EVM User's Guide: ADS111C02EVM ADS111C04EVM ADS111S02EVM ADS111S04EVM

ADS111C0x and ADS111S0x Evaluation Module

Description

The ADS111C04EVM, ADS111C02EVM, ADS111S04EVM, and ADS111S02EVM evaluation modules (EVM) allows users to evaluate the functionality and performance of the ADS111C04 and ADS111C02 using an Inter-Integrated Circuit (I2C) interface and the ADS111S04 and ADS111S02 using a Serial-Peripheral Interface (SPI). These devices are precision, low-power, 4/8-channel, 16-bit, 4kSPS, Delta-Sigma (ΔΣ) analog to digital converters (ADC) with a high-accuracy temperature sensor and a programmable gain amplifier (PGA).

Get Started

1. Order the ADS111C04EVM, ADS111S04EVM, ADS111C02EVM, or ADS111S02EVM.
2. Download example code from the Precision ADC GitHub.
3. Connect EVM to TI LaunchPad or other controller.
4. Refer to the ADS111C04, ADS111S04, ADS111C02, or ADS111S02 datasheet for device details.
5. Visit the E2E forums for support and questions.

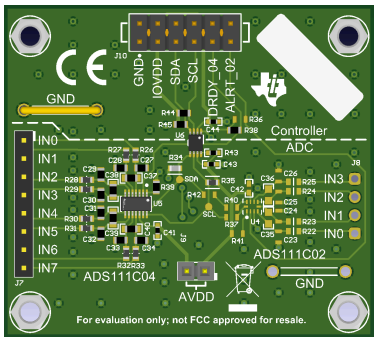
Features

- Wide supply range for VDD (1.74V to 5.5V)
- I2C or SPI for communication and configuration
- Level translator for independent digital logic levels
- Easy connection to TI LaunchPad development kits

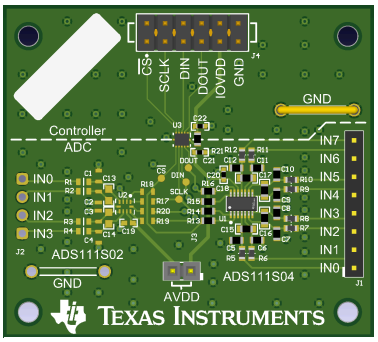
Applications

- Consumer electronics
- Portable instruments
- Leak detection in data centers
- Temperature measurement systems
- Factory automation and process control
- General purpose voltage and current monitoring

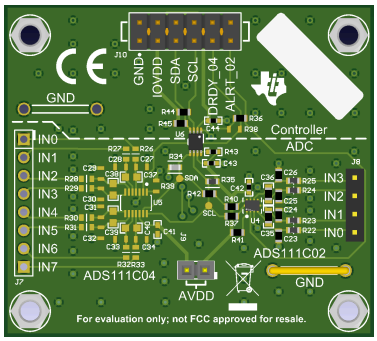
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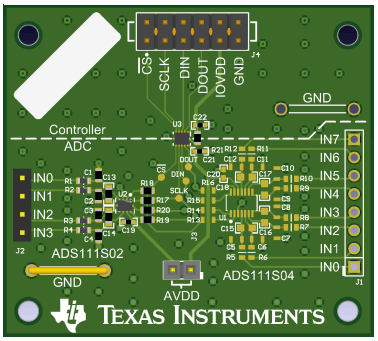
ADS111C04EVM



ADS111S04EVM



ADS111C02EVM



ADS111S02EVM

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1 Evaluation Module Overview

1.1 Introduction

This users guide describes the operation and use of the ADS111C04, ADS111S04, ADS111C02, and ADS111S02 evaluation modules.

Table 1-1. Evaluation Module Overview

PART NUMBER	ANALOG INPUTS	INTERFACE	EVALUATION MODULE	12-BIT DEVICE EQUIVALENT[1]
ADS111C04IDYY	8	I^2C	ADS111C04EVM	ADS101C04IDYY
ADS111S04IDYY	8	SPI	ADS111S04EVM	ADS101S04IDYY
ADS111C02IRUG	4	I^2C	ADS111C02EVM	ADS101C02IRUG
ADS111S02IRUG	4	SPI	ADS111S02EVM	ADS101S02IRUG

1. A 12-bit equivalent device can optionally be installed in place of the default device.

Table 1-1 shows that the devices in the ADS111C04 ADC family have similar characteristics other than the communication interface and channel count. For simplicity, the rest of the document uses the ADS111C04EVM as an example of the behavior and operation of all devices. If applicable, each section describes any differences between the ADS111C04EVM and the other devices shown in Table 1-1.

The ADS111C04EVM is a fully assembled evaluation platform that demonstrates how the ADS111C04 performance and operation enable this ADC to be used in low-power, space-constrained sensing applications. The evaluation module allows flexible control with a TI LaunchPad or any other external controller.

This evaluation module user's guide describes the characteristics and operation of the ADS111C04EVM. This users guide includes complete circuit descriptions, schematic diagrams, and a bill of materials. Throughout this document, the abbreviation EVM and the term evaluation module are synonymous with the ADS111C04EVM.

1.2 Kit Contents

The ADS111C04 evaluation module kit includes the following features:

- The hardware required for diagnostic testing as well as an accurate performance evaluation of the ADS111C04.
- Female-to-female jumper wires to connect the EVM to a TI LaunchPad.
- Example code compatible with the TI LaunchPad using Precision ADC GitHub.

1.3 Specification

Table 1-2 shows specifications that are applicable to the ADS111C04EVM.

Table 1-2. Evaluation Module Specifications

PARAMETER	CONDITIONS	VALUE
Temperature	Recommended operating free-air temperature range, T_A	$15°C \le T_A \le 35°C$
AVDD to GND	Recommended voltage range, external source	$+1.74V \le AVDD \le +5.5V$
IOVDD to GND	Recommended voltage range, external source	$+1.8V \le IOVDD \le +5.5V$
Input Voltage Range	Absolute input voltage versus GND for J1, J2, J7, J8	$GND \le V_{IO} \le AVDD$
Digital Inputs	Digital input levels versus GND for J4 and J9	$GND \le V_{DI} \le IOVDD$

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1.4 Device Information

Table 1-3 describes some important parameters and features for the ADS111C04 ADC family. Refer to device datasheets for complete specifications.

Table 1-3. ADS111C04 Device Family Information

DEVICE SPECIFICATION	VALUE
Operating temperature range	–40°C ≤ T_A ≤ 125°C
VDD to GND supply voltage	1.74V ≤ VDD ≤ 5.5V
Internal temperature sensor accuracy	1°C (Max) Error: –40°C to 125°C
Continuous-conversion mode current consumption	140µA (typical)
Absolute input current	50nA (maximum)

1.5 Getting Started with the ADS111C04EVM

The following steps provide an overview to quickly get the ADS111C04EVM setup and operational. The subsequent sections in this document expand on each step to explain in detail the available features on the ADS111C04EVM. Links below are provided to navigate from this quick start guide to the appropriate section at each step, where applicable:

1. Remove the ADS111C04EVM and female-to-female jumper wire set from the ADS111C04EVM box.
2. Download example code from the Precision ADC GitHub.
3. Connect the female-to-female jumper wires to the TI LaunchPad and to EVM digital pins:
   a. Digital Signal Connections (ADS111C02EVM and ADS111C04EVM)
   b. Digital Signal Connections (ADS111S02EVM and ADS111S04EVM)
4. Connect sensors or signals to the input terminal pins:
   a. Analog Inputs (ADS111C04EVM)
   b. Analog Inputs (ADS111C02EVM)
   c. Analog Inputs (ADS111S04EVM)
   d. Analog Inputs (ADS111S02EVM)
5. Configure internal register values using example code
6. Visit the E2E forums for support and questions.

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2 Hardware

The ADS111C04EVM is designed for easy interfacing with analog sources and the TI LaunchPad controller. This section describes the following topics in detail:

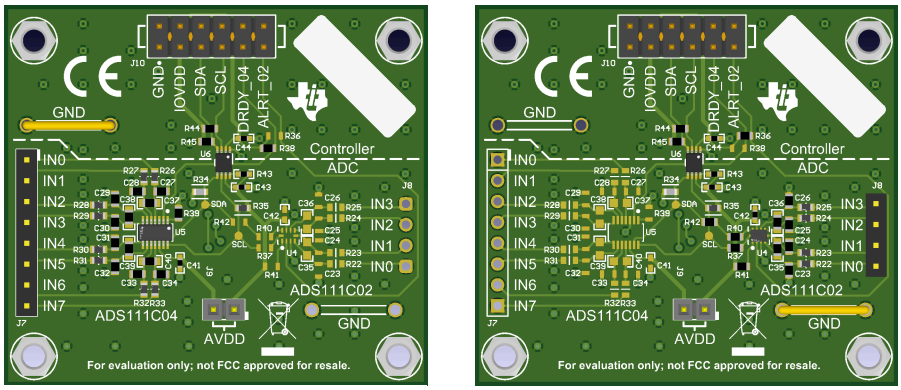
- ADS111C04EVM and ADS111C02EVM
  - Power Supplies (ADS111C02EVM and ADS111C04EVM)
  - Serial Interface (ADS111C02EVM and ADS111C04EVM)
    - Digital Signal Connections (ADS111C02EVM and ADS111C04EVM)
    - Level Translator (ADS111C02EVM and ADS111C04EVM)
  - ADS111C04EVM
    - ADC Connections and Decoupling (ADS111C04EVM)
    - Analog Inputs (ADS111C04EVM)
  - ADS111C02EVM
    - ADC Connections and Decoupling (ADS111C02EVM)
    - Analog Inputs (ADS111C02EVM)
- ADS111S04EVM and ADS111S02EVM
  - Power Supplies (ADS111S02EVM and ADS111S04EVM)
  - Serial Interface (ADS111S02EVM and ADS111S04EVM)
    - Digital Signal Connections (ADS111S02EVM and ADS111S04EVM)
    - Level Translator (ADS111S02EVM and ADS111S04EVM)
  - ADS111S04EVM
    - ADC Connections and Decoupling (ADS111S04EVM)
    - Analog Inputs (ADS111S04EVM)
  - ADS111S02EVM
    - ADC Connections and Decoupling (ADS111S02EVM)
    - Analog Inputs (ADS111S02EVM)

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2.1 ADS111C04EVM and ADS111C02EVM

Figure 2-1 shows both the ADS111C04EVM and ADS111C02EVM. The following section describes the board hardware specific to the ADS111C04EVM and ADS111C02EVMs.



ADS111C04EVM ADS111C02EVM

Figure 2-1. ADS111C04EVM and ADS111C02EVM

2.1.1 Power Supplies (ADS111C02EVM and ADS111C04EVM)

The EVM supports a wide ADC supply voltage range from 1.74V to 5.5V on the ADC_VDD pin. Use the analog power header (J9) to directly connect the ADC to a power supply or a TI LaunchPad.

The EVM also includes an IO_VDD rail to power the onboard level translator. Pins 3 and 4 on header J10 enable independent control of the digital communication voltage levels so the ADC can operate at a higher supply voltage while digital communication runs at a lower voltage level. This decoupling of the analog and digital supply voltages provides added flexibility when integrating the EVM into systems with varying power requirements.

Figure 2-2 shows both the EVM ADC_VDD and IO_VDD power pins.

