ANALOG DEVICES

Evaluation Board User Guide
UG-056

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Setting Up the Evaluation Board for the ADP124/ADP125

FEATURES

Input voltage range: 2.3 V to 5.5 V
Output current range: 0 mA to 500 mA
Output voltage accuracy: ±1%
Operating temperature range: −40°C to +125°C

GENERAL DESCRIPTION

This user guide explains the functionality of the ADP124/ ADP125 linear regulators.

Simple device measurements such as line and load regulation, dropout voltage, and ground current can be achieved with only a single voltage supply, a voltage meter, a current meter, and load resistors.

For more information about the ADP124/ADP125 linear regulators, see the ADP124/ADP125 data sheets.

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REVISION HISTORY

11/10—Rev. A to Rev. B

Added ADP124 to Figure 9 Caption ... 6
Added ADP124 to Figure 15 Caption ... 9
Changes to U1 Part No. Column, Table 2 ... 11

9/10—Rev. 0 to Rev. A

Added LFCSP Throughout ... Universal
Changes to Figure 1 and Figure 2, added Figure 3; Renumbered Sequentially ... 3
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3/10—Revision 0: Initial Version

EVALUATION BOARD PCB LAYOUT

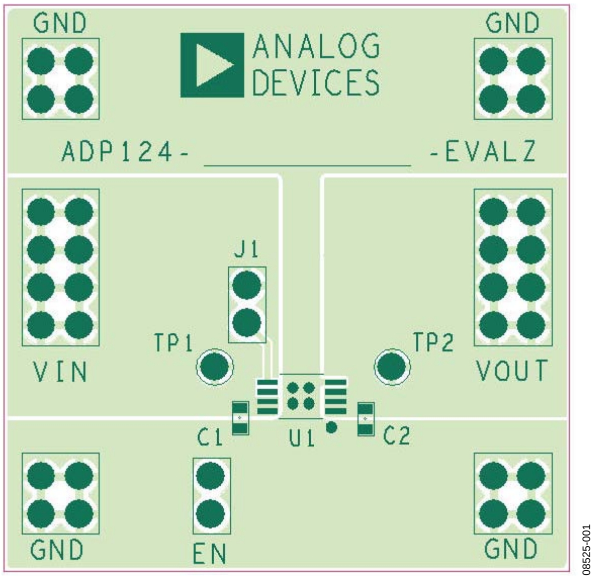

Figure 1. ADP124 PCB Layout, MSOP

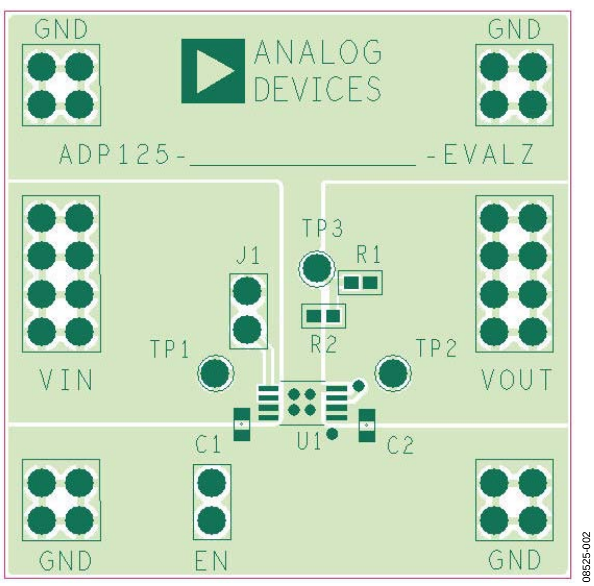

Figure 2. ADP125 PCB Layout, MSOP

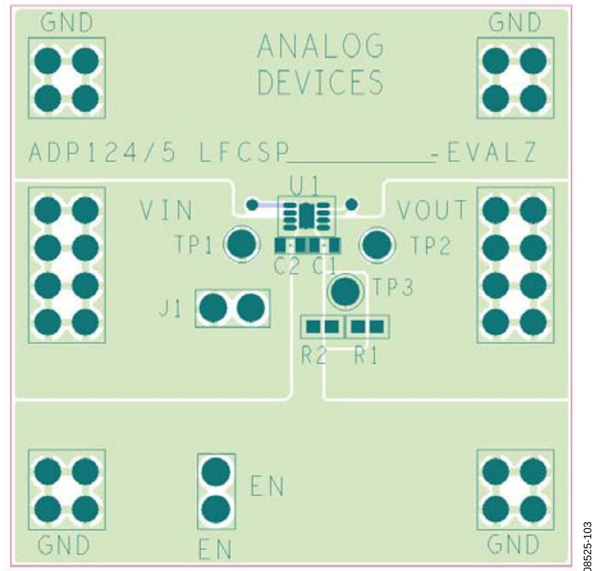

Figure 3. ADP124/ADP125 PCB Layout, LFCSP

EVALUATION BOARD HARDWARE

EVALUATION BOARD CONFIGURATIONS

