



PIC32MX USB Starter Board User's Guide

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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 “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 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 Board as a development tool to emulate and debug firmware on a target board. The user guide is composed of the following chapters:

- **Chapter 1. “Introducing the PIC32MX USB Starter Board”** provides a brief overview of the PIC32MX USB Starter Board, highlighting its features and uses.
- **Chapter 2. “PIC32MX USB Starter Board Tutorial”** provides step-by-step instructions for installing the PIC32MX USB Starter Board and using the Microchip MPLAB IDE to build and run the tutorial program on the PIC32MX USB Starter Board.
- **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 USB Starter Board.
- **Chapter 4. “PIC32MX USB Starter Board Hardware”** provides the hardware description of the PIC32MX USB Starter Board.
- **Appendix A. “PIC32MX USB Starter Board Schematics”** provides a block diagram and detailed schematics of the PIC32MX USB Starter 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	<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
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	<code>#define START</code>
	Filenames	<code>autoexec.bat</code>
	File paths	<code>c:\mcc18\h</code>
	Keywords	<code>_asm, _endasm, static</code>
	Command-line options	<code>-Opa+, -Opa-</code>
	Bit values	<code>0, 1</code>
	Constants (in source code)	<code>0xFF, 'A'</code>
Italic Courier New	A variable argument	<code>file.o</code> , where file can be any valid filename
Square brackets []	Optional arguments	<code>mcc18 [options] file [options]</code>
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	<code>errorlevel {0 1}</code>
Ellipses...	Replaces repeated text	<code>var_name [, var_name...]</code>
	Represents code supplied by user	<code>void main (void) { ... }</code>

RECOMMENDED READING

This user's guide describes how to use the PIC32MX USB Starter Board.

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

PIC32MX Data Sheet (DS61143)

Consult this document for detailed information on the PIC32MX 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® C32 C Compiler User's Guide (DS51686)

This document details the use of Microchip's MPLAB C32 C Compiler for PIC32MX devices to develop an application. MPLAB C32 is a GNU-based language tool, based on source code from the Free Software Foundation (FSF). For more information about FSF, see their web site at <http://www.fsf.org>.

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.

Universal Serial Bus Specification and Associated Documents

The Universal Serial Bus is defined by the USB 2.0 specification and its associated supplements and class-specific documents. These documents are available from the USB Implementor's Forum. See their website at <http://www.usb.org>.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at <http://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
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listings of seminars and events; and listings of Microchip sales offices, distributors and factory representatives

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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 <http://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, MPLAB C30, and MPLAB C32 C 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>.

DOCUMENT REVISION HISTORY

Revision A (June 2008)

This is the initial release of the PIC32MX USB Starter Board User's Guide.



PIC32MX USB STARTER BOARD USER'S GUIDE

Chapter 1. Introducing the PIC32MX USB Starter Board

1.1 INTRODUCTION

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

The starter board 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 USB Starter Board 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

The preprogrammed example code on the PIC32MX MCU is available via download. All project files have been included, so that the code may be used directly to restore the PIC32MX MCU on the starter board 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. Refer to Section 2.4 for download and installation instructions.

1.3 KIT CONTENTS

The PIC32MX USB Starter Board contains the following items:

- PIC32MX USB Starter Board
- USB Mini-B to full-sized A cable – USB debug cable to debug and power the board
- USB Micro-B to full-sized A cable – PIC32 USB cable to communicate with the PIC32 USB port

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 36.

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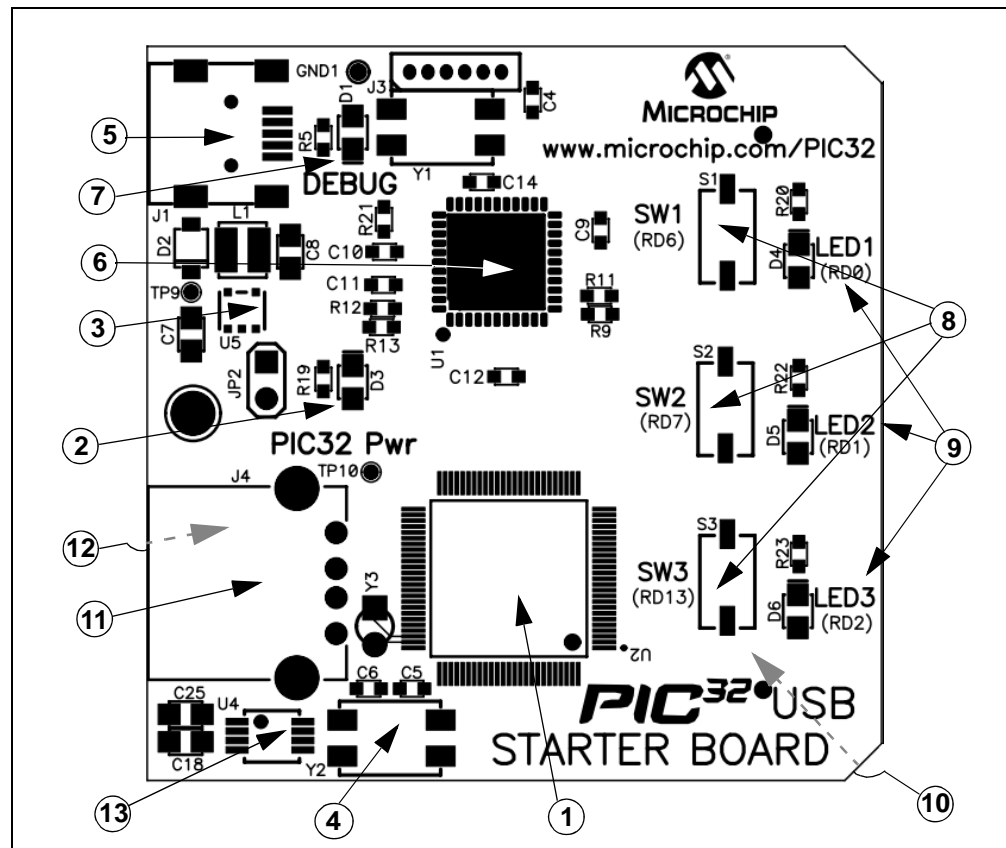
1.4 PIC32MX FUNCTIONALITY AND FEATURES

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

1. PIC32MX460F512L 32-bit microcontroller
2. Green power-indicator LED
3. Regulated +3.3V power supply for powering the starter 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 various expansion boards (on the underside of board)
11. USB Type A receptacle connectivity for PIC32MX Host based Applications
12. USB Type Micro-AB receptacle for OTG and USB Device connectivity for PIC32MX OTG/Device based Applications (on the underside on board)
13. USB Host and OTG power supply for powering PIC32MX USB applications.

- Note 1:** To power Rev B boards, the USB debug cable must be connected to a USB port on the host PC.
- 2:** When running USB device applications, open the jumper JP2 to prevent possibly back-feeding voltage onto VBUS from one port on the host to another (or from one host to another).

