



## GaAs MMIC SP3T Non-REFLECTIVE SWITCH, DC - 3.5 GHz

### Typical Applications

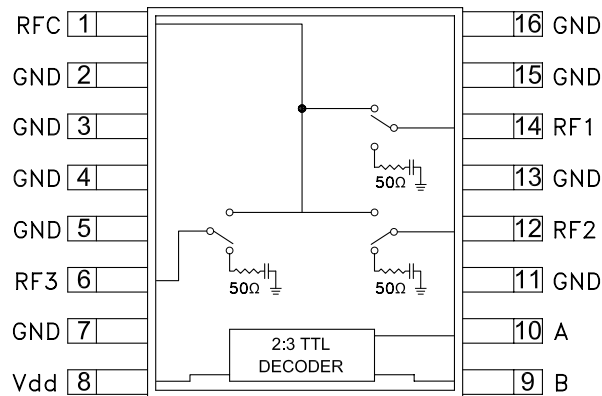
The HMC245AQS16 / 245AQS16E is ideal for:

- Basestation Infrastructure
- CATV / DBS
- Wireless Local Loop
- Test Equipment

### Features

- Low Insertion Loss: 0.7 dB @ 2.0 GHz
- Non-Reflective Design
- Integrated 2:3 TTL Decoder
- "All Off" Isolation State
- Single Positive Supply: Vdd = +5V
- 16 Lead QSOP SMT Package

### Functional Diagram



### General Description

The HMC245AQS16E is a low cost non-reflective SP3T switches in 16-lead QSOP surface mount packages. Covering DC to 3.5 GHz, the switch offers 30 to 40 dB isolation and a low insertion loss of 0.7 dB. A 2:3 TTL/CMOS compatible decoder is integrated on the switch requiring only 2 control lines and a single +5V bias to select each path, replacing 6 control lines normally required by GaAs SP3T switches.

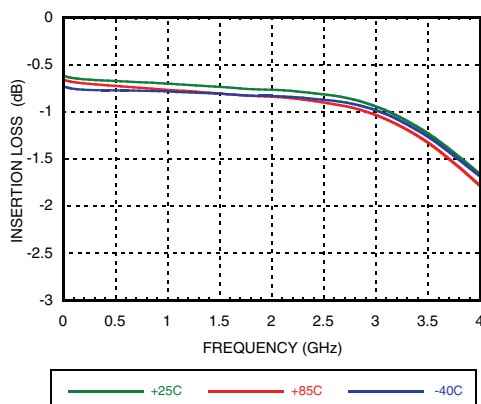
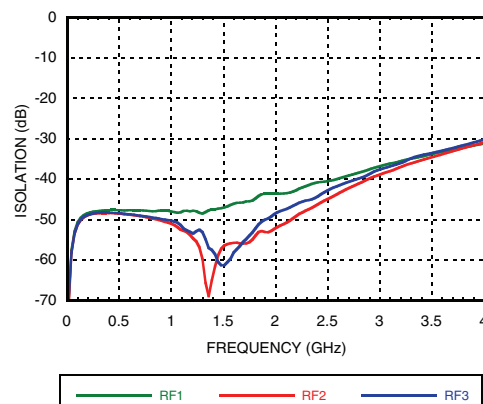
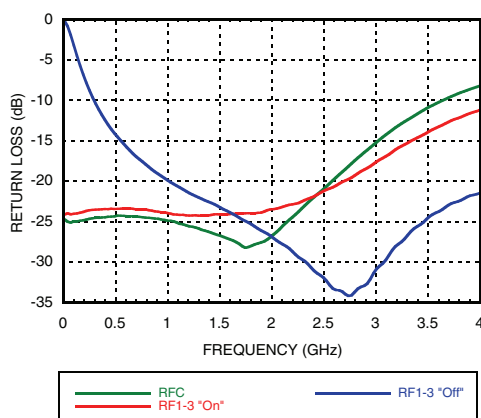
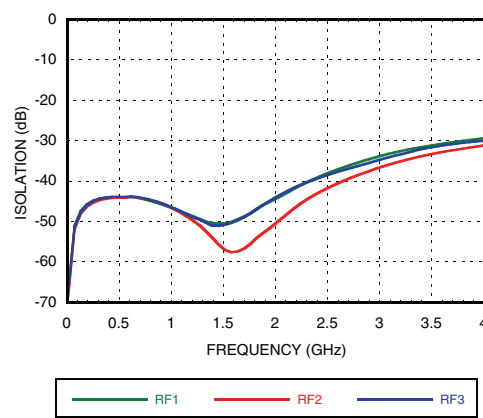
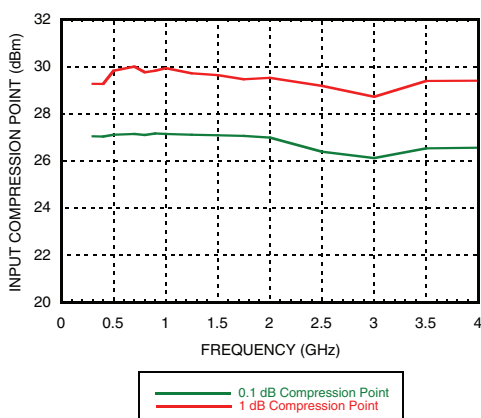
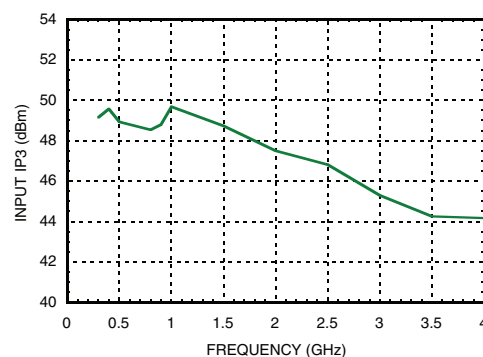
### Electrical Specifications,

