

AMC3301, AMC3302, and AMC3330 Evaluation Module



ABSTRACT

This user's guide describes the characteristics, operation, and use of the AMC3301EVM, AMC3302EVM, and the AMC3330EVM. The evaluation module (EVM) is an evaluation and development kit for evaluating the [AMC3301](#), [AMC3302](#), or the [AMC3330](#). These devices are precision isolation amplifiers with an integrated DC/DC converter that powers the high side of the amplifier. A complete circuit description as well as schematic diagram and bill of materials are included in this document.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the AMC3301EVM, AMC3302EVM, and AMC3330EVM.

The following related documentation is available through the Texas Instruments website at www.ti.com.

Related Documentation

Device	Literature Number
AMC3301	SBAS917
AMC3302	SBASA11
AMC3330	SBASA34

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1 EVM Overview

1.1 Features

This EVM supports the following features:

- Full-featured evaluation board for the AMC3301, AMC3302, or AMC3330 single-channel precision isolation amplifier with integrated DC/DC converter
- Screw terminals for easy access to analog inputs and outputs

1.2 Introduction

The AMC3301, AMC3302, and AMC3330 devices are precision isolation amplifiers with an output separated from the input circuitry by a silicon dioxide (SiO₂) barrier that is highly resistant to magnetic interference. This barrier is certified to provide basic galvanic isolation of up to 7000 V_{PEAK} according to UL1577 and IEC60747-5-2 specifications.

For use in high-resolution measurement applications, the inputs of the AMC3301, AMC3302, and AMC3330 are optimized for direct connection to shunt resistors or other low-level signal sources.

2 Analog Interface

The analog inputs to the AMC3301, AMC3302, and AMC3330 are routed from the two-wire screw terminal at J2. These screw terminals provide access to the inverting and non-inverting inputs of the AMC3301, AMC3302, or the AMCC3330 device installed at U1.

2.1 Analog Inputs

The analog inputs to the printed-circuit board (PCB) consists of an RC filter circuit and ferrite beads. By default, R2 and R4 on the analog input are populated as 10-Ω resistors. Capacitor C12 is populated with a 10-nF capacitor. This antialiasing filter has a cutoff frequency of 796 kHz, which is within the recommended cutoff frequency range of 200 kHz and 2 MHz. [Figure 2-1](#) shows an example input circuit for the AMC3301, AMC3302, and AMC3330 devices.

By using a signal generator or other voltage source, the user can apply an input signal directly to J2.1. The linear input voltage range of the AMC3301 is –250 mVDC to 250 mVDC, whereas the linear input voltage range of the AMC3302 is –50 mVDC to 50 mVDC, and the range of the AMC3330 is –1 VDC to 1 VDC referenced to J3.3, GND1. If measuring across an external shunt resistor, tie J2.1 to the positive Kelvin connection terminal and J2.2 and J2.3 to the negative Kelvin connection terminal of the shunt resistor.

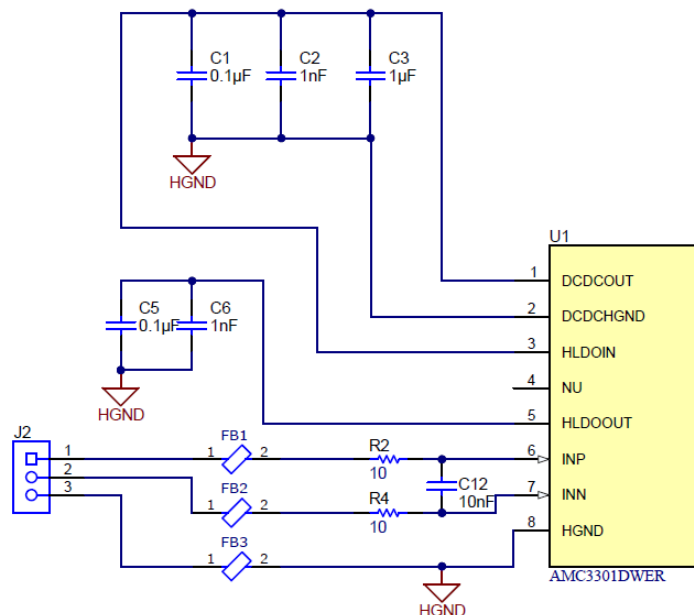


Figure 2-1. AMC3301, AMC3302, and AMC3330EVM Schematic: Analog Input Section

2.2 Analog Outputs

The analog outputs from the evaluation module are fully differential signals centered at a common-mode output voltage of 1.44 V. As [Figure 2-2](#) shows, the outputs are available on the three screw terminals of J3. OUTP is available at J3.2 and swings from 0.5 V to 2.5 V when a negative to positive full-scale linear input signal is applied to the input. OUTN is available at J3.1 and swings from 2.5 V to 0.5 V when a negative to positive full-scale linear input signal is applied to the input.

