

# Evaluation Board for the AD8337 VGA

## AD8337-EVAL

### FEATURES

- Factory tested and ready to use
- SMA input and output connectors
- Supplied in noninverting, inverting, and single-supply configurations
- Compact surface-mount layout can be applied to user application

### APPLICATIONS

- Hands-on evaluation of the [AD8337](#) in multiple configurations

### INTRODUCTION

The AD8337 is a versatile variable gain amplifier (VGA); therefore, the evaluation board should be just as versatile. The board is offered in three configurations: noninverting, inverting, and single supply (noninverting). These variations enable the user to quickly become familiar with the many operating characteristics and features of the [AD8337](#).

In the dual-supply versions, the board can be easily changed from noninverting to inverting by changing some resistors. A multipurpose copper pattern accommodates either configuration. However, if the user lacks the special skills and tools required, either version is available fully assembled and tested. Because of additional parts and connection requirements, the single-supply version has a unique board pattern, which is available fully assembled and tested.

These three variants are described within this data sheet.

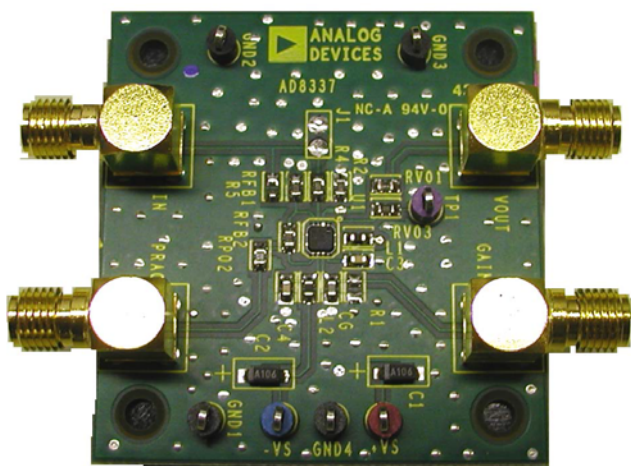


Figure 1. Evaluation Board for Dual Supplies

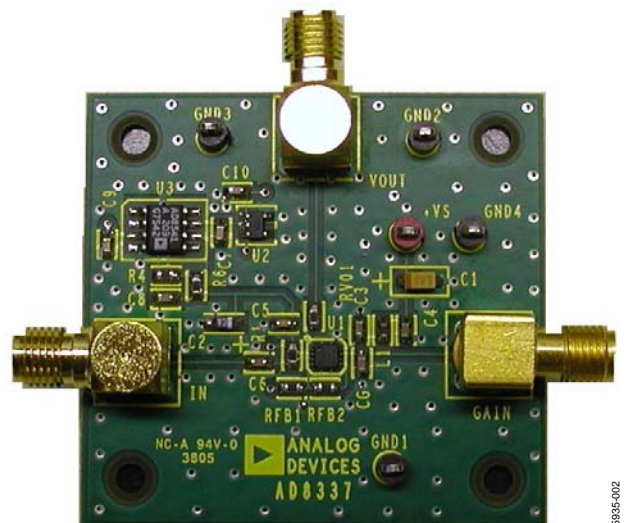


Figure 2. Evaluation Board for Single Supply

#### Rev. 0

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

TABLE OF CONTENTS

Features .....	1	Measurement Setup.....	5
Applications.....	1	Board Layout Considerations .....	5
Introduction .....	1	Parts List .....	7
Revision History .....	2	Ordering Guide .....	8
General Description .....	3	ESD Caution.....	8
Circuit Options .....	4		
Output Protection .....	4		

REVISION HISTORY

3/06—Revision 0: Initial Version

## GENERAL DESCRIPTION

The AD8337-EVAL provides a platform for test and evaluation of the [AD8337](#) VGA. Three circuit configurations are available:

- Direct coupled, with noninverting gain and dual-power supplies
- Direct coupled, with inverting gain and dual supplies
- AC-coupled, with noninverting gain configuration and a single-supply

These fully assembled and tested boards are ready to go. The user only needs to make the appropriate connections from a power supply and signal source. SMA connectors are provided for the preamplifier (PrA) and VGA outputs. Photos of fully assembled boards are shown in Figure 1 and Figure 2, and Figure 3 and Figure 4 show the board component side layouts.

