

ANALOG DEVICES ADRF5301 Evaluation Board Photograph User Guide

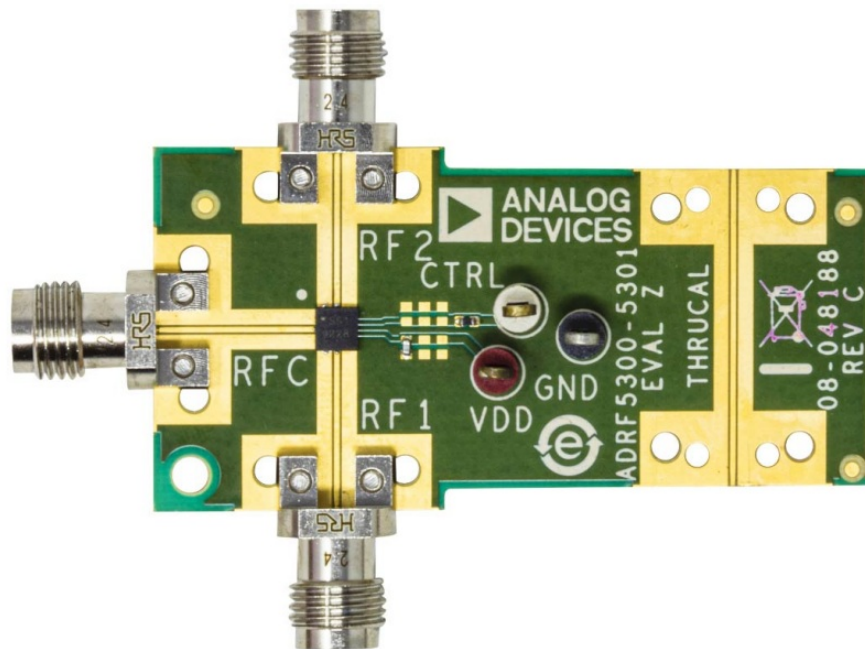
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ANALOG DEVICES ADRF5301 Evaluation Board Photograph



Specifications

- **Product:** EVAL-ADRF5301
- **User Guide:** UG-2061
- **Product Type:** Evaluation Board
- **Product Model:** ADRF5301-EVALZ
- **Product Description:** Silicon SPDT Switch, Reflective, 37 GHz to 49 GHz

Features

- Full-featured evaluation board for the ADRF5301
- Simple connection to test equipment
- On-board through line for calibration

Equipment Needed

- DC power supply
- Network and spectrum analyzer

General Description

- The ADRF5301-EVALZ is an evaluation board designed to evaluate the features and performance of the ADRF5301 silicon, SPDT, and reflective switch.
- The switch has a frequency range of 37 GHz to 49 GHz. The evaluation board is populated with a 2.4 mm connector.
- Please refer to the ADRF5301 data sheet in conjunction with this user guide when using the ADRF5301-EVALZ.

Evaluation Board Photograph

- Figure 1. Evaluation Board Photograph (not provided)

Evaluation Board Hardware Overview

- The ADRF5301-EVALZ is a connectorized evaluation board assembled with the ADRF5301 device and application circuitry. All components are located on the primary side of the ADRF5301-EVALZ.

Board Layout

- The ADRF5301-EVALZ is designed using RF circuit design techniques on a 4-layer printed circuit board (PCB). The PCB stack-up is shown in Figure 2 (not provided).

RF Inputs and Outputs

- The RF input and output ports (RFC, RF1, and RF2) are connected through 50Ω transmission lines to the 2.4 mm RF connectors, as shown in Table 1.
- These high-frequency RF connectors are installed onto the ADRF5301-EVALZ by contact and are not soldered onto the board.

2.4mm Connectors	Description
RFC	RF Common Port
RF1	RF Throw Port 1
RF2	RF Throw Port 2
THRU1	Through Line Input and Output
THRU2	Through Line Input and Output

- A through line (THRUCAL) is provided for calibration and connects the unpopulated RF connectors.
- This transmission line is the trace loss from the ADRF5301-EVALZ and is used to determine the device performance at the pins of the IC.

FAQ

Q: What is the frequency range of the ADRF5301?

- **A:** The ADRF5301 has a frequency range of 37 GHz to 49 GHz.

Q: How is the ADRF5301-EVALZ powered?

- **A:** The ADRF5301-EVALZ is powered by a DC power supply.

Q: What test equipment is required for using the ADRF5301-EVALZ?

- **A:** The ADRF5301-EVALZ requires a network and spectrum analyzer.

