

# GaAs SP4T 2.5V High Power Switch

## DC - 3 GHz

Jan 16 2002

Preliminary

MASWSS0020

### Features

- Low Voltage Operation 2.5V
- Low Harmonics > 65 dBc at +34 dBm & 1 GHz
- Low Insertion Loss 0.6 dB at 1 GHz
- High Isolation 23 dB at 2 GHz
- Miniature FQFP 16-lead 4x4mm Package
- 0.5 micron GaAs pHEMT Process

### Description

M/A-COM's MASWSS0020 is a GaAs PHEMT MMIC single pole four throw (SP4T) high power switch in a low cost miniature FQFP 16-lead 4x4mm package. The MASWSS0020 is ideally suited for applications where high power, low control voltage, low insertion loss, high isolation, small size and low cost are required. Typical applications are for GSM and DCS handset systems that connect separate transmit and receive functions to a common antenna, as well as other handset and related applications. This part can be used in all systems operating up to 3 GHz requiring high power at low control voltage.

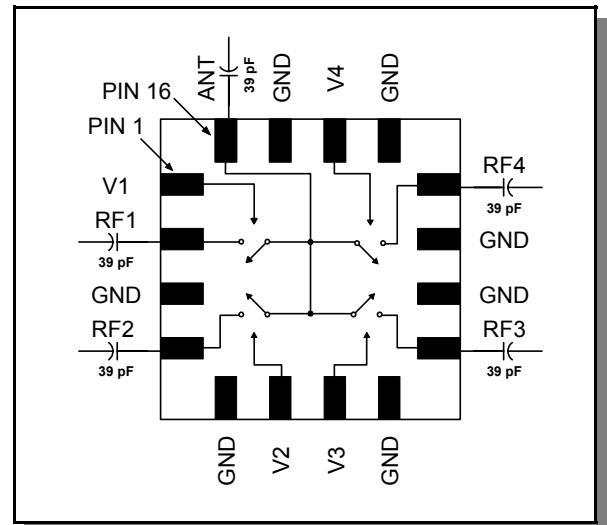
The MASWSS0020 is fabricated using a 0.5 micron gate length GaAs PHEMT process. The process features full passivation for performance and reliability.

### Absolute Maximum Ratings <sup>1</sup>

| Parameter                                   | Absolute Maximum  |
|---|-------------------|
| Max Input Power (0.5 - 3 GHz, 2.5V Control) | +38 dBm           |
| Operating Voltage                           | +8.5 volts        |
| Operating Temperature                       | -40 °C to +85 °C  |
| Storage Temperature                         | -65 °C to +150 °C |

1. Exceeding any one or combination of these limits may cause permanent damage.

### Functional Schematic



### Pin Configuration

| PIN No. | PIN Name     | Description  |
|---------|--------------|--------------|
| 1       | V1           | Control 1    |
| 2       | RF1          | RF Port 1    |
| 3       | GND          | RF Ground    |
| 4       | RF2          | RF Port 2    |
| 5       | GND          | RF Ground    |
| 6       | V2           | Control 2    |
| 7       | V3           | Control 3    |
| 8       | GND          | RF Ground    |
| 9       | RF3          | RF Port 3    |
| 10      | GND          | RF Ground    |
| 11      | GND          | RF Ground    |
| 12      | RF4          | RF Port 4    |
| 13      | GND          | RF Ground    |
| 14      | V4           | Control 4    |
| 15      | GND          | RF Ground    |
| 16      | ANT          | Antenna Port |
| 17      | GND (paddle) | RF Ground    |

Electrical Specifications:  $T_A = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ <sup>2</sup>

| Parameter                | Test Conditions   | Units | Min. | Typ. | Max. |
|--------------------------|---|-------|------|------|------|
| Insertion Loss           | DC – 1 GHz  | dB    |      | 0.6  | 0.8  |
|                          | 1 – 2 GHz   | dB    |      | 0.8  | 1.0  |
|                          | 2 – 3 GHz   | dB    |      | 1.0  |      |
| Isolation                | DC – 1 GHz  | dB    | 25   | 29   |      |
|                          | 1 – 2 GHz   | dB    | 21   | 23   |      |
|                          | 2 – 3 GHz   | dB    |      | 18.5 |      |
| Return Loss              | DC – 3 GHz  | dB    |      | 20   |      |
| IP3                      | Two Tone +10dBm, 5 MHz Spacing, > 50 MHz<br>$V_c = 0V/2.5V$ | dBm   |      | 57   |      |
| P1dB                     | $V_c = 0V/2.5V$   | dBm   |      | 38   |      |
| 2 <sup>nd</sup> Harmonic | 1 GHz, $P_{IN} = +34$ dBm, $V_c = 0V/2.5V$                  | dBc   | 65   |      |      |
| 3 <sup>rd</sup> Harmonic | 1 GHz, $P_{IN} = +34$ dBm, $V_c = 0V/2.5V$                  | dBc   | 65   |      |      |
| Trise, Tfall             | 50% control to 90% RF, and 50% control to 10% RF            | uS    |      |      | 1    |
| Ton, Toff                | 50 - 350 MHz  | uS    |      |      | 1    |
| Transients               |   | mV    |      | 10   |      |
| Gate Leakage             | $ V_c  = 2.5V$  | uA    |      |      | 100  |