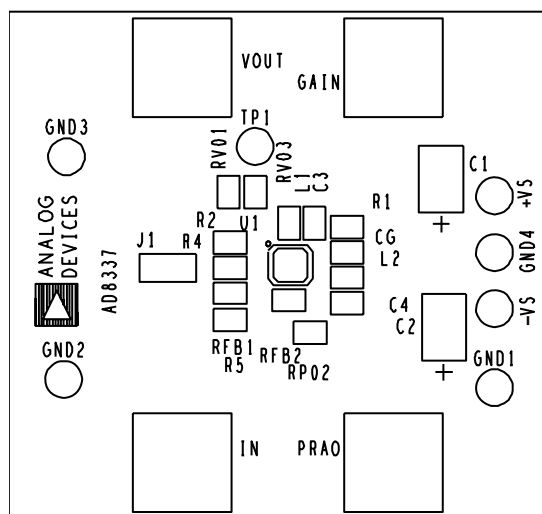


Figure 3. Assembly, Dual-Supply Evaluation Board

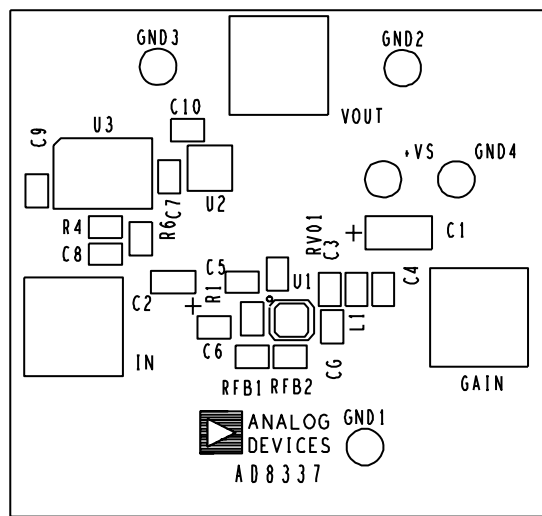


Figure 4. Assembly, Single-Supply Evaluation Board

Schematic diagrams of the dual-supply board for noninverting and inverting configurations are shown in Figure 5 and Figure 6. The dual-supply boards require  $\pm 2.5$  V to  $\pm 5$  V supplies capable of supplying 20 mA or greater. A schematic diagram of the single-supply board is shown in Figure 7. The single supply version accepts a +5 V to +10 V supply with 20 mA or greater capability.