The ADP124/ADP125 evaluation boards are supplied with different components, depending on the version that is ordered. Components common to both versions are C1, C2, TP1, TP2, and J1. Figure 4, Figure 5, and Figure 6 show the schematics of the various ADP124 and ADP125 evaluation board configurations. Table 1 describes the components.

The ADP125 is the same as the ADP124 except that the output voltage dividers are internally disconnected and the feedback input of the error amplifiers is brought out for each output. The output voltage can be set using the following formula:

$$V_{OUT} = 0.5\text{ V}(1 + R1/R2) + (\text{ADJ}_{I\text{-}BIAS})(R1)$$

The value of R1 should be less than 200 kΩ to minimize errors in the output voltage caused by the ADJ pin input current. For example, when R1 and R2 are equal to 200 kΩ, the output voltage is 1.0 V. The output voltage error introduced by the ADJ pin input current is 3 mV or 0.30%, assuming a typical ADJ pin input current of 15 nA at 25°C.

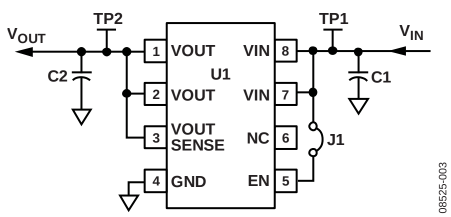

Figure 4. ADP124 MSOP Evaluation Board Schematic

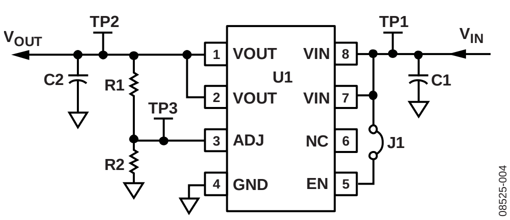

Figure 5. ADP125 MSOP Evaluation Board Schematic

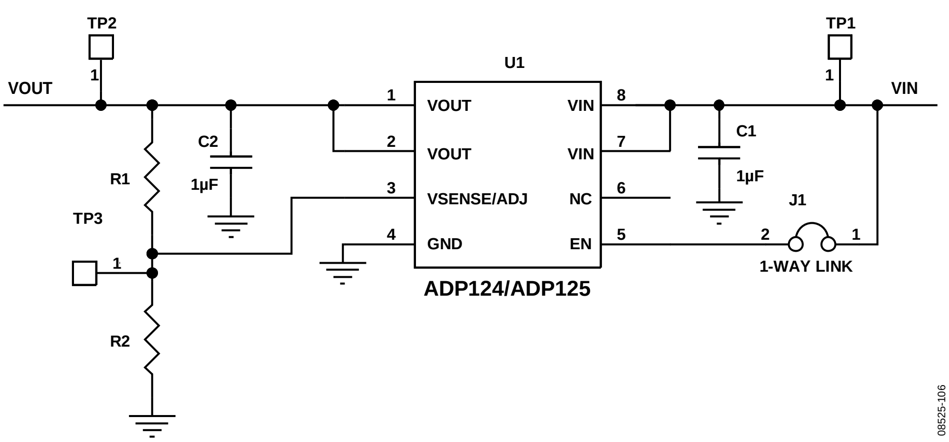

Figure 6. ADP124/ADP125 Evaluation Board Schematic, LFCSP

Table 1. Evaluation Board Hardware Components

Component	Description
U1[1]	ADP124/ADP125 low dropout linear regulators
C1	Input bypass capacitor, 1 µF, 0603 size
C2	Output capacitor, 1 µF, 0603 size
J1	Jumper (connects EN to VIN for automatic startup)
TP1	Testpoint closer to VIN
TP2	Testpoint closer to VOUT
TP3	Testpoint closer to ADJ (ADP125 evaluation board only)
R1, R2	0603 size feedback resistors between VOUT and ADJ (ADP125 evaluation board only)

[1] Component depends on evaluation board type ordered.