FIGURE 1-1: PIC32MX USB STARTER BOARD LAYOUT



Chapter 2. PIC32MX USB Starter Board Tutorial

2.1 INTRODUCTION

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

2.2 HIGHLIGHTS

Items discussed in this chapter include:

- Host Computer Requirements
- Installing the PIC32MX USB Starter Board Software
- Using the PIC32MX USB Starter Board Out of the Box
- Starting the Tutorial Project
- Building the Project
- Programming the Device
- Running the Program
- Tutorial Program Operation

2.3 HOST COMPUTER REQUIREMENTS

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

- PC-compatible system
- Two available USB ports on PC or powered USB hub
- Microsoft Windows XP® or Windows Vista® operating system
(The PIC32MX USB Starter Board has not been tested on Windows NT® and Windows 2000® operating systems.)

2.4 INSTALLING THE PIC32MX USB STARTER BOARD SOFTWARE

Starter board software and installation instructions are available on the Microchip.com web site at the following URL: <http://www.microchip.com/PIC32USBboard>. The web page will guide you through installation and setup of MPLAB IDE, MPLAB C32 C Compiler, and the demo projects. The page also provides links to other technical documents. After completing the online installation instructions, continue to the next section in this document.

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2.5 USING THE PIC32MX USB STARTER BOARD OUT OF THE BOX

Install software (instructions in section 2.4) before connecting the board to the host PC. The PIC32MX USB Starter Board 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 PIC32MX460F512L device and is ready for immediate use.

2.5.1 How to Play the Game

When the USB debug cable is plugged into the starter board's Mini-B (debug) receptacle, 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 the game. After a brief pause, you can press any switch to start a new game.

If you launch MPLAB IDE and connect to the starter board while the game is running, the game will stop. Further, if you perform a debug or program operation from MPLAB IDE, the demo application will be replaced with the current MPLAB project application. However, the game can be reloaded onto the starter board by opening the file `simon_says_demo.mcw` from `c:\Program Files\Microchip\pic32_solutions\simon_says_demo`.

The preprogrammed example code on the PIC32MX has been included in the PIC32MX USB Starter Board demo-projects download file located at the following URL: <http://www.microchip.com/PIC32USBboard>. 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.

2.6 STARTING THE TUTORIAL PROJECT

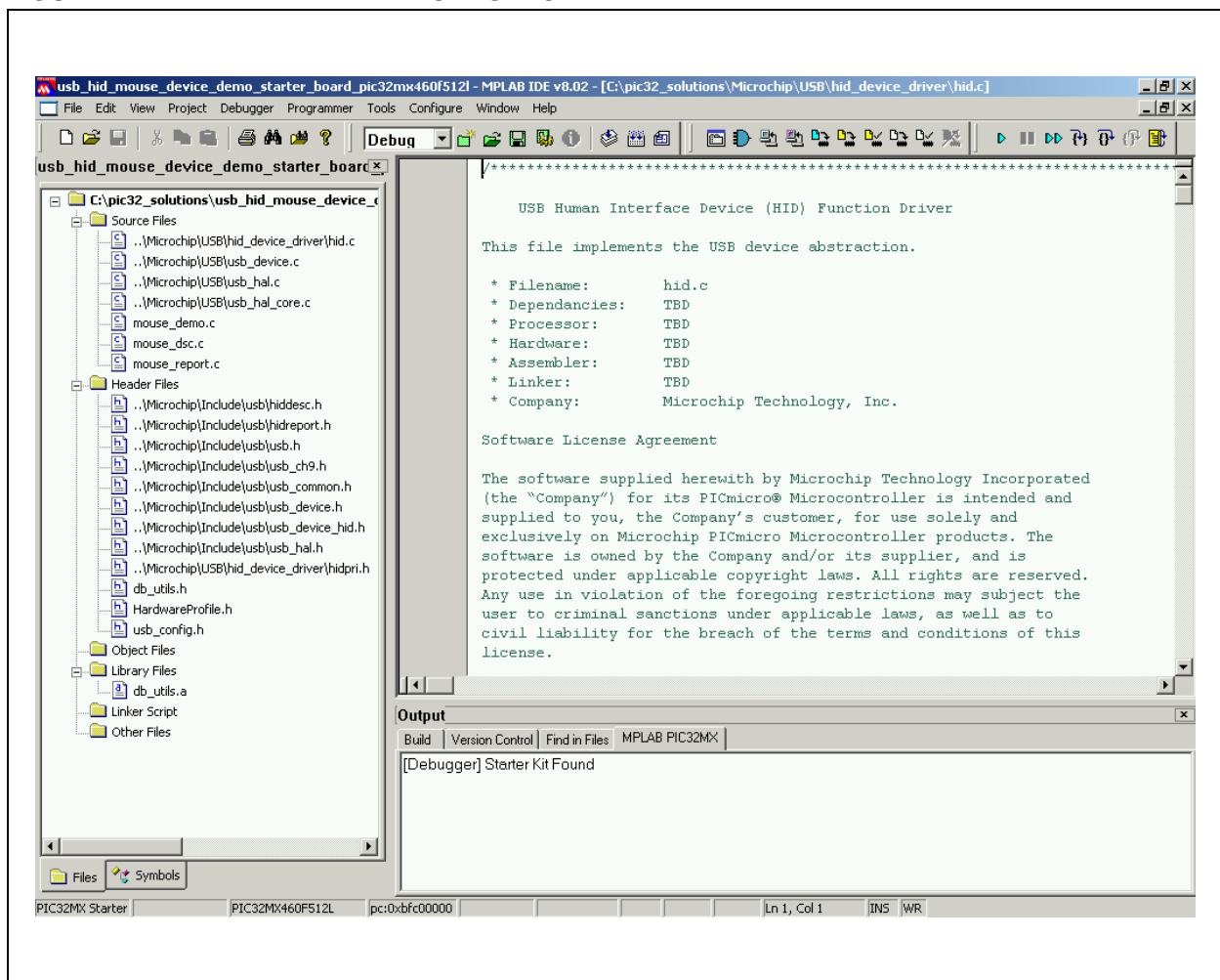
Connect the starter board to the host PC and click the MPLAB IDE icon on your computer desktop. Select *File>Open Workspace...* from the menu bar and browse to the tutorial project file: `c:\pic32_solutions\usb_hid_mouse_device_demo\ StarterBoard_Mousedemo.mcw`

(or browse to the file path that 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' (library) files that are used to build an application. The project files are organized by type into folders.

Select *Debugger>Select Tool>PIC32MX Starter Kit* from the menu bar. "Starter Kit Found" should then be displayed in the "Output" pane of the MPLAB IDE interface. If not, check the driver installation, as well as the connections between the hardware and the PC.

