

Evaluating the **ADP2360** DC-to-DC Switching Regulator

FEATURES

Input voltage range: 4.5 V to 60 V

Output voltage: 3.3 V

Power good output

EVALUATION KIT CONTENTS

ADP2360CP-EVALZ evaluation board

ADDITIONAL EQUIPMENT NEEDED

DC power supply

Multimeters for voltage and current measurements

Electronic load (ELOAD) or resistive load

GENERAL DESCRIPTION

The **ADP2360CP-EVALZ** evaluation board demonstrates the functionality of the **ADP2360** dc-to-dc converter.

Use this evaluation board to evaluate simple device measurements, such as line regulation, load regulation, and efficiency. The evaluation board provides a power-good output and other features, such as soft start time. The maximum inductor current can be modified by changing component values.

Full specifications for the **ADP2360** dc-to-dc converter are available in the product data sheet, which should be consulted in conjunction with this user guide when working with the evaluation board.

EVALUATION BOARD

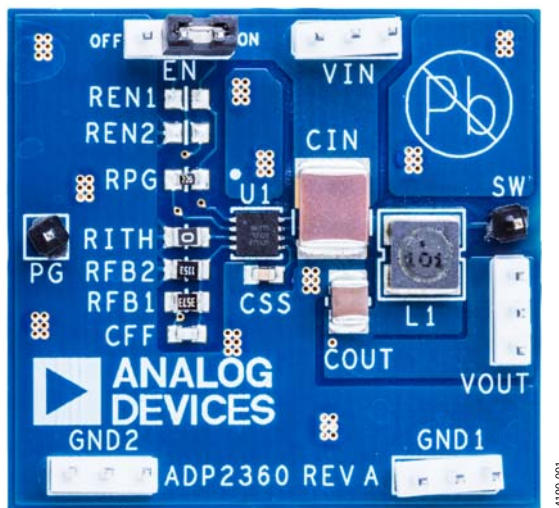


Figure 1. **ADP2360CP-EVALZ** LFCSP Evaluation Board

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REVISION HISTORY

4/2017—Rev. 0 to Rev. A

Changes to Features Section, Additional Equipment Needed Section, and General Description Section	1
Changes to Evaluation Board Hardware Section	3
Changed Evaluation Board Schematic Section to Evaluation Board Schematic and Artwork Section	6
Moved Figure 7	6
Deleted Evaluation Board Layout Section.....	7
Changes to Bill of Materials Section and Table 2	8

5/2016—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

The evaluation board is configured to provide a 3.3 V output from a 4.5 V to 60 V input. Table 2 lists the components for the [ADP2360CP-EVALZ](#) evaluation board. Table 1 lists the evaluation board functions and descriptions.

The evaluation board allows the end user to customize the design including modification of the soft start and peak current settings; refer to the [ADP2360](#) data sheet to obtain alternative component values.

Figure 2 outlines the evaluation board features available to the user.

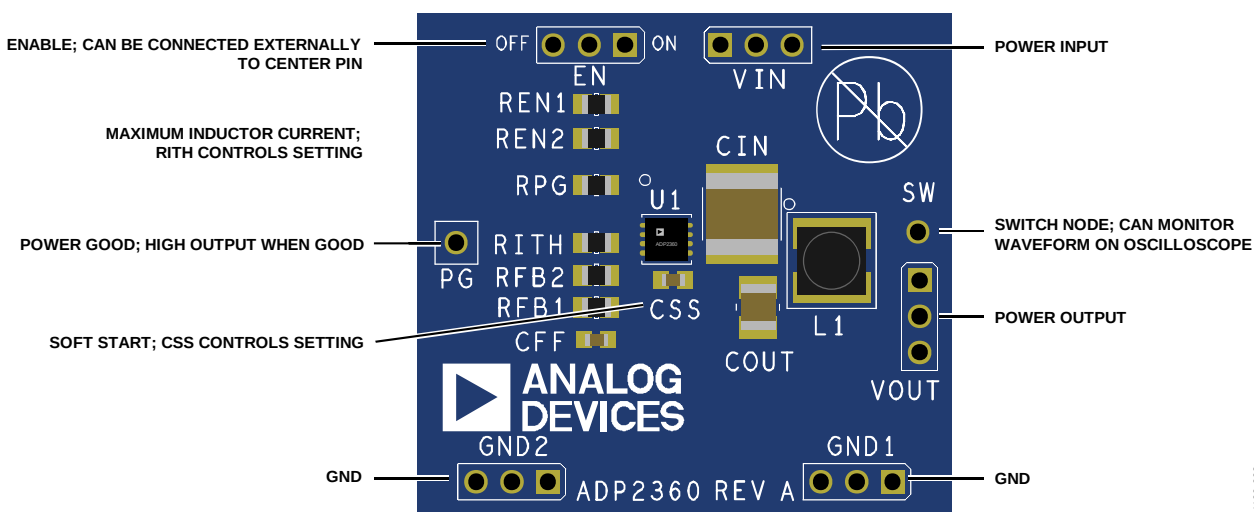


Figure 2. Evaluation Board Features

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Table 1. Evaluation Board Function Descriptions

