



## ABSTRACT

The AMC1350 and AMC1351 are precision isolation amplifiers with an output separated from the input circuitry by a silicon dioxide (SiO<sub>2</sub>) barrier that is highly resistant to magnetic interference. This barrier is certified to provide reinforced galvanic isolation of up to 7.071 kV<sub>PEAK</sub> per DIN V VDE V 0884-11 (VDE V 0884-11): 2017-01.

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## 1 Introduction

For use in high-resolution voltage measurement applications, the high-impedance input of the AMC1350 and AMC1351 is optimized for connection to high-voltage resistive dividers or other voltage signal sources with high-output resistance.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the AMC1350EVM or AMC1351EVM.

### 1.1 Features

This EVM has the following features:

- Full-featured evaluation module for the AMC1350 or AMC1351 single-channel precision isolation amplifier
- Screw terminals for easy access to high- and low-side power supplies, analog inputs, and analog outputs

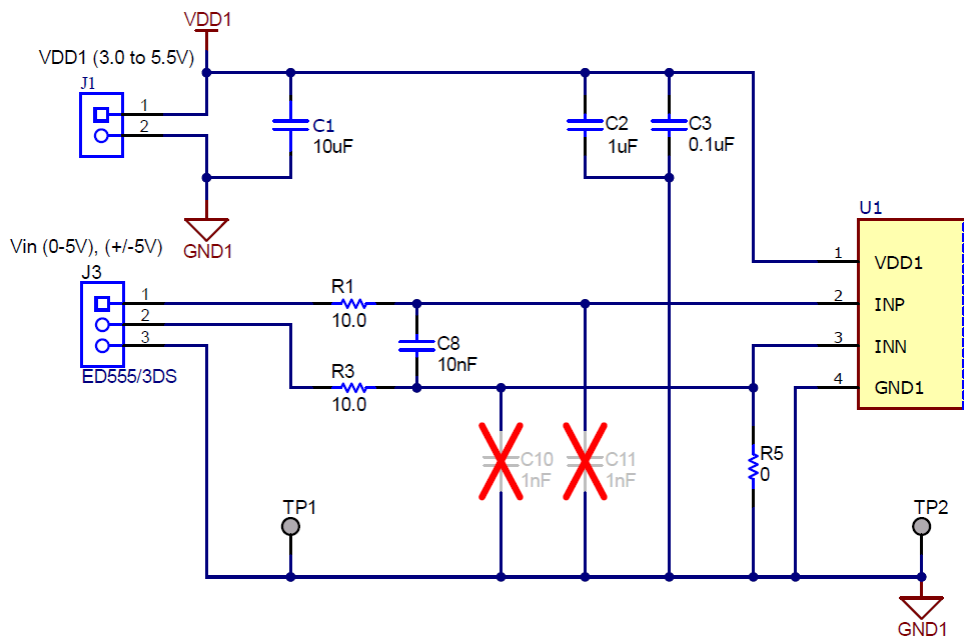
## 2 Analog Interface

The analog input to the AMC1350 or AMC1351 is routed from a three-wire screw terminal screw at J3.1 that provides access to the INP terminal for the AMC1350 or to the IN terminal for the AMC1351, referenced to J3.3, GND1. Access to the AMC1350 INN pin is provided at J3.2, which is shorted to GND1 by default by a 0- $\Omega$  resistor (R5).

### 2.1 Analog Input

The analog input of the AMC1350 and AMC1351 is accessible to the user by connector J3. The passive components of the analog input section of the AMC1350EVM board is comprised of R1, R3, and C8 that form a simple differential antialiasing filter with a corner frequency of 796 kHz. The input of the AMC1351 is single-ended; therefore, R3 is not installed. R1 and C8 on the AMC1351EVM form a simple antialiasing filter with a corner frequency of 1.6 MHz. An antialiasing cutoff frequency between 200 kHz and 2 MHz is recommended. By default, INN (pin 3) of the AMC1350 and GND1 (pin 3) of the AMC1351 is tied to GND1 (pin 4) by a 0- $\Omega$  resistor (R5). [Figure 2-1](#) shows the analog input circuit for the AMC1350EVM.

