ADM7160CP-EVALZ/ADM7160UJ-EVALZ User Guide
UG-746

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Evaluating the ADM7160 Ultralow Noise, 200 mA, Linear Regulator

FEATURES

Power supply rejection ratio (PSRR) performance: 54 dB at 100 kHz
Ultralow noise independent of V_{OUT}
- **3 µV rms, 0.1 Hz to 10 Hz**
- **9.5 µV rms, 0.1 Hz to 100 kHz**
- **9 µV rms, 10 Hz to 100 kHz**
- **17 µV rms, 10 Hz to 1 MHz**

Low dropout voltage: 150 mV at I_{LOAD} = 200 mA
Maximum output current: 200 mA
Input voltage range: 2.2 V to 5.5 V
Low quiescent and shutdown current
Initial accuracy: ±1%
Accuracy over line, load, and temperature: −2.5% to +1.5%
5-lead TSOT package and 6-lead LFCSP package

EVALUATION KIT CONTENTS

ADM7160CP-EVALZ evaluation board or ADM7160UJ-EVALZ evaluation board

ADDITIONAL EQUIPMENT NEEDED

A direct current (dc) power supply
Multimeters for voltage and current measurements
Electronic or resistive loads

GENERAL DESCRIPTION

The ADM7160 evaluation boards demonstrate the operation and functionality of the ADM7160 ultralow noise, 200 mA, linear regulator.

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

Complete specifications for the ADM7160 ultralow noise, 200 mA, linear regulator are available in the ADM7160 data sheet available from Analog Devices, Inc., and should be consulted in conjunction with this user guide when using the evaluation boards.

EVALUATION BOARDS

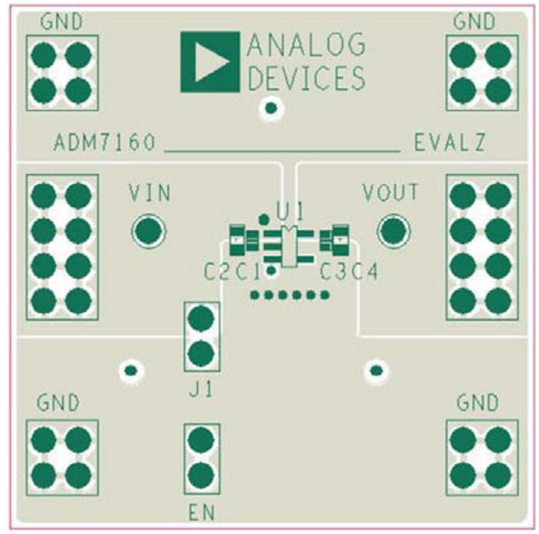

Figure 1. ADM7160UJ-EVALZ (5-Lead TSOT) Printed Circuit Board (PCB) Layout

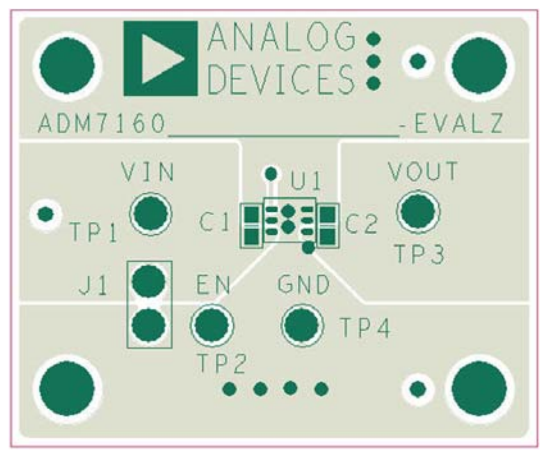

Figure 2. ADM7160CP-EVALZ (6-Lead LFCSP) PCB Layout

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REVISION HISTORY

10/14—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

EVALUATION BOARD CONFIGURATIONS

The ADM7160 evaluation boards come supplied with different components, depending on the version ordered. The schematics of these evaluation board configurations are shown in Figure 3 and Figure 4, and the components installed in the boards are shown in Table 1 and Table 2.

