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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 ±8% and high bandwidth while allowing up to ±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.

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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 µF tantalum and 0.1 µF ceramic capacitors.

Table 1. Link Connections

Link No.	Option
LK8	+5V and EXT

$\overline{\text{ASE}}$ CONFIGURATION

The part allows the user to configure the automatic store enable before powering up the board. If the $\overline{\text{ASE}}$ 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 $\overline{\text{ASE}}$ function is disabled and allows manually storage of the RDAC register into the NVM.

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.

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.

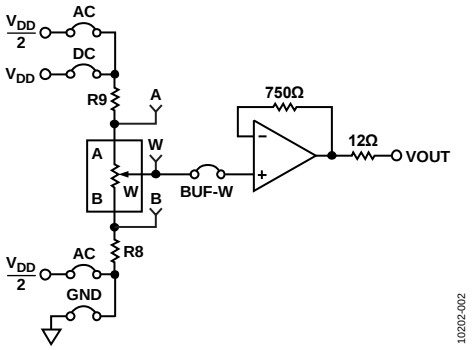

Figure 2. DAC

Table 3 shows the options available for the voltage references.

Table 3. DAC Voltage References

Terminal	Link	Options	Description
A	LK1	AC	Connects Terminal A to $V_{DD}/2$
		DC	Connects Terminal A to V_{DD}
W	BUF-W		Connects Terminal W to an output buffer
B	LK6	AC	Connects Terminal B to $V_{DD}/2$
		GND	Connects Terminal B to analog ground

The output voltage is defined in Equation 1.

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

where:
RDAC is the code loaded in the RDAC register.
V_A is the voltage applied to Terminal A (LK1 link).
V_B 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_A and V_B 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.

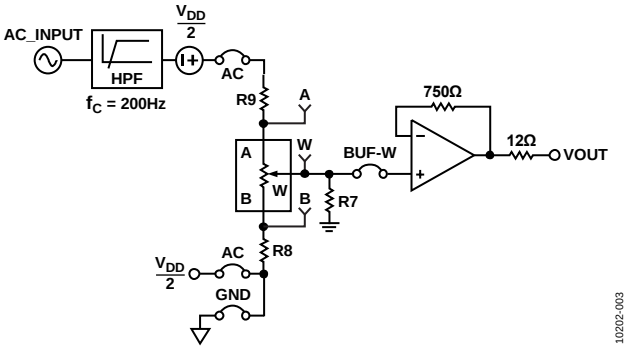

Figure 3. AC Signal Attenuator

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 $V_{DD}/2$
W	BUF-W		Connects Terminal W to an output buffer
B	LK6	AC1	Connects Terminal B to $V_{DD}/2$
		GND	Connects Terminal B to analog ground

[1] Recommended to ensure optimal total harmonic distortion (THD) performance.

The signal attenuation is defined in Equation 2.

