Texas Instruments

ADS1254 Analog-to-Digital Converter Evaluation Module

User's Guide

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Data Acquisition Products

SLAU083

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the power supply voltage range of 5.5 V to 15 V (5 V for regulated power inputs) and the analog input range of 0 V to 5 V.

Exceeding the specified supply range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the supply 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 40°C. The EVM is designed to operate properly with certain components above 40°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.

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Read This First

About This Manual

This users guide describes the function and operation of the ADS1254EVM analog-to-digital converter evaluation module. This manual helps you quickly set up the evaluation module and its accompanying software, so that you can rapidly test and evaluate the ADS1254. Complete circuit descriptions, as well as schematic diagrams, PCB layouts, and bill of materials, are also included.

How to Use This Manual

This manual begins with an introductory chapter which describes the EVM and what it can do. If you are anxious to set things up and start testing, we suggest you read at least the first two chapters. These two chapters introduce you to the board and how to set it up to start working with it.

Information About Cautions and Warnings

This book may contain cautions and warnings.

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software or equipment.

This is an example of a warning statement.

A warning statement describes a situation that could potentially cause harm to you.

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

Related Documentation From Texas Instruments

Data Sheets	Literature Number
ADS1254	SBAS213
MAX3238	SLLS349
MSP430F149	SLAS272
REG1117	SBVS001
REG103	SBVS010O
PA350	SBOS099
SN74LVC1G07	SCES296
SN74LVC1G08	SCES217
SN74LVC1G125	SCES223

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If you have questions about this or other Texas Instruments data converter evaluation modules, feel free to e–mail the data converter application team at dataconvapps@list.ti.com. Include the product name in the subject heading.

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Chapter 1

Introduction

This chapter provides an overview of the ADS1254EVM evaluation module and software.

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1.1 The ADS1254

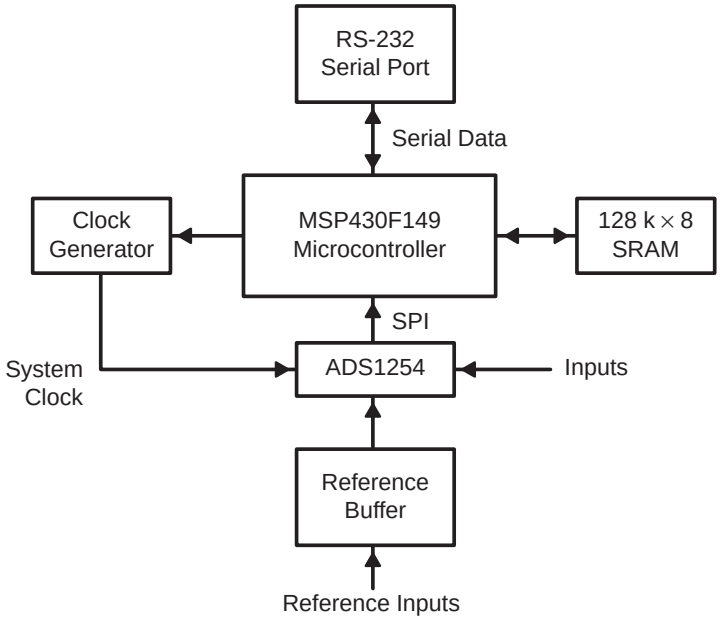
The ADS1254 is a precision 24-bit delta-sigma analog-to-digital converter with four differential input channels. The delta-sigma architecture employed in the ADS1254 enables the device to achieve 19 bits of effective resolution (1.8 ppm RMS noise) at data rates of up to 20 kHz. The part also has a *no-missing-codes* characteristic across the full 24 bit range.

The ADS1254 employs an unidirectional two-wire synchronous serial interface (modified SPI) for communication with the host system. Isolation can be applied to this interface at minimal cost.

1.2 EVM System Overview

A block diagram of the ADS1254 evaluation module is shown in Figure 1–1.

Figure 1–1. ADS1254EVM Block Diagram



During normal operation, data is read from the ADS1254 into the user's computer via the ADS1254EVMs RS-232 port. Once read, the data can be displayed and analyzed in a variety of ways using the supplied ADS1254EVM software.

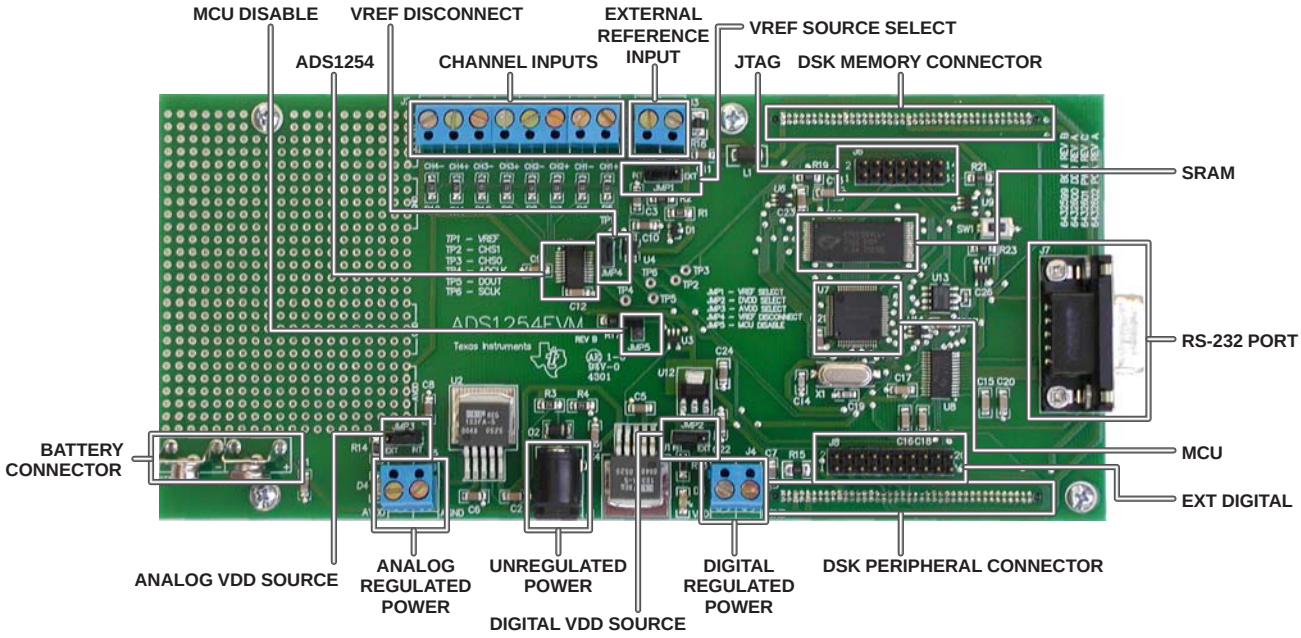
The ADS1254 can supply data much faster than it can be transmitted to the host PC over the RS-232 connection. Because of this, data read from the ADS1254 is stored in an onboard RAM, where it is kept until retrieved by the host system. This process is controlled by the user through the ADS1254EVM software.

The ADS1254EVM incorporates a PLL-based clock generator which can synthesize clocks of nearly arbitrary frequency up to the maximum of 8 MHz. The PLL exhibits increased jitter, so for certain clock frequencies, a direct divide-down circuit derived from a crystal oscillator is used instead. The divide-down is selected automatically.

