

## GaAs MMIC SPDT NON-REFLECTIVE SWITCH, DC - 28.0 GHz

### Typical Applications

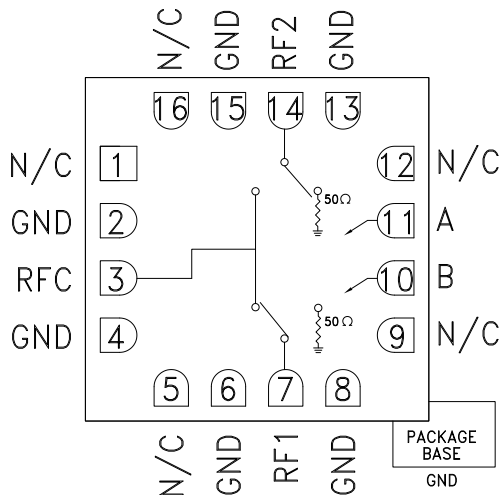
The HMC547ALC3 is ideal for:

- Fiber Optics & Broadband Telecom
- Microwave Radio & VSAT
- Military Radios, Radar, & ECM
- Test Instrumentation

### Features

- High Isolation: 45 dB @ 10 GHz  
39 dB @ 20 GHz
- Low Insertion Loss: 1.9 dB @ 10 GHz  
2.2 dB @ 20 GHz
- Fast Switching: 6 ns
- Non-Reflective Design
- 16 Lead Ceramic 3x3 mm SMT Package: 9mm<sup>2</sup>

### Functional Diagram

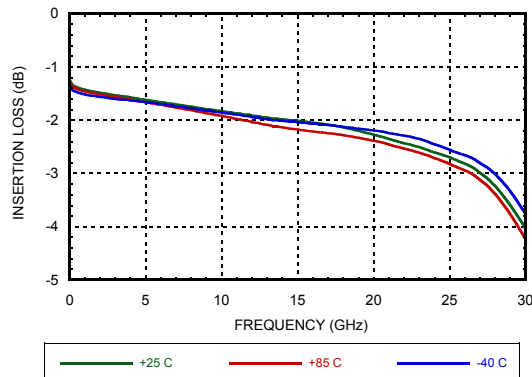
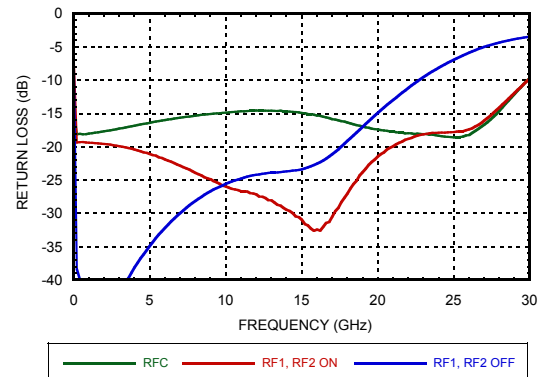
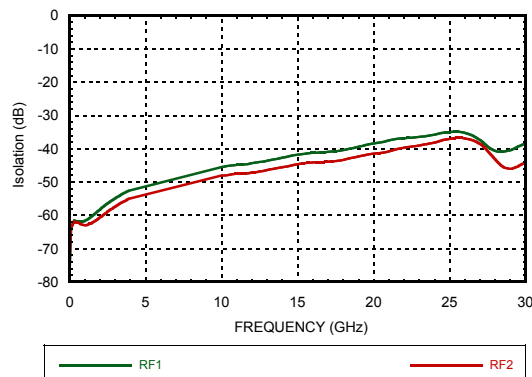
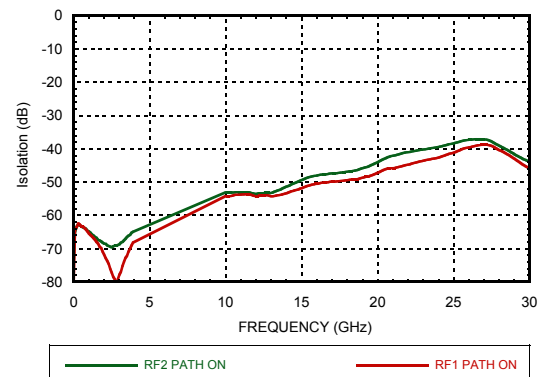
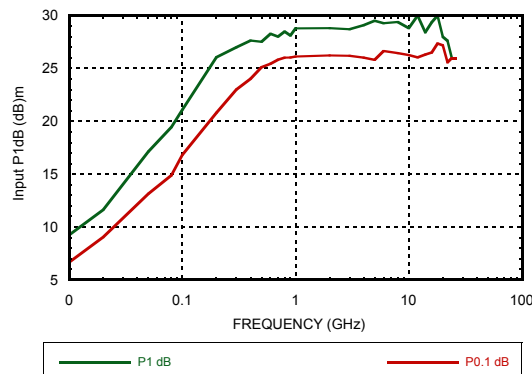
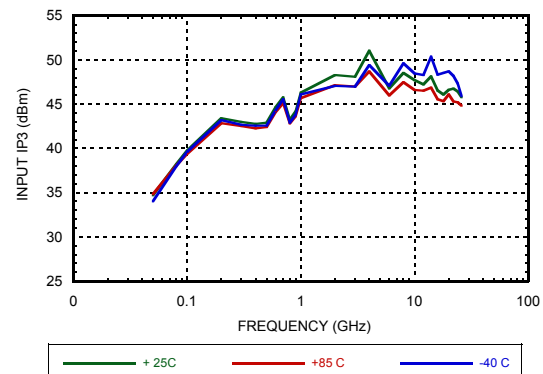


