

## Evaluation Board for the **AD5116** Digital Potentiometer

### FEATURES

- Full-featured evaluation board for the **AD5116**
- Several test circuits
- Various ac/dc input signals

### PACKAGE CONTENTS

- EVAL-AD511xSDZ evaluation board
- CD that includes
  - Electronic version of the **AD5116** data sheet
  - Electronic version of the UG-324 user guide

### GENERAL DESCRIPTION

This user guide describes the evaluation board for evaluating the **AD5116**—a single-channel, 64-position, nonvolatile memory digital potentiometer.

The **AD5116** supports single-supply 2.3 V to 5.5 V operation, making the device suited for battery-powered applications and many other applications, offering guaranteed low resistor tolerance errors of  $\pm 8\%$  and high bandwidth while allowing up to  $\pm 6$  mA current density in the A, B, and W pins.

A simple push-button interface allows manual switching and can save the last wiper position automatically into the EEPROM, making it suits to applications that require a power-up in the last wiper position.

Complete specifications for the **AD5116** part can be found in the **AD5116** data sheet, which is available from Analog Devices, Inc., and should be consulted in conjunction with this user guide when using the evaluation board.

### DIGITAL PICTURE OF EVALUATION BOARD



Figure 1.

**TABLE OF CONTENTS**

Features .....	1	ASE Configuration .....	3
Package Contents .....	1	Push Buttons .....	3
General Description .....	1	Test Circuits .....	4
Digital Picture of Evaluation Board .....	1	Evaluation Board Schematics and Artwork .....	5
Revision History .....	2	Ordering Information .....	8
Evaluation Board Hardware .....	3	Bill of Materials .....	8
Power Supplies .....	3		

**REVISION HISTORY**

11/11—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

The EVAL-AD5116SBZ supports using single power supplies.

The evaluation board should be powered externally by the EXTERNAL-1 and EXTERNAL-2 connectors, as described in Table 2. The link LK8 should be connected as shown in Table 1.

All supplies are decoupled to ground using 10  $\mu$ F tantalum and 0.1  $\mu$ F ceramic capacitors.

**Table 1. Link Connections**

Link No.	Option
LK8	+5V and EXT

**Table 2. Maximum and Minimum Voltages of the Connectors**

Connector No.	Label	Voltage
EXTERNAL-1	VDD	Analog positive power supply, $V_{DD}$ . It is 2.3 V to 5.5 V.
EXTERNAL-2	AGND	Analog ground, AGND.

### ASE CONFIGURATION

The part allows the user to configure the automatic store enable before powering up the board. If the ASE function is enabled, the led, D2, indicates when minimum/maximum resistance has been reached. The [AD5116](#) data sheet provides a detailed description of this pin.

### PUSH BUTTONS

The EVAL-AD5116EBZ provides three switches to operate the part:

- PU. This switch increases the resistance between  $R_{WB}$ .
- PD. This switch decreases the resistance between  $R_{WB}$ .
- NVM. This push button is enabled when the ASE function is disabled and allows manually storage of the RDAC register into the NVM.

**TEST CIRCUITS**

The EVAL-AD5116EBZ incorporates several test circuits to evaluate the AD5116 performance.

**DAC**

The AD5116 can be operated as a digital-to-analog converter (DAC), as shown in Figure 2.

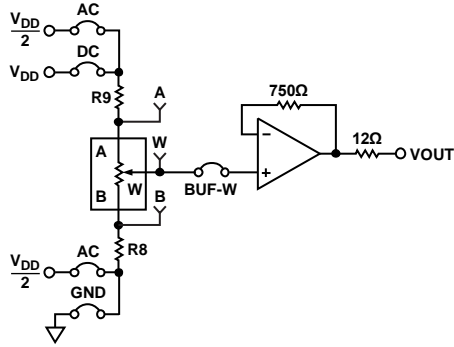


Figure 2. DAC

Table 3 shows the options available for the voltage references.

