ADP5300-EVALZ Evaluation Board User Guide

UG-879

One Technology Way • P.O. Box 9106 • Norwood, MA 02062-9106, U.S.A. • Tel: 781.329.4700 • Fax: 781.461.3113 • www.analog.com

Evaluating the ADP5300 50 mA/500 mA, High Efficiency, Ultralow Power Step-Down Regulator

GENERAL DESCRIPTION

The ADP5300 is an ultralow power, synchronous step-down dc-to-dc regulator with a load switch in a 10-lead LFCSP package. The ADP5300 runs from an input voltage range of 2.15 V to 6.50 V and requires minimal external components to provide a high efficiency solution with an integrated power switch, a synchronous rectifier, and internal compensation.

The ADP5300-EVALZ evaluation board provides an easy way to evaluate the device. This user guide describes how to quickly set up the board to collect performance data.

Complete information about the ADP5300 is available in the ADP5300 data sheet, which should be consulted in conjunction with this user guide when using the evaluation board.

ADP5300-EVALZ EVALUATION BOARD

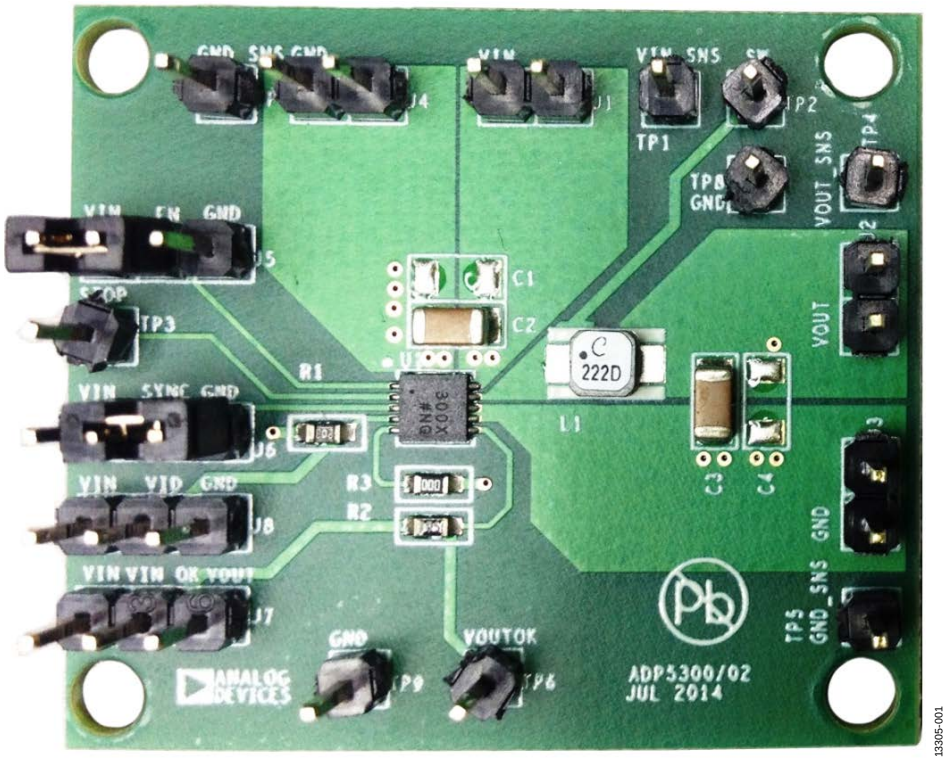

Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

9/15—Revision 0: Initial Version

SETTING UP THE EVALUATION BOARD

POWERING UP THE EVALUATION BOARD

The ADP5300-EVALZ evaluation board is fully assembled and tested. Before applying power to the ADP5300-EVALZ evaluation board, follow the setup procedures in this section.

Jumper Settings

Table 1 describes the jumper settings. Before selecting the jumper settings, make sure that the enable input, EN, is high.

