# HMC948LP3E

v02.0913

## 54 dB, LOGARITHMIC DETECTOR, 1 - 23 GHz

## Typical Applications

The HMC948LP3E is ideal for:

- Point-to-Point Microwave Radio
- VSAT
- Wideband Power Monitoring
- Receiver Signal Strength Indication (RSSI)
- Test & Measurement

## Features

Wide Input Bandwidth: 1 to 23 GHz

Wide Dynamic Range: 54 dB up to 23 GHz

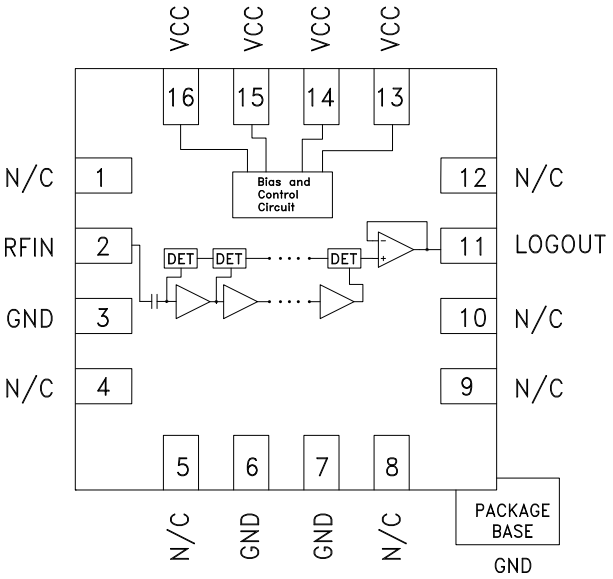
Single Positive Supply: +3.3V

Excellent Stability Over Temperature

Fast Rise / Fall Time: 5 / 7 ns

16 Lead 3x3 mm SMT Package: 9 mm²

## Functional Diagram




## General Description

The HMC948LP3E Logarithmic Detector converts RF signals at its input, to a proportional DC voltage at its output. The HMC948LP3E employs successive compression topology which delivers high dynamic range over a wide input frequency range. As the input power is increased, successive amplifiers move into saturation one by one creating an approximation of the logarithm function. The output of a series of square law detectors is summed, converted into the voltage domain and buffered to drive the LOG OUT output. The HMC948LP3E provides a nominal logarithmic slope of +14.2 mV/dB and an intercept of -111 dBm at 23 GHz. Ideal as a log detector for high volume microwave radio and VSAT applications, the HMC948LP3E is housed in a compact 3x3 mm RoHS compliant SMT plastic package.

## Electrical Specifications, $T_A$ = +25 C Vcc = +3.3V

| Parameter | Typ. | Typ. | Typ. | Typ. | Typ. | Typ. | Typ. | Units |
|---|---|---|---|---|---|---|---|---|
| Input Frequency[1] | 1 | 5 | 10 | 14 | 18 | 20 | 23 | GHz |
| ±3 dB Dynamic Range | 53 | 54 | 54 | 55 | 55 | 55 | 55 | dB |
| ±3 dB Dynamic Range Center | -23 | -25 | -24 | -22 | -20 | -15 | -15 | dBm |
| Log Error Over Temperature (-40 to +85) | ±1 | ±1 | ±1 | ±1.5 | ±1.5 | ±1.5 | ±1.5 | dB |
| Output Intercept | -104 | -107 | -109 | -112 | -113 | -108 | -111 | dBm |
| Output Slope | 16.8 | 16.7 | 15.9 | 15.2 | 14.6 | 14.4 | 14.2 | mV/dB |

[1] Video output load should be 1K Ohm or higher.



