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ANALOG DEVICES

ADP7112CB-EVALZ User Guide

UG-777

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Evaluating the ADP7112 Low Noise, CMOS LDO Linear Regulator

FEATURES

Input voltage range: 2.7 V to 20 V
Output current range: 0 mA to 200 mA
Output voltage initial accuracy: ±0.8%
Operating temperature range: −40°C to +125°C
Adjustable output voltage via two external resistors from any fixed output voltage option

GENERAL DESCRIPTION

The ADP7112CB-EVALZ is an evaluation board used to demonstrate the functionality of the ADP7112 linear regulator.

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

For more details about the linear regulators, visit www.analog.com.

Complete specifications for the ADP7112 are available in the ADP7112 data sheet available from Analog Devices, Inc., and should be consulted in conjunction with this user guide when using the evaluation board.

EVALUATION BOARD

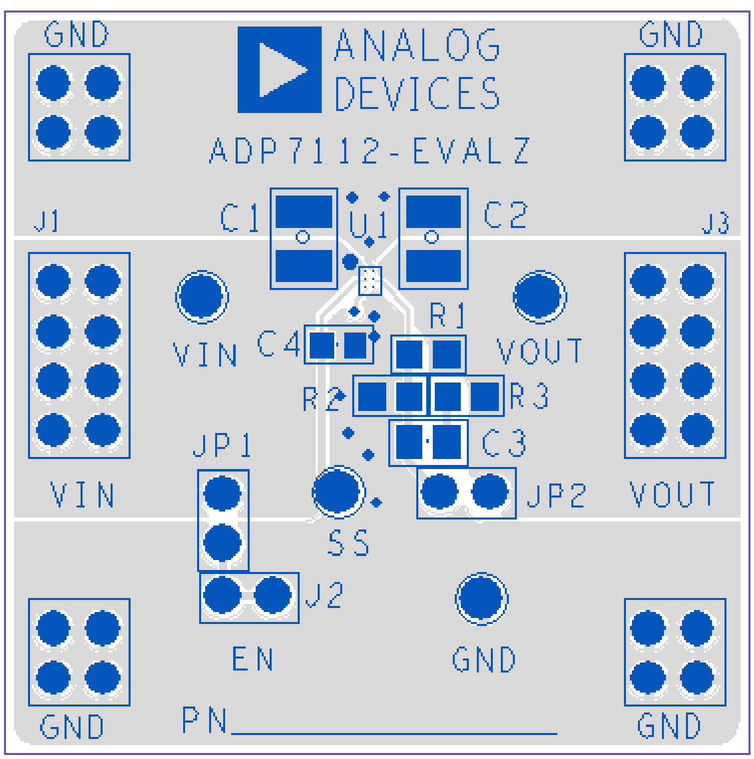

Figure 1. ADP7112CB-EVALZ Printed Circuit Board (PCB) Layout

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12/14—Revision 0: Initial Version

EVALUATION BOARD HARDWARE AND SCHEMATIC

EVALUATION BOARD CONFIGURATIONS

The evaluation board comes supplied with different components depending on which version is ordered. Components common to all versions are C1, C2, C3, JP1, and JP2. Resistors R1 and R2 adjust the output voltage above any fixed voltage option. C3 and R3 are not installed. C3 and R3 are optional components for the noise reduction network.

The output voltage is set by

$$V_{OUT} = V_{OUT\,(FIXED)} \times (1 + R1/R2)$$

Figure 2 shows the schematic of this evaluation board configuration.

