

# **BOOST-ADS7042 BoosterPack™ Plug-In Module**

This user's guide describes the characteristics, operation, and use of the BOOST-ADS7042 BoosterPack™ plug-in module, a quick and low-cost solution to evaluate the [ADS7042](#). This document also includes the schematic, printed circuit board (PCB) layout, and a bill of materials (BOM).

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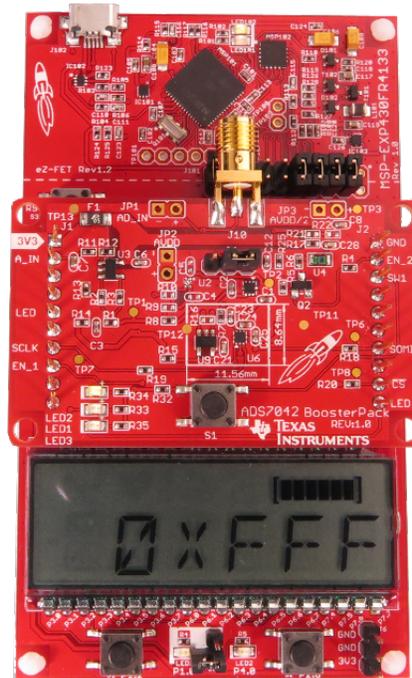
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## 1 BOOST-ADS7042 BoosterPack™ Overview

### 1.1 Description

The BOOST-ADS7042 BoosterPack™ plug-in module provides a quick and low-cost solution to evaluate the ADS7042. To quickly get started, a firmware for this BoosterPack™ is available for the MSP430FR4133 LaunchPad™ development kit ([MSP-EXP430FR4133](#)). [Figure 1](#) shows an overview of the BoosterPack™ hardware.



**Figure 1. BOOST-ADS7042 BoosterPack™ Overview**

### 1.2 Features

- Designed using the ADS7042 precision analog-to-digital converter (ADC), the [OPA316](#) precision ADC driver, and the [REF3330](#) precision voltage reference
- Nanowatt power consumption of the ADS7042 ADC when sampling at 1 kSPS
- ADC sampling rates between 1 kSPS and 1 MSPS
- SMA jack for an optional external analog signal input
- User-programmable push button and LEDs
- On-board ambient light sensor

## 2 ADS7042 Information

The ADS7042 is a 12-bit, 1-MSPS ADC. The device consumes 690  $\mu$ W of power at 3-V AVDD and at a throughput of 1 MSPS. The ADS7042 is available in 8-pin, miniature, leaded, VSSOP and 8-pin X2QFN packages. The ADS7042 datasheet ([SBAS608](#)) contains all relevant analog and digital electrical information pertaining to the device.

## 3 Getting Started

### 3.1 Configuring the LaunchPad™ Development Kit

The BOOST-ADS7042 functions with default jumper settings of the MSP430FR4133 LaunchPad™ development kit. [Figure 2](#) and [Table 1](#) provide the default jumper settings for the MSP430FR4133 LaunchPad™ development kit.

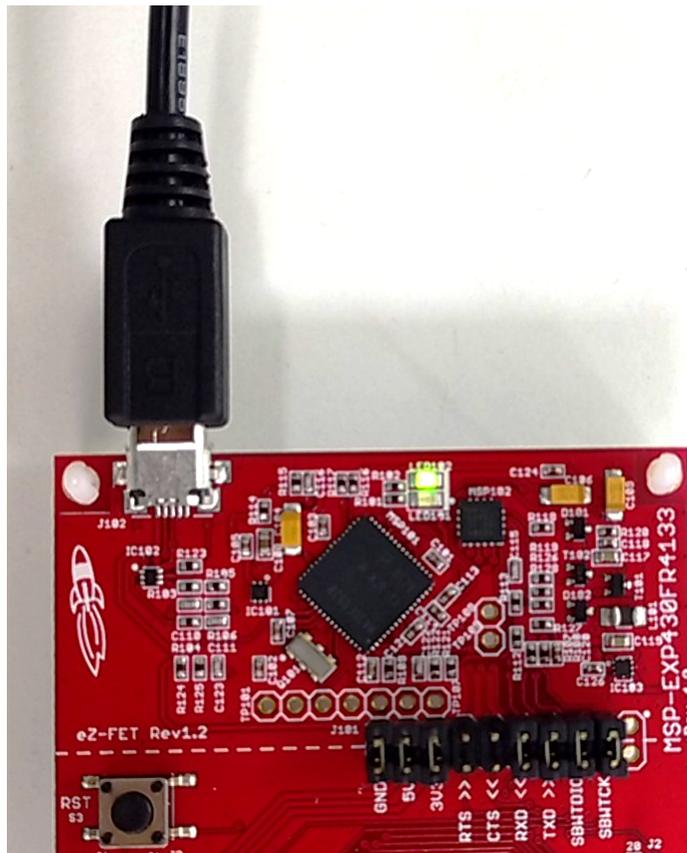


Figure 2. Jumper Settings for the MSP430FR4133 LaunchPad™ Development Kit

Table 1. Jumper Settings for the MSP430FR4133 LaunchPad™ Development Kit

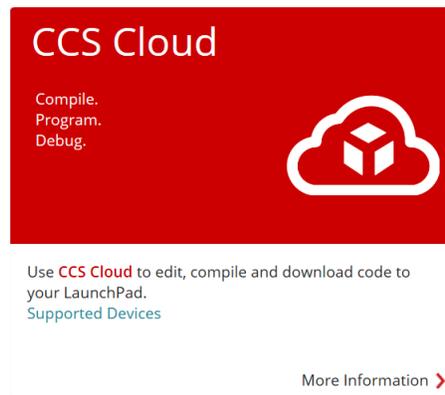
Jumper	Position
5V	Installed
GND	Installed
3V3	Installed
RTS	Not installed
CTS	Not installed
RXD	Installed
TXD	Installed
SBWTDIO	Installed
SBWTCK	Installed

### 3.2 Obtaining Firmware

Download the firmware for the BOOST-ADS7042 with the MSP430FR4133 LaunchPad™ development kit from the [SLYC144](#) zip file. The zip file downloaded must be loaded into the MSP430FR4133 LaunchPad™ development kit as per the steps described in [Section 3.2.1](#).

