ADC124S101EVM Booster Pack

User's Guide

Literature Number: SNAU166A
July 2014–Revised September 2014

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ADC124S101 Booster Pack Components

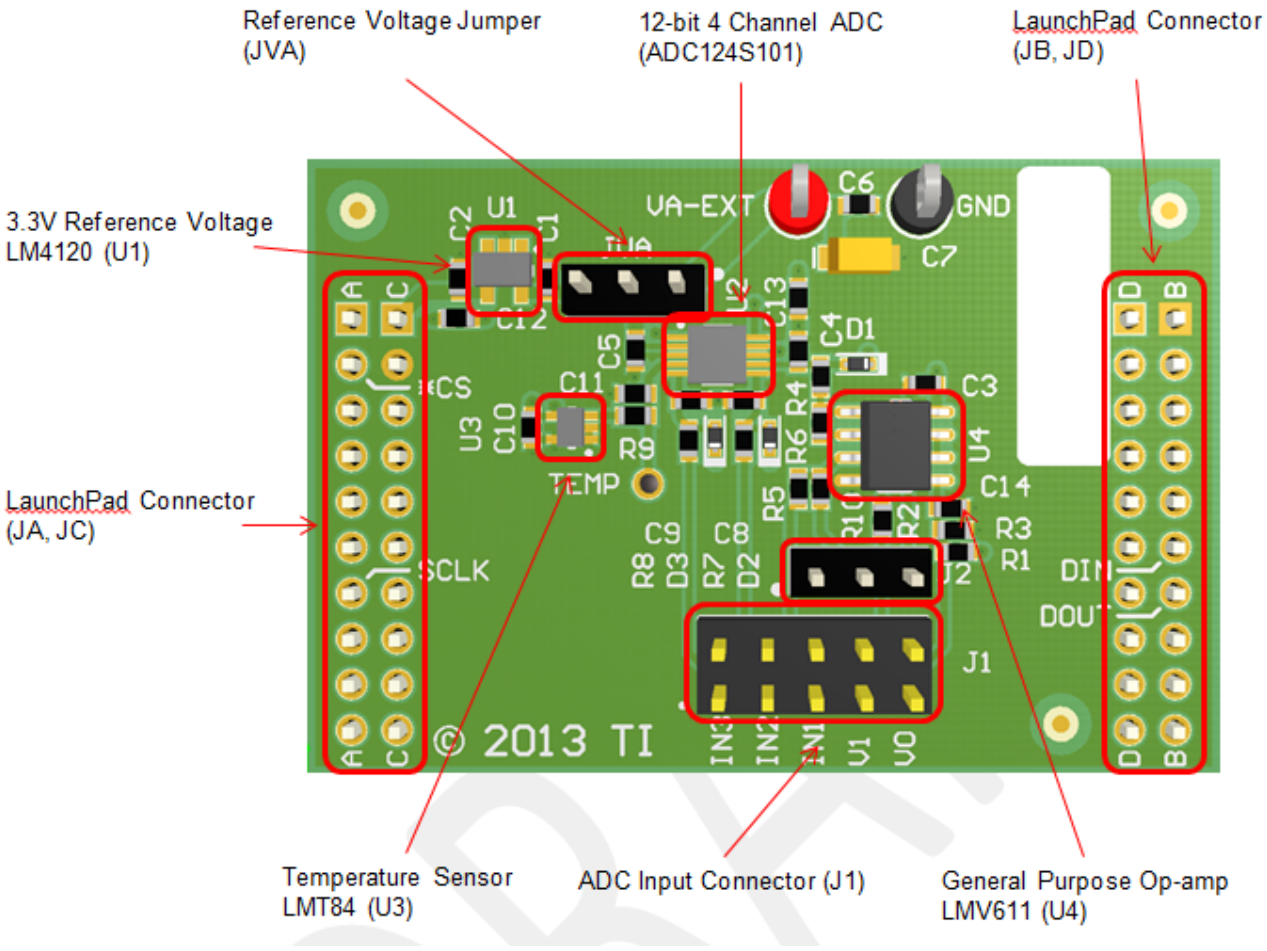


Figure 1-1. ADC124S101EVM Evaluation Board

Table 1-1. Device and Package Configurations

DEVICE	IC	PACKAGE
U1	LM4120IM5-3.3	SOT-23
U2	ADC124S101CIMM	VSSOP-10
U3	LMT84DCK	SC70
U4	LMV612MA	SOIC-8

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Software Installation

2.1 Graphical User Interface (GUI)

To use the ADC124S101EVM, install the ADC12xS10x software:

1. If the ADC124S101EVM came from an FAE, the software GUI is in a .zip file. Otherwise, click http://www.ti.com/product/adc124s101, scroll down to the Software section, and download the latest evaluation software.
2. Unzip the downloaded file into a known directory, and run the setup.exe file located in [Unzip location]\ADC12xS10x\EVM_GUI\ADC12xS10x_Installer_v11.zip\ADC12xS10x_Installer \Installer\Volume. Follow the pop-screen instructions by clicking the Next button to install the software.

