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Evaluation Board for the ADP5034 Micro Power Management Unit (PMU)

FEATURES

Full-featured evaluation board for the ADP5034
Standalone capability
Simple device measurements, including line and load regulation, demonstrable with
- **A single voltage supply**
- **A voltmeter**
- **A current meter**
- **Load resistors**

Easy access to external components
Cascading options to supply the low dropout (LDO) from either buck
Dedicated enable option for each channel
Mode option to change bucks from PFM to PWM operation

GENERAL DESCRIPTION

The ADP5034 evaluation board has two step-down regulators with two LDOs that enable evaluation of the ADP5034. The evaluation board is available in standard voltage options.

The ADP5034 uses a proprietary high speed, current mode, constant frequency, pulse-width modulation (PWM) control scheme for excellent stability and transient response. To ensure the longest battery life in portable applications, the ADP5034 features a power save mode (PSM) that reduces the switching frequency under light load conditions, as well as the option to change the mode to fixed PWM operation. The 3 MHz switching frequency minimizes the size of the external components.

The low quiescent current, low dropout voltage, and wide input voltage range of the ADP5034 LDO regulators extend the battery life of portable devices.

Full details on the ADP5034 are provided in the ADP5034 data sheet available from Analog Devices, Inc., which should be consulted in conjunction with this evaluation board user guide.

DIGITAL PICTURE OF THE EVALUATION BOARD

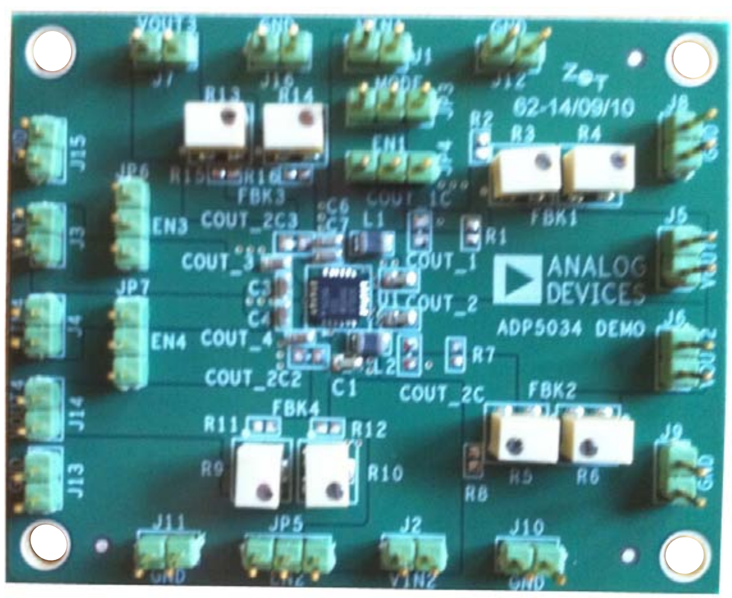

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Figure 1.

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REVISION HISTORY

8/11—Revision 0: Initial Version

USING THE EVALUATION BOARD

POWERING UP THE EVALUATION BOARD

The ADP5034 evaluation board is supplied fully assembled and tested. Before applying power to the evaluation board, follow the procedures in this section.

Enable

Each channel has its own enable pin, which must be pulled high to enable that channel (see Table 1).

Table 1. Channels of the Enable Pins

Channel	Enable Pin
1	JP4
2	JP5
3	JP6
4	JP7

Jumper J3 (MODE)

Jumper JP3 (MODE) pulled high to J1 (VIN_1) forces Buck 1 and Buck 2 into forced PWM operation. JP3 (MODE) pulled low to J11 (GND1) allows Buck 1 and Buck 2 to operate in automatic PWM/PSM operation.

Input Power Source

If the input power source includes a current meter, use that meter to monitor the input current. Connect the positive terminal of the power source to J1 (VIN_1) on the evaluation board and the negative terminal of the power source to J12 (GND).