**Table 3. DAC Voltage References**

Terminal	Link	Options	Description
A	LK1	AC DC	Connects Terminal A to V <sub>DD</sub> /2 Connects Terminal A to V <sub>DD</sub>
W	BUF-W		Connects Terminal W to an output buffer
B	LK6	AC GND	Connects Terminal B to V <sub>DD</sub> /2 Connects Terminal B to analog ground

The output voltage is defined in Equation 1.

$$V_{OUT} = (V_A - V_B) \times \frac{RDAC}{256} \tag{1}$$

where:

- RDAC is the code loaded in the RDAC register.
- V<sub>A</sub> is the voltage applied to Terminal A (LK1 link).
- V<sub>B</sub> is the voltage applied to Terminal B (LK6 link).

However, by using the R8 and R9 external resistors, the user can reduce the voltage of the voltage references. In this case, use the A and B test points to measure the voltage applied to the A and B terminals and recalculate V<sub>A</sub> and V<sub>B</sub> in Equation 1.

**AC Signal Attenuation**

The AD5116 can be used to attenuate an ac signal, which must be provided externally using the AC\_INPUT connector, as shown in Figure 3.

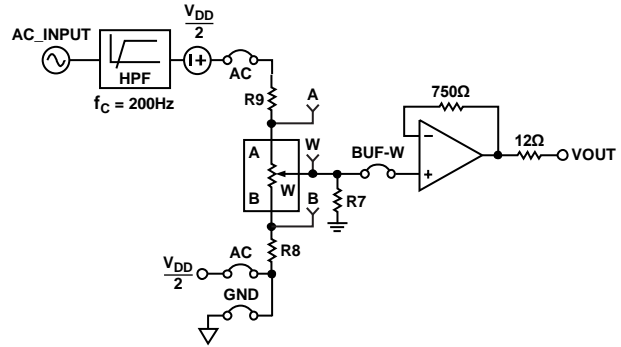


Figure 3. AC Signal Attenuator

Depending on the voltage supply rails and the dc offset voltage of the ac signal, various configurations can be used as described in Table 4.

**Table 4. AC Signal Attenuation Link Options**

Terminal	Link	Options	Description
A	LK1	AC	Remove dc voltage and biased the signal to V <sub>DD</sub> /2
W	BUF-W		Connects Terminal W to an output buffer
B	LK6	AC1 GND	Connects Terminal B to V <sub>DD</sub> /2 Connects Terminal B to analog ground

<sup>1</sup> Recommended to ensure optimal total harmonic distortion (THD) performance.

The signal attenuation is defined in Equation 2.

$$Attenuation \text{ (dB)} \approx 20 \times \log\left(\frac{RDAC}{128}\right) \tag{2}$$

where:

RDAC is the code loaded in the RDAC register.

In addition, R7 can be used to achieve an exponential attenuation. To do so, adjust the R7 resistor until a desirable transfer function is found, typically value is around 1.6 kΩ for a 10 kΩ potentiometer.

