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  - MIL-STD 883 Condition A
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## For price, delivery and to place orders

**HMC204**

# Analog Devices Welcomes Hittite Microwave Corporation

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# GaAs MMIC SPDT SWITCH DC - 4 GHz

## Typical Applications

The HMC240A is ideal for:

• Telecom Infrastructure

• Microwave Radio & VSAT

• Military & Space

• Test Instrumentation

## Features

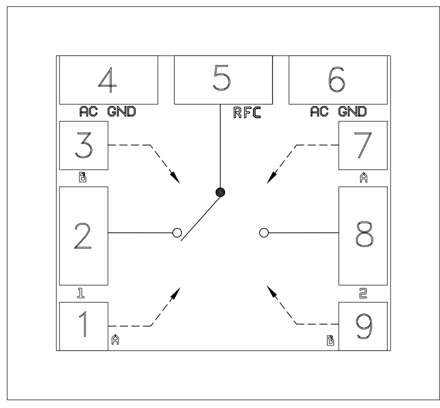
Broadband Performance: DC - 4 GHz

Low Insertion Loss: 0.5 dB @ 2 GHz

High IIP3: +48 dBm

Small Size: 0.66 x 0.60 x 0.18 mm

## Functional Diagram




*Pads 3 & 7 are alternate A & B Control Inputs.*

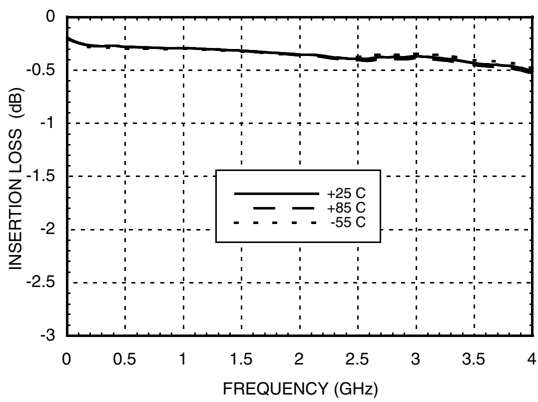
## General Description

The HMC240A is a low cost GaAs MESFET SPDT switch chip. Covering DC to 4 GHz, this switch offers high isolation and low insertion loss. RF1 and RF2 are reflective shorts when "off". The switch can operate using either two negative control logic inputs of -5/0V or two positive control voltage logic inputs of 0/+5V. All data is tested with the chip in a 50 Ohm test fixture connected via 0.025 mm (1 mil) diameter wire bonds of 0.31 mm (12 mils) length.

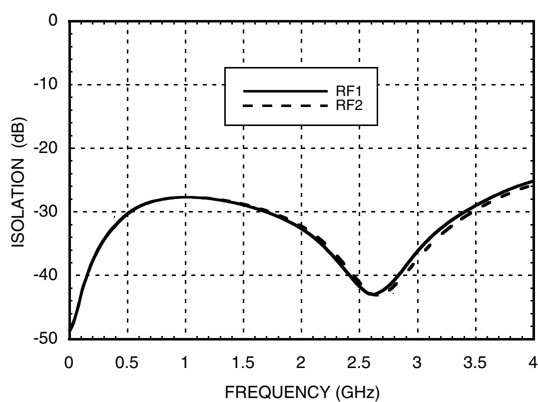
## Electrical Specifications, $T_A$ = +25° C, With 0/-5V Control or +5/0V Control, 50 Ohm System

