FEATURES
- Single Output Voltage: 5.0 V
- Output Current: 1.4 A
- Input voltage: 9 V to 20 V
- Ripple <1% ppk of Output Voltage
- Transient step ±5%, 50% max load

ADP1821 REFERENCE DESIGN DESCRIPTION
This ADP1821 Reference Design uses a 9 to 20 V input voltage to generate a 5.0 V output voltage ($V_{OUT1}$) with a maximum output current of 1.4 A.

The output voltage ripple is less than 1% peak-to-peak of the DC output voltage. The output voltage deviates less than 5% upon a 50% (0.7 A) load step and load release. The switching is externally set to 300 kHz on the ADP1821.

**Figure 1.** ADP1821 Demo Board
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REVISION HISTORY

12/21/2007—Revision 1: Initial Version
1/18/2008—Revision 2: Updated for new hardware, including lab data and scope shots (minor BOM changes)
GENERAL DESCRIPTION

The ADP1821 is a versatile and inexpensive, synchronous, pulse width-modulated (PWM), voltage-mode, step-down controller. It drives an all N-channel power stage to regulate an output voltage as low as 0.6 V. The ADP1821 can be configured to provide output voltages from 0.6 V to 85% of the input voltage and is sized to handle large MOSFETs for point-of-load regulators. The ADP1821 is well suited for a wide range of high power applications, such as DSP and processor core power in telecom, medical imaging, high performance servers, and industrial applications. It operates from a 3.0 V to 5.5 V supply with a power input voltage ranging from 1.0 V to 24 V. The ADP1821 operates at a pin-selectable, fixed switching frequency of either 300 kHz or 600 kHz, minimizing external component size and cost. For noise-sensitive applications, it can be synchronized to an external clock to achieve switching frequencies between 300 kHz and 1.2 MHz. The ADP1821 includes soft start protection to limit the inrush current from the input supply during startup, reverse current protection during soft start for precharged outputs, as well as a unique adjustable lossless current-limit scheme utilizing external MOSFET sensing. The ADP1821 operates over the –40°C to +85°C temperature range and is available in a 16-lead QSOP.
Figure 2. Schematic: 20V ->5V@1.4A

**SCHEMATIC**

5.0V at 1.4A
## BILL OF MATERIALS

Table 1. $V_{\text{OUT1}}$

<table>
<thead>
<tr>
<th>Description</th>
<th>Designator</th>
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<th>Manufacturer</th>
<th>MFR#</th>
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<tr>
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<td>Murata</td>
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<td>Coiltronic</td>
<td>FP3-150-R</td>
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<td>Single N-Channel MOSFET SOT-23 30V</td>
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<td>Vishay</td>
<td>Si2316ds</td>
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<td>Generic</td>
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<td>BAT54</td>
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<tr>
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<td>1</td>
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Figure 3. Top Assembly Drawing for 1829 Demo Board
POWERING THE ADP1821 REFERENCE DESIGN

The ADP1821 Reference Design is supplied fully assembled.

INPUT POWER SOURCE

1. Before connecting the power source to the ADP1821 Reference Design, make sure that it is turned off. If the input power source includes a current meter, use that meter to monitor the input current.
2. Connect the positive terminal of the power source to the VIN terminal on the evaluation board, and the negative terminal of the power source to the GND terminal next to the VIN terminal.
3. If the power source does not include a current meter, connect a current meter in series with the input source voltage.
4. Connect the positive lead (+) of the power source to the ammeter positive (+) connection, the negative lead (−) of the power source to the GND terminal on the board, and the negative lead (−) of the ammeter to the VIN terminal on the board.

OUTPUT LOAD

1. Although the ADP1821 Reference Design can sustain the sudden connection of the load, it is possible to damage the load if it is not properly connected.
2. Make sure that the power source is turned off before connecting the load.
   a) If the load includes an ammeter, or if the current is not measured, connect the load directly to the evaluation board with the positive (+) load connection to the \( V_O \) terminal and negative (−) load connection to the GND terminal next to \( V_O \).
   b) If an ammeter is used, connect it in series with the load; connect the positive (+) ammeter terminal to the evaluation board \( V_O \) terminal, the negative (−) ammeter terminal to the positive (+) load terminal, and the negative (−) load terminal to the evaluation board GND terminal next to \( V_O \).

Once the load is connected, make sure that it is set to the proper current before powering the ADP1821 Reference Design.

INPUT AND OUTPUT VOLTMETERS

Measure the input and output voltages with voltmeters.

1. Connect the voltmeter measuring the input voltage with the positive (+) lead connected to the VIN terminal on the test board and the negative lead (−) connected to the GND terminal next to VIN.
2. Connect the voltmeter measuring \( V_{OUT} \) with the positive lead (+) connected to the \( V_O \) terminal and the negative lead (−) connected to the adjacent GND terminal.
3. Make sure to connect the voltmeters to the appropriate evaluation board test points and not to the load or power source themselves.
4. If the voltmeters are not connected directly to the evaluation board at these connection points, the measured voltages will be incorrect due to the voltage drop across the leads connecting the evaluation board to both the source and load.
TURNING ON THE EVALUATION BOARD

Once the power source and loads are connected to the ADP1821 Reference Design, the board can be powered for operation. Slowly increase the input power source voltage until the input voltage exceeds the minimum input operating voltage of 9 V. If the load is not already enabled, enable the load and check that it is drawing the proper current and that the output voltage maintains voltage regulation.
TYPICAL PERFORMANCE CHARACTERISTICS

Figure 4. Efficiency

Figure 5. Load Regulation

Normalized Load Regulation
Figure 5.  Switching regulator turn on at no load: Ch1 = 5.0 V, Ch3 = Vin

Figure 6.  Switching regulator turn on at full load: Ch1 = 5.0 V, Ch3 = Vin
Figure 7. Switching regulator turn off at no load: Ch1 = 5.0 V, Ch3 = Vin

Figure 8. Switching regulator turn off at full load: Ch1 = 5.0 V, Ch3 = Vin
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Figure 20. Switchnode Falling 100% load Vin @ 20 V: Ch2 = Drain to Source of QL1
NOTES

The unnamed terminals adjacent to Vo and GND can be used to connect a common mode choke to the output. Simply move the Vout and GND connections to the dummy terminals and connect the common mode choke between Vo and GND and the dummy terminals.

Lout was meant to be populated with a low inductance ferrite bead. If it is necessary to populate this component to meet EMI then the loop compensation may need to be adjusted to guarantee stability.