# ADC121S101EVM User's Guide

# User's Guide



Literature Number: SNOU131
July 2014

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# ADC121S101 BoosterPack Components

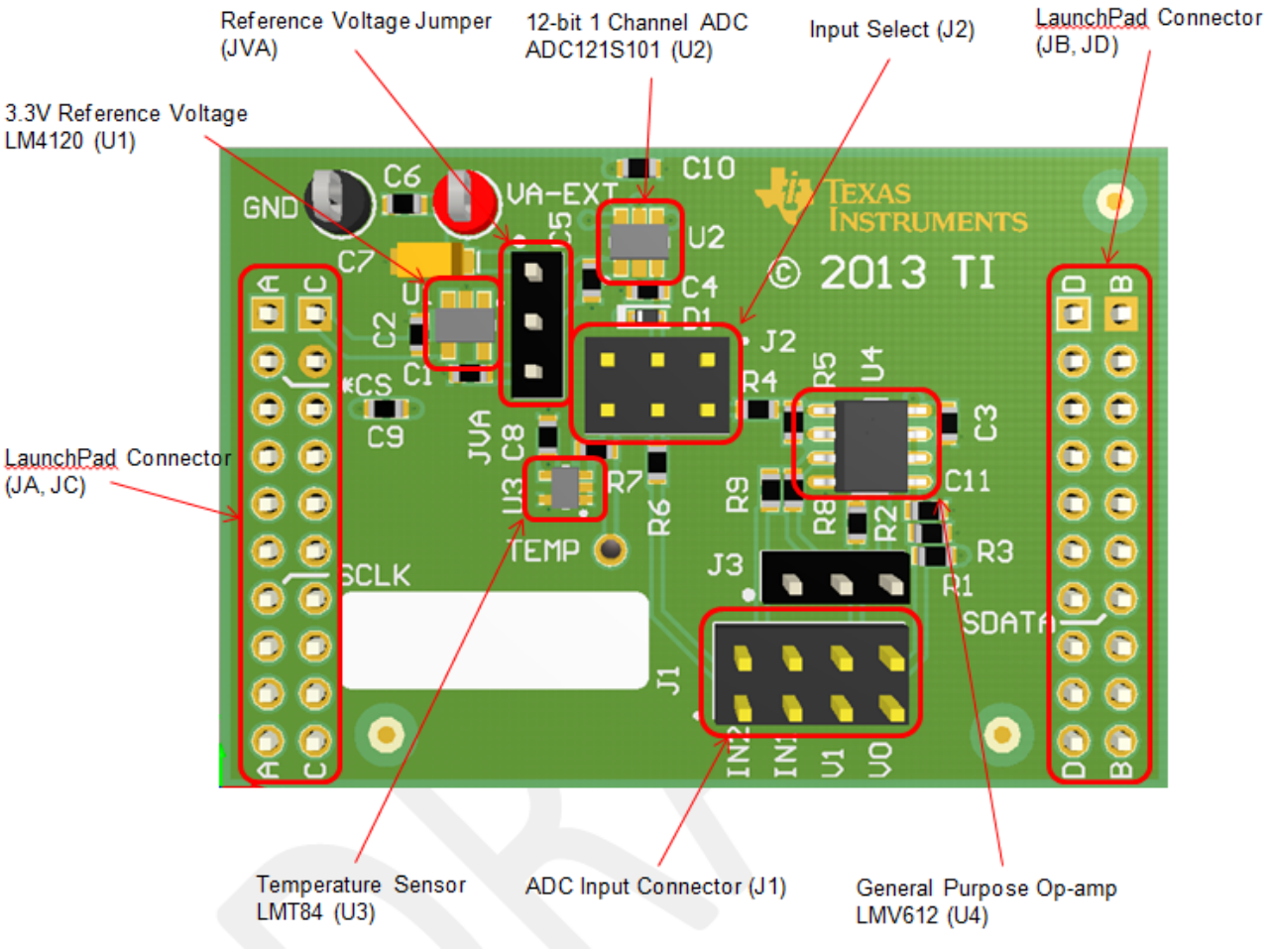



**Figure 1-1. ADC121S101EVM Evaluation Board**

**Table 1-1. Device and Package Configurations**

| DEVICE | IC | PACKAGE |
|---|---|---|
| U1 | LM4120IM5-3.3 | SOT-23 |
| U2 | ADC121S101CIMF | SOT-23 |
| U3 | LMT84DCK | SC70 |
| U4 | LMV612MA | SOIC-8 |


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# Software Installation

## 2.1 Graphical User Interface (GUI)

To use the ADC121S101EVM, install the ADC12xS10x software:

1. If the ADC121S101EVM came from an FAE, the software GUI is in a .zip file. Otherwise, click on http://www.ti.com/product/adc121s101, 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.

