



MICROCHIP

**28-PIN 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 “DSXXXXA”, where “XXXX” 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 online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the 28-Pin Demo Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Revision History

DOCUMENT LAYOUT

This document describes how to use the 28-Pin Demo Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Section Chapter 1. “28-Pin Demo Board Overview”** – This chapter provides an overview of the 28-pin Demo Board for Microchip’s 28-pin PIC[®] Microcontroller Units (MCU).
- **Appendix A. “Hardware Schematics”** – Illustrates the 28-Pin Demo Board hardware schematic diagram, PCB layout and Bill of Materials.

28-Pin Demo Board User's Guide

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB[®] IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> 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	<u><i>File>Save</i></u>
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	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [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) { ... }

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use 28-Pin Demo Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

PIC16F883/884/886/887 (DS40001291)

Consult this document for information regarding the PIC16F883/884/886/887 28/40/44-Pin Enhanced Flash-Based, 8-Bit CMOS Microcontroller.

PICKit™ 3 Microcontroller Programmer User's Guide (DS52116)

Consult this document for instructions on how to use the PICKit™ 3 In-Circuit Debugger/Microcontroller Programmer software and hardware.

MPLAB® ICD User's Guide (DS51184)

Consult this document for more information pertaining to the features and functions of the MPLAB In-Circuit Debugger (ICD) software.

MPLAB® X IDE User's Guide (DS50002027)

Consult this document for more information pertaining to the installation and features of the MPLAB X Integrated Development Environment (IDE) software.

MPLAB® Code Configurator User's Guide (DS40001725)

Consult this document for instructions on how to use the MPLAB Code Configurator to generate peripheral driver code.

Readme Files

For the latest information on using other tools, read the tool-specific Readme files in the Readmes subdirectory of the MPLAB X IDE installation directory. The Readme files contain update information and known issues that may not be included in this user's guide.

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THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **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

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM assembler); all MPLAB linkers (including MPLINK object linker); and all MPLAB librarians (including MPLIB object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICKit 3 debug express.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are non-production development programmers such as PICSTART Plus and PICKit 2 and 3.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

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

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://www.microchip.com/support>.

REVISION HISTORY

Revision A (October 2006)

- Initial Release of this Document.

Revision B (April 2015)

- Updated for PICKit™ 3, MPLAB® X IDE, XC8 compiler and MPLAB® Code Configurator.

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Chapter 1. 28-Pin Demo Board Overview

1.1 INTRODUCTION

The 28-Pin Demo Board is a small and simple demonstration PCB for Microchip's 28-pin Dual In-line Package (DIP) PIC[®] Microcontroller Units (MCUs). It is populated with a PIC16F886 MCU, four LEDs, a push button and a potentiometer. The demo board has several test points to access the I/O pins of the MCU and a prototyping area. The MCU can be programmed with the PICKit[™] 3 Microcontroller Programmer or the MPLAB[®] ICD 3 using the RJ-11 to 6-pin inline adapter (AC164110).

1.2 HIGHLIGHTS

This chapter discusses:

- 28-Pin Demo Board Supported Devices
- The 28-Pin Demo Board Overview
- Running the Default Demonstration

1.3 28-PIN DEMO BOARD SUPPORTED DEVICES

The 28-Pin Demo Board can be used with virtually any 28-pin Dual In-line Package (DIP) PIC MCU. The assembled 28-Pin Demo Board is populated with a PIC16F886-I/P microcontroller.