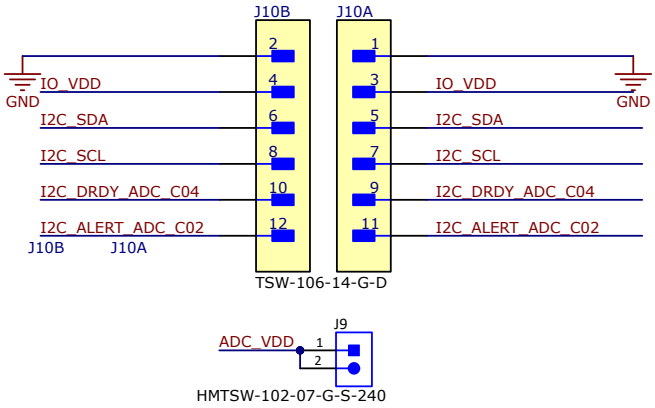


Figure 2-2. EVM Power Supply Connections

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2.1.2 Serial Interface (ADS111C02EVM and ADS111C04EVM)

The EVM uses an I²C-compatible interface for serial communication. Each target device on an I²C bus must have a unique address. The EVM uses address 0x48h to communicate with the ADS111C04 and address 0x49h to communicate with the ADS111C02. Communication on the I²C bus always takes place between two devices: one acting as the controller and the other as the target. Both the controller and target can receive and transmit data, but the target can only read or write under the direction of the controller. The EVM always acts as the I²C target devices.

2.1.2.1 Digital Signal Connections (ADS111C02EVM and ADS111C04EVM)

Figure 2-3 shows the EVM digital signal connectors header J10. Use these headers to connect the I2C signals from the ADC to the external controller. The user can also connect a logic analyzer to header J10 for easy digital debugging.

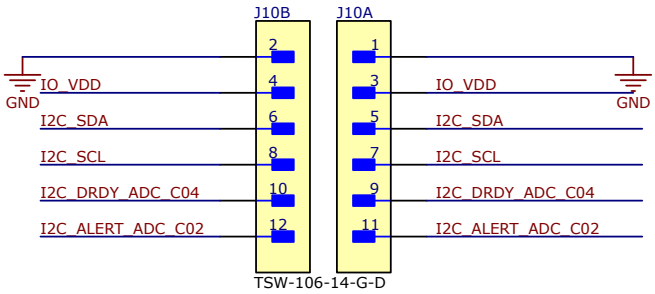


Figure 2-3. Digital Signal Connections (ADS111C04EVM and ADS111C02EVM)

2.1.2.2 Level Translator (ADS111C02EVM and ADS111C04EVM)

Figure 2-4 shows the Texas Instruments PCA9306, a 2-bit bidirectional 400kHz I²C voltage-level translator. The EVM uses the PCA9306 to translate voltage levels between the controller and the ADC. This translation decouples the ADC supply voltage from the controller I/O voltage so the user can power the EVM to enable higher input voltage measurements. For example, the user can set the ADC_VDD to 5V to measure larger signals while keeping the communication voltage (IO_VDD) at 3.3V.

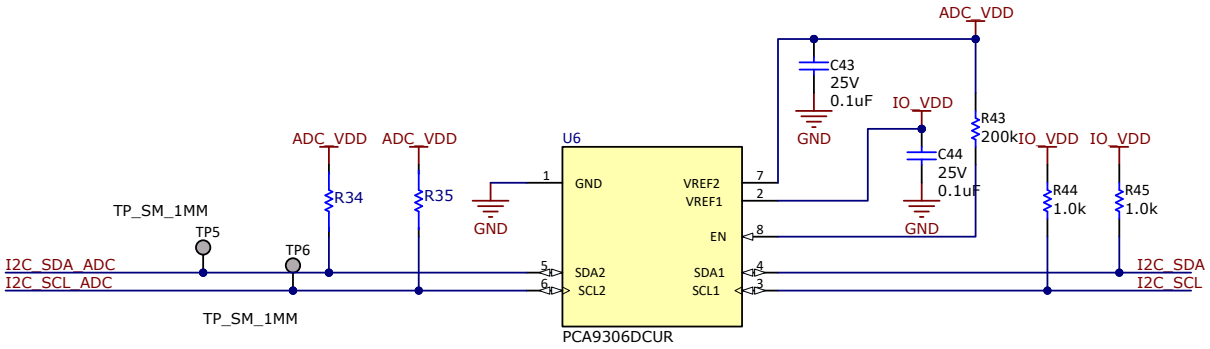


Figure 2-4. EVM Level Translator (PCA9306)

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2.1.3 ADS111C04EVM

The following section describes unique ADS111C04EVM features as shown in Figure 2-5

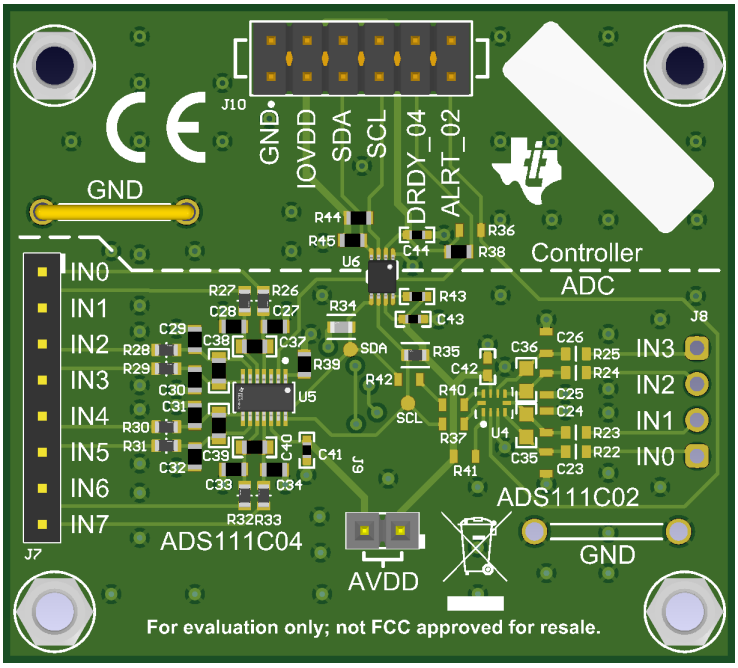


Figure 2-5. ADS111C04EVM

2.1.3.1 ADC Connections and Decoupling (ADS111C04EVM)

Figure 2-6 shows the connections to the ADS111C04 data converter (U5). The device includes a 0.1µF decoupling capacitor placed as close as possible to the ADC VDD pin (ADC_VDD net). This capacitor provides bulk charge to support transient current demand during ADC operation.

$\overline{\text{DRDY}}$ is a dedicated conversion-ready, open-drain output pin pulled up to VDD with a 10kΩ resistor. ADDR is connected to GND such that ADS111C04 device uses an I^2C address of 0x48h

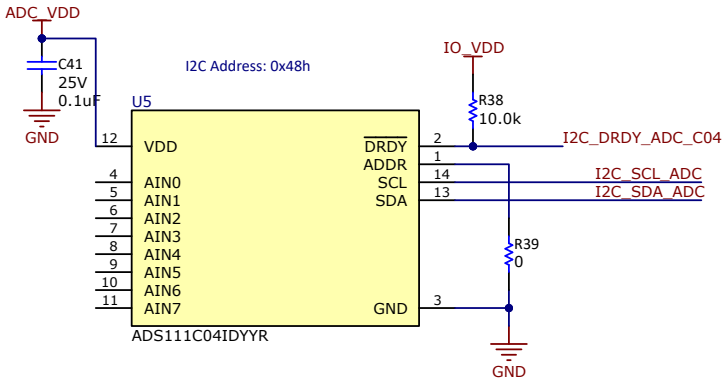


Figure 2-6. ADC Connections and Decoupling (ADS111C04EVM)

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2.1.3.2 Analog Inputs (ADS111C04EVM)

Figure 2-7 shows the analog input header J7. The analog inputs include first-order resistor-capacitor filters that limit aliasing and noise effects. The differential pairs include an additional common-mode capacitor that filters common-mode noise.

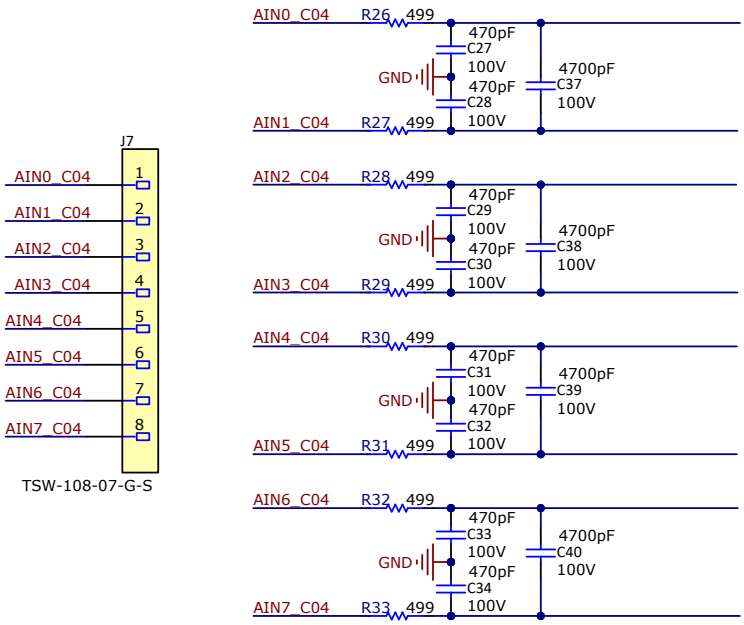


Figure 2-7. Analog Inputs (ADS111C04EVM)

Equation 1 shows the calculation for the differential cut-off frequency. Equation 2 shows the calculation for the common-mode cut-off frequency.

$$f_{c_{diff}} = 1/[2\ \pi\ \times (R1 + R2) \times C_{diff}] = 1/[2\ \pi\ \times (499 + 499) \times 4700pF] \cong 34kHz \quad (1)$$

$$f_{c_{cm}} = 1/[2\ \pi\ \times R \times C_{cm}] = 1/[2\ \pi\ \times 499 \times 470pF] \cong 680kHz \quad (2)$$

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2.1.4 ADS111C02EVM

The following section describes unique ADS111C02EVM features as shown in Figure 2-8

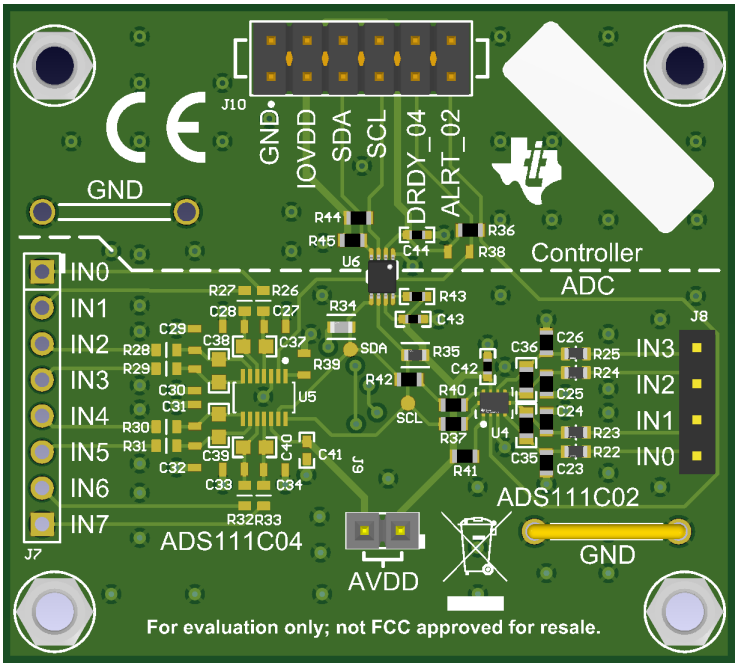


Figure 2-8. ADS111C02EVM

2.1.4.1 ADC Connections and Decoupling (ADS111C02EVM)

Figure 2-9 shows the connections to the ADS111C02 data converter (U4). The device includes a 0.1µF decoupling capacitor placed as close as possible to the ADC VDD pin (ADC_VDD net). This capacitor provides bulk charge to support transient current demand during ADC operation.

ALERT/RDY is an open-drain output pulled up to VDD with a 10kΩ resistor. ADDR is connected to VDD such that the ADS111C02 uses an I^2C address of 0x49h.