# EVALUATION BOARD SCHEMATICS AND ARTWORK

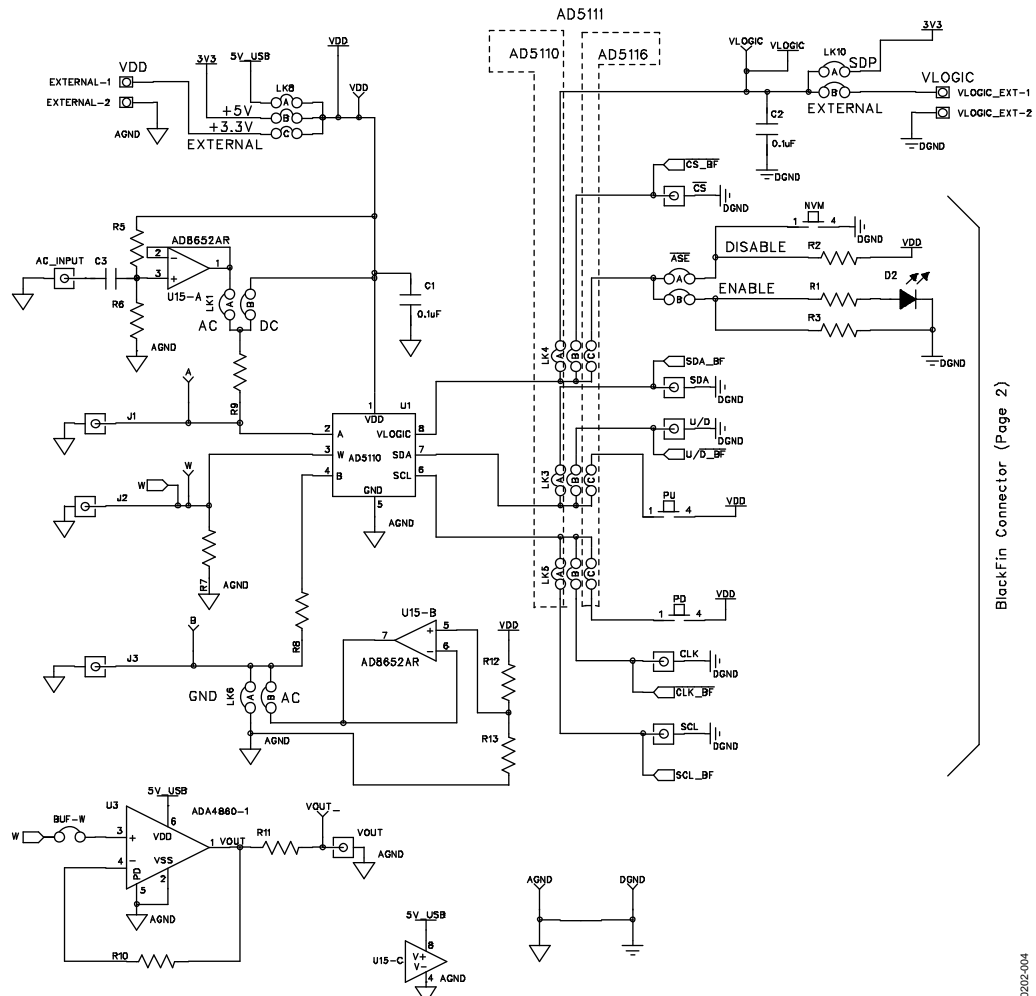


Figure 4. Schematic of the AD5116 Circuitry

10202-904

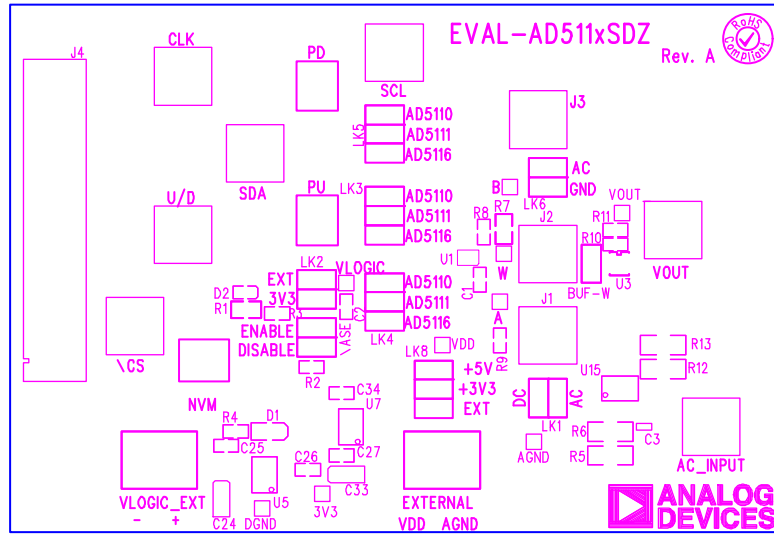


Figure 5. Component Placement Drawing

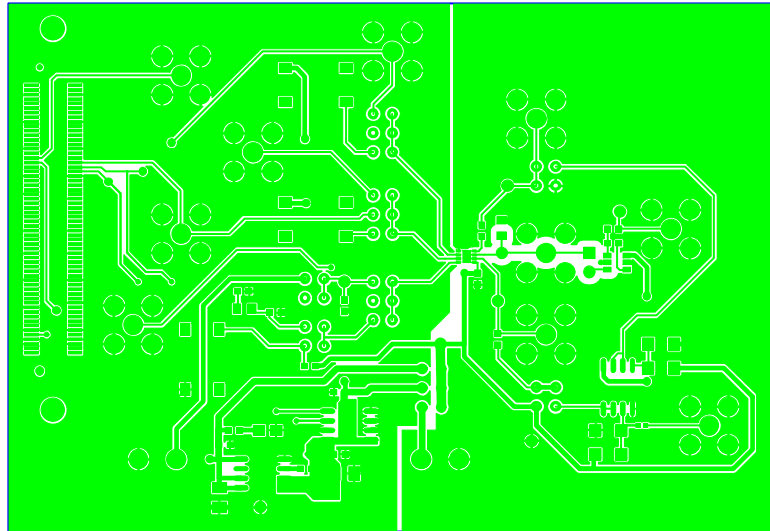


Figure 6. Component Side PCB Drawing

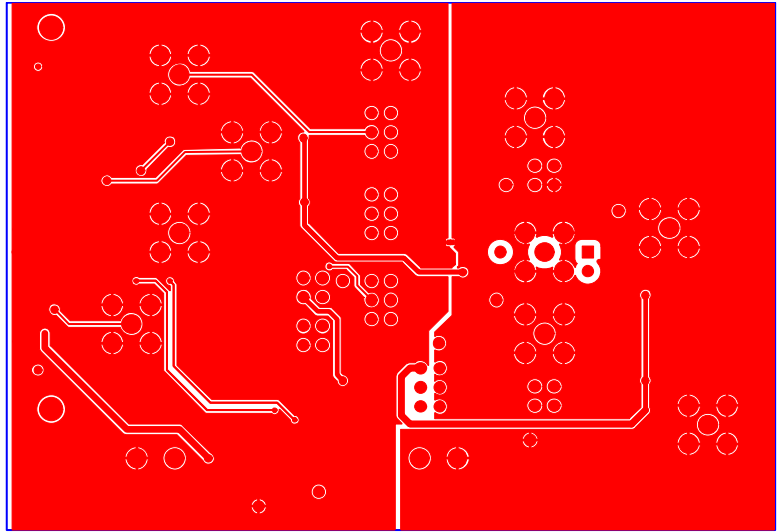


Figure 7. Solder Side PCB Drawing

110202-008

## ORDERING INFORMATION

## BILL OF MATERIALS

Table 5.

Qty	Reference Designator	Description	Supplier <sup>1</sup> /Part Number
1	C3	100 nF capacitor, 0402	FEC 1414580
1	C1	0.1 $\mu$ F capacitor, 0603	FEC 138-2224
1	C25	0.1 $\mu$ F capacitor, 0603	FEC 301-9482
1	C24	10 $\mu$ F capacitor, 1206	FEC 197-130
1	D1	LED, green	FEC 579-0852
1	D2	LED, red	FEC 1685068
1	EXTERNAL	2-pin connector	FEC 151789
3	PD, PU, NVM	Push-button	FEC 177-807
7	LK1, LK3, LK4, LK5, LK6, LK8, ASE	Header, 2-row, 36 + 36 way, and jumper socket, black	FEC 148-535 and FEC 150-411