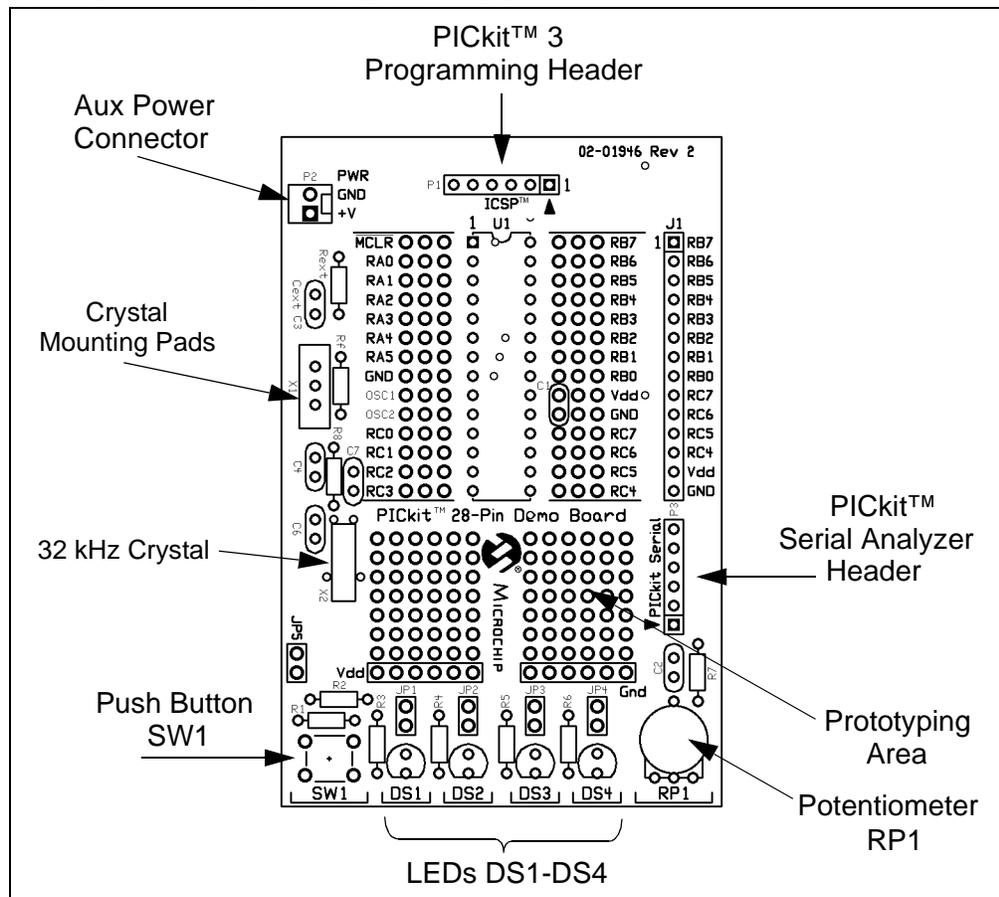
Additional 28-Pin Demo Boards can be ordered from Microchip Technology or distributors via the part number DM164120-3. It comes with one assembled demo board, two blank 28-Pin Demo Boards and samples of PIC16F1938 and PIC18F26K22. The blank demo board can be used for evaluating or prototyping circuits using any of the PIC10F, PIC12F, PIC16F or PIC18F 28-pin devices.

1.4 28-PIN DEMO BOARD OVERVIEW

The 28-Pin Demo Board is populated with a PIC16F886 MCU (U1), four LEDs (DS1-DS4), a push button (SW1), a 32 kHz crystal (X2) and a potentiometer (RP1). The board layout is shown in [Figure 1-1](#). The demo board has several test points to access the I/O pins of the MCU and a prototyping area. The MCU can be programmed with the PICKit[™] 3 via header P1 or the MPLAB[®] ICD 3 using the RJ-11 to 6-pin inline adapter (AC164110).

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FIGURE 1-1: 28-PIN DEMO BOARD



1.5 POWERING THE DEMO BOARD

The 28-Pin Demo Board supports the ability to power the board by two options.

