ADC161S626EVM User's Guide

User's Guide

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1 Introduction

The Texas Instruments ADC161S626EVM evaluation module (EVM) helps designers evaluate the operation and performance of the ADC161S626. The ADC161S626 is a 16-bit, 50kSPS to 250kSPS sampling Analog-to-Digital (A/D) converter. The converter uses a successive-approximation register (SAR) architecture, based upon capacitive redistribution and containing an inherent sample-and-hold function. The differential nature of the analog inputs is maintained from the internal sample-and-hold circuits throughout the A/D converter to provide excellent common-mode signal rejection.

The EVM contains an LMP8350 and an ADC161S626. The LMP8350 is an ultra-low distortion, fully-differential amplifier designed for driving high-performance precision analog-to-digital converters (ADC). The user can use the LMP8350 to drive the ADC, or test the performance of ADC161S626 directly. The evaluation board communicates with the MSP430's Launch-Pad through the SPI interface.

Table 1. Device and Package Configurations

COMPONENTS	IC	PACKAGE
U1	ADC161S626CIMM	VSSOP-10
U2	LMP8350MA	SOIC-8

2 Board Connectors and Components

This section describes the functions, jumpers, and connectors on the ADC161S626EVM. The top view of this board is shown in Figure 1. The detailed introductions for each part are shown as follows.

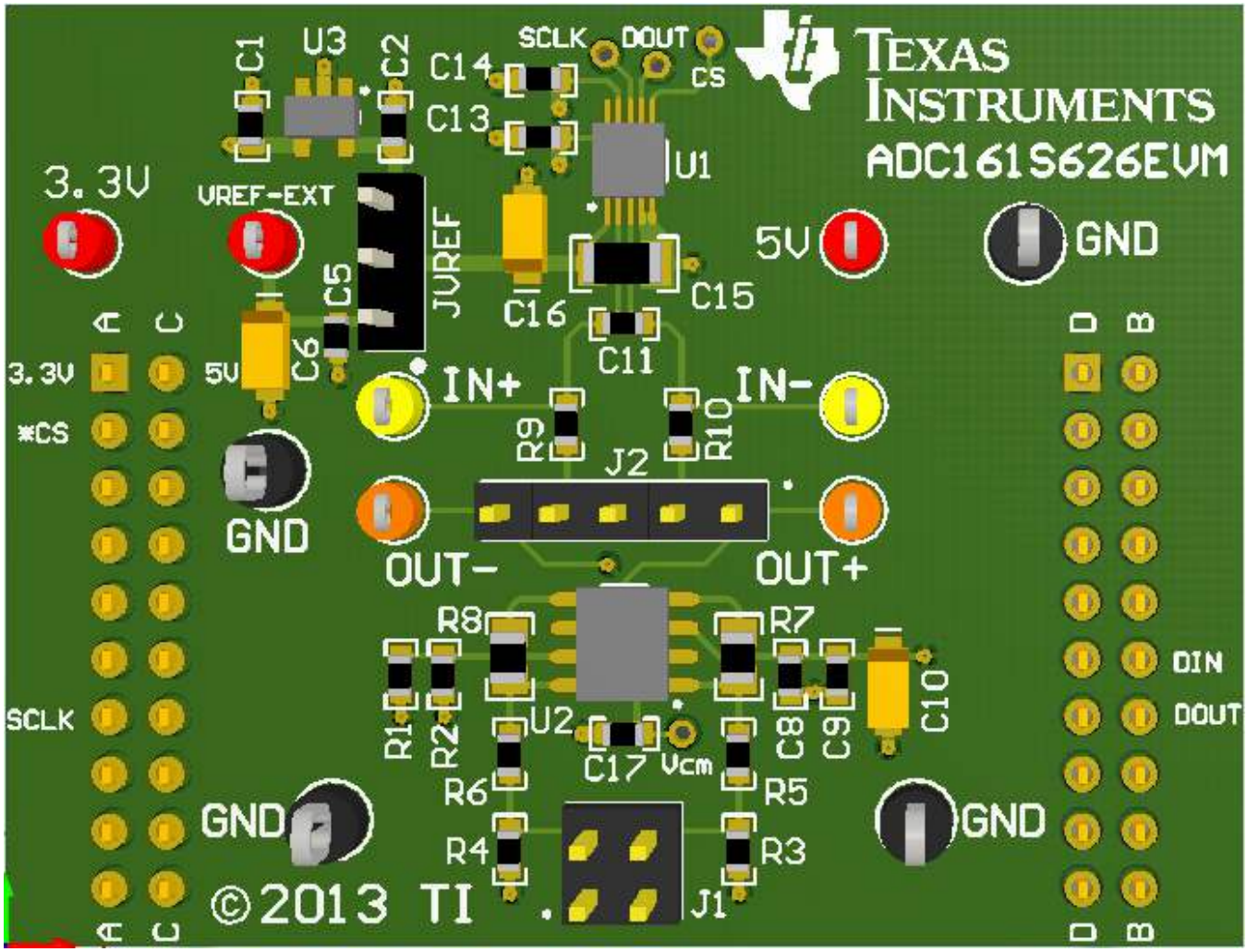

Figure 1. ADC161S626 Evaluation Board

2.1 Power Supply Input – VA, VIO

The EVM is powered by a launch pad through the 5 V pin and the 3.3 V pin. The single analog (VA) supply is connected with 5 V pin while the digital input/output (VIO) supply is connected with 3.3 V pin.

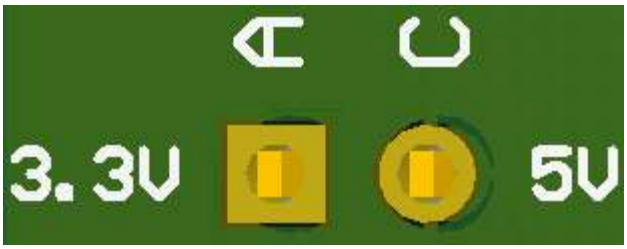

Figure 2. 5 V and 3.3 V Power Supply

2.2 Reference Voltage – VREF

The reference pin VREF should be supplied by external voltage through the test point VREF-EXT while pin 1 and pin 2 in the JVREF header should be shorted. Otherwise, the VREF pin should be connected with the U3 (LM4120AIM5-4.1), a 4.096 V precision micro-power low dropout voltage reference when pin 2 and pin 3 in the JVREF header are shorted.

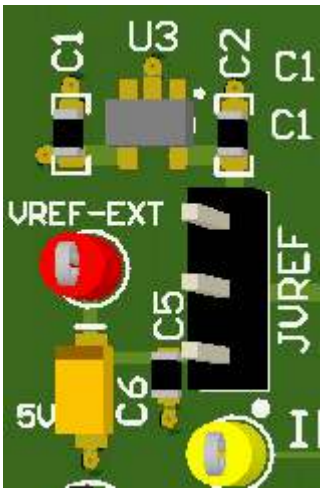

Figure 3. Reference Voltage VREF

2.3 The Driving Circuit about LM8350

The input signal can be connected with the J1 header. R3 and R4 are used for the single-ended input signal. R5, R6, R7, and R8 are used as the input resister and feedback resister, which determine the gain of the circuit. These are all 1k ohm, so the gain is one. R1 and R2 consist of the voltage divider, to determine the power mode of the LM8350 by connecting the EN pin. C17 is the bypass capacitor from VOCM to ground. C8, C9, and C10 are the bypass capacitors of power supply.

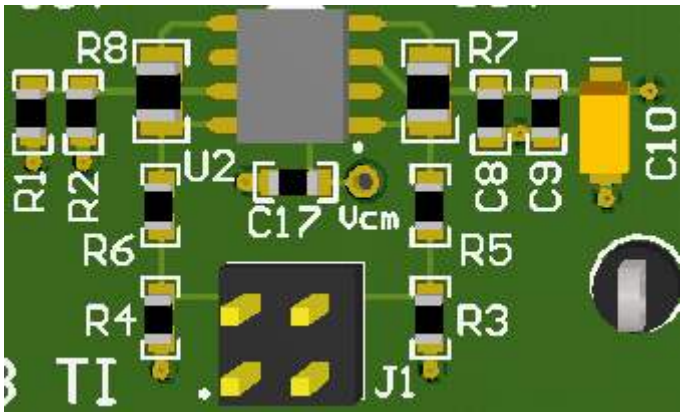

Figure 4. The Driving Circuit about LM8350

2.4 The Interface between LM8350 and ADC161S626

The standard 100 mils header J2 is the interface between LM8350 and ADC161S626. Pin 1 and pin 5 are the differential output of LM8350. The OUT+ and OUT- are test points to probe the LM8350 differential output. Pin 2 and pin 4 are the differential input of ADC161S626. The user can select LM8350 to drive ADC, just shorting pins 1-2 and pins 4-5. Otherwise the user could test the performance of the ADC161S626 directly when pin 2 and pin 4 are connected with an input differential signal. Pin 3 is GND.