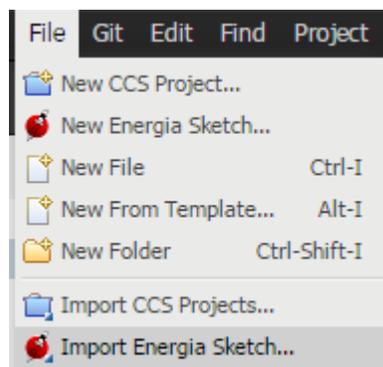
#### 3.2.1 Downloading Firmware

1. Extract and save the *BOOST-ADS7042\_Firmware\_xx.ino* file from the [SLYC144](#) zip file.
2. Connect the MSP430FR4133 LaunchPad™ development kit to a PC using a USB cable; see [Figure 2](#). Verify that jumpers are installed as per [Table 1](#).
3. Go to [dev.ti.com](#) using either Chrome™ or Firefox®.
4. Click on the Code Composer Studio™ (CCS) cloud logo to launch the Code Composer Studio™ Cloud, as shown in [Figure 3](#).



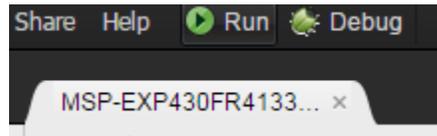
**Figure 3. Launching the Code Composer Studio™ Cloud**

5. Login with your myTI™ account.
6. Install the TI Cloud Agent (for the first time only) as described in [Section 7](#).
7. Import the Energia Sketch file (*BOOST-ADS7042\_Firmware\_xx.ino*), as shown in [Figure 4](#), that was extracted and saved in step 1.



**Figure 4. Importing the Energia Sketch File**

8. Load the Energia Sketch file (*BOOST-ADS7042\_Firmware\_xx.ino*) into the MSP430FR4133 LaunchPad™ development kit by clicking **Run**, as shown in [Figure 5](#).



**Figure 5. Loading the Energia Sketch File (Firmware) Into the MSP430FR4133 LaunchPad™ Development Kit**

#### **4 Using the BOOST-ADS7042 with the MSP430FR4133 LaunchPad™ Development Kit**

After downloading the firmware to the MSP430FR4133 LaunchPad™ development kit, the BoosterPack™ plug-in module must be connected to the LaunchPad™ development kit; see [Figure 6](#).

- Verify that the 3V3 supply pin on the BoosterPack™ plug-in module mates with the 3V3 supply pin on the LaunchPad™ development kit.
- Connect the LaunchPad™ development kit to a PC using a USB cable.

##### **4.1 Changing the Sampling Rate of the ADS7042**

- Press the **S2** switch on the LaunchPad™ development kit to increase the sampling rate of the ADS7042.
- Press the **S1** switch on the LaunchPad™ development kit to decrease the sampling rate of the ADS7042.

##### **4.2 Changing the Display**

- Press the **S1** switch on the BoosterPack™ plug-in module to change the display from power consumption in  $\mu\text{W}$  to ADC code in hexadecimal.