FIGURE 2-1: MPLAB® IDE WORKSPACE



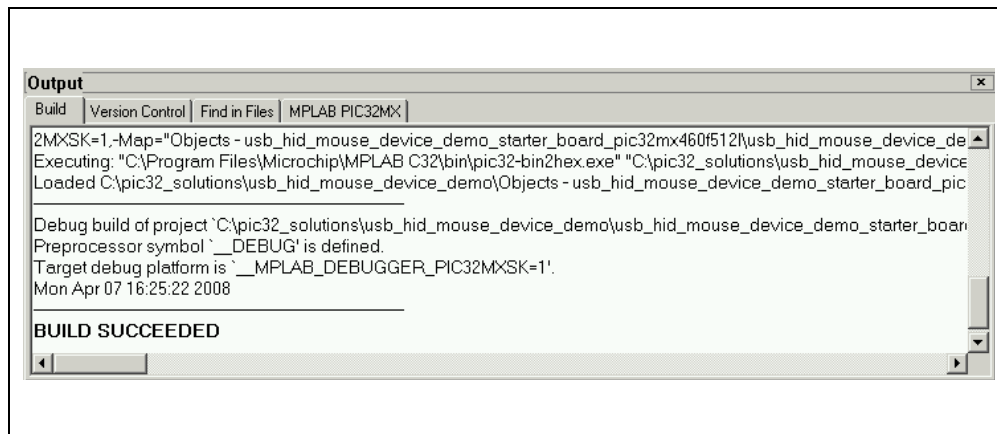
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2.7 BUILDING THE PROJECT

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

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

FIGURE 2-2: BUILD OUTPUT WINDOW

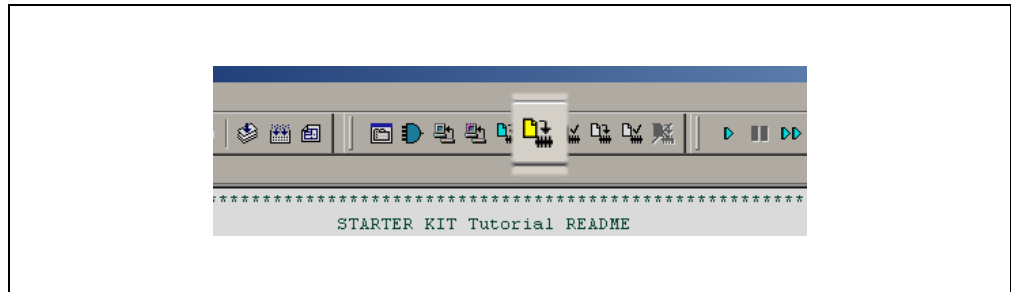


2.8 PROGRAMMING THE DEVICE

2.8.1 Program the Device

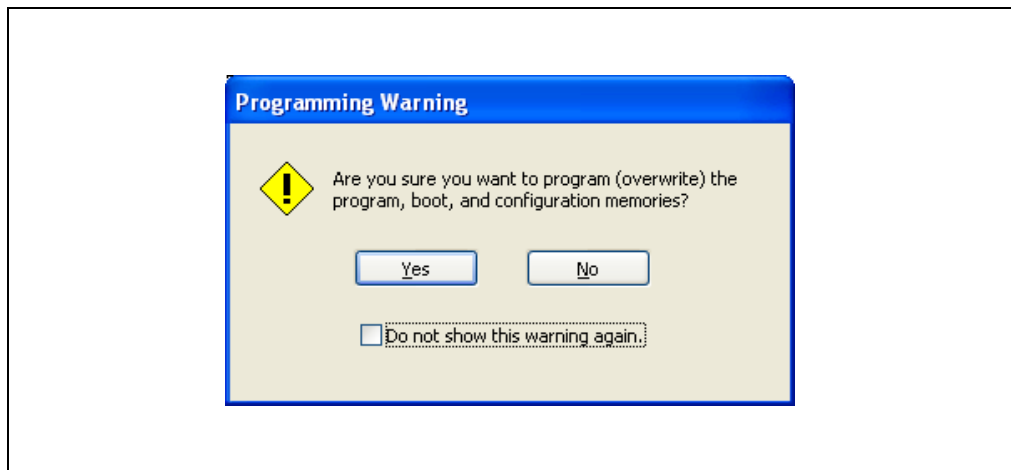
Click on the Program All Memories icon on the Program Device Tool Bar, as shown in Figure 2-3.

FIGURE 2-3: PROGRAM DEVICE TOOL BAR



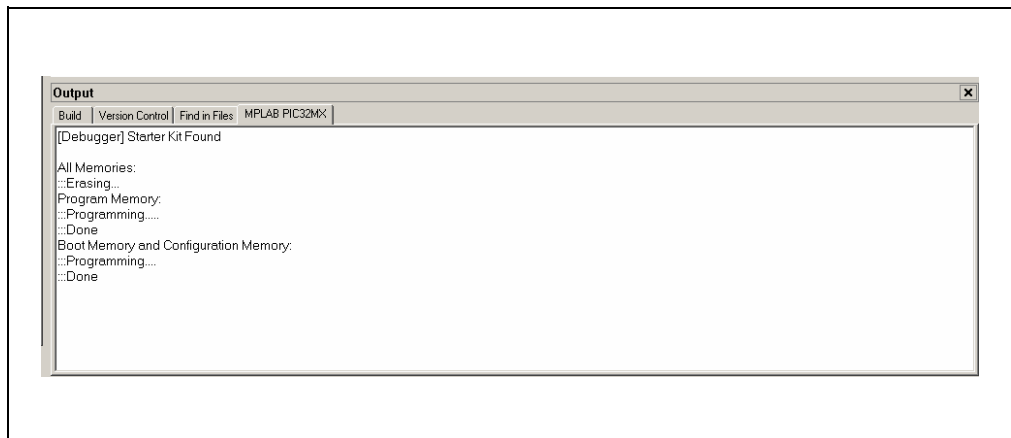
A Programming Warning window, shown in Figure 2-4, opens to warn you about overwriting the memory. Click **Yes**.

FIGURE 2-4: PROGRAMMING WARNING WINDOW



The Output window, shown in Figure 2-5 tracks the progress of the output. A "Done" entry indicates that the programming of the device is complete.

FIGURE 2-5: OUTPUT WINDOW

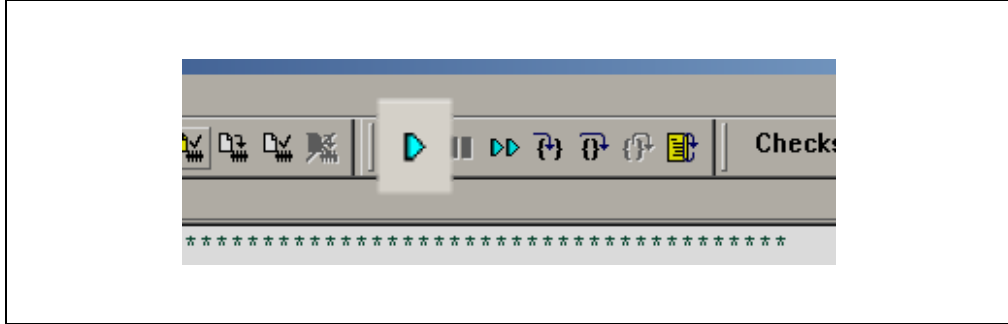


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2.9 RUNNING THE PROGRAM

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, shown in Figure 2-6, to run the new program.

