EV1HMC8413LP2F Evaluation Board User Guide
UG-1812

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Evaluating the HMC8413 Low Noise Amplifier, 0.01 GHz to 9 GHz

FEATURES

4-layer, Rogers 4350B and Isola 370HR evaluation board
End launch, 3.5 mm RF connectors
Through calibration path (depopulated)

EVALUATION KIT CONTENTS

EV1HMC8413LP2F evaluation board

EQUIPMENT NEEDED

RF signal generator
RF spectrum analyzer
RF network analyzer
5 V, 200 mA power supply

GENERAL DESCRIPTION

The EV1HMC8413LP2F consists of a 4-layer printed circuit board (PCB) fabricated from 10 mil thick, Rogers 4350B and Isola 370HR, copper clad, forming a nominal thickness of 62 mils. The RFIN and RFOUT ports on the EV1HMC8413LP2F are populated with 3.5 mm, female coaxial connectors, and the corresponding RF traces have a 50 Ω characteristic impedance. The EV1HMC8413LP2F is populated with components suitable for use over the entire −40°C to +85°C operating temperature range of the HMC8413. To calibrate board trace losses, a through calibration path is provided between the J1 and J2 connectors. J1 and J2 must be populated with RF connectors to use the through calibration path. Refer to Table 1 and Figure 3 for the through calibration path performance.

Access the EV1HMC8413LP2F ground path and RF_{OUT}/V_{DD} pin through the surface-mount technology (SMT) test point connectors, GND and VDD. A supplementary test point for VBIAS is included for simple access on the R_{BIAS} pin (see Figure 5 for the test point assembly).

The RF traces on the EV1HMC8413LP2F are 50 Ω, grounded, coplanar waveguide. The package ground leads and the exposed pad connect directly to the ground plane. Multiple vias connect the top and bottom ground planes with particular focus on the area directly beneath the ground paddle to provide adequate electrical conduction and thermal conduction to the heat sink.

The power supply decoupling capacitors on the EV1HMC8413LP2F represent the configuration used to characterize and qualify the device. It is possible to reduce the number of capacitors, but this reduction varies from system to system. It is recommended to first remove or combine the largest capacitors that are farthest from the HMC8413 when reducing the number of capacitors.

For full details on the HMC8413, see the HMC8413 data sheet, which must be consulted in conjunction with this user guide when using the EV1HMC8413LP2F.

EVALUATION BOARD PHOTOGRAPHS

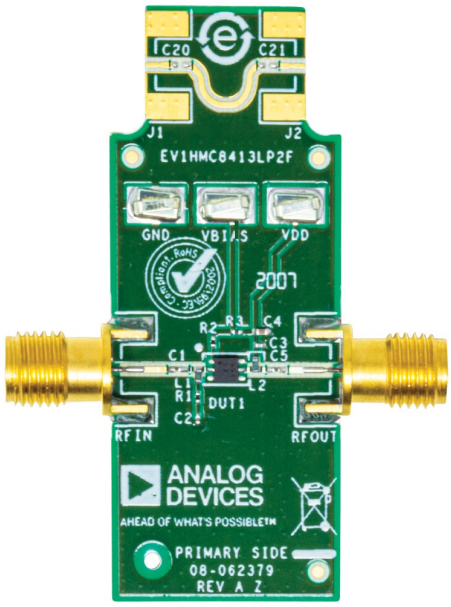

Figure 1. EV1HMC8413LP2F Primary Side

Figure 2. EV1HMC8413LP2F Secondary Side

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REVISION HISTORY

11/2021—Revision 0: Initial Version

OPERATING THE EV1HMC8413LP2F

A 5 V, 200 mA power supply is required to provide the bias to the HMC8413 when using the EV1HMC8413LP2F. Connect the 5 V power supply to the SMT test point, VDD. Connect the ground reference to the GND test point.

Refer to the HMC8413 data sheet for the recommended resistor values to achieve different supply currents.