Internally, the ADM7160 consists of a reference, an error amplifier, a feedback voltage divider, and a positive metal-oxide semiconductor (PMOS) pass transistor. The ADM7160 is available in 16 fixed output voltage options, ranging from 1.1 V to 3.3 V.

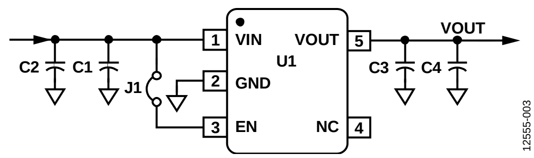

Figure 3. ADM7160UJ-EVALZ (5-Lead TSOT) Schematic

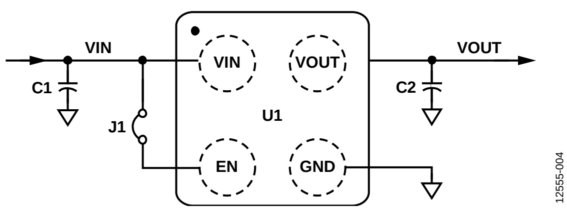

Figure 4. ADM7160CP-EVALZ (6-Lead LFCSP) Schematic

Table 1. ADM7160UJ-EVALZ Hardware Components

Component	Description
U1	ADM7160 low dropout linear regulator
C1	Input bypass capacitor (C_{IN}), 4.7 µF, 0402 size
C2	Input bypass capacitor (C_{IN}), 4.7 µF, 0603 size (not installed in the evaluation board)
C3	Output capacitor (C_{OUT}), 4.7 µF, 0402 size
C4	Output capacitor (C_{OUT}), 4.7 µF, 0603 size (not installed in the evaluation board)
J1	Jumper (connects the EN pin to the VIN pin for automatic startup)

Table 2. ADM7160CP-EVALZ Hardware Components

Component	Description
U1	ADM7160 low dropout linear regulator
C1	Input bypass capacitor (C_{IN}), 4.7 µF, 0603 size
C2	Output capacitor (C_{OUT}), 4.7 µF, 0603 size
J1	Jumper (connects the EN pin to the VIN pin for automatic startup)

OUTPUT VOLTAGE MEASUREMENTS

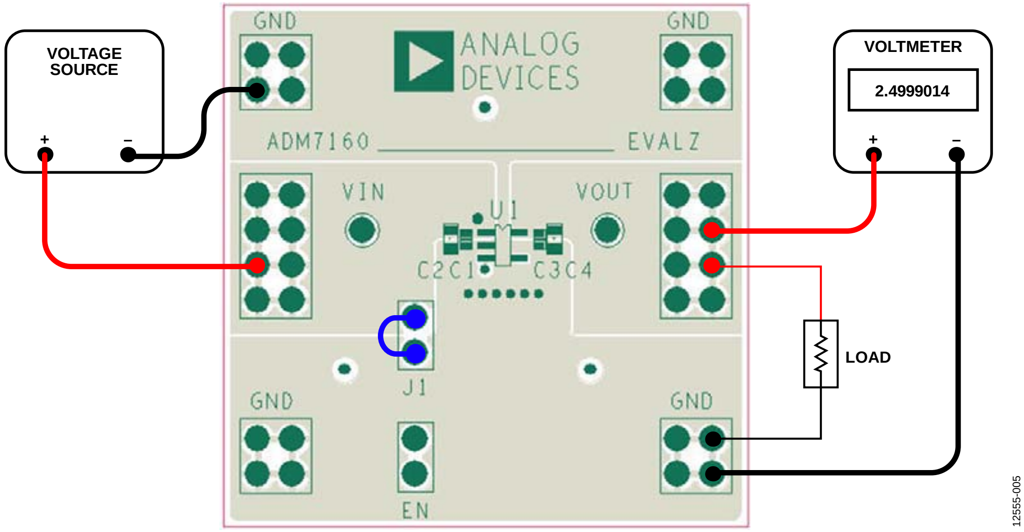

Figure 5. Output Voltage Measurement Setup, ADM7160UJ-EVALZ (5-Lead TSOT)