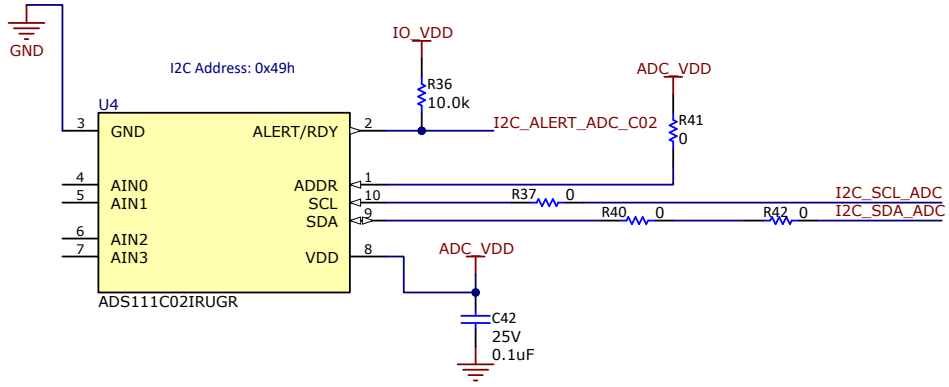


Figure 2-9. ADC Connections and Decoupling (ADS111C02EVM)

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2.1.4.2 Analog Inputs (ADS111C02EVM)

Figure 2-10 shows the analog input header J8. The analog inputs include first-order resistor-capacitor filters that limit aliasing and noise effects. The differential pairs include an additional common-mode capacitor that filters common-mode noise.

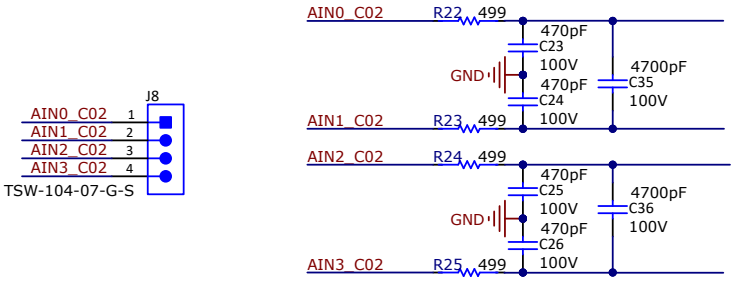


Figure 2-10. Analog Inputs (ADS111C02EVM)

Equation 3 shows the calculation for the differential cut-off frequency. Equation 4 shows the calculation for the common-mode cut-off frequency.

$$f_{c_{diff}} = 1/[2\ \pi\ \times (R1 + R2) \times C_{diff}] = 1/[2\ \pi\ \times (499 + 499) \times 4700pF] \cong 34kHz \quad (3)$$

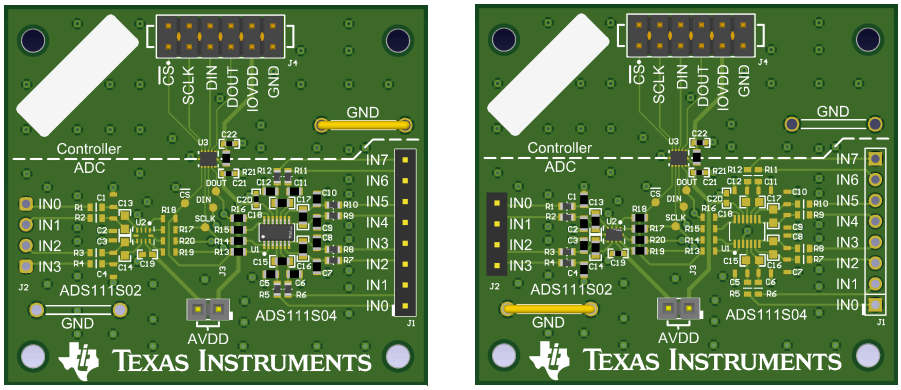
$$f_{c_{cm}} = 1/[2\ \pi\ \times R \times C_{cm}] = 1/[2\ \pi\ \times 499 \times 470pF] \cong 680kHz \quad (4)$$

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2.2 ADS111S04EVM and ADS111S02EVM

Figure 2-11 shows both the ADS111S04EVM and ADS111S02EVM. The following section describes the board hardware specific to the ADS111S04EVM and ADS111S02EVMs.



ADS111S04EVM ADS111S02EVM

Figure 2-11. ADS111S04EVM and ADS111S02EVM

2.2.1 Power Supplies (ADS111S02EVM and ADS111S04EVM)

The EVM supports a wide ADC supply voltage range from 1.74V to 5.5V on the ADC_VDD pin. Use the analog power header (J3) to directly connect the ADC to a power supply or a TI LaunchPad.

The EVM also includes an IO_VDD rail to power the onboard level translator. Pins 3 and 4 on header J4 enable independent control of the digital communication voltage levels so the ADC can operate at a higher supply voltage while digital communication runs at a lower voltage level. This decoupling of the analog and digital supply voltages provides added flexibility when integrating the EVM into systems with varying power requirements.

Figure 2-12 shows both the EVM ADC_VDD and IO_VDD power pins.

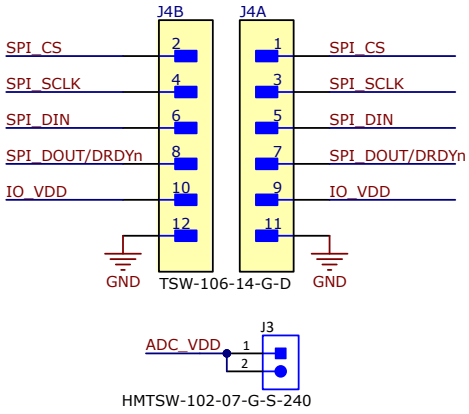


Figure 2-12. EVM Power Supply Connections

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2.2.2 Serial Interface (ADS111S02EVM and ADS111S04EVM)

The EVM uses serial peripheral interface (SPI) for serial communication. The serial interface is used to read conversion data, configure device registers, and control ADC conversions. The serial interface consists of four signals: $\overline{CS}$, SCLK, DIN, and DOUT/$\overline{DRDY}$. $\overline{CS}$ can be tied low to operate the interface in 3-wire SPI mode. The host always drives SCLK and the EVM always acts as the peripheral. The interface only supports the SPI mode where SCLK idles low data updates on SCLK rising edges, and data latches on SCLK falling edges (CPOL = 0 and CPHA = 1). The interface supports full-duplex operation such that input data and output data can be transmitted simultaneously.

2.2.2.1 Digital Signal Connections (ADS111S02EVM and ADS111S04EVM)

Figure 2-13 shows the EVM digital signal connectors header J4. Use these headers to connect the SPI signals from the ADC to the external controller. The user can also connect a logic analyzer to header J4 for easy digital debugging.

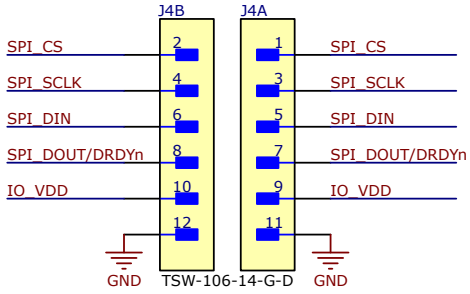


Figure 2-13. Digital Signal Connections (ADS111S02EVM and ADS111S04EVM)

2.2.2.2 Level Translator (ADS111S02EVM and ADS111S04EVM)

Figure 2-14 shows the Texas Instruments TXB0104, a 4-bit bidirectional voltage-level shifter with auto direction sensing. The EVM uses the TXB0104 to translate voltage levels between the controller and the ADC. This translation decouples the ADC supply voltage from the controller I/O voltage so the user can power the EVM to enable higher input voltage measurements. For example, the user can set the ADC_VDD to 5V to measure larger signals while keeping the communication voltage (IO_VDD) at 3.3V

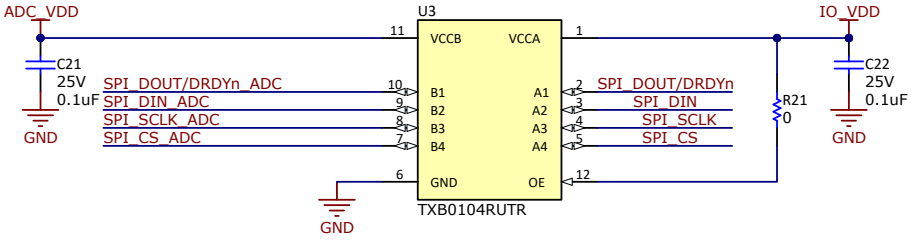


Figure 2-14. EVM Level Translator (TXB0104)

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2.2.3 ADS111S04EVM

The following section describes unique ADS111S04EVM features as shown in Figure 2-15

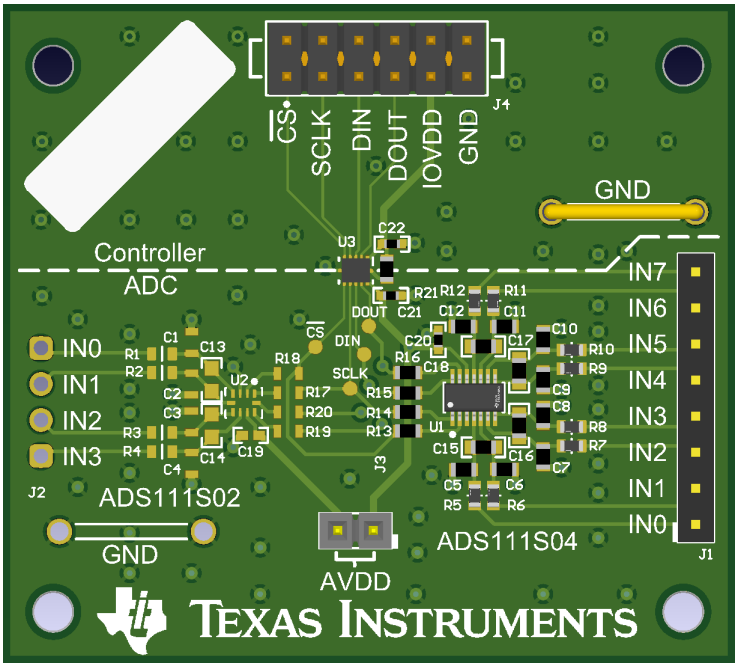


Figure 2-15. ADS111S04EVM

2.2.3.1 ADC Connections and Decoupling (ADS111S04EVM)

Figure 2-16 shows the connections to the ADS111S04 data converter (U1). The device includes a 0.1µF decoupling capacitor placed as close as possible to the ADC VDD pin (ADC_VDD net). This capacitor provides bulk charge to support transient current demand during ADC operation.

Each digital pin includes a 47Ω series resistor. These resistors smooth digital signal edges to minimize overshoot and ringing.

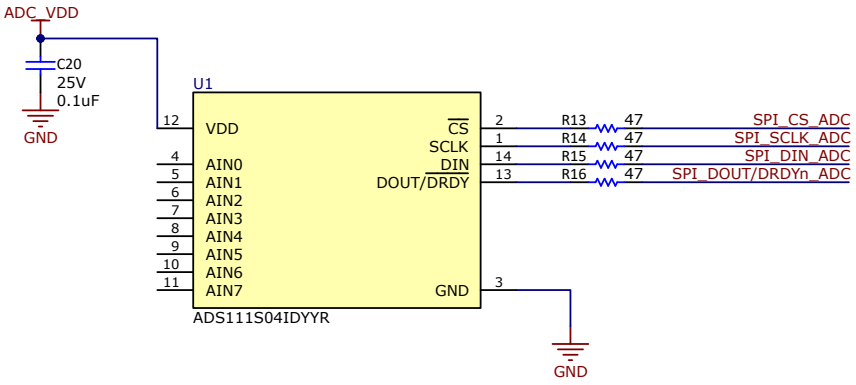


Figure 2-16. ADC Connections and Decoupling (ADS111S04EVM)

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2.2.3.2 Analog Inputs (ADS111S04EVM)

Figure 2-17 shows the analog input header J1. The analog inputs include first-order resistor-capacitor filters that limit aliasing and noise effects. The differential pairs include an additional common-mode capacitor that filters common-mode noise.

