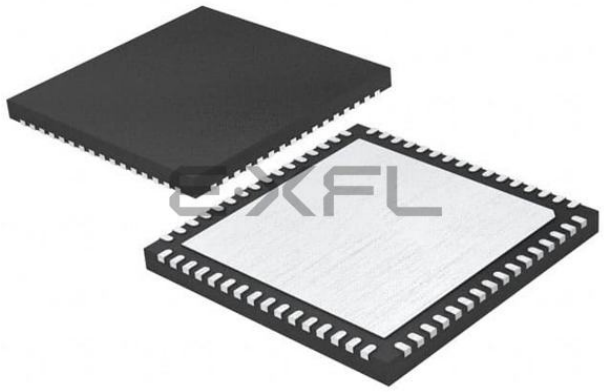
Microchip Technology - PIC32MX440F256HT-80V/MR Datasheet



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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	MIPS32® M4K™
Core Size	32-Bit Single-Core
Speed	80MHz
Connectivity	I²C, IrDA, LINbus, PMP, SPI, UART/USART, USB OTG
Peripherals	Brown-out Detect/Reset, DMA, POR, PWM, WDT
Number of I/O	53
Program Memory Size	256KB (256K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	32K x 8
Voltage - Supply (Vcc/Vdd)	2.3V ~ 3.6V
Data Converters	A/D 16x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-VFQFN Exposed Pad
Supplier Device Package	64-VQFN (9x9)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic32mx440f256ht-80v-mr

PIC32MX STARTER KIT USER'S GUIDE

Table of Contents

PIC32MX STARTER KIT 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.

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 PIC32MX. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- 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 PIC32MX Starter Kit as a development tool to emulate and debug firmware on a target board. The manual is composed of the following chapters:

- **Chapter 1. "Introducing the PIC32MX Starter Kit"** provides a brief overview of the PIC32MX Starter Kit, highlighting its features and uses.
- **Chapter 2. "PIC32MX Starter Kit Tutorial"** provides step-by-step instructions for installing the PIC32MX and using the Microchip MPLAB® IDE to build and run the tutorial program on the PIC32MX Starter Kit.
- **Chapter 3. "Create a New Project"** provides step-by-step instructions for creating a new project using the MPLAB IDE and loading it onto the PIC32MX Starter Kit.
- **Chapter 4. "PIC32MX Starter Kit Hardware"** provides a more detailed description of the features of the hardware included in the PIC32MX Starter Kit.
- **Appendix A. "PIC32MX Starter Kit Schematics"** provides a block diagram and detailed schematics of the PIC32MX Starter Kit.

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 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 (in source code)	`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 PIC32MX Starter Kit.

The following Microchip documents are available and recommended as supplemental reference resources.

Release Notes for PIC32MX Starter Kit
For the latest information on the PIC32MX Starter Kit, open `PIC32MX Starter Kit Release Notes.htm` located in either the root directory of the PIC32MX Starter Kit CD or (default):
`c:\Microchip Starter Kits\PIC32 Starter Kits\documentation`
The file generally contains the most current update information, as well as any issues that may not have been available when this user's guide was published.

PIC32MX Data Sheet **(DS61143)**
Consult this document for detailed information on the PIC32MX general purpose, 32-bit devices. Reference information found in this data sheet includes:

- Device memory map
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included on the device

MPLAB® C Compiler for PIC32 User's Guide **(DS51686)**
This document, formerly the MPLAB C32 C Compiler for PIC32 User's Guide, details the use of Microchip's MPLAB C Compiler for PIC32 to an develop application.

MPLAB® IDE User's Guide **(DS51519)**
Consult this document for more information pertaining to the installation and implementation of the MPLAB IDE software, as well as the MPLAB Editor and MPLAB SIM Simulator software that are included with it.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site makes files and information easily available to customers. Accessible by most Internet browsers, 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 listings
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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, and MPLAB C Compiler for PIC32 compilers; ASM32, MPASM™ and MPLAB ASM30 assemblers; MPLINK™, and MPLAB LINK30, MPLAB LINK32 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.
- **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 the MPLAB ICD 2 and PICkit™ 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 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 the MPLAB PM3 device programmer and the PICSTART® Plus, PICkit™ 1 and PICkit 2 development programmers.