FIGURE 2-6: DEBUG WINDOW



2.10 TUTORIAL PROGRAM OPERATION

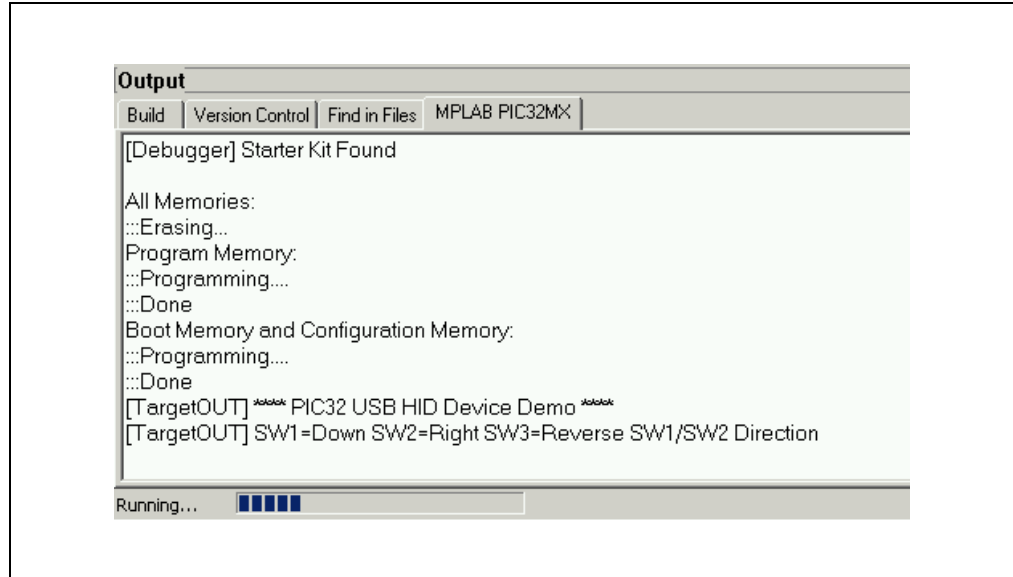
The USB Human Interface Device (HID) mouse tutorial project demonstrates a simple USB peripheral device by emulating a mouse. Depending on the revision of your USB starter board, make the following connections to run the mouse demo.

- For Rev B of the USB starter board, the host PC must have two available USB ports:
 1. Move jumper JP2 to the open position.
 2. Use the USB debug cable (Mini-B to A) to attach the board's debug connector J1 to the first USB port of the host PC. Rev B boards source power from the debugger connection.
 3. Use the USB Micro-B to full-sized A cable to attach the board's J5 connector (type Micro-AB receptacle) to the second USB port of the host PC.
- For a later revision of the USB starter board:
 1. Move jumper JP2 to the open position.
 2. Use the USB Micro-B to full-sized A USB cable to attach the board's J5 connector (type Micro-AB receptacle) to an available USB port on the host PC.

Note: For the HID mouse demo (and all other USB device demos), the JP2 jumper should be open to prevent the possibility of back-feeding voltage onto VBus from one port on the host to another (or from one host to another).

After a pause, the PIC32MX USB Starter Board will enumerate as a standard mouse HID, using drivers built into the host's operating system. The successful completion of this process is usually accompanied by a "bing-bong" tone from the host PC. The output window will display a message indicating that the demo is running, as shown in Figure 2-7.

FIGURE 2-7: OUTPUT WINDOW



To move the mouse cursor, press the button switches on the starter board. Table 2-1 shows the action associated with each button.

TABLE 2-1: BUTTONS FOR CURSOR MOVEMENT

Button Pressed	Mouse Cursor Action
SW1	Moves Cursor Down
SW2	Moves Cursor to Right
SW1 and SW3	Moves Cursor Up
SW2 and SW3	Moves Cursor Left

To disable the HID mouse demo, disconnect the host PC from the Micro-AB receptacle on the starter board. The host PC usually plays a reverse “bong-bing” tone to indicate the successful disconnection of the peripheral device.

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NOTES:

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 PIC32MXUSB Starter Board
- 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:

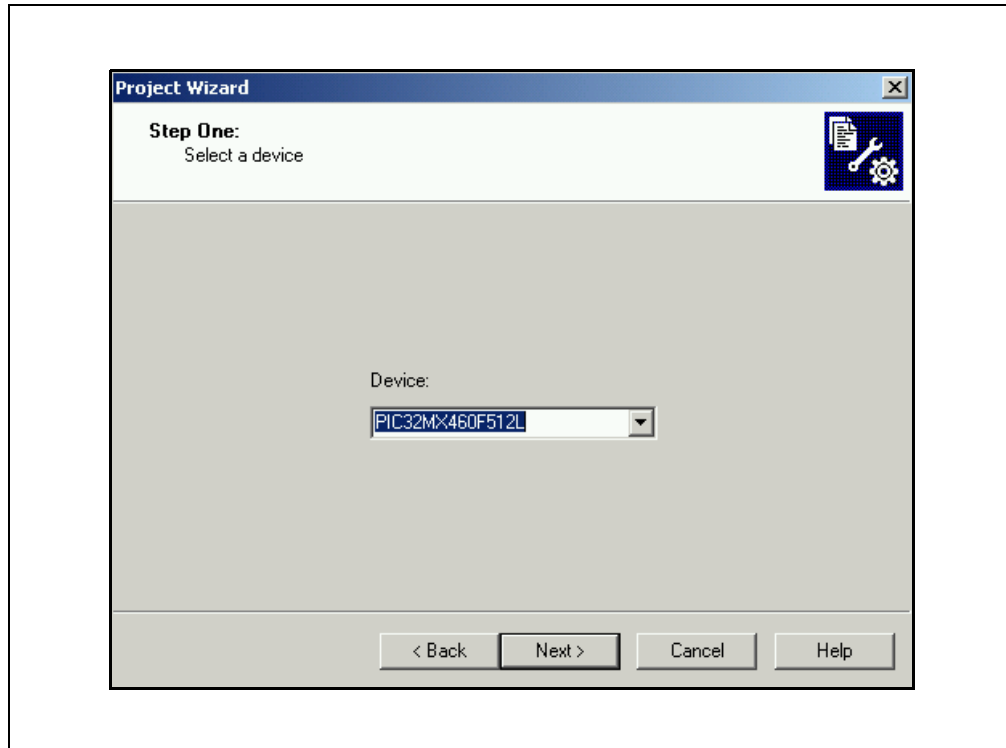
Task 1, Select a Device	page 16
Task 2, Select the Language Toolsuite	page 17
Task 3, Name Your Project	page 18
Task 4, Add Files to Your Project	page 19
Task 5, Confirm the Configuration Settings	page 21
Task 6, Build the Project	page 22
Task 7, Program the Device	page 23
Task 8, Run the Program	page 24

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3.3.1 Task 1, Select a Device

