MCP3221
PICtail™ Demo Board
User's Guide

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MCP3221 PICTAIL™ DEMO BOARD USER'S GUIDE

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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.

For the most up-to-date information on development tools, see the MPLAB® IDE on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP3221 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 MCP3221 PICtail Demo Board. The manual layout is as follows:

- **Chapter 1. "Overview"** – Important information about the MCP3221 PICtail Demo Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with this demo board, with a detailed description of each function.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP3221 PICtail Demo Board.
- **Appendix B. "Bill-Of-Materials (BOM)"** – Lists the parts used to build the MCP3221 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
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier font:		
Plain Courier	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	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}`

RECOMMENDED READING

This user's guide describes how to use the MCP3221 PICtail Demo Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP3221 Data Sheet, *"Low Power 12-Bit A/D Converter with I²C™ Interface"*, DS21732

This data sheet provides detailed information regarding the MCP3221 device.

AN845, *"Communicating with the MCP3221 using PICmicro® Microcontrollers"*, DS00845

This application note provides the necessary firmware for interfacing to the MCP3221 device.

THE MICROCHIP WEB SITE

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- **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

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- 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 (FAE) 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

In addition, there is a Development Systems Information Line which lists the latest versions of Microchip's development systems software products. This line also provides information on how customers can receive currently available upgrade kits.

The Development Systems Information Line numbers are:

1-800-755-2345 – United States and most of Canada

1-480-792-7302 – Other International Locations

DOCUMENT REVISION HISTORY

Revision A (March 2005)

- Initial Release of this Document.

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP3221 PICtail Demo Board and covers the following topics:

- What is the MCP3221 PICtail Demo Board?
- What the MCP3221 PICtail Demo Board Kit Includes

1.2 WHAT IS THE MCP3221 PICtail DEMO BOARD?

The MCP3221 device is a low-power, 12-bit A/D Converter (ADC) in a SOT-23 package. It communicates via an I^2C™ interface.

A stand-alone demonstration is possible using a USB port and the DataView™ software. The MCP3221 PICtail Demo Board is also used to evaluate and demonstrate the MCP3221 device using the PICkit™ 1 Flash Starter Kit.

1.3 WHAT THE MCP3221 PICtail DEMO BOARD KIT INCLUDES

This MCP3221 PICtail Demo Board Kit includes:

- The MCP3221 PICtail Demo Board (with MCP3221 installed)
- A USB Cable
- MCP3221 DataView™ software
- MCP3221 PICtail™ Demo Board User's Guide (DS51545)
- MCP3221 Data Sheet, *"Low Power 12-Bit A/D Converter with I^2C™ Interface",* (DS21732)
- AN845, *"Communicating with the MCP3221 using PICmicro® Microntrollers"* , (DS00845) – includes firmware

NOTES:

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP3221 PICtail Demo Board is designed to demonstrate Microchip Technology's MCP3221 device performance with the DataView™ software, a Personal Computer (PC) GUI, by way of the USB port. A mechanical potentiometer and a prototype area are used as the optional input sources to the device. This demo board can be used to demonstrate firmware development to the MCP3221 device using the PICKit™ 1 Flash Starter Kit.

This board is designed to evaluate the MCP3221 with minimum PCB noise. It uses a two-layer board with both analog and digital ground planes. The circuit schematic and layout have been carefully considered such that the user can evaluate true 12-bit performance using a simple PC USB power supply.

2.2 FEATURES

The MCP3221 PICtail Demo Board has the following features:

- Allows simple evaluation of device performance using USB interface and DataView software
- On-board PIC16C745 USB for DataView communication
- Data is displayed in an easy-to-read format complete with data-logging
- Easy to interface to PICKit™ 1 Flash Starter Kit evaluation system
- Simple DC signal generation using mechanical potentiometer

2.3 GETTING STARTED

The MCP3221 PICtail Demo Board is used for evaluation and demonstration of the PGA's features. A block diagram of the demo board layout is shown in Figure 2-1. The following procedure describes how to operate this demo board.

1. Install and run the GUI from the PC.
2. Connect the MCP3221 PICtail Demo Board to a PC using a USB cable.
3. Use jumper JP1 to select the mechanical potentiometer.
4. The ADC output code will be graphically displayed on the PC.