The ADS1254EVM can be powered using an ac power adapter (not included), a 9-volt battery, or a user-supplied laboratory power supply.

A photograph of the ADS1254EVM with the locations of major components highlighted is shown in Figure 1–2.

Figure 1–2. ADS1254EVM Component Locations



1.3 Analog Inputs

Analog input is supplied through the eight-way screw terminal block, J2. Each input is connected to the ADS1254 through a 1-kΩ resistor. The inputs are not protected against overvoltage.

1.4 Prototyping Area

A prototyping area is provided on the ADS1254EVM. This may be used to incorporate additional circuitry, such as special reference or conditioning circuits, into the system. Certain holes are connected to convenient circuit points, such as ground, reference, etc.

1.5 Power Requirements

The ADS1254EVM must be supplied with 5.5 V–15 V for proper operation. Power can be supplied through barrel jack, J1 (tip positive), screw terminal blocks J4 and J5, or with a 9-volt battery connected to battery snap BT1.

1.6 Host Computer Requirements

The ADS1254EVM software is designed to run on a PC running any Windows platform (Windows 95, 98, NT, 2000, etc.).

Minimum Requirements:

- ❑ IBM-compatible 486 PC or higher
- ❑ Windows 95/98/2000 or NT4.0
- ❑ 64 MB RAM minimum
- ❑ 20 MB available hard disk space
- ❑ CD-ROM drive
- ❑ Available serial port

Chapter 2

Getting Started

This chapter guides you through unpacking your EVM and setting it up so you can begin working with it immediately.

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2.1 Unpacking the EVM

After unpacking the ADS1254EVM kit, check to make sure you received all of the items listed here:

- ADS1254EVM board
- 9-pin D-sub male-female serial cable
- Software CD-ROM

If any of these items are missing, contact Texas Instruments to receive replacements.

2.2 Default Configuration

Although much of the ADS1254EVMs operation is controlled by the host PC, some configuration must be done directly on the board, using five jumpers (shorting blocks). The ADS1254EVM is configured as follows at the factory:

Table 2–1. Factory Jumper Settings

Jumper Identifier	Description	Default Setting
JMP1	External reference select	2–3
JMP2	Digital power supply source	1–2
JMP3	Analog power supply source	1–2
JMP4	Reference disconnect	1–2
JMP5	MCU disable	Disconnected

For more information about the jumpers, see Section 3.1.

2.3 Quick Start

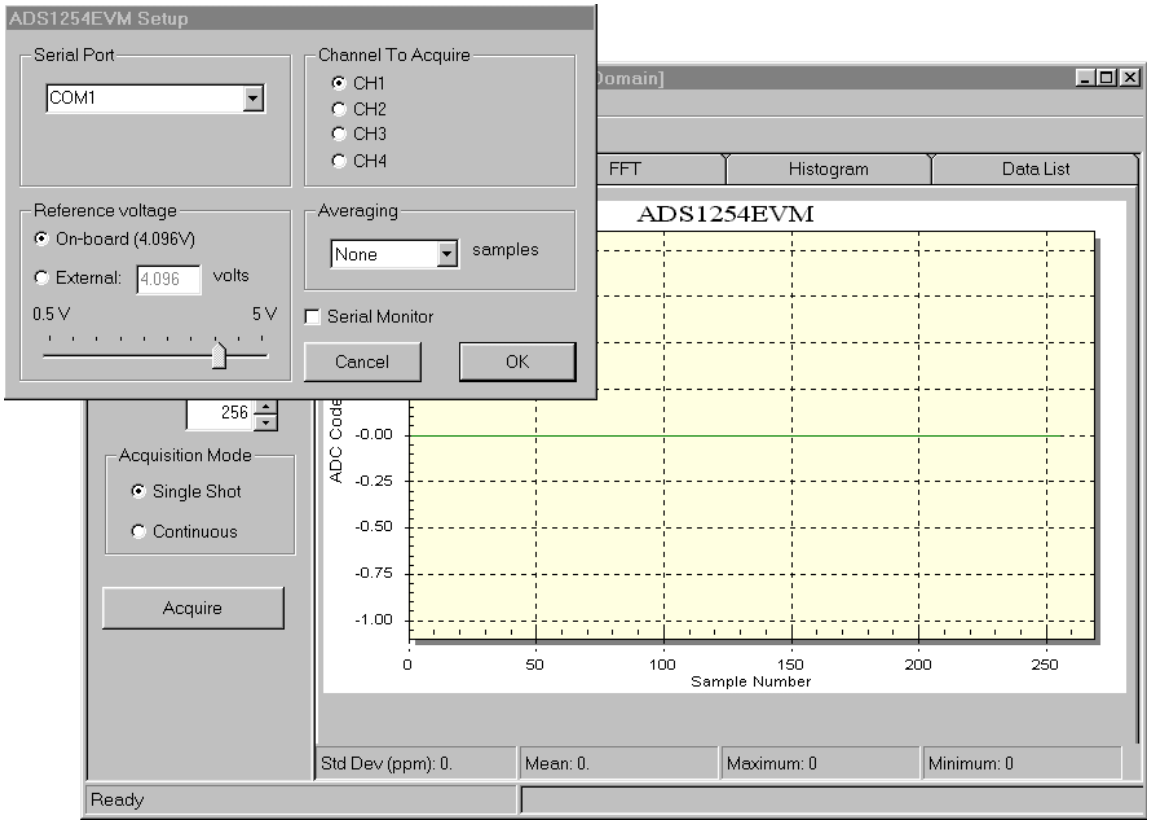
Once the ADS1254EVM has been unpacked from its shipping container, and you have verified that the board is configured as shown in Table 2–1, it can be powered on and tested.

First, connect the board to the host PC using the supplied 9-pin serial cable. Then power the board on by plugging a wall power adapter into a suitable ac power source and plugging the barrel plug into the barrel jack on the ADS1254EVM, or by connecting your laboratory power supply to the external power inputs and setting JMP2 and JMP3 to the 2 – 3 position. (You do not have to connect the serial cable first; it is also acceptable to apply power to the board first.) When the board is properly powered on, the two *power good* indicator lamps near the power connectors glow brightly. (The 5-V LED may glow brighter than the 3.3-V LED; this is normal.)

Place the CD-ROM into your PCs CD-ROM drive. Locate the setup program on the disk, and run it. The setup program installs the ADS1254EVM software on your PC. If you are running a Windows platform that is NT-based, such as Windows NT or Windows 2000, you need administrator privileges to install the software. Follow the instructions that the installer gives you.

Once the program has been successfully installed, it can be executed. When the program is run, it displays a title screen, and then you see something like the display in Figure 2–1.

Figure 2–1. Start-Up Display



The setup window appears first, allowing you to make adjustments to the programs configuration. For the test run, you should select the serial port to which the ADS1254EVM is connected, using the serial port menu.

If no serial ports are available, a message box appears informing you that the program cannot run. This is usually because other programs are using all of the available serial ports. If this is the case, closing these programs and rerunning the program should fix the problem.

Once the correct serial port has been selected, click *OK*. The setup dialog disappears and you see the main window. Click the acquire button. After a period of activity, you see data displayed in the data display window.

Chapter 3

Operation

This chapter describes each function of the ADS1254EVM, and how to use the accompanying software to control the ADS1254.

