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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

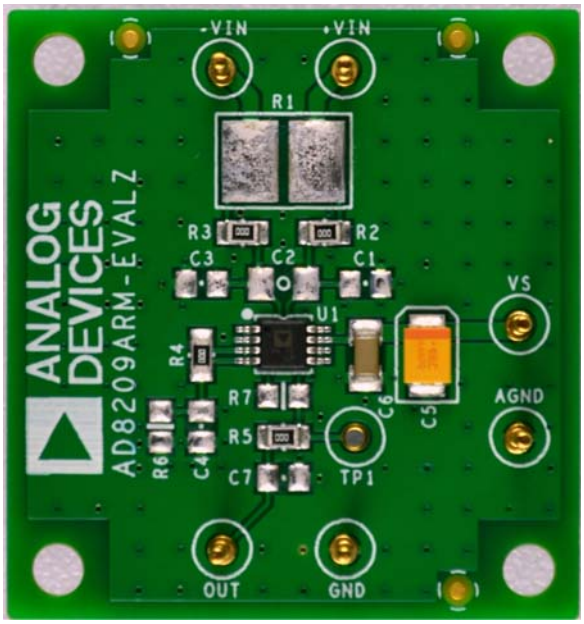

Figure 1. AD8209A-EVALZ Evaluation Board

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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.

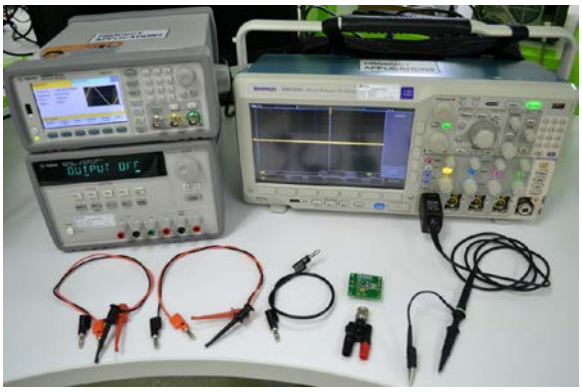

Figure 2. Minimum Components Required for Quick Start Operation

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.

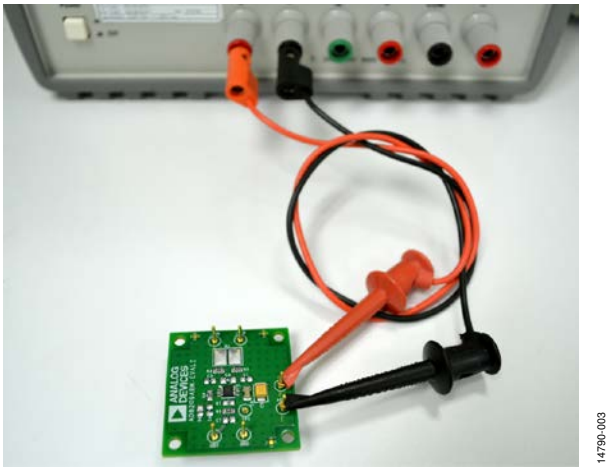

Figure 3. Basic Power Connections of the AD8209A Evaluation Board

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.

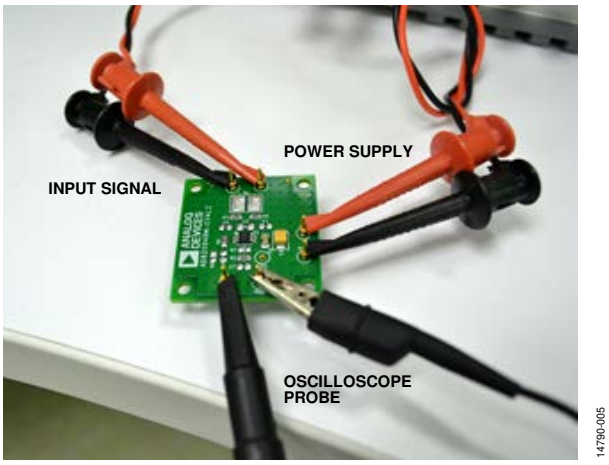

Figure 5. Completed Connections for Quick Start Operation

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.

