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MCP6SX2 PGA THERMISTOR PICtail™ DEMO BOARD USER'S GUIDE

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MCP6SX2 PGA THERMISTOR PICtail™ DEMO BOARD USER'S GUIDE

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP6SX2 PGA Thermistor PICtail™ Demo Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MCP6SX2 PGA Thermistor PICtail™ Demo Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – An introduction to the MCP6SX2 PGA Thermistor PICtail™ Demo Board. It covers the kit contents, associated tools and how they work together.
- **Chapter 2. "Setup and Installation"** – Covers the initial set-up of the MCP6SX2 PGA Thermistor PICtail™ Demo Board. It lists the required tools, shows how to connect this board and demonstates how to verify the set-up.
- **Chapter 3. "Using the MCP6SX2 PGA Thermistor PICtail™ Demo Board"** – Discusses different light sources, using the Signal Analysis PC application and setting up the board as a stand-alone.
- **Appendix A. "Schematic and Layouts"** – Gives detailed information on the MCP6SX2 PGA Thermistor PICtail™ Demo Board. Includes detailed circuit explanation, schematic and board layouts.
- **Appendix B. "Bill Of Materials (BOM)"** – List the parts used to build the MCP6SX2 PGA Thermistor PICtail™ Demo Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	`file`.o, where `file` can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options] file [options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

RECOMMENDED READING

This user's guide describes how to use the MCP6SX2 PGA Thermistor PICtail™ Demo Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

PICkit™ 1 Flash Starter Kit User's Guide (DS40051)

Contains instructions on how to use the PICkit 1 Flash Starter Kit hardware and software.

Signal Analysis PICtail™ Daughter Board User's Guide (DS51476)

Contains instructions on how to use the Signal Analysis PICtail™ Daughter Board's hardware and software.

AN897, "Thermistor Temperature Sensing with MCP6SX2 PGAs" (DS00897)

Explains the functionality and design of this board's circuit. Contains measurement results.

MCP6S21/2/6/8 Data Sheet (DS21117)

Gives detailed information on the MCP6S21/2/3/6/8 Programmable Gain Amplifiers (PGA).

MCP6S91/2/3 Data Sheet (DS21908)

Gives detailed information on the MCP6S91/2/3 PGAs.

PIC16F684 Data Sheet (DS41202)

Gives detailed information on the PICmicro microcontroller used on the Signal Analysis PICtail Daughter Board.

PIC16C745/765 Data Sheet (DS41124)

Gives detailed information on the PICmicro® microcontroller used on the PICkit 1 Flash Starter Kit.

THE MICROCHIP WEB SITE

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- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

MCP6SX2 PGA Thermistor PICtail™ Demo Board User's Guide

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or field application engineer for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://support.microchip.com

DOCUMENT REVISION HISTORY

Revision B (May 2006)

- Updated Bill of Materials (BOM) to show RoHS-compliant part numbers.
- Updated title of this document to match web site board name.

Revision A (October 2004)

- Initial Release of this Document.

Chapter 1. Product Overview

1.1   INTRODUCTION

The following name and assembly number are found on the MCP6SX2 PGA Thermistor PICtail™ Demo Board's Printed Circuit Board (PCB):

- MCP6SX2DM-PICTLTH
- 102-00028

This PCB goes by the following title:

- MCP6SX2 PGA Thermistor PICtail™ Demo Board

This board is supported by AN897, *"Thermistor Temperature-Sensing with MCP6SX2 PGAs"*, (DS00897). It uses a BC Components® 2322 640 55103 NTC thermistor to detect temperature. The circuit also includes a voltage divider and a MCP6S22 Programmable Gain Amplifier (PGA).
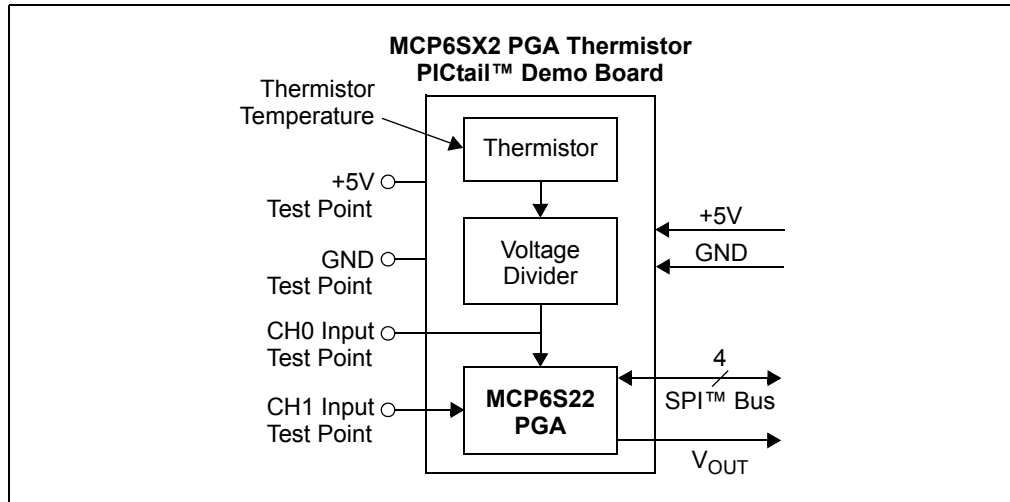
- Kit Contents
- MCP6SX2 PGA Thermistor PICtail™ Demo Board
- Associated Tools
- Initial Set-up

1.2   WHAT IS THE MCP6SX2 PGA THERMISTOR PICTAIL™ DEMO BOARD?

The MCP6SX2 PGA Thermistor PICtail™ Demo Board contains the analog circuitry represented in Figure 1-1. It uses BC Components' 2322 640 55103 NTC thermistor to convert temperature to resistance. The thermistor is placed in a voltage divider which converts resistance to voltage. This voltage is filtered and placed at the MCP6S22 Programmable Gain Amplifier's (PGA) CH0 input. The PGA gains and buffers this output, which is sent off board (V_{OUT}). Board power is applied at the +5V and GND inputs. The SPI bus makes it possible to control the PGA; its gain and input channel can be set, as desired, from the software.

