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Evaluating the ADP2230 Dual 2 MHz, 800 mA, Synchronous, Low Quiescent Current Buck Regulator

FEATURES

- Input voltage range: 2.3 V to 6.5 V
  - Adjustable output voltage range: 0.8 V to 6 V
- Up to 94% efficiency
- Low quiescent current of 15 µA for both channels in power saving mode (PSM)
- Low shutdown current: 0.1 µA (typical)
- 100% duty cycle for low dropout operation
- SYNC pin switching frequency options
  - 2 MHz fixed pulse-width modulation (PWM) mode
  - 2 MHz PSM/PWM automatic transitioning mode
  - External clock synchronization from 1.5 MHz to 2.5 MHz
- Enable input with precision thresholds for each output
- 180° phase shifted PWM outputs for minimum V_{IN} ripple
- Current-limit and thermal shutdown (TSD) protection
- Quick output discharge (QOD)
- 10-lead, 3 mm × 3 mm × 0.75 mm LFCSP package
- Operating temperature range: −40°C to +85°C

GENERAL DESCRIPTION

The ADP2230 evaluation board aids in rapid testing of the performance of the ADP2230. The evaluation board ships with the adjustable output option, which allows testing to be performed on multiple output voltages. The board comes preconfigured with one output set to 1.2 V and one output set to 3.3 V. To adjust the output, replace the set feedback resistors on the evaluation board.

For more information about the ADP2230 dual buck converter, see the ADP2230 data sheet.

EVALUATION BOARD PHOTOGRAPH

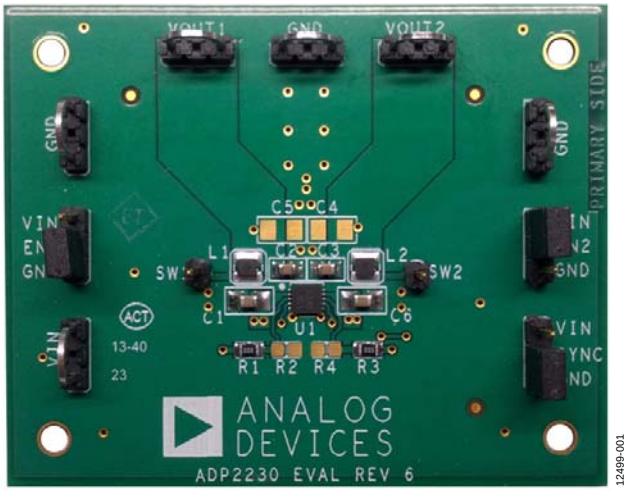

Figure 1. ADP2230CP-EVALZ

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REVISION HISTORY

4/15—Revision 0: Initial Version

EVALUATION BOARD HARDWARE AND SCHEMATIC

EVALUATION BOARD CONFIGURATIONS

The ADP2230 evaluation board comes preset with two different output voltages. V_{OUT1} is set to 1.2 V and V_{OUT2} is set to 3.3 V. Change R1 to R4 to select different voltages. Figure 2 shows the evaluation board configuration.

Set the output voltages according to the following equations:

$$V_{OUT1} = \left(1 + \frac{R1}{R2}\right) \times V_{FB}$$

$$V_{OUT2} = \left(1 + \frac{R3}{R4}\right) \times V_{FB}$$

where V_{FB} = 0.8 V (typical).

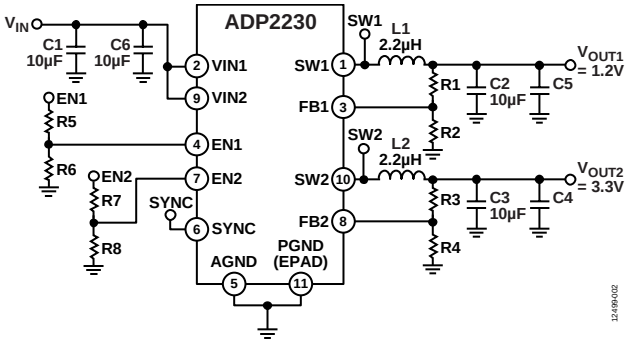

Figure 2. ADP2230 Evaluation Board Schematic

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1	Dual buck IC	ADP2230 dual buck regulator
C1, C6	Input capacitor	10 µF input bypass capacitor, 1206 case
C2, C3	Output capacitors	10 µF output capacitors, 0805 case; required for stability and transient performance
C4, C5	Output capacitors	Extra pads for additional output capacitance if desired, 1206 case; do not install by default
L1, L2	Inductors	2.2 µH inductors for buck regulators
R1, R2, R3, R4	Setpoint resistors	Select R1 through R4 to set output voltages, 0603 case
R5, R6, R7, R8	Resistors	Precision enable conditioning resistors, 0603 case; do not leave enable pins floating

