



## GaAs MMIC SP4T NON-REFLECTIVE POSITIVE CONTROL SWITCH, DC\* - 8 GHz

### Typical Applications

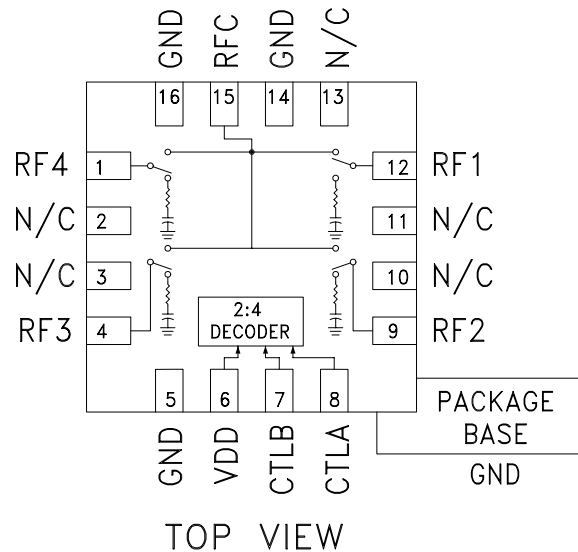
This switch is suitable for usage in DC - 8.0 GHz 50-Ohm or 75-Ohm systems:

- Broadband
- Fiber Optics
- Switched Filter Banks
- Wireless below 8 GHz

### Features

- Broadband Performance: DC - 8 GHz
- High Isolation: 35 dB@ 6 GHz
- Low Insertion Loss: 2.0 dB@ 6 GHz
- Integrated Positive Supply 2:4 TTL Decoder
- 16 Lead 3x3mm QFN Package: 9 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC345ALP3E is a broadband non-reflective GaAs MESFET SP4T switch in a low cost leadless surface mount packages. Covering DC to 8 GHz, this switch offers high isolation and low insertion loss. This switch also includes an on board binary decoder circuit which reduces the required logic control lines to two. The switch operates using a positive control voltage of 0/+5V, and requires a fixed bias of +5V.

\* Blocking capacitors are required at ports RFC and RF1, 2, 3, & 4. Their value will determine the lowest transmission frequency.

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

| Parameter   | Frequency     | Min.          | Typ. | Max. | Units |
|---|---------------|---------------|------|------|-------|
| Insertion Loss  | DC - 2.0 GHz  |               | 1.7  | 2.4  | dB    |
|   | DC - 6.0 GHz  |               | 2.0  | 2.6  | dB    |
|   | DC - 8.0 GHz  |               | 2.4  | 2.9  | dB    |
| Isolation   | DC - 2.0 GHz  | 37            | 42   |      | dB    |
|   | DC - 4.0 GHz  | 32            | 37   |      | dB    |
|   | DC - 6.0 GHz  | 31            | 35   |      | dB    |
|   | DC - 8.0 GHz  | 27            | 33   |      | dB    |
| Return Loss   | DC - 2.0 GHz  |               | 16   |      | dB    |
|   | DC - 4.0 GHz  |               | 16   |      | dB    |
|   | DC - 6.0 GHz  |               | 16   |      | dB    |
|   | DC - 8.0 GHz  |               | 13   |      | dB    |
| Return Loss (RF1 - RF4)   |               |               |      |      |       |
|   | "On State"    | 2.0 - 8.0 GHz | 14   |      | dB    |
| Return Loss (RF1 - RF4)   |               |               |      |      |       |
|   | "Off State"   | 2.0 - 8.0 GHz | 14   |      | dB    |
| Input Power for 1 dB Compression  | 2.0 - 8.0 GHz | 23            | 28   |      | dBm   |
| Input Third Order Intercept<br>(Two-Tone Input Power = +10 dBm Each Tone, 1MHz Tone Separation) | 2.0 - 8.0 GHz | 37            | 43   |      | dBm   |
| Switching Characteristics<br>tRISE, tFALL (10/90% RF)<br>tON, tOFF (50% CTL to 10/90% RF)       | DC - 8.0 GHz  |               | 40   |      | ns    |
|   |               |               | 100  |      | ns    |