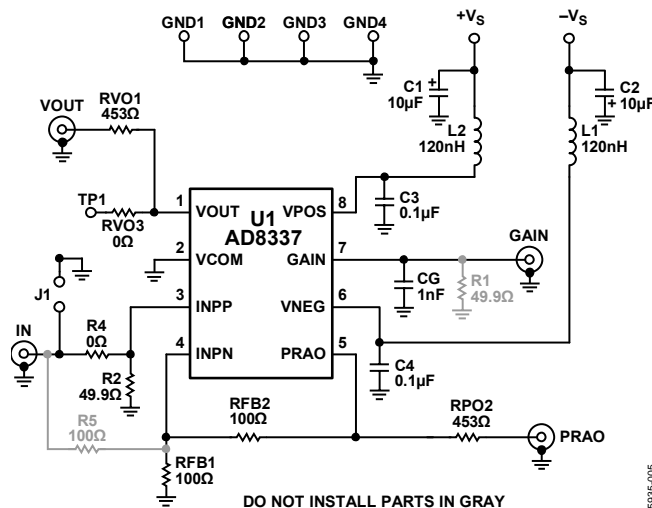


Figure 5. Evaluation Board Schematic—Noninverting Configuration

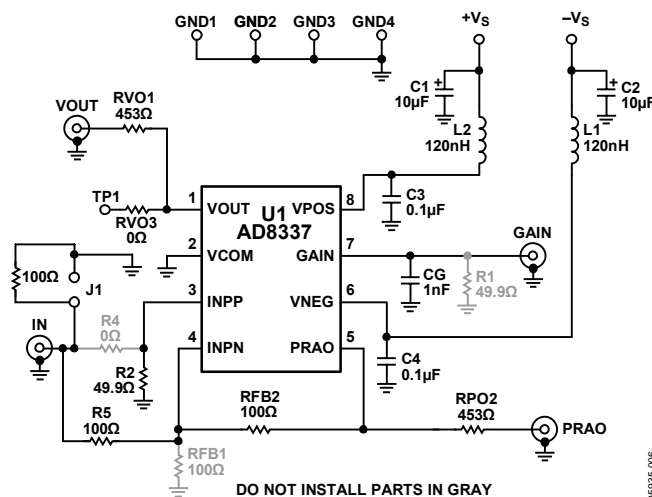


Figure 6. Evaluation Board Schematic—Inverting Configuration



Figure 7. Evaluation Board Schematic—Single-Supply Version

## CIRCUIT OPTIONS

Part numbers for fully assembled boards are listed in Table 1.

Table 1. AD8337 Evaluation Board Variations

Part Number	Configuration
AD8337-EVAL	Dual-supply noninverting
AD8337-EVAL-INV	Dual-supply inverting
AD8337-EVAL-SS	Single-supply noninverting

Within limits, the AD8337 preamplifier gain is controlled by Resistor RFB1 and Resistor RFB2. See the [AD8337](#) data sheet for rules applying to the current-feedback preamplifier. Figure 5, Figure 6, and Figure 7 are schematics for the various circuit configurations.

## OUTPUT PROTECTION

The AD8337 VGA output stage is specified for driving loads of 500  $\Omega$  or greater. To protect the stage from accidental overload, a 453  $\Omega$  resistor is provided which, when connected to 50  $\Omega$  test equipment inputs, enables safe operation. In certain high load impedance situations, the user can reduce the value of this resistor; however, if load capacitance values greater than approximately 20 pF are anticipated, such as a BNC cable, the minimum series resistor value should not be less than 20  $\Omega$ .

An alternate test pin is also provided for direct access to the output of the [AD8337](#) VGA. The pin is typically used for a probe, and a 0  $\Omega$  resistor is provided between the test loop and the output pin. If the test loop is connected to loads  $\leq 500 \Omega$ , then the 0  $\Omega$  resistor should be changed to an appropriate value.

TOP: SIGNAL GENERATOR  
10.05MHz, 500mV p-p



POWER AMPLIFIERS



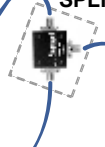
SPECTRUM ANALYZER



BOTTOM: SIGNAL GENERATOR  
9.95MHz, 500mV p-p



POWER SPLITTER



SIGNAL INPUT

PREAMP OUTPUT

VGAIN



-5V

+5V

POWER SUPPLY



Figure 8. Typical Board Test Connections (One Channel Shown)

06935-000

## MEASUREMENT SETUP

As an example, Figure 8 shows board connections for two generators. In this instance, the experiment illustrates IMD measurements using standard off-the-shelf test equipment that is used by Analog Devices, Inc. Of course, any equivalent equipment can also be used.

## BOARD LAYOUT CONSIDERATIONS

The AD8337 evaluation board is designed using four layers. Interconnecting circuitry is located on the component and wiring sides, with the inner layers dedicated to power and ground planes. Figure 9 through Figure 13 show the copper layouts.

For ease of assembly, all board components are located on the primary side and all are 0603 size surface mounts. Higher density applications can require components on both sides of the board and present no problem to the AD8337, as demonstrated in unreleased versions of the board that featured secondary-side components and vias. Not evident in the figures are thermal vias within the pad that solder to the mating pad of the AD8337 chip-scale package. These vias serve as a thermal path and are the primary means of removing heat from the device. The thermal specifications in the AD8337 data sheet are predicated on the use of multilayer board construction with these thermal vias to enable heat conductivity from the die.

