



MICROWAVE CORPORATION v00.0311



# HMC239AS8 / 239AS8E

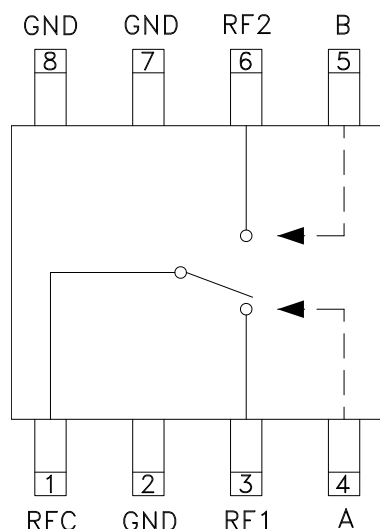
## GaAs MMIC SPDT SWITCH DC - 2.5 GHz

### Typical Applications

The HMC239AS8 / HMC239AS8E is ideal for:

- MMDS & WirelessLAN
- Basestation Infrastructure
- Portable Wireless

### Functional Diagram



### Features

- Low Insertion Loss: 0.4 dB
- High Isolation: 35 dB
- Fast Switching Speed: 2 ns
- High Input IP3: +50 dBm

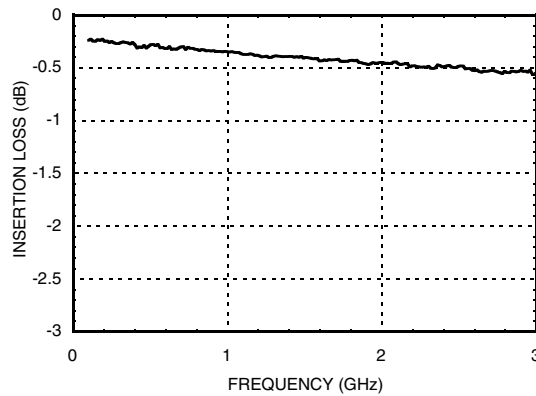
### General Description

The HMC239AS8 & HMC239AS8E are low-cost GaAs MMIC SPDT switches in 8-lead SOIC packages. The switch can control signals from DC to 2.5 GHz. It is especially suited for low or medium power applications which require extremely fast switching with minimal insertion loss. The two control voltages require a minimal amount of DC current which is optimal for battery powered radio systems. RF1 and RF2 are reflective shorts when "Off".

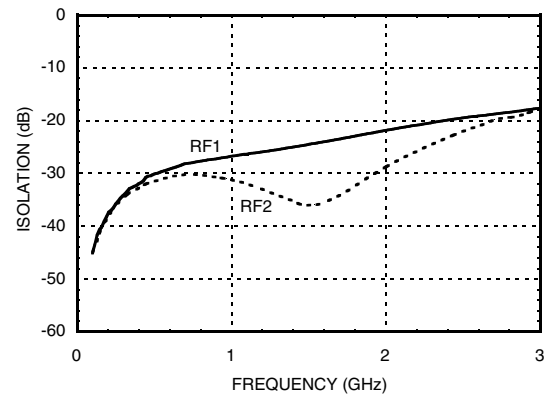
### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{ctl} = 0 / -5\text{V}$ , 50 Ohm System