If the power source does not include a current meter, connect a current meter in series with the input source voltage. Connect the positive lead (+) of the power source to the ammeter positive (+) connection, the negative lead (−) of the power source to J12 (GND) on the evaluation board, and the negative lead (−) of the ammeter to J1 (VIN_1) on the board. Be aware that the current meters add resistance to the input source, and this voltage reduces with high output currents.

Output Load

Connect an electronic load or resistor to set the load current. 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 connected to one of the channels. For example, connect Buck 1, J5 (VOUT1) and the negative (−) load connection to J8 (GND)

If an ammeter is used, connect it in series with the load. Connect the positive (+) ammeter terminal to the evaluation board for Buck 1, J5 (VOUT1), the negative (−) ammeter terminal to the positive (+) load terminal, and the negative (−) load terminal to the evaluation board at J8 (GND).

Input and Output Voltmeters

Measure the input and output voltages with voltmeters. Make sure that the voltmeters are connected to the appropriate evaluation board terminals and not to the load or power sources themselves.

If the voltmeters are not connected directly to the evaluation board, the measured voltages will be incorrect due to the voltage drop across the leads and/or connections between the evaluation board, the power source, and/or the load.

Connect the input voltage measuring voltmeter positive terminal (+) to the evaluation board at J5 (VIN_1), and input voltage measuring voltmeter negative (−) terminal to the evaluation board at J12 (GND1).

Connect the output voltage measuring voltmeter positive (+) terminal to the evaluation board at J5 (VOUT1) for measuring the output voltage of Buck 1, and the output voltage measuring voltmeter negative (−)terminal to the evaluation board at J8 (PGND).

Turning On the Evaluation Board

When the power source and load are connected to the ADP5034 evaluation board, the board can be powered for operation. Ensure that:

- The power source voltage is >2.3 V and <5.5 V.
- The desired channel is enabled and monitors the output voltage.

If the load is not enabled, enable the load; check that it is drawing the proper current and that the output voltage maintains voltage regulation.

MEASURING EVALUATION BOARD PERFORMANCE

Measuring Output Voltage Ripple on the Buck Regulator

To observe the output voltage ripple of Buck 1, place an oscilloscope probe across the output capacitor (COUT_1) with the probe ground lead at the negative (−) capacitor terminal and the probe tip at the positive (+) capacitor terminal. Set the oscilloscope to ac, 20 mV/division, and 2 µs/division time base.

Measuring the Switching Waveform

To observe the switching waveform with an oscilloscope, place the oscilloscope probe tip at the end of the inductor with the probe ground at GND. Set the oscilloscope to dc, 2 V/division, and 2 µs/division time base.

Measuring Load Regulation

Test the load regulation by increasing the load at the output and looking at the change in output voltage. To minimize voltage drop, use short low resistance wires, especially for loads approaching maximum current.

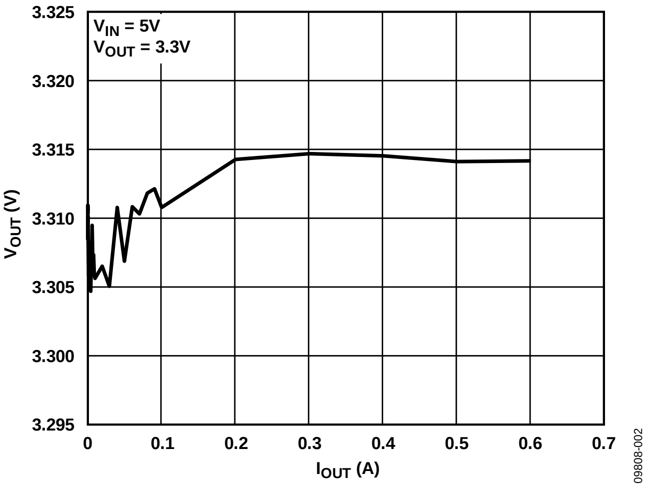

Figure 2. Buck Load Regulation

Measuring Line Regulation

Vary the input voltage and examine the change in the output voltage.