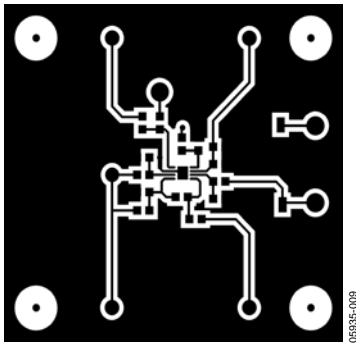


Figure 9. Dual-Supply Component Side Copper

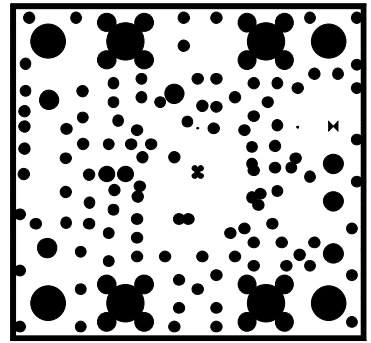


Figure 13. Dual-Supply Power Plane

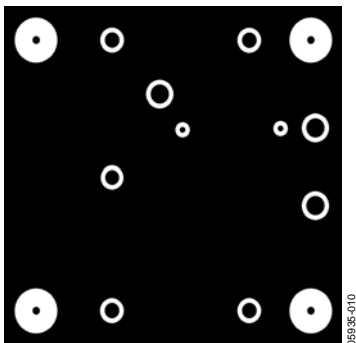


Figure 10. Dual-Supply Wiring Side Copper

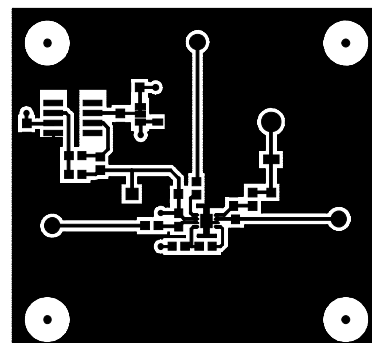


Figure 14. Single-Supply Component Side Copper

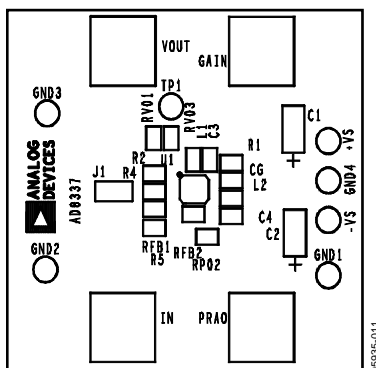


Figure 11. Dual-Supply Component Side Silk-Screen

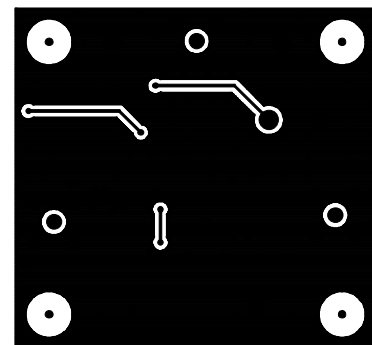


Figure 15. Single Side Wiring Side Copper

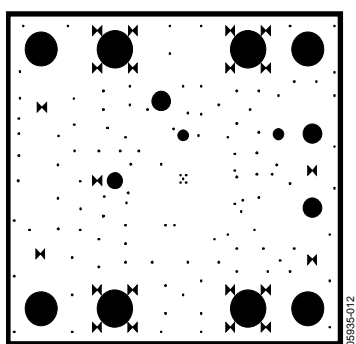


Figure 12. Dual-Supply Ground Plane

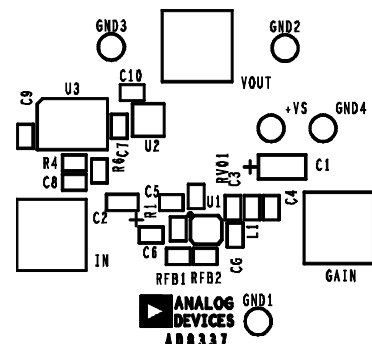


Figure 16. Single-Supply Component Side Silkscreen

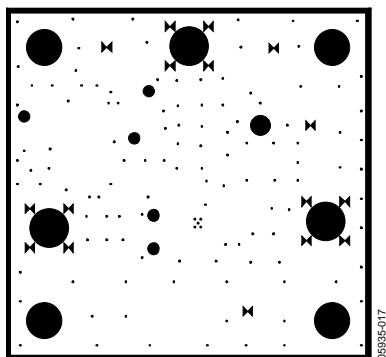


Figure 17. Single-Supply Ground Plane

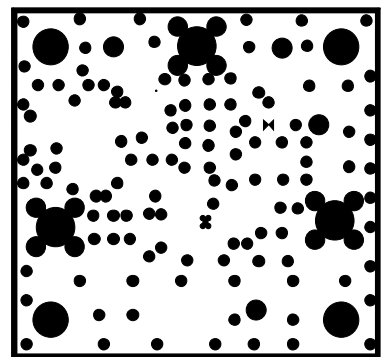


Figure 18. Single-Supply Power Plane

## PARTS LIST

**Table 2. Dual-Supply Noninverting Parts List**

Qty.	Name	Description	Reference Designator	Manufacturer	Mfg. Part Number
1	Test Point	Loop, 0.125" dia., Red	+V <sub>s</sub>	Bisco Industries	TP-104-01-02
