THE DATASHEET OF

ADS1100EVM

ADS1100EVM

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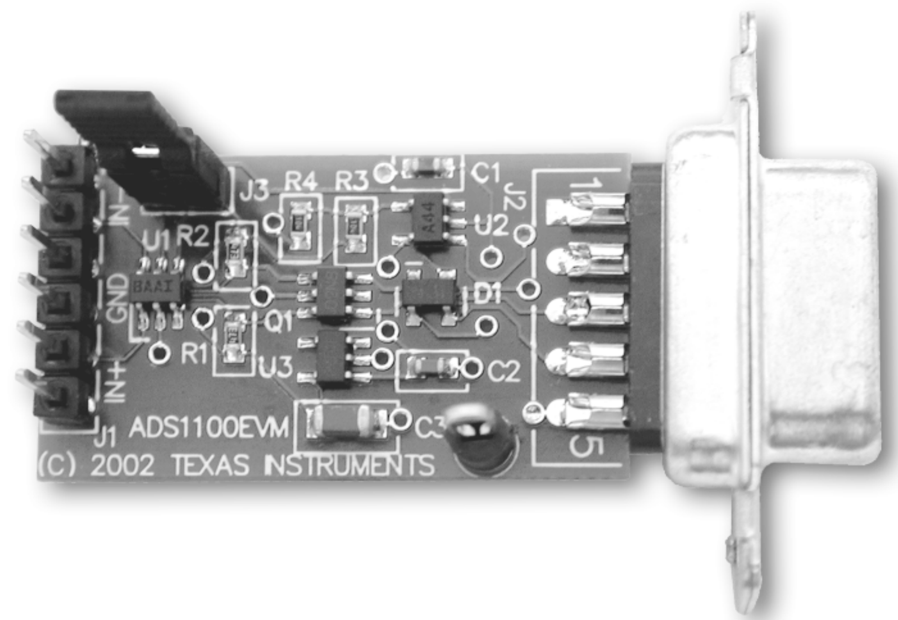

FEATURES

- 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 I^{2}C communication.

The I^{2}C 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.

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.

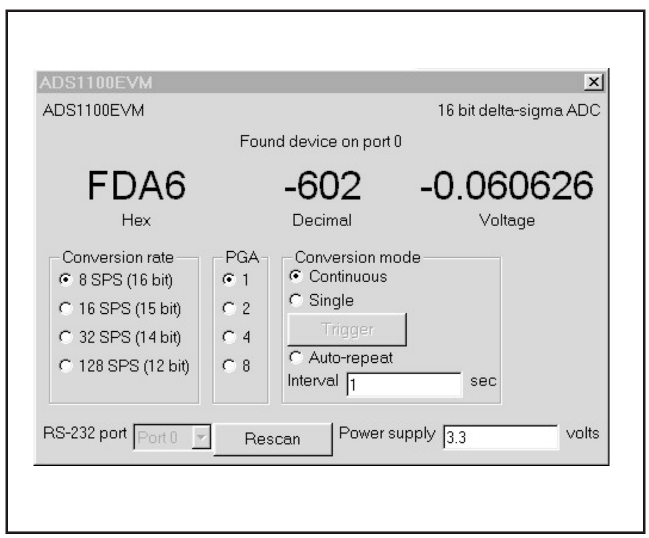

FIGURE 1. ADS1100EVM Main Window.

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 I^{2}C 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.

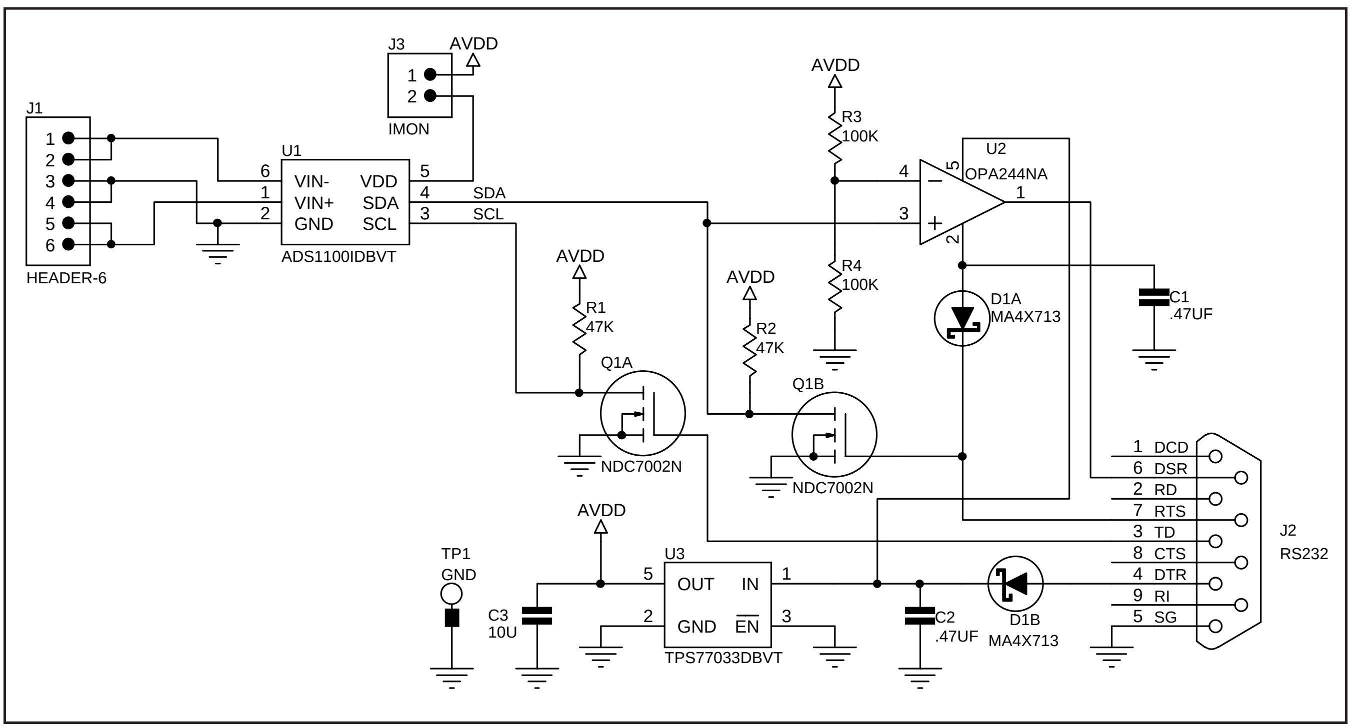

FIGURE 2. ADS1100EVM Schematic.

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 I^2C 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.

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