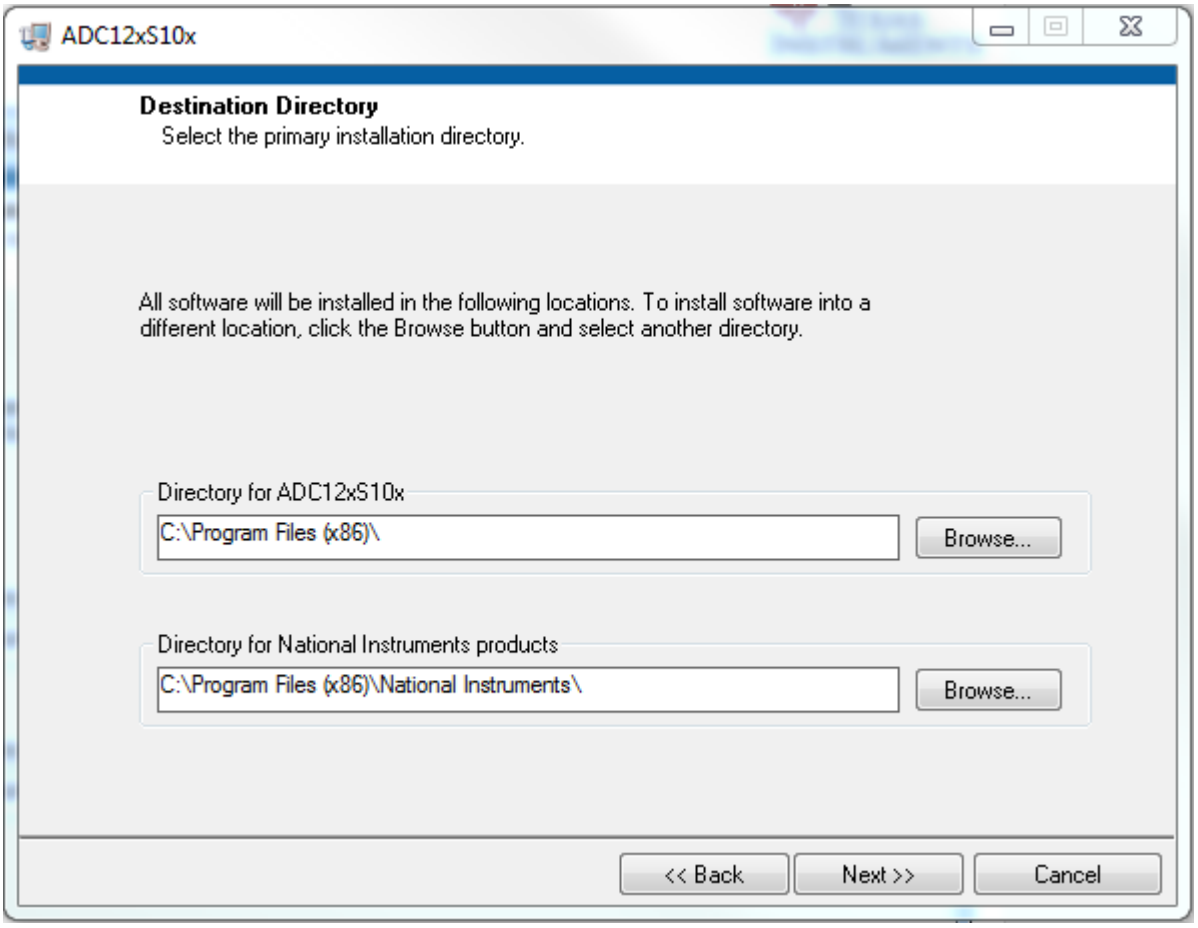


Figure 2-1. ADC12xS10x Installation Directory

3. When the installation is finished, click the Finish button.

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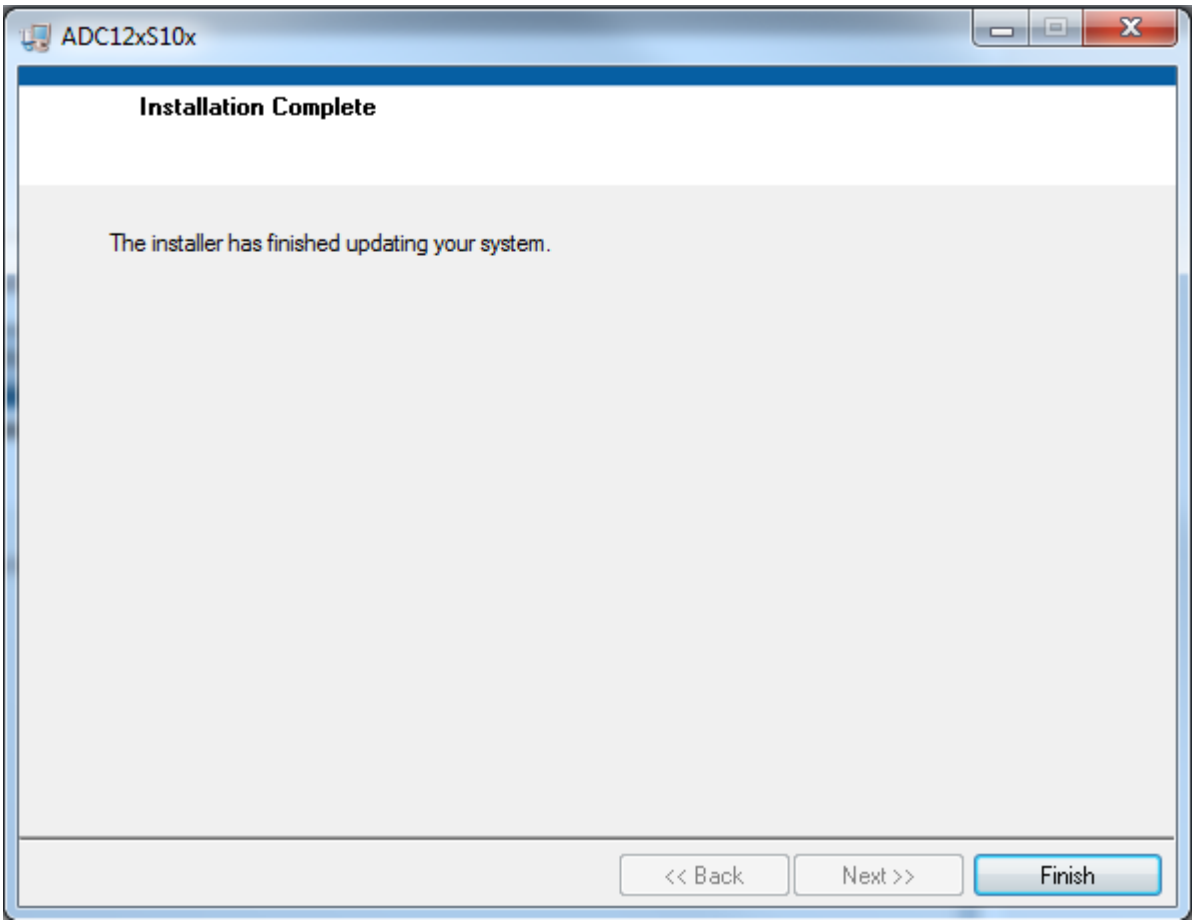


Figure 2-2. ADC12xS10x Installation Finish

2.2 Launchpad Firmware Upgrade

This section is only necessary with a brand new Launchpad. If the Launchpad is shipped with an ADC124S101EVM, skip this section.

MSP430 firmware upgrade application installation:

1. Navigate to http://www.ti.com/tool/msp430usbdevpack and click Get Software.
2. Scroll down to the end of the page to find the USB Collateral Installers section.
3. Click on MSP430_USB_Firmware_Upgrade_Example-x-x-x-Setup.exe to download the tool; the page redirects to a submission form.
4. Complete the information requested and submit the form; if approved, a download button appears.
5. Run the installation file and follow the on-screen instructions until completion. When asked about the setup type, select Application Only. Click Finish when done.

Firmware upgrade:

1. If the ADC124S101EVM came from an FAE, the firmware is the text file adc12xs10x_fw-v0.92.txt.
2. Open the MSP430 USB Firmware Upgrade application. By default, the application launches from Start > Programs > Texas Instruments > MSP430 USB Firmware Upgrade Example.
3. Click Next to proceed on the first prompt; read and accept the license agreement and click Next to continue.

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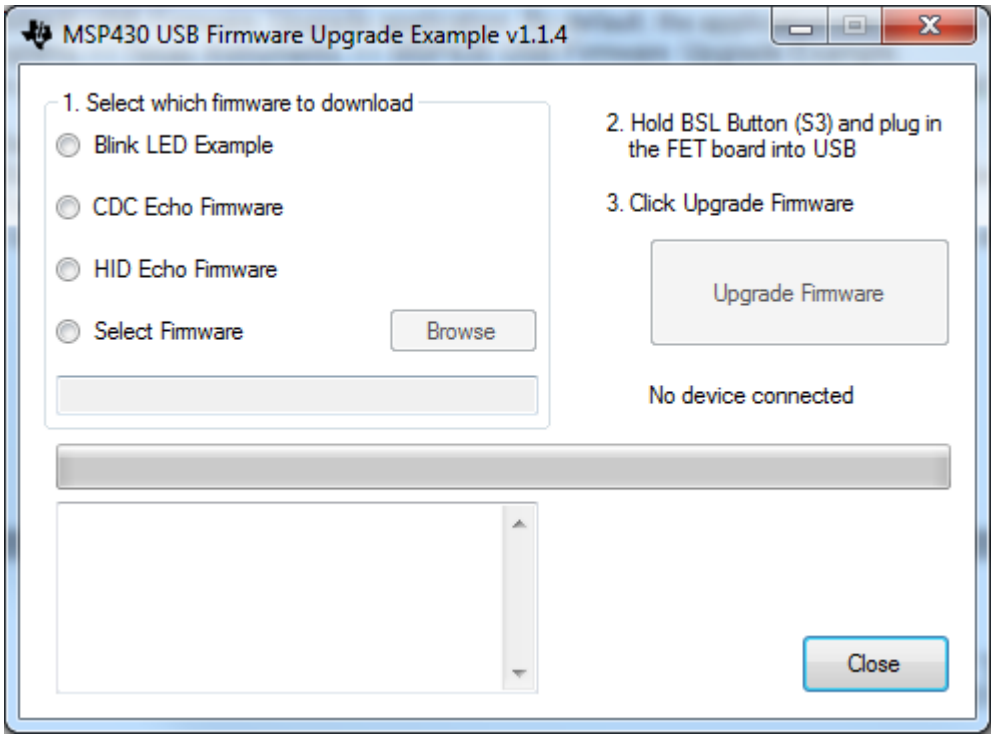


Figure 2-3. USB Firmware Upgrade Window

4. Enable the Select Firmware button and browse to open the downloaded firmware adc12xs10x_fw-v0.92.txt.
5. Press the BSL button on the MSP430 LaunchPad and connect to the PC with a USB cable; if detected, the text on the Firmware Upgrade tool changes from No device connected to Found 1 device.
6. Click on the Upgrade Firmware button to program the LaunchPad. Close the application when done.