1.5.1 External power supply

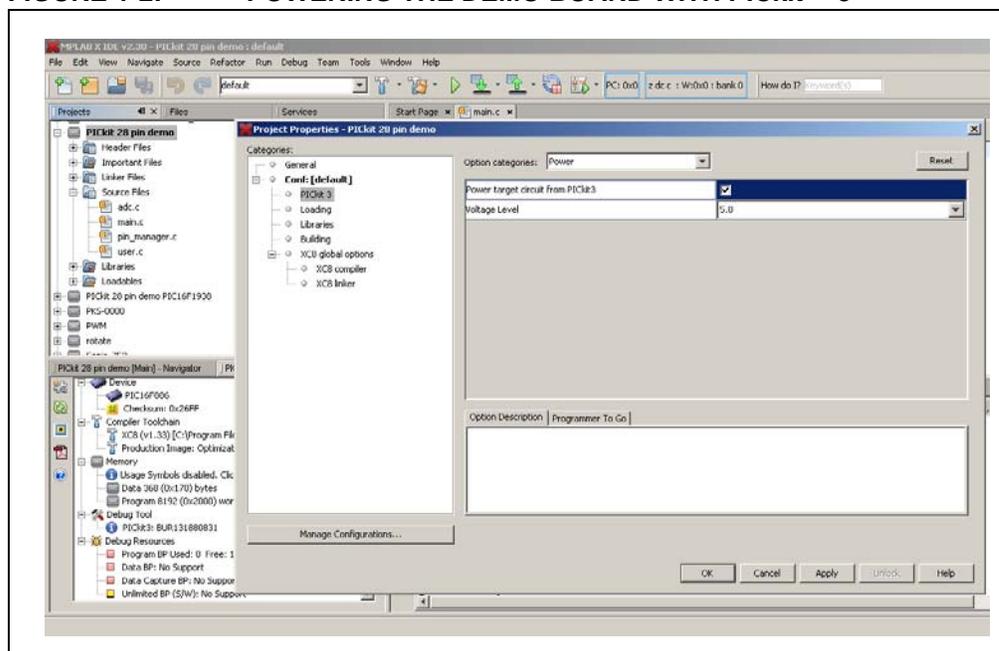
The 28-Pin Demo Board can be powered with an external 3 to 5.5V power supply. Connect a 3 to 5.5V bench power supply to header P2.

1.5.2 Power by Programmer

In order to use the PICkit™ Microcontroller Programmer, connect it to a PC USB port using the USB cable. Connect the PICkit™ 3 to the ICSP™ connector header P1 on the 28-pin Demo Board. Open the Project Properties window in the MPLAB® X IDE, click on the PICkit 3 option and select *Options > Categories > Power*. Select the checkbox labeled "Power target circuit from PICkit 3". Then select 5V for voltage, as shown in Figure 1-2. Click **Apply** and then **OK**. The board can be programmed with these settings.

28-Pin Demo Board Overview

FIGURE 1-2: POWERING THE DEMO BOARD WITH PICKit™ 3



1.6 THE DEFAULT DEMONSTRATION PROGRAM

The assembled 28-Pin Demo Board populated with a PIC16F886-I/P comes preprogrammed with a demonstration program.

A demo program for PIC16F1938 is also available. Driver APIs for the peripherals to be used in the application can be generated automatically using the Microchip Code Configurator (MCC) for the latest 8-bit PIC microcontrollers.

Note: Driver APIs for PIC16F1938 in the demo program are generated using MCC. For details about the Microchip Code Configurator (MCC) go to http://www.microchip.com/pagehandler/en_us/devtools/code_configurator.

The Demo Board will blink the LEDs in the Reset pattern. The Reset pattern consists of three different LED blink patterns. During the first pattern, the LEDs will “ping-pong” (LED1, 2, 3 and 4, then LED 4, 3, 2 and 1). Then, the LEDs will blink ON and OFF in unison. In the third pattern, the LEDs will perform the ADC, where values 0x0A, 0x0D and 0x0C will be displayed in sequence followed by the Most Significant four bits of the ADC result measuring channel 1, which is the on-board potentiometer.