1.3   WHAT THE MCP6SX2 PGA THERMISTOR PICTAIL™ DEMO BOARD KIT INCLUDES

- MCP6SX2 PGA Thermistor PICtail™ Demo Board – An assembled and tested PCB (102-00028)
- PICkit™ 1 CD-ROM (DS40049) – Contains the files and literature mentioned in this user's guide
- Stand-off, screw and an additional PGA (MCP6S92) provided in an anti-static bag

**FIGURE 1-1:** *MCP6SX2 PGA Thermistor PICtail™ Demo Board Block Diagram.*

The test points make it easier to test key points in the circuit, change the input signals, and to use this as a stand-alone board.

• GND Test Point – Connected to the ground plane, it is a convenient ground point for any lab equipment
• +5V Test Point – Allows measurement of the positive supply voltage and provides a means to power this board with a laboratory power supply
• CH0 Test Point – The place to measure the voltage divider's output (also the PGA's CH0 input)
• CH1 Test Point – Makes it possible to send any desired signal to the PGA

More details on the circuit and its design can be found in **Appendix A. "Schematic and Layouts"** and in AN897 (DS00897).

1.4   ASSOCIATED TOOLS

Figure 1-2 shows the block diagram of the hardware and software tools that the MCP6SX2 PGA Thermistor PICtail™ Demo Board is designed to work with. More information on these tools can be found in the **"Recommended Reading"** section.
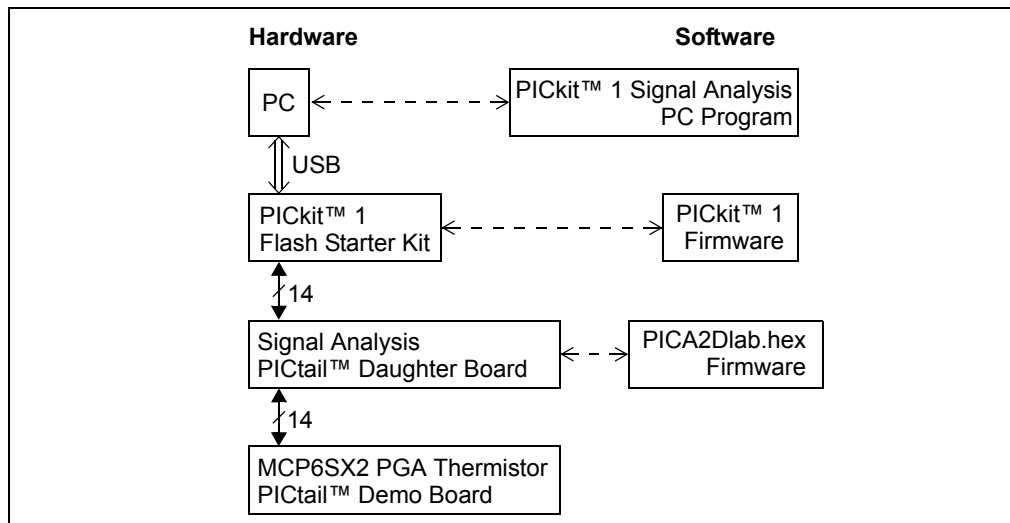
FIGURE 1-2: *Measurement Set-up Block Diagram.*

1.4.1 PC Platform

The Personal Computer (PC) shown in Figure 1-2 needs to run on Windows® 98 SE or later. It provides a convenient interface for the user, communicates with the other boards and provides power through the USB connection.

1.4.2 PICkit™ 1 Signal Analysis PC Program

The PICkit™ 1 Signal Analysis PC program configures and programs the PIC16F684 PICmicro® microcontroller on the Signal Analysis PICtail Daughter Board through the USB port on the PICkit 1 Flash Starter Kit. It also imports data through the same connection and displays the data in strip-chart, histogram, FFT plot and oscilloscope plot formats. Data can be output in CSV format for importing into a spreadsheet program.

1.4.3 PICkit 1 Flash Starter Kit

The PICkit 1 Flash Starter Kit (DV164101) programs PICmicro microcontrollers. It uses the PIC16C745's USB port to communicate with the PICkit 1 Signal Analysis PC program. It connects to the Signal Analysis PICtail Daughter Board via a header (see Figure 2-1).

This board provides a single +5V supply voltage for the daughter boards. It can drive up to 5 µF on the supply; a larger capacitance may interfere with program timing.

1.4.4 PICkit 1 Firmware

This software resides on the PICkit 1 Flash Starter Kit's PIC16C745 microcontroller. Use version 2.0.2 or later.

1.4.5 Signal Analysis PICtail Daughter Board

This board is Microchip Development Tool AC164120. It connects to the PICkit 1 Flash Starter Kit, which it uses for both power and as a communications link to the PC. The on-board PIC16F684 has a 10-bit ADC which converts the MCP6SX2 PGA Thermistor PICtail™ Demo Board's output voltage. The results are temporarily stored on the board's 25LC640 serial EEPROM chips.

The +5V single supply voltage from the PICkit 1 Flash Starter Kit board is bypassed with a bulk 1 µF capacitor and local 0.1 µF capacitors for each IC.

1.4.6 Firmware for the Signal Analysis PICtail Daughter Board

PICA2Dlab.hex is the standard file that supports the PICkit™ 1 Signal Analysis PC program. The PGA and 10-bit ADC configuration are selected in the Signal Analysis PC program and written to the PIC16F684. The PIC16F684 then sends the command(s) over the SPI™ bus to the PGA. It displays the ADC code on the strip chart.

Therm_PGA1.hex implements the first design in AN897. It supports the PICkit™ 1 Signal Analysis PC program, but with reduced functionality; its output can be viewed on the strip chart only. The results need to be manually converted to commonly-seen temperature (codes 0 to 1023 convert to 0.0°C to 102.3°C).