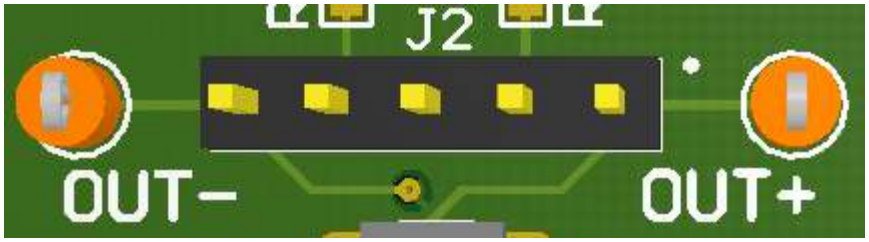

Figure 5. The Interface between LM8350 and ADC161S626

2.5 The ADC161S626 Circuit

The R9, R10, and C11 are the anti-aliasing filter for the differential input of the ADC161S626. C15 and C16 are the bypass capacitors of reference voltage VREF. C13 and C14 are the bypass capacitors of the analog supply and digital input/output supply, respectively. The ADC161S626 communicates with the launch pad through the 3 wire SPI interface (SCLK, DOUT and CS).

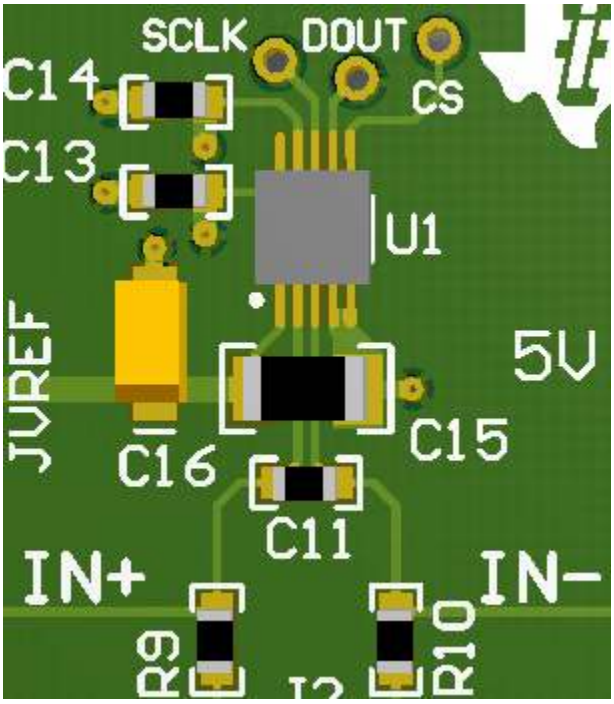

Figure 6. The ADC161S626 Circuit

3 Software Installation

3.1 Graphical User Interface (GUI)

Install the ADC1x1S62x software before connecting the ADC161S626EVM board to the PC. Download the ADC1x1S62x software from TI's website at http://www.ti.com/product/adc161s626. Follow these steps to install the ADC161S626EVM software:

1. Click http://www.ti.com/product/adc161s626, 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]\ADC161S626EVM\EVM_GUI\ADC1x1S62x Installer\Volume. Follow the pop-screen instructions by clicking the Next button to install the software.

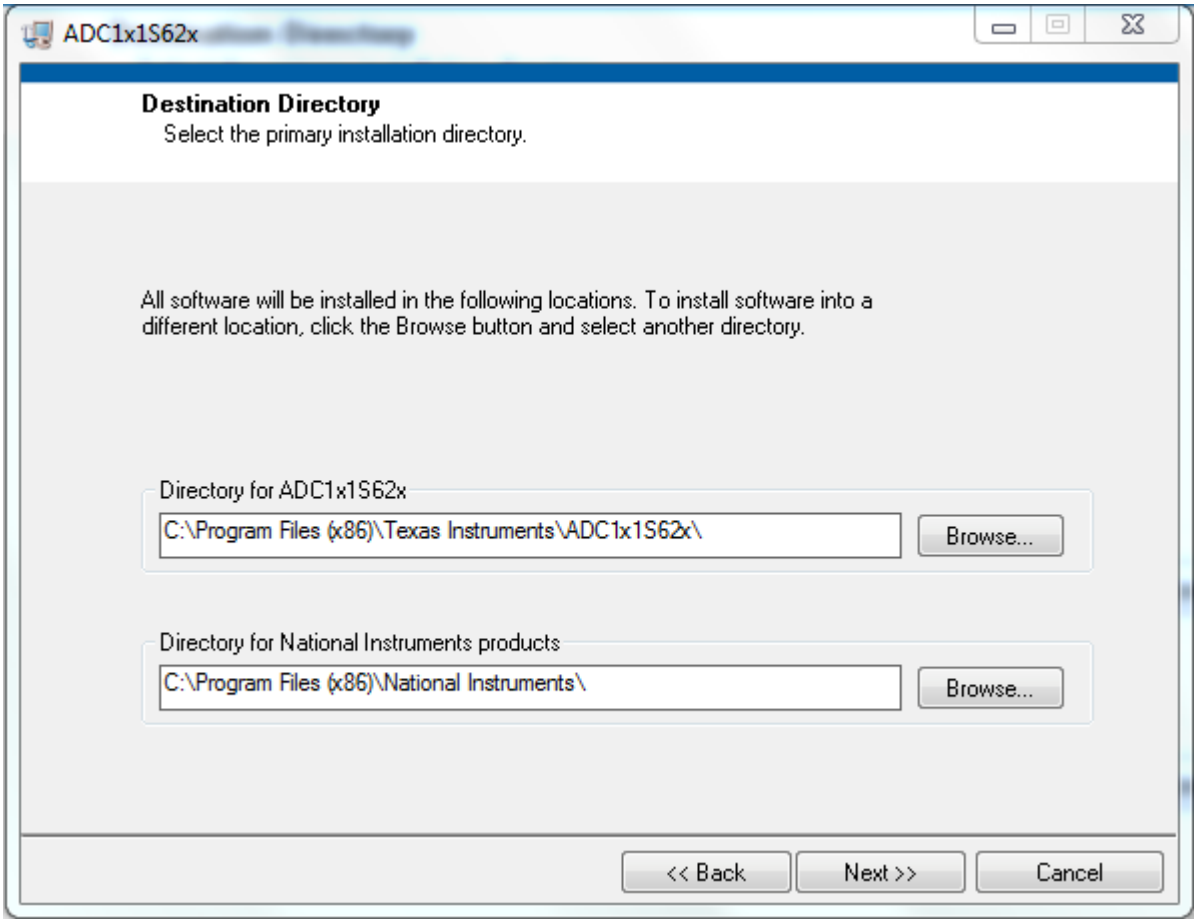

Figure 7. ADC1x1S62x Installation Directory

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

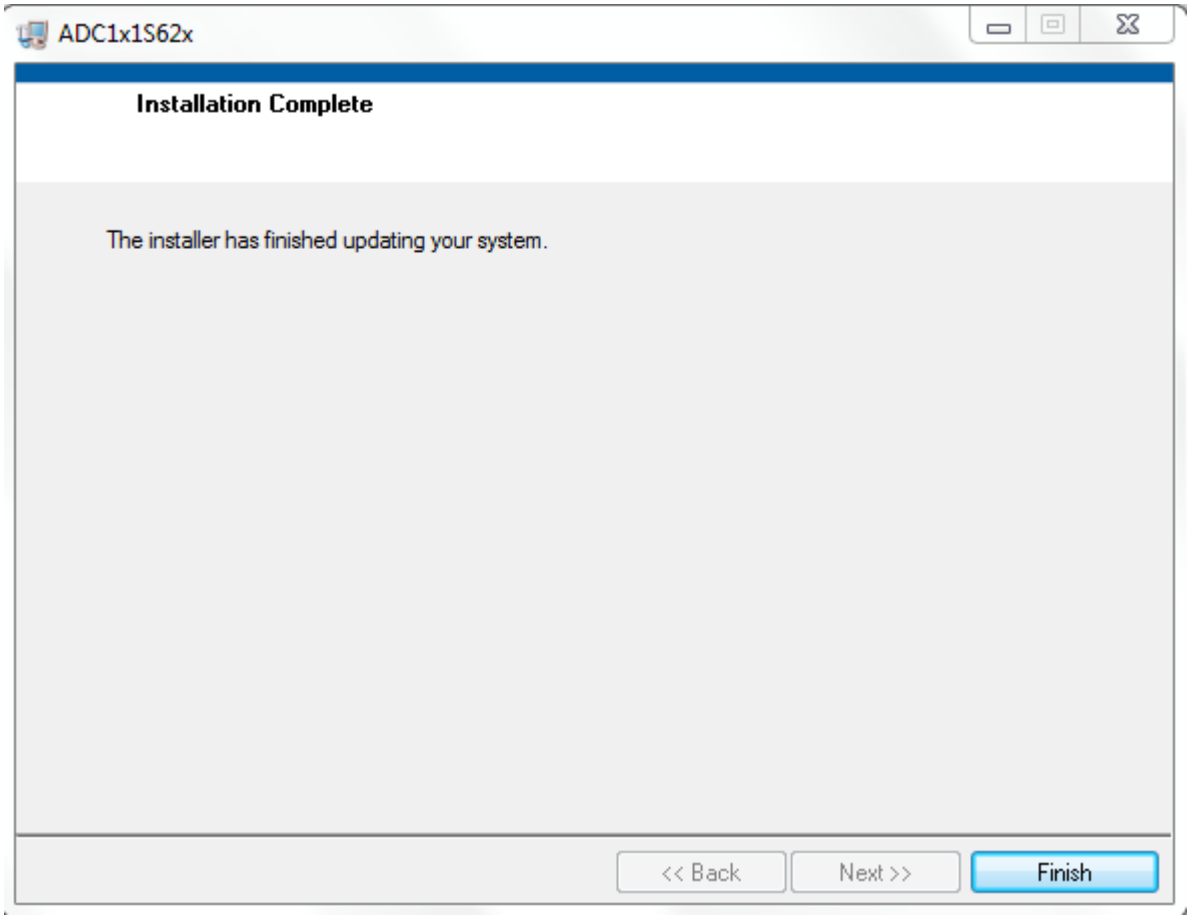

Figure 8. ADC1x1S62x Installation Finish

3.2 Launchpad Firmware Update

Note: This section is only necessary for a brand new Launchpad. If a Launchpad is shipped with an ADC161S626EVM, then 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 will redirect 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 you are receiving the ADC161S626EVM from a FAE, the firmware is a text file called adc161s626_fw-v0.95-50kHz-PID0x094e.
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.