See the HMC8413 data sheet for the bias sequencing information. The following bias conditions are recommended to achieve optimal performance: V_{DD} = 5 V and supply current (I_{DQ}) = 95 mA.

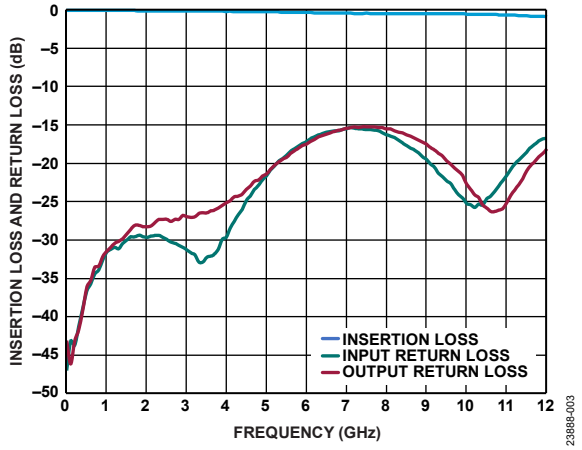

Figure 3. Insertion Loss and Return Loss of the Through Calibration Path, 0 GHz to 12 GHz

Table 1. Insertion Loss of the Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)
0.01	−0.05
0.1	−0.04
0.5	−0.033
1.0	−0.056
2.0	−0.103
3.0	−0.132
4.0	−0.179
5.0	−0.237
6.0	−0.338
7.0	−0.427
8.0	−0.465
9.0	−0.469
10.0	−0.529
11.0	−0.656
12.0	−0.88

