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User Guide for the ADP7102/ADP7104 Evaluation Board

FEATURES

Input voltage range: 3.3 V to 20 V
Output current range: 0 mA to 500 mA
Output voltage accuracy: ±0.8 %
Operating temperature range: −40°C to +125°C
Adjustable option voltage set with two external resistors
V_{OUT} = 1.22 V × (1 + R1/R2)

GENERAL DESCRIPTION

The ADP7102/ADP7104 evaluation board is used to demonstrate the functionality of the ADP7102/ADP7104 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 ADP7102/ADP7104 linear regulators, visit www.analog.com.

EVALUATION BOARDS

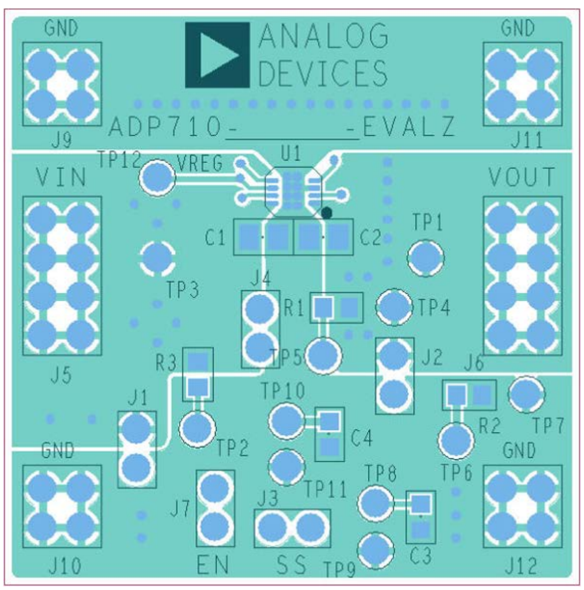

Figure 1. ADP7102/ADP7104 LFCSP Evaluation Board

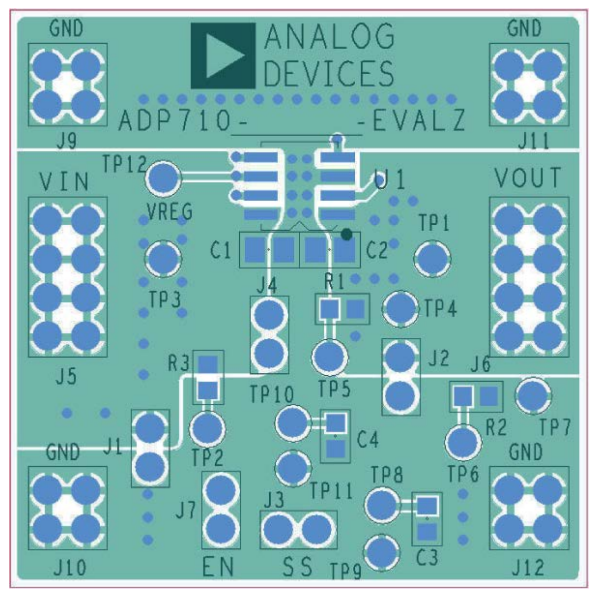

Figure 2. ADP7102/ADP7104 SOIC Evaluation Board

TABLE OF CONTENTS

REVISION HISTORY

6/12—Rev. 0 to Rev. A

Changes to Features Section ... 1
Changes to Evaluation Board Configurations Section ... 3

10/11—Revision 0: Initial Version

EVALUATION BOARD HARDWARE AND SCHEMATIC

EVALUATION BOARD CONFIGURATIONS

The ADP7102/ADP7104 evaluation boards come supplied with different components depending on which version is ordered. Components common to all versions are C1, C2, R3, J1, and J2. Resistors R1 and R2 are used for the adjustable output option. The output voltage is set by $V_{OUT} = 1.22\ V \times (1 + R1/R2)$.

Figure 3 shows the schematic of this evaluation board configuration. The ADP7102 is rated for output currents up to 300 mA whereas the ADP7104 can handle 500 mA output currents.

