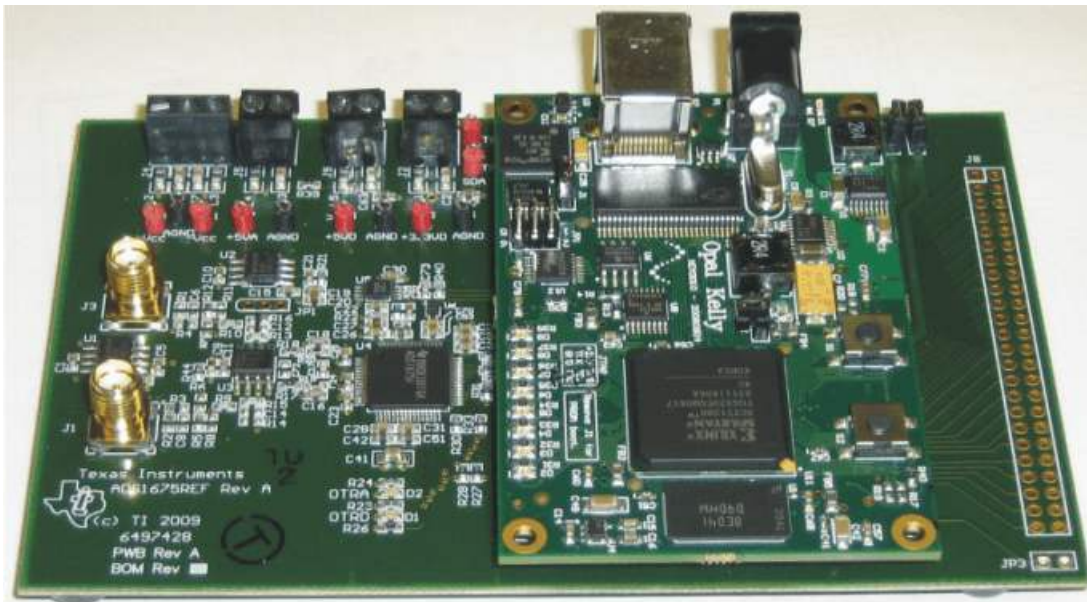


ADS1675REF



ADS1675REF

This user's guide describes the characteristics, operation, and use of the ADS1675REF reference design board. This reference design board (REF) is an evaluation platform for the [ADS1675](#), a 4MSPS, high-speed, high-precision, 24-bit analog-to-digital converter (ADC). The ADS1675REF allows evaluation of all aspects of the ADS1675 device. A complete circuit description as well as schematic diagram and bill of materials are included.

The following related documents are available through the Texas Instruments web site at <http://www.ti.com> except where indicated.

Related Documents

Device	Literature Number
ADS1675	SBAS416C
THS4503	SLOS352D
OPA211	SBOS377
REF5025	SBOS410
XEM3010	http://www.opalkelly.com/products/xem3010

ADCPro is a trademark of Texas Instruments.
Microsoft, Windows, WindowsXP, Vista are registered trademarks of Microsoft Corporation.
All other trademarks are the property of their respective owners.

Contents

1	Preface	2
2	Overview	3
3	Power-Supply Requirements	4
4	Analog Interface	5
5	Digital Interface	6
6	Reference Voltage	6
7	ADS1675REF Plug-in Operation	8
8	Schematic and Bill of Materials	15

List of Figures

1	ADS1675REF Schematic: Typical Analog Input Section	6
2	ADS1675REF Reference Circuit	7
3	ADCPro Software Start-up Display Window	9
4	ADS1675REF Plug-in Display Window	10
5	ADS1675REF Plug-in Status Information Display Window	10
6	XEM3010 Driver Installation (Screen 1)	11
7	XEM3010 Driver Installation (Screen 2)	11
8	XEM3010 Driver Installation (Screen 3)	12
9	XEM3010 Driver Installation (Screen 4)	12
10	LVDS or CMOS Mode Selection	13
11	Low-Latency or Wide-Bandwidth Digital Filter	13
12	Six Default Data Rates for LVDS	14
13	Four Default Data Rates for CMOS	14
14	MultiFFT Test Plug-In (Example)	14
15	CMOS Mode with Wide-Bandwidth Filter at 1MSPS Sample Rate	15
16	ADS1675REF Silkscreen Drawing	17

List of Tables

1	Recommended Power-Supply Inputs	4
2	Factory Jumper Defaults	8
3	ADS1675REF Bill of Materials	16

1 Preface

1.1 How to Use This Manual

This document contains the following sections:

- REF Overview ([Section 2](#))
- Introduction ([Section 2.2](#))
- Power-Supply Requirements ([Section 3](#))
- Analog Interface ([Section 4](#))
- Digital Interface ([Section 5](#))
- Reference Voltage ([Section 6](#))
- ADS1675REF Plug-In Operation ([Section 7](#))
- ADS1675REF Schematic and Board Layout ([Section 8](#))

2 Overview

2.1 Features

ADS1675REF Features:

- Full-featured evaluation board for the ADS1675 24-bit, Delta-Sigma ($\Delta\Sigma$) analog-to-digital converter
- Analog inputs can be applied to the ADC through an analog input driver circuit
- Onboard voltage references
- Clock options: onboard adjustable frequency default setup is 32MHz
- Supports both serial CMOS and low-voltage differential signaling (LVDS) interface modes by two different versions of software plug-in

ADCPro™ Plug-In Features:

- Easy-to-use evaluation software for Microsoft® Windows® XP
- Data collection to text files
- Built-in analysis tools including scope, FFT, and histogram displays
- Complete control of board settings
- Easily expandable with new analysis plug-in tools from Texas Instruments

This kit combines the ADS1675REF board with the FPGA and SDRAM-based XEM3010 board, and includes ADCPro™ software for evaluation.

You can connect the ADS1675REF to the XEM3010 board and then to a computer via an available USB port. This manual shows how to use the XEM3010 as part of the ADS1675REF kit, but does not provide technical details about the XEM3010 itself. Refer to the Opal Kelly website (at www.opalkelly.com) for specific details about the XEM3010-1500.

ADCPro is a program for collecting, recording, and analyzing data from ADC evaluation boards. ADCPro has a number of plug-in programs, so it can be expanded easily with new test and data collection plug-ins. You control the ADS1675REF with a plug-in that runs in ADCPro. For more information about ADCPro, see the [ADCPro™ Analog-to-Digital Converter Evaluation Software User's Guide](#) (literature number [SBAU128](#)), available for download from the TI web site.

This manual covers the operation of both the ADS1675REF and the ADS1675REF Plug-in for ADCPro. Throughout this document, the abbreviation *REF* and the term *reference board* are synonymous with the ADS1675REF.

2.2 Introduction

The ADS1675REF is a 24-bit, $\Delta\Sigma$ analog-to-digital converter that operates from independent AVDD (+5V) and DVDD (+3V) supplies. The analog input pre-amplifier [THS4503](#) can be powered from +9V and -4V supplies. The XEM3010 FPGA processor board can be supplied either with a +5V external wall adapter power supply or with +5V (JP4) from the ADS1675REF board itself.

The maximum sample rate of the ADS1675 is 4MSPS. The maximum output clock speed is 96MHz.

The output interface can be configured as either CMOS or LVDS interface; the ADS1675REF works easily with both interfaces.

There are two digital decimation filters built into the ADS1675 device. The first one is low-latency filter that can reduce digital processing time, but only provide narrow signal bandwidth; this filter is best used for fast digital processing applications. The second option is a wide-bandwidth digital filter that can provide a much wider and flat signal bandwidth, but with slower processing time.

The ADS1675REF hardware platform consists of a two-board solution: one ADS1675REF printed circuit board (PCB) plus one FPGA processor board (XEM3010). The ADS1675REF hardware uses a very common FPGA Spartan-3, Micron 16-MByte (16-bit word-wide) synchronous DRAM (SDRAM) chip, Cypress CY22393 PLL, and USB 2.0 microcontroller.

The SDRAM controller code is preloaded within the FPGA. The ADCPro software works with the USB 2.0 driver in the ADS1675REF environment, so that 8M, 24-bit sampled ADC data can be captured and saved in the SDRAM per single acquisition in order to allow the FPGA processor to do post-data processing or transfer the test data continually through the FPGA, SDRAM, and USB interface into a PC processor for further data processing.

The Cypress CY22393 PLL can provide up to five clocks. The ADS1675REF platform uses one 48MHz clock for the USB microcontroller, one 64MHz clock for the SDRAM chip, one 64MHz clock for the FPGA processor, and one 32MHz clock for the ADS1675 device.

The ADS1675REF supports fast response mode for both the wide-bandwidth and low-latency filter paths, as well as an internal shift clock (SCLK) mode for LVDS and CMOS digital output interfaces.