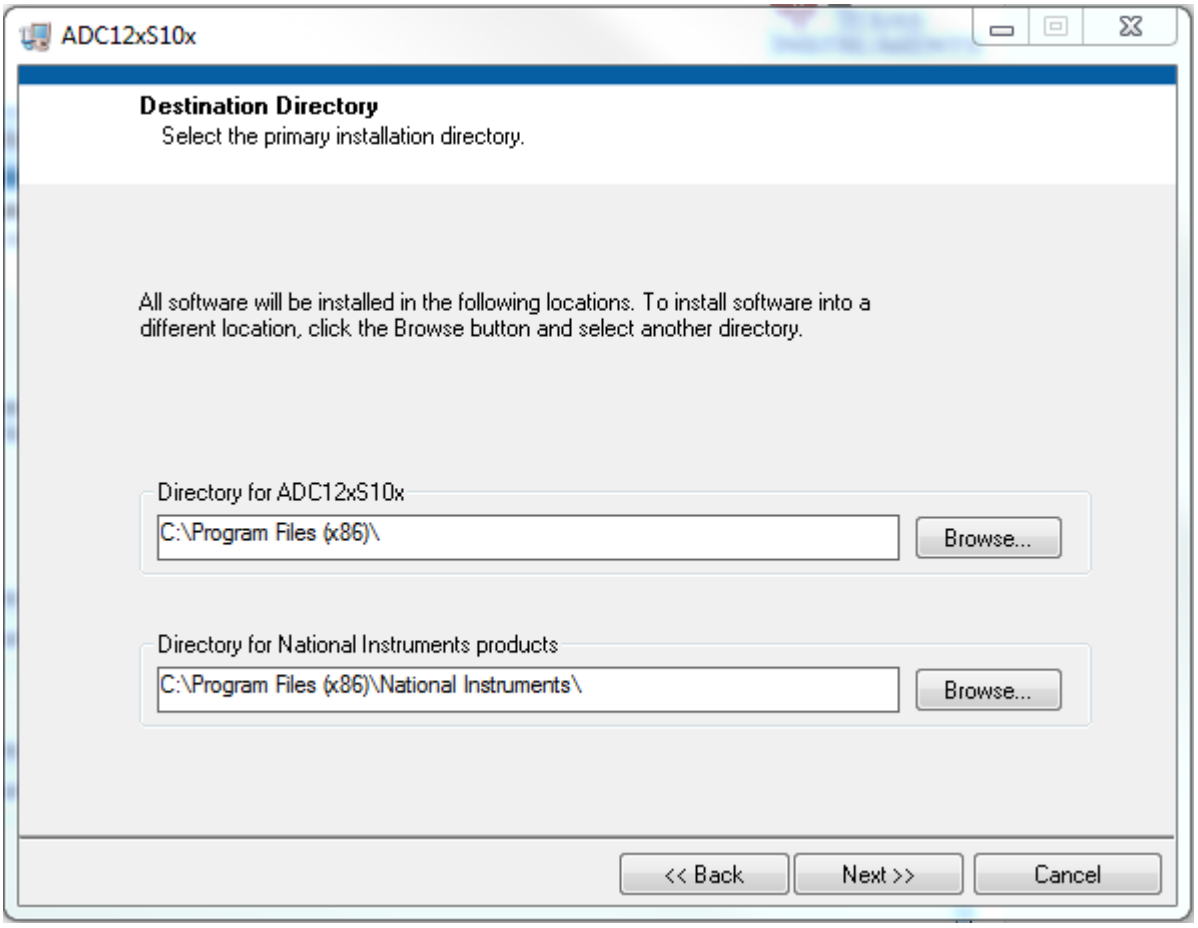



**Figure 2-1. ADC12xS10x Installation Directory**

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


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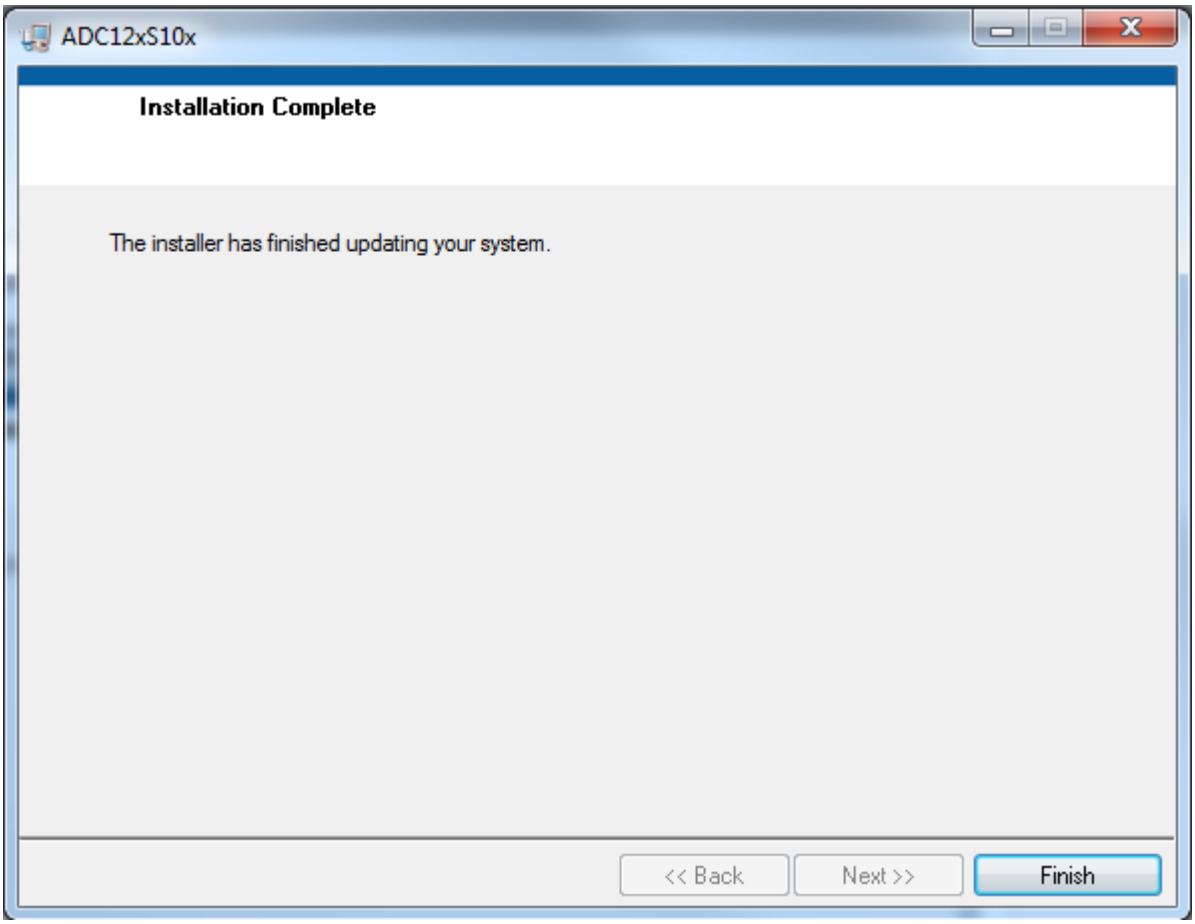



**Figure 2-2. ADC12xS10x Installation Finish**

## 2.2 Launchpad Firmware Upgrade

This section is only necessary with a brand new Launchpad. If a Launchpad is shipped with an ADC121S101EVM, skip this section.

**MSP430 Firmware Upgrade Application Installation**:

1. Navigate to http://www.ti.com/tool/msp430usbdevpack and click on 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 ADC121S101EVM is 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 is launched 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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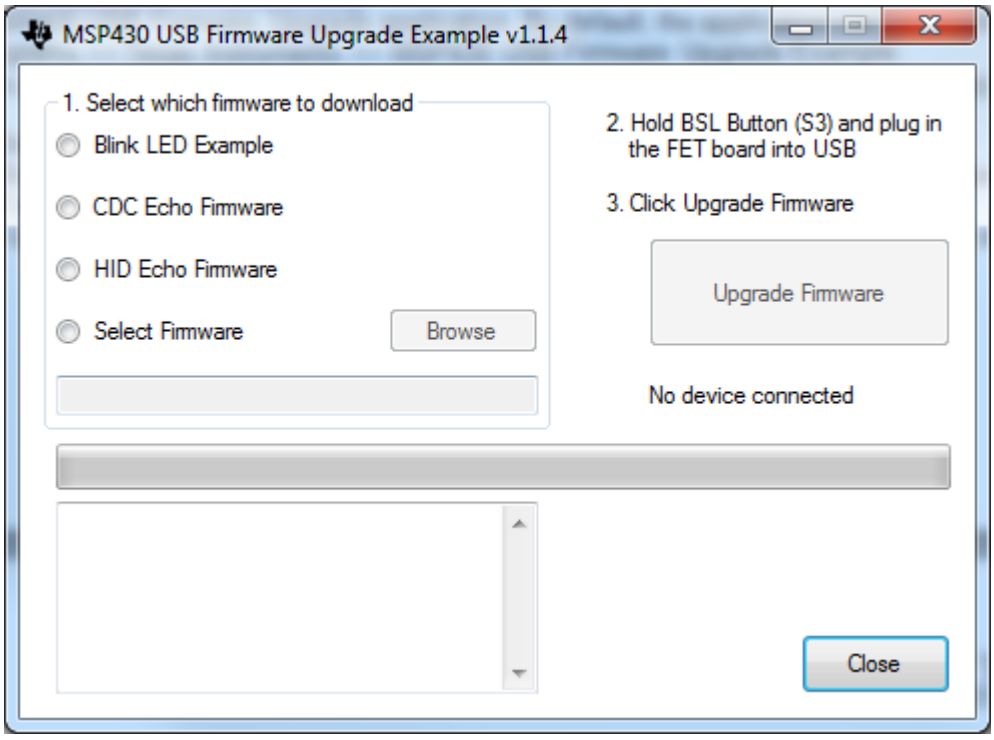



**Figure 2-3. USB Firmware Upgrade Window**

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 ADC121S101EVM board to a USB port of the PC. Go to the Device Manager and find MSP43-USB Example. Right click and select Update Driver Software.