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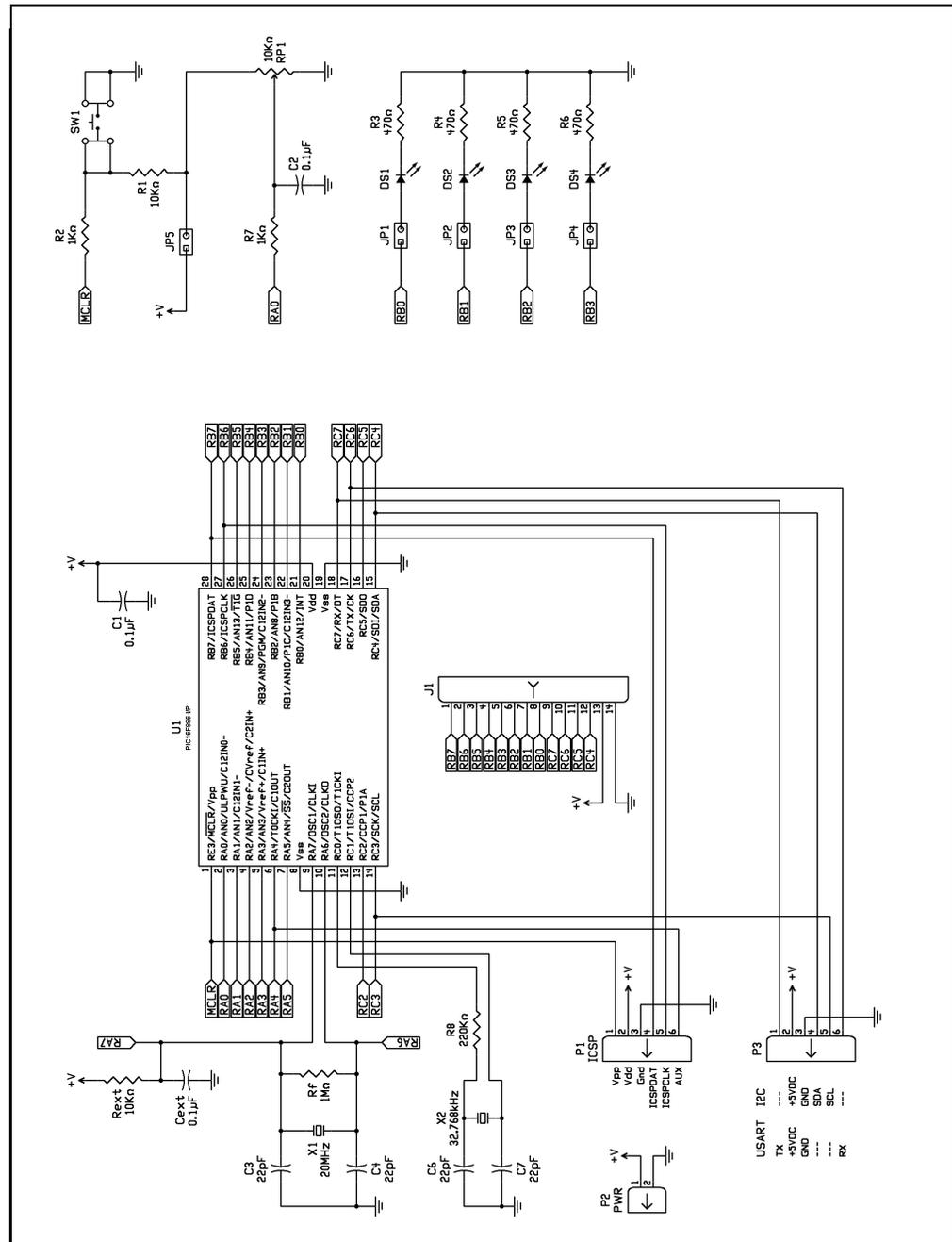
NOTES:

Appendix A. Hardware Schematics

A.1 INTRODUCTION

This appendix contains the 28-Pin Demo Board schematic, PCB layout and Bill of Materials.