3 Power-Supply Requirements

WARNING

The Opal Kelly XEM3010 board can only accept a maximum 5V power supply. When the 5V external wall adaptor is applied, remove JP4. (See [Table 1](#) for additional details.)

The factory configuration of the board is for the analog input driver THS4503 with +9V and –4V supplies and a shared +5V supply for analog and digital REF board circuitry sections as well as the XEM3010 board. For the best total harmonic distortion (THD) performance, the user can provide independent digital +5V to +5VD, +3.0V to 3.3VD, and wall adaptor +5V to P1 on the XEM3010 board. All power to the board is recommend to be sourced from a well-regulated linear supply that has current-limiting capabilities; for example, a 40mA limit for +9V and –4V, and 400mA limit for +VA.

Power must be supplied through jumpers J2, J4, J5, and J9 (top side of the REF board) and port P1 on the XEM3010 board. [Table 1](#) shows the recommended power-supply input configuration.

Table 1. Recommended Power-Supply Inputs

Signal Name	Connector Number		Description
+5VA	J5-1	J5-2	Analog +5V supply
+V _{CC}	J4-1	J4-2	Analog input driver +9V supply
–V _{CC}	J4-3	J4-2	Analog input driver –4V supply
+5VD (optional for the best performance; remove R39 when using +5VD)	J9-1	J9-2	Digital +5V supply
+3.3VD (optional for the best performance; remove JP2 when applying +3.0V)	J2-1	J2-2	Digital +3.0V supply
+5V (optional for the best performance; remove JP4 when applying a +5V wall adaptor to the XEM3010)	P1-1	P1-2	XEM3010 board +5V wall adaptor supply

For standalone operation, the power sources can be applied via various test points located on the REF board. Refer to the schematic (located at the end of this document) for additional details.

3.1 Analog Input Driver +9V and –4V Supplies

The ADS1675REF analog input driver is a THS4503 (U3), a wideband, fully-differential amplifier, to drive the differential inputs of the ADS1675 (U4). This device was selected because of its wide bandwidth (370MHz) and low harmonic distortion. It is pre-configured at the factory for +9V and –4V analog operation. The THS4503 can tolerate maximum power supplies of $\pm 7.5V_{DC}$. Care must be taken to ensure the user-supplied $15V_{DC}$ limit is not exceeded, or potential damage to the op amps under the test circuits can occur. The +9V and –4V voltages are to be applied to J4 pins +V_{CC} and –V_{CC} referenced to GND.

3.2 Analog +5V Supply

The ADS1675REF board requires an independent analog +5V supply to power the analog portion of the device under test, the external reference, and the external reference buffer, as well as provide the amplifier common-mode voltage. This voltage is applied to J5 pin 3 and is denoted as +5VA. This supply can be monitored at TP7.

3.3 Digital +5V Supply

For the best THD performance, the ADS1675 requires an independent digital +5V supply to power the clock portion of the device under test. This voltage is applied to J9 pin 3 and is denoted as +5VD. This supply can be monitored at TP3. For a quick function test, the digital +5VD can be shared with the analog +5VA on this REF board. R₃₉ is a short circuit that supplies both the analog and digital 5V to the ADS1675 device.

3.4 Digital +3.0V Supply

For the best THD performance, the ADS1675 also requires an independent digital +3.0V supply to power the digital portion of the device under test. This voltage is applied to J2 pin 3 and is denoted as +3.3VD. This supply can be monitored at TP5. For a quick function test, the digital +3.0V can be fed back from the 3.3V regulator on the XEM3010 board and connected by jumper JP2 on the REF.

For optimal performance, it is recommended to remove the shunt jumpers from JP2 and JP4. This configuration requires the user to supply an independent 3.0V digital supply to the ADS1675 at J2. The user must also provide separate power to the XEM3010 at P1; refer to the Opal Kelly website for specific details about configuring the XEM3010 board.

3.5 XEM3010 Board +5V Supply

To obtain the best THD performance, the ADS1675 requires an independent +5V supply to power the XEM3010 board. This voltage is applied to P1 on the XEM3010 from an external wall adapter power supply. For a quick function test, the +5V can be shared with the digital +5VD on the ADS1675REF by jumper JP4.

4 Analog Interface

The analog circuit of the board is divided into four parts. The first part is the analog input buffer or front-end circuit of the ADC. Its function is to provide optional gain and impedance matching of the input signal. The second part of the analog circuit is the analog power supplies for both the high voltage rails on the ADC and the input buffer. The final sections of the analog input include the basic analog functions of the ADS1675 and the optional external reference circuit. Each of these sections is described below.

The analog inputs to the ADS1675REF board can be applied to J1 and J3 of the input differential connectors. The range of the analog input depends on the range setting of the ADS1675 and THS4503.

The analog input to the ADS1675REF board consists of the THS4503 operational amplifier. The THS4503 is powered from a user-provided, 9V and -4V analog supply. The amplifier is used as true differential driver. When the analog supply is 5V, the ADS1675 analog difference input common-mode voltage is 2.5V. This configuration requires the output of the THS4503 amplifier common-mode voltage to be set as 2.5V. The common-mode voltage to the THS4503 is set by the onboard REF5025 (U1), which sets this voltage at 2.5V.

To maximize the dynamic range of the THS4503 and reduce the THD impact from this amplifier, +9V and -4V are used for this THS4503. This configuration gives a maximum $\pm 6.5\text{V}$ swing range. Figure 1 illustrates the typical analog input section of the ADS1675REF.

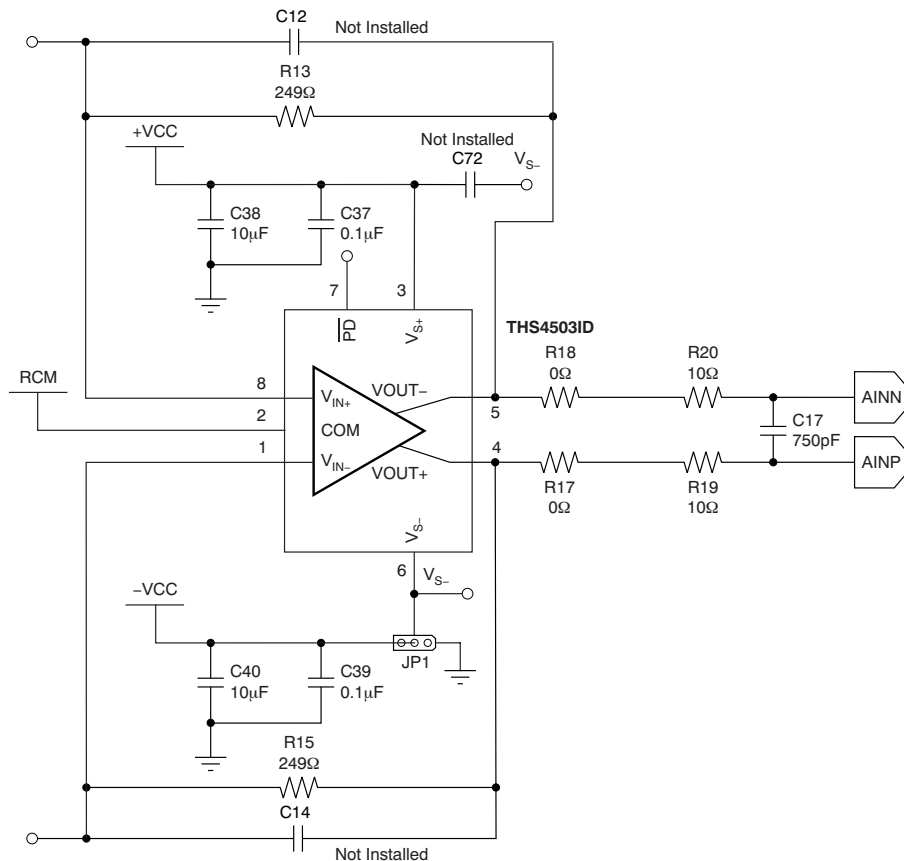


Figure 1. ADS1675REF Schematic: Typical Analog Input Section

5 Digital Interface

The ADS1675REF is designed for easy interfacing with the USB2.0 interface for use with the XEM3010 board. The ADS1675REF kit also provides ADCPro software so that the user can configure the ADS1675 and read out the captured data through the USB interface on the XEM3010 board.

6 Reference Voltage

The ADS1675REF provides a 3.0V reference source via a REF5030 (U2) and OPA211A (U5) to provide a high-quality reference voltage for ADS1675. The REF5030 (U2) generates the 3.0V reference signal. The output of the REF5030 is heavily filtered to remove noise. The onboard OPA211 (U5) again filters and buffers the reference signal so that the reference signal noise to the ADS1675 is less than the noise generated by the converter itself. The OPA211 is a low-noise, unity-gain stable amplifier that provides a reliable current source for the ADS1675 reference input. The OPA211 and output decoupling capacitors work together to settle the VREFP (ADS1675) reference input voltage to within $\pm 1/2$ LSB, every 50ns. This board uses a 10 μF ceramic capacitor with a 0.1 μF ceramic capacitor directly across the reference inputs, VREFP and VREFN. Note that the 10 μF and 0.1 μF capacitors are placed as close to the ADS1675 reference pins as possible. These capacitors further reduce noise that is common to both inputs. The ADS1675 VREFN pin goes to ground.