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

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

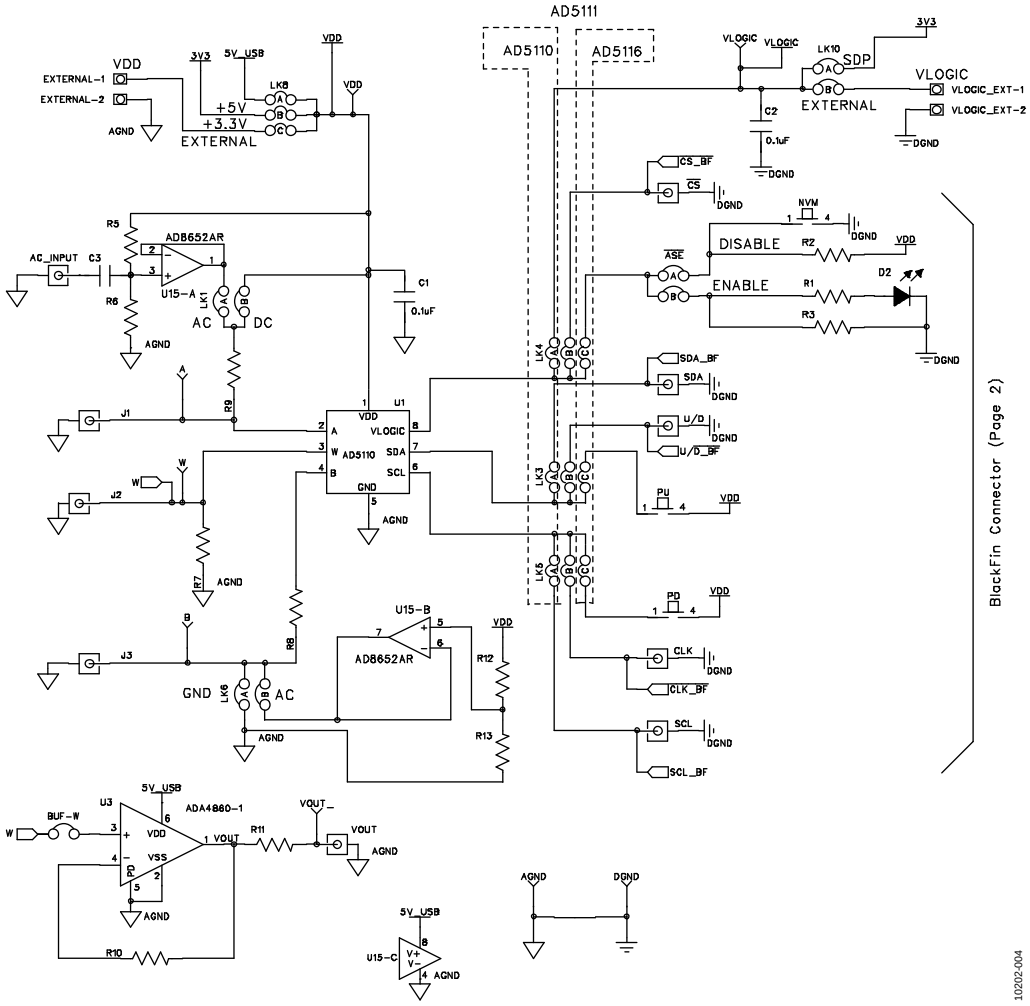

Figure 4. Schematic of the AD5116 Circuitry

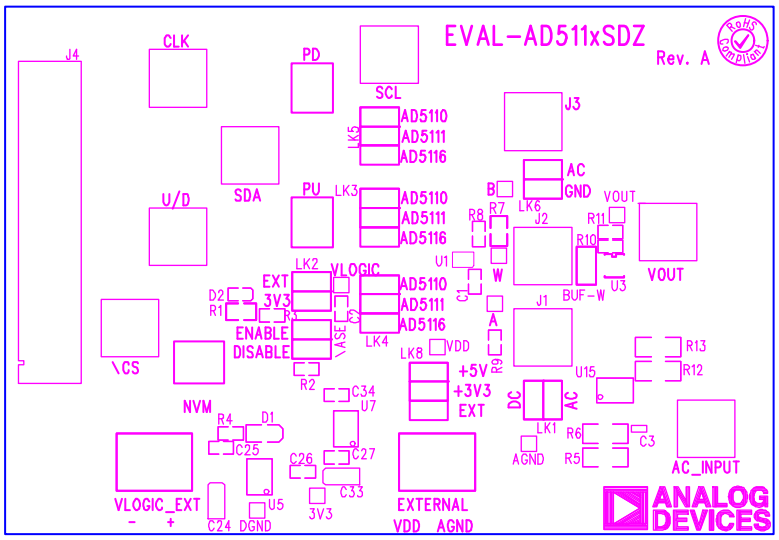

Figure 5. Component Placement Drawing

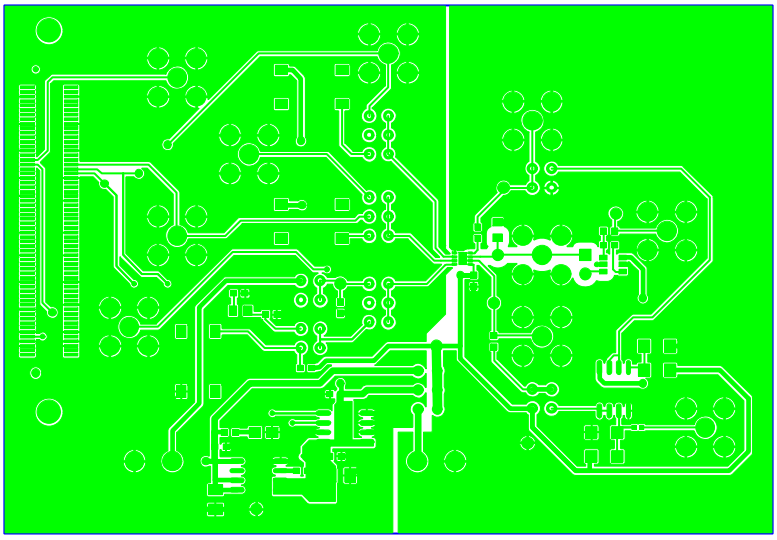

Figure 6. Component Side PCB Drawing

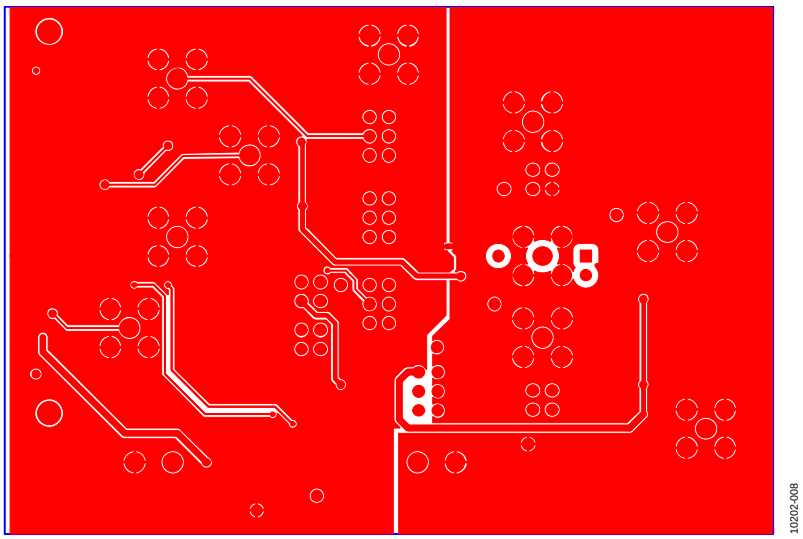

Figure 7. Solder Side PCB Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5.

Qty	Reference Designator	Description	Supplier[1]/Part Number
1	C3	100 nF capacitor, 0402	FEC 1414580
1	C1	0.1 µF capacitor, 0603	FEC 138-2224
1	C25	0.1 µF capacitor, 0603	FEC 301-9482
1	C24	10 µF 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, $\overline{\text{ASE}}$	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 Ω resistor, 0603, 1%	FEC 9330534
1	R10	750 Ω resistor, 0603, 1%	FEC 9331506
1	R4	1 kΩ resistor, 0603, 0.01%	FEC 9330380
1	R1	1.8 kΩ resistor, 0805, 1%	FEC 1400055
4	R5, R6, R12, R13	2.7 kΩ resistor, 1206, 1%	FEC 9337288
2	R2, R3	110 kΩ resistor, 0603, 1%	FEC 9331247
2	R8, R9	0 Ω 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	AD5116	Analog Devices AD5116
1	U3	ADA4860	Analog Devices ADA4860
1	U15	AD8652	Analog Devices AD8652

[1] FEC refers to Farnell Electronic Component Distributors.

I²C 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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