2.3 Update USB Driver

1. Before launching the ADC12xS10x software, connect the ADC124S101EVM board to a USB port of the PC. Go to Device Manager and find MSP43-USB Example. Right click and select Update Driver Software.

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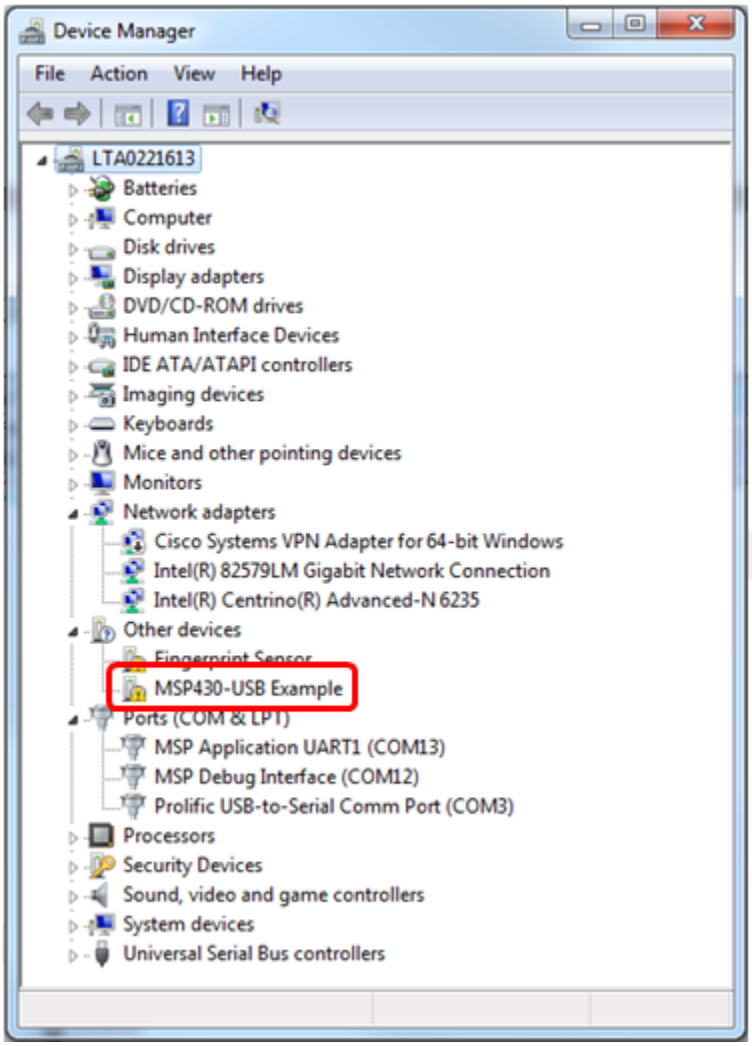


Figure 2-4. Driver Not Installed

2. On the next screen, select the Browse my computer for driver software option, go to the directory of the install files, and select the MSP430_CDC_PID0x094e_ADC_DAC_EVMs.in" file.
3. If prompted with a warning window, select Install this Driver Anyway. Close the installation window when done. The device manager should now display a TI_ADC_DAC_EVMs item followed by a COM port number.

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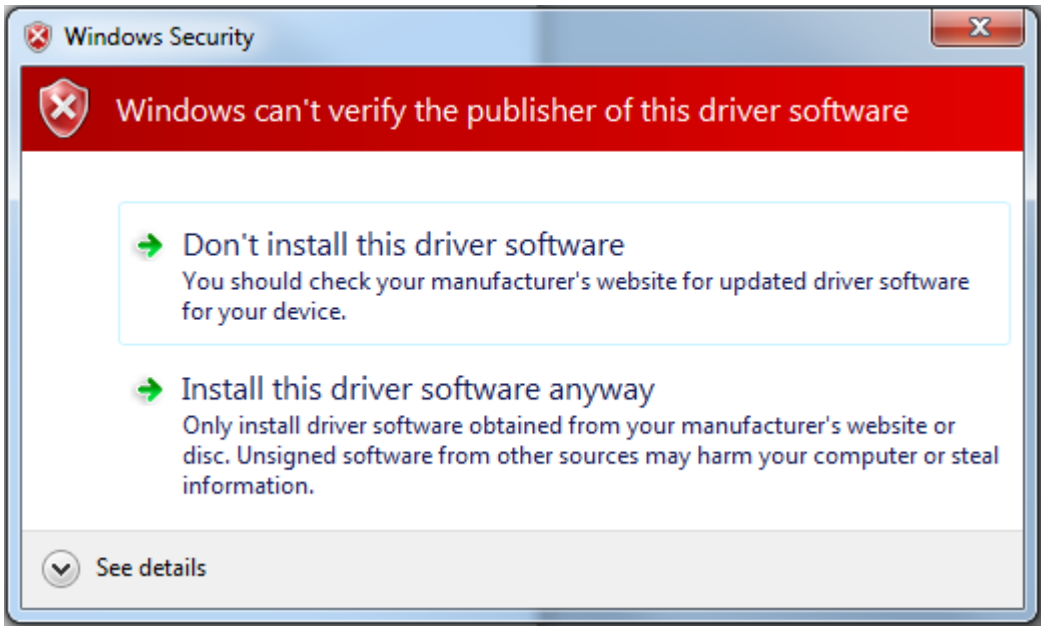


Figure 2-5. Driver Authentication Warning

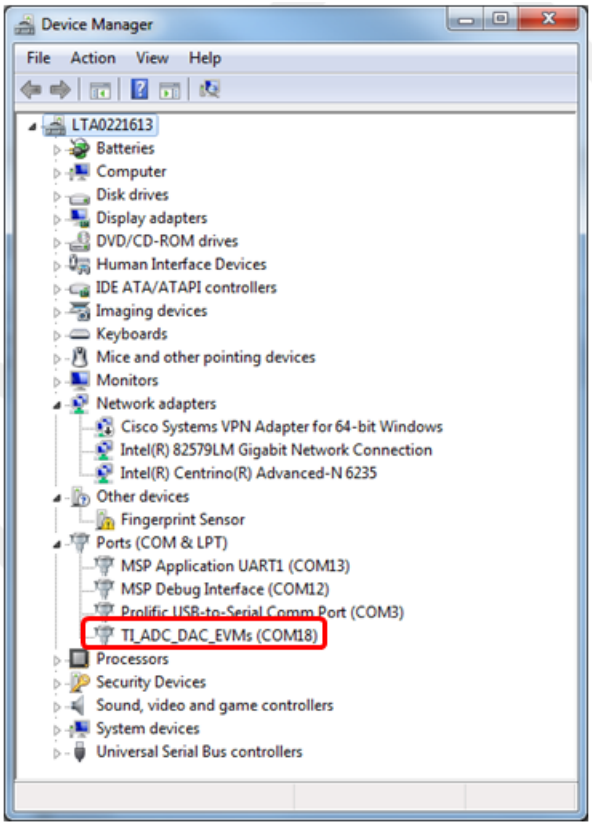


Figure 2-6. Driver Installed

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ADC124S101 BoosterPack Setup and Operation

3.1 Connections

1. Attach the ADC124S101EVM BoosterPack onto the MSP430 LaunchPad using connectors JA, JB, JC, JD. The proper orientation of the Launchpad and ADC124S101EVM occurs when the text “LaunchPad” and “2013 TI” are aligned in the same direction.

