28-PIN DEMO BOARD USER'S GUIDE

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- Microchip is willing to work with the customer who is concerned about the integrity of their code.
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28-PIN DEMO BOARD USER'S GUIDE

Table of Contents

NOTES:

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 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
- Document 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.

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) { ... }`

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 (DS41291)

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

PICkit™ 2 Microcontroller Programmer User's Guide (DS51553)

Consult this document for instructions on how to use the PICkit 2 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® IDE Simulator, Editor User's Guide (DS51025)

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

Readme Files

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

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

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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 and other language tools. These include the MPLAB C18 and MPLAB C30 C compilers; MPASM™ and MPLAB ASM30 assemblers; MPLINK™ and MPLAB LINK30 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.
- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB ICE 2000 and MPLAB ICE 4000.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 2.
- **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 SIM simulator, MPLAB IDE Project Manager and general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 and PRO MATE® II device programmers and the PICSTART® Plus and PICkit™ 1 development programmers.

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://support.microchip.com

DOCUMENT REVISION HISTORY

Revision A (October 2006)

- Initial Release of this Document.

NOTES:

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 Inline Package (DIP) PIC® Microcontroller Units (MCU). It is populated with a PIC16F886 MCU, four LEDs, push button and potentiometer. The demo board has several test points to access the I/O pins of the MCU and a generous prototyping area. The MCU can be programmed with the PICkit™ 2 Microcontroller Programmer or the MPLAB® ICD 2 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 Inline Package (DIP) PIC MCU. The assembled 28-Pin Demo Board is populated with a PIC16F886-I/P microcontroller.

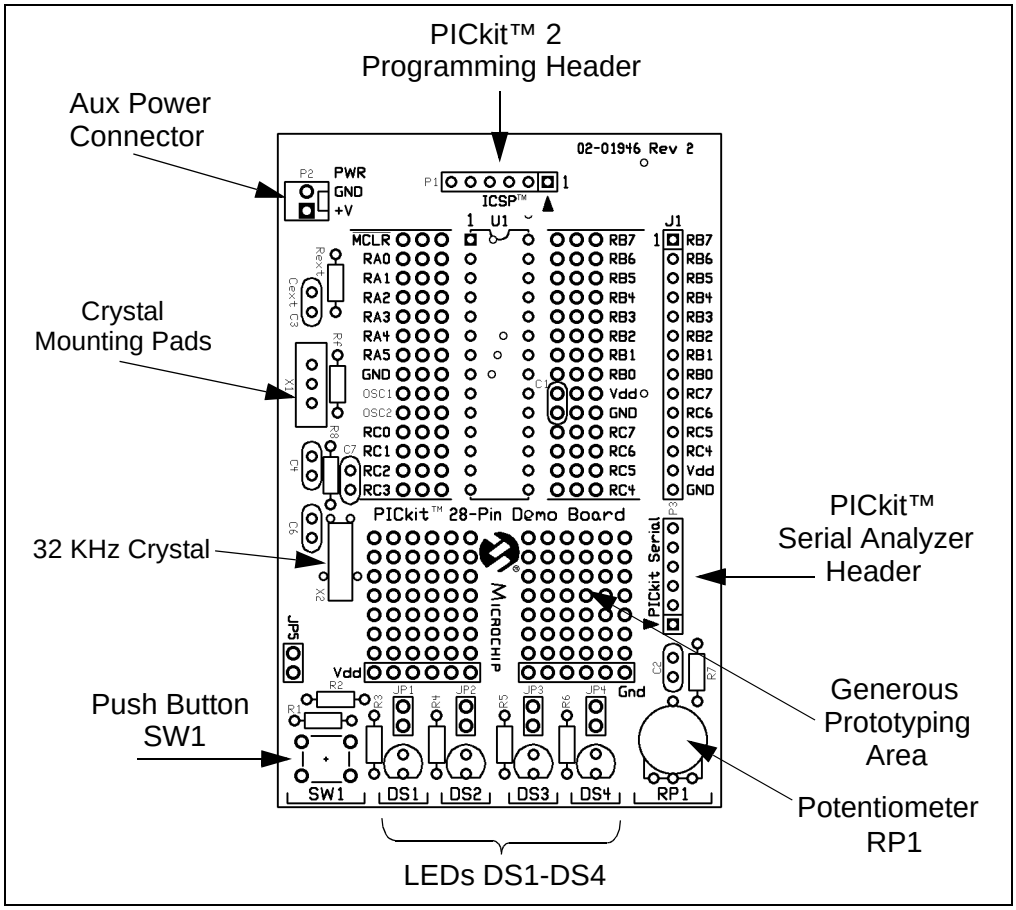
Additional 28-Pin Demo Boards can be ordered from Microchip Technology and distributors. Part number, DM164120-3, comes with one assembled and two blank 28-Pin Demo Boards. The blank demo board can be used for evaluating or prototyping circuits using any of the 28-pin devices listed below.