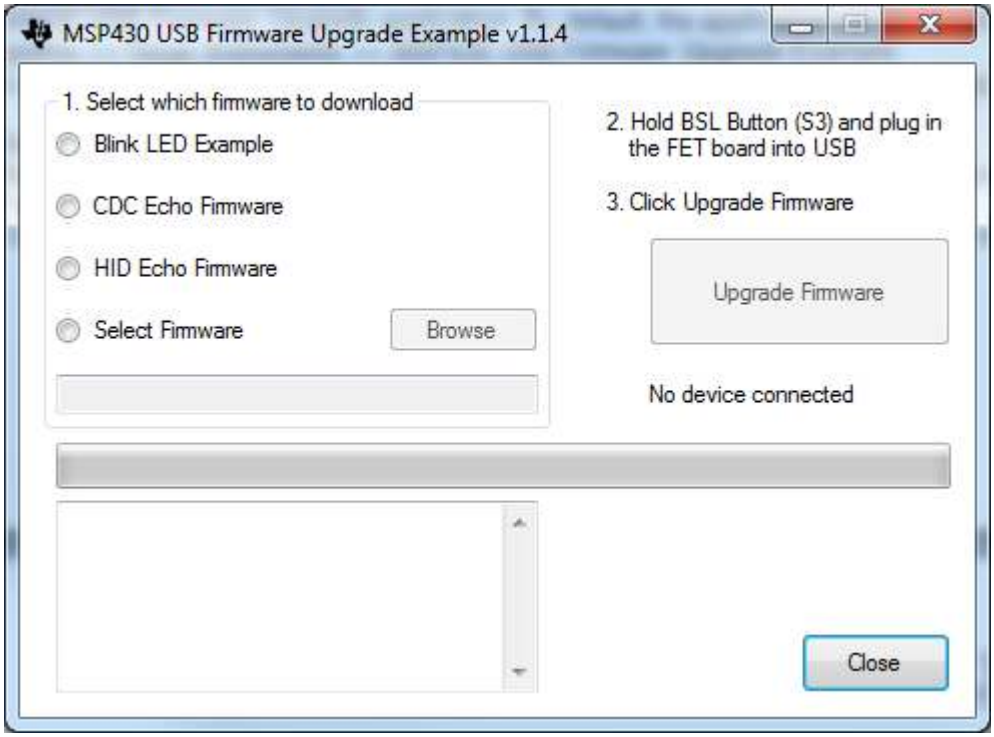

Figure 9. USB Firmware Upgrade Window

4. Enable the Select Firmware button and browse to open the downloaded firmware adc161s626_fw-v0.95-50kHz-PID0x094e.
5. Press the BSL button on the MSP430 Launch-Pad and connect to the PC with a USB cable; if detected, the text on the Firmware Upgrade tool will change from No device connected to Found 1 device.
6. Click on the Upgrade Firmware button to program the Launch-Pad. Close the application when done.

3.3 Update USB Driver

1. Before launching the ADC1x1S62x software, connect the ADC161S626EVM board to a USB port of the PC. Go to Device Manager and find MSP43-USB Example. Right click and select Update Driver Software.

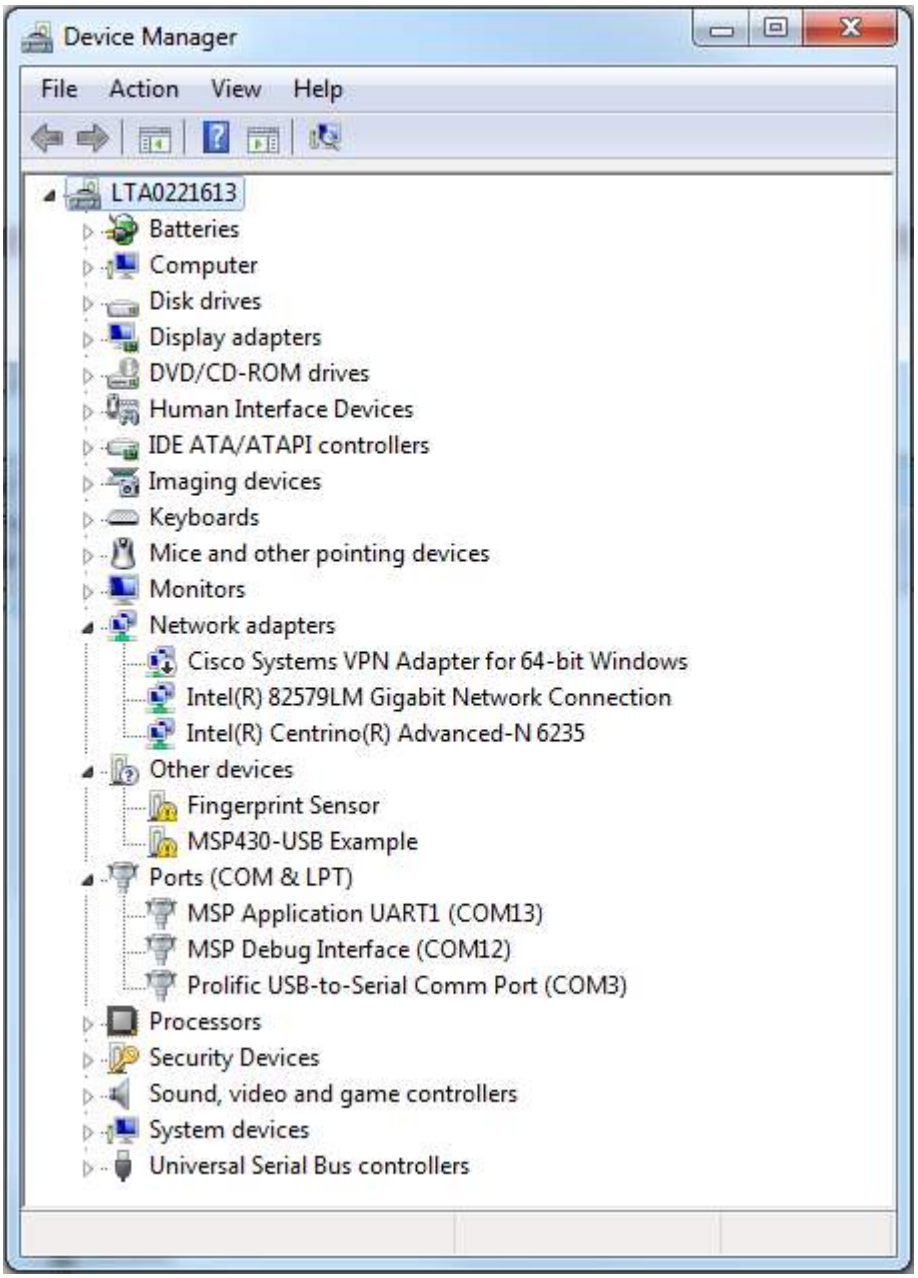

Figure 10. Driver Not Installed

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.inf 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.