Topic **Page**

3.1 Jumpers

Table 3–1 shows the function of each jumper on the EVM:

Table 3–1. Jumper/Function Reference

Reference Designator	Setting	Function	Default	Section
JMP1	1 to 2	External reference	2–3	Section 3.1.1
	2 to 3	Onboard reference		
JMP2	1 to 2	Digital power supplied from barrel jack, battery, or DSK	1–2	Section 3.1.2
	2 to 3	Digital power supplied from screw terminal block J4		
JMP3	1 to 2	Analog power supplied from barrel jack, battery, or DSK	1–2	Section 3.1.2
	2 to 3	Analog power supplied from screw terminal block J4		
JMP4	Connected	Reference pin is connected	Connected	Section 3.1.3
	Disconnected	Reference pin is not connected		
JMP5	Connected	MCU controls ADS1254	Disconnected	Section 3.1.4
	Disconnected	MCU does not control ADS1254		

3.1.1 JMP1: Reference Source Select

The ADS1254EVM can use an externally supplied reference or an onboard 4.096-V zener reference (D1 and R1); use JMP1 to connect the desired reference source. Shorting pins 1 and 2 connects the external reference; shorting pins 2–3 connects the onboard reference.

3.1.2 JMP2, JMP3: Power Source Select

The ADS1254 has separate analog and digital power supplies. JMP2 is used to select the source for the digital power supply, and JMP3 is used to select the source for the analog supply. To use the barrel jack or battery (onboard regulator), short pins 1–2; if you wish to use an external power supply, short pins 2–3.

3.1.3 JMP4: Reference Disconnect

JMP4 is used to connect an external reference directly to the ADS1254, without using the onboard filtering. Removing this jumper disconnects the ADS1254 reference pin. External reference voltage must be applied to pin 2.

3.1.4 JMP5: MCU Disable

Shorting the pins of this jumper has the same effect as plugging the ADS1254EVM into a DSP DSK: the onboard regulators are shut down, and if power is still available, the MCU is disabled. Power may still be supplied through the external power connectors J4 and J5, or through the DSK; however, power cannot be supplied to the onboard clock generator from the DSK, since the clock generator is only supplied from the onboard regulators.

If you want to use an external system to control the ADS1254, instead of the onboard MCU, you must connect this jumper to prevent conflicts with the MCU. Since this jumper disables the onboard power supply, you must also power the board externally.

If JMP5 is shorted, and power is available to the MCU, it is active, but it effectively *disconnects* itself from the ADS1254 by 3-stating any pins leading to the 1254. This prevents conflicts with the DSK. The MCU can still communicate with the host PC in this mode.

3.2 Reset Switch

Switch SW1 is a miniature pushbutton which, when pressed, forces the MCUs $\overline{\text{RESET}}$ line low. When released, the MCU enters a reset cycle. If communication becomes disrupted between the host and the board, or the board is unresponsive, pressing $\overline{\text{RESET}}$ returns the system to normal operation.

3.3 Connectors

The various connectors on the ADS1254EVM are described in this section.

3.3.1 J7: RS-232 Connector

The host PC controls the board through this connector, which is a 9-pin female D-shell type, pinned out in the usual manner. Certain of the flow control lines are used for special purposes by the ADS1254EVM board; these are described in the table.

In the RS-232 electrical specification, –5 V to –15 V on a line indicates a logic *high* (mark), and 5 V to 15 V indicates logic *low* (space). Line states are described here according to their logical states.

If a *non-handshaking* RS-232 cable is used, that is, one which connects only RD, TD, and signal ground. The board can still operate normally, but it cannot be reset by the host PC, and bootstrap firmware upgrading cannot be performed through the serial port (it can still be done through the JTAG port J6, but this requires a special programming adapter and software).

Table 3–2. J7: RS-232 Port Pinout

Pin Number	Signal Name	RS-232 Name	Direction (at board)	Function
1	DCD	Data carrier detect	Output	None
2	RD	Receive data	Output	Serial data output to host PC
3	TD	Transmit data	Input	Serial data input from host PC
4	DTR	Data terminal ready	Input	Connected to the MCUs reset circuit. A low on this line resets the MCU. Must be held high for normal operation
5	SG	Signal ground	Power	Ground reference
6	DSR	Data set ready	Output	None
7	RTS	Request to send	Input	Connected to TCK on MCU. Used for boot-strap firmware loading. Must be held high for normal operation
8	CTS	Clear to send	Output	None
9	RI	Ring indicator	Output	None

3.3.2 J6: 3.3-V JTAG Port

This connector is used mainly during firmware development. It provides a fast way to download firmware into the MCU, and also allows access to the MCU's hardware debugging features. If you have MSP430 software development tools, you can use this port to write your own firmware for the ADS1254EVM.

> **CAUTION**
>
> This port is designed for use *only* with 3.3-V JTAG tools, such as those provided by TI for use with the MSP430. If you attempt to use 5-V JTAG tools with this port, you permanently damage the MSP430, as it is not 5-V tolerant.

Table 3–3. J8: 3.3-V JTAG Port

Pin Number	Pin Symbol	Signal Name	Direction (at board)	Function
1	TDI/TDO	Test data in/out	Output	JTAG TDO port (see JTAG standard)
2	VCCTOOL	Power from JTAG adapter	Power	JTAG adapter–provided power supply (not used on ADS1254EVM)
3	TDI/VPP	Test data in/programming voltage	Input	Used as a test data input, and for blowing the security fuse
4	VCCLOCAL	Power sense from board	Output	High rail from board; used for signal sense when board is using its own power supply during programming
5	TMS	Test mode select	Input	JTAG test mode select pin (see JTAG standard)
6	NC	Not connected	–	Not used
7	TCK	Test clock	Input	JTAG serial clock input (see JTAG standard)
8	NC	Not connected	–	Not used
9	GND	Ground	Power	Signal ground
10	NC	Not connected	–	Not used
11	$\overline{\text{RST}}$/NMI	Reset/non-maskable interrupt	Input	MCU reset line
12	NC	Not connected	–	Not used
13	NC	Not connected	–	Not used
14	NC	Not connected	–	Not used

3.3.3 J1, J4, J5, BT1: Power Connectors

The ADS1254EVM features a flexible power supply. Externally generated power, the onboard regulator circuitry and an ac adaptor, or a 9-V battery may all be used to supply power. Furthermore, the separated analog and digital power supplies may be powered differently; for example, the analog power supply may be powered externally, and the digital power supply may use the built-in regulator, at the same time. (This is configured using jumpers JMP2 and JMP3.) The exception to this is that the battery and ac adaptor cannot be used at the same time (see below).

An additional source of power may come from a DSP development board (DSK). When the ADS1254EVM is plugged in to a DSK motherboard, the onboard regulators are shut down, and power is sourced from the DSK. The DSK's power supply, however, may not be suitable for powering the analog circuitry, as it is likely to be somewhat *dirty*, so for best performance it is necessary to use an external supply for the analog circuitry when using the ADS1254EVM with a DSK.

Four power connectors are provided: screw terminal blocks J4 and J5 for external power, battery terminal BT1 for a 9-V *transistor radio* battery, and J1 for a *wall-wart*. J1 is a *switched* jack: connecting a plug to J1 automatically disconnects the battery terminal. This prevents the battery and J1 from supplying power simultaneously.

