



# HMC348LP3 / 348LP3E

## GaAs MMIC SPDT NON-REFLECTIVE CATV SWITCH, DC - 2.5 GHz

### Typical Applications

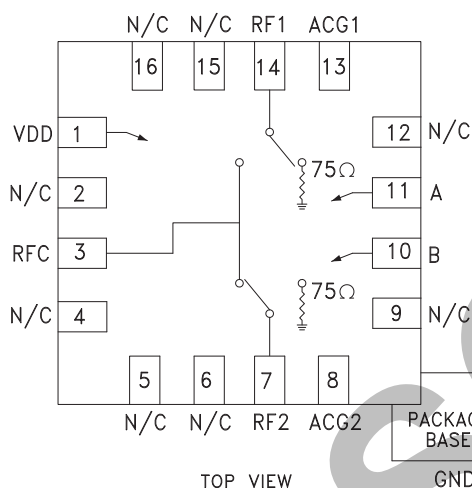
The HMC348LP3 / HMC348LP3E is ideal for:

- 75 Ohm Systems  
CATV Signal Distribution, Cable Modem  
Headend & DBS IF Switching
- 50 Ohm Systems  
Basestation Infrastructure & Test Equipment

### Features

- High Isolation: >80 dB @ 5 MHz (50 Ohm)  
>55 dB @ 1 GHz (50 Ohm)
- “All Off” Isolation State
- Non-Reflective Design, 75 Ohm Terminations
- 3x3 mm SMT Package

### Functional Diagram



### General Description

The HMC348LP3 & HMC348LP3E are non-reflective GaAs MESFET SPDT switches in low cost leadless QFN surface mount plastic packages ideal for CATV applications. Covering DC to 2.5 GHz, the switch offers high isolation, low insertion loss, integrated 75 Ohm terminations and an “all off” state. The switch features >80 dB isolation at 5 MHz and >55 dB isolation up to 1 GHz. The switch operates using complementary positive control voltage logic lines of +5/0V and requires a +5V bias supply (Vdd). This switch offers excellent performance in both 50 Ohm & 75 Ohm systems for either SPDT or SPST functions.

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

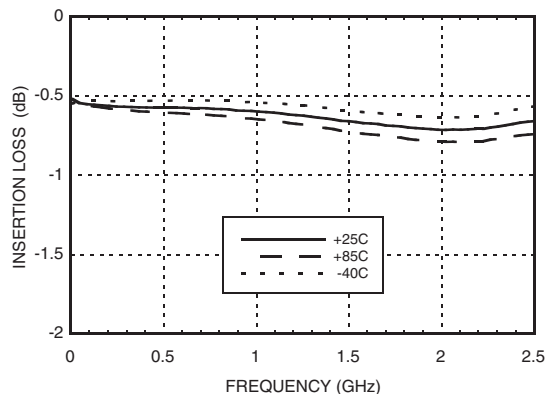
| Parameter                                                                                      | Frequency     | Min.          | Typ. | Max. | Units |
|------------------------------------------------------------------------------------------------|---------------|---------------|------|------|-------|
| Insertion Loss                                                                                 | DC - 1000 MHz |               | 0.6  | 0.9  | dB    |
|                                                                                                | DC - 2500 MHz |               | 0.7  | 1.0  | dB    |
| Isolation                                                                                      | DC - 250 MHz  | 63            | 68   |      | dB    |
|                                                                                                | DC - 750 MHz  | 53            | 58   |      | dB    |
|                                                                                                | DC - 1000 MHz | 50            | 55   |      | dB    |
|                                                                                                | DC - 2000 MHz | 47            | 52   |      | dB    |
|                                                                                                | DC - 2500 MHz | 45            | 50   |      | dB    |
| Return Loss                                                                                    | “On State”    | DC - 2500 MHz | 15   | 20   | dB    |
| Return Loss RF1, RF2                                                                           | “Off State”   | DC - 1000 MHz | 9    | 12   | dB    |
|                                                                                                | “Off State”   | DC - 2500 MHz | 8    | 11   | dB    |
| Input Power for 1 dB Compression                                                               | 50 MHz        | 20            | 23   |      | dBm   |
|                                                                                                | 1000 MHz      | 25            | 28   |      | dBm   |
| Input Third Order Intercept<br>(Two-Tone Input Power= 0 dBm Each Tone, 6 MHz Tone Separation)  | 50 MHz        |               | 43   |      | dBm   |
|                                                                                                | 1000 MHz      |               | 48   |      | dBm   |
|                                                                                                | 2500 MHz      |               | 51   |      | dBm   |
| Input Second Order Intercept<br>(Two-Tone Input Power= 0 dBm Each Tone, 6 MHz Tone Separation) | 50 MHz        |               | 72   |      | dBm   |
|                                                                                                | 1000 MHz      |               | 89   |      | dBm   |
|                                                                                                | 2500 MHz      |               | 80   |      | dBm   |
| Switching Characteristics<br>tRISE, tFALL (10/90% RF)<br>tON, tOFF (50% CTL to 10/90% RF)      | DC - 2500 MHz |               | 25   |      | ns    |
|                                                                                                |               |               | 600  |      | ns    |