CUSTOMER SUPPORT

Several channels are available to assist the users of Microchip products:

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

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

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

Chapter 1. Introducing the PIC32MX Starter Kit

1.1 INTRODUCTION

Thank you for purchasing the Microchip Technology PIC32MX Starter Kit. This kit provides a low-cost, modular development system for Microchip's new line of 32-bit microcontrollers.

The starter kit comes pre-loaded with demonstration software for the user to explore the new features of the PIC32MX. It is also expandable through a modular expansion interface, which allows the user to extend its functionality. The PIC32MX Starter Kit also supplies on-board circuitry for full debug and programming capabilities.

1.2 HIGHLIGHTS

This chapter covers the following topics:

- Kit Contents
- PIC32MX Functionality and Features
- Installing the PIC32MX Starter Kit CD
- Using the PIC32MX Starter Kit Out of the Box
- PIC32MX Demonstration Program

The preprogrammed example code on the PIC32MX MCU has been included on the PIC32MX Starter Kit CD-ROM for future reference. All project files have been included, so that the code may be used directly to restore the PIC32MX MCU on the starter kit to its original state (i.e., if the sample device has been reprogrammed with another program), or so you can use the tutorial code as a platform for further experimentation.

1.3 KIT CONTENTS

The PIC32MX Starter Kit contains the following items:

- PIC32MX Starter Kit Board
- USB Mini-B cable
- PIC32 Starter Kit Installation CD-ROM, which includes:
  - *PIC32MX Starter Kit User's Guide* (DS61144)
  - *PIC32MX Family Data Sheet* (DS61143)
  - *PIC32MX Family Reference Manual* (DS61132)
  - *PIC32MX Peripheral Library Manual*
  - Code examples for use with the PIC32MX devices

If you are missing any part of the kit, contact a Microchip sales office for assistance. A list of Microchip offices for sales and service is provided on page 44.