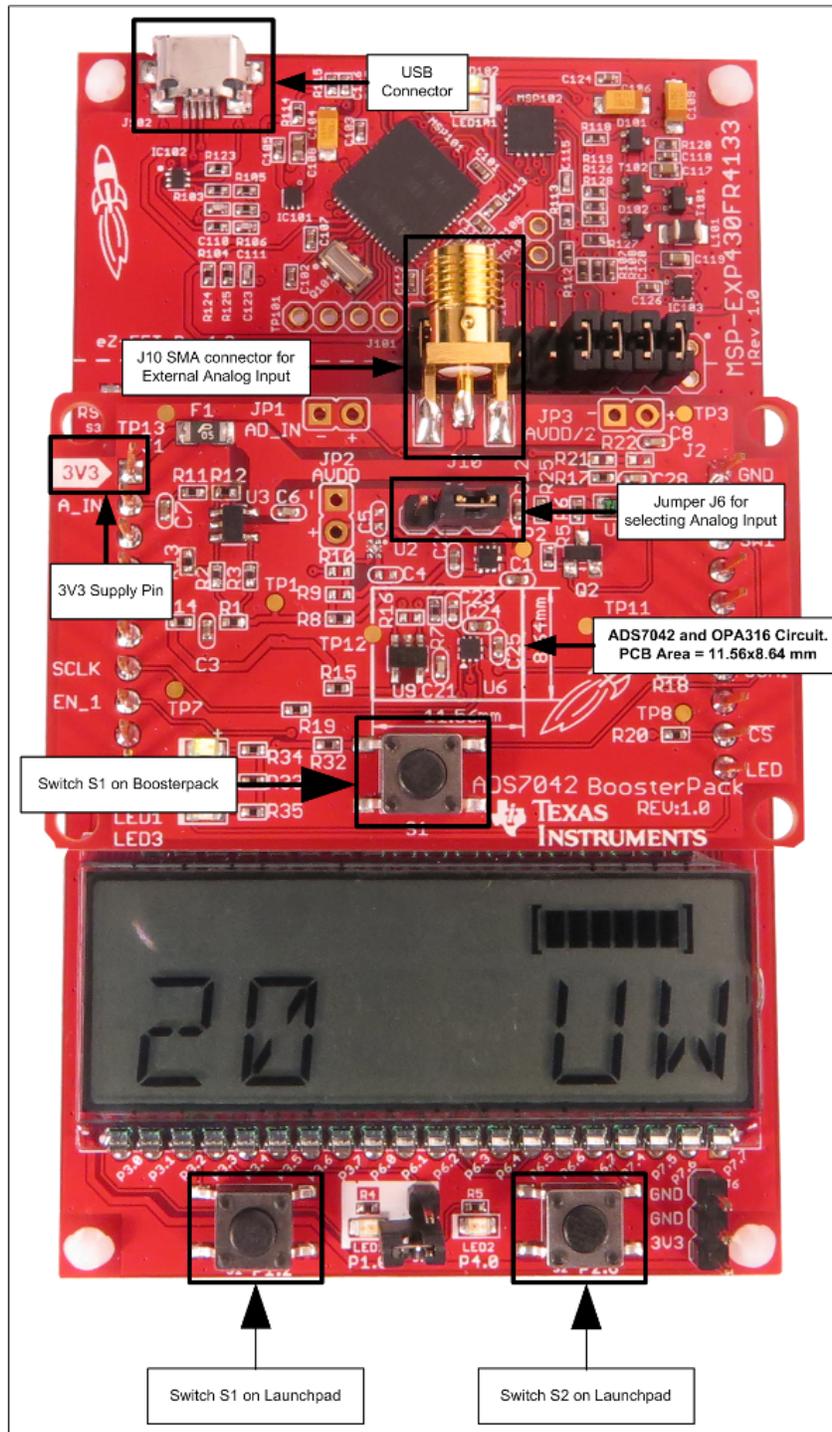


Figure 6. Connecting the MSP430FR4133 LaunchPad™ Development Kit to the BOOST-ADS7042

### 4.3 Measuring the Output of the Ambient Light Sensor

The output of the ambient light sensor can be directly measured with the ADS7042 by installing jumper J6 between pin 1 and pin 2 of J6, as shown in Figure 7. The light intensity can be estimated from Equation 1.

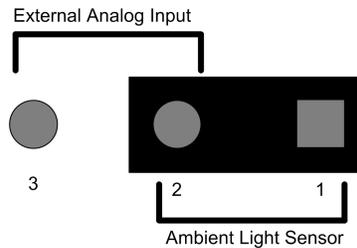


Figure 7. Configuring Jumper J6

$$\text{Light Intensity(Lux)} = \frac{\text{ADS7042\_Code}}{4096} \times 1304$$

where

- $I_{PC} = 23 \mu\text{A} / 100 \text{ Lux}$  for the ambient light sensor TEMT6200FX01 (U4) (1)

### 4.4 Applying an External Analog Input

An external analog input can be applied on the SMA connector J10 on the BoosterPack™ plug-in module. The analog input must be between 0 V and 3 V. The external analog input is provided to the noninverting input of the OPA316 amplifier (U9) that drives the analog input of the ADS7042.

### 4.5 Measuring Power Consumption

The BoosterPack™ plug-in module has the provision of measuring the sum of power consumption of the REF3330 (U1) and the analog power consumption of the ADS7042 (U6). The power measured is displayed on the LCD of the MSP430FR4133 LaunchPad™ development kit. Equation 2 provides an estimate of the measured power.

$$\text{Power}(\mu\text{W}) = 3\text{V} \times [3.9\mu\text{A} + (0.2 \times F_s)\mu\text{A}]$$

where

- $F_s$  is the sampling rate of the ADS7042 in kSPS. (2)

### 4.6 Software Flow Diagram for the BOOST-ADS7042

Figure 8 shows the software flow for the firmware of the BOOST-ADS7042.