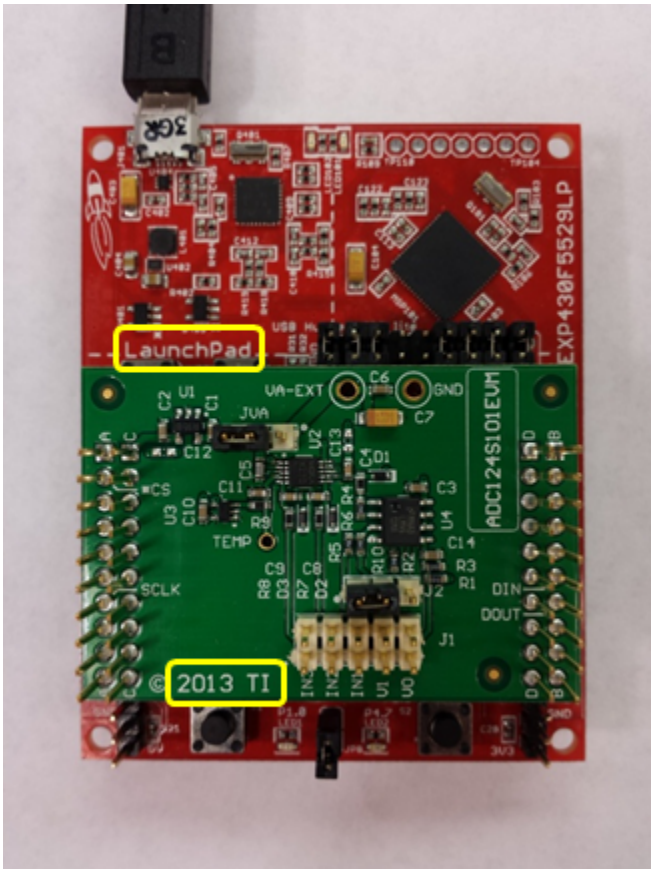


Figure 3-1. ADC124S101EVM Attached to MSP430

2. Connect the USB cable from the LaunchPad to the PC.

3.2 Launching the Software

1. The ADC12xS10x GUI software runs by clicking on Start > All Program > ADC12xS10x. After running the GUI, select ADC124S101.

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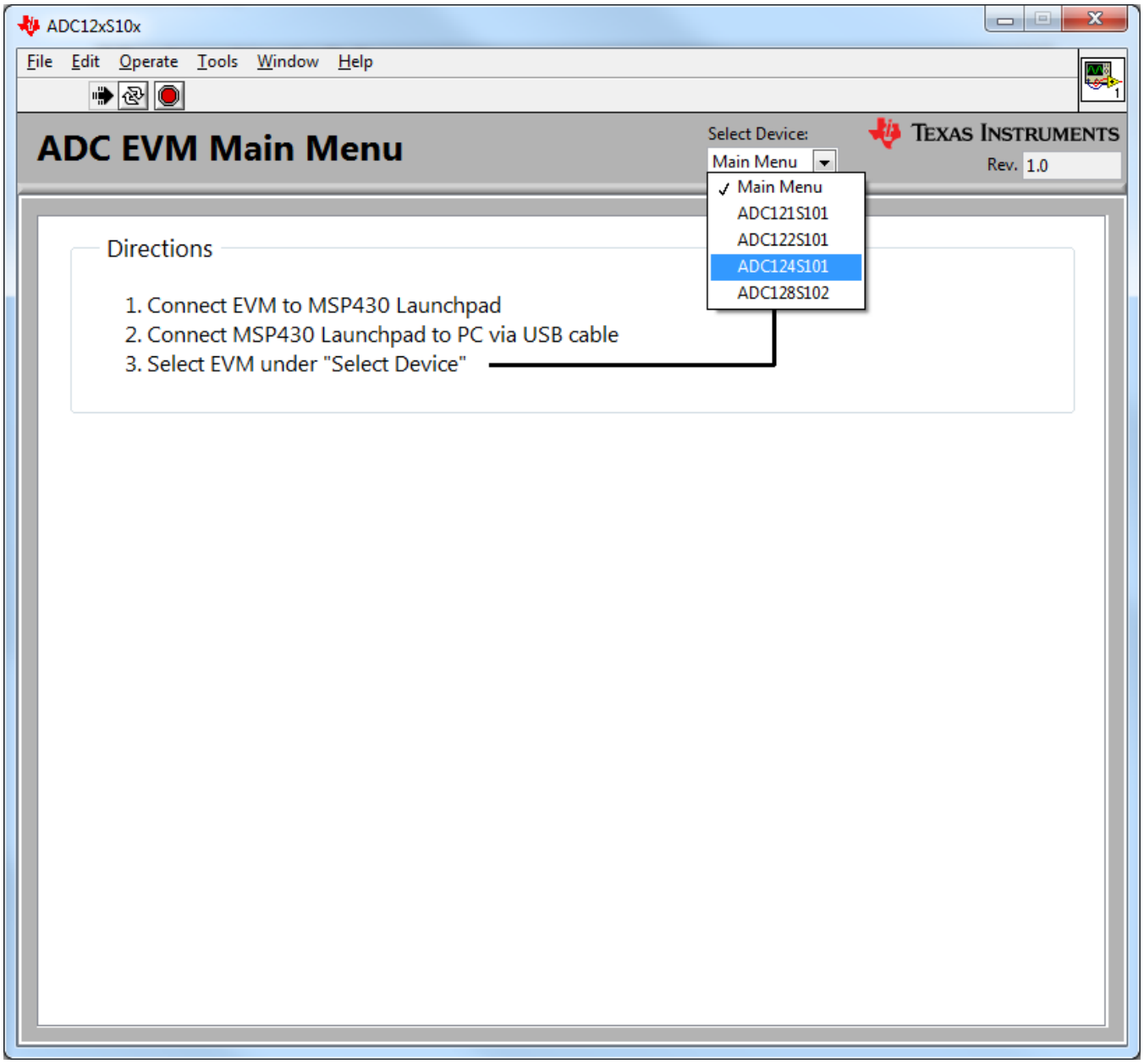


Figure 3-2. Part Select

2. GUI Descriptions:
   - Ref. Voltage: User defines the reference voltage in volts.
   - Channel #: Option to select channels 0-3.
   - Output Type:
     - Decimal is the ADC code
     - mV is millivolts
     - Temperature is in Celsius and only available on channel 3.
   - Single Read: Read a single conversion.
   - Continuous Read: Read conversion results continuously.
   - Zoom Out:
     - Checked: Graph zooms out.

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  - Unchecked: Graph resolves to LabView default.
- Burst Mode:
  - Checked: Graph updates with 1024 ADC conversions.
  - Unchecked: Graph updates with one ADC conversion.
- Save Results to File:
  - Checked: Saves continuous read data to a text file.
  - Unchecked: No data is saved.