Battery power is regulated by the same circuitry that regulates J1 (wall-wart) power.

> **CAUTION**
>
> Be *very* careful when connecting external power supplies to J4 and J5. They are not protected against reversed polarity. If you connect them backwards (that is, with reversed polarity), permanent damage to the ADS1254EVM is likely.

Table 3–4. J1: Unregulated Power Input Connector

Terminal Name	Function
Tip	Positive power supply input
Sleeve	Power ground

Table 3–5. J4: External Digital Power Supply Input Connector

Terminal Number	Function
1	Digital positive power supply input
2	Digital ground

Table 3–6. J5: External Analog Power Supply Input Connector

Terminal Number	Function
1	Analog positive power supply input
2	Analog ground

Table 3–7. BT1: 9-V Battery Connector

Terminal Name	Function
Split (female) ring	Positive (mates with solid/male post on battery)
Solid (male) ring	Negative (mates with split/female post on battery)

3.3.4 J2: Analog Inputs

Terminal block J2 is the main analog input to the ADS1254EVM. Two terminals are provided for each of the ADS1254 four differential inputs. Each terminal is connected to the ADS1254 through a 1-kΩ resistor.

Table 3–8. J2: Analog Inputs

Terminal Number	Terminal Name	ADS1254 Pin	Function
1	CH4–	19	Channel 4 negative input
2	CH4+	20	Channel 4 positive input
3	CH3–	6	Channel 3 negative input
4	CH3+	5	Channel 3 positive input
5	CH2–	4	Channel 2 negative input
6	CH2+	3	Channel 2 positive input
7	CH1–	2	Channel 1 negative input
8	CH1+	1	Channel 1 positive input

3.3.5 J3: External Reference Input

The ADS1254EVM has an onboard 4.096-V bandgap reference. If a lower-noise reference source or a reference with a different voltage is desired, it can be connected to screw–terminal block J3. The reference source, onboard or external, is selected using JMP3. Both the onboard and external reference inputs are filtered and buffered by R2, C3, and U4, and bypassed by C10.

It is also possible to supply a reference voltage directly to the ADS1254 by disconnecting JMP4 and connecting the reference to pin 2.

Table 3–9. J3: External Reference Input

Terminal Number	Function
1	External reference voltage input
2	Analog ground

3.3.6 J8: External Digital Control

Header J8 provides access to certain signals connected between the DSK and the ADS1254. It can also be used as an additional place to connect external equipment for communicating with the ADS1254.

Table 3–10. J8: 3.3-V JTAG Port

Pin Number	Pin Symbol	Signal Name	Direction (at board)	Function
1	NC	–	–	Not connected
3	HOST_CLKXA	SERIAL_CLK	Input	SPI clock for ADS1254
5	HOST_CLKRA	HOST_CLKRA	Output	SPI clock from board; not used
7	HOST_DXA	HOST_DXA	Output	SPI data from board; not used
9	HOST_DRA	HOST_DRA	Input	SPI data for ADS1254 from DSK
11	HOST_FSXA	HOST_FSXA	Output	Frame sync from board; not used
13	HOST_FSRA	HOST_FSRA	Input	Frame sync from DSK; not used
15	HOST_CLKOUT	HOST_CLKOUT	–	Not used
17	HOST_CLKSA	HOST_CLKSA	–	Not used
19	NC	–	–	Not connected
Even-numbered pins	DGND	DGND	Power	Signal ground

3.3.7 J9, J10: DSK Motherboard Connectors

These two connectors are used as both electrical connection and mechanical support for plugging the ADS1254EVM into a DSP DSK. Communication between a DSP on a DSK and the ADS1254 on the EVM is accomplished through these connectors.

J9, the memory interface connector, carries the DSP external bus. J10, the peripheral and control connector, carries various GPIO and peripheral signals from the DSP.

The ADS1254, being a purely SPI part, does not make use of the DSP external parallel bus; therefore, only one signal connection from J9, a timer output, is used.

J10 carries the DSK serial channels. Texas Instruments DSPs currently available on DSKs incorporate a multichannel buffered serial port, or McBSP, which among other things supports full-duplex SPI and a *frame-sync* signal. The ADS1254 has neither of these, so only the McBSPs SPI clock and data outputs are connected. The other McBSP signals are brought to J8 for convenience.

3.3.8 TP1–6: Test Point

The test points are used to monitor certain signals on the board, or to connect external signals to the ADS1254.

Consult the ADS1254 data sheet for information on the signals connected directly to the ADS1254.

Table 3–11. TP1–6: Test Points

Test Point Designator	ADS1254 Pin Number	ADS1254 Pin Name	Signal Description
TP1	–	–	Onboard reference voltage
TP2	15	CHS1	Channel Select 1
TP3	16	CHS0	Channel Select 0
TP4	8	ADCLK	ADS1254 timing and conversion clock
TP5	13	DOUT	SPI data from MCU
TP6	14	SCLK	SPI clock

3.4 Circuit Description

The ADS1254EVM combines a microcontroller, RAM, and an ADS1254 to provide a platform for simplified evaluation of the ADS1254.

3.4.1 ADS1254

The ADS1254 (U5) is supported by reference circuitry D1, U4 and associated components; inputs come from J2 through current–limiting resistors R5 – R12. The clock generation circuitry is described below.

For detailed information about the ADS1254, consult the ADS1254 product data sheet.

3.4.2 Microcontroller

A Texas Instruments MSP430F149 microcontroller (U7), clocked at 8 MHz, provides intelligence for the system. It communicates with the ADS1254 using one of its two built-in USARTs in synchronous mode, and with the host PC using the other USART in asynchronous mode. Firmware is stored in and executed from the onboard flash memory.

Bulk storage of datapoints collected from the ADS1254 is provided by a 128-kilobyte static RAM (U10). It is connected to the MSP430 using 28 GPIO lines.

For detailed information about the MSP430F149, consult the relevant documentation, which is available from Texas Instruments website.

3.4.3 Clock Generation

The ADS1254 requires a system clock, from which it derives its sampling rate; the sampling rate is the system clock frequency divided by 384. The system clock's maximum specified rate is 8 MHz (maximum sampling frequency is 20833 Hz); up to this maximum, virtually any sampling frequency may be selected by generating a clock of the appropriate frequency.

To support a wide range of evaluation situations, the ADS1254EVM has a variable-frequency clock generation system consisting of the MCU, PLL clock generator U13, and gate U14. The ICD2053 is a programmable frequency generator containing a PLL oscillator and programmable dividers; it is capable of generating frequencies in the 500 kHz – 8 MHz range. The reference clock for the ICD2053 is a buffered version of the MCU main clock, which runs at 8 MHz.

Although the ICD2053 adds great flexibility to the ADS1254EVM, its jitter is rather high, degrading performance somewhat. The MCU clock source is much *cleaner*. Therefore, those frequencies which can be produced using the MCU are sourced from the MCU instead of the ICD2053. This includes 8 MHz, 4 MHz, 2 MHz, and 1 MHz. The choice between the PLL clock and the MCU clock is made by the firmware.

3.4.4 Firmware and Host Communication

The ADS1254EVM firmware controls the acquisition of data from the ADS1254 and the clock generation circuitry. It is capable of receiving data from the ADS1254 at the full data rate, while simultaneously performing averaging.