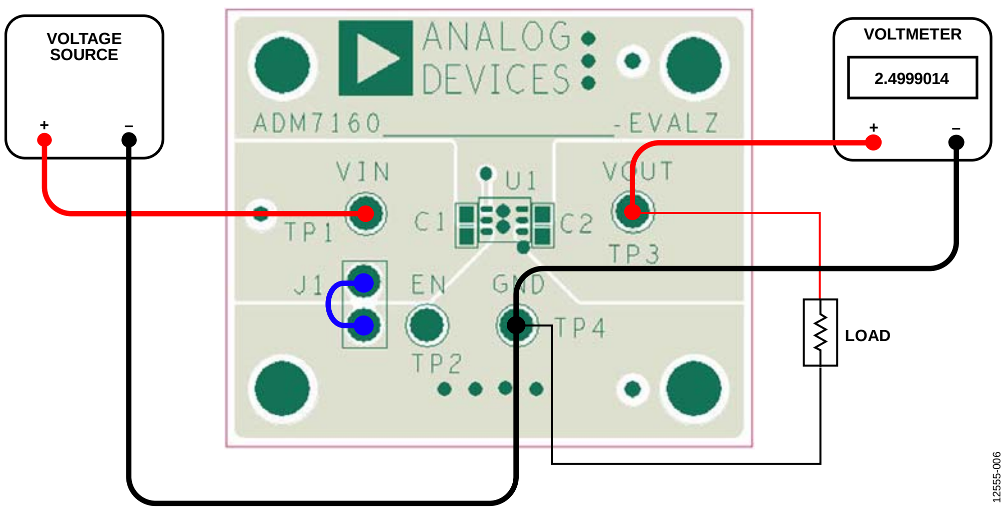

Figure 6. Output Voltage Measurement Setup, ADM7160CP-EVALZ (6-Lead LFCSP)

The connections of the ADM7160 evaluation boards to a voltage source and a voltmeter for basic output voltage accuracy measurements are shown in Figure 5 and Figure 6. A resistor can be used as the load for the regulator. Ensure that the resistor has a power rating that can handle the power 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.

The steps on how to connect either of the ADM7160 evaluation boards to a voltage source and a voltmeter are as follows:

1. Connect the negative terminal (−) of the voltage source to one of the GND pins on the ADM7160 evaluation board.
2. Connect the positive terminal (+) of the voltage source to the VIN pin of the ADM7160 evaluation board.
3. Connect a load between the VOUT pin and one of the GND pins.
4. Connect the negative terminal (−) of the voltmeter to one of the GND pins.
5. Connect the positive terminal (+) of the voltmeter to the VOUT pin.

When these steps are completed, the voltage source can be turned on. If J1 is inserted (connecting the EN pin to the VIN pin 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 voltage drops.

LINE REGULATION MEASUREMENTS

For line regulation measurements, the output of the regulator is monitored while its input is varied. For good line regulation, the output must maintain a minimal change in voltage with respect to varying the input voltage levels. To ensure that the device is not in dropout mode during this measurement, vary V_{IN} between V_{OUT_NOM} + 0.4 V (or 2.2 V, whichever is greater) and V_{IN_MAX}. For example, for an ADM7160 with a fixed 2.5 V output, vary V_{IN} between 2.9 V and 5.5 V. This measurement can be repeated under different load conditions. The typical line regulation performance of an ADM7160 with a fixed 2.5 V output is shown in Figure 7.