### General Description

The HMC547ALC3 is a general purpose broadband high isolation non-reflective GaAs pHEMT SPDT switch in a ceramic 3x3 mm leadless surface mount package. Covering DC to 28.0 GHz, the switch offers over 40 dB isolation and less than 2 dB insertion loss at midband. The wide bandwidth, fast switching, and compact size make this absorptive SPDT ideal for military EW/ECM and test equipment applications. The switch operates using complementary negative control voltage logic lines of -5/0V and requires no bias supply.

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

| Parameter                                                               | Frequency       | Min. | Typ. | Max. | Units |
|-------------------------------------------------------------------------|-----------------|------|------|------|-------|
| Insertion Loss                                                          | DC - 10.0 GHz   |      | 1.9  | 2.4  | dB    |
|                                                                         | 10.0 - 20.0 GHz |      | 2.2  | 2.8  | dB    |
|                                                                         | 20.0 - 26.0 GHz |      | 2.8  | 3.4  | dB    |
|                                                                         | 26.0 - 28.0 GHz |      | 3.1  | 3.7  | dB    |
| Isolation                                                               | DC - 10.0 GHz   | 40   | 45   |      | dB    |
|                                                                         | 10.0 - 20.0 GHz | 34   | 40   |      | dB    |
|                                                                         | 20.0 - 28.0 GHz | 30   | 34   |      | dB    |
| Return Loss                                                             | "On State"      |      |      |      |       |
|                                                                         | DC - 28.0 GHz   |      | 17   |      | dB    |
| Return Loss RF1, RF2                                                    | "Off State"     |      |      |      |       |
|                                                                         | DC - 10.0 GHz   |      | 25   |      | dB    |
|                                                                         | 10.0 - 20.0 GHz |      | 15   |      | dB    |
| Input Power for 1 dB Compression                                        | 20.0 - 28.0 GHz |      | 8    |      | dB    |
|                                                                         | DC - 0.5 GHz    |      | 16   |      | dBm   |
| Input Third Order Intercept<br>(Two-Tone Input Power= +7 dBm Each Tone) | 0.5 - 28.0 GHz  | 20   | 26   |      | dBm   |
|                                                                         | DC - 0.5 GHz    |      | 35   |      | dBm   |
| Switching Characteristics                                               | 0.5 - 28.0 GHz  |      | 46   |      | dBm   |
|                                                                         | DC - 28.0 GHz   |      | 3    |      | ns    |
| tRISE, tFALL (10/90% RF)                                                |                 |      | 6    |      | ns    |
| tON, tOFF (50% CTL to 10/90% RF)                                        |                 |      |      |      | ns    |

