# HMC800LP3E

v00.0110

## 10 dB GaAs MMIC 1-BIT DIGITAL POSITIVE CONTROL ATTENUATOR, DC - 10 GHz

### Typical Applications

The HMC800LP3E is ideal for:

- Test Equipment and Sensors
- ISM, MMDS, WLAN, WiMAX, WiBro
- Microwave Radio & VSAT
- Cellular Infrastructure

### Features

± 0.3 dB Typical Step Error

Low Insertion Loss: 2 dB

High IP3: +55 dBm

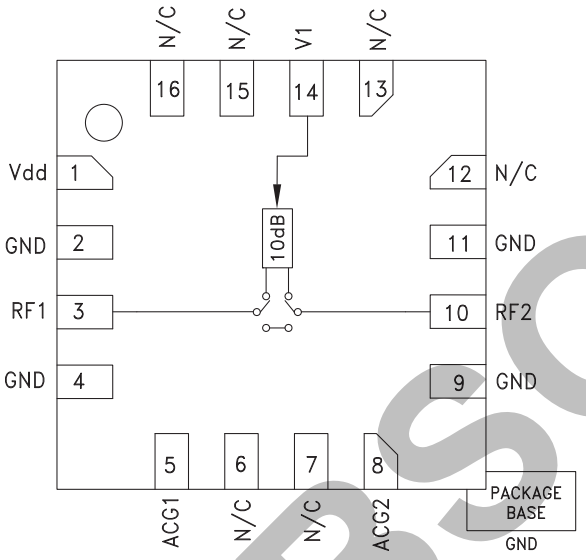
Single Control Line

TTL/CMOS Compatible Control

Single +5V Supply

16 Lead 3x3 mm SMT Package: 9 mm²

### Functional Diagram




### General Description

The HMC800LP3E is a broadband bidirectional 1-bit GaAs IC digital attenuator in a low cost leadless surface mount package. This single positive control line digital attenuator utilizes off chip AC ground capacitors for near DC operation, making it suitable for a wide variety of RF and IF applications. Covering DC to 10 GHz, the insertion loss is 2 dB typical and attenuation accuracy is excellent at ±0.3 dB typical step error. The attenuator also features a high Input IP3 of +55 dBm. One TTL/CMOS control input is used to select the attenuation state and a single Vdd bias of +5V is required.

OBSOLETE

### Electrical Specifications, $T_A$ = +25° C, With Vdd = +5V & Vctl = 0/+5V

| Parameter | Frequency | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Insertion Loss | DC - 4 GHz<br>4 - 8 GHz<br>8 - 10 GHz | | 1.0<br>2.0<br>2.5 | 2.0<br>3.0<br>3.5 | dB<br>dB<br>dB |
| Attenuation Range | DC - 10 GHz | | 10 | | dB |
| Return Loss (RF1 & RF2, Both States) | DC - 6 GHz<br>6 - 10 GHz | | 18<br>12 | | dB<br>dB |
| Attenuation Accuracy: (Referenced to Insertion Loss) | DC - 6 GHz<br>6 - 10 GHz | | ± 0.2<br>± 0.3 | ± 0.4<br>± 0.6 | dB<br>dB |
| Input Power for 0.1 dB Compression | DC - 0.4 GHz<br>0.4 - 10 GHz | | 20<br>30* | | dBm |
| Input Third Order Intercept Point<br>(Two-Tone Input Power= 0 dBm Each Tone) | DC - 0.4 GHz<br>0.4 - 10 GHz | | 45<br>55 | | dBm |
| Switching Characteristics<br>tRISE, tFALL (10/90% RF)<br>tON, tOFF (50% CTL to 10/90% RF) | DC - 10 GHz | | <br>120<br>150 | | <br>ns<br>ns |

* For frequencies greater than 0.4 GHz, the 0.1 dB compression point is greater than the absolute maximum RF input power of 30 dBm.

*Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.*

*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

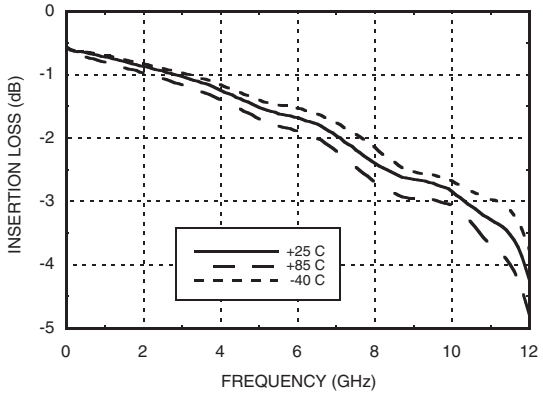
RoHS✓ EARTH FRIENDLY

# 10 dB GaAs MMIC 1-BIT DIGITAL POSITIVE CONTROL ATTENUATOR, DC - 10 GHz

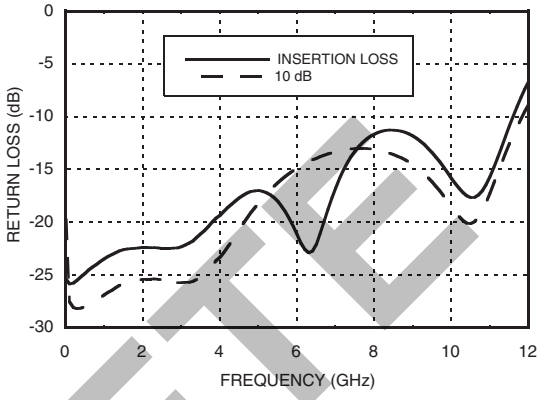


OBSOLETE

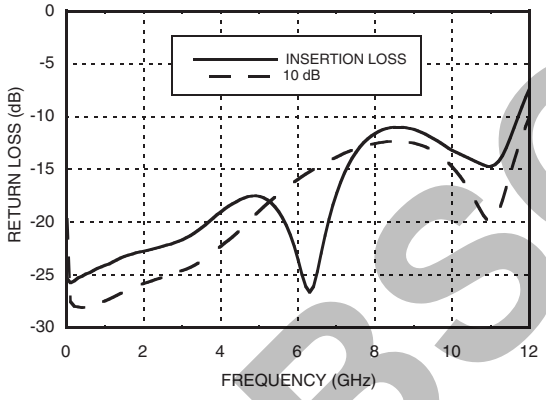
## Insertion Loss



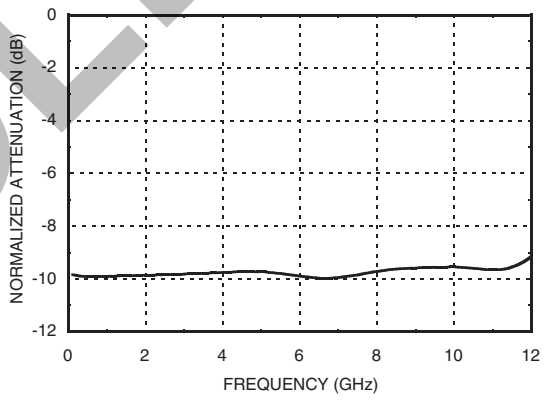

## Input Return Loss



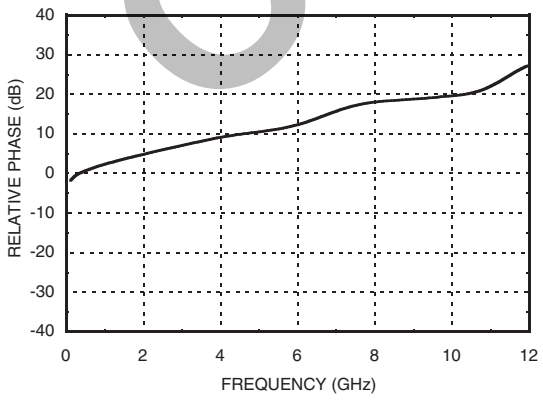

## Output Return Loss



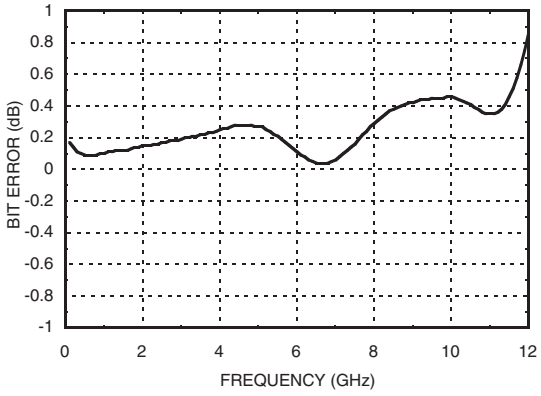

## Relative Attenuation




## Relative Phase vs. Frequency




## Bit Error vs. Frequency

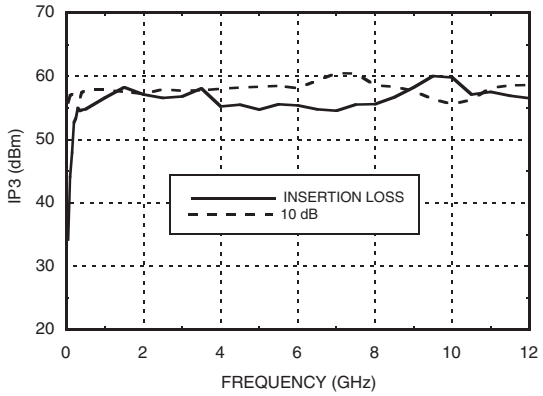



*Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.*

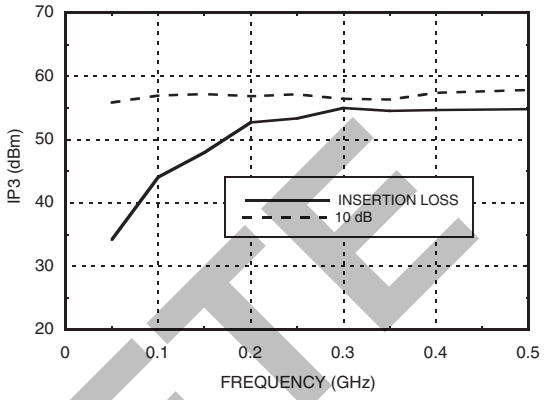
*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