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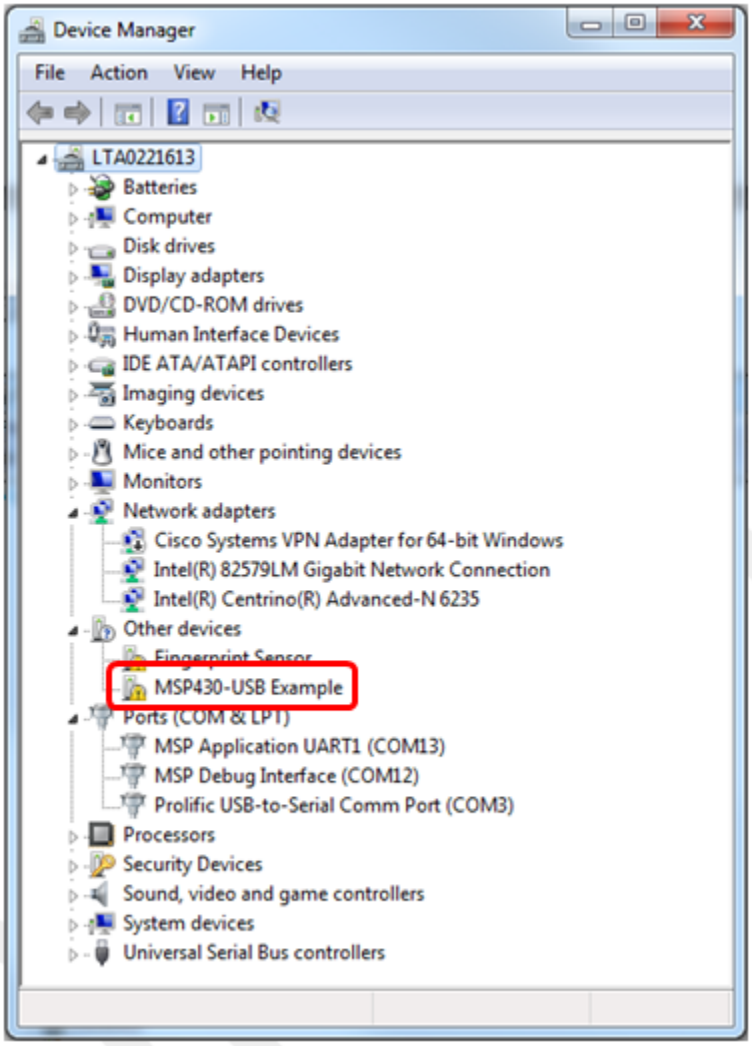



**Figure 2-4. Driver Not Installed**

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


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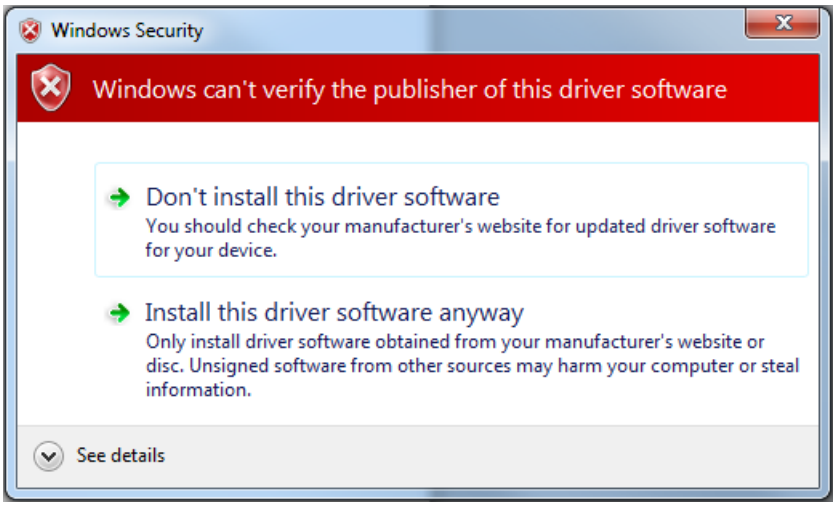



**Figure 2-5. Driver Authentication Warning**

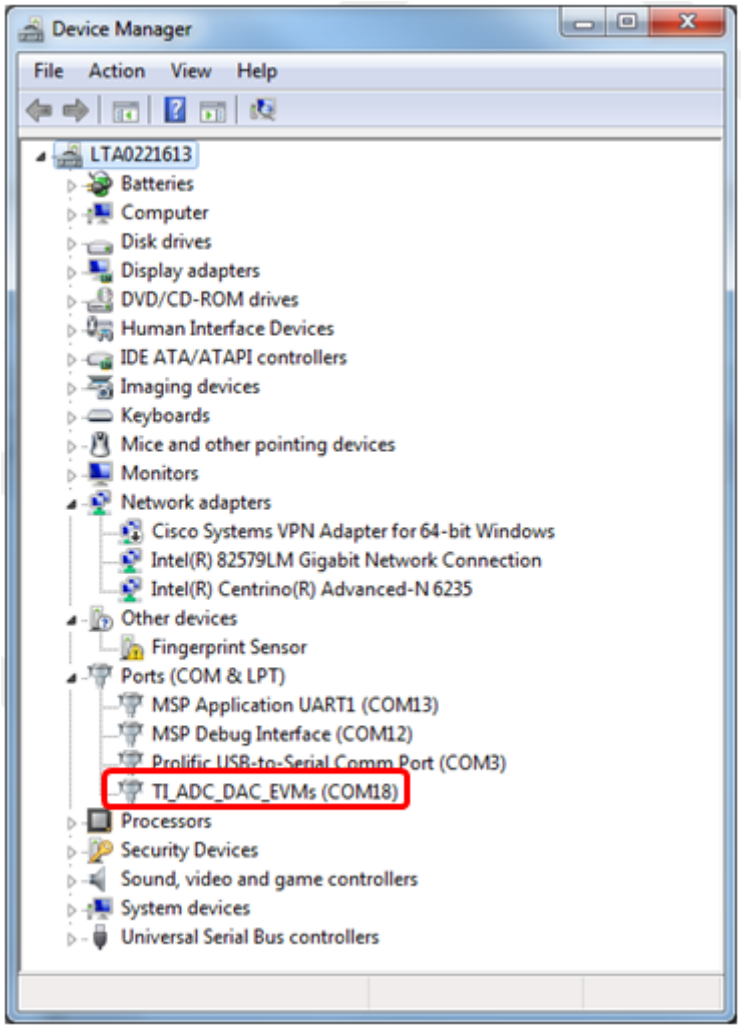



**Figure 2-6. Driver Installed**


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# ADC121S101 BoosterPack Setup and Operation

## 3.1 Connections

1. Attach the ADC121S101EVM BoosterPack onto the MSP430 LaunchPad using connectors JA, JB, JC, JD. Align the Launchpad and ADC121S101EVM so that the text “LaunchPad” and “2013 TI” are in the same direction.