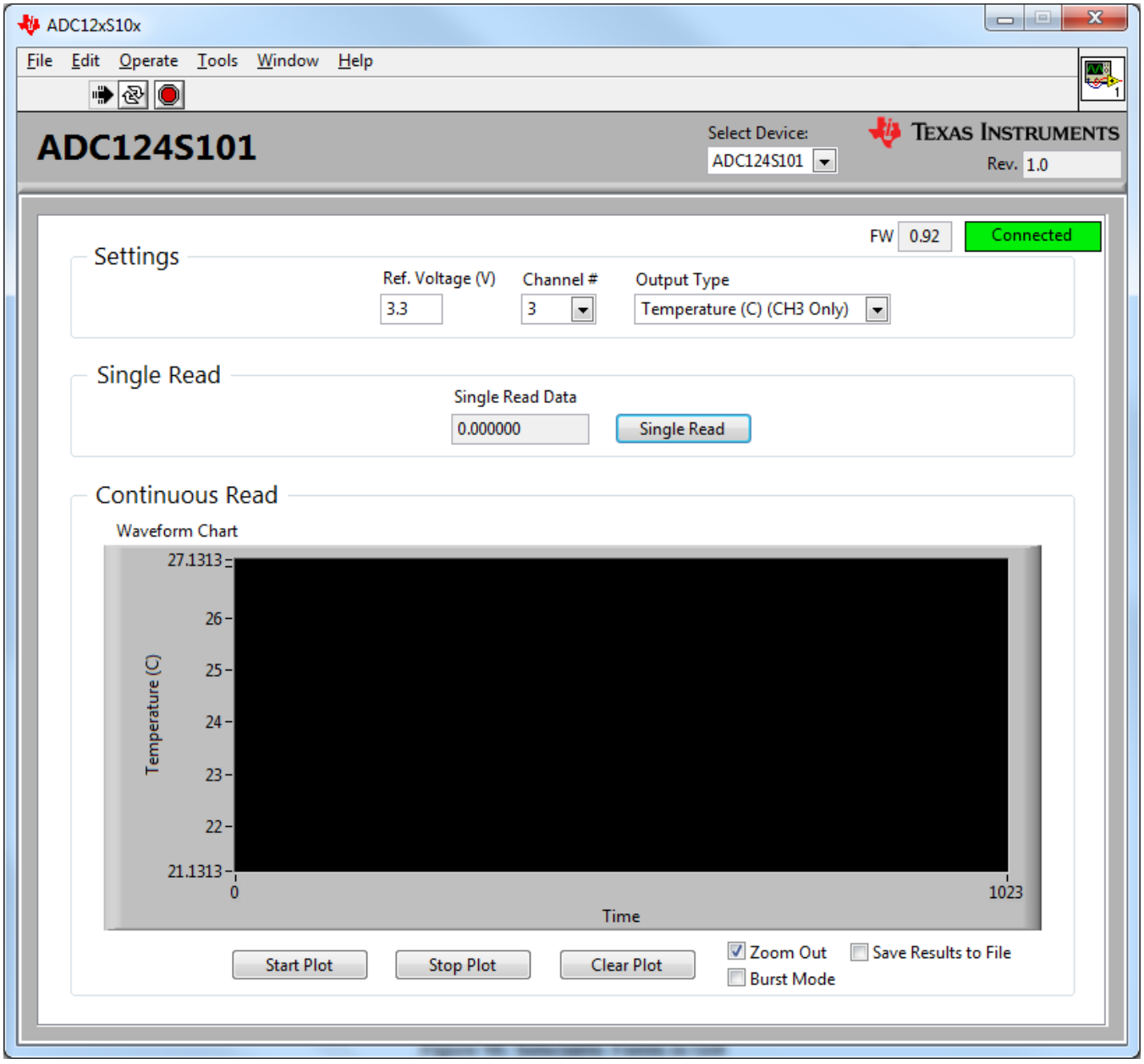


Figure 3-3. Selectable Fields in GUI

3. Test the ADC124S101 by placing a finger on U3 to observe the temperature change.

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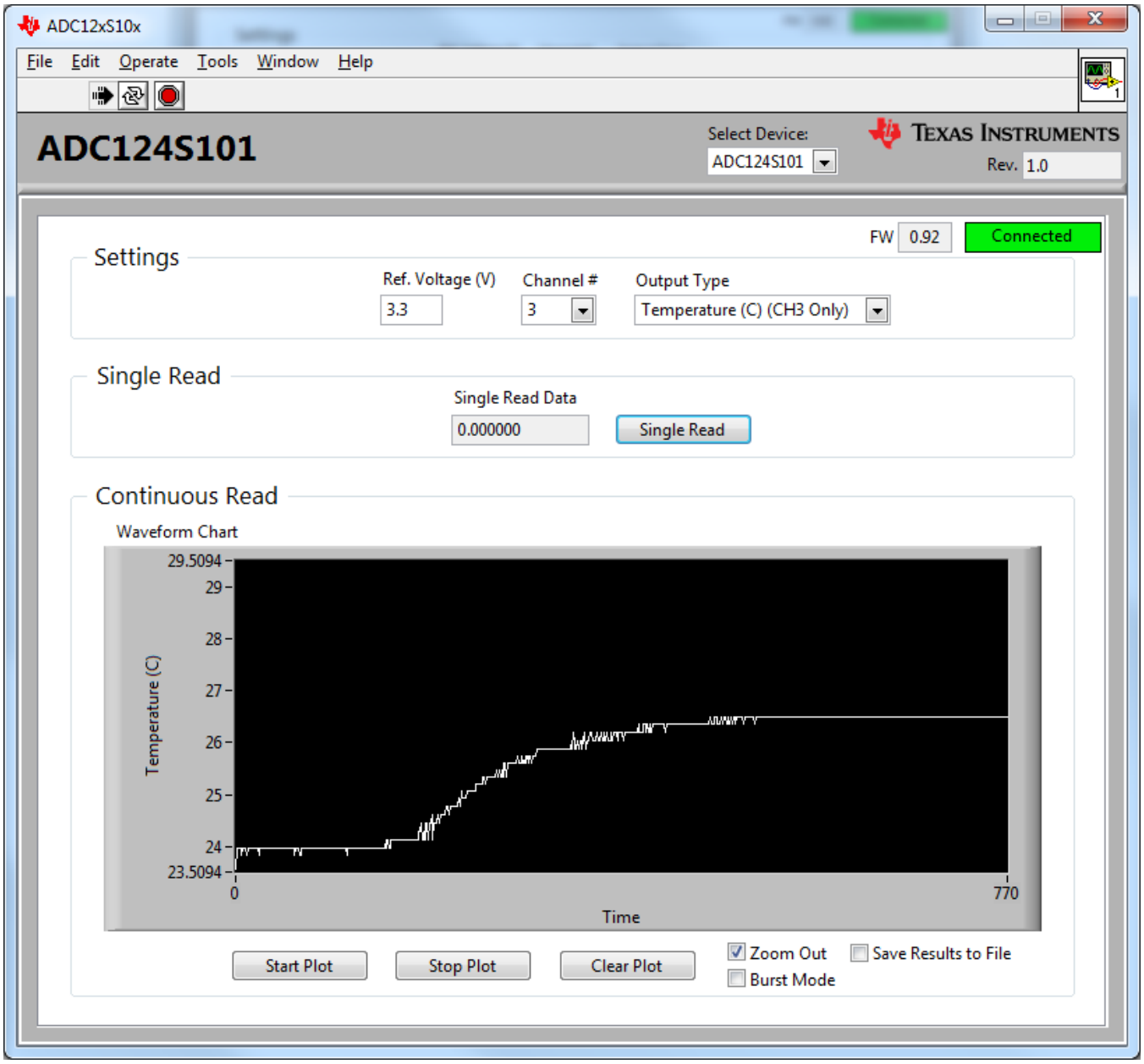


