User's Guide

AMC1411 Evaluation Module

ABSTRACT

The AMC1411 is a precision isolation amplifier with an output separated from the input circuitry by a silicon dioxide (SiO2) barrier that is highly resistant to magnetic interference. This barrier has been certified to provide reinforced galvanic isolation of up to 10.5 kV_{PEAK} per DIN V VDE V 0884-11 (VDE V 0884-11): 2017-01.

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Trademarks

1 Introduction

For use in high-resolution voltage measurement applications, the high-impedance input of the AMC1411 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 AMC1411EVM.

1.1 Features

This EVM has the following features:

- Full-featured evaluation module for the AMC1411 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 AMC1411 is routed from a three-wire screw terminal screw at J3.1 which provides access to the VINP terminal, referenced to J3.3, GND1. Access to the SHTDN pin is provided at J3.2 which is shorted to GND1 by default via 0-Ω resistor R4.

2.1 Analog Input

The analog input of the AMC1411 is accessible to the user via connector J3. The passive components of analog input section of the AMC1411EVM board is comprised of R1, R2, and C7 which form a simple differential anti-aliasing filter with a corner frequency of 796 kHz. Figure 2-1 shows the input circuit for the AMC1411EVM.

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 AMC1411 via J3.1 is 0-2 VDC referenced to J3.3, GND1. If measuring across an external shunt resistor, J3.1 should be tied to the positive Kelvin connection terminal, while J3.3 should be tied to the negative Kelvin connection terminal of the shunt resistor.

