PICkit™ Serial I²C™ Demo Board User's Guide

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PICkit™ SERIAL I²C™ 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 PICkit™ Serial I^{2}C™ 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 PICkit™ Serial I^{2}C™ Demo Board as a development tool. The manual layout is as follows:

• **Chapter 1. "Product Overview"** – Important information about the PICkit™ Serial I^{2}C™ Demo Board.
• **Chapter 2. "Installation and Operation"** – Includes instructions on how to use the PICkit™ Serial I^{2}C™ Demo Board.
• **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the PICkit™ Serial I^{2}C™ Demo Board.
• **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the PICkit™ Serial I^{2}C™ Demo Board.

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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 PICkit™ Serial I^{2}C™ Demo Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

24AA02/24LC02B Data Sheet, *"2K I^{2}C Serial EEPROM"* **(DS21709)**

This data sheet provides detailed information regarding the 24LC02B family.

MCP9800/1/2/3 Data Sheet, *"2-Wire High-Accuracy Temperature Sensor"* **(DS21909)**

This data sheet provides detailed information regarding the MCP9801 product.

MCP3221 Data Sheet, *"Low Power 12-Bit A/D Converter w/I^{2}C Interface"* **(DS21732)**

This data sheet provides detailed information regarding the MCP3221 product.

TC1321 Data Sheet, *"10-Bit Digital-to-Analog Converter w/Two-Wire Interface"* **(DS21387)**

This data sheet provides detailed information regarding the TC1321 product.

MCP23008/MCP23S08 Data Sheet, *"8-Bit I/O Expander with Serial Interface"* **(DS21919)**

This data sheet provides detailed information regarding the MCP23008/MCP23S08 product.

MCP1525/41 Data Sheet, "2.5V and 4.096V Voltage Reference" (DS21653)

This data sheet provides detailed information regarding the MCP1525/41 product.

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• Distributor or Representative
• Local Sales Office
• Field Application Engineer (FAE)
• Technical Support

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

PICkit™ Serial I²C™ Demo Board User's Guide

DOCUMENT REVISION HISTORY

Revision A (May 2007)

• Initial Release of this Document.

Chapter 1. Product Overview

1.1 INTRODUCTION

The PICkit™ Serial I²C™ Demo Board demonstrates I²C serial communications and operation of the following devices:

- 24LC02B - 2Kbit Serial EEPROM
- MCP9801 - High-Accuracy Temperature Sensor
- MCP3221 - Low-Power 12-Bit A/D Converter
- TC1321 - 10-Bit Digital-to-Analog Converter
- MCP23008 - 8-Bit I/O Expander

The PICkit™ Serial I²C™ Demo Board was designed to easily connect to the PICkit Serial Analyzer (DV164122). The PICkit Serial Analyzer provides the I²C master mode serial communications and power. The PICkit™ Serial I²C™ Demo Board devices all operate in the I²C slave mode. The PICkit™ Serial I²C™ Demo Board can easily be connected to virtually any demo or development board by connecting the communications lines to connector P1.

1.2 HIGHLIGHTS

This chapter discusses:

- I²C Serial Communications
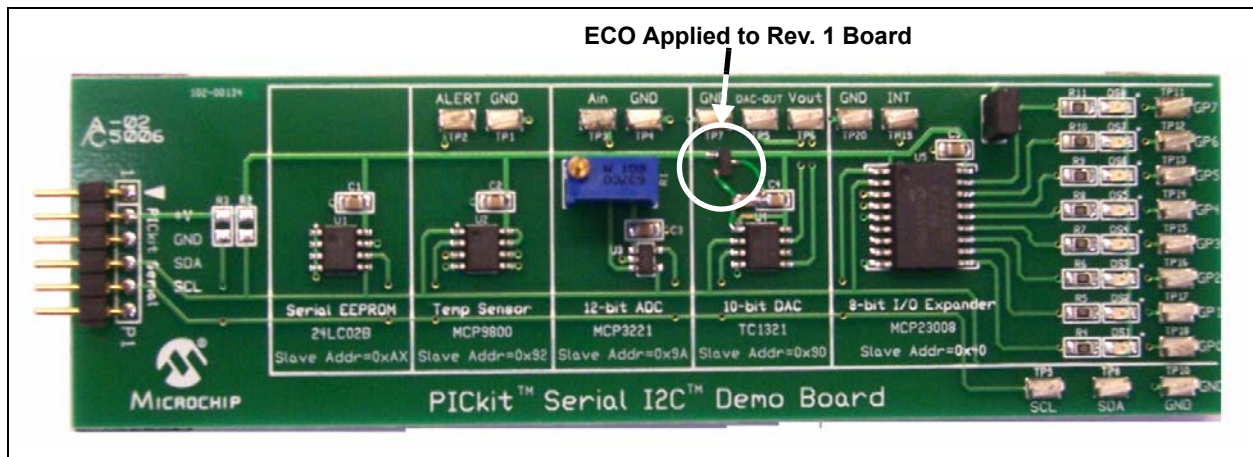- I²C Demo Board Operation
- I²C Demo Board Devices

FIGURE 1-1: *PICkit™ Serial I²C™ Demo Board.*

> **Note:** Figure 1-1 shows the Rev. 1 board with an ECO (Engineering Change Notice) applied to it. The Rev. 1 board with ECO and the Rev. 2 board are electrically the same. Refer to **Appendix A. "Schematic and Layouts"** for Rev. 2 schematics and board layouts.

PICkit™ Serial I^{2}C™ Demo Board User's Guide

1.3 I^{2}C SERIAL COMMUNICATIONS

It is assumed that the user is familiar with I^{2}C Serial Communications. For more information see:

- The I^{2}C-Bus Specification Version 2.1 January 2000 is available from NXP Semiconductor (formally Philips Semiconductor) website at http://www.nxp.com/acrobat_download/literature/9398/39340011.pdf
- An I^{2}C Master Communications tutorial is available on the Microchip Technology website. Click on the links: Support --> Getting Started --> PIC MCU Tutorials --> I^{2}C Master Mode
- Several application notes are available on the Microchip Technology website. Click on links: Design --> App Notes --> Function: Communications --> I^{2}C

1.4 WHAT THE PICkit™ SERIAL I^{2}C™ DEMO BOARD KIT INCLUDES

This PICkit™ Serial I^{2}C™ Demo Board Kit includes:

- PICkit™ Serial I^{2}C™ Demo Board (102-00134)
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
  - PICkit™ Serial I^{2}C™ Demo Board User's Guide (DS51657)

Chapter 2. Installation and Operation

2.1 I²C DEMO BOARD OPERATION

The PICkit™ Serial I²C™ Demo Board was designed to easily connect to the PICkit Serial Analzyer (DV164122). Refer to the PICkit Serial Analyzer User's Guide (DS51647) chapter on I²C Master Communications mode for configuration and operation information of the PICkit Serial Analyzer.

The PICkit Serial Analyzer provides the I²C master mode serial communications and power. The PICkit™ Serial I²C™ Demo Board devices all operate in the I²C slave mode. Figure 2-1 shows the PICkit™ Serial I²C™ Demo Board block diagram.

