Evaluating the ADL8154 Low Phase Noise Amplifier, 10 MHz to 6 GHz

FEATURES

- 4-layer, Rogers 4350B and Isola 370HR evaluation board
- End launch, 2.92 mm RF connectors
- Through calibration path (depopulated)

EVALUATION KIT CONTENTS

- ADL8154-EVALZ evaluation board

EQUIPMENT NEEDED

- RF signal generator
- RF spectrum analyzer
- RF attenuator: 20 dB, 1 W (optional)
- RF coupler: 20 dB (optional)
- RF power meter and power sensor (optional)
- RF network analyzer
- 5.5 V, 300 mA power supply

GENERAL DESCRIPTION

The ADL8154-EVALZ is a 4-layer printed circuit board (PCB) fabricated from a 10 mil thick (0.25 mm) Rogers 4350B and Isola 370HR copper clad, forming a nominal thickness of 62 mils (1.57 mm). The RFIN and RFOUT ports on the ADL8154-EVALZ are populated with 2.92 mm, female coaxial connectors, and the corresponding RFIN and RFOUT traces have a 50 Ω characteristic impedance. The ADL8154-EVALZ is populated with components suitable for use over the entire −55°C to +125°C operating temperature range of the ADL8154.The ADL8154-EVALZ includes a calibration path (see Figure 6 and Table 3). THRUCAL (J1 and J2) must be populated with RF connectors to use the through calibration path. The calibration path includes two AC coupling capacitors (C11 and C12), which must be populated to mimic the AC coupling capacitors in the main signal path.

Incorporated on the ADL8154-EVALZ is the LT3045 ultralow noise, ultrahigh power supply rejection ratio (PSRR), linear regulator. This low noise regulator provides a clean power source to bias the ADL8154.

The RFIN and RFOUT traces on the ADL8154-EVALZ 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 pad to provide adequate electrical conduction and thermal conduction.

The power supply decoupling capacitors on the ADL8154-EVALZ represent the configuration used to characterize and qualify the device.

For full details on the ADL8154, see the ADL8154 data sheet, which must be consulted in conjunction with this user guide when using the ADL8154-EVALZ evaluation board.

EVALUATION BOARD PHOTOGRAPHS

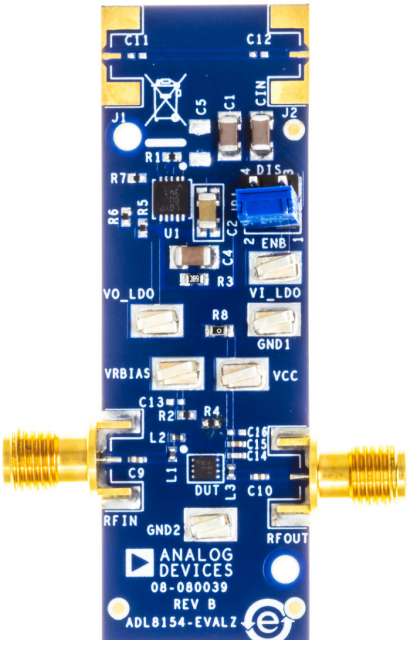

Figure 1. ADL8154-EVALZ Evaluation Board Photograph, Primary Side

Figure 2. ADL8154-EVALZ Evaluation Board Photograph, Secondary Side

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REVISION HISTORY

11/2024—Revision 0: Initial Version

OPERATING THE ADL8154-EVALZ

The ADL8154-EVALZ is equipped with the LT3045 ultralow noise regulator. By default, the ADL8154-EVALZ is configured to use the regulator to power the ADL8154. The regulator is configured to provide 5 V to the ADL8154. To adjust the output voltage (V_{OUT}), change the R3 resistor value (see Table 1). When using the regulator, connect a 5.5 V, 300 mA power supply between the surface-mount technology (SMT) pins, VI_LDO and GND1.

