Evaluating the ADPA9005 1GHz to 28GHz, 37.5dBm, GaN Power Amplifier

FEATURES

- 4-layer Rogers 4003C evaluation board with heat spreader
- End launch, 2.92mm RF connectors
- Through calibration path

EVALUATION KIT CONTENTS

- 4-layer Rogers 4003C, ADPA9005-EVALZ evaluation board with heat spreader

EQUIPMENT NEEDED

- RF signal generator
- RF spectrum analyzer
- RF network analyzer
- RF attenuator: ≥20dB, 50W
- RF coupler: 10dB, 1W
- RF power meter and power sensor
- 24V, 2A power supply
- −4V to 0V, 10mA power supply
- 5V, 20mA power supply
- Thermal plate or heatsink

ADPA9005-EVALZ EVALUATION BOARD PHOTOGRAPHS

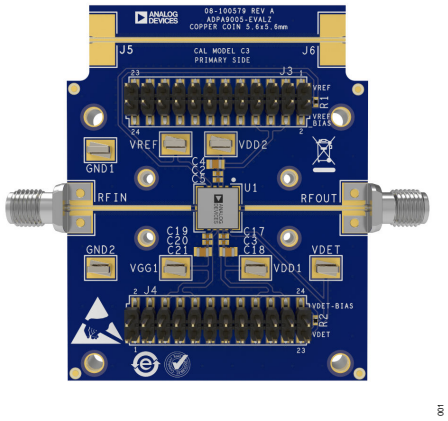


Figure 1. ADPA9005-EVALZ Evaluation Board, Primary Side

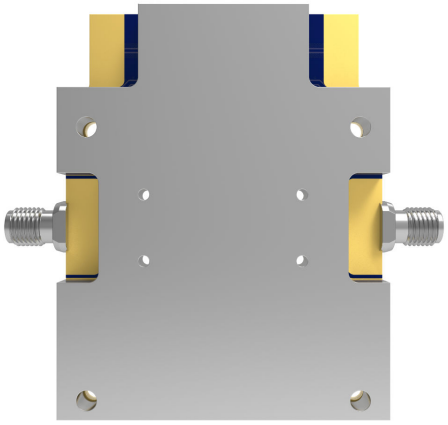


Figure 2. ADPA9005-EVALZ Evaluation Board, Secondary Side

GENERAL DESCRIPTION

The ADPA9005-EVALZ consist of a 4-layer printed circuit board (PCB) fabricated from 8mil thick Rogers 4003C copper clad, forming a nominal thickness of 64 mils, mounted to an aluminum heat spreader. The evaluation board incorporates a copper coin beneath the exposed paddle of the ADPA9005, in addition to the heat spreader, providing enhanced thermal dissipation and mechanical support for the PCB. The mounting holes on the heat spreader allow attachment to larger heatsinks to improve thermal management. The RFIN and RFOUT ports are populated by 2.92mm female coaxial connectors, and their respective RF traces are of 50Ω characteristic impedance. The ADPA9005-EVALZ is populated with components suitable for use over the entire operating temperature range of the ADPA9005.

The RF transmission lines are 50Ω grounded coplanar waveguides. The package ground leads and the exposed pad connect directly to the ground plane. Multiple vias are used to 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 spreader.

The power supply decoupling capacitors shown in Figure 5 represent the configuration used to characterize the device.

For full details on the ADPA9005, see the ADPA9005 data sheet, which must be consulted in conjunction with this user guide when using the ADPA9005-EVALZ evaluation board.

PLEASE SEE THE LAST PAGE FOR AN IMPORTANT WARNING AND LEGAL TERMS AND CONDITIONS.

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REVISION HISTORY

10/2026—Revision 0: Initial Version

OPERATING THE ADPA9005-EVALZ

Figure 3 shows a block diagram of a typical bench setup for operating the ADPA9005-EVALZ. The DC connections required to operate the ADPA9005-EVALZ are shown in Figure 3. The ADPA9005-EVALZ can also be biased through the J3 and J4 header pins (see Table 1).

An on-chip power monitor is provided to allow convenient monitoring of the power present at the output of the ADPA9005. To use this feature, apply 5V to VDET_BIAS and VREF_BIAS and monitor the voltage on the VREF and VDET pins. The temperature compensated voltage proportional to the ADPA9005 output power is (VREF voltage (V_{REF}) − VDET voltage (V_{DET})). User calibration is required when using this feature.

