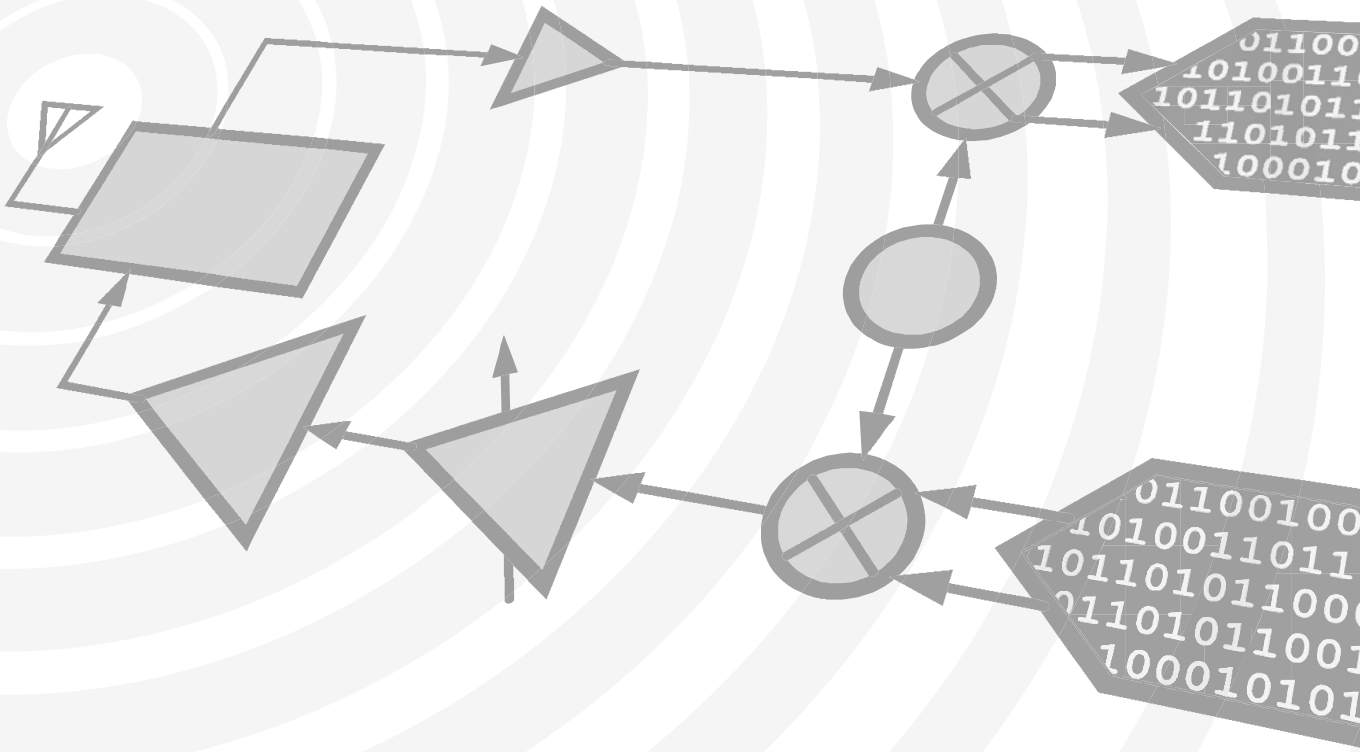
ANALOG DEVICES

Hittite MICROWAVE PRODUCTS FROM ANALOG DEVICES

# Analog Devices Welcomes Hittite Microwave Corporation

**NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED**



www.analog.com

www.hittite.com

# HMC842* Product Page Quick Links

Last Content Update: 11/01/2016

## Comparable Parts

View a parametric search of comparable parts

## Evaluation Kits

- HMC842LC4B Evaluation Board

## Documentation

### Data Sheet

- HMC842 Data Sheet

## Reference Materials

### Quality Documentation

- Package/Assembly Qualification Test Report: LC4, LC4B (QTR: 2014-00380 REV: 01)
- Semiconductor Qualification Test Report: BiCMOS-C (QTR: 2013-00241)

## Design Resources

- HMC842 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## Discussions

View all HMC842 EngineerZone Discussions

## Sample and Buy

Visit the product page to see pricing options

## Technical Support

Submit a technical question or find your regional support number

* This page was dynamically generated by Analog Devices, Inc. and inserted into this data sheet. Note: Dynamic changes to the content on this page does not constitute a change to the revision number of the product data sheet. This content may be frequently modified.