| Parameter                                                                | Frequency                          | Min. | Typ. | Max. | Units |
|--------------------------------------------------------------------------|------------------------------------|------|------|------|-------|
| Insertion Loss                                                           | DC - 0.1 GHz                       |      | 0.4  | 0.6  | dB    |
|                                                                          | DC - 0.5 GHz                       |      | 0.4  | 0.6  | dB    |
|                                                                          | DC - 1.0 GHz                       |      | 0.5  | 0.7  | dB    |
|                                                                          | DC - 2.0 GHz                       |      | 0.6  | 0.8  | dB    |
|                                                                          | DC - 2.5 GHz                       |      | 0.7  | 1.0  | dB    |
| Isolation                                                                | DC - 0.5 GHz                       | 33   | 36   |      | dB    |
|                                                                          | DC - 1.0 GHz                       | 26   | 29   |      | dB    |
|                                                                          | DC - 2.0 GHz                       | 18   | 21   |      | dB    |
|                                                                          | DC - 2.5 GHz                       | 14   | 17   |      | dB    |
| Return Loss                                                              | DC - 1.0 GHz                       | 18   | 21   |      | dB    |
|                                                                          | DC - 2.0 GHz                       | 17   | 21   |      | dB    |
|                                                                          | DC - 2.5 GHz                       | 15   | 20   |      | dB    |
| Input Power for 1 dB Compression                                         | 0.5 - 1.0 GHz                      | 25   | 29   |      | dBm   |
|                                                                          | 0.5 - 2.5 GHz                      | 23   | 27   |      | dBm   |
| Input Third Order Intercept<br>(Two-Tone Input Power = +7 dBm Each Tone) | 0.5 - 1.0 GHz                      | 45   | 50   |      | dBm   |
|                                                                          | 0.5 - 2.5 GHz                      | 44   | 49   |      | dBm   |
| Switching Characteristics                                                | DC - 2.5 GHz                       |      |      |      |       |
|                                                                          | tRISE, tFALL (10 / 90% RF)         |      | 2    |      | ns    |
|                                                                          | tON, tOFF (50% CTL to 10 / 90% RF) |      | 10   |      | ns    |

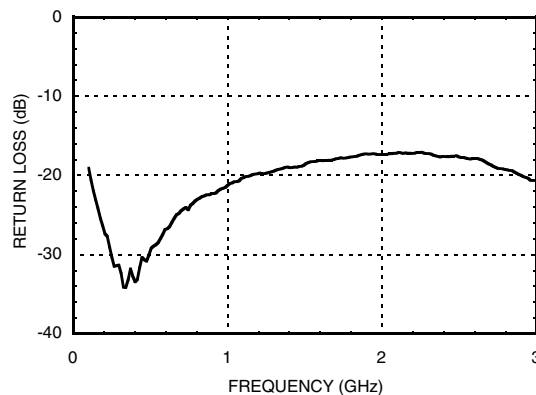
### Insertion Loss



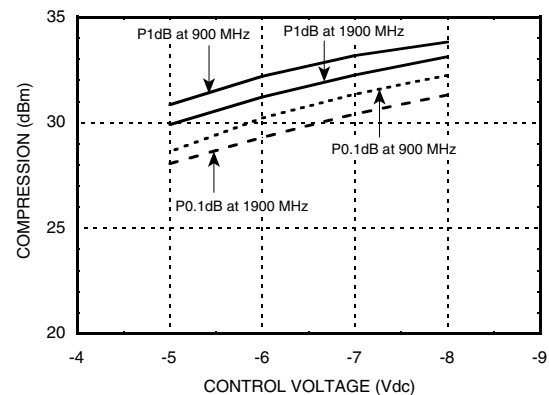
### Isolation



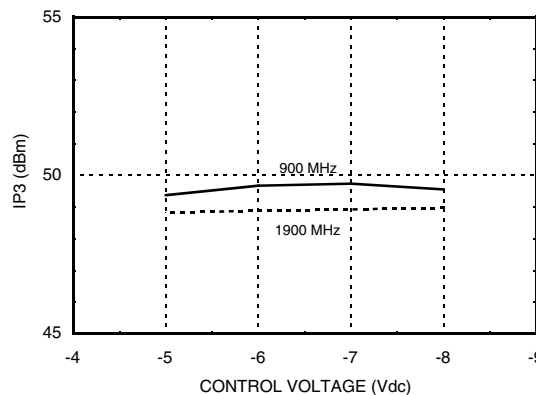
### Return Loss



### Input 0.1 and 1.0 dB Compression vs. Control Voltage



### Input Third Order Distortion vs. Control Voltage



### Truth Table

\*Control Input Voltage Tolerances are  $\pm 0.2$  Vdc.

