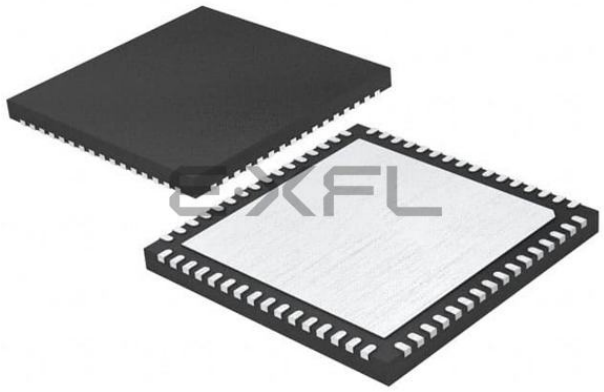
Microchip Technology - PIC32MX440F256H-80I/MR Datasheet



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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 ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-VFQFN Exposed Pad
Supplier Device Package	64-VQFN (9x9)
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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.

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

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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.

1.5 INSTALLING THE PIC32MX STARTER KIT CD

The default PIC32MX Starter Kit installation directory is:
`c:\Microchip Starter Kits\PIC32 Starter Kits`

Note, throughout this document, the following phrase "`[install directory]`" refers to this default installation, `c:\Microchip Starter Kits`, or a directory selected by the user during the time of installation.

The starter kit CD-ROM contains the MPLAB IDE, MPLAB C32 C Compiler tools, code examples, sample projects, technical documentation, a getting started tutorial, and this *PIC32MX Starter Kit User's Guide*. When the CD is placed into your CD drive, an automatic installation application will guide you to install the tools and relevant documents.

1.6 USING THE PIC32MX STARTER KIT OUT OF THE BOX

The PIC32MX Starter Kit may be used directly from the box as a demonstration board for the PIC32MX device. The PIC32MX is preprogrammed with the classic "Simon Says" game (`simon_says_demo.hex`) in the PIC32MX360F512L device and is ready for immediate use.

1.6.1 How to Play the Game

When the USB cable is plugged into the starter kit, the three LEDs start blinking to indicate the start of a new game. Begin the game by pressing one of the switches, SW1-SW3, to choose the level of game difficulty. SW3 is the easiest, SW1 is the hardest. The goal is to imitate the light patterns as long as you can, without getting frazzled. Ultimately, you will make a mistake and all of the LEDs will light up to signal the end of a game. After a brief pause, you can press a switch again to start a new game.

If the starter kit is connected to the MPLAB IDE, the game stops. It will be replaced by the MPLAB IDE project that you select when the program button is pressed. The game can be reloaded onto the starter kit by opening `simon_says_demo.mcw` from the following directory:
`[install directory]\PIC32 Starter Kits\simon_says_demo`

1.7 PIC32MX DEMONSTRATION PROGRAM

The preprogrammed example code on the PIC32MX has been included as part of the PIC32MX Starter Kit installation. All project files have been included, so that the code may be used directly to restore a PIC32MX 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.

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:

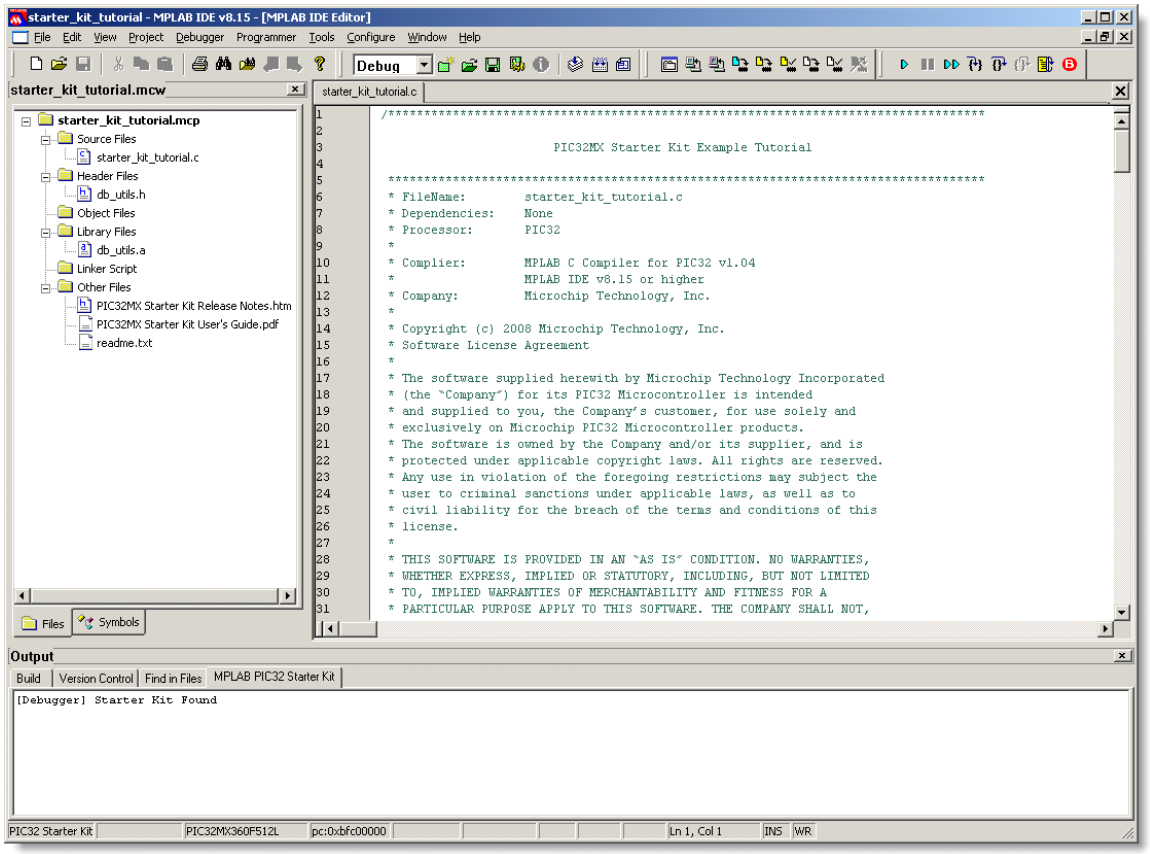
`[install directory]\PIC32 Starter Kits\`
`Starter_Kit_Tutorial\starter_kit_tutorial.mcw`

(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

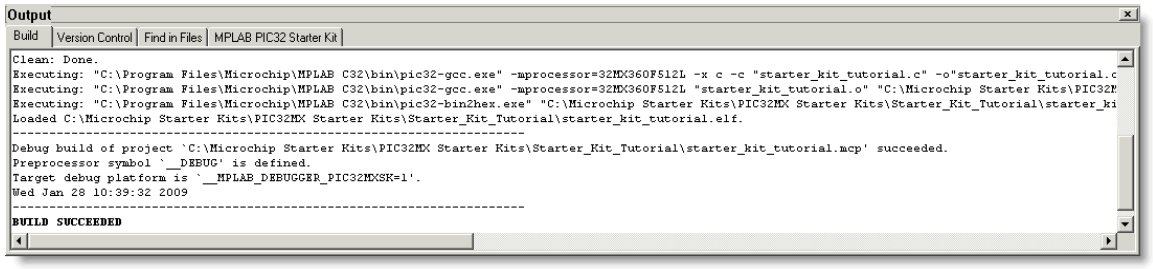


2.6 BUILDING THE PROJECT

From the menu bar of the main MPLAB IDE window, click *Project>Make*. The build Output window displays, as shown in Figure 2-8.

Observe the progress of the build. When the “BUILD SUCCEEDED” message displays, you are ready to program the device.

FIGURE 2-8: BUILD OUTPUT WINDOW



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.

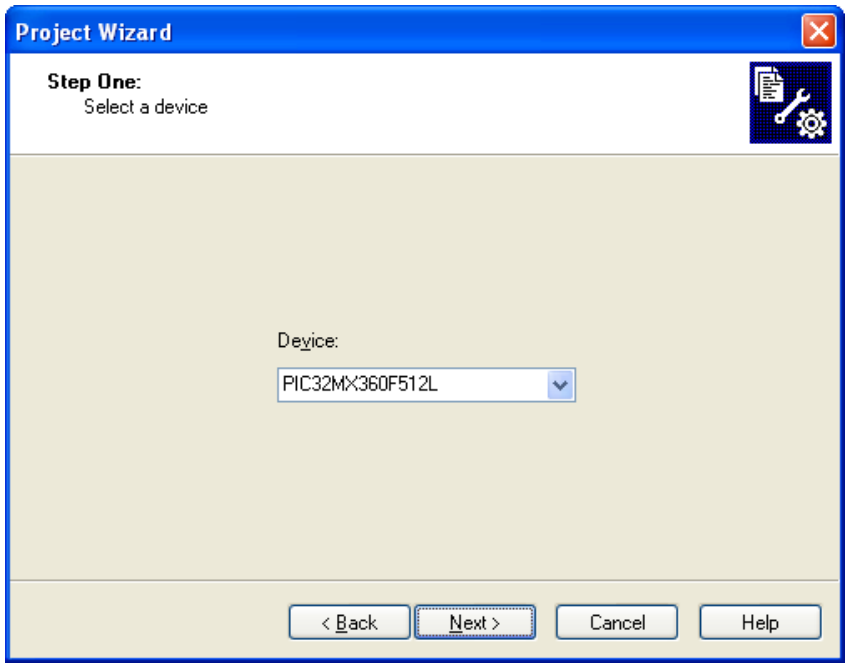
MPLAB IDE contains a Project Wizard to help create a new project.

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

3.3.1 Task 1, Select a Device

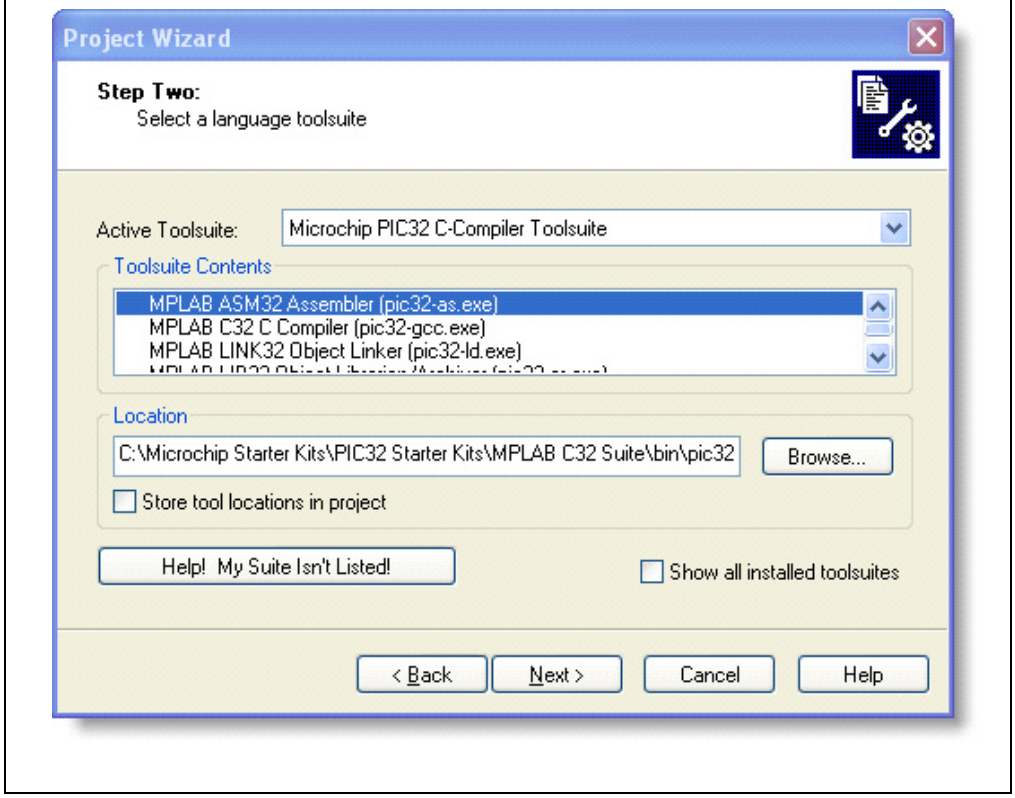
1. Start MPLAB IDE.
2. Click *File>Close Workspace* on the menu bar, to close any workspace that is open.
3. Click *Project>Project Wizard...* to start the wizard.
4. In the Welcome window, click **Next**. The Project Wizard Step One: window is displayed, as shown in Figure 3-1.

FIGURE 3-1: SELECTING THE DEVICE



5. From the "Device" drop-down list, select "PIC32MX360F512L".
6. Click **Next**. The Project Wizard Step Two: dialog box opens, as shown in Figure 3-2.

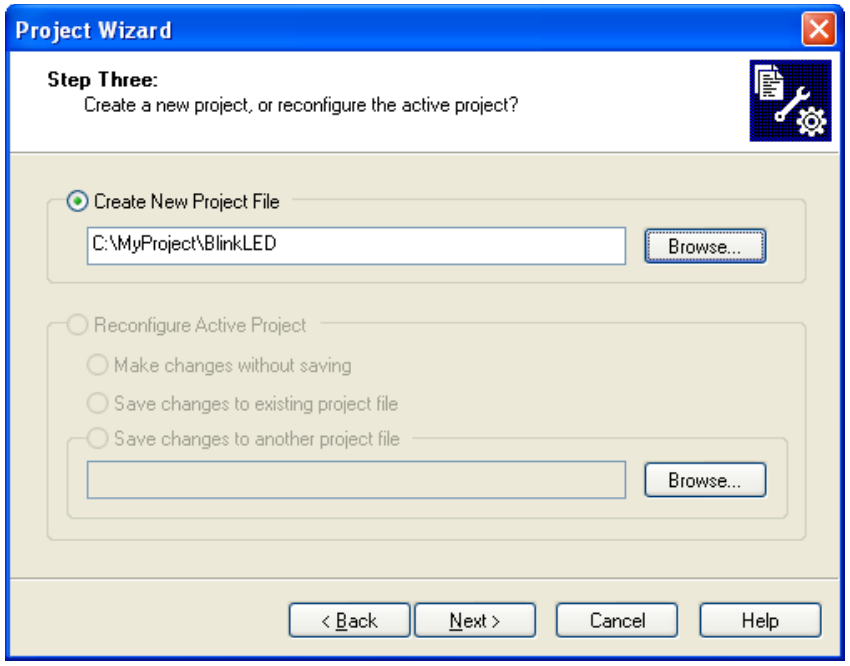
FIGURE 3-2: SELECTING THE TOOLSUITE



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.

FIGURE 3-3: NAMING YOUR PROJECT



3.3.3 Task 3, Name Your Project

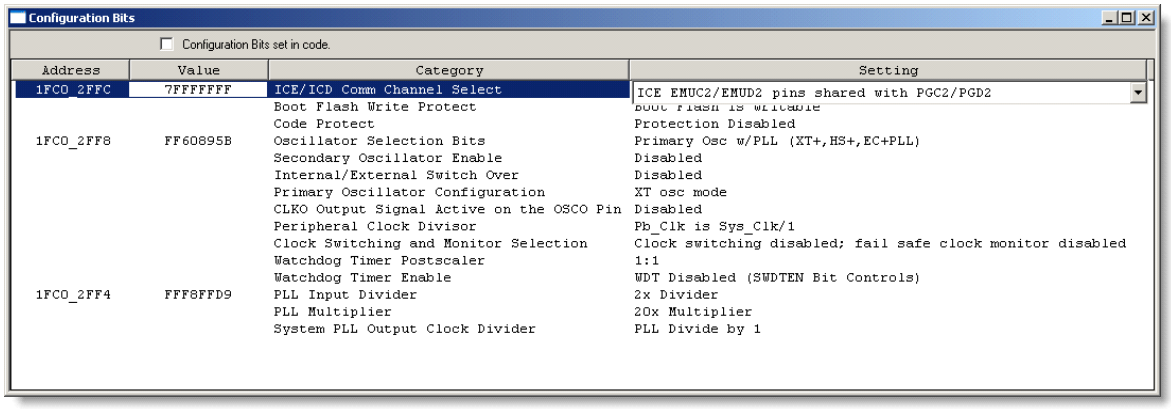
1. In the "Create New Project File" field, type **C:\MyProject\BlinkLED**.
2. Click **Next** and **Ok** to continue. The Project Wizard Step Four: dialog opens, as shown in Figure 3-4.

3.3.5 Task 5, Confirm the Configuration Settings

Click *Configure>Configuration Bits* to confirm that the configuration settings are correct. Typical configuration settings for the starter kit are shown in Figure 3-6.

Note: The "Configuration Bits set in code" check box must be unchecked if the config bits are set via this window and not in the code.
The configuration settings can also be embedded in the source file. See the *MPLAB C Compiler for PIC32 User's Guide* (DS51686) for information.

FIGURE 3-6: CONFIGURATION BIT SETTINGS



CAUTION

Setting the PIC32 Starter Kit configuration bits to cause the PIC32MX to operate faster than the maximum 80MHz system clock speed may cause the PIC32MX to stop communicating with the PIC18F4550 Starter Kit debugger. Should this occur, run the `sk_erase.exe` **utility to re-flash the PIC32MX with a default configuration. This utility is located on the PIC32 Starter Kit CD or in the PIC32MX Starter Kit directory:**
`[install directory]\PIC32 Starter Kits\tools`

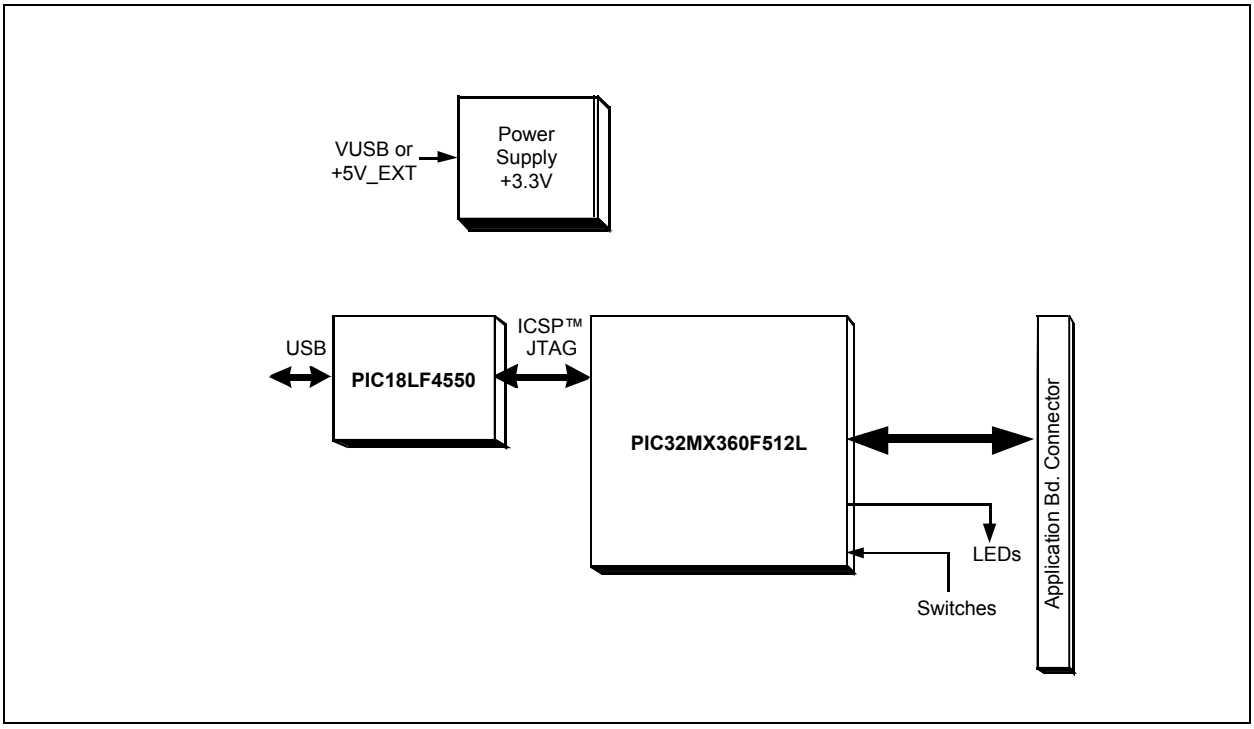
Appendix A. PIC32MX Starter Kit Schematics

A.1 INTRODUCTION

This section provides detailed technical information about the PIC32MX Starter Kit.

A.2 DEVELOPMENT BOARD BLOCK DIAGRAM

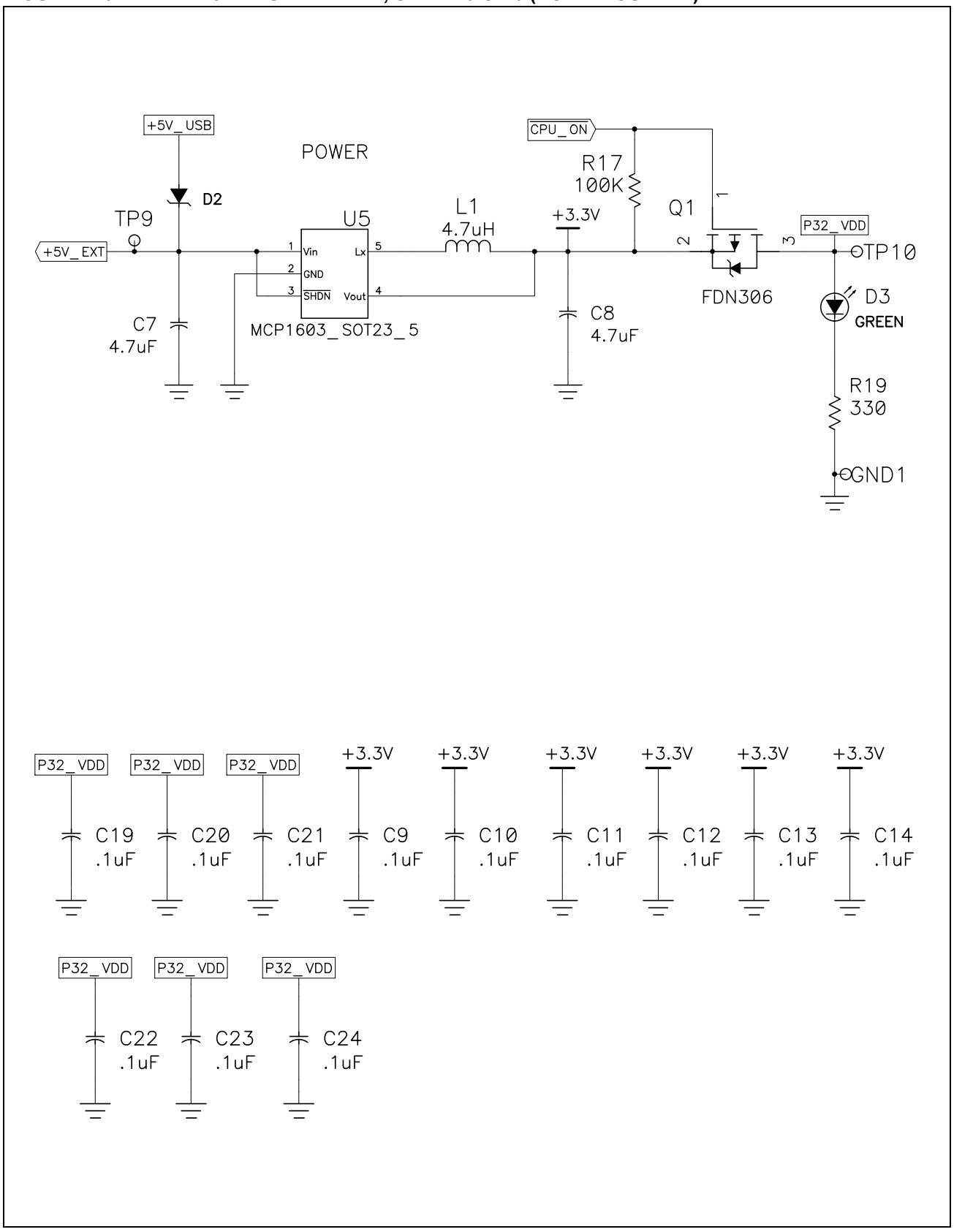
FIGURE A-1: HIGH-LEVEL BLOCK DIAGRAM OF THE PIC32MX STARTER KIT



A.3 STARTER KIT BOARD SCHEMATICS

Figure A-2. PIC32MX CPU
Figure A-3. PIC18LF4550 Debug CPU
Figure A-4. Application Board Connector
Figure A-5. Switches and LEDs
Figure A-6. Power Supply

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



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