# 10 dB GaAs MMIC 1-BIT DIGITAL POSITIVE CONTROL ATTENUATOR, DC - 10 GHz

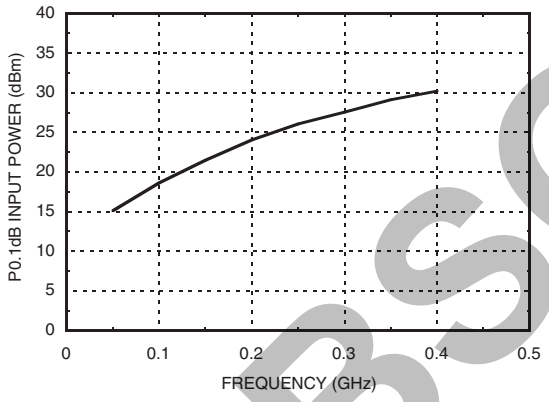
## Input IP3 vs. Frequency




## Input IP3 vs. Frequency
(Low Frequency Detail)




## Input Power for 0.1 dB Compression*
(Low Frequency Detail)




## Truth Table

| Control Voltage Input V1 | Attenuation State RF1 - RF2 |
|---|---|
| High | Reference Insertion Loss |
| Low | 10 dB |

## Bias Voltage & Current

| Vdd = +5 Vdc ± 10% | |
|---|---|
| Vdd (Vdc) | Idd (Typ.) (mA) |
| 4.5 | 0.21 |
| 5.0 | 0.23 |
| 5.5 | 0.25 |

## Control Voltage

| State | Bias Condition |
|---|---|
| Low | 0 to +0.8V @ -1 µA Typ. |
| High | +2 to +5V @ 30 µA Typ. |
| Note: Vdd = +5V | |

OBSOLETE

* For frequencies greater than 0.4 GHz, the 0.1 dB compression point is greater than the absolute maximum RF input power of 30 dBm.

*Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.*

*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

# 10 dB GaAs MMIC 1-BIT DIGITAL POSITIVE CONTROL ATTENUATOR, DC - 10 GHz



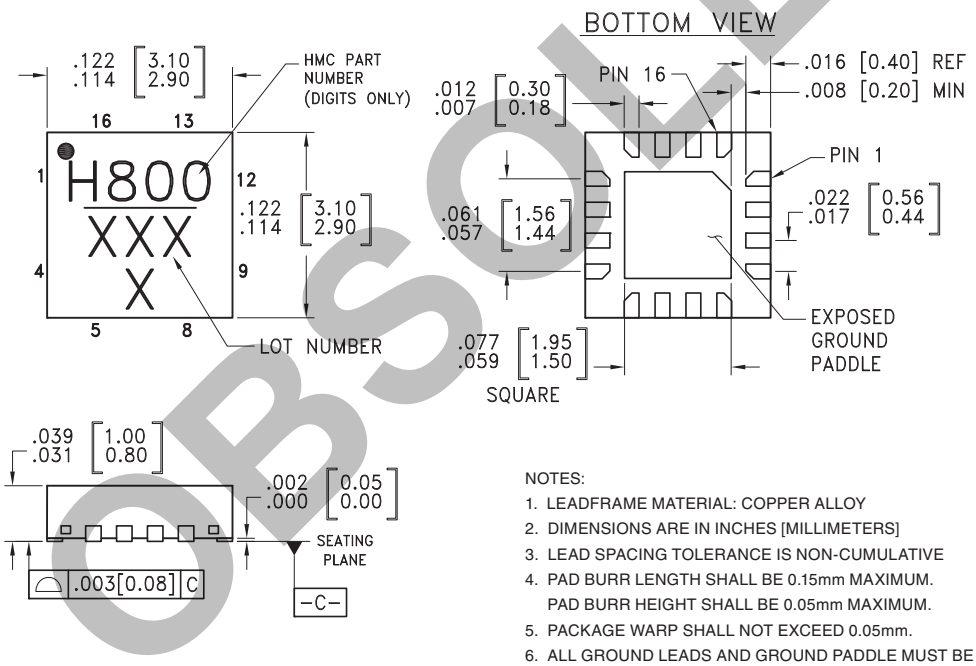
## Absolute Maximum Ratings

| | |
|---|---|
| RF Input Power (DC - 10 GHz) | +30 dBm |
| Control Voltage Range (V1) | -1 to Vdd +1 V |
| Bias Voltage (Vdd) | +7 Vdc |
| Channel Temperature | 150 °C |
| Continuous Pdiss (T = 85 °C) (derate 12 mW/°C above 85 °C) | 0.783 W |
| Thermal Resistance (Channel to ground paddle) | 83 °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

OBSOLETE

## 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 [2] |
|---|---|---|---|---|
| HMC800LP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [1] | H800<br>XXXX |

[1] Max peak reflow temperature of 260 °C
[2] 4-Digit lot number XXXX

*Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.*

*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

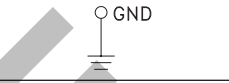
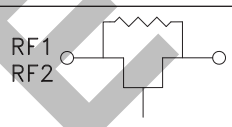
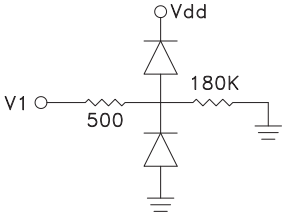
ANALOG DEVICES