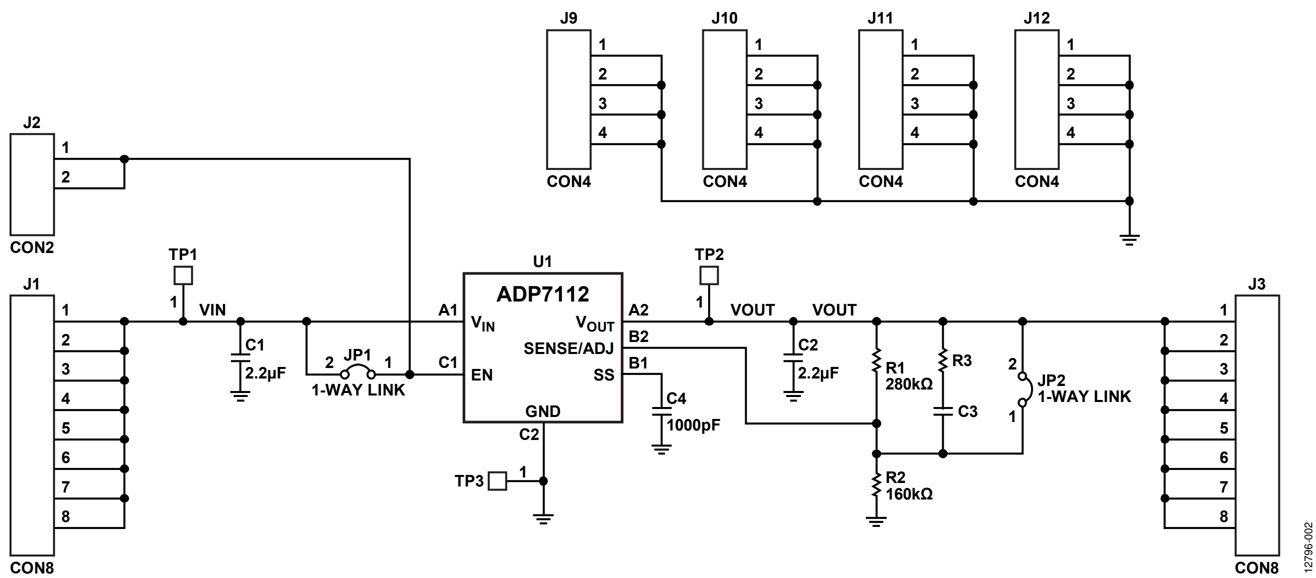

Figure 2. Evaluation Board Schematic

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1	Linear regulator	ADP7112 linear regulator. The adjustable (1.2 V) model option is used on the evaluation board.
C1	Input capacitor	2.2 µF input bypass capacitor.
C2	Output capacitor	2.2 µF output capacitor. Required for stability and transient performance.
C3	Noise reduction capacitor	Not installed. Noise reduction network with R3. See the ADP7112 data sheet for the value of C3 and R3 noise reduction components.
C4	Soft start capacitor	1000 pF soft start capacitor. Sets the soft start time to limit inrush current.
R1	Output resistor divider	280 kΩ output resistor divider. Sets the output voltage to 3.3 V with R2.
R2	Output resistor divider	160 kΩ output resistor divider. Sets the output voltage to 3.3 V with R1.
R3	Noise reduction resistor	Not installed. Noise reduction network with C3. See the ADP7112 data sheet for the value of C3 and R3 noise reduction components.
JP1	Jumper	Connects the EN pin to the VIN pin for automatic startup.
JP2	Jumper	Connects the SENSE pin to the output for fixed output options.

OUTPUT VOLTAGE MEASUREMENTS

Figure 3 shows 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 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 be turned on after these steps are complete. If JP1 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 along the PCB traces.

