



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



Evaluation Board User Guide for the **AD8209A** High Voltage, Precision Difference Amplifier

FEATURES

- Full featured evaluation board for the **AD8209A**
- Enables quick bread boarding/prototyping
- Includes provisions for the current sense resistor
- All analog design, no software required
- Footprints provided for alternate configurations

EVALUATION KIT CONTENTS

- AD8209A-EVALZ** evaluation board

ADDITIONAL EQUIPMENT NEEDED

- A signal generator
- A power supply
- An oscilloscope with a bandwidth of at least 20 MHz
- BNC male to dual banana jack female adapter
- At least 4 banana to grabber cables
- Banana plug to banana plug cable

ONLINE RESOURCES

- AD8209A** data sheet

GENERAL DESCRIPTION

This user guide describes the evaluation board for the **AD8209A**, a high voltage, single-supply, precision difference amplifier. The design of this board emphasizes simplicity and ease of use; the board can be readily mounted with a current sense resistor of a maximum standard size of 2818. The board design also allows flexibility with loads. This board comes with vector pins for the input and output terminals in a predefined configuration.

The **AD8209A** data sheet covers the details of the device operation and describes the basic connections for operating the device, as well as common circuit configurations and applications. Consult the data sheet in conjunction with this user guide for a better understanding of the device operation, especially when powering up the evaluation board for the first time.

EVALUATION BOARD PHOTOGRAPH

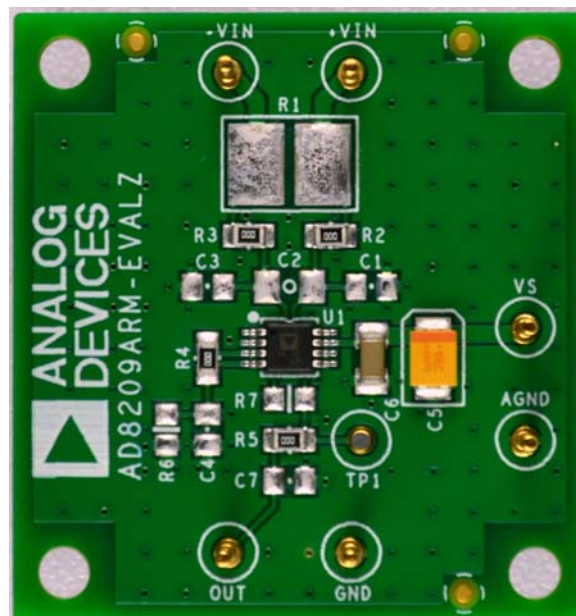


Figure 1. **AD8209A-EVALZ** Evaluation Board

TABLE OF CONTENTS

Features	1	Power-Up Procedure.....	4
Evaluation Kit Contents.....	1	Evaluation Board Configuration	5
Additional Equipment Needed.....	1	Gain Adjustment Options	5
Online Resources	1	Gain Values Less Than 14	5
General Description	1	Gains Values Greater Than 14.....	5
Evaluation Board Photograph.....	1	Low-Pass Filtering.....	5
Revision History	2	Provisions for External Components	5
Quick Start Procedure.....	3	Evaluation Board Schematic and Artwork.....	6
Overview.....	3	Evaluation Board Layout	7
Required Equipment	3	Ordering Information.....	8
Initial Configuration	3	Bill of Materials.....	8

REVISION HISTORY

7/2016—Revision 0: Initial Version

QUICK START OPERATION

OVERVIEW

This section outlines the most basic configuration of the [AD8209A](#) evaluation board to test basic functionality of the device. For first time users, quick start operation is the best option to begin immediately using the evaluation board.

REQUIRED EQUIPMENT

In addition to the [AD8209A](#) evaluation board, there are a minimum of nine other components required (see Figure 2):

- A signal source, such as an arbitrary waveform generator.
- A power supply.
- An oscilloscope with probes and a bandwidth of at least 20 MHz.
- A banana plug to banana plug cable.
- A BNC male to dual banana jack female adapter.
- At least four banana to grabber cables to connect the power supply and the input signal to the [AD8209A](#) evaluation board.