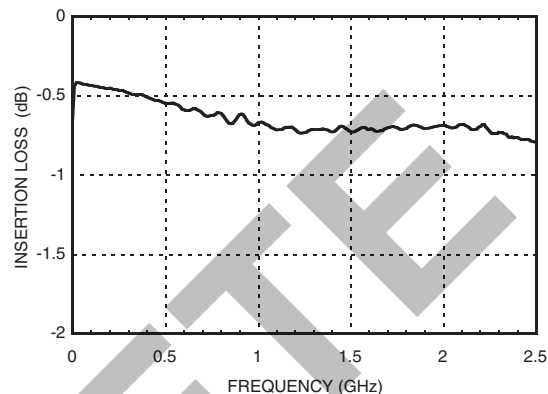
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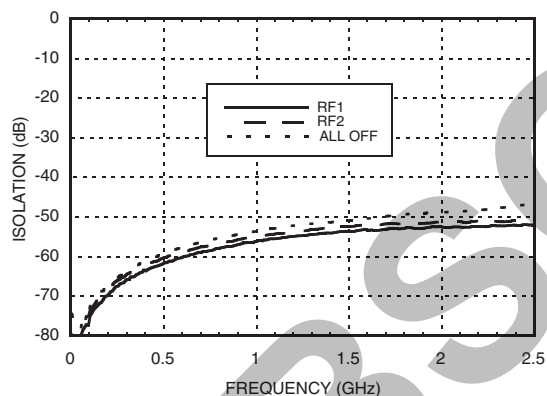
**Insertion Loss, 50 Ohm System**