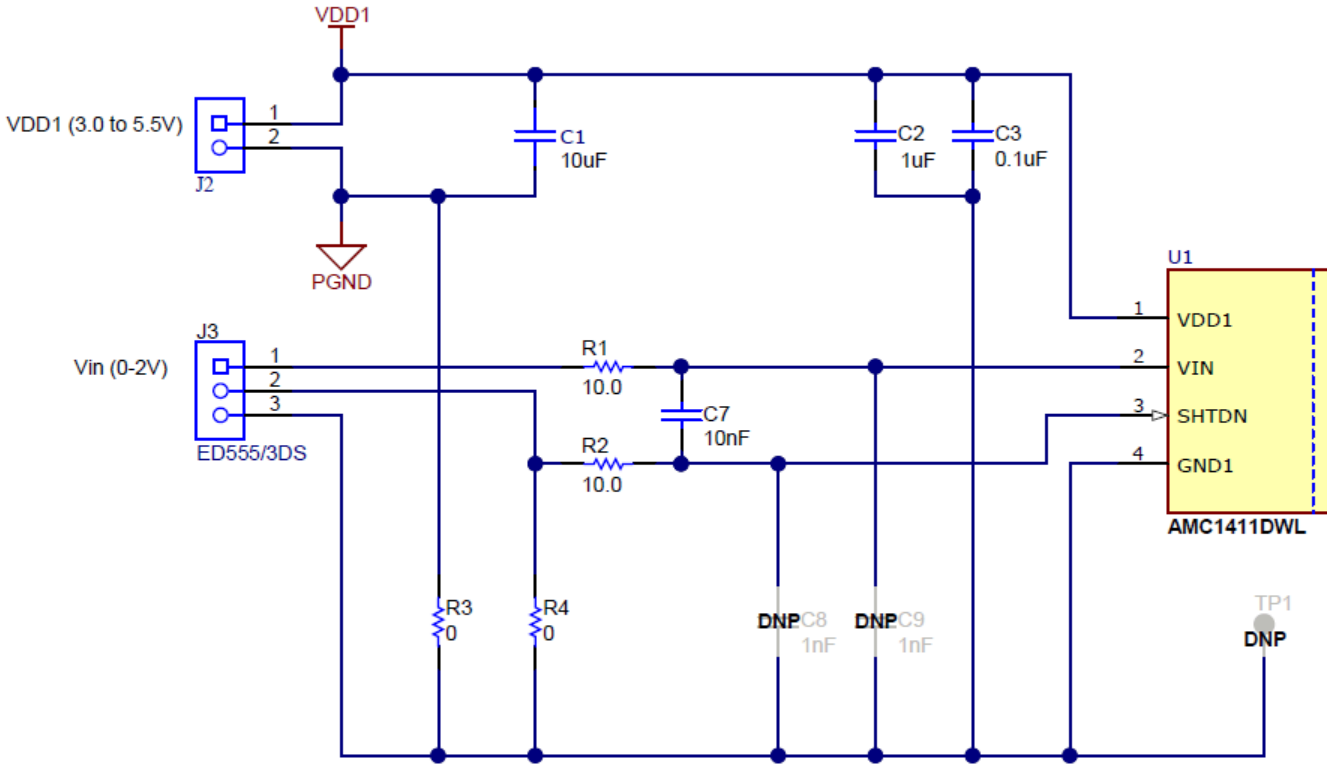

Figure 2-1. AMC1411EVM Schematic – Analog Input Section

2.2 Shutdown

The AMC1411 features a shutdown option which is an active high input. Resistor R4 is installed by default and allows for normal operation of the AMC1411 device. When the resistor is removed, the SHTDN pin can be controlled externally via J3.2 to shutdown the AMC1411. When shutdown, the AMC1411 enters into a low-power mode by means of an internal pullup resistor for battery or other power-sensitive applications.

2.3 Analog Output

The analog output from the AMC1411EVM board is a fully-differential signal centered at 1.44 V. Figure 2-2 shows that the differential output of U1 is available on the two screw terminals of J4. VOUTP is available via J4.3 and swings from 1.44 V to 2.5 V when a 0–2 V signal is applied to the input. VOUTN is available via J4.2 and swings from 0.5 V to 1.44 V when a 0–2 V signal is applied to the input. Texas Instruments recommends using 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 Tech Note* for help with designing the differential to single-ended circuit.