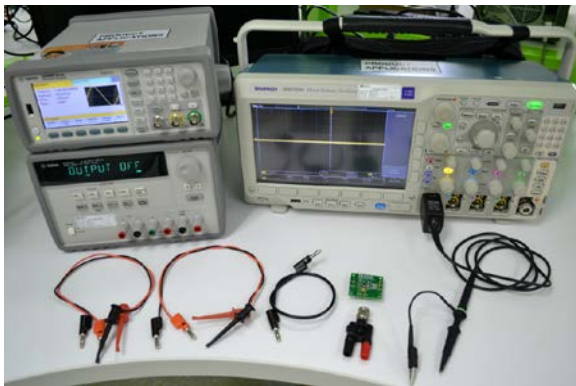


Figure 2. Minimum Components Required for Quick Start Operation

INITIAL CONFIGURATION

To start the initial board configuration, use the following procedure:

1. Ensure that the power supply is off. Connect the power supply leads to the vector pins labelled VS and AGND, as shown in Figure 3.



Figure 3. Basic Power Connections of the [AD8209A](#) Evaluation Board

2. Connect the signal source to +VIN and –VIN using the combination of the BNC male to dual banana jack female adapter and the banana to grabber cables. Ensure that there is a common ground between the signal generator and the power supply through the banana to banana cable.



Figure 4. [AD8209A](#) Evaluation Board with the Source Signal Connected

3. Connect the oscilloscope probe to the OUT pin as shown in Figure 5.

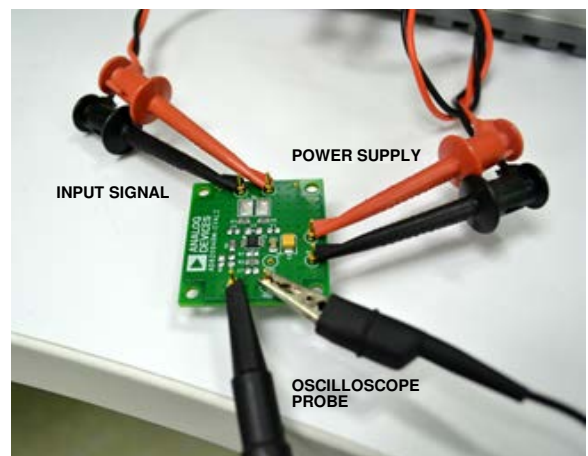


Figure 5. Completed Connections for Quick Start Operation

POWER-UP PROCEDURE

After completing the initial configuration, use the following procedure to power up the board:

1. Set the power supply to 5.0 V.
2. Turn on the power supply. The typical supply current of [AD8209A](#) is 1.6 mA. Current drawn from the power supply must not exceed 3 mA.
3. Configure the signal source to output a 1 kHz sine wave, 200 mV p-p with a 100 mV offset voltage. If the signal source is relative to a 50 Ω impedance, set the amplitude to 100 mV p-p.
4. Enable the signal source. The oscilloscope must be able to measure 2.8 V p-p sine wave at the output of the [AD8209A](#).

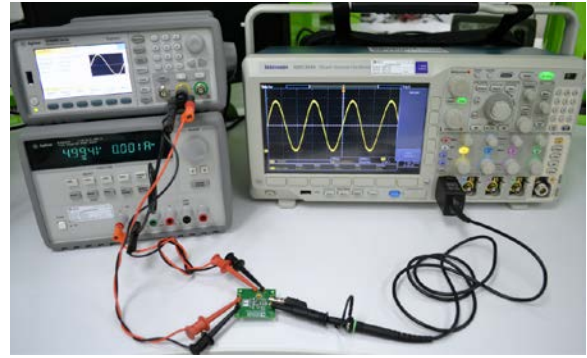


Figure 6. Final Result of the Quick Start Procedure with a 2.8 V p-p Signal Appearing on the Oscilloscope Using an [AD8209A-EVALZ](#) Board

EVALUATION BOARD CONFIGURATION

GAIN ADJUSTMENT OPTIONS

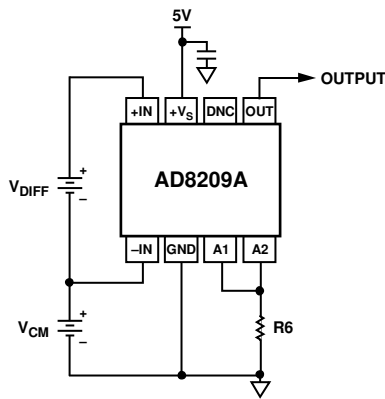
By default, the gain of the preamplifier and the buffer are 7 V/V and 2 V/V, respectively, resulting in a composite gain of 14 V/V. The gain can be lowered or raised with the addition of external resistors.

