

Evaluating the ADL8121 GaAs, pHEMT, MMIC, Low Noise Amplifier, 0.025 GHz to 12 GHz

FEATURES

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

EVALUATION KIT CONTENTS

- ADL8121-EVALZ evaluation board

EQUIPMENT NEEDED

- RF signal generator
- RF spectrum analyzer
- RF network analyzer
- 5 V, 300 mA power supply

GENERAL DESCRIPTION

The ADL8121-EVALZ 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 ADL8121-EVALZ are populated with Subminiature A (SMA) female coaxial connectors, and the corresponding RF traces have a $50\ \Omega$ characteristic impedance. The ADL8121-EVALZ is populated with components suitable for use over the entire -40°C to $+85^\circ\text{C}$ operating temperature range of the [ADL8121](#). 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 and capacitors to use the through calibration path. Refer [Figure 3](#) to [Table 1](#) and for the through calibration path performance.

Access the ADL8121-EVALZ ground path and RFOUT/VDD 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 RBIAS pin (see [Figure 5](#) for the test point locations).

The RF traces on the ADL8121-EVALZ are $50\ \Omega$, 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 ADL8121-EVALZ represent the configuration used to characterize and qualify the device.

For full details on the ADL8121, see the [ADL8121 data sheet](#), which must be consulted in conjunction with this user guide when using the ADL8121-EVALZ.

EVALUATION BOARD PHOTOGRAPHS

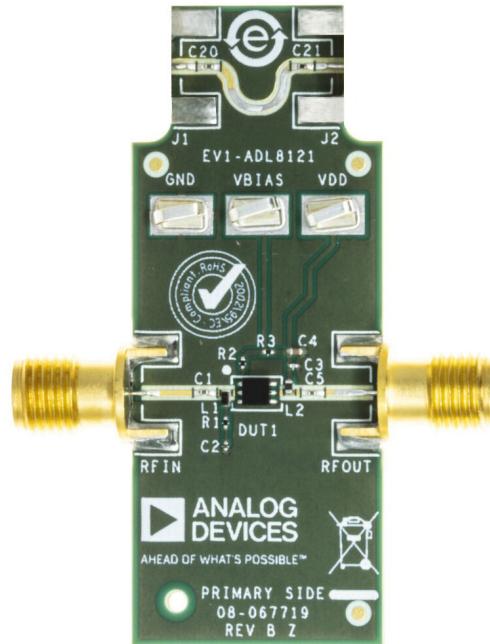


Figure 1. ADL8121-EVALZ Primary Side

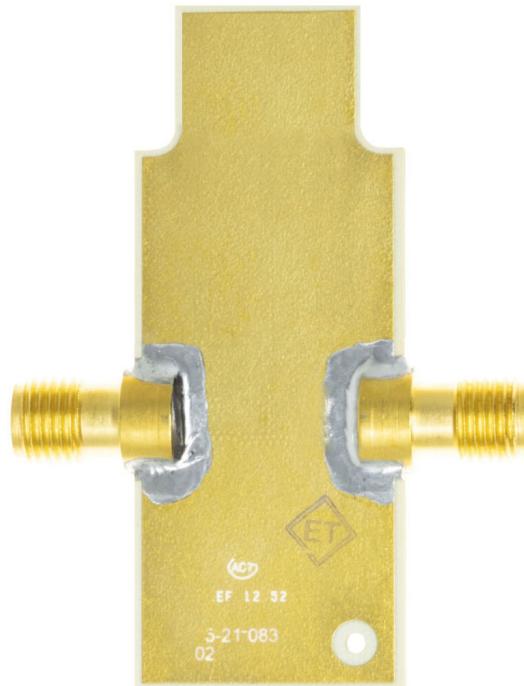


Figure 2. ADL8121-EVALZ Secondary Side

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REVISION HISTORY

4/2022—Revision 0: Initial Version

OPERATING THE ADL8121-EVALZ

A 5 V, 300 mA power supply is required to provide the bias to the [ADL8121](#) when using the ADL8121-EVALZ. Connect the 5 V power supply to the SMT test points, VDD. Connect the ground reference to the GND test point.

Refer to the ADL8121 data sheet for the recommended resistor values to achieve different supply currents. The default value of the external resistor, R2, connected on the ADL8121-EVALZ is 324 Ω , which is the same value used to characterize the ADL8121.

The following bias conditions are recommended to achieve the performance specified in the ADL8121 data sheet: $V_{DD} = 5$ V, supply current ($I_{DQ} = 95$ mA, and bias resistance ($R_{BIAS} = 324 \Omega$.

