Evaluating the ADTR1107 with 6 GHz to 18 GHz, Front-End IC

FEATURES

- 2-layer Rogers 4350 evaluation board with heat sink
- End launch 2.9 mm RF connectors
- Through calibration path (unpopulated)

EVALUATION KIT CONTENTS

- 2-layer, Rogers 4350, ADTR1107-EVALZ evaluation board with heat sink

EQUIPMENT NEEDED

- RF signal generator
- RF spectrum analyzer
- RF network analyzer
- 5 V, 1 A power supply
- 3.3 V, 500 mA power supply
- 0 V to −2 V, 100 mA power supply
- Dual supply ±3.3 V, 100 mA power supply

GENERAL DESCRIPTION

The ADTR1107-EVALZ evaluation board consists of a two-layer printed circuit board (PCB) fabricated from a 10 mil thick, Rogers 4350B copper clad mounted to an aluminum heat sink. The heat sink assists in providing thermal relief to the device as well as mechanical support to the PCB. Mounting holes on the heat sink allow attachment to larger heat sinks for improved thermal management.

The TX_IN, ANT, RX_OUT, and CPLR_OUT ports are populated by 2.9 mm, female coaxial connectors. The respective RF traces of the ports have a 50 Ω characteristic impedance. The ADTR1107-EVALZ is populated with components suitable for use over the −40°C to +85°C operating temperature range of the ADTR1107. To calibrate board trace losses, a through calibration path is provided. However, to use the through calibration path, users must install and populate the path with RF connectors.

Access to drain, ground, and gate control voltages is through two, 24-pin headers.

RF traces are 50 Ω grounded, coplanar waveguide. Package ground leads and the exposed paddle 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.

For more information about the ADTR1107, refer to the ADTR1107 data sheet. Consult the ADTR1107 data sheet in conjunction with this user guide when using the ADTR1107-EVALZ evaluation board.

ADTR1107-EVALZ PHOTOGRAPHS

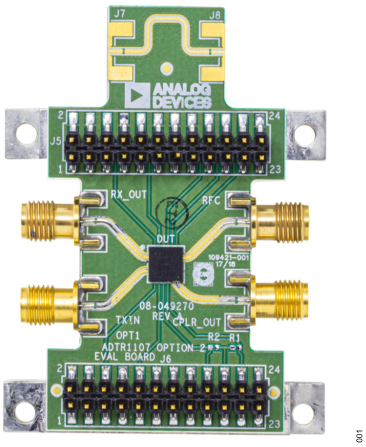

Figure 1. ADTR1107-EVALZ Top Side

Figure 2. ADTR1107-EVALZ Bottom Side

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REVISION HISTORY

11/2022—Rev. 0 to Rev. A

Changed ADTR1107-EVAL to ADTR1107-EVALZ (Throughout) 1
Changes to Operating the ADTR1107-EVALZ Section 3
Changes to Figure 3 4
Changes to Figure 4 and Figure 5 5
Changes to Table 4 6

1/2020—Revision 0: Initial Version

OPERATING THE ADTR1107-EVALZ

A 5 V, 1 A power supply is required to provide the bias to the power amplifier in the transmit path. The 5 V power supply is connected through Pin 10 of the J6 header. Additionally, a 0 V to −2 V, 100 mA power supply is required to provide the required gate control voltage. The gate control voltage is supplied through Pin 6 of the J6 header.

A 3.3 V, 100 mA power supply is required to provide the bias to the low noise amplifier (LNA) in the receive path. The 3.3 V supply is connected to the VDD_LNA pin through Pin 6 of the J5 header. Optionally, the LNA can be operated at a reduced bias current. To accomplish this, apply a voltage between 0 V and −1.5 V to the VGG_LNA pin.

The dual ±3.3 V, 100 mA supply is required to provide the bias to the switch. The 3.3 V supply connects to the VDD_SW pin through Pin 22 of the J5 header. The −3.3 V supply connects to the VSS_SW pin through Pin 18 of the J5 header.

