

Evaluating the ADPA1112 1GHz to 22GHz, 15W, GaN Power Amplifier

FEATURES

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

EVALUATION KIT CONTENTS

- ▶ 2-layer Rogers 4350B, ADPA1112-EVALZ evaluation board with heat spreader

EQUIPMENT NEEDED

- ▶ RF signal generator
- ▶ RF spectrum analyzer
- ▶ RF network analyzer
- ▶ 30V, 3A power supply
- ▶ -3V to 0V, 10mA power supply
- ▶ 5V, 20mA power supply

GENERAL DESCRIPTION

The ADPA1112-EVALZ is a 2-layer printed circuit board (PCB) fabricated from 10mil thick Rogers 4350B copper clad mounted to an aluminum heat spreader. The heat spreader is providing thermal relief to the ADPA1112 and mechanical support to 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 ADPA1112-EVALZ is populated with components suitable for use over the entire operating temperature range of the ADPA1112.

The RF transmission lines are 50Ω grounded coplanar waveguides. The package ground leads connect directly to the ground plane. The package flange 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 from the flange bottom to the heat spreader, an indium shim sits between them.

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

Consult the ADPA1112 data sheet in conjunction with this user guide when working with the ADPA1112-EVALZ evaluation board.

ADPA1112-EVALZ EVALUATION BOARD PHOTOGRAPHS

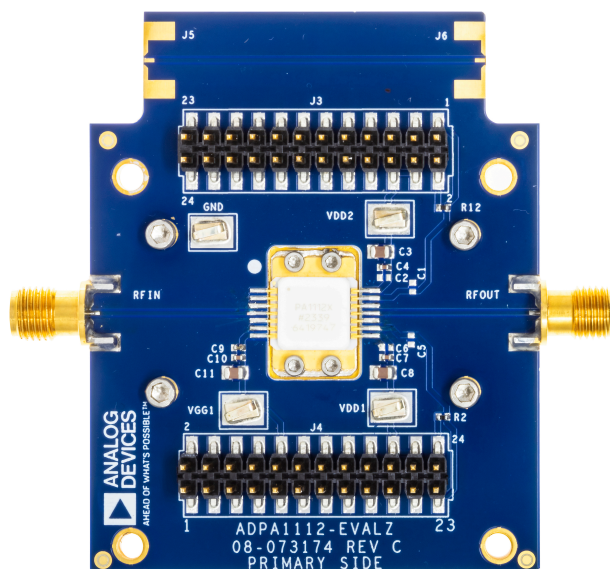


Figure 1. ADPA1112-EVALZ Evaluation Board, Primary Side

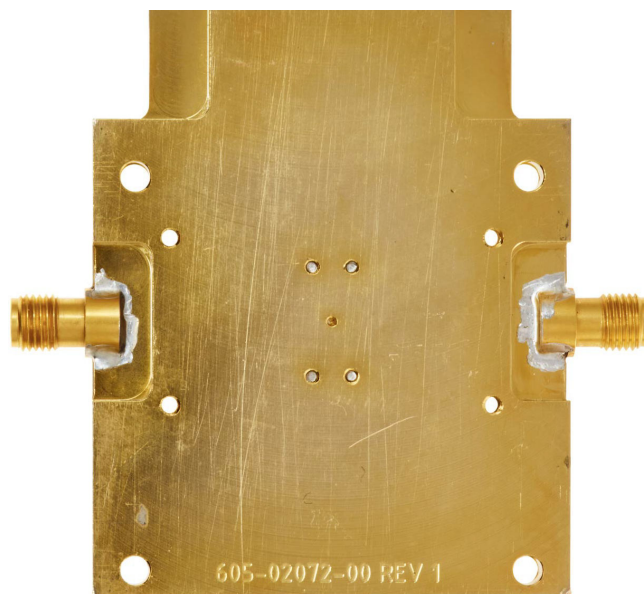


Figure 2. ADPA1112-EVALZ Evaluation Board, Secondary Side

TABLE OF CONTENTS

| | | | |
|-----------------------------------|---|---|---|
| Features..... | 1 | Power-Up Sequence..... | 4 |
| Evaluation Kit Contents..... | 1 | Power-Down Sequence..... | 4 |
| Equipment Needed..... | 1 | Through Calibration Path | 4 |
| General Description..... | 1 | Evaluation Board Schematic and Artwork..... | 5 |
| ADPA1112-EVALZ Evaluation Board | | Ordering Information..... | 6 |
| Photographs..... | 1 | Evaluation Boards..... | 6 |
| Operating the ADPA1112-EVALZ..... | 3 | Bill of Materials..... | 6 |

REVISION HISTORY

6/2025—Revision 0: Initial Version

OPERATING THE ADPA1112-EVALZ

Figure 3 shows a block diagram of a typical bench setup for operating ADPA1112-EVALZ. The DC connections required to operate the ADPA1112-EVALZ are shown in the Figure 3. The ADPA1112-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 ADPA1112. 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 ADPA1112 output power is (VREF – VDET). User calibration is required when using this feature.

Table 1. J3 and J4 Header Connections to the ADPA1112

| 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 | VDD2 |
| J4 | |
| 1, 2, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15, 16, 17, 19, 21 | AGND |
| 6, 8, 18 | Open (do not use) |
| 10 | VGG1 |
| 20, 22 | VDD1 |
| 23 | VDET |
| 24 | VDET_BIAS |