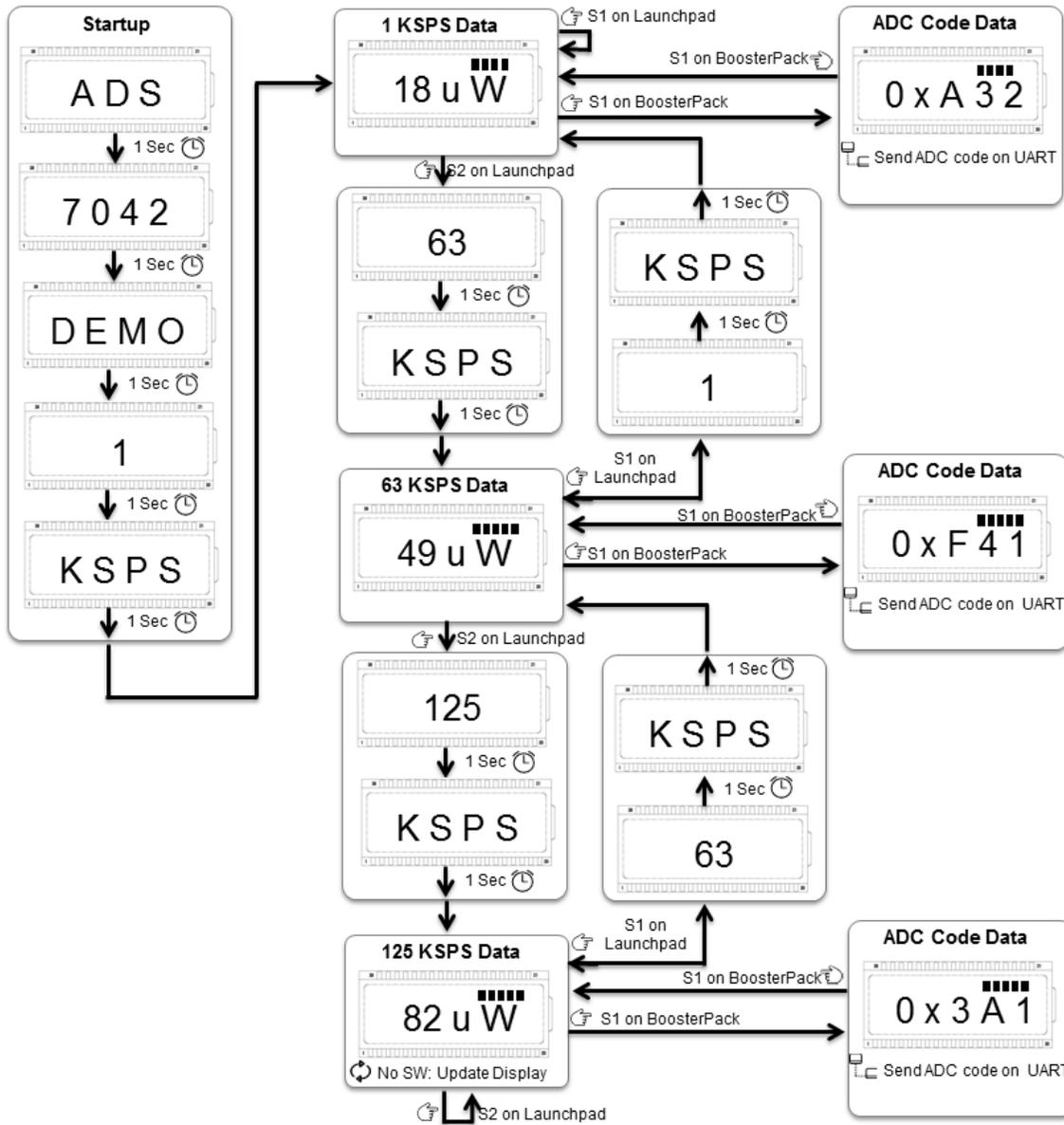
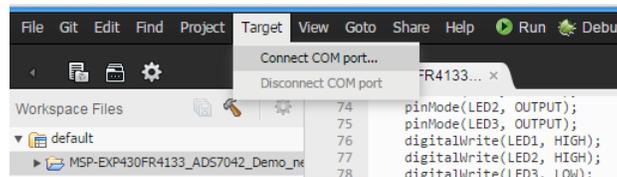


Figure 8. Software Flow Diagram for the BOOST-ADS7042

## 4.7 UART Communication

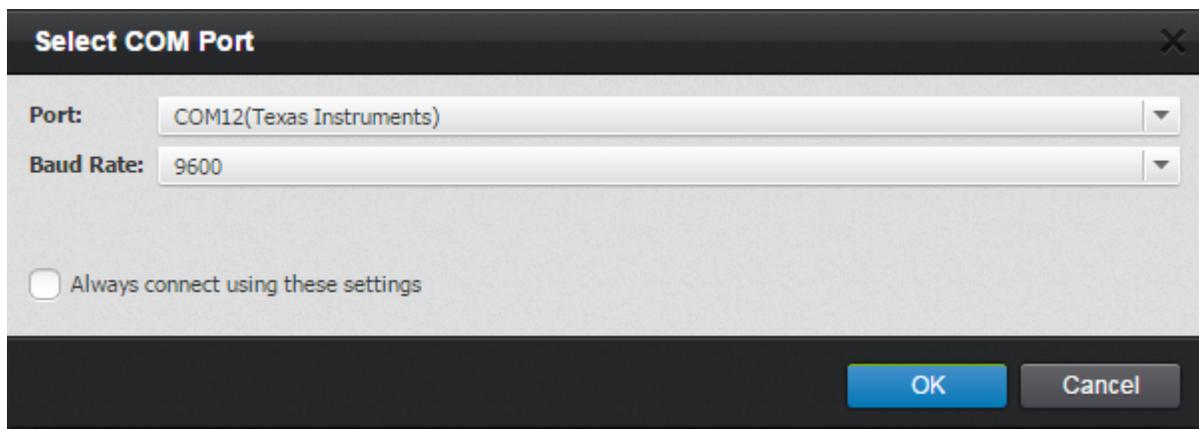
The output codes from the ADS7042 are sent over the universal asynchronous receiver, transmitter (UART) to the PC through the serial communication port of the MSP430FR4133 LaunchPad™ development kit. The codes can be captured in the Code Composer Studio™ Cloud by following these steps:

- Connect the LaunchPad™ development kit to the BoosterPack™ plug-in module; see [Figure 6](#).
- Connect the LaunchPad™ development kit to a PC with a USB cable.
- Launch the Code Composer Studio™ Cloud and run the firmware as described in step 8 of [Section 3.2.1](#).
- Click on the *Connect COM port* from the *Target* menu, as shown in [Figure 9](#).



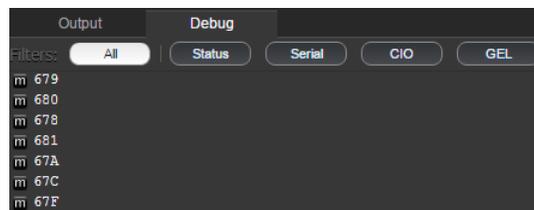
**Figure 9. Connecting to the COM Port**

- Select the COM port for MSP430FR4133 LaunchPad™ development kit, as shown in [Figure 10](#).



**Figure 10. Selecting the COM Port**

- Click *Ok* and the data are displayed in the *Debug* window, as shown in [Figure 11](#).



**Figure 11. Debug Window**

## 5 Schematic, PCB Layout, and Bill of Materials

This section contains the block diagram, schematic diagram, printed circuit board (PCB) layout, and a complete bill of materials for the BOOST-ADS7042 BoosterPack™ plug-in module.