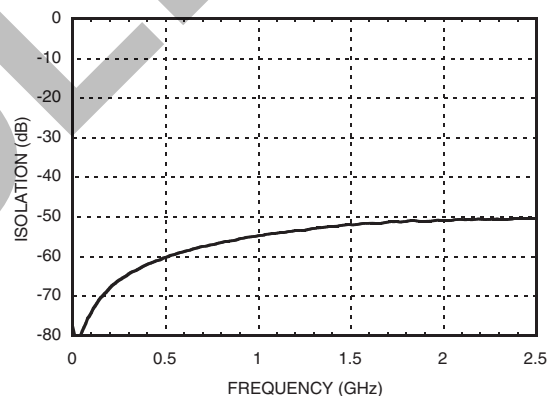
**Insertion Loss, 75 Ohm System**



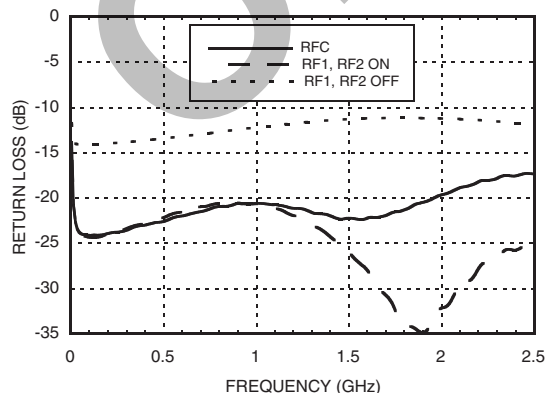
**Isolation, 50 Ohm System**



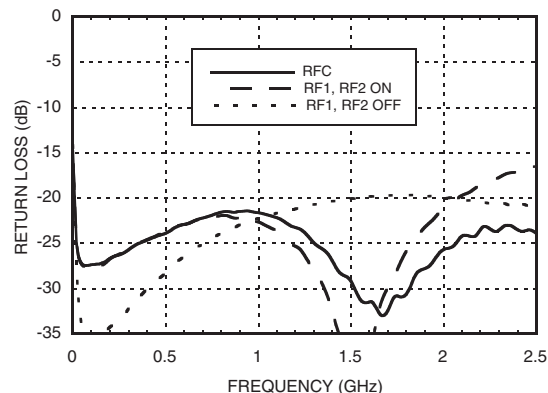
**Isolation, 75 Ohm System**



**Return Loss, 50 Ohm System**



**Return Loss, 75 Ohm System**

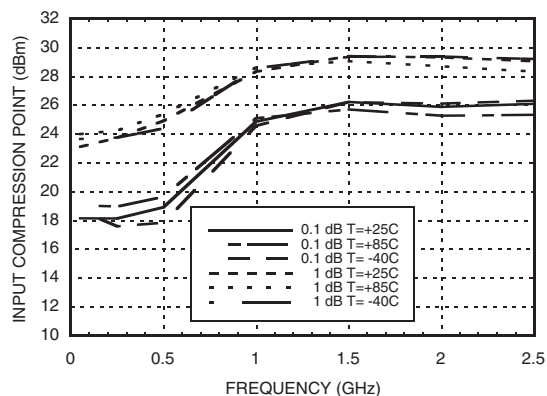




# HMC348LP3 / 348LP3E

## GaAs MMIC SPDT NON-REFLECTIVE CATV SWITCH, DC - 2.5 GHz

### Input Compression Point, 50 Ohm System



### Absolute Maximum Ratings

|                                                                          |                        |
|--------------------------------------------------------------------------|------------------------|
| Bias Voltage Range (Vdd)                                                 | +7.0 Vdc               |
| RF Input Power                                                           | +30 dBm                |
| Control Voltage Range (A & B)                                            | +0.5V to Vdd + 1.0 Vdc |
| Channel Temperature                                                      | 150 °C                 |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 4 mW/°C above 85 °C) | 0.3 W                  |
| Thermal Resistance<br>(Insertion Loss Path)                              | 104 °C/W               |
| Thermal Resistance<br>(Terminated Path)                                  | 240 °C/W               |
| Storage Temperature                                                      | -65 to +150 °C         |
| Operating Temperature                                                    | -40 to +85 °C          |
| ESD Sensitivity (HBM)                                                    | Class 1A               |



**ELECTROSTATIC SENSITIVE DEVICE**  
OBSERVE HANDLING PRECAUTIONS

### Bias Voltage & Current

| Vdd Range = +5.0 Vdc ±10% |                    |                    |
|---------------------------|--------------------|--------------------|
| Vdd<br>(Vdc)              | Idd (Typ.)<br>(mA) | Idd (Max.)<br>(mA) |
| +5.0                      | 1.1                | 2.2                |