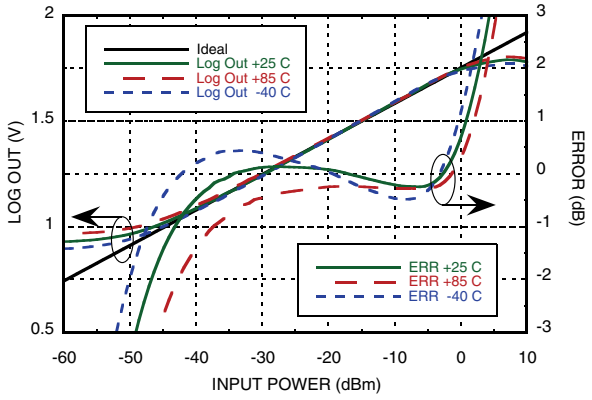
*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

## Electrical Specifications, (continued)

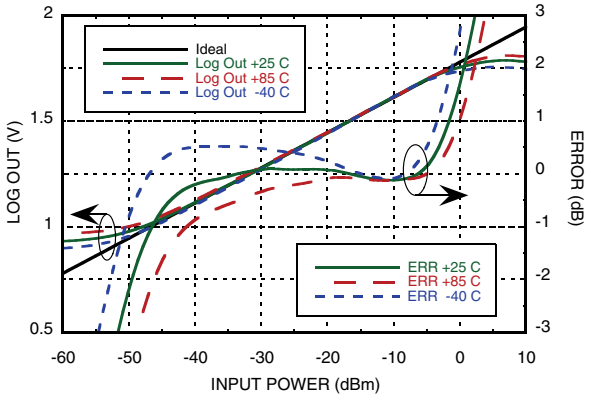
| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| **LOGOUT Interface** | | | | | |
| Output Voltage Range | | 0.9 | | 1.8 | V |
| Output Rise Time [1] / Fall Time [2] | f = 10 GHz | | 5 / 7 | | ns |
| **Power Supply (Vcc)** | | | | | |
| Operating Voltage Range | | 3.15 | 3.3 | 3.45 | V |
| Supply Current in Normal Mode | | | 91 | | mA |

[1] 0 dBm Input Pulsed; measured from 10% to 90%
[2] 0 dBm Input Pulsed; measured from 90% to 10%

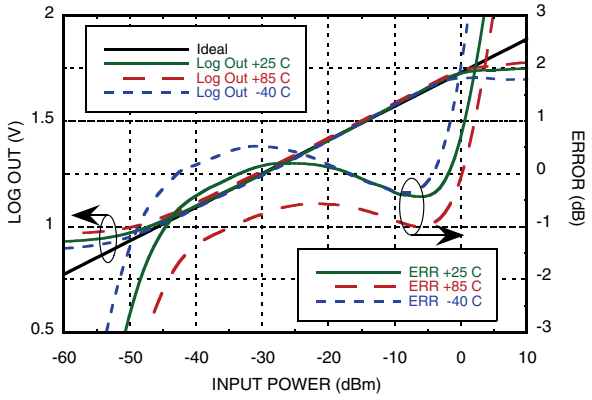
### LOG OUT & Error vs. Input Power, Fin = 1 GHz



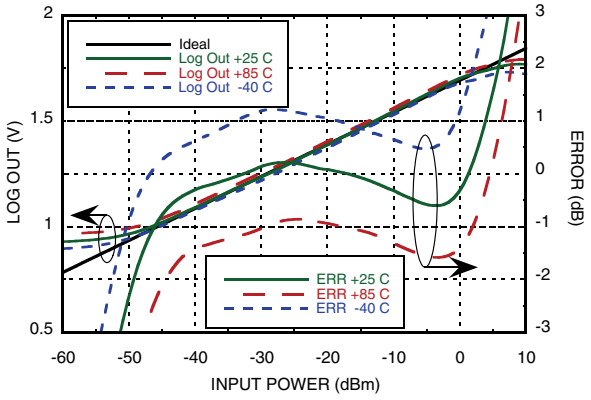

### LOG OUT & Error vs. Input Power, Fin = 5 GHz




### LOG OUT & Error vs. Input Power, Fin = 10 GHz




### LOG OUT & Error vs. Input Power, Fin = 14 GHz




*Unless otherwise noted: Vcc = +3.3V, $T_A$ = +25 °C*



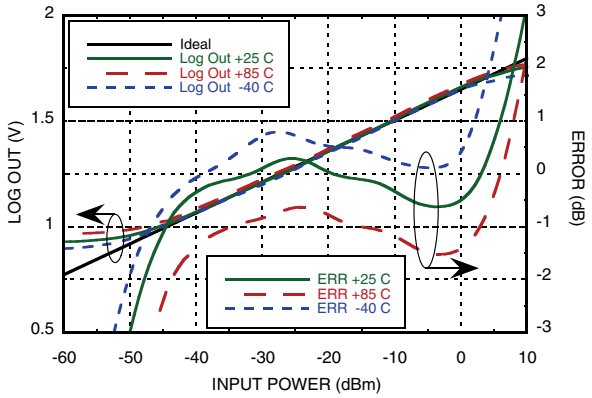
*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