Figure 2 shows the ADS1675REF reference circuit.

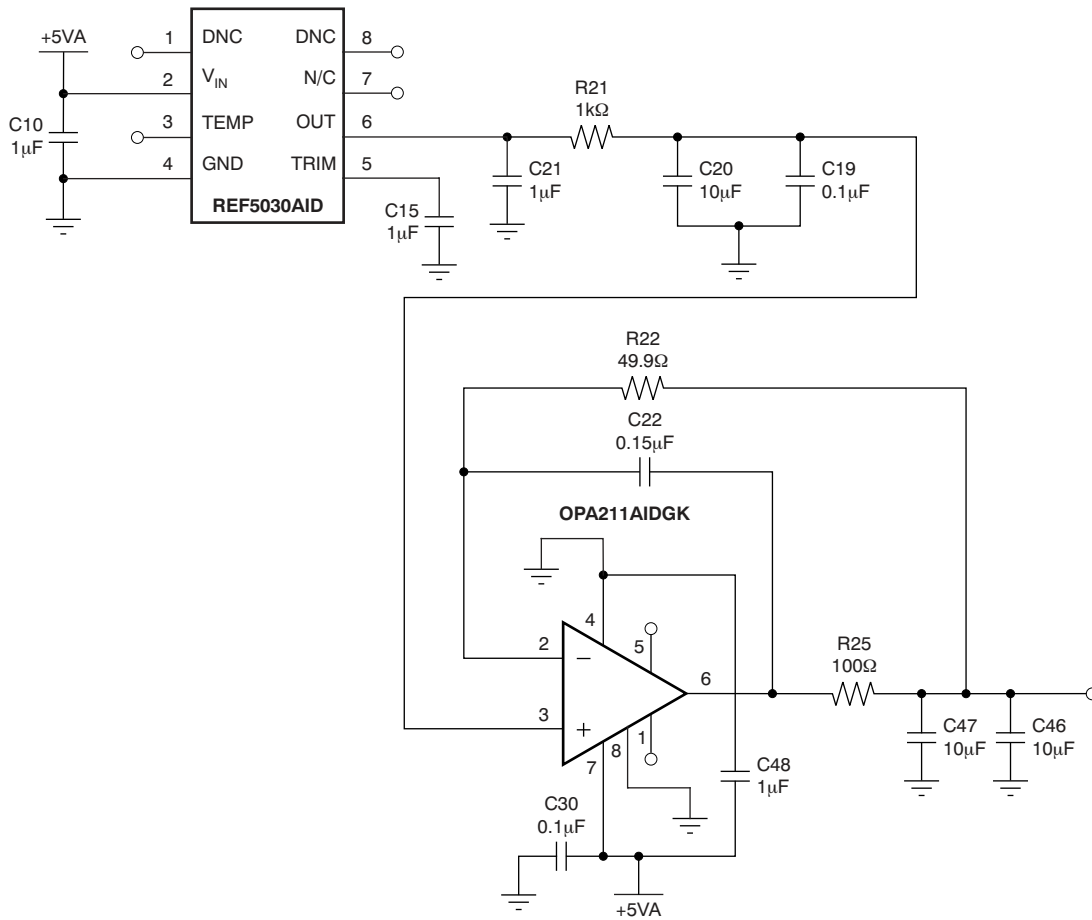


Figure 2. ADS1675REF Reference Circuit

7 ADS1675REF Plug-in Operation

This section provides information on using the ADS1675REF Plug-in, including setup, program installation, and program usage. The board is factory-configured for the analog input driver THS4503 with +9V and -4V supplies and the shared analog, digital, and XEM3010 board with a +5VA supply on the ADS1675. [Table 2](#) lists the default jumper setup.

Table 2. Factory Jumper Defaults

Shunt Jumpers	Position	Description
ADS1675REF Jumpers		
U3 Negative Supply (JP1)	1-2; use 2mm shunt jumper	-V is supplied by J4
OK3.3V (JP2)	Closed; use 2mm shunt jumper	3.3V _{DC} is supplied to ADS1675REF from the Opal Kelly Board
OK5V (JP4)	Closed; use 2mm shunt jumper	5.0V _{DC} is supplied to the Opal Kelly board from the user's external 5V supply
CAPT (JP3)	Open	Strobe for data capture card used in debug
XEM3010 Jumpers		
J1	Closed	
J2	Open	
JP1	Open	

To prepare to evaluate the ADS1675 with the ADS1675REF Plug-in, complete the following steps:

- Step 1. Verify all jumper settings against the settings described in [Table 2](#).
- Step 2. Download the latest version of the ADCPro software from www.ti.com/adcpro.
- Step 3. Install the ADCPro application. Once the application is installed, run the *ADS1675REF-plug-in* file located on the CD-ROM (included with the ADS1675REF package) under the *Plug-in Installer* directory. Please note that while installing the ADS1675 plug-in, a separate installer for the Opal Kelly board will also be launched. Accept all default settings and choose the *Continue anyway* option if you see a warning regarding driver authenticity.
- Step 4. Complete the Microsoft Windows USB driver installation process.
- Step 5. Ensure the XEM3010 board is firmly seated onto the mating connectors found on the ADS1675REF board.
- Step 6. Apply power to the ADS1675REF board as described in [Section 7.2](#); note that best performance is achieved by using clean linear supplies. Set the current limits and voltages first, then connect power leads to the board before enabling the supply outputs.
- Step 7. Apply +9V and -4V to the screw terminals marked J4. +V_{CC}, GND, and -V_{CC} are labeled below the entry point to the screw terminal.
- Step 8. Apply +5 VDC to the screw terminal marked J5. +5VA and GND are marked at the terminal entry points. R₃₉ is a short circuit that supplies both the digital 5V to the ADS1675 and 5V to the XEM3010 board. The XEM3010 generates a 3.3V supply that is fed back to the ADS1675.

7.1 Installing the ADCPro Software

The latest version of the ADCPro software is available from Texas Instruments' website at <http://www.ti.com/adcpro>. The CD-ROM shipped with the ADS1675REF may not contain the latest software, but the ADCPro installer will check for updates when executed (if connected to the Internet), and then give you the option of downloading and installing the latest version. Refer to the [ADCPro™ Analog-to-Digital Converter Evaluation Software User's Guide](#) for instructions on installing and using ADCPro.

To install the ADS1675REF plug-in, run the file: **ads1675ref-plug-in-1.0.0.exe** (1.0.0 is the version number, and increments with software version releases; you may have a different version on your CD). Double-click the file to run it; then follow the instructions shown. After installation, you can use the ADCPro *Update Check* feature to check for newer versions of the ADS1675REF plug-in.

The software should now be installed, but the USB drivers may not have been loaded by the PC operating system. The USB driver upload step completes when the ADCPro software is executed (see [Section 7.2, Running the Software and Completing the Driver Installation](#)).

7.2 Running the Software and Completing the Driver Installation

NOTE: The software is continually under development. These instructions and screen images are current at the time of this writing, but may not exactly correspond to future releases.

ADCPro uses a series of software plug-ins to communicate with the ADS1675REF. The ADS1675REF plug-in is included in the ADS1675REF package.

The program currently runs only on Microsoft Windows platforms of WindowsXP®; Windows Vista® is **not** supported.

Follow these procedures to run ADCPro and complete the necessary driver installation.

- Step 1. Start the software by selecting ADCPro from the Windows Start menu. The screen in [Figure 3](#) appears.