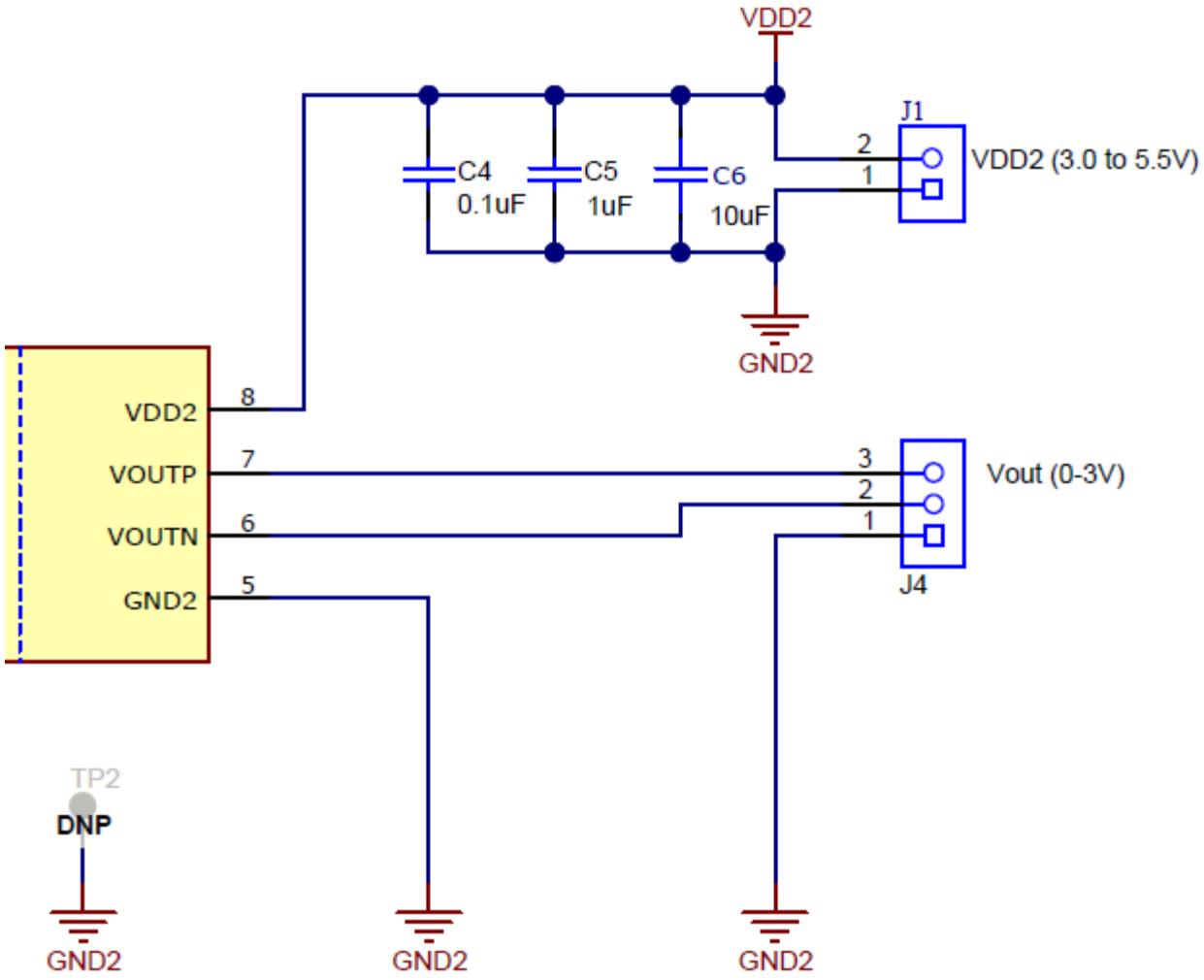

Figure 2-2. AMC1411EVM Schematic – Analog Output Section

3 Power Supplies

The AMC1411EVM requires two separate power rails, VDD1 and VDD2. VDD1 is on the high-voltage side of the amplifier. VDD2 is on the user side of the amplifier.

3.1 VDD1 Input

The EVM provides access to VDD1 via J2.1. The VDD1 supply should be between 3 and 5.5 VDC with respect to GND1, where J3.3 provides direct access to GND1. J2.2 provides access to PGND, which by default is tied to GND1 via resistor R3. This flexibility of connections for the high side grounds allows users to manually alter the common-mode input voltage of the AMC1411EVM. The input power scheme is shown in Figure 3-1.