Therm_PGA2.hex implements the second design in AN897. It supports the PICkit™ 1 Signal Analysis PC program, but with reduced functionality; its output can be viewed on the strip chart only. The results need to be manually converted to commonly-seen temperature (codes 0 to 1023 convert to 0.0°C to 102.3°C).

1.4.7 Interface Details

A more detailed look at how the MCP6SX2 PGA Thermistor PICtail™ Demo Board interfaces with the other boards is shown in Figure 1-3.
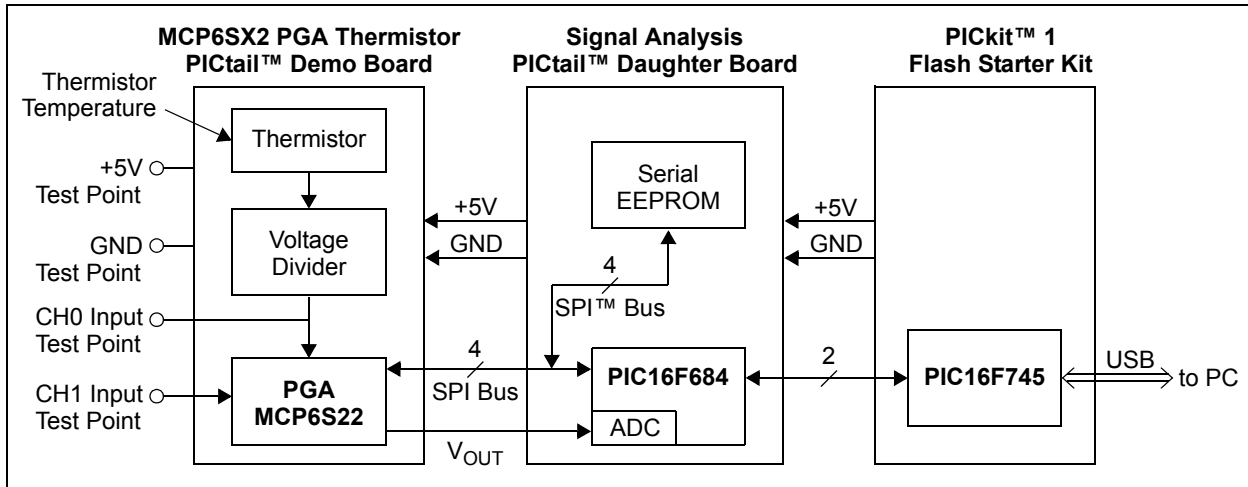
FIGURE 1-3: *Detailed Interface Diagram.*

Chapter 2. Setup and Installation

2.1   INTRODUCTION

This chapter shows how to set up the MCP6SX2 PGA Thermistor PICtail™ Demo Board. This chapter discusses:

- Required Tools
- Connecting the MCP6SX2 PGA Thermistor PICtail™ Demo Board
- Set-up Verification

2.2   REQUIRED TOOLS

The PICkit™ 1 Flash Starter Kit User's Guide explains how to set up the PC and the PICkit™ 1 Flash Starter Kit. Use firmware version 2.0.2 or later.

The Signal Analysis PICtail™ Daughter Board User's Guide shows how to install the PICkit 1 Signal Analysis PC Program on the PC and set up the Signal Analysis PICtail Daughter Board. It also covers the features of the PICkit 1 Signal Analysis PC program.

The PICkit 1 CD-ROM (DS40049) contains many of the necessary files.

2.3   CONNECTING THE MCP6SX2 PGA THERMISTOR PICTAIL™ DEMO BOARD

An exploded view of how the different boards connect is shown in Figure 2-1.
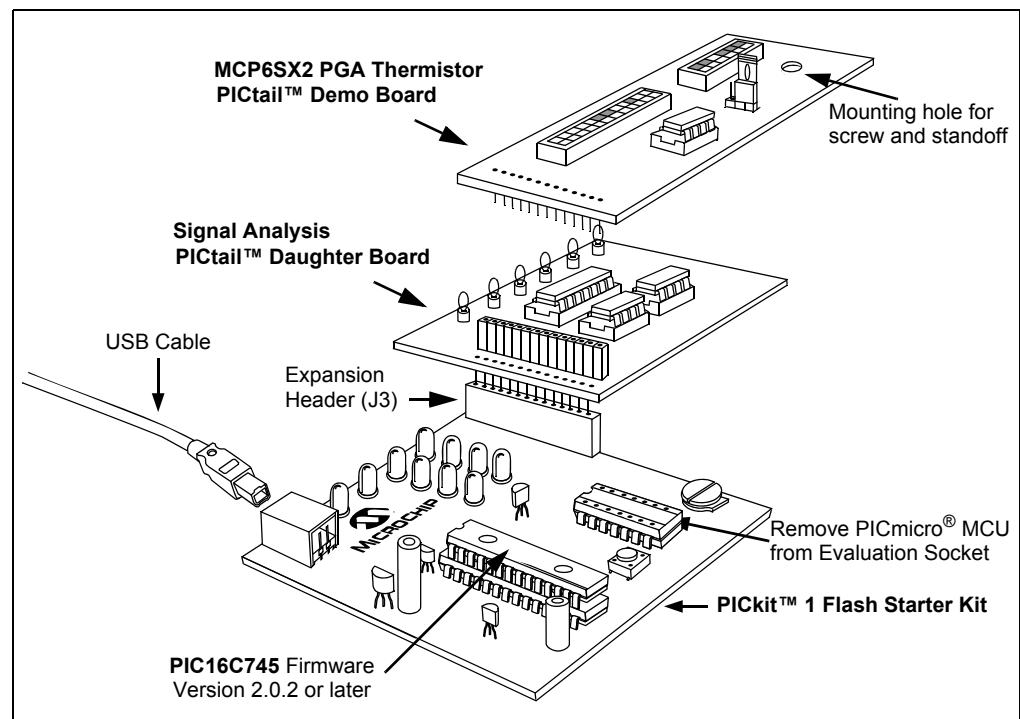
FIGURE 2-1:   *Board Connections.*

2.3.1 PCB Standoff

The standoff and screw listed in Table B-2 are installed at the mounting hole shown in Figure 2-1. The standoff goes on bottom, and the screw on top.