**Figure 3-1. ADC121S101EVM 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 ADC121S101.


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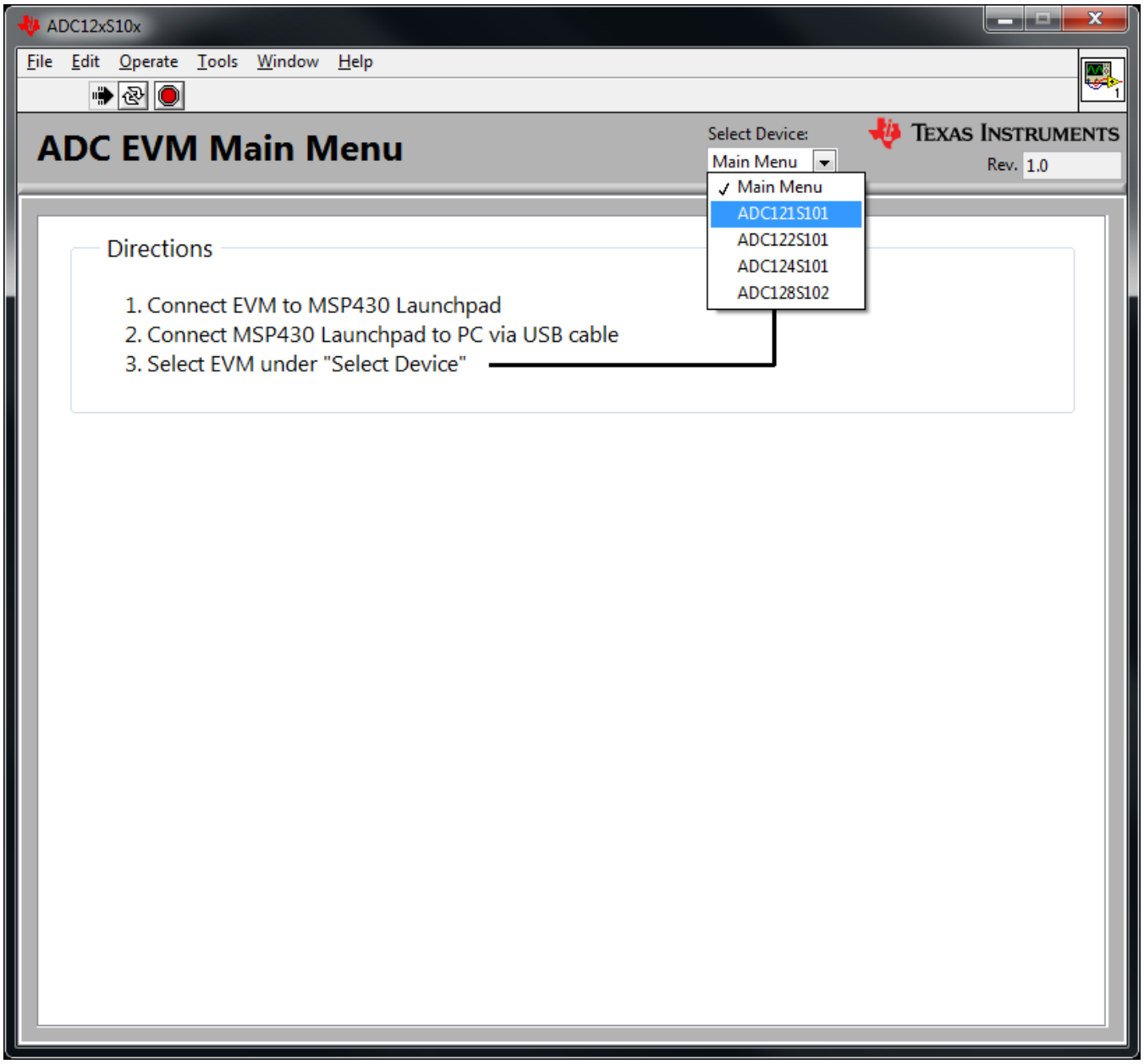



**Figure 3-2. Part Select**

2. GUI Descriptions:
   - Ref. Voltage: User can define 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 is 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: Save continuous read data to a text file.
  - Unchecked: No data is saved.

