

ADS1601/02 EVM User's Guide

This user's guide describes the characteristics, operation, and use of the ADS1601/02 EVM 16-bit analog-to-digital evaluation board. A complete circuit description, a schematic diagram, and a bill of materials are included.

Contents

1	Related Documentation from Texas Instruments.....	2
2	EVM Overview	2
3	Analog Interface	6
4	Digital Interface	9
5	Power Distribution.....	11
6	Getting the Most From Your EVM	12
Appendix A	ADS1601/ADS1602EVM Bill of Materials	19
Appendix B	ADS1601/02 Schematic	21
Appendix C	ADS1601/02 EVM Layout Details	22

List of Figures

1	ADS1601/02 EVM Board Major Sections	3
2	FFT Plot, -1 dB, Internal Reference	5
3	FFT Plot, -1 dB, External Reference	5
4	FFT Plot, -6 dB, Internal Reference	5
5	FFT Plot, -6 dB, External Reference	5
6	FFT Plot, -10 dB, Internal Reference	5
7	FFT Plot, -10 dB, External Reference	5
8	Board Stack-Up	6
9	Single-Ended Via SMA Connector	7
10	Reference Voltage Block Diagram	8
11	ADS1601/02 Serial Control Signals	10
12	Control Signal Routing	10
13	5-6K Interface Board Options for TI DSK	12
14	Jumper Settings for J13 and J14 on 5-6K Interface Board	13
15	CCS Project Menu	14
16	CCS Project Open Dialog	15
17	CCS Project View	15
18	CCS Context Menu	16
19	CCS Graph Property Window	17
20	CCS Window with Graph.....	18
C-1	Top Tracking Layer	22
C-2	Internal Power Layer.....	22
C-3	Internal Ground Layer	23
C-4	Bottom Tracking Layer	23

List of Tables

1	EXTCLK/EXTREF	3
2	EXTCLK/INTREF	3

3	INTCLK/EXTREF	4
4	INTCLK/INTREF	4
5	Analog Interface Jumper Functions	7
6	Internal/External Reference	8
7	W2 Jumper Selection	8
8	Reference Designator and Function	8
9	Modulator Clock Source Selection	9
10	Optional Settings for the ADS1601/02	9
11	Jumpers Associated With the Digital Control Section	10
12	Jumper W12 Factory Setting	11
13	Connector Pinout	11
14	Jumper Settings for J13 and J14 on the 5–6K Interface Board	14
A-1	Bill of Materials	19

1 Related Documentation from Texas Instruments

To obtain a copy of any of the following TI documents, call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580. When ordering, identify this document by its title and literature number. Updated documents can also be obtained through the TI Web site, <http://www.ti.com>.

Data Sheets	Literature Number
ADS1601	SBAS274
ADS1602	SBAS341
REF02	SBVS003
OPA2822	SBOS188

2 EVM Overview

2.1 Features

- Evaluation board featuring the ADS1601 ADC (order ADS1601EVM) or ADS1602 (order ADS1602EVM).
- Onboard reference with recommended buffer circuitry
- Onboard signal conditioning for the analog input
- Digital interface

2.2 Introduction

The ADS1601/02 are high-speed, high-resolution, delta-sigma ($\Delta\Sigma$) analog-to-digital converters (ADC). The evaluation module (EVM) is a stand-alone, full-featured system that offers data-sheet performance. Additionally, the EVM conforms to a common electrical and mechanical pinout for analog input/output (I/O), digital I/O, and power, enabling the EVM to be quickly adapted to various host platforms.

Code Composer Studio is a trademark of Texas Instruments.

Audio Precision, Audio Precision System Two are trademarks of Audio Precision, Inc..

2.3 ADS1601/02 EVM Major Blocks

The EVM is organized into several sections. Figure 1 illustrates the physical locations of these major sections.

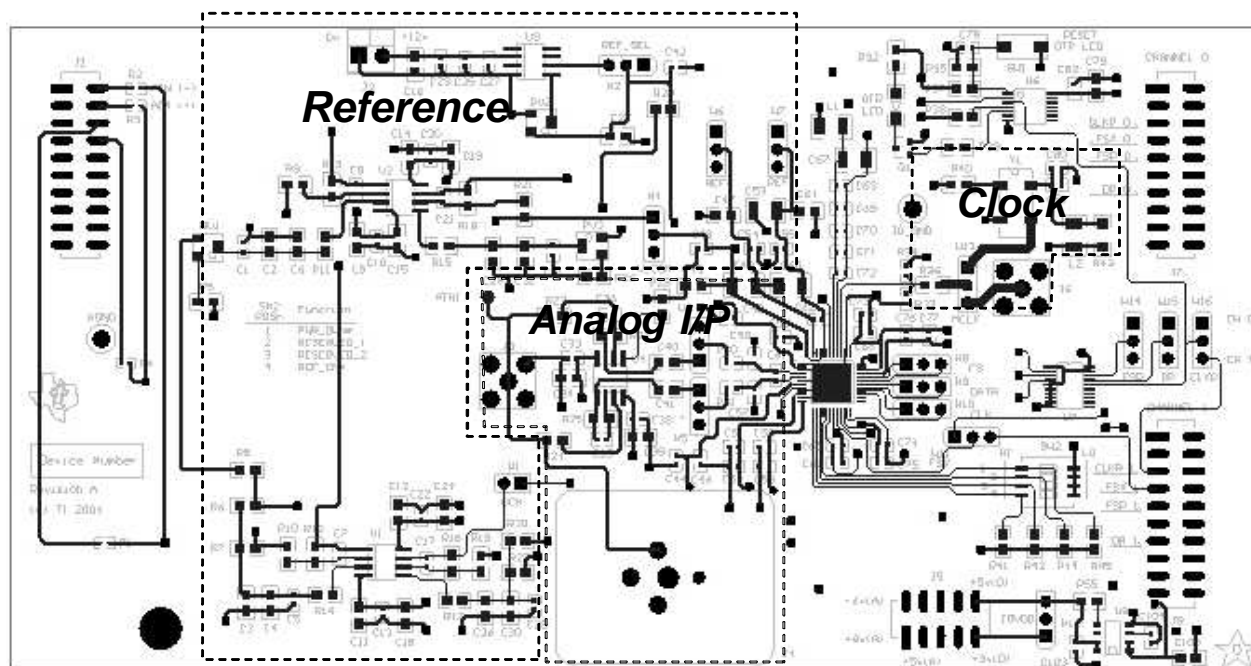


Figure 1. ADS1601/02 EVM Board Major Sections

2.4 ADS1601 Performance

The typical performance of the ADS1601 EVM under various conditions of modulator clock and reference are given in Table 1 through Table 4.

Table 1. EXTCLK/EXTREF

V_{IN} (dB)	SNR (dB)	THD (dB)	SFDR (dB)
-1	90.60	-91.45	92.05
-6	86.42	-101.51	104.81
-10	82.73	-99.25	101.37

Table 2. EXTCLK/INTREF

V_{IN} (dB)	SNR (dB)	THD (dB)	SFDR (dB)
-1	90.38	-91.58	92.32
-6	86.46	-102.49	105.42
-10	82.75	-99.08	100.99

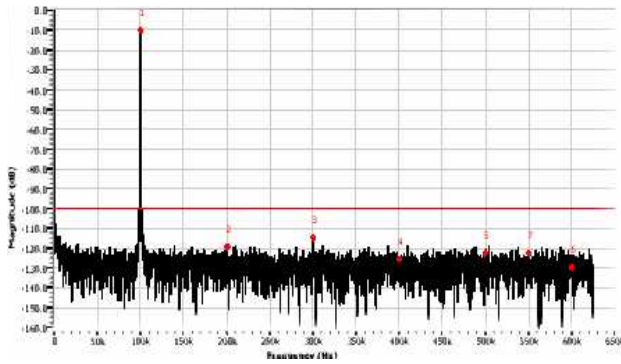
Table 3. INTCLK/EXTREF

V_{IN} (dB)	SNR (dB)	THD (dB)	SFDR (dB)
-1	90.34	-91.08	91.59
-6	86.27	-102.31	105.56
-10	82.66	-99.19	101.39

Table 4. INTCLK/INTREF

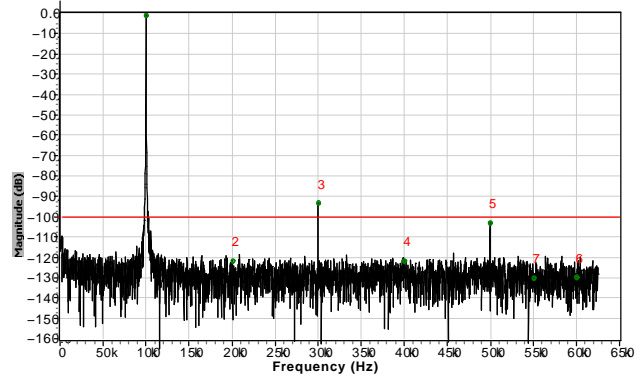
V_{IN} (dB)	SNR (dB)	THD (dB)	SFDR (dB)
-1	90.71	-91.04	91.66
-6	86.43	-101.71	104.62
-10	82.94	-99.87	102.32

Typical FFT plots obtained from the EVM under various conditions are given in [Figure 2](#) through [Figure 7](#).



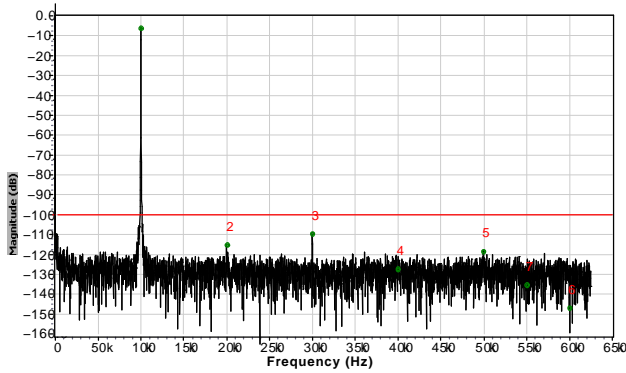
Reference Source	Input Amplitude	Modulator Clock
Internal	-1 dB	Internal

Figure 2. FFT Plot, -1 dB, Internal Reference



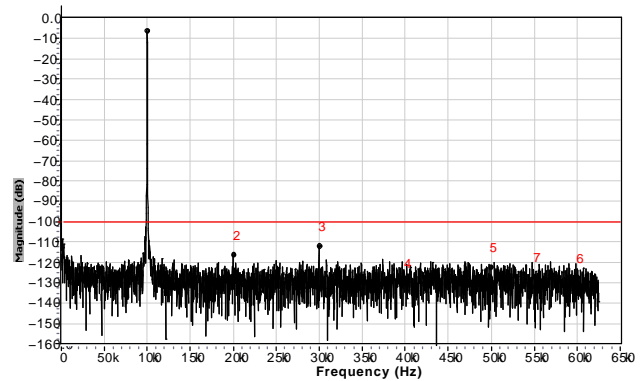
Reference Source	Input Amplitude	Modulator Clock
External	-1 dB	External