4	Test Points	Loop, 0.125" dia., Black	GND1 to GND4	Bisco Industries	TP-104-01-00
1	Test Point	Loop, 0.125" dia., Blue	–V <sub>s</sub>	Bisco Industries	TP-104-01-06
1	Test Point	Loop, 0.125" dia., Purple	TP1	Bisco Industries	TP-104-01-07
2	Capacitors	0.1 $\mu$ F, 16 V, 0603, X7R	C3, C4	KEMET	C0603C104K4RACTU
1	Capacitor	1000 pF, 50 V, X7R, 10%, 0603	CG	Panasonic	ECJ-1VB2A102K
2	Capacitors	Tantalum, 10 $\mu$ F, 10 V, A Size	C1, C2	Nichicon	T491A106M010AS
1	Integrated Circuit	VGA	U1	Analog Devices, Inc.	AD8337BCPZ-WP
4	Connectors	SMA Fem PC Mount RA	GAIN, IN, PRAO, VOUT	Amphenol	901-143-6RFX
2	Ferrite Beads	120 nH, 0603	L1, L2	Murata	BLM18BA750SN1D
1	Resistor	49.9 $\Omega$ , 1%, 1/16 W, 0603	R2	Panasonic	ERJ-3EKF49R9V
2	Resistors	0 $\Omega$ , 5%, 1/10 W, 0603	R4, RVO3	Panasonic	ERJ-2GE0R00X
2	Resistors	100 $\Omega$ , 1%, 1/16 W, 0603	RFB1, RFB2	Panasonic	ERJ-3EKF1000V
2	Resistors	453 $\Omega$ , 1/16 W, 1%, 0603	RPO2, RVO1	Panasonic	ERJ-3EKF4530V
4	Bumpers		Mnt to wiring side of PCB	3M	SJ-67A11 (BLACK)