OUTPUT VOLTAGE MEASUREMENTS

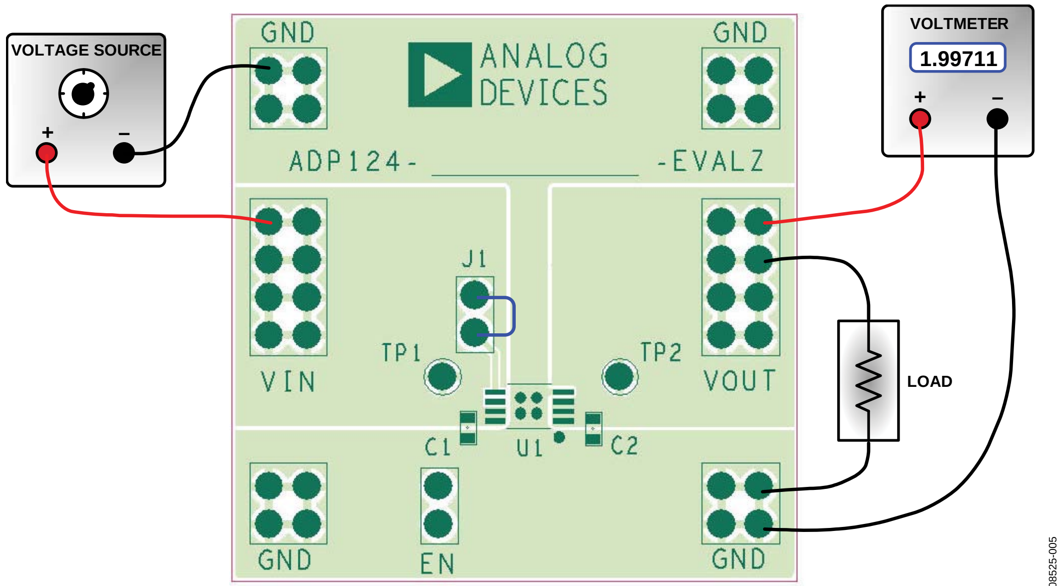

Figure 7. ADP124 Output Voltage Measurement Setup, MSOP

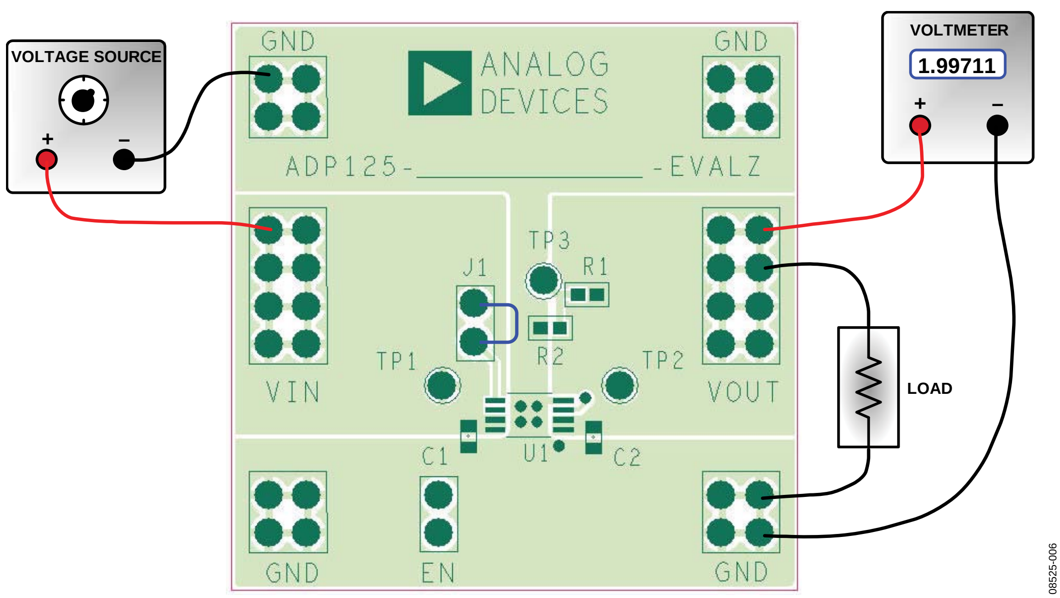

Figure 8. ADP125 Output Voltage Measurement Setup, MSOP

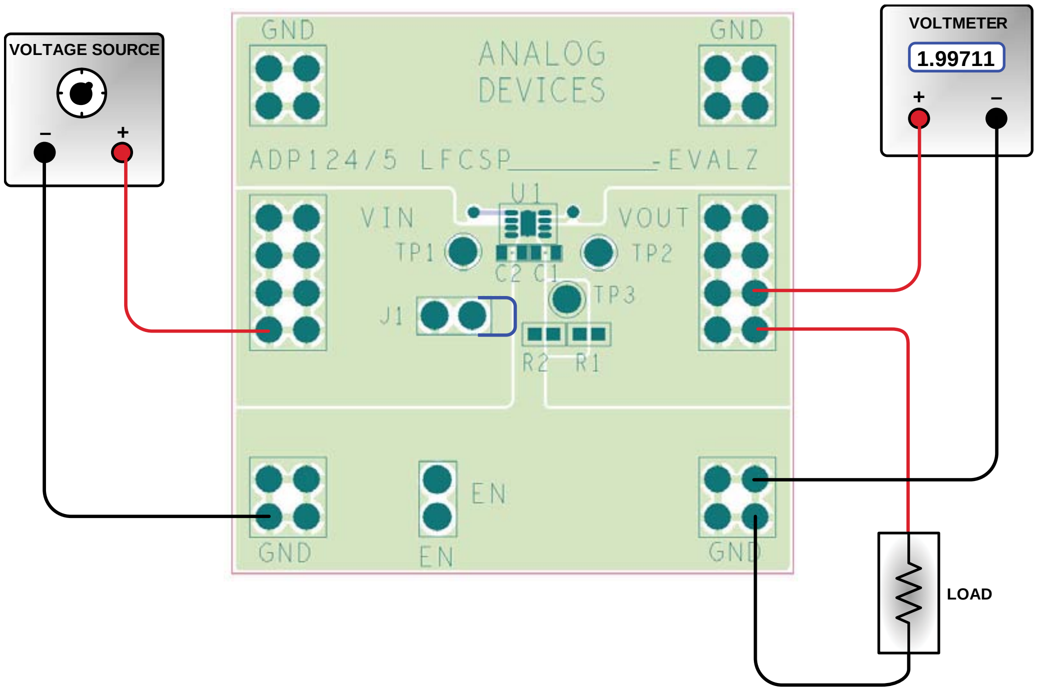

Figure 9. ADP124/ADP125 Output Voltage Measurement Setup, LFCSP

Figure 7, Figure 8, and Figure 9 show how the evaluation boards can be connected to a voltage source and a voltage meter for basic out-put 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 to handle the power that is expected to dissipate 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.

Follow these steps to connect to a voltage source and voltage meter:

1. Connect the negative terminal (–) of the voltage source to one of the GND pads on the evaluation board.
2. Connect the positive 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 negative terminal (–) of the voltage meter to one of the GND pads.
5. Connect the positive terminal (+) of the voltage meter to the VOUT pad.
6. If the ADP124 LFCSP board is being used, short R1. Otherwise, install R1 and R2 for the ADP125 adjustable LDO.

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

If the load current is large, the user must connect the voltage meter as close as possible to the output capacitor to reduce the effects of IR 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 change as little as possible with varying input levels. To ensure that the device is not in dropout mode during this measurement, V_{IN} must be varied between V_{OUTNOM} + 0.3 V (or 2.3 V, whichever is greater) and V_{INMAX}.

For example, for the ADP124 with a fixed 3.3 V output, V_{IN} must be varied between 3.6 V and 5.5 V. This measurement can be repeated under different load conditions. Figure 10 shows the typical line regulation performance of the ADP124 with a fixed 3.3 V output.