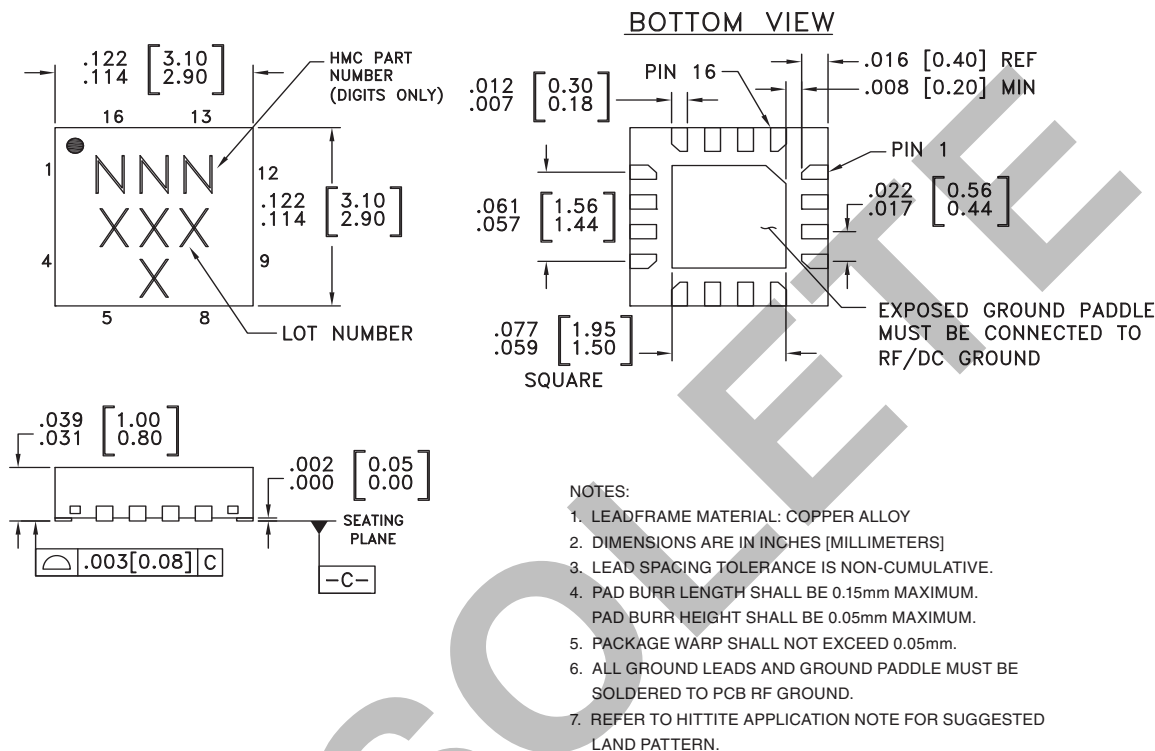
### Control Voltages

| State | Bias Condition                   |
|-------|----------------------------------|
| Low   | 0 to +0.8V @ 5 uA Typical        |
| High  | +2.0 to +5.0 Vdc @ 35 uA Typical |

### Truth Table

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

## Outline Drawing



## Package Information

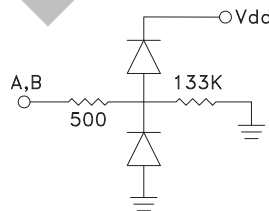
| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC348LP3   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 348<br>XXXX                    |
| HMC348LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 348<br>XXXX                    |

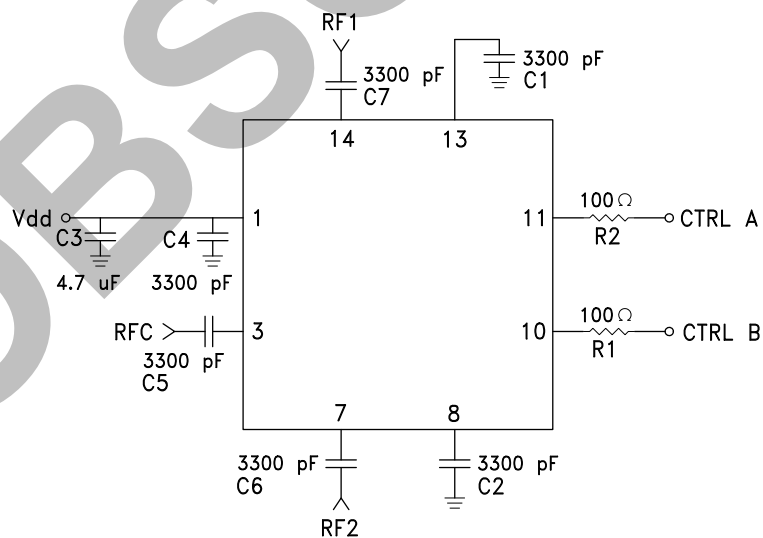
[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