OUTPUT VOLTAGE MEASUREMENTS

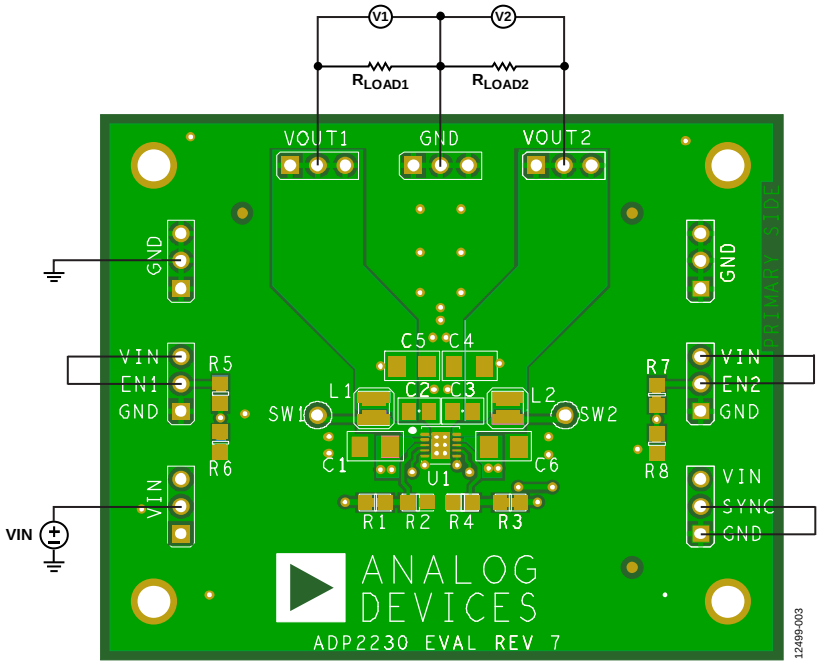

Figure 3. Output Voltage Measurement Setup

Figure 3 shows the ADP2230 evaluation board connected to a voltage source and voltmeters for basic output voltage accuracy measurements. Use resistors as the load for the regulator. Ensure that the resistors have a power rating adequate for handling the power expected to be dissipated across them. An electronic load can also be used as an alternative. In addition, ensure that the voltage source can supply enough current for the expected load levels. Follow these steps to connect to a voltage source and monitor output voltages:

1. Connect the negative (−) terminal of the voltage source to one of the GND pads on the evaluation board.
2. Connect the positive (+) terminal of the voltage source to the VIN pad on the evaluation board.
3. Connect a load between the VOUT1 pad and the GND pad and between the VOUT2 pad and the GND pad.
4. Connect the negative (−) terminals of the voltmeters or oscilloscopes to one of the GND pads.
5. Connect the positive (+) terminals of the voltmeters or oscilloscopes to VOUT1 and VOUT2.
6. Drive EN1 and EN2 high by connecting a jumper to enable the channel.
7. Drive SYNC high to force the device to operate in 2 MHz fixed PWM mode. Drive SYNC low to force the device to operate in 2 MHz PSM/PWM automatic transitioning mode. Apply an external clock between 1.5 MHz and 2.5 MHz to the SYNC pin to synchronize the ADP2230 switching to the applied external clock. Do not leave the SYNC pin floating.
8. Turn the voltage source on.

LINE REGULATION

For line regulation measurements, the regulator outputs are monitored at the same time the regulator input is varied. For good line regulation, the outputs must change as little as possible with varying input levels. This measurement can be repeated under different load conditions. Figure 4 and Figure 5 show the typical line regulation performance of the ADP2230 1.2 V and 3.3 V outputs, respectively.