Using a signal generator or other voltage source, the user can apply an input signal directly to J3.1. The linear input voltage range of the AMC1350 by J3.1 is  $-5$  VDC to 5 VDC whereas the linear input voltage range of the AMC1351 is 0 VDC to 5 VDC referenced to J3.3, GND1. If measuring across an external shunt resistor, tie J3.1 to the positive Kelvin connection terminal, and tie J3.3 to the negative Kelvin connection terminal of the shunt resistor.



**Figure 2-1. AMC1350EVM Schematic: Analog Input Section**

## 2.2 Analog Output

The analog output from the AMC1350EVM and AMC1351EVM is a fully differential signal centered at 1.44 V. Figure 2-2 shows that the differential output of the AMC1350 or AMC1351 is available on the two screw terminals of J4. OUTP is available at J4.3 and swings from 0.5 V to 2.5 V when a –5-V to 5-V signal is applied to the input of the AMC1350 or from 1.44 V to 2.5 V when a 0-V to 5-V signal is applied to the input of the AMC1351. OUTN is available at J4.2 and swings from 0.5 V to 2.5 V when a –5-V to 5-V signal is applied to the input of the AMC1350 or from 0.5 V to 1.44 V when a 0-V to 5-V signal is applied to the input of the AMC1351. The pads of R2, R4, C9, C7, and C12 allow users to install their own output filtering. Table 2-1 lists a few example filters. Common-mode filter capacitors C7 and C12 are recommended to be at least 20x less than the differential filter capacitor.

Table 2-1. Analog Output Filter Examples

Cutoff Frequency	Resistance	Differential Capacitor
100 kHz	R2 = R4 = 100 Ω	C9 = 8.2 nF
300 kHz	R2 = R4 = 100 Ω	C9 = 2.7 nF
600 kHz	R2 = R4 = 100 Ω	C9 = 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 designing the differential to single-ended circuit.

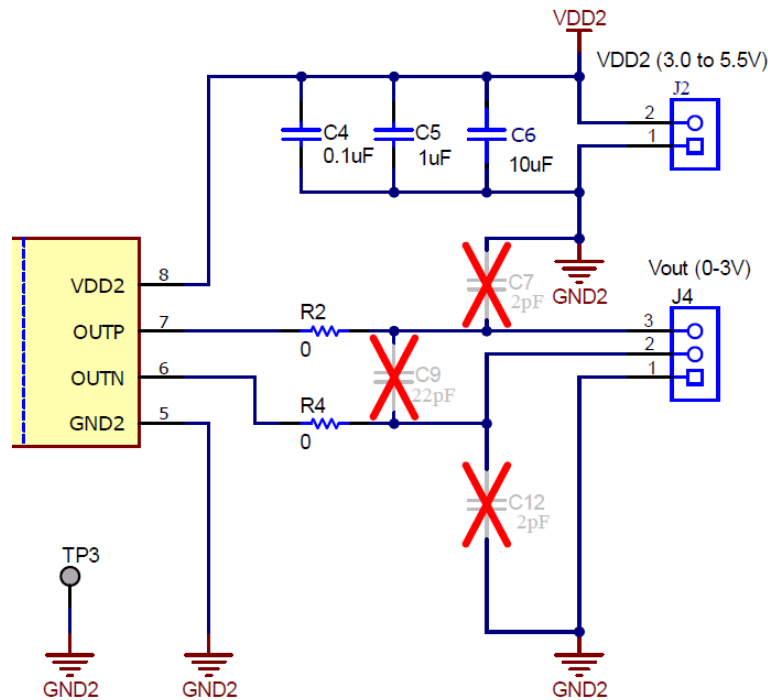


Figure 2-2. AMC1350EVM Schematic: Analog Output Section

## **3 Power Supplies**

The EVM requires two separate power rails, VDD1 and VDD2. VDD1 is on the high-voltage side of the amplifier and is accessed by J1. VDD2 is on the low side of the amplifier and is accessed by J2.

### **3.1 VDD1 Input**

The EVM provides access to VDD1 by J1.1. The VDD1 supply must be between 3 VDC and 5.5 VDC with respect to GND1, where J1.2 and J3.3 provide direct access to GND1.