Figure 3. FFT Plot, -1 dB, External Reference



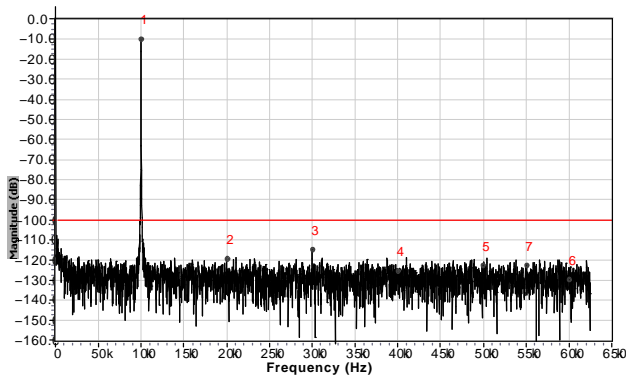
Reference Source	Input Amplitude	Modulator Clock
Internal	-6 dB	Internal

Figure 4. FFT Plot, -6 dB, Internal Reference



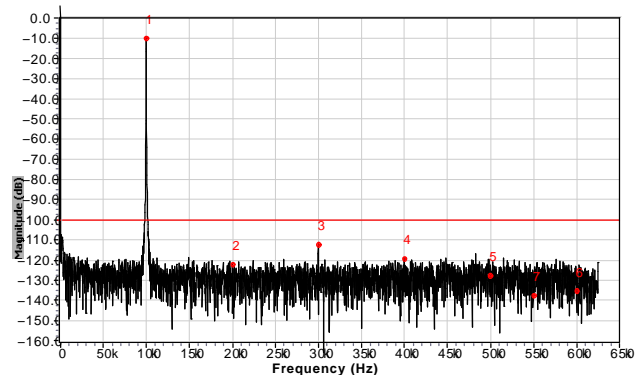
Reference Source	Input Amplitude	Modulator Clock
External	-6 dB	External

Figure 5. FFT Plot, -6 dB, External Reference



Reference Source	Input Amplitude	Modulator Clock
Internal	-10 dB	Internal

Figure 6. FFT Plot, -10 dB, Internal Reference



Reference Source	Input Amplitude	Modulator Clock
External	-10 dB	External

Figure 7. FFT Plot, -10 dB, External Reference

2.5 Modular EVM

The ADS1601/02 EVM meets the mechanical and electrical provisions of TI's modular signal chain. This methodology allows users to evaluate the performance of any device in several ways:

- Stand-alone system — Users can readily access the EVM control and data signals. They have the freedom to connect the appropriate signals to a host system or timing generator and apply the proper stimulus to the EVM for operation
- DSK-driven system — TI offers a range of DSP Starter Kits (known as DSKs) which enable users, unfamiliar with DSP systems, an inexpensive route to gain experience in DSPs and quickly build a system. For example, DSKs can assist users in proving a concept or in developing software before investing time and money in customized hardware. The DSKs are fully functional DSP systems and include the necessary software to quickly begin programming DSPs. Most DSKs provide for expansion connectors, address data, and control signals via two 80-pin connectors.

The ADS1601EVM and ADS1602EVM connect to the DSKs via a mezzanine-level board referred to as the 5-6K Interface Board. Information about this board can be found in user's guide [SLAU104](#). [Figure 8](#) illustrates the board stack-up.

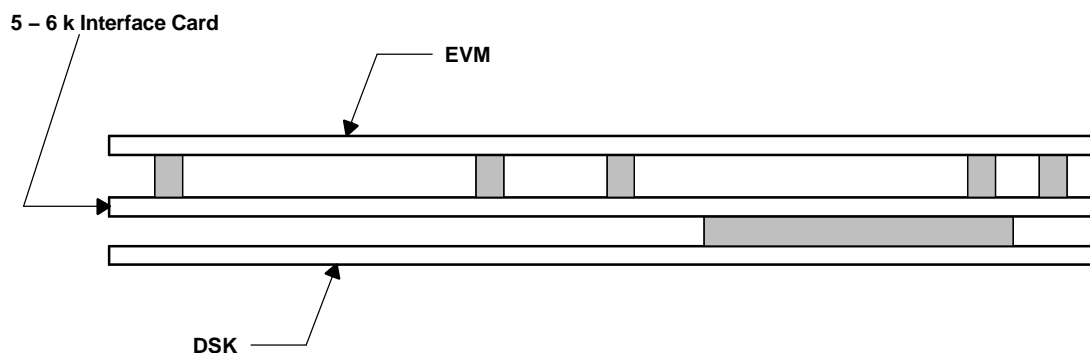


Figure 8. Board Stack-Up

3 Analog Interface

The analog interface consists of the following subsections:

- Analog input
- Reference
- Modulator clock

Users can modify the analog interface by various jumpers; [Table 5](#) summarizes the function of each jumper.

Table 5. Analog Interface Jumper Functions

REFERENCE DESIGNATOR	DESCRIPTION	FACTORY-SET CONDITION	
		1-2	2-3
ANALOG INPUT OPTIONS			
W3	Selects AIN - source	Installed	Not installed
W5	Selects AIN + source	Installed	Not installed
REFERENCE VOLTAGE OPTIONS			
W1	Connects VCM for onboard reference	Installed	—
W2	Selects reference source	Installed	Not installed
W4	Selects VCOM source	Installed	Not installed
W6	Selects VREFP source	Installed	Not installed
W7	Selects VREFM source	Installed	Not installed
MODULATOR CLOCK			
W13	Modulator clock source	Installed	Not installed

3.1 Analog Input

Both the ADS1601 and ADS1602 offer one differential analog input. Various options are available to provide maximum flexibility for delivery of the signal to the ADC.

- Single-ended via SMA connector at J3 (default)
- Differentially via socket strip/header at J1/P1
- Differentially via the Audio Precision™ source at J4

The default configuration used by the EVM (see [Figure 9](#)) provides a convenient method to convert a single-ended bipolar signal into a differential signal. The signal is centered on a common mode voltage derived from the reference section of the EVM.

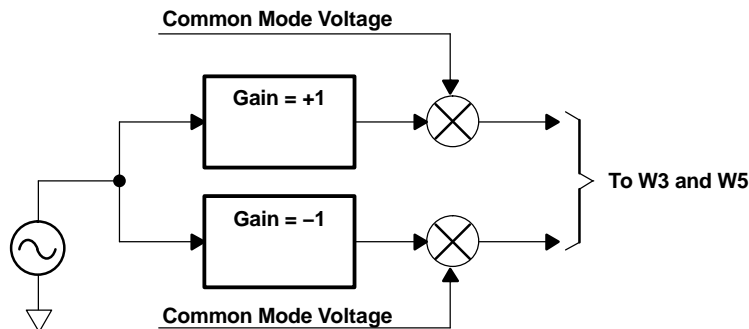


Figure 9. Single-Ended Via SMA Connector

The differential signal is routed to W3 and W5, which also enables the user to provide an external signal.

3.1.1 Differentially via an Audio Precision Source

For the characterization of the ADS1601 and ADS1602 EVM, the Audio Precision System Two™– 2322 source was used to provide a low-distortion signal.

The mating connector for the AP source is located at J4 on the EVM; however, it is not installed in the regular EVM configuration. Before using the AP source, the mating connector (Neutrik part no. NC3FD-V-B) should be installed.

3.1.2 External Reference

The selection between the device's internal reference and an external reference is made by SW2-4 (see [Table 6](#)).

Table 6. Internal/External Reference

REFERENCE DESIGNATOR	VOLTAGE REFERENCE SELECTION	
	INTERNAL	EXTERNAL
SW2-4		
LO	Not selected	Selected
HI	Selected	Not selected

If the user chooses not to use the on-chip reference, two options are available as detailed in [Table 7](#).

Table 7. W2 Jumper Selection

1-2	2-3	DESCRIPTION
Installed	Not installed	Reference voltage is derived directly from AVDD power supply plane
Not installed	Installed	Reference voltage is derived from an external reference device installed on the EVM. In this case, the user must supply an input voltage between 8 V and 40 V to the reference device via J7.

The external reference voltage is generated differentially and can be adjusted by three potentiometers, detailed in [Table 8](#)

Table 8. Reference Designator and Function

REFERENCE DESIGNATOR	FUNCTION
RV2	Adjusts main +5 V
RV1	Adjusts REF+ voltage
RV3	Adjusts REF- voltage

[Figure 10](#) shows a block diagram of the reference voltage configuration

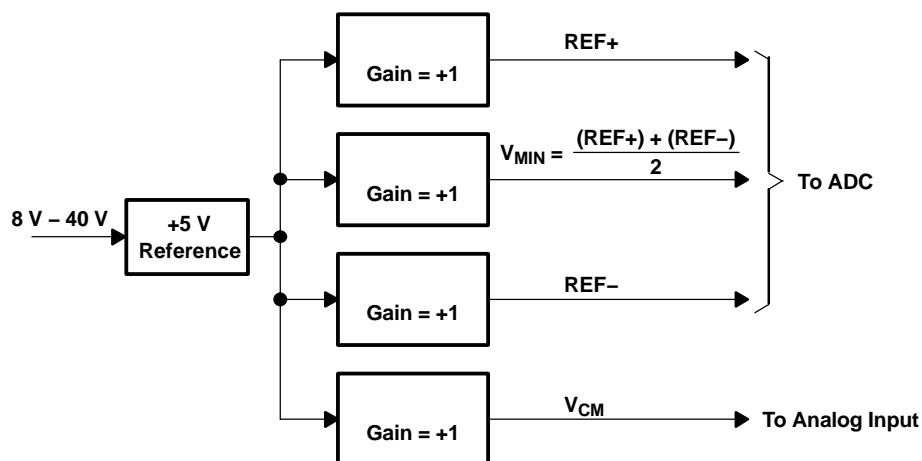


Figure 10. Reference Voltage Block Diagram

3.2 Modulator Clock

The EVM offers two options for selecting the source of the modulator clock. The clock can be supplied

- By the onboard oscillator (either 20 MHz or 40 MHz)
- By an external source connected via the SMA connector at J6. This option is useful for low-jitter coherent sampling during testing.

Table 9. Modulator Clock Source Selection

REFERENCE DESIGNATOR	DESCRIPTION	FACTORY-SET CONDITION	
		1–2	2–3
W13	Modulator clock source	Installed	Not Installed

4 Digital Interface

The digital interface consists of the following subsections:

- Board-level control
- External interface to host systems

4.1 Board-Level Control

4.1.1 DIP Switch Options

The optional settings for the ADS1601/02 are set and controlled manually via a DIP switch, SW2. [Table 10](#) summarizes the functions controlled by this switch.

Table 10. Optional Settings for the ADS1601/02

SWITCH		FACTORY-SET CONDITION	
SWITCH NO.	FUNCTION	HI	LO
1	Power down	ADS1601 / 02 is not powered down	ADS1601 / 02 is powered down
2	Reserved for future use	Set this switch HI	—
3	Reserved for future use	—	Set this switch LO
4	External reference enable	External reference is enabled	External reference is disabled

4.1.2 Jumper Options

The functions of the seven jumpers associated with the digital control section are detailed in [Table 11](#).

Table 11. Jumpers Associated With the Digital Control Section

REFERENCE DESIGNATOR	DESCRIPTION	FACTORY-SET CONDITION	
		1-2	2-3
W8	FS source	Installed	Not installed
W9	Data source	Installed	Not installed
W10	Clock source	Installed	Not installed
W11	Sync source	Not Installed	Installed
W14	FS destination	Not Installed	Installed
W15	Data destination	Not Installed	Installed
W16	Clock destination	Not Installed	Installed

Because the ADS1601/02 provide both regular serial control signals and their complementary signal, jumpers W8, W9, and W10 provide a means to select either the regular signals or the complementary signals (see Figure 11). Note that these signals should be selected en-masse.