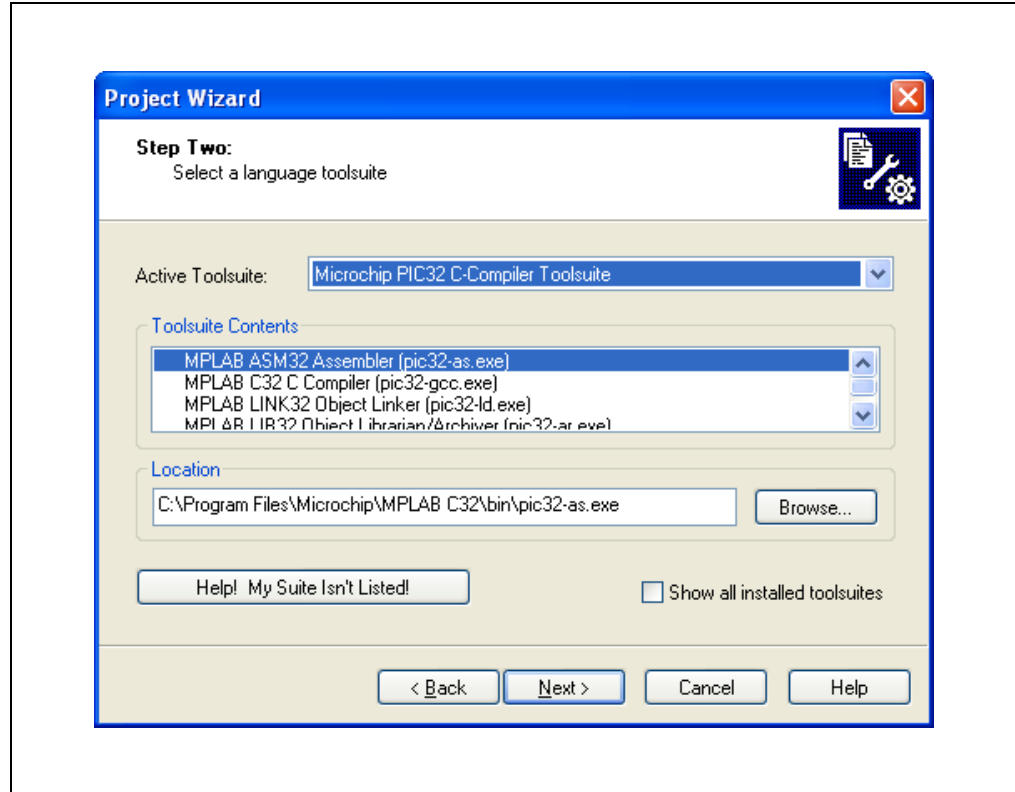
1. Start MPLAB IDE.
2. Click *File>Close Workspace* on the menu bar, to close any open workspace.
3. Click *Project>Project Wizard...* to start the wizard.
4. In the Welcome window, click **Next**. The Project Wizard Step One: window is displayed, as shown in Figure 3-1.

FIGURE 3-1: SELECTING THE DEVICE



5. From the "Device" drop-down list, select "PIC32MX460F512L".
6. Click **Next**. The Project Wizard Step Two: dialog box opens, see Figure 3-2.

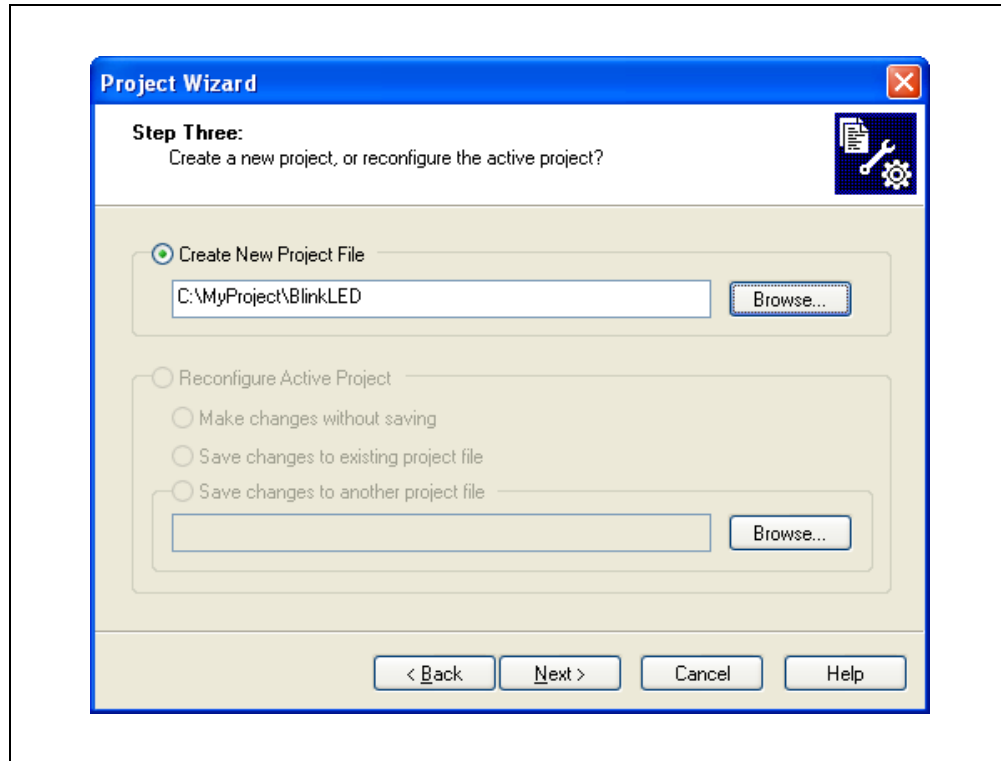
FIGURE 3-2: SELECTING THE TOOLSUITE



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 compiler, 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.

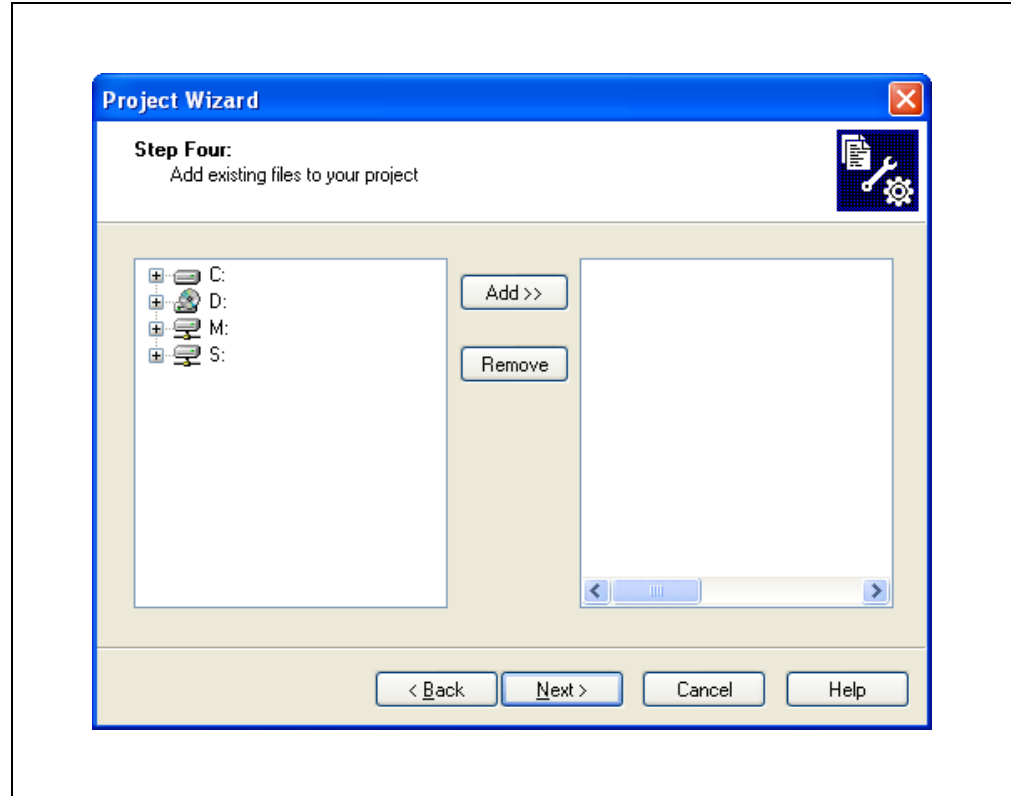
FIGURE 3-3: NAMING YOUR PROJECT



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.