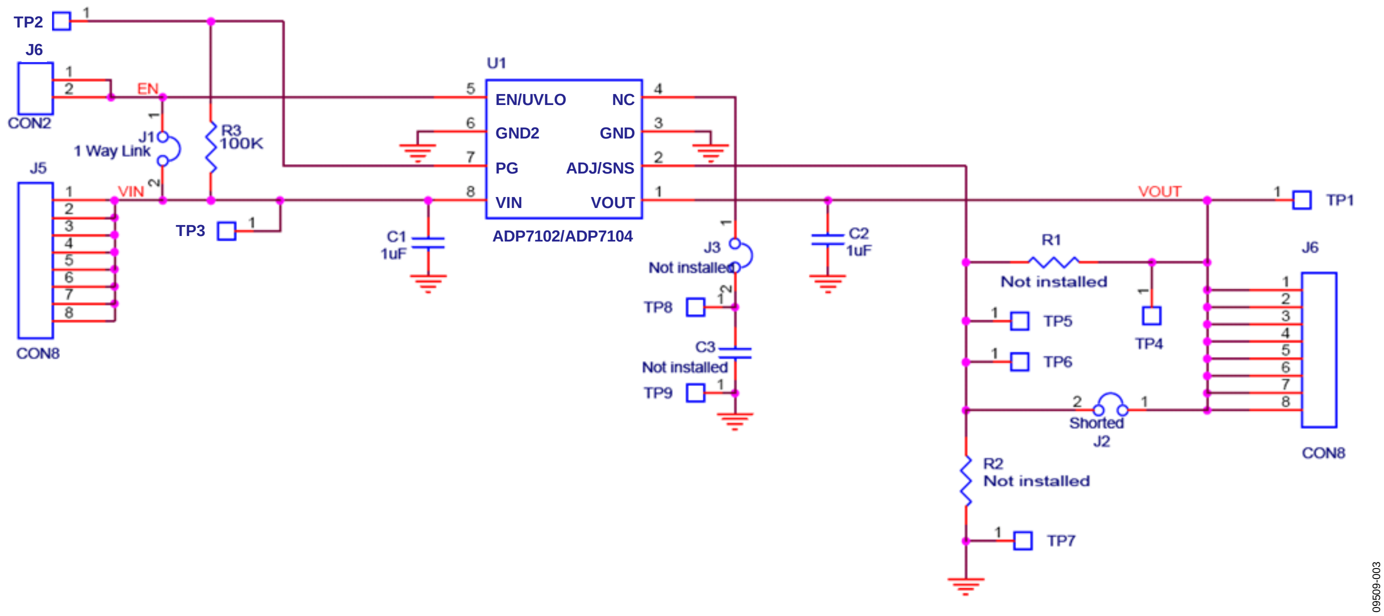

Figure 3. Evaluation Board Schematic

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1[1]	Linear regulator	ADP7102/ADP7104 linear regulator.
C1	Input capacitor	1 µF input bypass capacitor.
C2	Output capacitor	1 µF output capacitor. Required for stability and transient performance.
R1	Output divider	Sets output voltage with R2 in adjustable option.
R2	Output divider	Sets output voltage with R1 in adjustable option.
R3	Pull-up resistor	Power-good (PG) pull-up resistor.
J1	Jumper	Jumper. Connects EN to VIN for automatic startup.
J2	Jumper	Jumper. Connects SENSE/ADJ pin to output for fixed output options.

[1] Component varies depending on the evaluation board type ordered.