2.4 MCP3221 PICtail DEMO BOARD DESCRIPTION

The major components of the MCP3221 PICtail demo board are listed.

1. MCP3221 device (U1)
2. PICmicro® MCU – PIC16C745 (U2)
3. PICkit™ Starter Kit Header (J1)
4. USB Connector (J2)
5. Analog Input and Prototype Area (TP)
6. Input Selection Jumper (JP1)
7. Potentiometer Input (VR1)

For more detailed circuit information, refer to **Appendix A. "Schematic and Layouts"** and **Appendix B. "Bill-Of-Materials (BOM)"**.

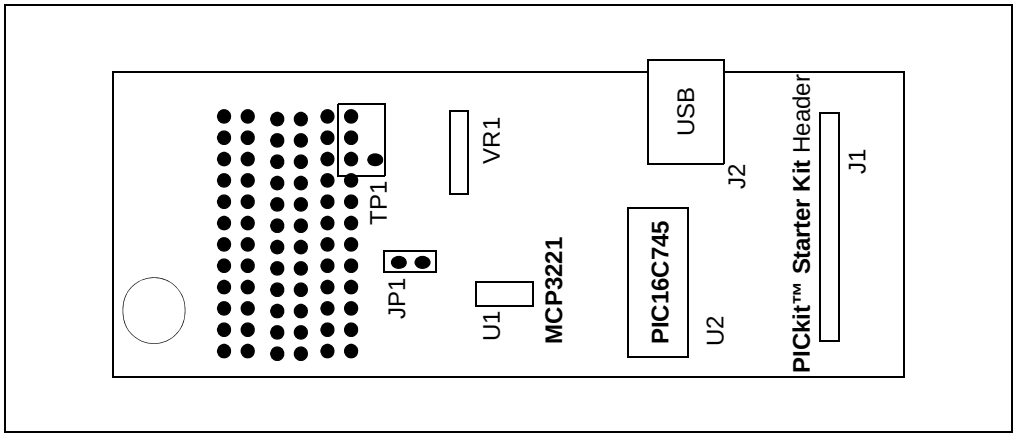

FIGURE 2-1: *MCP3221 PICtail™ Demo Board Block Diagram.*

2.4.1 Hardware Power

The USB power is regulated and filtered before supplying power to the MCP3221 device. The raw USB power supplies the digital voltage to the PICmicro MCU only. This digital power supply is filtered through the LRC circuit and the 4.1V regulator as it becomes the analog voltage (A_{VDD}) for the MCP3221. This analog power supply is also used as the reference for the mechanical potentiometer. This regulated ratiometric connection achieves superior performance from the typically noisy PC USB power supply.

2.4.2 MCP3221 Interface to PICkit™ 1 Flash Starter Kit

The MCP3221 is an infrared device. The two data lines, SCL and SDA, are connected from the PICkit Starter Kit header J1 to the appropriate port pins, RC0 and RC1. +5V and V_{SS} are the other two PICkit Starter Kit connections made on the MCP3221 PICkit header.

2.4.3 Selecting The Analog Input

The MCP3221 analog input is tied directly to TP1, next to a small area for prototyping. A mechanical potentiometer is also connected to this node, allowing for a quick DC evaluation of the device's function. When the jumper is selected, the wiper of the mechanical potentiometer is connected to the analog input of the device. When the jumper is de-selected, the analog input is connected only to TP1 and the prototype area.

2.4.4 Reading the MCP3221 Output Using the DataView™ Software GUI

The DataView software displays the digital output of the MCP3221 ADC in a graphical format on any Windows® compatible PC. Through the USB port, each 12-bit word is transferred from the MCP3221 to the PC, converted to decimal and then plotted on the graph shown in Figure 2-2. Each consecutive conversion is added to the **right side** of the graph. The y-axis of the graph displays the output codes that have been collected and automatically scales for any given output code range.The x-axis of the graph automatically scrolls to the left once the entire graph has been filled with samples.

