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](image-url)
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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>
<thead>
<tr>
<th>Jumper</th>
<th>State or Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>J5 (EN)</td>
<td>High, Low</td>
<td>Enable $V_{OUT}$, Disable $V_{OUT}$</td>
</tr>
<tr>
<td>J8 (VID)</td>
<td>VIN, GND, Floating</td>
<td>2.5 V, 3 V, Program $V_{OUT}$ by external resistor</td>
</tr>
<tr>
<td>J6 (SYNC/MODE)</td>
<td>VIN, GND, External frequency</td>
<td>FPWM mode, Hysteresis mode, Set frequency from 1.2 MHz to 2.5 MHz</td>
</tr>
<tr>
<td>J7 (VOUT_OK)</td>
<td>VIN, VOUT</td>
<td>Pull VOUT_OK to VIN, Pull VOUT_OK to $V_{OUT}$</td>
</tr>
</tbody>
</table>

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 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, \( \eta \), by comparing the input power with the output power.

\[
\eta = \frac{V_{\text{OUT}} \times I_{\text{OUT}}}{V_{\text{IN}} \times I_{\text{IN}}}
\]

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.

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).
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.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Part Number</th>
<th>PCB Footprint</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>C1, C4</td>
<td>No connect</td>
<td>Not applicable</td>
<td>C1206</td>
<td>Not applicable</td>
</tr>
<tr>
<td>2</td>
<td>C2, C3</td>
<td>10 µF/10 V</td>
<td>GRM31CR71A106K01</td>
<td>C1206</td>
<td>Murata</td>
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<tr>
<td>1</td>
<td>J1</td>
<td>VIN</td>
<td>M20-9990245</td>
<td>SIP2</td>
<td>Harwin</td>
</tr>
<tr>
<td>1</td>
<td>J2</td>
<td>VOUT</td>
<td>M20-9990245</td>
<td>SIP2</td>
<td>Harwin</td>
</tr>
<tr>
<td>2</td>
<td>J3, J4</td>
<td>GND</td>
<td>M20-9990245</td>
<td>SIP2</td>
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<tr>
<td>1</td>
<td>J5</td>
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<td>SIP3</td>
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<tr>
<td>1</td>
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<td>Harwin</td>
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<tr>
<td>1</td>
<td>J7</td>
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<td>SIP3</td>
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<tr>
<td>1</td>
<td>J8</td>
<td>VID</td>
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<tr>
<td>1</td>
<td>L1</td>
<td>2.2 µH</td>
<td>LP53015-222MR</td>
<td>Inductor 45 x 32</td>
<td>Coilcraft</td>
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<td>1</td>
<td>R1</td>
<td>19.6 kΩ</td>
<td>CRCW060319K6FKEA</td>
<td>R0603</td>
<td>Vishay Dale</td>
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<td>1</td>
<td>R2</td>
<td>1 MΩ</td>
<td>CRCW06031M00FKEA</td>
<td>R0603</td>
<td>Vishay Dale</td>
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<tr>
<td>1</td>
<td>R3</td>
<td>0 Ω</td>
<td>CRCW06030000FKEA</td>
<td>R0603</td>
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<td>1</td>
<td>TP1</td>
<td>VOUT_SNS</td>
<td>M20-9990245</td>
<td>SIP1</td>
<td>Harwin</td>
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<td>1</td>
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<td>1</td>
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<td>STOP</td>
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<td>SIP1</td>
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<tr>
<td>1</td>
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<td>SIP1</td>
<td>Harwin</td>
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<tr>
<td>2</td>
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<td>GND</td>
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<td>SIP1</td>
<td>Harwin</td>
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<tr>
<td>1</td>
<td>U1</td>
<td>IC</td>
<td>ADP5300ACPZ-1-R7</td>
<td>QFN10_3x3</td>
<td>Analog Devices, Inc.</td>
</tr>
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</table>

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 permanent degradation or loss of functionality.

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