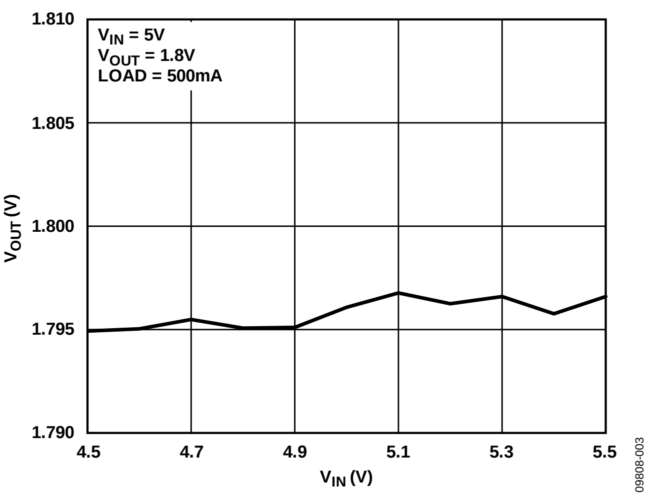

Figure 3. Buck Efficiency

Measuring Efficiency

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

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

Measure the input and output voltages as close as possible to the input and output capacitors to reduce the effect of IR drops.

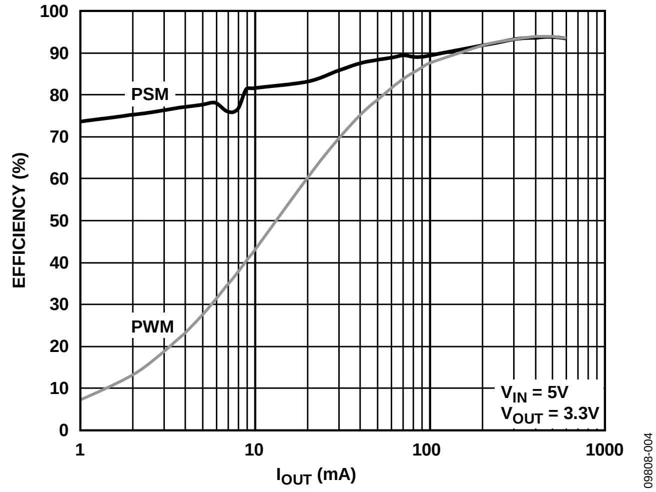

Figure 4. Buck Efficiency

Measuring Inductor Current

Measure the inductor current by removing one end of the inductor from its pad and connecting a current loop in series. A current probe can be connected to this wire.

Line Regulation of LDOs

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 mode during this measurement, V_{IN} must be varied between V_{OUT} nominal + 0.5 V (or 2.3 V, whichever is greater) and V_{IN} maximum. For example, a fixed 2.8 V output needs V_{IN} to be varied between 3.3 V and 5.5 V. This measurement can be repeated under different load conditions. Figure 5 shows the typical line regulation performance of the LDO with a fixed 2.8 V output.

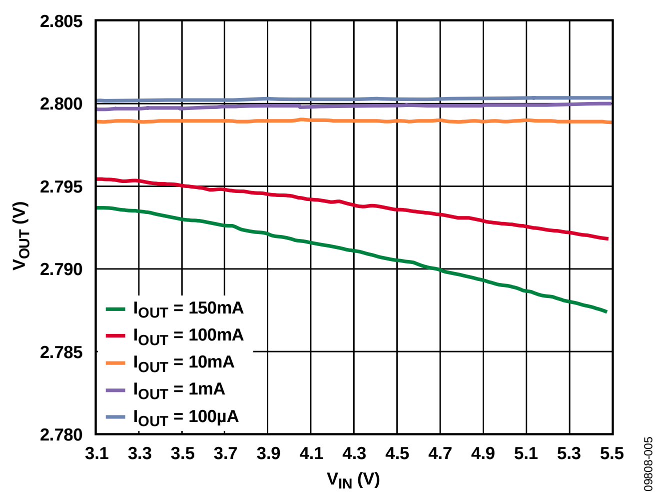

Figure 5. LDO Line Regulation

Load Regulation of LDO

For load regulation measurements, the regulator output is monitored 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. The load current can be varied from 0 mA to 150 mA. Figure 6 shows the typical load regulation performance of the LDO with a fixed 2.8 V output for an input voltage of 3.3 V.