### **3.2 VDD2 Input**

The low side of the AMC1350 and AMC1351 isolation amplifier is rated for 3 VDC to 5.5 VDC and is applied to the amplifier using J1.2 with respect to J1.1.

## 4 EVM Operation

The following sections describe the general operation of the AMC1350EVM or AMC1351EVM.

### 4.1 Analog Input and VDD1 Power: J3 and J1

The analog input voltage to the AMC1350EVM or AMC1351EVM can be applied directly to J3 pin 1.

[Table 4-1](#) lists the details of J3.

**Table 4-1. J3: Analog Input**

Pin Number	Signal	Description
J3.1	INP/IN	Analog positive input to the AMC1350 or input to the AMC1351 (pin 2)
J3.2	INN/GND1	Analog negative input to the AMC1350 or GND1 to the AMC1351 (pin 3)
J3.3	GND1	Connection to the AMC1350 or AMC1351 GND1 terminal (pin 4)

The isolated power input to the AMC1350EVM or AMC1351EVM printed circuit board (PCB) can be applied directly to J2 pins 1 and 2. [Table 4-2](#) lists the details of J2.

**Table 4-2. J2: VDD1 Power**

Pin Number	Signal	Description
J2.1	VDD1	Connection to the AMC1350 or AMC1351 VDD1 terminal (pin 1).
J2.2	GND1	Connection to GND1. Tie this pin to the AMC1350 or AMC1351 GND1 terminal (pin 4).

#### CAUTION

Carefully review the [AMC1350 data sheet](#) or [AMC1351 data sheet](#) for limitations of the analog input range and make sure the appropriate analog and digital voltages are applied prior to connecting any analog input to the EVM. The board is not certified for high-voltage operation.

### 4.2 Analog Outputs and VDD2 Power: J4 and J2

The differential analog output voltage from the AMC1350EVM or AMC1351EVM printed circuit board is applied directly to J4.3 and J4.2 with respect to GND2, J4.1. [Table 4-3](#) lists the details of J4.

**Table 4-3. J4: Differential Analog Output**

Pin Number	Signal	Description
J4.3	OUTP	Noninverting analog output from the AMC1350 or AMC1351 (pin 7)
J4.2	OUTN	Inverting analog output from the AMC1350 or AMC1351 (pin 6)
J4.1	GND2	Connection to the AMC1350 or AMC1351 GND2 terminal (pin 5)

The VDD2 power input to the AMC1411EVM printed circuit board can be applied directly to J1 pins 1 and 2. [Table 4-4](#) lists the details of J1.

**Table 4-4. J1: VDD2 Power**

Pin Number	Signal	Description
J1.2	VDD2	Connection to the AMC1350 or AMC1351 VDD2 terminal (pin 8)
J1.1	GND2	Connection to the AMC1350 or AMC1351 GND2 terminal (pin 5)

### 4.3 Device Operation

When the VDD1 and VDD2 power is applied to the EVM, the analog output is available with a fixed gain of 0.4 and a DC offset equal to 1.44 V (typical).

An analog input signal can be applied directly at screw terminal J3. See [Section 2.1](#) and [Section 3.1](#) for details. The analog input range is specified at  $-5\text{ V}$  to  $5\text{ V}$  for the AMC1350 and at  $0\text{ V}$  to  $5\text{ V}$  for the AMC1351.

The analog output has a nominal gain of 0.4, and the nominal output is  $-2\text{ V}$  to  $2\text{ V}$  differential for the AMC1350 or  $0\text{ V}$  to  $2\text{ V}$  differential for the AMC1351. The output voltage is centered on 1.44 V, providing a convenient analog input range to the embedded ADCs of the [MSP430](#) and [TMS320C2000](#) series of digital processors.

### 5 Board Layout

[Figure 5-1](#) and [Figure 5-2](#) show the top and bottom printed circuit board (PCB) drawings of the AMC1350EVM and AMC1351EVM, respectively.

#### Note

Board layouts are not to scale. These layouts are intended to show how the board is laid out, and are not intended to be used for manufacturing the AMC1350EVM and AMC1351EVM PCBs.