FIGURE 3-4: ADDING FILES TO THE PROJECT



3.3.4 Task 4, Add Files to Your Project

This window can be skipped, since no '.c' files have been created.

1. Click **Next** to continue.
2. Click **Finish** on the summary screen. A project and workspace have been created in the MPLAB IDE.
`BlinkLED.mcw` is the workspace file and `BlinkLED.mcp` is the project file.
3. Click *File>New* from the menu bar to create a new file. A new file is created.
4. Click *File>Save As...* and save this file as 'blinkLED.c' in the same folder, in this case, the `C:\MyProject` folder.
5. Now copy the source code provided in Example 3-1 to the `blinkLED.c` file.

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EXAMPLE 3-1: PROJECT SOURCE CODE

```
#include <plib.h> /* include PIC32 peripheral library */

int main(void)
{
    int i;

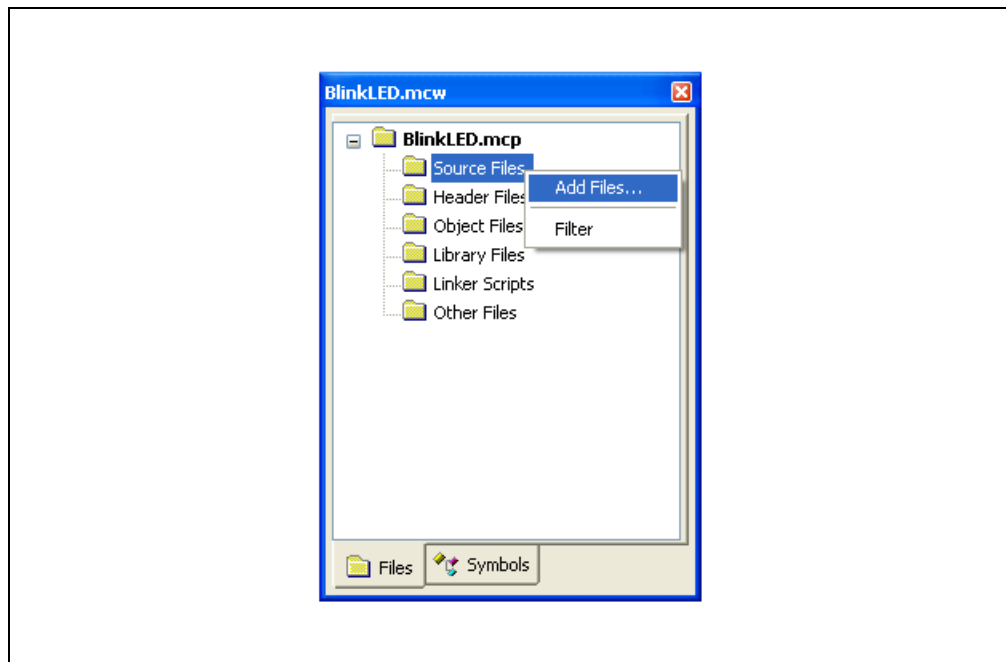
    /* Setup LED's */
    mPORTDClearBits(BIT_0); /* Turn off LED1 on startup */
    mPORTDSetPinsDigitalOut(BIT_0); /* Make RD0 (LED1) as output */
    mPORTDClearBits(BIT_1); /* Turn off LED2 on startup */
    mPORTDSetPinsDigitalOut(BIT_1); /* Make RD1 (LED2) as output */
    mPORTDClearBits(BIT_2); /* Turn off LED3 on startup */
    mPORTDSetPinsDigitalOut(BIT_2); /* Make RD2 (LED3) as output */

    while(1)
    {
        for(i=0; i<200000; i++); /* put a delay */
        mPORTDToggleBits(BIT_0); /* turn ON LED1 */
        for(i=0; i<200000; i++); /* put a delay */
        mPORTDToggleBits(BIT_1); /* turn ON LED2 */
        for(i=0; i<200000; i++); /* put a delay */
        mPORTDToggleBits(BIT_2); /* turn ON LED3 */
    };

    return 0;
}
```

6. In the Project window, right-click on the Source Files folder. Select Add Files and choose `blinkLED.c` to add the file to the source directory, see Figure 3-5.

FIGURE 3-5: ADDING SOURCE FILES



7. Click *Debugger>Select Tool>PIC32MX Starter Kit* from the menu bar, for the Target board.

Note: Make sure that the starter board is connected to your PC.

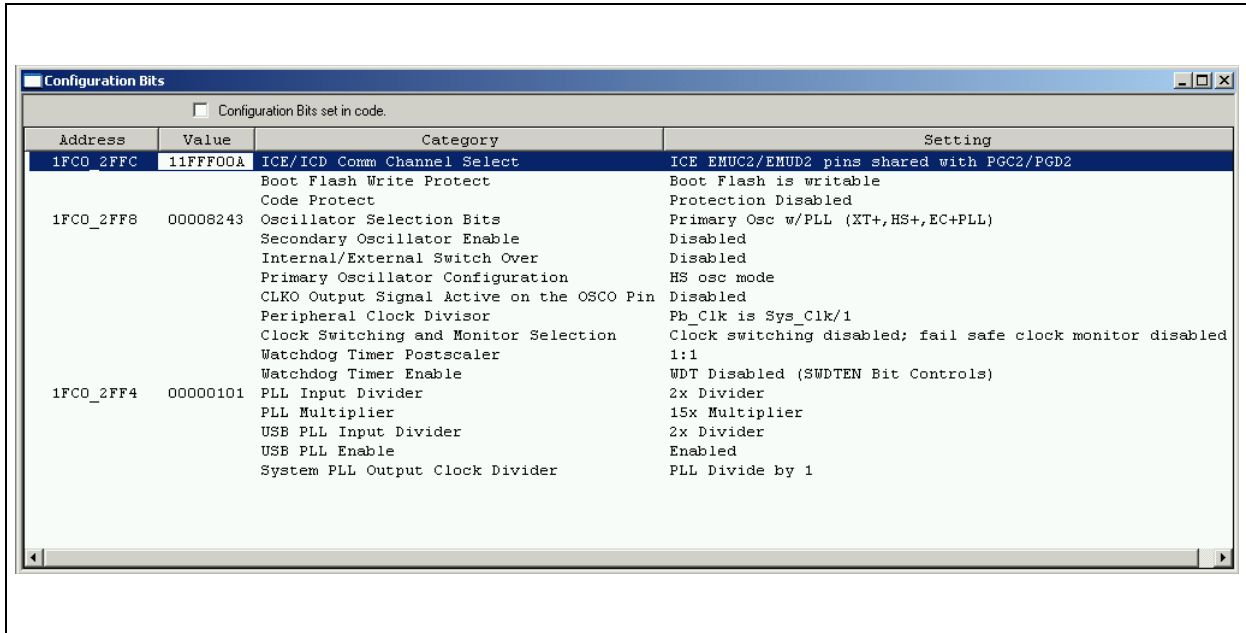
3.3.5 Task 5, Confirm the Configuration Settings

Click [Configure>Configuration Bits](#) to confirm that the configuration settings are correct.