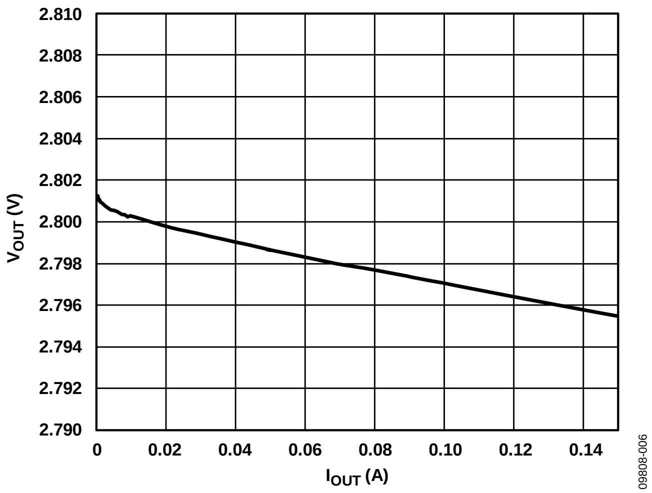

Figure 6. LDO Load Regulation

Dropout Voltage of LDO

Dropout voltage is defined as the input-to-output voltage differential when the input voltage is set to the nominal output voltage. This applies only for output voltages greater than 2.3 V. Dropout voltage increases with larger loads. For more accurate measurements, a second voltmeter can be used to monitor the input voltage across the input capacitor. The input supply voltage may need to be adjusted to account for IR drops, especially if large load currents are used.

Ground Current Consumption of LDO

Ground current measurements can determine how much current the internal circuits of the regulator consume while the circuits perform the regulation function. To be efficient, the regulator needs to consume as little current as possible. Typically, the regulator uses the maximum current when supplying its largest load level (150 mA). When the device is disabled, the ground current drops to less than 1 mA.

MEASURING OUTPUT VOLTAGE

Figure 7 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 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.