FEATURES

- Full-featured evaluation board for the ADRF5301
- Simple connection to test equipment
- On-board through line for calibration

EQUIPMENT NEEDED

- DC power supply
- Network and spectrum analyzer

GENERAL DESCRIPTION

- The ADRF5301-EVALZ is designed to evaluate the features and performance of the ADRF5301 silicon, SPDT, reflective switch, which has a frequency range of 37 GHz to 49 GHz. The ADRF5301-EVALZ (see Figure 1) is populated with a 2.4 mm connector.
- For full details, see the ADRF5301 data sheet, which must be consulted in conjunction with this user guide when using the ADRF5301-EVALZ.

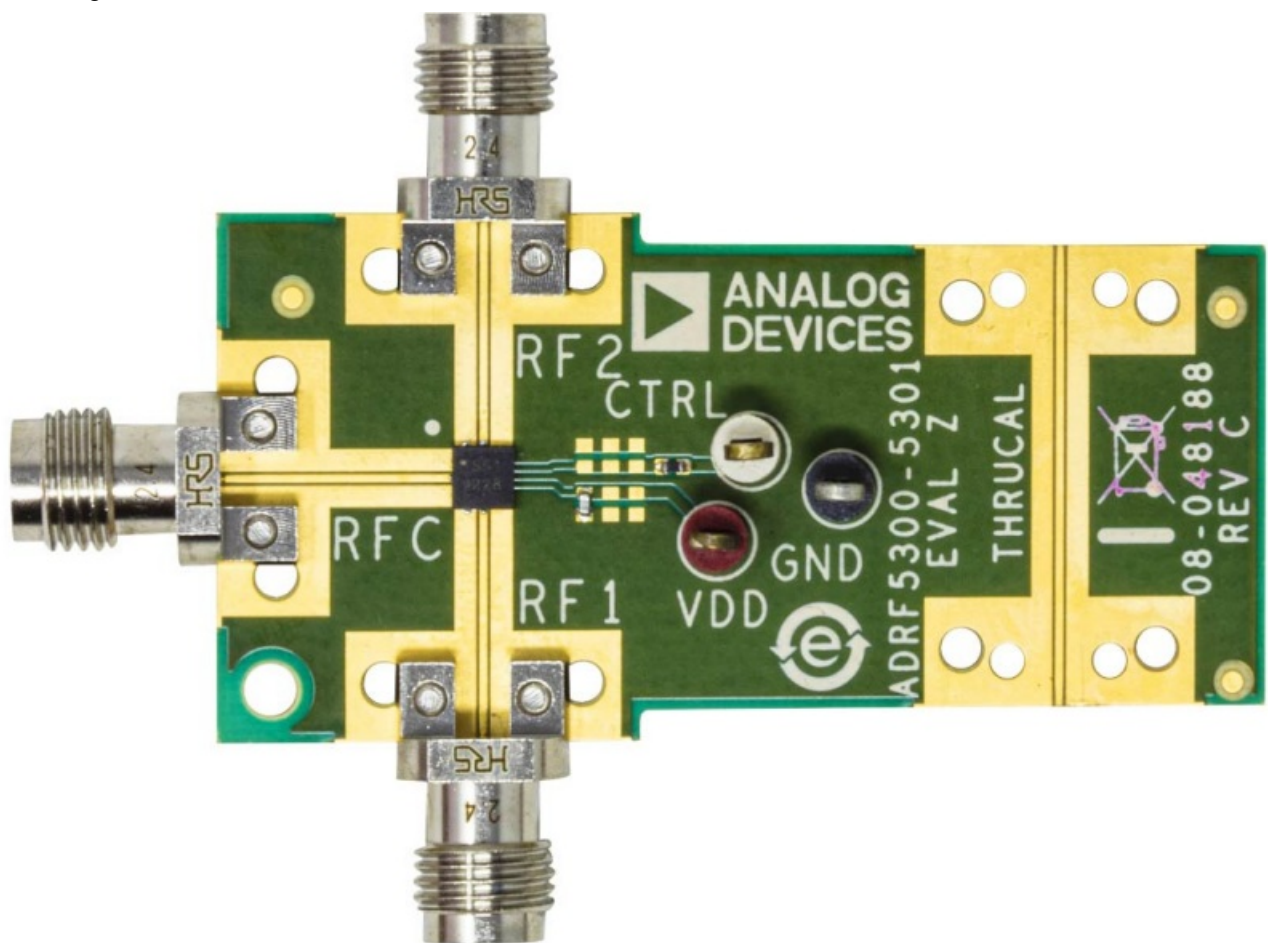


Figure 1. Evaluation Board Photograph

EVALUATION BOARD HARDWARE OVERVIEW

- The ADRF5301-EVALZ is a connectorized evaluation board assembled with the ADRF5301 device and application circuitry.
- All components are located on the primary side of the ADRF5301-EVALZ. Figure 5 shows the ADRF5301-EVALZ schematic, and Figure 6 shows the assembly drawing.
- Table 4 shows the bill of materials for the ADRF5301-EVALZ components.