Pull-up resistors R2 and R3 are not populated. The PICkit Serial Analyzer can be configured to enable internal pull-up resistors. When using the PICkit Serial Analyzer, enable internal pull-up resistors. Or resistors R2 and R3 can be populated by the user for use with other development boards or the PICkit Serial Analyzer internal pull-up resistors disabled.
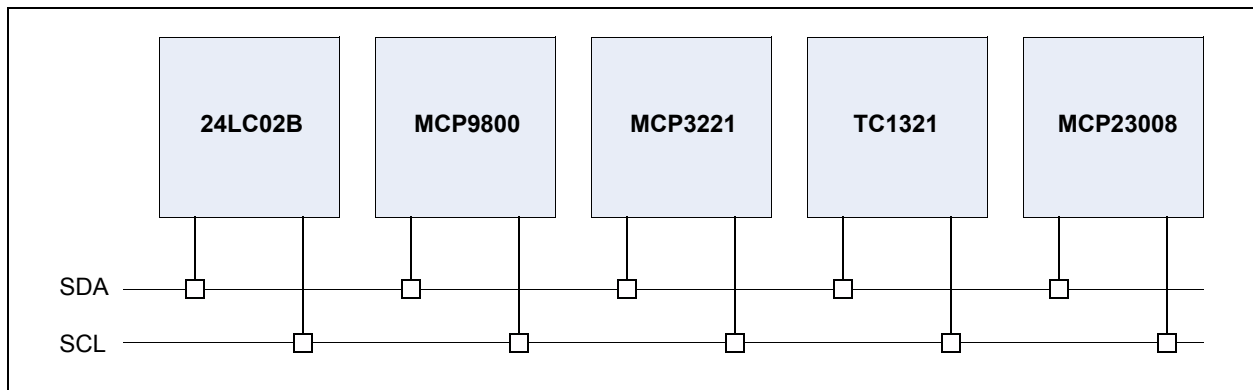

FIGURE 2-1: *PICkit™ Serial I²C™ Demo Board Block Diagram.*

Connector P1 connects to the PICkit Serial Analyzer or virtually any demo or development board. Connector P1 pin assignments are listed in Table 2-1.

TABLE 2-1: **I²C DEMO BOARD CONNECTOR P1 PIN ASSIGNMENTS**

Pin	Label	Type	Description
1	—	—	No Connection
2	+V	Power	Power
3	GND	Ground	Ground
4	SDA	Input/Output	Serial Data
5	SCL	Input	Serial Clock
6	—	—	No Connection

2.2   DEVICES

2.2.1   24LC02B 2Kbit Serial EEPROM

The 24LC02B is a 2Kbit Serial EEPROM. Refer to the 24AA02/24LC02B Data Sheet (DS21709) for complete information. The slave address is 0xAX (where x = any value).

Data can be read or written to the 24LC02B.

2.2.2   MCP9801 High-Accuracy Temperature Sensor

The MCP9801 is a High-Accuracy Temperature Sensor. Refer to the MCP9800/MCP9801 Data Sheet (DS21909) for complete information. The slave address is 0x92.

The temperature can be read from the MCP9801. Test points **ALERT** and **GND** provide signals that can be read using a voltmeter or oscilloscope.

2.2.3   MCP3221 Low-Power 12-Bit A/D Converter

The MCP3221 is a Low Power 12-Bit A/D Converter. Refer to the MCP3221 Data Sheet (DS21732) for complete information. The slave address is 0x9A.

Potentiometer R1 is configured as a voltage divider (see schematic in **Appendix A. "Schematic and Layouts"**). The wiper is connected to the input. The voltage can be read by the MCP3221 and can be verified using an volt meter on test points A_{IN} and **GND**.

2.2.4   TC1321 10-Bit Digital-to-Analog Converter

The TC1321 is a 10-Bit Digital-to-Analog Converter. Refer to the TC1321 Data Sheet (DS21387) for complete information. The slave address is 0x90.

The V_{REF} signal is generated by a MCP1525 2.5 Voltage Reference. The DAC output voltage swing (V_{SW}) will be between 0 - 2.5V.

The output of the TC1321 can be measured using a volt meter at test points V_{OUT}, **DAC-OUT**, and **GND**.

2.2.5   MCP23008 8-Bit I/O Expander

The MCP23008 is an 8-bit I/O Expander. Refer to the MCP23008/MCP23S08 Data Sheet (DS21919) for complete information. The slave address is 0x40.

The output of the MCP23008 drives LEDs **DS1** through **DS8**. The LEDs provide an easy to see indication of the MCP23008 operation. Jumper **JP1** must be closed using a 2-pin shunt for the LEDs to operate. The LEDs can be disabled by removing **JP1**.