Communication with the host is performed using TI's CSR-232 protocol, which is designed for efficient system control over point-to-point serial links. CSR-232 is based on IEEE P1212r, the control and status registers draft standard.

The firmware may be upgraded by the user through the serial port. TI may periodically make enhancements to the ADS1254EVM firmware; these upgrades are available on TI's web site, together with a program for performing the upgrades.

3.4.5 Power Supply

Power is brought into the board through external power connectors J4 and J5, battery connector BT1, unregulated power input J1, or through the DSK connectors J9 and J10. If a wall power adaptor is plugged into J1, the battery is disconnected.

Power supplied from the battery or through J1 is regulated by voltage regulators U1, U12, and U2, which provide 5-V digital and analog supplies, and a 3.3-V digital supply. Power supplied from the external connectors is not filtered; regulated power of the correct voltages must be supplied to these connectors. Power from the DSK is filtered and bypassed. Resistors R15 and R16 limit current in case a DSK is plugged in and the onboard regulators have not yet shut down.

The board is laid out with separate *analog* and *digital* power supplies. Analog power is 5 V and is supplied from regulator U2, external power connector J5, or the DSK. 3.3-V *digital* power is supplied from regulator U12 or the DSK. When the external power connector J4 is used, it supplies regulator U12.

Only one component on the board, clock generator U13, uses 5-V *digital* power. When the DSK is used, this component does not operate; however, this is of no concern, as the DSK supplies its own clock.

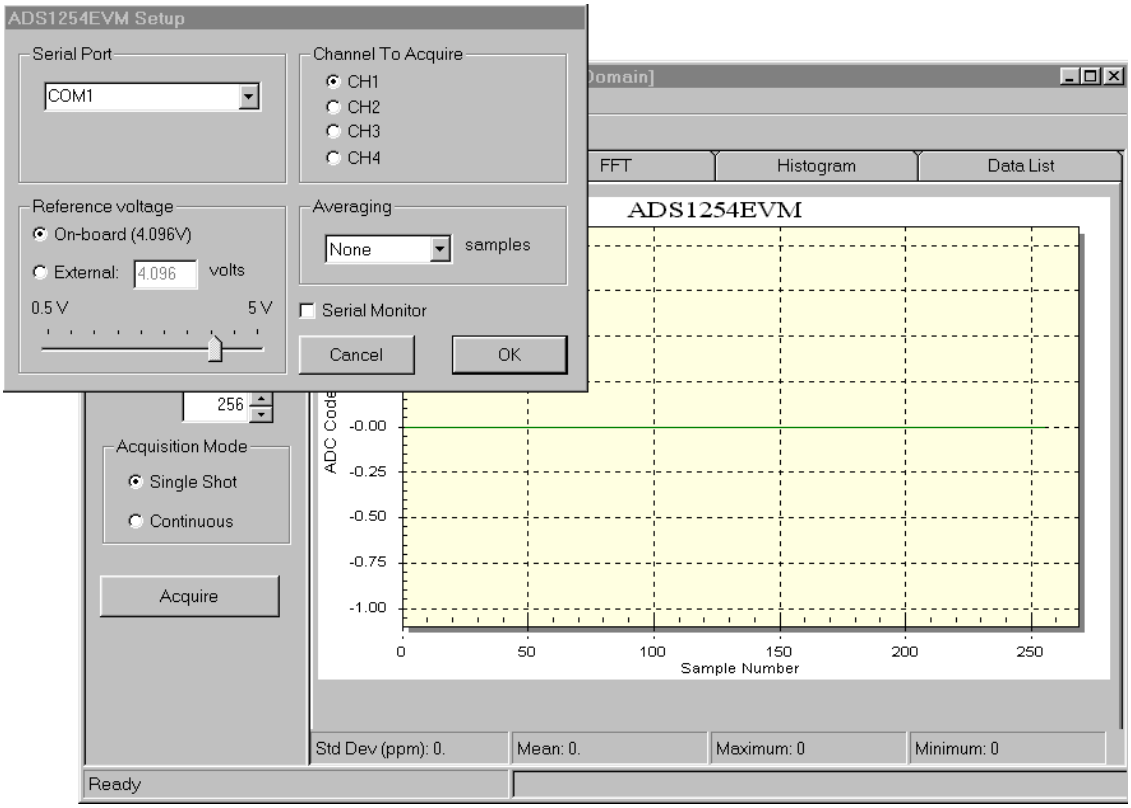
3.5 Host PC Software

After having installed the software for the ADS1254EVM as described in Section 2.3, you can use it to evaluate the ADS1254. The software is described in the following subsections.

3.5.1 Main Window

The main window is shown in Figure 3–1. The window is shown as it first comes up when the program is started.

Figure 3–1. Main Window



3.5.1.1 Performing an Acquisition

Clicking the *acquire* button causes an acquisition to begin. Acquisition is performed in the following sequence:

1) The software configures the ADS1254EVM, telling it what sampling rate to use, how many averages to perform per sample (this is configured in the Setup window), and how many samples to take.

2) The software instructs the ADS1254EVM to begin sampling.

3) The ADS1254EVM begins collecting samples. The ADS1254EVM informs the software of the progress of the acquisition approximately four times a second; this information is displayed in the status bar at the bottom of the window.

4) The ADS1254EVM tells the software that the acquisition has completed.

5) The software begins reading sample data from the ADS1254EVM. The read can take some time; the progress of the read operation is indicated in the status bar.

6) When all of the requested sample data has been read, it is displayed.

3.5.1.2 Acquisition Modes

Two modes of acquisition are available: single shot, and continuous. The modes are selected using the acquisition mode radio buttons.

In single shot acquisition mode, the program requests one conversion each time the *acquire* button is clicked. In continuous acquisition mode, the program automatically initiates another conversion when a conversion completes; this process continues until the *STOP* button is clicked. The *STOP* button appears when an acquisition is started in continuous mode.

3.5.1.3 Sampling Rate

To change the sampling rate, type the desired sampling frequency in hertz in the *sample data rate* edit box, and press *enter*. The program immediately requests that the board change to this sampling rate.

Not all sampling rates are realizable by the board; that is, the clock generator circuitry has a finite resolution. The board configures the clock generator so that it generates the nearest frequency to that requested. It then reports back the frequency actually being generated. The program replaces the typed-in frequency with the actual frequency being generated by the board, so that you can always see what the actual sampling frequency is.

Note that the actual frequency of the clock generator is the sampling frequency times 384. This adjustment is made by the board.

3.5.1.4 Number of Samples to Acquire

When an acquisition begins, the program requests that the board acquire a certain number of samples. The number of samples to acquire is set using the *number of samples* box. You can type a value in or use the up and down buttons to select the number of samples to acquire.

3.5.2 Display Modes

The evaluation software offers four ways to display sample data:

- Scope displays the data as a sample number versus amplitude graph, similar to an oscilloscope
- FFT displays a fast Fourier transform of the data on a frequency versus magnitude graph
- Histogram displays the data on a value versus count graph (histogram)
- Data list displays the raw sample data in a list

Modes are selected by clicking a tab on the tab bar above the data display area, or by selecting an option from the *View* menu.

The modes are fully described in the following sections.

3.5.2.1 Scope

In scope mode, collected data are displayed as a function of sample number, with the vertical axis measured by code.