Jumper/Connector Mnemonic	Description
VIN	Power supply to the ADP2360 . This connector can be connected to a supply between 4.5 V and 60 V.
VOUT	Output from the ADP2360 . The output voltage is 3.3 V in the default configuration.
GND1, GND2	Ground.
EN	Precision enable. The EN pin is compared to an internal precision reference to enable the regulator output. Connect this jumper to the on position to turn on the regulator. Connect this jumper to the off position or remove this jumper to turn the regulator off (an internal pull-down is present in the ADP2360). An external enable can be connected to the center pin.
PG	Power-good output. This pin is an open-drain, power-good indicator and is pulled up to VIN by the PG resistor. As a 22 MΩ resistor pulls up the PG pin, a high impedance meter is required for accurate measurement. This resistor value is selected to minimize power when the device is not enabled.
SW	Switch node. This node allows the switching waveform to be viewed on an oscilloscope.

MEASUREMENT SETUP

The setup in Figure 3 is suggested for evaluating the device. For efficiency measurements, an additional voltmeter connected between GND1 and VIN is preferred to ensure that the voltage

is measured as close to the device as possible and to eliminate voltage drop from the power lead impedance.

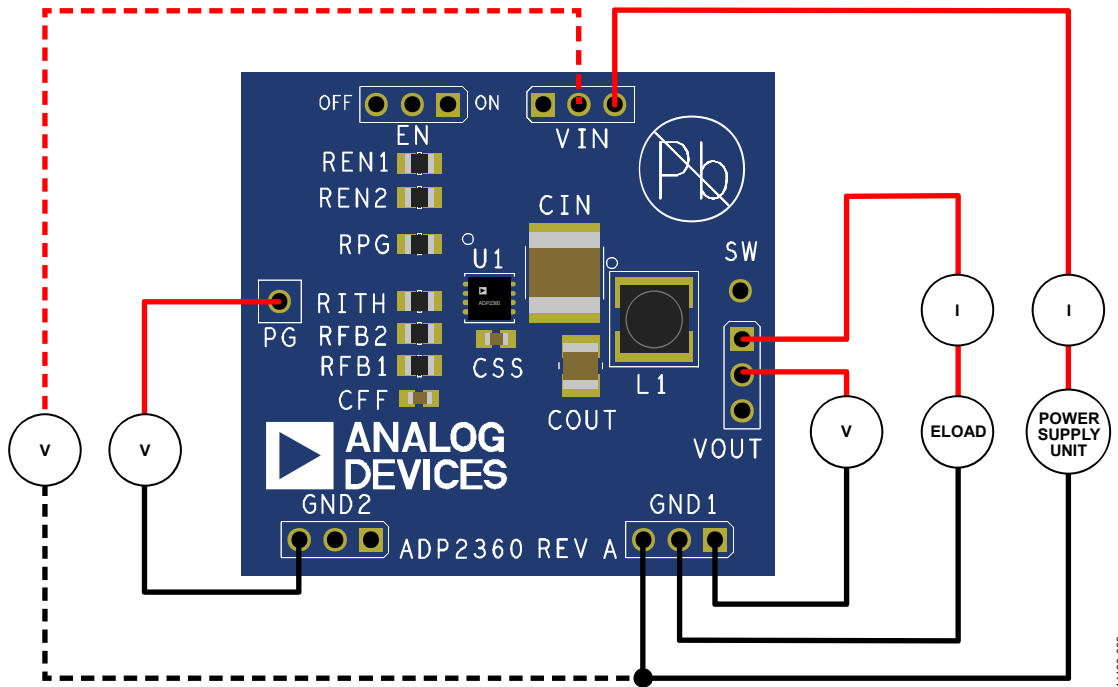


Figure 3. Measurement Setup

OUTPUT VOLTAGE MEASUREMENTS

For basic output voltage accuracy measurements, connect the evaluation board to a voltage source and a voltmeter. Use a resistor or an electronic load as the load for the regulator.

When using a resistive load, ensure that the resistor has an adequate power rating to handle the expected power dissipation. Ensure that the voltage source can supply up to 500 mA.

Complete the following steps to connect to a voltage source and voltmeter:

1. Connect the negative (–) terminal of the voltage source to the GND1 terminal.
2. Connect the positive (+) terminal of the voltage source to the VIN terminal.
3. Connect a load between the VOUT terminal and the GND1 terminal.
4. Connect the voltmeter in parallel with the load resistor.