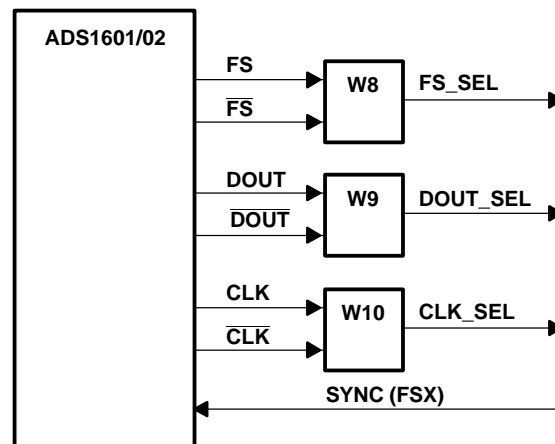


Figure 11. ADS1601/02 Serial Control Signals

The 5-6K Interface Board provides two serial port channels. The group of control signals selected can be routed to either channel 0 or channel 1 via W14, W15, and W16 as shown in Figure 12.

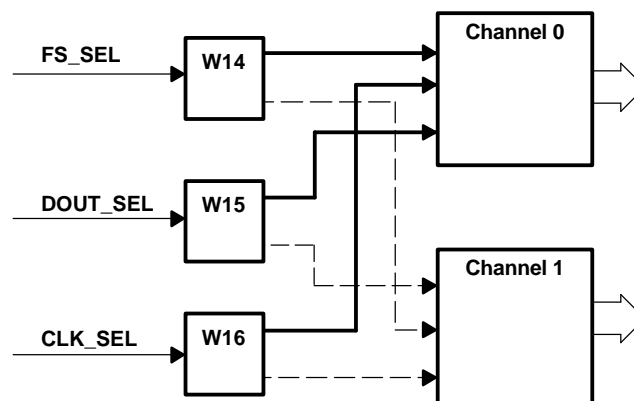


Figure 12. Control Signal Routing

4.1.3 Synchronizing the ADS1601/02

In normal operation, the ADS1601/02 begins conversion immediately on power up. The user must perform a one-time synchronization of the device to ensure that the data received is aligned properly. This is achieved on the EVM by using the appropriate FSX signal, either FSX from channel 0 or channel 1 (see [Figure 12](#) and [Table 11](#) for details).

4.1.4 Out-of-Range Indication

LED D1 indicates if an out-of-range (OTR) event has occurred. This LED does not affect the device's performance. To clear the LED, the device can be reset manually via SW2.

5 Power Distribution

The ADS1601/02EVM board requires various power sources for operation.

- A dual ± 6 -VDC supply for best performance of the analog front-end. If a ± 6 -VDC supply is not readily available, a ± 5 -VDC supply is sufficient. This voltage is delivered by P5/J5 pins 1 and 2.
- Two +5-VDC supplies
 - One supply provides the power for the analog section of the ADC. This voltage is delivered by P5/J5 pin 3.
 - One supply provides the power for the digital I/O section of the ADC and the EVM. This voltage is delivered by P5/J5 pin 10.
- A single +3-VDC supply for the digital core; a 3.3-V supply is acceptable. This voltage is defined on the power connector P5/J5 and supplied via pin 9.

A jumper gives the user some flexibility in choosing to operate the I/O interface at either 3 V or 5 V. The factory-set condition for this operation is 3 V.

Table 12. Jumper W12 Factory Setting

REFERENCE DESIGNATOR	DESCRIPTION	FACTORY-SET CONDITION	
		1–2	2–3
W12	I/O supply voltage	Installed	Not installed

The simplest way to provide these voltages is to use the power connector P4 / J4 and derive the voltages elsewhere, preferably via linear supplies.

The pinout for this connector is shown in [Table 13](#).

Table 13. Connector Pinout

SIGNAL	P5/J5 PIN NUMBER		SIGNAL
+VA	1	2	–VA
+5VA	3	4	–5VA
DGND	5	6	AGND
+1.8VD	7	8	VD1
+3.3VD	9	10	+5VD

Getting the Most From Your EVM

Should the user decide to use a TI DSK, the digital requirements for pin 9 and pin 10 can be supplied by the DSK via the 5-6K Interface Board; see [Figure 13](#) for details.

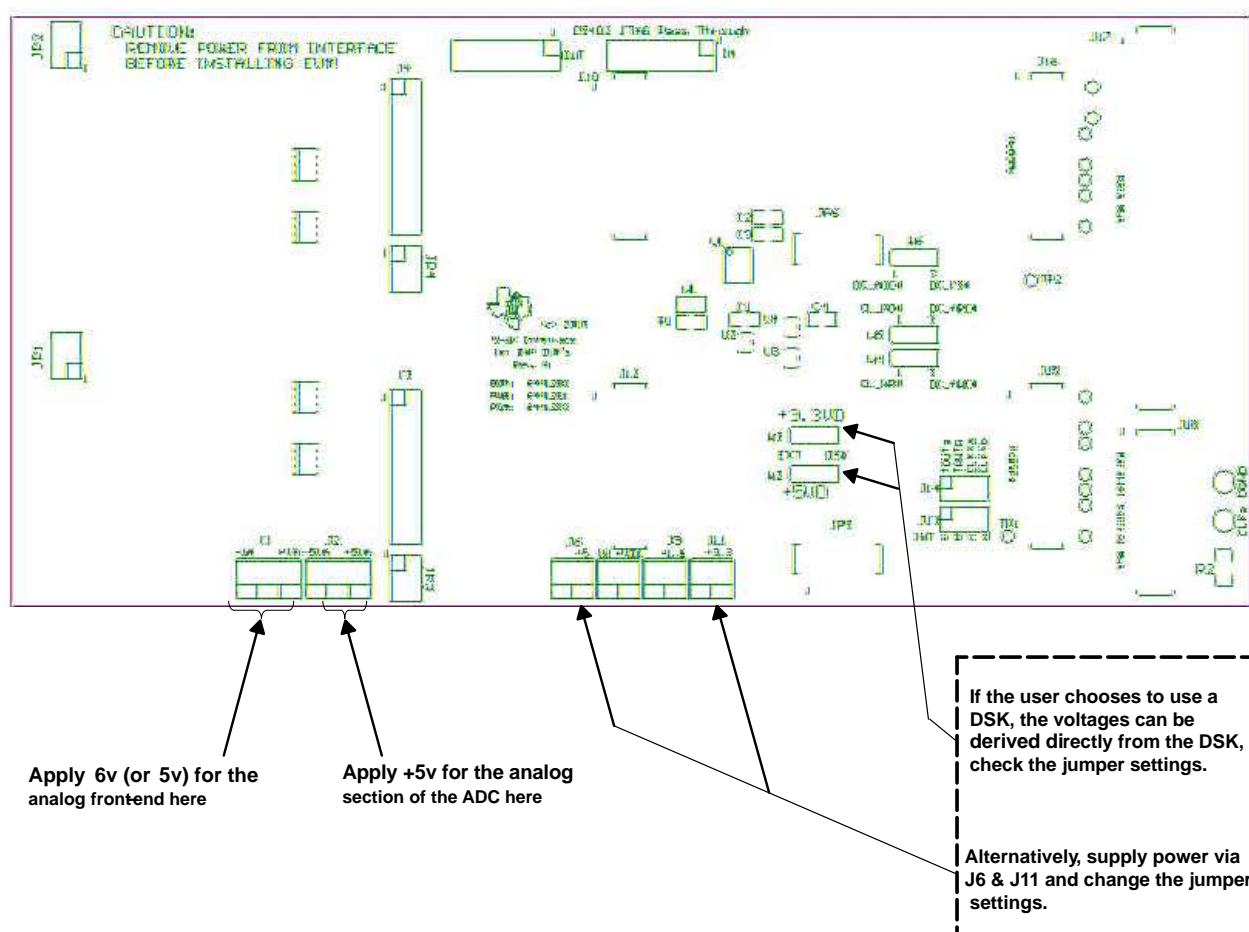


Figure 13. 5-6K Interface Board Options for TI DSK

A single 8-VDC to 40-VDC supply may also be required if the user wishes to use the voltage reference on the EVM rather than the voltage reference on the device; see [Section 3.1.2](#) for more details

6 Getting the Most From Your EVM

In general, the user can take two hardware directions with the EVM

6.1 Stand-Alone EVM

The EVM can function as a stand-alone tool. As such, users must provide a custom digital interface between the EVM and a host system. Users are responsible for ensuring proper timing requirements are met in addition to providing any glue logic necessary. Users must also provide the necessary analog interface and supply power to the EVM

6.2 DSP Interface

Depending on the DSP that a user chooses, a number of TI DSKs are available. DSKs (DSP Starter Kits) provide users with a DSP starter system that contains all the necessary hardware and software to quickly begin prototype construction.

6.3 TMS320C6713 DSP Interface

6.3.1 Example Program

This section is a step-by-step description of how to use one of the example programs available on the TI Web site. The goal of the program is to display the digitized analog input of the ADS1601/02 on the PC, as shown in [Figure 20](#).

The hardware is set up as follows:

- TMS320C6713 DSK
- 5-6K Interface Board
- ADS1601/02 EVM

Given this configuration, the hardware will be assembled as previously shown in [Figure 8](#).

The example program uses the driver files created with the Data Converter Plug-in of Code Composer Studio™, which can be downloaded from the TI Web site at <http://www.ti.com/sc/dcplug-in>.

The program itself performs the following steps:

1. Initialization of the global variables by calling the function *dc_configure()* with the settings of the ADS1601/02. These settings are stored in the *ADS1601/02_1* data structure (defined in the file *t1601_fn.h*) which contains the information about the physical settings used by the driver. If the initialization fails for any reason, an error message will appear in the stdout window of Code Composer Studio.
2. Enabling of the interrupts of the DSP.
3. Reading a block of data from the ADS1601/02, by calling the *dc_rblock()* function (residing the file *t1601_ob.c*) with the settings of the ADS1601/02, the address of the memory block where the data should be written to and the block size. Once the transfer is complete, the semaphore *ADS1601/02_1.xferInProgress* will be reset and a new transfer will be initiated

In order to get the expected result, the following steps need to be performed:

- Make sure that the jumpers on the 5–6K Interface Board are set according to the following [Figure 14](#) and [Table 14](#):

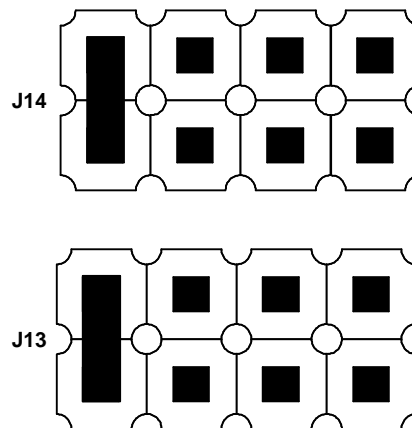


Figure 14. Jumper Settings for J13 and J14 on 5-6K Interface Board

Table 14. Jumper Settings for J13 and J14 on the 5–6K Interface Board

REFERENCE DESIGNATOR	POSITION	
	1–2	2–3
W1	Installed	—
W2	Not installed	Installed
W3	Installed	Not installed
W4	Not installed	Installed
W5	Not installed	Installed
W6	Installed	Not installed