**THIS PAGE INTENTIONALLY LEFT BLANK**

v03.0914

# HMC842LC4B

## 45 Gbps, FANOUT BUFFER w/ PROGRAMMABLE OUTPUT VOLTAGE

### Typical Applications

The HMC842LC4B is ideal for:

- OC-768 and SDH STM-256 Equipment
- RF ATE Applications
- Short, intermediate, & Long Haul Fiber Optic Applications
- Broadband Test & Measurement
- Serial Data Transmission up to 45 Gbps
- Clock Buffering up to 28 GHz

### Features

Supports Clock Frequencies up to 28 GHz

Independent Programmable Output Swing for Each Channel: 400 - 1200 mVp-p Diff.

Supports Single-Ended or Differential Operation

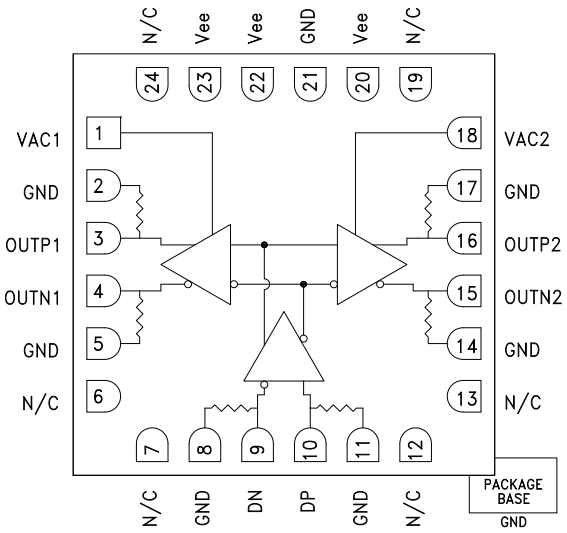
Power Consumption: 465 mW

Less than 500 fs Additive RMS Jitter

Fast Rise and Fall Times: <12ps

24 Lead 4x4mm SMT Package: $16mm^2$

### Functional Diagram




### General Description

The HMC842LC4B is a 1:2 Fanout Buffer designed to support data transmission rates up to 45 Gbps. The device can also operate with clock signals up to 28 GHz. During normal operation, input data (or clock) is transferred to both output channels. Differential input and output signals of the HMC842LC4B are terminated with 50 Ohms to ground on-chip, and may be either AC or DC coupled. The Outputs can be connected directly to a 50 Ohms-to-ground terminated system, while DC blocking capacitors should be used if the terminating system is 50 Ohms to a non-ground DC voltage.

The HMC842LC4B also features two separate output level control pins, VAC1 and VAC2 which provide loss compensation and signal level optimization for each output channel independently. The HMC842LC4B operates from a single -3.3V DC supply and is available in a ceramic RoHS compliant 4 x 4 mm SMT package.

### Electrical Specifications, $T_A$ = +25°C, Vee = -3.3V

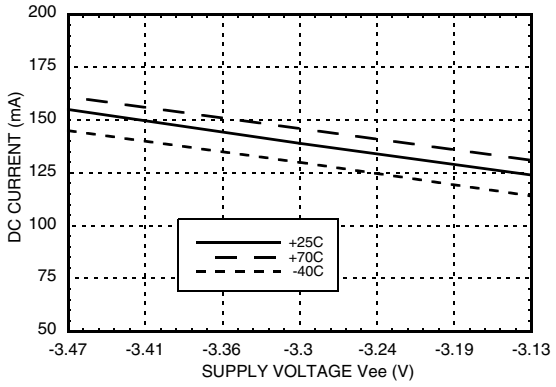
| Parameter | Conditions | Min. | Typ. | Max | Units |
|---|---|---|---|---|---|
| Power Supply Voltage | ±5 % Tolerance | -3.47 | -3.3 | -3.13 | V |
| Power Supply Current | VAC1 = VAC2 = -0.3V (Vout = 930 mVp-p diff @ 40 Gbps) | 120 | 140 | 160 | mA |
| Output Amplitude Control Voltage [1] (VAC1, VAC2) | | -1.4 | -0.3 | 0 | V |
| Maximum Data Rate | | 45 | | | Gbps |
| Maximum Clock Rate | | 28 | 32 | | GHz |
| Input Amplitude | Single-ended, peak-to-peak | 50 | | 1000 | mVp-p |
| | Differential, peak-to-peak | 100 | | 2000 | |
| Input High Voltage | | -0.5 | | 0.5 | V |
| Input Low Voltage | | -1 | | 0 | V |