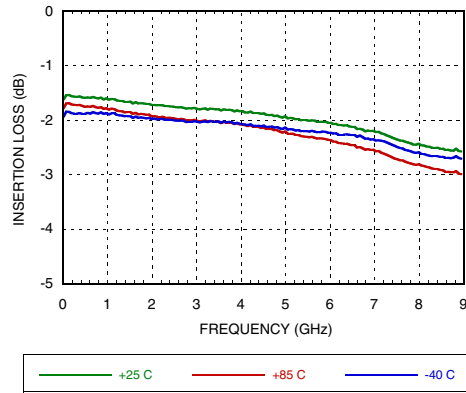
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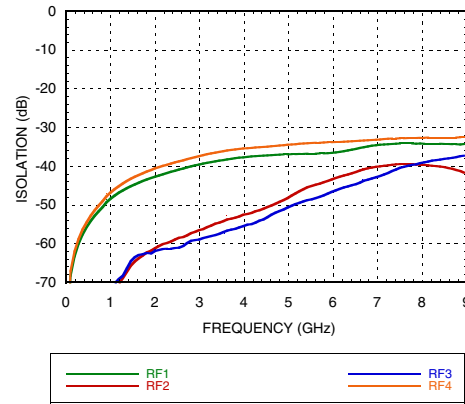


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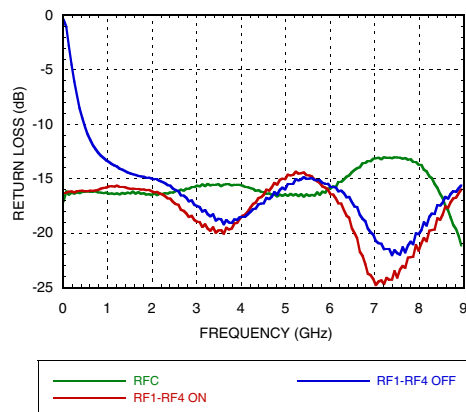
**Insertion Loss vs. Temperature**



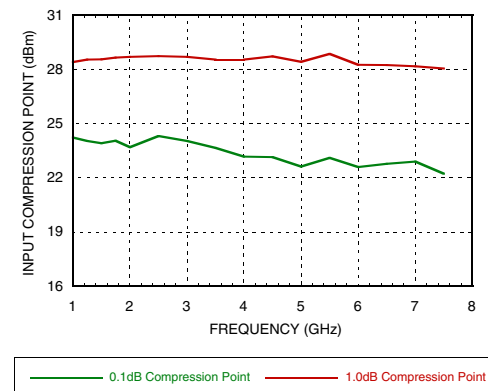
**Isolation**



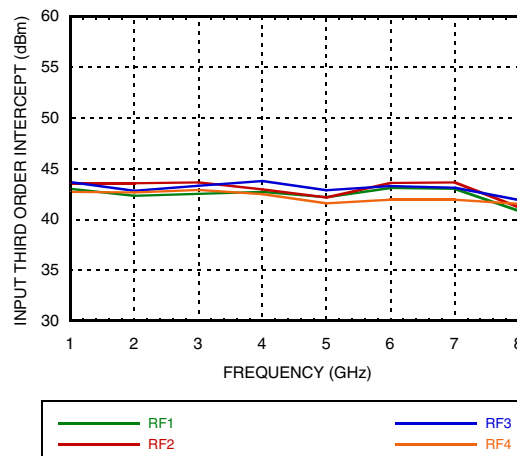
**Return Loss**



**0.1 and 1 dB Input Compression Point**



**Input Third Order Intercept Point**





## GaAs MMIC SP4T NON-REFLECTIVE POSITIVE CONTROL SWITCH, DC\* - 8 GHz

### Absolute Maximum Ratings

|  |                       |
|--|-----------------------|
| Bias Voltage Range (Vdd)                 | +7.0 Vdc              |
| Control Voltage Range (A & B)            | -0.5V to Vdd +1.0 Vdc |
| Channel Temperature                      | 150 °C                |
| Thermal Resistance (Insertion Loss Path) | 154 °C/W              |
| Thermal Resistance (Terminated Path)     | 228 °C/W              |
| Storage Temperature                      | -65 to +150 °C        |
| Operating Temperature                    | -40 to +85 °C         |
| Maximum Input Power                      | +24 dBm               |
| ESD Sensitivity (HBM)                    | Class 1A              |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

### Bias Voltage & Current

| Vdd Range = +5 Vdc ± 10% |                 |                 |
|--------------------------|-----------------|-----------------|
| Vdd (Vdc)                | Idd (Typ.) (mA) | Idd (Max.) (mA) |
| +5                       | 2.5             | 6.0             |

### Control Voltages

| State | Bias Condition                 |
|-------|--------------------------------|
| Low   | 0 to +0.8 Vdc @ 1 µA Typical   |
| High  | +2.0 to +5 Vdc @ 50 µA Typical |

### Truth Table

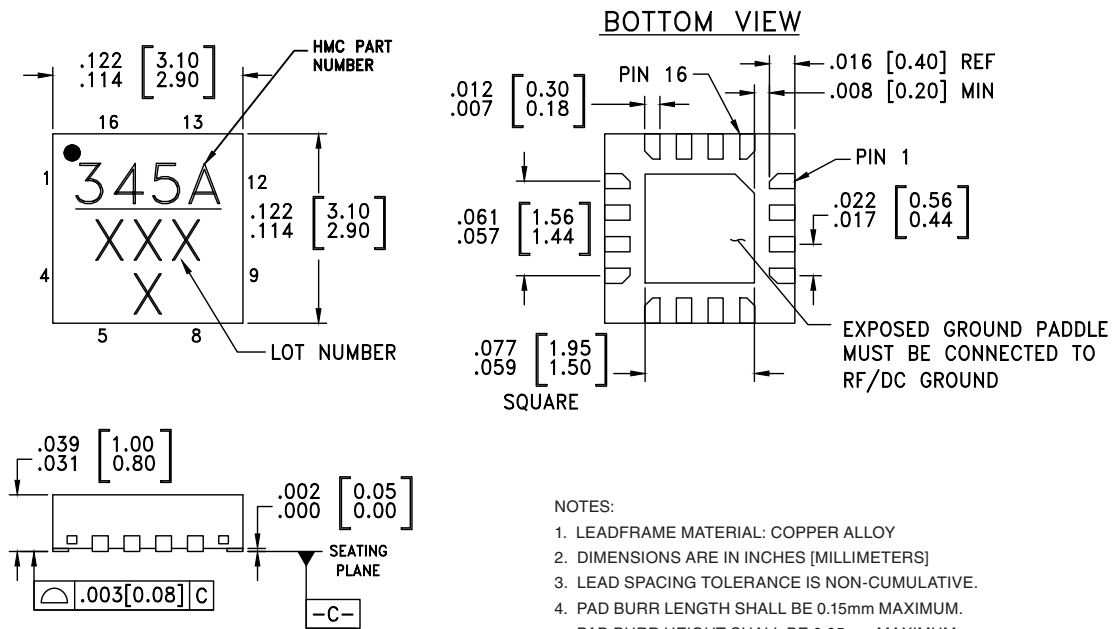
| Control Input |      | Signal Path State |
|---------------|------|-------------------|
| A             | B    | RFCOM to:         |
| Low           | Low  | RF1               |
| High          | Low  | RF2               |
| Low           | High | RF3               |
| High          | High | RF4               |

*Note: DC blocking capacitors are required at ports RFC and RF1, 2, 3, & 4. Their value will determine the lowest transmission frequency.*



**GaAs MMIC SP4T NON-REFLECTIVE POSITIVE CONTROL SWITCH, DC\* - 8 GHz**

**Outline Drawing**



- NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
  2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
  3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
  4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
  5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
  6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
  7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

**Package Information**

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[2]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC345ALP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 <sup>[1]</sup> | 345A<br>XXXX                   |


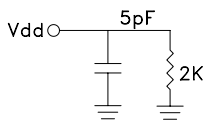
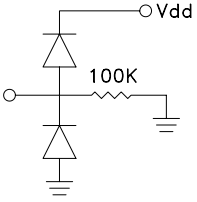
[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX



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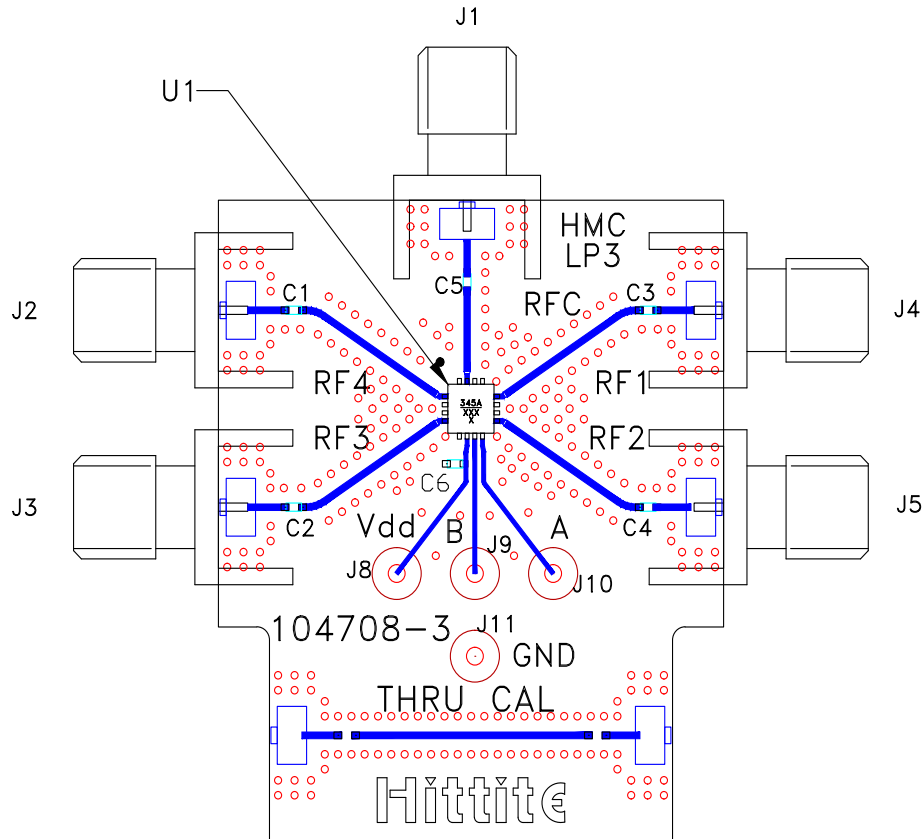
### Pin Descriptions

| Pin Number          | Function                   | Description   | Interface Schematic  |
|---------------------|----------------------------|---|--|
| 1, 4,<br>9, 12, 15  | RF4, RF3,<br>RF2, RF1, RFC | This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required.       |  |
| 2, 3,<br>10, 11, 13 | N/C                        | This pin should be connected to PCB RF ground to maximize isolation.                  |  |
| 5, 14, 16           | GND                        | Package bottom has exposed metal paddle that must also be connected to PCB RF ground. |   |
| 6                   | VDD                        | Supply Voltage +5V ± 10%  |   |
| 7                   | CTLB                       | See truth table and control voltage table.  |  |
| 8                   | CTLA                       | See truth table and control voltage table.  |  |



## GaAs MMIC SP4T NON-REFLECTIVE POSITIVE CONTROL SWITCH, DC\* - 8 GHz

### Evaluation PCB



### List of Materials for Evaluation PCB EV1HMC345ALP3<sup>[1]</sup>

| Item     | Description                       |
|----------|-----------------------------------|
| J1 - J5  | PCB Mount SMA RF Connector        |
| J8 - J11 | DC Pin                            |
| C1 - C5  | 100 pF Capacitor, 0402 Pkg.       |
| C6       | 1k pF Capacitor, 0402 Pkg.        |
| U1       | HMC345ALP3E SP4T Switch           |
| PCB [2]  | 104708 Evaluation PCB 1.29"x1.55" |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final 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 backside ground slug 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.

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