Table 1. R3 Resistor Values vs. Regulator V_{OUT}

R3 (kΩ)	V_{OUT} (V)
40.2	4.0
45.3	4.5
49.9	5.0
55	5.5

To connect a different supply, bypass the regulator by removing R8 and directly power the ADL8154 from an external power supply by connecting a 5.0 V power supply between the SMT terminals, VCC and GND2.

POWER-UP SEQUENCE

The recommended power-up bias sequence follows:

1. Connect a 5.5 V, 300 mA power supply to the SMT test point, VI_LDO.
2. Connect the ground reference to the GND1 test point.
3. Apply RF.

POWER-DOWN SEQUENCE

The recommended power-down bias sequence follows:

1. Turn off the RF.
2. Set the power supply to 0 V.

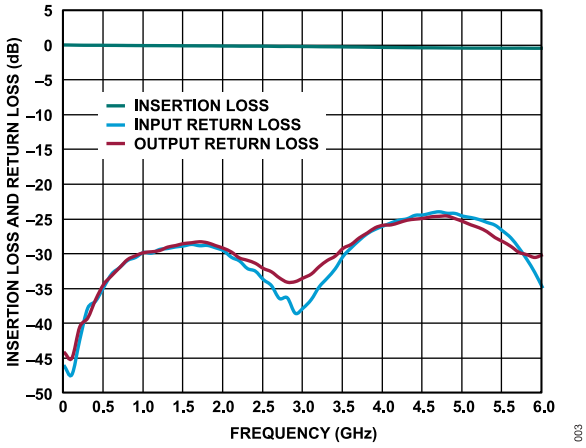

Figure 3. Insertion Loss and Return Loss of the Through Calibration Path

Table 2. Insertion Loss of the Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)
0.01	−0.001
0.21	−0.02
0.4	−0.03
0.6	−0.04
0.8	−0.06
1.0	−0.07
1.3	−0.08
1.5	−0.1
1.8	−0.11
2.0	−0.13
2.4	−0.15
2.7	−0.19
3.0	−0.2
3.3	−0.24
3.6	−0.27
4.0	−0.33
4.5	−0.39
5.0	−0.43
5.5	−0.45
6.0	−0.45

