

GaAs MMIC SPDT NON-REFLECTIVE SWITCH, DC - 20 GHz

Typical Applications

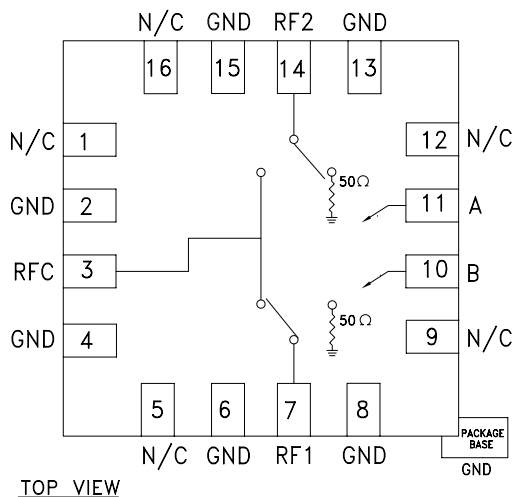
The HMC547ALP3E is ideal for:

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

Features

- High Isolation: >50 dB up to 5 GHz
>40 dB up to 15 GHz
- Low Insertion Loss: 1.8 dB @ 10 GHz
2.5 dB @ 20 GHz
- Fast Switching
- Non-Reflective Design
- QFN SMT Package, 9 mm²

Functional Diagram



General Description

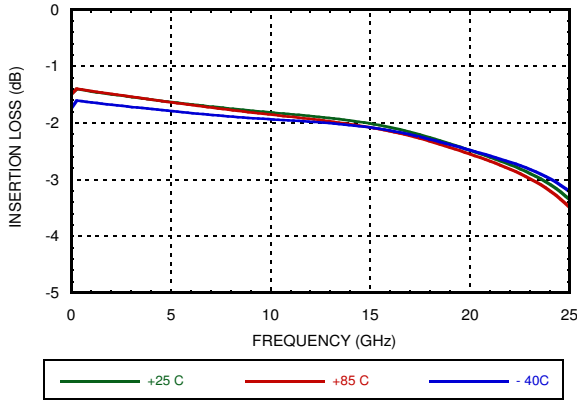
The HMC547ALP3E is a general purpose broadband high isolation non-reflective GaAs pHEMT SPDT switch in low cost leadless QFN surface mount plastic package. Covering DC to 20 GHz, the switch offers high isolation and low insertion loss. The switch features >50 dB isolation up to 5 GHz and >40 dB isolation up to 15 GHz. The switch operates using complementary negative control voltage logic lines of -5/0V and requires no bias supply. The HMC547ALP3E are packaged in leadless QFN 3x3 mm surface mount packages.

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

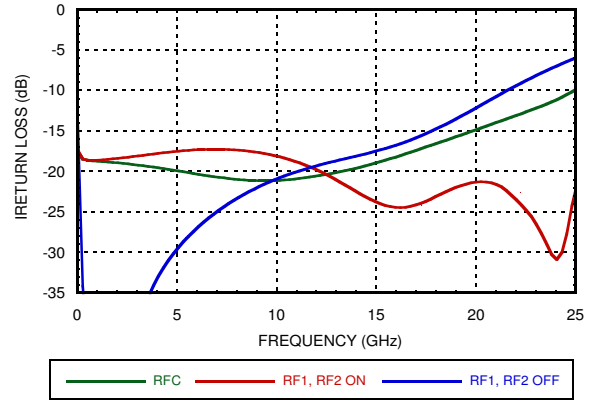
| Parameter | Frequency | Min. | Typ. | Max. | Units |
|---|----------------|---------------|------|------|-------|
| Insertion Loss | DC - 6.0 GHz | | 1.7 | 2.1 | dB |
| | DC - 10.0 GHz | | 1.8 | 2.2 | dB |
| | DC - 15.0 GHz | | 2.0 | 2.4 | dB |
| | DC - 20.0 GHz | | 2.5 | 3.0 | dB |
| Isolation | DC - 6.0 GHz | 43 | 48 | | dB |
| | DC - 15.0 GHz | 35 | 40 | | dB |
| | DC - 20.0 GHz | 31 | 36 | | dB |
| Return Loss RFC | "On State" | DC - 6.0 GHz | 17 | | dB |
| | | DC - 20 GHz | 15 | | dB |
| Return Loss RF1, RF2 | "Off State" | DC - 6.0 GHz | 26 | | dB |
| | | DC - 15.0 GHz | 17 | | dB |
| | | DC - 20.0 GHz | 11 | | dB |
| Input Power for 1 dB Compression | 0.5 - 20.0 GHz | 24 | 29 | | dBm |
| Input Third Order Intercept (Two-Tone Input Power= +7 dBm Each Tone) | 0.5 - 10.0 GHz | | 47 | | dBm |
| | 0.5 - 20.0 GHz | | 45 | | dBm |
| Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF) | DC - 20 GHz | | 2 | | ns |
| | | | 10 | | ns |