**GaAs MMIC SPDT NON-REFLECTIVE  
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**Insertion Loss**

**Return Loss**

**Isolation Between Ports RFC and RF1/RF2**

**Isolation Between Ports RF1 and RF2**

**Input P1dB and P0.1dB  
Compression Point**

**Input Third Order Intercept Point**


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**Absolute Maximum Ratings**

|                                                                                                 |                      |
|-------------------------------------------------------------------------------------------------|----------------------|
| RF Input Power (Vctl = -5V)                                                                     | +29 dBm              |
| Control Voltage Range (A & B)                                                                   | +0.5V to -7.5 V      |
| Hot Switch Power Level (Vctl = -5V)                                                             | +23 dBm              |
| Channel Temperature                                                                             | 150 °C               |
| Continuous P <sub>diss</sub> (T=85°C)<br>(derate 8.5 mW/°C above 85°C)<br>(Insertion Loss Path) | 0.55W                |
| Thermal Resistance<br>(Insertion Loss Path)                                                     | 118 °C/W             |
| Terminated Power Level<br>(Vctl = -5V)                                                          | +25dBm               |
| Continuous P <sub>diss</sub> (T=85°C)<br>(derate 5.0 mW/°C above 85°C)<br>(Terminated Path)     | 0.32W                |
| Thermal Resistance<br>(Terminated Path)                                                         | 200 °C/W             |
| Storage Temperature                                                                             | -65 to +150 °C       |
| Operating Temperature                                                                           | -40 to +85 °C        |
| ESD Sensitivity (HBM)                                                                           | Class 0; Passed 150V |

**Control Voltages**

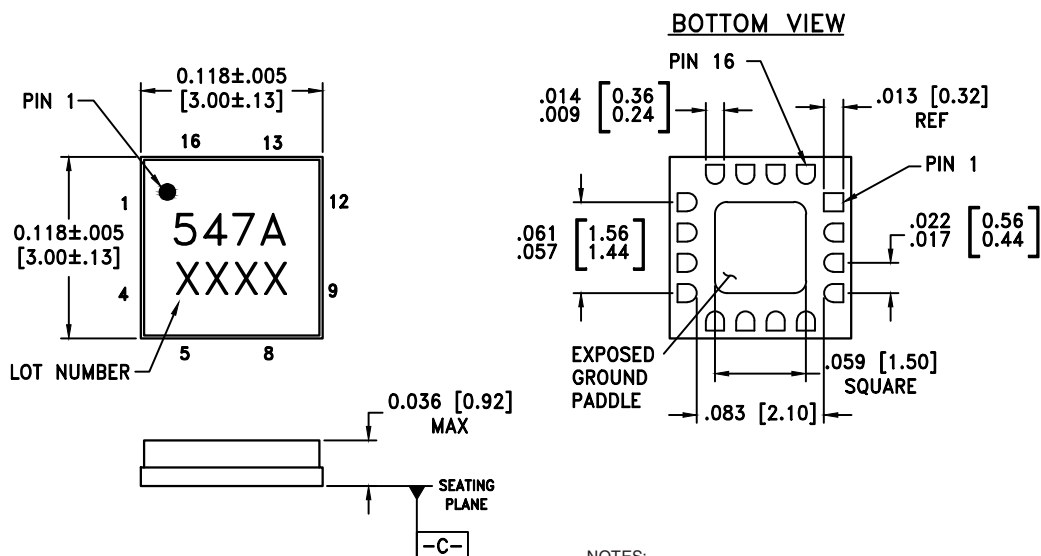
| State | Bias Condition                                |
|-------|-----------------------------------------------|
| Low   | 0 to -0.2V @ 10 uA Max.                       |
| High  | -5V @ 10 uA Typ. to -7V @ 40 uA Typ. (± 0.5V) |

**Truth Table**

| Control Input |      | Signal Path State |            |
|---------------|------|-------------------|------------|
| A             | B    | RFC to RF1        | RFC to RF2 |
| High          | Low  | On                | Off        |
| Low           | High | Off               | On         |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

**GaAs MMIC SPDT NON-REFLECTIVE  
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**Outline Drawing**

**NOTES:**

1. PACKAGE BODY MATERIAL: ALUMINA.
2. LEAD AND GROUND PADDLE PLATING: GOLD FLASH OVER NICKEL.
3. DIMENSIONS ARE IN INCHES (MILLIMETERS).
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. PACKAGE WARP SHALL NOT EXCEED 0.05MM DATUM .
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