## Electrical Specifications, (continued)

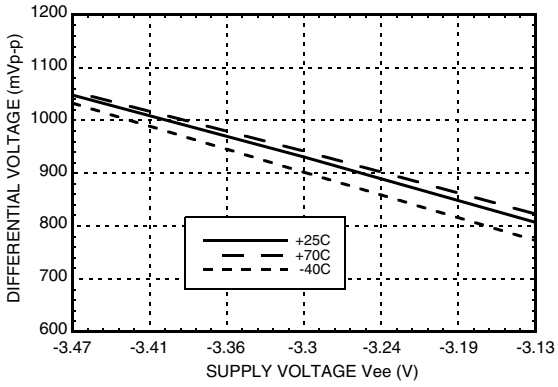
| Parameter | Conditions | Min. | Typ. | Max | Units |
|---|---|---|---|---|---|
| Output Amplitude | Differential, peak-to-peak @ 40 Gbps | 400 | | 1200 | mVp-p |
| Output High Voltage | | VAC = -0.3 | -10 | | mV |
| Output Low Voltage | | VAC = -0.3 | -550 | | mV |
| Input Return Loss | frequency < 32 GHz | | 10 | | dB |
| Output Return Loss | frequency < 32 GHz | | 7 | | dB |
| Deterministic Jitter, Jd [2] | | | 3 | | ps, pp |
| Additive Random Jitter Jr | @ 28 GHz Clock Input | | | 0.3 | ps rms |
| | @ 32 GHz Clock Input | | | 0.6 | ps rms |
| Rise Time, tr [2] | | | 11 | | ps |
| Fall Time, tf [2] | | | 11 | | ps |
| Propagation Delay, td | | | 10 | | ps |
| OUT1 to OUT2 Data Skew, $t_{skew}$ [2] | | | 2 | | ps |

[1] VAC1=VC2 and VAC2=VC1 on evaluation board
[2] Data Input: 40 Gbps PRBS $2^{23}$-1 pattern, 150 mVp-p single-ended

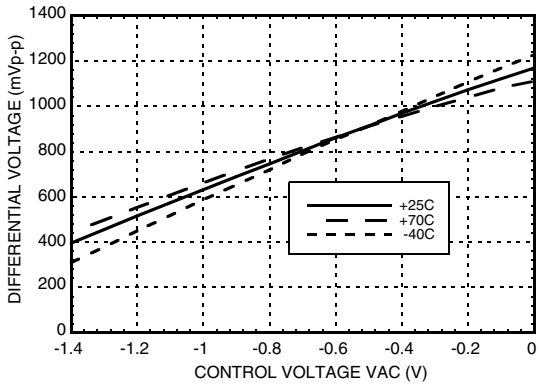
### DC Current vs. Supply Voltage [1] [2]



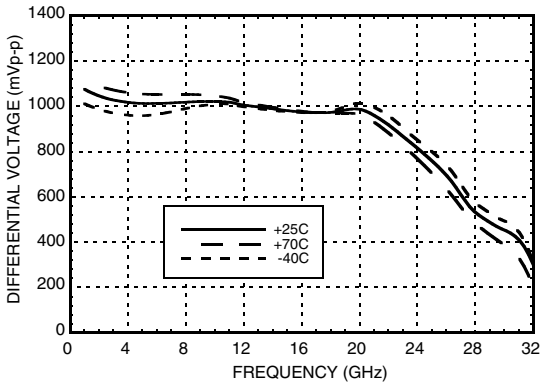

### Differential Output Swing vs. Supply Voltage [1] [2]




### Differential Output Swing vs. VAC [3]




### Differential Output Swing vs. Frequency [1]

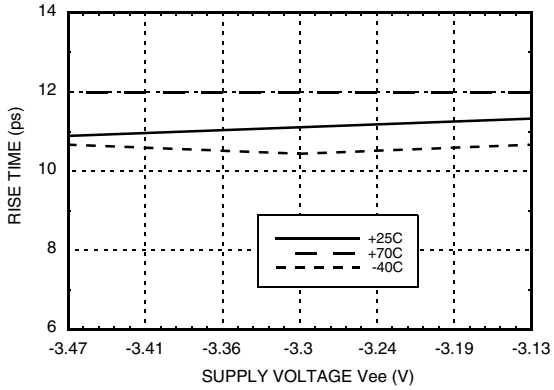



[1] VAC = -0.3V [2] Input data rate: 40 Gbps PRBS $2^{23}$-1 [3] Frequency = 20 GHz