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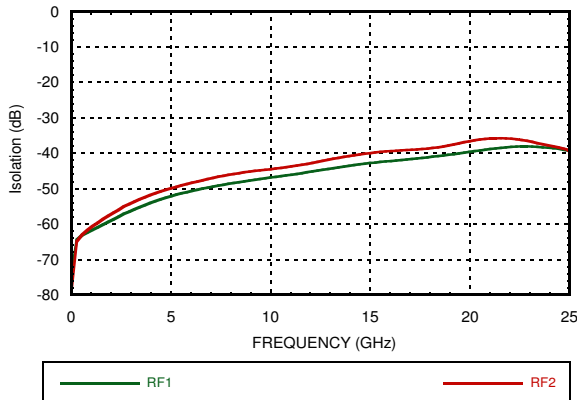
Insertion Loss



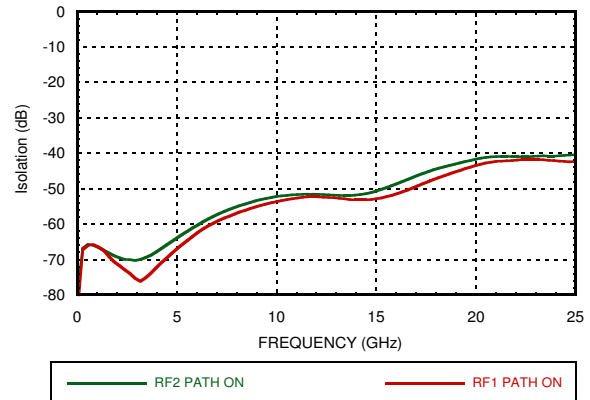
Return Loss



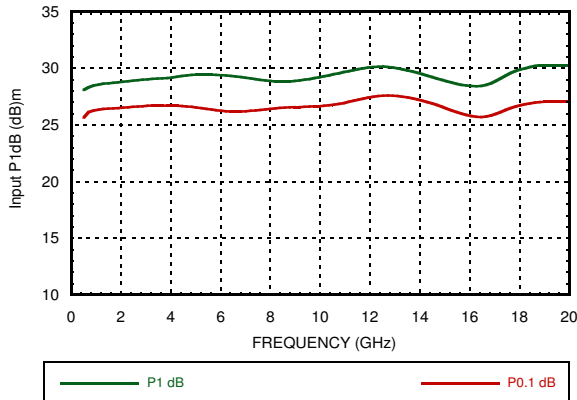
Isolation Between Ports RFC and RF1/RF2



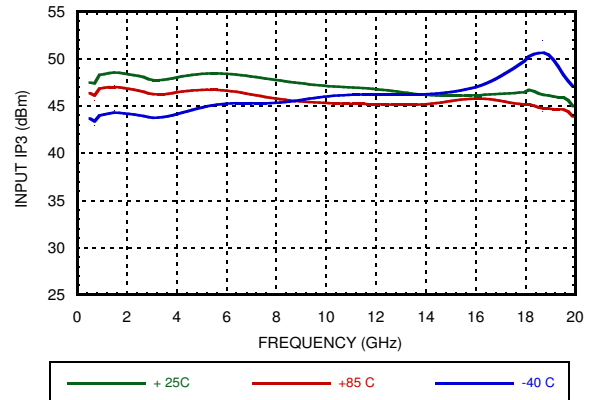
Isolation Between Ports RF1 and RF2



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



Input Third Order Intercept Point



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Absolute Maximum Ratings

| | |
|--|-----------------|
| RF Input Power (Vctl = -5V) | +30 dBm |
| Control Voltage Range (A & B) | +0.5V to -7.5 V |
| Hot Switch Power Level (Vctl = -5V) | +23 dBm |
| Channel Temperature | 150 °C |
| Terminated Power Level (Vctl = -5V) | +25dBm |
| Thermal Resistance (Insertion Loss Path) | 118 °C/W |
| Thermal Resistance (Terminated Path) | 200 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |
| ESD Sensitivity (HBM) | Class 1A |