RoHS✓ EARTH FRIENDLY

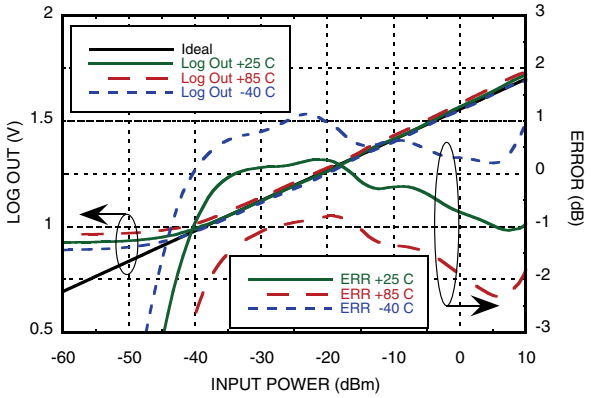
## 54 dB, LOGARITHMIC DETECTOR, 1 - 23 GHz



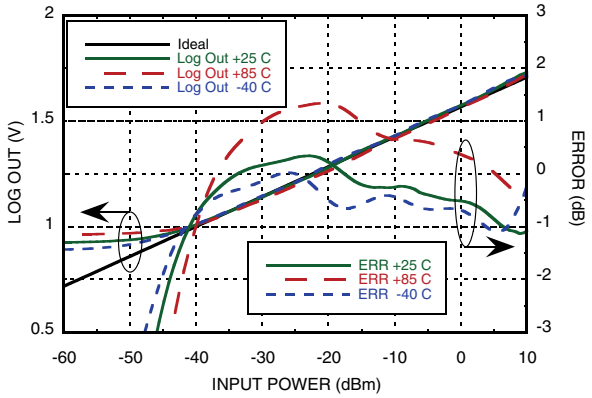
### LOG OUT & Error vs. Input Power, Fin = 18 GHz