OUTPUT VOLTAGE MEASUREMENTS

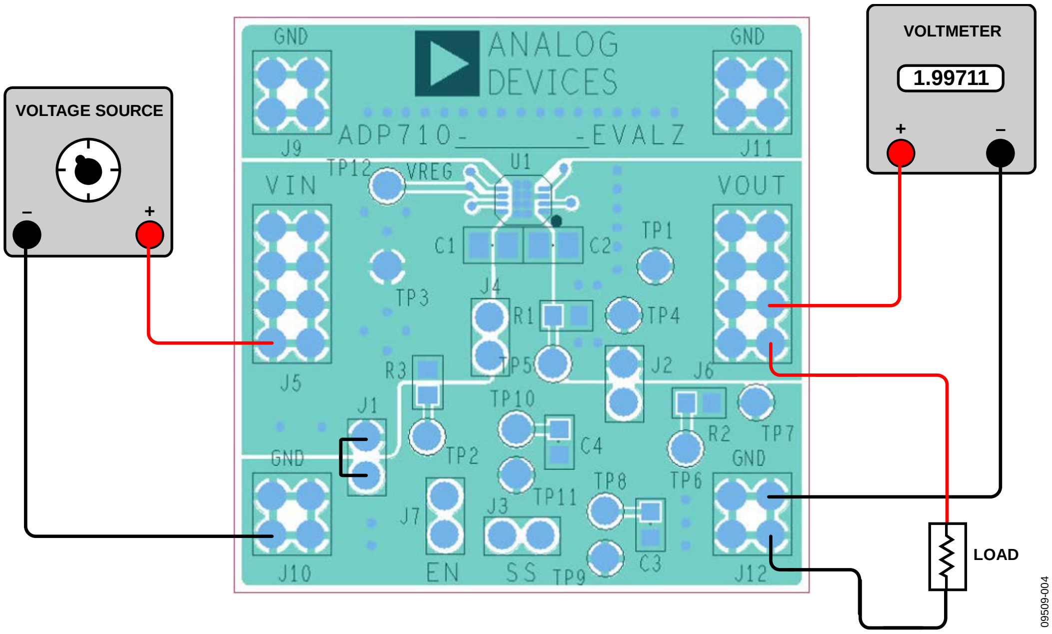

Figure 4. Output Voltage Measurement, LFCSP

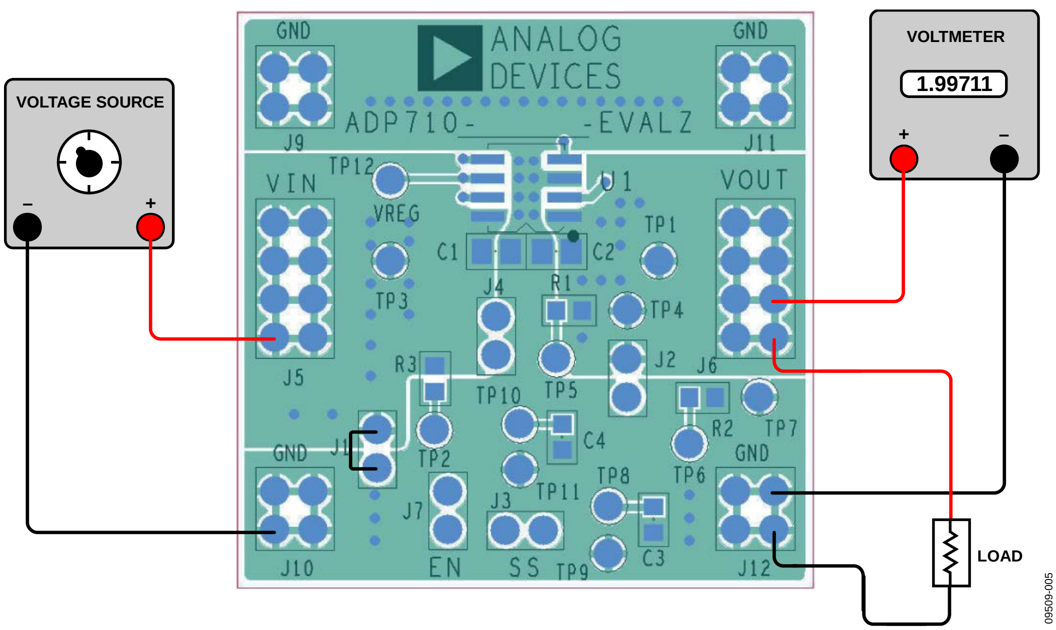

Figure 5. Output Voltage Measurement, SOIC

Figure 4 and Figure 5 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 adequate to handle 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 to a voltage source and voltmeter:

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 voltmeter to one of the GND pads.
5. Connect the positive terminal (+) of the voltmeter to the VOUT pad.

The voltage source can now 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 needs to 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 regulator's output 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 V (or 3.3 V, whichever is greater) and V_{INMAX}. For example, for an ADP7104 with fixed 5 V output, V_{IN} needs to be varied between 6 V and 20 V. This measurement can be repeated under different load conditions. Figure 6 shows the typical line regulation performance of an ADP7104 with fixed 5 V output.

