ANALOG DEVICES

EVAL-ADP1606/EVAL-ADP1607 User Guide

UG-488

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Evaluating the ADP1606/ADP1607 2 MHz, Synchronous Boost, DC-to-DC Converters

FEATURES

- 0.8 V to V_{OUT} input voltage range
- Low 0.9 V input start-up voltage
- Jumper for enable/shutdown control
- ADP1606-1.8-EVALZ
  - Pin selectable auto or fixed pulse-width modulation (PWM) mode
  - Jumper for mode selection
  - 1.8 V fixed output voltage
- ADP1607-EVALZ and ADP1607-001-EVALZ
  - Auto pulse frequency modulation (PFM)/PWM transition mode (ADP1607-EVALZ)
  - Fixed 2 MHz PWM mode only (ADP1607-001-EVALZ)
  - Adjustable output voltage
  - R1 and R2 selected for V_{OUT} = 3.3 V output voltages

TYPICAL APPLICATION CIRCUITS

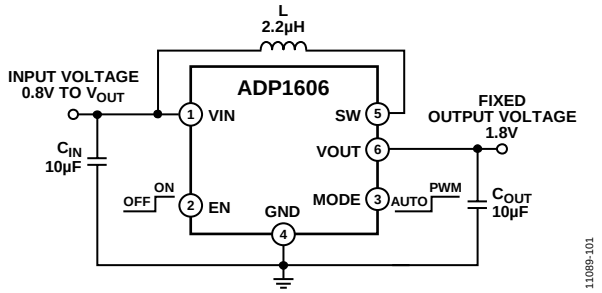

Figure 1. ADP1606 Step-Up Regulator Configuration

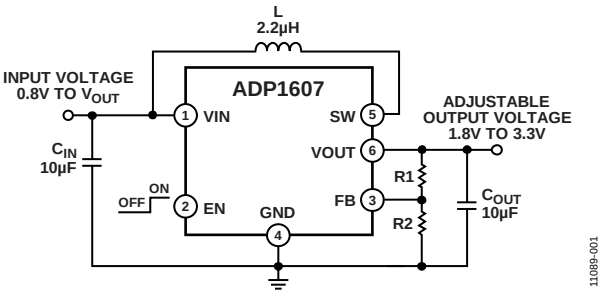

Figure 2. ADP1607 Step-Up Regulator Configuration

GENERAL DESCRIPTION

The ADP1606/ADP1607 are high efficiency, synchronous, fixed frequency, step-up, dc-to-dc switching converters for use in portable applications.

The ADP1606/ADP1607 evaluation boards are complete step-up, dc-to-dc switching converter applications with components selected to allow operation over the full input voltage and load ranges. The ADP1606 evaluation board has a 1.8 V fixed output voltage and requires no external resistors. The ADP1607 evaluation boards are set to transition automatically between PFM and PWM (ADP1607-EVALZ) or fixed to operate in PWM mode only (ADP1607-001-EVALZ). The ADP1607 evaluation boards can be adjusted for different output voltages by changing the feedback resistors, R1 and R2.

The 2 MHz operating frequency enables the use of small footprint, low profile external components. Additionally, the synchronous rectification, internal compensation, internal fixed current limit, and current mode architecture allow excellent transient response and a minimal external part count. Other key features include fixed PWM and light load PFM mode options, true output isolation, thermal shutdown (TSD), and logic controlled enable.

This user guide includes input/output descriptions, setup instructions, and the schematics and printed circuit board (PCB) layout drawings for the ADP1606/ADP1607 step-up converter evaluation boards.

Complete specifications for the ADP1606/ADP1607 are available in the ADP1606/ADP1607 data sheet, which should be consulted in conjunction with this document when using the evaluation boards.

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REVISION HISTORY

8/14—Rev. 0 to Rev. A

Added ADP1606-1.8-EVALZ ..... Universal
Changes to Features Section and General Description Section 1
Added Figure 1; Renumbered Sequentially 1
Added MODE Test Bus (ADP1606-1.8-EVALZ Only) Section and Figure 6 to Figure 8 3
Changes to VOUT Test Bus Section and Evaluation Setup Section 3
Changes to PCB Layout Guidelines Section 5
Added Figure 9 to Figure 11 5
Added Table 1; Renumbered Sequentially 7
Changes to Table 2 and Table 3 7

11/12—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

The ADP1606/ADP1607 evaluation boards are fully assembled and tested. The following sections describe the various connectors on the boards, the proper evaluation setup, and the testing capabilities of the evaluation boards.

