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Evaluation Board for the 800 mA, 3 MHz Buck Regulator

FEATURES

- **Full-featured evaluation board for the ADP2138/ADP2139**
- **Standalone capability**
- **Simple device measurements, including line and load regulation, demonstrable with**
  - **A single voltage supply**
  - **A voltage meter**
  - **A current meter**
  - **Load resistors**
- **Easy access to external components**

GENERAL DESCRIPTION

The ADP2138 and ADP2139 are high efficiency, low quiescent current, synchronous step-down dc-to-dc converters. The ADP2139 has the additional feature of an internal discharge switch. The total solution requires only three tiny external components.

When the MODE pin is set high, the buck regulator operates in forced PWM mode, which provides low peak-to-peak ripple for power supply noise sensitive loads at the expense of light load efficiency. When the MODE pin is set low, the buck regulator automatically switches operating modes, depending on the load current level. At higher output loads, the buck regulator operates in PWM mode. When the load current falls below a predefined threshold, the regulator operates in power save mode (PSM), improving light load efficiency.

The 3 MHz switching frequency minimizes the size of external components. Full details on the ADP2138/ADP2139 are provided in the ADP2138/ADP2139 data sheet available from Analog Devices, Inc., which should be consulted in conjunction with this data sheet.

DIGITAL PICTURE OF THE EVALUATION BOARD

Figure 1.

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REVISION HISTORY

3/11—Revision 0: Initial Version

USING THE EVALUATION BOARD

POWERING UP THE EVALUATION BOARD

The ADP2138/ADP2139 evaluation board is supplied fully assembled and tested. Before applying power to the evaluation board, follow the procedures in this section.

Jumper TB2 (Enable)

Jumper TB2 (EN) enables/disables the ADP2138/ADP213. Connect a jumper between TB2 and TB1 (VIN) to enable the ADP2138/ADP2139. Connecting TB2 (EN) to TB4 (GND) disables the ADP2138/ADP2139 and brings the current to < 1 µA.

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 TB1 (V_{IN}) on the evaluation board, and the negative terminal of the power source to TB4 (GND OUT) of the evaluation board.

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 TB4 (GND OUT) on the evaluation board, and the negative lead (−) of the ammeter to TB1 (V_{IN}) on the board.

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 connection to TB3 (V_{OUT}) and the negative (−) load connection to TB4 (GND).

If an ammeter is used, connect it in series with the load. Connect the positive (+) ammeter terminal to the evaluation board TB3 (VOUT), the negative (−) ammeter terminal to the positive (+) load terminal, and the negative (−) load terminal to the evaluation board TB4 (GND OUT).

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 source themselves. If the voltmeters are not connected directly to the evaluation board, the measured voltages are 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 TB1 (VIN), and the negative (−) terminal to the evaluation board TB4 (GND OUT). Connect the output voltage measuring voltmeter positive (+) terminal to the evaluation board TB3 (VOUT) and the negative (−) terminal to the evaluation board TB4 (GND OUT).

Turning On the Evaluation Board

Once the power source and load are connected to the ADP2138/ADP2139 evaluation board, the board can be powered for operation. Perform the following steps:

1. Ensure that the power source voltage is > 2.3 V and < 5.5 V.
2. Ensure that TB2 (EN) is high and monitor the output voltage.

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

Changing the Mode of the Device

Each ADP2138/ADP2139 has a MODE pin, which determines the operation of the buck regulator in either PWM mode (when the MODE pin is set high by connecting TB6 to TB1) or power save mode (when the mode pin is set low by connecting TB6 to TB4).

MEASURING EVALUATION BOARD PERFORMANCE

Measuring Output Voltage Ripple

To observe the output voltage ripple, place an oscilloscope probe across the output capacitor (C_{OUT}) 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 OUT. Set the oscilloscope to dc, 2 V/division, and 2 µs/division time base.

Measuring Load Regulation

The load regulation must be tested 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.

Measuring Line Regulation

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

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.

