# Evaluation Board User Guide
## UG-488

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# Evaluating the ADP1607 2 MHz, Synchronous Boost, DC-to-DC Converter

## FEATURES

**0.8 V to $V_{OUT}$ input voltage range**
**Low 0.9 V input start-up voltage**
**Fixed 2 MHz PWM and light load PFM mode options**
- **Auto PFM/PWM transition modes (ADP1607-EVALZ)**
- **PWM mode only (ADP1607-001-EVALZ)**

**3.3 V output voltage**
**Jumper for enable/shutdown control**
**R1 and R2 selected for VOUT = 3.3 V output voltages**

## GENERAL DESCRIPTION

The ADP1607 evaluation board is a complete step-up, dc-to-dc switching converter application with components selected to allow operation over the full input voltage and load ranges for VOUT = 3.3 V. The boost converter is set to transition automatically between PFM and PFM (ADP1607-EVALZ) or fixed to operate in PWM mode only (ADP1607-001-EVALZ). The evaluation boards can be adjusted for different output voltages by changing the feedback resistors, R1 and R2.

The ADP1607 is a high efficiency, synchronous, fixed frequency, step-up dc-to-dc switching converter with an adjustable output voltage between 1.8 V and 3.3 V for use in portable applications.

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 for 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 I/O descriptions, setup instructions, and the schematic and PCB layout drawings for the ADP1607 step-up converter evaluation board.

Complete specifications for the ADP1607 are available in the ADP1607 data sheet and should be consulted in conjunction with this document when using the evaluation board.

## TYPICAL APPLICATION CIRCUIT

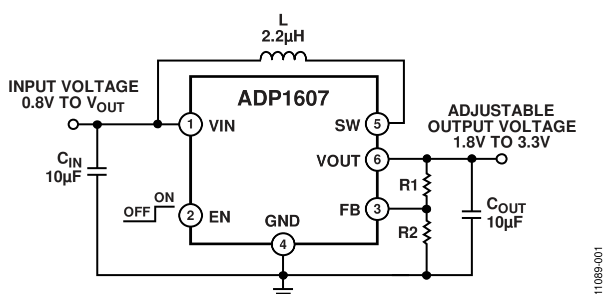


*Figure 1. Step-Up Regulator Configuration*

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## REVISION HISTORY

**11/12—Revision 0: Initial Version**

# EVALUATION BOARD HARDWARE

The ADP1607 evaluation board is fully assembled and tested. The following sections describe the various connectors on the board, the proper evaluation setup, and the testing capabilities of the evaluation board.

## 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 2).

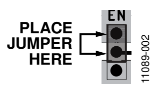


Figure 2. Enabled Jumper Position

- 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 3).

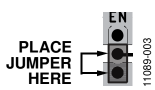


Figure 3. Disabled Jumper Position

- 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 4).

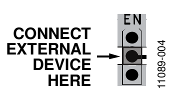


Figure 4. EN Pin Direct Connection

### 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 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 ADP1607 switching frequency.

### VOUT Test Bus

The output voltage at the VOUT test bus is set by the resistive voltage divider network, R1 and R2. 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 part 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 ADP1607 evaluation board:

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 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. 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 ADP1607 data sheet.

### Line Regulation

The line regulation is observed and measured by monitoring the output voltage (VOUT) while varying the input voltage (VIN).

### Load Regulation

The load regulation is observed and measured by monitoring the output voltage (VOUT) 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 (VIN) and observing the behavior of the evaluation board at the output (VOUT).