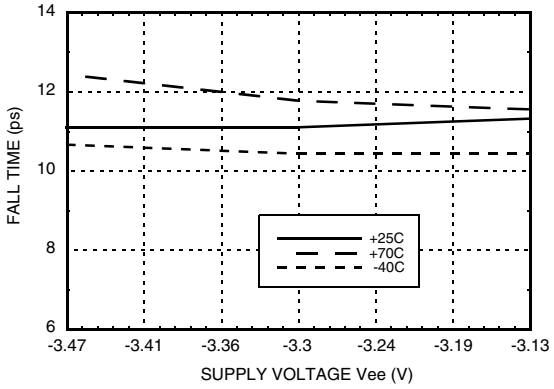
# HMC842LC4B

## 45 Gbps, FANOUT BUFFER w/ PROGRAMMABLE OUTPUT VOLTAGE

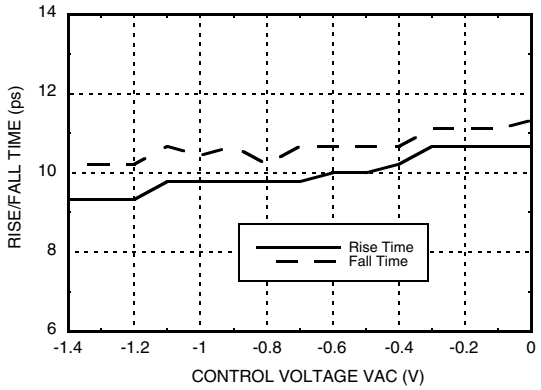
### Rise Time vs. Supply Voltage [1][2][3]