$T_A = +25^\circ \text{C}$ , For TTL Control and Vdd= +5V in a 50 Ohm System

| Parameter                                                                 | Frequency     | Min.                             | Typ. | Max. | Units |
|---------------------------------------------------------------------------|---------------|----------------------------------|------|------|-------|
| Insertion Loss                                                            | DC - 2.0 GHz  |                                  | 0.7  | 1.0  | dB    |
|                                                                           | DC - 3.0 GHz  |                                  | 0.8  | 1.3  | dB    |
|                                                                           | DC - 3.5 GHz  |                                  | 1.1  | 1.5  | dB    |
| Isolation                                                                 | DC - 1.0 GHz  | 40                               | 46   |      | dB    |
|                                                                           | DC - 2.0 GHz  | 35                               | 42   |      | dB    |
|                                                                           | DC - 2.5 GHz  | 31                               | 40   |      | dB    |
|                                                                           | DC - 3.5 GHz  | 26                               | 32   |      | dB    |
| Return Loss                                                               | "On State"    | DC - 1.5 GHz                     | 23   |      | dB    |
|                                                                           |               | DC - 3.5 GHz                     | 17   |      | dB    |
| Return Loss RF1 - 3                                                       | "Off State"   | 0.3 - 3.5 GHz                    | 12   |      | dB    |
|                                                                           |               | 0.5 - 3.5 GHz                    | 15   |      | dB    |
| Input Power for 1 dB Compression                                          | 0.3 - 2.5 GHz | 26                               | 29   |      | dBm   |
|                                                                           | 0.3 - 3.5 GHz | 25                               | 28   |      | dBm   |
| Input Third Order Intercept<br>(Two-tone Input Power = +10 dBm each tone) | 0.3 - 2.5 GHz | 44                               | 48   |      | dBm   |
|                                                                           | 0.3 - 3.5 GHz | 40                               | 44   |      | dBm   |
| Switching Characteristics                                                 | 0.3 - 3.5 GHz | tRISE, tFALL (10/90% RF)         | 40   |      | ns    |
|                                                                           |               | tON, tOFF (50% CTL to 10/90% RF) | 150  |      | ns    |
|                                                                           |               |                                  |      |      |       |