OPERATING THE ADL8154-EVALZ

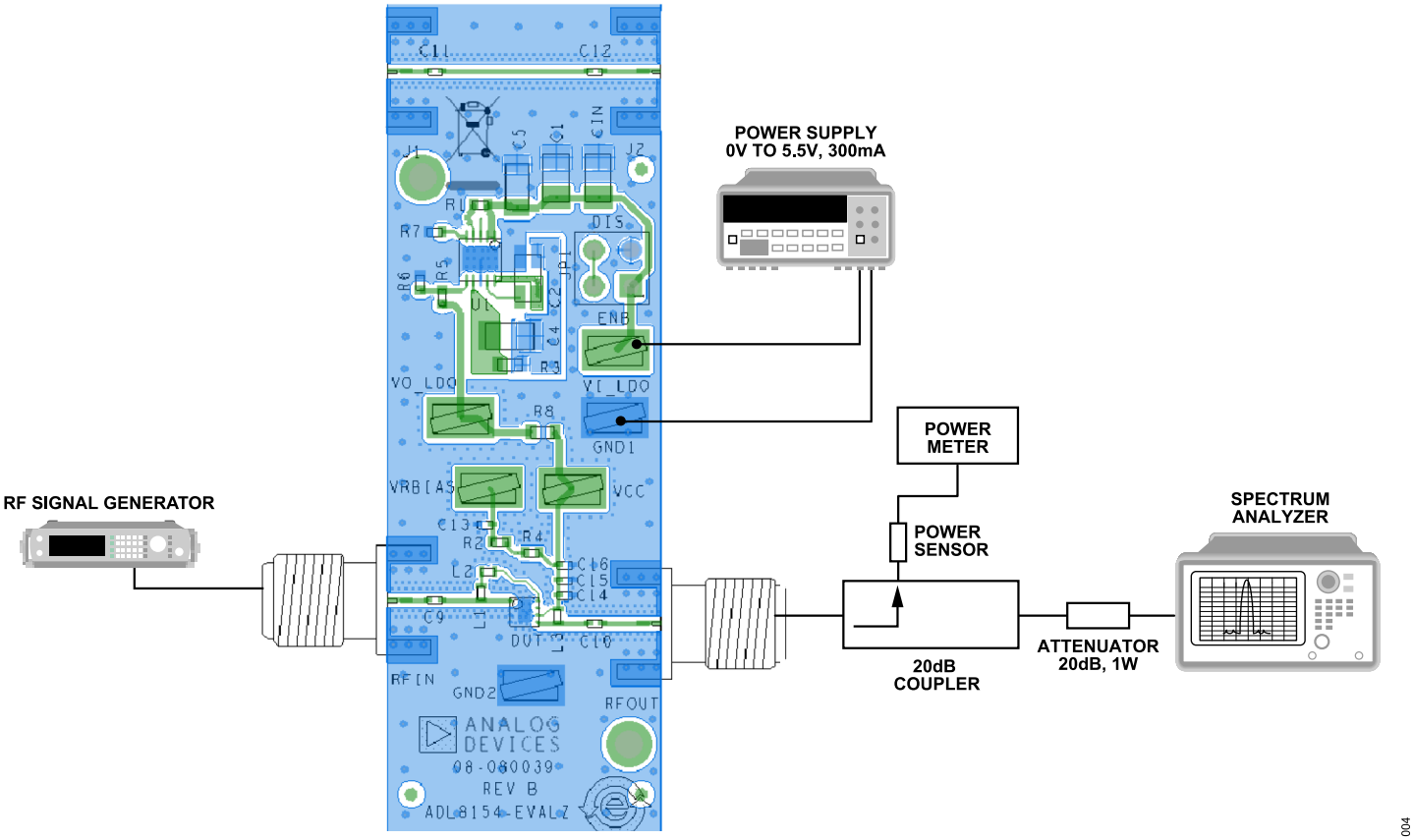

Figure 4. Power Test Equipment Setup

OPERATING THE ADL8154-EVALZ

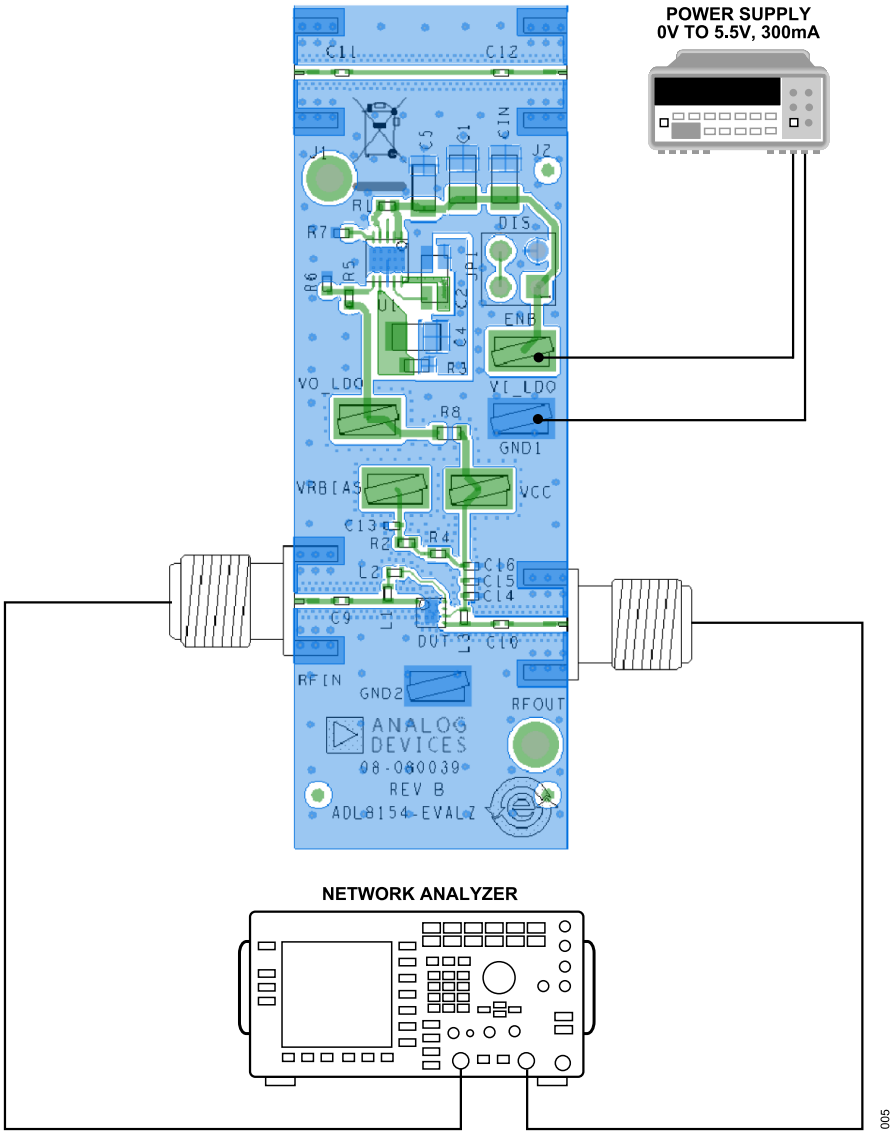