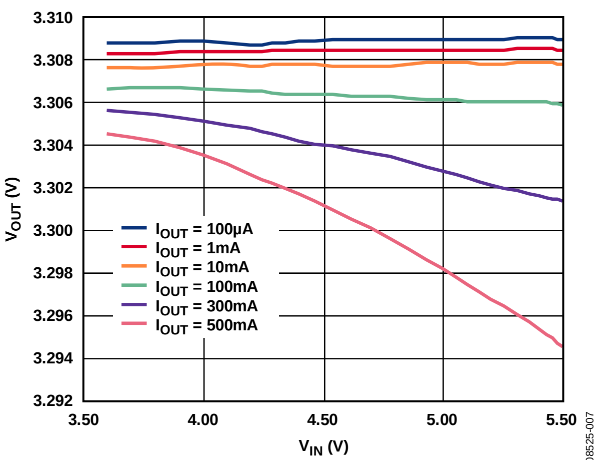

Figure 10. Output Voltage (V_{OUT}) vs. Input Voltage (V_{IN}) at T_A = 25°C

LOAD REGULATION MEASUREMENTS

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 500 mA.

Figure 11 shows the typical load regulation performance of the ADP124 with a fixed 3.3 V output for an input voltage of 3.6 V.

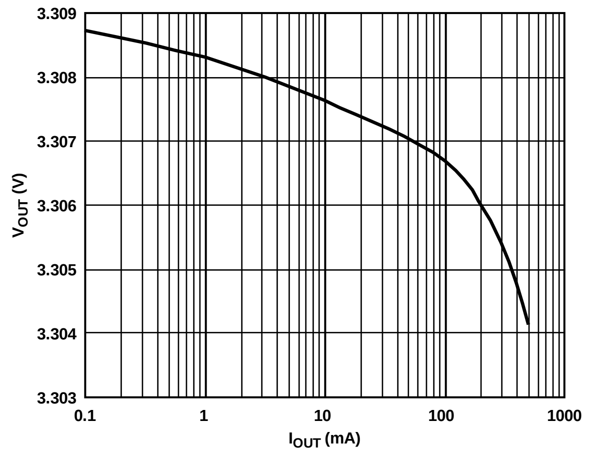

Figure 11. Output Voltage (V_{OUT}) vs. Load Current (I_{OUT}) at V_{IN} = 3.6 V, V_{OUT} = 3.3 V, T_A = 25°C

DROPOUT VOLTAGE MEASUREMENTS

Dropout voltage can be measured using the configurations shown in Figure 7, Figure 8, and Figure 9. 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 to output voltages above 2.3 V. Dropout voltage increases with larger loads.

For more accurate measurements, a second voltage meter can be used 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 12 shows the typical curve of dropout voltage measurements with different load currents.

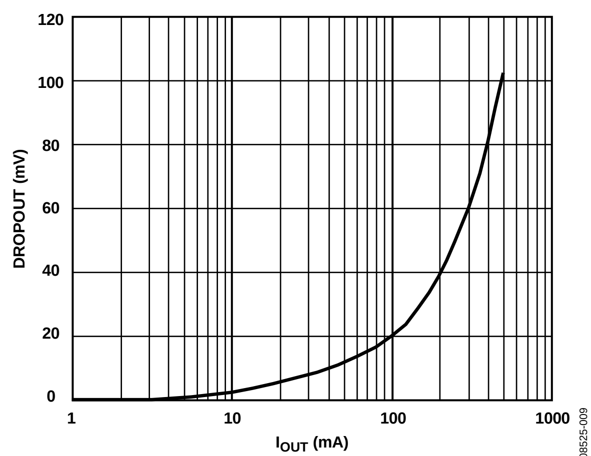

Figure 12. Dropout Voltage vs. Load Current (I_{OUT}) at V_{OUT} = 3.3 V, T_A = 25°C