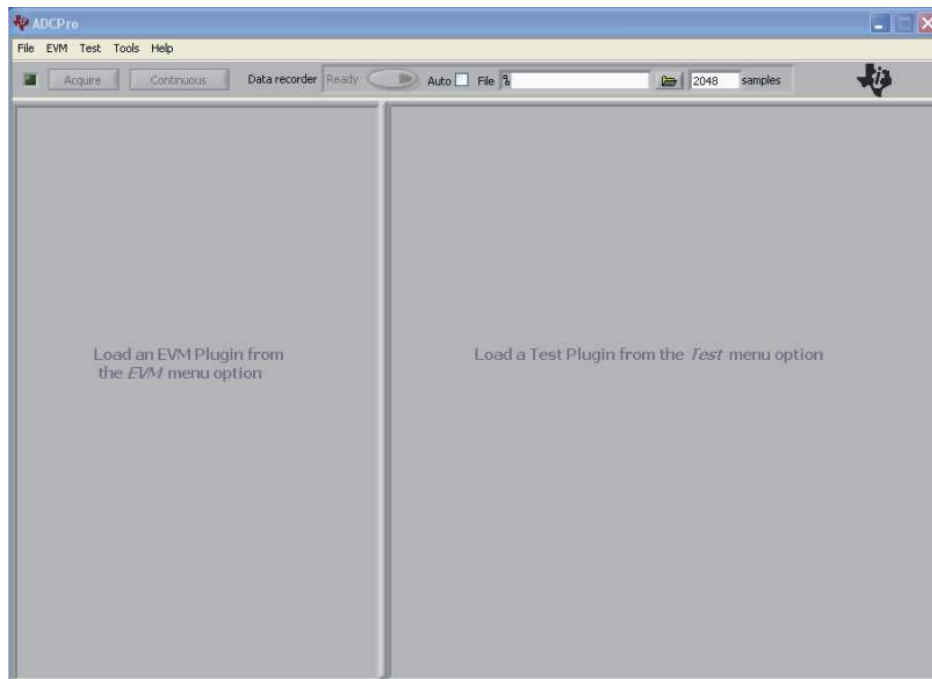


Figure 3. ADCPro Software Start-up Display Window

Step 2. Select *ADS1675REF* from the REF drop-down menu. The ADS1675REF plug-in appears in the left pane, as shown in [Figure 4](#).

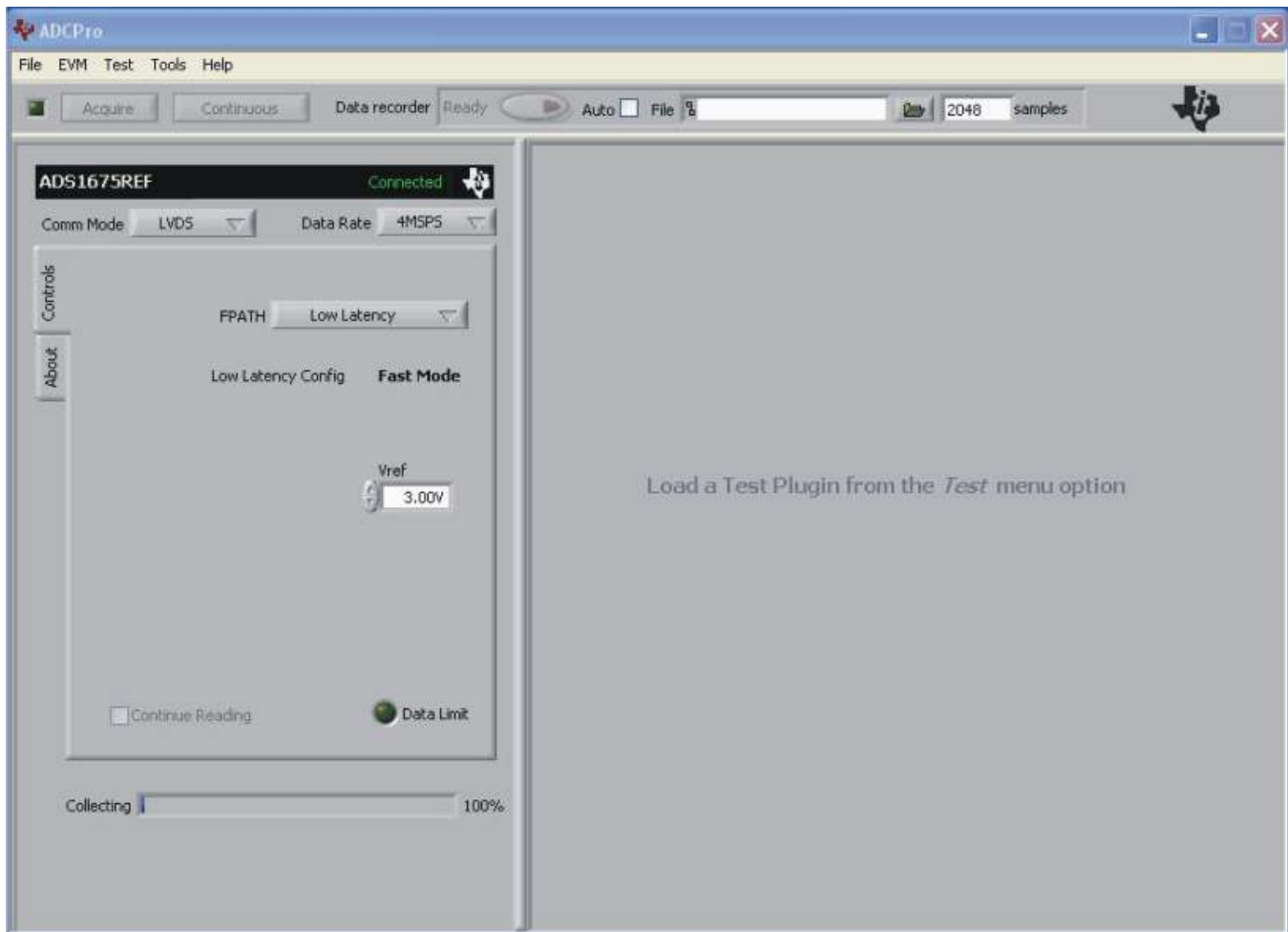


Figure 4. ADS1675REF Plug-in Display Window

Step 3. The ADS1675REF plug-in window has a status area at the top of the screen. When the plug-in is first loaded, the plug-in searches for the board. You will see a series of messages in the status area that indicate this action, such as *Connected* (as [Figure 5](#) illustrates).

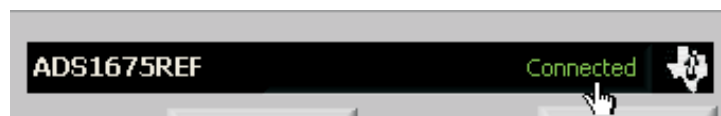


Figure 5. ADS1675REF Plug-in Status Information Display Window

Step 4. Apply power to the REF board and connect the board to an available PC USB port.

Step 5. If you have not yet loaded the XEM3010 system drivers, Windows will display the Windows *Found New Hardware Wizard* sequence (illustrated in [Figure 6](#) through [Figure 9](#)). When prompted, accept the *Continue Anyway* option as [Figure 8](#) shows.



Figure 6. XEM3010 Driver Installation (Screen 1)

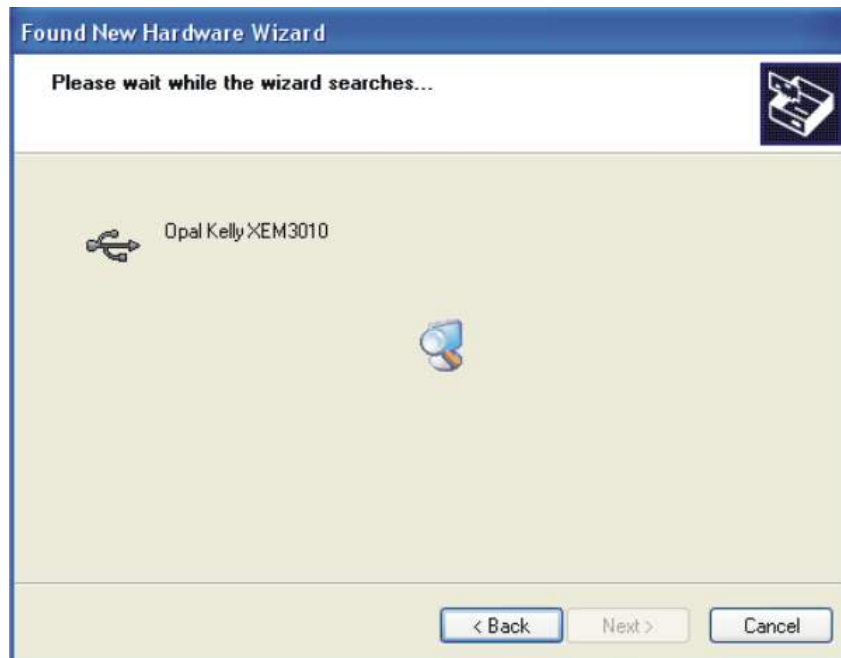


Figure 7. XEM3010 Driver Installation (Screen 2)