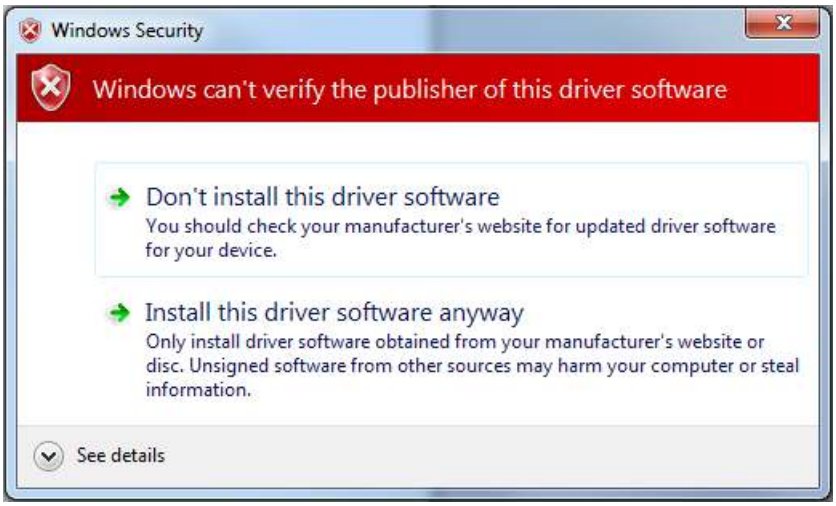

Figure 11. Driver Authentication Warning

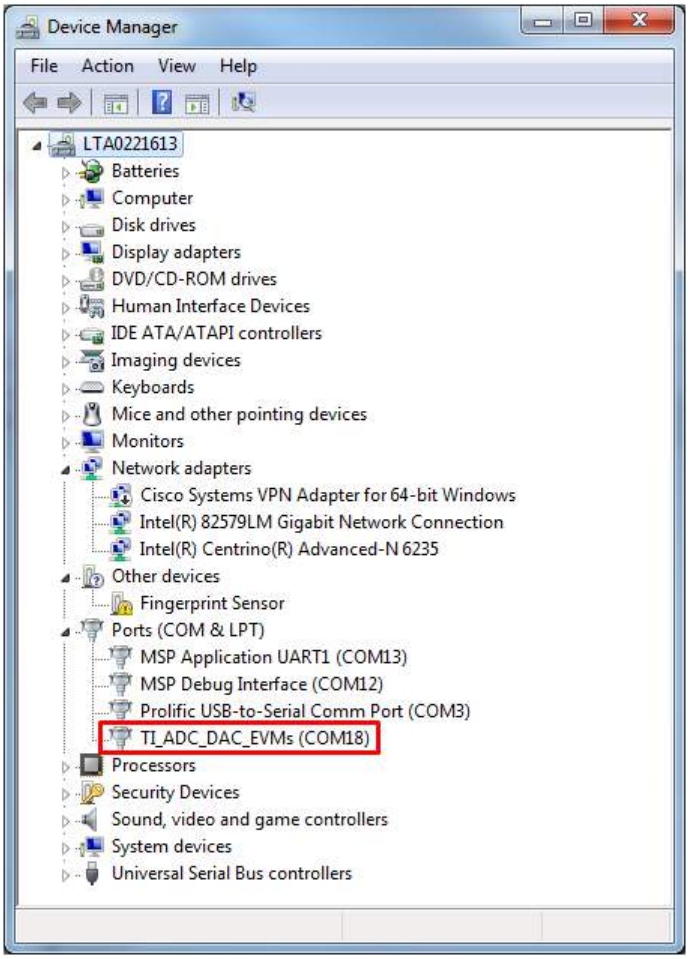

Figure 12. Example COM Port Number

4 Board Setup and Operation

4.1 Board Setup

1. The female headers JA, JB, JC, and JD on ADC161S626EVM should be connected with the MSP430 Launch Pad correctly as shown in Figure 13. The ADC161S626EVM is supplied by the MSP 430 Launch-Pad through 5 V and 3.3 V pins.
2. By default, the ADC161S626EVM JVREF should be jumped for pin2-3. This allows the VREF of the ADC to be sourced from an on-board 4.096 V regulator. The user can also use an external VREF by shorting pin1-2.
3. The outputs of the differential amplifier are connected with inputs of ADC161S626 by shorting pin1-2 and pin 4-5 on J2 by default.

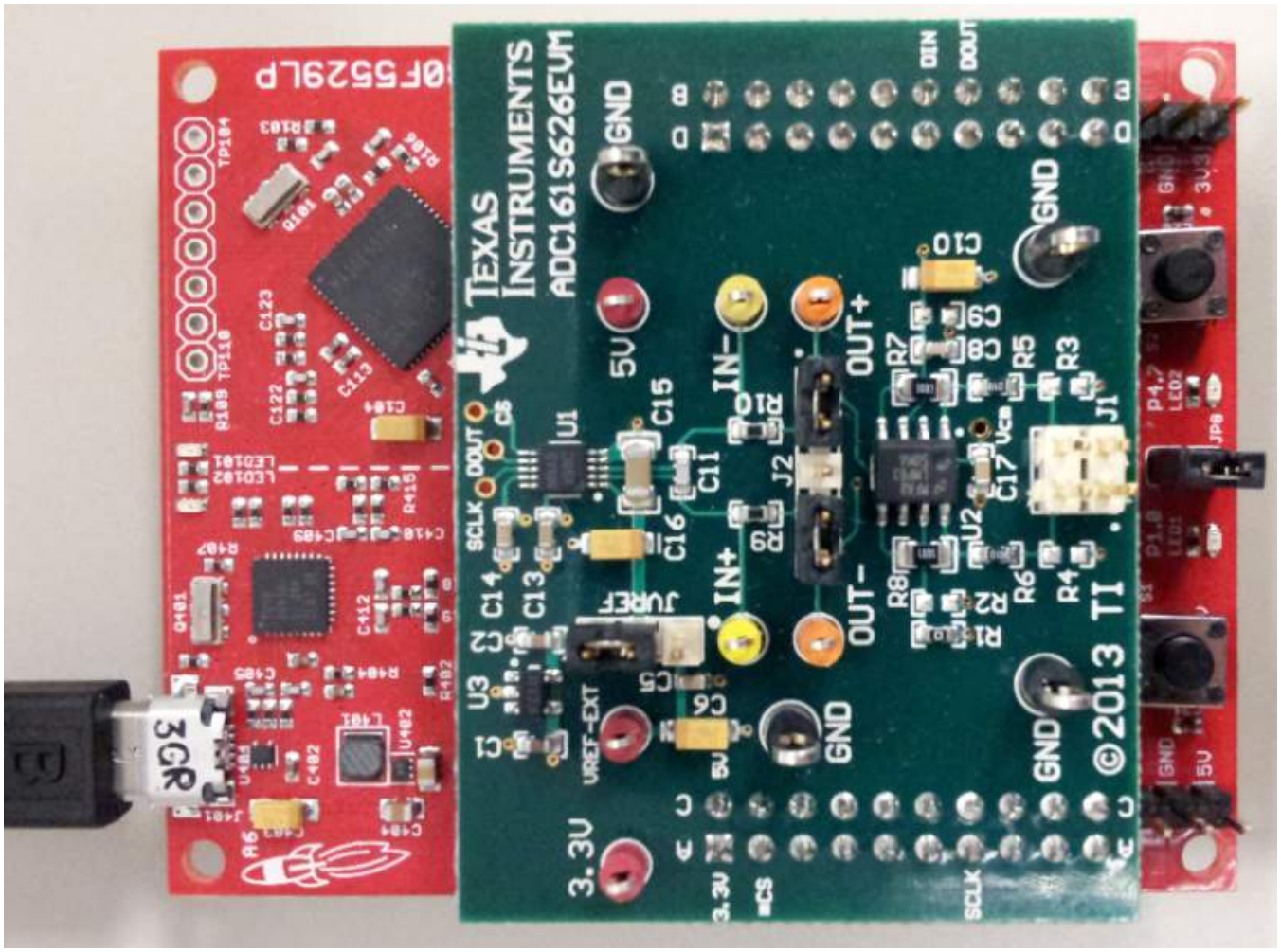

Figure 13. ADC161S626EVM Hardware Connection

4.2 Launching the Software

1. The ADC161S626EVM GUI software is run by clicking on Start > All Programs > ADC1x1S62x. Launching the software takes the user directly to the GUI as shown in Figure 14. There is a pull down menu in which the user can select ADC161S626.

