EV2HMC788ALP2, HMC788A Evaluation Board with Surface-Mount Wideband Bias Tee User Guide

FEATURES

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

EVALUATION KIT CONTENTS

- EV2HMC788ALP2 evaluation board

EQUIPMENT NEEDED

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

GENERAL DESCRIPTION

The EV2HMC788ALP2 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 and includes a surface mount wideband bias tee circuit. The RFIN and RFOUT ports on the EV2HMC788ALP2 are populated with 3.5 mm, female coaxial connectors, and the corresponding RF traces have a 50 Ω characteristic impedance. The EV2HMC788ALP2 is populated with components suitable for use over the entire −40°C to +85°C operating temperature range of the HMC788A. 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 Figure 3 and Table 1 for the through calibration path performance.

Access the EV2HMC788ALP2 ground path and RF_{OUT}/V_{CC} pin through the surface-mount technology (SMT) test point connectors, GND and VCC (see Figure 11 for the test point assembly).

The RF traces on the EV2HMC788ALP2 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 spreader.

For full details on the HMC788A, see the HMC788A data sheet, which must be consulted in conjunction with this user guide when using the EV2HMC788ALP2.

EVALUATION BOARD PHOTOGRAPHS

Figure 1. EV2HMC788ALP2 Primary Side

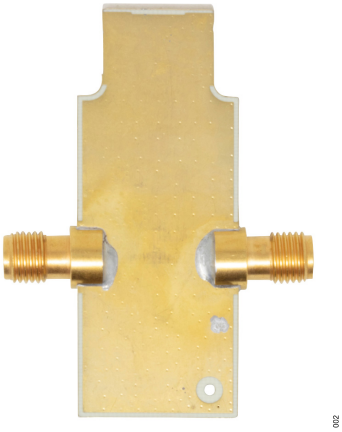

Figure 2. EV2HMC788ALP2 Secondary Side

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REVISION HISTORY

10/2023—Revision 0: Initial Version

OPERATING THE EV2HMC788ALP2

A 5 V, 200 mA power supply is required to provide the bias to the HMC788A when using the EV2HMC788ALP2. Connect the 5 V power supply to the SMT test point labeled VCC. Connect the ground reference to the GND test point.

The following bias conditions are recommended to achieve the performance specified in the HMC788A data sheet: VCC = 5 V, total current (I_{CC}) = 76 mA.

RECOMMENDED BIAS SEQUENCING

During Power-Up

To power up, follow this bias sequence:

1. Set VCC to 5 V.
2. Apply the RF signal.

During Power-Down

To power down, follow this bias sequence:

1. Turn off the RF signal.
2. Set VCC to 0 V.

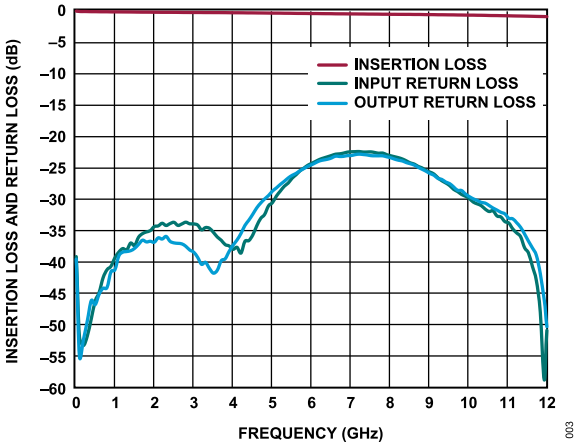

Figure 3. Insertion Loss and Return Loss of the Through Calibration Path, 0 GHz to 12 GHz

Table 1. Insertion Loss of the Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)
0.01	0.049
0.1	−0.014
0.5	−0.036
1.0	−0.073
2.0	−0.14
3.0	−0.188
4.0	−0.236
5.0	−0.292
6.0	−0.358
7.0	−0.425
8.0	−0.486
9.0	−0.54
10	−0.627
11	−0.733
12	−0.872

For the typical response of the EV2HMC788A using the calibration path, see the EV2HMC788ALP2 Typical Response section.