The pads of R3, R5, C11, C10, and C13 allow users to install their own output filtering. [Table 2-1](#) lists a few example filters. Common-mode filter capacitors C10 and C13 are recommended to be at least 20 times less than the differential filter capacitor, C11.

Table 2-1. Analog Output Filter Examples

Cutoff Frequency	Resistance	Differential Capacitor
100 kHz	R3 = R5 = 100 Ω	C11 = 8.2 nF
300 kHz	R3 = R5 = 100 Ω	C11 = 2.7 nF
600 kHz	R3 = R5 = 100 Ω	C11 = 1.3 nF

Use the differential output if the application allows. If a single-ended output is desired, consult the [Interfacing a Differential-Output \(Isolated\) Amplifier to a Single-Ended Input ADC](#) application report for help with designing the differential to single-ended circuit.

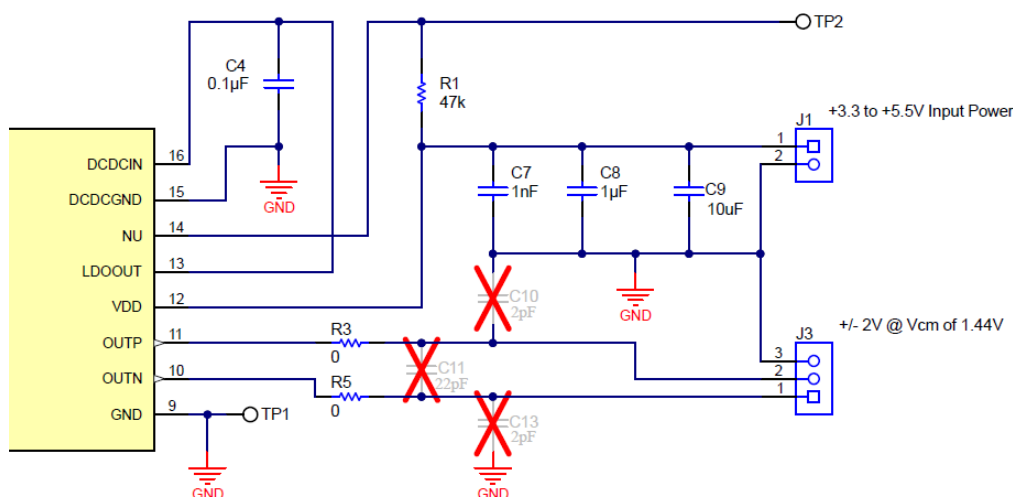


Figure 2-2. AMC3301, AMC3302, and AMC3330EVM Schematic: Analog Output Section

3 Power Supplies

The evaluation module requires a single power rail, VDD. VDD is on the low voltage side of the amplifier. Power for the high side of the amplifier is generated internally via the DC/DC converter circuit employed in the AMC3301, AMC3302, and AMC3330 device.

3.1 VDD Input

J1 provides access to the VDD supply. Use a voltage between 3.0 VDC and 5.5 VDC applied to J1.1 (VDD) with respect to J1.2 or J3.3 (GND) for the user-applied VDD supply. [Figure 3-1](#) shows the power connections.