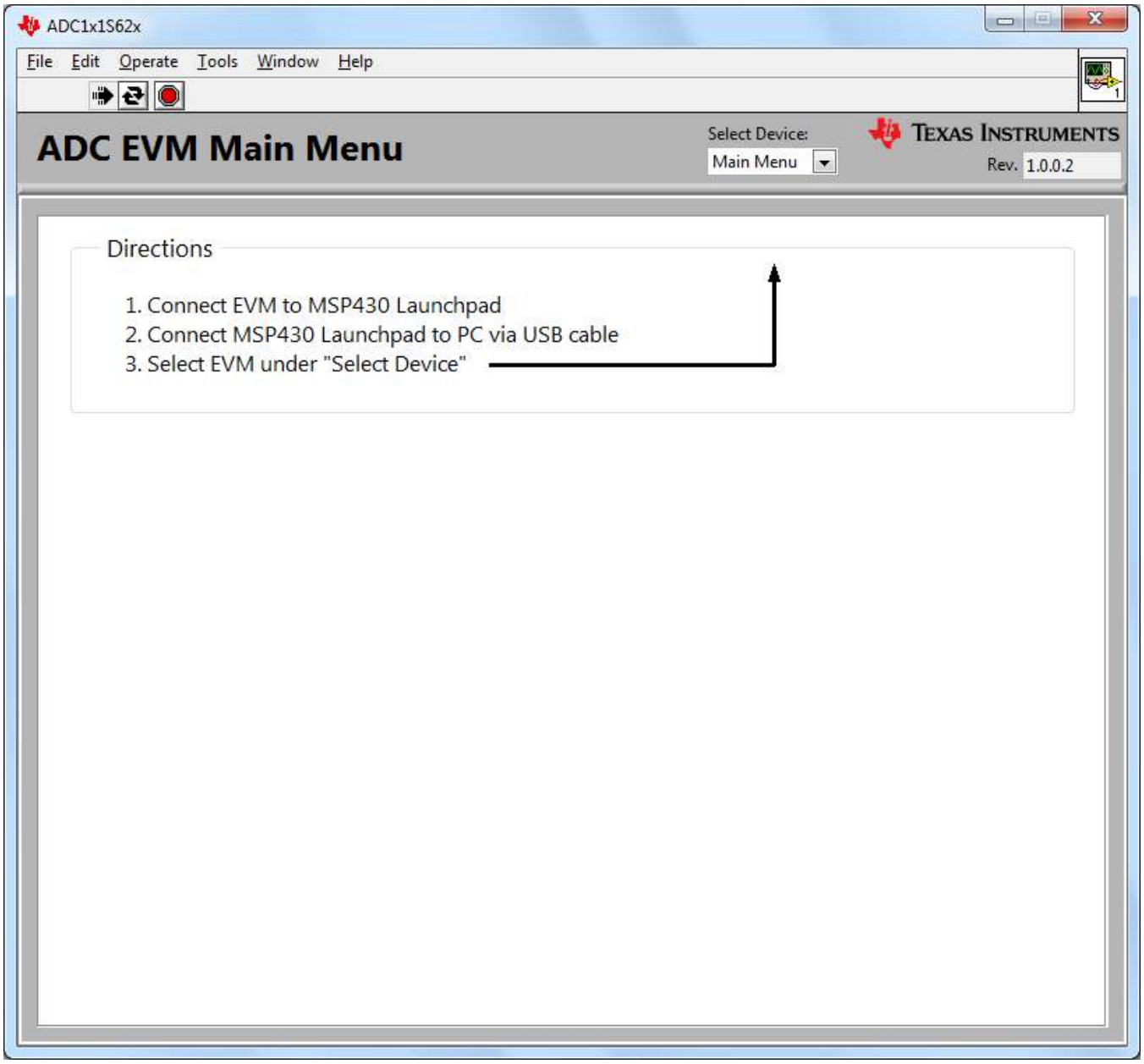

Figure 14. The Main Menu of ADC1x1S62x Software

2. The setting area contains the Ref. Voltage which is 4.096 V by default, channel select and output type. There is only one usable channel. In the output type tabs, the user can choose mV or decimal to represent the output value. There are two operation modes: single mode and continuous mode.

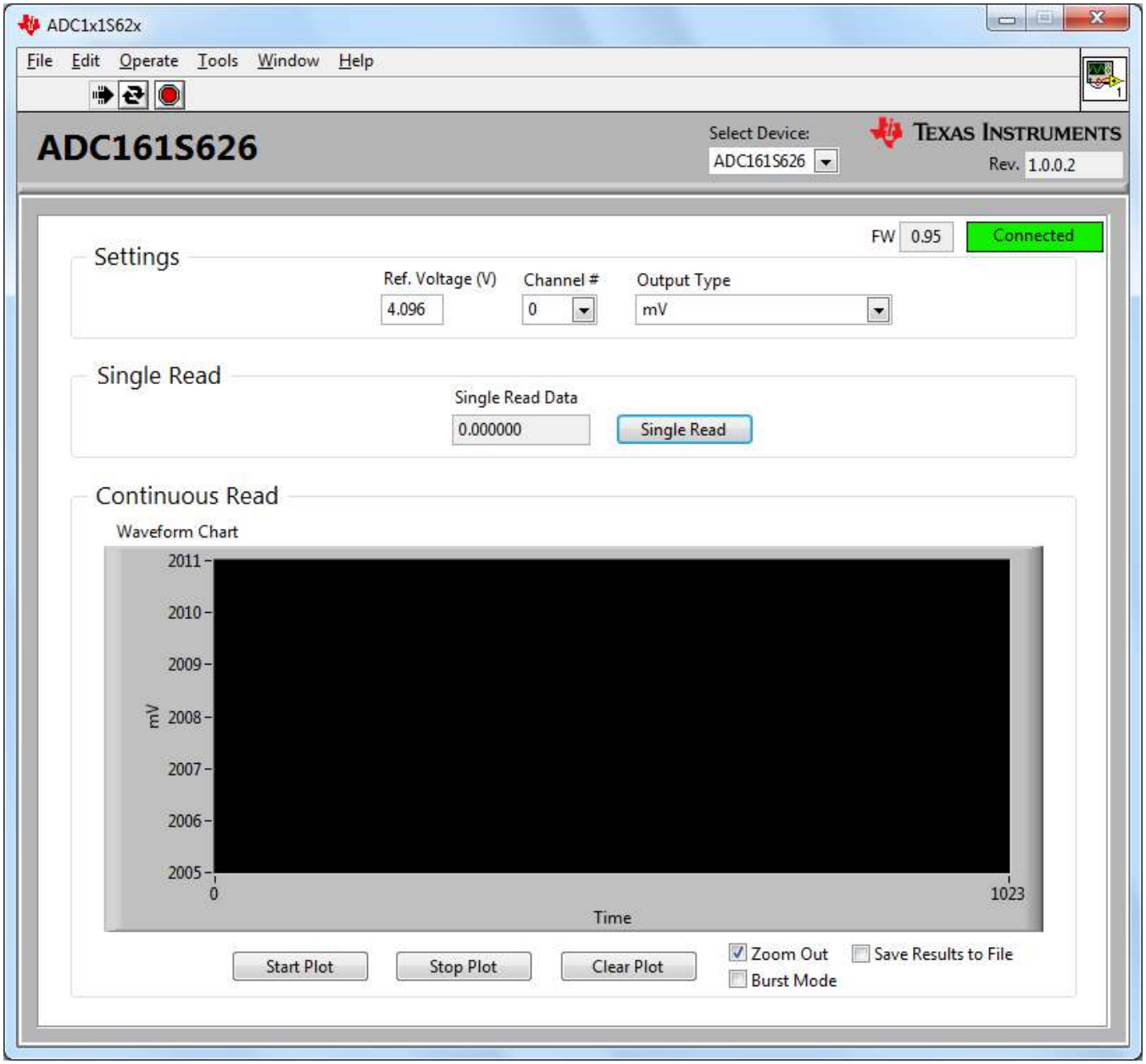

Figure 15. Selectable Fields in GUI

3. In single mode, click the single read tabs to get and show a single data, while in continuous mode the waveform chart displays the digital code output of the ADC161S626. Choose the burst mode and click Start Plot to catch and display the data.

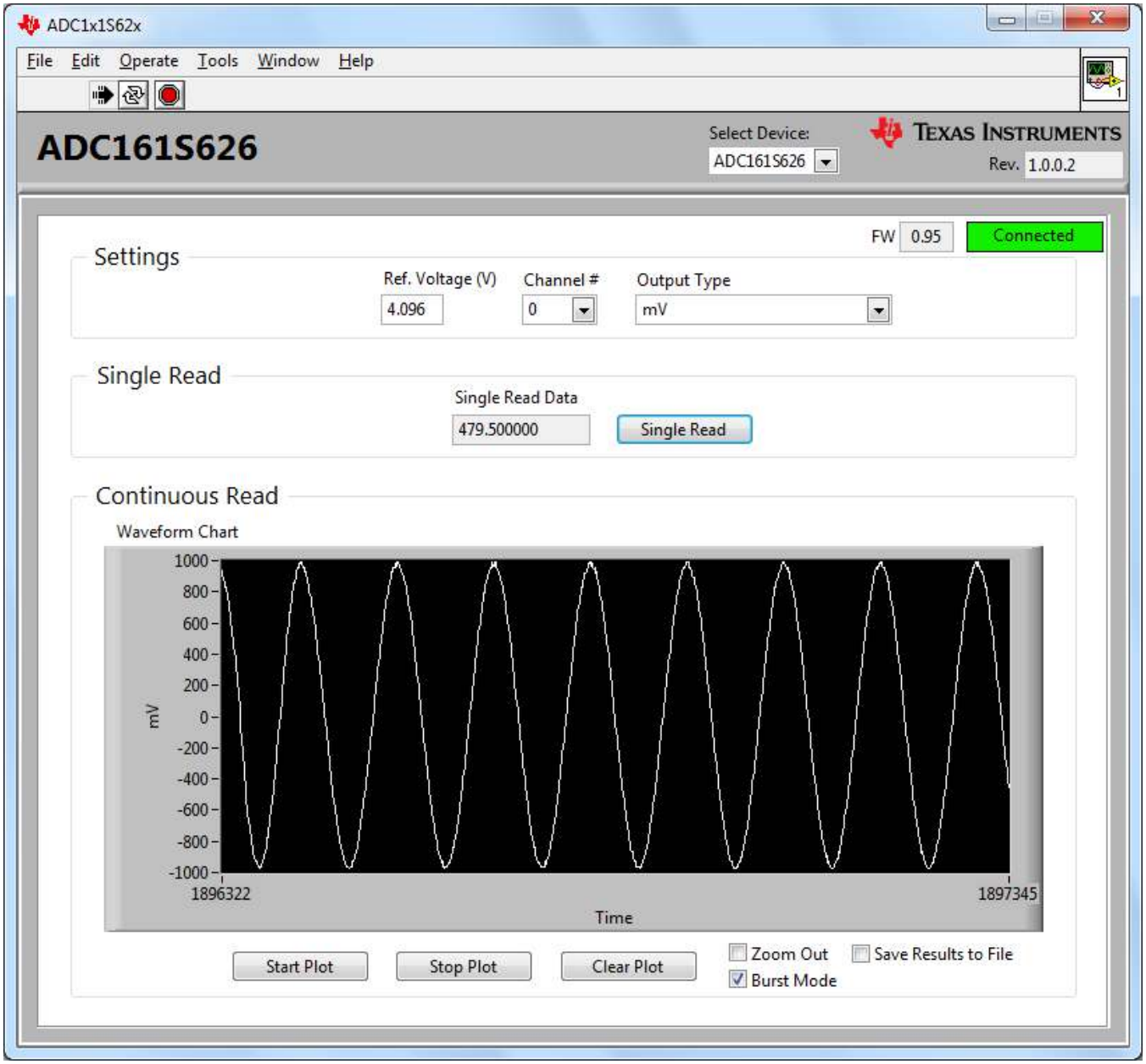

Figure 16. Testing in the GUI

5 Board Layout

The following figures show the board layout for the ADC161S626EVM.