2.3.2 PICkit 1 Flash Starter Kit

1. Remove any PICmicro microcontroller that may be in the evaluation socket.
2. Connect the USB cable to the PC and the PICkit 1 Flash Starter Kit board. The status LEDs (green POWER and yellow BUSY in the LED array) should light up.

It is easiest to use this board when it lays directly on a bench top.

2.3.3 Signal Analysis PICtail Daughter Board

This board plugs into the PICkit 1 Flash Starter Kit's expansion header J3 and must not cover the LED array. There should be no change in the status LEDs on the PICkit 1 Flash Starter Kit board after it is plugged in.

2.3.4 MCP6SX2 PGA Thermistor PICtail™ Demo Board

If you would rather use the MCP6S92 PGA, take it out of the anti-static bag and replace the already installed MCP6S22 PGA.

1. Plug this board into, and directly above, the Signal Analysis PICtail Daughter Board. There should be no change in the status LEDs on the PICkit 1 Flash Starter Kit board after it is plugged in.

2.3.4 Set-up Verification

1. Select the **Real Time Mode** radio button.
2. Click on the **Strip Chart** button.
3. Change the sample speed to 20 Sample/Secs.
4. Click on the green **GO** button; the strip chart will show the measured output of the MCP6SX2 PGA Thermistor PICtail™ Demo Board.
5. Change the switch positions (SW_1 and SW_2) and verify that the strip chart changes. Figure 2-2 shows the result when R_A was set to 10 kΩ and Rvar to 0Ω, then 12.8 kΩ, and then 217.6 kΩ (see **Section 3.2 "Configuring Board"**).
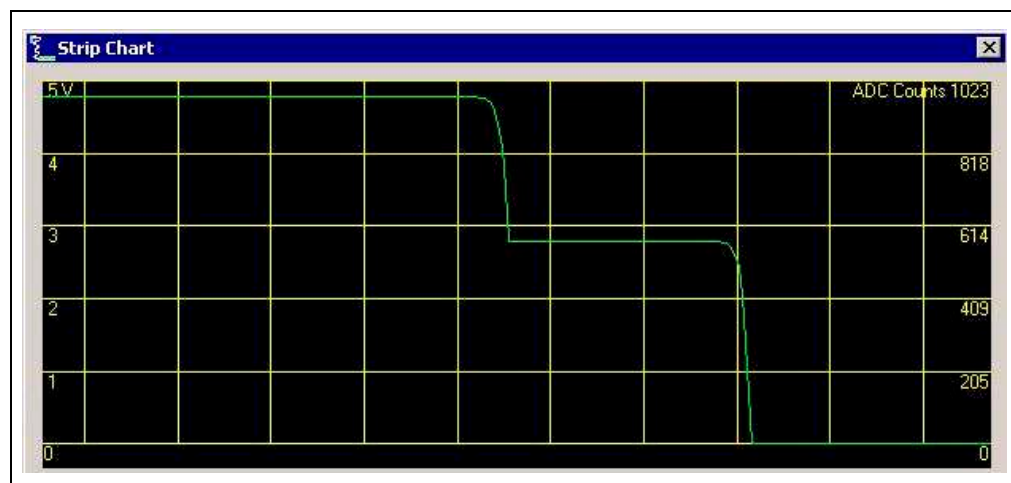

FIGURE 2-2:   *Strip Chart.*

Chapter 3. Using the MCP6SX2 PGA Thermistor PICtail™ Demo Board

3.1 INTRODUCTION

This demonstration board makes it easy to explore the operation of two thermistor applications using the MCP6S22 PGA. Items discussed in this chapter include:
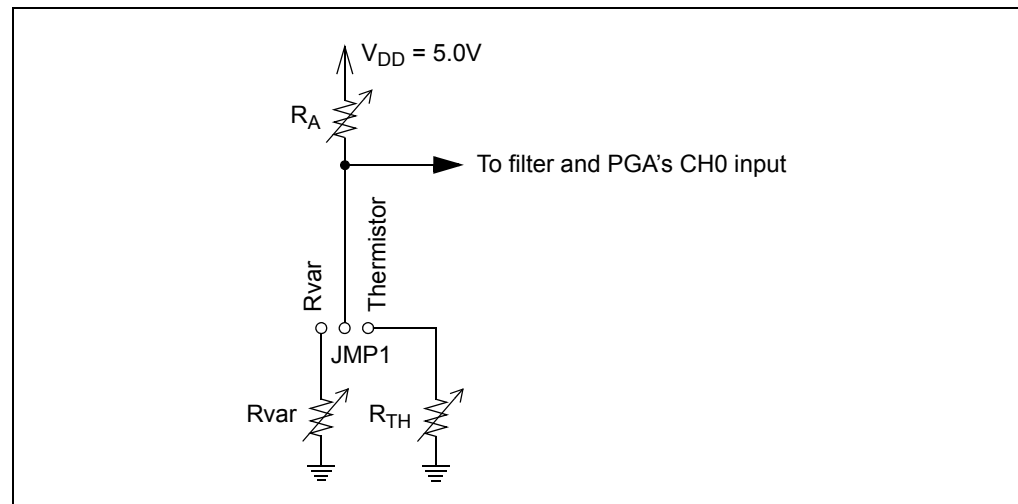
- Configuring the Board
- Using the Signal Analysis PC Program for This Board
- Stand-Alone Board Set-up

3.2 CONFIGURING BOARD

3.2.1 Configuring Jumper JMP1 (select Thermistor or Rvar)

Figure 3-1 shows how jumper JMP_1 configures the circuit. When the shorting bar is on the right side of jumper JMP_1, the thermistor R_{TH} is connected to the circuit. When it is on the left side of jumper JMP_1, the thermistor emulator Rvar is connected to the circuit.