PIC16F57	PIC16CR63	PIC18F2510
PIC16F72	PIC16CR72	PIC18F2520
PIC16F73	PIC16CR73	PIC18F2515
PIC16F737	PIC16CR76	PIC18F2523
PIC16F767	PIC18F2220	PIC18F2525
PIC16F870	PIC18F2221	PIC18F2550
PIC16F872	PIC18F2320	PIC18F2580
PIC16F873A	PIC18F2321	PIC18F2585
PIC16F876A	PIC18F2331	PIC18F2610
PIC16F913	PIC18F2410	PIC18F2620
PIC16F916	PIC18F2420	PIC18F2680
PIC16C55A	PIC18F2423	PIC18F2682
PIC16C62B	PIC18F2431	PIC18F2685
PIC16C63A	PIC18F2450	PIC18F24J10
PIC16C745	PIC18F2455	PIC18F25J10
PIC16C773	PIC18F2480	

1.4 28-PIN DEMO BOARD OVERVIEW

The 28-Pin Demo Board is populated with a PIC16F886 MCU (U1), four LEDs (DS1-DS4), push button (SW1), 32 KHz crystal (X2) and 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 generous prototyping area. The MCU can be programmed with the PICkit™ 2 Microcontroller Programmer from header P1.

FIGURE 1-1: 28-PIN DEMO BOARD



1.5 RUNNING THE DEFAULT DEMONSTRATION

The assembled 28-Pin Demo Board comes preprogrammed with a demonstration program. To use this program, power the demo board (3.0-5.5 VDC) using a PICkit™ 2 Microcontroller Programmer, or a bench power supply connected to header P2. To use the PICkit™ 2 Microcontroller Programmer, connect it to a PC USB port using the USB cable. Start the PICkit™ 2 Microcontroller Programmer PC application and click on the target power box to apply power to the demo board. The demo board will blink the LEDs in the Reset pattern. The Reset pattern consists of three different LED blink patterns. First, the LEDs will "ping pong" (LED1, 2, 3 and 4, then LED 4, 3, 2 and 1). Second, the LEDs will blink on and off in unison. Third, the LEDs will perform the ADC display where values 0x0A, 0x0D and 0x0C display in sequence followed by the Most Significant 4 bits of the ADC result measuring channel 1, which is the on-board potentiometer.