Table 1. J3 and J4 Header Connections to the ADPA9005

Header Pin No.	Mnemonic
J3	
1	VREF
2	VREF_BIAS
3, 5, 7, 9, 10, 11, 12, 13, 14, 15, 17, 19, 21, 22, 23, 24	AGND
4, 6, 8	VDD2
16, 18, 20	Open (do not use)
J4	
1, 2, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15, 16, 17, 19, 21	AGND
6, 8, 10	VGG1
18, 20, 22	VDD1
23	VDET
24	VDET_BIAS

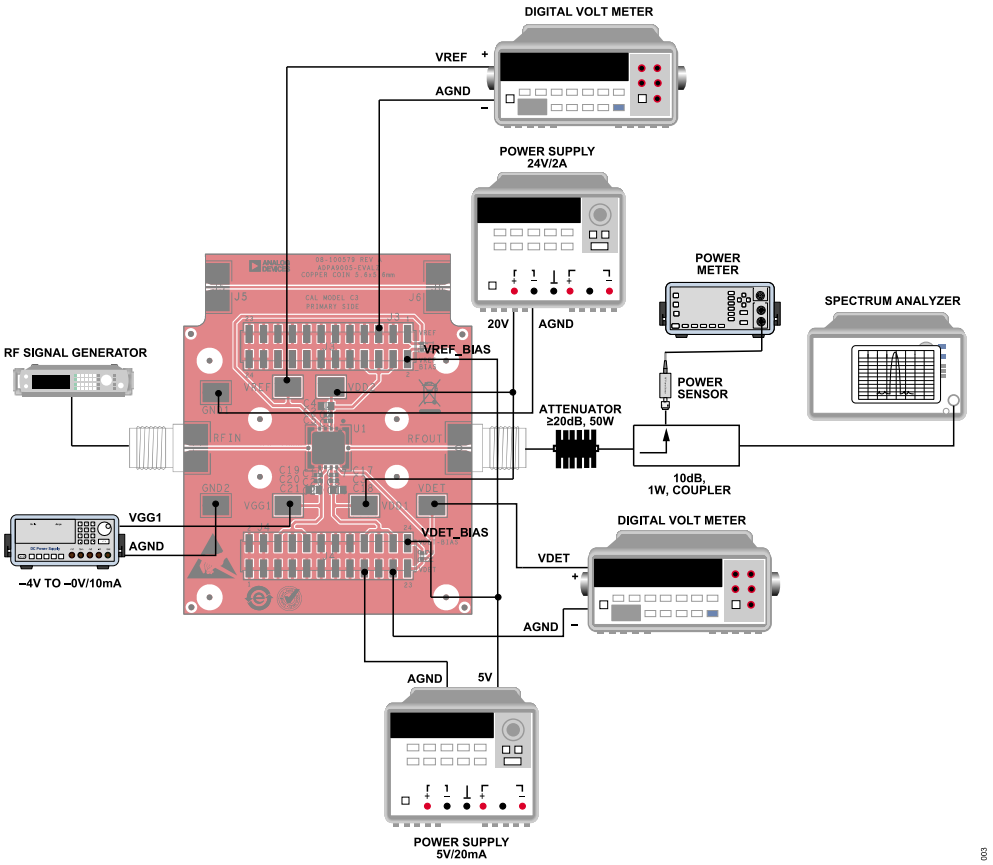


Figure 3. Typical Bench Setup and Operation Connections

OPERATING THE ADPA9005-EVALZ

POWER-UP SEQUENCE

Take the following steps to power up the ADPA9005-EVALZ:

1. Set VGG1 to −4V.
2. Set VDD1 and VDD2 to 20V.
3. Adjust VGG1 between −3V and −1V to achieve a quiescent current (I_{DQ}) of 560mA.
4. To operate the on-chip power detectors, apply 5V to VREF_BIAS and VDET_BIAS (Pin 2 of J3 and Pin 24 of J4, respectively).
5. Apply the RF signal to the RFIN connector of the ADPA9005-EVALZ.