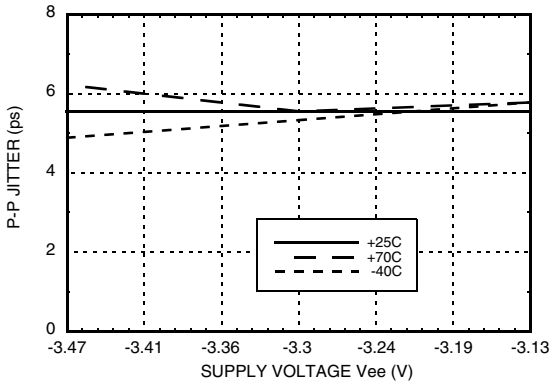

### Fall Time vs. Supply Voltage [1][2][3]



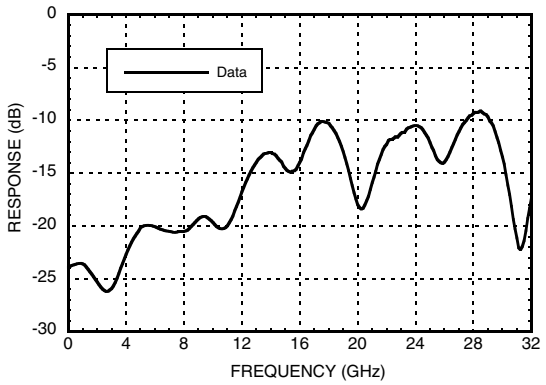

### Rise / Fall Time vs. VAC [1][2][3]



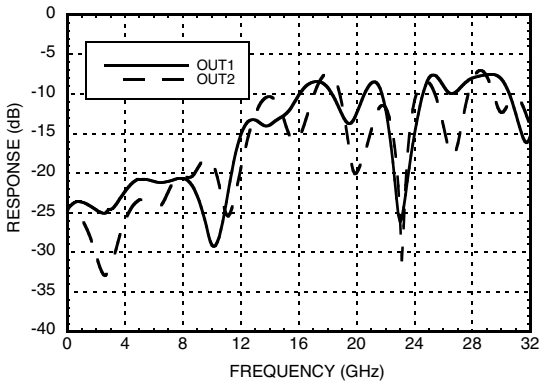

### Peak-to-Peak Jitter vs. Supply Voltage [1][2][3][4]




### Input Return Loss vs. Frequency [1][5]

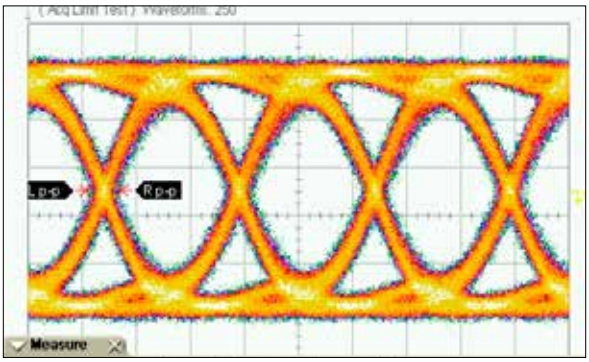



### Output Return Loss vs. Frequency [1][5]




[1] VAC = -0.3V [2] Input data rate: 40 Gbps PRBS $2^{23}$-1 [3] Data was taken at single ended output
[4] Source jitter was not deembeded [5] Device measured on evaluation board with single-ended time domain gating.

### 40 Gbps Differential Output Eye Diagram

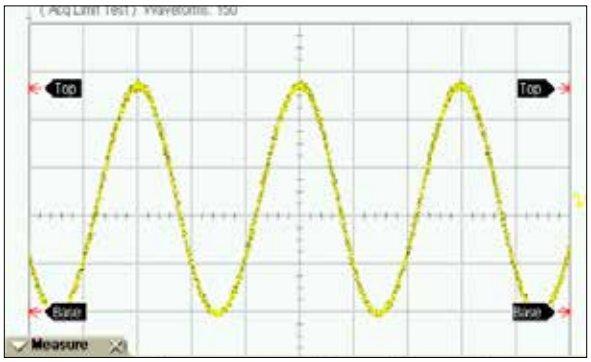



| Measurements | | | | |
|---|---|---|---|---|
| | Current | Min | Max | Total Meas. |
| Eye Amp | 921 mV | 920 mV | 922 mV | 75 |
| Rise Time | 11.11 ps | 10.89 ps | 11.11 ps | 75 |
| Fall Time | 11.11 ps | 10.44 ps | 11.11 ps | 75 |
| p-p Jitter | 5.778 ps | 5.333 ps | 5.778 ps | 75 |

Time Scale: 10 ps/div
Amplitude Scale: 210 mV/div

Test Conditions:
Vee = -3.3V, VAC = -0.3V
Input Data: Single ended 150 mVp-p 40 Gbps NRZ PRBS $2^{23}$-1 pattern

### 28 GHz Differential Output Eye Diagram

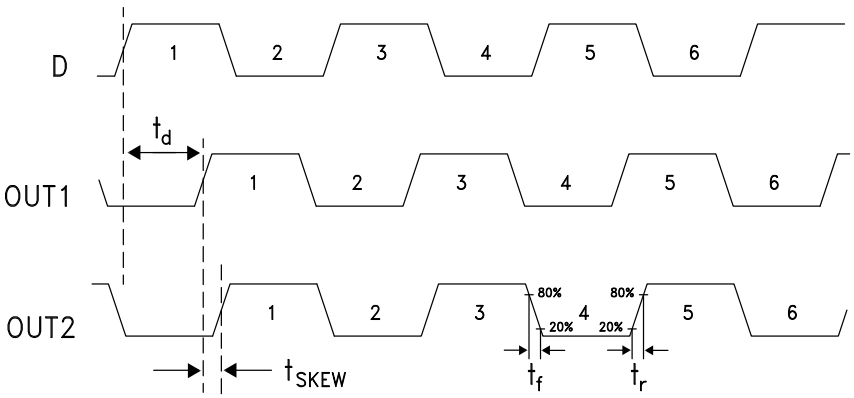



| Measurements | | | | |
|---|---|---|---|---|
| | Current | Mean | Min | Max |
| V Amp | 558.99 mV | 556.8 mV | 543.46 mV | 577.62 mV |
| Rise Time | 6.86 ps | 6.816 ps | 6.28 ps | 7.43 ps |
| Fall Time | 6.91 ps | 6.473 ps | 5.84 ps | 7.01 ps |

Time Scale: 12 ps/div
Amplitude Scale: 120 mV/div

Test Conditions:
Vee = -3.3V, VAC = -0.3V
Input Data: Single ended 300 mVp-p 28 GHz clock signal