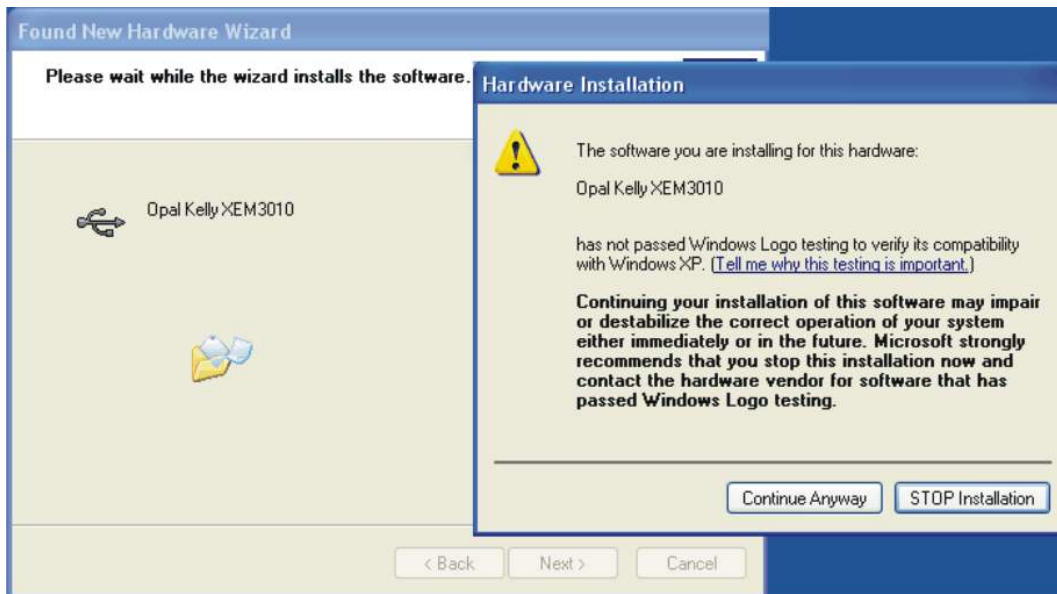


Figure 8. XEM3010 Driver Installation (Screen 3)



Figure 9. XEM3010 Driver Installation (Screen 4)

- Step 6. When Windows installs the software driver, the plug-in downloads the firmware to the XEM3010.
- Step 7. Windows will display the installation wizard a second time. Again, accept the default settings.
- Step 8. The status area displays a connected message. The software is now ready to use.

The *Found New Driver* wizard sequence should not appear again, unless you connect the board to a different USB port.

7.3 Evaluating with the ADCPro Software

The evaluation software is based on ADCPro, a program that operates using a variety of plug-ins. To use ADCPro, you must load both a REF plug-in and a test plug-in. To load a REF plug-in, select it from the *REF* menu. To load a test plug-in, select it from the *Test* menu. To unload a plug-in, select the *Unload* option from the corresponding menu.

Only one of each type of plug-in (REF and Test) can be loaded at a time. If you select a different plug-in, the previous plug-in is unloaded.

7.4 Using the ADC1675REF Plug-in

The ADS1675REF plug-in for ADCPro provides complete control over all settings of the ADS1675. It consists of a tabbed interface (see [Figure 4](#)), with all of the functions available on the main tab. The controls on the main tab are described in this section.

You can adjust the ADS1675REF settings when you are not acquiring data. During acquisition, all controls are disabled and settings may not be changed.

When you change a setting on the ADS1675REF plug-in, the setting is immediately updated on the board.

Settings on the ADS1675REF correspond to settings described in the ADS1675 data sheet; see the [ADS1675 data sheet](#) (available for download at the [TI web site](#)) for details.

Because the effective data rate of the ADS1675 depends on settings of the Comm Mode (either LVDS or CMOS, as [Figure 10](#) shows) and the FPATH selection (either Low-Latency or Wide-Bandwidth, as illustrated in [Figure 11](#)), and the Data Rate, the Data Rate indicator (displayed in the upper right corner of the plug-in interface; see [Figure 12](#) and [Figure 13](#)) is always visible and updated whenever a setting is changed that affects the data rate.

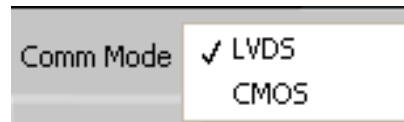


Figure 10. LVDS or CMOS Mode Selection



Figure 11. Low-Latency or Wide-Bandwidth Digital Filter

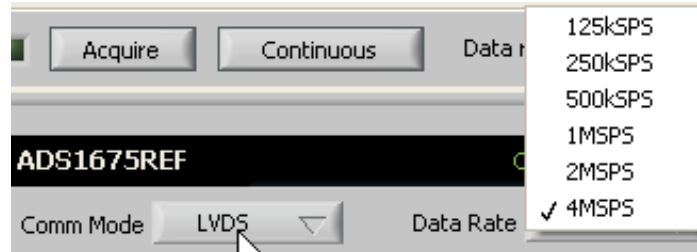


Figure 12. Six Default Data Rates for LVDS

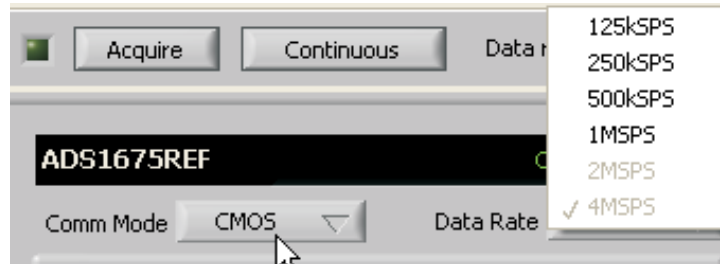


Figure 13. Four Default Data Rates for CMOS

Choose a test to run from the *Test* menu. In the example shown in Figure 14, the MultiFFT test was chosen.

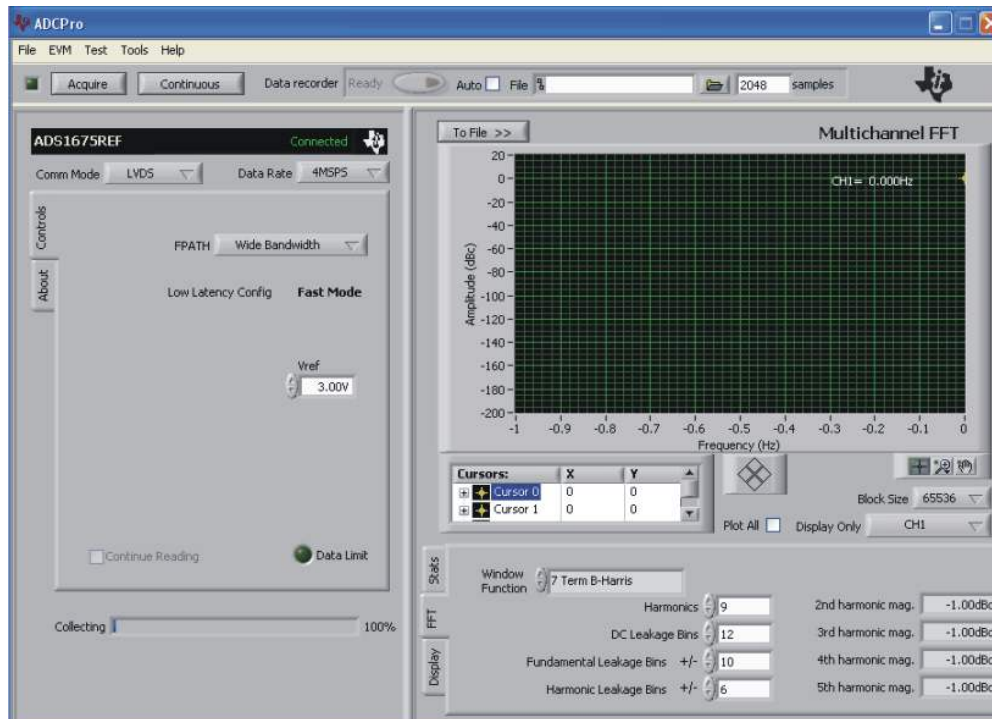


Figure 14. MultiFFT Test Plug-In (Example)

Press the **Acquire** button. Depending on the size of the sample set captured and the speed for which the ADS1675 is configured, the time required to display the data in the screen varies. [Figure 15](#) shows the results of a 1MSPS sample rate in CMOS mode with the wide-bandwidth filter selected.