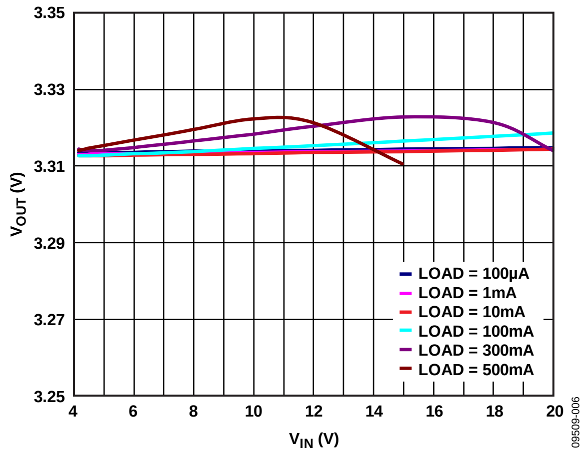

Figure 6. Output Voltage vs. Input Voltage

LOAD REGULATION

For load regulation measurements, the regulator's output 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 7 shows the typical load regulation performance of an ADP7104 with fixed 5 V output for an input voltage of 6 V.

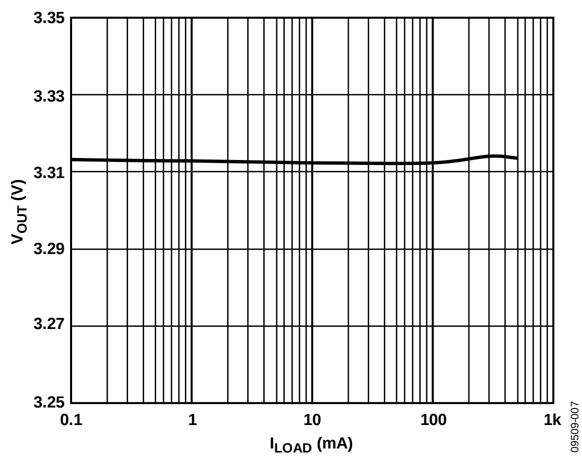

Figure 7. Output Voltage vs. Load Current

DROPOUT VOLTAGE

Dropout voltage can be measured using the configuration shown in Figure 4 and Figure 5. 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 greater than 3.3 V. Dropout voltage increases with larger loads. For more accurate measurements, a second voltmeter 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 8 shows a typical curve of dropout voltage measurements with different load currents.

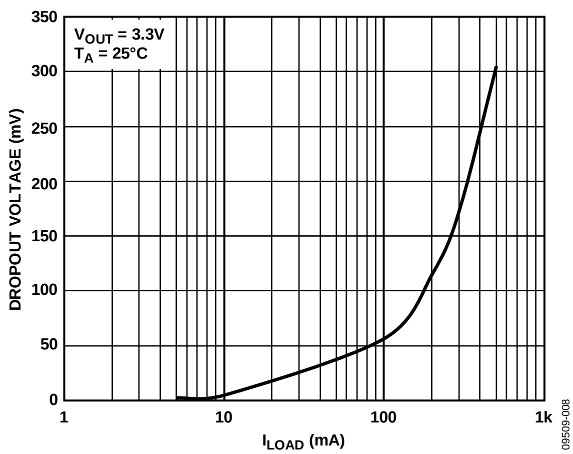

Figure 8. Dropout Voltage vs. Load Current

POWER GOOD

The ADP7102/ADP7104 provide a power-good pin, PG, to indicate the status of the output. This open-drain output requires an external pull-up resistor to any voltage, including VIN. If the part is in shutdown mode, current-limit mode, or thermal shutdown, or if it falls below 90% of the nominal output voltage, the power-good pin (TP2) immediately transitions low. During soft start, the rising threshold of the power good signal is 93.5% of the nominal output voltage.

The open-drain output is held low when the ADP7102/ADP7104 have sufficient input voltage to turn on the internal PG transistor.

Power-good accuracy is 93.5% of the nominal regulator output voltage when this voltage is rising and with a 90% trip point when this voltage is falling. Regulator input voltage brownouts or glitches trigger power no good signals if V_{OUT} falls below 90%.