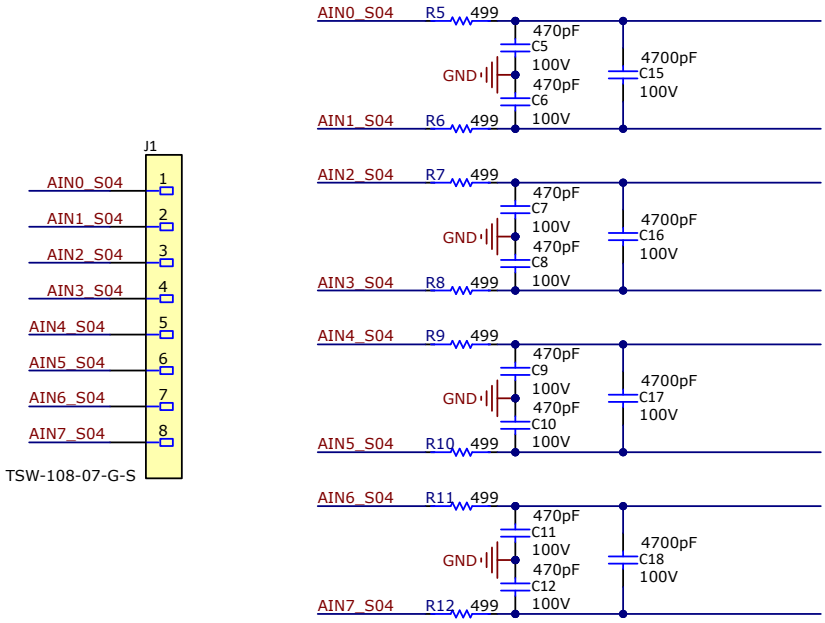


Figure 2-17. Analog Inputs (ADS111S04EVM)

Equation 5 shows the calculation for the differential cut-off frequency. Equation 6 shows the calculation for the common-mode cut-off frequency.

$$f_{c_{diff}} = 1/[2\ \pi\ \times (R1 + R2) \times C_{diff}] = 1/[2\ \pi\ \times (499 + 499) \times 4700pF] \cong 34kHz \quad (5)$$

$$f_{c_{cm}} = 1/[2\ \pi\ \times R \times C_{cm}] = 1/[2\ \pi\ \times 499 \times 470pF] \cong 680kHz \quad (6)$$

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2.2.4 ADS111S02EVM

The following section describes unique ADS111S02EVM features as shown in Figure 2-18

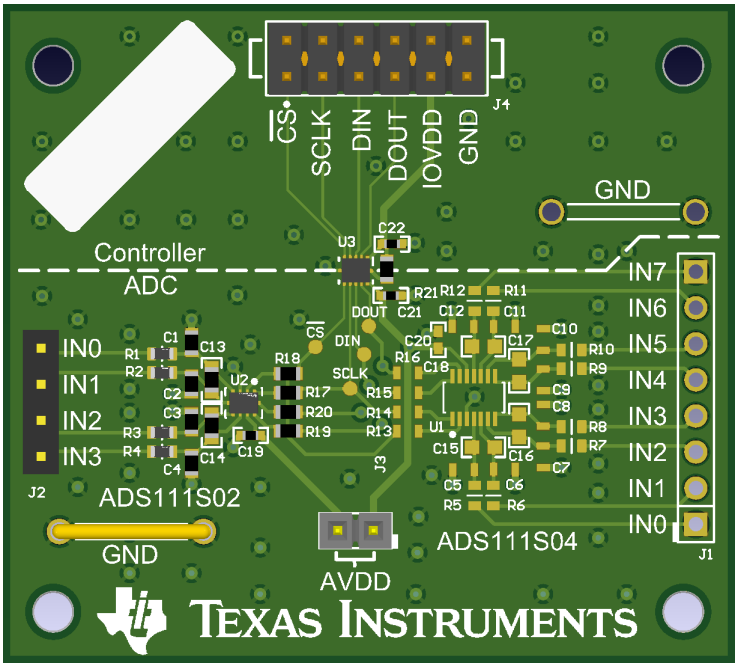


Figure 2-18. ADS111S02EVM

2.2.4.1 ADC Connections and Decoupling (ADS111S02EVM)

Figure 2-19 shows the connections to the ADS111S02 data converter (U2). The device includes a 0.1µF decoupling capacitor placed as close as possible to the ADC VDD pin (ADC_VDD net). This capacitor provides bulk charge to support transient current demand during ADC operation.

Each digital pin includes a 47Ω series resistor. These resistors smooth digital signal edges to minimize overshoot and ringing.

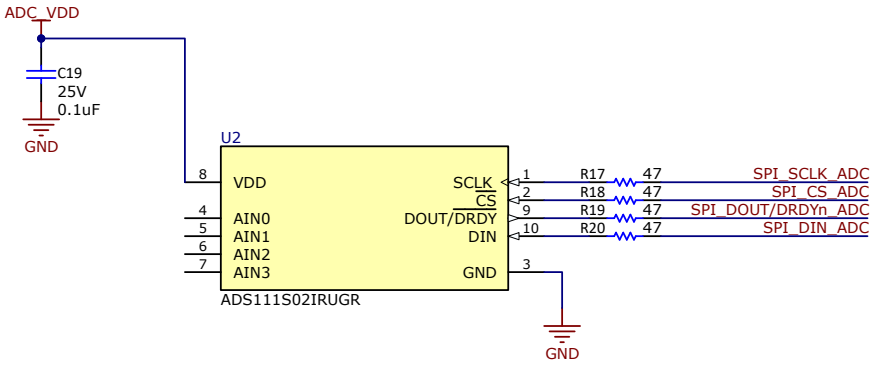


Figure 2-19. ADC Connections and Decoupling (ADS111S02EVM)

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2.2.4.2 Analog Inputs (ADS111S02EVM)

Figure 2-20 shows the analog input header J2. The analog inputs include first-order resistor-capacitor filters that limit aliasing and noise effects. The differential pairs include an additional common-mode capacitor that filters common-mode noise.

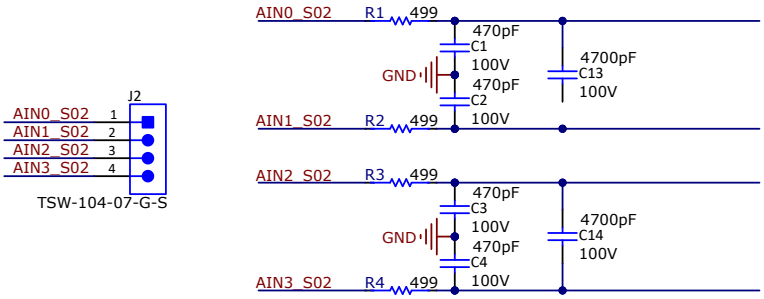


Figure 2-20. Analog Inputs (ADS111S02EVM)

Equation 7 shows the calculation for the differential cut-off frequency. Equation 8 shows the calculation for the common-mode cut-off frequency.

$$f_{c_{diff}} = 1/[2\,\pi\,\times(R1 + R2)\times C_{diff}] = 1/[2\,\pi\,\times(499 + 499)\times 4700pF] \cong 34kHz \quad (7)$$

$$f_{c_{cm}} = 1/[2\,\pi\,\times R\times C_{cm}] = 1/[2\,\pi\,\times 499\times 470pF] \cong 680kHz \quad (8)$$

3 Software

3.1 Software Description

Load the ADS111C04, ADS111C02, ADS111S04, or ADS111S02 firmware example to the external controller to get started quickly with the EVM. Refer to the Precision ADC GitHub page for more information. Example programs, functions, and files are available for each of the devices in the ADS111C04EVM family.

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4 Hardware Design Files

4.1 Schematics (ADS111C04EVM)

Figure 4-1 and Figure 4-2 show the ADS111C04EVM schematic.

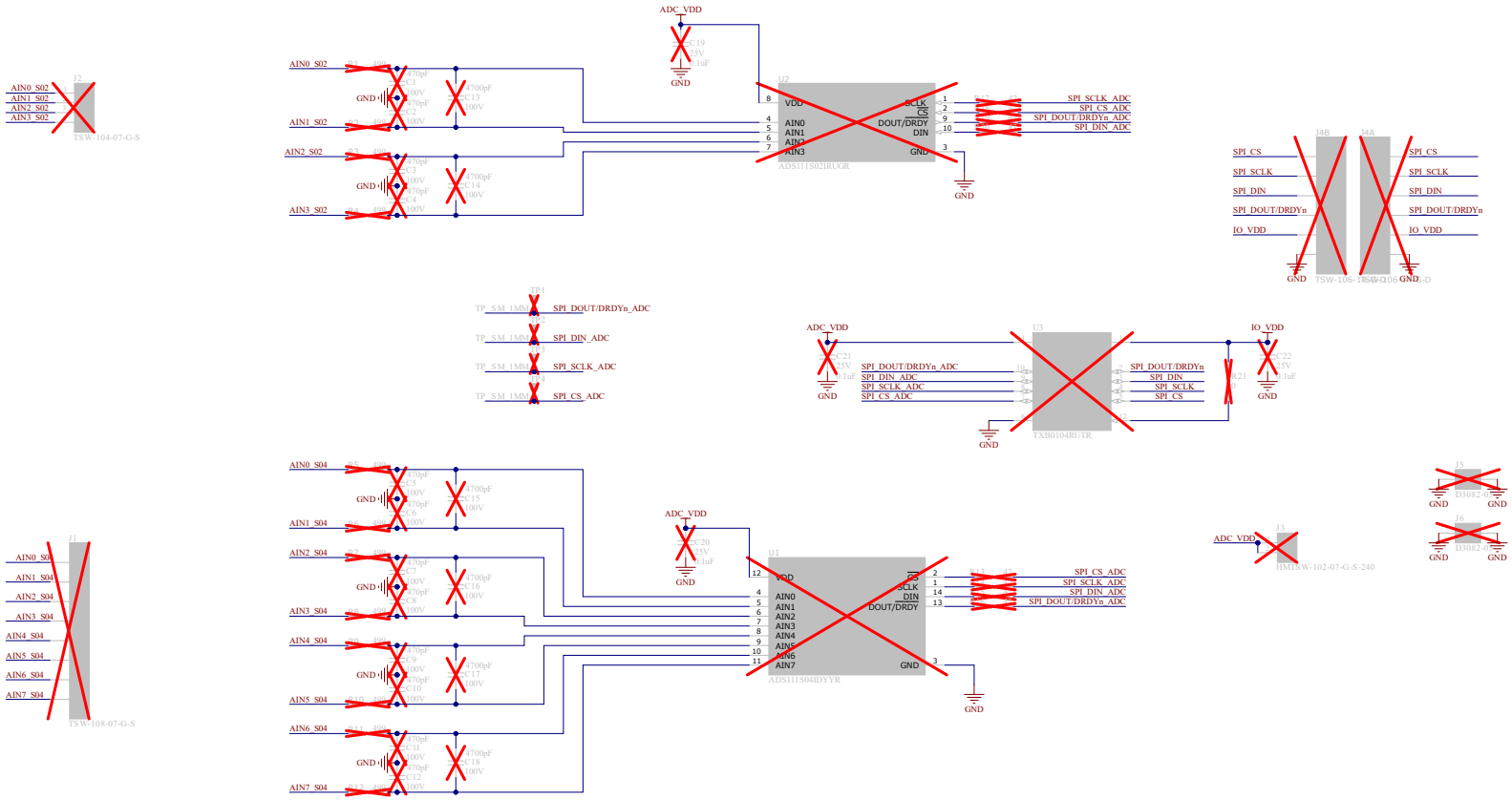


Figure 4-1. ADS111C04EVM (Top Side)