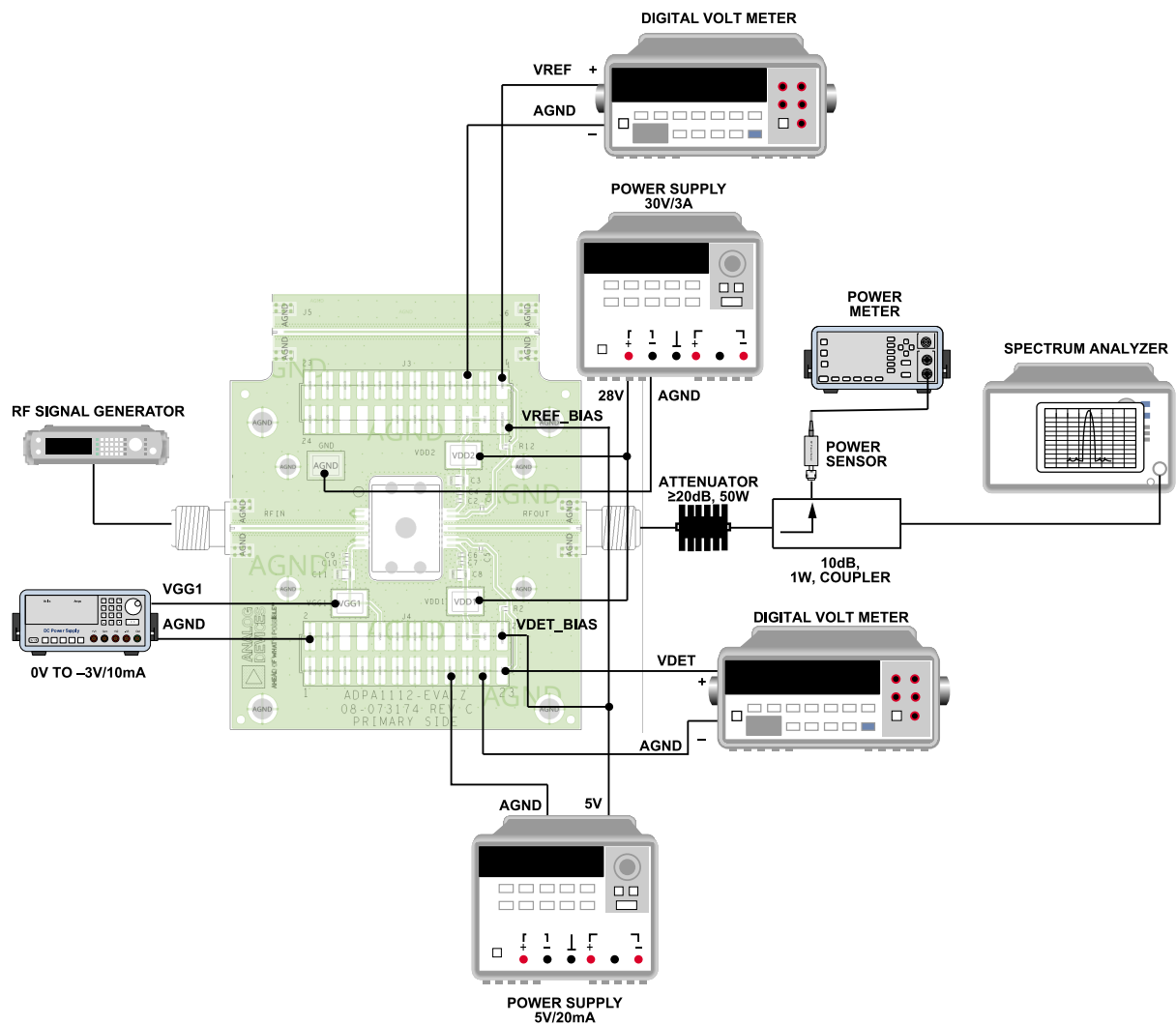


Figure 3. Typical Bench Setup and Operation Connections

OPERATING THE ADPA1112-EVALZ

POWER-UP SEQUENCE

Take the following steps to power up the ADPA1112-EVALZ:

- 1. Set the VGG1 pin to -3V.
- 2. Set the VDD1 and VDD2 pins to 28V.
- 3. Adjust the VGG1 pin between -3V and 0V to achieve a quiescent drain current (I_{DQ}) of 600mA.
- 4. To operate the on-chip power detectors, apply 5V to the VREF_BIAS and VDET_BIAS pins (Pin 2 of J3 and Pin 24 of J4).
- 5. Apply the RF signal to the RFIN connector of the ADPA1112-EVALZ.

POWER-DOWN SEQUENCE

Take the following steps to power down the ADPA1112-EVALZ:

- 1. Turn off the RF signal.
- 2. Set the VGG1 pin to -3V.
- 3. Set the VDD1 and VDD2 pins to 0V.
- 4. Set the VREF_BIAS and VDET_BIAS pins to 0V.
- 5. Increase the VGG1 pin 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 | -0.59 |
| 2 | -0.84 |
| 3 | -0.97 |
| 4 | -1.09 |
| 5 | -1.18 |
| 6 | -1.28 |
| 7 | -1.37 |
| 8 | -1.47 |
| 9 | -1.56 |
| 10 | -1.63 |
| 11 | -1.70 |
| 12 | -1.75 |
| 13 | -1.81 |
| 14 | -1.86 |
| 15 | -1.90 |
| 16 | -1.95 |
| 17 | -1.98 |
| 18 | -2.06 |
| 19 | -2.08 |
| 20 | -2.15 |
| 21 | -2.18 |
| 22 | -2.26 |