### Timing Diagram




| Input | Outputs | |
|---|---|---|
| D | OUT1 | OUT2 |
| L | L | L |
| H | H | H |
| Notes:<br>D = DP - DN<br>OUT1 = OUTP1 - OUTN1<br>OUT2 = OUTP2 - OUTN2 | H - Logic High<br>L - Logic Low | |

# HMC842LC4B

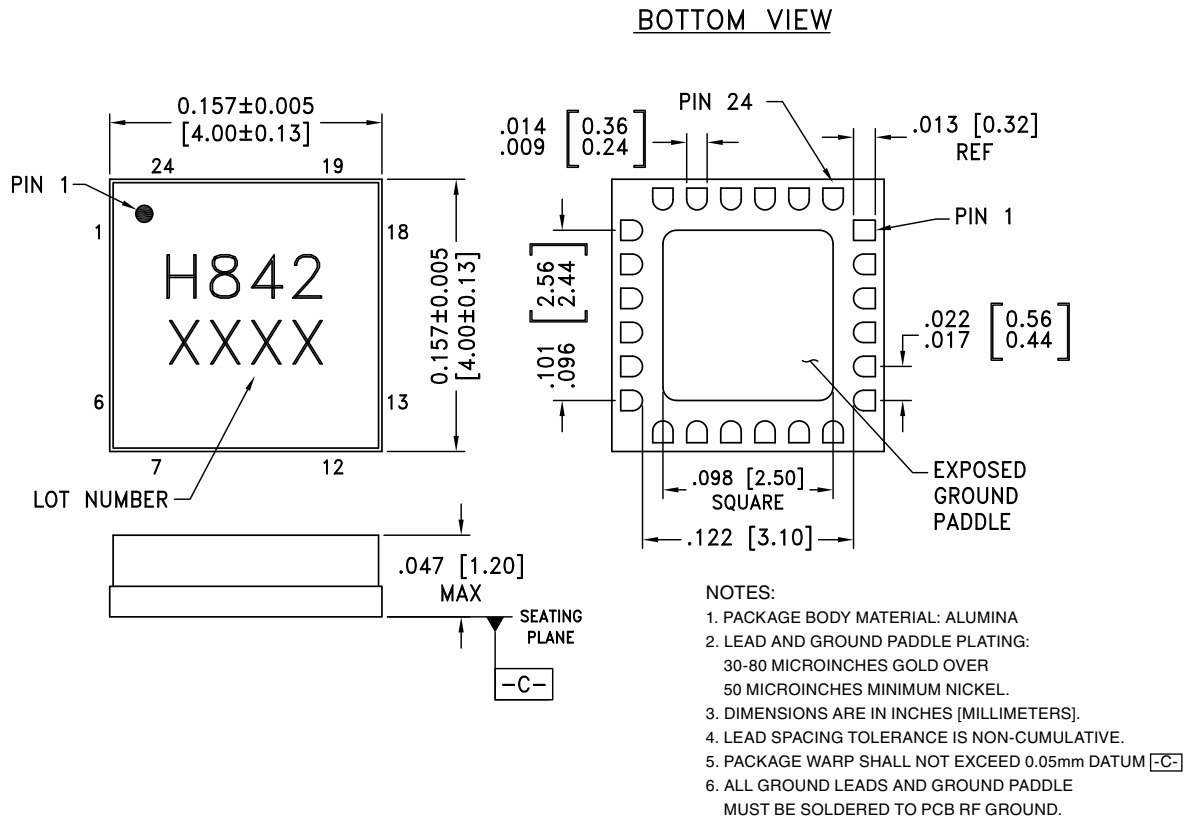
## 45 Gbps, FANOUT BUFFER w/ PROGRAMMABLE OUTPUT VOLTAGE

### Absolute Maximum Ratings

| | |
|---|---|
| Power Supply Voltage (Vee) | -3.7V to +0.5V |
| Input Voltage | -1.3V to +0.5V |
| Channel Temperature | 125°C |
| Continuous Pdiss (T = 85°C) (derate 18.48 mW/°C above 85°C) | 0.74 W |
| Thermal Resistance (channel to ground paddle) | 54.11 °C/W |
| Storage Temperature | -65°C to +125°C |
| Operating Temperature | -40°C to +70°C |
| Output Amplitude Control Voltage (VAC) | -2.3V to +0.5V |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