Measuring Inductor Current

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

EVALUATION BOARD SCHEMATICS AND ARTWORK

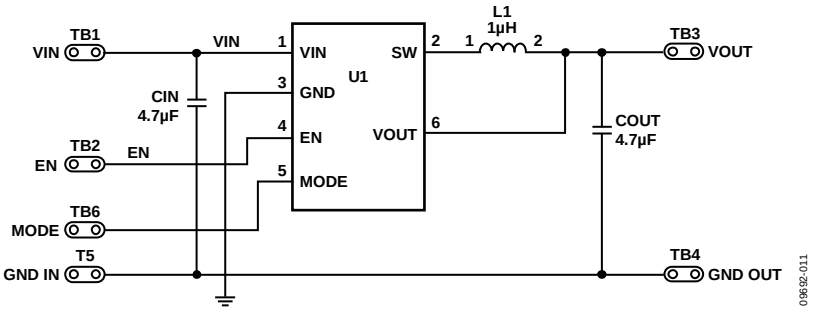

Figure 2. Evaluation Board Schematic

EVALUATION BOARD LAYOUT

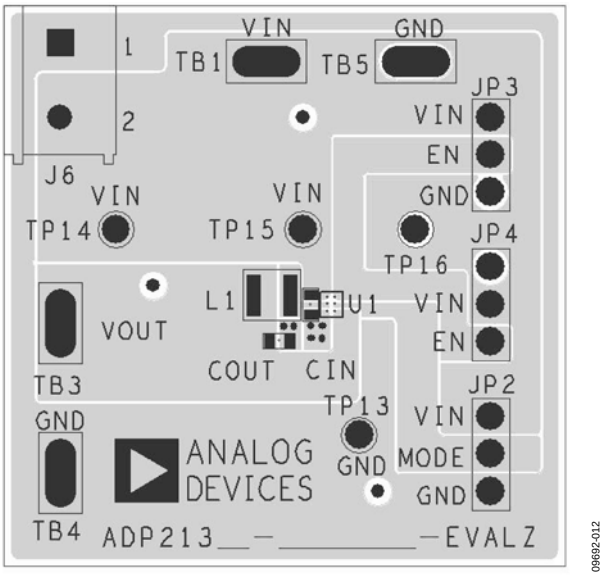

Figure 3. Top Layer

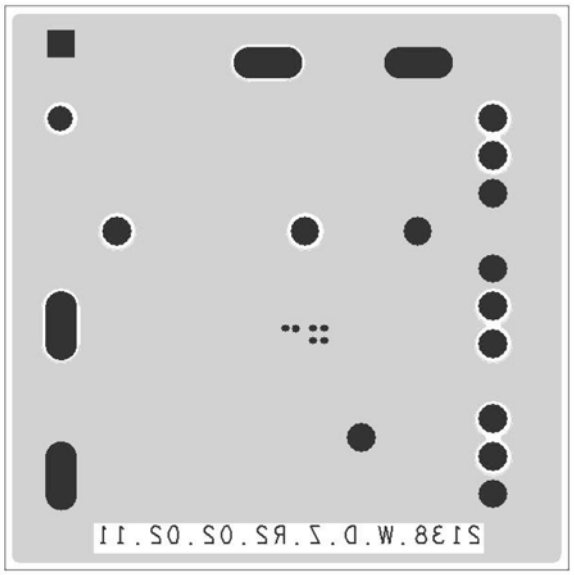

Figure 4. Bottom Layer

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Qty.	Reference Designator	Description	Manufacturer	Part Number
1	U1	ADP2138/ADP2139 buck regulator	Analog Devices, Inc.	ADP2138/ADP2139
1	C_{IN}	Capacitor, MLCC, 4.7 µF, 6.3 V, 0603, X5R	Murata Manufacturing Co., Ltd	GRM188R60J475
1	C_{OUT}	Capacitor, MLCC, 4.7 µF, 6.3 V, 0603, X5R	Murata Manufacturing Co., Ltd	GRM188R60J475
1	L1	Inductor, 1.0 µH, 1.4 A, 85 mΩ	Murata Manufacturing Co., Ltd	LQM2MPN1R0NG0B

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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.

UG09692-0-3/11(0)

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