Control Voltages

| State | Bias Condition |
|-------|--|
| Low | 0 to -0.2V @ 10 uA Max. |
| High | -5V @ 3uA Typ. to -7V @ 40 uA Max. (± 0.5 Vdc) |

Truth Table

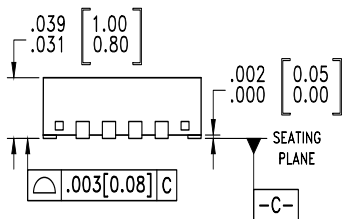
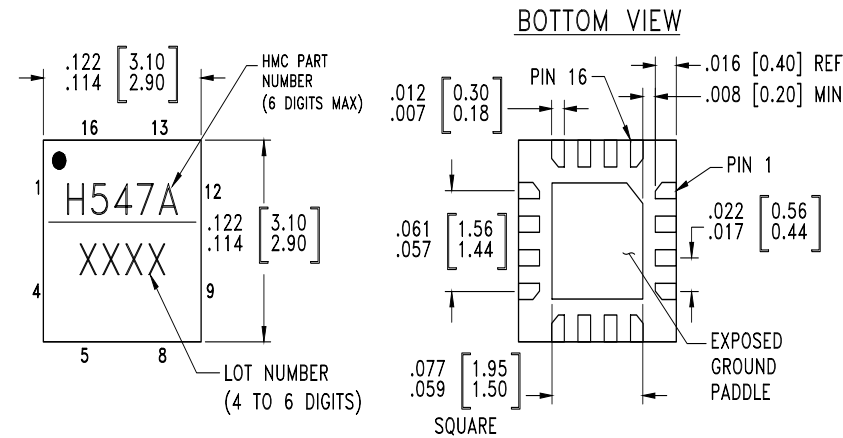
| Control Input | | Signal Path State | |
|---------------|------|-------------------|------------|
| A | B | RFC to RF1 | RFC to RF2 |
| High | Low | On | Off |
| Low | High | Off | On |



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

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Outline Drawing



NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY.
3. LEAD AND GROUND PADDLE PLATING: 100% MATTE TIN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
6. CHARACTERS TO BE HELVETICA MEDIUM, .018 HIGH, WHITE INK, OR LASER MARK LOCATED APPROX. AS SHOWN.
7. PAD BURR LENGTH SHALL BE 0.15mm MAX. PAD BURR HEIGHT SHALL BE 0.05mm MAX.
8. PACKAGE WARP SHALL NOT EXCEED 0.05mm
9. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
10. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.
11. UNDERLINE THE LOT NUMBER TO DESIGNATE 2000A FIRST LAYER NITRIDE DIE FAB OPTION AS SPECIFIED BY THE PO

Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[2] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC547ALP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[1] | H547A XXXX |