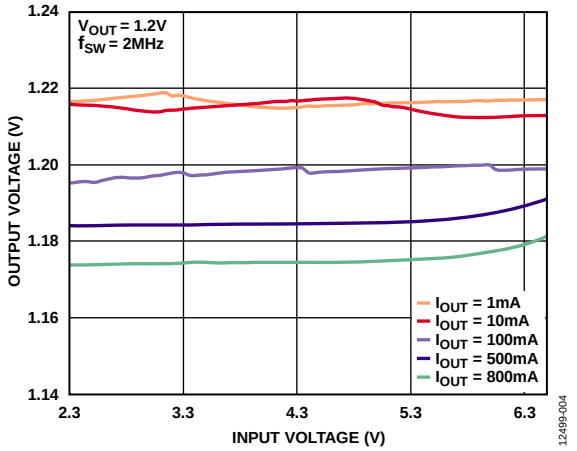

Figure 4. Line Regulation, V_{OUT} = 1.2 V, Different Loads

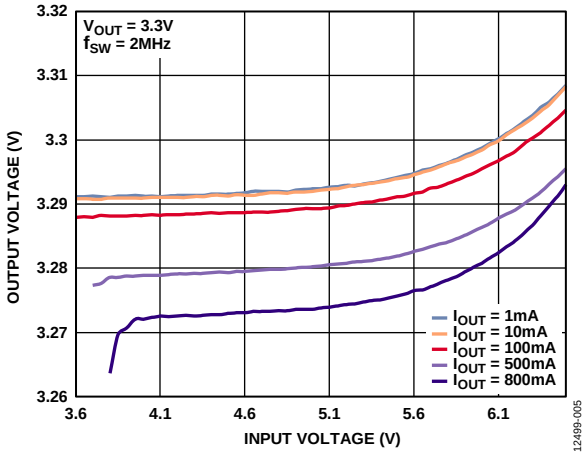

Figure 5. Line Regulation, V_{OUT} = 3.3 V, Different Loads

LOAD REGULATION

For load regulation measurements, the regulator outputs are monitored at the same time the loads are varied. For good load regulation, the outputs must change as little as possible with varying loads. The input voltage must be held constant during this measurement. Vary the load currents from 0 mA to 800 mA per output. Figure 6 and Figure 7 show the typical load regulation performance of the ADP2230 1.2 V and 3.3 V outputs, respectively, in both PWM and auto modes.

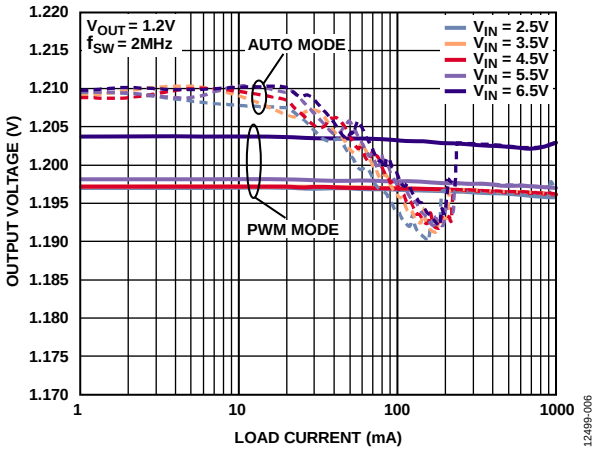

Figure 6. Load Regulation, V_{OUT} = 1.2 V

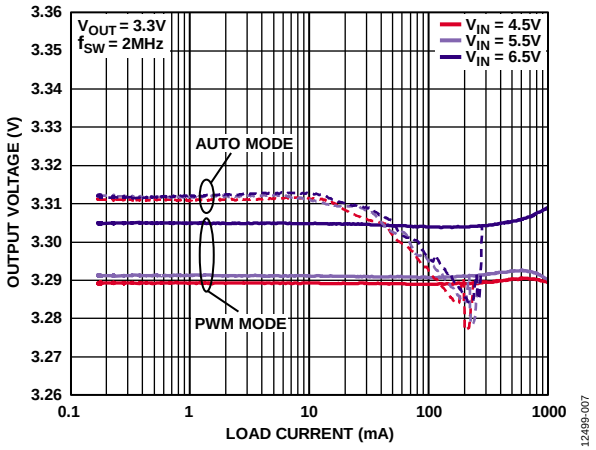

Figure 7. Load Regulation, V_{OUT} = 3.3 V

PCB LAYOUT CONSIDERATIONS

For high efficiency, good regulation, and stability with the ADP2230, a well designed printed circuit board (PCB) is required. Poor layout may affect the ADP2230 buck performance, causing electromagnetic interference (EMI), poor electromagnetic compatibility (EMC), ground bounce, and voltage losses.

To improve heat dissipation from the package, increase the amount of copper attached to the pins of the ADP2230.

Use the following guidelines when designing PCBs:

- Keep the low effective series resistance (ESR) input and output capacitors, C1 to C6, and the inductors, L1 and L2, as close as possible to the ADP2230. Avoid long trace lengths from the device to the capacitors because they add series inductance and may cause instability or increased ripple.
- Route the output voltage path away from the inductor and the SWx node to minimize noise and magnetic interference.
- Keep high current traces as short and as wide as possible.
- To prevent radiated noise injection, avoid routing high impedance traces near any node connected to SWx or near the inductor.
- Use a ground plane with several vias connected to the component side ground to reduce noise interference on sensitive circuit nodes.
- Use 0402 or 0603 capacitors to achieve the smallest possible footprint solution where board area is limited.

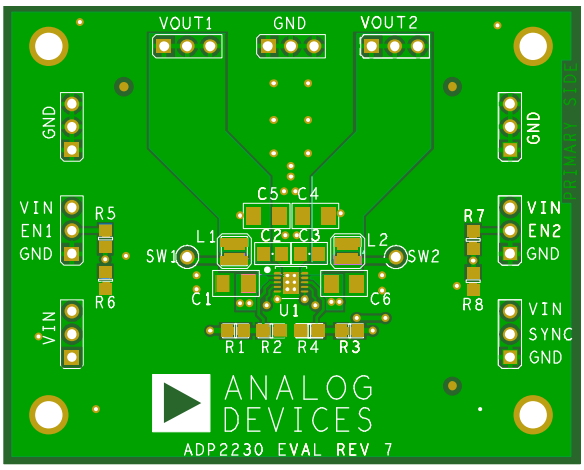

Figure 8. PCB Layout, Top

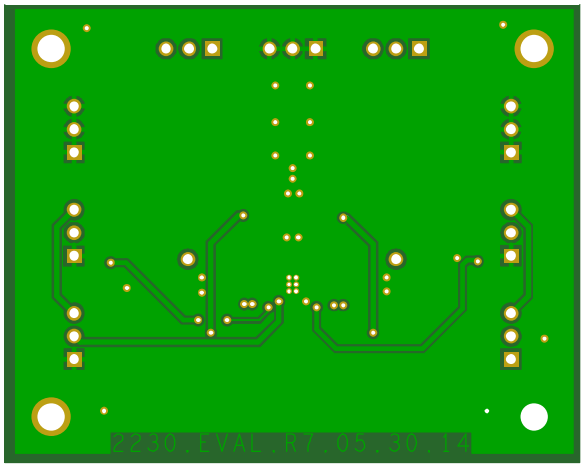

Figure 9. PCB Layout, Bottom

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Qty	Reference Designator	Description	Manufacturer	Part Number
1	U1	ADP2230 dual, synchronous, 2 MHz buck	Analog Devices, Inc.	ADP2230ACPZ-R7
2	C1, C6	Capacitor, 10 µF, 16 V, 1206	Murata	GRM31CR61C106KA88L
2	C2, C3	Capacitor, 10 µF, 16 V, 0805	Murata	GRM21BR61C106KE15
2	C4, C5	Capacitor—do not install	Not applicable	Not applicable
2	L1, L2	Inductor, 2.2 µH, 1.35 A	Coilcraft	XFL3012-222MEB
1	R1	Resistor, 499 kΩ, ±1%, 0603	Vishay Dale	CRCW0603499KFKEA
1	R2	Resistor, 1 MΩ, ±1%, 0603	Vishay Dale	CRCW06031M00FKEA
1	R3	Resistor, 432 kΩ, ±1%, 0603	Vishay Dale	CRCW0603432KFKEA
1	R4	Resistor, 137 kΩ, ±1%, 0603	Vishay Dale	CRCW0603137KFKEA
1	R5	Resistor, 1.82 MΩ, ±1%, 0603	Vishay Dale	CRCW06031M82FKEA
1	R6	Resistor, 10 MΩ, ±1%, 0603	Vishay Dale	CRCW060310M0FKEA
1	R7	Resistor, 0 Ω, ±1%, 0603	Vishay Dale	WSL0603R0100FEA
1	R8	Resistor—do not install	Not applicable	Not applicable

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.

UG12499-0-4/15(0)

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