Figure 3-4. Testing the Part

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Board Layout

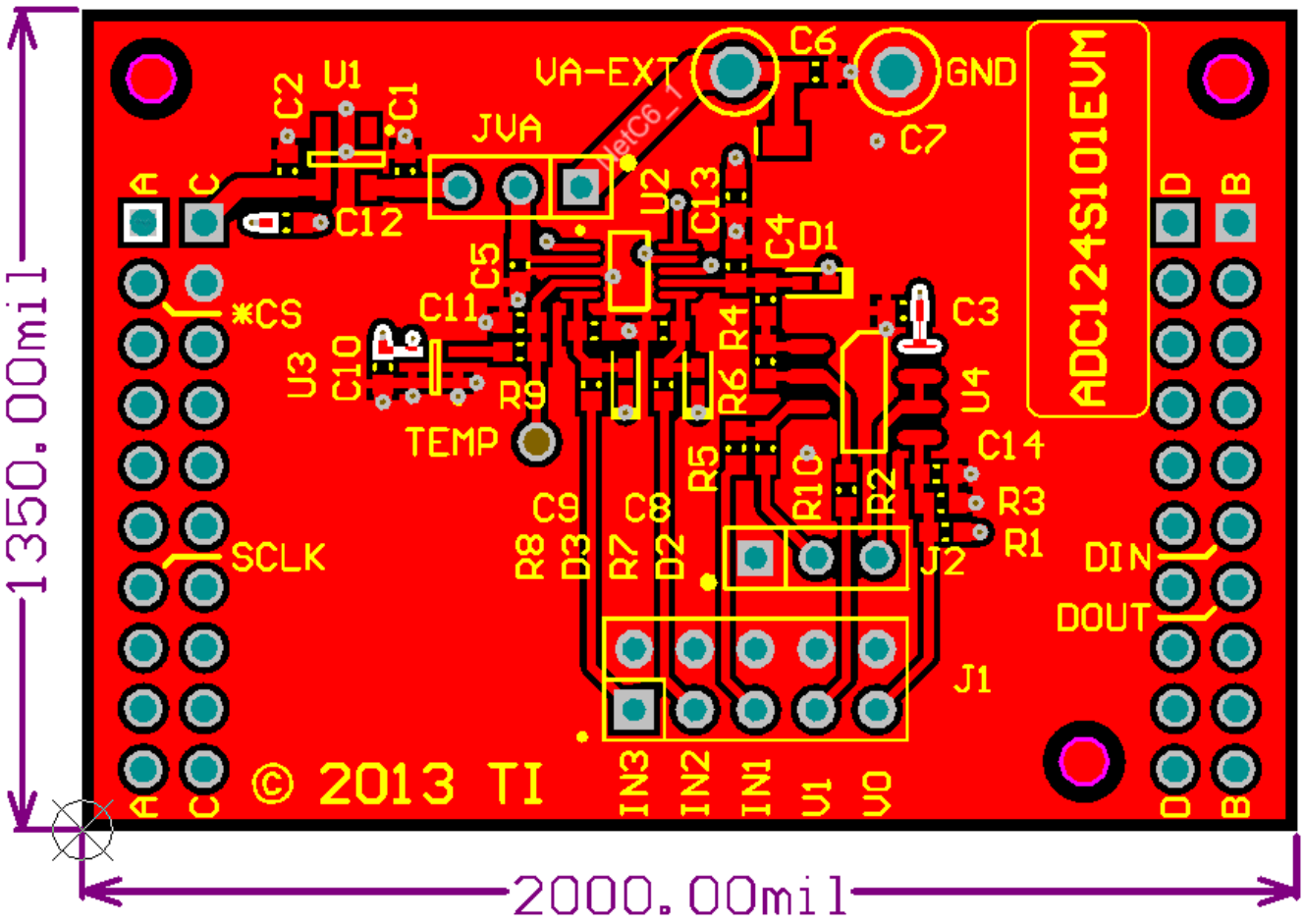


Figure 4-1. Top Assembly Layer

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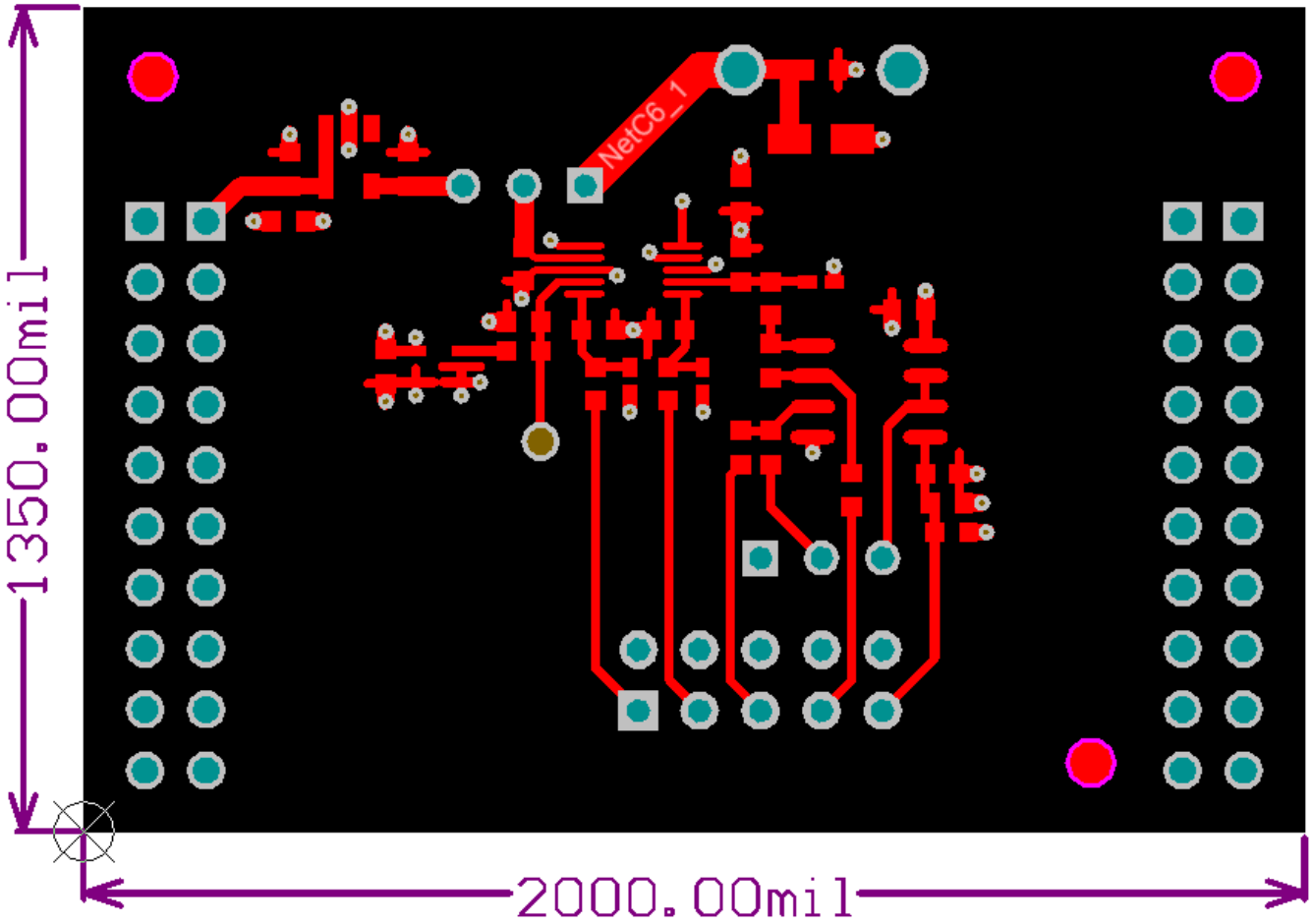


Figure 4-2. Top Layer Routing

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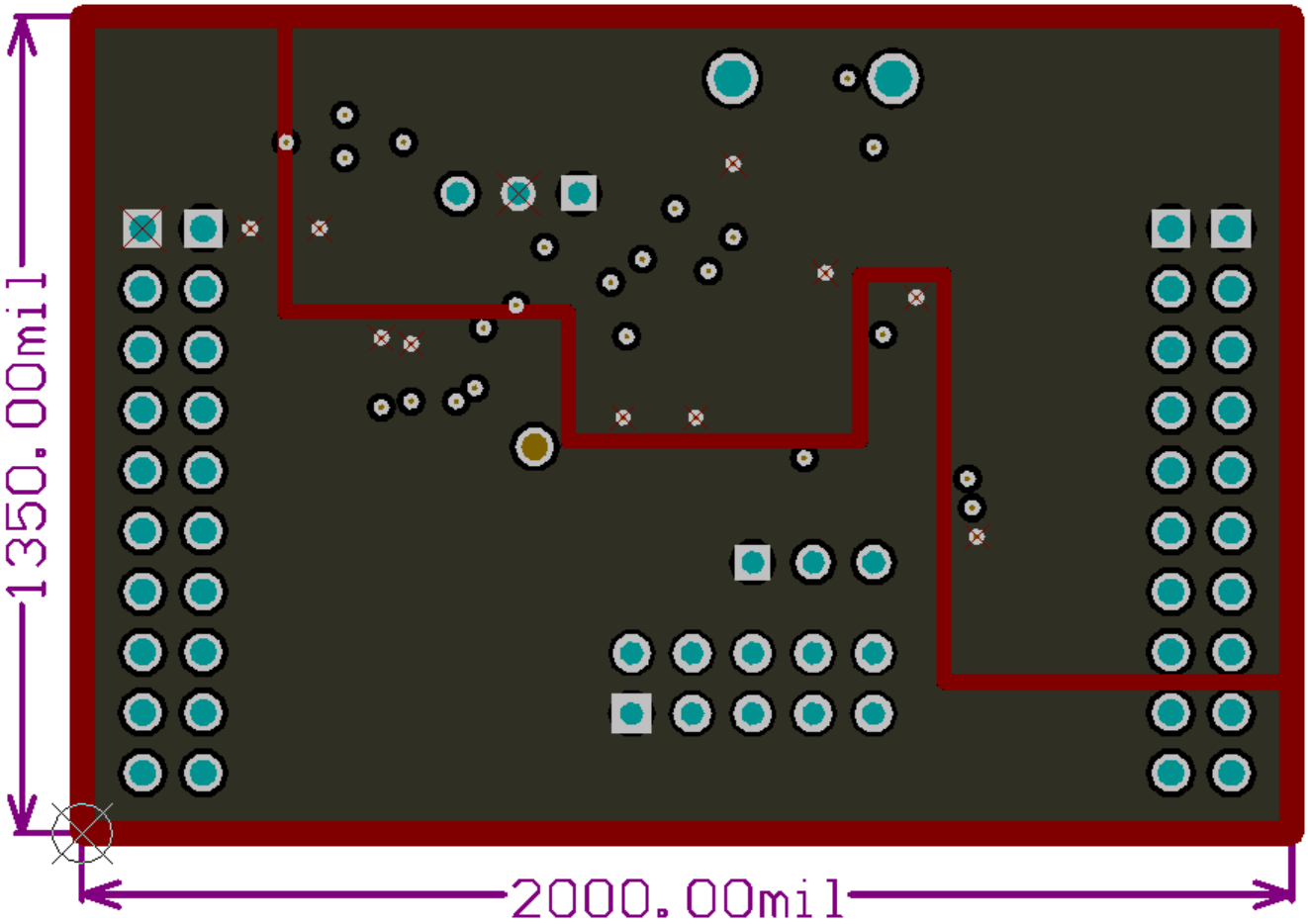