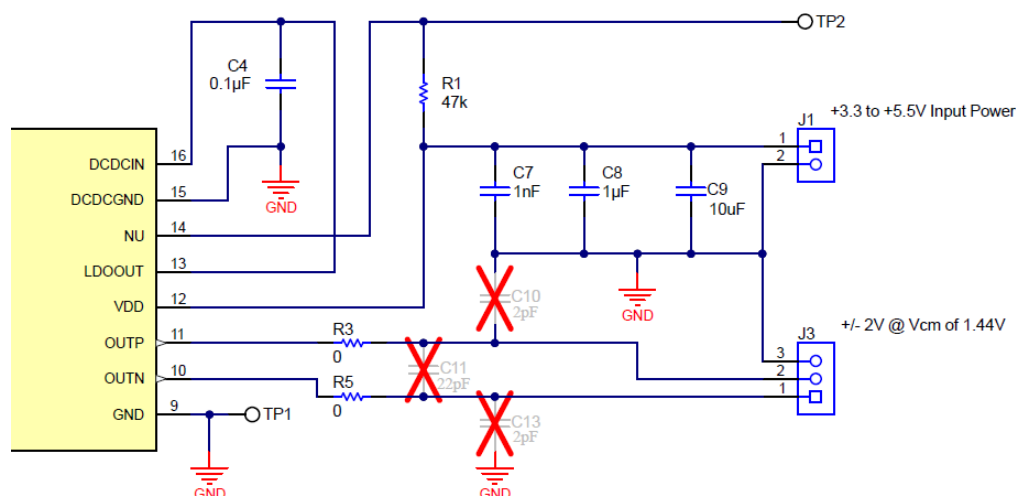


Figure 3-1. AMC3301EVM, AMC3302EVM, and AMC3330EVM VDD Input

4 EVM Operation

This section describes the general operation of the AMC3301EVM, AMC3302EVM, and the AMC3330EVM.

4.1 Analog Inputs: J2

The analog input to the evaluation module can be applied directly to J2 pins 1 and 2. To ensure that the input voltage remains within the common-mode input range of the device, tie INN (pin 7) to HGND (pin 8) externally.

CAUTION

See the [AMC3301](#), [AMC3302](#), or [AMC3330](#) data sheets for the limitations of the analog input range and to ensure that the appropriate analog and digital voltages are applied before connecting any analog input to the EVM. The board is not certified for high-voltage operation.

[Table 4-1](#) summarizes the details of J2.

Table 4-1. J2: Analog Inputs

Pin Number	Signal	Description
J2.1	INP	Noninverting input to U1 (pin 6)
J2.2	INN	Inverting analog input to U1 (pin 7)
J2.3	HGND	HGND connection to U1 (pin 8)

4.2 User Power and Analog Output: J1 and J3

The differential analog output from the EVM is applied directly to J3.1 and J3.2 with respect to GND, J3.3. [Table 4-2](#) summarizes the details of J3.

Table 4-2. J3: Analog Output

Pin Number	Signal	Description
J3.1	OUTN	Inverting analog output from U1 (pin 10)
J3.2	OUTP	Noninverting output from U1 (pin 11)
J3.3	GND	Ground reference (pin 9)

The VDD power input to the AMC3301EVM, AMC3302EVM, and AMC3330EVM PCB can be applied directly to J1, pins 1 and 2. [Table 4-3](#) lists the details of J1.

Table 4-3. J1: VDD Power

Pin Number	Signal	Description
J1.1	VDD	VDD input from U1 (pin 12)
J1.2	GND	GND connection from U1 (pin 9)

4.3 Device Operation

After the VDD power is applied to the AMC3301EVM, AMC3302EVM, or AMC3330EVM, the analog outputs are available with a fixed gain and a DC common-mode offset equal to 1.44 V.

An analog input signal can be applied directly at screw terminal J2. See [Figure 2-1](#) and [Table 4-1](#) for details. The differential analog input range for the AMC3301, INP to INN, is specified as ± 250 mV with a maximum of ± 320 mV before clipping occurs. The differential analog input range for the AMC3302, INP to INN, is specified as ± 50 mV with a maximum of ± 64 mV before clipping occurs. The differential analog input range for the AMC3330, INP to INN, is specified as ± 1 V with a maximum of ± 1.25 V before clipping occurs.

The analog output of the AMC3301 isolation amplifier has a nominal gain of 8.2, whereas the AMC3302 isolation amplifier has a nominal gain of 41, and the AMC3330 isolation amplifier has a nominal gain of 2. For the AMC3301, with a full-scale input voltage of ± 250 mV, the nominal output is ± 2.05 V. For the AMC3302, with a full-scale input voltage of ± 50 mV, the nominal output is ± 2.05 V. For the AMC3330, with a full-scale input voltage of ± 1 V the nominal output is ± 2 V.

The output voltage of the AMC3301EVM, AMC3302EVM, and AMC3330EVM is centered on 1.44 V and provides a convenient analog input range to the embedded analog-to-digital converters (ADCs) of the [MSP430](#) and [TMS320C2000](#) series of digital processors.