- Make sure that all jumpers on the ADS1601/02 EVM are set to the factory defaults, as described in sections 3 and 4 of this User's Guide.
- Apply power to the DSP starter kit and also to the EVM, as described in Section 5, Power Distribution.
- Apply an analog signal on either J3, pins 1 and 2 of J1, or via the AP source connector. For example, apply a 10 kHz sine wave with 1 V_{pp} and 0 V offset.
- Start Code Composer Studio (CCS).
- In Code Composer Studio, open the project for your DSP hardware platform (see [Figure 15](#) and [Figure 16](#)) by clicking on *Project -> Open* on Code Composer Studios menu bar and loading the respective project for your hardware/starter kit from the path, where you copied the example projects to:
 - For the TMS320VC5510 DSK: — Open *ADS1601/02-C5510.pjt*
 - For the TMS320C6711 DSK: — Open *ADS1601/02-C6711.pjt*
 - For the TMS320C6713 DSK: — Open *ADS1601/02-C6713.pjt*
 - For the TMS320C6416 DSK: — Open *ADS1601/02-C6414.pjt*

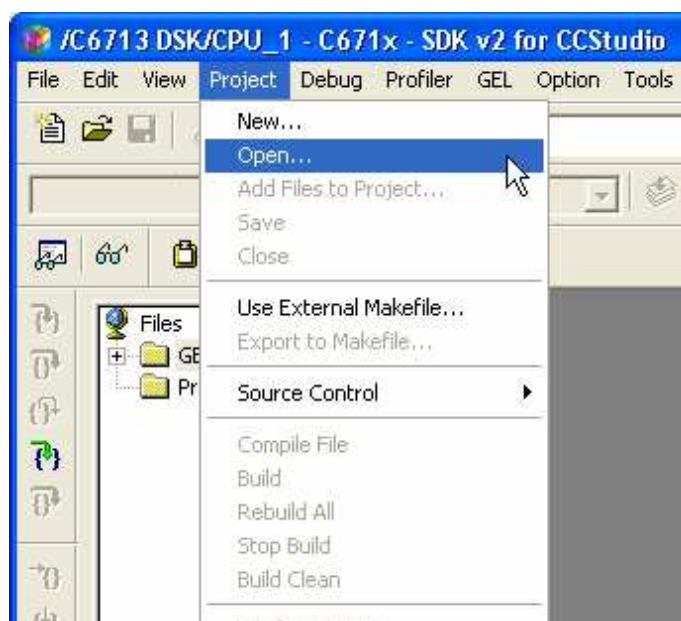


Figure 15. CCS Project Menu

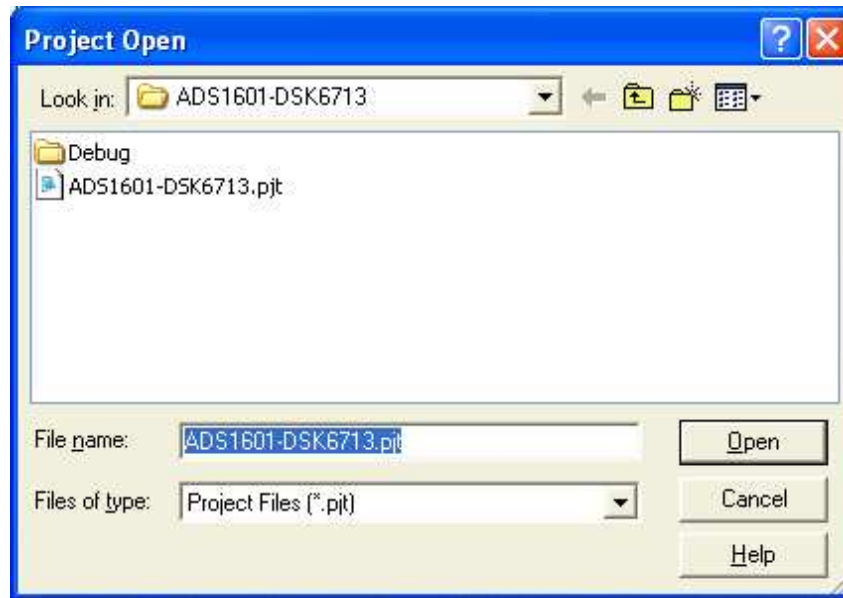


Figure 16. CCS Project Open Dialog

- Once the project is open, expand the project tree by clicking on the + in front of it and expand the Source Files as well. The project window should then look like the one in Figure 17.

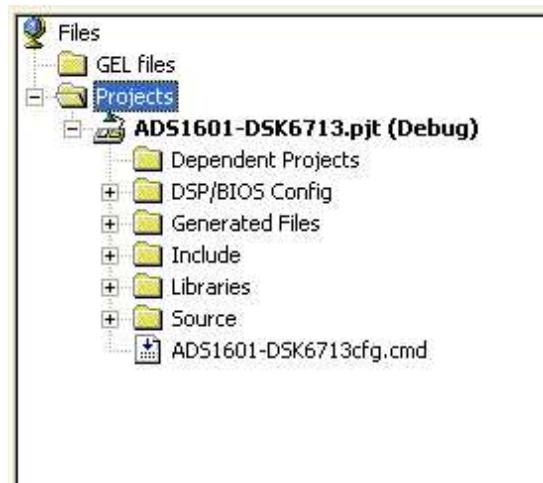


Figure 17. CCS Project View

- The next step is to load the executable program provided into the DSP by clicking on *File* → *Load Program* and selecting the file *ADS1601-XXXX.out* from the *Debug* submenu, where the XXXX in the filename stands for the platform you use (5510, 6711, 6713, 6416).
- Now open the *main.c* source file by double-clicking on the file name in the project view and scroll down to the line, where the read command for the ADS1601/02 is issued (*dc_rblock()* function). This line reads:

```

while(1)                /* loop forever                */
{
    while(Ads1601_1.xferInProgress);
    dc_rblock(&Ads1601_1, r_buffer, BUFFER_SIZE, 0);
    i++;
}
  
```

- Set the cursor in front of the *dc_rblock()* command and right click in this line. A new pop-up menu opens; select *Insert Graph* (see Figure 18).

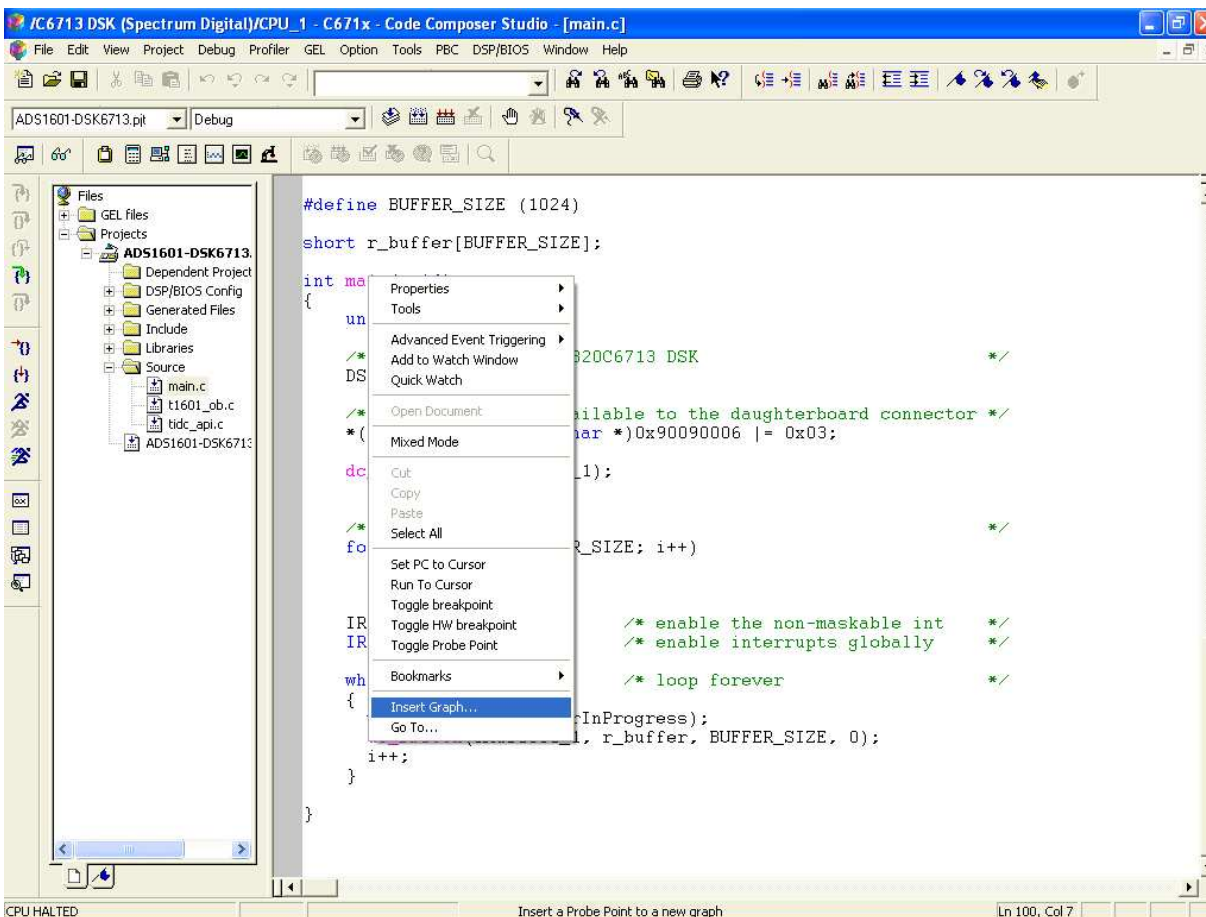


Figure 18. CCS Context Menu

- With this done, a new dialog window with the properties of the graph appears (see [Figure 19](#)). Here, a few values must be entered, whereas the most settings can be left in the default position:
 - **Start Address:** This is the starting location of the acquisition buffer containing the data to be graphed. When the graph is updated, the acquisition buffer, starting at this location, is fetched from target board. This acquisition buffer then updates the display buffer, which is graphed. In the case of the sample program, set it to `r_buffer`.
 - **Acquisition Buffer Size:** This is the size of the acquisition buffer you are using on your target board. In the case of the sample program, the size of the `r_buffer` is defined with the symbol `BUFFER_SIZE` in the `main.c` file and should be set to **1024** in the dialog window.
 - **Display Data Size:** This is the size of the display buffer that you use. The contents of the display buffer are graphed on your screen. The display buffer resides on the host, so a history of your signal can be displayed even though it no longer exists on the target board. In case of the sample program, set it to **1024** as well.
 - **DSP Data Type:** Select 16-bit signed integer from the drop-down list, as the ADS1601/02 is a 16-bit converter.
 - **Sampling Rate (Hz):** This field contains the sampling frequency for acquisition buffer samples, such as for analog to digital conversion. The sampling rate is used to calculate the time and frequency values displayed on the graph. For a time domain graph, this field calculates the values for the time axis. The axis is labeled from 0 to (Display Data Size * 1/Sampling Rate). For the sample program, set it to **1250000** (1.25 MHz).

More information on the different settings can be found in the help file of Code Composer Studio.

Once all settings are entered, click on the *OK* button to close the dialog. The graph window appears, currently with no useful values, as the program was not started yet.