# HMC800LP3E

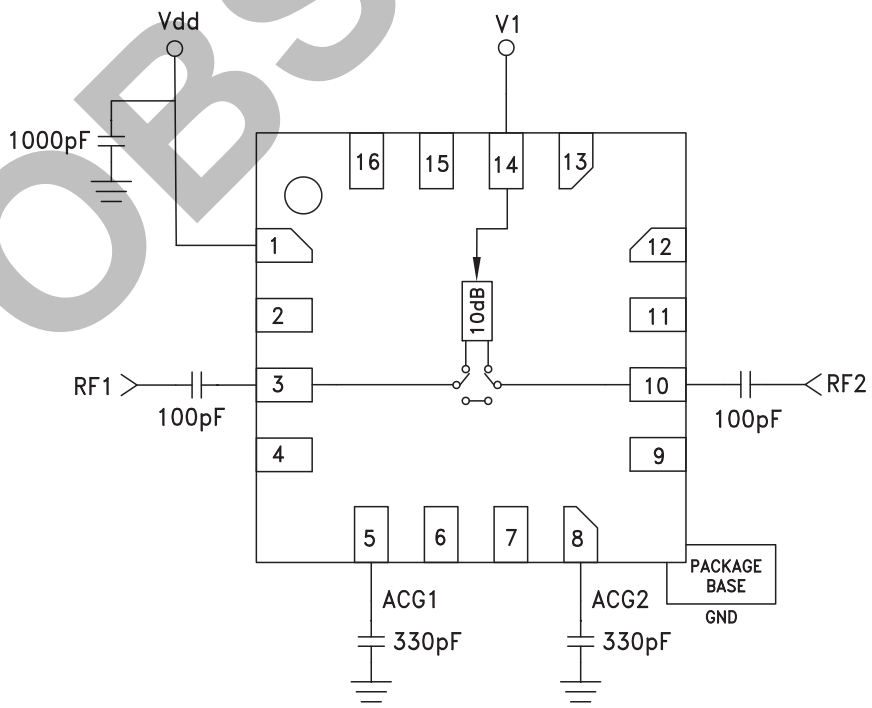
v00.0110

## 10 dB GaAs MMIC 1-BIT DIGITAL POSITIVE CONTROL ATTENUATOR, DC - 10 GHz

### Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 | Vdd | Supply Voltage. | |
| 2, 4, 9, 11 | GND | These pins and the exposed ground paddle must be connected to RF/DC ground. |   |
| 3, 10 | RF1, RF2 | These pins are DC coupled and matched to 50 Ohms. Blocking capacitors are required. Select value based on lowest frequency of operation. |   |
| 5, 8 | ACG1, ACG2 | External capacitor to ground is required. Select value for lowest frequency of operation. Place capacitor as close to pins as possible. | |
| 6, 7, 12, 13, 15, 16 | N/C | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |
| 14 | V1 | See truth table and control voltage table. |   |

### Application Circuit

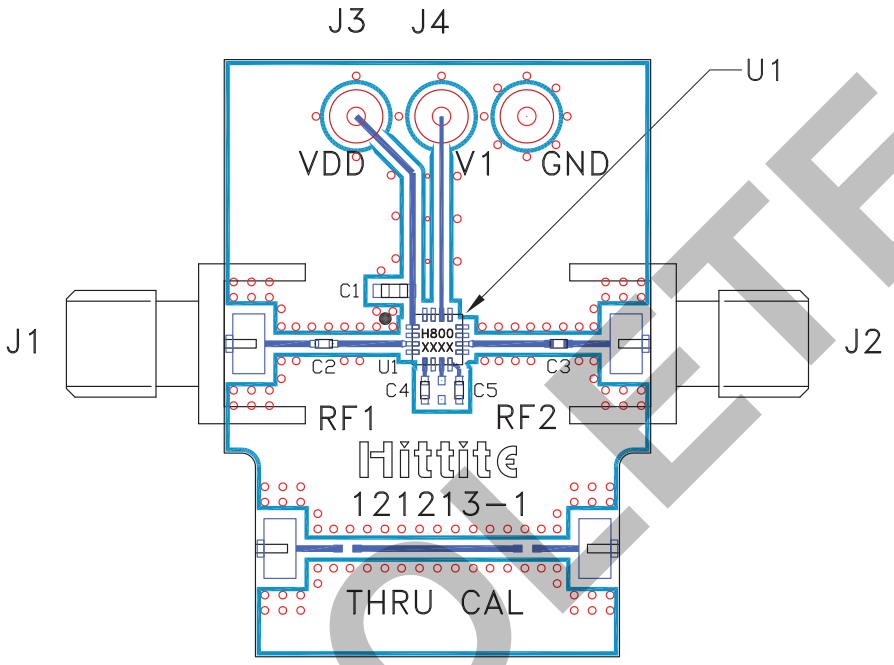



OBSOLETE

*Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.*

*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

## Evaluation PCB




OBSOLETE

## List of Materials for Evaluation PCB 126894 [1]

| Item | Description |
|---|---|
| J1, J2 | PCB Mount SMA Connector |
| J3, J4 | DC Connector |
| C1 | 1000 pF Capacitor, 0603 Pkg. |
| C2, C3 | 100 pF Capacitor, 0402 Pkg. |
| C4, C5 | 330 pF Capacitor, 0402 Pkg. |
| U1 | HMC800LP3E Digital Attenuator |
| PCB [2] | 121213 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25 FR

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.

*Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.*

*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*