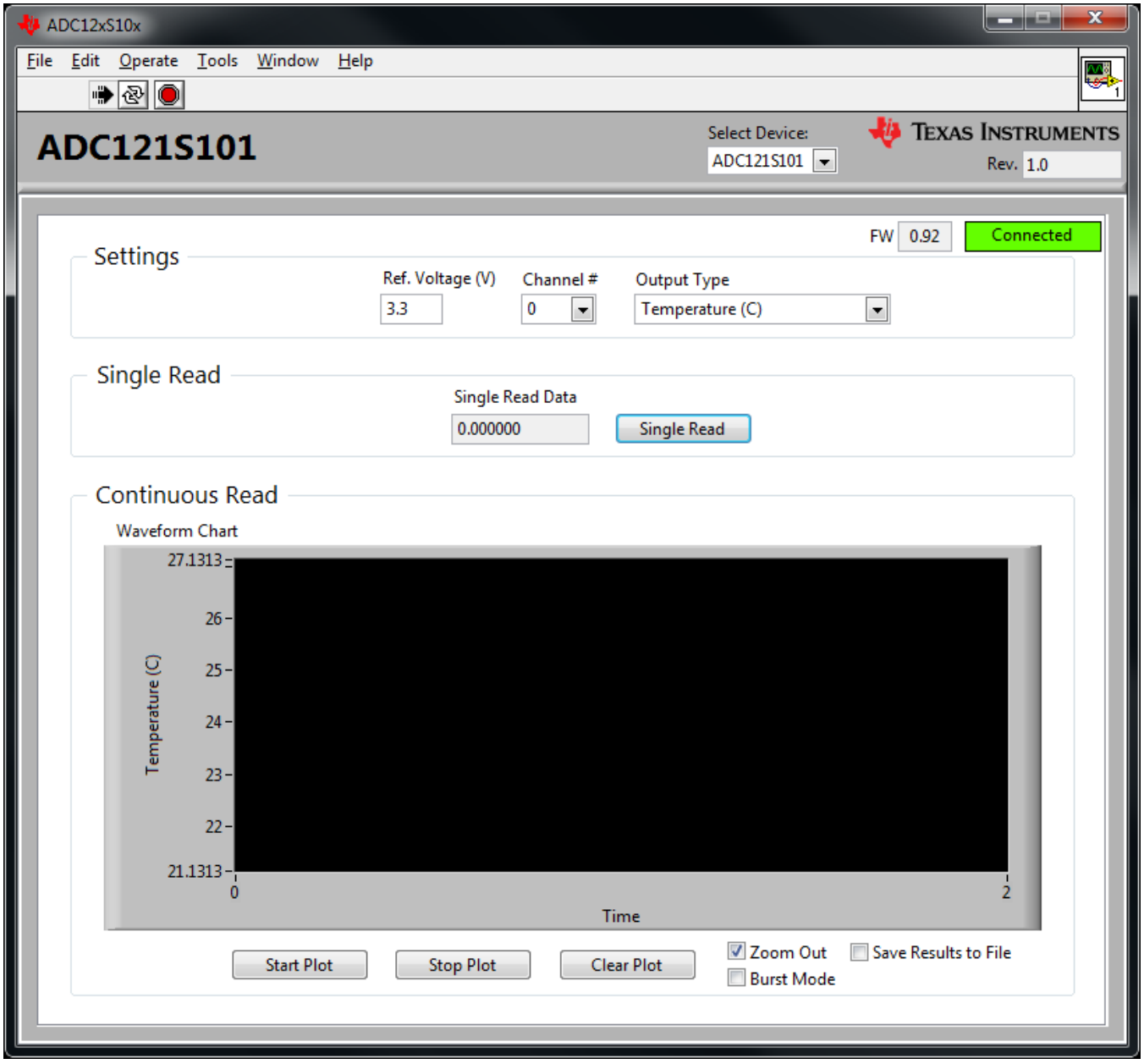



**Figure 3-3. Selectable Fields in GUI**

3. Test the ADC121S101 by placing a finger on U3 to observe the temperature change.


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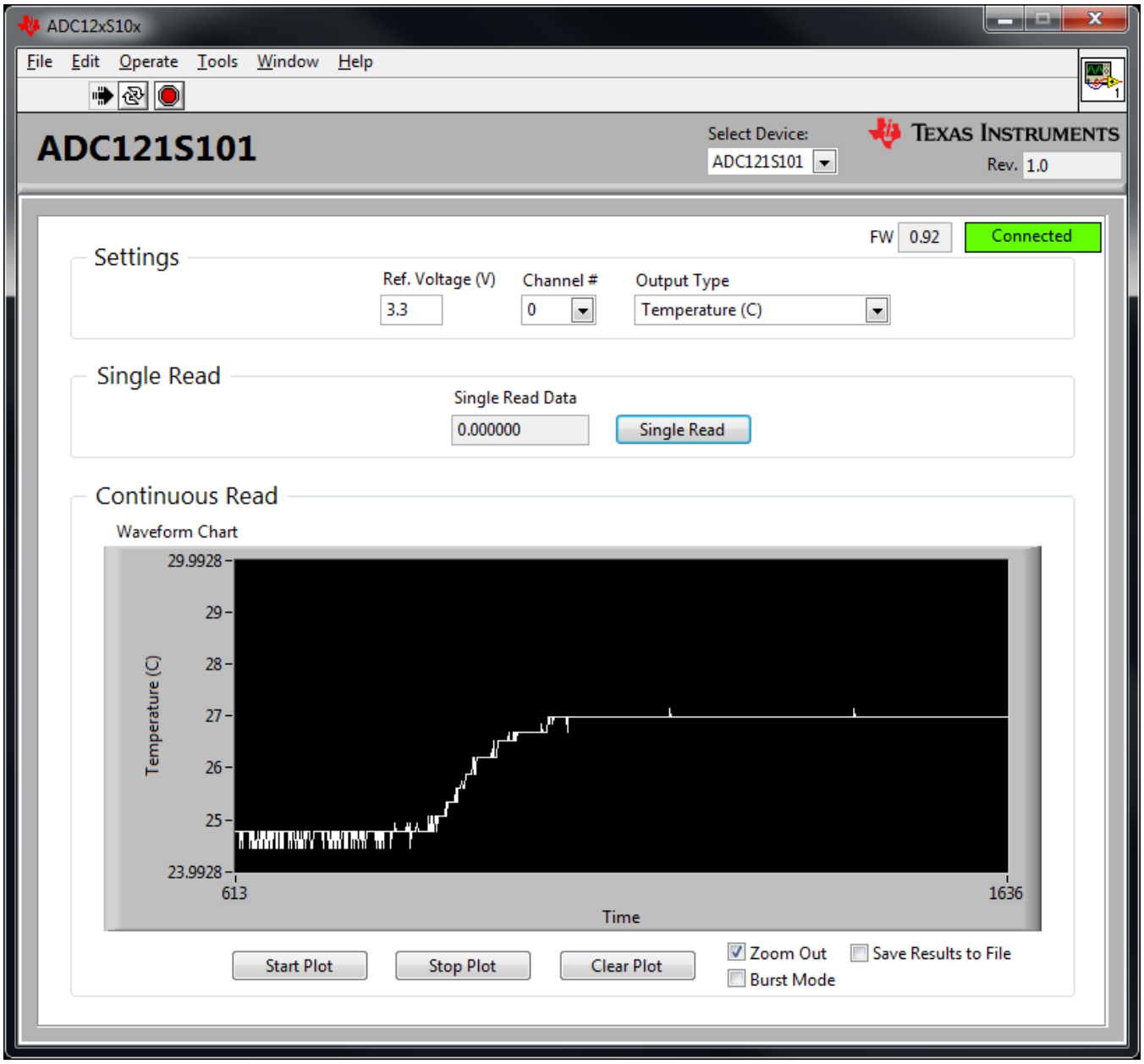