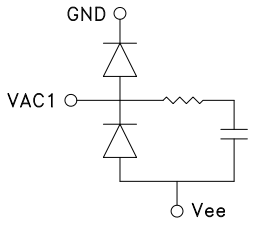
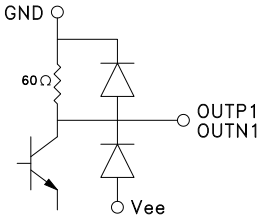
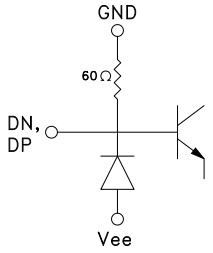
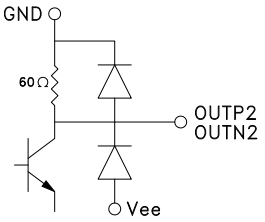
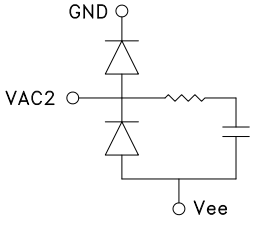

NOTES:
1. PACKAGE BODY MATERIAL: ALUMINA
2. LEAD AND GROUND PADDLE PLATING:
   30-80 MICROINCHES GOLD OVER
   50 MICROINCHES MINIMUM NICKEL.
3. DIMENSIONS ARE IN INCHES [MILLIMETERS].
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm DATUM -C-
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

### Package Information

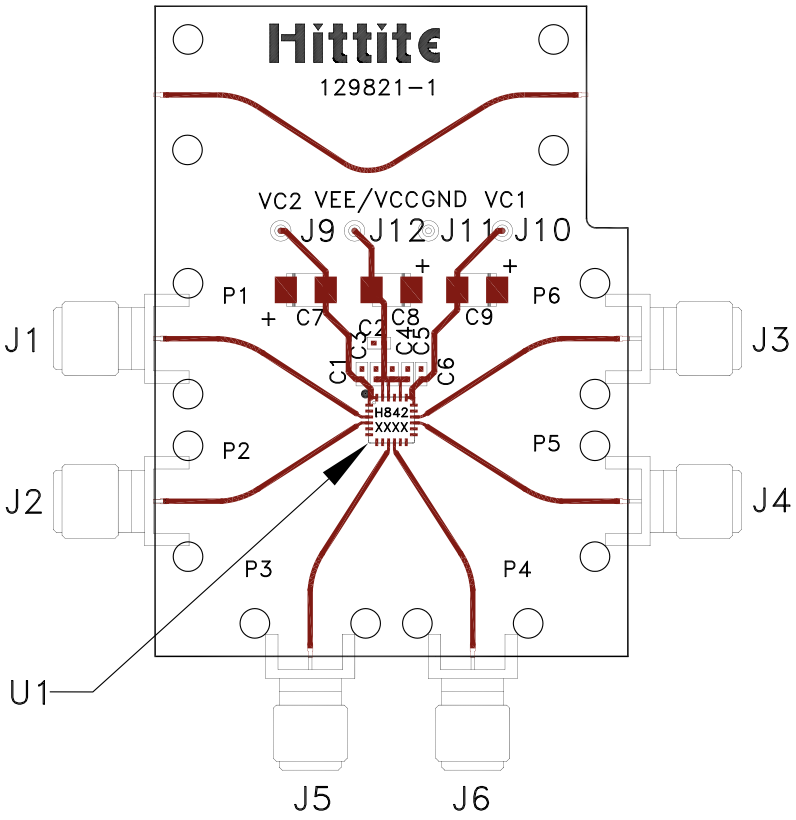
| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [2] |
|---|---|---|---|---|
| HMC842LC4B | Alumina, White | Gold over Nickel | MSL3 [1] | H842<br>XXXX |

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

## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 | VAC1 | Output Amplitude Control Voltage for OUT1<br><br>Note: VAC1=VC2 on evaluation board |  |
| 2, 5, 8, 11, 14, 17, 21 Package Bottom | GND | Signal and supply grounds |  |
| 3, 4 | OUTP1, OUTN1 | Differential (OUTP1-OUTN1)<br>or single ended (OUTP1) outputs |  |
| 6, 7, 12, 13, 19, 24 | N/C | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |
| 9, 10 | DN, DP | Differential (DP-DN) or single ended (DP) inputs |  |
| 15, 16 | OUTN2, OUTP2 | Differential (OUTP2-OUTN2)<br>or single ended (OUTP2) outputs |  |
| 18 | VAC2 | Output Amplitude Control Voltage for OUT2<br><br>Note: VAC2=VC1 on evaluation board |  |
| 20, 22, 23 | Vee | Power Supply (-3.3V) | |