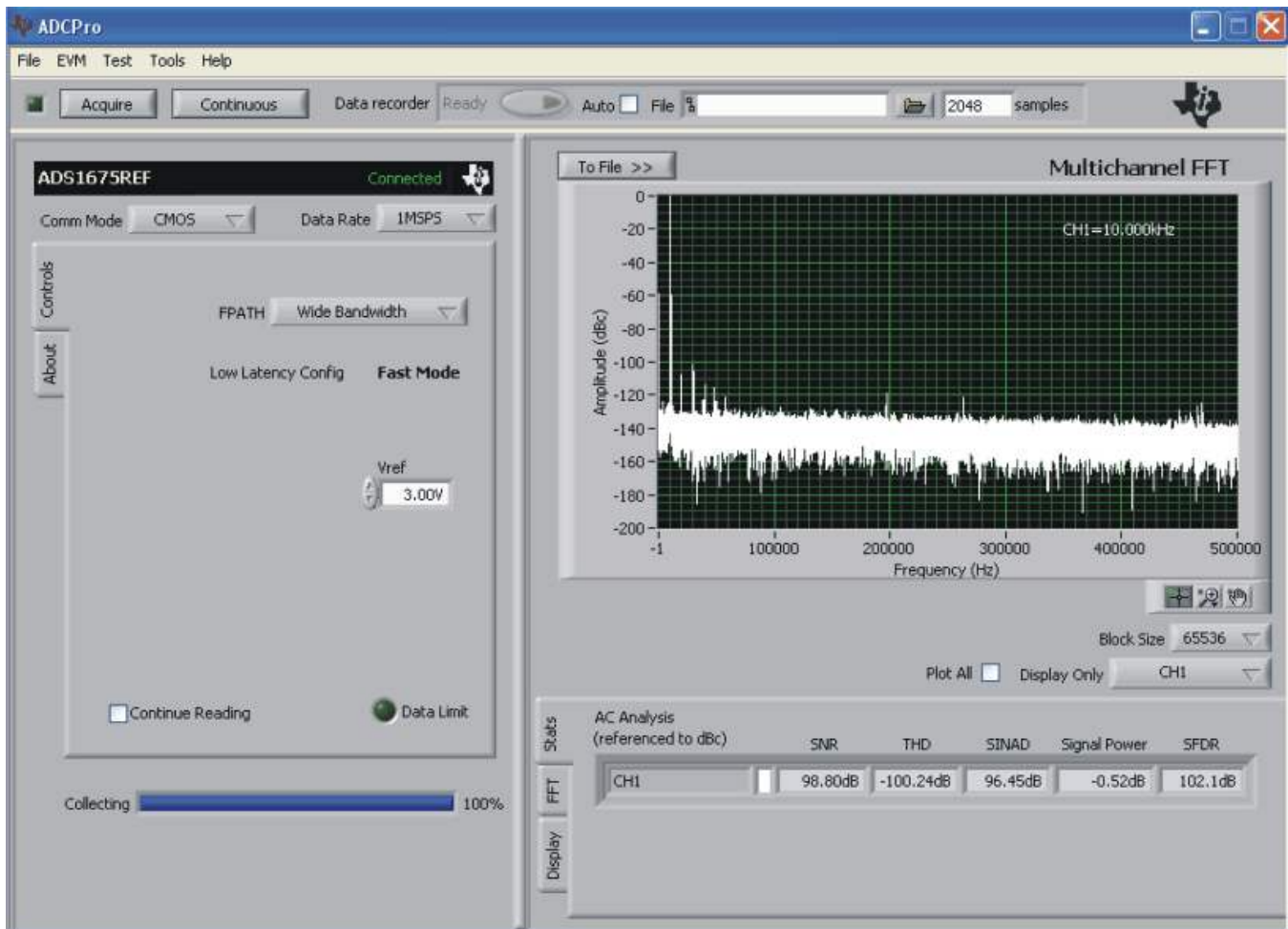


Figure 15. CMOS Mode with Wide-Bandwidth Filter at 1MSPS Sample Rate

NOTE: 100% of ADS1675REF boards have been tested to ensure that 10kHz analog input signal at 4MSPS data sheet limits are achievable with the ADS1672REF and ADCPro.

7.5 Troubleshooting

If ADCPro stops responding while the ADS1675REF is connected, try unplugging the power supply from the REF, making sure to unload and reload the plug-in before reapplying power to the board.

8 Schematic and Bill of Materials

Schematics for the ADS1675REF are appended to this user's guide. The bill of materials is listed in [Table 3](#). [Figure 16](#) shows a top-level silkscreen of the PCB.

NOTE: Board layouts are not to scale. These figures are intended to show how the board is laid out; they are not intended to be used for manufacturing ADS1675REF PCBs.

8.1 Bill of Materials

NOTE: All components should be compliant with the European Union Restriction on Use of Hazardous Substances (RoHS) Directive. Some part numbers may be either leaded or RoHS. Verify that purchased components are RoHS-compliant. (For more information about TI's position on RoHS compliance, see the [Quality and Eco-Info information on the TI web site.](#))

Table 3. ADS1675REF Bill of Materials

Item	Quantity	Value	Reference Designators	Description	MFR	Part Number
1	1		N/A	Printed wiring board	TI	6497428
2	10	1 μ F	C1, C3, C5, C10, C15, C21, C32, C48, C49, C50	0603, Ceramic, 16V, X7R, 10%	TDK	C1608X7R1C105K
3	8	10 μ F	C2, C4, C7, C13, C60, C61, C62, C63	0805, Ceramic, 10V, X5R, 10%	Taiyo Yuden	LMK212BJ106KG-T
4	0		C6, C8, C12, C14, C72	Not installed		
5	7	10 μ F	C9, C20, C27, C38, C40, C46, C47	0603, Ceramic, 6.3V, X5R, 20%	TDK	C1608X5R0J106M
6	19	0.1 μ F	C11, C19, C23, C24, C25, C26, C28, C30, C31, C34, C35, C36, C37, C39, C52, C53, C58, C59, C70	0603, Ceramic, 25V, X7R, 10%	TDK	C1608X7R1E104K
7	2	100pF	C16, C18	0603, Ceramic, 50V, C0G, 5%	TDK	C1608C0G1H101J
8	1	750pF	C17	0603, Ceramic, 50V, NPO, 5%	Kemet	C0603C751J5GACTU
9	1	0.15 μ F	C22	0603, Ceramic, 16V, X7R, 10%	TDK	C1608X7R1C154K
10	11	4.7 μ F	C29, C33, C42, C43, C44, C45, C51, C54, C55, C56, C71	0603, Ceramic, 10V, X5R, 10%	Taiyo Yuden	LMK107BJ475KA-T
11	1	22 μ F	C41	0805, Ceramic, 6.3V, X5R, 10%	Taiyo Yuden	JMK212BJ226KG-T
12	5	1000pF	C57, C66, C67, C68, C69	0603, Ceramic, 50V, C0G, 5%	TDK	C1608C0G1H102J
13	2	47 μ F	C64, C65	1206, Ceramic, 10V, X5R, 20%	Taiyo Yuden	LMK316BJ476ML-T
14	1	4.7pF	C73	0603, Ceramic, 50V, C0G, 5%	TDK	C1608C0G1H4R7C
15	2		D1, D2	LED 565nm Grn Diff 0603 SMD	Lumex	SML-LX0603GW-TR
16	2		J1, J3	Conn SMA Jack Straight PCB	Amphenol	132134
					Emerson	142-0701-201
17	3		J2, J5, J9	Terminal Block 3.5mm 2-pos PCB	On Shore	ED555/2DS
18	1		J4	Terminal Block 3.5mm 3-pos PCB	On Shore	ED555/3DS
19	2		J6, J7	0.80mm pitch	Samtec	BTE-040-01-F-D-A
20	0		J8	Not installed	—	—
21	0		JP1	Not installed	—	—
22	2		JP2, JP4	2 Pin 2mm Header	Samtec	TMM-102-01-T-S
23	1		JP3	2 Pin 0.1inch, Header	Samtec	TSW-102-07-T-S
24	5		L1, L2, L3, L4, L5	Ferrite Chip 600 Ω 500mA 0805	TDK	MMZ2012R601A
25	0		R1, R2, R3, R4, R6, R7, R8, R11, R14, R16, R35, R36	Not installed	—	—
26	5	0.0 Ω	R5, R12, R17, R18, R39	1/10W 5% 0603	Yageo	RC0603JR-070RL
27	4	249 Ω	R9, R10, R13, R15	1/10W 0.1% 0603	BCC	2312-201-72491
28	2	10 Ω	R19, R20	10 Ω , 1/10W 5%, 0603	Yageo	RC0603JR-0710RL
29	1	1k Ω	R21	1/10W, 1%, 0603	Yageo	RC0603FR-071KL
30	2	49.9 Ω	R22 R40	1/10W, 1%, 0603	Yageo	RC0603FR-0749R9L
31	2	220 Ω	R23, R24	1/10W, 1%, 0603	Yageo	RC0603FR-07220RL
32	4	100 Ω	R25, R29, R31, R32	1/10W, 1%, 0603	Yageo	RC0603FR-07100RL
33	6	10k Ω	R26, R27, R28, R41, R42, R43	1/10W, 1%, 0603	Yageo	RC0603FR-0710KL
34	2	33 Ω	R30, R33	1/10W, 1%, 0603	Yageo	RC0603FR-0733RL
35	1	6.04k Ω	R34	1/10W, 1%, 0603	Yageo	RC0603FR-076K04L
36	2	4.70k Ω	R37, R38	1/10W, 1%, 0603	Yageo	RC0603FR-074K7L
37	1	80.6 Ω	R44	1/16W 0603 Chip Resistor	Yageo	RC0603FR-0780R6L