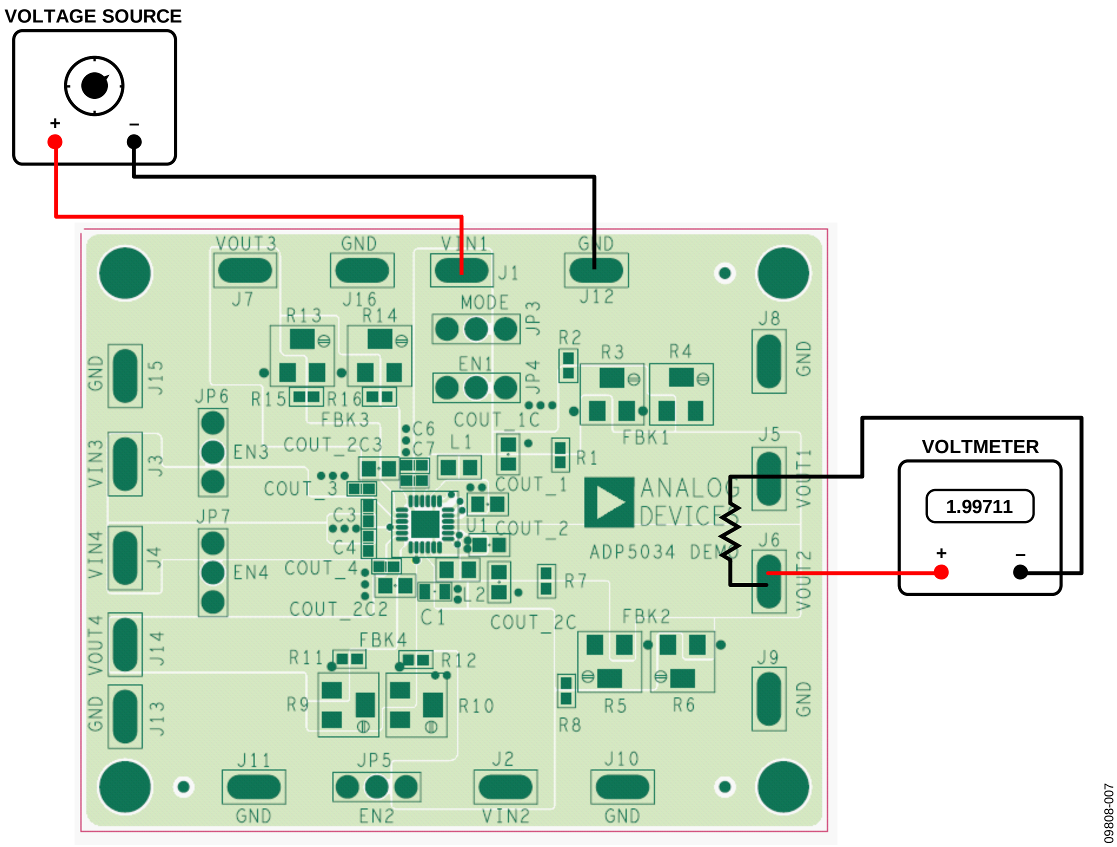

Figure 7. Output Voltage Measurement

MEASURING GROUND CURRENT

Figure 8 shows the evaluation board 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.