### Load Transient

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

### 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 SCHEMATIC AND LAYOUT

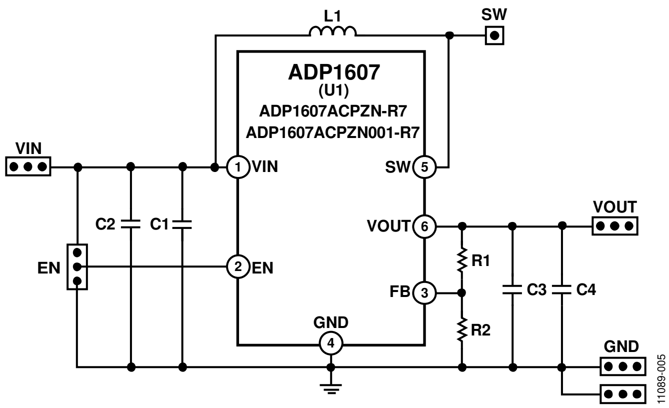


*Figure 5. ADP1607 Boost Application Evaluation Board Schematic*

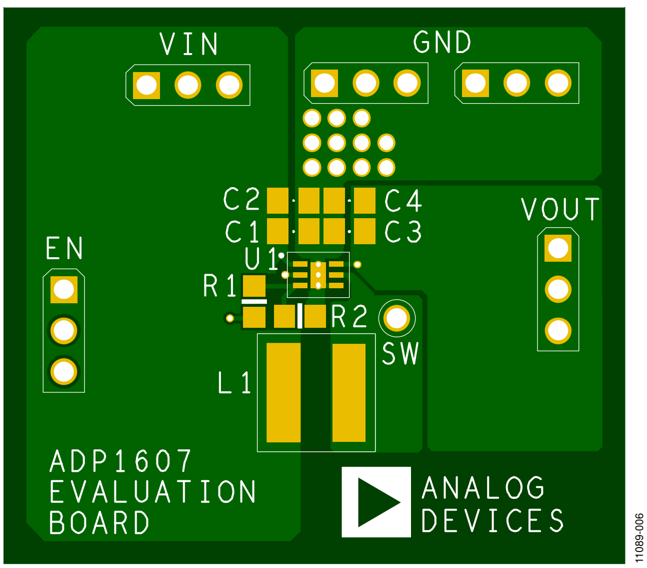


*Figure 6. ADP1607 Boost Application Printed Circuit Board (PCB) Top Layer*

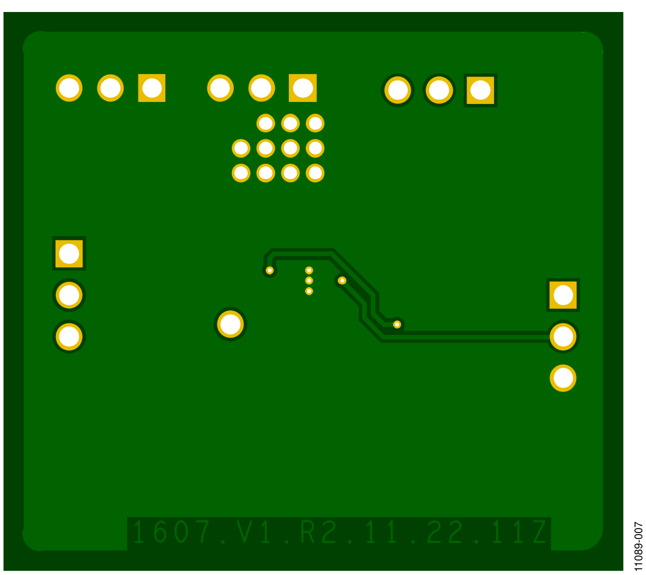


*Figure 7. ADP1607 Boost Application PCB Bottom Layer*

## LAYOUT GUIDELINES

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

Use the following guidelines when designing printed circuit boards.

- Keep the low ESR input capacitor, C1, close to VIN and GND. This minimizes noise injected into the part from board parasitic inductance.
- Keep the high current path from C1 through the L1 inductor to SW as short as possible.
- Place the feedback resistors, R1 and R2, as close to FB as possible to prevent noise pickup. Connect the ground of the feedback network directly to an AGND plane that makes a Kelvin connection to the GND pin.
- 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 part from board parasitic inductance.
- Connect Pin 7 (EPAD) and GND to a large copper plane for proper heat dissipation.

# ORDERING INFORMATION

## BILL OF MATERIALS

Table 1. 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 in, single, straight, 3-pin | Sullins Connector Solutions | PBC03SAAN[2] |
| 1 | SW | Headers, 0.100 in, single, straight, 1-pin | Sullins Connector Solutions | PBC01SAAN[2] |
| 4 | VIN, VOUT, GND (2) | Test point loop connectors | Aavid Thermalloy | 125800D00000G |

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

Table 2. 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 in, single, straight, 3-pin | Sullins Connector Solutions | PBC03SAAN[2] |
| 1 | SW | Headers, 0.100 in, single, straight, 1-pin | Sullins Connector Solutions | PBC01SAAN[2] |
| 4 | VIN, VOUT, GND (2) | Test point loop connectors | Aavid Thermalloy | 125800D00000G |

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

## NOTES

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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.





**UG11089-0-11/12(0)**

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