Refer to Figure A.4 for the complete schematic.

FIGURE 3-1:   *Simplified Jumper Circuit.*

3.2.2 Configuring DIP Switch SW1 (R_A)

DIP switch SW_1 and resistors $R_1 – R_7$ in Figure 3-2 emulate the voltage divider resistor (R_A in Figure 3-1). R_1 is placed in series with the others to prevent shorting the supplies together. These resistors produce a binary sequence of values between 0.5 kΩ and 32.0 kΩ.

Refer to Figure A.4 for the complete schematic.
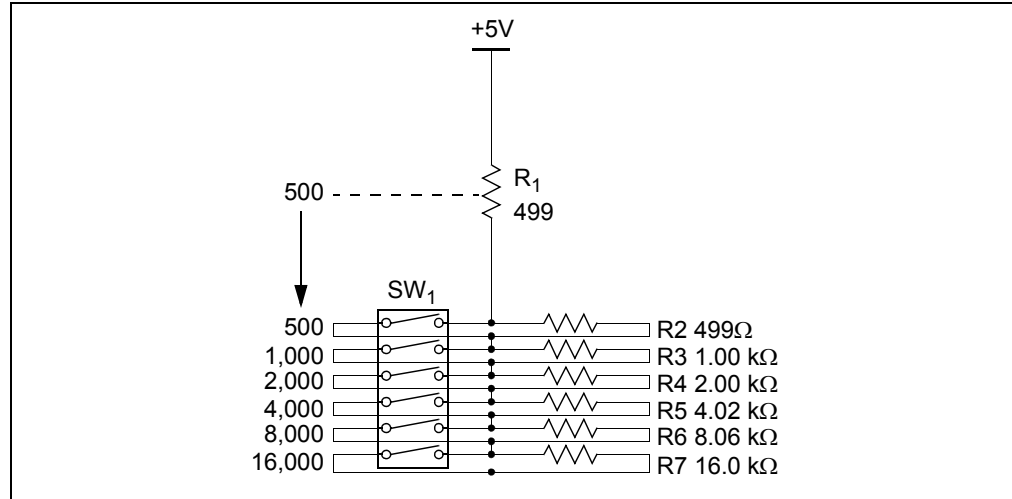
FIGURE 3-2: *R_A Emulator.*

Each resistor with its switch (in SW_1) pointing to the right, away from the silk screen resistor values, is not added into the total for R_A (it shorts that resistor).

Each resistor with its switch (in SW_1) pointing to the left, towards the silk screen resistor values, is added into the total for R_A.

As an example, if the top four switches are to the right, and the bottom two are to the left, then R_A is calculated as 500 + 0 + 0 + 0 + 0 + 8,000 + 16,000 = 24,500Ω.

3.2.3 Using the Thermistor (R_{TH})

R_{21} in **Section A.4 "Board Schematic"** is the thermistor (R_{TH} in Figure 3-1). The resistance changes depending on temperature; see AN897, *"Thermistor Temperature Sensing with MCP6SX2 PGAs"* (DS00897).

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3.2.4 Configuring DIP Switch SW2 (R_{TH} Emulator, Rvar)

DIP switch SW2 and resistors $R_8 - R_{19}$ in Figure 3-3 comprise the thermistor emulator (Rvar in Figure 3-1). Rvar produces a binary sequence of resistances between 0Ω and 409.5 kΩ.

Refer to Figure A.4 for the complete schematic.
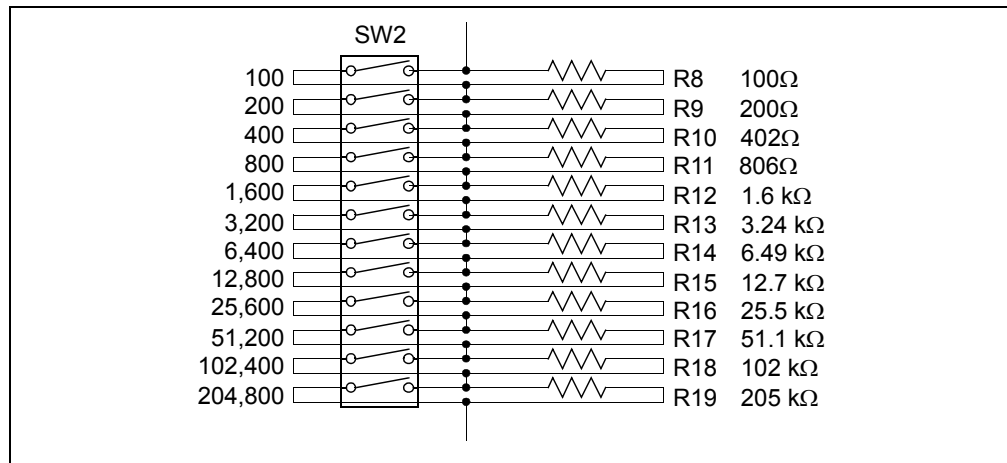
FIGURE 3-3: R_{TH} Emulator (Rvar).

Each resistor with its switch (in SW_2) pointing to the right, away from the silk screen resistor values, is not added into the total for R_A (it shorts that resistor).

Each resistor with its switch (in SW_2) pointing to the left, towards the silk screen resistor values, is added into the total for R_A.

As an example, if the top ten switches are to the right, and the bottom two are to the left, then Rvar is calculated as 0 + 0 + ... + 0 + 102,400 + 204,800 = 307,200Ω.

AN897, *"Thermistor Temperature Sensing with MCP6SX2 PGAs"* (DS00897) contains information on converting this resistance to the equivalent, nominal thermistor temperature, and visa-versa.

3.2.5 Using the Signal Analysis PC Application for This Board

See **"Chapter 2. Using the PICkit™ Signal Analysis PC Application"** of the *"Signal Analysis PICtail™ Daughter Board User's Guide"* (DS51476) for details on displaying measured results. The possible formats include: oscilloscope, FFT, histogram and strip-chart.