POWER-DOWN SEQUENCE

Take the following steps to power down the ADPA9005-EVALZ:

1. Turn off the RF signal.
2. Set VGG1 to −4V.
3. Set VDD1 and VDD2 to 0V.
4. Set VREF_BIAS and VDET_BIAS to 0V.
5. Increase VGG1 to 0V.

THROUGH CALIBRATION PATH

To calibrate out board trace losses, a through calibration path is provided.

J5 and J6 must be populated with 2.92mm RF connectors to use the through calibration path.

Figure 4 shows the plot of the data in Table 2 of the through calibration path (J5 to J6). See Figure 5 for the evaluation board schematic.

Table 2. Insertion Loss of Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)
1	−0.28
2	−0.42
3	−0.49
4	−0.55
5	−0.62
6	−0.7

Table 2. Insertion Loss of Through Calibration Path (Continued)

Frequency (GHz)	Insertion Loss (dB)
7	−0.81
8	−0.91
9	−1
10	−1.14
11	−1.18
12	−1.3
13	−1.35
14	−1.44
15	−1.51
16	−1.61
17	−1.66
18	−1.78
19	−1.84
20	−1.89
21	−2
22	−2.01
23	−2.1
24	−2.15
25	−2.23
26	−2.32
27	−2.41
28	−2.52