| Control Input* |            | Control Current  |                  | Signal Path State |              |
|----------------|------------|------------------|------------------|-------------------|--------------|
| A<br>(Vdc)     | B<br>(Vdc) | Ia<br>( $\mu$ A) | Ib<br>( $\mu$ A) | RF to<br>RF1      | RF to<br>RF2 |
| -5             | 0          | -5               | 5                | ON                | OFF          |
| 0              | -5         | 5                | -5               | OFF               | ON           |
| -6             | 0          | -12              | 12               | ON                | OFF          |
| 0              | -6         | 12               | -12              | OFF               | ON           |
| -7             | 0          | -20              | 20               | ON                | OFF          |
| 0              | -7         | 20               | -20              | OFF               | OM           |
| -8             | 0          | -32              | 32               | ON                | OFF          |
| 0              | -8         | 32               | -32              | OFF               | ON           |



MICROWAVE CORPORATION v00.0311

**HMC239AS8 / 239AS8E****GaAs MMIC SPDT SWITCH  
DC - 2.5 GHz****Compression vs. Bias Voltage**

| Control Input | Carrier at 900 MHz                 |                                    | Carrier at 1900 MHz                |                                    |
|---------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
|               | Input Power for 0.1 dB Compression | Input Power for 1.0 dB Compression | Input Power for 0.1 dB Compression | Input Power for 1.0 dB Compression |
| (Vdc)         | (dBm)                              | (dBm)                              | (dBm)                              | (dBm)                              |
| -5            | 28                                 | 30                                 | 27                                 | 29                                 |
| -6            | 29                                 | 31                                 | 28                                 | 30                                 |
| -8            | 31                                 | 33                                 | 30                                 | 32                                 |

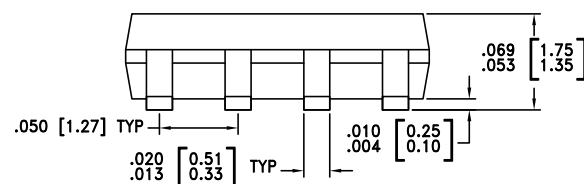
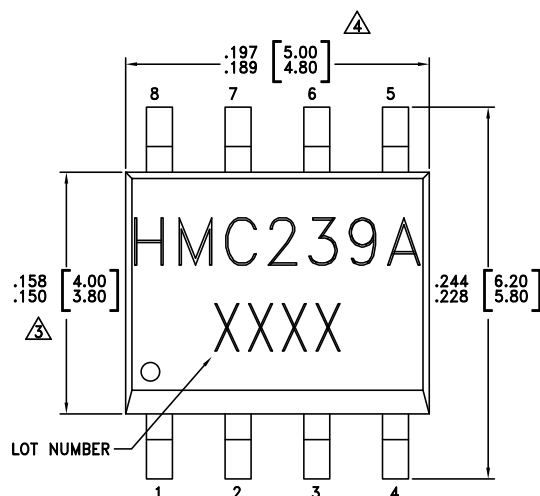
Caution: Do not operate in 1 dB compression at power levels above +30 dBm and do not "hot switch" power levels greater than +20 dBm (Vctl = -5 Vdc).

**Distortion vs. Bias Voltage**

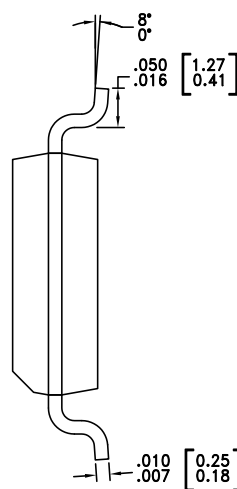
| Control Input | Third Order Intercept (dBm)<br>+7 dBm Each Tone |          |
|---------------|-------------------------------------------------|----------|
|               | 900 MHz                                         | 1900 MHz |
| (Vdc)         |                                                 |          |
| -5            | 50                                              | 49       |
| -8            | 50                                              | 49       |

**Absolute Maximum Ratings**

|                                   |                         |                    |
|-----------------------------------|-------------------------|--------------------|
| Max. Input Power (VCTL = 0 / -8V) | 0.05 GHz<br>0.5 - 2 GHz | +27 dBm<br>+34 dBm |
| Control Voltage Range (A & B)     | +2 to -12 Vdc           |                    |
| Storage Temperature               | -65 to +150 °C          |                    |
| Operating Temperature             | -40 to +85 °C           |                    |

**Outline Drawing**

**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

**NOTES:**

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
- △ DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15 mm PER SIDE.
- △ DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25 mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