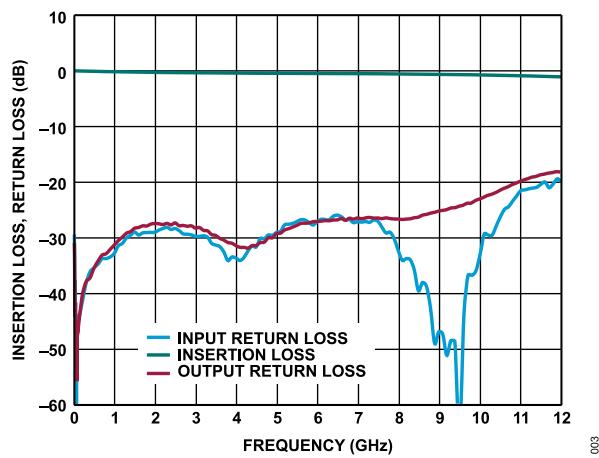


Figure 3. Insertion Loss and Return Loss of the Through Calibration Path

Table 1. Insertion Loss of the Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)	Input Return Loss (dB)	Output Return Loss (dB)
1	-0.14	-32.70	-31.22
2	-0.21	-28.92	-27.37
3	-0.26	-29.65	-28.18
4	-0.29	-33.54	-31.33
5	-0.35	-28.95	-29.17
6	-0.40	-27.05	-27.00
7	-0.45	-27.02	-26.38
8	-0.51	-32.14	-26.57
9	-0.6	-46.85	-25.15
10	-0.72	-32.83	-22.99
11	-0.88	-21.43	-19.82
12	-1.07	-19.83	-18.13

RECOMMENDED BIAS SEQUENCING

During Power-Up

To power up the ADL8121-EVALZ, take the following bias sequencing steps:

1. Connect the VDD power supply
2. Set the VDD supply to 5 V.
3. Apply the RF input signal.

During Power-Down

To power down the ADL8121-EVALZ, take the following bias sequencing steps:

1. Turn off the RF input signal.
2. Set the VDD supply to 0 V.

EVALUATION BOARD SCHEMATIC AND ARTWORK

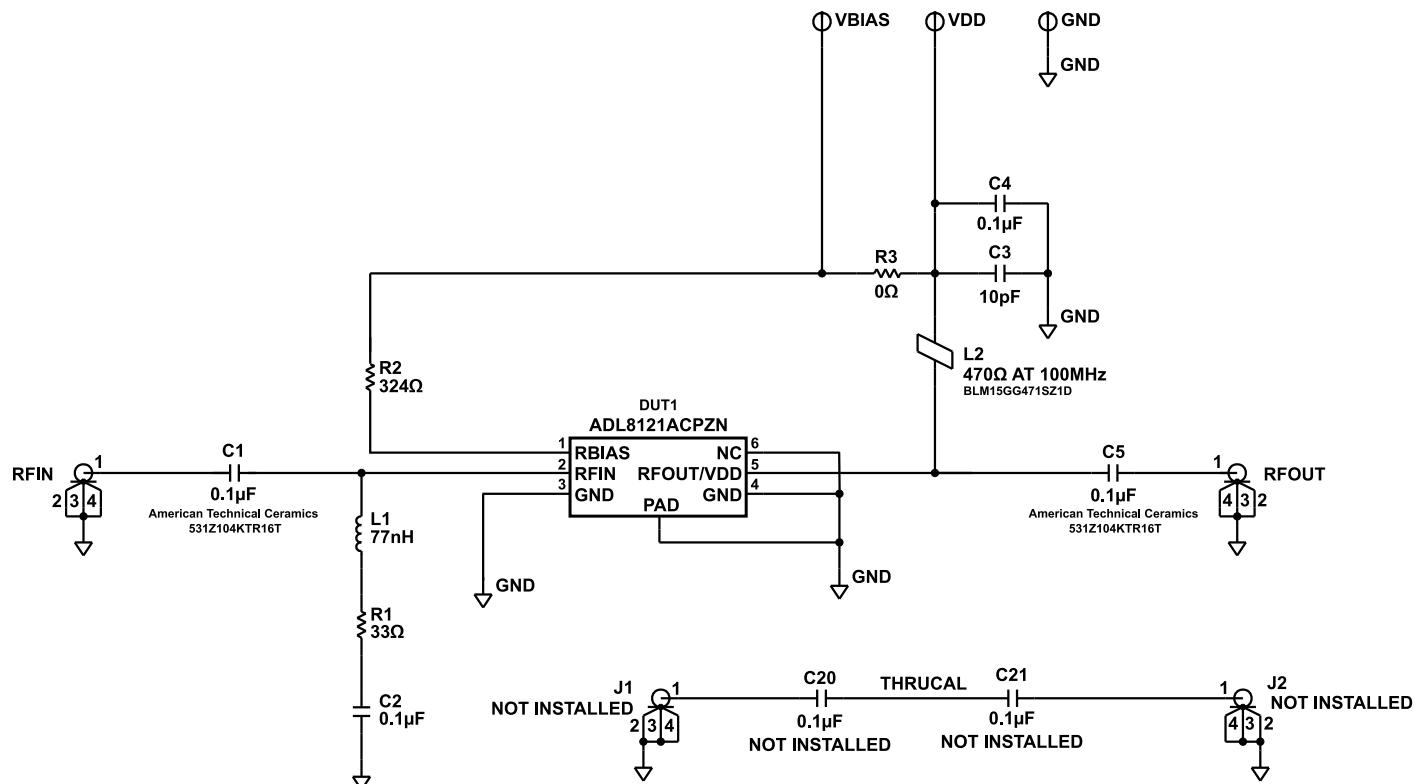


Figure 4. ADL8121-EVALZ Schematic

EVALUATION BOARD SCHEMATIC AND ARTWORK

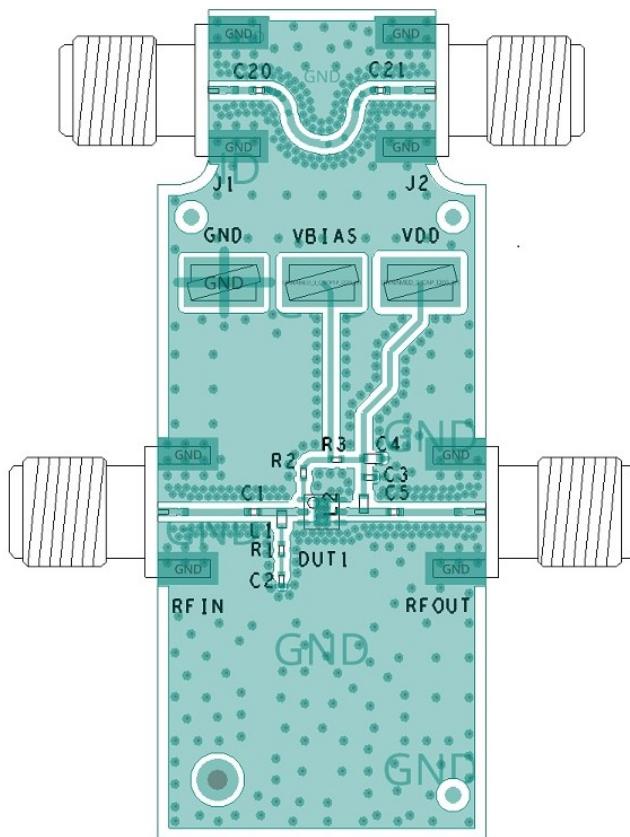


Figure 5. ADL8121-EVALZ Assembly Drawing (J1 and J2 Not Installed)

ORDERING INFORMATION

BILL OF MATERIALS

Table 2. Bill of Materials

Reference Designator	Description	Manufacturer	Part Number
C1, C5	0.1 μ F ceramic capacitors, 16 V, 10%, X5R, 0201	American Technical Ceramics	531Z104KTR16T
C2	0.1 μ F ceramic capacitor, 25 V, 10%, X5R, 0201	Murata	GRM033R61E104KE14D
C3	10 pF ceramic capacitor, 25 V, 5%, C0G, 0201	Murata	GRM0335C1E100JA01D
C4	0.1 μ F ceramic capacitor, 50 V 10%, X7R, 0402	TDK	C1005X7R1H104K050BE
VDD, VBIAS, GND	PCB connectors (CONN-PCB) surface-mount technology (SMT), test points	Keystone Electronics	5016
L1	Inductor, wire wound, 77 nH, 5%, 0402	Coilcraft, Inc.	0402DF-770XJRU
L2	Inductor, ferrite bead, 470 Ω , 25%, 0402	Murata	BLM15GG471SZ1D
R1	33 Ω resistor, SMD, 1%, 1/20 W, 0201	Panasonic	ERJ-1GNF33R0C
R2	324 Ω resistor, SMD, 1%, 1/20 W, 0201	Panasonic	ERJ-1GNF3240C
R3	0 Ω resistor, SMD, jumper, 1/20 W, 0201	Panasonic	ERJ-1GN0R00C
RFIN, RFOUT	CONN-PCB, jack, SMA, 62 mils, BRDTHK	Winchester Interconnect	21-146-1000-01
J1, J2	CONN-PCB, jack, SMA, 62 mils, BRDTHK, not installed	Winchester Interconnect	21-146-1000-01
C20, C21	0.1 μ F ceramic capacitors, 16 V, 10%, X5R, 0201, not installed	American Technical Ceramics	531Z104KTR16T
U1	GaAs, pHEMT, MMIC, low noise amplifier, 0.025 GHz to 12 GHz	Analog Devices, Inc.	ADL8121ACPZN

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[ADL8121-EVALZ](#)