[1] Max peak reflow temperature of 260 °C

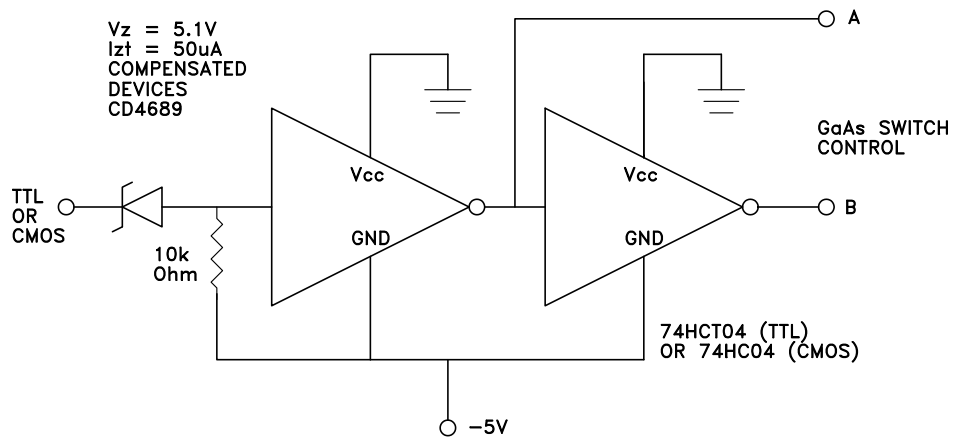
[2] 4-Digit lot number XXXX

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Pin Descriptions

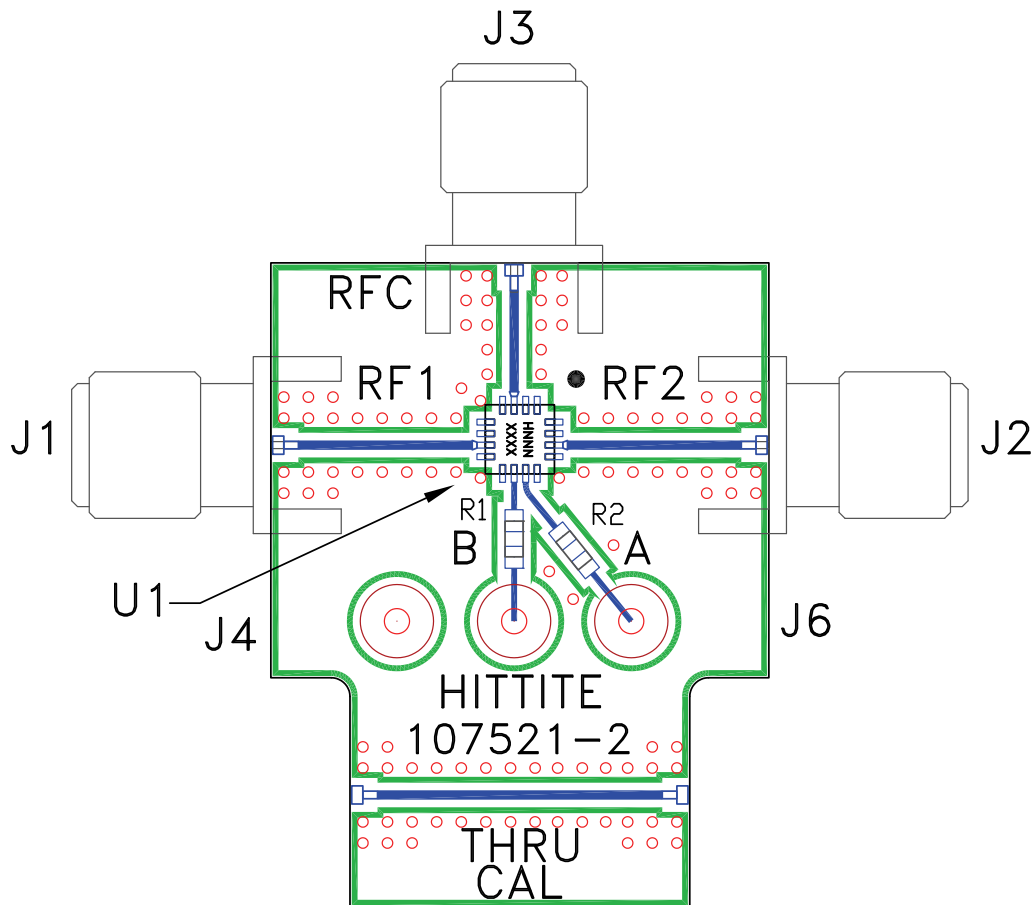
| Pin Number | Function | Description | Interface Schematic |
|--------------------|---------------|---|---------------------|
| 1, 5, 9, 12, 16 | N/C | This pin should be connected to PCB RF ground to maximize isolation | |
| 2, 4, 6, 8, 13, 15 | GND | Package bottom has exposed metal paddle that must 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. | |

Suggested Driver Circuit



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Evaluation PCB



List of Materials for Evaluation EV1HMC547ALP3

| Item | Description |
|---------|-----------------------------|
| J1 - J3 | PCB Mount SRI SMA Connector |
| J4 - J6 | DC Pin |
| R1 - R2 | 100 Ohm Resistor, 0603 Pkg. |
| U1 | HMC547ALP3E SPDT Switch |
| PCB [2] | 107521 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 Inc. upon request.

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