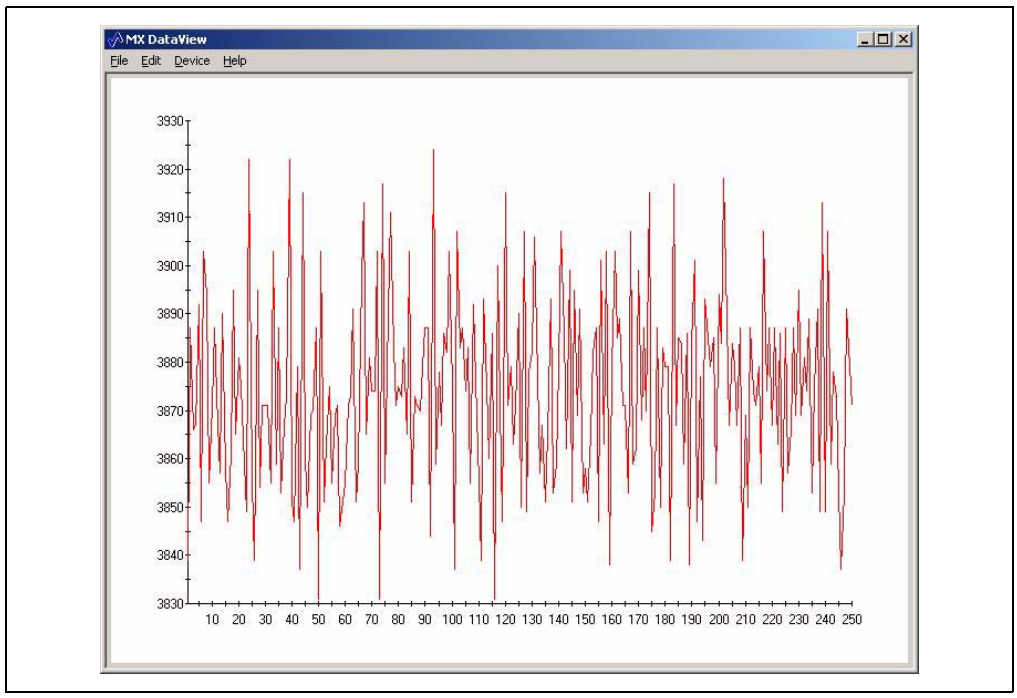

FIGURE 2-2: *DataView™ Software Output.*

2.4.5 Using the Data Logging Feature of the DataView™ Software

The DataView software can be used to record MCP3221 conversion data and then to save to a ASCII text file by selecting "File >> Save Data" from the Program menu. The frequency of conversion and subsequent data log is user-selected under "Device >> Configure" from the Program menu. Here the number of samples and polling interval is selected. Please note the polling interval refers to the PC to PICmicro MCU polling interval, not the PICmicro MCU to ADC sample rate.

NOTES:

Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP3221 PICtail Demo Board:

- Board Schematic – Digital circuitry
- Board – Top Layer
- Board – Bottom Layer

A.2 SCHEMATICS AND PCB LAYOUT

Figure A-2 shows the MCP3221 PICtail Demo Board schematic, while Figure A-3 and Figure A-4 show the layout for the two different layers. The layer order is shown in Figure A-1.