INPUT/OUTPUT CONNECTORS

EN Test Bus

The EN connector is used to enable/disable the converter via the EN pin. Use one of the following methods to enable the converter. Do not leave the EN pin floating.

- Use a jumper to connect the top two pins of the EN test bus. This connects EN to VIN and enables the converter (see Figure 3).

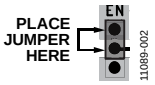

Figure 3. Enabled Jumper Position

- Use a jumper to connect the bottom two pins of the EN test bus. This connects EN to GND and disables the converter (see Figure 4).

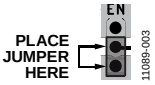

Figure 4. Disabled Jumper Position

- Alternatively, connect a voltage between VIN and GND to the center pin of the EN test bus for independent control of the EN pin voltage (see Figure 5).

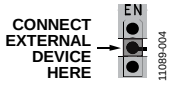

Figure 5. EN Pin Direct Connection

MODE Test Bus (ADP1606-1.8-EVALZ Only)

The MODE connector is used to enable/disable the converter via the MODE pin. Use one of the following methods to enable the converter. Do not leave the MODE pin floating.

- Use a jumper to connect the top two pins of the MODE test bus. This connects MODE to VIN and enables the converter (see Figure 6).

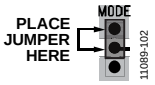

Figure 6. Enabled Jumper Position

- Use a jumper to connect the bottom two pins of the MODE test bus. This connects MODE to GND and disables the converter (see Figure 7).

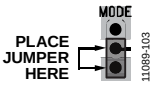

Figure 7. Disabled Jumper Position

- Alternatively, connect a voltage between VIN and GND to the center pin of the MODE test bus for independent control of the MODE pin voltage (see Figure 8).

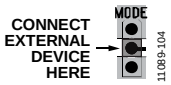

Figure 8. MODE Pin Direct Connection

VIN Test Bus

The VIN test bus connects the positive input supply voltage to the VIN pin. Connect the power supply to this bus and keep the wires as short as possible to minimize electromagnetic interference (EMI) transmissions.

SW Test Point

The SW test point is for monitoring the switch node (SW pin) behavior and switching frequency. Connect a BNC cable to this test point to measure the ADP1606/ADP1607 switching frequency.

VOUT Test Bus

For the ADP1606, the output voltage at the VOUT test bus is fixed to 1.8 V. For the ADP1607, the resistive voltage divider network, R1 and R2, sets the output voltage at the VOUT test bus. A load can be attached from the VOUT test bus to the GND test bus.

GND Test Bus

The GND test bus is the power ground connection for the device via the GND pin as well as the bypass capacitors. Connect ground connections from external equipment to this bus.

EVALUATION SETUP

To ensure proper operation of the ADP1606/ADP1607 evaluation boards:

1. Connect the input supply ground to GND.
2. Connect the positive input supply to VIN.
3. Connect the desired load between VOUT and GND. The maximum continuous output current of the ADP1606/ADP1607 is dependent upon the input and output voltage conditions.
4. Apply a voltage between 0.9 V and V_{OUT} to the VIN test bus.
5. If working with the ADP1606-1.8-EVALZ, affix the jumper on the MODE test bus for the desired mode. Alternatively, attach a power supply to the center pin on the MODE test bus and adjust between 0 V and V_{OUT} for the desired mode. If working with the ADP1607-EVALZ or the ADP1607-001-EVALZ, this step can be ignored.
6. Move the jumper on the EN test bus to the enabled position.

PERFORMANCE EVALUATION

The following sections discuss tests and the resulting oscilloscope waveforms. Oscilloscope waveforms and typical performance characteristics are provided in the ADP1606/ADP1607 data sheet.

Line Regulation

The line regulation is observed and measured by monitoring the output voltage (V_{OUT}) while varying the input voltage (V_{IN}).

Load Regulation

The load regulation is observed and measured by monitoring the output voltage (V_{OUT}) while sweeping the applied load between VOUT and GND. To minimize voltage drop, use short low resistance wires, especially for heavy loads.

Efficiency

The efficiency, η, is measured by comparing the input power to the output power.

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

Line Transient

The line transient performance is evaluated by generating a high speed voltage transient on the input (V_{IN}) and observing the behavior of the evaluation board at the output (V_{OUT}).

Load Transient

The load transient performance is evaluated by generating a fast current transient on the output (V_{OUT}) and observing the behavior of the evaluation board at the output (V_{OUT}.)