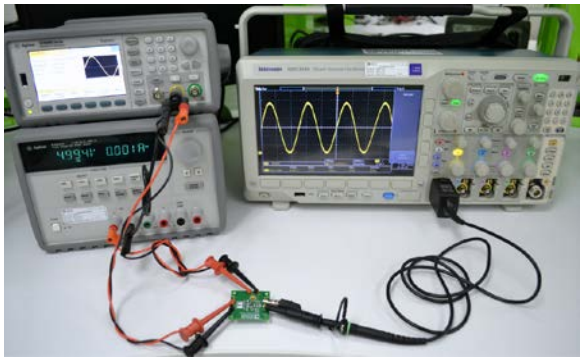

Figure 6. Final Result of the Quick Start Procedure with a 2.8 V p-p Signal Appearing on the Oscilloscope Using an AD8209A-EVALZ Board

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:

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

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

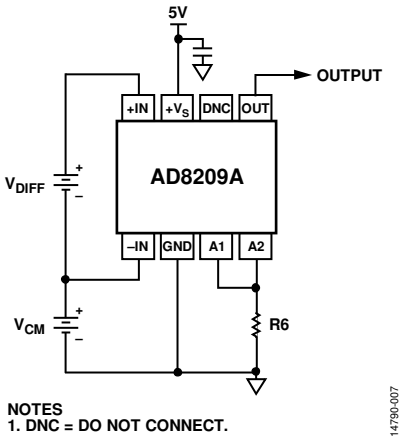

Figure 7. Adjusting for Gains Less Than 14

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):

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

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

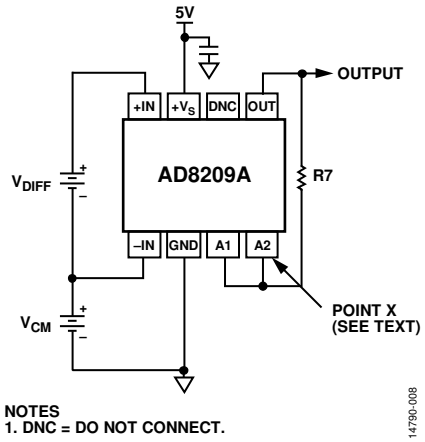

Figure 8. Adjusting for Gains Greater Than 14

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 (f_C) 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.