### 5.1 Schematic

[Figure 12](#) illustrates the schematic of the BOOST-ADS7042 BoosterPack™ plug-in module.

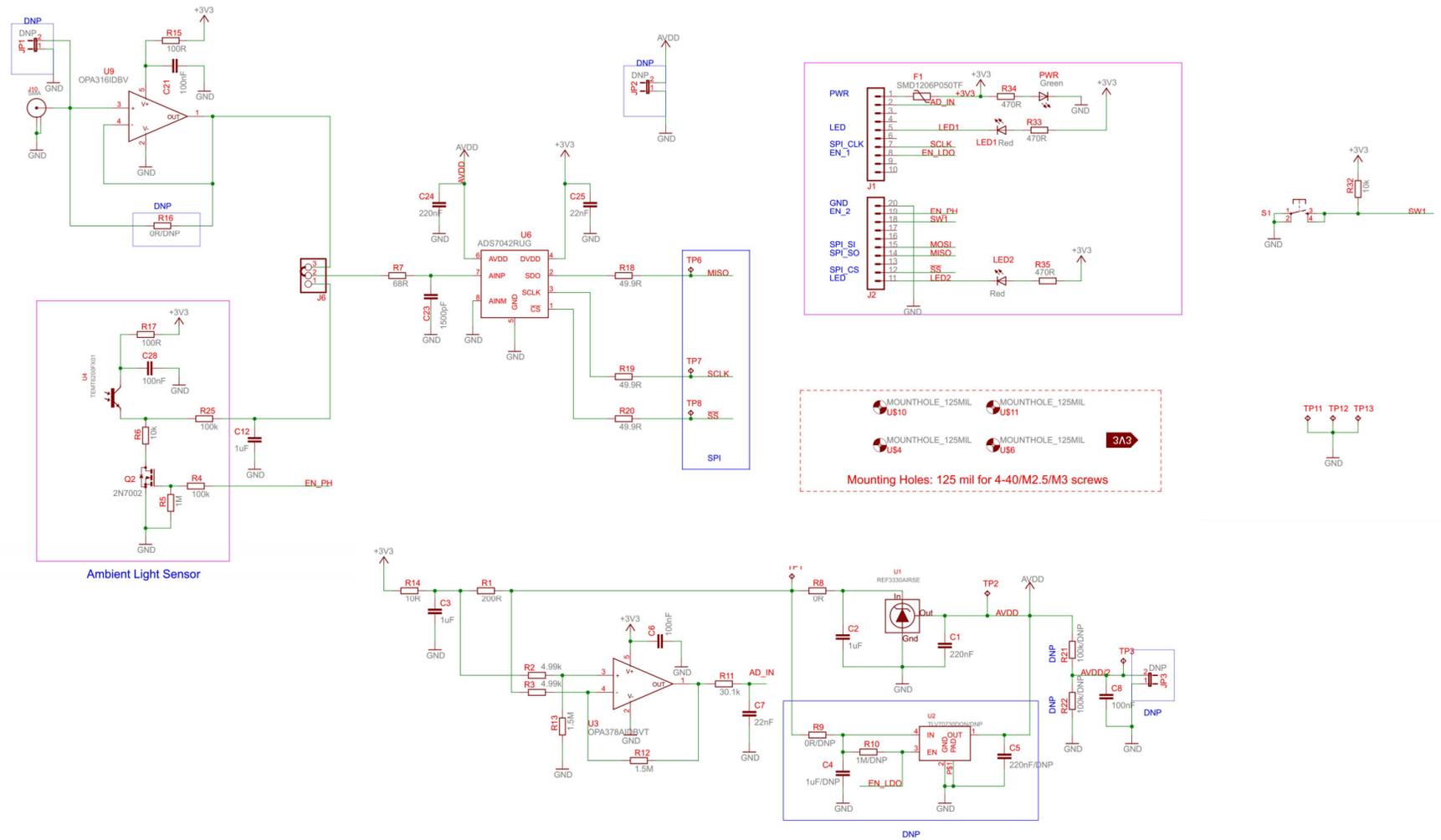


Figure 12. Schematic

## 5.2 PCB Layout

Figure 13 and Figure 14 illustrate the PCB layout of the BOOST-ADS7042 BoosterPack™ plug-in module.