EVALUATION BOARD SCHEMATIC AND ARTWORK

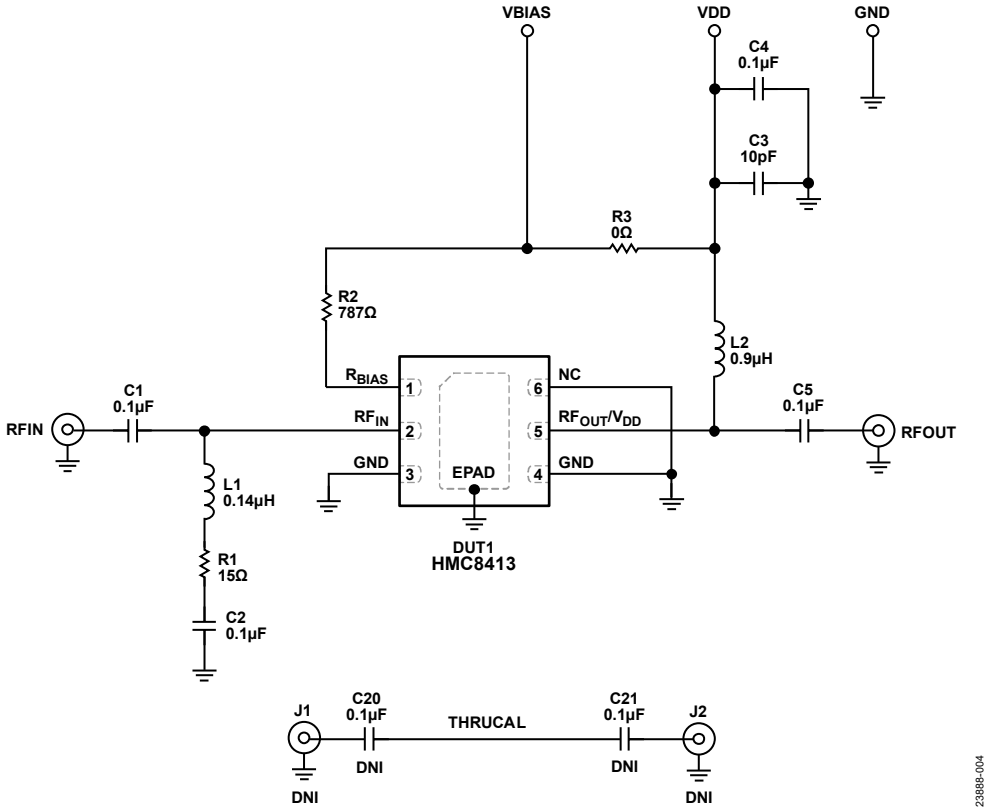

Figure 4. EV1HMC8413LP2F Schematic

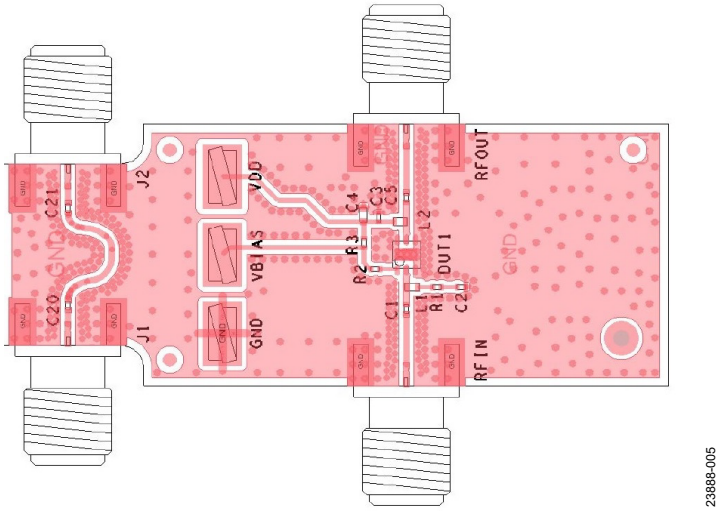

Figure 5. EV1HMC8413LP2F Assembly Drawing (J1 and J2 are Not Installed)

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Reference Designator	Description	Manufacturer	Part Number
C1, C5	Ceramic capacitors, 0201, surface-mount device (SMD), 0.1 µF	American Technical Ceramics	531Z104KTR16T
C2	Ceramic capacitors, 0201, SMD, general-purpose, 0.1 µF	Murata	GRM033R61E104KE14D
C3	Ceramic capacitors, C0G (NP0), 0201, SMD, general-purpose, 10 pF	Murata	GRM0335C1E100JA01D
C4	Ceramic capacitors, X7R, 0402, SMD, soft termination, 0.1 µF	TDK	C1005X7R1H104K050BE
C20, C21	Ceramic capacitors, 0201, SMD, 0.1 µF, do not install (DNI)	American Technical Ceramics	531Z104KTR16T
L1	Chip inductor, 0402, 0.141 Ω dc resistance (DCR), 750 mA, 0.14 µH, 5%	Coilcraft Inc.	0402DF-141XJRU
L2	Chip inductor, 0402, 1.5 Ω DCR, 230 mA, 0.9 µH, 5%	Coilcraft Inc.	0402DF-901XJRW
RFIN, RFOUT	Connectors, 3.5 mm, jack edge	SRI Connector Gage Co.	21-146-1000-01
VDD, GND, VBIAS	Connectors, SMT test points	Keystone Electronics	5016
J1, J2	Connectors, 3.5 mm, jack edge, DNI	SRI Connector Gage Co.	21-146-1000-01
R1	Resistor, 0201, SMD chip jumper, 15 Ω	Panasonic	ERJ-1GEJ150C
R2	Resistor, 0201, SMD chip, 787 Ω, 1%, 1/20 W	Vishay	CRCW0201787RFKED
R3	Resistor, 0201, SMD chip jumper, 0 Ω	Panasonic	ERJ-1GN0R00C
U1	Gallium arsenide (GaAs), pseudomorphic high electron mobility transistor (pHEMT), monolithic microwave integrated circuit (MMIC), 0.01 GHz to 9 GHz, low noise amplifier	Analog Devices, Inc.	HMC8413

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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