You can zoom in on the graph by selecting a rectangular area with the mouse, by clicking and dragging. To zoom out, left-click on the graph and select *undo zoom* from the popup menu that appears; the graph will return to its original scale.

Left-clicking on the graph brings up a pop–up menu containing numerous display options. Double-clicking with the right mouse button brings up an options dialog containing other display options. You can export the graph in various file formats by selecting *export dialog* from the popup menu.

3.5.2.2 FFT

In FFT mode, a fast discrete Fourier transform is applied to the dataset, and displayed as a graph of frequency in hertz versus magnitude in dB of full scale. A number of options for changing certain parameters of the FFT, such as window type and normalization type, are available by clicking the *options* tab.

You can zoom in on the graph by selecting a rectangular area with the mouse, by clicking and dragging. To zoom out, left-click on the graph and select *undo zoom* from the popup menu that appears; the graph returns to its original scale.

Left-clicking on the graph brings up a popup menu containing numerous display options. Double-clicking with the right mouse button brings up an options dialog containing other display options. You can export the graph in various file formats by selecting *export dialog* from the popup menu.

3.5.2.3 Histogram

In histogram mode, the data are analyzed to see how many times each value occurs; this information is shown on a count-versus-value bar graph. For example, if the column marked zero shows a bar which is 2 units high, it means that two zeros are present in the data. Histograms are useful for analyzing readings of dc voltages for accuracy.

You can zoom in on the graph by selecting a rectangular area with the mouse, by clicking and dragging. To zoom out, left-click on the graph and select *undo zoom* from the popup menu that appears; the graph returns to its original scale.

Left-clicking on the graph brings up a popup menu containing numerous display options. Double-clicking with the right mouse button brings up an options dialog containing other display options. You can export the graph in various file formats by selecting *export dialog* from the popup menu.

3.5.2.4 Data List

In data list mode, the data are shown in a list, in order of reception. The data may be shown in one of four modes:

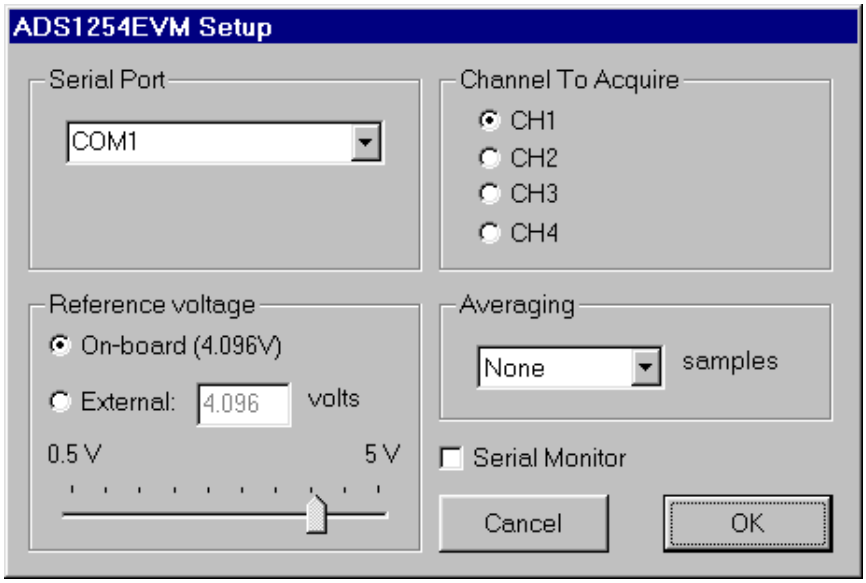
- As integers: Each sample is displayed as a signed base-10 integer. The sample values are shown exactly as received from the ADS1254.
- As hexadecimal integers: Each sample is displayed as an unsigned hexadecimal number. The hexadecimal values are precisely those codes read out from the ADS1254.
- As percentage of full scale: The percentage of full scale of each sample is calculated and displayed.
- Scaled by LSB: The voltage measured at each point is calculated and displayed.

3.5.3 Setup Dialog

The setup dialog allows you to configure several aspects of the ADS1254EVM software's operation. It is shown when the program is started, and when the *EVM setup* option is selected from the edit menu.

Once you are finished making changes in the setup dialog, click the *OK* button to make them effective, or *cancel* to discard the changes. No changes you make in the setup dialog take effect before you click the *OK* button.

Figure 3–2. Setup Dialog



3.5.3.1 Serial Port Menu

The serial port menu allows you to choose which serial port to use for communication with the ADS1254EVM. The ADS1254EVM must be connected to the port selected here, or the program will not work.

All of the available ports are shown in the menu. If you know that a port exists, but you do not see it in the menu, it usually means that the port is being used by another program.

3.5.3.2 Channel to Acquire

The ADS1254EVM can read any of four differential channels. Use the *channel to acquire* buttons to select which channel to read when performing an acquisition.

By default, this is set to CH1 (channel 1).

3.5.3.3 Reference Voltage

Here you can tell the program what reference voltage you are using. This value is used in certain display calculations. You must input the correct reference voltage here, because the board cannot detect the reference voltage, so the software has no way to obtain the information automatically.

Changing the reference voltage here does not affect the operation of the board; it only changes the reference voltage value used by the program in certain calculations. If the reference voltage selected here is incorrect, some values shown by the program will be incorrect, but the program and board operate normally otherwise.

3.5.3.4 Averaging

The ADS1254EVM board can average together a selectable number of samples for each reading. If you want to perform averaging on the data, this can drastically reduce the download time, since averaging is performed on the board, and only the averaged data is downloaded by the host. It also allows much longer readings to be taken, since the board's RAM is not filled up by samples which are averaged together; instead, averaging is done before the data is written into the board's RAM.

The figure selected here is the number of successive samples that are collected together and averaged to form one sample. For example, if you select 32 here, then for each reading, 32 samples are taken and averaged together to form that reading. This means that if you request 256 samples to be acquired, 256 samples are returned, but each sample returned is actually 32 successive samples averaged together; so for that acquisition, 8,192 samples are taken by the ADS1254.

Note that this changes the effective sampling rate of the returned data. Requesting 32 averages per sample, for example, divides the effective sampling rate by 32. This is not reflected in the main window; the sampling rate you select there is always the *basic* sampling rate, and not the effective sampling rate after averaging.

The ADS1254EVM can only average samples in quantities which are powers of 2. This dramatically simplifies the averaging calculations that the board's microcontroller must perform. The allowable values are all shown in the Averaging menu; up to 32,768 samples per reading can be averaged together. Selecting none from the menu—the default—means that no averages are taken, and data is returned as read from the ADS1254.

3.5.3.5 Serial Monitor

Checking this box causes the serial monitor window to appear when the setup dialog is closed. This window displays, as it occurs, all serial communications between the program and the ADS1254EVM, in hexadecimal bytes.

Chapter 4

Physical Description

This chapter contains the schematic drawings and PCB layouts for the ADS1254EVM board.