Table 3. ADS1675REF Bill of Materials (continued)

Item	Quantity	Value	Reference Designators	Description	MFR	Part Number
38	7		TP1, TP2, TP3, TP5, TP7, TP9, TP11	Test Point PC Mini .040"D Red	Keystone	5000
39	4		TP4, TP6, TP8, TP10	Test Point PC Mini .040"D Black	Keystone	5001
40	1		U1	IC Prec V-REF 2.5V LN 8-SOIC	TI	REF5025ID
41	1		U2	IC Prec V-REF 3.0V LN 8-SOIC	TI	REF5030AID
42	1		U3	IC Op Amp Diff 300MHz SGL 8SOIC	TI	THS4503ID
43	1		U4	IC ADC 24-Bit 4MSPS 64-TQFP	TI	ADS1675IPAG
44	1		U5	IC Op Amp GP R-R 80MHz SGL 8MSOP	TI	OPA211AIDGK
45	1		U6	IC Sngl 2-in pos-OR Gate SOT-5	TI	SN74AHC1G32DRLR
46	0		U7	Not Installed	—	—

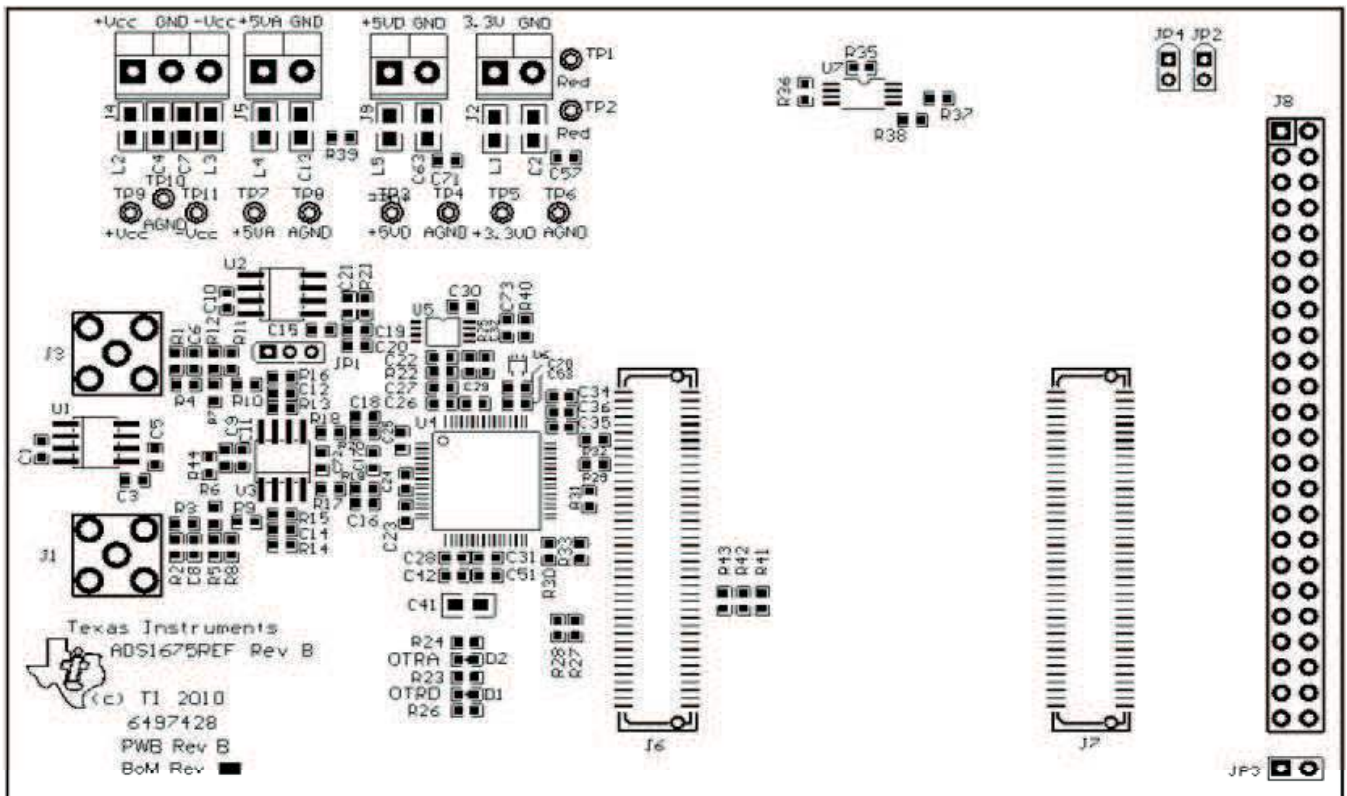


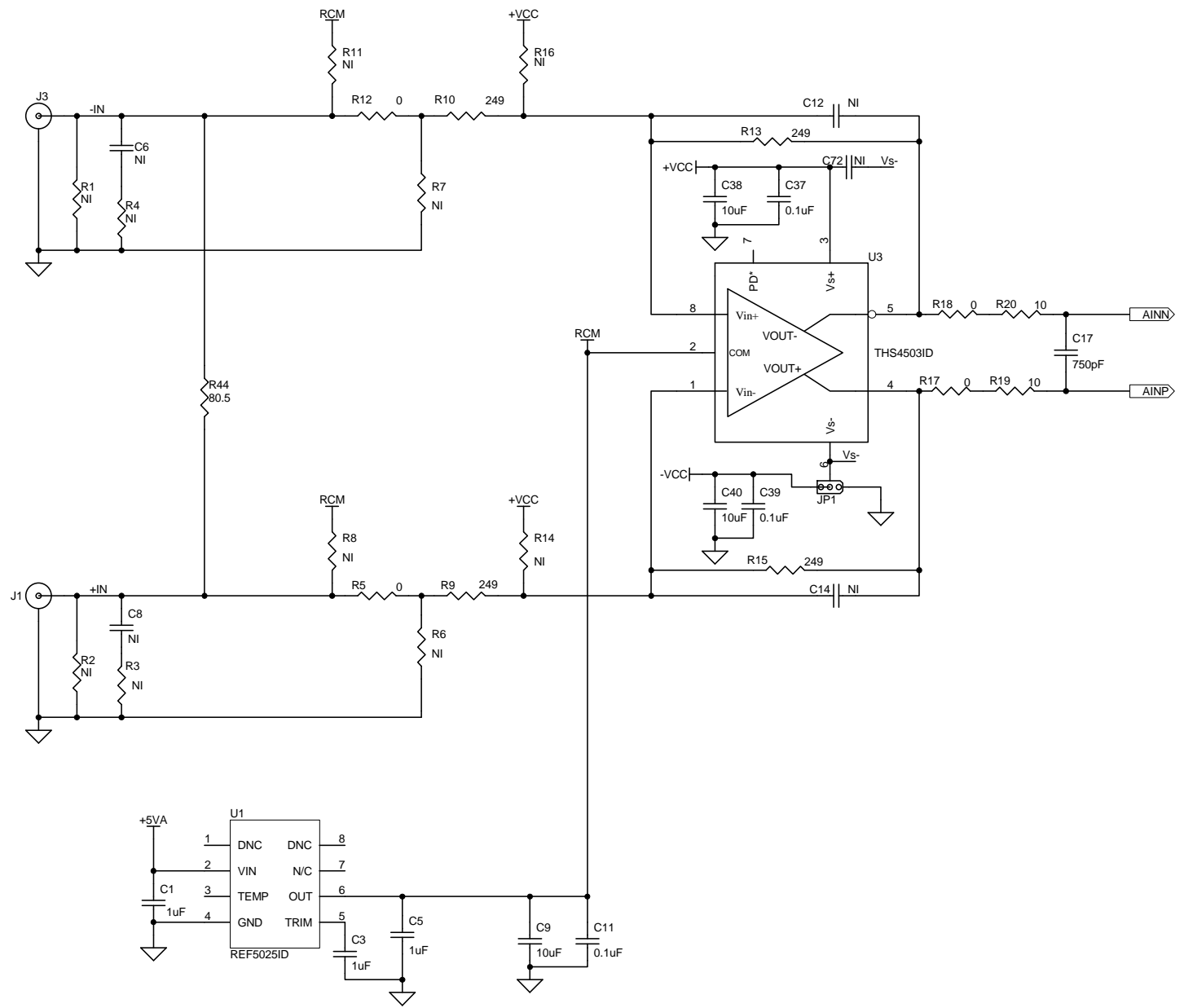
Figure 16. ADS1675REF Silkscreen Drawing

Revision History

Changes from Original (December, 2009) to A Revision	Page
• Updated Bill of Materials	16
• Changed Figure 16 to show Revision B of the board	17
• Changed schematics to reflect Revision B of the board	17