The output of the MCP23008 is connected to test points **GP0** through **GP7** and **GND**. These test points can be monitored by a volt meter or connected to an external device. LEDs **DS1** through **DS8** can be used to monitor the output by closing **JP1** with a 2-pin shunt or disable by removing **JP1**.
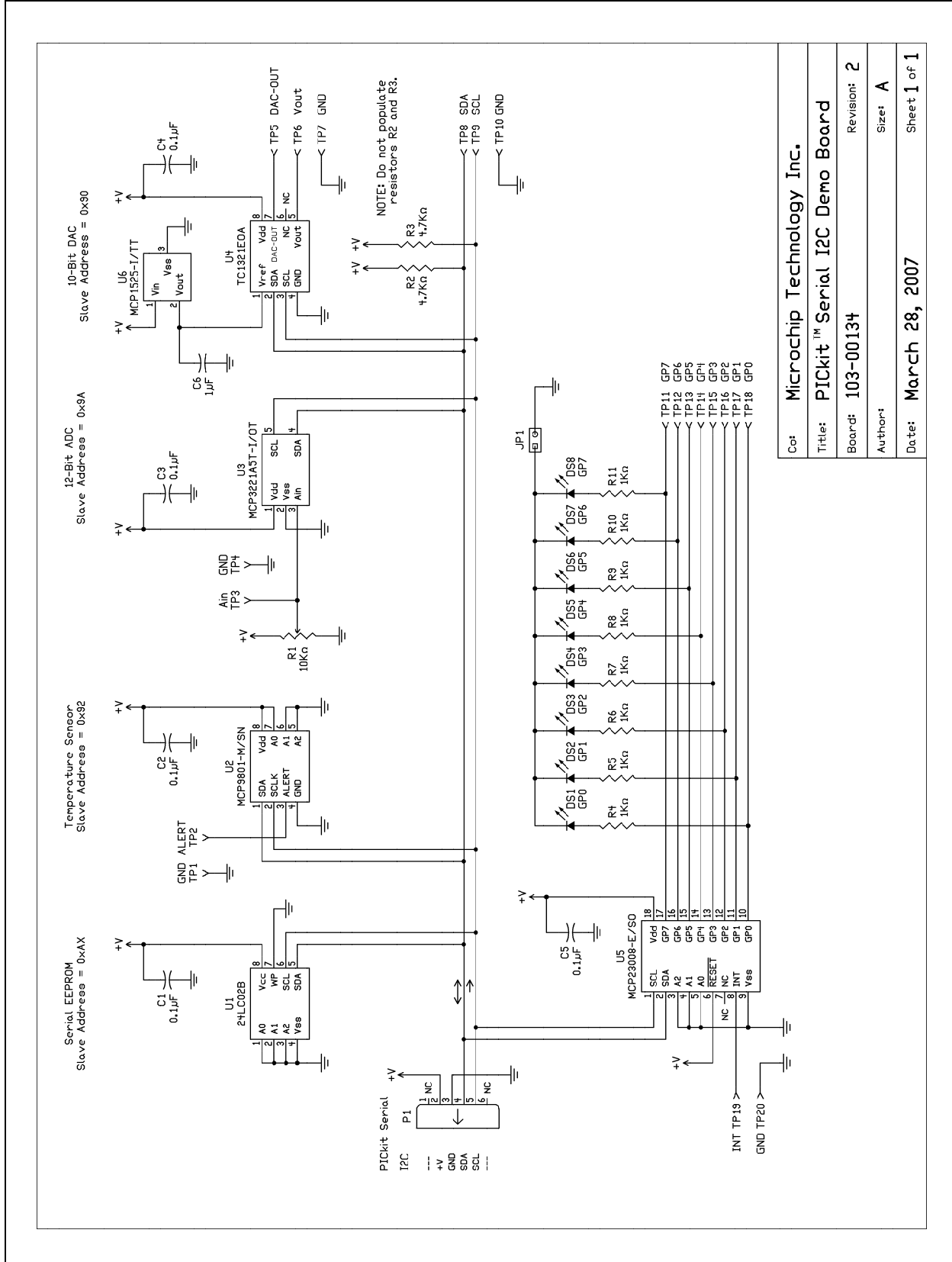
Appendix A. Schematic and Layouts