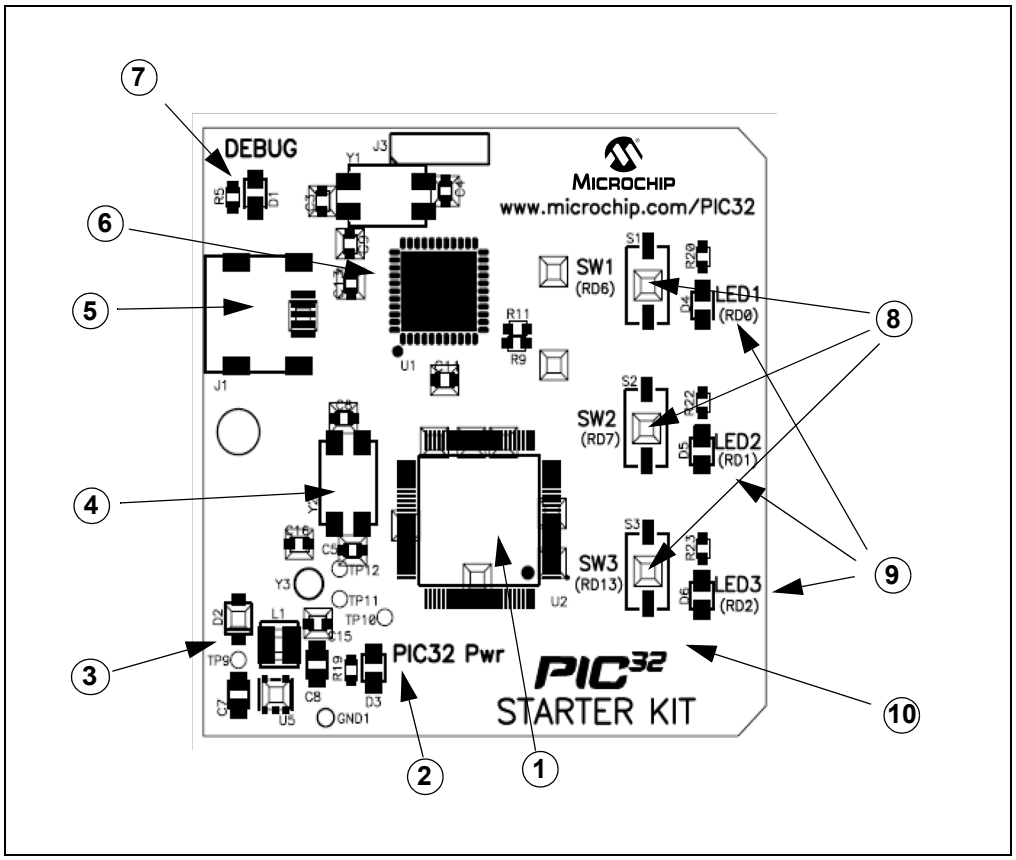
1.4 PIC32MX FUNCTIONALITY AND FEATURES

A representation of the layout of the PIC32MX Starter Kit is shown in Figure 1-1. The board includes these key features, as indicated in the diagram:

1. PIC32MX360F512L 32-bit microcontroller
2. Green power-indicator LED
3. Regulated +3.3V power supply for powering the starter kit board via USB or expansion board
4. On-board crystal for precision microcontroller clocking (8 MHz)
5. USB connectivity for on-board debugger communications
6. PIC18LF4550 USB microcontroller for on-board debugging
7. Orange Debug indicator LED
8. Three push-button switches for user-defined inputs
9. Three user-defined indicator LEDs
10. Connector for connecting various expansion boards (on the underside of board)

For details on these features, refer to **Chapter 4. "PIC32MX Starter Kit Hardware"**.

FIGURE 1-1: PIC32MX STARTER KIT DEMO BOARD LAYOUT



NOTES:

Chapter 2. PIC32MX Starter Kit Tutorial

2.1 INTRODUCTION

This chapter is a self-paced tutorial to get you started using the PIC32MX Starter Kit.

2.2 HIGHLIGHTS

Items discussed in this chapter include:

- Host Computer Requirements
- Installing the Starter Kit Board
- Starting with the Tutorial Project
- Building the Project
- Programming the Device
- Running the Program
- Operation of the Tutorial Program

2.3 HOST COMPUTER REQUIREMENTS

To communicate with and program the starter kit board, the following hardware and software requirements must be met:

- PC-compatible system
- An available USB port on PC or powered USB hub
- CD-ROM drive
- Microsoft Windows XP®
  (The PIC32MX Starter Kit has not been tested on Windows NT®, Windows 2000® or Microsoft Vista™ operating systems)

2.4 INSTALLING THE STARTER KIT BOARD

As a USB device, the starter kit board requires very little effort to install; most of the work is done by the operating system. Begin by closing all applications.

2.4.1 Install the Tools and Projects

1. Insert the PIC32 Starter Kit CD into your CD-ROM drive and click the install from CD menu option. If the installation application does not automatically start, navigate to the files on the CD and open `setup.exe`.

   The following window is displayed:

FIGURE 2-1: INSTALLING THE PIC32 STARTER KIT BOARD

2. Reboot your system when prompted to do so.

Note: The dialog also provides an option to check the Microchip web site for newer versions of the starter kit software.

2.5 STARTING THE TUTORIAL PROJECT

Click the MPLAB IDE icon on your computer desktop. The MPLAB IDE opens with the starter kit tutorial project loaded, as shown in Figure 2-7. If the MPLAB IDE does not have the starter kit tutorial project loaded, select *File>Open Workspace...* from the menu bar and browse to the tutorial project file:

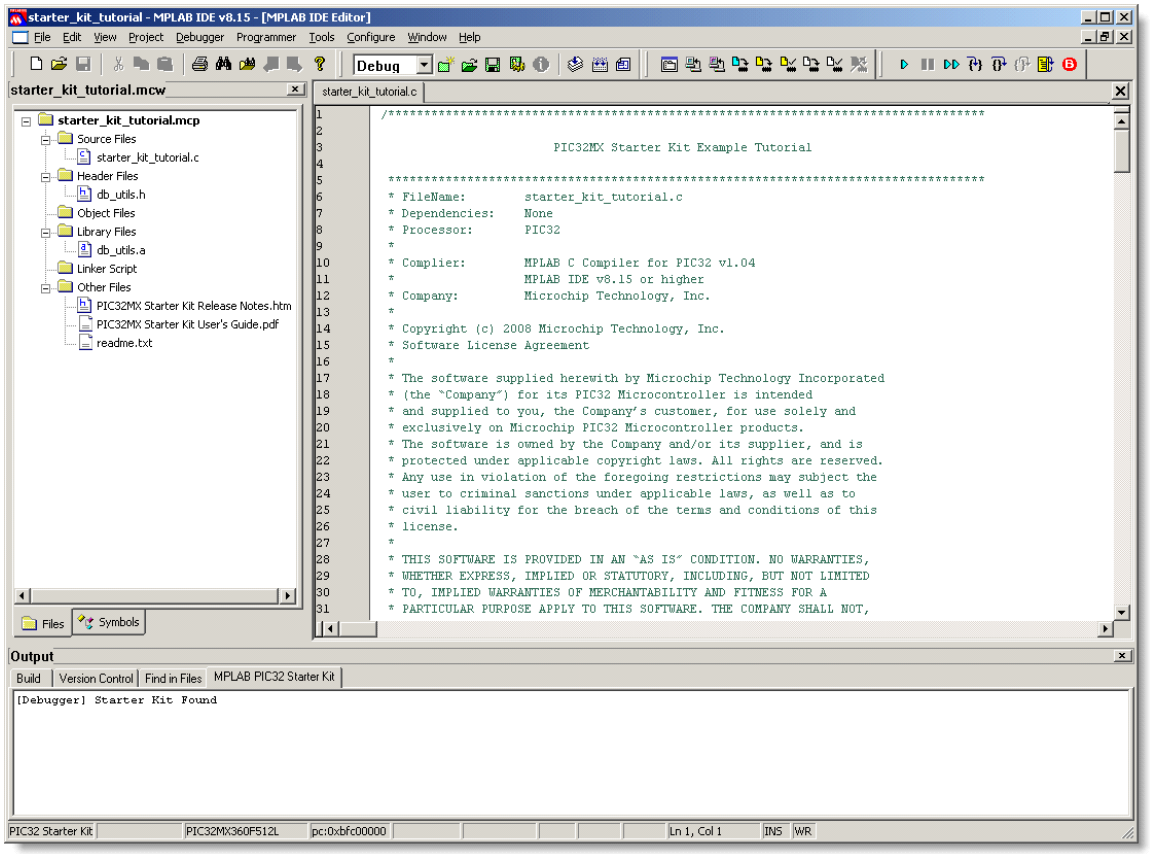
`[install directory]\PIC32 Starter Kits\`
`Starter_Kit_Tutorial\starter_kit_tutorial.mcw`

(or browse to the file path you used when you installed the MPLAB IDE).

The pane on the left of the MPLAB IDE interface displays project files, the '`.c`', '`.h`' and '`.a`' files that are used to build an application. The project files are organized by type into folders.

"Starter Kit Found" should be displayed in the "Output" pane of the MPLAB IDE interface. If you do not see this message, select *Debugger>Select Tool>PIC32MX Starter Kit* from the menu bar. If that sequence fails to find the project, check the driver installation, as well as the connections between the hardware and the PC.

FIGURE 2-7: MPLAB® IDE WORKSPACE



2.8 RUNNING THE PROGRAM

Either click *Debugger>Run* from the menu bar of the MPLAB IDE or click the Run icon (the turquoise triangle) on the Debug Tool Bar (Figure 2-12) to run the new program.

FIGURE 2-12: DEBUG WINDOW

2.9 TUTORIAL PROGRAM OPERATION

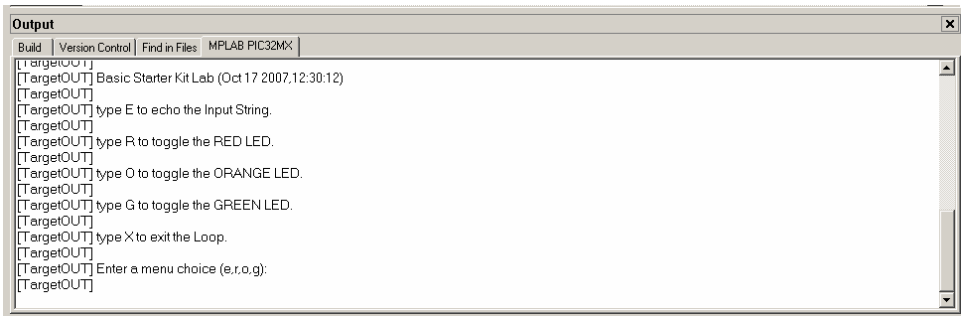
The starter kit tutorial demonstrates a simple application. The program responds according to the user input menu. The program prints the available menu choices to the starter kit Output window in the MPLAB IDE. The program flow is shown in Figure 2-13.