Topic **Page**

4.1 Board Layouts

Figure 4–1. Board Layout Top Layer

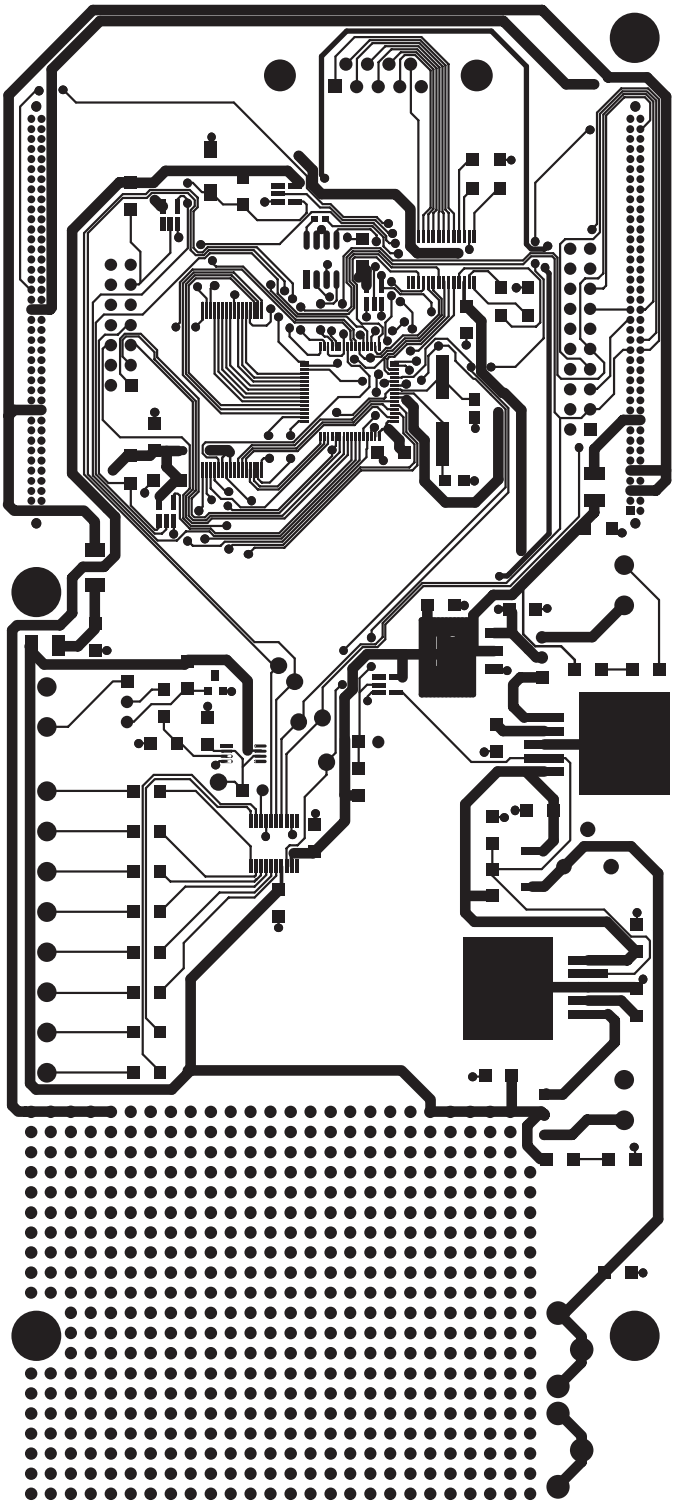
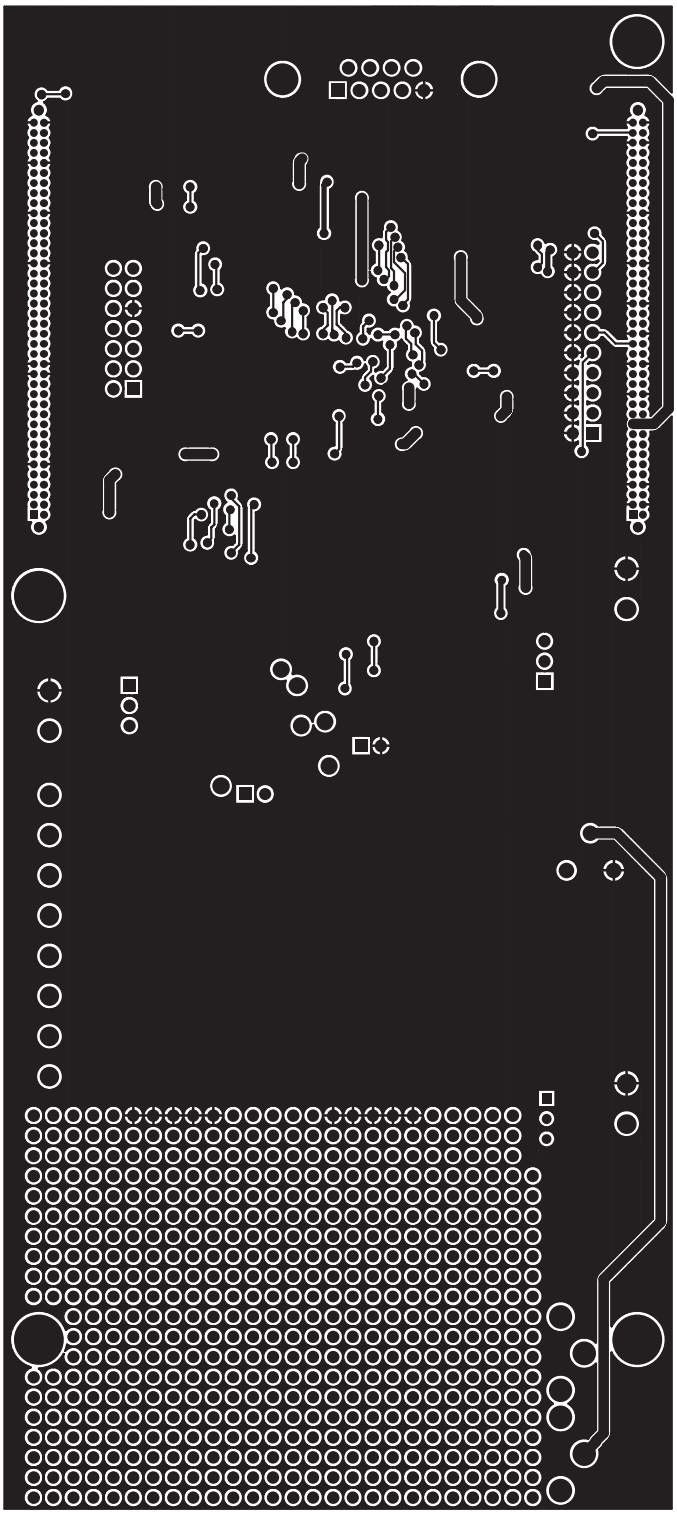


Figure 4–2. Board Layout Bottom Layer



4.2 Schematics

The ADS1254 schematics are shown on the following pages.