The measured results can then be interpreted as temperature; see AN897, *"Thermistor Temperature Sensing with MCP6SX2 PGAs"* (DS00897).

3.2.6 Choosing Firmware for the Signal Analysis PICtail Daughter Board

Use the standard `PICA2Dlab.hex` file to measure and analyze the PGA's output voltage. This file supports all of the display functionality of the PICkit 1 Signal Analysis PC application program.

Use `Therm_PGA1.hex` to implement the first design shown in AN897, *"Thermistor Temperature Sensing with MCP6SX2 PGAs"* (DS00897). Its output can only be viewed on the strip chart. The results need to be manually converted to commonly-seen temperatures (codes 0 to 1023 convert to 0.0°C to 102.3°C).

Use `Therm_PGA2.hex` to implement the second design in AN897, *"Thermistor Temperature Sensing with MCP6SX2 PGAs"* (DS00897). Its output can only be viewed on the strip chart. The results need to be manually converted to commonly-seen temperatures (codes 0 to 1023 convert to 0.0°C to 102.3°C).
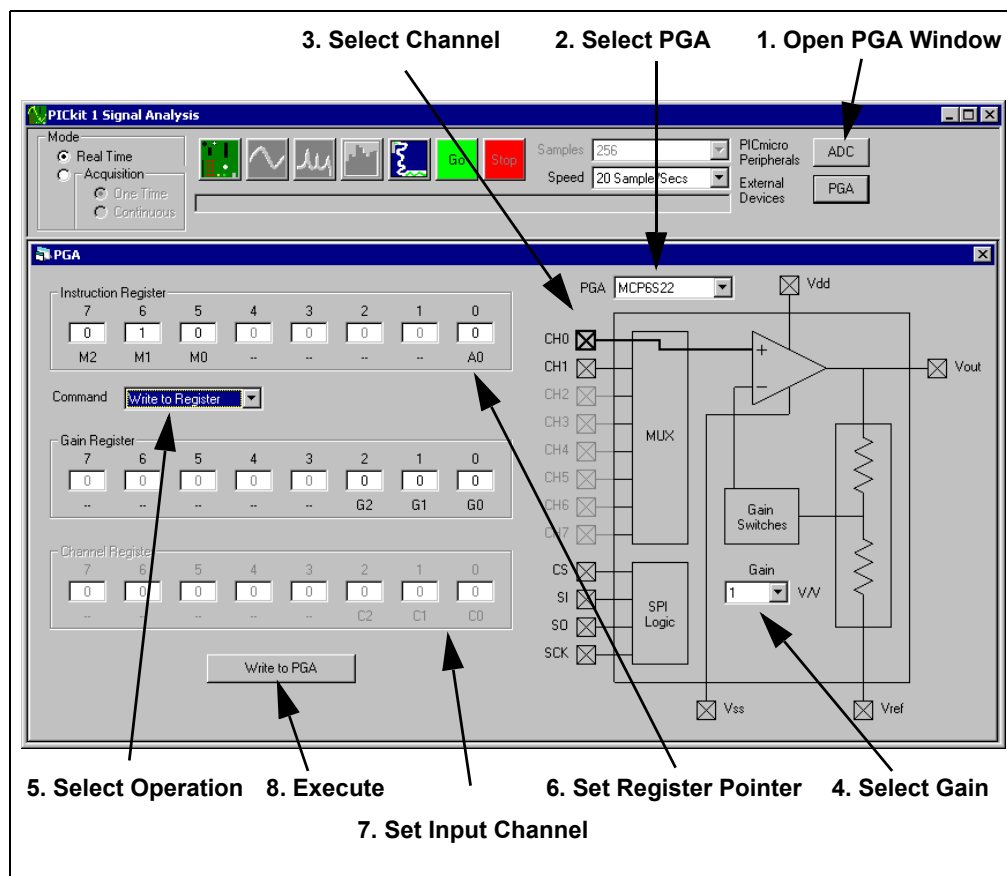
3.2.7 Configure the PGA

The PICkit 1 Signal Analysis PC program can configure the PGA; see Figure 3-4. The MCP6S22 PGA defaults to a gain of 1 and CH0.

> **Note:** The MCP6S92 PGA powers up to a random state; it must have its gain and input written to it before it will operate as expected.

1. Open the PGA window by clicking the **External Devices** button.
2. Select the correct PGA from the indicated pull-down list.
3. Select the desired PGA input. Usually the selection will be CH0 for the thermistor output, but it can be CH1 when another input source is provided at the CH1 test point (Figure 1-1).
   a. Select **Write to Register** from the indicated pull-down list. (Figure 3-4, #5)
   b. Set A0 = 1. (Figure 3-4, #6)
   c. Set C2:C0 to all zeros. (Figure 3-4, #7)
   d. Execute the command by clicking on the **Write to PGA** button. (Figure 3-4, #8)
4. Select the desired PGA gain.
   a. Select **Write to Register** from the indicated pull-down list. (Figure 3-4, #5)
   b. Set A0 = 0. (Figure 3-4, #6)
   c. Select PGA gain from the pull-down list. (Figure 3-4, #4))
   d. Execute the command by clicking on the **Write to PGA** button. (Figure 3-4, #8)

FIGURE 3-4:   *PGA Configuration.*

3.2.8   Configure the ADC

The ADC is automatically setup by the PICkit 1 Signal Analysis PC program. The two possible inputs are shown in Figure 3-5.