A normal power-down triggers power no good when V_{OUT} drops below 90%.

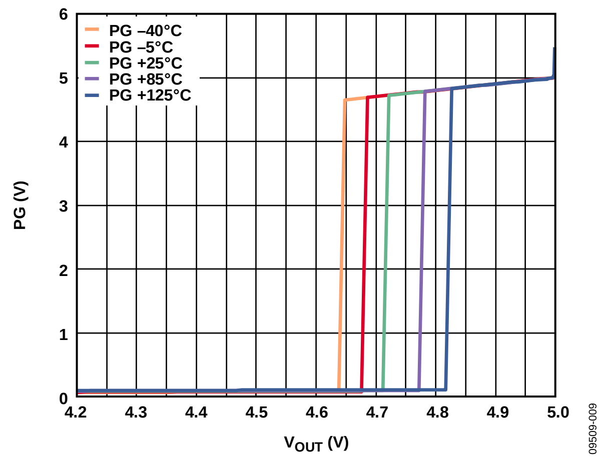

Figure 9. Power-Good Threshold, Output Voltage Rising

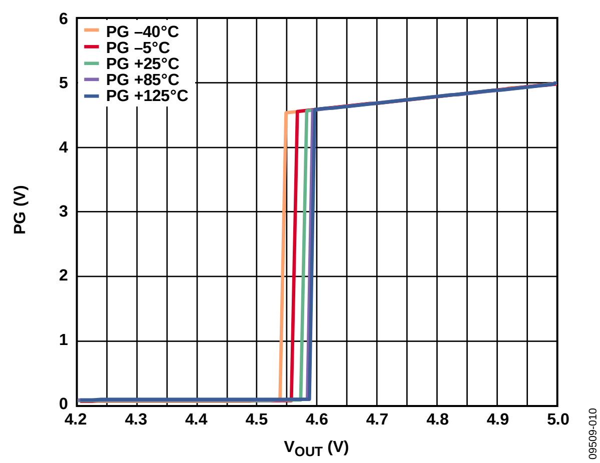

Figure 10. Power-Good Threshold, Output Voltage Falling

PROGRAMMABLE UNDERVOLTAGE LOCKOUT

The ADP7102/ADP7104 use the EN/UVLO pin to enable and disable the VOUT pin under normal operating conditions. As shown in Figure 12, when a rising voltage on EN/UVLO crosses the upper threshold, VOUT turns on. When a falling voltage on EN/UVLO crosses the lower threshold, VOUT turns off. The hysteresis of the EN/UVLO threshold is determined by the Thevenin equivalent resistance of the external voltage divider connected to the EN/UVLO pin.

Figure 12 shows the typical hysteresis current of the EN/UVLO pin. The upper and lower thresholds are user programmable and can be set using two resistors. When the EN/UVLO pin voltage is below 1.22 V, the LDO is disabled. When the EN/UVLO pin voltage transitions above 1.22 V, the LDO is enabled and a 10 µA hysteresis current is sourced out of the pin, raising the voltage and thus providing threshold hysteresis. Typically, two external resistors program the minimum operational voltage for the LDO. The resistance values, R1 and R2, can be determined from

$$R1 = V_{HYS}/10\ \mu A$$

$$R2 = 1.22\ V \times R1/(V_{IN} - 1.22\ V)$$

where:
V_{HYS} is the desired EN/UVLO hysteresis level.
V_{IN} is the desired turn-on voltage.

Hysteresis can also be achieved by connecting a resistor in series with EN/UVLO pin. Therefore, for the example shown in Figure 11, the enable threshold is 2.44 V with a hysteresis of 500 mV.