Figure 5. S-Parameter Test Equipment Setup

EVALUATION BOARD SCHEMATIC AND ARTWORK

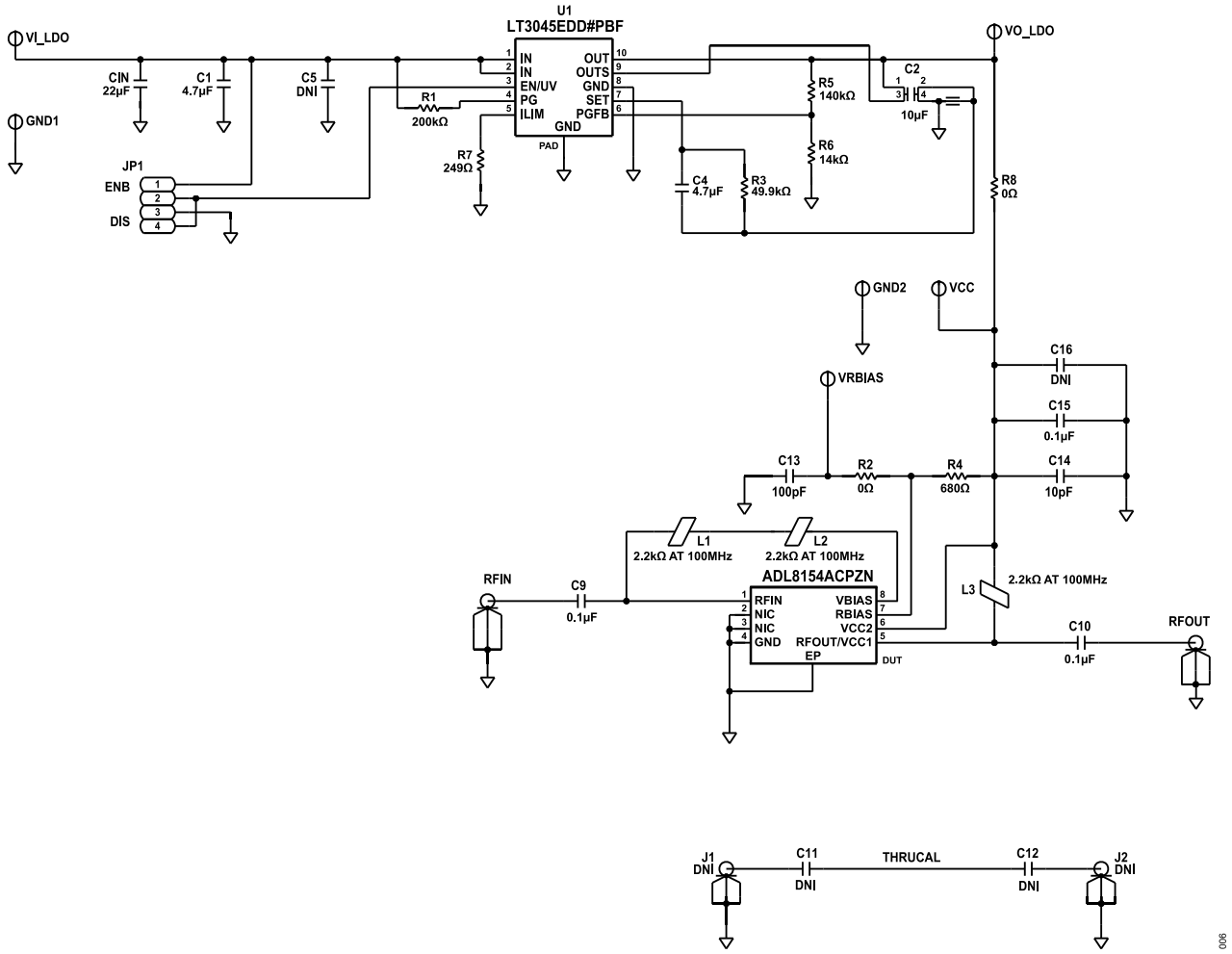

Figure 6. ADL8154-EVALZ Schematic