1. If in the Real Time Mode of operation (Strip Chart), select the **Number of Samples** from the first pull-down list.
2. Select the **Sample Rate** from the second pull-down list.
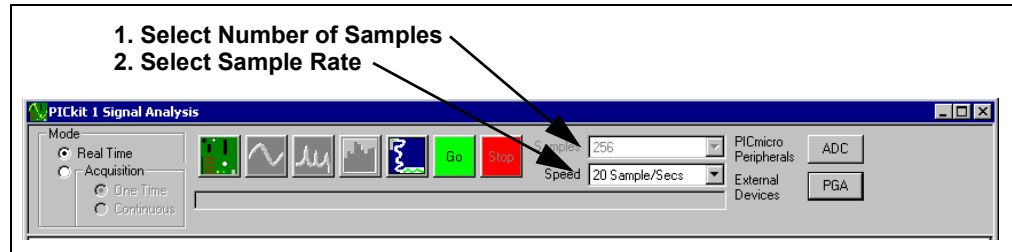
FIGURE 3-5:   *Standard ADC Options.*

The PICkit 1 Signal Analysis PC program allows the user to manually configure the ADC.

1. Clicking the ADC button (see Figure 3-6) opens the ADC configuration window. This window starts at the power-on default conditions for the ADC; therefore, it must be configured before use.

See the PIC16F684 data sheet (DS41202) for more information on configuring the registers.
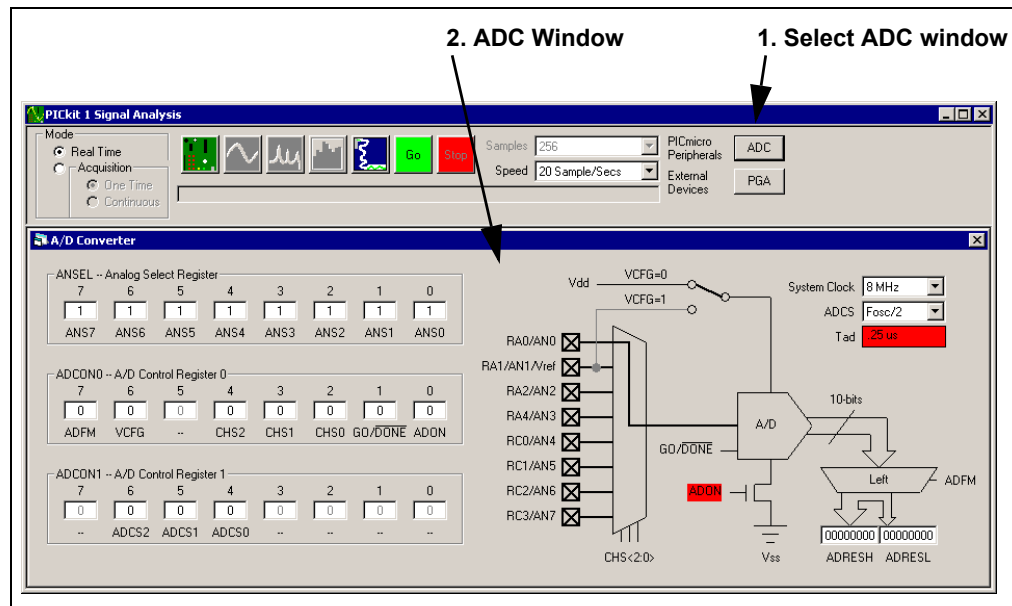
FIGURE 3-6:   *Manual ADC Configuration.*

3.2.9 Measurement Example

Jumper JMP_1 was configured to select the thermistor, R_{21} (R_{TH} in Figure 3-1). R_A was set at 10 kΩ (Design # 1). The thermistor was at room temperature. The MCP6S22 PGA was at its default settings, input CH0 and gain = 1. The results using the `PICA2Dlab.hex` file (**Section 3.2.6 "Choosing Firmware for the Signal Analysis PICtail Daughter Board"**) are shown in Figure 3-7. The output voltage is 2.568V.
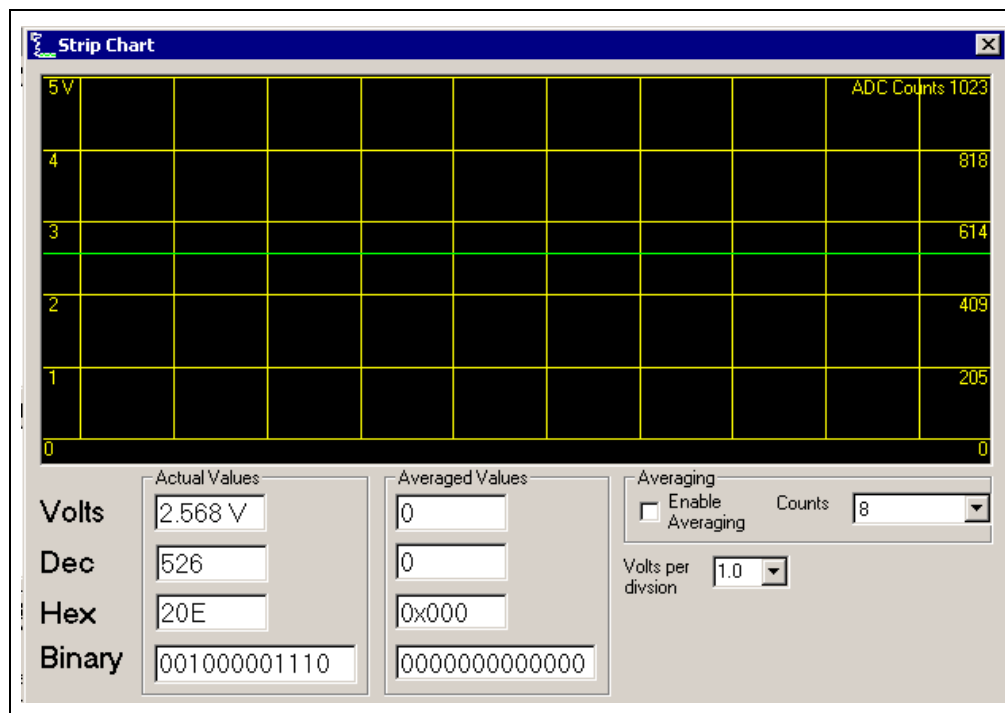

FIGURE 3-7:   *Measurement Results.*

The output voltage was used to calculate $R_{TH} \approx 10.56$ kΩ and $T_{TH} \approx 23.5°C$ (74.3°F).