BOARD LAYOUT

- The ADRF5301-EVALZ is designed using RF circuit design techniques on a 4-layer printed circuit board (PCB). The PCB stack-up is shown in Figure 2.

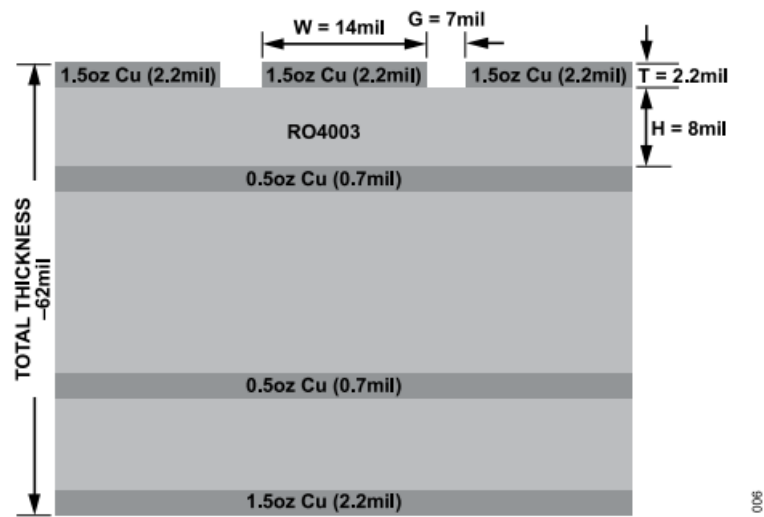


Figure 2. Evaluation Board Stack-Up

- The outer copper layers are 1.5 oz (2.2 mil) thick and the inner layers are 0.5 oz (0.7 mil) thick.
- All RF and DC traces are routed on the top copper layer, whereas the inner and bottom layers are grounded planes that provide a solid ground for the RF transmission lines.
- The top dielectric material is 8 mil Rogers RO4003, offering optimal high-frequency performance. The middle and bottom dielectric materials provide mechanical strength.
- The total board thickness is 62 mil, which allows 2.4 mm RF edge launch connectors to be placed at the board edges.
- The RF transmission lines are designed using a coplanar wave-guide (CPWG) model with a width of 14 mils and ground spacing of 7 mils to have a characteristic impedance of 50 Ω.
- Ground via fences is arranged on both sides of a coplanar waveguide to improve isolation between nearby RF lines and other signal lines.

RF INPUTS AND OUTPUTS

- The RF input and output ports (RFC, RF1, and RF2) are connected through 50 Ω transmission lines to the 2.4 mm RF connectors, as shown in Table 1.
- These high-frequency RF connectors are installed onto the ADRF5301-EVALZ by contact and are not soldered onto the board.

Table 1. RF Inputs and Outputs

2.4mm Connectors/Description

RFC	RF Common Port
RF1	RF Throw Port 1
RF2	RF Throw Port 2
THRU1	Through Line Input and Output
THRU2	Through Line Input and Output

- A through line (THRU1) is provided for calibration and connects the unpopulated RF connectors.
- This transmission line is the trace loss from the ADRF5301-EVALZ and is used to determine the device performance at the pins of the IC.

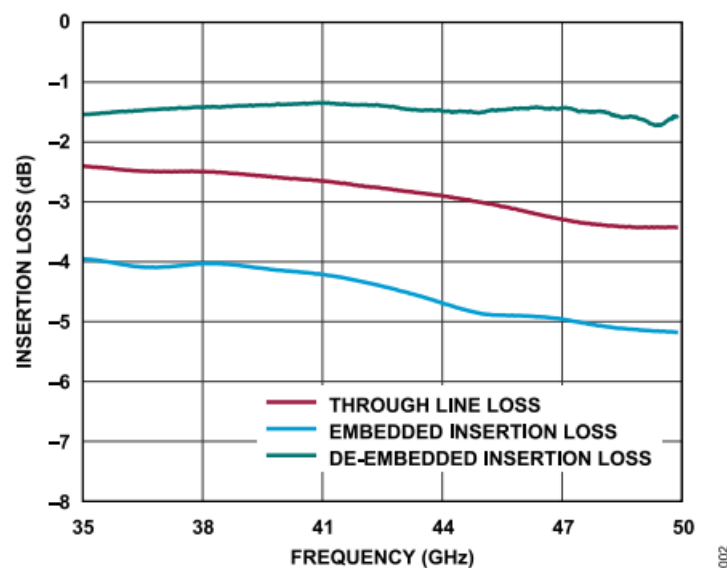


Figure 3. Insertion Loss vs. Frequency

EVALUATION BOARD HARDWARE POWER SUPPLY AND CONTROL INPUTS

- Because the ADRF5301 incorporates a negative voltage generator (NVG) to operate with a single positive supply of 3.3 V applied to the VDD pin, only one power supply is needed to power up the ADRF5301-EVALZ.
- The control input is connected to the CTRL test point, and the ground reference is connected to the GND test point.
- On the supplied trace, a 100 pF bypass capacitor filters the high-frequency noise. Additionally, unpopulated component positions are available for applying extra bypass capacitors.
- On the control trace, there are provisions for an RC filter to eliminate DC-coupled noise, if required by the application.

Table 2. Power Supply and Control Inputs

Test Points Description

- **VDD** Supply Voltage

- **CTRL** Control Voltage
- **GND** Ground

TEST PROCEDURE

- The ADRF5301-EVALZ is shipped assembled and tested. Figure 4 shows a basic setup diagram to measure the scattering parameters response of the ADRF5301.
- To complete the test setup and verify the operation of the ADRF5301-EVALZ, perform the following steps:
 1. Connect the GND test point to the ground terminal of the two 3.3 V DC power supplies.
 2. Connect the VDD test point to the voltage-output terminal of the 3.3 V DC power supply.
 3. Connect the CTRL test point to the voltage-output terminal or ground terminal of the other 3.3 V DC power supply. The ADRF5301 can be configured in different modes by connecting the CTRL test point to 3.3 V or 0 V, as shown in Table 3.
 4. Connect the RFC, RF1, and RF2 ports to a calibrated network analyzer.
 5. Turn on the 3.3 V DC power supply connected to the VDD test point.
 6. Turn on the 3.3 V DC power supply connected to the CTRL test point.
 7. Measure the scattering parameters.

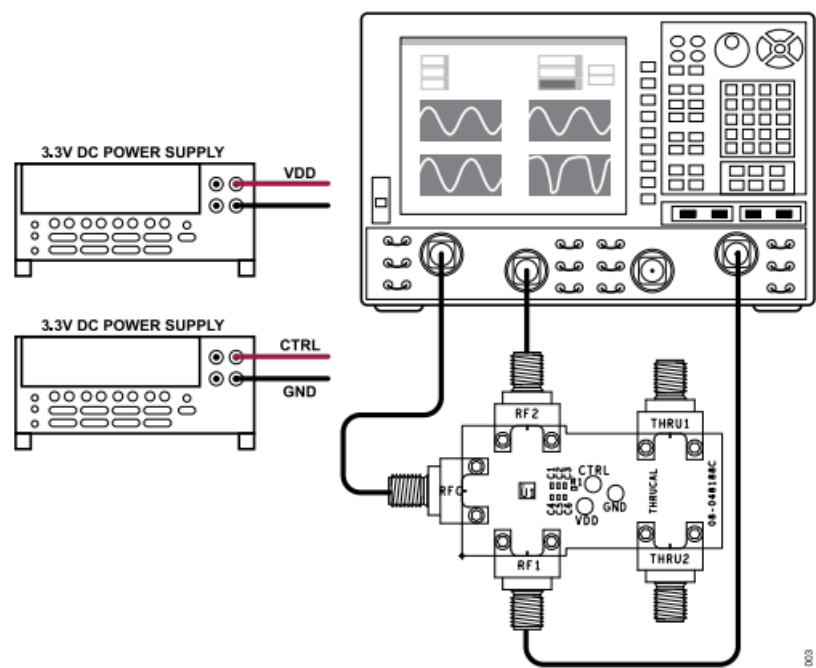


Figure 4. Scattering Parameter Test Setup Diagram for the ADRF5301-EVALZ

Table 3. Control Voltage		Truth Table	
Digital Control Input		RF Paths	
CTRL		RF1 to RFC	RF2 to RFC
High Low		Insertion loss (on) Isolation (off)	Isolation (off) Insertion loss (on)