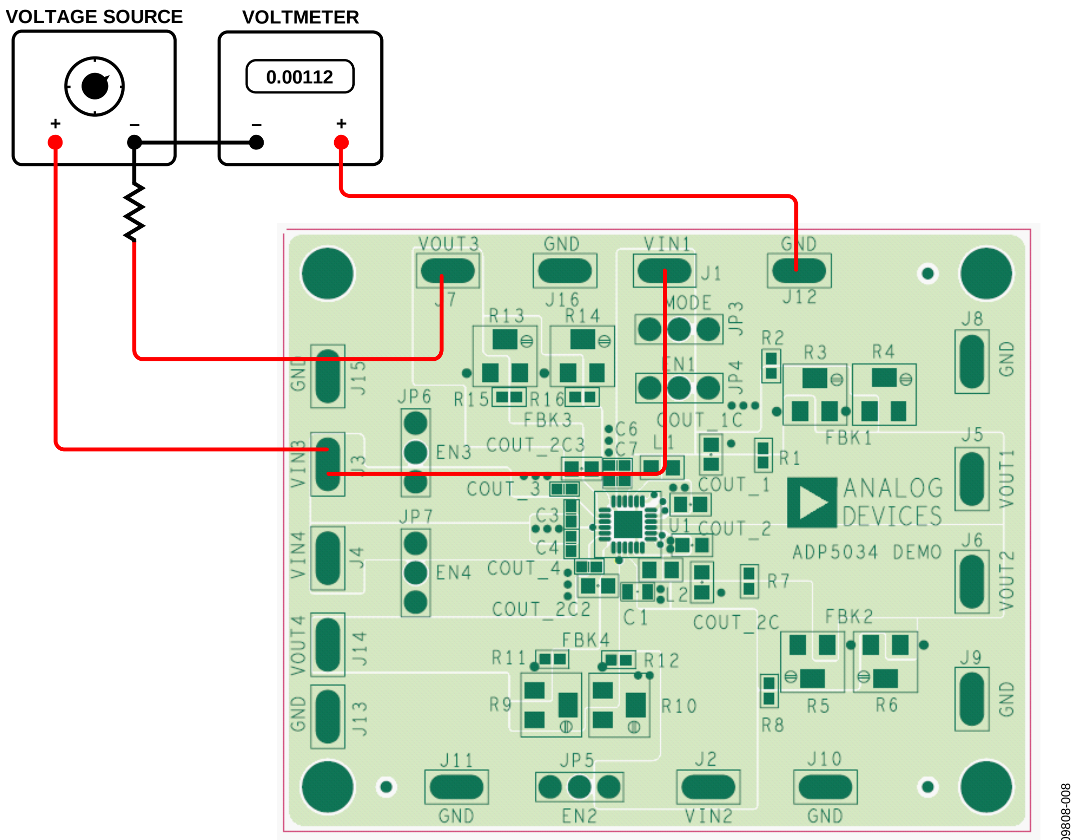

Figure 8. Ground Current Measurement

EVALUATION BOARD SCHEMATICS AND ARTWORK

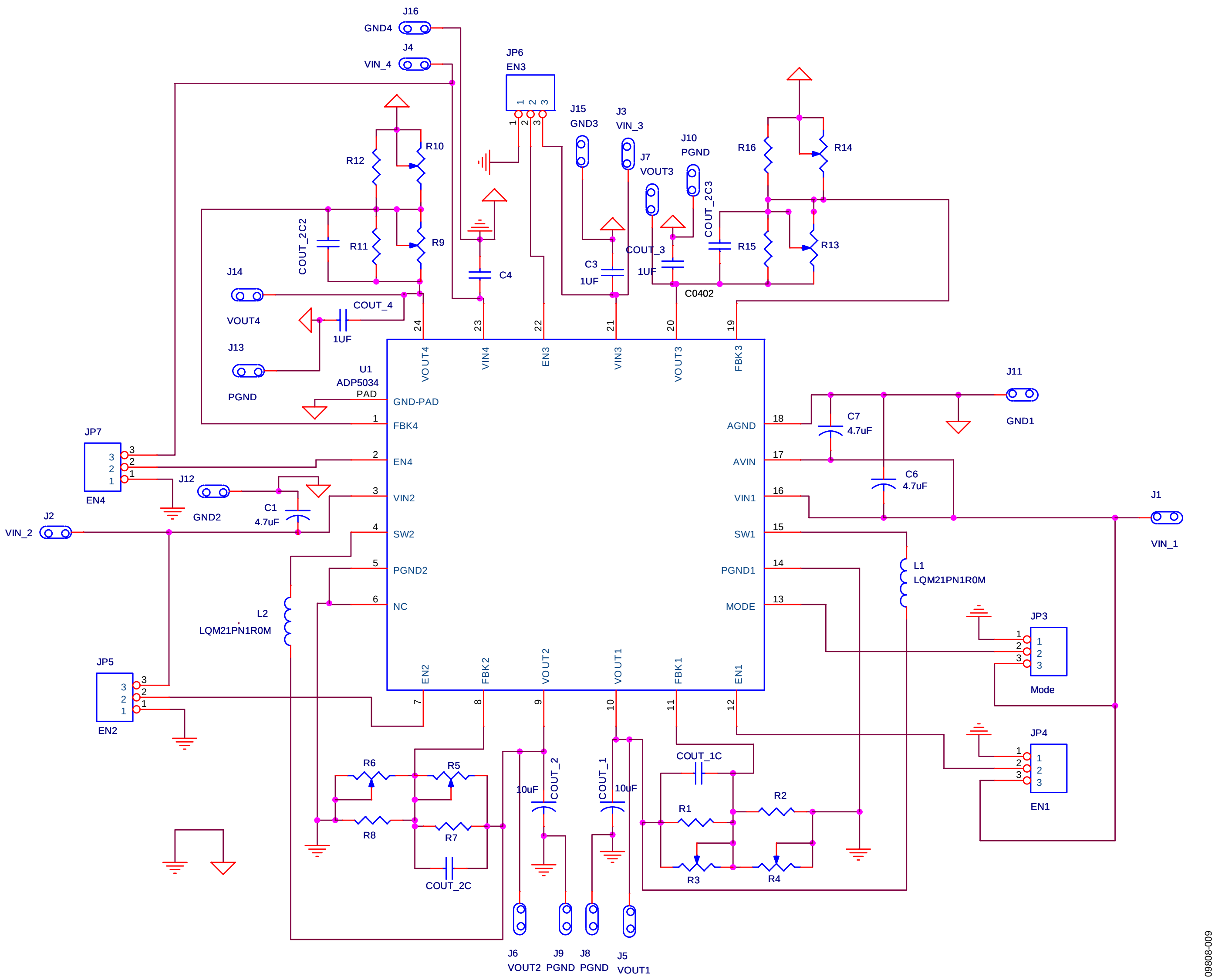