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

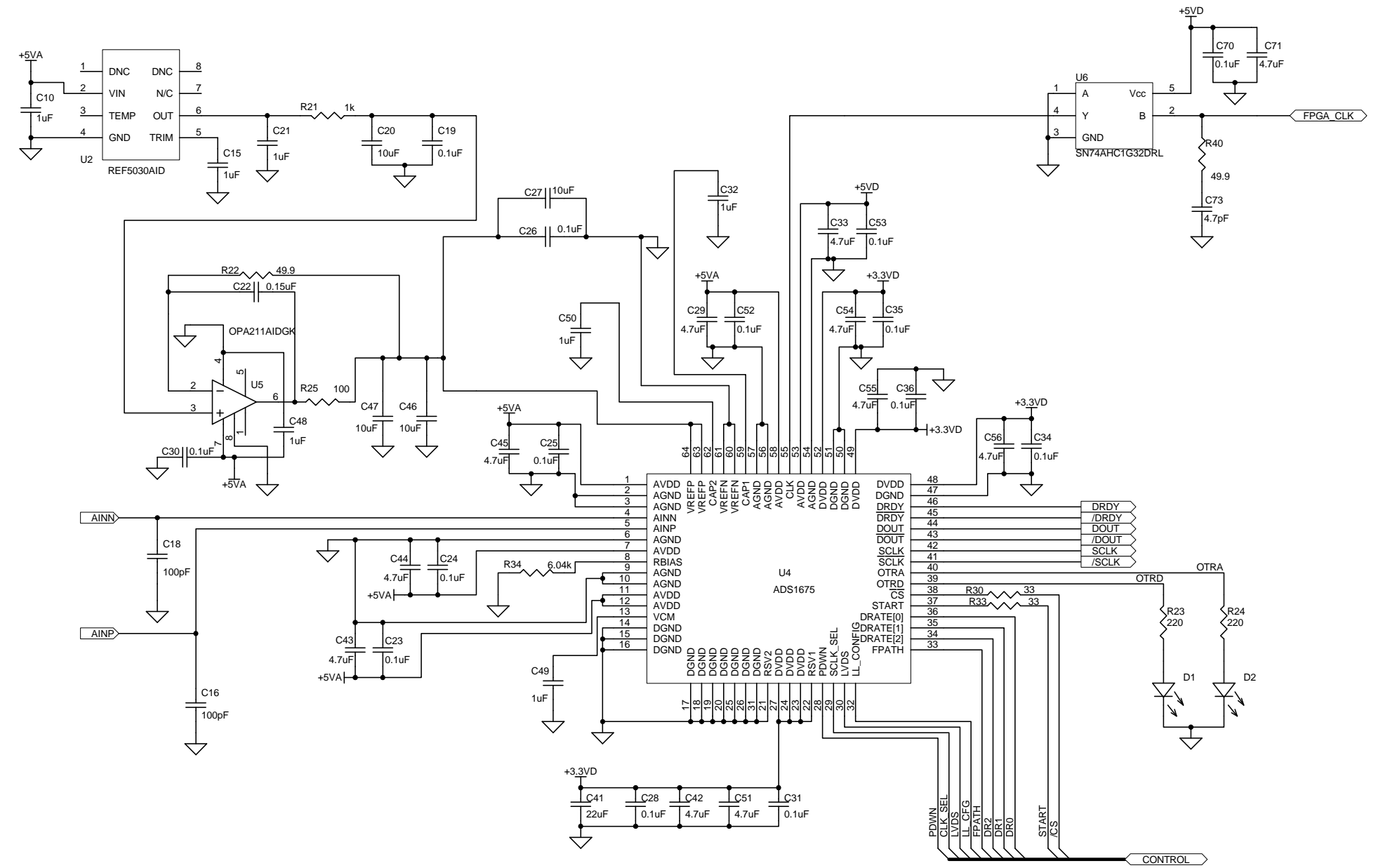
Revision History		
REV	ECN Number	Approved



Title: **ADS1675REF**

Engineer:	DOCUMENT CONTROL #	REV: B
Drawn By:	6497434	
FILE: Sheet 1_b	DATE: 9-Sep-2010	SIZE: SHEET: 2 OF: 4

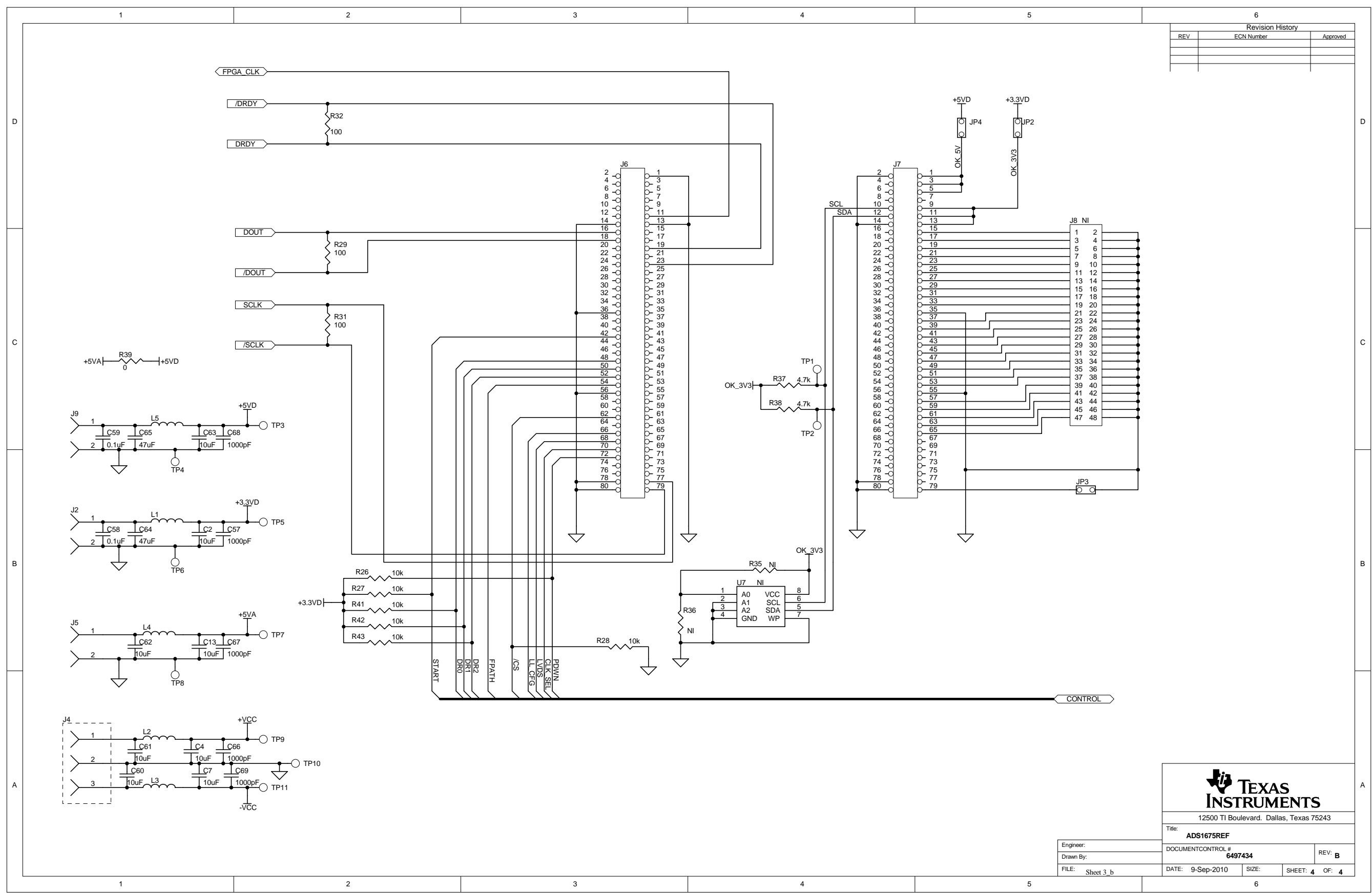
Revision History		
REV	ECN Number	Approved



Title: **ADS1675REF**

Engineer:	DOCUMENT CONTROL #	REV: B
Drawn By:	6497434	
FILE: Sheet 2_b	DATE: 9-Sep-2010	SIZE: SHEET: 3 OF: 4

Revision History		
REV	ECN Number	Approved



Title: **ADS1675REF**

Engineer:	DOCUMENT CONTROL #	REV: B
Drawn By:	6497434	
FILE: Sheet 3_b	DATE: 9-Sep-2010	SIZE: SHEET: 4 OF: 4

Evaluation Board/Kit Important Notice

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive.**

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 3.3V to 5V and the output voltage range of 0V to 5V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than +30° C. The EVM is designed to operate properly with certain components above +85° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated

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 TI 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. Information of third parties may be subject to additional restrictions.

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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

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
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated