

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-EVAL 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-EVAL 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-EVAL 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.

ADTR1107-EVAL PHOTOGRAPHS

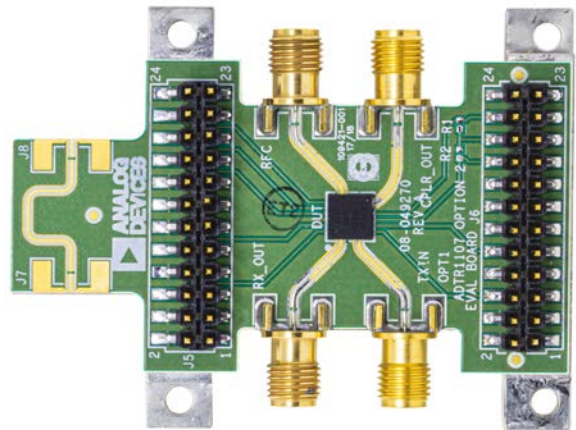


Figure 1. ADTR1107-EVAL Top Side

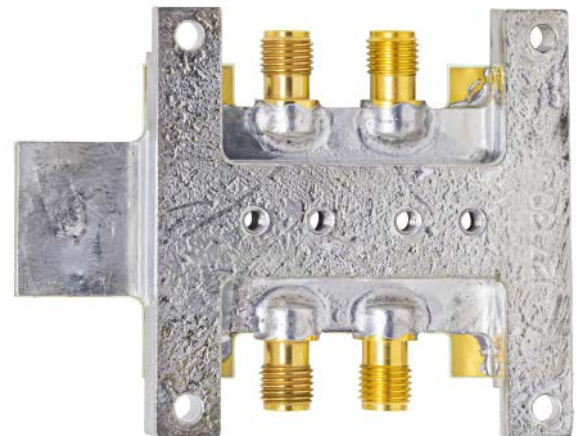


Figure 2. ADTR1107-EVAL Bottom Side

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-EVAL evaluation board.

TABLE OF CONTENTS

| | | | |
|-----------------------------------|---|---|---|
| Features | 1 | Recommended Bias Sequences | 3 |
| Evaluation Kit Contents..... | 1 | Through Path Insertion Loss | 4 |
| Equipment Needed..... | 1 | Evaluation Board Schematic and Artwork..... | 5 |
| General Description | 1 | Ordering Information..... | 6 |
| ADTR1107-EVAL Photographs | 1 | Bill of Materials..... | 6 |
| Revision History | 2 | | |
| Operating the ADTR1107-EVAL | 3 | | |

REVISION HISTORY

1/2020—Revision 0: Initial Version

OPERATING THE ADTR1107-EVAL

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 VGG_LNA pin through Pin 6 of the J5 header.

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

| Control Input (V _{CTRL}) State | Signal Path 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).

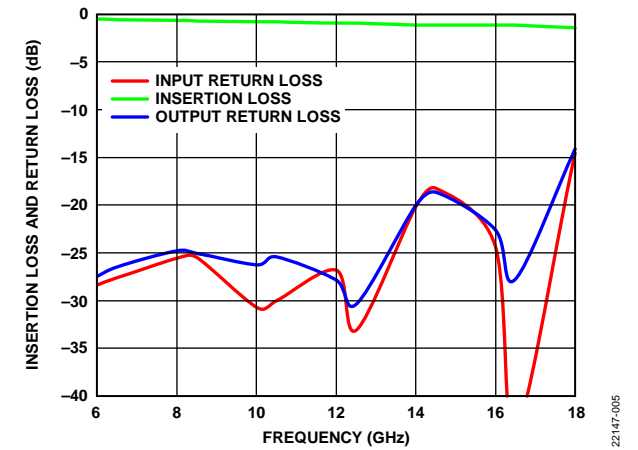


Figure 3. Insertion Loss and Return Loss (Input and Output) of the Through Calibration Path