See AN897, *"Thermistor Temperature Sensing with MCP6SX2 PGAs"* (DS00897).

3.2.10 Stand-Alone Board Setup

Figure 3-8 shows one possible method for using the MCP6SX2 PGA Thermistor PICtail™ Demo Board as a stand-alone (without the accompanying tools shown in Figure 1-2). Most of the probes from the lab equipment (on the left) connect to the test points. The oscilloscope (O-Scope) probe to V_{OUT} connects to header J2's pin # 10 (labeled RC0).
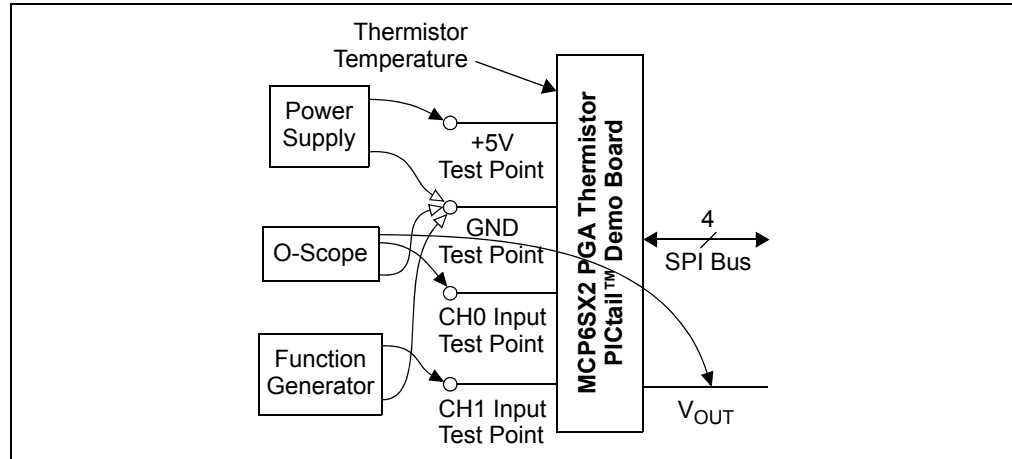
FIGURE 3-8: *MCP6SX2 PGA Thermistor PICtail™ Demo Board Block Diagram.*

The PGAs' power supply range is between 2.5V and 5.5V. The SPI bus needs to be connected to a microcontroller with the appropriate firmware. The MCP6S22 PGA powers up to input CH0 and 1 V/V gain. The MCP6S92 needs to be initialized after power-up.

Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the schematics and layouts for the MCP6SX2 PGA Thermistor PICtail™ Demo Board.

The MCP6SX2-PICTLTH demonstration board is constructed using a two-layer Printed Circuit Board (PCB). The top layer is for components and traces, while the bottom layer is the ground plane.

Information on this board includes:

• Board Schematic
• Board - Top Silk-Screen And Metal Layers
• Board - Top Metal Layer
• Board - Bottom Metal Layer

A.2 DEMONSTRATION BOARD DESCRIPTION

A simplified block diagram of this board is shown in Figure 1-1. The detailed schematic is given in Figure A.4.

DIP switch SW_1 and resistors $R_1 - R_7$ emulate the voltage divider's series resistor (R_A in Figure 3-1). R_1 is placed in series with the others to prevent shorting the supplies together. Resistors $R_1 - R_7$ produce a binary sequence of values between 0.5 kΩ and 32.0 kΩ.

R_{21} is the thermistor (R_{TH} in Figure 3-1).

DIP switch SW_2 and resistors $R_8 - R_{19}$ (labeled Rvar in top silk screen) emulate the thermistor. Rvar produces a binary sequence between 0Ω and 409.5 kΩ.

The jumper JMP_1 selects either the thermistor or its emulator Rvar. R_{20} and C_1 are the low-pass analog filters used to minimize noise. They also act as anti-aliasing filters for the ADC.

U_1 is either the MCP6S22 or the MCP6S92 Programmable Gain Amplifier (PGA). The PGA buffers the transimpedance amplifier output and makes it possible to gain up weak signals before conversion by the ADC. J_2 connects this board to the Signal Analysis board. C_2 and C_3 are bypass capacitors that minimize power supply noise.

The demonstration board includes test points for convenience on the bench. The +5V and GND test points connect to the board's supply voltages. The CH0 test point connects to the PGA's CH0 input; it is also connected to the voltage divider's output (with filtering). The CH1 test point allows the user to place any desired signal at the PGA's CH1 input.

> **Note:** While headers J1, J2, and J3 are shown together in the schematic (see Figure A.4), J2 is installed (see Table B-1), while J1 and J3 are not. J2 and J3 are placeholders only.

A.3   ADDITIONAL COMMENTS

The demonstration board includes test points for convenience on the bench. The +5V and GND test points connect to the board's supply voltages. The CH0 test point connects to the PGA's CH0 input; it is also connected to the voltage divider's output (with filtering). The CH1 test point allows the user to place any desired signal at the PGA's CH1 input.

The PIC16F684 (and 10-bit ADC) are not part of the demo board schematic; see Figure 1-3 instead.

The PICkit 1 Flash Starter Kit provides a +5V single supply voltage. It can drive up to 5 µF on the supply; a larger capacitive load causes current loading and timing issues.

The PICkit 1 Flash Starter Kit Signal Analysis PICtail Daughter Board uses the +5V single supply voltage. It has 0.1 µF local bypass capacitors for each IC, and a 1 µF bulk bypass capacitor for the entire board.

This demonstration board also uses the +5V single supply voltage. It has a 0.1 µF local bypass capacitor for the PGA, and a 1 µF bulk bypass capacitor for the entire board. A solid ground plane provides a good ground for the PGA.

High-frequency design practices are used to minimize digital interference:

• Solid ground plane
• Surface-mount devices
• Separate digital and analog lines and sections
• Straight and short lines to the PGA

A.4   BOARD SCHEMATIC