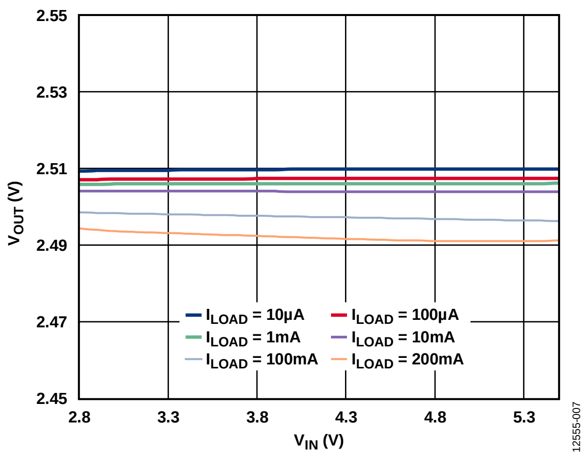

Figure 7. Output Voltage (V_{OUT}) vs. Input Voltage (V_{IN}), V_{OUT} = 2.5 V, T_A = 25°C, C_{IN} = C_{OUT} = 4.7 µF

LOAD REGULATION MEASUREMENTS

For load regulation measurements, the output voltage of the regulator is monitored while the load current is varied. For a good load regulation, the output must maintain a minimal voltage change with respect to varying load current levels. Hold the input voltage constant during this measurement. The load current can be varied from 0 mA to 200 mA. The typical load regulation performance of an ADM7160 with a fixed 2.5 V output for an input voltage of 2.9 V is shown in Figure 8.

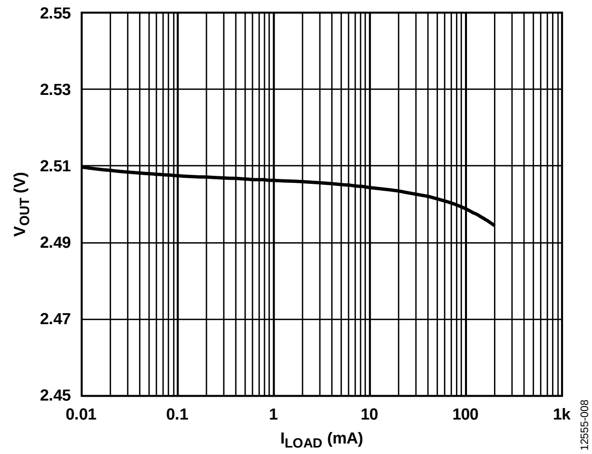

Figure 8. Output Voltage (V_{OUT}) vs. Load Current (I_{LOAD}), V_{OUT} = 2.5 V, T_A = 25°C, C_{IN} = C_{OUT} = 4.7 µF

DROPOUT VOLTAGE MEASUREMENTS

Dropout voltage is the amount of voltage above the rated output voltage that is needed to maintain a fixed output voltage. It can be measured as the difference of the input to the output voltage of the regulator. This definition is only applicable to output voltages above 2.2 V. Dropout voltage increases with larger loads. Figure 5 and Figure 6 show the configuration for measuring dropout voltage.

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 for voltage drops, especially if large load currents are used. The typical curve of dropout voltage measurements over varying load current levels is shown in Figure 9.

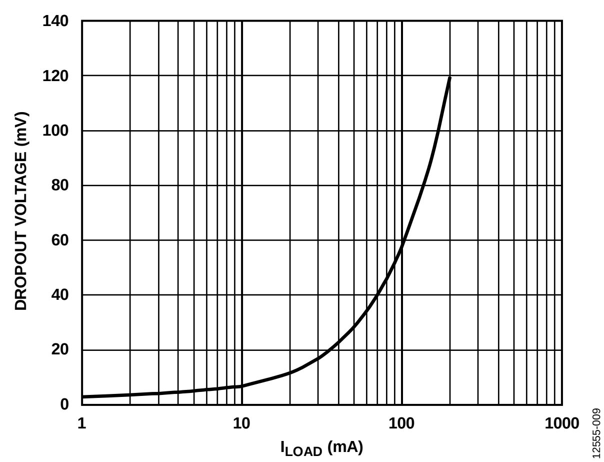

Figure 9. Dropout Voltage vs. Load Current (I_{LOAD}), V_{OUT} = 2.5 V, T_A = 25°C, C_{IN} = C_{OUT} = 4.7 µF