A.1   INTRODUCTION

This appendix contains the following schematics and layouts for the PICkit™ Serial I²C™ Demo Board User's Guide:
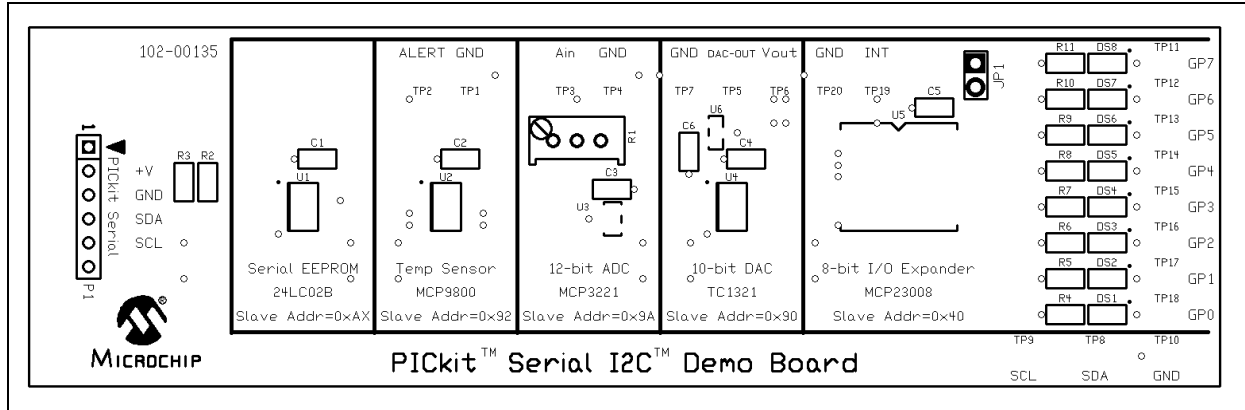
• Board – Schematic
• Board – Top Silk Layer
• Board – Top Metal Layer
• Board – Bottom Metal Layer

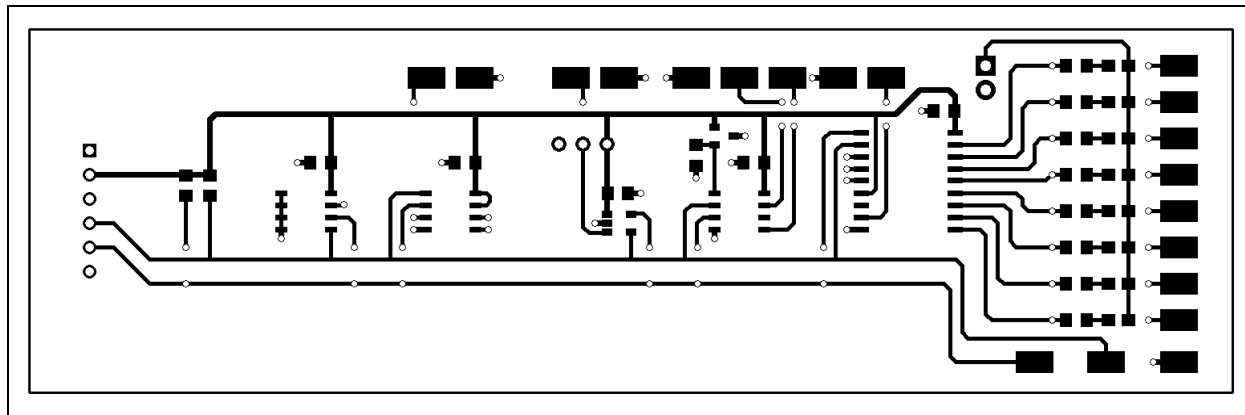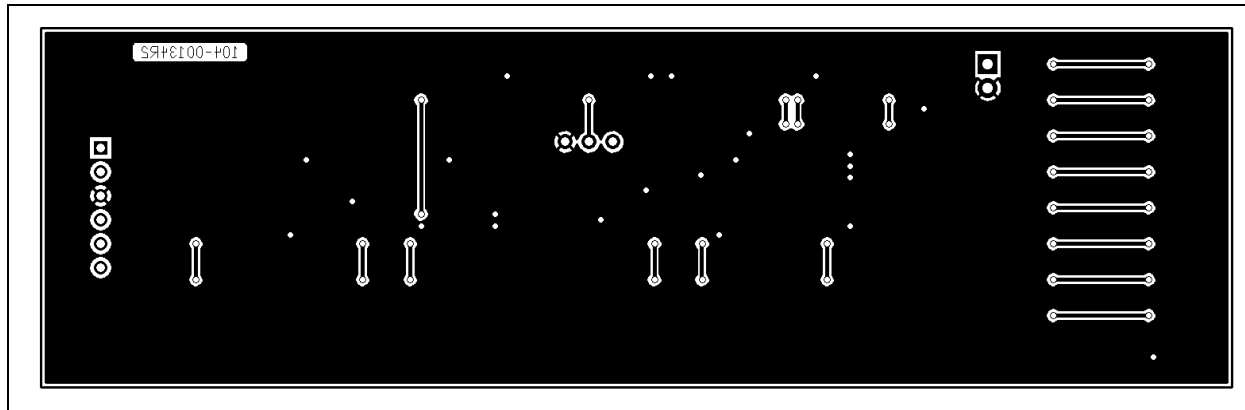# PICkit™ Serial I²C™ Demo Board User's Guide