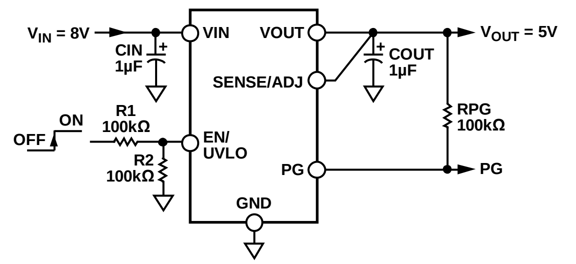

Figure 11. Typical EN/UVLO Pin Voltage Divider

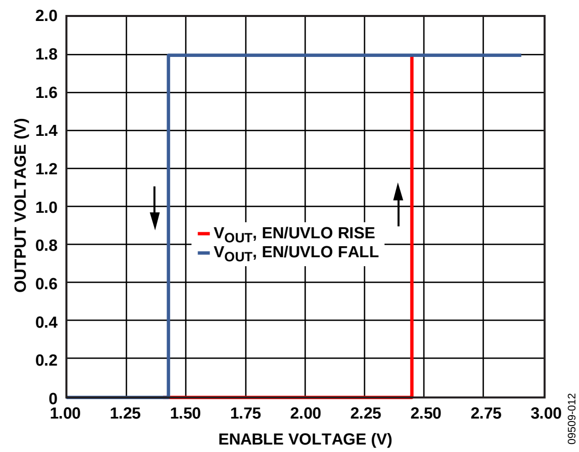

Figure 12. ADP7102 Typical EN/UVLO Pin Thresholds

Figure 12 shows the typical hysteresis of the EN/UVLO pin. This prevents on/off oscillations that can occur due to noise on the EN/UVLO pin as it passes through the threshold points.