Turn the voltage source on and move the EN jumper to the on position.

If long power leads are used from the power supply, especially at higher loads, connect a large capacitor (5000 μ F or more) across the VIN terminal to prevent losses from lead inductance. Measure the input voltage at these terminals or use a power supply with a 4-wire supply and sense arrangement.

LINE REGULATION

For line regulation measurements, monitor the regulator output while its input is varied. For good line regulation, the output must change as little as possible with varying input levels. It is possible to repeat this measurement under different load conditions. During line regulation tests, keep the power supply leads short and remove any additional input capacitor.

Figure 4 shows the typical line regulation performance of the ADP2360 at both the output and feedback pins.

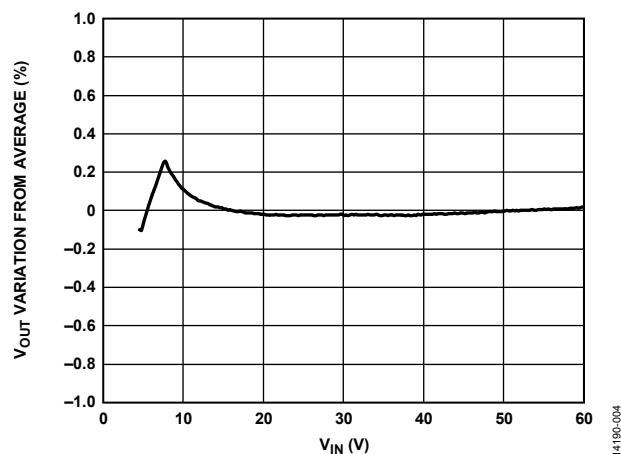


Figure 4. Line Regulation, $V_{OUT} = 3.3$ V Fixed, $R_{ITH} = 0 \Omega$, Load = 10 mA

LOAD REGULATION

For load regulation measurements, monitor the regulator output while the load is varied. For good load regulation, the output must change as little as possible with varying loads. The input voltage must be held constant during this measurement. Keep power leads short during this test and use a power supply with remote sense.

EFFICIENCY

For efficiency measurements, monitor the regulator input and output while the load is varied. The input voltage must be held constant during this measurement. Keep power leads short during this test and use a power supply with remote sense. Connect ammeters in series with the input and output. Connect voltmeters to the printed circuit board (PCB) side of the ammeter and measure the voltage across the input and output terminals. For the best results, measure the voltage across the input and output capacitors. If possible, particularly at low currents, trigger the meters simultaneously and set to average readings for a period of a few hundred milliseconds or more. Averaging the readings removes the switching ripple and skip mode effects. Figure 5 shows typical efficiency curves.

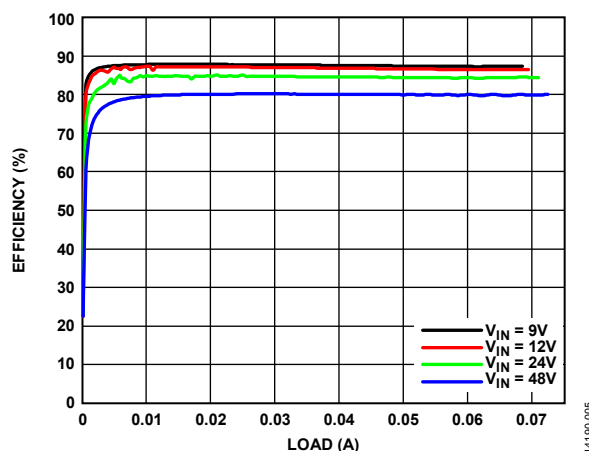


Figure 5. Efficiency vs. Load, $V_{OUT} = 3.3$ V Fixed, $R_{ITH} = 0 \Omega$, $T_A = 25^\circ\text{C}$