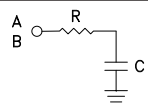
**Package Information**

| Part Number | Package Body Material | Lead Finish      | MSL Rating          | Package Marking <sup>[2]</sup> |
|-------------|-----------------------|------------------|---------------------|--------------------------------|
| HMC547ALC3  | Alumina, White        | Gold over Nickel | MSL3 <sup>[1]</sup> | 547A<br>XXXX                   |

[1] Max peak reflow temperature of 260 °C

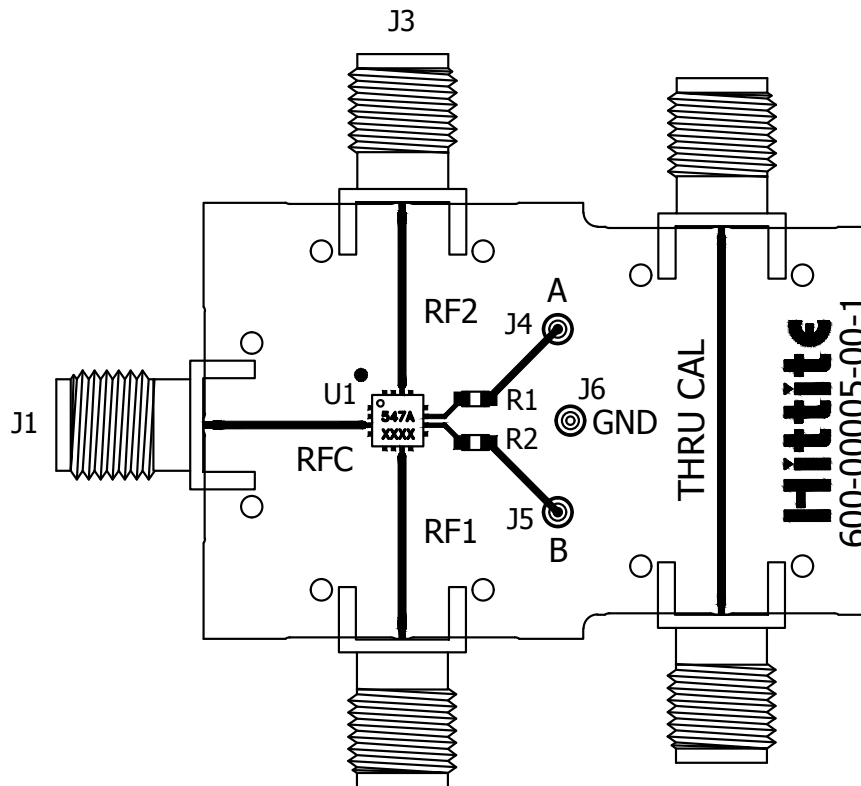
[2] 4-Digit lot number XXXX

**GaAs MMIC SPDT NON-REFLECTIVE  
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**Pin Descriptions**

| Pin Number         | Function      | Description                                                                                                             | Interface Schematic                                                                 |
|--------------------|---------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1, 5, 9, 12, 16    | N/C           | This pin should be connected to PCB RF ground to maximize isolation                                                     |                                                                                     |
| 2, 4, 6, 8, 13, 15 | GND           | Package bottom has exposed metal paddle that must also be connected to PCB RF ground.                                   |  |
| 3, 7, 14           | RFC, RF1, RF2 | This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required if RF line potential is not equal to 0V. |                                                                                     |
| 10                 | B             | See truth table and control voltage table.                                                                              |  |
| 11                 | A             | See truth table and control voltage table.                                                                              |                                                                                     |

**GaAs MMIC SPDT NON-REFLECTIVE  
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**Evaluation PCB**



**List of Materials for Evaluation PCB EV1HMC547ALC3 <sup>[1]</sup>**

| Item               | Description                   |
|--------------------|-------------------------------|
| J1 - J3            | PCB Mount SRI SMA Connector   |
| J4 - J6            | DC Pin                        |
| R1 - R2            | 100 Ohm Resistor, 0603 Pkg.   |
| U1                 | HMC547ALC3 SPDT Switch        |
| PCB <sup>[2]</sup> | 600-00005-00-1 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 Analog Devices upon request.