Figure 4-3. Power Layer Routing

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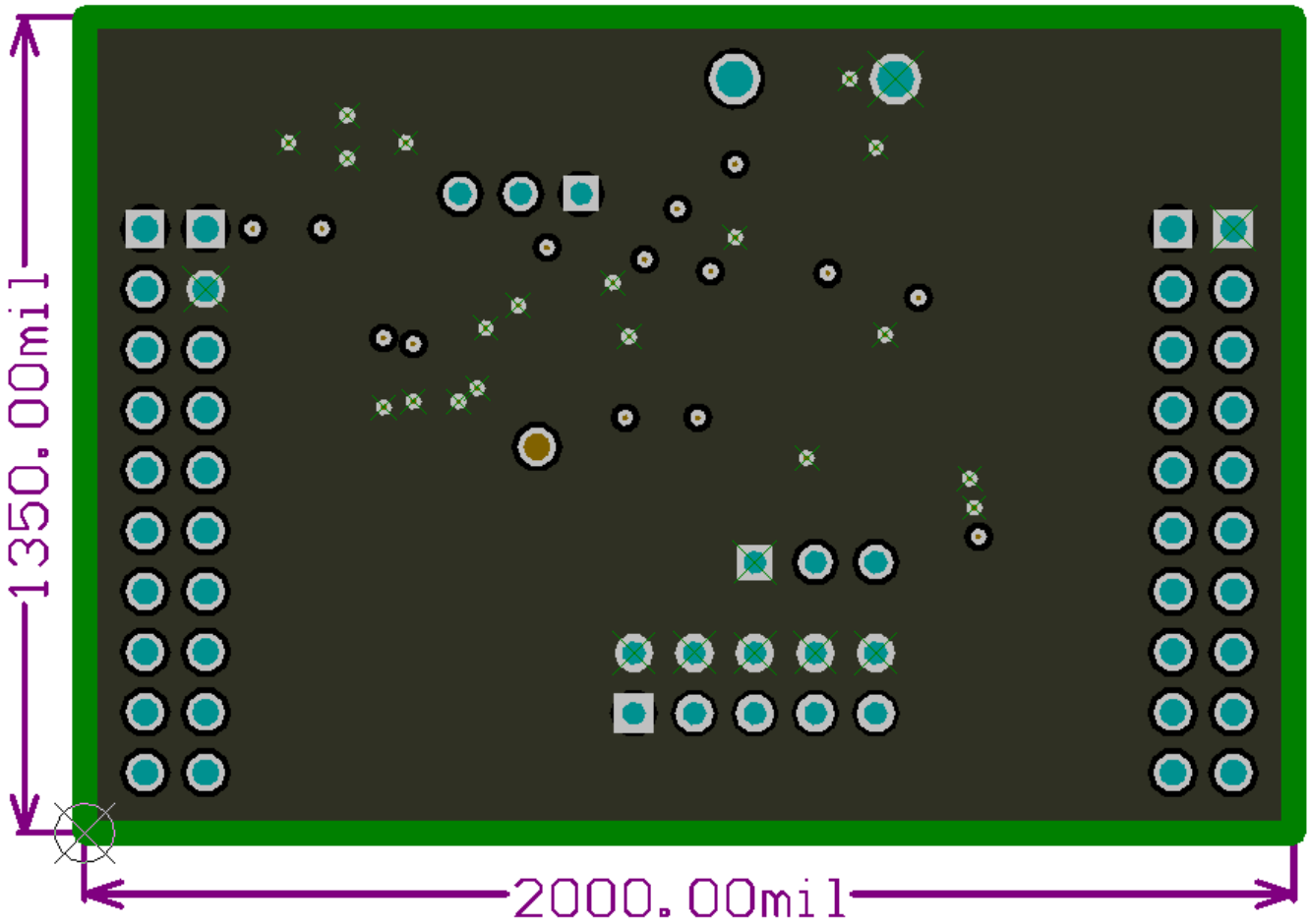


Figure 4-4. Ground Layer Routing

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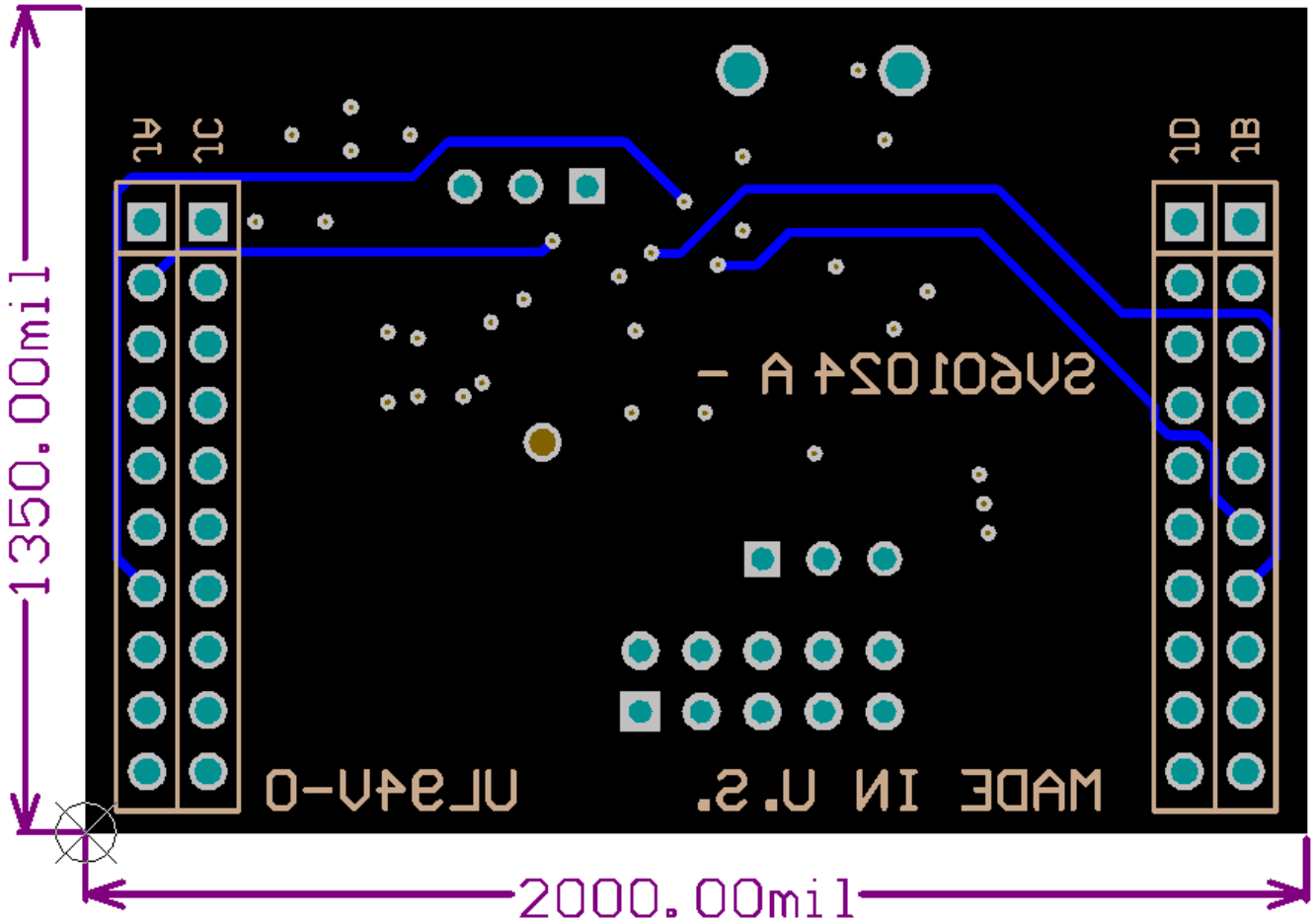