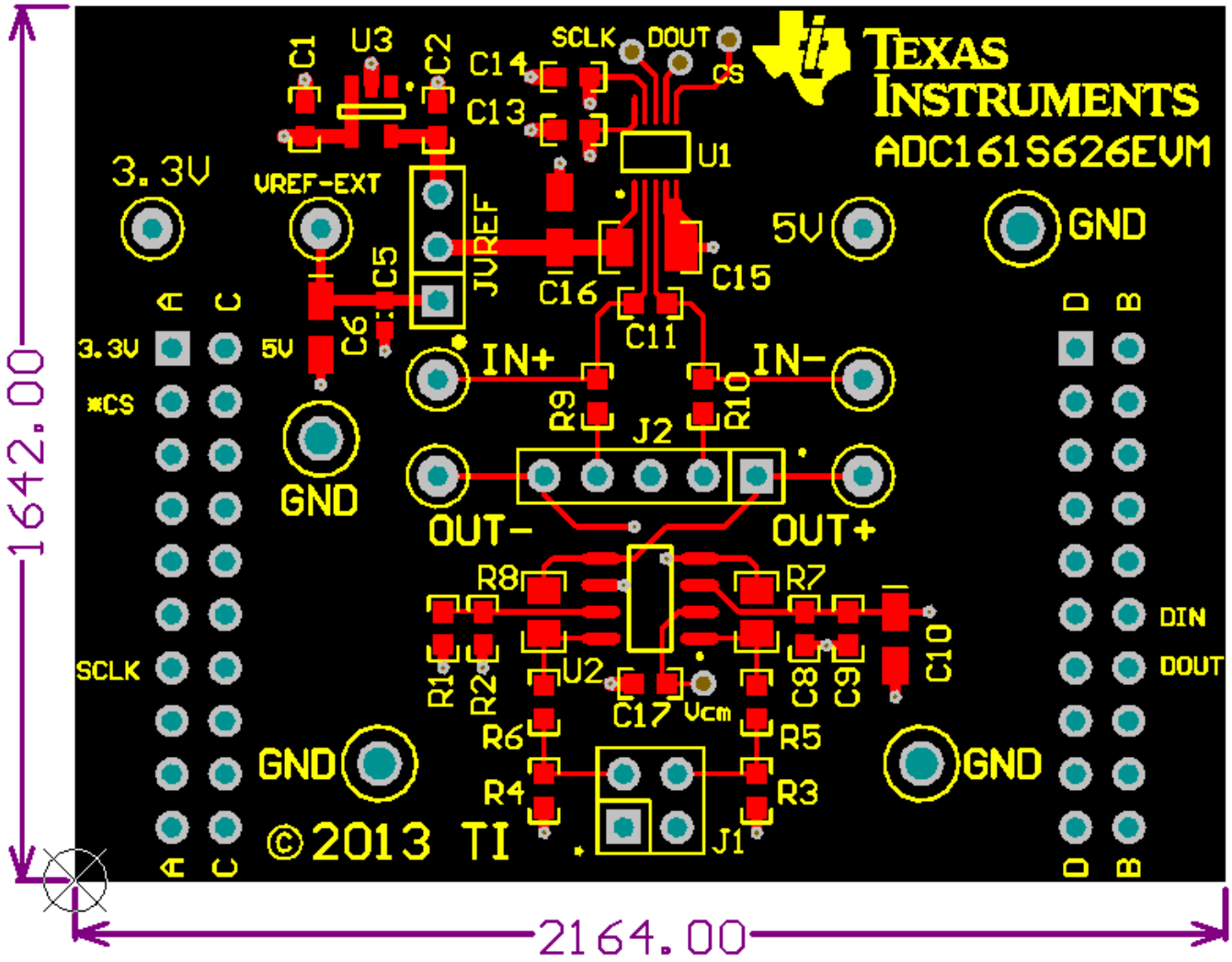

Figure 17. Top Assembly Layer

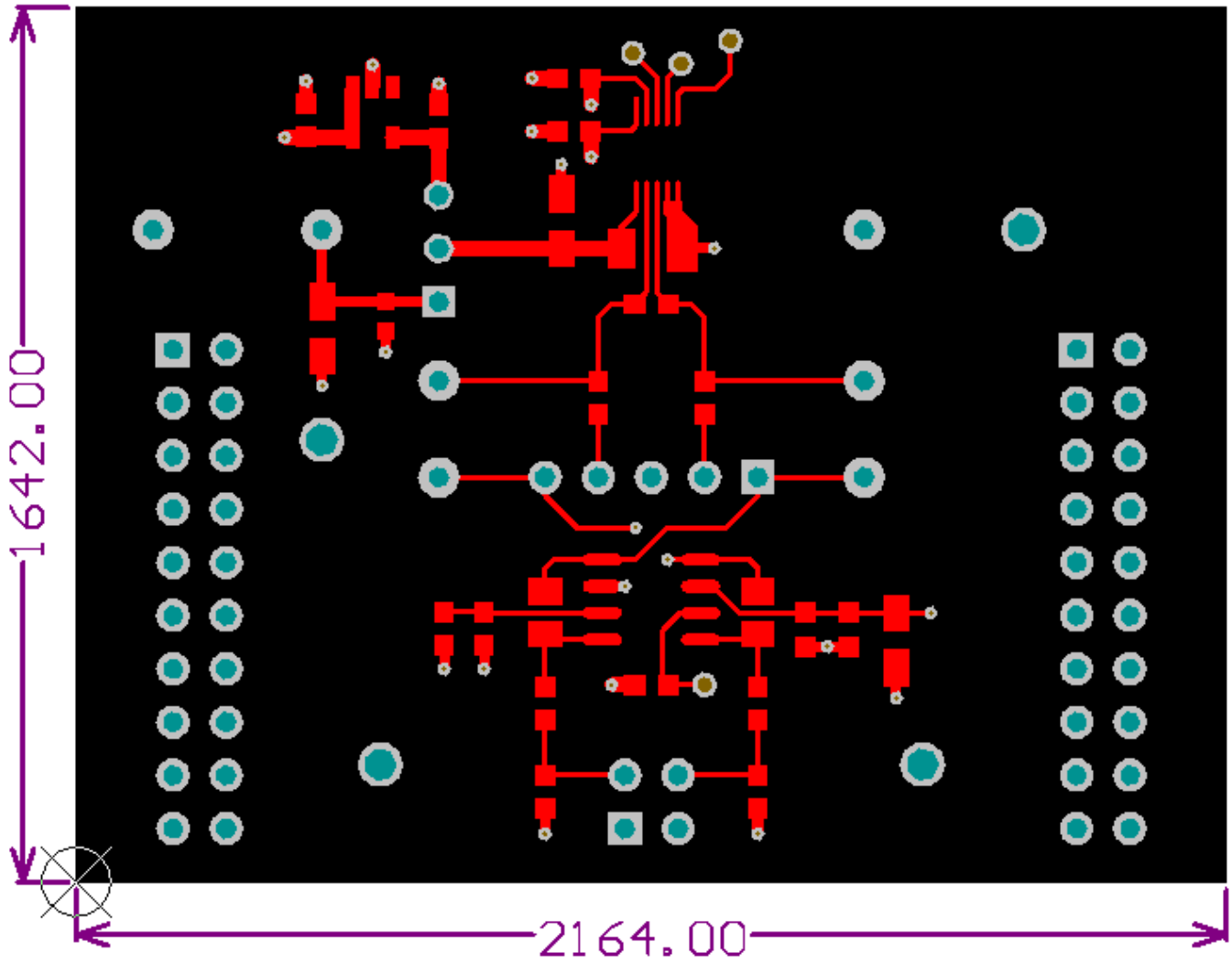

Figure 18. Top Layer Routing

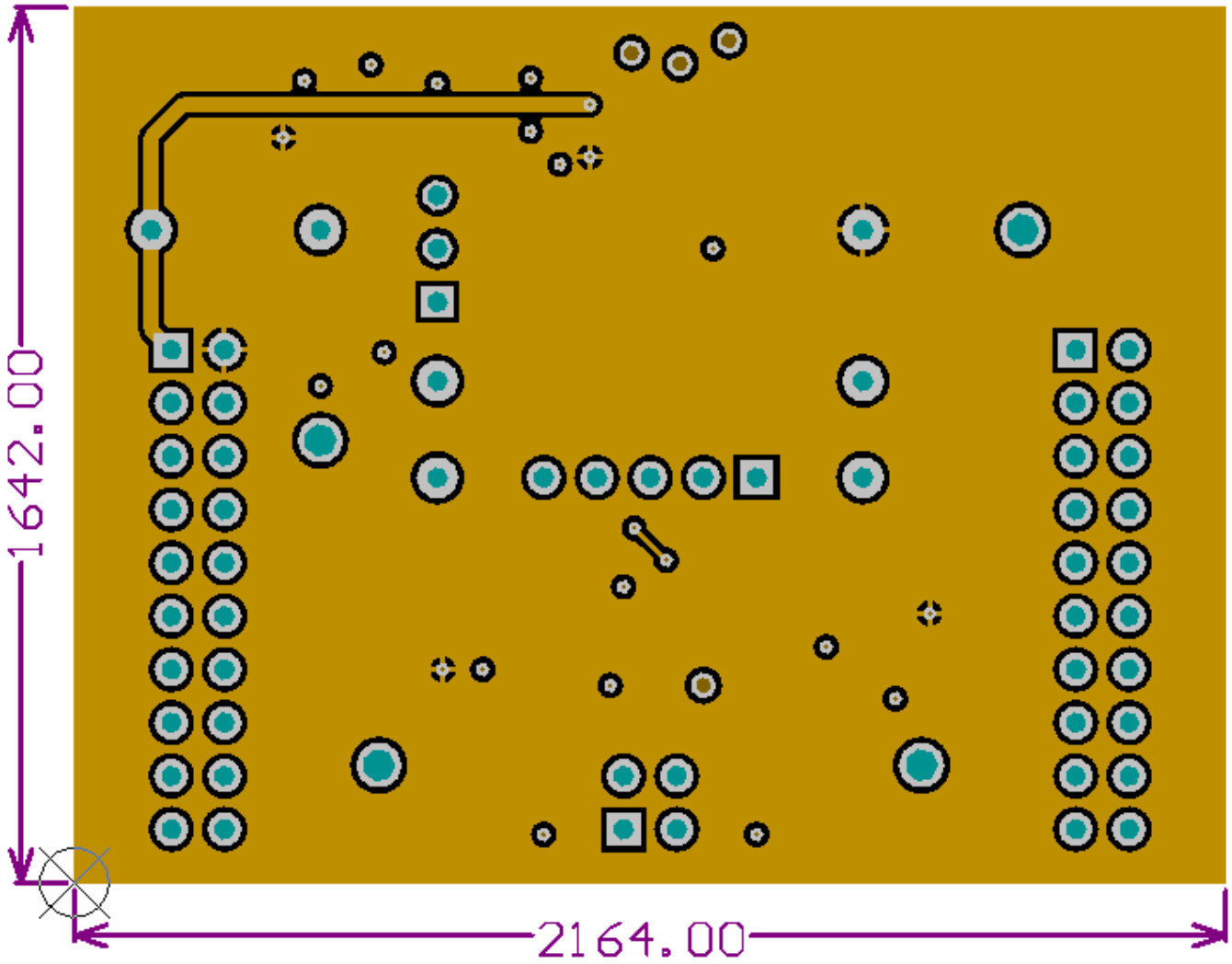

Figure 19. Power Layer Routing

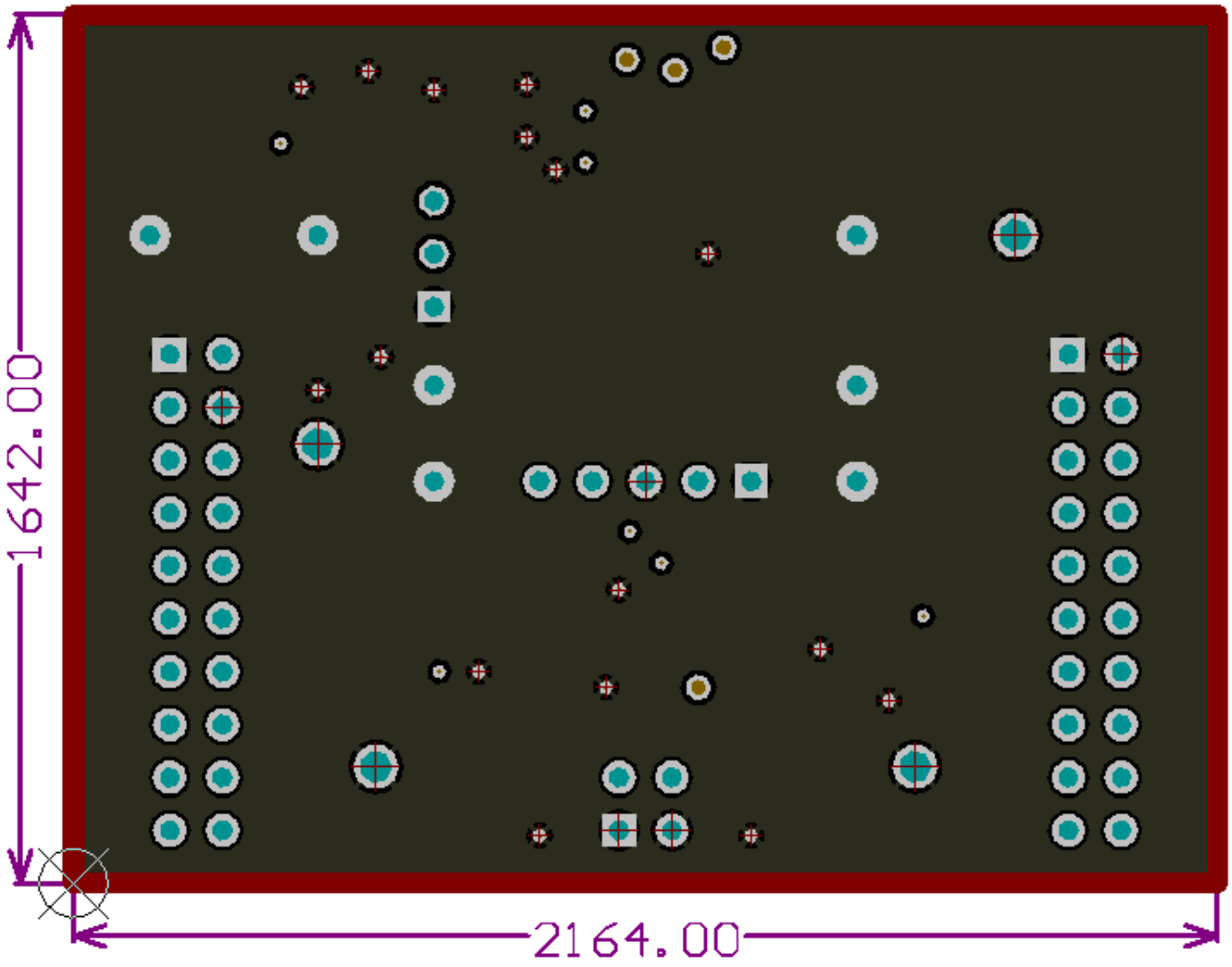

Figure 20. Ground Layer Routing

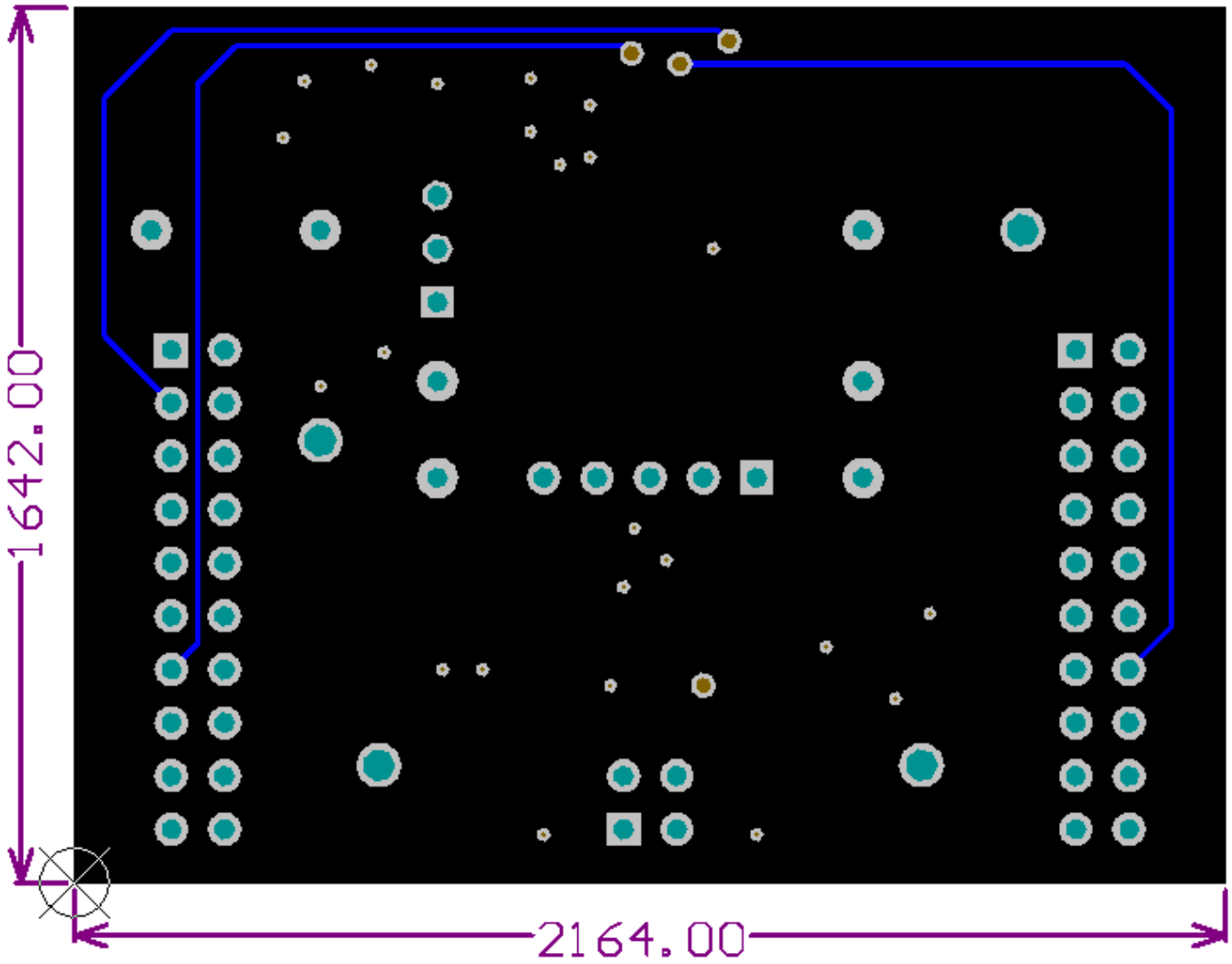

Figure 21. Bottom Layer Routing

6 Schematic

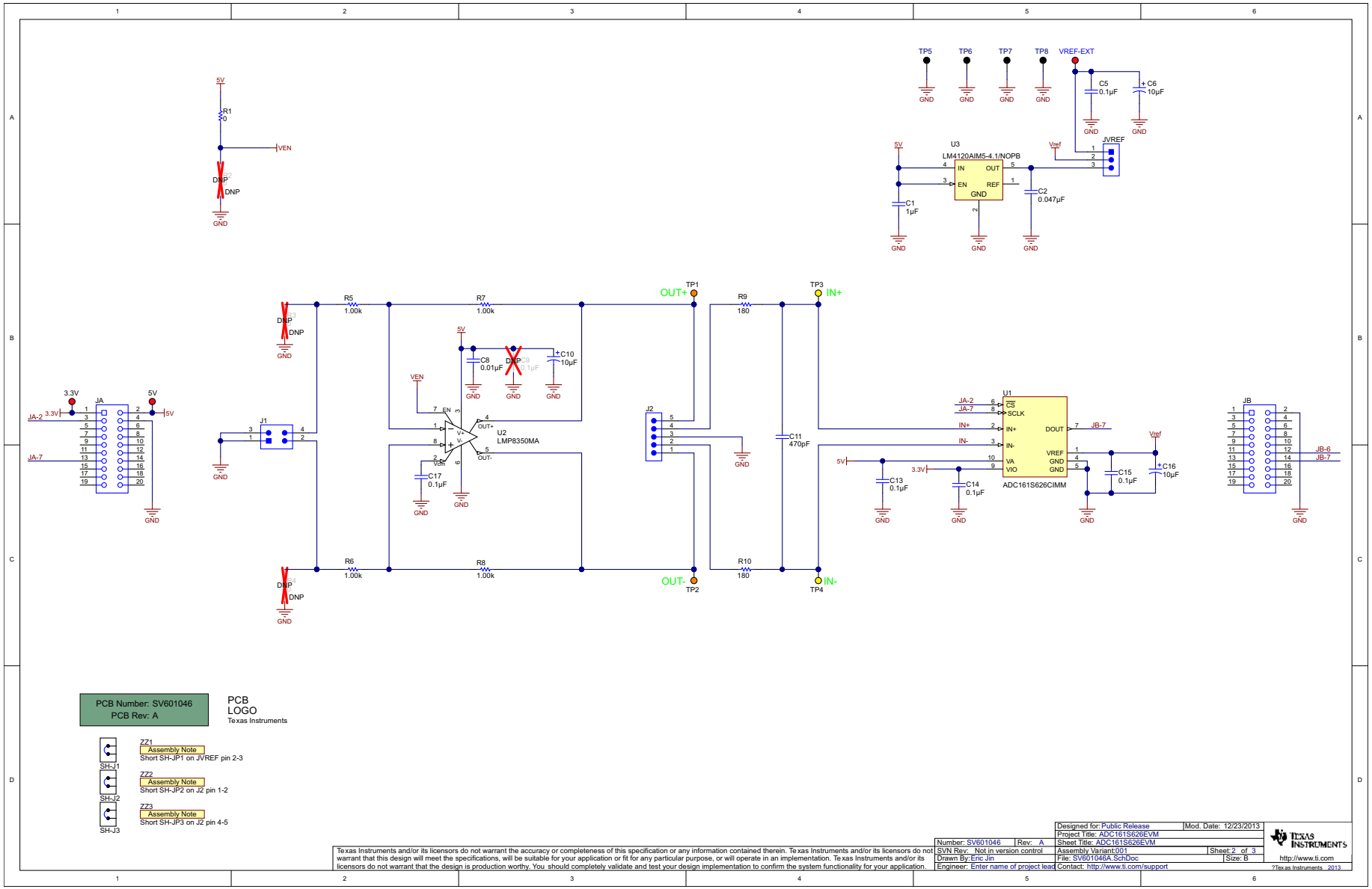

Figure 22. ADC161S626EVM DUT Schematic

7 Bill of Materials

Table 2. ADC161S626EVM Bill of Materials

Designator	Quantity	Description	PartNumber	Manufacturer
PCB	1	Printed Circuit Board	SV601046	Texas Instruments
3.3V, 5V, VREF-EXT	3	Test Point, Miniature, Red, TH	5000	Keystone
C1	1	CAP, CERM, 1uF, 10V, +/-10%, X5R, 0603	C1608X5R1A105K	TDK
C2	1	CAP, CERM, 0.047uF, 25V, +/-5%, X7R, 0603	06033C473JAT2A	AVX
C5	1	CAP, CERM, 0.1uF, 10V, +/-10%, X7R, 0603	C0603C104K8RACTU	Kemet
C6	1	CAP, TA, 10uF, 10V, +/-10%, 0.9 ohm, SMD	TPSA106K010R0900	AVX
