

Evaluating the **ADP2126** Ultralow Profile, 6 MHz, Step-Down Converter

FEATURES

500 mA, 6 MHz, synchronous, step-down dc-to-dc converter

Low profile, tiny footprint ceramic inductor and capacitors

0.33 mm (maximum) height solution

Input voltage range: 2.1 V to 5.5 V

1.20 V fixed output voltage

EXTCLK pin compatible with clock and logic enable control

GENERAL DESCRIPTION

The **ADP2126** evaluation board is a complete 6 MHz, low quiescent current, synchronous buck dc-to-dc converter solution that is capable of producing up to 500 mA of output current at a fixed 1.20 V output voltage. The converter operates with an input voltage in the 2.1 V to 5.5 V range. At high load currents, the device uses a voltage regulating pulse-width modulation (PWM) mode that maintains a constant frequency with excellent stability and transient response. For light load currents, the state of the **MODE** pin determines the operating mode of the converter. In

forced PWM mode, the converter continues operating in PWM for light loads. In auto mode, the **ADP2126** can automatically enter a power saving mode that utilizes pulse-frequency modulation (PFM) to reduce the effective switching frequency and ensure the longest battery life in portable applications.

The evaluation board demonstrates the operation and performance of the **ADP2126**, as well as its compatibility with tiny ceramic components for a small area solution.

This user guide includes I/O descriptions, setup instructions, the evaluation board schematic, and printed circuit board (PCB) layout drawings for the **ADP2126** low profile step-down switching converter evaluation board.

Complete specifications for the **ADP2126** can be found in the **ADP2126** data sheet available from Analog Devices, Inc., and should be consulted in conjunction with this user guide when using the evaluation board.

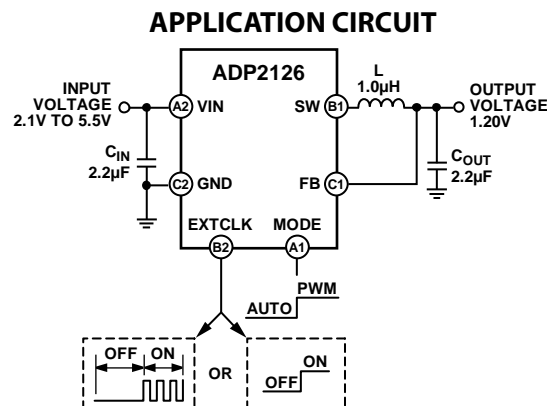


Figure 1. **ADP2126** 0.33 mm Maximum Height Solution

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REVISION HISTORY

12/11—Rev. 0 to Rev. A

Deleted ADP2127	Universal
Changes to Features Section and General Description Section and Deleted Figure 2	1
Changes to EXTCLK Test Point Section	3
Deleted Figure 5 and Figure 6.....	5
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8/11—Revision 0: Initial Version

EVALUATION BOARD OVERVIEW

The [ADP2126](#) 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

MODE Jumper

The MODE connector controls the operating mode of the [ADP2126](#). Use a jumper to connect the center pin to GND or VIN. Alternatively, connect to the center pin and control the MODE pin directly with an external device. See the specifications section in the [ADP2126](#) data sheet for the high and low threshold voltage levels. Do not leave the MODE pin floating.

EXTCLK Test Point

This test point is used to enable or disable the converter. Connect the EXTCLK pin to GND to disable the converter. Apply a 6 MHz to 27 MHz clock signal or a logic high signal to the EXTCLK pin to enable the converter. See the specifications section in the [ADP2126](#) data sheet for the high and low threshold voltage levels. Do not leave the EXTCLK pin floating.

VOOUT Test Bus

The VOOUT test bus provides access to the regulated output voltage and the FB (feedback) pin of the part. A load of up to 500 mA can be applied to this bus.

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 the EMI transmission.

GND Test Bus

The GND test bus is the ground connection for the part and the external components via the GND pin. Attach ground connections from external equipment to this bus.

SW Test Point

The SW test point allows access to the switch node (SW pin) of the [ADP2126](#) to monitor the switching behavior. An LC filter is connected to this pin on the board. Connect a BNC cable to measure the switching frequency to this test point.

The [ADP2126](#) incorporates spread spectrum via a controlled variance of the switching frequency over a wider band of frequencies. This distribution of the frequency content spreads the spectral density over a wider bandwidth, resulting in lower peak emission levels.

EVALUATION SETUP

Follow these setup instructions to ensure proper operation of the [ADP2126](#) evaluation board:

1. Connect the input supply ground to GND.
2. Connect the positive input supply to VIN.
3. Connect the desired load between VOOUT and PGND. The [ADP2126](#) can supply up to 500 mA.
4. Connect the EXTCLK pin to GND to disable the converter, or apply a 6 MHz to 27 MHz clock signal or a logic high signal to the EXTCLK pin to enable the converter.
5. Apply an input voltage between 2.1 V and 5.5 V (6.0 V absolute maximum.)

PERFORMANCE EVALUATION

Typical performance characteristic graphs and oscilloscope waveforms are provided in the [ADP2126](#) data sheet.