Typical configuration settings for the starter board are shown in Figure 3-6.

Note: The configuration settings can also be embedded in the source file. See the *MPLAB C32 C Compiler User's Guide (DS51686)* for information.

FIGURE 3-6: CONFIGURATION BIT SETTINGS

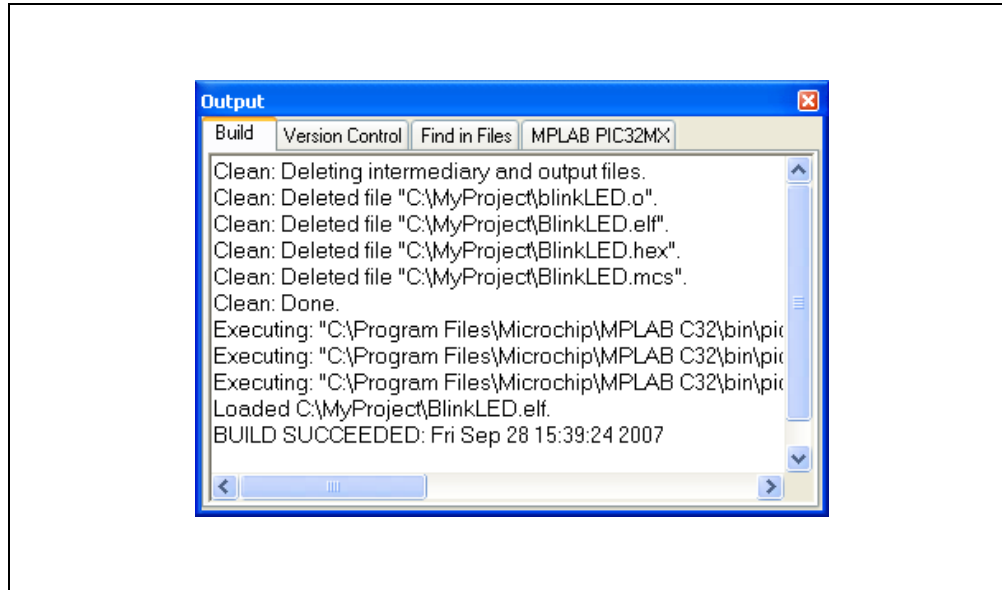


Note: The "Configuration Bits set in code" check box must be unchecked if the config bits are set via this window and not in the code.

3.3.6 Task 6, Build the Project

1. Click *Project>Make* from the menu bar of the main MPLAB IDE window. The build Output window displays (Figure 3-7).
2. Observe the progress of the build. When the "BUILD SUCCEEDED" message displays, you are ready to program the device.

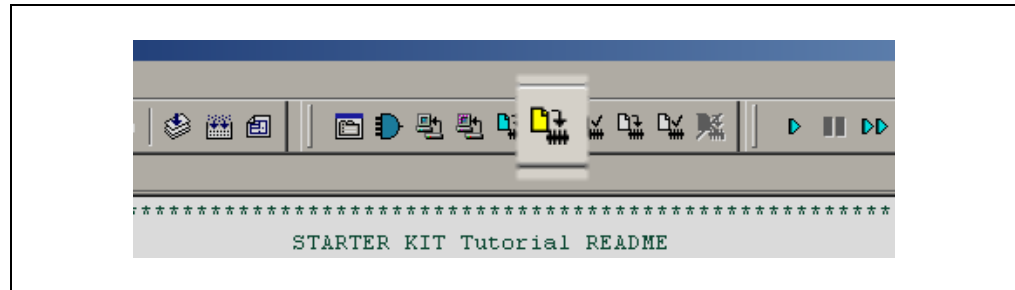
FIGURE 3-7: BUILD OUTPUT WINDOW



3.3.7 Task 7, Program the Device

1. Click the Program All Memories icon on the Program Device Tool Bar, as shown in Figure 3-8.

FIGURE 3-8: PROGRAM DEVICE WINDOW



A Programming Warning window opens to warn you about overwriting the memory, as shown in Figure 3-9.

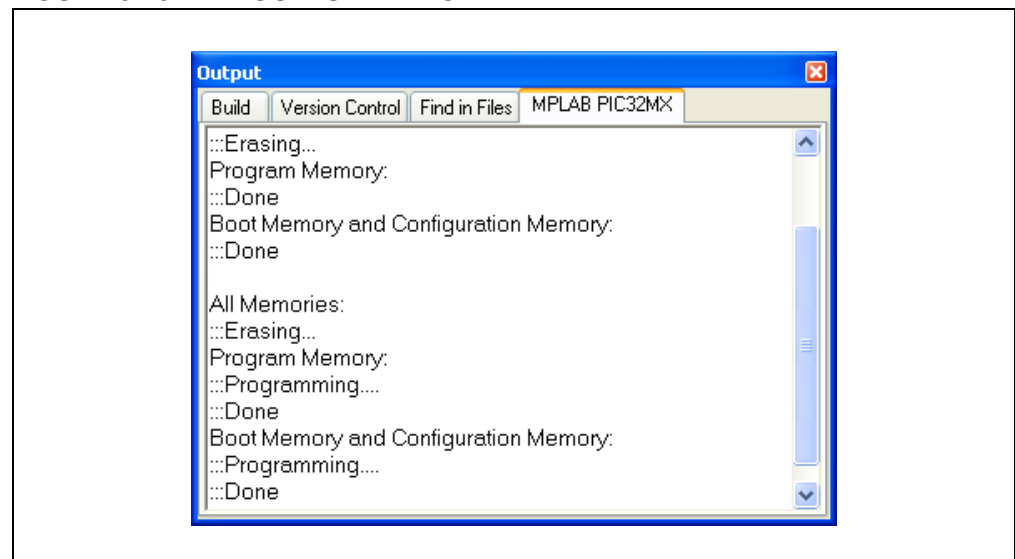
2. Click **Yes**.

FIGURE 3-9: PROGRAMMING WARNING WINDOW



The Output window, shown in Figure 3-10, tracks the progress of the output. "Done" signals that the programming of the device is complete.

FIGURE 3-10: OUTPUT WINDOW



3.3.8 Task 8, Run the Program

Click *Debugger>Run* from the menu bar of the MPLAB IDE or click the Run icon (the turquoise triangle) on the Debug Tool Bar, as indicated in Figure 3-11, to run the new program.

FIGURE 3-11: RUN THE PROGRAM



The starter board LEDs blink to indicate that the program is running successfully.

Chapter 4. PIC32MX USB Starter Board Hardware

4.1 INTRODUCTION

This chapter describes the hardware features of the PIC32MX USB Starter Board.

4.2 HARDWARE FEATURES

The key features of the PIC32MX USB Starter Board are listed below. They are presented in the order given in **Section 1.4 “PIC32MX Functionality and Features”**. You can refer to Figure 1-1 on page 6 for their locations on the board.

4.2.1 Processor Support

The PIC32MX USB Starter Board is designed with a permanently mounted (i.e., soldered) PIC32MX460F512L processor.