Table 1. Jumper Settings

Jumper	State or Connection	Function
J5 (EN)	High Low	Enable V_{OUT} Disable V_{OUT}
J8 (VID)	VIN GND Floating	2.5 V 3 V Program V_{OUT} by external resistor
J6 (SYNC/MODE)	VIN GND External frequency	FPWM mode Hysteresis mode Set frequency from 1.2 MHz to 2.5 MHz
J7 (VOUT_OK)	VIN VOUT	Pull VOUT_OK to V_{IN} Pull VOUT_OK to V_{OUT}

Input Power Source Connection

Before connecting the power source to the ADP5300-EVALZ, ensure that the evaluation board is turned off. If the input power source includes a current meter, use the meter to monitor the input current as follows:

1. Connect the positive terminal of the power source to the VIN terminal (J1) on the evaluation board.
2. Connect the negative terminal of the power source to the GND terminal (J3) on the board.

If the power source does not include a current meter, connect a current meter in series with the input source voltage as follows:

1. Connect the positive terminal of the power source to the positive terminal (+) of the current meter.
2. Connect the negative terminal of the power source to the GND terminal (J3) on the evaluation board.
3. Connect the negative terminal (−) of the current meter to the VIN terminal (J1) on the evaluation board.

Output Load Connection

Before connecting the load to the ADP5300-EVALZ, ensure that the evaluation board is turned off. If the load includes a current meter, or if the current is not measured, connect the load directly to the ADP5300-EVALZ as follows:

1. Connect the positive load connection (+) to the VOUT terminal (J2).
2. Connect the negative load connection (−) to the GND terminal (J4).

If a current meter is used, connect it in series with the load as follows:

1. Connect the positive terminal (+) of the current meter to the VOUT terminal (J2) on the ADP5300-EVALZ.
2. Connect the negative terminal (−) of the current meter to the positive terminal (+) of the load.
3. Connect the negative terminal (−) of the load to the GND terminal (J4) on the ADP5300-EVALZ.

Input and Output Voltmeter Connections

Measure the input and output voltages with voltmeters. Make sure that the voltmeters are connected to the appropriate test points on the board. If the voltmeters are not connected to the correct test point, the measured voltages may be incorrect due to the voltage drop across the leads or due to the connections between the board, the power source, and/or the load.

1. Connect the positive terminal (+) of the input voltage measuring voltmeter to Test Point TP1 on the ADP5300-EVALZ.
2. Connect the negative terminal (−) of the input voltage measuring voltmeter to Test Point TP5 on the ADP5300-EVALZ.
3. Connect the positive terminal (+) of the output voltage measuring voltmeter to Test Point TP4 on the ADP5300-EVALZ.
4. Connect the negative terminal (−) of the output voltage measuring voltmeter to Test Point TP7 on the ADP5300-EVALZ.

Power on the ADP5300-EVALZ

When the power source and load are connected to the ADP5300-EVALZ, the evaluation board can be powered on. If the input power source exceeds 2.06 V (typical), the output voltage rises to 1.8 V by default.

MEASURING EVALUATION BOARD PERFORMANCE

Measuring the Switching Waveform

To observe the switching waveform with an oscilloscope, place the oscilloscope probe tip at TP2, and ensure that the probe ground is connected to GND at TP5. Set the oscilloscope to a dc coupling, 2 V/division, 1 µs/division time base. The switching waveform must alternate between 0 V and the approximate input voltage.

Measuring Load Regulation

Test load regulation by increasing the load at the output and measuring the output voltage between the TP4 and TP7 test points.

Measuring Line Regulation

Vary the input voltage and measure the output voltage at a fixed output current. Measure the input voltage between TP1 and TP5. The output voltage is measured between TP4 and TP7.