Gain Values Less Than 14

The preamplifier has an output resistance of 100 kΩ. Populating an external resistor, R6, on the evaluation board decreases the gain of the AD8209A. To calculate the effective gain or the value of the required external resistor (R6), refer to the following equations:

$$Gain = \frac{14 \times R6}{R6 + 100 \text{ k}\Omega}$$

$$R6 = 100 \text{ k}\Omega \times \frac{Gain}{14 - Gain}$$



NOTES
1. DNC = DO NOT CONNECT.

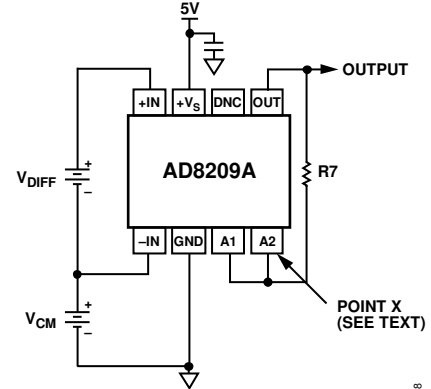
Figure 7. Adjusting for Gains Less Than 14

Gains Values Greater Than 14

Populating R7 on the board increases the gain of the AD8209A. An overall gain as high as 50 is achievable, but note that the accuracy of the gain becomes critically dependent on the resistor value at high gains. See the following equations to calculate the effective gain or to calculate the value of the external resistor (R7):

$$Gain = \frac{14 \times R7}{R7 - 100 \text{ k}\Omega}$$

$$R7 = 100 \text{ k}\Omega \times \frac{Gain}{Gain - 14}$$

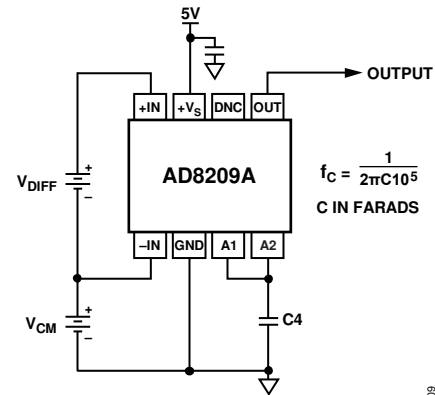


NOTES
1. DNC = DO NOT CONNECT.

Figure 8. Adjusting for Gains Greater Than 14

LOW-PASS FILTERING

Implement the simplest low-pass filter by adding a capacitor to C4. This forms a single-pole filter (20 dB/decade) together with the internal 100 kΩ resistor. Note that the corner frequency changes after R4, R6, or R7 are populated. Adding a resistor to R6 to lower the gain increases the corner frequency (fc) of the filter. Consequently, populating R7 to increase the gain lowers the corner frequency of the filter by the same factor by which the gain is raised.



NOTES
1. DNC = DO NOT CONNECT.

Figure 9. Single-Pole, Low-Pass Filter Using the Internal 100 kΩ Resistor

PROVISIONS FOR EXTERNAL COMPONENTS

There are provisions available on the AD8209A evaluation board for the following components:

- Sense resistor (R1)
- Input common-mode filters (C1 and C3)
- Input differential filter (C2)
- Low-pass, single-pole filter option (C4)
- Load capacitor (C7)
- Option for lowering the gain (R6)
- Option for increasing the gain (R7)