Control the state of the switch by applying the proper logic level to Pin 20 of the J5 header, as defined in the Table 1.

Use the biasing sequences described in the Transmit State Power-Up section, the Transmit State Power-Down section, the Receive State Power-Up section, and the Receive State Power-Down section when powering up and powering down. Refer to Table 2 for the ADTR1107 pin connections through the header connector.

Table 1. Switch Logic Truth Table

	Signal Path State	
Control Input (V_{CTRL}) State	TX_IN to ANT	ANT to RX_OUT
Low	On	Off
High	Off	On

RECOMMENDED BIAS SEQUENCES

Transmit State Power-Up

The recommended bias sequence during the transmit state power-up is as follows:

1. Connect all GND pins to ground.
2. Set the VDD_SW pin to 3.3 V.
3. Set the VSS_SW pin to −3.3 V.
4. Set the CTRL_SW pin to 0 V.
5. Set the VGG_LNA pin to 0 V.
6. Set the VDD_LNA pin to 0 V.
7. Set the VGG_PA pin to −1.75 V.
8. Set the VDD_PA pin to 5 V.
9. Increase the VGG_PA pin voltage to achieve the desired quiescent current (I_{DQ}_PA) of the power amplifier.
10. Apply the RF signal to the TX_IN pin.

Transmit State Power-Down

The recommended transmit state bias sequence during power-down is as follows:

1. Turn off the RF signal.
2. Decrease the VGG_PA pin voltage to −1.75 V.
3. Set the VDD_PA pin to 0 V.
4. Set the VSS_SW to 0 V.
5. Set the VDD_SW to 0 V.

Receive State Power-Up

The recommended bias sequence during the receive state power-up is as follows:

1. Connect all GND pins to ground.
2. Set the VDD_SW pin to 3.3 V.
3. Set the VSS_SW pin to −3.3 V.
4. Set the CTRL_SW pin to 3.3 V.
5. Set the VGG_PA pin to −1.75 V.
6. Set the VDD_PA pin to 0 V.
7. Set the VGG_LNA pin to 0 V.
8. Set the VDD_LNA pin to 3.3 V.
9. Apply the RF signal to the ANT pin.

Receive State Power-Down

The recommended receive state bias sequence during power-down is as follows:

1. Turn off the RF signal.
2. Set the VDD_PA pin to 0 V.
3. Set the VGG_PA pin to 0 V.
4. Set the CTRL_SW pin to 0 V.
5. Set the VSS_SW pin to 0 V.
6. Set the VDD_SW pin to 0 V.

Table 2. J5 and J6 Header Connections to the ADTR1107

Connector	Header	ADTR1107 Pin
J5	1 to 5, 7 to 9, 11 to 17, 19, 21, 23, 24	GND
	6	VDD_LNA
	10	VGG_LNA
	18	VSS_SW
	20	CTRL_SW
	22	VDD_SW
J6	1 to 5, 7 to 9, 11 to 24	GND
	6	VGG_PA
	10	VDD_PA

THROUGH PATH INSERTION LOSS

Figure 3 shows the data plot in Table 3 of the through calibration path (J7 to J8).

OPERATING THE ADTR1107-EVALZ

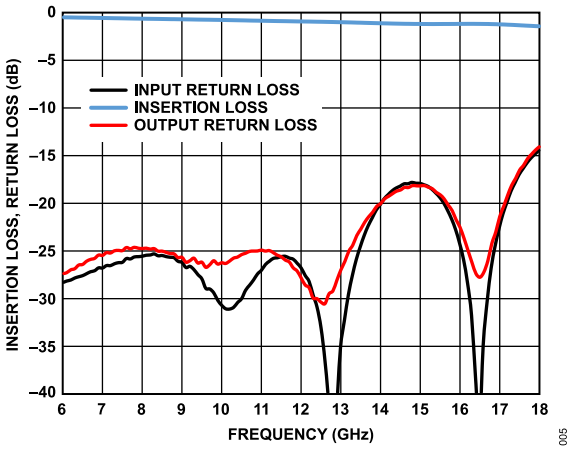

Figure 3. Insertion Loss and Return Loss (Input and Output) of the Through Calibration Path