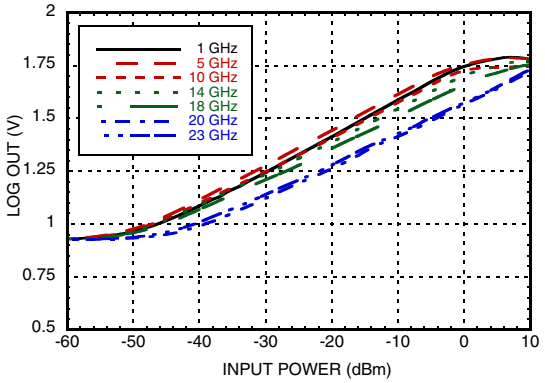

### LOG OUT & Error vs. Input Power, Fin = 20 GHz




### LOG OUT & Error vs. Input Power, Fin = 23 GHz




### LOG OUT vs. Frequency

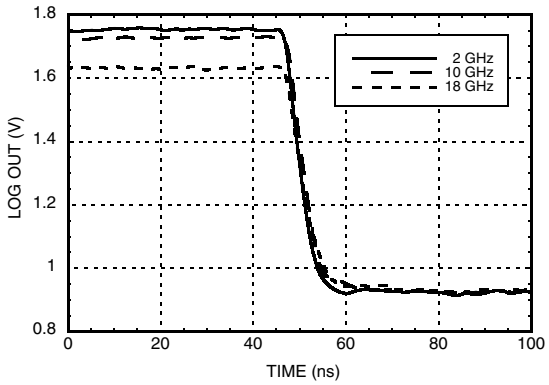



*Unless otherwise noted: Vcc = +3.3V, $T_A$ = +25 °C*

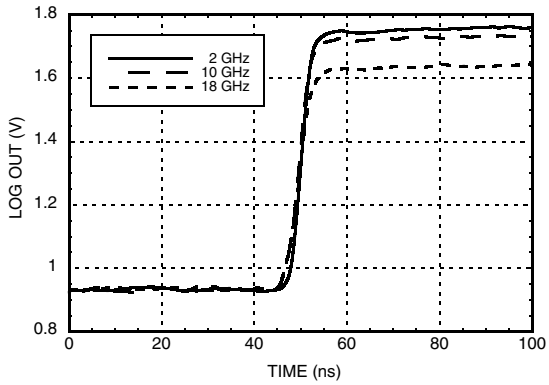


*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

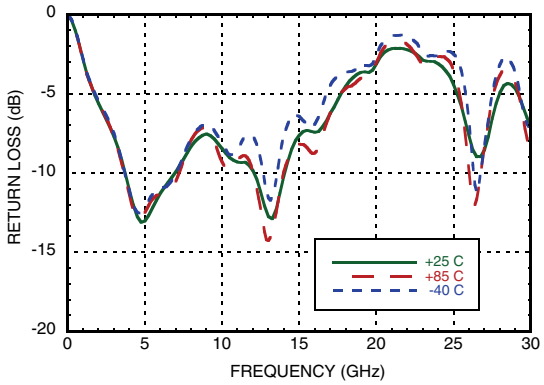
### Fall Time for Various Frequencies @ 0 dBm