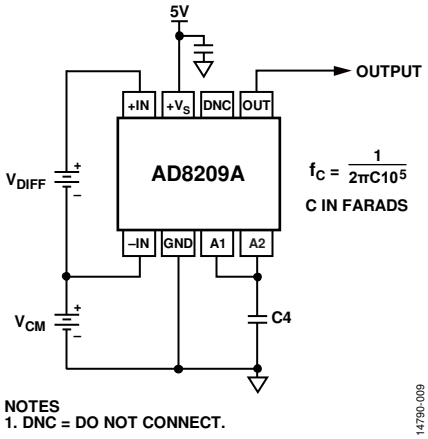

Figure 9. Single-Pole, Low-Pass Filter Using the Internal 100 kΩ Resistor

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

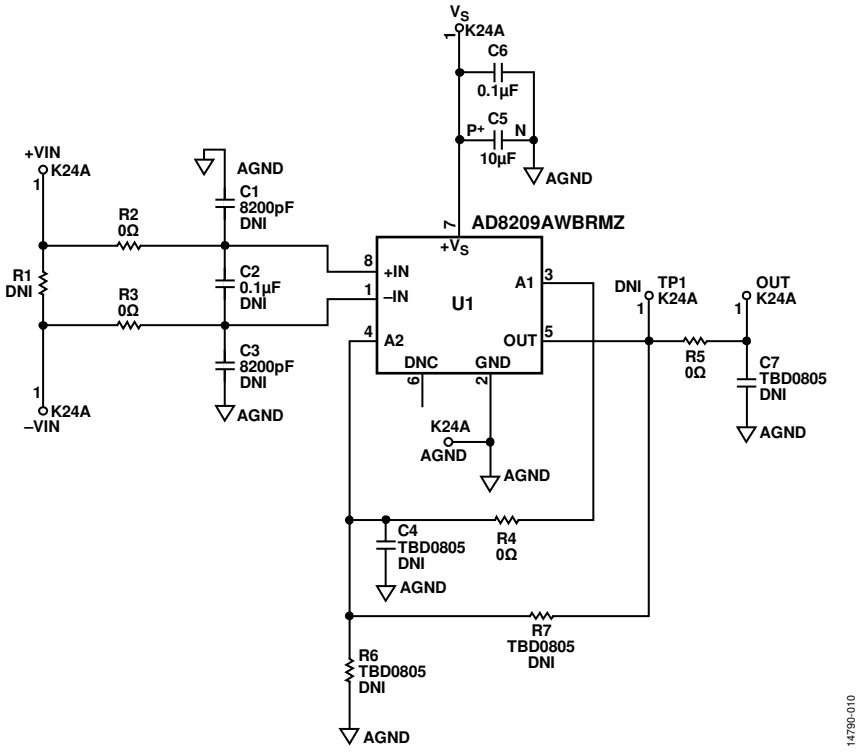

Figure 10. Evaluation Board Schematic

EVALUATION BOARD LAYOUT

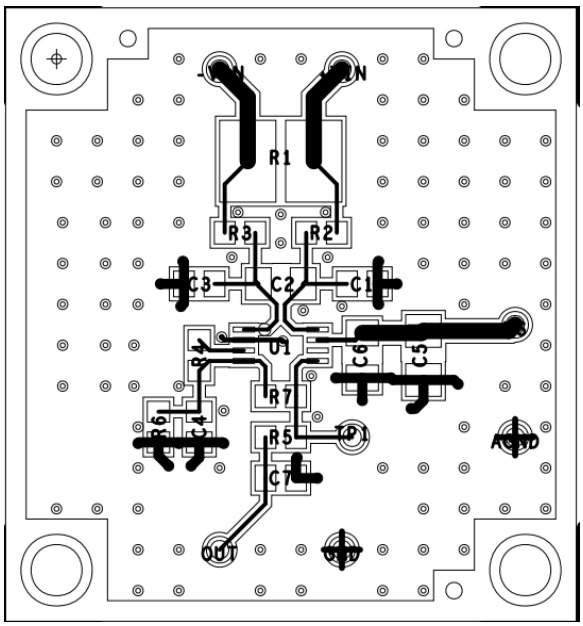

Figure 11. Component Side Layout

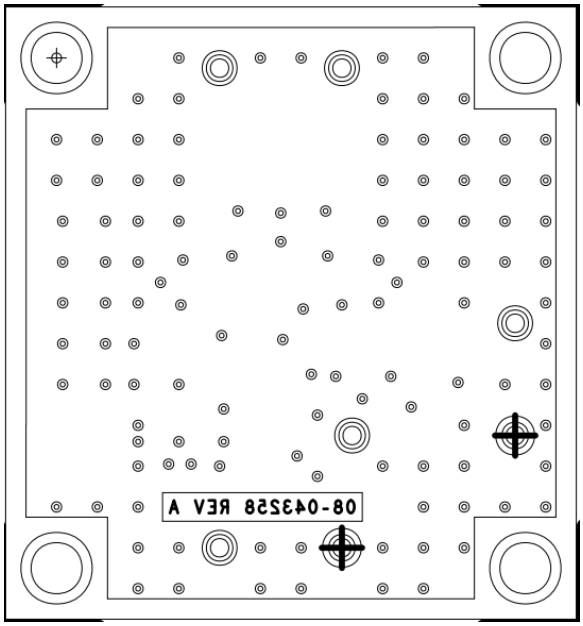

Figure 12. Circuit Side Layout

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 µF
2	C4, C7	C0805	User defined capacitor
1	C5	C3528	Capacitor, 10 µF
1	R1	R2818	User defined capacitor
4	R2 to R5	R0805	Resistor, 0 Ω
2	R6, R7	R0805	User defined resistor