The tutorial program includes the Debug Print Library, which facilitates print functionality. A peripheral library header file for flashing the LEDs is also included. The header file for print functionality is `db_utils.h`.

Depending on the macro definition given in the print header file, the debug print macros will be expanded. The print functionality in the tutorial is routed to the Output window on the **MPLAB PIC32MX** tab in the interface window. In order to achieve this, the macro definition “PIC32_STARTER_KIT” is added to the MPLAB C Compiler for PIC32 options.

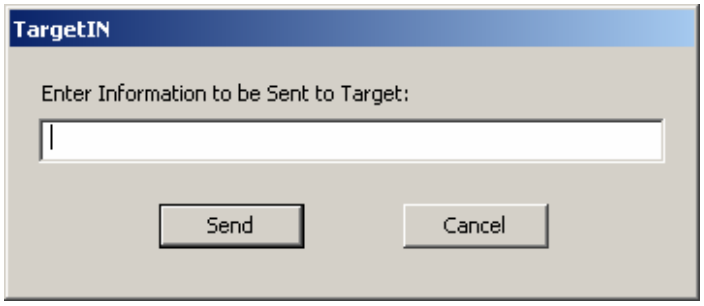
As the program runs, the Output window (Figure 2-14) tracks the progress.

FIGURE 2-14: OUTPUT WINDOW



After printing the menu, the application displays a prompt that requests your input, see Figure 2-15.

FIGURE 2-15: TARGET IN WINDOW



Type your choice into the Enter Information to be Sent to Target box, and click **Send**.

The program responds according to the menu entry. Watch the LEDs on the starter kit board. If your entry is incorrect, the LEDs will toggle once.

Chapter 3. Create a New Project

3.1 INTRODUCTION

This chapter explains how to create a new project.

3.2 HIGHLIGHTS

Items discussed in this chapter include:

- Creating a New Project
- Building the Project
- Programming the Device
- Running the Program

After completing this chapter, you should be able to accomplish the following tasks:

- Create a project using the Project Wizard
- Assemble and link the code, and set the Configuration bits
- Set up the MPLAB IDE to use the PIC32MX Starter Kit
- Program the chip, and run the program

3.3 CREATING A NEW PROJECT

The first step is to create a project and a workspace in the MPLAB IDE. Typically, there is a single project per workspace.

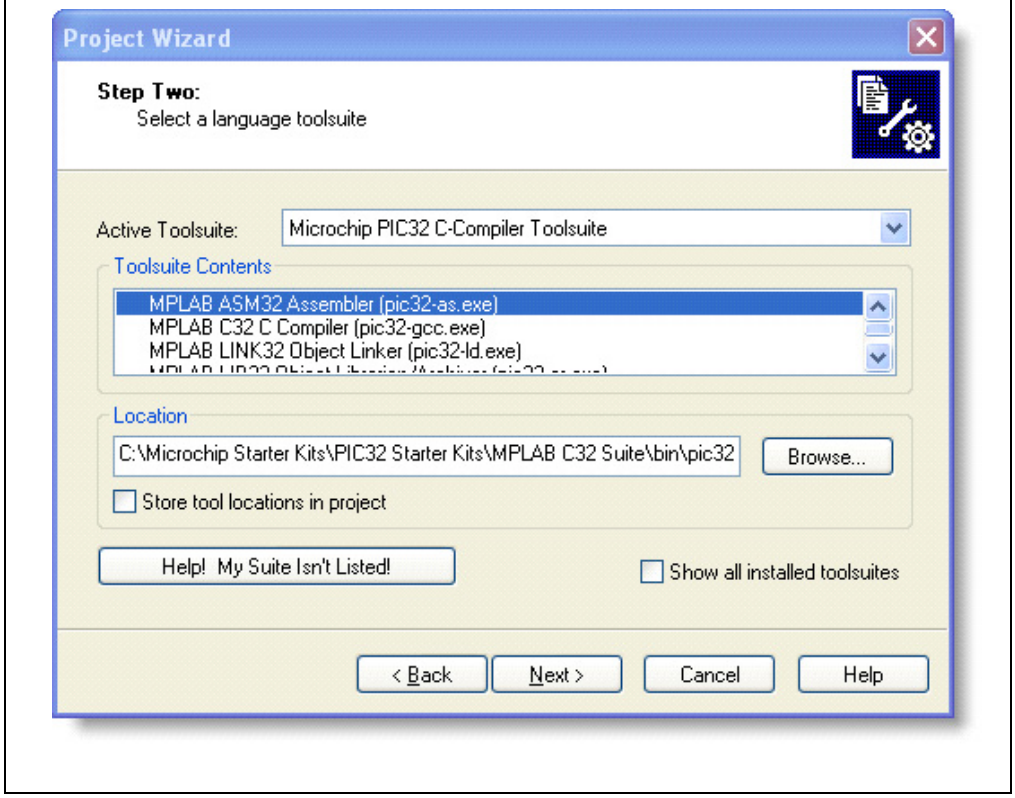
A project contains the files needed to build an application (i.e., source code, header files, library, etc.), and their corresponding build options.