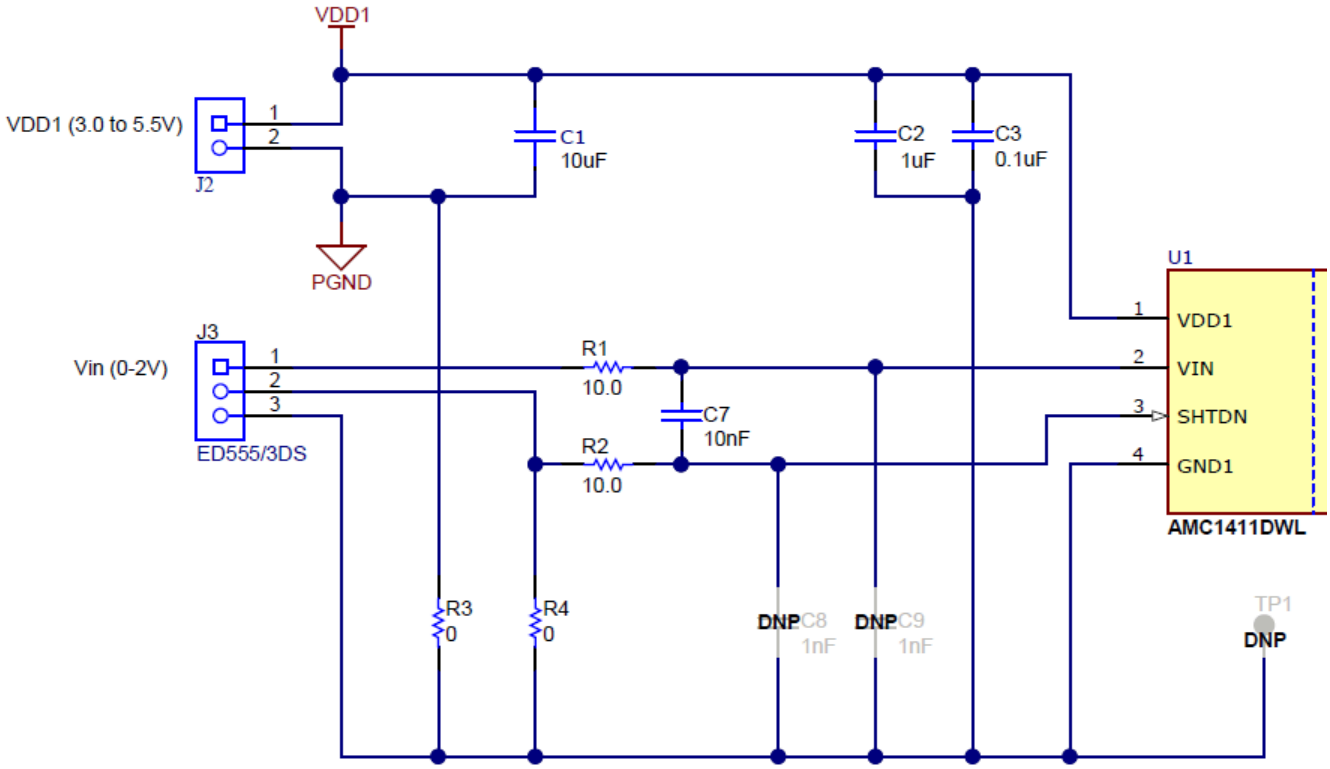

Figure 3-1. AMC1411EVM Input

3.2 VDD2 Input

The user side of the AMC1411 isolation amplifier is rated for 3.0 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 AMC1411EVM.

4.1 Analog Input and VDD1 Power: J3 and J2

The analog input voltage to the AMC1411EVM 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	VINP	Analog input to the AMC1411
J3.2	SHTDN	Optional input to drive the shutdown pin from an external source
J3.3	GND1	Connection to the AMC1411 GND1 terminal (pin 4)

The isolated power input to the AMC1411EVM 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 SBASAA7AMC1411 VDD1 terminal (pin 1)
J2.2	PGND	Connection to PGND. Tied to AMC1411 GND1 terminal (pin 4) by default via resistor R4

CAUTION

Carefully review the *AMC1411 High-Impedance, 2-V Input, Reinforced Isolated Amplifier in 15 mm Data Sheet* for the limitations of the analog input range, and ensure that 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 J1

The differential analog output voltage from the AMC1411EVM printed circuit board is applied directly to J4.3 and J4.2. Table 4-3 lists the details of J4.

Table 4-3. J4 – Differential Analog Output

Pin Number	Signal	Description
J4.3	VOUTP	Non-inverting analog output from the AMC1411 (pin 7)
J2.2	VOUTN	Inverting analog output from the AMC1411 (pin 6)
J4.1	GND2	Connection to the AMC1411 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 AMC1411 VDD2 terminal (pin 8)
J1.1	GND2	Connection to the AMC1411 GND2 terminal (pin 5)

4.3 Device Operation

Once the VDD1 and VDD2 power is applied to the AMC1411EVM, the analog output will be available with a fixed gain of one and a DC offset equal to 1.44 V (typical).

An analog input signal may be applied directly at screw terminal J3. See Figure 2-1 and Table 4-2 for details. The analog input range is specified at 0 to 2 V.