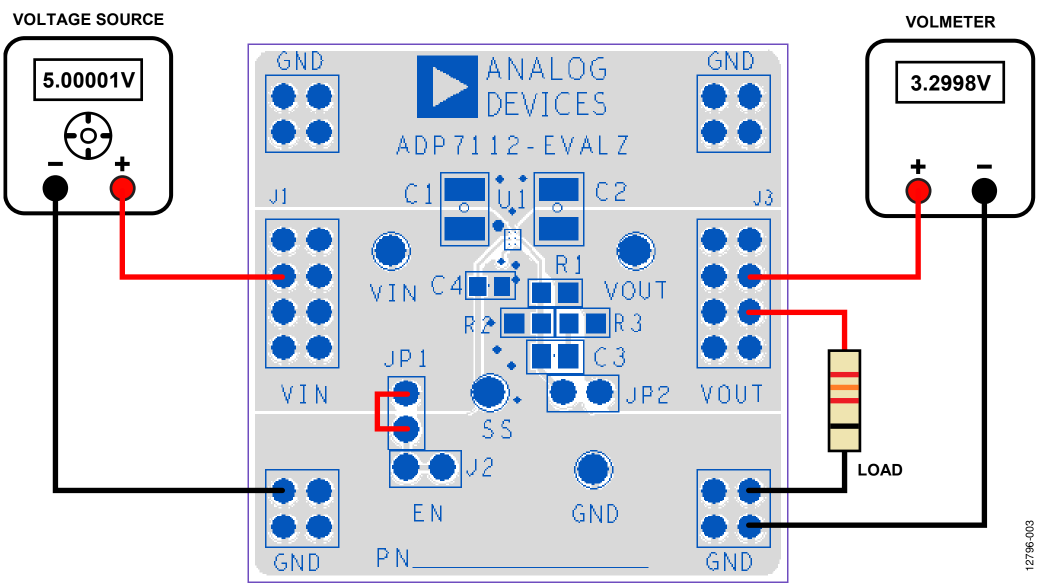

Figure 3. Output Voltage Measurement

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_{OUT_NOM} + 1 V (or 2.7 V, whichever is greater) and V_{IN_MAX}. For example, for an ADP7112 with a 3.3 V output, V_{IN} must be varied between 4.3 V and 20 V. This measurement can be repeated under different load conditions. Figure 4 shows the typical line regulation performance of an ADP7112 with a 3.3 V output.

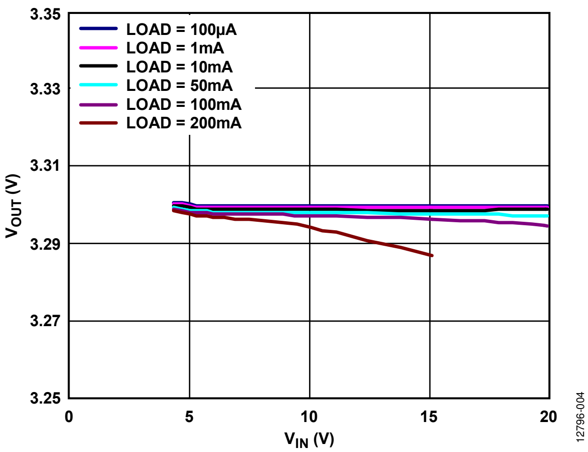

Figure 4. Output Voltage (V_{OUT}) vs. Input Voltage (V_{IN})

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 a 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 5 shows the typical load regulation performance of an ADP7112 with a 3.3 V output for an input voltage of 4.3 V.

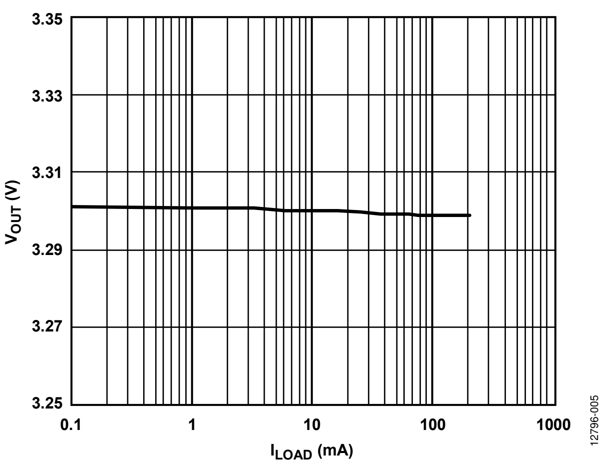

Figure 5. Output Voltage (V_{OUT}) vs. Load Current (I_{LOAD})

DROPOUT VOLTAGE

Dropout voltage can be measured using the configuration shown in Figure 3. Dropout voltage is the input to output voltage differential when the input voltage is set to the nominal output voltage, V_{OUT_NOM}. This definition applies only for output voltages greater than 2.3 V. 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 voltage drops, especially if large load currents are used. Figure 6 shows a typical curve of dropout voltage measurements over the load currents.

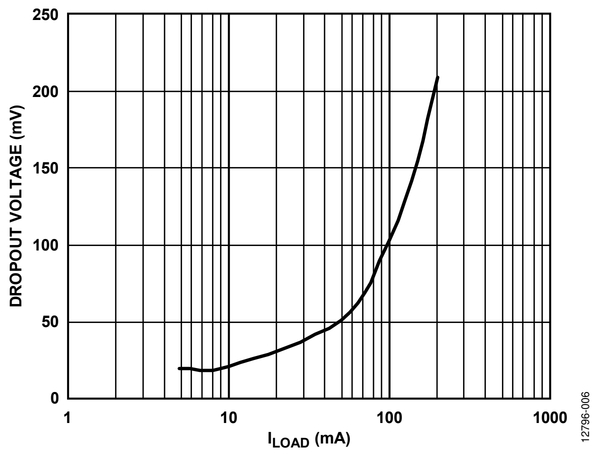

Figure 6. Dropout Voltage vs. Load Current (I_{LOAD})

GROUND CURRENT MEASUREMENTS

Figure 8 shows 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 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 be turned on after these steps are completed. If JP1 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 are consuming 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). Figure 7 shows the typical ground current consumption over load level at an input voltage of 4.3 V for an output voltage of 3.3 V.