5 Layout, BOM, and Schematic

This section contains the PCB layout, [bill of materials](#), and [schematic](#) of the AMC3301EVM, AMC3302EVM, and AMC3330EVM.

5.1 Layout

This section contains the and printed-circuit board (PCB) layout of the EVM. For applications that undergo radiated emissions testing, see the [Best Practices to Attenuate AMC3301 Family Radiated Emissions EMI application report](#).

Note

Board layout is not to scale. [Figure 5-1](#) and [Figure 5-2](#) are intended to show how the board is laid out and are not intended to be used for manufacturing the AMC3301EVM, AMC3302EVM, and AMC3330EVM PCBs.

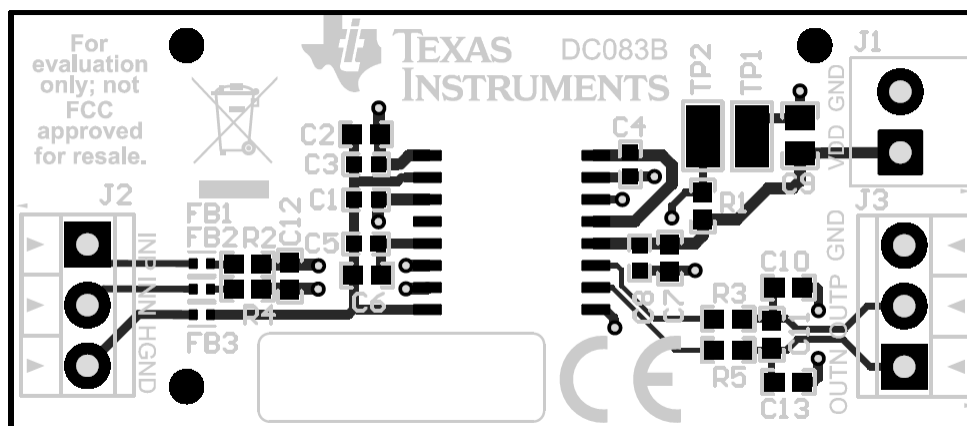


Figure 5-1. AMC3301EVM, AMC3302EVM, and AMC3330EVM Top Drawing

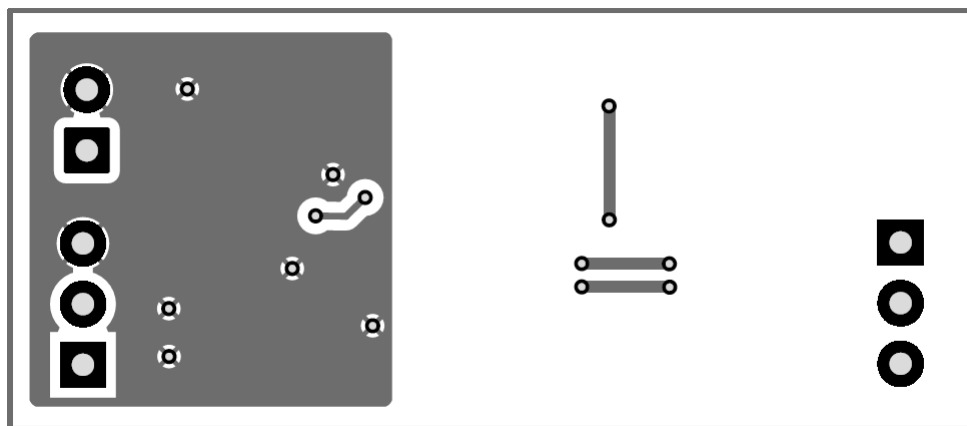


Figure 5-2. AMC3301EVM, AMC3302EVM, and AMC3330EVM Bottom Drawing

5.2 Bill of Materials

Table 5-1 lists the bill of materials.

Note

All components must be RoHS compliant. Some part numbers can be leaded or RoHS. Verify that purchased components are RoHS compliant.