A.2   BOARD - SCHEMATIC

Schematic and Layouts

A.3   BOARD - TOP SILK LAYER

A.4   BOARD - TOP LAYER

A.5   BOARD - BOTTOM LAYER

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NOTES:

Appendix B. Bill Of Materials (BOM)

TABLE B-1:   BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
5	C1, C2, C3, C4, C5	CAP .1UF 16V CERAMIC X7R 0805	Panasonic® - ECG	ECJ-2VB1C104K
1	C6	1UF 10V CERAMIC X7R 0805	Kemet	C0805C105K8RACTU
8	DS1, DS2, DS3, DS4, DS5, DS6, DS7, DS8	LED RED ORANGE CLEAR 0805 SMD	LITE-ON INC	LTST-C170EKT
4	EA Corner	BUMPON SQUARE .40X.10 BLACK	3M	SJ-5007 (BLACK)
1	JP1	CONN HEADER 2POS .100 VERT TIN	Molex/Waldom Electronics Corp	22-28-4020
1	JP1	CONN JUMPER SHORTING GOLD FLASH	Sullins Electronics Corp.	SPC02SYAN
1	PCB	RoHS Compliant Bare PCB, PICkit Serial I2C demo board	—	104-00134
1	P1	CONN HEADER 6POS .100 R/A GOLD	Molex/Waldom Electronics Corp	22-28-8062
1	R1	POT 10K OHM 3/8" SQ CERM SL MT	Bourns Inc.	3296W-1-103LF
2	R2, R3	DO NOT POPULATE	—	—
8	R4, R5, R6, R7, R8, R9, R10, R11	RES 1.0K OHM 1/8W 5% 0805 SMD	Panasonic - ECG	ERJ-6GEYJ102V
20	TP1 - TP20	TEST POINT PC COMPACT SMT	Keystone Electronics®	5016
1	U1	IC SERIAL EEPROM 2K 2.5V 8-SOIC	Microchip Technology Inc.	24LC02B-I/SN
1	U2	2-Wire High-Accuracy Temperature Sensor	Microchip Technology Inc.	MCP9800-M/SN
1	U3	Low Power 12-Bit A/D Converter With I2C™ Interface	Microchip Technology Inc.	MCP3221A5T-I/OT
1	U4	10-Bit Digital-to-Analog Converter with Two-Wire Interface	Microchip Technology Inc.	TC1321EOA
1	U5	8-Bit I/O Expander with Serial Interface	Microchip Technology Inc.	MCP23008-E/SO
1	U6	MCP1525, 2.5V Voltage Reference	Microchip Technology Inc.	MCP1525-I/TT

Note 1:   The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

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