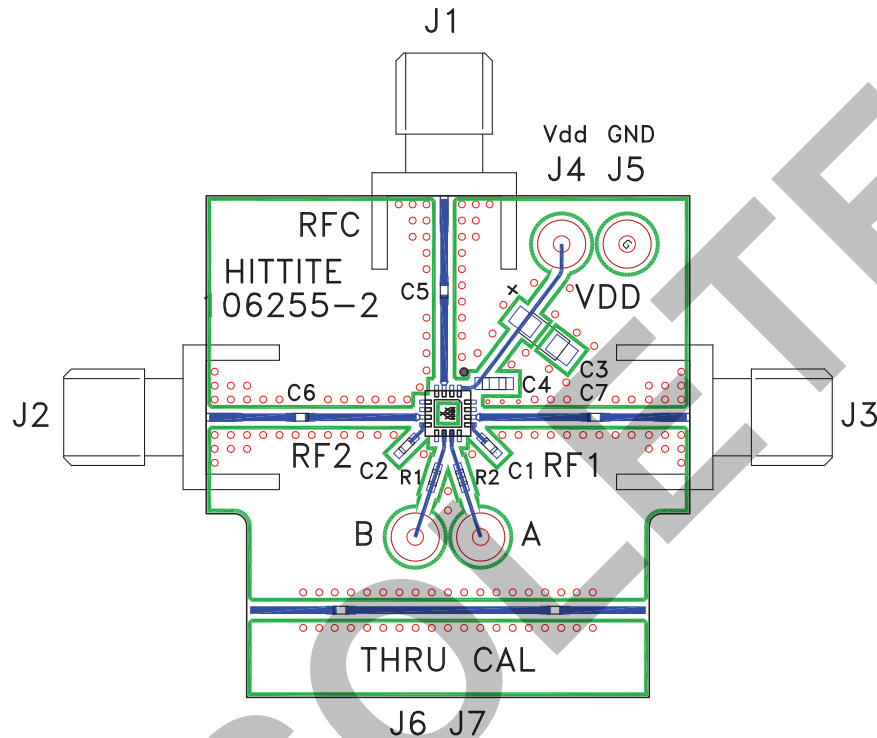
[3] 4-Digit lot number XXXX


**GaAs MMIC SPDT NON-REFLECTIVE  
CATV SWITCH, DC - 2.5 GHz**
**Pin Descriptions**

| Pin Number                   | Function      | Description                                                                                   | Interface Schematic                                                                  |
|------------------------------|---------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1                            | Vdd           | Supply Voltage +5V $\pm 10\%$                                                                 |                                                                                      |
| 2, 4, 5, 6,<br>9, 12, 15, 16 | N/C           | These pins should be connected to PCB RF ground to maximize isolation.                        |                                                                                      |
| 3, 7, 14                     | RFC, RF1, RF2 | These pins are DC coupled and matched to 75 Ohms. Blocking capacitors are required.           |                                                                                      |
| 8, 13                        | ACG1, ACG2    | External capacitors to ground are required. Select value for optimal isolation below 500 MHz. |                                                                                      |
| 10                           | B             | See truth table and control voltage table.                                                    |  |
| 11                           | A             | See truth table and control voltage table.                                                    |                                                                                      |

**Application Circuit**


The value of capacitors C1 & C2 are critical for low frequency isolation performance below 500 MHz. 3300 pF 0402 size capacitors are recommended for optimal isolation down to 5 MHz. If the frequency of operation is above 500 MHz then 100 pF to 300 pF 0402 capacitors will be sufficient.

**Evaluation PCB (50 Ohms)**

**List of Materials for Evaluation PCB 106343 <sup>[1]</sup>**

| Item               | Description                           |
|--------------------|---------------------------------------|
| J1 - J3            | PCB Mount SMA RF Connector            |
| J4 - J7            | DC Pin                                |
| R1 - R2            | 100 Ohm Resistor, 0402 Pkg.           |
| C1, C2, C4 - C7    | 3300 pF Capacitor, 0402 Pkg.          |
| C3                 | 4.7 uF Tantalum Capacitor             |
| U1                 | HMC348LP3 / HMC348LP3E<br>SPDT Switch |
| PCB <sup>[2]</sup> | 106255 Evaluation PCB                 |

[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 package bottom should be connected directly to the ground plane similar to that shown above. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.

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