Table 5-1. AMC3301EVM Bill of Materials

Item	Qty	Ref Des	Description	Manufacturer	Part Number
1	3	C1, C4, C5	CAP, CERM, 0.1 μ F, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	Kemet	C0603C104K5RACAUTO
2	3	C2, C6, C7	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	Kemet	C0603C102K5RACTU
3	2	C3, C8	CAP, CERM, 1 μ F, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	TDK	CGA3E1X7R1E105K080A C
4	1	C9	CAP, CERM, 10 μ F, 16 V, +/- 10%, X5R, 0805	Taiyo Yuden	EMK212BJ106KG-T
5	1	C12	CAP, CERM, 0.01 μ F, 25 V, +/- 10%, X7R, 0603	MuRata	GRM188R71E103KA01D
6	3	FB1, FB2, FB3	1.8 kOhms @ 100MHz 1 Power, Signal Line Ferrite Bead 0402 (1005 Metric) 210mA 2.1Ohm	Würth Electronics	74269244182
7	1	J1	Terminal Block, 3.5mm Pitch, 2x1, TH	On-Shore Technology	ED555/2DS
8	2	J2, J3	Terminal Block, 3.5mm Pitch, 3x1, TH	On-Shore Technology	ED555/3DS
9	1	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H	Brady	THT-14-423-10
10	1	R1	RES, 47 k, 5%, 0.1 W, 0603	Yageo	RC0603JR-0747KL
11	2	R2, R4	RES, 10, 5%, 0.25 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW060310R0JNEAHP
12	2	R3, R5	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Panasonic	ERJ-3GEY0R00V
13	2	TP1, TP2	Test Point, Miniature, SMT	Keystone	5015
18	1	U1	AMC3301 Precision, \pm 250-mV Input, Reinforced Isolated Amplifier with Integrated DC/DC Converter	Texas Instruments	AMC3301DWER

5.3 Schematic

Figure 5-3 shows the AMC3301EVM schematic.

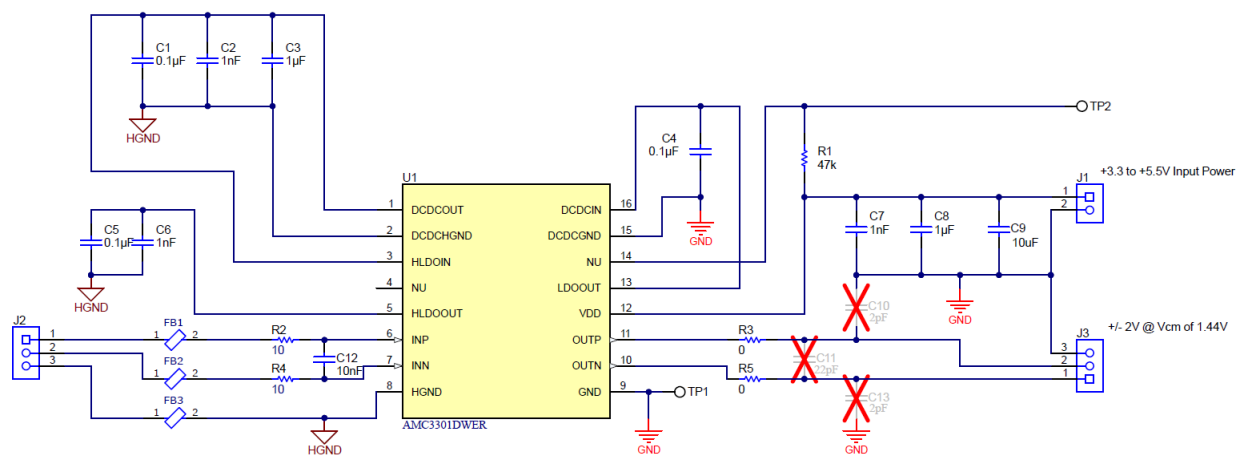


Figure 5-3. AMC3301EVM Schematic

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision B (September 2020) to Revision C (January 2022)	Page
• Changed <i>Analog Inputs</i> section.....	2
• Changed <i>Analog Outputs</i> section.....	3
• Changed <i>VDD Input</i> section.....	4
• Changed <i>Analog Inputs: J2</i> section.....	5
• Changed <i>User Power and Analog Output: J1 and J3</i> section to correct discussion of J1 and J3.....	5
• Changed <i>(VIN+) – (VIN–) to INP to INN</i> in <i>Device Operation</i> section.....	6
• Changed <i>Layout</i> section.....	7
• Changed <i>AMC3301EVM Bill of Materials</i> table.....	8
• Changed <i>Schematic</i> section.....	9

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