2. Insertion Loss can be optimized by varying the DC Blocking Capacitor value, ie. 1000 pF for 100 MHz - 500 MHz, 39 pF for 0.5 GHz - 3 GHz.

Truth Table<sup>3</sup>

| V1           | V2           | V3           | V4           | ANT- RF1 | ANT - RF2 | ANT - RF3 | ANT - RF4 |
|--------------|--------------|--------------|--------------|----------|-----------|-----------|-----------|
| +2.5 to +5V  | $0 \pm 0.2V$ | $0 \pm 0.2V$ | $0 \pm 0.2V$ | On       | Off       | Off       | Off       |
| $0 \pm 0.2V$ | +2.5 to +5V  | $0 \pm 0.2V$ | $0 \pm 0.2V$ | Off      | On        | Off       | Off       |
| $0 \pm 0.2V$ | $0 \pm 0.2V$ | +2.5 to +5V  | $0 \pm 0.2V$ | Off      | Off       | On        | Off       |
| $0 \pm 0.2V$ | $0 \pm 0.2V$ | $0 \pm 0.2V$ | +2.5 to +5V  | Off      | Off       | Off       | On        |

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

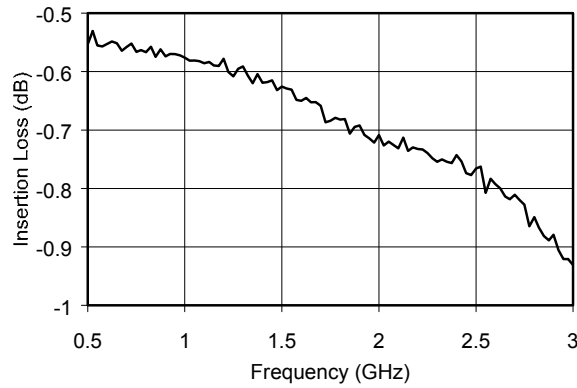
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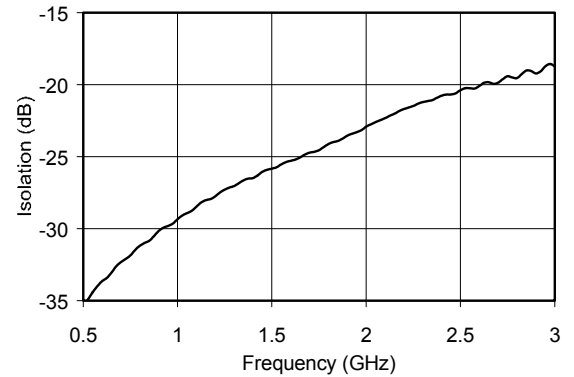
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Typical Performance Curves

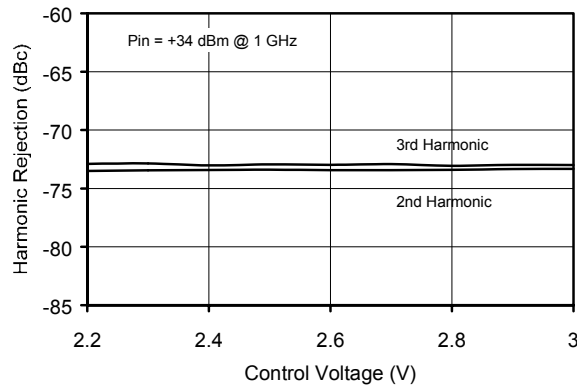
Insertion Loss vs. Frequency,  
25 °C, 39 pF