GROUND CURRENT MEASUREMENTS

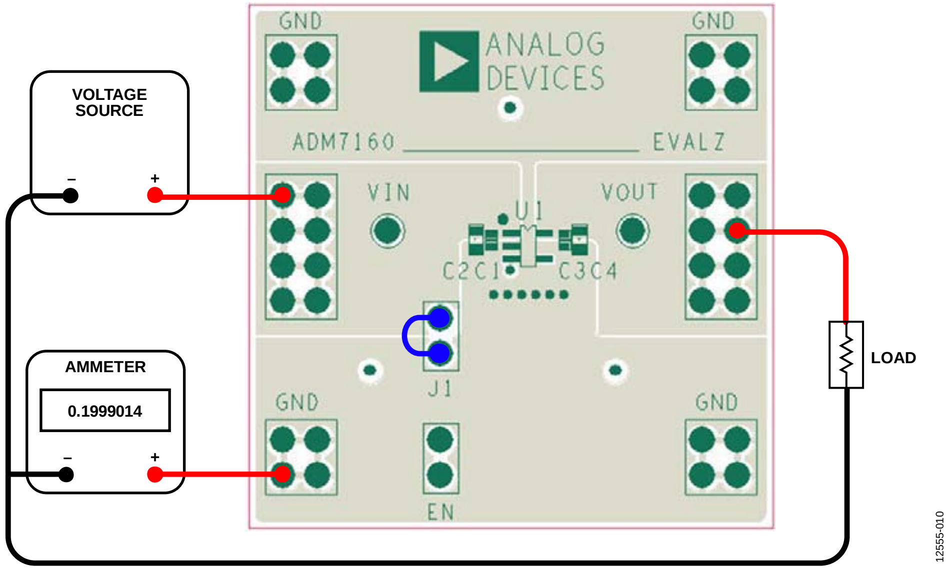

Figure 10. Ground Current Measurement Setup, ADM7160UJ-EVALZ (5-Lead TSOT)

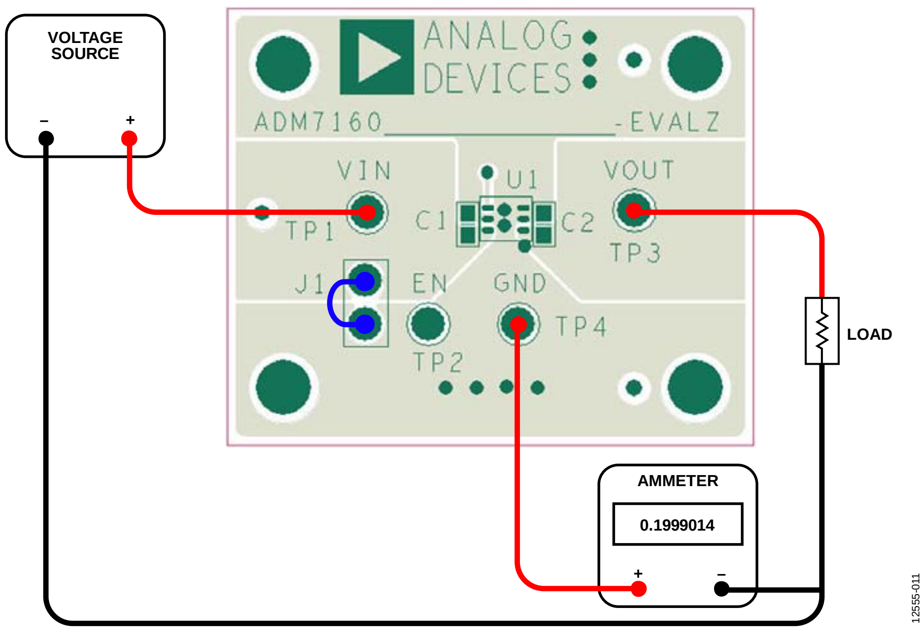

Figure 11. Ground Current Measurement Setup, ADM7160CP-EVALZ (6-Lead LFCSP)

The connections of the ADM7160 evaluation boards to a voltage source and an ammeter for ground current measurements are shown in Figure 10 and Figure 11. A resistor can be used as a load for the regulator. Ensure that the resistor has a power rating that can handle the power dissipated across it. An electronic load can be used as an alternative. Ensure that the voltage source can supply enough current for the expected load levels.