GROUND CURRENT MEASUREMENTS

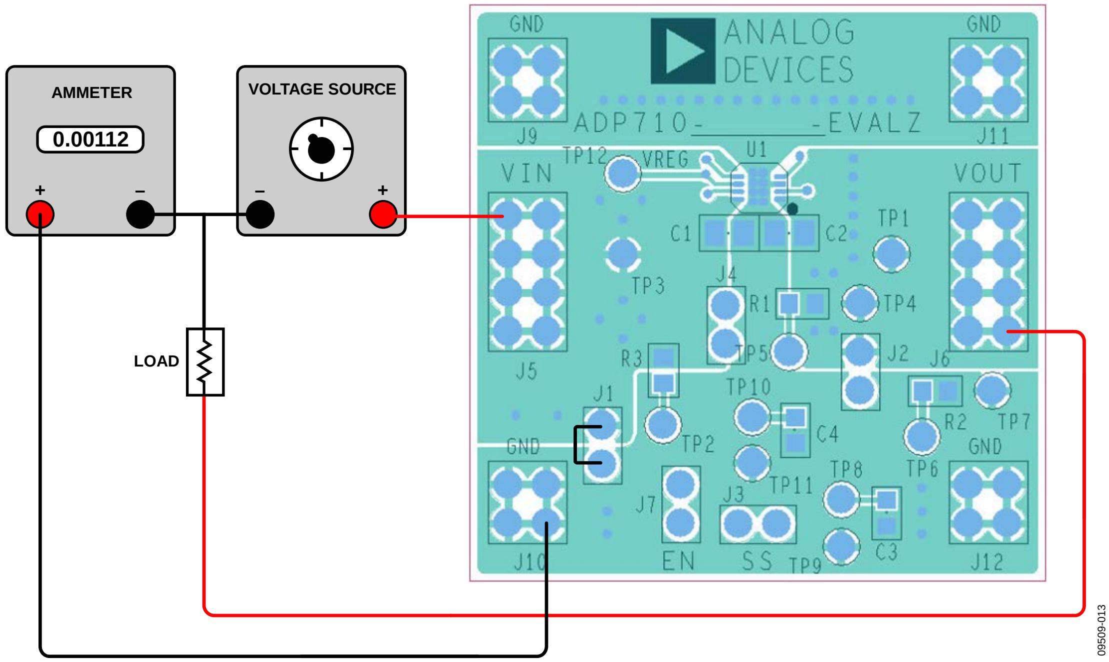

Figure 13. Ground Current Measurement, LFCSP

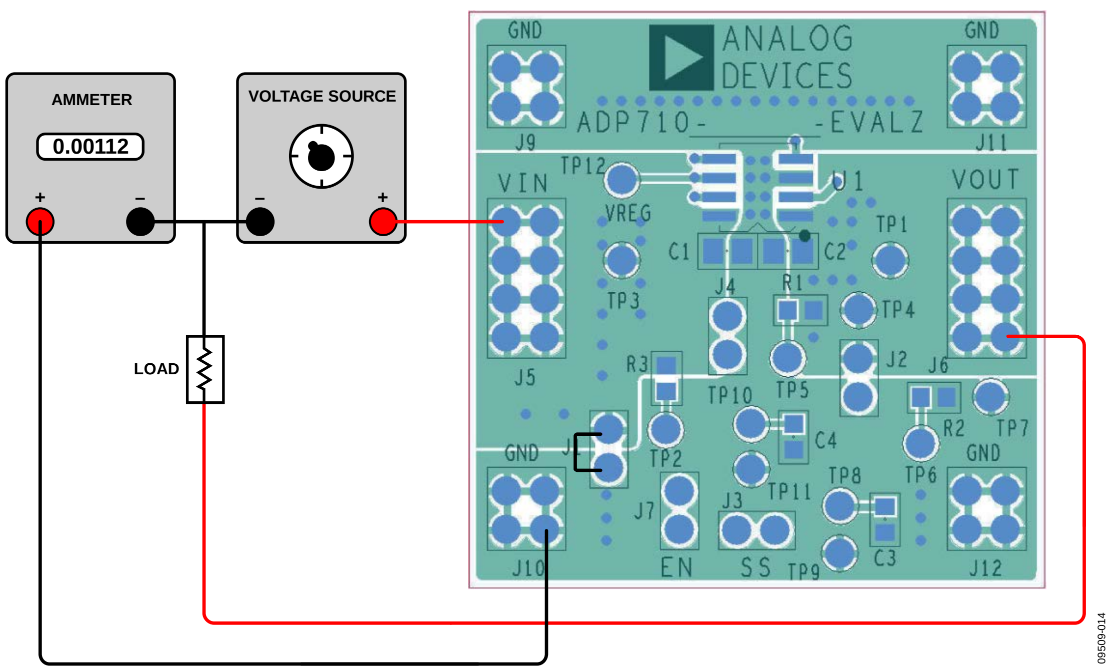

Figure 14. Ground Current Measurement, SOIC

Figure 13 and Figure 14 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 adequate to handle 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 to a voltage source and ammeter:

1. Connect the positive terminal (+) of the voltage source to the VIN pad on the evaluation board.
2. Connect the positive terminal (+) of the ammeter to one of the GND pads 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 negative (−) terminal of the voltage source and the VOUT pad of the evaluation board.

The voltage source can now 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 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 (500 mA). Figure 15 shows the typical ground current consumption for various load levels at an input voltage of 6 V for an output voltage of 5 V.

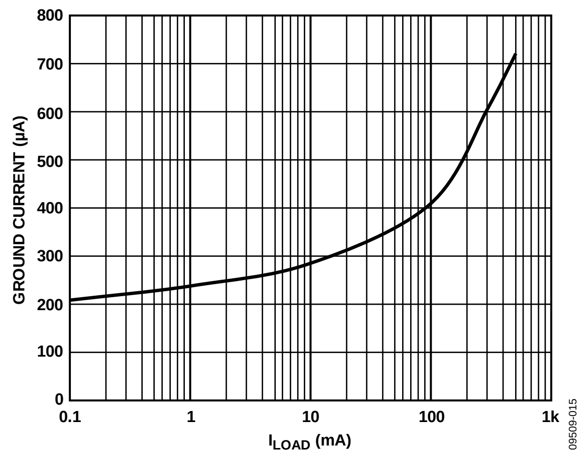

Figure 15. Ground Current vs. Load Current

When the device is disabled (EN = GND), the ground current drops to less than 40 µA.

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Quantity	Reference Designator	Description	Manufacturer/Vendor	Vendor Part Number
1	U1	ADP7102 or ADP7104	Analog Devices, Inc.	ADP7102 or ADP7104
2	C1, C2	Capacitor, MLCC, 1 µF, 25 V, 0805, X5R	Murata (or equivalent)	GRM216R61E105KA12
2	J1, J2	Header, single, STR, 2 pins	Sullins Connector Solutions	PEC02SAAN
1	R3	Resistor, 1%, 0603 case		CRCW0603xxxxF

NOTES

NOTES

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.

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