Figure 9. Evaluation Board Schematic of the ADP5034

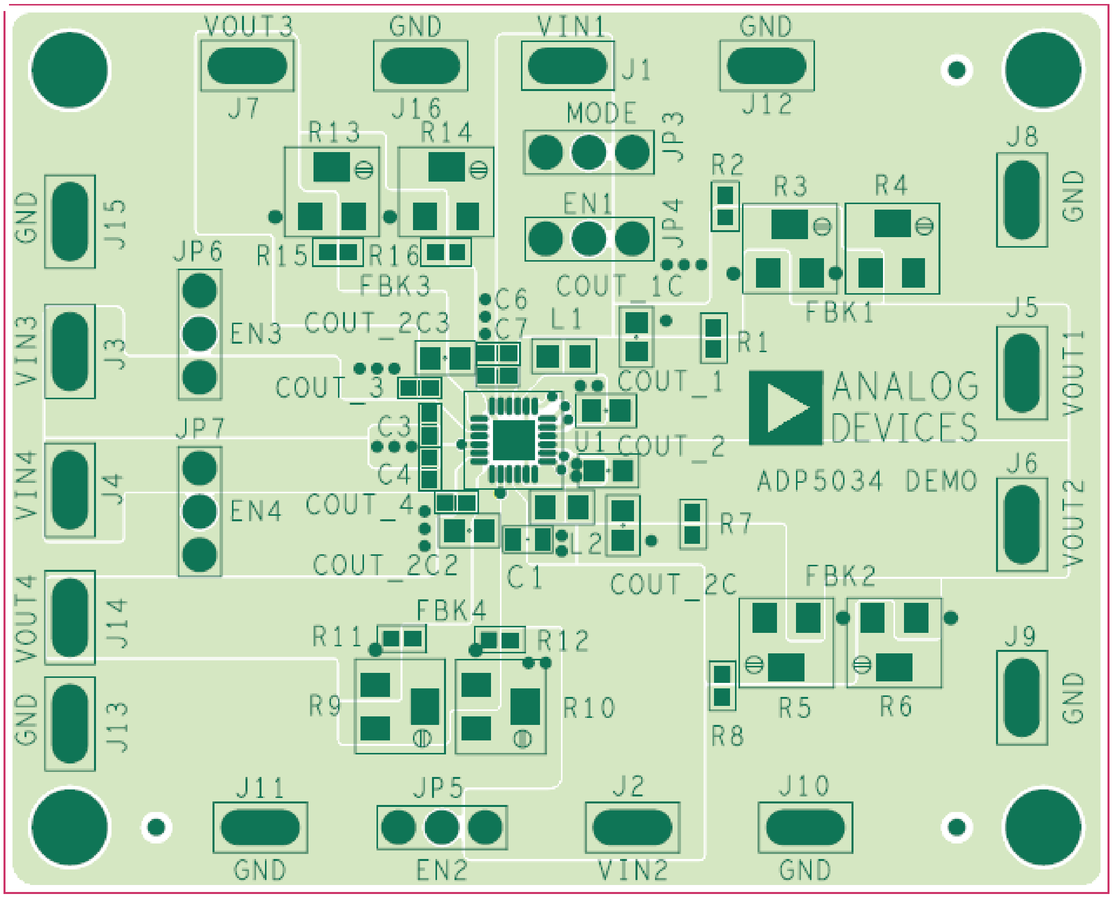

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Figure 10. Top Layer, Recommended Layout