Oscillator Frequency

The oscillator frequency can be measured by connecting an oscilloscope to the SW pin.

Inductor Current

The inductor current is made accessible by removing one side of the inductor from its pad and connecting a current loop in series. Place an oscilloscope current probe on the loop to view the current waveform.

EVALUATION BOARD SCHEMATICS AND LAYOUTS

PCB LAYOUT GUIDELINES

For high efficiency, good regulation, and stability, a well-designed PCB layout is required.

Use the following guidelines when designing PCBs.

- Keep the low equivalent series resistance (ESR) input capacitor, C1, close to VIN and GND. This minimizes noise injected into the device from board parasitic inductance.
- Keep the high current path from C1 through the L1 inductor to SW as short as possible.
- If working with the ADP1607-EVALZ or the ADP1607-001-EVALZ, place the feedback resistors, R1 and R2, as close to FB as possible to prevent noise pickup, as shown in Figure 13. Connect the ground of the feedback network directly to an AGND plane that makes a Kelvin connection to the GND pin. If working with the ADP1606-1.8-EVALZ, this step can be ignored.
- Avoid routing high impedance traces from feedback resistors near any node connected to SW or near the inductor to prevent radiated noise injection.
- Keep the low ESR output capacitor, C3, close to VOUT and GND. This minimizes noise injected into the device from board parasitic inductance.
- Connect Pin 7 (EPAD) and GND to a large copper plane for proper heat dissipation.