1	BUF-W	Header, 1-row, 2-way, and jumper socket, black	FEC 102-2247 and FEC 150-411
1	R11	12 $\Omega$ resistor, 0603, 1%	FEC 9330534
1	R10	750 $\Omega$ resistor, 0603, 1%	FEC 9331506
1	R4	1 k $\Omega$ resistor, 0603, 0.01%	FEC 9330380
1	R1	1.8 k $\Omega$ resistor, 0805, 1%	FEC 1400055
4	R5, R6, R12, R13	2.7 k $\Omega$ resistor, 1206, 1%	FEC 9337288
2	R2, R3	110 k $\Omega$ resistor, 0603, 1%	FEC 9331247
2	R8, R9	0 $\Omega$ resistor, 0603	FEC 9331662
2	DGND, AGND	Test point, PCB, black, PK100	FEC 873-1128
6	3V3, A, B, VDD, VOUT, W	Test point, PCB, red, PK100	FEC 873-1144
1	U1	<a href="#">AD5116</a>	Analog Devices <a href="#">AD5116</a>
1	U3	<a href="#">ADA4860</a>	Analog Devices <a href="#">ADA4860</a>
1	U15	<a href="#">AD8652</a>	Analog Devices <a href="#">AD8652</a>

<sup>1</sup> FEC refers to Farnell Electronic Component Distributors.

<sup>12</sup>C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

**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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