EVALUATION BOARD SCHEMATIC AND ARTWORK

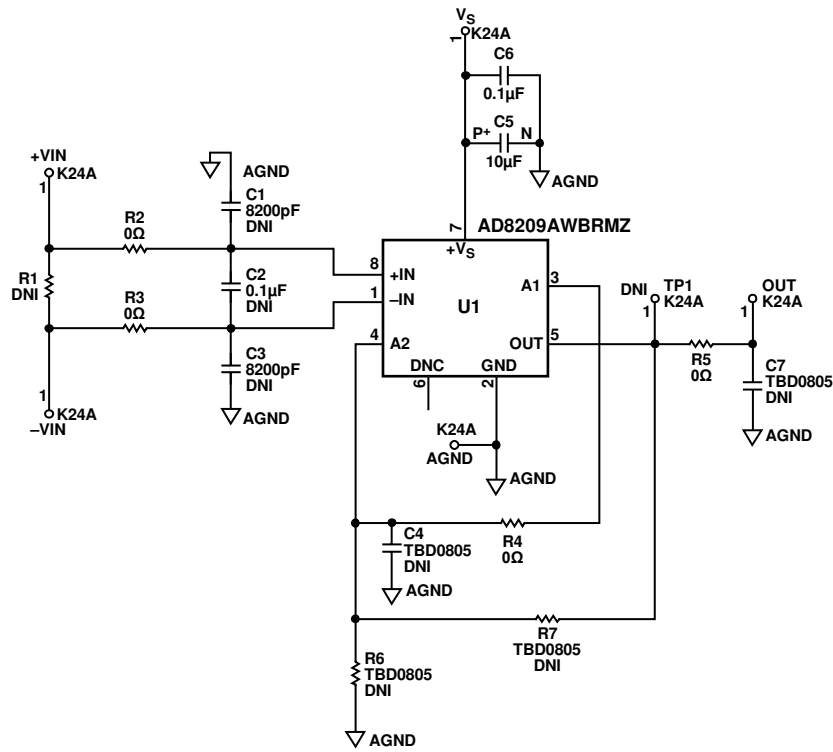
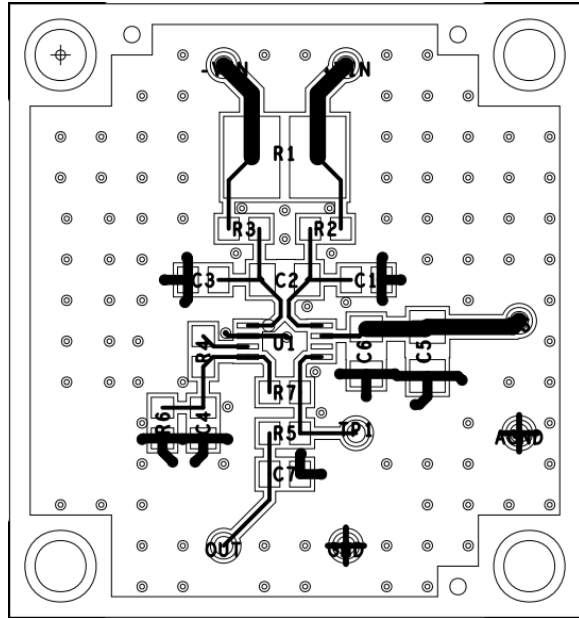


Figure 10. Evaluation Board Schematic

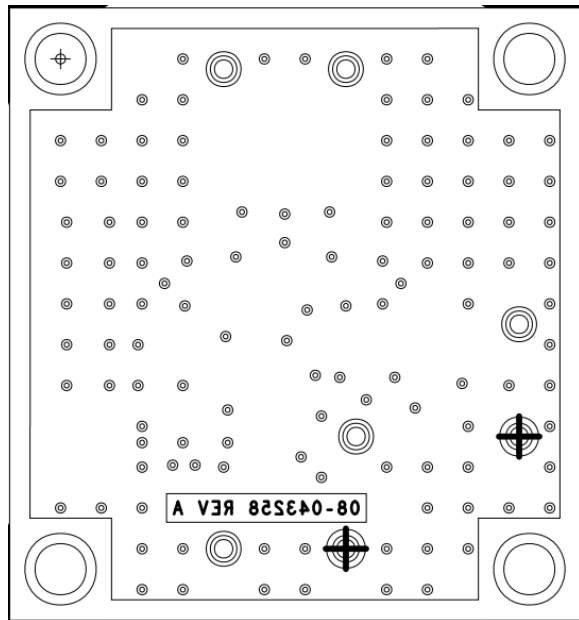
14790-010

EVALUATION BOARD LAYOUT



14790-011

Figure 11. Component Side Layout



14790-012

Figure 12. Circuit Side Layout

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Quantity	Reference Designator	Package	Description
1	U1	8-lead MSOP	AD8209AWBRMZ
7	VS, AGND, +VIN, -VIN, OUT, GND, TP1	CNLOOPTP_D45	Connector, printed circuit board (PCB) pin vector
2	C1, C3	C0805	Capacitor, 8200 pF
1	C2, C6	C1206	Capacitor, 0.1 μ F
2	C4, C7	C0805	User defined capacitor
1	C5	C3528	Capacitor, 10 μ F
1	R1	R2818	User defined capacitor
4	R2 to R5	R0805	Resistor, 0 Ω
2	R6, R7	R0805	User defined resistor



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 Technology Way, Norwood, MA 02062, USA. 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.