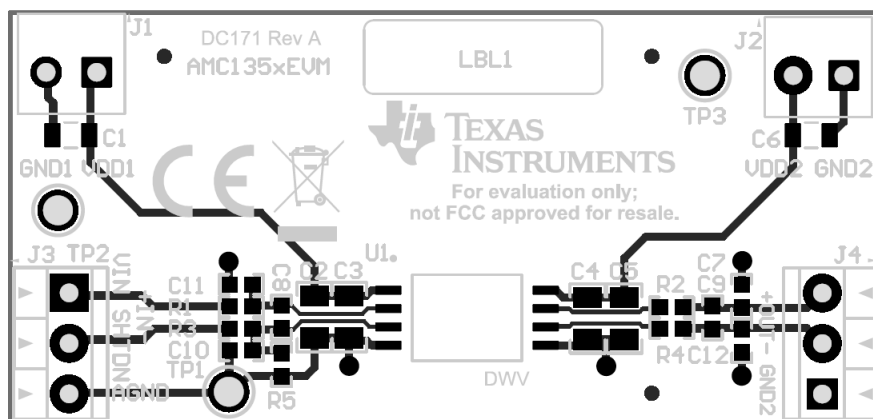


Figure 5-1. AMC1350EVM and AMC1351EVM Top PCB Drawing

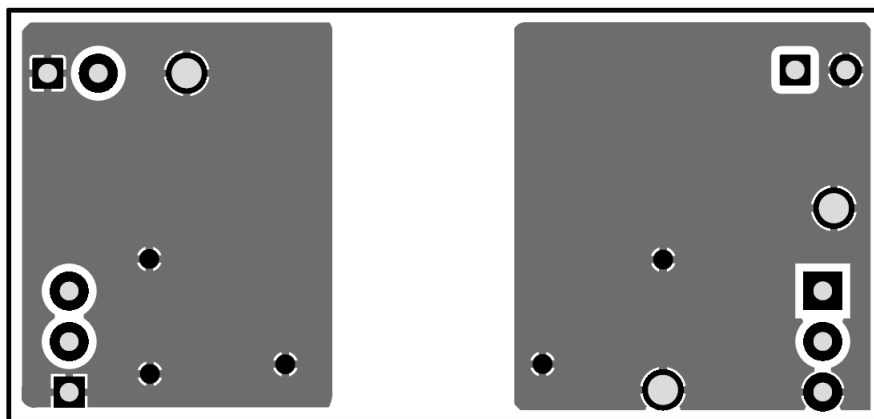


Figure 5-2. AMC1350EVM and AMC1351EVM Bottom PCB Drawing

## 6 Bill of Materials and Schematic

This section contains the complete bill of materials and schematic diagram of the AMC1350EVM and AMC1351EVM.

### 6.1 Bill of Materials

Table 6-1 shows the AMC1350EVM bill of materials (BOM).

**Table 6-1. Bill of Materials**

Designator	Description	Manufacturer	Mfg. Part Number
C1, C6	CAP, CERM, 10 $\mu$ F, 16 V, $\pm$ 10%, X7R, 1206	Samsung	CL31B106KOHVPNE
C2, C5	CAP, CERM, 1 $\mu$ F, 25 V, $\pm$ 10%, X7R, 1206	AVX	12063C105KAT2A
C3, C4	CAP, CERM, 0.1 $\mu$ F, 50 V, $\pm$ 10%, X7R, 1206	Yageo America	CC1206KRX7R9BB104
J1, J2	Terminal Block, 3.5-mm Pitch, 2x1, TH	On-Shore Technology	ED555/2DS
J3, J4	Terminal Block, 3.5mm Pitch, 3x1, TH	On-Shore Technology	ED555/3DS
R1, R2	RES, 10.0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW060310R0FKEA
R3, R4, R5	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Panasonic	ERJ-3GEY0R00V
TP1, TP2, TP3	Terminal, Turret, TH, Double	Keystone	1573-2
U1	Precision $\pm$ 5 V Input Reinforced Isolated Amplifier for Voltage Sensing	Texas Instruments	AMC1350DWV

## 6.2 Schematics

Figure 6-1 shows the AMC1350EVM schematic.