A workspace contains one or more projects, information on the selected device, debug/programmer tool, and MPLAB IDE configuration settings.

MPLAB IDE contains a Project Wizard to help create a new project.

You will perform the following tasks as you create a new project:

FIGURE 3-2: SELECTING THE TOOLSUITE



3.3.2 Task 2, Select the Language Toolsuite

1. From the “Active Toolsuite” drop-down list, click “Microchip PIC32 C Compiler Toolsuite”. The toolsuite includes the assembler and linker that will be used. If the PIC32 compiler option is not available, check the “show all installed toolsuites” box.
2. Click **Next** to continue. The Project Wizard Step Three: dialog opens, as shown in Figure 3-3.

NOTES:

FIGURE A-5: PIC32MX SCHEMATIC, SHEET 5 OF 6 (SWITCHES AND LEDS)

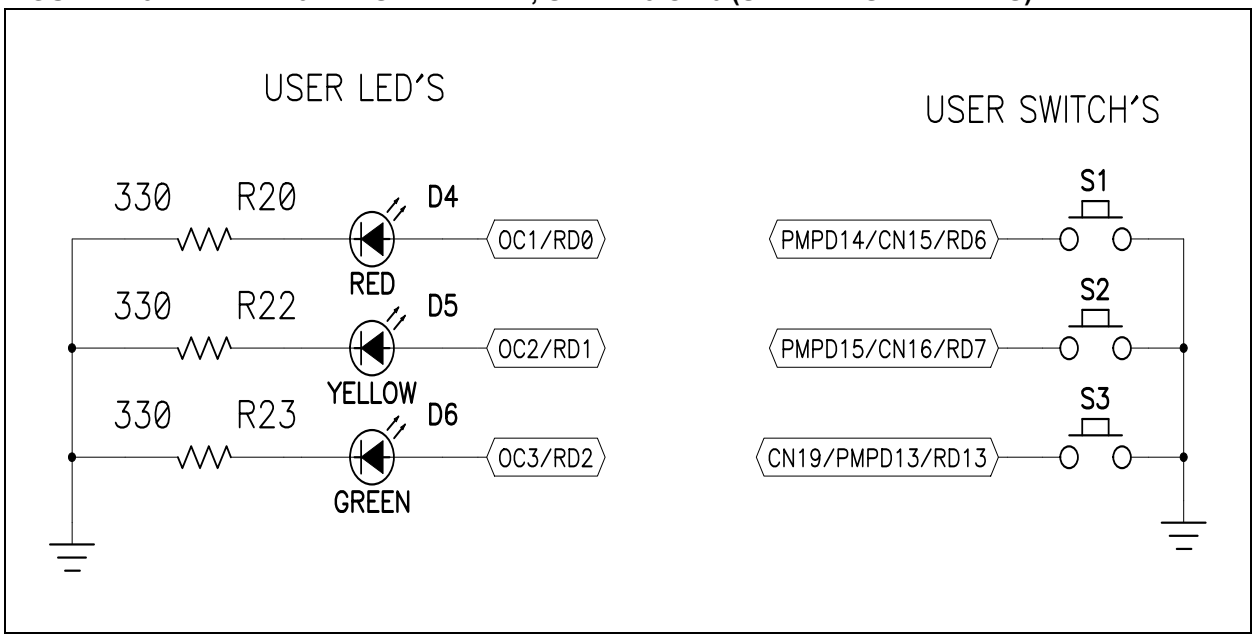
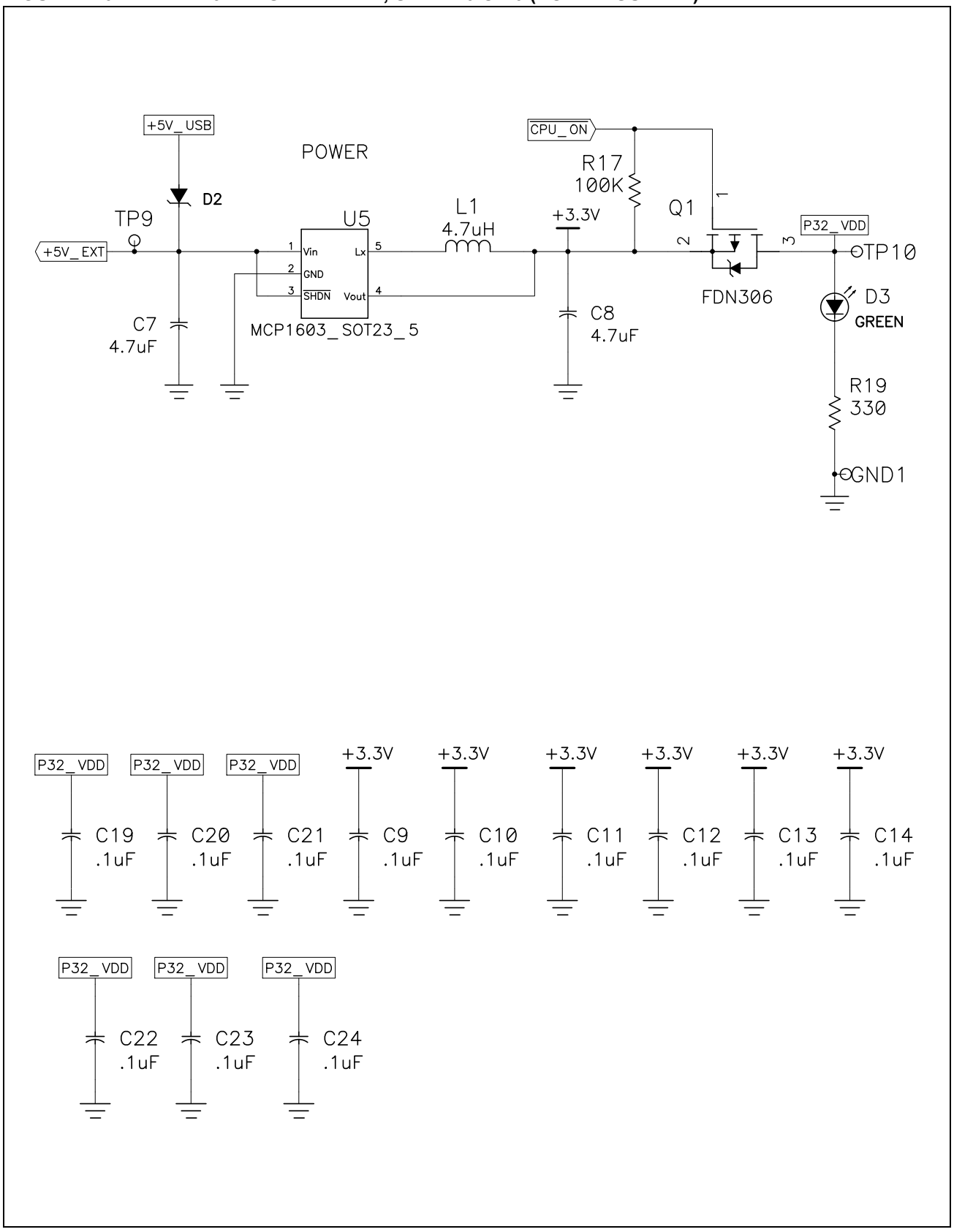


FIGURE A-6: PIC32MX SCHEMATIC, SHEET 6 OF 6 (POWER SUPPLY)



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