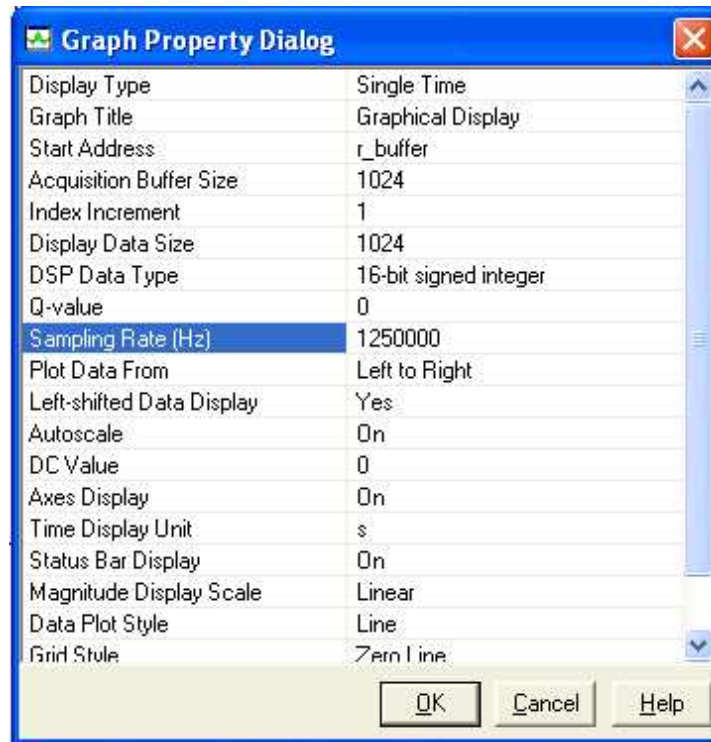


Figure 19. CCS Graph Property Window

- Start the program by pressing the <F5> key on your keyboard. After a short time, the graph window is updated and shows the waveform of the analog signal (see [Figure 20](#)).

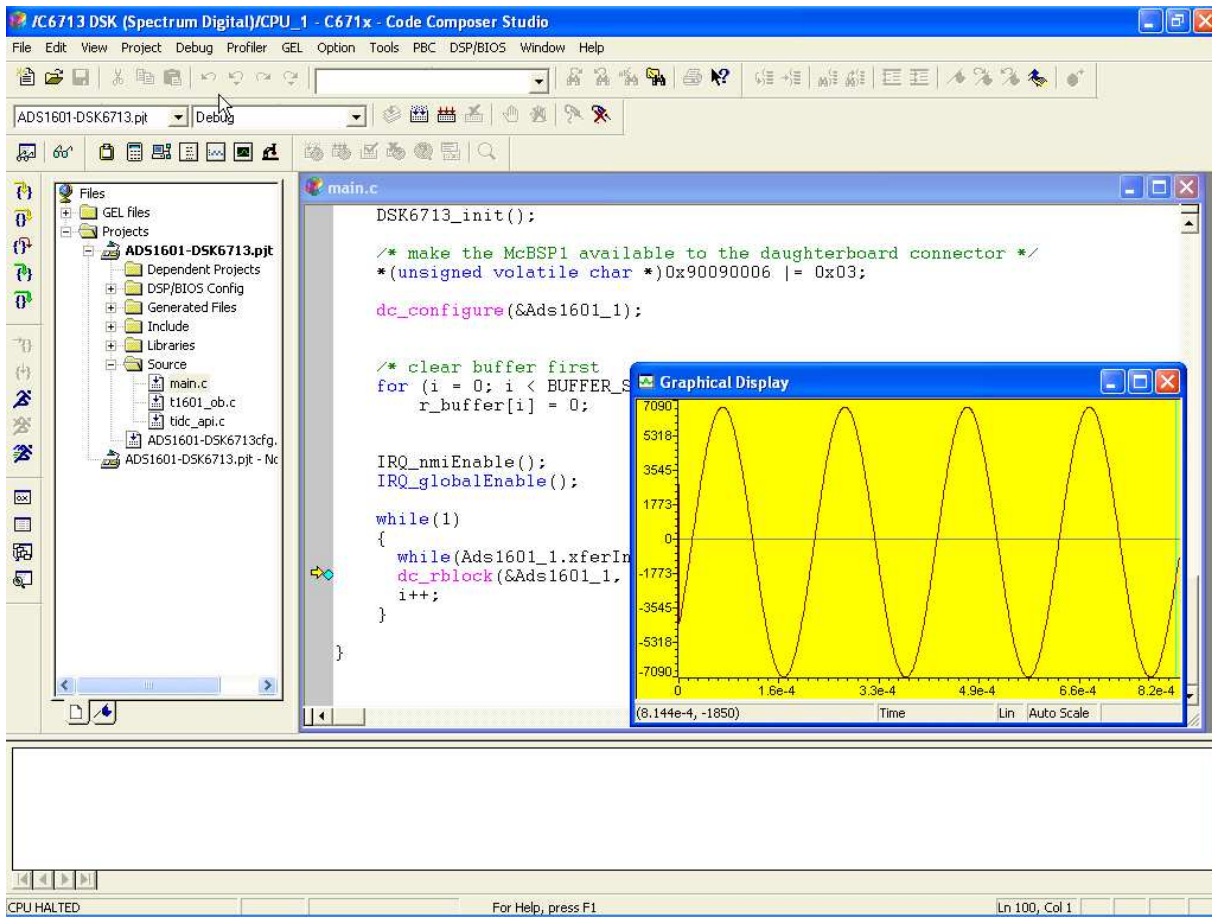


Figure 20. CCS Window with Graph

Appendix A ADS1601/ADS1602EVM Bill of Materials
Table A-1. Bill of Materials

Item No.	Qty	Value	Ref Des	Description	Vendor	Part Number
1	3	0R	R2 R3 R51	Resistor 0 Ω 1/16W 5% 0402 SMD	Panasonic	ERJ-2GE0R00X
2	1	2.2R	R43	Resistor 2.2 Ω 1/4W 5% 1206	Panasonic	ERJ-8GEYJ2R2V
3	4	33R	R36 R52 R53 R54	Resistor 33 Ω 1/8W 5% 0805 SMD	Panasonic	ERJ-6GEYJ330V
4	3	49.9R	R30 R31 R46	Resistor 49.9 Ω 1/16W 1% 0603 SMD	Panasonic	ERJ-3EKF49R9V
5	2	100R	R33 R34	Resistor 100 Ω 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ101V
6	1	100R	R32	Resistor 150 Ω 1/8W 5%	Panasonic	ERJ-6GEYJ151V
7	17	392R	R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R21 R23 R24 R25 R27 R29	0805 SMD 0805 Resistor 0.1% tolerance 10 PPM 392R	Holsworth	279-RN73CA-392R
8	2	1K	R47 R48	Resistor 1.0 kΩ 1/16W .1% 0603 SMD	Panasonic	ERA-3YEB102V
9	2	3.01K	R7 R22	SMD Thin Film Chip Resistor 0805 3.01K 0.1% 25PPM	KOA Speer	RN732ALTD3011B25
10	2	4.12K	R8 R26	Thin Film Chip Resistor, 0805 4.12K 0.1% 25PPM	KOA Speer	RN732ALTD4121B25
11	1	9.09K	R6	0805 SMD Thin Film Chip Resistor 9.09K 0.1% 25PPM	KOA Speer	RN732ALTD9091B25
12	11	10K	R5 R28 R37 R38 R39 R40 R41 R42 R44 R45 R55	KOA Speer 0805 SMD Thin Film Chip Resistors 0805 10K 0.1% 25PPM	KOA Speer	RN732ALTD1002B25
13	1	12.1K	R20	0805 SMD Thin Film Chip Resistor 12.1K 0.1% 25PPM	KOA Speer	RN732ALTD1212B25
14	1	60.4K	R49	Resistor 60.4 kΩ 1/10W 1% 0805 SMD	Panasonic	ERJ-6ENF6042V
15	1	130K	R35	Resistor 130 kΩ 1/8W 5% 0805 SMD	Panasonic	ERJ-6GEYJ134V
16	2	5K	RV1 RV3	TRIMPOT 5 kΩ 4MM TOP ADJ SMD	Bourns	3224W-1-502E
17	1	10K	RV2	TRIMPOT 10 kΩ 4MM TOP ADJ SMD	Bourns Inc.	3224W-1-103E
18	4	220 μH	L1 L2 L3 L4	Inductor 220 μH 10% SA TYPE SMD	Panasonic - ECG	ELJ-SA221KF
19	2	NI	R1 R4	*	*	*
20	2	22 pF	C35 C36	Capacitor ceramic 22 pF 50V C0G 0603	TDK	C1608C0G1H220J
21	2	100 pF	C50 C57	Capacitor ceramic 100 pF 50V C0G 0603	TDK	C1608C0G1H101J
22	1	390 pF	C61	Capacitor ceramic 390 pF 50V C0G 5% 0603	TDK	C1608C0G1H391J
23	5	0.001 μF	C7 C8 C17 C21 C88	Capacitor ceramic 1000 pF 50V C0G 5% 0603	TDK	C1608C0G1H102J
24	10	0.01 μF	C2 C3 C9 C11 C14 C24 C26 C32 C40 C41	Capacitor ceramic 10000 pF 50V C0G 5% 0805	TDK	C2012C0G1H103J
25	1	0.01 μF	C27	Capacitor ceramic 10000 pF 25V X7R 10% 0402	TDK	C1005X7R1E103K
26	31	0.1 μF	C25 C33 C38 C42 C43 C46 C51 C54 C55 C56 C58 C62 C66 C68 C70 C71 C75 C76 C78 C81 C82 C84 C85 C90 C93 C99 C101 C103 C104	Capacitor ceramic 0.10 μF 25V X7R 10% 0603	TDK	C1608X7R1E104K
27	24	1 μF	C1 C5 C10 C13 C20 C22 C23 C29 C31 C44 C48 C52 C59 C65 C69 C72 C73 C74 C77 C80 C87 C97 C98 C102	Capacitor ceramic 1.0 μF 16V X5R 10% 0603	TDK	C1608X5R1C105K

Table A-1. Bill of Materials (continued)