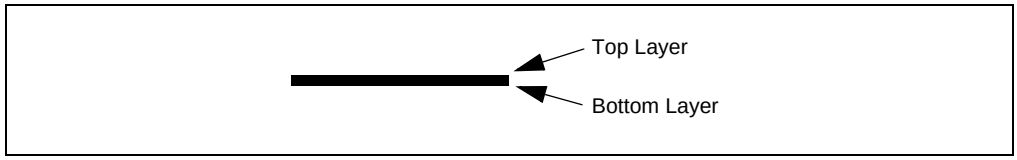

FIGURE A-1: *Layer Order.*

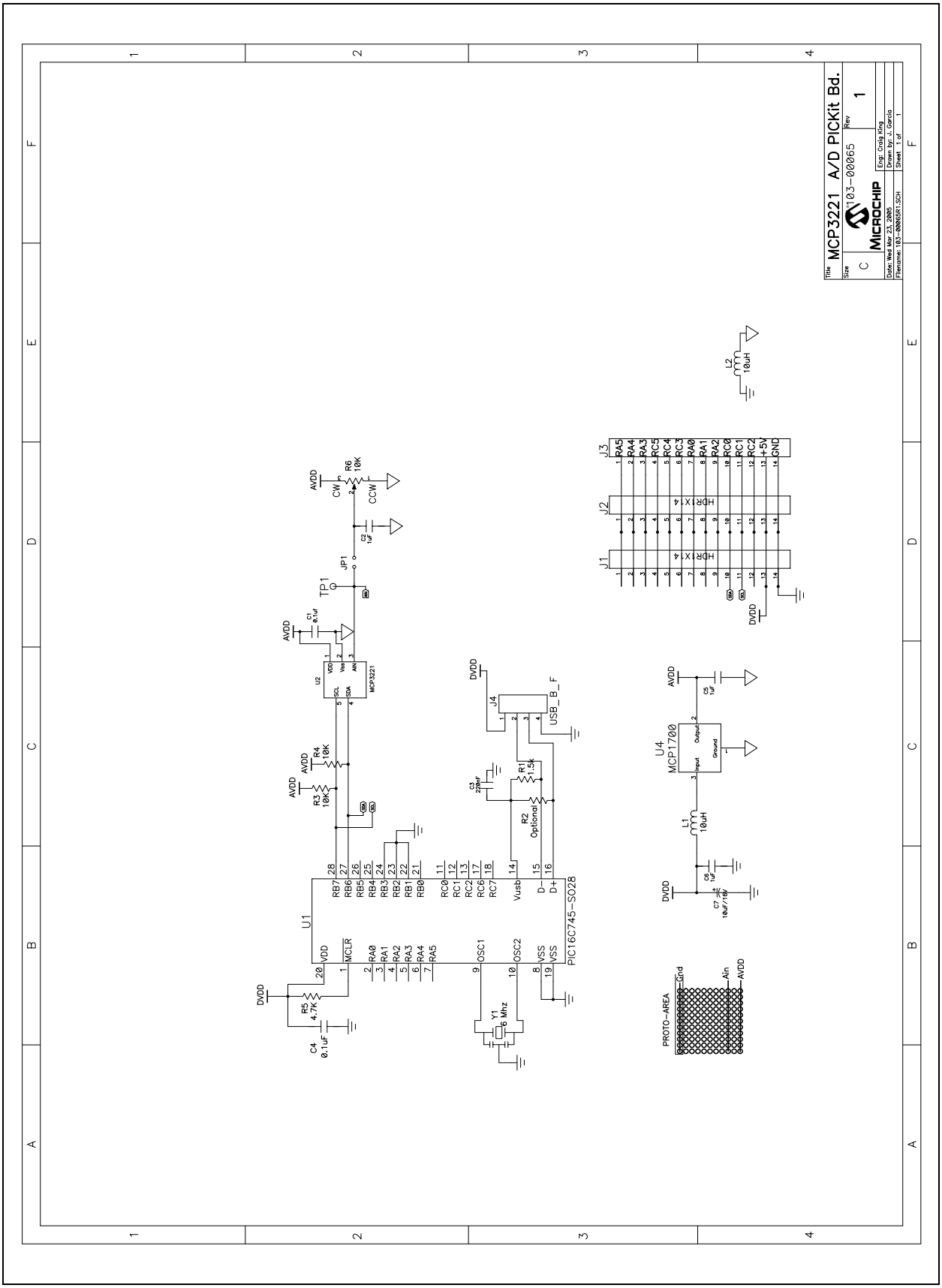

FIGURE A-2: *MCP3221 PICtail™ Demo Board Schematic.*

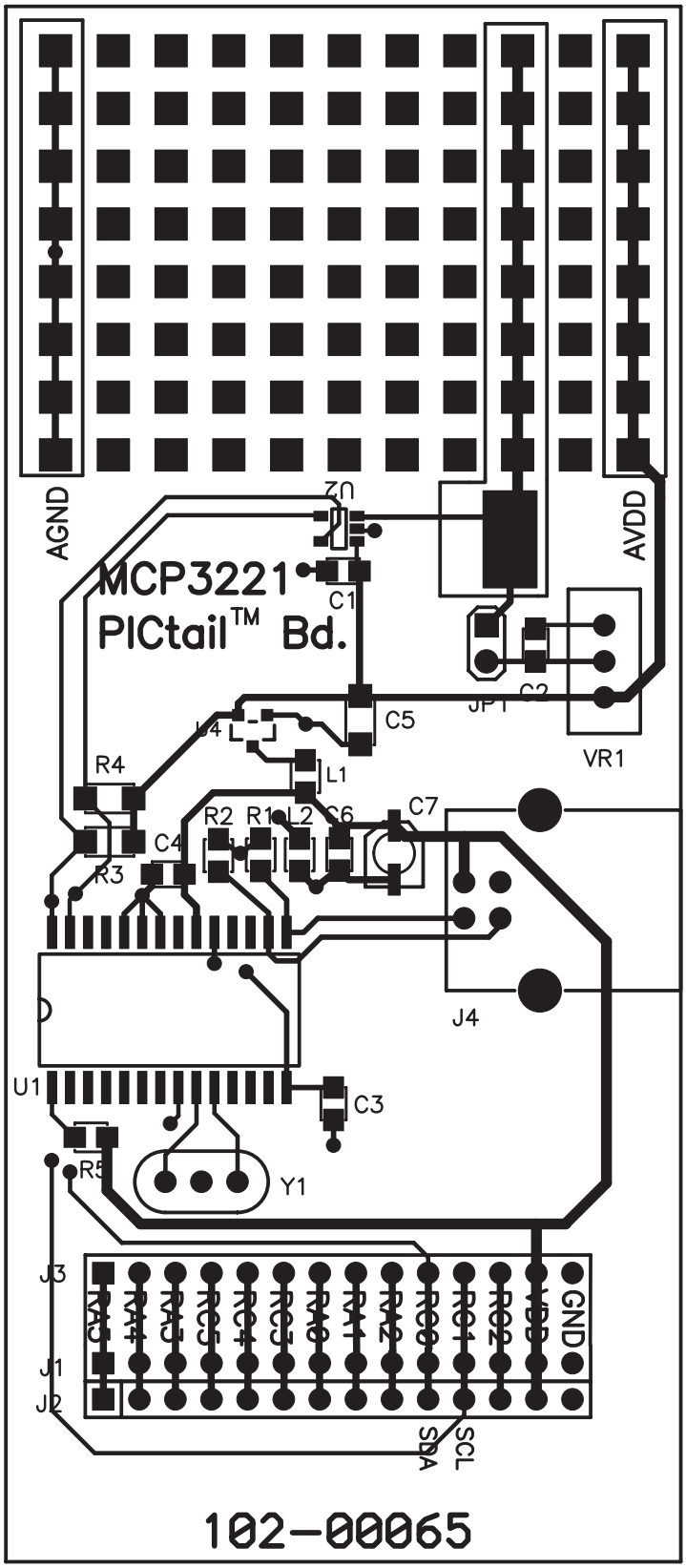

FIGURE A-3: *MCP3221 PICtail™ Demo Board Layout – Top Layer.*

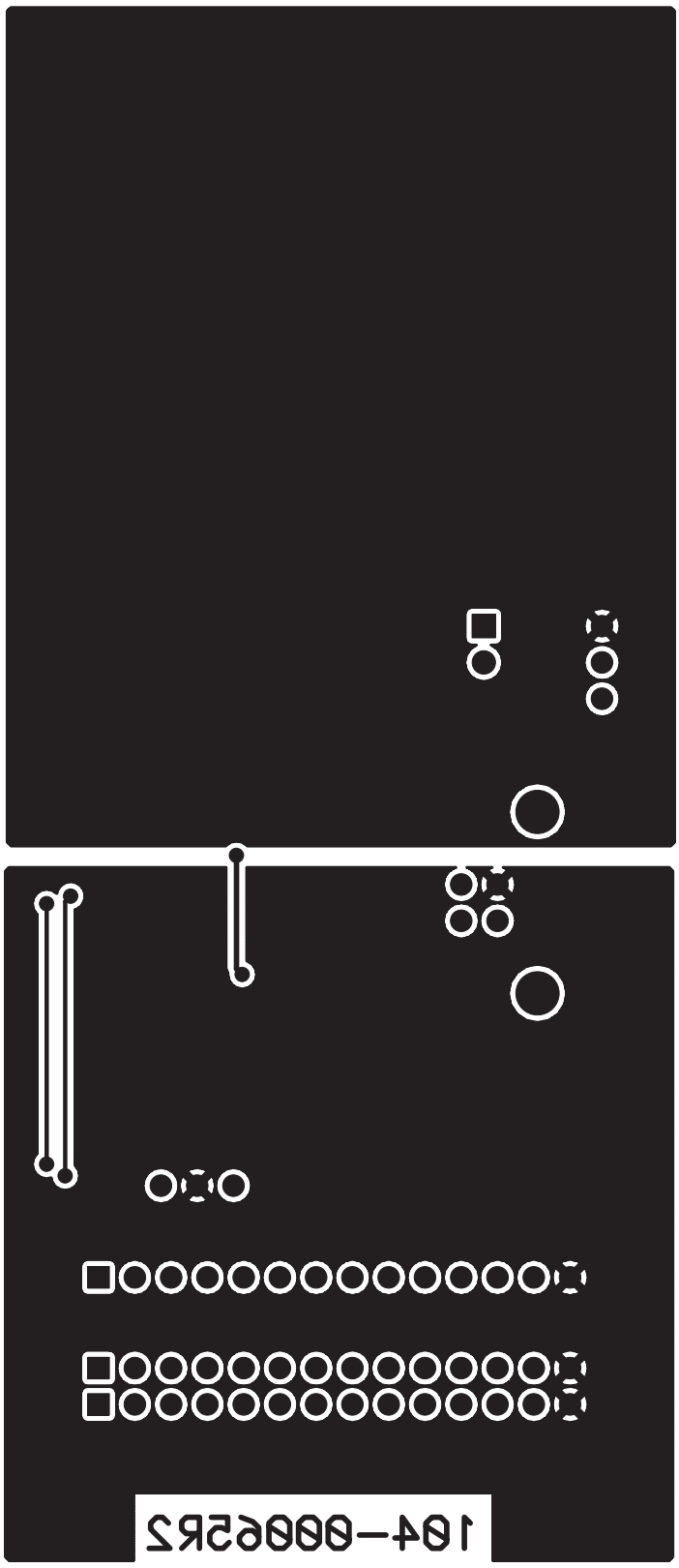

FIGURE A-4: *MCP3221 PICtail™ Demo Board Layout – Bottom Layer.*

Appendix B. Bill-Of-Materials (BOM)

TABLE B-1: BILL-OF-MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
1	C1,C4	CAP .1UF 25V CERAMIC X7R 0805	Panasonic® - ECG	ECJ-2VB1E104K