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

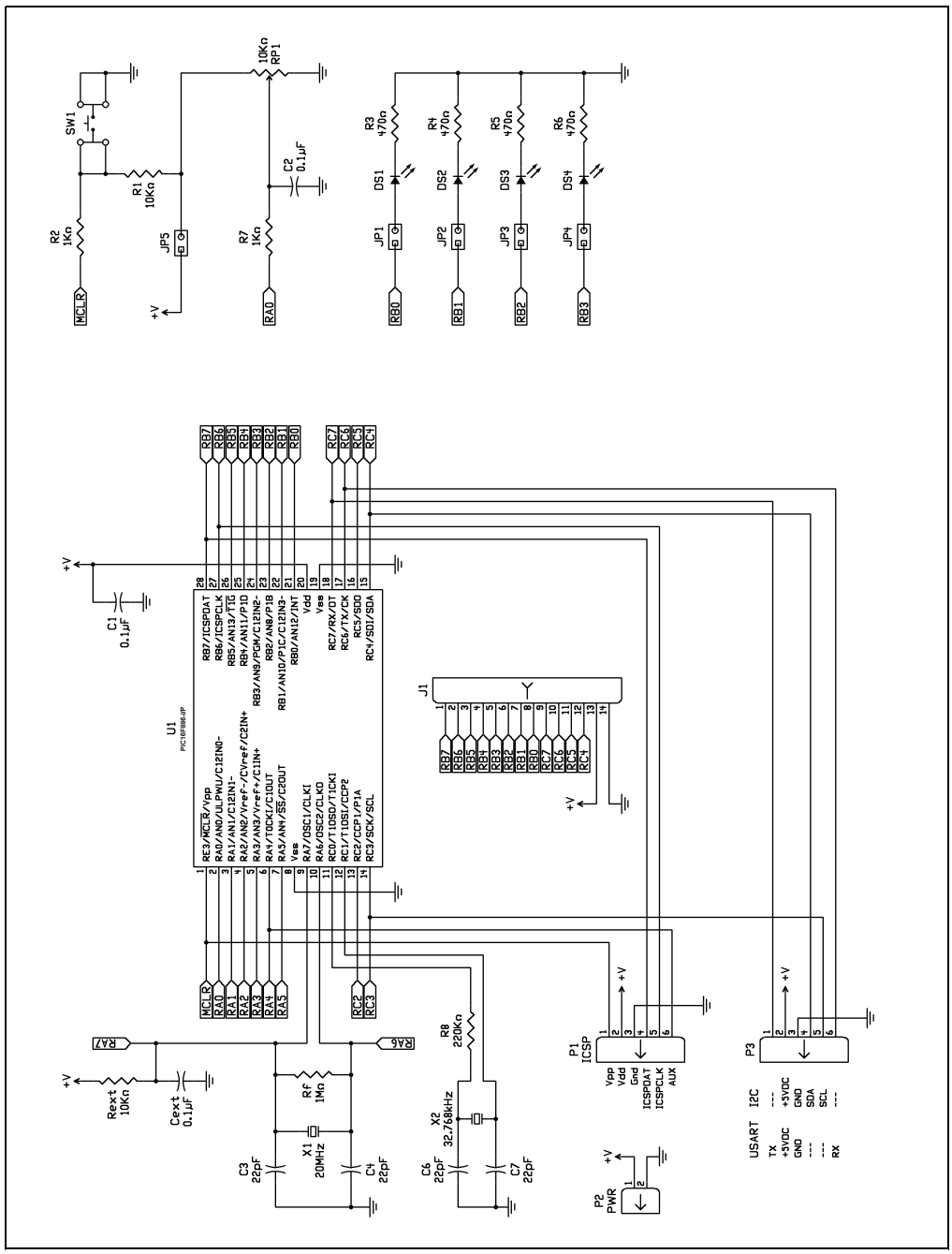


FIGURE A-2: SILKSCREEN

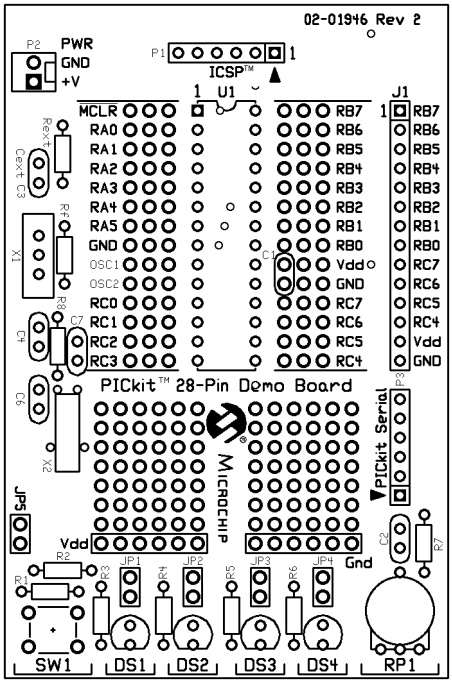


FIGURE A-3: TOP COPPER

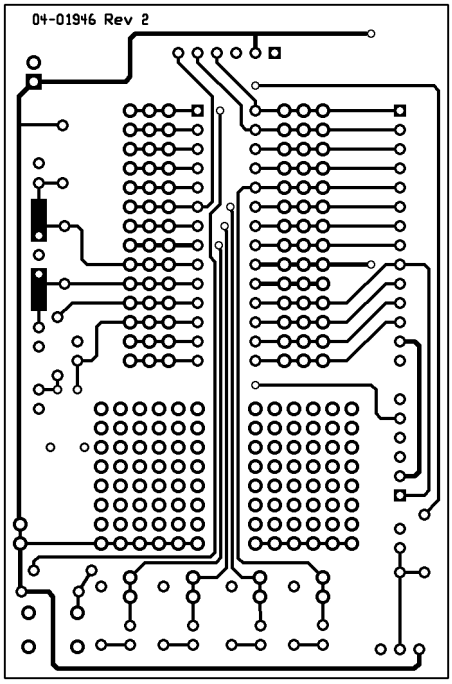


FIGURE A-4: BOTTOM COPPER

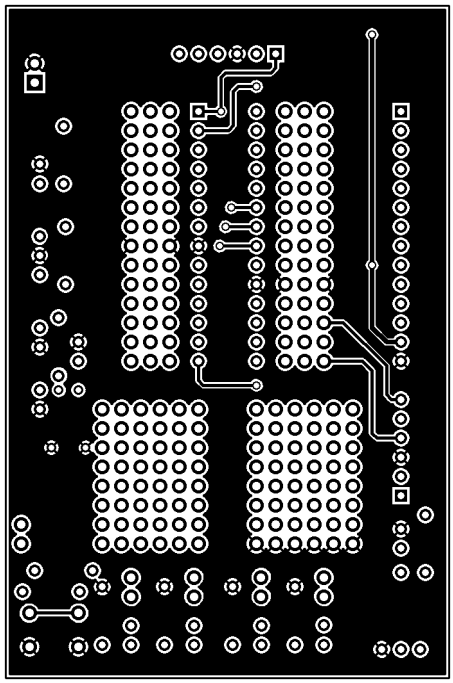


TABLE A-1: BILL OF MATERIALS

Bill of Materials		
Designation	**Qty**	**Description**
C1, C2	2	Capacitor, Ceramic, 0.1 µF, 5%, X7R
C6, C7	2	Capacitor, Ceramic, 122 pF, 50V, C0G
R3-R6	4	Resistor, 470Ω, 5%, 1/8W
R2, R7	2	Resistor, 1 kΩ, 5%, 1/8W
R1	1	Resistor, 10 kΩ, 5%, 1/8W
R8	1	Resistor 200 kΩ, 5%, 1/8W
RP1	1	Potentiometer 10 kΩ, 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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