| Parameter | Frequency | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Insertion Loss | DC - 1.0 GHz<br>DC - 2.0 GHz<br>DC - 3.0 GHz<br>DC - 4.0 GHz | | 0.4<br>0.5<br>0.6<br>0.9 | 0.7<br>0.8<br>0.9<br>1.4 | dB<br>dB<br>dB<br>dB |
| Isolation | DC - 4.0 GHz | 24 | 28 | | dB |
| Return Loss "On State" | DC - 1.0 GHz<br>DC - 2.0 GHz<br>DC - 3.0 GHz<br>DC - 4.0 GHz | | 22<br>16<br>14<br>11 | | dB<br>dB<br>dB<br>dB |
| Input Power for 1 dB Compression | 0.5 - 1.0 GHz<br>0.5 - 4.0 GHz | 25<br>23 | 30<br>29 | | dBm<br>dBm |
| Input Third Order Intercept<br>(Two-Tone Input Power= +7 dBm Each Tone) | 0.5 - 1.0 GHz<br>0.5 - 4.0 GHz | 43<br>40 | 48<br>45 | | dBm<br>dBm |
| Switching Characteristics<br>tRISE, tFALL (10/90% RF)<br>tON, tOFF (50% CTL to 10/90% RF) | DC - 4.0 GHz | | <br>3<br>10 | | <br>ns<br>ns |

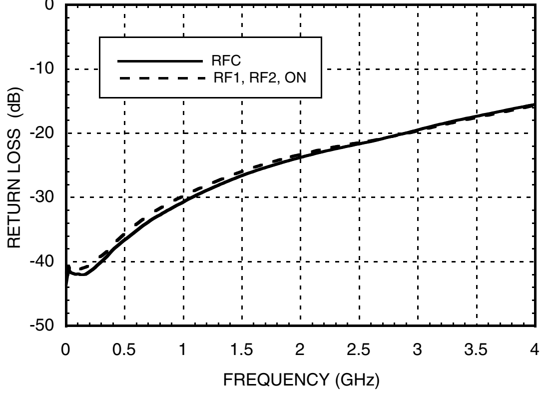
### Insertion Loss vs. Temperature



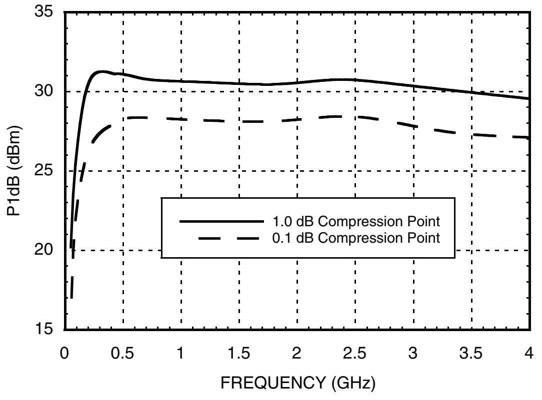

### Isolation



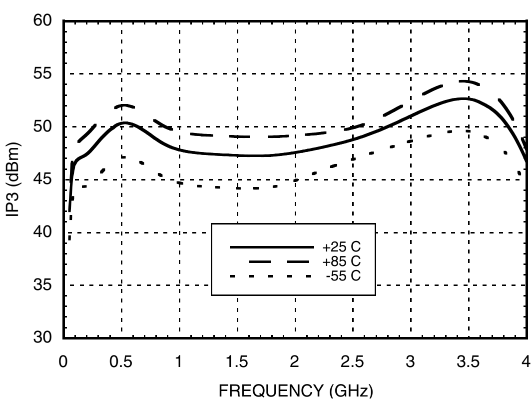

### Return Loss




### 0.1 and 1 dB Input Compression Point




### Input Third Order Intercept Point



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Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at www.hittite.com
Application Support: Phone: 978-250-3343 or apps@hittite.com

## Positive Control Voltage

| State | Bias Condition |
|---|---|
| Low | 0 Vdc @ 5 uA |
| High | +3 Vdc @ 3 uA to +8 Vdc @ 32 uA |
| Control input voltage tolerences are ±0.2 Vdc. | |

## Negative Control Voltage

| State | Bias Condition |
|---|---|
| Low | -3 Vdc @ 3 uA to -8 Vdc @ 32 uA |
| High | 0 Vdc @ 5 uA |
| Control input voltage tolerences are ±0.2 Vdc. | |