3	C2,C5,C6	CAP 1.0UF 10V CERAMIC X7R 0805	Kemet®	C0805C105K8RACTU
1	C3	CAP .22UF 16V CERAMIC Y5V 0805	Panasonic - ECG	ECJ-2VF1C224Z
1	C7	CAP 10UF 16V ELECT HD SMD	Panasonic - ECG	EEV-HD1C100R
1	R1	RES 1.50K OHM 1/10W 1% 0805 SMD	Panasonic - ECG	ERJ-6ENF1501V
1	R2	OPEN/Optional		NOT USED
2	R3,R4	RES 10.0K OHM 1/10W 1% 0805 SMD	Panasonic - ECG	ERJ-6ENF1002V
1	R5	RES 4.75K OHM 1/10W 1% 0805 SMD	Panasonic - ECG	ERJ-6ENF4751V
1	R6	POT 10K OHM THUMBWHEEL CERM ST	Bourns® Inc.	3352W-1-103
2	L1,L2	INDUCTOR MULTILAYER 10UH 1008	TDK® Electronics Co., LTD	NLV25T-100J-PF
1	TP1	PC TEST POINT COMPACT SMT	Keystone® Electronics	5016
1	JP1	CONN HEADER 2POS .100 VERT TIN	Molex®/Waldom® Electronics Corp.	22-28-4021
1	Y1	RESONATOR 6.00 MHZ CERAMIC W/CAP	ECS™ Inc	ZTT-6.00MT
1	U1	PIC16C745I/SO	Microchip Technology Inc.	Will Provide
1	U2	MCP3221A5T-I/OT	Microchip Technology Inc.	Will Provide
1	U4	MCP1700T-3302E/TT	Microchip Technology Inc.	Will Provide
1	J4	CONN USB RTANG FEMALE TYPE B PCB	Assmann Electronics, Inc	AU-Y1007
4	4 CORNERS	BUMPON HEMISPHERE .44X.20 CLEAR	3M®/ESM	SJ-5303 (CLEAR)

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