Isolation vs. Frequency,  
25 °C, 39 pF



Harmonic Rejection vs. Control Voltage,  
25 °C, 39 pF

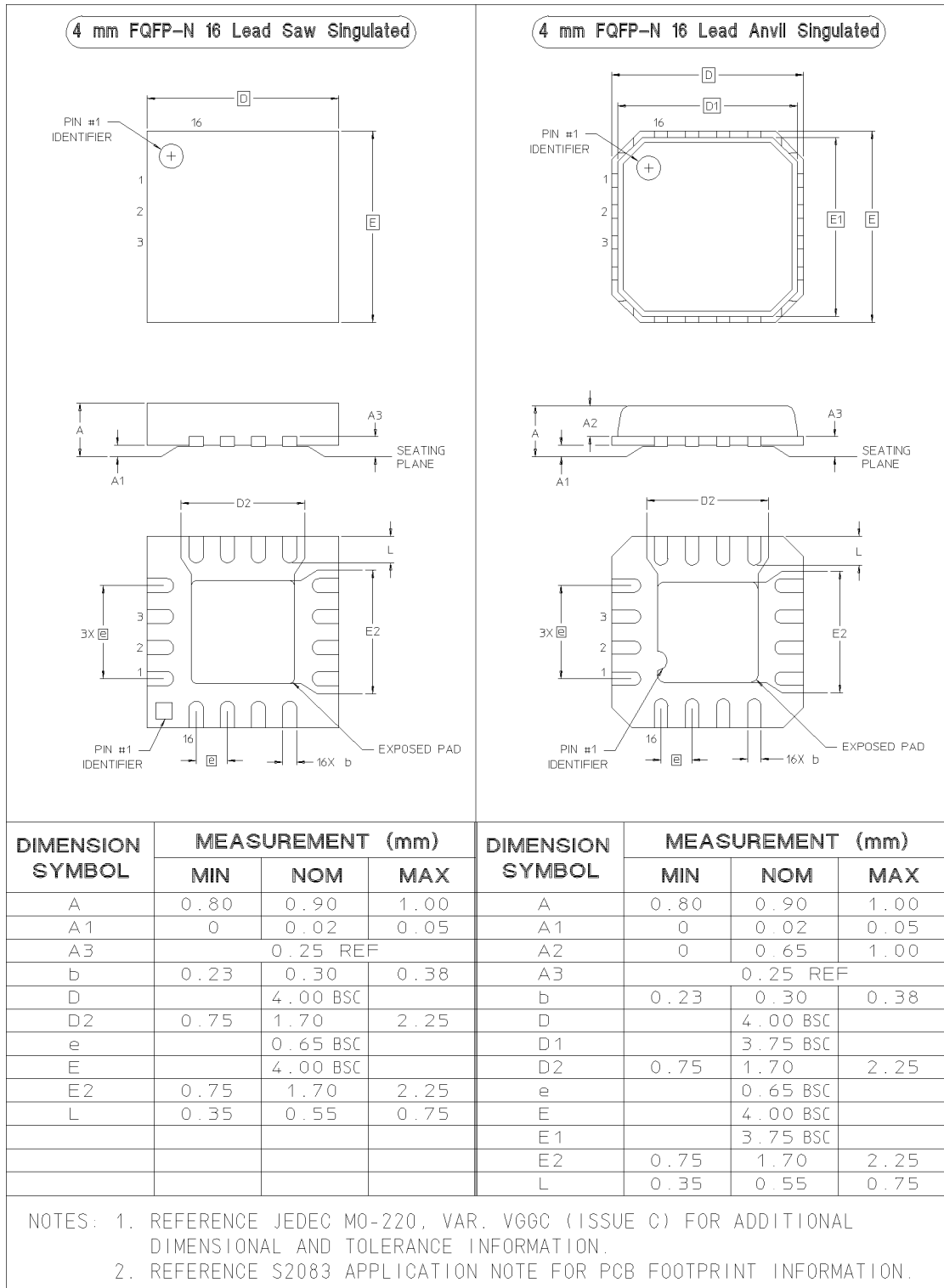


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FQFP 16-lead 4x4 mm



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## Handling Procedures

The following precautions should be observed to avoid damage:

### *Static Sensitivity*

Gallium Arsenide Integrated Circuits are ESD sensitive and can be damaged by static electricity. Proper ESD techniques should be used when handling these devices.

## Ordering Information

| Part Number   | Package                        |
|---------------|--------------------------------|
| MASWSS0020    | FQFP-N 16-lead Plastic Package |
| MASWSS0020TR  | 1000 piece reel                |
| MASWSS0020SMB | Sample Test Board              |

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