GROUND CURRENT MEASUREMENTS

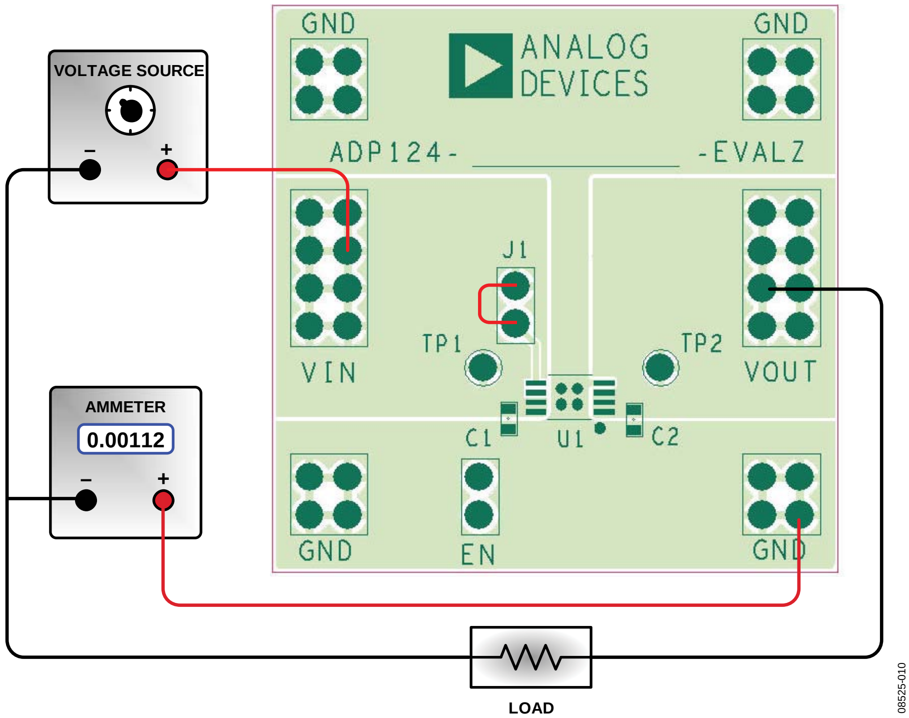

Figure 13. ADP124 Ground Current Measurement Setup, MSOP

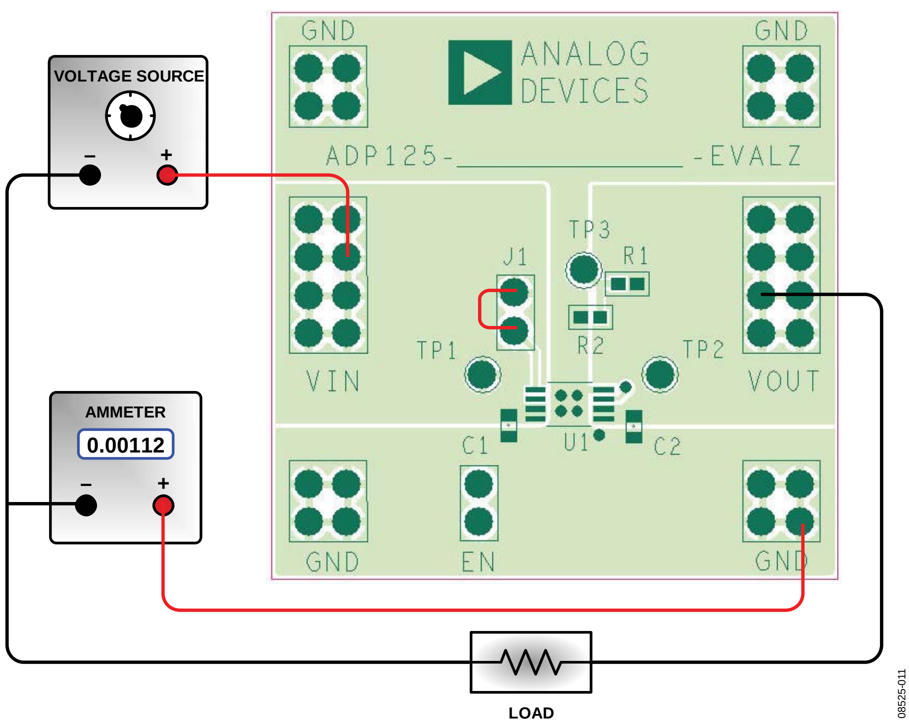

Figure 14. ADP125 Ground Current Measurement Setup, MSOP

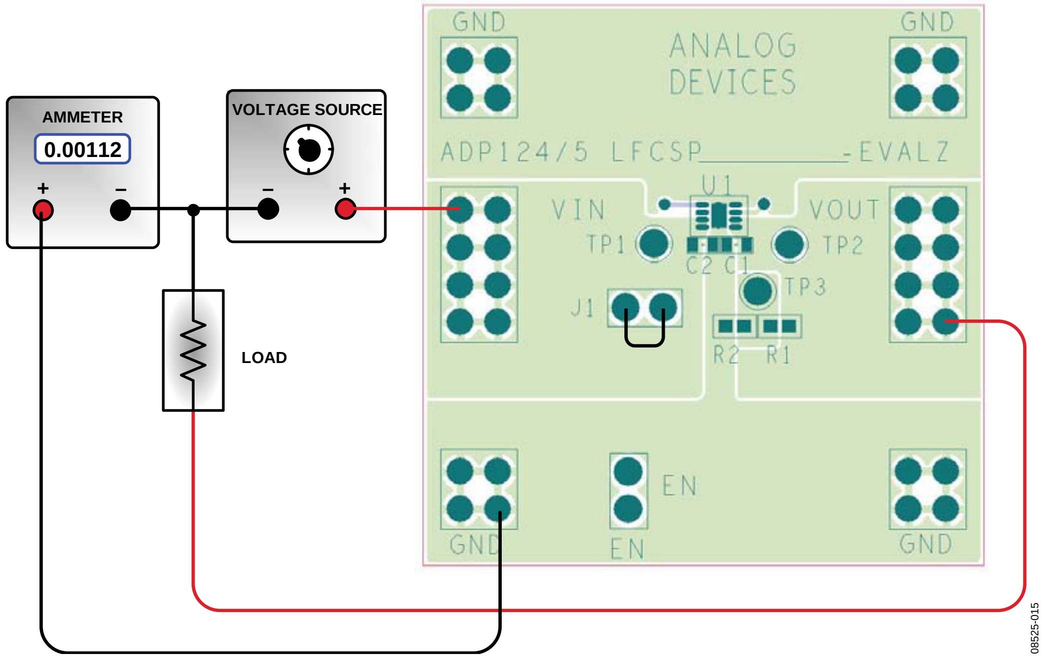

Figure 15. ADP124/ADP125 Ground Current Measurement Setup, LFCSP

Figure 13, Figure 14, and Figure 15 show how the evaluation boards 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 to handle the power that is expected to dissipate 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.

Follow these steps to connect to a voltage source and ammeter:

1. Connect the positive terminal (+) of the voltage source to the VIN pad of the evaluation board.
2. Connect the positive terminal (+) of the ammeter to one of the GND pads on 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 pad of the evaluation board and the negative (−) terminal of the voltage source.
5. If the ADP124 LFCSP board is being used, short R1. Otherwise, install R1 and R2 for the ADP125 adjustable LDO.