Item No.	Qty	Value	Ref Des	Description	Vendor	Part Number
28	1	22 µF	C37	Capacitor ceramic 2.2 µF 10V X5R 0805	TDK	C2012X5R1A225K
29	3	4.7 µF	C63 C89 C94	Capacitor ceramic 4.7 µF 6.3V X5R 20% 0603	TDK	C1608X5R0J475M
30	17	10 µF	C4 C6 C12 C15 C16 C18 C19 C28 C30 C34 C39 C45 C47 C64 C79 C83 C100	Capacitor ceramic 10 µF 6.3V X5R 20% 0603	TDK	C2012X5R0J106M
31	5	22 µF	C49 C53 C60 C86 C92	Capacitor ceramic 22 µF 10V X5R 20% 1210	TDK	C3225X5R1A226M
32	4	47 µF	C67 C91 C95 C96	Capacitor ceramic 22 µF 10V X5R 20% 1210	TDK	C3225X5R1A226M
33	1	NI	C105	–	–	–
34	3	OPA2822U	U1 U2 U4	IC Dual WDBND OP AMP 8-VSSOP	Texas Instruments	OPA2822E/250
35	1	REF02	U3	IC +5V Voltage reference 8-SOIC	Texas Instruments	REF02BU
36*	1	ADS1601	U5	16-bit Oversampling ADC - 40 MHz	Texas Instruments	ADS1601IPFBT
37	1	SN74AHC74	U6	IC Dual EDG-TRG DTYP F-F 14 TSSO	Texas Instruments	SN74AHC74PWR
38	1	SN74AHC541	U7	IC OCT BUFF/DRVR 3-state 20-TSSOP	Texas Instruments	SN74AHC541PW
39	1	REG101UA-3.3	U8	IC LDO Regulator 3.3V 100 mA 8SOP	Texas Instruments	REG101UA-3.3
40	1	TRANSISTOR – NPN	Q1	TRANS NPN 40 V SOT-23	Infineon	SMBT3904E6327
41	1	SM_LED_1206	LED	Red LED	Chicago Miniature Lamp Co.	CMD15-21VRC/TR8
42*	1	OSCILLATOR	X1	VF3 Series miniature oscillator - 20 MHz	Valpey Fisher	VF900536-20.000MHz
43	1			ADS1601 / 02 PWB		6464619
44	3		J1 J7 J8	2 x 10 x 0.1 SMT Terminal strip	Samtec	TSM-110-01-T-DV-P
45	3		P1, P7, P8	2 x 10 x 0.1 SMT Socket strip	Samtec	SSW-110-22-F-D-VS-K
46	1		J2	2-pole screw terminal 3.5mm pitch Black	On Shore Technology	ED-555-2-BK
47	1		J3	Right Angle SMA Connector	Johnson Components Inc.	142-0701-301
48	1		J6	Straight Jack Receptacle	Johnson Components Inc.	142-0701-231
49	1		J5	5 x 2 x 0.1 SMT Terminal strip	Samtec	TSM-105-01-T-DV-P
50	1		P5	5 x 2 x 0.1 SMT Socket strip	Samtec	SSW-105-22-F-D-VS-K
51	1		J4	*	*	*
52	1		W1	2 Position Jumper _ 0.1" spacing	Samtec	TSW-102-07-L-S
53	15		W2 W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 W13 W14 W15 W16	3-position jumper	Samtec	TSW-103-07-L-S
54	1		SW1	Switch LT TOUCH 6X3.5 240GF SMD	Panasonic	EVQ-PJU04K
55	1		SW2	SWITCH DIP 4 POS HALF PITCH SMT	ITT Industries (C&K division)	TDA04H0SK1
56	1		AIN (+)	SMT Test Point	Keystone Electronics	5015
57	2		AGND IO_GND	Turret Terminal test point	Cambion	180-7337-02-05
58	1			0.500/4-40 NYLON HEX THREAD SP	Keystone Electronics	1902C
59	1			4-40 X 1/4 MACHINE SCREW PH SS	Building Fasteners	PMSSS 440 0025 PH
60	16	See assembly drawing for details		Shunt	Samtec	SNT-100-BK-T

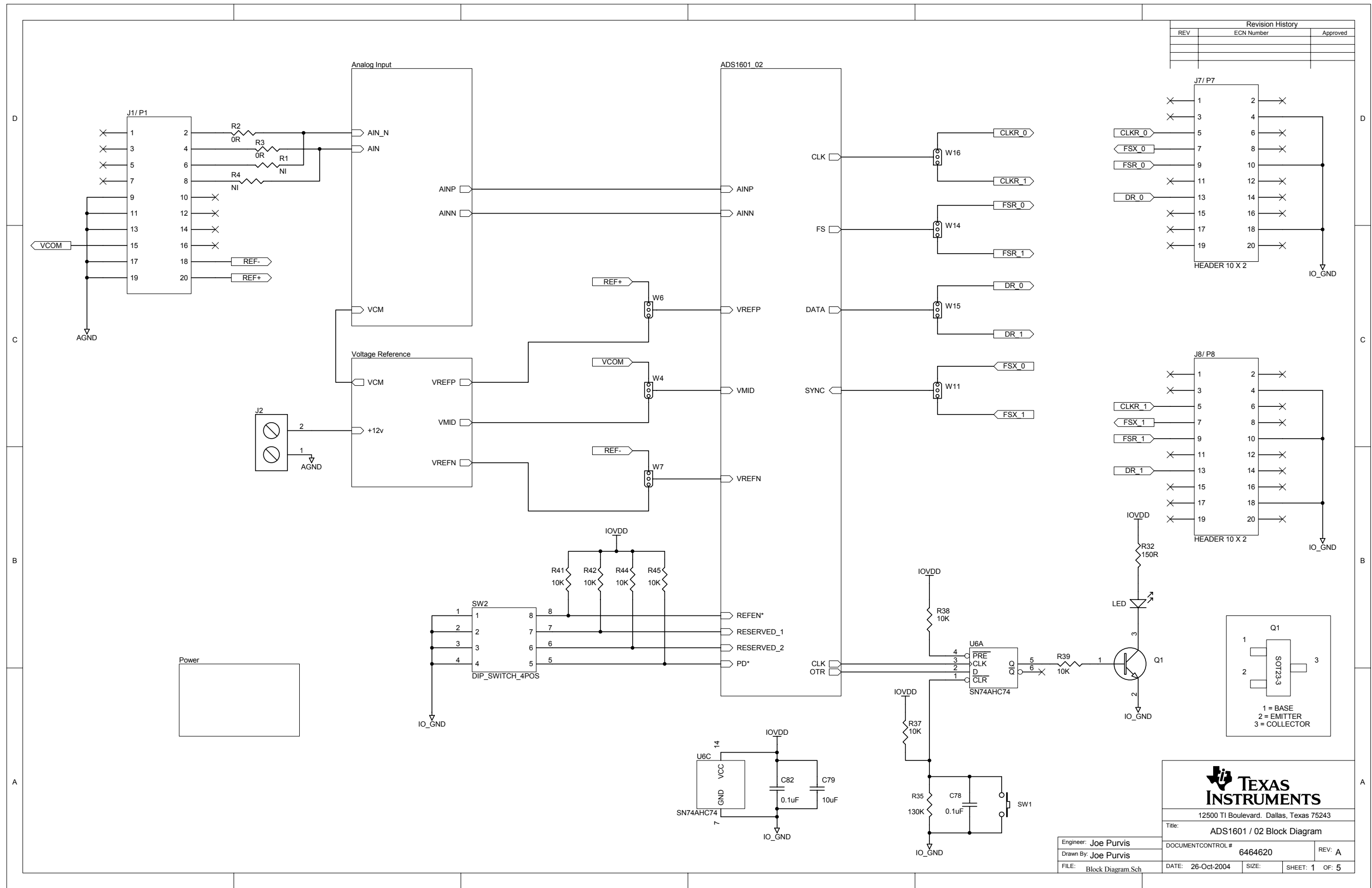
*For ADS1602, substitute the following:

Item No.	Qty	Value	Ref Des	Description	Vendor	Part Number
36	1	ADS1602	U5	16-Bit oversampling ADC	TI	ADS1602IPFBT
42	2	Oscillator	X1	VF3 Series miniature oscillator - 40 MHz	Valpey Fisher	VF900537-40.000MHz

Appendix B ADS1601/02 Schematic

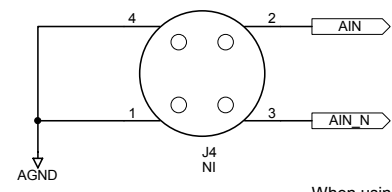
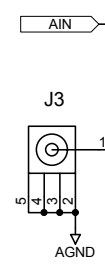
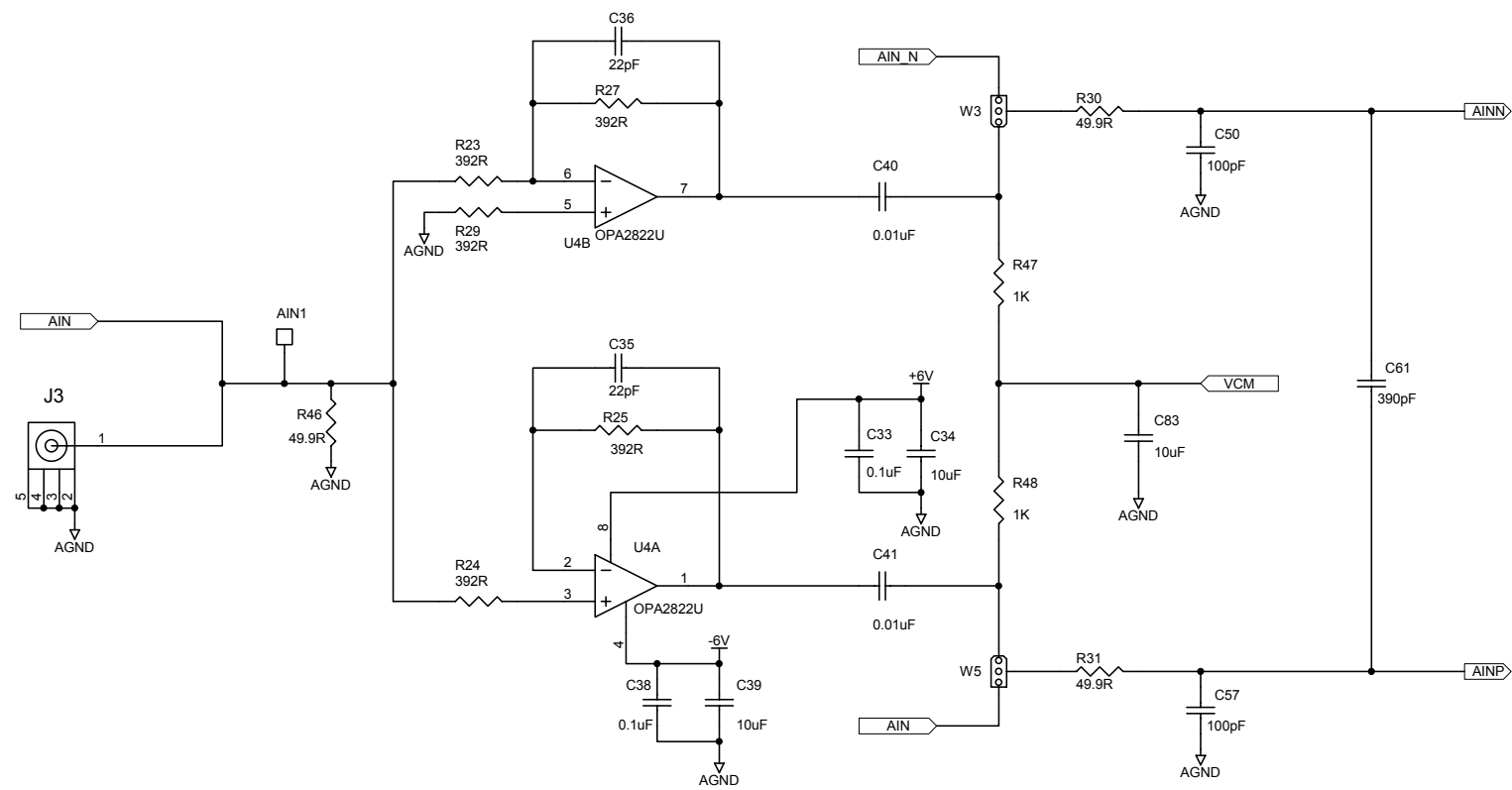
Schematic diagrams are appended following this page.

Revision History		
REV	ECN Number	Approved



12500 TI Boulevard, Dallas, Texas 75243
 Title: ADS1601 / 02 Block Diagram
 DOCUMENT CONTROL # 6464620
 REV: A
 DATE: 26-Oct-2004
 SIZE: SHEET: 1 OF: 5

Engineer: Joe Purvis
 Drawn By: Joe Purvis
 FILE: Block Diagram.Sch

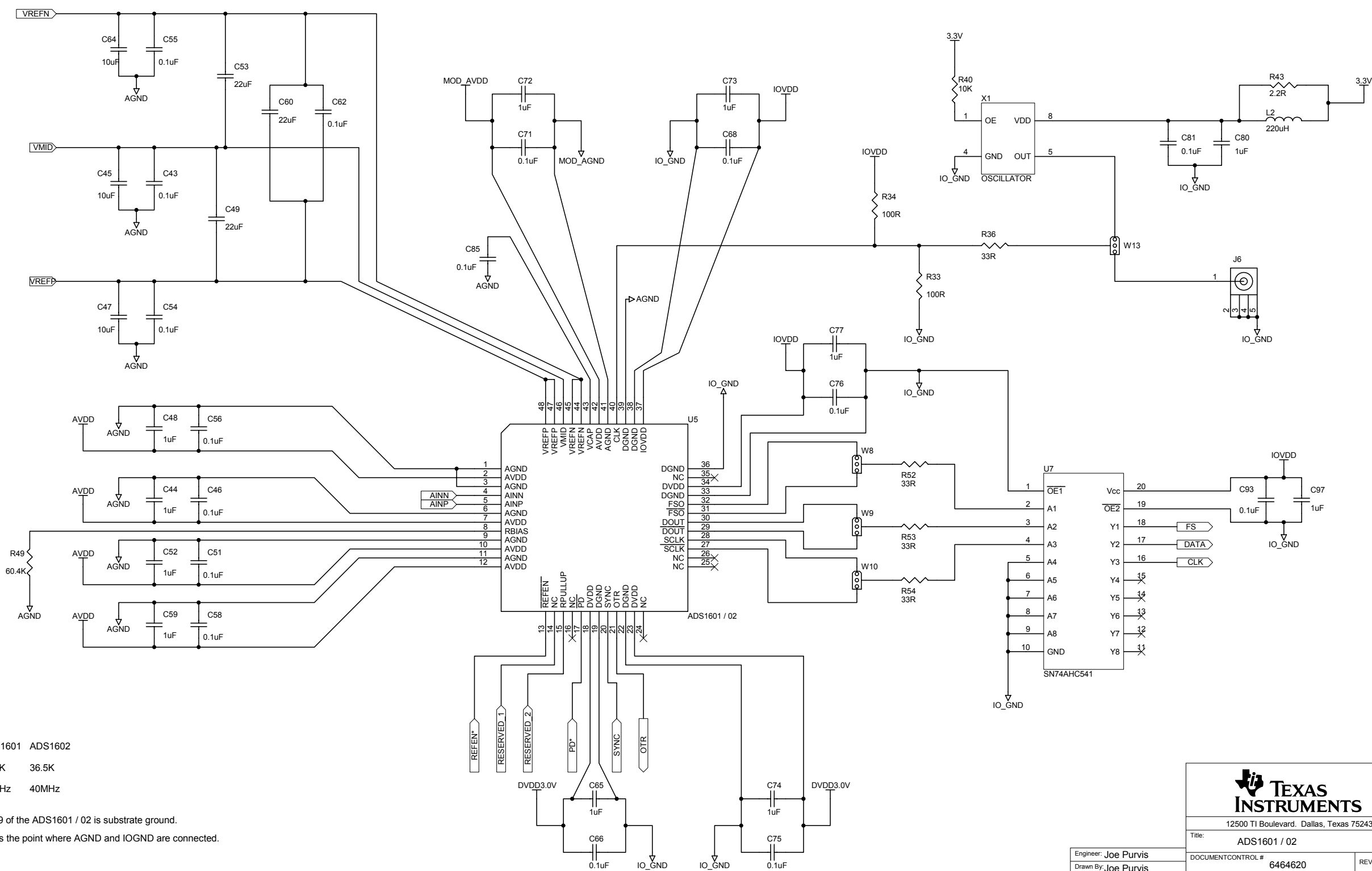


When using the Audio Precision source remove R23, R24 and R46.

12500 TI Boulevard, Dallas, Texas 75243		
Title: ADS1601 / 02 Analog Input		
Engineer: Joe Purvis	DOCUMENT CONTROL # 6464620	REV: A
Drawn By: Joe Purvis	DATE: 26-Oct-2004	SIZE: SHEET: 2 OF: 5

Engineer: Joe Purvis	DOCUMENT CONTROL # 6464620	REV: A
Drawn By: Joe Purvis	DATE: 26-Oct-2004	SIZE: SHEET: 2 OF: 5

Revision History		
REV	ECN Number	Approved

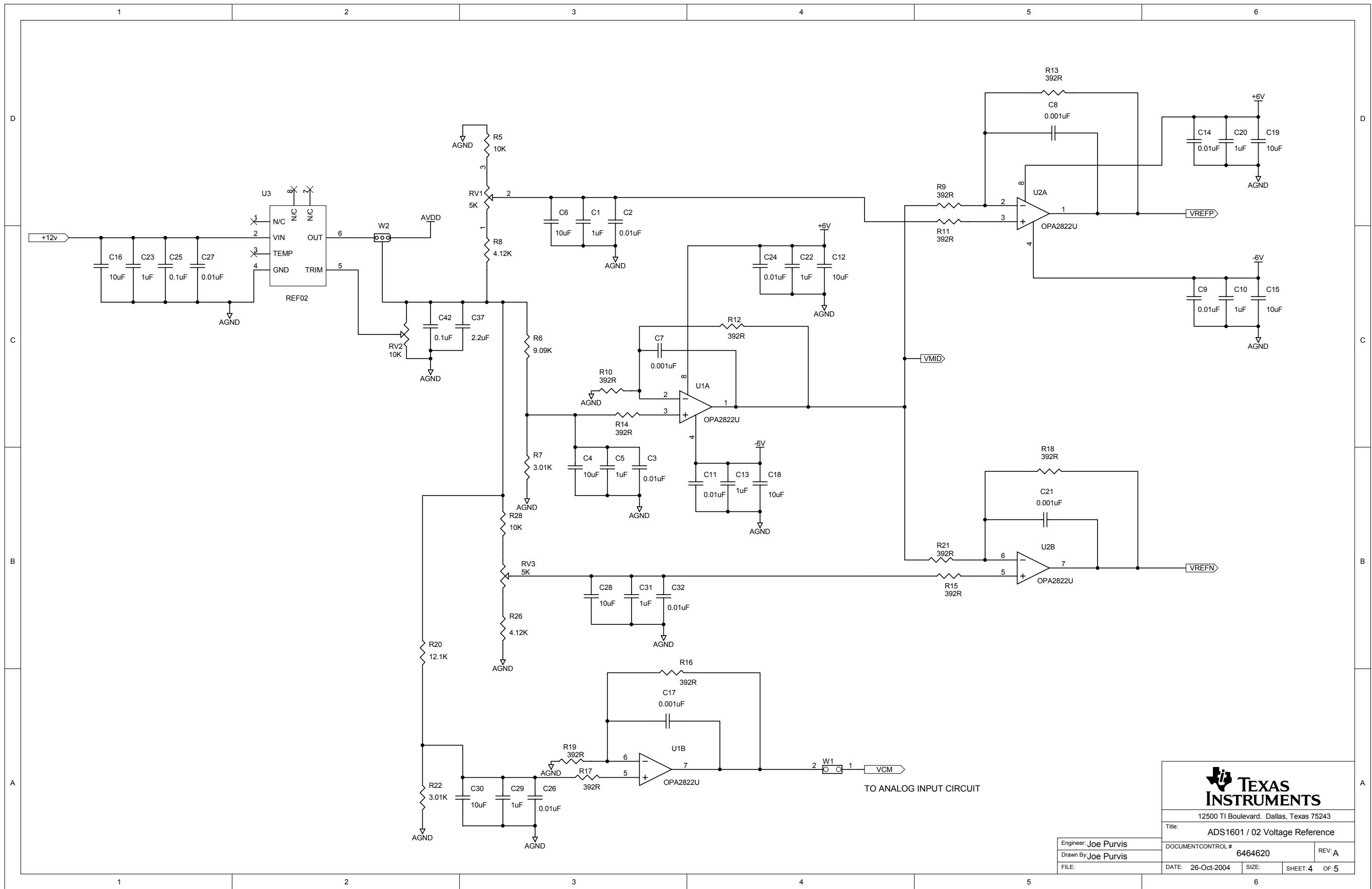


ADS1601 ADS1602
R49 60.4K 36.5K
X1 20MHz 40MHz

Pin 39 of the ADS1601 / 02 is substrate ground.
This is the point where AGND and IOGND are connected.



Engineer: Joe Purvis	DOCUMENT CONTROL # 6464620	REV: A
Drawn By: Joe Purvis	DATE: 26-Oct-2004	SIZE: SHEET: 3 OF: 5
FILE: ADS1601_02.Sch		

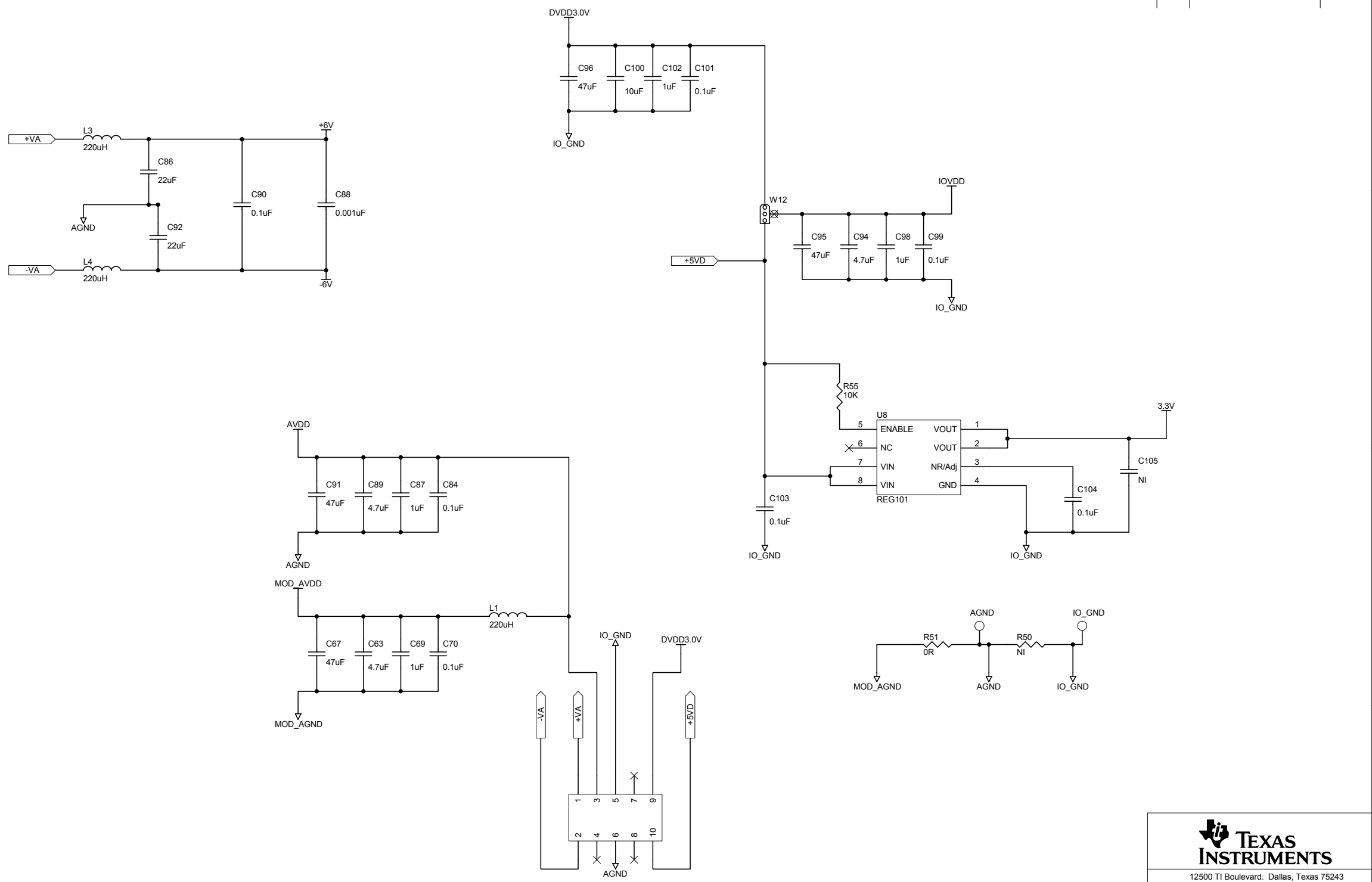


12500 TI Boulevard, Dallas, Texas 75243
 Title: ADS1601 / 02 Voltage Reference
 DOCUMENT CONTROL # 6464620 REV: A
 DATE: 26-Oct-2004 SIZE: SHEET: 4 OF: 5

Engineer: Joe Purvis
 Drawn By: Joe Purvis

TO ANALOG INPUT CIRCUIT

Revision History		
REV	ECN Number	Approved



U9
PWB Notes

NOTES

N1
TI LOGO

TI LOGO

TEXAS INSTRUMENTS

12500 TI Boulevard, Dallas, Texas 75243

Title: ADS1601 / 02 Power

DOCUMENT CONTROL # 6464620

REV A

Engineer: Joe Purvis
Drawn By: Joe Purvis
FILE: Power.Sch

DATE: 26-Oct-2004
SIZE: SHEET 5 OF 5

1 2 3 4 5 6

D

C

B

A

1 2 3 4 5 6

Appendix C ADS1601/02 EVM Layout Details

The Gerber files are available from Texas Instruments; contact the Product Information Center if you require a copy.

C.1 Top Tracking Layer

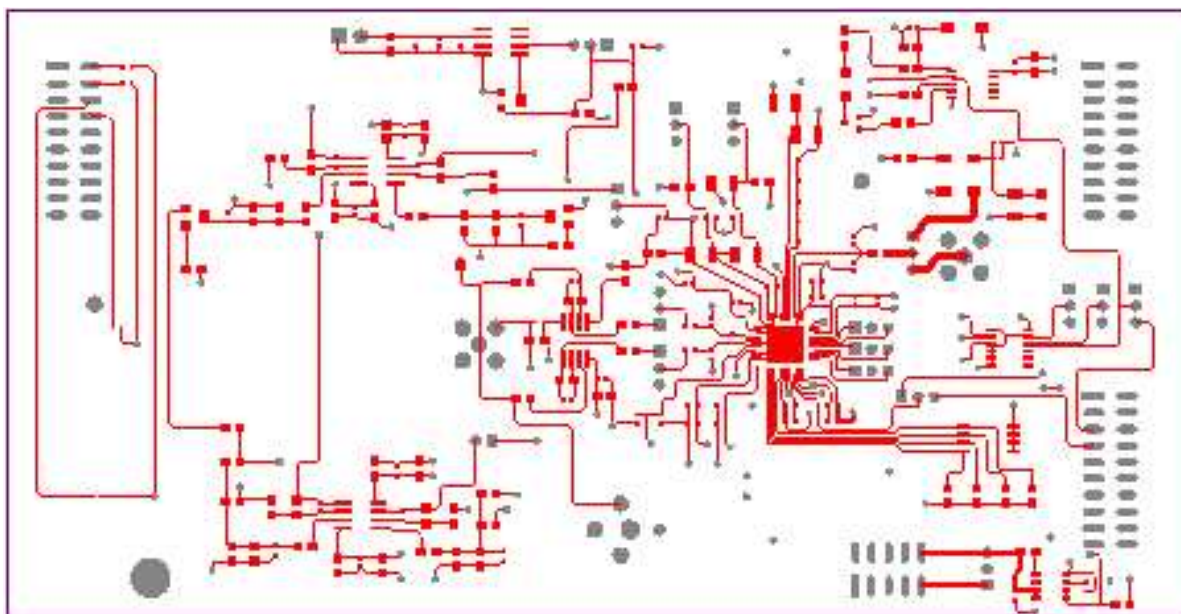


Figure C-1. Top Tracking Layer

C.2 Internal Power Layer

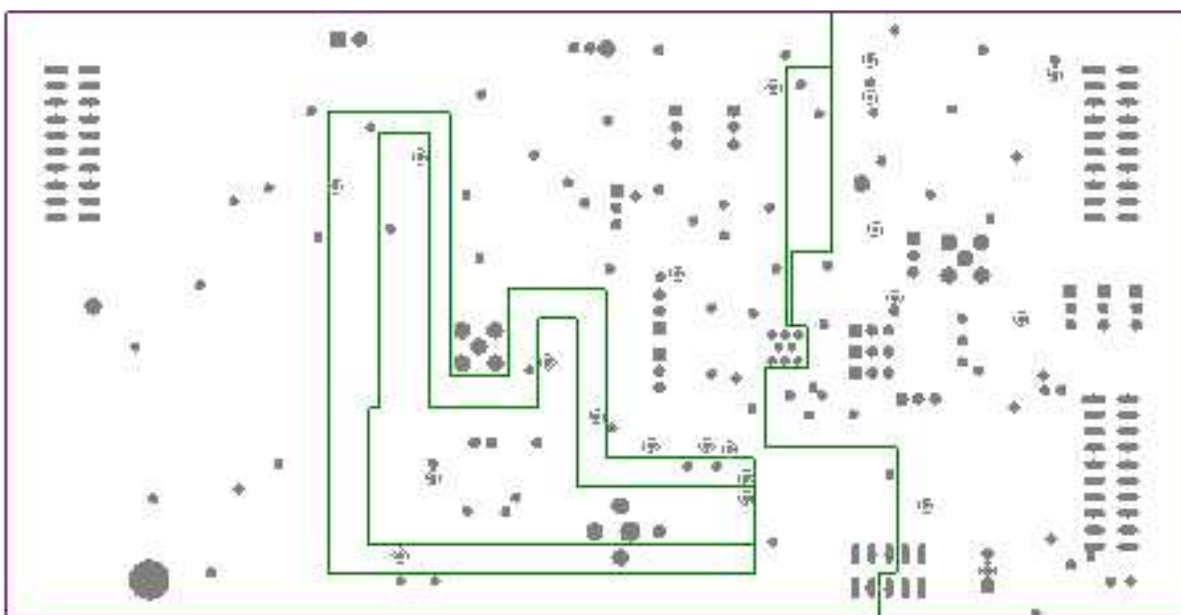


Figure C-2. Internal Power Layer

C.3 Internal Ground Layer

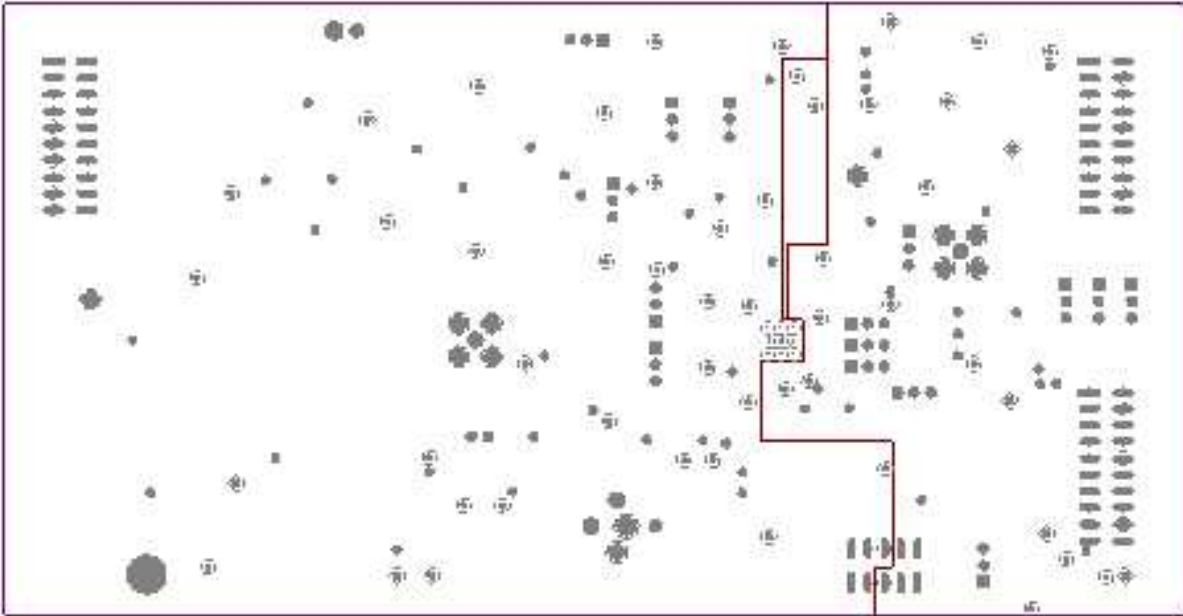


Figure C-3. Internal Ground Layer

C.4 Bottom Tracking Layer

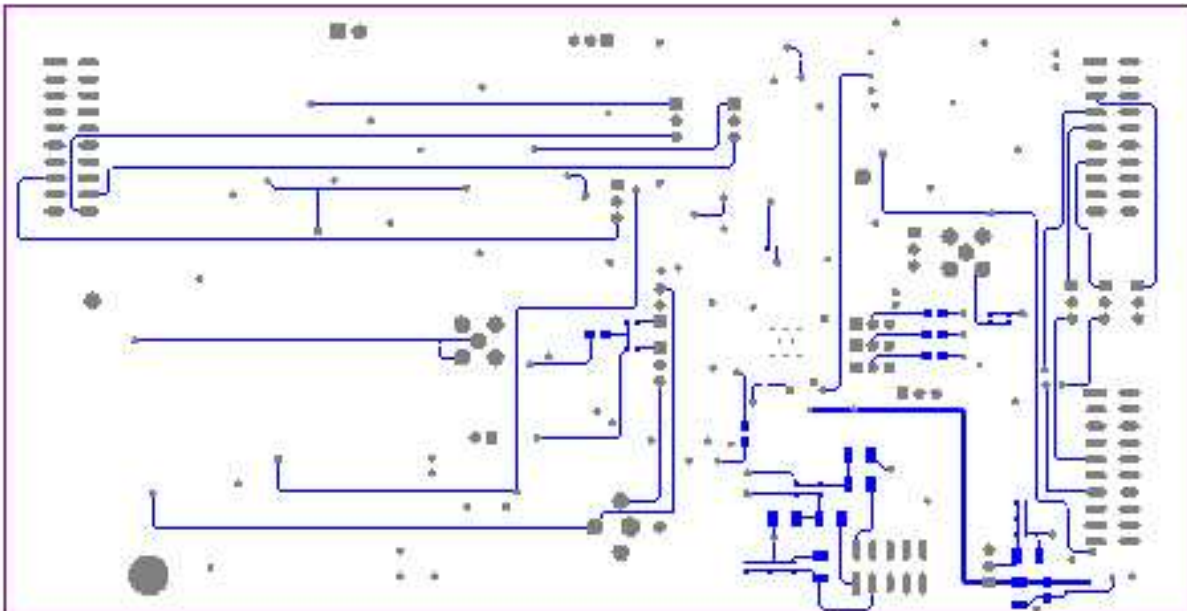


Figure C-4. Bottom Tracking Layer

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Texas Instruments:](#)

[ADS1602EVM](#) [ADS1601EVM](#)