FIGURE A-1: SCHEMATIC DIAGRAM



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FIGURE A-2: SILKSCREEN

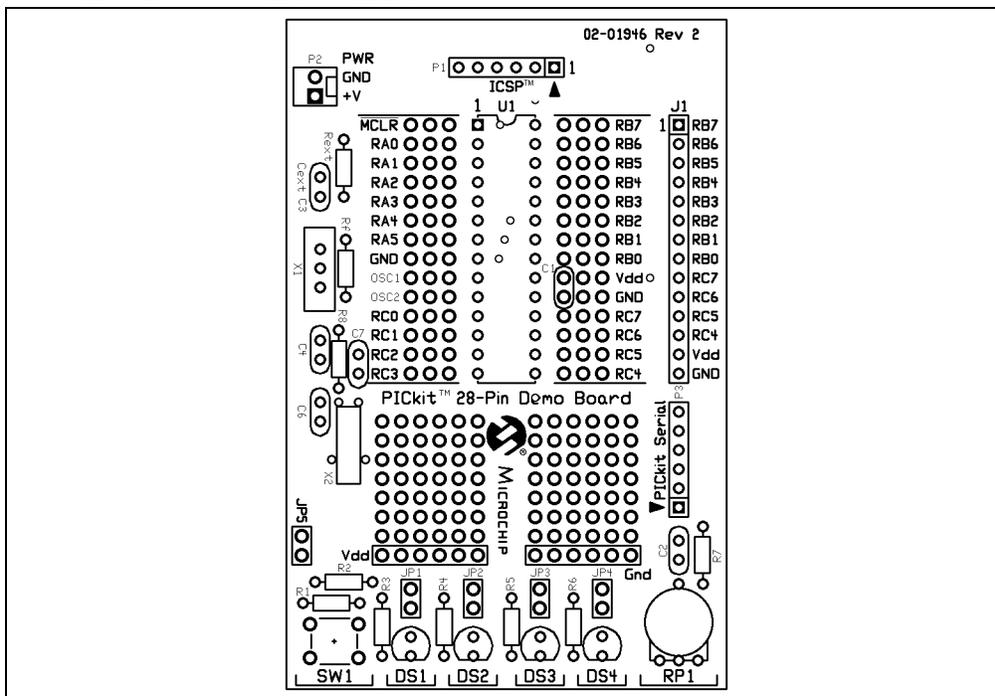


FIGURE A-3: TOP COPPER

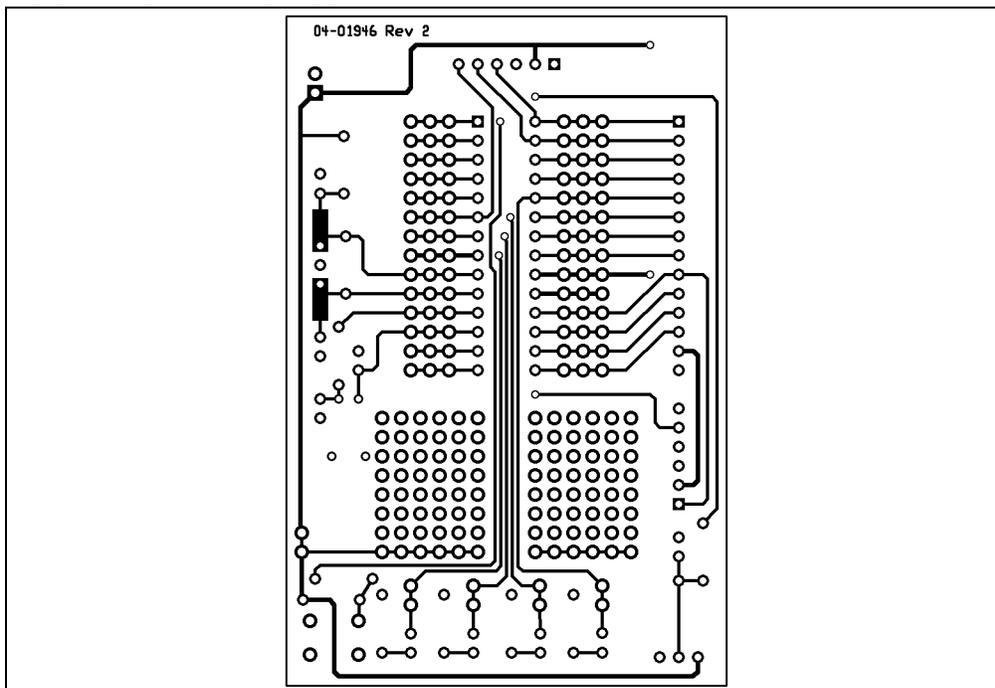


FIGURE A-4: BOTTOM COPPER

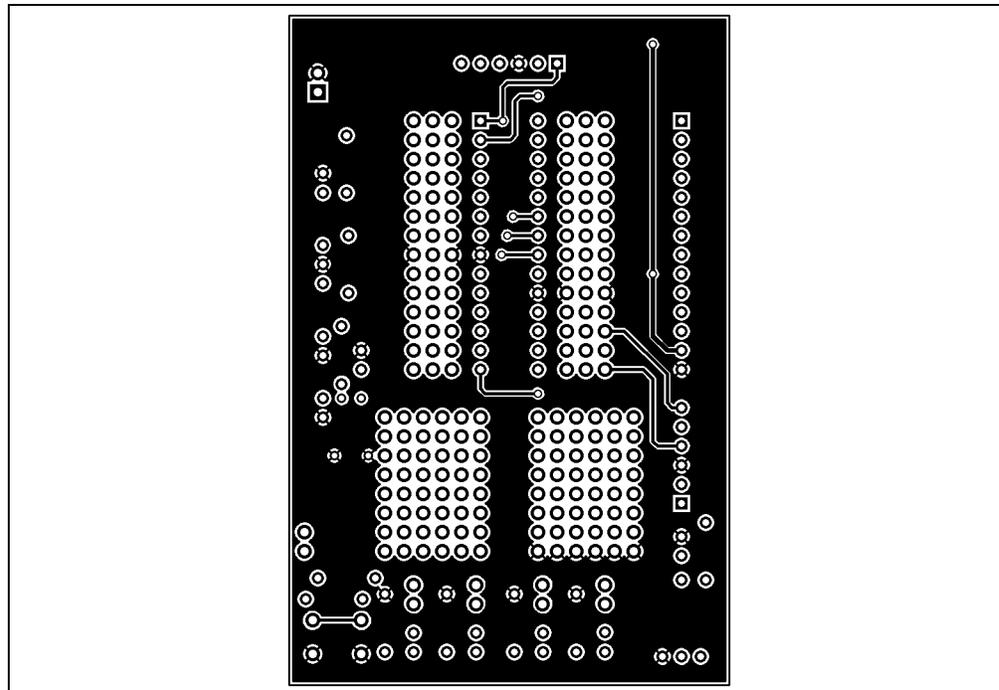


TABLE A-1: BILL OF MATERIALS

Bill of Materials		
Designation	Qty	Description
C1, C2	2	Capacitor, Ceramic, 0.1 μ F, 5%, X7R
C6, C7	2	Capacitor, Ceramic, 122 pF, 50V, C0G
R3-R6	4	Resistor, 470 Ω , 5%, 1/8W
R2, R7	2	Resistor, 1 k Ω , 5%, 1/8W
R1	1	Resistor, 10 k Ω , 5%, 1/8W
R8	1	Resistor 200 k Ω , 5%, 1/8W
RP1	1	Potentiometer 10 k Ω , thumbwheel
DS1-DS4	4	LED, Red T1-3/4
SW1	1	Switch, push button, momentary
U1 – Microcontroller	1	28-pin PIC [®] MCU
P1, P3	2	Connector, header, right-angle, 6-pin, 0.100" spacing, 0.025"
JP1	1	Connector, header, 2-pin, 0.100" spacing, 0.025" square
Rubber Feet	4	Bumpon square, 0.40 x 0.10, black
X2	1	Crystal, tuning fork, cylinder, 12.5 pF
J1	1	Connector, receptacle 1x14-pin

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