EV2HMC788ALP2 TYPICAL RESPONSE

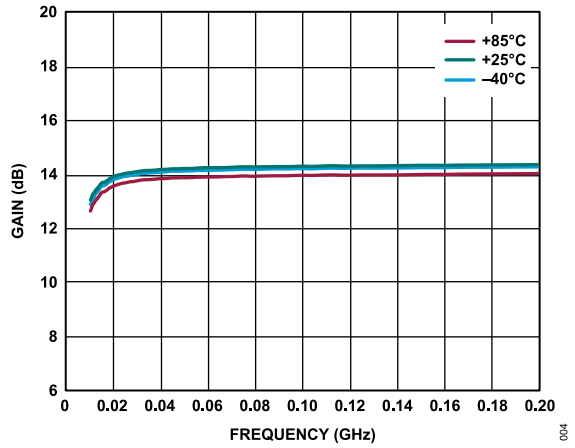

Figure 4. Gain vs. Frequency at Various Temperatures, 0.01 GHz to 2 GHz

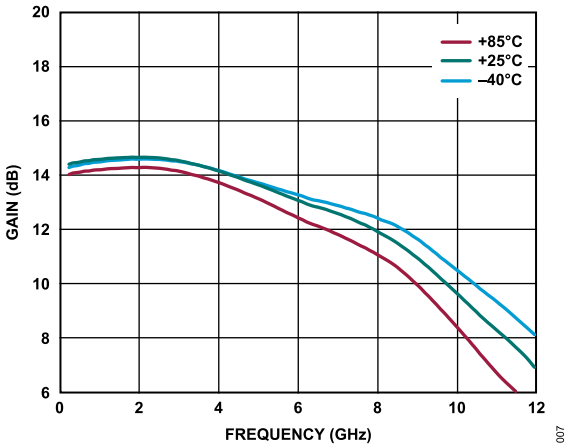

Figure 7. Broadband Gain vs. Frequency at Various Temperatures, 2 GHz to 12 GHz

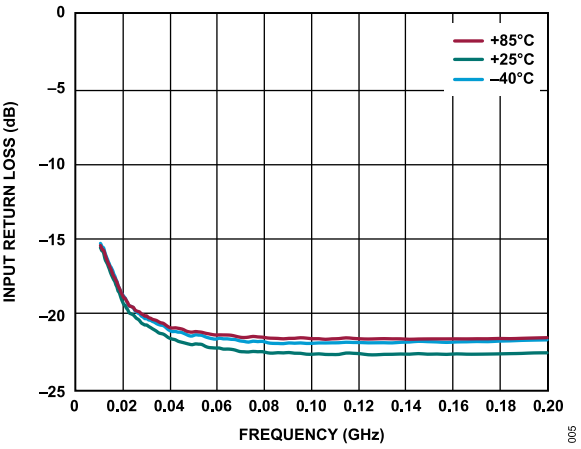

Figure 5. Input Return Loss vs. Frequency at Various Temperatures, 0.01 GHz to 2 GHz

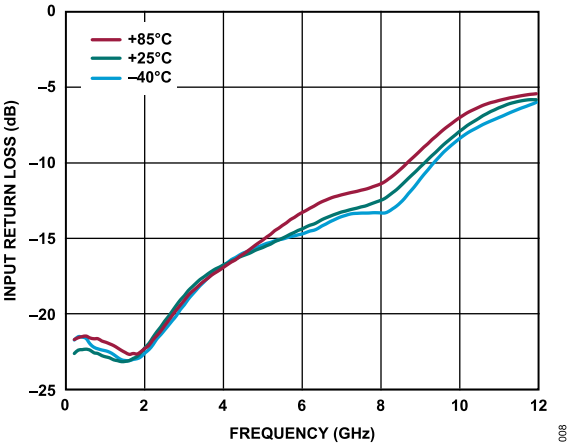

Figure 8. Input Return Loss vs. Frequency at Various Temperatures, 2 GHz to 12 GHz

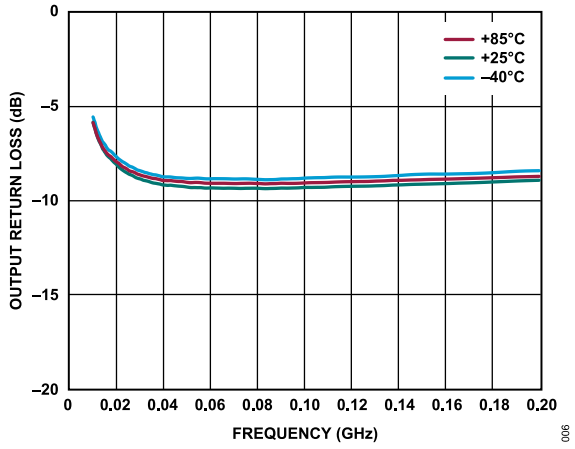

Figure 6. Output Return Loss vs. Frequency at Various Temperatures, 0.01 GHz to 2 GHz