Output Accuracy

The output accuracy is verified by monitoring the output voltage at VOOUT while testing both the line and load regulation.

Line Regulation

The line regulation is observed and measured by monitoring the output voltage at VOOUT while varying the input voltage applied to the VIN test bus.

Load Regulation

The load regulation is observed and measured by monitoring the output voltage at VOOUT while sweeping the applied load between VOOUT and GND. To minimize voltage drop, use short low resistance wires, especially for heavy loads.

Efficiency

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

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

Output Voltage Ripple

The output voltage ripple is visible by placing an oscilloscope across the output capacitor (COOUT). Set the oscilloscope to ac coupling or apply a dc offset for proper resolution.

Line Transient

Generate a high speed transient in the voltage applied to VIN and observe the behavior of the evaluation board at the SW test point and the VOOUT test bus. To see the most accurate line transient waveform, place a probe directly on the output capacitor terminal with a short path to ground to limit noise and stray inductance.

Load Transient

Generate a fast transient in the current applied to VOUT and observe the behavior of the evaluation board at the SW test point and the VOUT test bus. To see the most accurate load transient waveform, place a probe directly on the output capacitor terminal with a short path to ground to limit noise and stray inductance.

Oscillator Frequency

The oscillator frequency is measured by connecting an oscilloscope to the SW test point. To see the spread spectrum behavior, measure the oscillator frequency over time.

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

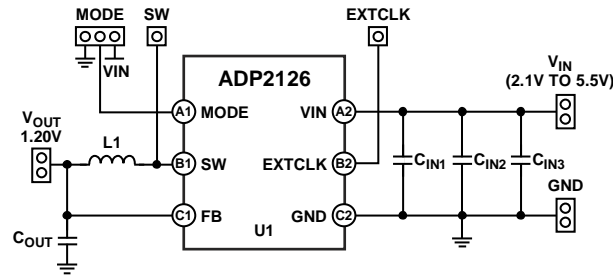


Figure 2. ADP2126 Evaluation Board Schematic

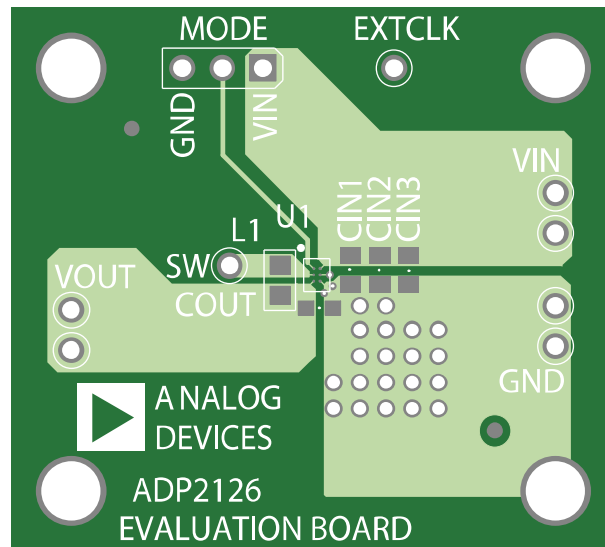


Figure 3. ADP2126

LAYOUT GUIDELINES

For high efficiency, good regulation, and stability with the [ADP2126](#), a well-designed and manufactured PCB is essential. Use the following guidelines when designing PCBs:

- Keep the low ESR input capacitor, CIN, close to VIN and GND.
- Keep high current traces as short and as wide as possible.
- Avoid routing high impedance traces near any node connected to SW or near the inductor to prevent radiated noise injection.
- Keep the low ESR output capacitor, COUT, close to the FB and GND pins of the [ADP2126](#). Long trace lengths from the part to the output capacitor add series inductance and may cause instability or increased ripple.

ORDERING INFORMATION**BILL OF MATERIALS**Table 1. [ADP2126](#)—0.33 mm Height Solution

Quantity	Reference Designator	Description	Manufacturer	Part Number
1	U1	ADP2126 low profile, 500 mA, 6 MHz, synchronous, step-down, dc-to-dc converter	Analog Devices	ADP2126ACDZ-1.20R7
1	CIN1	Input capacitor, MLCC, 2.2 μ F, 6.3 V, 0402, X5R	Murata Manufacturing Co., Ltd.	GRM153R60J225ME95
Open	CIN2, CIN3	Extra input capacitor	Open	
1	COU1	Output capacitor, MLCC, 2.2 μ F, 4 V, 0402, X5R	Murata Manufacturing Co., Ltd.	GRM153R60G225M
1	L1	Inductor, 1.0 μ H, 0603	Taiyo Yuden	CKP1608S1R0M
2	SW, EXTCLK	Headers, 0.100 in, single, straight, 1-pin	Sullins Connector Solutions	PBC01SAAN ¹
3	VOU1, VIN, GND	Headers, 0.100 in, single, straight, 2-pin	Sullins Connector Solutions	PBC02SAAN ¹
1	MODE	Headers, 0.100 in, single, straight, 3-pin	Sullins Connector Solutions	PBC03SAAN ¹

¹ 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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.