**Package Information**

| Part Number | Package Body Material                              | Lead Finish    | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|----------------|---------------------|--------------------------------|
| HMC239AS8   | Low Stress Injection Molded Plastic                | Sn / Pb Solder | MSL1 <sup>[1]</sup> | HMC239A<br>XXXX                |
| HMC239AS8E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn  | MSL1 <sup>[2]</sup> | HMC239A<br>XXXX                |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

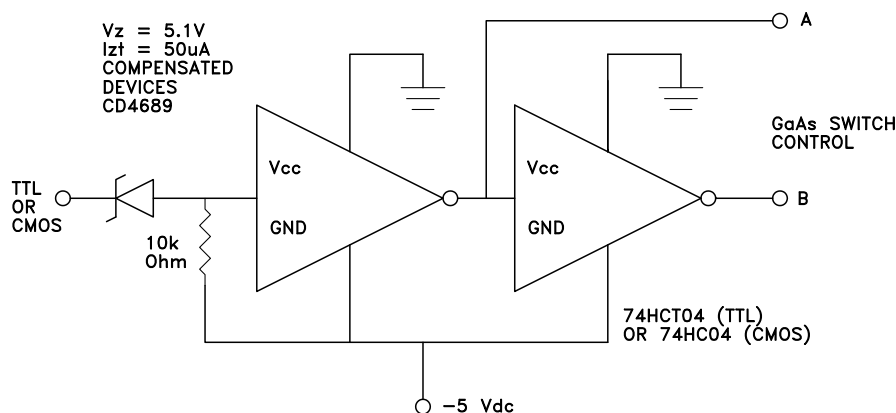
[3] 4-Digit lot number XXXX

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824

Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)

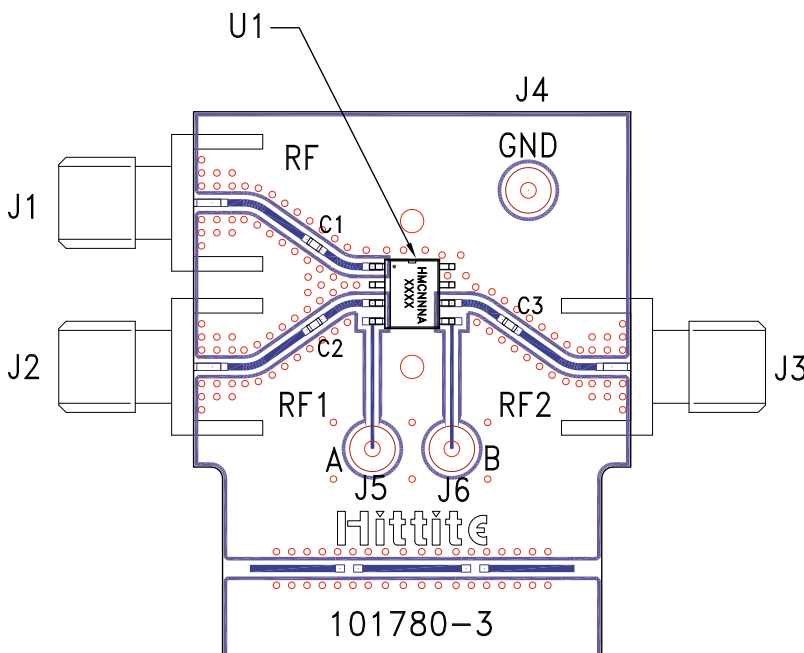
Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

### Typical Application Circuit



Simple driver using inexpensive standard logic ICs provides fast switching using minimum DC current.

### Evaluation Circuit Board



### List of Materials for Evaluation PCB 101782 [1]

| Item    | Description                        |
|---------|------------------------------------|
| J1 - J3 | PCB Mount SMA RF Connector         |
| J4 - J6 | DC Pin                             |
| C1 - C3 | 330 pF capacitor, 0402 Pkg.        |
| U1      | HMC239AS8 / HMC239AS8E SPDT Switch |
| PCB [2] | 101780 Evaluation PCB              |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should be generated with proper RF circuit design techniques. Signal lines at the RF port should have 50 Ohm impedance and the package ground leads and package bottom should be connected directly to the ground plane similar to that shown above. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.