### Rise Time for Various Frequencies @ 0 dBm




### Input Return Loss




*Unless otherwise noted: Vcc = +3.3V, $T_A$ = +25 °C*



*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

## 54 dB, LOGARITHMIC DETECTOR, 1 - 23 GHz

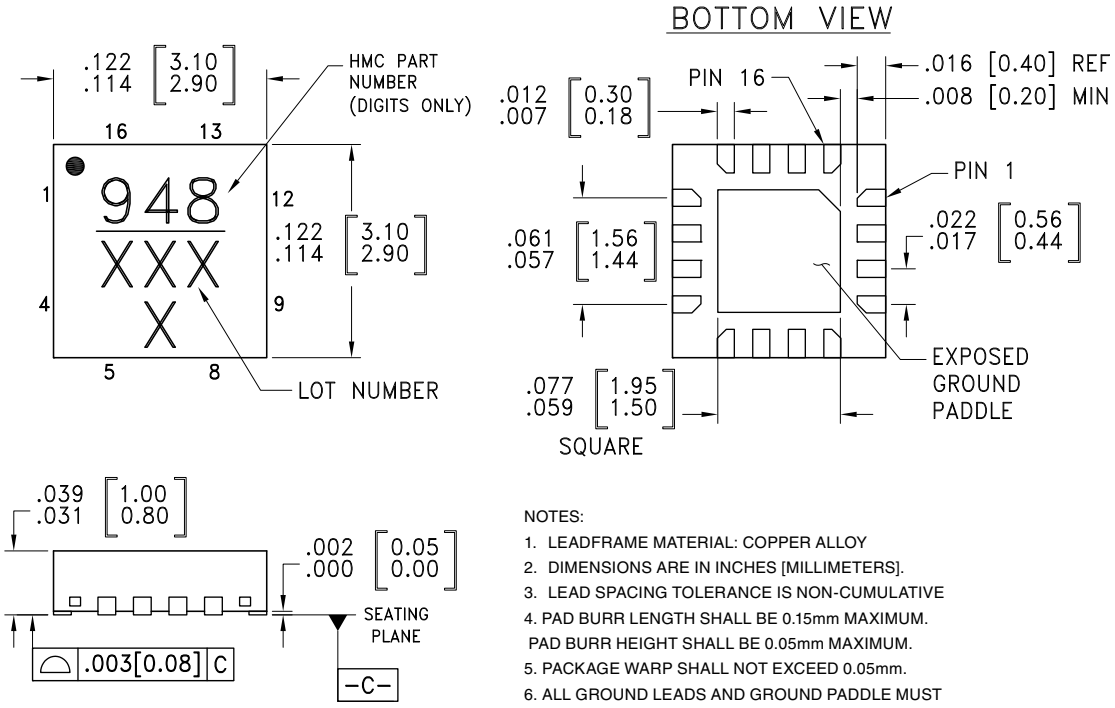


### Absolute Maximum Ratings

| | |
|---|---|
| Vcc | +3.6V |
| RF Input Power | +15 dBm |
| Junction Temperature | 125 °C |
| Continuous Pdiss (T = 85°C) (Derate 11.62 mW/°C above 85°C) | 0.46W |
| Thermal Resistance ($R_{th}$) (junction to ground paddle) | 86.09 °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

### 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 HMC APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

### Package Information

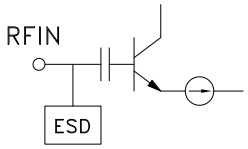
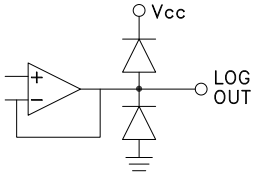
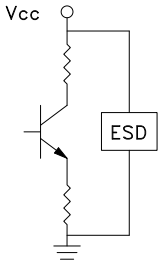
| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [1] |
|---|---|---|---|---|
| HMC948LP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | 948<br>XXX |

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



*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*

## Pin Descriptions

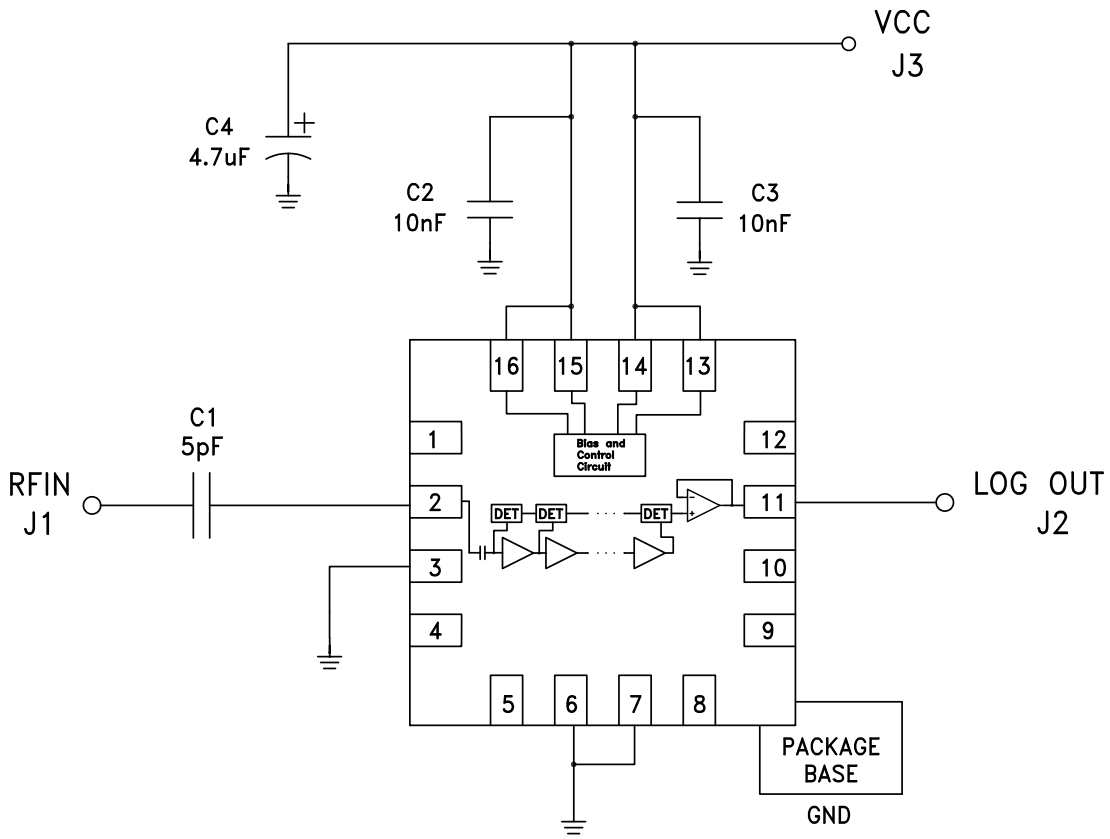
| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 4, 5, 8, 9, 10, 12 | N/C | No connection necessary. These pins may be connected to RF/DC ground without affecting performance. | |
| 2 | RFIN | RF input pin. |  |
| 3, 6, 7 | GND | These pins and the exposed package bottom must be connected to a high quality RF/DC ground. |  |
| 11 | LOG OUT | Log out load should be at least 1K Ohm or higher. |  |
| 13 - 16 | Vcc | Bias Supply. Connect supply voltage to these pins with appropriate filtering.<br>To ensure proper start-up supply rise time should be faster than 100usec |  |