The analog output has a nominal gain of 1 through the AMC1411 isolation amplifier. With an input voltage of 0–2 V, the nominal output is 0–2 V differential. 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

This section contains the and printed-circuit board (PCB) layout of the AMC1411EVM.

Note

Board layouts are not to scale. These are intended to show how the board is laid out, and are not intended to be used for manufacturing AMC1411EVM PCBs.

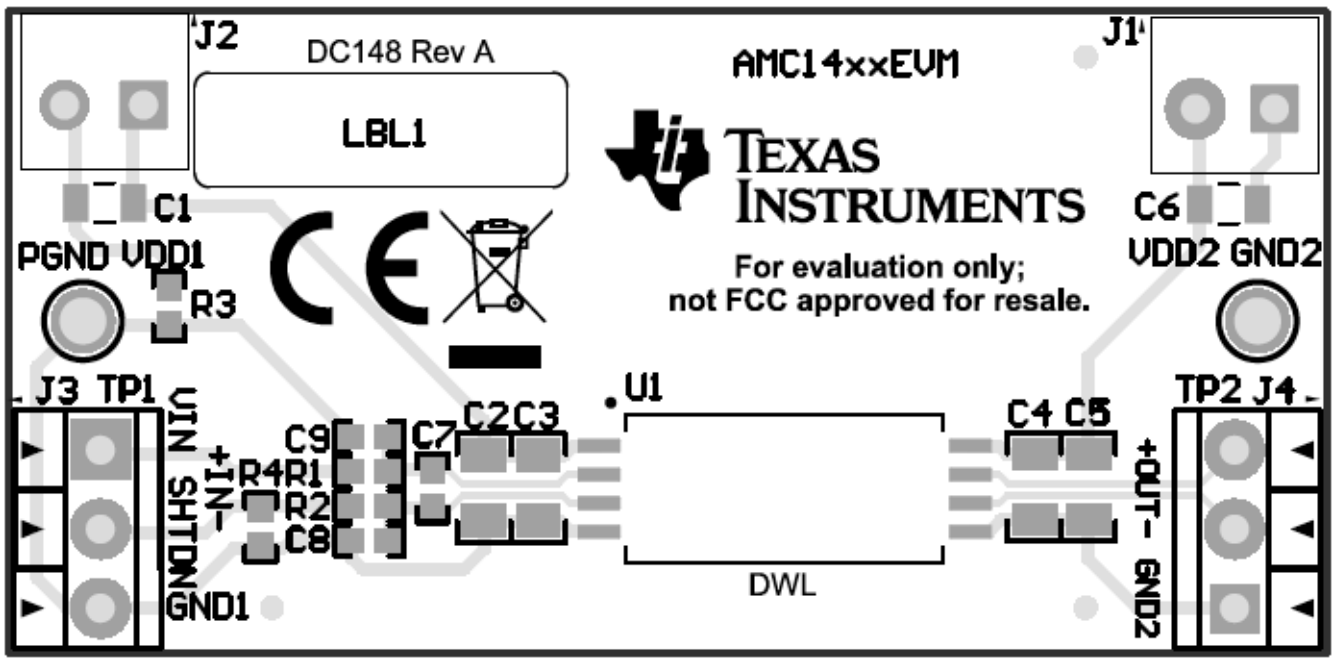

Figure 5-1. AMC1411 Silk Screen Drawing

6 Bill of Materials and Schematic

This section contains the complete bill of materials, and schematic diagram of the AMC1411EVM.

6.1 Bill of Materials

Table 6-1 shows the EVM bill of materials.

Table 6-1. Bill of Materials

Designator	Description	Manufacturer	Mfg. Part Number
C1, C6	CAP, CERM, 10 µF, 16 V, ±10%, X7R, 1206	Samsung	CL31B106KOHVPNE
C2, C5	CAP, CERM, 1 uF, 25 V, ±10%, X7R, 1206	AVX	12063C105KAT2A
C3, C4	CAP, CERM, 0.1 uF, 50 V, ±10%, X7R, 1206	Yageo America	CC1206KRX7R9BB104
C7	CAP, CERM, 0.01 uF, 25 V, ±10%, X7R, 0603	MuRata	GRM188R71E103KA01D
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	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Panasonic	ERJ-3GEY0R00V
TP1, TP2	Terminal, Turret, TH, Double	Keystone	1573-2
U1	High CMTI Reinforced Isolated Amplifier for Current Sensing in ultra-wide-body SOIC8 package	Texas Instruments	AMC1411DWL
C8, C9	CAP, CERM, 1000 pF, 50 V,+/- 10%, X7R, 0603	Wurth Elektronik	885012206083

6.2 Schematic

Figure 6-1 shows the EVM schematic.

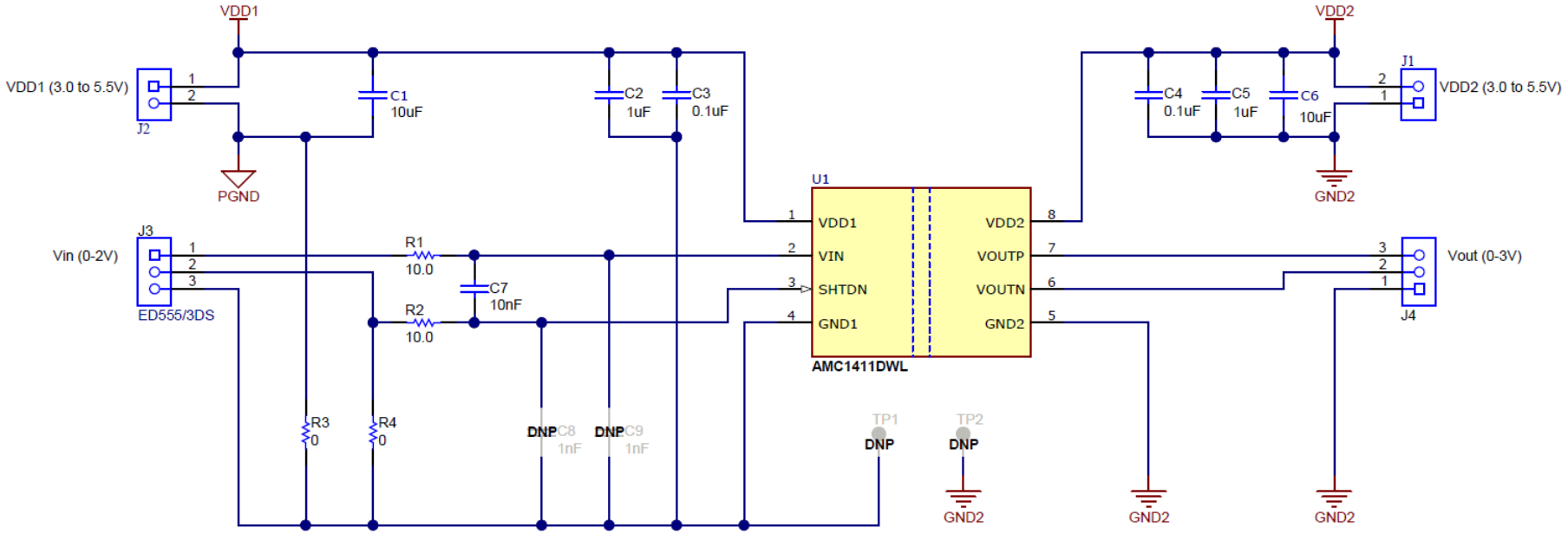

Figure 6-1. AMC1411EVM Schematic

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 booklet by its title and literature number. Updated documents can also be obtained through our website at www.ti.com/.

- Texas Instruments, *AMC1411 Precision, 2-V Input, Reinforced Isolated Amplifier Data Sheet*

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CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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