

Evaluating the **ADP7182** Low Noise, Linear Regulator

FEATURES

Input voltage range: -2.7 V to -28 V

Output current range: 0 mA to -200 mA

Output voltage accuracy: ±1%

Operating temperature range: -40°C to +125°C

Adjustable option voltage set with two external resistors

$$V_{OUT} = -1.22 \text{ V} \times (1 + R1/R2)$$

GENERAL DESCRIPTION

The **ADP7182** evaluation board is used to demonstrate the functionality of the **ADP7182** series of linear regulators.

Simple device measurements such as line and load regulation, dropout, and ground current can be demonstrated with just a single voltage source, a voltmeter, an ammeter, and load resistors.

For more details about the **ADP7182** linear regulator, see the **ADP7182** data sheet, available at www.analog.com.

LAYOUT OF THE EVALUATION BOARDS

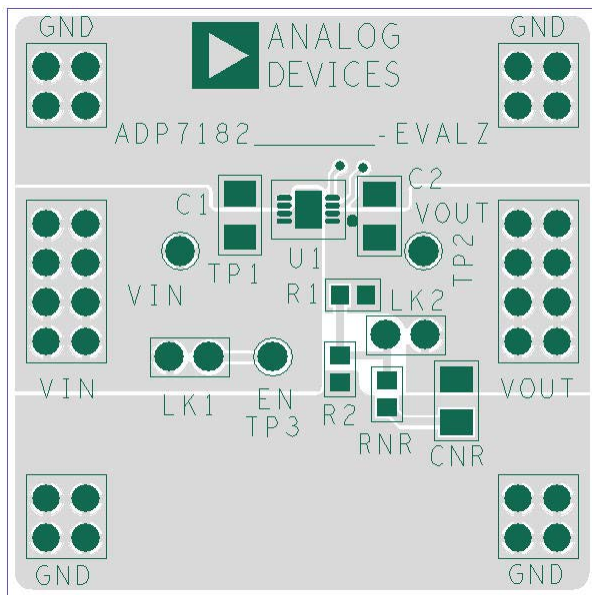


Figure 1. **ADP7182** LFCSP Evaluation Board

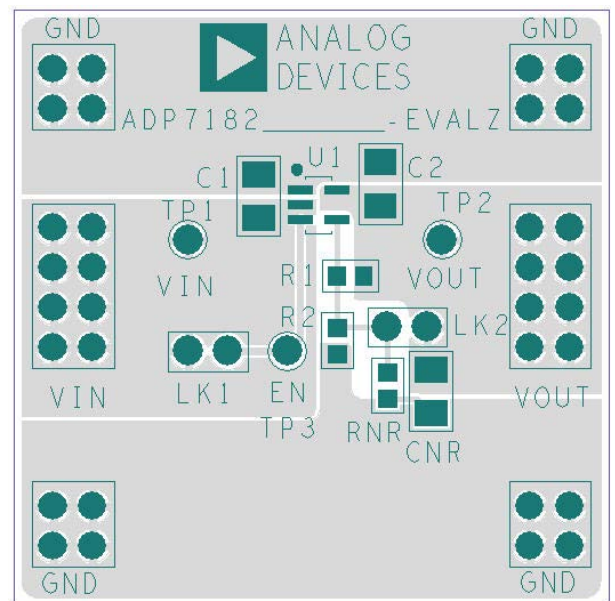


Figure 2. **ADP7182** TSOT Evaluation Board

TABLE OF CONTENTS

Features	1	Line Regulation.....	5
General Description	1	Load Regulation	5
Layout of the Evaluation Boards.....	1	Dropout Voltage	5
Revision History	2	Ground Current Measurements	6
Evaluation Board Hardware and Schematics.....	3	Ground Current Consumption	7
Evaluation Board Configurations	3	Bill of Materials.....	8
Output Voltage Measurements	4		

REVISION HISTORY

4/13—Revision 0: Initial Version

EVALUATION BOARD HARDWARE AND SCHEMATICS

EVALUATION BOARD CONFIGURATIONS

The [ADP7182](#) evaluation boards come supplied with different components, depending on which version of the board is ordered. Components common to both versions are C1, C2, LK1, and LK2.

Resistors R1 and R2 are used to set the output voltage of the adjustable output option. The output voltage is set by

$V_{OUT} = -1.22 \text{ V} \times (1 + R1/R2)$. With the values shown in Figure 3 and Figure 4, the output voltage is approximately -15 V .

For -1.22 V fixed output voltage operation, LK2 can be inserted or a 0Ω resistor can be installed for R1. Figure 4 shows the schematic of this evaluation board configuration. The [ADP7182](#) is rated for output currents of up to -200 mA .

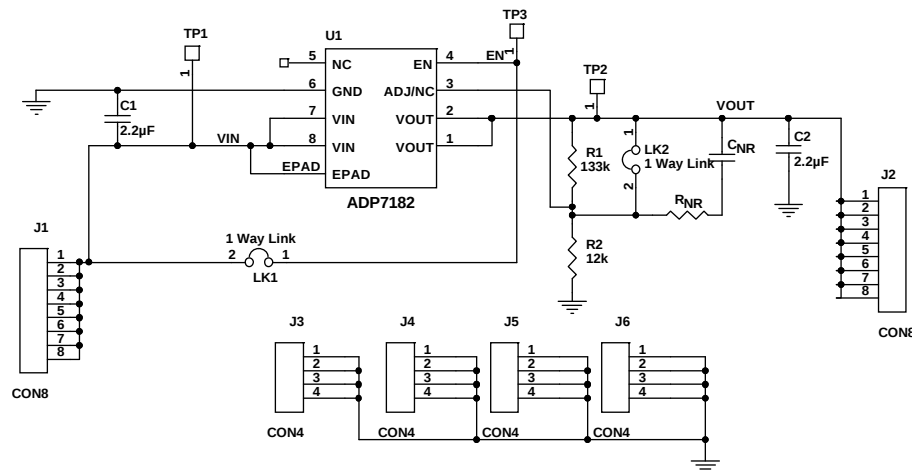


Figure 3. LFCSP Evaluation Board Schematic

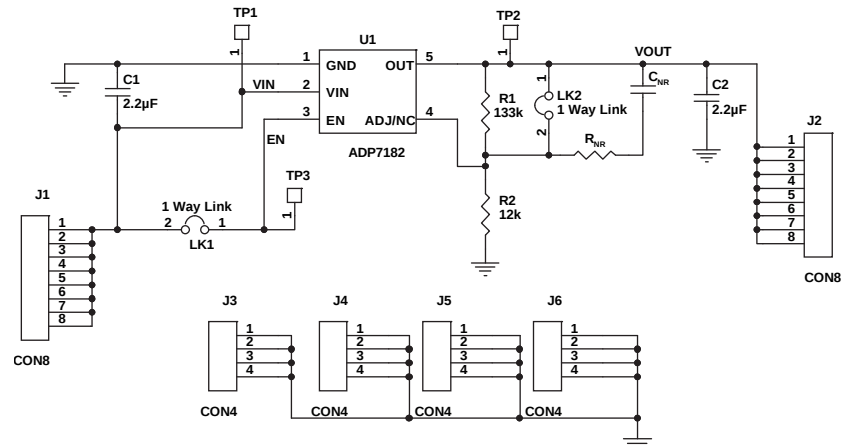


Figure 4. TSOT Evaluation Board Schematic

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1 ¹	Linear regulator	ADP7182 linear regulator.
C1	Input capacitor	2.2 µF input bypass capacitor.
C2	Output capacitor	2.2 µF output capacitor. Required for stability and transient performance.
R1	Output divider	Part of the external resistor divider (composed of R1 and R2) that sets the output voltage for the adjustable option; $V_{OUT} = -15 \text{ V}$ with the values shown in Figure 3 and Figure 4.
R2	Output divider	Part of the external resistor divider (composed of R1 and R2) that sets the output voltage for the adjustable option; $V_{OUT} = -15 \text{ V}$ with the values shown in Figure 3 and Figure 4.
R _{NR}	Noise reduction	Forms the noise reduction network (composed of R _{NR} and C _{NR}) for the adjustable option.
C _{NR}	Noise reduction	Forms the noise reduction network (composed of R _{NR} and C _{NR}) for the adjustable option.
LK1, LK2	Jumper	LK1 connects EN to VIN for automatic startup. To achieve -1.22 V with the adjustable output option, LK2 must be installed to connect the ADJ pin to the output.

¹ Component varies depending on the version of the evaluation board.

OUTPUT VOLTAGE MEASUREMENTS

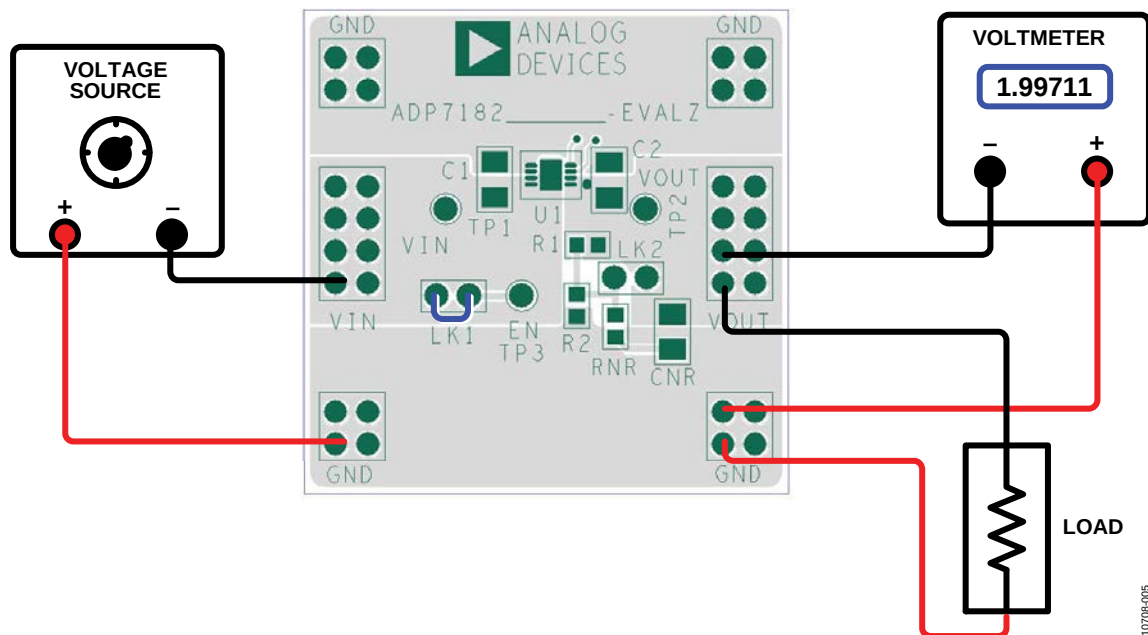


Figure 5. Output Voltage Measurements, LFCSP

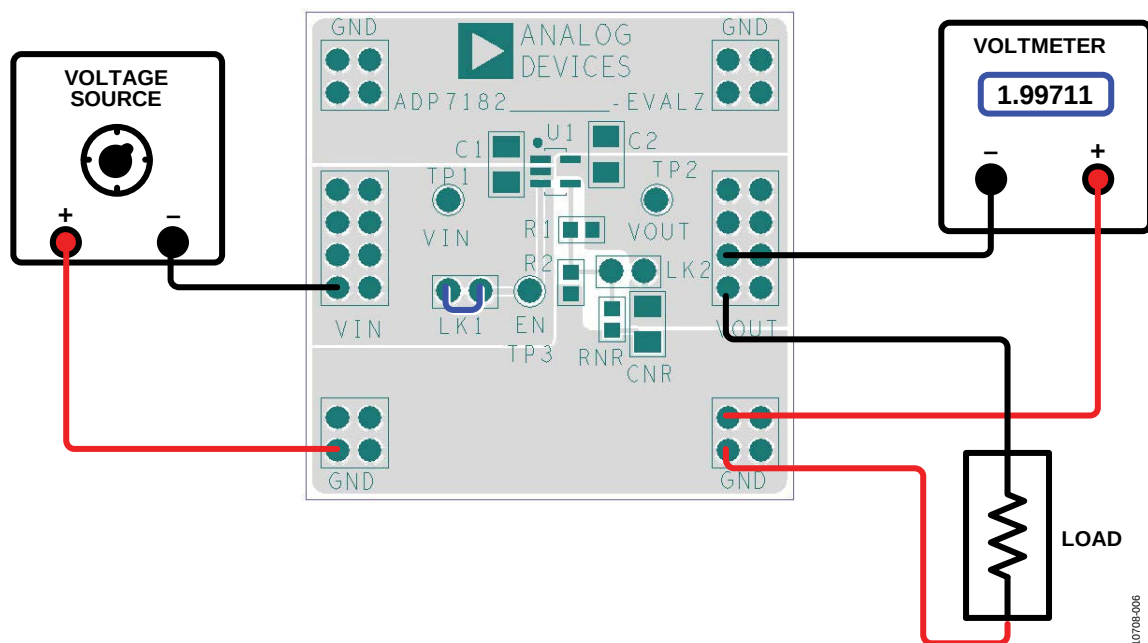


Figure 6. Output Voltage Measurements, TSOT

Figure 5 and Figure 6 show how the evaluation board can be connected to a voltage source and a voltmeter for basic output voltage accuracy measurements. A resistor can be used as the load for the regulator. Ensure that the resistor has a power rating that is adequate for handling the power expected to be dissipated across it. An electronic load can also be used as an alternative. Ensure that the voltage source can supply enough current for the expected load levels.

Use the following steps to connect the evaluation board to a voltage source and voltmeter:

1. Connect the positive terminal (+) of the voltage source to one of the GND pads on the evaluation board.
2. Connect the negative terminal (–) of the voltage source to the VIN pad of the evaluation board.
3. Connect a load between the VOUT pad and one of the GND pads.
4. Connect the positive terminal (+) of the voltmeter to one of the GND pads.
5. Connect the negative terminal (–) of the voltmeter to the VOUT pad.

The voltage source can then be turned on. If LK1 is inserted (connecting EN to VIN for automatic startup), the regulator powers up.

If the load current is large, connect the voltmeter as close as possible to the output capacitor to reduce the effects of IR drops.

LINE REGULATION

For line regulation measurements, the output of the regulator is monitored while its input is varied. For good line regulation, the output must change as little as possible with varying input levels. To ensure that the device is not in dropout during this measurement, V_{IN} must be varied between $V_{OUTNOM} - 1\text{ V}$ (or -2.7 V , whichever is greater) and V_{INMAX} . For example, for an adjustable [ADP7182](#) set to -15 V , V_{IN} must be varied between -16 V and -28 V . This measurement can be repeated under different load conditions. Figure 7 shows the typical line regulation performance of an [ADP7182](#) with a -15 V output.

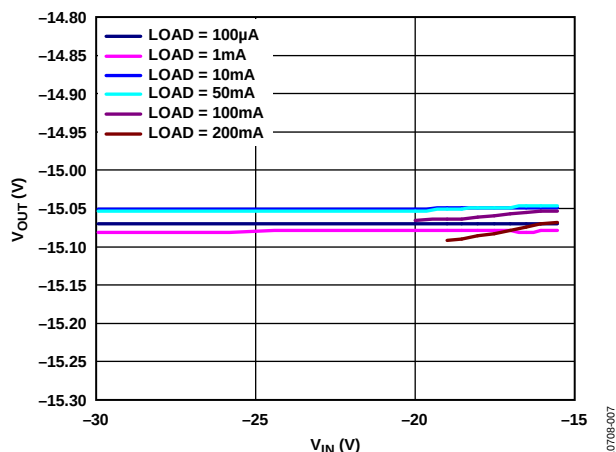


Figure 7. Output Voltage vs. Input Voltage

LOAD REGULATION

For load regulation measurements, the output of the regulator is monitored while the load is varied. For good load regulation, the output must change as little as possible with varying load. The input voltage must be held constant during this measurement. The load current can be varied from 0 mA to -200 mA . Figure 8 shows the typical load regulation performance of an [ADP7182](#) with a -15 V output for an input voltage of -16 V .

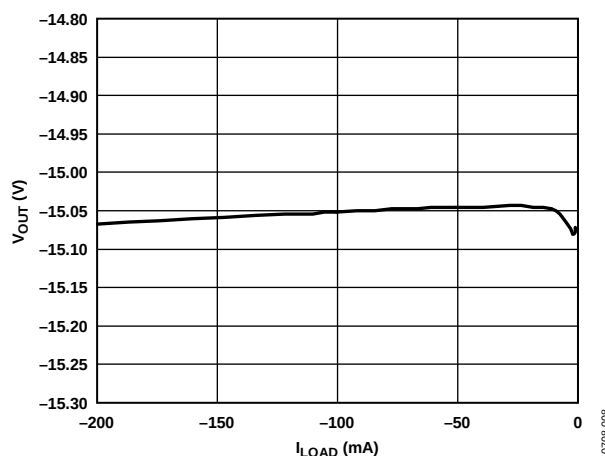


Figure 8. Output Voltage vs. Load Current

DROPOUT VOLTAGE

The dropout voltage can be measured using the configurations shown in Figure 5 and Figure 6. The dropout voltage is defined as the input-to-output voltage differential when the input voltage is set to the nominal output voltage. This applies only for output voltages less than -3 V . The dropout voltage increases with larger loads. For more accurate measurements, use a second voltmeter to monitor the input voltage across the input capacitor. The input supply voltage may need to be adjusted to account for IR drops, especially if large load currents are used. Figure 9 shows a typical curve of dropout voltage measurements with different load currents.

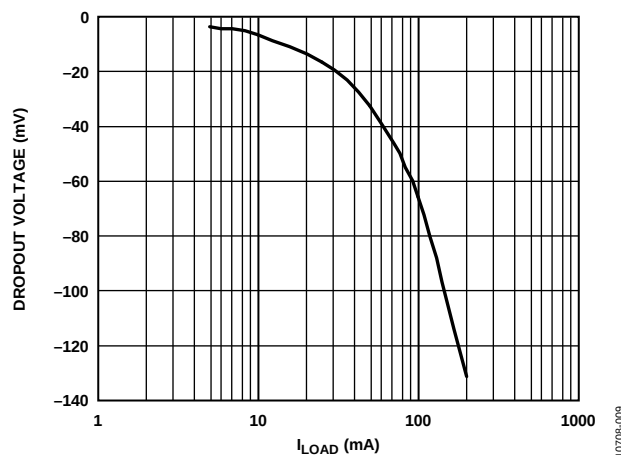


Figure 9. Dropout Voltage vs. Load Current

GROUND CURRENT MEASUREMENTS

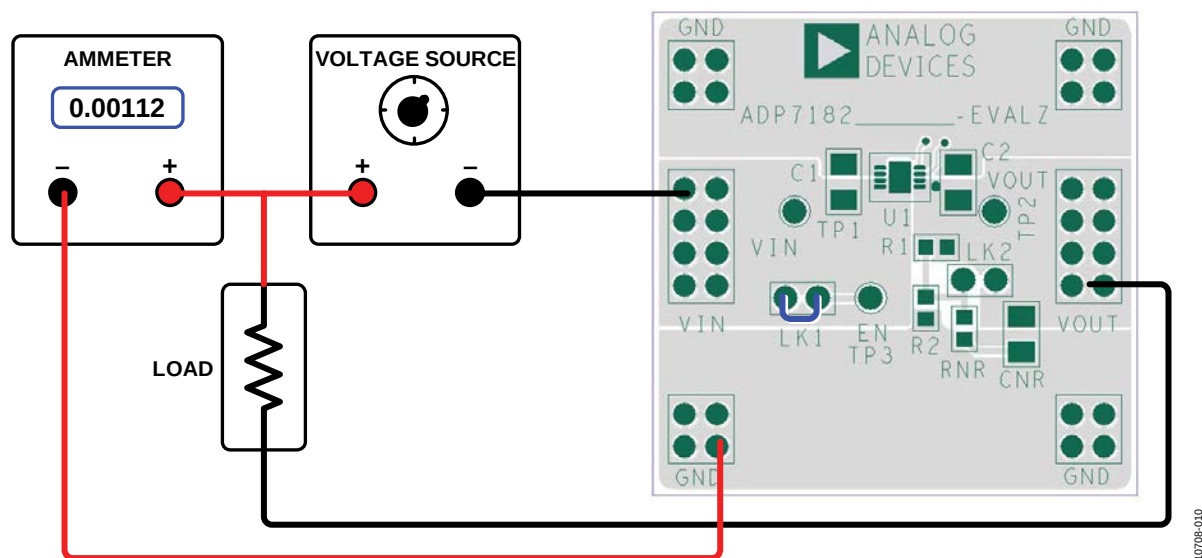


Figure 10. Ground Current Measurements, LFCSP

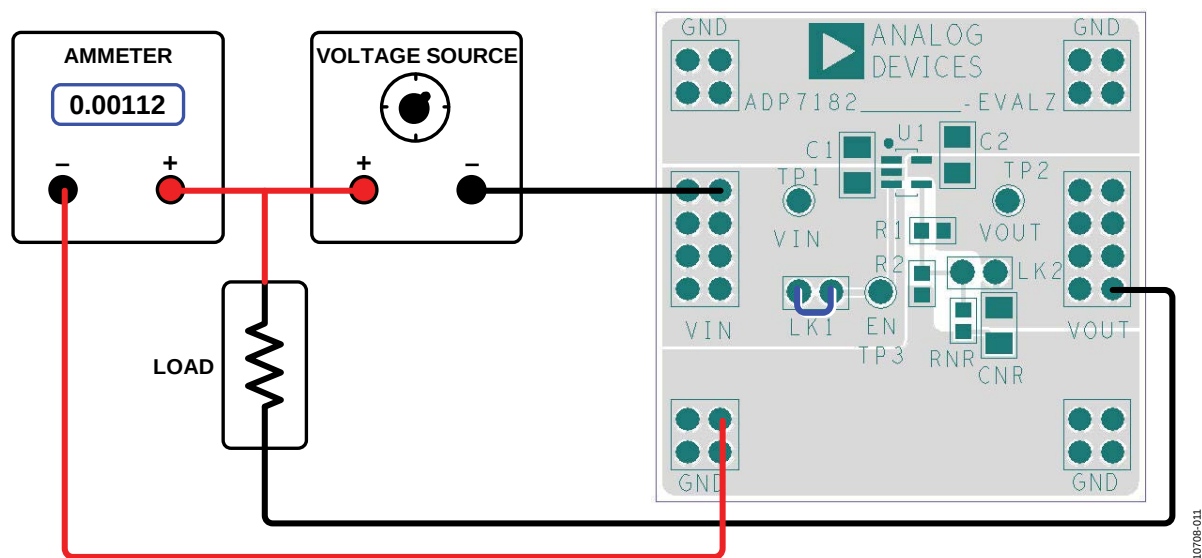


Figure 11. Ground Current Measurements, TSOT

Figure 10 and Figure 11 show how the evaluation board can be connected to a voltage source and an ammeter for ground current measurements. A resistor can be used as the load for the regulator. Ensure that the resistor has a power rating that is adequate for handling the power expected to be dissipated across it. An electronic load can be used as an alternative. Ensure that the voltage source used can supply enough current for the expected load levels.

Use the following steps to connect the evaluation board to a voltage source and ammeter:

1. Connect the negative terminal (–) of the voltage source to the VIN pad on the evaluation board.
2. Connect the negative terminal (–) of the ammeter to one of the GND pads of the evaluation board.
3. Connect the positive terminal (+) of the ammeter to the positive terminal (+) of the voltage source.
4. Connect a load between the positive terminal (+) of the voltage source and the VOUT pad of the evaluation board.

The voltage source can then be turned on. If LK1 is inserted (connecting EN to VIN for automatic startup), the regulator powers up.

GROUND CURRENT CONSUMPTION

Ground current measurements can determine how much current the regulator's internal circuits are consuming while the circuits perform the regulation function. To be efficient, the regulator needs to consume as little current as possible. Typically, the regulator uses the maximum current when supplying its largest load level (–200 mA). Figure 12 shows the typical ground current consumption for various load levels at an input voltage of –16 V for an output voltage of –15 V.

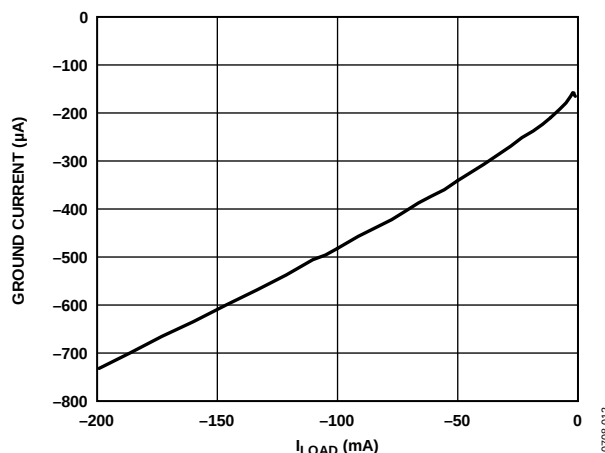


Figure 12. Ground Current vs. Load Current

When the device is disabled (EN = GND), the ground current drops to less than $-2 \mu A$.

BILL OF MATERIALS

Table 2.

Qty	Reference Designator	Description	Manufacturer/Vendor	Vendor Part Number
1	U1	ADP7182	Analog Devices, Inc.	ADP7182ACPZ/ADP7182AUJZ
2	C1, C2	Capacitor, MLCC, 2.2 μ F, 50 V, 1206, X5R	Murata (or equivalent)	GRM31CR61H225KA88
2	LK1, LK2	Header, single, STR, two pins	Sullins Connector Solutions	PEC02SAAN
1	R1	133k/1% resistor for setting output voltage		
1	R2	12k/1% resistor for setting output voltage		



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.