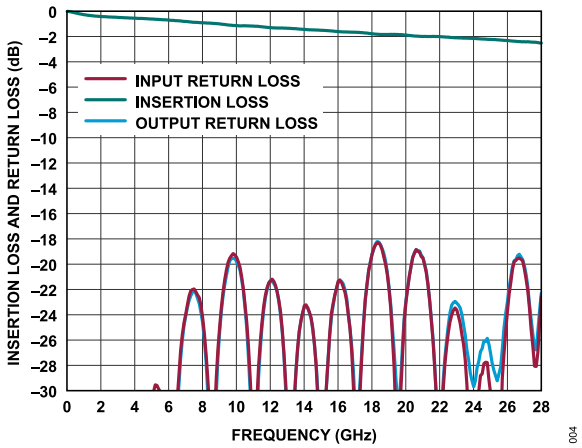


Figure 4. Insertion Loss of the Through Calibration Path

EVALUATION BOARD SCHEMATIC AND ARTWORK

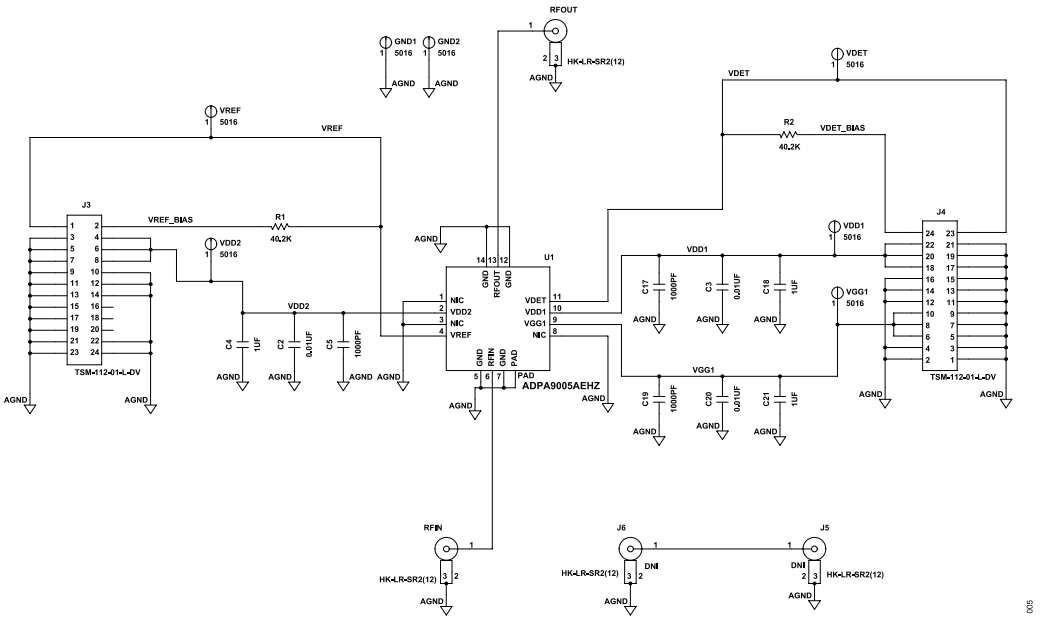


Figure 5. ADPA9005-EVALZ Evaluation Board Schematic

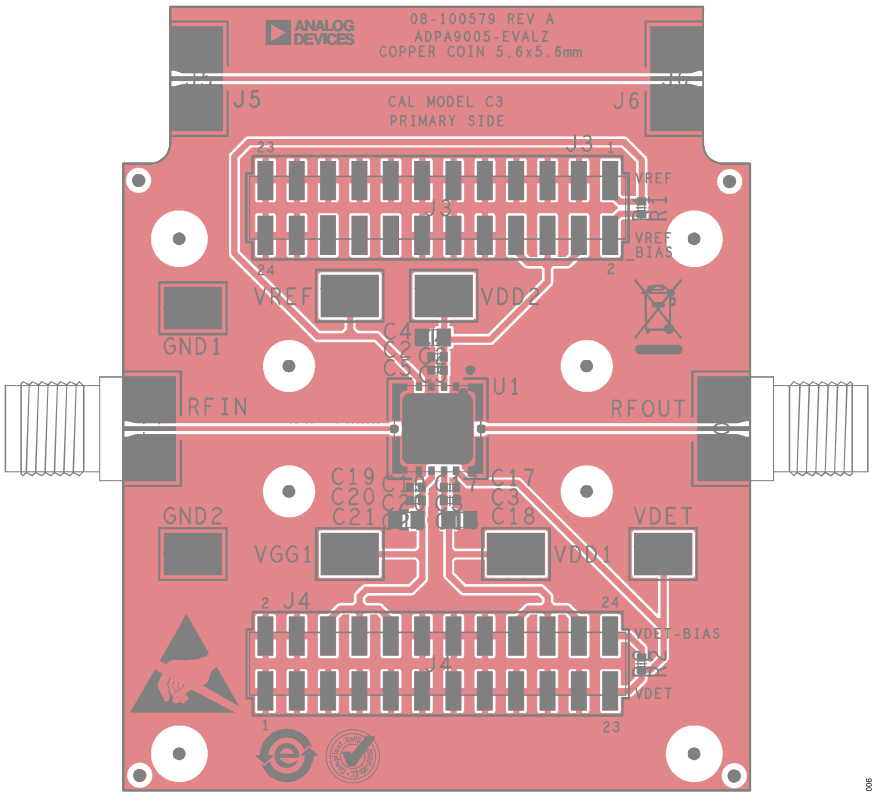


Figure 6. ADPA9005-EVALZ Assembly Drawing (J5 and J6 Not Installed)

ORDERING INFORMATION

ORDERING GUIDE

Model[1]	Description
ADPA9005-EVALZ	Evaluation Board

[1] Z = RoHS-Compliant Part.

BILL OF MATERIALS

Table 3. ADPA9005-EVALZ Bill of Materials

Reference Designator	Description	Manufacturer	Part Number
C2, C3, and C20	0.01µF ceramic capacitors, 100V, 10%, X7S, 0402	TDK	C1005X7S2A103K050BB
C4, C18, and C21	1µF ceramic capacitors, 100V, 10%, X7S, 0805	Murata	GRJ21BC72A105KE11L
C5, C17, and C19	1000pF ceramic capacitors, 100V, 10%, X7R, 0402	Wurth Elektronik	885012205080
RFIN and RFOUT	Connectors, PCB, 2.92m coax, 50Ω, 40GHz	Hirose Electric Company	HK-LR-SR2(12)
J3 and J4	Connector, PCB, 24-position male headers, unshrouded, double row straight, 2.54mm pitch	Samtec, Inc.	TSM-112-01-L-DV
U1	1GHz to 28GHz, 37.5dBm, gallium nitride (GaN) power amplifier	Analog Devices, Inc.	ADPA9005AEHZ
GND1, GND2, VDD1, VDD2, and VGG1	Connector, PCB, SMT test points	Keystone Electronics	5016
J5 and J6	Connectors, PCB, 2.92mm coax, 50Ω, 40GHz, do not installed (DNI)	Hirose Electric Company	HK-LR-SR2(12)
R1 and R2	Resistors, 40.2kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic	ERJ-2RKF4022X
Not Applicable	Aluminum heatsink, 2.51in × 1.91in	Analog Devices	605-04458-00

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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