*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*

## Application & Evaluation PCB Schematic

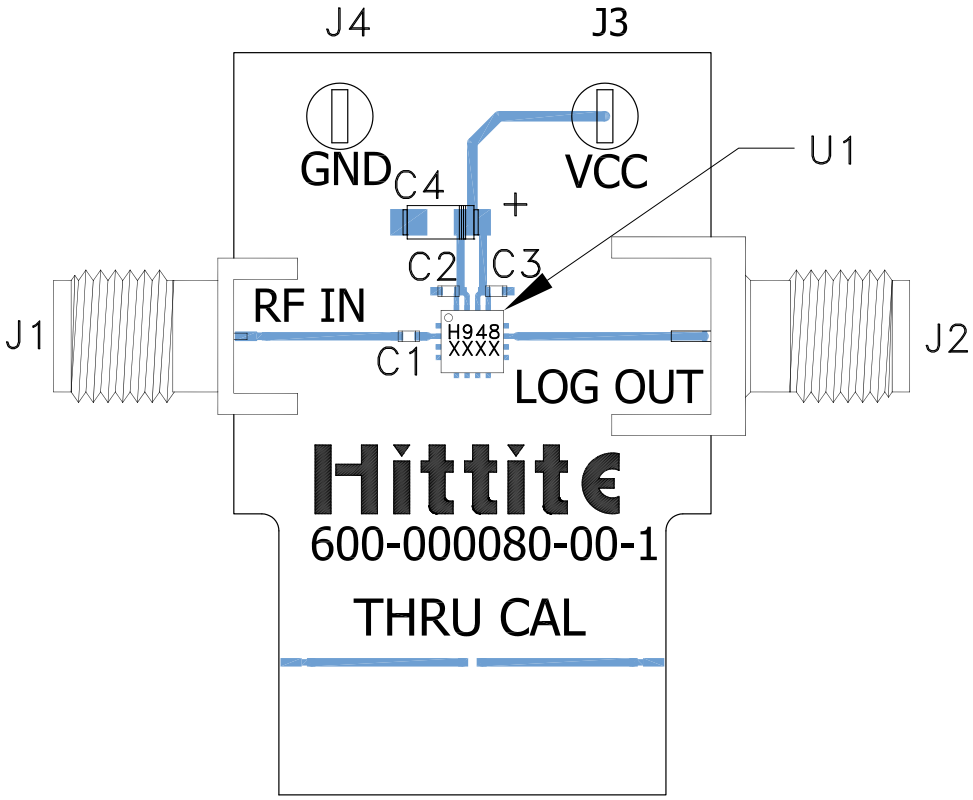



Note: Log output load should be 1K Ohm or higher.



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




### List of Materials for Evaluation PCB 132032 [1]

| Item | Description |
|---|---|
| J1 | K-Type Connector |
| J2 | SMA Connector |
| J3, J4 | DC Pin |
| C1 | 5 pF Capacitor, 0402 Pkg. |
| C2, C3 | 10 nF Capacitor, 0402 Pkg. |
| C4 | 4.7 µF Tantalum Capacitor, CASE A Pkg. |
| U1 | HMC948LP3E Log Detector |
| PCB [2] | 600-00008-00 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 pckage 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.



*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*