EVALUATION BOARD SCHEMATIC AND ARTWORK

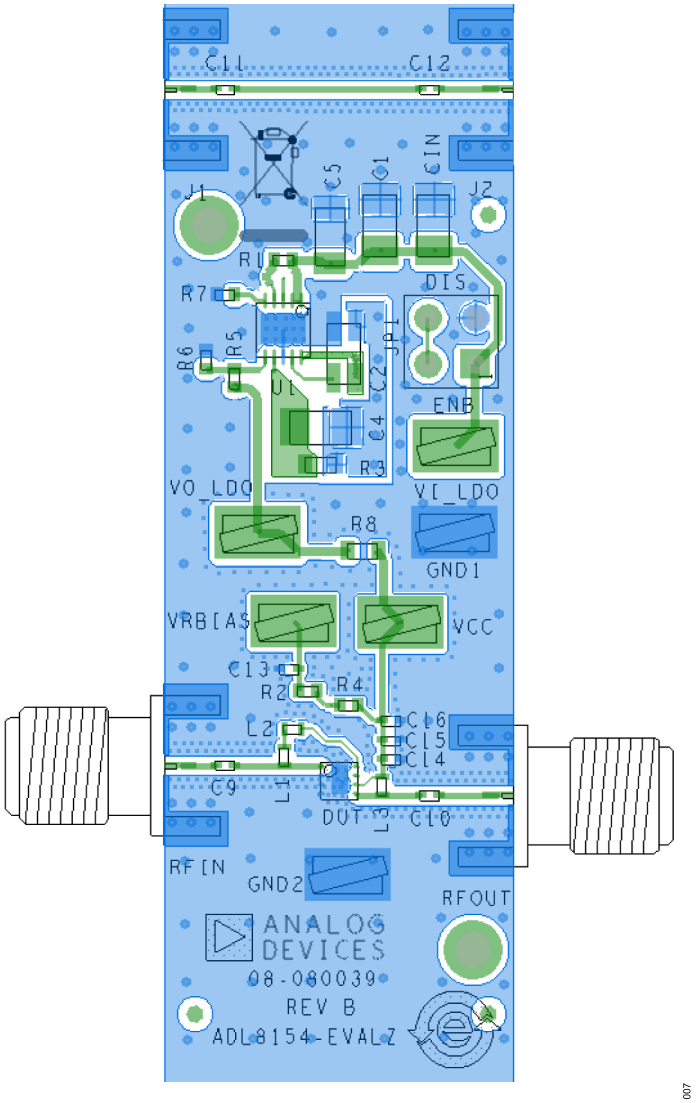

Figure 7. ADL8154-EVALZ Assembly Drawing (J1, J2, C11, and C12 Not Installed)