**Figure 3-4. Testing the Part**


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# Board Layout

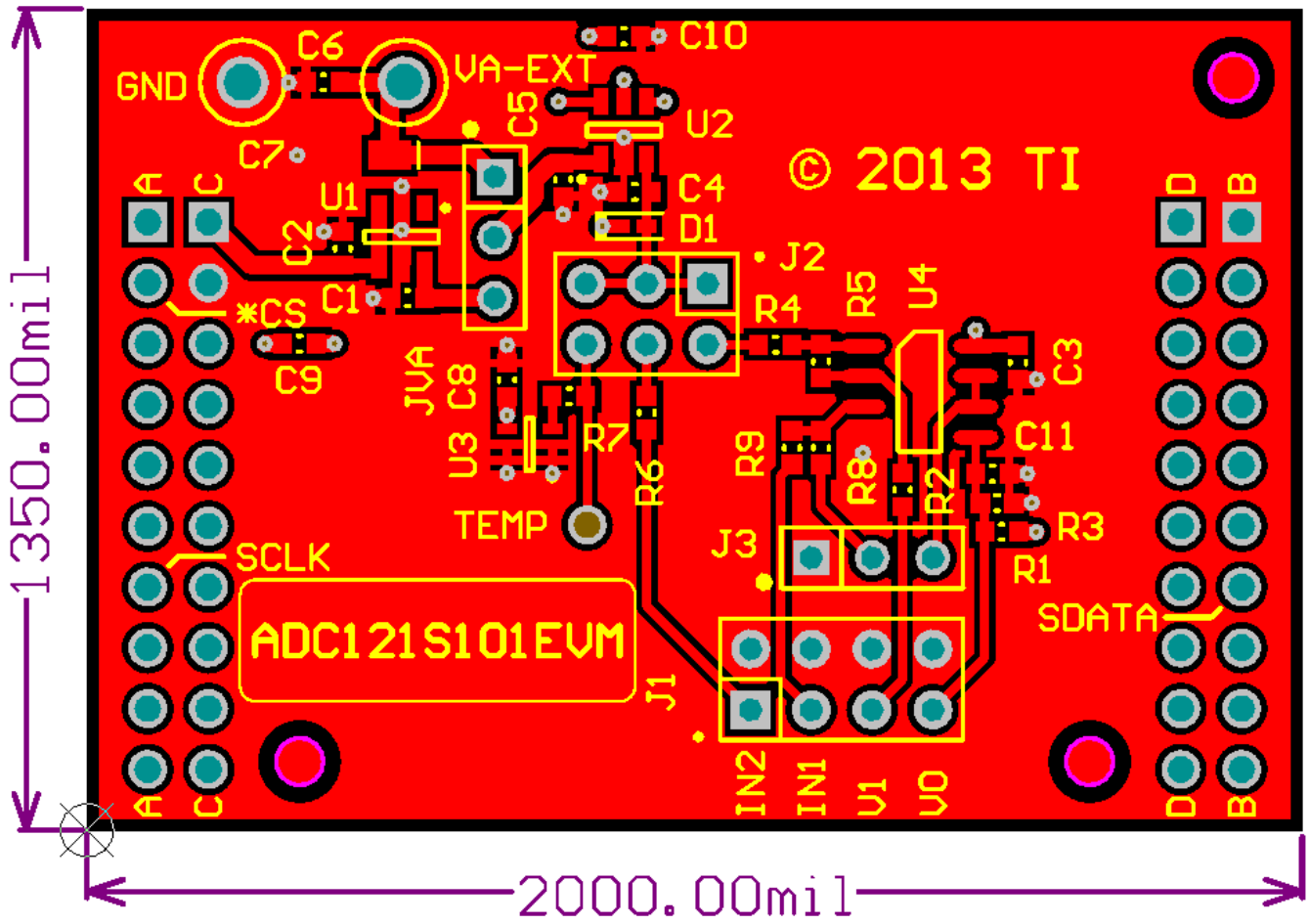



**Figure 4-1. Top Assembly Layer**



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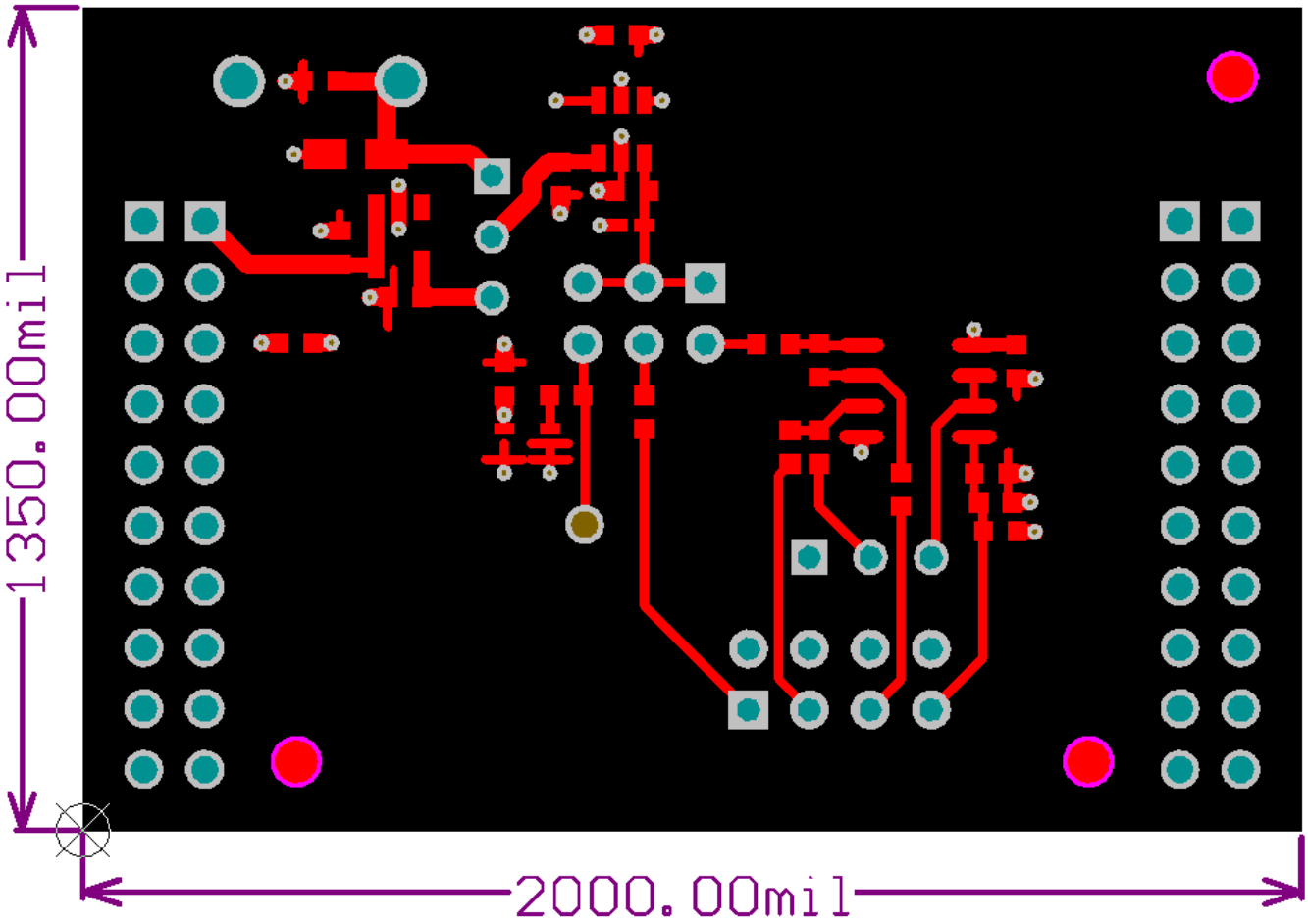



**Figure 4-2. Top Layer Routing**


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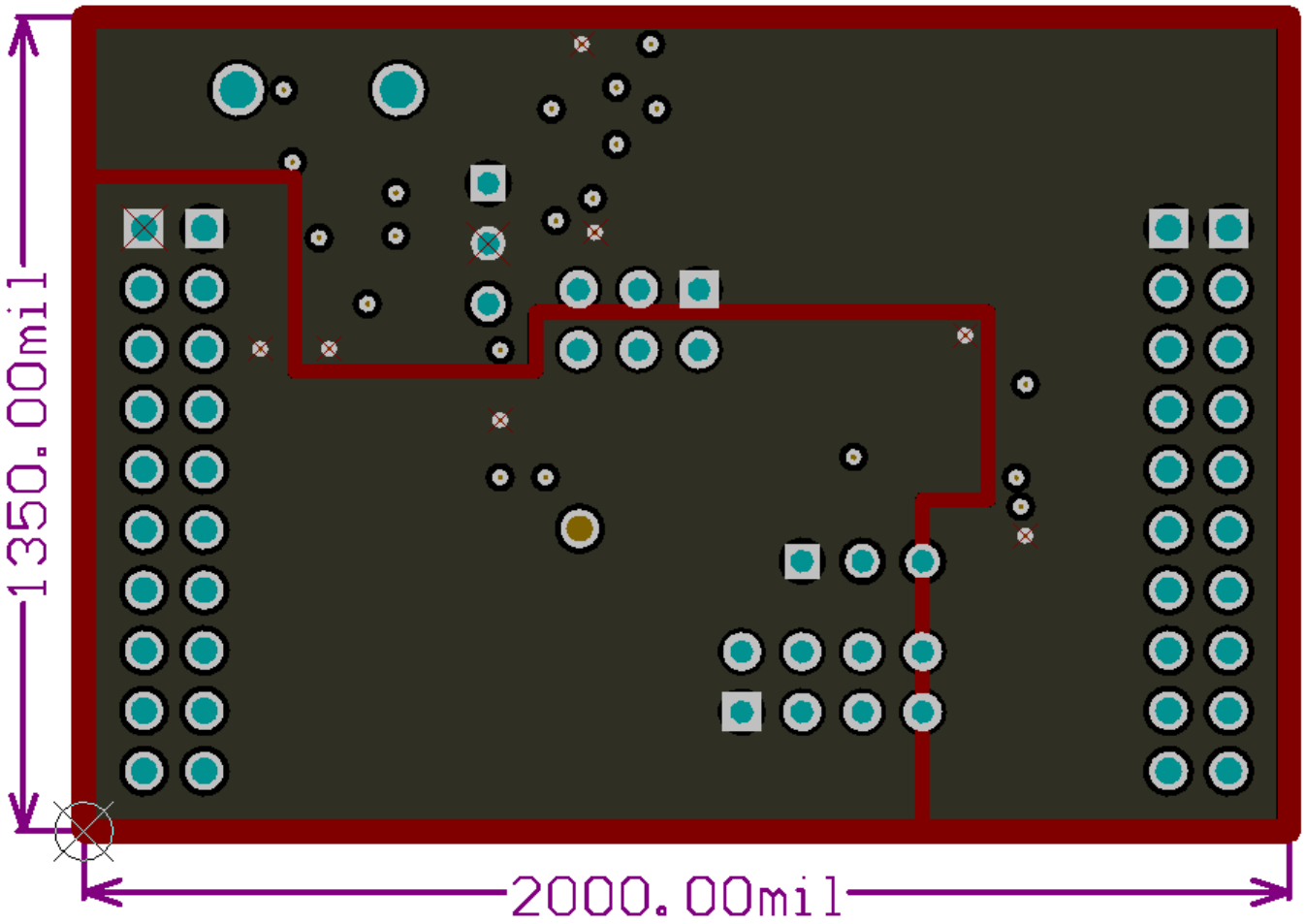