EVALUATION BOARD SCHEMATIC AND ARTWORK

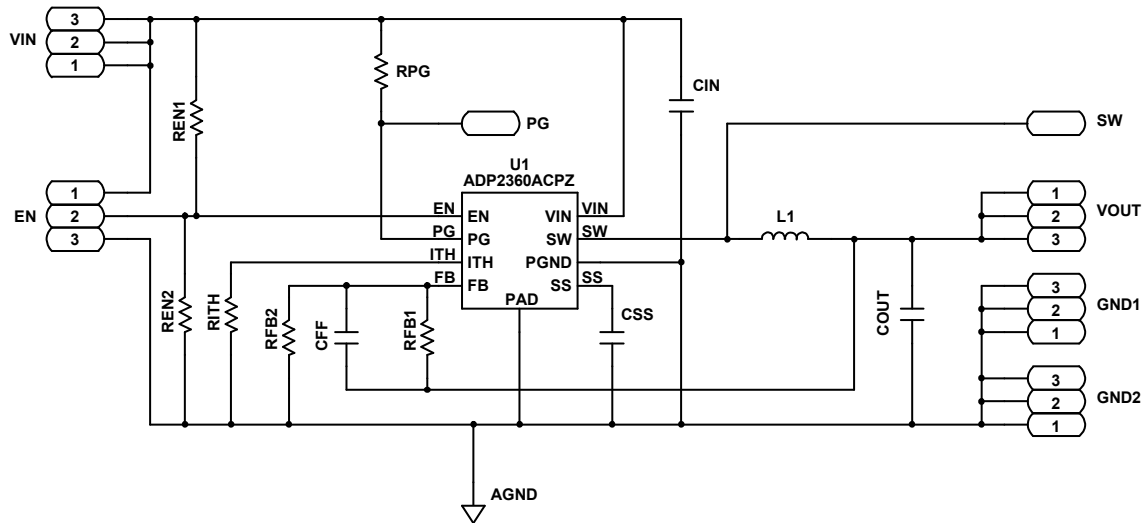


Figure 6. Evaluation Board Schematic for the [ADP2360](#)

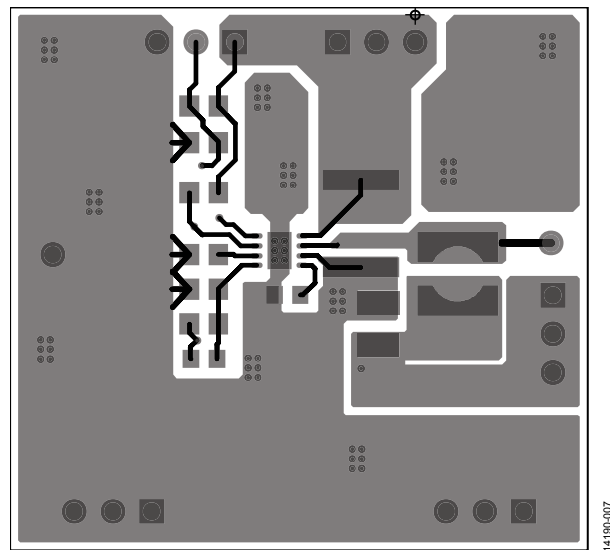


Figure 7. PCB Top Copper Layer

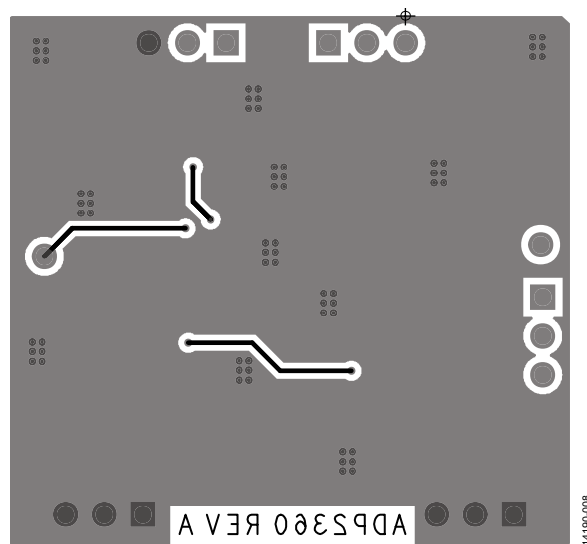


Figure 8. PCB Bottom Copper Layer

ORDERING INFORMATION

BILL OF MATERIALS

N/A in Table 2 means not applicable.

Table 2.

Reference Designator	Package	Description	Value	Tolerance	Voltage	Part Number	Manufacturer
U1	LFCSP	ADP2360 LFCSP	ADP2360	N/A	Adjustable	ADP2360ACPZ-R7	Analog Devices, Inc.
COUT	2220	Output capacitor	10 μ F	10%	50 V	GRM32ER71H106KA12L	Murata
L1	WE-TPC	Inductor	100 μ H	30%	N/A	744043101	Würth
RFB1	0805	Top feedback resistor	357 k Ω	1%	N/A	N/A	N/A
RFB2	0805	Bottom feedback resistor	115 k Ω	1%	N/A	N/A	N/A
RITH	0805	Maximum inductor current selection resistor	0 Ω	1%	N/A	N/A	N/A
RPG	0805	Power-good resistor	22 M Ω	1%	N/A	N/A	N/A
CIN	2220	Input capacitor	10 μ F	20%	100 V	C5750X7S2A106M230KB	TDK
CFF	0603	Feedforward capacitor	10 pF	5%	50 V	GRM1885C1H100JA01D	Murata
CSS	0603	Soft start capacitor	10 nF	10%	50 V	GRM188R71H103KA01D	Murata
VIN, VOUT, GND1, GND2, EN, PG	N/A	Pin headers	N/A	N/A	N/A	N/A	N/A



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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