| 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

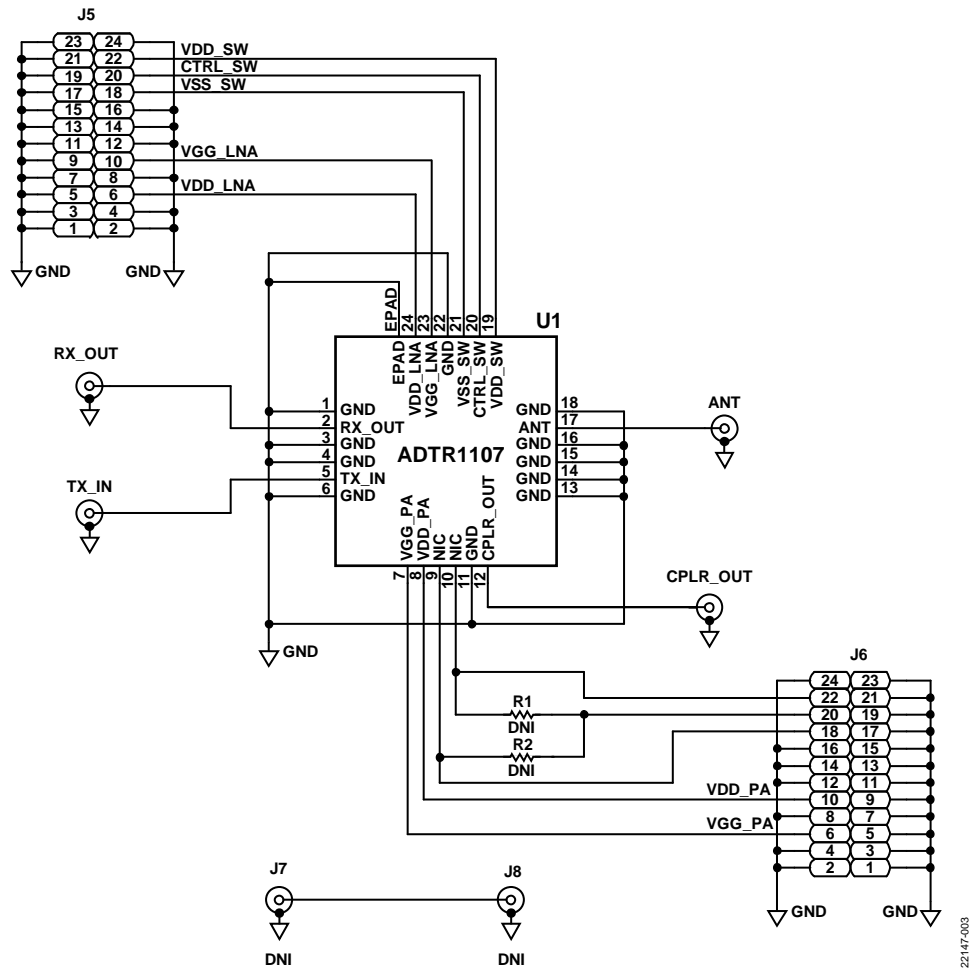


Figure 4. ADTR1107-EVAL Evaluation Board Schematic

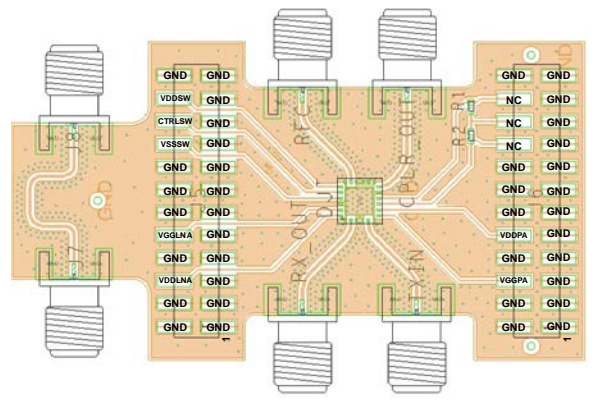


Figure 5. ADTR1107-EVAL Assembly Drawing (J7, J8, R1, and R2 Not Installed)

ORDERING INFORMATION

BILL OF MATERIALS

Table 4.

| Reference Designator | Description | Manufacturer | Part Number |
|------------------------------|--|----------------------|------------------------------|
| 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.

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