C8	1	CAP, CERM, 0.01uF, 25V, +/-10%, X7R, 0603	GRM188R71E103KA01D	Murata
C10, C16	2	CAP, TA, 10uF, 10V, +/-10%, 1.8 ohm, SMD	TPSA106K010R1800	AVX
C11	1	CAP, CERM, 470pF, 50V, +/-5%, C0G/NP0, 0603	06035A471JAT2A	AVX
C13, C14, C17	3	CAP, CERM, 0.1uF, 25V, +/-5%, X7R, 0603	06033C104JAT2A	AVX
C15	1	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 1206	12065C104KAT2A	AVX
J1	1	Header, TH, 100mil, 2x2, Gold plated, 230 mil above insulator	TSW-102-07-G-D	Samtec
J2	1	Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	TSW-105-07-G-S	Samtec
JA, JB	2	Receptacle, 10x2, 100mil, TH	PPPC102LFBN-RC	Sullins Connector Solutions
JVREF	1	Header, 100mil, 3x1, Tin plated, TH	PEC03SAAN	Sullins Connector Solutions
R1	1	RES, 0 ohm, 5%, 0.1W, 0603	CRCW06030000Z0EA	Vishay-Dale
R5, R6	2	RES, 1.00k ohm, 1%, 0.1W, 0603	CRCW06031K00FKEA	Vishay-Dale
R7, R8	2	RES, 1.00k ohm, 1%, 0.125W, 0805	CRCW08051K00FKEA	Vishay-Dale
R9, R10	2	RES, 180 ohm, 1%, 0.1W, 0603	RC0603FR-07180RL	Yageo America
SH-J1, SH-J2, SH-J3	3	Shunt, 100mil, Gold plated, Black	969102-0000-DA	3M
TP1, TP2	2	Test Point, Miniature, Orange, TH	5003	Keystone
TP3, TP4	2	Test Point, Miniature, Yellow, TH	5004	Keystone
TP5, TP6, TP7, TP8	4	Test Point, TH, Multipurpose, Black	5011	Keystone Electronics
U1	1	16-Bit, 50 to 250 kSPS, Differential Input, MicroPower ADC, 10-pin MSOP	ADC161S626CIMM	Texas Instruments
U2	1	Precision ADC Driver with Adjustable Power Levels	LMP8350MA	Texas Instruments
U3	1	Precision Micropower Low Dropout Voltage Reference, 5-pin SOT-23, Pb-Free	LM4120AIM5-4.1/NOPB	Texas Instruments
C9	1	CAP, CERM, 0.1uF, 25V, +/-5%, X7R, 0603	06033C104JAT2A	AVX
R2, R3, R4	3	RES, 0 ohm, 5%, 0.1W, 0603	CRCW06030000Z0EA	Vishay-Dale

Revision History

Changes from Original (July 2014) to A Revision	Page
• Updated Figure 22	24

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

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