

FEATURES

- **ALLOWS EASY EVALUATION OF THE ADS1100**
- **CONVENIENT RS-232 PORT INTERFACE**
- **POWERED FROM THE RS-232 PORT**
- **ONLY 1" X 0.75" IN SIZE**

DESCRIPTION

The ADS1100EVM is an evaluation fixture for the ADS1100 analog-to-digital converter. The board measures only 1" x 0.75" in size and takes its power from the RS-232 port, which also provides I²C communication.

The I²C SDA and SCL lines, and the direction of the SDA line, are manipulated through level-conversion circuitry using RS-232 control lines, and by sending BREAK conditions or chosen data bytes on the RS-232 TX line. This scheme obviates the need for a microcontroller on the ADS1100EVM.

The included host software runs on the Linux[®] and Windows[®] operating systems. Complete source code for the program is provided.

Linux is a registered trademark of Linus Torvalds.

Windows is a registered trademark of Microsoft Corp.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

INSTALLATION

To install the ADS1100EVM, simply unpack it and plug it into a 9-pin RS-232 port. You can connect it to an RS-232 cable, as long as the cable carries the proper conductors; some RS-232 cables carry only the receive and transmit lines, which are not sufficient to operate the ADS1100EVM.

Signals enter the ADS1100EVM through the connector opposite the RS-232 connector. Each pair of pins is connected together. The pin pairs are marked on the board; the IN+ and IN- pins connect directly to the pins of the same name on the ADS1100, and the GND pins are connected to the board's ground, which is the same as the host PC's ground.

A jumper, J3, is provided to allow you to measure the ADS1100's current consumption. To use it, remove the jumper and connect an ammeter between the jumper's pins. The board's single test point is connected to ground.

WINDOWS SOFTWARE INSTALLATION

To install the Windows version of the software, copy the folder called "ads1100evm-w32" from the provided CD-ROM disc onto your hard drive. You can put the folder anywhere you like. To run the program, open the folder and double-click the executable file, which is called "ads1100evm.exe".

LINUX SOFTWARE INSTALLATION

To use the Linux version of the software, you must have a version of XWindows™ running on your system. It also is recommended that you use at least kernel 2.2 (the software uses a feature of the serial-port drivers which may not be available on some very old kernels). This section describes the installation of the "tarball" package, which has an extension .tgz; distribution-specific packages may be provided on the CD-ROM. See the README.TXT file on the CD-ROM for information.

To install the software, change to a suitable directory and unpack the tarball. This can be done with the following command (entered in a terminal window):

```
tar xzf /mnt/cdrom/ads1100evm-linux-elf-x86.tgz
```

This will create a directory called "ads1100evm". Change to this directory and type

```
./ads1100evm
```

to execute the software.

EXECUTING THE SOURCE CODE

The ADS1100EVM software is written as a Python script; the script can be run directly on both Windows and Linux platforms, as long as the prerequisite wxWindows and Python packages are installed.

It is relatively easy to port the ADS1100EVM software to other operating systems, if necessary, because the software is written in Python using wxWindows. See the README.TXT file on the CD-ROM for information.

XWindows is a trademark of Massachusetts Institute of Technology.

SOFTWARE OPERATION

The ADS1100EVM evaluation software functions as a simple digital voltmeter. Each feature of the ADS1100 can be exercised using the program.

When the program is run, it scans the system to see what serial ports are available. If it finds at least one, it searches each serial port for an ADS1100EVM, and uses the first one it finds. If the program does not find any ADS1100EVMs, it displays a warning message. At any time, you can perform the scan again by clicking the "Rescan" button.

After the board search is complete, the program's window, shown in Figure 1, will appear. The window has the following elements:

- Near the top of the screen is a line used to display various status messages. When you change a setting on the ADS1100, the program displays the new configuration register code here.
- Below the status line are three text boxes which display the most recent reading obtained from the ADS1100. The reading is displayed in hexadecimal, decimal, and as a voltage. The voltage is calculated using the value in the power-supply field at the bottom of the window.
- The buttons in the PGA box are used to change the PGA setting. Note that changing the PGA setting often will cause little change in the voltage reading because the voltage reading reflects the voltage present at the input pins.
- The buttons in the Conversion Rate box are used to change the data rate setting.
- The controls in the Conversion Mode box are used to change the operating mode. See "Conversion Modes" below.
- If multiple ADS1100EVMs are connected, you can select between them using the RS-232 port menu. If only one is ADS1100EVM is detected, the menu is disabled.