ADP1606 SCHEMATICS AND PCB LAYERS

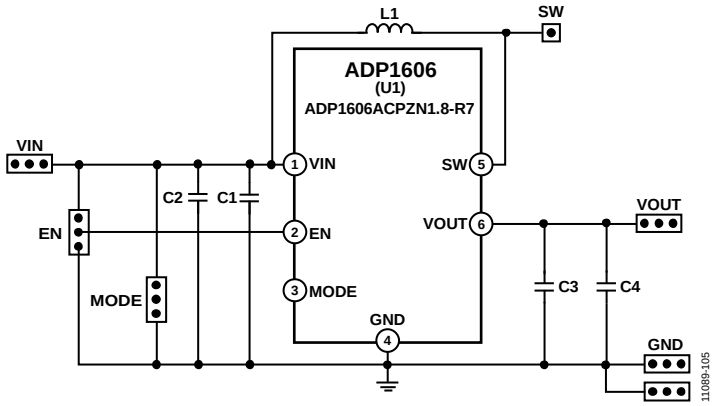

Figure 9. ADP1606 Boost Application Evaluation Board Schematic

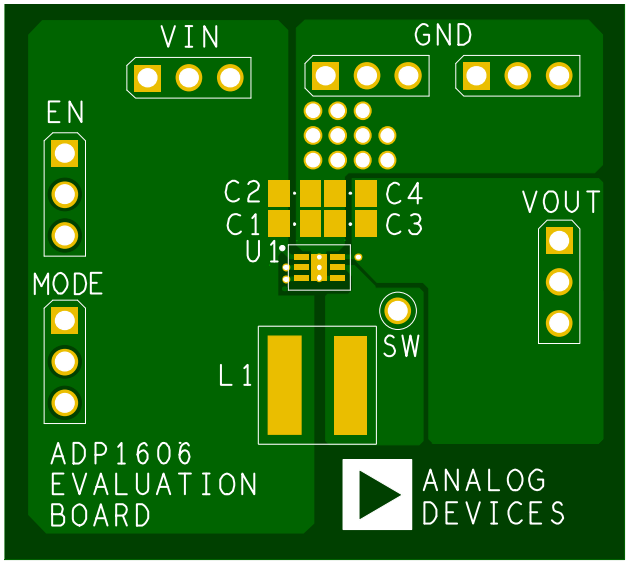

Figure 10. ADP1606 Boost Application PCB Top Layer

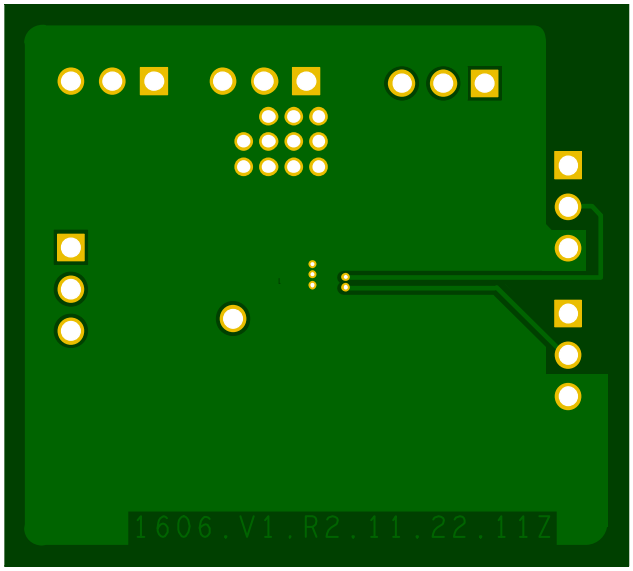

Figure 11. ADP1606 Boost Application PCB Bottom Layer

ADP1607 SCHEMATICS AND PCB LAYERS

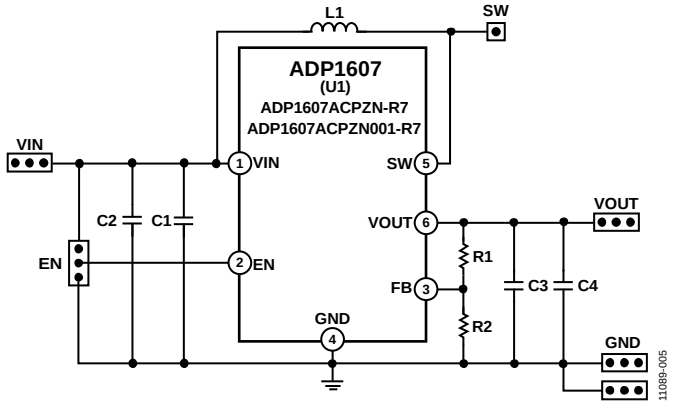

Figure 12. ADP1607 Boost Application Evaluation Board Schematic

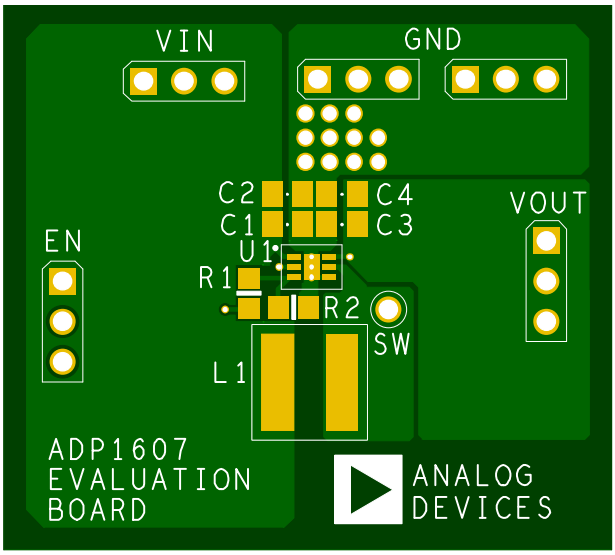

Figure 13. ADP1607 Boost Application PCB Top Layer

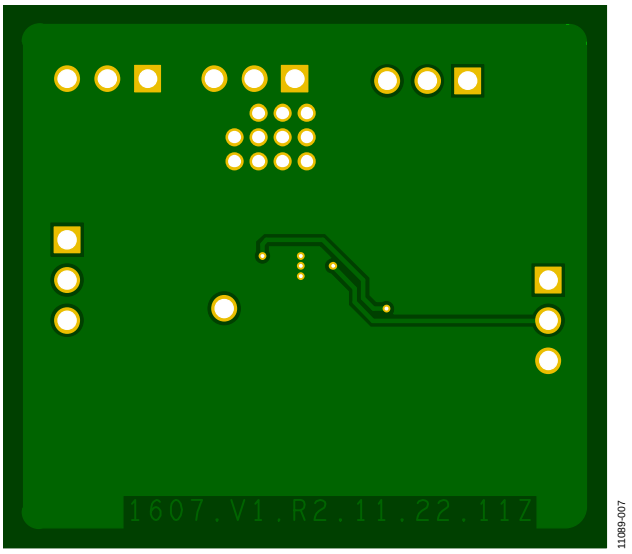

Figure 14. ADP1607 Boost Application PCB Bottom Layer

ORDERING INFORMATION

BILL OF MATERIALS

Table 1. ADP1606-1.8-EVALZ

Qty	Reference Designator	Description	Manufacturer[1]	Part Number
1	U1	ADP1606 V_{OUT} = 1.8 V	Analog Devices, Inc.	ADP1606ACPZN1.8-R7
1	L1	Inductor, 2.2 µH, 1.26 A	TDK	VLF302512MT-2R2M
1	C1	Input capacitor, 10 µF, 10 V, 0603, ±20%	Taiyo Yuden	LMK107BJ106MALTD
1	C2	Input capacitor	Open	
1	C3	Output capacitor, 10 µF, 10 V, 0603, ±20%	Taiyo Yuden	LMK107BJ106MALTD
1	C4	Output capacitor	Open	
2	EN, MODE	Headers, 0.100 inches, single, straight, 3-pin	Sullins Connector Solutions	PBC03SAAN[2]
1	SW	Headers, 0.100 inches, single, straight, 1-pin	Sullins Connector Solutions	PBC01SAAN[2]
4	VIN, VOUT, GND (2)	Test point loop connectors	Aavid Thermalloy	125800D00000G
2	EN, MODE	Conn jumper shorting gold	Sullins Connector Solutions	SSC02SYAN

[1] Equivalent substitutions may be made for all resistors and capacitors.
[2] Alternatively, PBC36SAAN can be purchased and cut as necessary.

Table 2. ADP1607-EVALZ (Automatic PFM/PWM Switching Modes, V_{OUT} = 3.3 V)

Qty	Reference Designator	Description	Manufacturer[1]	Part Number
1	U1	ADP1607 automatic PFM/PWM switching modes	Analog Devices, Inc.	ADP1607ACPZN-R7
1	L1	Inductor, 2.2 µH, 1.26 A	TDK	VLF302512MT-2R2M
1	C1	Input capacitor, 10 µF, 10 V, 0603, ±20%	Taiyo Yuden	LMK107BJ106MALTD