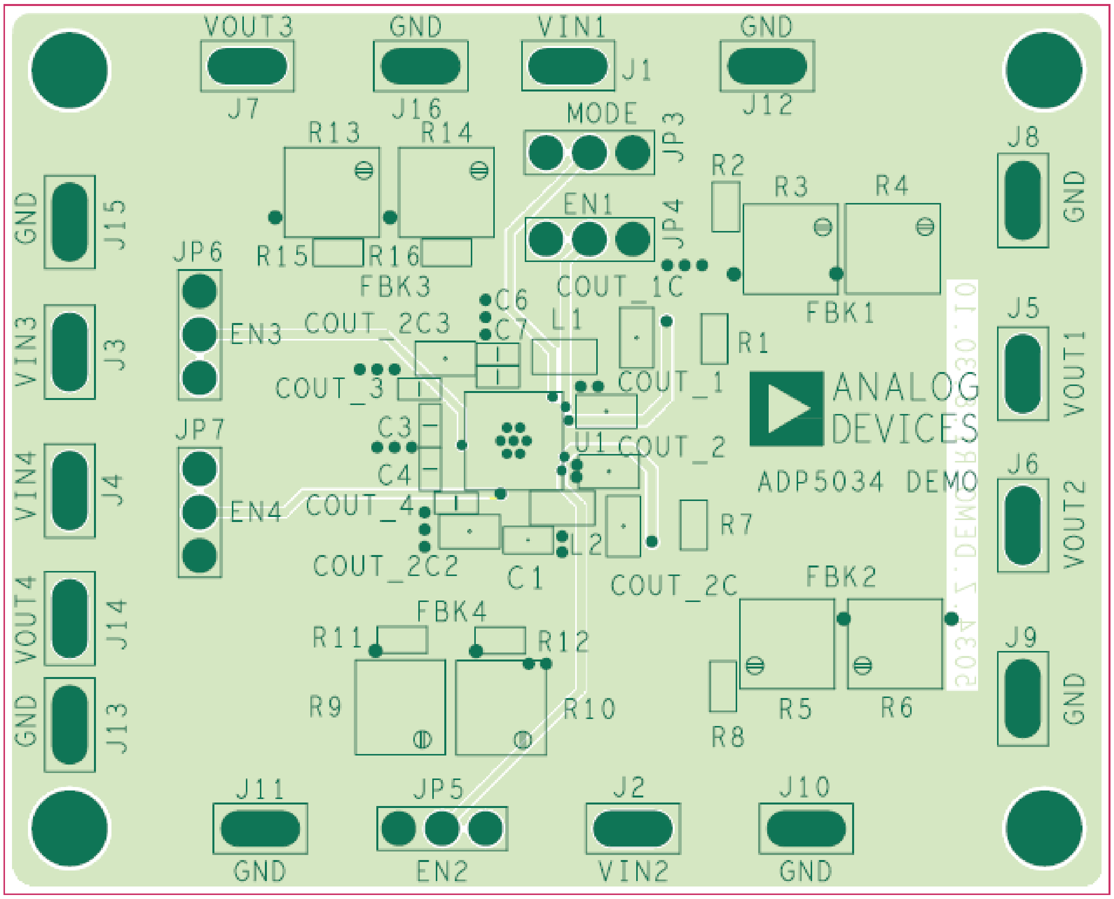

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Figure 11. Bottom Layer, Recommended Layout

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Qty.	Reference Designator	Description	Manufacturer	Part Number
1	U1	Micro PMU, four regulators	Analog Devices	ADP5034
2	C6, C1	Capacitor, MLCC, 4.7 μF	Panasonic, ECG	GRM188R60J475ME19D
5	C7, C4, C3, COUT_3, COUT_4	Capacitor, MLCC, 1.0 μF	Taiyo Yuden Co., Ltd.	GRM188R60J105KA01B
2	COUT_2, COUT_1	Capacitor, MLCC, 10.0 μF	Taiyo Yuden Co., Ltd.	GRM188R60J106ME47D
2	L1, L2	Inductor, 1.0 μH	Taiyo Yuden Co., Ltd.	LQM2HPN1R0MJ0L
8	R3, R4, R5, R6, R9, R10, R13,R14	Trimmer resistors, 200 kΩ	Bournes, Inc.	3214W-1-204E
8	R8, R7, R1, R2, R15, R16, R11, R12	Not fitted	Not fitted	Not fitted
4	COUT_1C, COUT_2C, COUT2C2, COUT_2C3	Not fitted	Not fitted	Not fitted

NOTES

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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