## Truth Table: Positive Control Voltage

| Control Input | | Control Current | | Signal Path State | |
|---|---|---|---|---|---|
| A (Vdc) | B (Vdc) | Ia (uA) | Ib (uA) | RFC to RF1 | RFC to RF2 |
| 0 | +5 | -5 | 5 | ON | OFF |
| +5 | 0 | 5 | -5 | OFF | ON |

## Truth Table: Negative Control Voltage

| Control Input | | Control Current | | Signal Path State | |
|---|---|---|---|---|---|
| A (Vdc) | B (Vdc) | Ia (uA) | Ib (uA) | RFC to RF1 | RFC to RF2 |
| -5 | 0 | -5 | 5 | ON | OFF |
| 0 | -5 | 5 | -5 | OFF | ON |

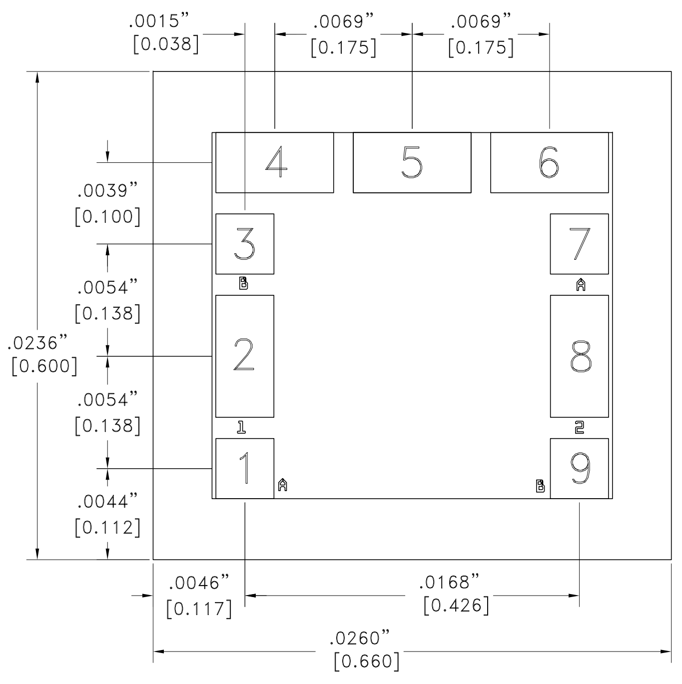
## Absolute Maximum Ratings

| | | |
|---|---|---|
| RF Input Power $V_{ctrl}$= 0/+5 (-5)V | < 0.5 GHz<br>0.5 - 4 GHz | +27 dBm<br>+34 dBm |
| Control Voltage Range (A & B= 0/+5V) | | -0.2 to +10 Vdc |
| Control Voltage Range (A & B= -5/0V) | | -10 to +0.2 Vdc |
| Storage Temperature | | -65 to +150 deg C |
| Operating Temperature | | -55 to +85 deg C |
| ESD Sensitivity (HBM) | | Class 1A |

*Note:*
*This part can be controlled with either positive or negative voltages per the above table. DC blocks are required at ports RFC, RF1 and RF2 if positive control voltage is used.*