## Evaluation PCB




Note: VC1 on evaluation board is VAC2 and VC2 on evaluation board is VAC1

| Item | Description |
|---|---|
| J1 | OUTP1 |
| J2 | OUTN1 |
| J3 | OUTP2 |
| J4 | OUTN2 |
| J5 | DN |
| J6 | DP |
| J9 | VAC1 |
| J10 | VAC2 |
| J11 | GND |
| J12 | Vee |

## List of Materials for Evaluation PCB 129151 [1]

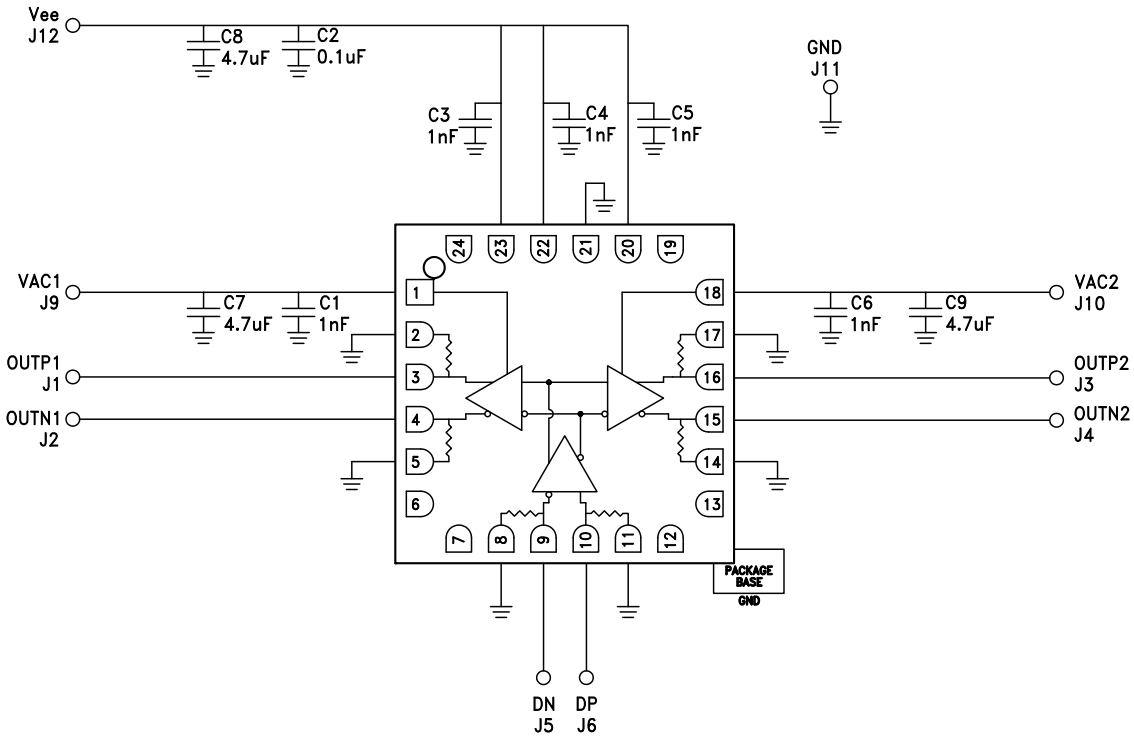
| Item | Description |
|---|---|
| J1 - J6 | K Connector |
| J9 - J12 | DC Pin |
| C1, C3 - C6 | 1000 pF Capacitor, 0402 Pkg. |
| C2 | 0.1 µF Capacitor, 0402 Pkg. |
| C7 - C9 | 4.7 µF Capacitor, Tantalum |
| U1 | HMC842LC4B 1:2 Fanout Buffer |
| PCB [2] | 129821 Evaluation Board |

[1] Reference this number when ordering complete evaluation PCB

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

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 should be connected directly to the ground plane similar to that shown. The exposed metal package base must be connected to Vee. 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.

## Application Circuit




Note: VAC1(J9)=VC2 and VAC2(J10)=VC1 on evaluation board.