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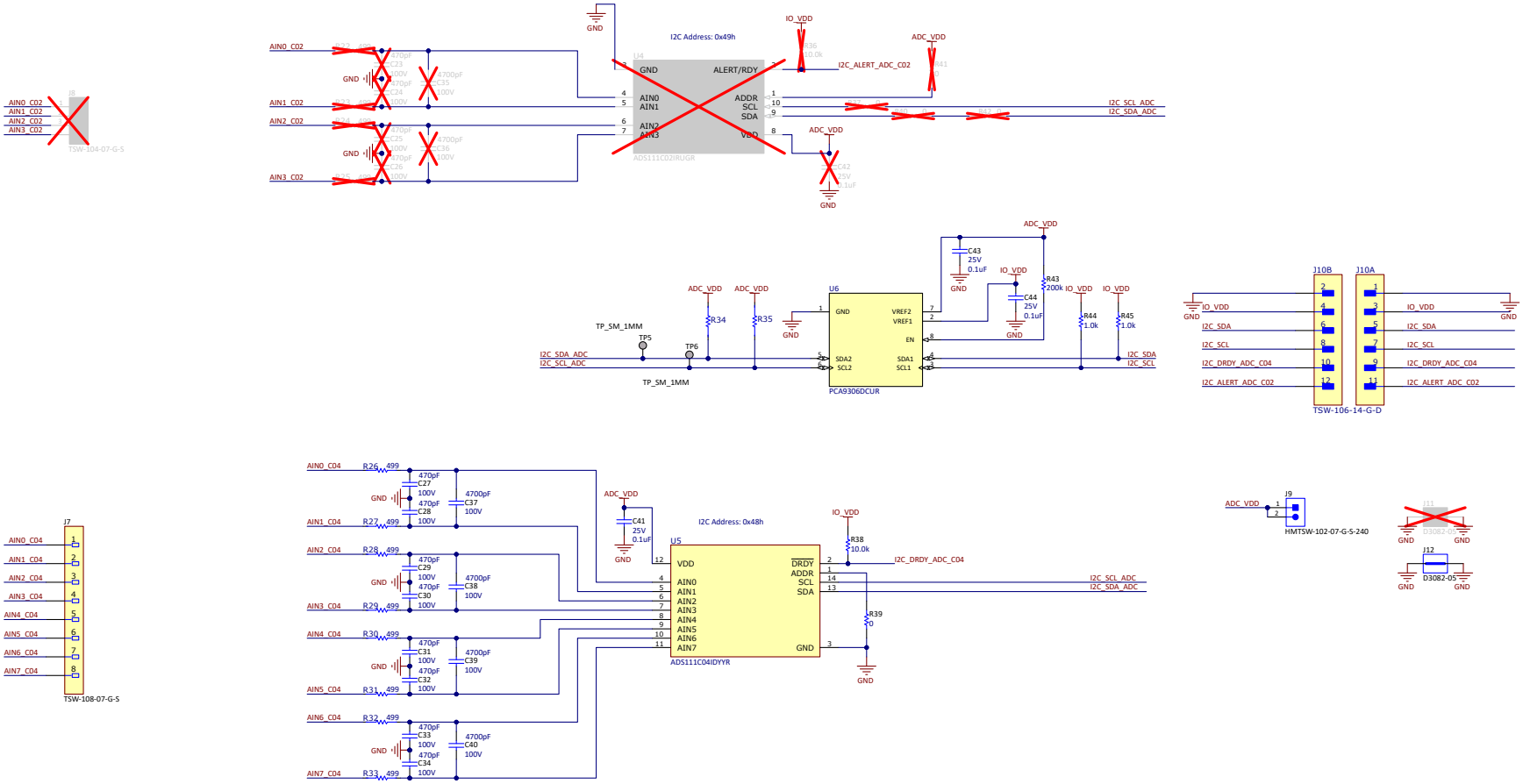


Figure 4-2. ADS111C04EVM (Bottom Side)

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4.2 Schematics (ADS111C02EVM)

Figure 4-3 and Figure 4-4 show the ADS111C02EVM schematic.

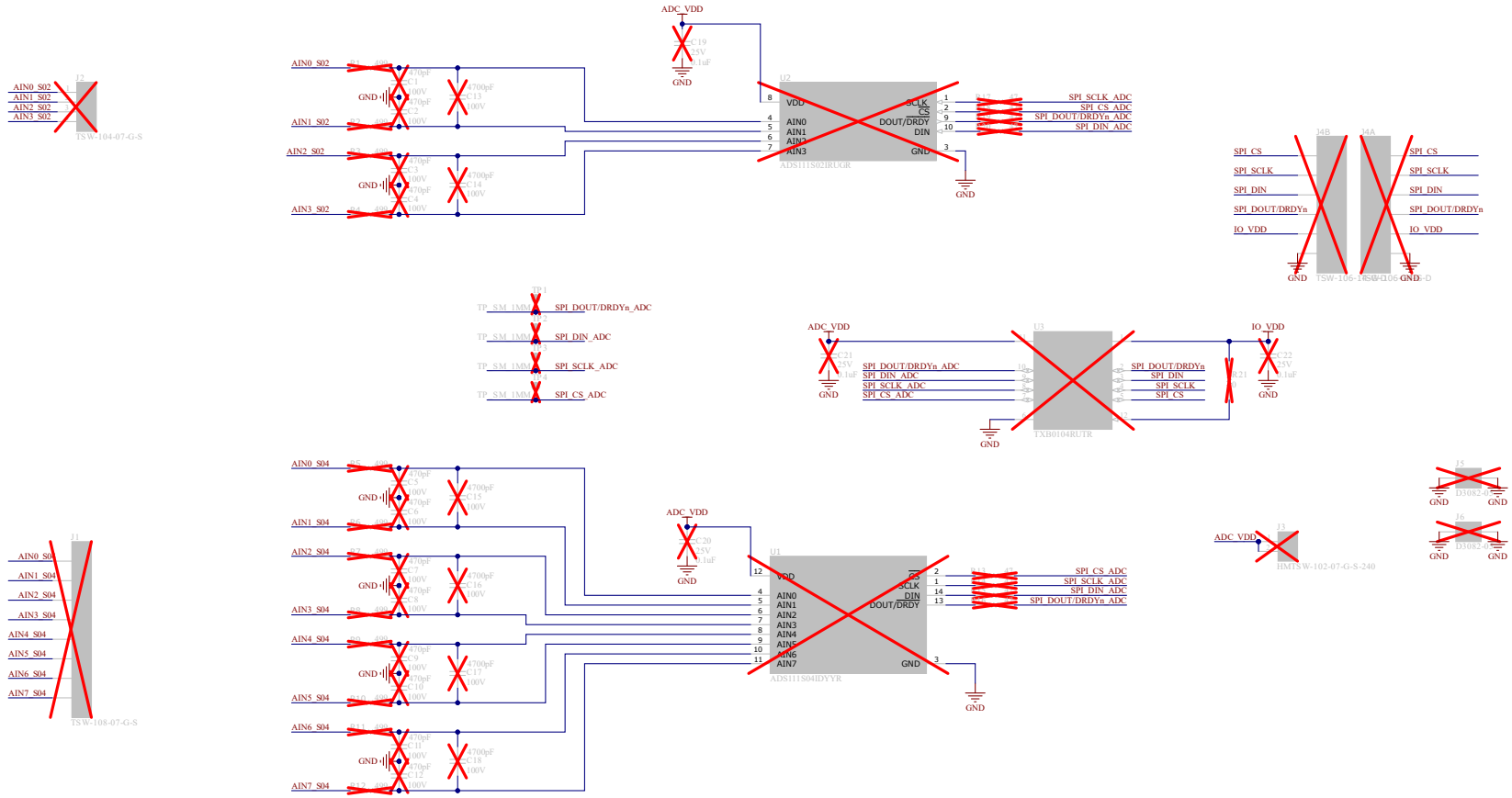


Figure 4-3. ADS111C02EVM (Top Side)

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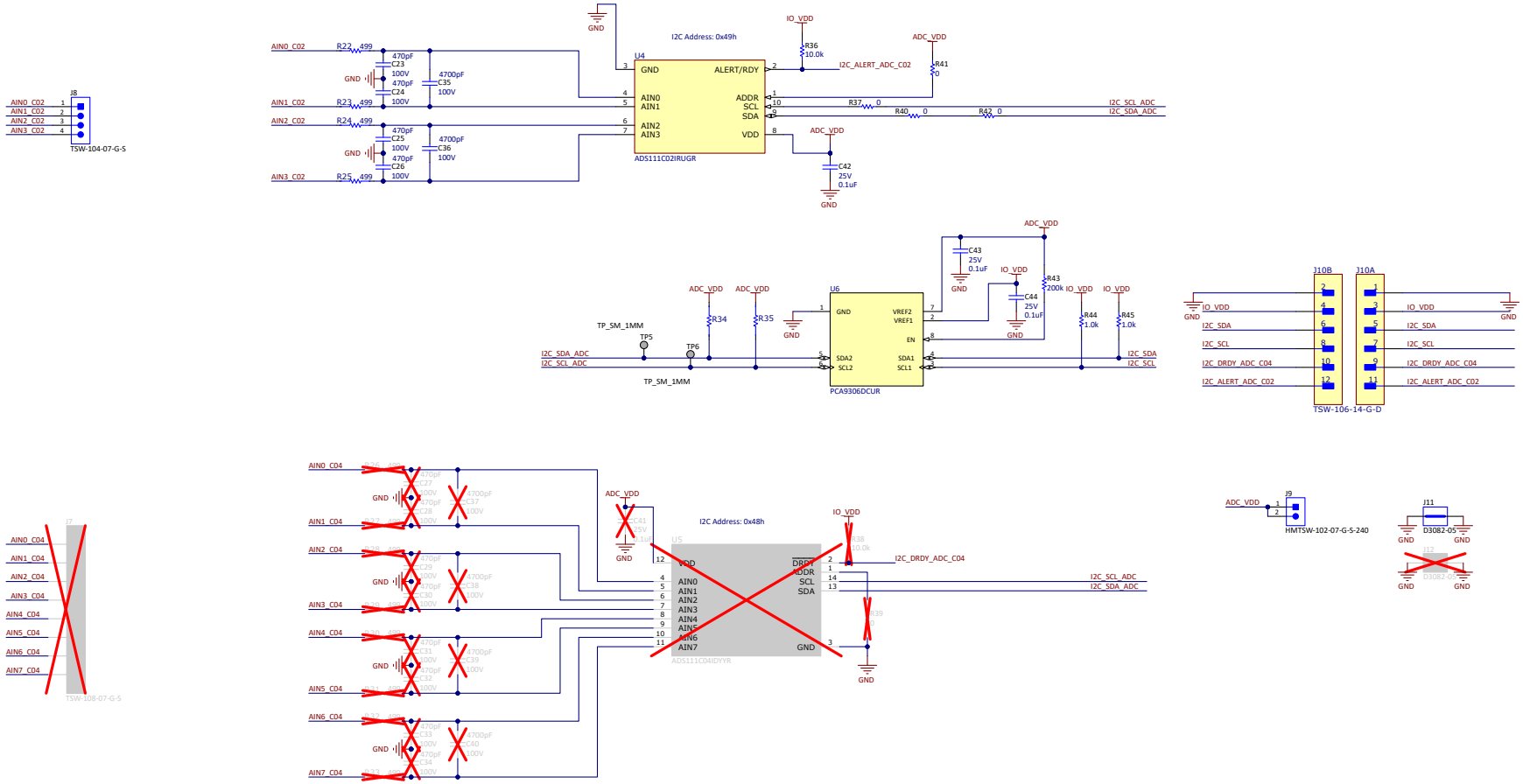


Figure 4-4. ADS111C02EVM (Bottom Side)

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4.3 Schematics (ADS111S04EVM)

Figure 4-5 and Figure 4-6 show the ADS111S04EVM schematic.

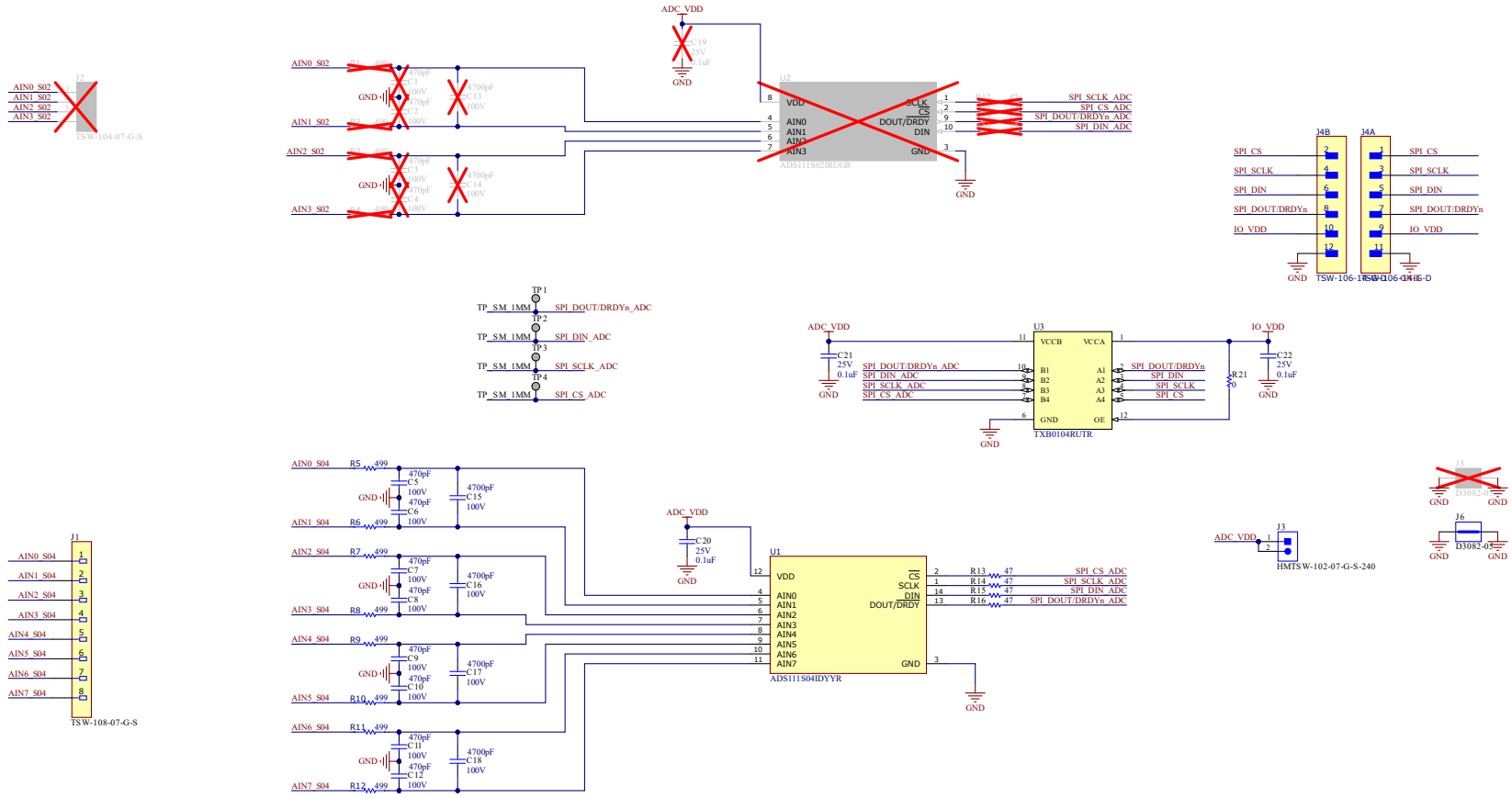


Figure 4-5. ADS111S04EVM (Top Side)

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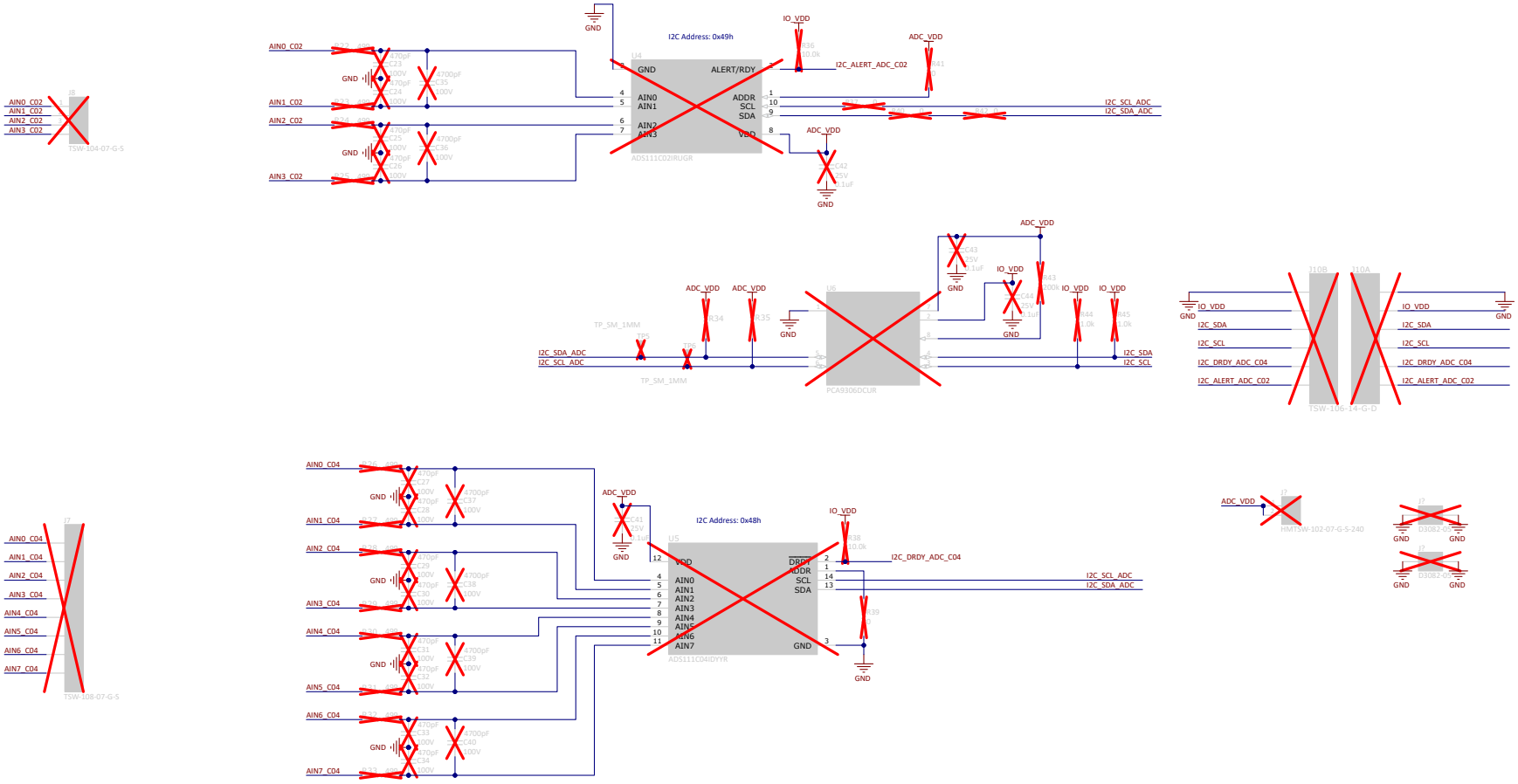


Figure 4-6. ADS111S04EVM (Bottom Side)

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4.4 Schematics (ADS111S02EVM)

Figure 4-7 and Figure 4-8 show the ADS111S02EVM schematic.

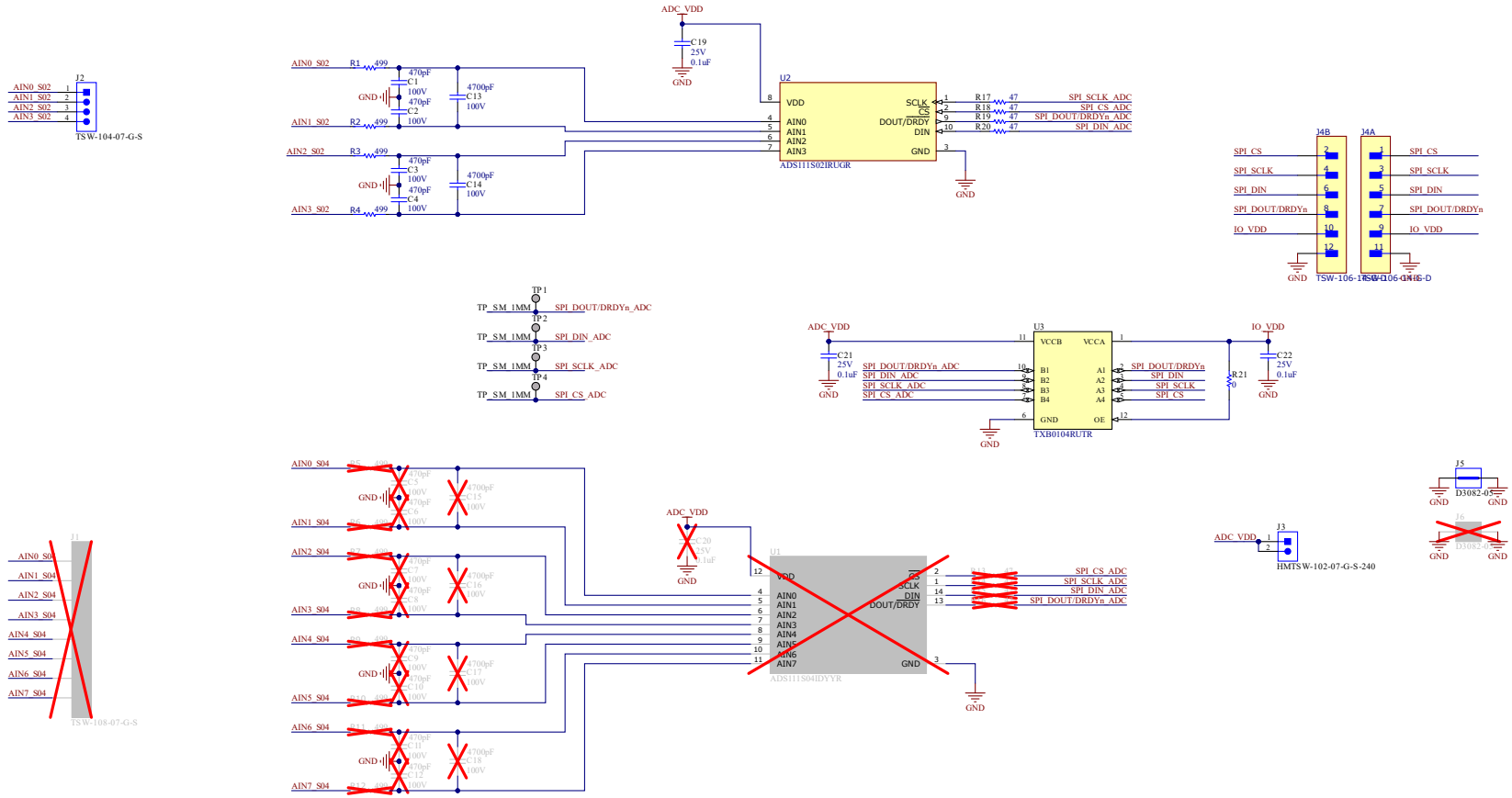


Figure 4-7. ADS111S02EVM (Top Side)

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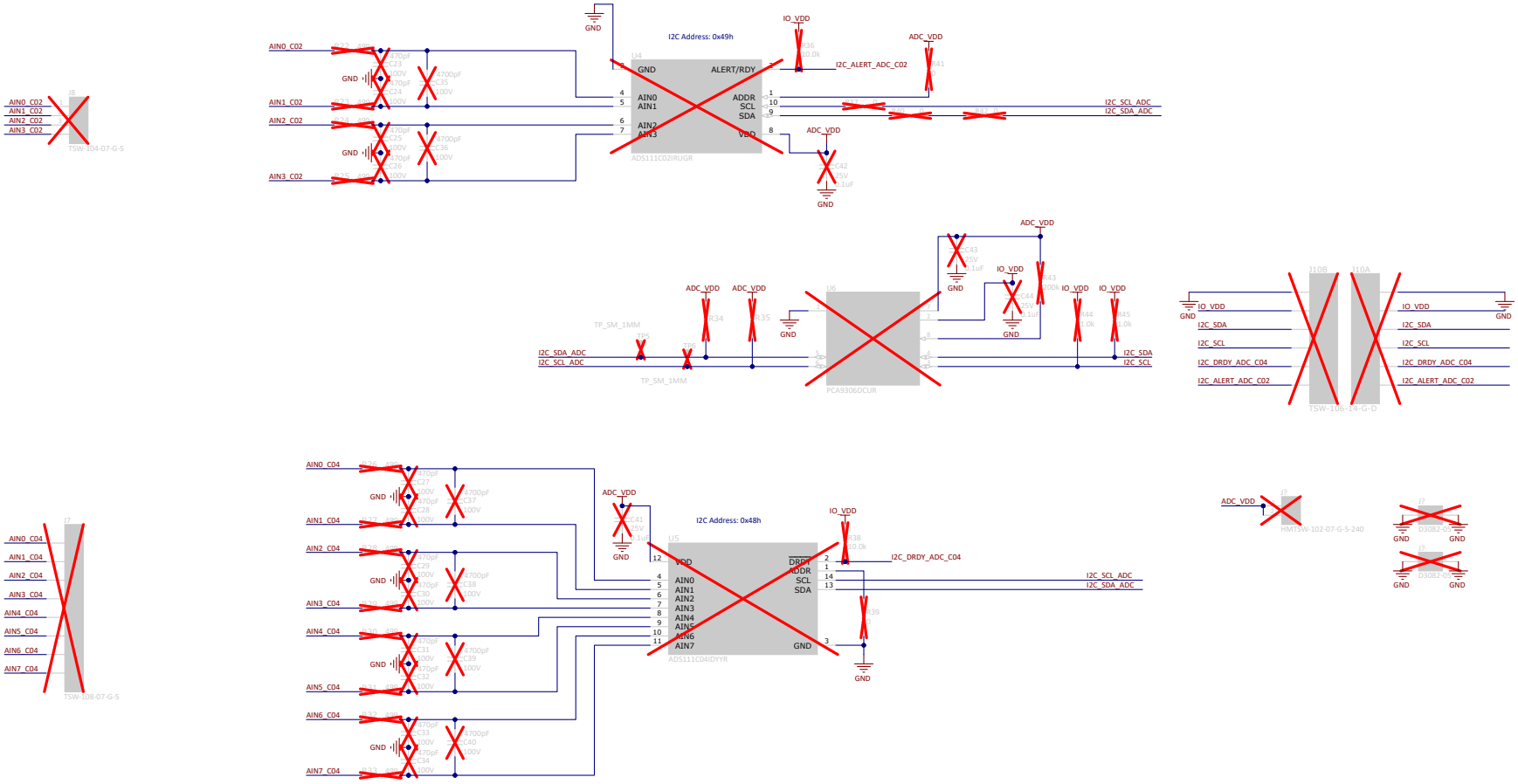


Figure 4-8. ADS111S02EVM (Bottom Side)

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4.5 Schematics (EVM Hardware)

Figure 4-9 shows the hardware for the EVM.

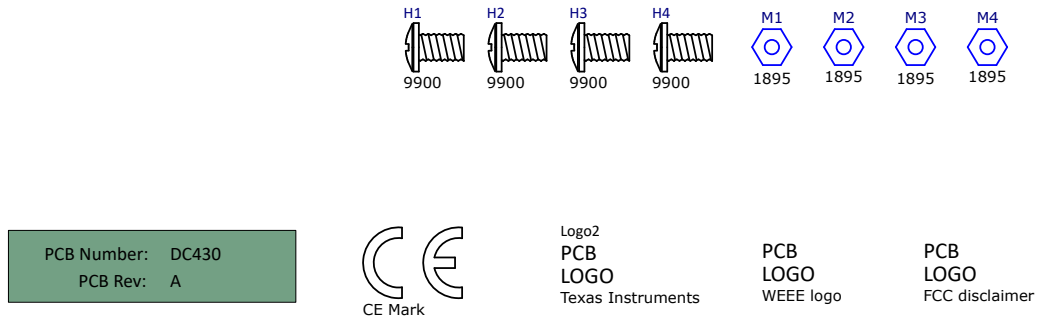


Figure 4-9. EVM Hardware Schematic

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4.6 PCB Layouts

Figure 4-10 through Figure 4-13 show the ADS111C04EVM PCB layout.

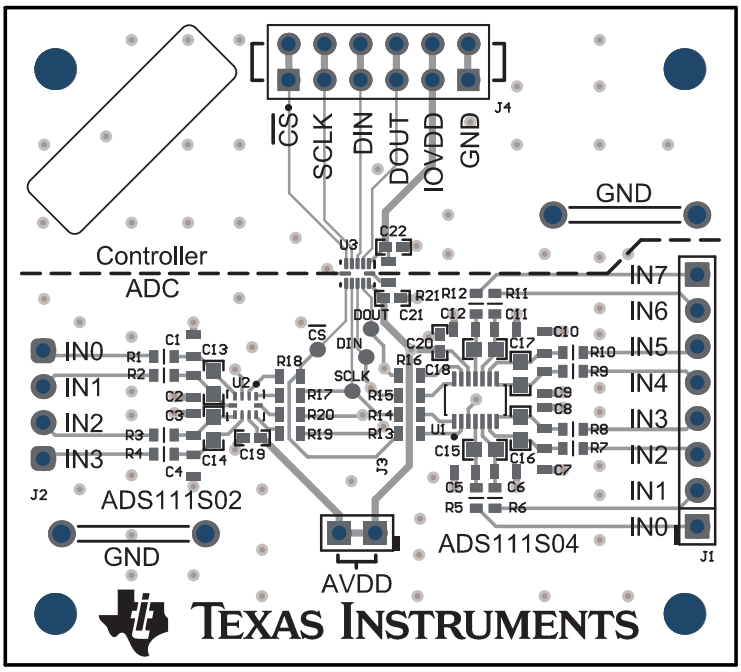


Figure 4-10. Top Layer

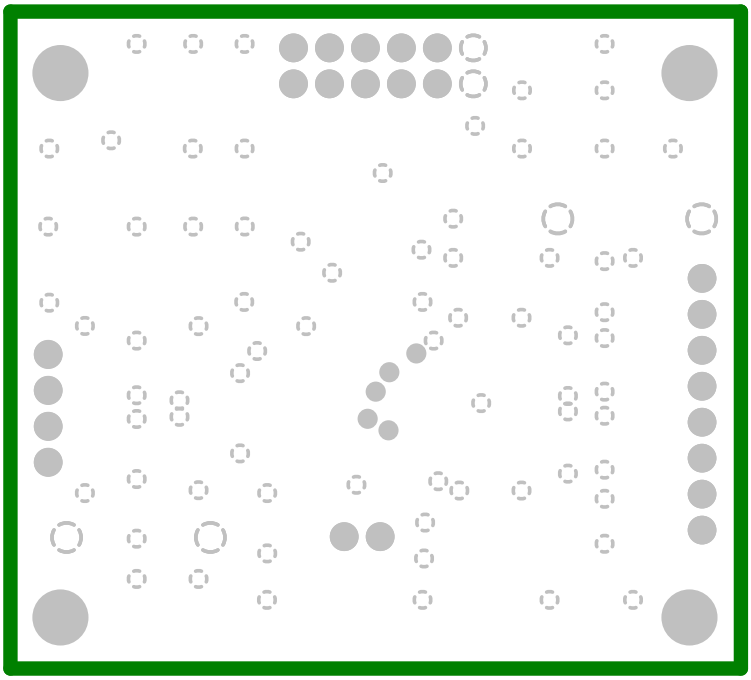


Figure 4-11. Ground Layer 1

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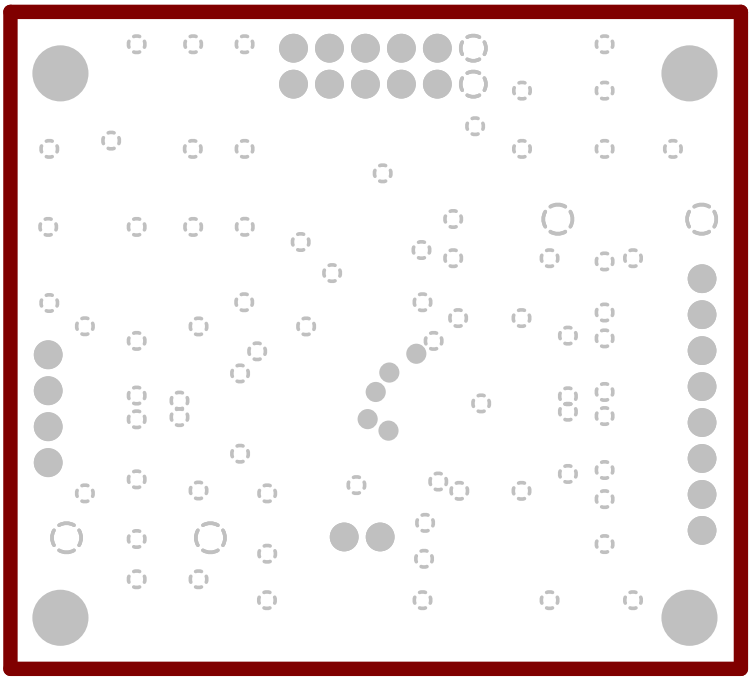


Figure 4-12. Ground Layer 2

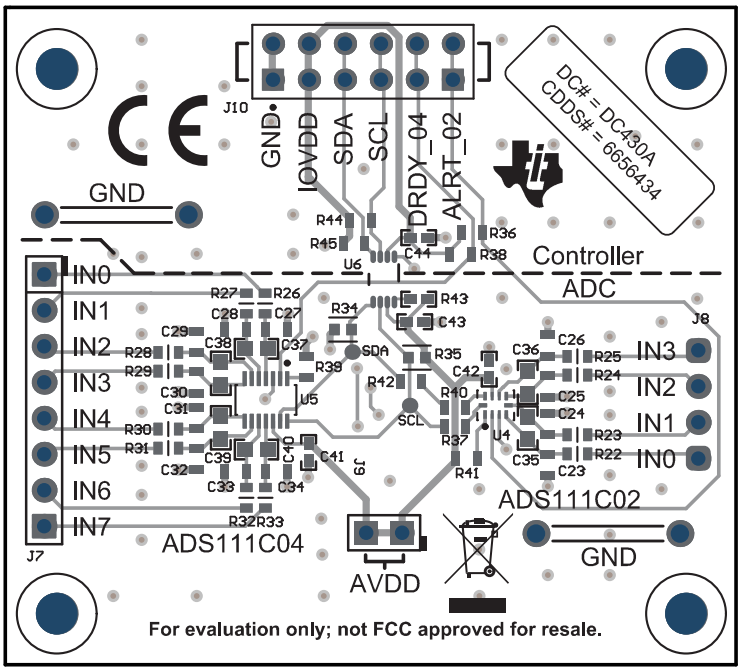


Figure 4-13. Bottom Layer

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4.7 Bill of Materials (BOM)

Table 4-1 lists the ADS111C04EVM bill of materials (BOM)

Table 4-1. ADS111C04EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		DC430	Any
C27, C28, C29, C30, C31, C32, C33, C34	8	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	GRM1885C2A471JA01D	MuRata
C37, C38, C39, C40	4	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C41, C43, C44	3	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	C1005X7R1E104M050BB	TDK
H1, H2, H3, H4	4		MACHINE SCREW PAN PHILLIPS 4-40		9900	Keystone
J7	1		Header, 100mil, 8x1, Gold, TH	8x1 Header	TSW-108-07G-S	Samtec
J9	1		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J10	1		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
J12	1		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
LBL2	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
M1, M2, M3, M4	4		Hex Standoff Threaded #4-40 Aluminum 0.750" (19.05mm) 3/4"	HEX_STANDOFF_4-40	1895	Keystone
R26, R27, R28, R29, R30, R31, R32, R33	8	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R34, R35	2	1k	1 kOhms ±0.01% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	RNCF0603TKW1K00	Stackpole Electronics
R38	1	10.0k	RES, 10.0k, 1%, 0.1W, 0603	0603	RCG060310K0FKEA	Vishay Draloric
R39	1	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R43	1	200k	RES, 200k, 1%, 0.1W, 0402	0402	ERJ-2RKF2003X	Panasonic
R44, R45	2	1.0k	RES, 1.0k, 5%, 0.1W, 0603	0603	RC0603JR-071KL	Yageo
U5	1		ADS111C04IDYYR	SOT-23-THIN14	ADS111C04IDYYR	Texas Instruments
U6	1		2-Bit Bidirectional I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	PCA9306DCUR	Texas Instruments

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Table 4-1. ADS111C04EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C23, C24, C25, C26	0	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	GRM1885C2A471JA01D	MuRata
C13, C14, C15, C16, C17, C18, C35, C36	0	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C19, C20, C21, C22, C42	0	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	C1005X7R1E104M050BB	TDK
J1	0		Header, 100mil, 8x1, Gold, TH	8x1 Header	TSW-108-07G-S	Samtec
J2, J8	0		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07G-S	Samtec
J3	0		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J4	0		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
J5, J6, J11	0		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
LBL1	0		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R22, R23, R24, R25	0	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R13, R14, R15, R16, R17, R18, R19, R20	0	47	RES, 47, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ470V	Panasonic
R21, R37, R40, R41, R42	0	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R36	0	10.0k	RES, 10.0k, 1%, 0.1W, 0603	0603	RCG060310K0FKEA	Vishay Draloric
U1	0		ADS111S04IDYYR	SOT-23-THIN14	ADS111S04IDYYR	Texas Instruments
U2	0		ADS111S02IRUGR	X2QFN10	ADS111S02IRUGR	Texas Instruments
U3	0		4-Bit Bidirectional Voltage-Level Shifter with Auto Direction Sensing and +/-15 kV ESD Protect, RUT0012A (UQFN-12)	RUT0012A	TXB0104RUTR	Texas Instruments
U4	0		ADS111C02IRUGR	X2QFN10	ADS111C02IRUGR	Texas Instruments

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Table 4-2 lists the ADS111C02EVM bill of materials (BOM)

Table 4-2. ADS111C02EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		DC430	Any
C23, C24, C25, C26	4	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	C1608C0G2A471J080AA	TDK
C35, C36	2	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C42, C43, C44	3	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	CGA2B3X7R1V104K050BB	TDK
H1, H2, H3, H4	4		MACHINE SCREW PAN PHILLIPS 4-40		9900	Keystone
J8	1		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07G-S	Samtec
J9	1		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J10	1		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
J11	1		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
LBL2	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
M1, M2, M3, M4	4		Hex Standoff Threaded #4-40 Aluminum 0.750" (19.05mm) 3/4"	HEX_STANDOFF_4-40	1895	Keystone
R22, R23, R24, R25	4	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R34, R35	2	1k	1 kOhms ±0.01% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	RNCF0603TKW1K00	Stackpole Electronics
R36	1	10.0k	RES, 10.0k, 1%, 0.1W, 0603	0603	RCG060310K0FKEA	Vishay Draloric
R37, R40, R41, R42	4	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R43	1	200k	RES, 200k, 1%, 0.1W, 0402	0402	ERJ-2RKF2003X	Panasonic
R44, R45	2	1.0k	RES, 1.0k, 5%, 0.1W, 0603	0603	RC0603JR-071KL	Yageo
U4	1		ADS111C02IRUGR	X2QFN10	ADS111C02IRUGR	Texas Instruments
U6	1		2-Bit Bidirectional I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	PCA9306DCUR	Texas Instruments

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Table 4-2. ADS111C02EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C27, C28, C29, C30, C31, C32, C33, C34	0	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	GRM1885C2A471JA01D	MuRata
C13, C14, C15, C16, C17, C18, C37, C38, C39, C40	0	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C19, C20, C21, C22, C41	0	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	C1005X7R1E104M050BB	TDK
J1, J7	0		Header, 100mil, 8x1, Gold, TH	8x1 Header	TSW-108-07G-S	Samtec
J2	0		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07G-S	Samtec
J3	0		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J4	0		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
J5, J6, J12	0		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
LBL1	0		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R26, R27, R28, R29, R30, R31, R32, R33	0	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R13, R14, R15, R16, R17, R18, R19, R20	0	47	RES, 47, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ470V	Panasonic
R21, R39	0	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R38	0	10.0k	RES, 10.0k, 1%, 0.1W, 0603	0603	RCG060310K0FKEA	Vishay Draloric
U1	0		ADS111S04IDYYR	SOT-23-THIN14	ADS111S04IDYYR	Texas Instruments
U2	0		ADS111S02IRUGR	X2QFN10	ADS111S02IRUGR	Texas Instruments
U3	0		4-Bit Bidirectional Voltage-Level Shifter with Auto Direction Sensing and +/-15 kV ESD Protect, RUT0012A (UQFN-12)	RUT0012A	TXB0104RUTR	Texas Instruments
U5	0		ADS111C04IDYYR	SOT-23-THIN14	ADS111C04IDYYR	Texas Instruments

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Table 4-3 lists the ADS111S04EVM bill of materials (BOM)

Table 4-3. ADS111S04EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		DC430	Any
C5, C6, C7, C8, C9, C10, C11, C12	8	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	GRM1885C2A471JA01D	MuRata
C15, C16, C17, C18	4	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C20, C21, C22	3	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	C1005X7R1E104M050BB	TDK
H1, H2, H3, H4	4		MACHINE SCREW PAN PHILLIPS 4-40		9900	Keystone
J1	1		Header, 100mil, 8x1, Gold, TH	8x1 Header	TSW-108-07G-S	Samtec
J3	1		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J4	1		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
J6	1		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
M1, M2, M3, M4	4		Hex Standoff Threaded #4-40 Aluminum 0.750" (19.05mm) 3/4"	HEX_STANDOFF_4-40	1895	Keystone
R5, R6, R7, R8, R9, R10, R11, R12	8	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R13, R14, R15, R16	4	47	RES, 47, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ470V	Panasonic
R21	1	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
U1	1		ADS111S04IDYYR	SOT-23-THIN14	ADS111S04IDYYR	Texas Instruments
U3	1		4-Bit Bidirectional Voltage-Level Shifter with Auto Direction Sensing and +/-15 kV ESD Protect, RUT0012A (UQFN-12)	RUT0012A	TXB0104RUTR	Texas Instruments
C1, C2, C3, C4, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34	0	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	GRM1885C2A471JA01D	MuRata
C13, C14, C35, C36, C37, C38, C39, C40	0	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C19, C41, C42, C43, C44	0	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	C1005X7R1E104M050BB	TDK

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Table 4-3. ADS111S04EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
J2, J8	0		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07G-S	Samtec
J5, J11, J12	0		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
J7	0		Header, 100mil, 8x1, Gold, TH	8x1 Header	TSW-108-07G-S	Samtec
J9	0		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J10	0		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
LBL2	0		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
R1, R2, R3, R4, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33	0	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R17, R18, R19, R20	0	47	RES, 47, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ470V	Panasonic
R34, R35	0	1k	1 kOhms ±0.01% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	RNCF0603TKW1K00	Stackpole Electronics
R36, R38	0	10.0k	RES, 10.0k, 1%, 0.1W, 0603	0603	RCG060310K0FKEA	Vishay Draloric
R37, R39, R40, R41, R42	0	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R43	0	200k	RES, 200k, 1%, 0.1W, 0402	0402	ERJ-2RKF2003X	Panasonic
R44, R45	0	1.0k	RES, 1.0k, 5%, 0.1W, 0603	0603	RC0603JR-071KL	Yageo
U2	0		ADS111S02IRUGR	X2QFN10	ADS111S02IRUGR	Texas Instruments
U4	0		ADS111C02IRUGR	X2QFN10	ADS111C02IRUGR	Texas Instruments
U5	0		ADS111C04IDYYR	SOT-23-THIN14	ADS111C04IDYYR	Texas Instruments
U6	0		2-Bit Bidirectional I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	PCA9306DCUR	Texas Instruments

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Table 4-4 lists the ADS111S02EVM bill of materials (BOM)

Table 4-4. ADS111S02EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		DC430	Any
C1, C2, C3, C4	4	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	C1608C0G2A471J080AA	TDK
C13, C14	2	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C19, C21, C22	3	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	CGA2B3X7R1V104K050BB	TDK
H1, H2, H3, H4	4		MACHINE SCREW PAN PHILLIPS 4-40		9900	Keystone
J2	1		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07G-S	Samtec
J3	1		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J4	1		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
J5	1		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
M1, M2, M3, M4	4		Hex Standoff Threaded #4-40 Aluminum 0.750" (19.05mm) 3/4"	HEX_STANDOFF_4-40	1895	Keystone
R1, R2, R3, R4	4	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R17, R18, R19, R20	4	47	RES, 47, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ470V	Panasonic
R21	1	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
U2	1		ADS111S02IRUGR	X2QFN10	ADS111S02IRUGR	Texas Instruments
U3	1		4-Bit Bidirectional Voltage-Level Shifter with Auto Direction Sensing and +/-15 kV ESD Protect, RUT0012A (UQFN-12)	RUT0012A	TXB0104RUTR	Texas Instruments
C5, C6, C7, C8, C9, C10, C11, C12, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34	0	470pF	CAP, CERM, 470pF, 100V, +/-5%, C0G/NP0, 0603	0603	GRM1885C2A471JA01D	MuRata
C15, C16, C17, C18, C35, C36, C37, C38, C39, C40	0	4700pF	CAP, CERM, 4700pF, 100V, +/-5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet

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Table 4-4. ADS111S02EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C20, C41, C42, C43, C44	0	0.1uF	CAP, CERM, 0.1uF, 25V, +/-20%, X7R, 0402	0402	C1005X7R1E104M050BB	TDK
J1, J7	0		Header, 100mil, 8x1, Gold, TH	8x1 Header	TSW-108-07G-S	Samtec
J6, J11, J12	0		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin
J8	0		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07G-S	Samtec
J9	0		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07G-S-240	Samtec
J10	0		Connector Header Through Hole 12 position 0.100" (2.54mm)	HDR12	TSW-106-14G-D	SAMTEC
LBL2	0		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch	THT-14-423-10	Brady
R5, R6, R7, R8, R9, R10, R11, R12, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33	0	499	499 Ohms ±0.1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	ERA-3AEB4990V	Panasonic Electronic Components
R13, R14, R15, R16	0	47	RES, 47, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ470V	Panasonic
R34, R35	0	1k	1 kOhms ±0.01% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200 Thin Film	0603	RNCF0603TKW1K00	Stackpole Electronics
R36, R38	0	10.0k	RES, 10.0k, 1%, 0.1W, 0603	0603	RCG060310K0FKEA	Vishay Draloric
R37, R39, R40, R41, R42	0	0	RES, 0, 1%, 0.1W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R43	0	200k	RES, 200k, 1%, 0.1W, 0402	0402	ERJ-2RKF2003X	Panasonic
R44, R45	0	1.0k	RES, 1.0k, 5%, 0.1W, 0603	0603	RC0603JR-071KL	Yageo
U1	0		ADS111S04IDYYR	SOT-23-THIN14	ADS111S04IDYYR	Texas Instruments
U4	0		ADS111C02IRUGR	X2QFN10	ADS111C02IRUGR	Texas Instruments
U5	0		ADS111C04IDYYR	SOT-23-THIN14	ADS111C04IDYYR	Texas Instruments
U6	0		2-Bit Bidirectional I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	PCA9306DCUR	Texas Instruments

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5 Additional Information

5.1 Trademarks

All trademarks are the property of their respective owners.

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STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

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2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

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