# GaAs MMIC SPDT SWITCH DC - 4 GHz

## Outline Drawing




## Die Packaging Information [1]

| Standard | Alternate |
|---|---|
| GP-5 (Gel-Pak®) | [2] |

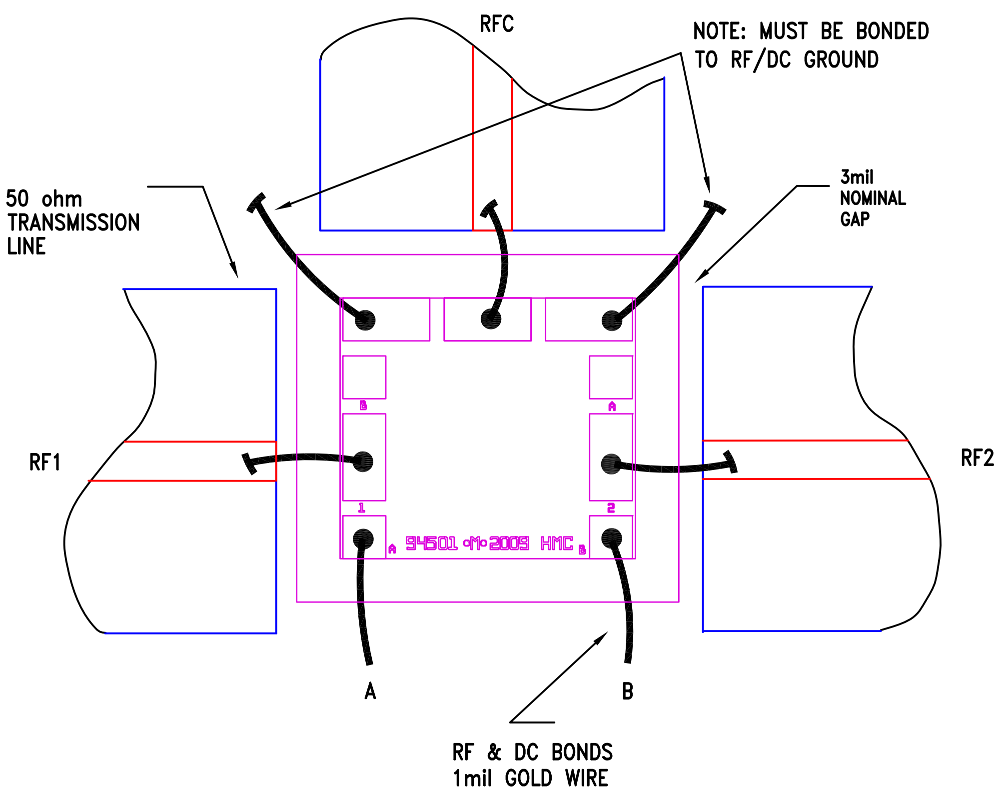
*[1] Refer to the “Packaging Information” section for die packaging dimensions.*
*[2] For alternate packaging information contact Hittite Microwave Corporation.*

NOTES:
1. DIMENSIONS IN INCHES [MILLIMETERS].
2. DIE THICKNESS IS 0.005”.
3. TYPICAL BOND PAD IS 0.004” SQUARE.
4. TYPICAL BOND PAD SPACING IS 0.006” CENTER TO CENTER.
5. BOND PAD METALLIZATION: GOLD.
6. PADS 4 AND 6 MUST BE CONNECTED TO RF/DC GROUND.

## Pad Descriptions

| Pad Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 7 | A, A (alt.) | See truth table and control voltage table.<br>Connect either pad 1 or pad 7 to control logic input. | A R C |
| 2, 5, 8 | RF1, RFC, RF2 | These pads are DC coupled and matched to 50 Ohms.<br>Blocking capacitors are required. | |
| 3, 9 | B, B (alt.) | See truth table and control voltage table.<br>Connect either pad 3 or pad 9 to control logic input. | B R C |
| 4, 6 | AC GND | Must be connected to RF/DC ground. | ACGND |

### Assembly Diagram







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## Handling Precautions

*Follow these precautions to avoid permanent damage.*

**Storage:** All bare die are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

**Cleanliness:** Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

**Static Sensitivity:** Follow ESD precautions to protect against ESD strikes.

**Transients:** Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

**General Handling:** Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip has fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

## Mounting

*The chip is back-metallized and can be die mounted with electrically conductive epoxy. The mounting surface should be clean and flat.*

**Epoxy Die Attach:** Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

## Wire Bonding

Ball or wedge bond with 0.025mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 deg. C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31mm (12 mils).