>                                    | Two-tone inputs up to +5 dBm                                  | 50 MHz<br>0.5 - 4.0 GHz | dBm<br>dBm | _          | 36<br>46 | _          |
| Switching Speed  | Ton (50% Control to 10% RF)                                   | —                       | ns         |            | 31       | _          |
| _  | Toff (50% Control to 90% RF)                                  | —                       | ns         | _          | 19       | —          |
|  | Trise (10% to 90% RF)   | —                       | ns         |            | 6        | —          |
|  | Tfall (90% to 10% RF)   | —                       | ns         |            | 2        | —          |
| Vcc  | -   | —                       | V          | 4.5        | 5.0      | 5.5        |
| V <sub>IL</sub><br>V <sub>IH</sub>                       | LOW-level input voltage<br>HIGH-level input voltage           | _                       | V<br>V     | 0.0<br>2.0 | _        | 0.8<br>5.0 |
| lin (Input Leakage Current)                              | Vin = V <sub>CC</sub> or GND                                  | —                       | uA         | -1.0       | _        | 1.0        |
| Icc <sup>5</sup>   | Vcc min to max, Logic "0" or "1"                              | —                       | mA         | —          | 5        | 8          |
| Turn-on Current <sup>6</sup>                             | For guaranteed start-up                                       | —                       | mA         |            |          | 125        |
| ∆Icc<br>(Additional Supply Current Per<br>TTL Input Pin) | $V_{CC}$ = Max, Vcntrl = $V_{CC}$ - 2.1 V                     | _                       | mA         | _          | _        | 1.0        |
| Switching Noise  | Generated from DC-DC Converter<br>with recommended capacitors | 3.5 MHz                 | dBm        | _          | -93      | -          |
| Thermal Resistance θjc                                   | _   | —                       | °C/W       | —          | 15       | —          |

5. During turn-on, the device requires an initial start up current (Icc) specified as "Turn-on Current". Once operational, Icc will drop to the specified levels.

6. The DC-DC converter is guaranteed to start in 100 μs as long as the power supplies have the maximum turn-on current available for start-up.

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#### Absolute Maximum Ratings<sup>7,8</sup>

| Parameter  | Absolute Maximum   |
|--|--|
| Max. Input Power<br>0.05 GHz<br>0.5 - 4.0 GHz <sup>9</sup> | +27 dBm<br>+34 dBm   |
| V <sub>CC</sub>  | $-0.5 V \le V_{CC} \le +6.0 V$   |
| Vin <sup>10</sup>  | $-0.5 \text{V} \leq \text{Vin} \leq \text{V}_{\text{CC}} + 0.5 \text{V}$ |
| Operating Temperature                                      | -40°C to +85°C   |
| Storage Temperature  | -65°C to +125°C  |

7. 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.
- 9. When the RF input is applied to the terminated port, the absolute maximum power is +30 dBm.
- 10.Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

#### RF2 0.46 0.398 018 .016 0.711 30X Ø 0.343 PIN 1 $\overline{}$ PIN 1 MARKER 2.819 RFC TTan 2.779 .111 7772 (77<del>2</del>) 109 111 man 77 0.279 30X 6X 45° CHAMFER RF1 ON PAD 4.763 188 6 604 .260 RECOMMENDED PC BOARD LAYOUT CIRCUIT MATERIAL: TETRA II .010 INCH THICK RELIEVEN AND A CONTAINT 44 RELINES ARE COPLANER- USE GND SPACING OF 016 GROUND VIAS 014 RE PORTS ARE 50 OHMS 01 µF ±10% CAPACITOR REQUIRED BETWEEN PINS 23 AND 24 0.1 $\mu F$ ±10% BYPASS CAPACITOR REQUIRED ON Vcc TRACE NEAR PIN 20 0.1 $\mu F$ ±10% BYPASS CAPACITOR REQUIRED ON Vee TRACE NEAR PIN 26

## **Recommended PCB Configuration**<sup>11</sup>

## 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.

#### **Moisture Sensitivity**

The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

#### 11. Application Note S2083 is available on line at www.macom.com

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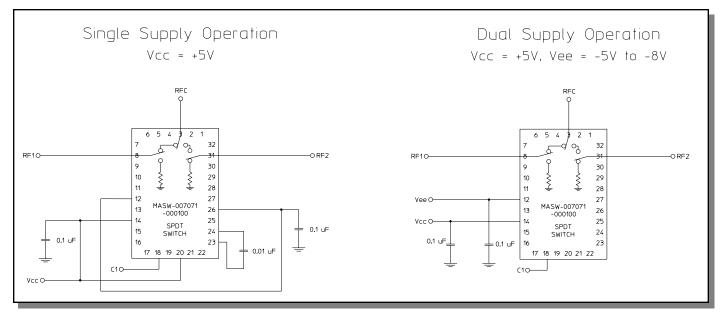
# MASW-007071-000100





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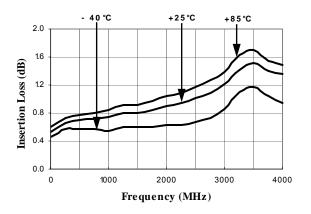
## Functional Schematic<sup>12</sup>



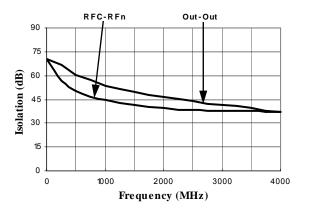
12. Dual Supply Operation will eliminate the start-up current mentioned in Note 5. It will also eliminate spurious signals caused by the DC-DC converter that are present in single supply operation.

## **Typical Performance Curves**

#### Insertion Loss vs. Frequency



#### Isolation (dB) vs. Frequency



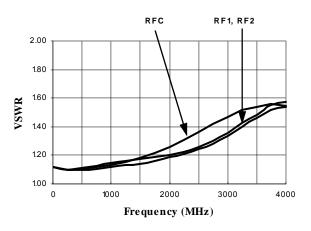
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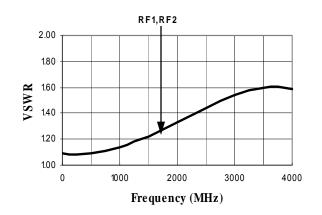
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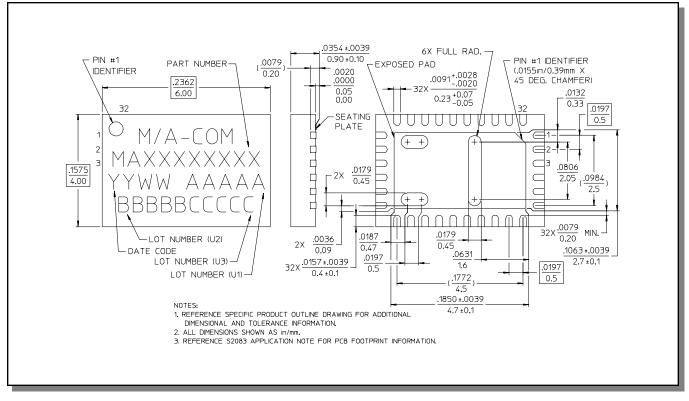
#### On VSWR vs. Frequency



#### VSWR (Terminations) vs. Frequency



#### CSP-1, Lead-Free 4 x 6 mm, 32-lead PQFN<sup>†</sup>



# Reference Application Note M538 for lead-free solder reflow recommendations.

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