**Table 3. Dual-Supply Inverting Gain Parts List**

Qty.	Name	Description	Reference Designator	Manufacturer	Mfg. Part Number
1	Test Point	Loop, 0.125" dia., Red	+V <sub>s</sub>	Bisco Industries	TP-104-01-02
4	Test Points	Loop, 0.125" dia., Black	GND1 to GND4	Bisco Industries	TP-104-01-00
1	Test Point	Loop, 0.125" dia., Blue	–V <sub>s</sub>	Bisco Industries	TP-104-01-06
1	Test Point	Loop, 0.125" dia., Purple	TP1	Bisco Industries	TP-104-01-07
2	Capacitors	0.1 $\mu$ F, 16 V, 0603, X7R	C3, C4	KEMET	C0603C104K4RACTU
1	Capacitor	1000 pF, 50 V, X7R, 10%, 0603	CG	Panasonic	ECJ-1VB2A102K
2	Capacitors	Tantalum, 10 $\mu$ F, 10 V, A Size	C1, C2	Nichicon	T491A106M010AS
1	Integrated Circuit	VGA	U1	Analog Devices, Inc.	AD8337BCPZ-WP
4	Connectors	SMA Fem PC Mount RA	GAIN, IN, PRAO, VOUT	Amphenol	901-143-6RFX
2	Ferrite Beads	120 nH, 0603	L1, L2	Murata	BLM18BA750SN1D
1	Resistor	49.9 $\Omega$ , 1%, 1/16 W, 0603	R2	Panasonic	ERJ-3EKF49R9V
1	Resistor	0 $\Omega$ , 5%, 1/10 W, 0603	RVO3	Panasonic	ERJ-2GE0R00X
3	Resistors	100 $\Omega$ , 1%, 1/16 W, 0603	RFB2, R5, J1 (J1 POSITION)	Panasonic	ERJ-3EKF1000V
2	Resistors	453 $\Omega$ , 1/16 W, 1%, 0603	RPO2, RVO1	Panasonic	ERJ-3EKF4530V
4	Bumpers		Mnt to wiring side of PCB	3M	SJ-67A11 (BLACK)

# AD8337-EVAL

**Table 4. Single-Supply Parts List**

Qty.	Name	Description	Reference Designator	Manufacturer	Mfg. Part Number
1	Test Point	Loop, 0.125" dia., Red	+V <sub>s</sub>	Bisco Industries	TP-104-01-02
1	Capacitor	Tantalum, 10 $\mu$ F, 10 V, A Size	C1	Nichicon	T491A106M010AS
1	Capacitor	Tantalum, 1 $\mu$ F, P Size	C2	Nichicon	F921C105MPA
7	Capacitors	0.1 $\mu$ F, 16 V, 0603, X7R	C3, C4, C5, C6, C7, C9, C10	KEMET	C0603C104K4RACTU
1	Capacitor	0.22 $\mu$ F, 10%, 0603, X7R	C8	Panasonic	ECJ-1VB1H223K
1	Capacitor	1000 pF, 50 V, X7R, 10%, 0603	CG	Panasonic	ECJ-1VB2A102K
3	Connectors	SMA Fem PC Mount RA	GAIN, IN, VOUT	Amphenol	901-143-6RFX
4	Test Points	Loop, 0.125" dia., Black	GND1 to GND 4	Bisco Industries	TP-104-01-00
1	Ferrite Bead	120 nH, 0603	L1	Murata	BLM18BA750SN1D
1	Resistor	49.9 $\Omega$ , 1%, 1/16 W, 0603	R1	Panasonic	ERJ-3EKF49R9V
1	Resistor	10 k $\Omega$ , 1%, 1/16 W, 0603	R4	Panasonic	ERJ-3EKF1002V
3	Resistors	100 $\Omega$ , 1%, 1/16 W, 0603	RFB1, RFB2, R6	Panasonic	ERJ-3EKF1000V
1	Resistor	453 $\Omega$ , 1%, 1/16 W, 0603	RVO1	Panasonic	ERJ-3EKF4530V
1	Integrated Circuit	VGA	U1	Analog Devices, Inc.	AD8337BCPZ-WP
1	Integrated Circuit	2.5 V Regulator	U2	Analog Devices, Inc.	ADR391AUJZ-R2
1	Integrated Circuit	SS Rail-to-Rail Op Amp	U3	Analog Devices, Inc.	AD8541AR
4	Bumpers		Mnt to Wiring side of PCB	3M	SJ-67A11 (BLACK)

## ORDERING GUIDE

Model	Description
AD8337-EVAL	Evaluation Board
AD8337-EVAL-INV	Evaluation Board—Inverting Gain
AD8337-EVAL-SS	Evaluation Board—Single Supply

## ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