Measuring Efficiency

Measure the efficiency, η, by comparing the input power with the output power.

$$\eta = \frac{V_{OUT} \times I_{OUT}}{V_{IN} \times I_{IN}}$$

Measuring Inductor Current

Measure the inductor current by removing one end of the inductor from the pad on the ADP5300-EVALZ and using a wire connected between the pad and the inductor. Then, use a current probe to measure the inductor current.

Measuring Output Voltage Ripple

To observe the output voltage ripple, place an oscilloscope probe across the C2 output capacitor, with the probe ground lead placed at the negative capacitor terminal (−) and the probe tip placed at the positive capacitor terminal (+). Set the oscilloscope to an ac coupling, 10 mV/division, 2 µs/division time base and a 20 MHz bandwidth.

A standard oscilloscope probe has a long wire ground clip. For high frequency measurements, this ground clip picks up high frequency noise and injects it into the measured output ripple.

Figure 2 shows how to measure the output ripple. Measuring the output ripple requires removing the oscilloscope probe sheath and wrapping an unshielded wire around the oscilloscope probe. By keeping the ground lengths of the oscilloscope probe as short as possible, true ripple can be measured.

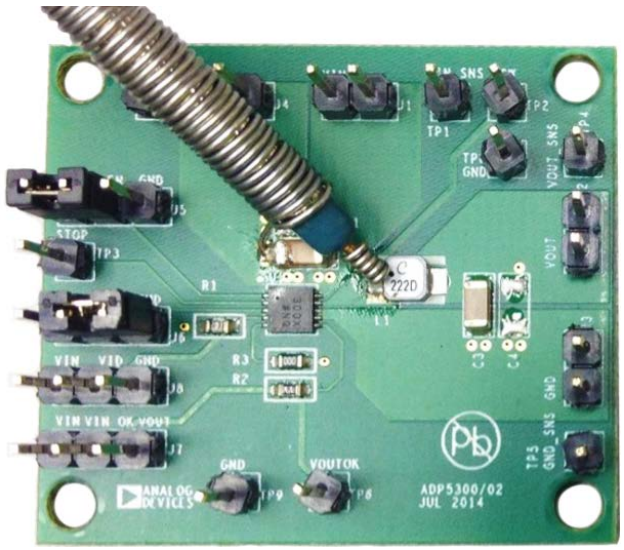

Figure 2. Output Ripple Measurement

Output Voltage Change

The output voltage of the evaluation board is preset to 1.8 V. However, the output voltage can be adjusted with an external VID resistor (see the ADP5300 data sheet).

EVALUATION BOARD SCHEMATIC

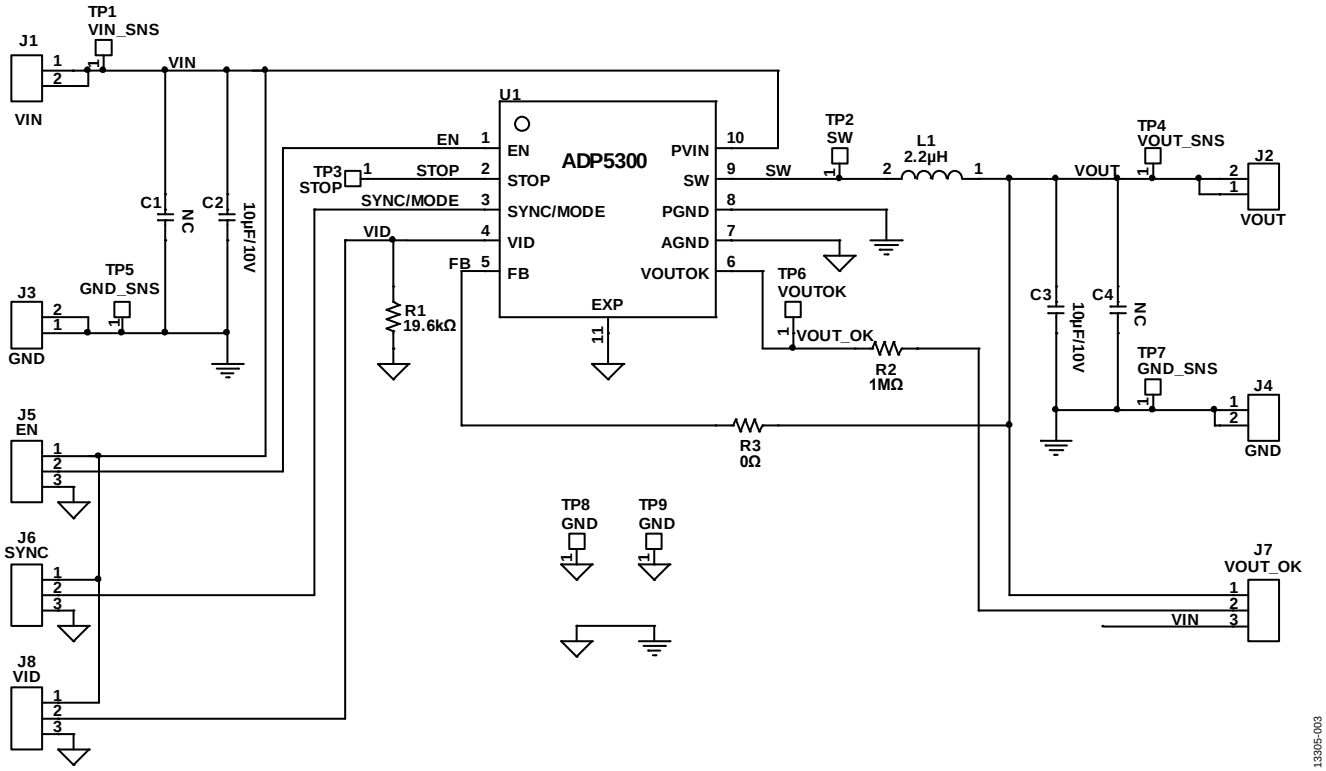

Figure 3. ADP5300-EVALZ Evaluation Board Schematic

EVALUATION BOARD LAYOUT

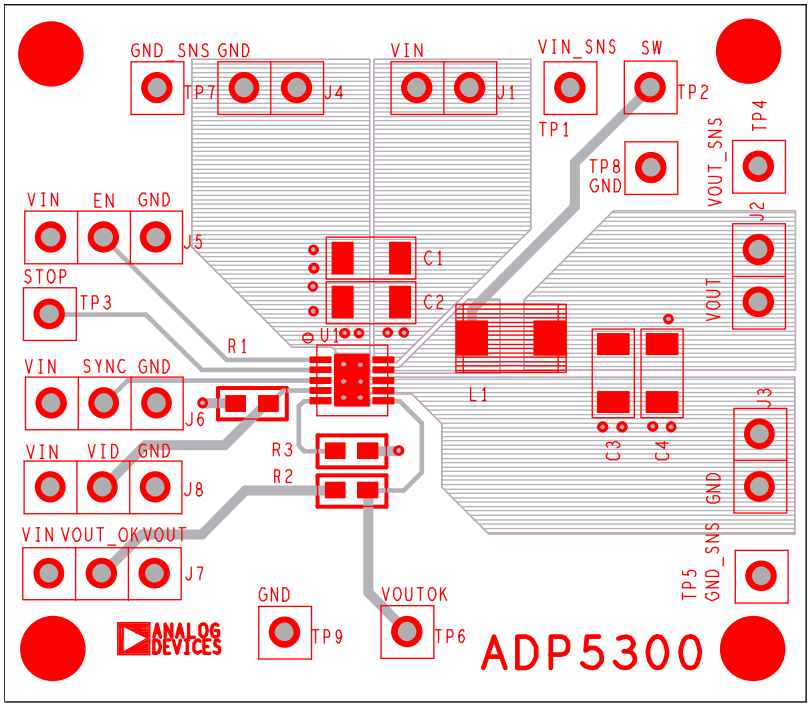

Figure 4. ADP5300-EVALZ Top Layer

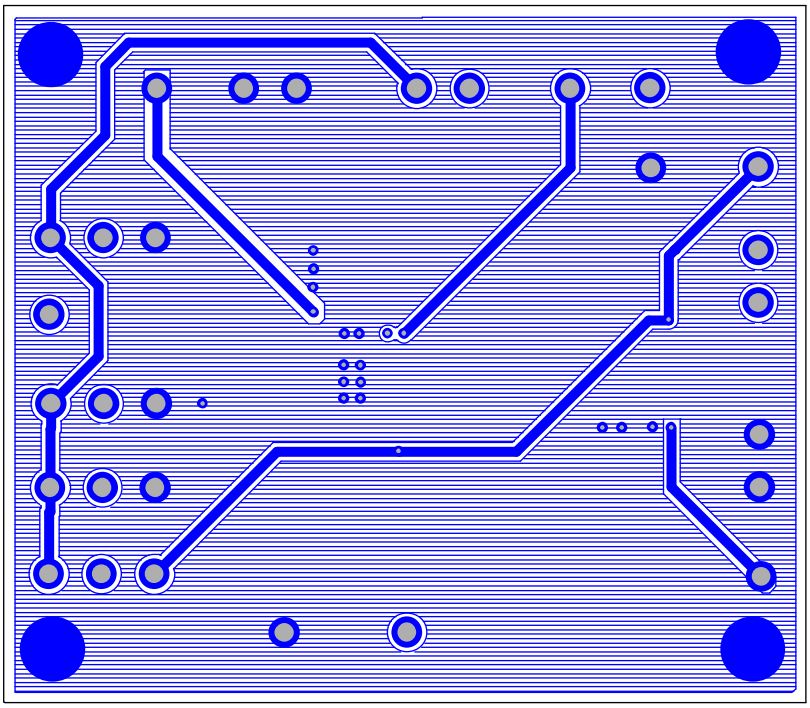

Figure 5. ADP5300-EVALZ Second Layer

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Quantity	Reference Designator	Description	Part Number	PCB Footprint	Vendor
2	C1, C4	No connect	Not applicable	C1206	Not applicable
2	C2, C3	10 µF/10 V	GRM31CR71A106KA01	C1206	Murata
1	J1	VIN	M20-9990245	SIP2	Harwin
1	J2	VOUT	M20-9990245	SIP2	Harwin
2	J3, J4	GND	M20-9990245	SIP2	Harwin
1	J5	EN	M20-9990246	SIP3	Harwin