Table 3. Insertion Loss and Input and Output Return Loss of the Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)
6	−0.5
6.5	−0.5
8	−0.6
8.5	−0.7
10	−0.8
10.5	−0.8
12	−0.9
12.5	−0.9
14	−1.1
14.5	−1.1
16	−1.1
16.5	−1.2
18	−1.4

EVALUATION BOARD SCHEMATIC AND ARTWORK

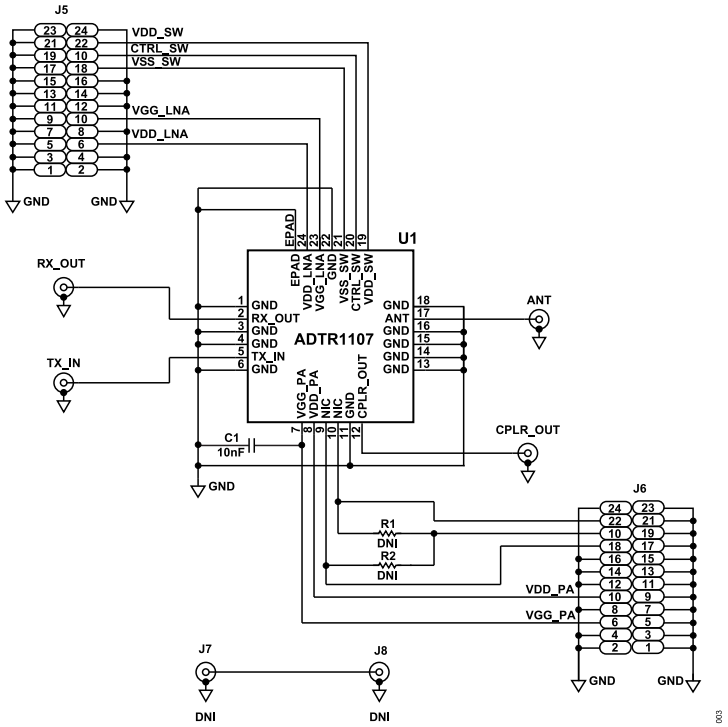

Figure 4. ADTR1107-EVALZ Evaluation Board Schematic

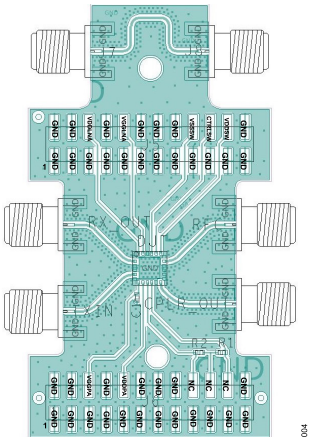

Figure 5. ADTR1107-EVALZ Assembly Drawing (J7, J8, R1, and R2 Not Installed)

ORDERING INFORMATION

BILL OF MATERIALS

Table 4.

Reference Designator	Description	Manufacturer	Part Number
C1	Capacitor, SMT, 0402, X7R, 25 V	TDK	CGA2B2X7R1E103K050BA
TX_IN, RX_OUT, ANT, CLPR_OUT	Connectors, Type K, jack edge	Winchester Connector	25-146-1000-92
J7, J8	Connectors, Type K, jack edge, do not install (DNI)	Winchester Connector	25-146-1000-92
J5 and J6	PCB connector headers, 24-position male headers, unshrouded double row, surface-mount (SMT), 2.54 mm pitch	Samtec, Inc.	TSM-112-01-L-DV
R1 and R2	Thick film resistor chip. DNI	Not applicable	Not applicable
U1	IC, transmit/receive module	Analog Devices, Inc.	ADTR1107ACCZ
Not Applicable	2.51 inch × 1.9 inch heat sink	Not applicable	Not applicable

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.