EVALUATION BOARD SCHEMATIC AND ASSEMBLY DIAGRAM

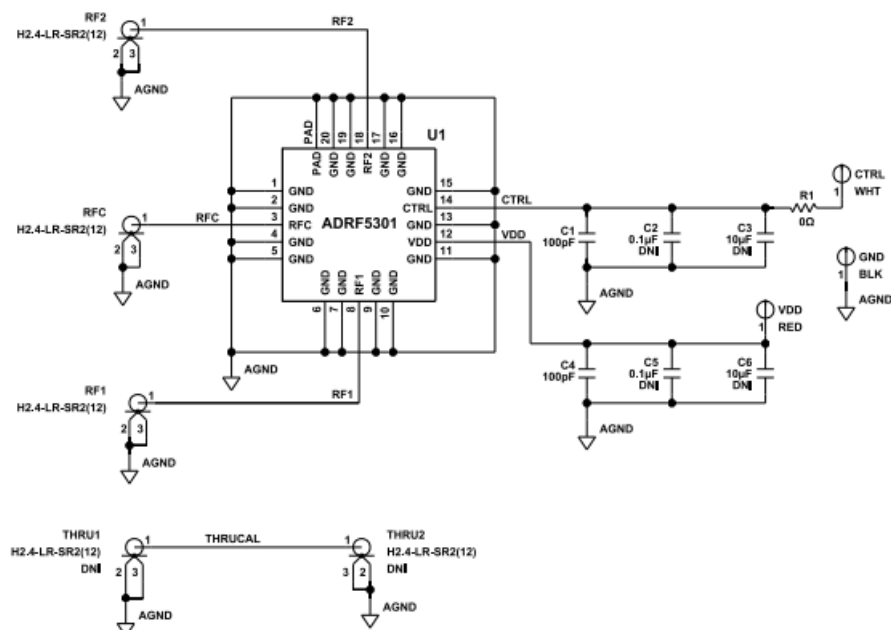


Figure 5. ADRF5301-EVALZ Schematic

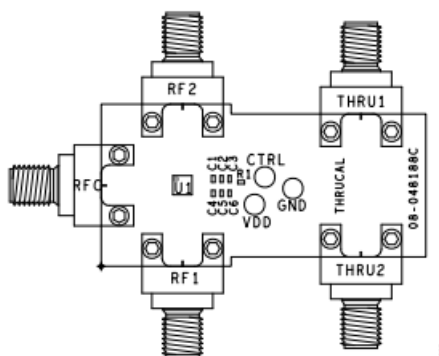


Figure 6. ADRF5301-EVALZ Assembly Diagram

ORDERING INFORMATION

BILL OF MATERIALS Table 4. Evaluation Board Components

Qty	Reference Designator	Description
Manufacturer	Part Number	
1	U1	74VHC04
1	U2	74VHC04
1	U3	74VHC04
1	U4	74VHC04
1	U5	74VHC04
1	U6	74VHC04
1	U7	74VHC04
1	U8	74VHC04
1	U9	74VHC04
1	U10	74VHC04
1	U11	74VHC04
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1	U96	74VHC04
1	U97	74VHC04
1	U98	74VHC04
1	U99	74VHC04
1	U100	74VHC04

2	C1, C4	Capacitors, 100 pF, 50 V, C0402 package	TDK	C1005NP01H101J050BA
			American Technical	
2	C2, C5	Capacitors, 0.1 μ F, 10 V, C0402 package, do not install (DNI)	Ceramics	545L104KT10C
2	C3, C6	Capacitors, 10 μ F, 4 V, C0402 package, DNI	Murata	GRM155R60G106ME44D
3	RFC, RF1, RF2	2.4 mm coaxial for frequency test measurements, 50 Ω , 50 GHz	Hirose Electric	H2.4-LR-SR2(12)
2	THRU1, THRU2	2.4 mm coaxial for frequency test measurements, 50 Ω , 50 GHz,	Hirose Electric	H2.4-LR-SR2(12)
		DNI		
1	R1	Resistor, 0 Ω , 0402 package	Panasonic	ERJ-2GE0R00X
3	VDD, CTRL, GND	Through-hole mount test points	Components Corp.	TP-104-01-XX
1	U1	Silicon, SPDT switch, reflective, 37 GHz to 49 GHz	Analog Devices, Inc.	ADRF5301
1	PCB	Evaluation PCB	Analog Devices	BR-048188

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.

Legal Terms and Conditions

- By using the evaluation board discussed herein (together with any tools, components documentation, or support materials, the “Evaluation Board”), you are agreeing to be bound by the terms and conditions set forth below (“Agreement”) unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you (“Customer”) and Analog Devices, Inc. (“ADI”), with its principal place of business at Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or

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- Massachusetts and Customer hereby submit to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

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References

- [User Manual](#)