**Figure 4-3. Power Layer Routing**


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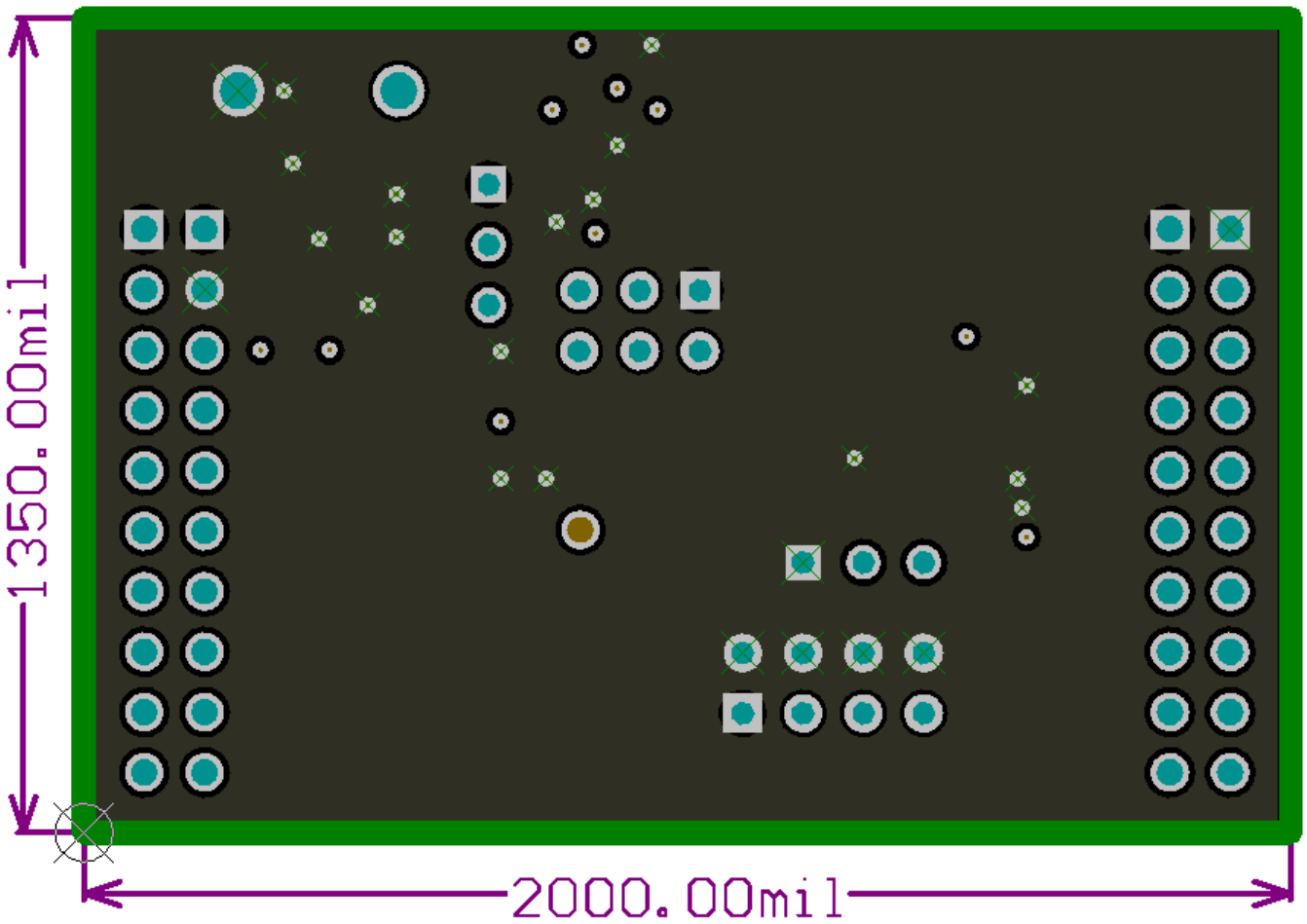



**Figure 4-4. Ground Layer Routing**


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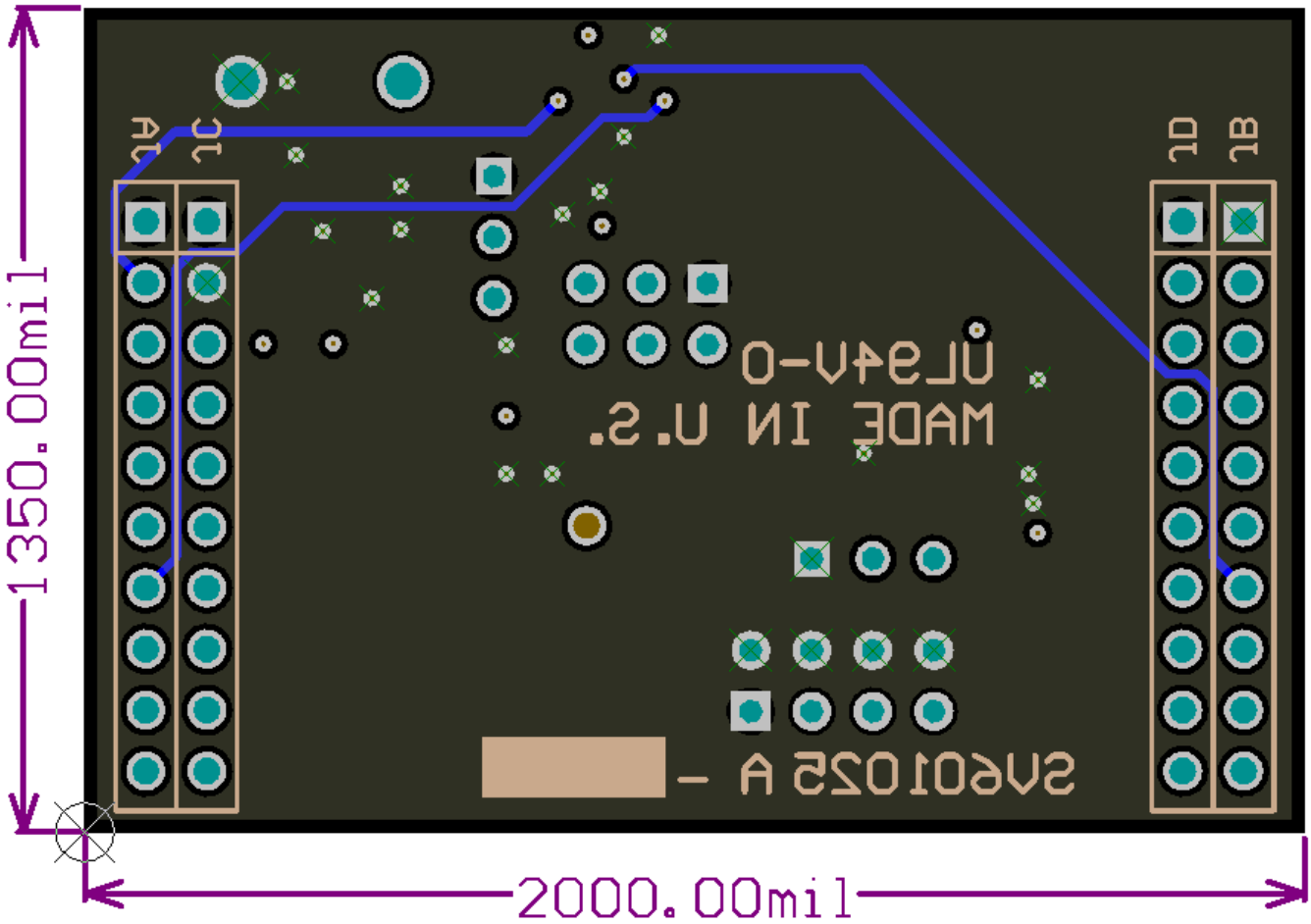