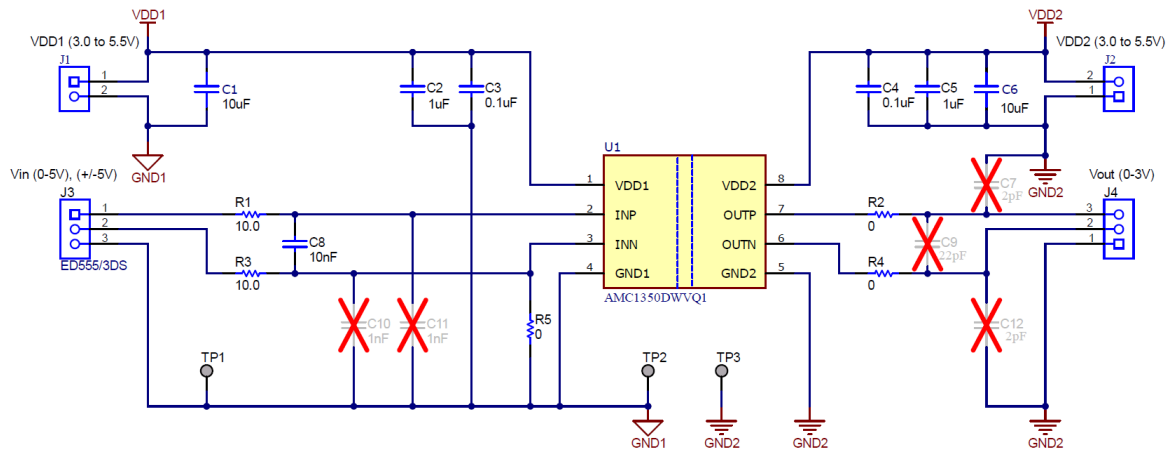


Figure 6-1. AMC1350EVM Schematic

Figure 6-2 shows the AMC1351EVM schematic.

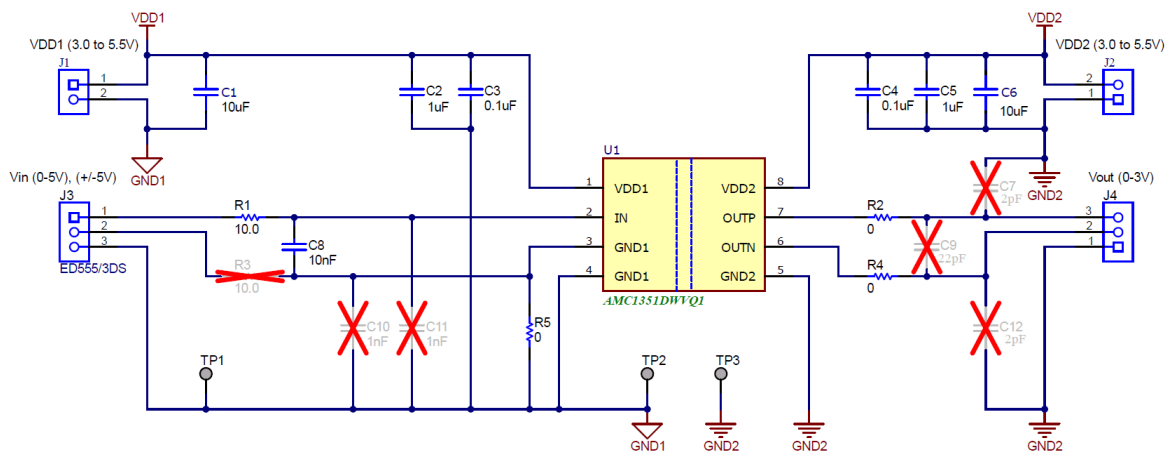


Figure 6-2. AMC1351EVM Schematic



## 7 Related Documentation

To obtain a copy of any of the following TI documents, call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580. When ordering, please identify this document by its title and literature number. Updated documents can also be obtained through our website at [www.ti.com](http://www.ti.com).

- Texas Instruments, [AMC1350 Precision, +/-5-V Input, Reinforced Isolated Amplifier data sheet](#)
- Texas Instruments, [AMC1351 Precision, 5-V Input, Reinforced Isolated Amplifier data sheet](#)
- Texas Instruments, [Interfacing a Differential-Output \(Isolated\) Amplifier to a Single-Ended Input ADC application report](#)

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