

Evaluating the ADPA1113 2 GHz to 6 GHz, 46 dBm (40 W), GaN Power Amplifier

FEATURES

- 2-layer Rogers 4350B evaluation board with heat spreader
- ▶ End launch 2.92 mm RF connectors
- Through calibration path (depopulated)

EVALUATION KIT CONTENTS

2-layer Rogers 4350B evaluation board with heat spreader

EQUIPMENT NEEDED

- ► RF signal generator
- RF spectrum analyzer
- ► RF network analyzer
- ▶ 28 V, 5 A power supply
- ▶ 0 V to -8 V, 100 mA power supply
- ► 50 W attenuator ≥ 20 dB
- ▶ RF coupler 30 dB, 50 W
- RF power meter and power sensor
- ► Thermal plate or heatsink

GENERAL DESCRIPTION

The ADPA1113-EVALZ is a 2-layer printed circuit board (PCB) fabricated from 10 mil thick Rogers 4350B copper clad mounted to an aluminum heat spreader. The heat spreader provides thermal relief to the ADPA1113 and mechanical support to the PCB. Mounting holes on the heat spreader allow it to be attached to larger heatsinks for improved thermal management. The RFIN and RFOUT ports are populated by 2.92 mm female coaxial connectors, and their respective RF traces are of 50 Ω characteristic impedance. The ADPA1113-EVALZ is populated with components suitable for use over the entire operating temperature range of the ADPA1113.

The RF traces are 50 Ω grounded coplanar waveguides, and the package ground leads connect directly to the ground plane. Multiple vias are used to connect the top and bottom ground planes. The package base, along with an indium foil shim, is mechanically connected to the heat spreader using four, 0-80 × 3/16" stainless steel, socket head screws to ensure adequate electrical and thermal conduction.

The power supply decoupling capacitors shown in Figure 5 represent the configuration that was used to characterize the device. Note that it is possible to reduce the number of capacitors; however, this reduction varies by system. Instead, it is recommended to first remove or combine the largest capacitors that are farthest from the device.

Consult the ADPA1113 data sheet in conjunction with this user guide when working with the ADPA1113-EVALZ evaluation board.

ADPA1113-EVALZ EVALUATION BOARD PHOTOGRAPHS



Figure 1. ADPA1113-EVALZ Evaluation Board, Primary Side



Figure 2. ADPA1113-EVALZ Evaluation Board, Secondary Side

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OPERATING THE ADPA1113-EVALZ

The DC connections required to operate the ADPA1113-EVALZ are accessed through the P1 and P2 header pins, see Table 1 for pin descriptions.

Table 1. P1 and P2 Header Connections to the ADPA1113

Header Pin No.	Mnemonic
P1	
1, 2, 16, 18, 20	Open
3, 5, 7, 9, 10, 11, 12, 13, 14, 15, 17, 19, 21, 22, 23, 24	GND
4	VDD3A
6	VDD2A
8	VDD1
P2	
1, 2, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15, 16, 17, 19, 21	GND
6	VGG1
8, 10, 18, 23, 24,	Open
20, 22	VDD2B and VDD3B, respectively

Attach the ADPA1113-EVALZ to a thermal plate or a heatsink and then complete the power-up and power-down sequences that follow to evaluate the performance of the ADPA1113.

POWER-UP SEQUENCE

Take the following steps to power up:

- 1. Set VGG1 (Pin 6 of P2) to -4 V.
- 2. Set VDD1, VDD2A, VDD3A, VDD2B, and VDD3B (Pin 8, Pin 6, and Pin 4 of P1 and Pin 20 and Pin 22 of P2) to 28 V.
- Adjust VGG1 between -4 V and -1.9 V to achieve a quiescent current of 750 mA. The nominal gate voltage is approximately -2.2 V.
- 4. Apply the RF signal to the RFIN connector of the ADPA1113.

POWER-DOWN SEQUENCE

Take the following steps to power down:

- 1. Turn off the RF signal.
- 2. Set VGG1 to -4 V.
- 3. Set VDD to 0 V.
- 4. Set VGG1 to 0 V.

TEST SETUP DIAGRAM

See Figure 3 for the test setup diagram.



Figure 3. Test Setup Diagram

OPERATING THE ADPA1113-EVALZ

THROUGH CALIBRATION PATH

To calibrate out board trace losses, a through (thru) calibration path is provided between J3 and J4. Both J3 and J4 must be populated with RF connectors to use the through calibration path.

Figure 4 shows the plot of the data in Table 2 of the through calibration path (J3 to J4). See Figure 5 for the evaluation board schematic.



Figure 4. Insertion Loss and Return Loss of Through Calibration Path

Frequency (GHz)	Insertion Loss (dB)	
2	-0.42	
2.5	-0.47	
3	-0.51	
3.5	-0.55	
3.7	-0.57	
4.2	-0.6	
4.6	-0.63	
4.9	-0.65	
5.2	-0.66	
5.66	-0.7	
5.86	-0.72	
6	-0.74	

Table 2. Insertion Loss of Through Calibration Path

EVALUATION BOARD SCHEMATIC AND ARTWORK







Figure 6. ADPA1113-EVALZ Assembly Drawing (Note That J1 and J2 Are Not Installed)

ORDERING INFORMATION

BILL OF MATERIALS

Table 3. ADPA1113-EVALZ Bill of Materials

Reference Designator	Description	Manufacturer	Part Number
C3, C5, C8, C10, C12, C14	Ceramic capacitors, 2.2 µF, X5R, 50 V, 10%, 0603	Murata	GRM188R61H225KE11J
C4, C6, C7, C9, C11, C13	Ceramic capacitors, 1000 pF, X7R, 50 V, 10%, 0402, AEC- Q200, low effective series resistance (ESR)	TDK	CGA2B2X7R1H102K050BA
Not Applicable	2.5 in × 2.0 in heat spreader	Not applicable	Not applicable
P1, P2	Printed circuit board (PCB) connectors, surface-mount, 24- position, male header, unshrouded, double row straight, 2.54 mm pitch	Samtec, Inc.	TSM-112-01-L-DV
RFIN, RFOUT	2.92 mm connectors, jack, EDGE_LAUNCH	Winchester Interconnect	25-146-1000-92
J3, J4	2.92 mm connectors, jack, EDGE_LAUNCH (not installed)	Winchester Interconnect	25-146-1000-92
U1	2 GHz to 6 GHz, GaN, 46 dBm (40 W) power amplifier	Analog Devices, Inc.	ADPA1113AEJZ



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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