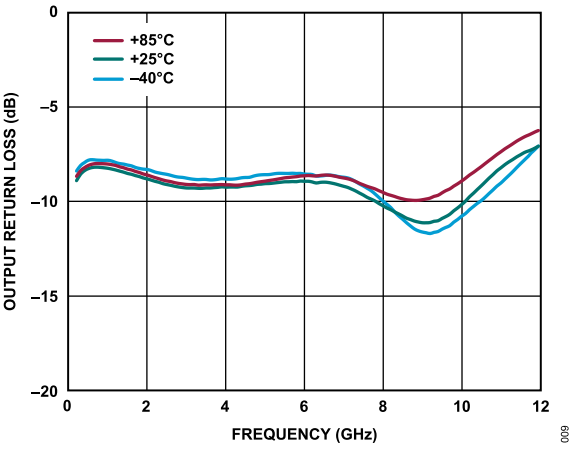

Figure 9. Output Return Loss vs. Frequency at Various Temperatures, 2 GHz to 12 GHz

EVALUATION BOARD SCHEMATIC AND ARTWORK

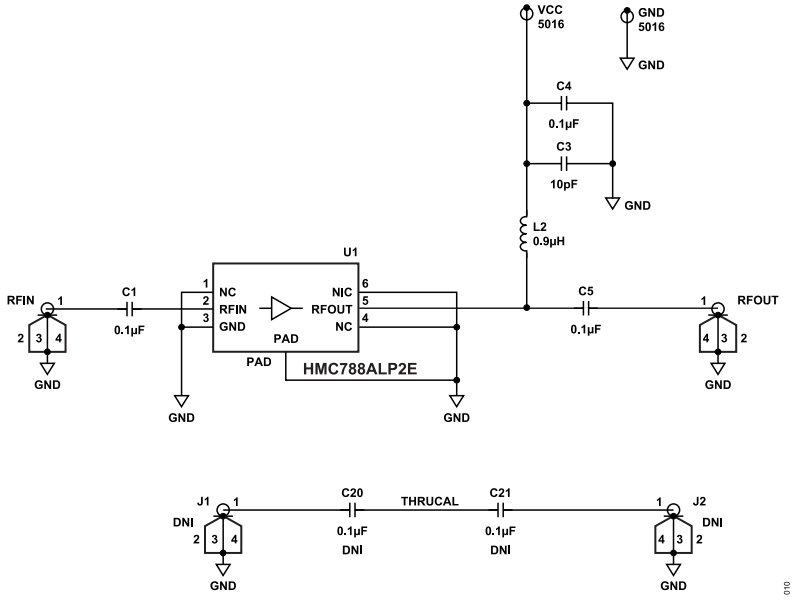

Figure 10. EV2HMC788ALP2 Schematic

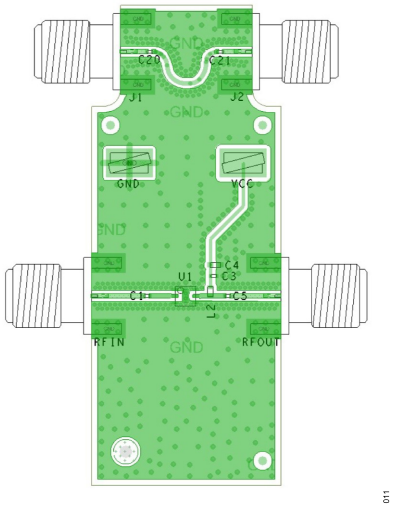

Figure 11. EV2HMC788ALP2 Assembly Drawing (J1 and J2 are Not Installed)

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
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
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
VCC, GND	Connectors, SMT test points	Keystone Electronics	5016
J1, J2	Connectors, 3.5 mm, jack edge, DNI	SRI Connector Gage Co.	21-146-1000-01
U1	Gallium arsenide (GaAs), pseudomorphic high electron mobility transistor (pHEMT), monolithic microwave integrated circuit (MMIC), 0.01 GHz to 10 GHz amplifier	Analog Devices, Inc.	HMC788ALP2E

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.