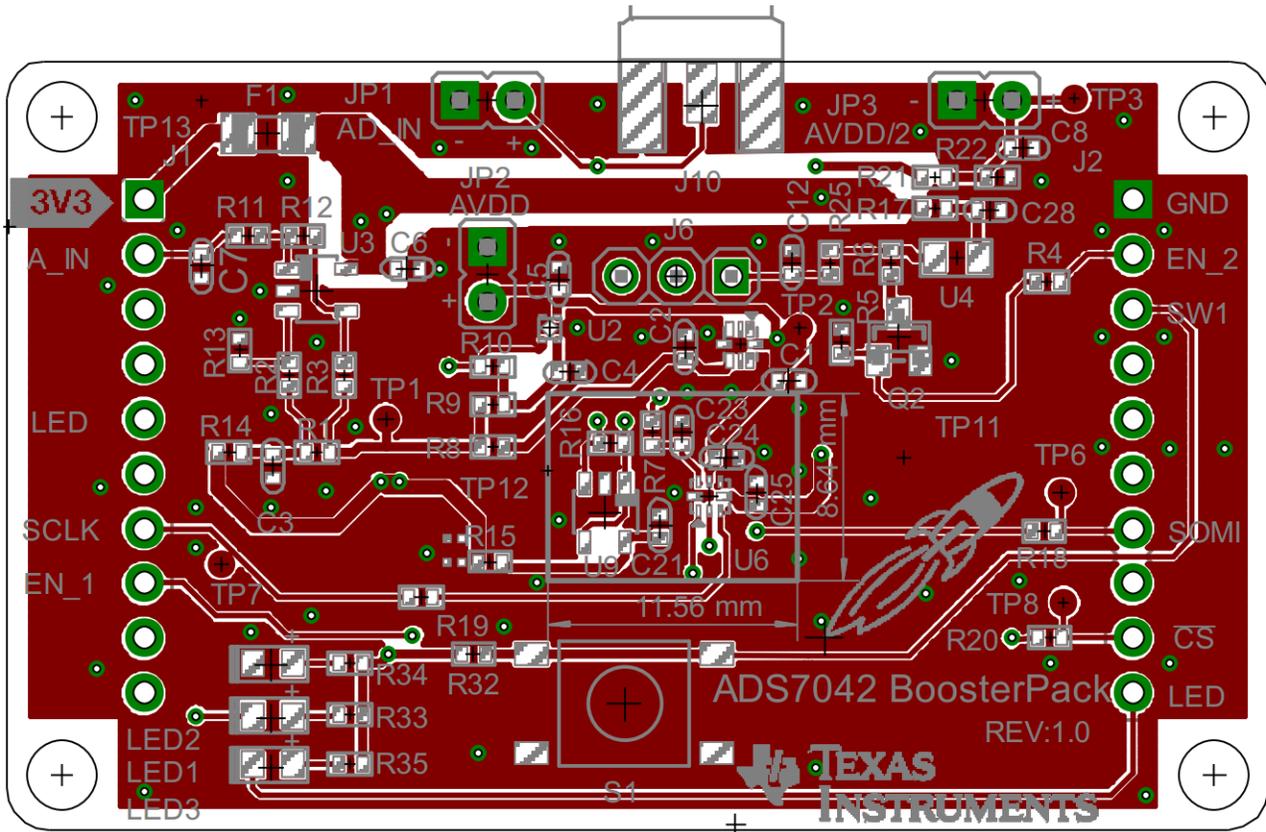


Figure 13. PCB Top Layer

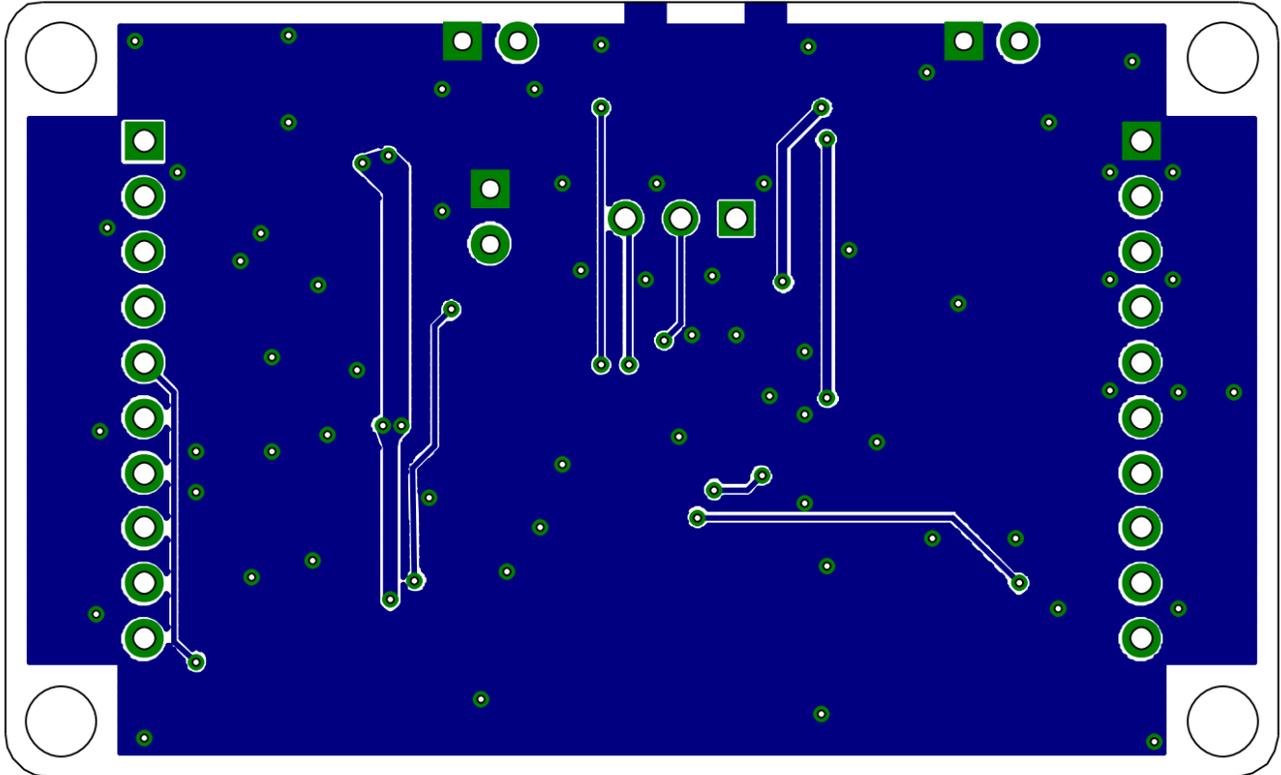


Figure 14. PCB Bottom Layer

### 5.3 Bill of Materials

Table 2 lists the bill of materials.