1	C2	Input capacitor	Open	
1	C3	Output capacitor, 10 µF, 10 V, 0603, ±20%	Taiyo Yuden	LMK107BJ106MALTD
1	C4	Output capacitor	Open	
1	R1	Output voltage divider top resistor, 392 kΩ, ±1%	Vishay Dale	CRCW0805392KFKEA
1	R2	Output voltage divider bottom resistor, 243 kΩ, ±1%	Vishay Dale	CRCW0805243KFKEA
1	EN	Headers, 0.100 inches, single, straight, 3-pin	Sullins Connector Solutions	PBC03SAAN[2]
1	SW	Headers, 0.100 inches, single, straight, 1-pin	Sullins Connector Solutions	PBC01SAAN[2]
4	VIN, VOUT, GND (2)	Test point loop connectors	Aavid Thermalloy	125800D00000G
1	EN	Conn jumper shorting gold	Sullins Connector Solutions	SSC02SYAN

[1] Equivalent substitutions may be made for all resistors and capacitors.
[2] Alternatively, PBC36SAAN can be purchased and cut as necessary.

Table 3. ADP1607-001-EVALZ (PWM Mode Only, V_{OUT} = 3.3 V)

Qty	Reference Designator	Description	Manufacturer[1]	Part Number
1	U1	ADP1607 PWM mode only	Analog Devices, Inc.	ADP1607ACPZN001-R7
1	L1	Inductor, 2.2 µH, 1.26 A	TDK	VLF302512MT-2R2M
1	C1	Input capacitor, 10 µF, 10 V, 0603, ±20%	Taiyo Yuden	LMK107BJ106MALTD
1	C2	Input capacitor	Open	
1	C3	Output capacitor, 10 µF, 10 V, 0603, ±20%	Taiyo Yuden	LMK107BJ106MALTD
1	C4	Output capacitor	Open	
1	R1	Output voltage divider top resistor, 392 kΩ, ±1%	Vishay Dale	CRCW0805392KFKEA
1	R2	Output voltage divider bottom resistor, 243 kΩ, ±1%	Vishay Dale	CRCW0805243KFKEA
1	EN	Headers, 0.100 inches, single, straight, 3-pin	Sullins Connector Solutions	PBC03SAAN[2]
1	SW	Headers, 0.100 inches, single, straight, 1-pin	Sullins Connector Solutions	PBC01SAAN[2]
4	VIN, VOUT, GND (2)	Test point loop connectors	Aavid Thermalloy	125800D00000G
1	EN	Conn jumper shorting gold	Sullins Connector Solutions	SSC02SYAN

[1] Equivalent substitutions may be made for all resistors and capacitors.
[2] Alternatively, PBC36SAAN can be purchased and cut as necessary.

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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