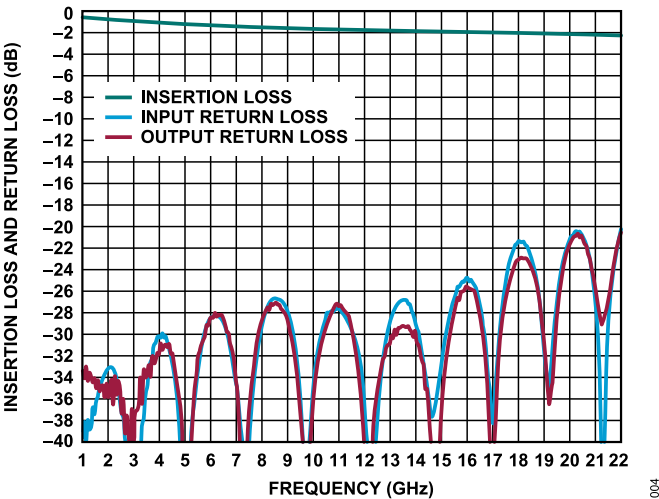


Figure 4. Insertion Loss of the Through Calibration Path

EVALUATION BOARD SCHEMATIC AND ARTWORK

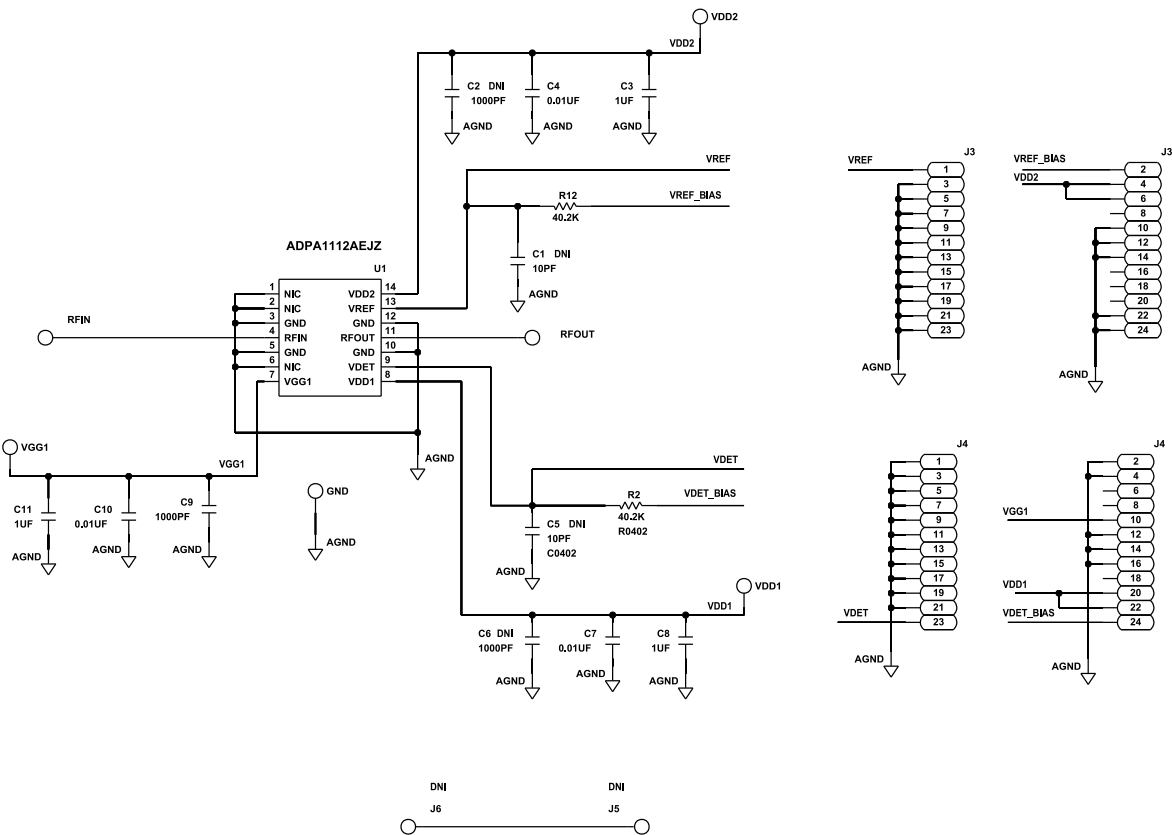


Figure 5. ADPA1112-EVALZ Evaluation Board Schematic

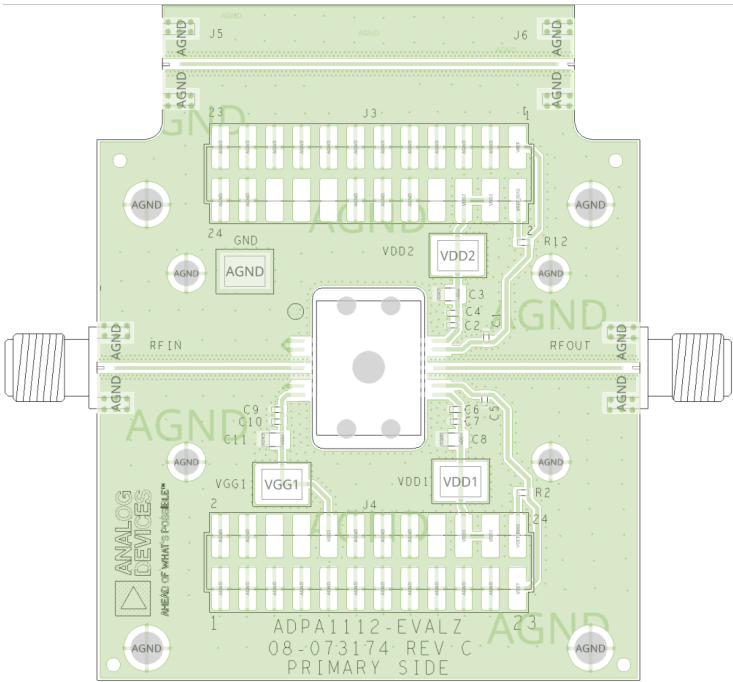


Figure 6. ADPA1112-EVALZ Assembly Drawing (J5 and J6 Not Installed)

ORDERING INFORMATION

EVALUATION BOARDS

Table 3. Evaluation Boards

| Model ¹ | Description |
|--------------------|------------------|
| ADPA1112-EVALZ | Evaluation Board |

¹ Z = RoHS-Compliant Part.

BILL OF MATERIALS

Table 4. ADPA1112-EVALZ Bill of Materials

| Reference Designator | Description | Manufacturer | Part Number |
|---------------------------|--|-------------------------|--------------------------|
| C1 and C5 | 10pF ceramic capacitors, 50V, 5%, C0G, 0402, do not install (DNI) | Yageo | C2012X5R1H475K125AB |
| C2 and C6 | 1000pF ceramic capacitors, 100V, 10%, X7R, 0402, DNI | Würth Elektronik | 885012205080 |
| C4, C7, and C10 | 0.01μF ceramic capacitors, 100V, 10%, X7S, 0402 | TDK | C1005X7S2A103K050BB |
| C3, C8, and C11 | 1μF ceramic capacitors, 100V, 10%, X7S, 0805 | TDK | C2012X7S2A105K125AB |
| C9 | 1000pF ceramic capacitor, 100V, 10%, X7R, 0402 | Würth Elektronik | 885012205080 |
| RFIN and RFOUT | Edge launch jack connectors | Winchester Interconnect | 25-146-1000-92 |
| 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 22GHz, 15W, gallium nitride (GaN) power amplifier | Analog Devices, Inc. | ADPA1112 |
| GND, VDD1, VDD2, and VGG1 | Connector-PCB, SMT test points | Keystone Electronics | 5016 |
| J5 and J6 | Edge launch jack connectors (DNI) | Winchester Interconnect | 25-146-1000-92 |
| R2 and R12 | Resistors, 40.2kΩ, 1%, 1/10W, 0402, AEC-Q200 | Panasonic | ERJ-2RK4022X |
| Not Applicable | Heat sink, F14 test fixture, 2.500inches × 2.000inches | Analog Devices | 605-02072-00 |

**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.

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 One Analog Way, Wilmington, MA 01887-2356, U.S.A. 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 distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits 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. All Analog Devices products contained herein are subject to release and availability.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Analog Devices Inc.:](#)

[ADPA1112-EVALZ](#)