**Table 2. Bill of Materials**

Item No.	Ref Des	Value	Description	Vendor/Mfr	Part Number
1	J1, J2	10Pin socket	Connector, Pin Socket, Straight, Female, 1x10 Pin, 2.54MM pitch, 8.5, 3.2, Gold Flash 1u, black, DIP	JXT	FH2543-10GT10
2	J6	3Pin Header	Connector, Pin Header, Straight, Male, 1x3 Pin, 2.54MM pitch, 6.00, 3.00, Gold Flash 1u, black, DIP,alt_code:15071706	CHIN-BAN	P6E03A-602530-B1
3	R8	0R	RES, 0R, +/-5%, 1/16W, SMD0402	YAGEO	RC0402JR-070RL
4	R9, R16	0R/DNP			
5	R5	1M	RES, 1M, +/-5%, 1/16W, SMD0402	YAGEO	RC0402JR-071ML
6	R10	1M/DNP			
7	C7	33nF	CAP CER 0.033UF 10V X7R 0402	Kemet	C0402C333K8RACTU
8	C2,C3,C12	1uF	CAP, 1UF, +/-10%, X5R, 10V, SMD0402	Murata	GRM155R61A105KE15D
9	C4	1uF/DNP			GRM155R61A105KE15D
10	Q2	2N7002	Mosfet, N-Channel, 2N7002, 60V, 115mA, SOT-23, SMD	Fairchild	2N7002
11	R14	10R	RES, 10R, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-0710RL
12	R6, R32	10k	RES, 10K, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-0710KL
13	R2, R3	4.99k	RES SMD 4.99K OHM 1% 1/16W 0402	YAGEO	RC0402FR-074K99L
14	C25	22nF	CAP, 22NF, +/-10%, X7R, 16V, SMD0402	Murata	GRM155R71C223KA01D
15	R11	30.1k	RES, 30K1, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-0730K1L
16	R18, R19, R20	49.9R	RES, 49R9, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-0749R9L
17	R1	200R	RES SMD 200 OHM 1% 1/16W 0402	YAGEO	RC0402FR-07200RL
18	R7	68R	RES, 68R, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-0768RL
19	R15, R17	100R	RES, 100R, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-07100RL
20	R4,R25	100k	RES, 100K, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-07100KL
21	C6, C8, C21, C28	100nF	CAP, 100NF, +/-10%, X7R, 16V, SMD0402	Murata	GRM155R71C104KA88D
22	C1, C24	220n	CAP, 220NF, +/-10%, X7R, 16V, SMD0402	Murata	GRM155R71C224KA12D
23	C5	220n/DNP			GRM155R71C224KA12D
24	R33, R34, R35	470R	RES, 470R, +/-1%, 1/16W, SMD0402	YAGEO	RC0402FR-07470RL
25	R12, R13	1.5M	RES SMD 1.5M OHM 1% 1/16W 0402	YAGEO	RC0402FR-071M5L
26	C23	1500pF	CAP CER 1500PF 25V NP0 0402	Kemet	C0402H152J3GAC7867
27	U6	ADS7042IRUGR	Ultra-Low Power, Ultra-Small Size, 12-Bit, 1-MSPS, SAR ADC	TI	ADS7042IRUGR
28	JP1, JP2, JP3	2Pin header/DNP			P6E02A-602530-B1
29	LED2	Green led	LED, Super Yellow Green, Water Clear, 20mA, SMD0805	Everlight	17-215SYGC/S530-E2/TR8

**Table 2. Bill of Materials (continued)**

Item No.	Ref Des	Value	Description	Vendor/Mfr	Part Number
30	U3	OPA378AIDBVT	1-MHz, Micro-Power, Low-Noise, RRIO, .8-V CMOS OPERATIONAL AMPLIFIER	TI	OPA378AIDBVT
31	U9	OPA316IDBV	10-MHz, Low-Power, Low-Noise, RRIO, 1.8-V CMOS Operational Amplifier	TI	OPA316IDBVR
32	U1	REF3330AIRSE	3.9 $\mu$ A, SC70-3, 30ppm/ $^{\circ}$ C Drift VOLTAGE REFERENCE	TI	REF3330AIRSER
33		Jump	Connector, Shunt, 2 Pin, 2.54MM Pitch, 6MM Height, Gold Flash 1u, black, Bulk	Townes	MJ501-EOGF-B-K
34	LED1, LED3	Red led	LED, Brilliant Red, Water Clear, 20mA, SMD0805	Everlight	17-215SURC/S530-A2/TR8
35	J10	SMA	SMA Jack, Edge Mount, Gold, Straight	SAMTEC	SMA-J-P-X-ST-EM1
36	F1	SMD1206P050TF	Polyswitch, SMD1206P050TF, 6V, Ihold = 0.5A, Itrip = 1A, 0.4ohm, SMD1206	PTTC	SMD1206P050TF
37	S1	TP-1138K9-BE1125	Switch, Tacticle, 160gf+/-50gf, black housing, black plunger	Toneparts	TP-1138K9-BE1125
38	U4	TEMT6200FX01	AMBIENT LIGHT SENSOR 0805 SMD	Vishay	TEMT6200FX01
39	U2	TLV70730DQN/DNP			TLV70730DQN
40	R21,R22	100k/DNP			RC0402FR-07100KL
41		PCB			

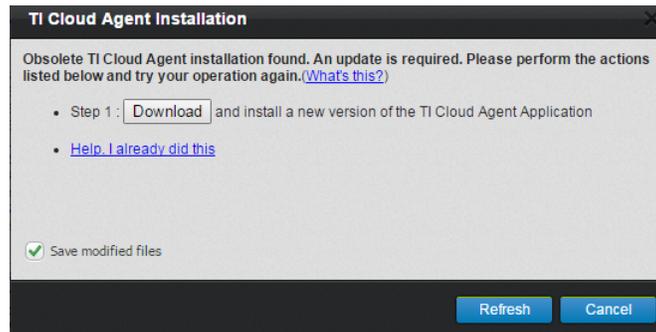
## 6 References

1. ADS7042 Datasheet, [SBAS608](#)
2. REF3330 Datasheet, [SBOS392](#)
3. OPA378 Datasheet, [SBOS417](#)
4. OPA316 Datasheet, [SBOS703](#)