1	J6	SYNC	M20-9990246	SIP3	Harwin
1	J7	VOUT_OK	M20-9990246	SIP3	Harwin
1	J8	VID	M20-9990246	SIP3	Harwin
1	L1	2.2 µH	LPS3015-222MR	Inductor 45 × 32	Coilcraft
		2.2 µH	74438334022	Inductor 45 × 32	Wurth Elektronik
1	R1	19.6 kΩ	CRCW060319K6FKEA	R0603	Vishay Dale
1	R2	1 MΩ	CRCW06031M00FKEA	R0603	Vishay Dale
1	R3	0 Ω	CRCW06030000FKEA	R0603	Vishay Dale
1	TP1	VIN_SNS	M20-9990245	SIP1	Harwin
1	TP2	SW	M20-9990245	SIP1	Harwin
1	TP3	STOP	M20-9990245	SIP1	Harwin
1	TP4	VOUT_SNS	M20-9990245	SIP1	Harwin
2	TP5, TP7	GND_SNS	M20-9990245	SIP1	Harwin
1	TP6	VOUT_OK	M20-9990245	SIP1	Harwin
2	TP8, TP9	GND	M20-9990245	SIP1	Harwin
1	U1	IC	ADP5300ACPZ-1-R7	QFN10_3x3	Analog Devices, Inc.