Figure 4-3. Schematic (Sheet 1 of 2)

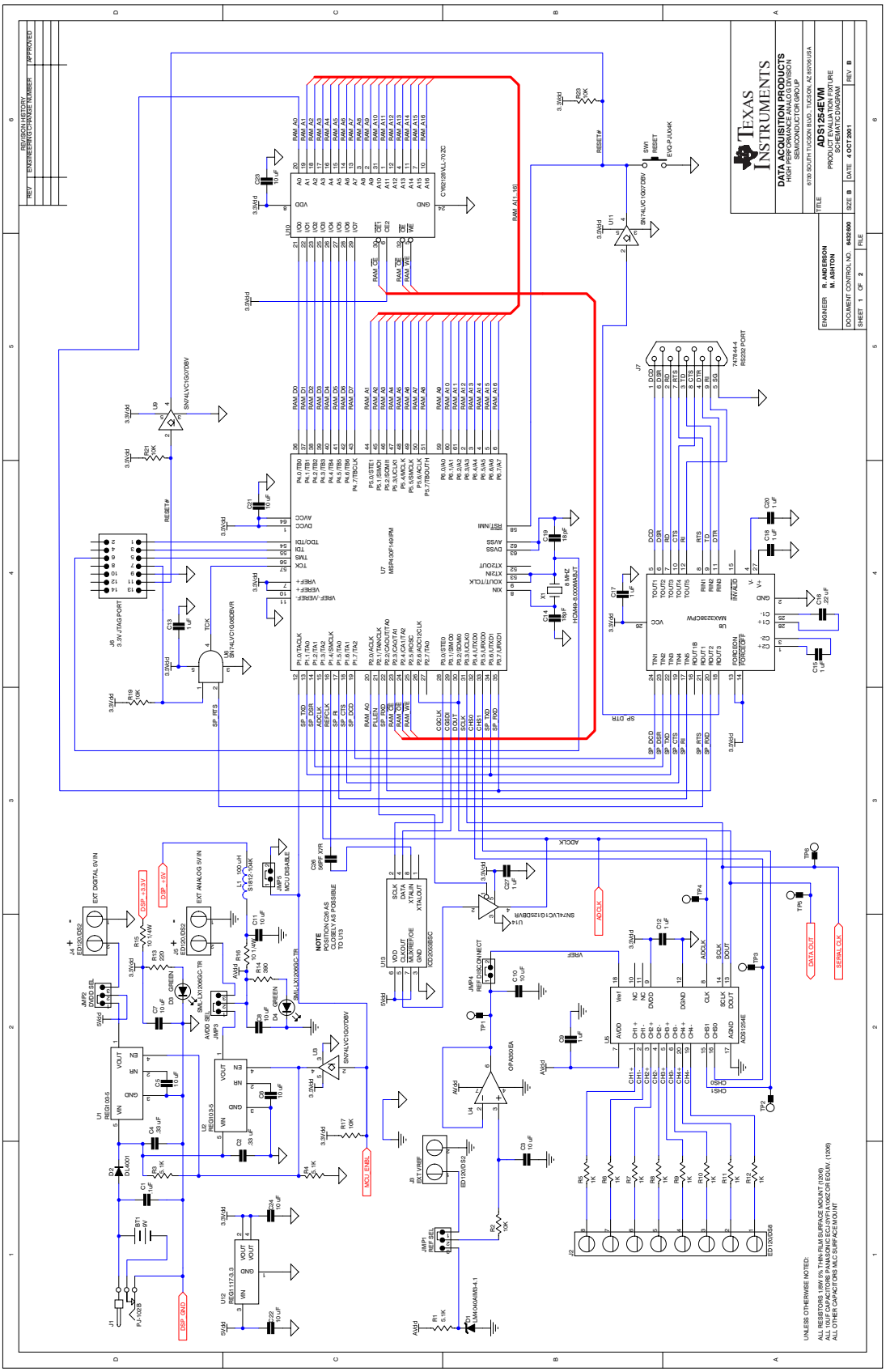
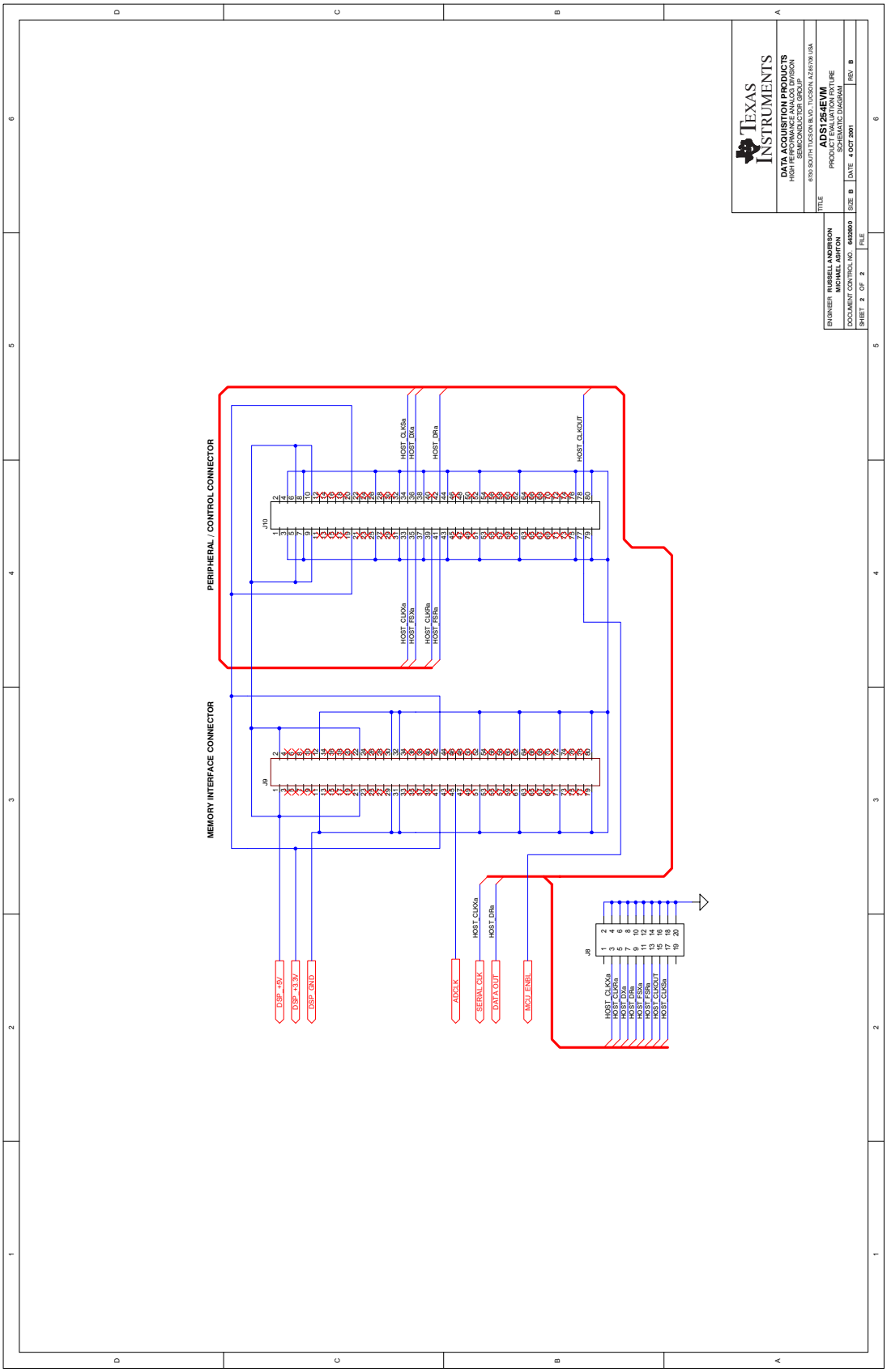


Figure 4-4. Schematic (Sheet 2 of 2)



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