## 7 Appendix A

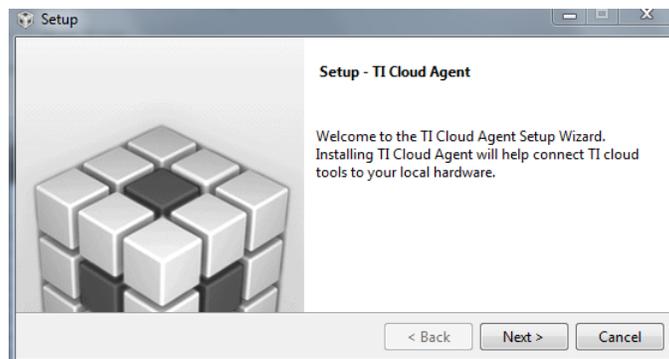
The TI Cloud Agent must be installed when the MSP430FR4133 LaunchPad™ development kit is connected to a PC and the BOOST-ADS7042 firmware is downloaded for the first time. The following steps describe the procedure for installing the TI Cloud Agent:

Click **Download** to save the *ticloudagent\_xx\_msp430.exe* file, as shown in [Figure 15](#).



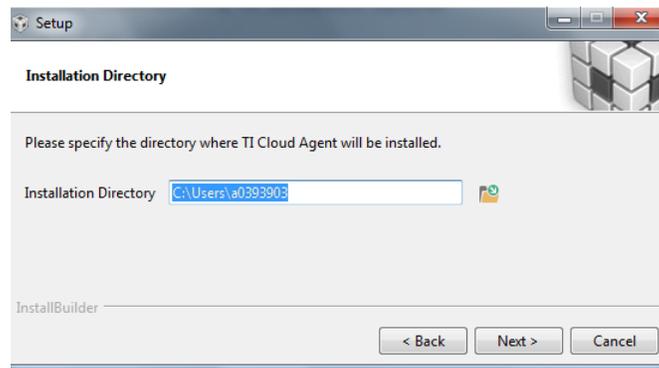
**Figure 15. Step I for the TI Cloud Agent Installation**

Run the *ticloudagent\_xx\_msp430.exe* file from the saved location and click **Next**, as shown in [Figure 16](#).



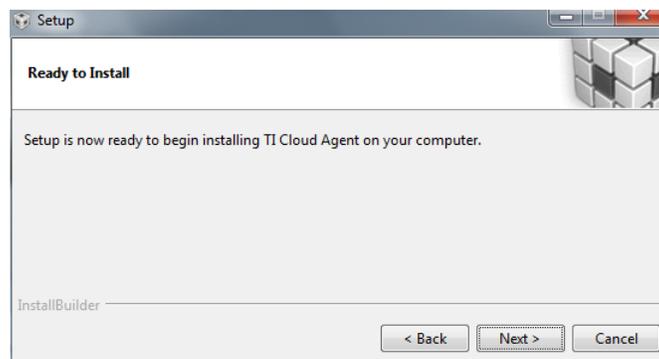
**Figure 16. Step II for the TI Cloud Agent Installation**

Select the default installation directory and click **Next**, as shown in [Figure 17](#).



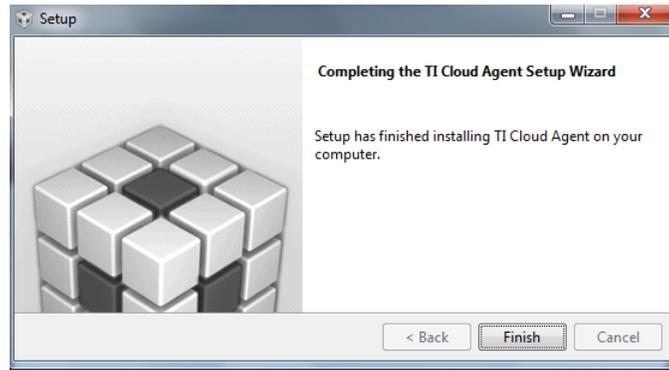
**Figure 17. Step III for the TI Cloud Agent Installation**

Click **Next**, as shown in [Figure 18](#).



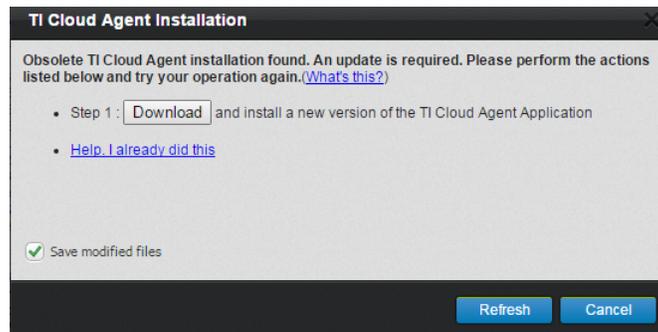
**Figure 18. Step IV for the TI Cloud Agent Installation**

Click **Finish**, as shown in [Figure 19](#).



**Figure 19. Step V for the TI Cloud Agent Installation**

Click **Refresh**, as shown in [Figure 20](#).



**Figure 20. Step VI for the TI Cloud Agent Installation**

## STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.
  - 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 semiconductor 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 and conditions 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 and conditions 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.
  - 2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.
3. *Regulatory Notices:*
  - 3.1 *United States*
    - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

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

#### Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). 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/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/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。  
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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 by Radio Law of Japan to follow the instructions below with respect to EVMs:

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.

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#### 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.
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