When these steps are completed, the voltage source can be turned on. If J1 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 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 (500 mA). Figure 16 shows the typical ground current consumption for various load levels at V_{OUT} = 3.3 V and T_A = 25°C.

When the device is disabled (EN = GND), the ground current drops to less than 1 µA.

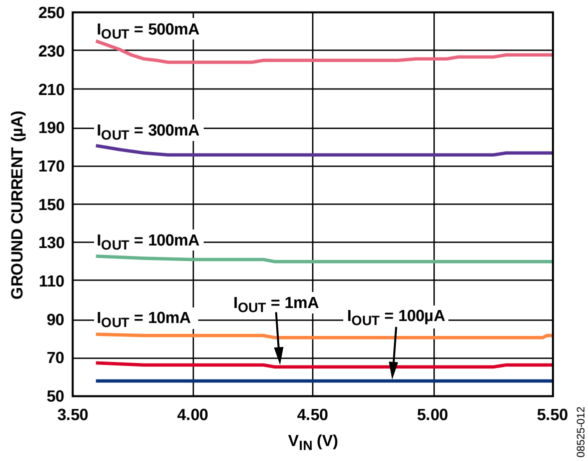

Figure 16. Ground Current vs. Input Voltage (V_{IN}) at V_{OUT} = 3.3 V, T_A = 25°C

ORDERING INFORMATION

BILL OF MATERIALS FOR THE EVALUATION BOARD

Table 2.

Reference Designator	Description	Manufacturer	Part No.
C1, C2	Capacitor, MLCC, 1 µF, 16 V, 0603, X5R	Murata (or equivalent)	GRM188R61C105KA93
R1, R2 (ADP125 only)	100 kΩ 0603 size resistors	Vishay	CRCW06031003F
J1	Jumper, single, STR, two pins	Sullins Connector Solutions	PEC02SAAN
U1	IC, LDO regulator	Analog Devices, Inc.	ADP124ARHZ-3.3-R7 ADP125ARHZ-R7 ADP124ACPZ-3.3-R7 ADP125ACPZ-R7

NOTES

UG08525-0-11/10(B)

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