ORDERING INFORMATION

BILL OF MATERIALS

Table 3. Bill of Materials

Reference Designator	Description	Manufacturer	Part Number
C1, C4	Capacitors, ceramic, 4.7 µF, 25 V, X7R, 1206	Kemet	C1206C475K3RACTU
C2	Capacitor, ceramic, 25 V, 10%, X5R, 1206, split pads	Yageo	CC1206KKX5R8BB106
C9, C10	Capacitors, ceramic, 0.1 µF, 16 V, −20% to +25%, 0402, ultrabroadband	American Technical Ceramics	560L104YTRN
C14	Capacitor, ceramic, 10 pF, 50 V, 2%, C0G, 0402, ultralow equivalent series resistance (ESR)	AVX	04025U100GAT2A
C15	Capacitor, ceramic, 0.1 µF, 50 V, 10%, X7R, 0402, soft termination	TDK	C1005X7R1H104K050BE
CIN	Capacitor, ceramic, 22 µF, 35 V, 20%, X5R, 1206, low ESR	TDK	C3216X5R1V226M160AC
GND1, GND2, VCC,VI_LDO, V_LDO, VRBIAS	SMTs	Keystone Electronics	5016
JP1	Connector, vertical header, 4-position double row, 2.54 mm pitch	Samtec, Inc.	TSW-102-07-T-D
Not applicable	Mini jumper	Amphenol, FCI	65474-001LF
L1, L2, L3	Ferrite beads, 2.2 kΩ, 25%, 100 MHz, 0.15 A, 0402	TDK	MMZ1005A222ET000
R1	Resistor, 200 kΩ,1%, 1/10 W, 0402, AEC-Q200	Panasonic	ERJ-2RKF2003X
R2	Resistor, 0 Ω, jumper, 1/16 W, 0402	Yageo	RC0402JR-070RL
R3	Resistor, 49.9 kΩ, 1%, 1/10 W, 0603, AEC-Q200	Panasonic	ERJ-3EKF4992V
R4	Resistor, 680 Ω, 1%, 1/10 W, 0402, AEC-Q200	Panasonic	ERJ-2RKF6800X
R5	Resistor, 140 kΩ, 1%, 1/10 W, 0402, AEC-Q200	Panasonic	ERJ-2RKF1403X
R6	Resistor, 14 kΩ, 1%, 1/16 W, 0402, AEC-Q200	Panasonic	ERA-2AEB1402X
R7	Resistor, 249 Ω, 1%, 1/16 W, 0402	Venkel	CR0402-16W-2490FT
R8	Resistor, 0 Ω, jumper, 1/3 W, 0603, AEC-200	VISHAY	CRCW06030000Z0EAHP
RFIN, RFOUT	Connectors, 2.92 mm, jack, printed circuit board (PCB) mount receptacle	Winchester Interconnect	25-146-1000-92
U1	20 V, 500 mA, ultralow noise, ultrahigh power supply rejection ratio (PSRR) linear regulator	Analog Devices, Inc.	LT3045EDD#PBF
DUT	Low phase noise amplifier, 10 MHz to 6 GHz	Analog Devices	ADL8154ACPZN
C5	Ceramic capacitor, do not install (DNI)	Not applicable	Not applicable
C11, C12	Capacitors, ceramic, 0.1 µF, 16 V, −20% to +25%, 0402, utlrabroadband, DNI	American Technical Ceramics	560L104YTRN
C13	Capacitor, ceramic, 100 pF, 25 V, 10%, C0G, 0402	AVX	04023A101KAT2A
C16	Capacitor, ceramic, 1 µF, 25 V, 10%, X5R, 0402, DNI	TDK	C1005X5R1E105K050BC
J1, J2	Connectors, 2.9 mm, jack, PCB mount receptacle, DNI	SRI Connector Gage Co.	25-146-1000-92

ORDERING INFORMATION

NOTES

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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Analog Devices Inc.:

ADL8154-EVALZ