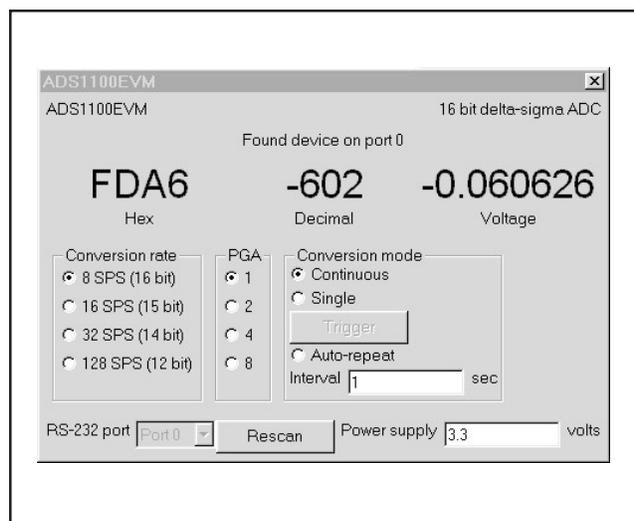


FIGURE 1. ADS1100EVM Main Window.

CONVERSION MODES

The ADS1100EVM software supports both the single and continuous conversion modes of the ADS1100, and additionally offers an “auto-repeat” mode which allows you to perform single conversions at specified intervals.

Continuous conversion mode is the default, and is entered when the Continuous button is checked. In this mode, the ADS1100 converts continuously, and the ADS1100EVM software reads from the ADS1100 continuously.

In single conversion mode, which is entered by checking the Single button, the ADS1100 converts only when instructed by the host. To perform a conversion in this mode, click the Trigger button.

In auto-repeat mode, the ADS1100 software repeatedly requests single conversions from the ADS1100 and displays the results. Conversions are requested at the interval you type in the Interval field. Note that this is a feature of the software, and not of the ADS1100 itself.

POWER-SUPPLY SELECTION

To display readings in volts, the ADS1100EVM software must be told what reference voltage the ADS1100 is using. For the ADS1100, the reference voltage is the same as the power supply. The power-supply value is taken from the “Power supply” field at the bottom of the window.

The ADS1100EVM is shipped with a 3.3V regulator installed. The regulator used is also available in versions having several other supply voltage levels. If you install a different regulator, you can enter its voltage level in the power supply field, and the voltage reading will be calculated using this value.

CIRCUIT DESCRIPTION

The ADS1100EVM is designed to be as simple as possible. It derives power from the RS-232 port to which it is connected, and interfaces the ADS1100's I²C connection to the RS-232 port using a FET pair and an op-amp. The function of each of the RS-232 signals are shown in Table I.

PIN NO.	SIGNAL NAME	DIRECTION FROM ADS1100EVM	FUNCTION
1	DCD	Output	Not Used
2	RD	Output	Not Used
3	TD	Input	SCL Control
4	DTR	Input	Power Supply
5	SG	Ground	Ground
6	DSR	Output	SDA Output
7	RTS	Input	SDA Control
8	CTS	Output	Not Used
9	RI	Output	Not Used

TABLE I. RS-232 Signal Functions.

Only three inputs from the computer are available, but this is enough to control the ADS1100. One pin, DTR, is used to supply power for the board. When at positive voltage, most systems will generate 10V to 12V, which is enough to drive low-dropout regulator U3 through reverse-voltage protection diode D1B. A regulator with extremely low quiescent current was chosen for this.

To control SCL and SDA, the DSR and transmit-data lines are used. Dual MOSFET Q1 is used to translate the high-voltage RS-232 levels into the ADS1100's logic levels. The pullups R1 and R2 are made relatively large so as to consume minimal current in the logic LOW state; since we communicate with the device slowly, the slow rise times caused by these values are of no concern.