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**GaAs MMIC SP3T Non-REFLECTIVE  
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**Insertion Loss vs. Temperature****Isolation****Return Loss****Off State Isolation****0.1 and 1 dB Input Compression Point****Input Third Order Intercept Point**


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**Bias Voltage & Current**

| Vdd Range= +5 Vdc $\pm$ 10% |                |                |
|-----------------------------|----------------|----------------|
| Vdd (Vdc)                   | Idd (Typ) (mA) | Idd (Max) (mA) |
| +5                          | 2.2            | 6.0            |

**TTL/CMOS Control Voltages**

| State | Bias Condition                   |
|-------|----------------------------------|
| Low   | 0 to +0.8 Vdc @ 0.2 $\mu$ A Typ. |
| High  | +2.0 to +5 Vdc @ 35 $\mu$ A Typ. |

**Truth Table**

| Control Input |      | Signal Path State |
|---------------|------|-------------------|
| A             | B    | RF COM to:        |
| Low           | Low  | RF1               |
| High          | Low  | RF2               |
| Low           | High | RF3               |
| High          | High | All Off           |



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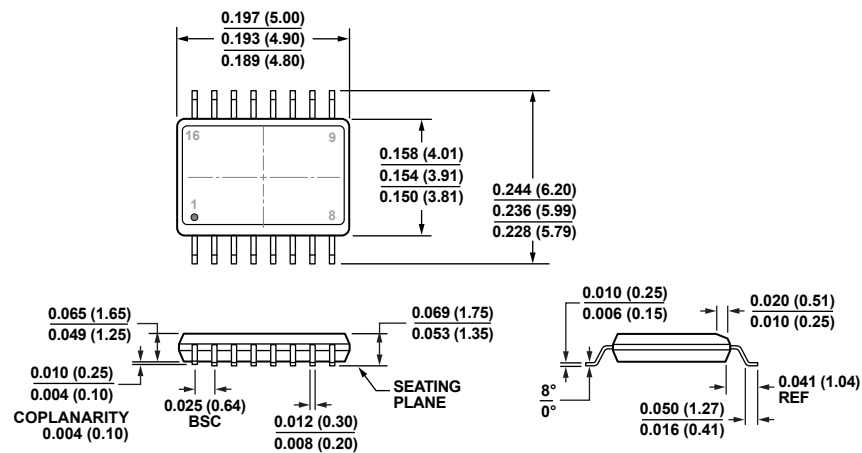
### Absolute Maximum Ratings

|                                     |                     |
|-------------------------------------|---------------------|
| Bias Voltage Range (Port Vdd)       | +7.0 Vdc            |
| Control Voltage Range (A & B)       | -0.5V to Vdd +1 Vdc |
| Channel Temperature                 | 150 °C              |
| Thermal Resistance                  |                     |
| Insertion Loss Path                 | 150 °C/W            |
| Terminated Path                     | 297 °C/W            |
| Storage Temperature                 | -65 to +150 °C      |
| Operating Temperature               | -40 to +85 °C       |
| Maximum Input Power<br>Vdd = +5 Vdc |                     |
| Insertion Loss Path                 | +28.5 dBm           |
| Terminated Path                     | +23.4 dBm           |
| ESD Sensitivity (HBM)               | Class 1A            |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



COMPLIANT TO JEDEC STANDARDS MO-137-AB  
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS  
(IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR  
REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

16-Lead Shrink Small Outline Package [QSOP]  
(RQ-16)

Dimensions shown in inches and (millimeters)

08-122014-A

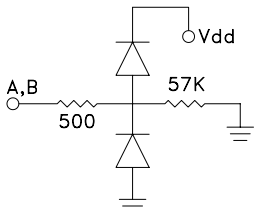
### Package Information

| Part Number  | Package Body Material                                                             | Leadframe Plating | MSL Rating | Package Marking [2] |
|--------------|-----------------------------------------------------------------------------------|-------------------|------------|---------------------|
| HMC245AQS16E | RoHS-compliant Low Stress Injection Molded Plastic Silica and Silicon Impregnated | 100% Matte Tin    | MSL1 [1]   | H245A<br>XXXX       |

[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

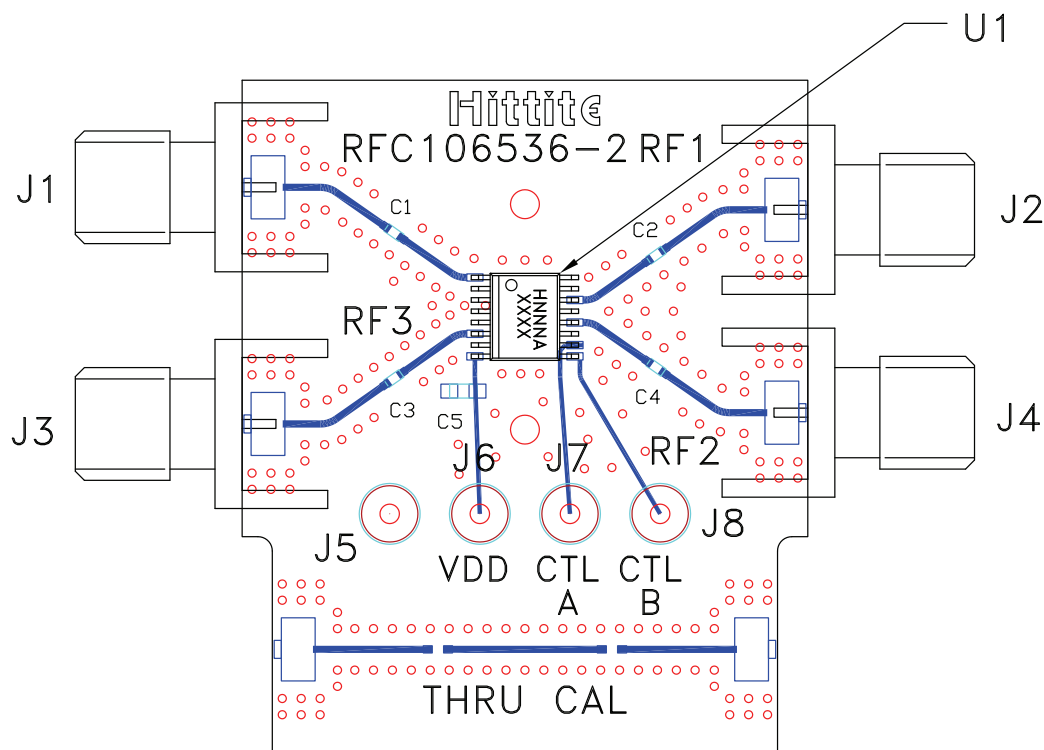

**GaAs MMIC SP3T Non-REFLECTIVE  
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**Pin Descriptions**

| Pin Number                  | Function              | Description                                                                         | Interface Schematic                                                                 |
|-----------------------------|-----------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1, 6, 12, 14                | RF3, RF2,<br>RF1, RFC | This pin is DC coupled and matched to 50 Ohms.<br>Blocking capacitors are required. |                                                                                     |
| 2 - 5, 7, 11, 13,<br>15, 16 | GND                   | This pin must be connected to PCB RF<br>ground to maximize isolation.               |  |
| 8                           | Vdd                   | Supply Voltage +5 Vdc $\pm$ 10%                                                     |                                                                                     |
| 9                           | B                     | See truth table and control voltage table.                                          |  |
| 10                          | A                     | See truth table and control voltage table.                                          |                                                                                     |



**GaAs MMIC SP3T Non-REFLECTIVE  
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**Evaluation PCB**



**List of Materials for Evaluation PCB EV1HMC245AQS16 [1]**

| Item    | Description                            |
|---------|----------------------------------------|
| J1 - J4 | PCB Mount SMA RF Connector             |
| J5 - J8 | DC Pin                                 |
| C1 - C4 | 100 pF Capacitor, 0402 Pkg.            |
| C5      | 10k pF Capacitor, 0603 Pkg.            |
| U1      | HMC245AQS16 / 245AQS16E<br>SP3T Switch |
| PCB [2] | 106536 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 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.