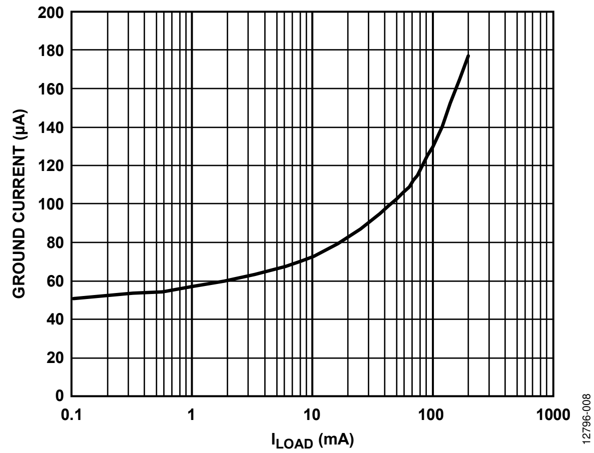

Figure 7. Ground Current vs. Load Current (I_{LOAD})

When the device is disabled (EN = GND), the ground current drops to less than 3 µA.

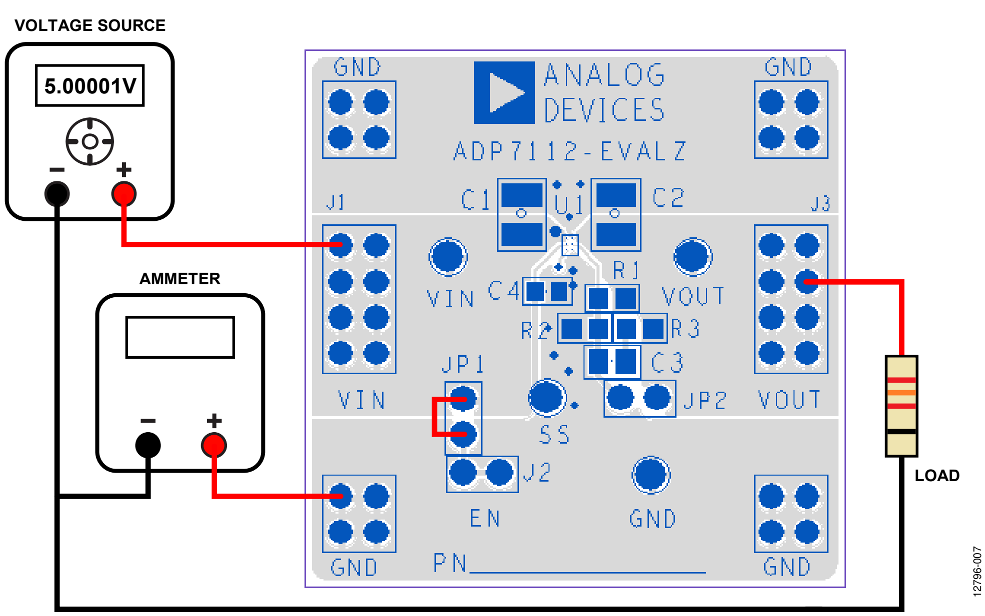

Figure 8. Ground Current Measurement

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Quantity	Reference Designator	Description	Manufacturer/Vendor	Vendor Part Number
1	U1	ADP7112 linear regulator	Analog Devices, Inc.	ADP7112ACBZ-1.2-R7
2	C1, C2	Capacitor, MLCC, 2.2 μF, 16 V, 1206, X7R	Murata (or equivalent)	GRM31CR71H225KA88L
1	C3	Capacitor, MLCC, 0603 case	Not installed	
1	C4	Capacitor, MLCC, 1 μF, 16 V, 0603 case	Murata (or equivalent)	GRM1885C1H102JA01D
2	JP1, JP2	Header, single, STR, two pins	M20-9990246	M20-9990246
1	R1	Resistor, 280 kΩ, 1%, 0603 case	Panasonic (or equivalent)	ERJ-3EKF2803V
1	R2	Resistor, 160 kΩ, 1%, 0603 case	Panasonic (or equivalent)	ERJ-3EKF1603V
1	R3	Resistor, 3.01 kΩ, 1%, 0603 case	Not installed	

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