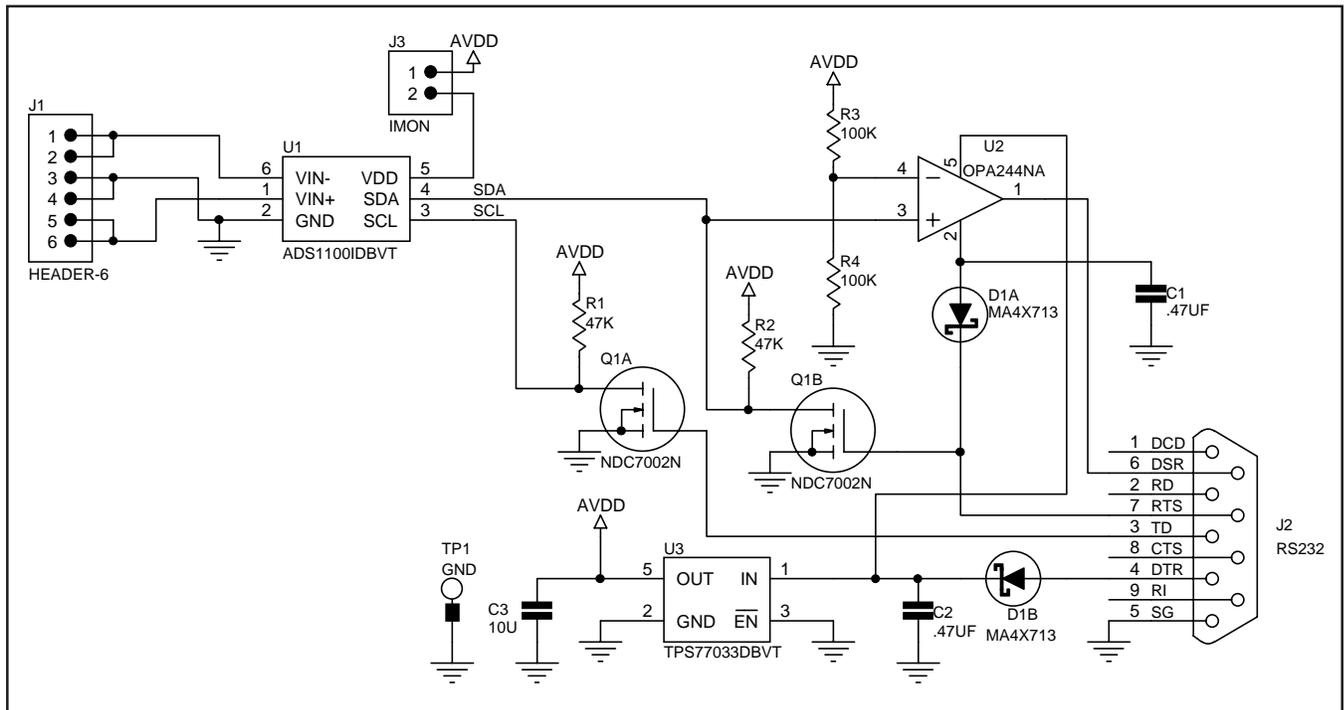


FIGURE 2. ADS1100EVM Schematic.

TD controls serial clock, since this is the output of the host's UART. The operation of this is described below. SDA is controlled by RTS. This same line serves as a kind of "read-enable" for SDA, which is read by the host through the DSR pin; when RTS is at -12V, Q1B is not pulling the SDA line LOW, so the host can then see, by reading DSR, whether the ADS1100 is doing so.

Op-amp U2 generates the voltage for the DSR pin, which is used by the host to read the state of SDA. Rather than generate RS-232 voltages onboard, we use the voltages generated by the host to feed them back to the host. U2 is connected without feedback, so that it functions as a comparator with reference voltage set midway between the supplies by R3 and R4. Since I²C is a synchronous protocol, and SDA is only latched by SCL, no hysteresis is needed.

When SDA is HIGH, the op-amp goes to the positive supply rail, which is the voltage on DTR minus a Schottky diode drop. When SDA is LOW, the op-amp goes to the negative supply rail, which is the voltage on RTS minus a Schottky diode drop. Both levels are read accurately by the host as space or mark, respectively. This scheme of "stealing" the RS-232 levels from the port itself obviates the need for a voltage generator.

Note that RTS, which is used to control SDA, also supplies the op-amp's negative rail; clearly, this changes during operation, while the host is writing to the ADS1100. When the host pulls SDA LOW, it places +12V on RTS, so the op-amp is essentially turned off, and Q1B pulls SDA to ground. However, the host would not be able to read SDA at that time even if the op-amp were on, since it would always read zero. The host must set RTS to -12V to read SDA; doing this turns Q1B off, and also supplies the op-amp with the proper voltage on its negative rail. At this time, DSR will correctly reflect the value on SDA.

To control SCL, we use the TD pin, which is the asynchronous serial output from the host. Any 16450-based UART, installed on any PC with a built-in RS-232 port, can send an indefinitely long BREAK condition on TD; to do this, a bit is set in the 16450's configuration registers. Using a BREAK of indefinite length, TD can be used as a general-purpose output, just as DTR and RTS can.

Unfortunately, some operating environments or hardware do not have the necessary facilities to send an indefinitely long BREAK. In this situation, TD can be used as a bit-pattern generator. For example, a mark-space-mark pulse can be transmitted by writing 0x3C to the serial port. The duration of the pulse can be controlled with good accuracy by setting the serial port's baud-rate. TD was chosen to control SCL because of this possibility of using it as a bit-pattern generator.

EVM IMPORTANT NOTICE

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

This evaluation kit being sold by TI is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not considered by TI to be fit for commercial use. As such, the goods being provided may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product incorporating the goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this evaluation kit not meet the specifications indicated in the EVM User's Guide, the 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. Please be aware that the products received may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). 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 EVM User's Guide and, specifically, the EVM Warnings and Restrictions notice in the EVM User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact the TI application engineer.

Persons handling the product must have electronics training and observe good laboratory practice standards.

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.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Copyright © 2002, Texas Instruments Incorporated

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 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.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Copyright © 2002, 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 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.

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
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
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
Low Power Wireless	www.ti.com/lpw	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2007, Texas Instruments Incorporated