The steps on how to connect either of the ADM7160 evaluation boards to a voltage source and an ammeter are as follows:

1. Connect the positive terminal (+) of the voltage source to the VIN pin of the ADM7160 evaluation board.
2. Connect the positive terminal (+) of the ammeter to one of the GND pins of the evaluation board.
3. Connect the negative terminal (–) of the ammeter to the negative (–) terminal of the voltage source.
4. Connect a load between the VOUT pin of the ADM7160 evaluation board and the negative (–) terminal of the voltage source.

When these steps are completed, the voltage source can be turned on. If J1 is inserted (connecting the EN pin to the VIN pin for automatic startup), the regulator powers up.

GROUND CURRENT CONSUMPTION

Ground current measurements can determine how much current the internal circuits of the regulator consume while the circuits perform the regulation function. To be efficient, the regulator must consume as little current as possible. Typically, the regulator uses the maximum current when supplying its largest load level (200 mA). The typical ground current consumption for various load current levels at V_{OUT} = 2.5 V and T_A = 25°C is shown in Figure 12.

When the device is disabled (EN = GND), the ground current typically drops to 0.2 µA.

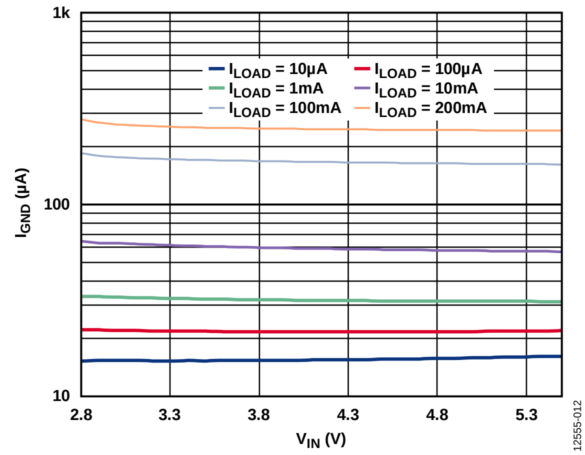

Figure 12. Ground Current (I_{GND}) vs. Input Voltage (V_{IN}), V_{OUT} = 2.5 V, T_A = 25°C, C_{IN} = C_{OUT} = 4.7 µF

ORDERING INFORMATION

BILL OF MATERIALS

Table 3. ADM7160UJ-EVALZ (5-Lead TSOT)

Reference Designator	Description	Manufacturer	Manufacturing Part No.
U1	ADM7160, IC, ultralow noise LDO, 2.5 V	Analog Devices, Inc.	ADM7160AUJZ-2.5-R7 ADM7160UJ-EVALZ
C1, C3	Capacitor, MLCC, 4.7 µF, 10 V, 0402, X5R, 10%	TDK or equivalent	C1005X5R1A475K050BC
C2,[1] C4[1]	Capacitor, MLCC, 4.7 µF, 10 V, 0603, X5R, 10%	TDK or equivalent	CGB3B1X5R1A475K055AC
J1, VIN, VOUT, GND	Header 0.100, single, STR, two pins	Sullins Electronics/3M	S1012E-36-ND

[1] Not installed in the evaluation board.

Table 4. ADM7160CP-EVALZ (6-Lead LFCSP)

Reference Designator	Description	Manufacturer	Manufacturing Part No.
U1	ADM7160, IC, ultralow noise LDO, 2.5 V	Analog Devices, Inc.	ADM7160ACPZN2.5-R7 ADM7160CP-EVALZ
C1, C2	Capacitor, MLCC, 4.7 µF, 10 V, 0603, X5R, 10%	TDK or equivalent	CGB3B1X5R1A475K055AC
J1, VIN, VOUT, GND	Header 0.100, single, STR, two pins	Sullins Electronics/3M	S1012E-36-ND

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