**Figure 4-5. Bottom Layer Routing**


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# Schematic

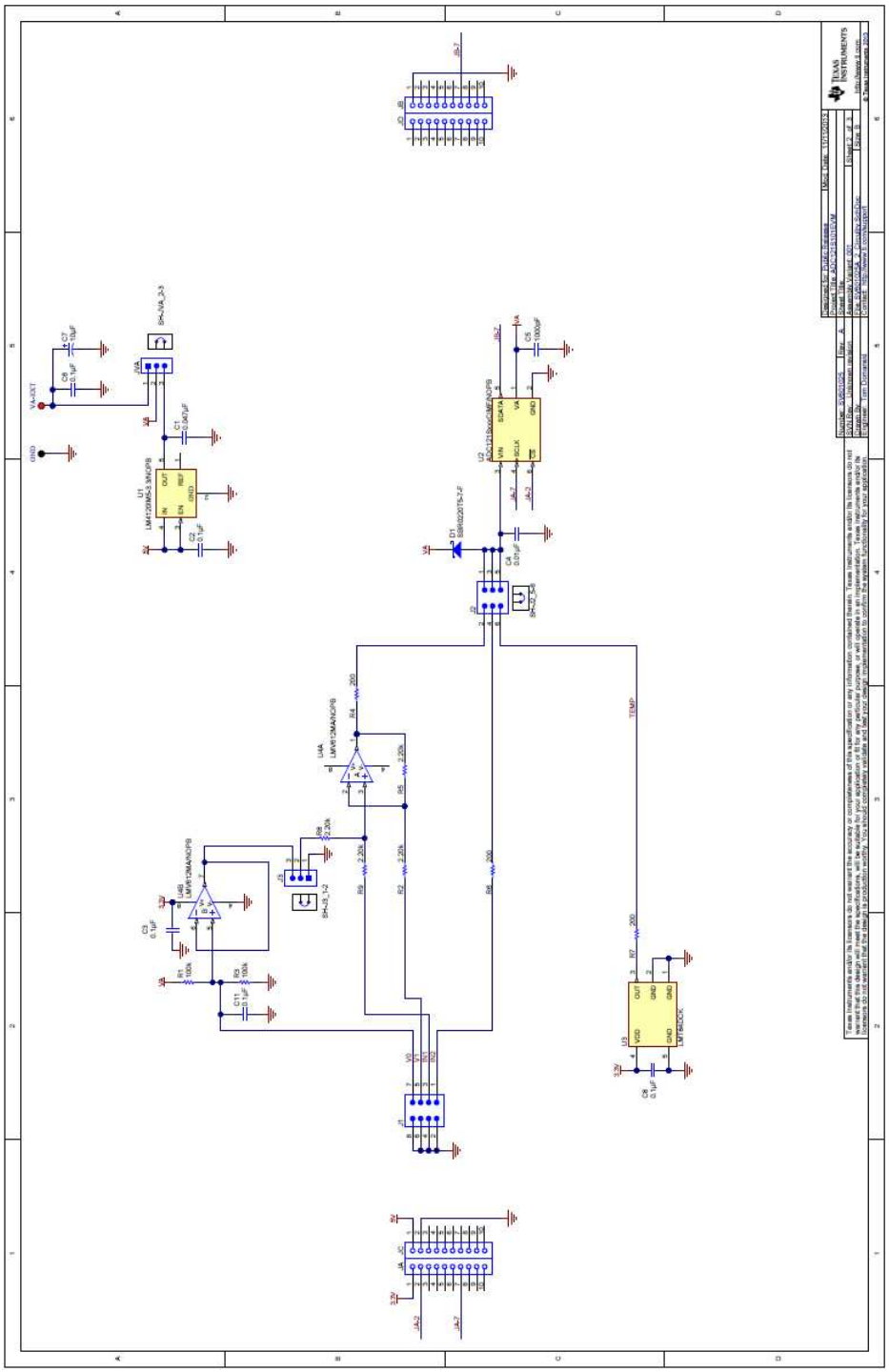


**Figure 5-1. ADC121S101EVM Schematic**


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# Bill Of Materials

**Table 6-1. ADC121S101 Bill of Materials**

| Designator | Quantity | Value | Description | Part Number | Manufacturer |
|---|---|---|---|---|---|
| !PCB | 1 | | Printed circuit board | SV601025 | Any |
| C1 | 1 | 0.047 uF | CAP, CERM, 0.047 uF, 6.3 V, +/-10%, X7R, 0603 | GRM188R70J473KA01D | Murata |
| C2, C3, C6, C8, C11 | 5 | 0.1 uF | CAP, CERM, 0.1 uF, 10 V, +/-10%, X7R, 0603 | C0603C104K8RACTU | Kemet |
| C4 | 1 | 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 | 1 | 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, 4x2, gold plated, 230 mil above insulator | TSW-104-07-G-D | Samtec |
| J2 | 1 | | Header, TH, 100 mil, 3x2, gold plated, 230 mil above insulator | TSW-103-07-G-D | Samtec |
| J3, 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, R8, R9 | 4 | 2.20k | RES, 2.20k ohm, 1%, 0.1W, 0603 | RC0603FR-072K2L | Yageo America |
| R4, R6, R7 | 3 | 200 | RES, 200 ohm, 1%, 0.1W, 0603 | CRCW0603200RFKEA | Vishay-Dale |
| SH-J2_5-6, SH-J3_1-2, SH-JVA_2-3 | 3 | 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 | | Single channel, 0.5 to 1 MSPS, 12-bit A/D converter, 6-pin SOT-23, Pb-free | ADC121S101CIMF/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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**Table 6-1. ADC121S101 Bill of Materials (continued)**

| Designator | Quantity | Value | Description | Part Number | Manufacturer |
|---|---|---|---|---|---|
| C9, C10 | 2 | | CAP, CERM, xxxF, xxV, [TempCo], xx%, [PackageReference] | Used in BOM report | Used in BOM report |


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# 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 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 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/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 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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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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4.1 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.

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