Figure 4-5. Bottom Layer Routing

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Schematic

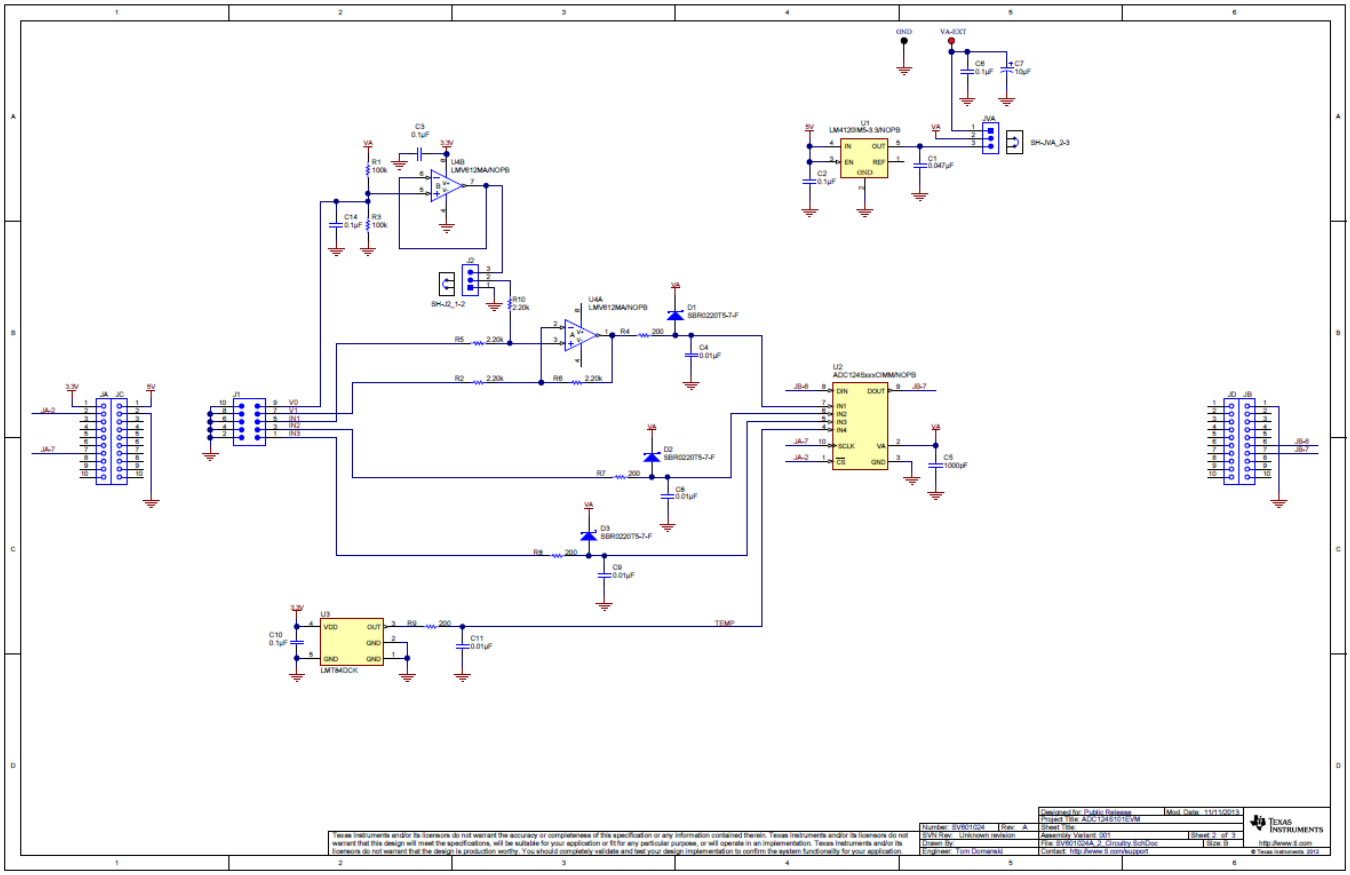


Figure 5-1. ADC124S101EVM Schematic

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Bill of Materials

Table 6-1. ADC124S101 Bill of Materials

Designator	Quantity	Value	Description	Part Number	Manufacturer
C1	1	0.047 uF	CAP, CERM, 0.047 uF, 6.3 V, +/-10%, X7R, 0603	GRM188R70J473KA01D	Murata
C2, C3, C6, C10, C14	5	0.1 uF	CAP, CERM, 0.1 uF, 10 V, +/-10%, X7R, 0603	C0603C104K8RACTU	Kemet
C4, C8, C9, C11	4	0.01 uF	CAP, CERM, 0.01 uF, 25 V, +/-10%, X7R, 0603	GRM188R71E103KA01D	Murata
C5	1	1000 pF	CAP, CERM, 1000 pF, 50 V, +/-5%, C0G/NP0, 0603	C1608C0G1H102J	TDK
C7	1	10 uF	CAP, TA, 10 uF, 10 V, +/-10%, 0.9 ohm, SMD	TPSA106K010R0900	AVX
D1, D2, D3	3	20 V	Diode, Schottky, 20 V, 0.2 A, SOD-523	SBR0220T5-7-F	Diodes Inc.
FID1, FID2, FID3	3		Fiducial mark. There is nothing to buy or mount.	N/A	N/A
GND	1	Black	Test point, TH, multipurpose, black	5011	Keystone Electronics
J1	1		Header, TH, 100 mil, 5x2, gold plated, 230 mil above insulator	TSW-105-07-G-D	Samtec
J2, JVA	2		Header, 100 mil, 3x1, tin plated, TH	PEC03SAAN	Sullins Connector Solutions
JA, JB, JC, JD	4		Connector, receptacle, 100 mil, 10x1, gold plated, TH	SSW-110-23-F-S	Samtec
LBL1	1		Thermal transfer printable labels, 0.650" W x 0.200" H - 10,000 per roll	THT-14-423-10	Brady
R1, R3	2	100k	RES, 100k ohm, 1%, 0.1W, 0603	RC0603FR-07100KL	Yageo America
R2, R5, R6, R10	4	2.20k	RES, 2.20k ohm, 1%, 0.1W, 0603	RC0603FR-072K2L	Yageo America
R4, R7, R8, R9	4	200	RES, 200 ohm, 1%, 0.1W, 0603	CRCW0603200RFKEA	Vishay-Dale
SH-J2_1-2, SH-JVA_2-3	2	1x2	Shunt, 100 mil, gold plated, black	382811-6	AMP
U1	1		Precision micropower low dropout voltage reference, 5-pin SOT-23, Pb-free	LM4120IM5-3.3/NOPB	Texas Instruments
U2	1		4 Channel, 50 kSPS to 200 kSPS, 12-bit A/D converter, 10-pin mini SOIC, Pb-free	ADC124S101CIMM/NOPB	Texas Instruments
U3	1		Analog temperature sensors with Class-AB output, DCK0005A	LMT84DCK	Texas Instruments
U4	1		Dual 1.4 MHz, low power general purpose, 1.8 V, D0008A	LMV612MA/NOPB	Texas Instruments
VA-EXT	1	Red	Test point, TH, multipurpose, red	5010	Keystone Electronics

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Revision History

Changes from Revision (July 2014) to A Revision **Page**

- Changed to "Texas Instruments" from "National Semiconductor" 20
- Changed to "ADC124S101CIMM/NOPB" from "ADC124S021CIMM/NOPB" 20
- Changed to "Texas Instruments" from "National Semiconductor" 20

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

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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.

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   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/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。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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

If User uses EVMs in 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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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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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.

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