4.2.2 Power Supply

There are three ways to supply power to the PIC32MX USB Starter Board:

- USB bus power connected to USB debug connector J1.
- USB bus power connected to PIC32 USB connector J5 – if using Rev C or later revision of the board.
- An external application board with a regulated DC power supply that provides +5V can be connected to the J2 application board connector that is provided on the bottom side of the board.

One green LED (D3) is provided to show that the PIC32 microcontroller is powered up.

4.2.3 Debug USB Connectivity

The PIC32MX USB Starter Board includes a PIC18LF4550 USB microcontroller that provides debugger connectivity over USB. The PIC18LF4550 is hard-wired to the PIC32MX device to provide two types of protocol translation:

- I/O pins of PIC18LF4550 to ICSP™ pins of PIC32MX
- I/O pins of PIC18LF4550 to JTAG pins of PIC32MX

The PIC32MX USB Starter Board currently uses the JTAG pins of the PIC32MX device for programming and debugging.

4.2.4 PIC32MX USB Connectivity

There are three possible ways to connect to the PIC32MX USB microcontroller:

- **HOST Mode**

Connect the device to the Type A connector J4, located on the top side of the USB starter board. If using the Debug USB port to power the Host port, install jumper JP2 to short the back-power prevention diode. Note that a maximum of ~400 mA can be supplied from the Debug USB port to the Host port using this method. If the full 500 mA supply is needed, an external supply must be connected to the application board. Also, remove JP2 to prevent back powering the Debug USB port.

- **DEVICE Mode**

First, connect the debug Mini-B USB cable to port J1. Next, connect the USB starter board to the host using a cable with a Type-B Micro plug to the USB starter board's Micro A/B port J5, located on the bottom side of the USB starter board. The other end of the cable must have a Type-A plug. Connect it to a USB host.

- **OTG Mode**

Connect the USB starter board to the OTG device using an OTG Micro A/B cable to the Micro A/B port J5, located on the bottom side of the USB starter board. The USB starter board provides an on board power supply capable of providing 120mA Max. This supply is controlled by the PIC32MX460 microcontroller.

4.2.5 Switches

Push-button switches provide the following functionality:

- SW1: Active-low switch connected to RD6
- SW2: Active-low switch connected to RD7
- SW3: Active-low switch connected to RD13

The switches do not have any debounce circuitry and require the use of internal pull-up resistors; this allows you to investigate software debounce techniques. When Idle, the switches are pulled high (+3.3V). When pressed, they are grounded.

4.2.6 LEDs

The RD0 through RD2 LEDs are connected to PORTD of the processor. The PORTD pins are set high to light the LEDs.

4.2.7 Oscillator Options

The installed microcontroller has an oscillator circuit connected to it. The main oscillator uses an 8 MHz crystal (Y2) and functions as the controller's primary oscillator. Use of an external crystal is required to develop USB applications. USB specification dictates frequency tolerance of +/- 0.25% for full speed. Non-USB applications can use the internal oscillators. The USB starter board also has provisions for an external secondary oscillator (Y3); however, this is not populated.

The PIC18LF4550 is independently clocked and has its own 8 MHz crystal (Y1).

4.2.8 120-Pin Modular Expansion Connector

The PIC32MX USB Starter Board has been designed with a 120-pin modular expansion interface, which allows the board to provide basic generic functionality now and easy extendability to new technologies as they become available.

TABLE 4-1: STARTER BOARD CONNECTOR PART NUMBERS

	HIROSE Electric PN
Starter Board Connector	FX10A-120P/12-SV1(71)
Application Board Connector	FX10A-120S/12-SV(71)

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NOTES:

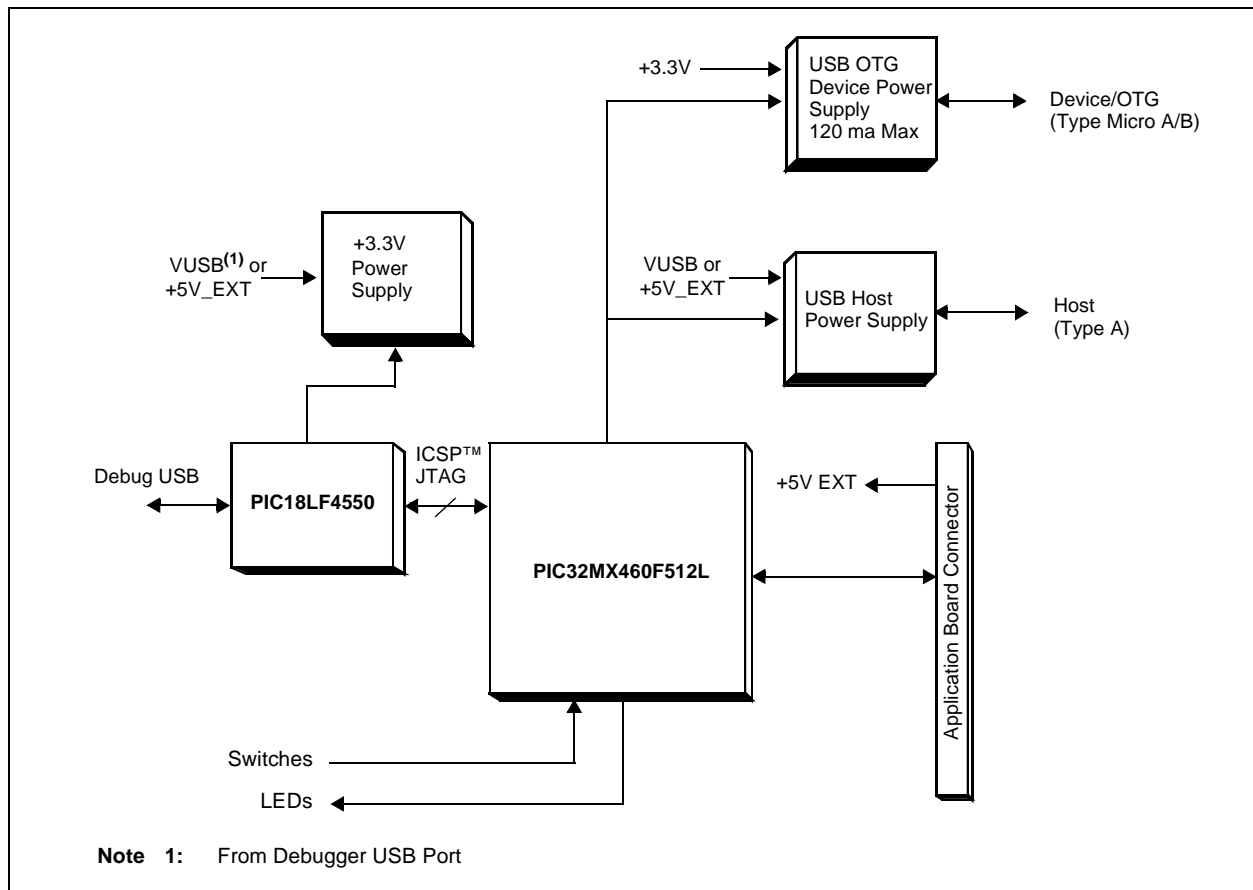
Appendix A. PIC32MX USB Starter Board Schematics

A.1 INTRODUCTION

This section provides detailed technical information about the PIC32MX USB Starter Board.

A.2 DEVELOPMENT BOARD BLOCK DIAGRAM

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

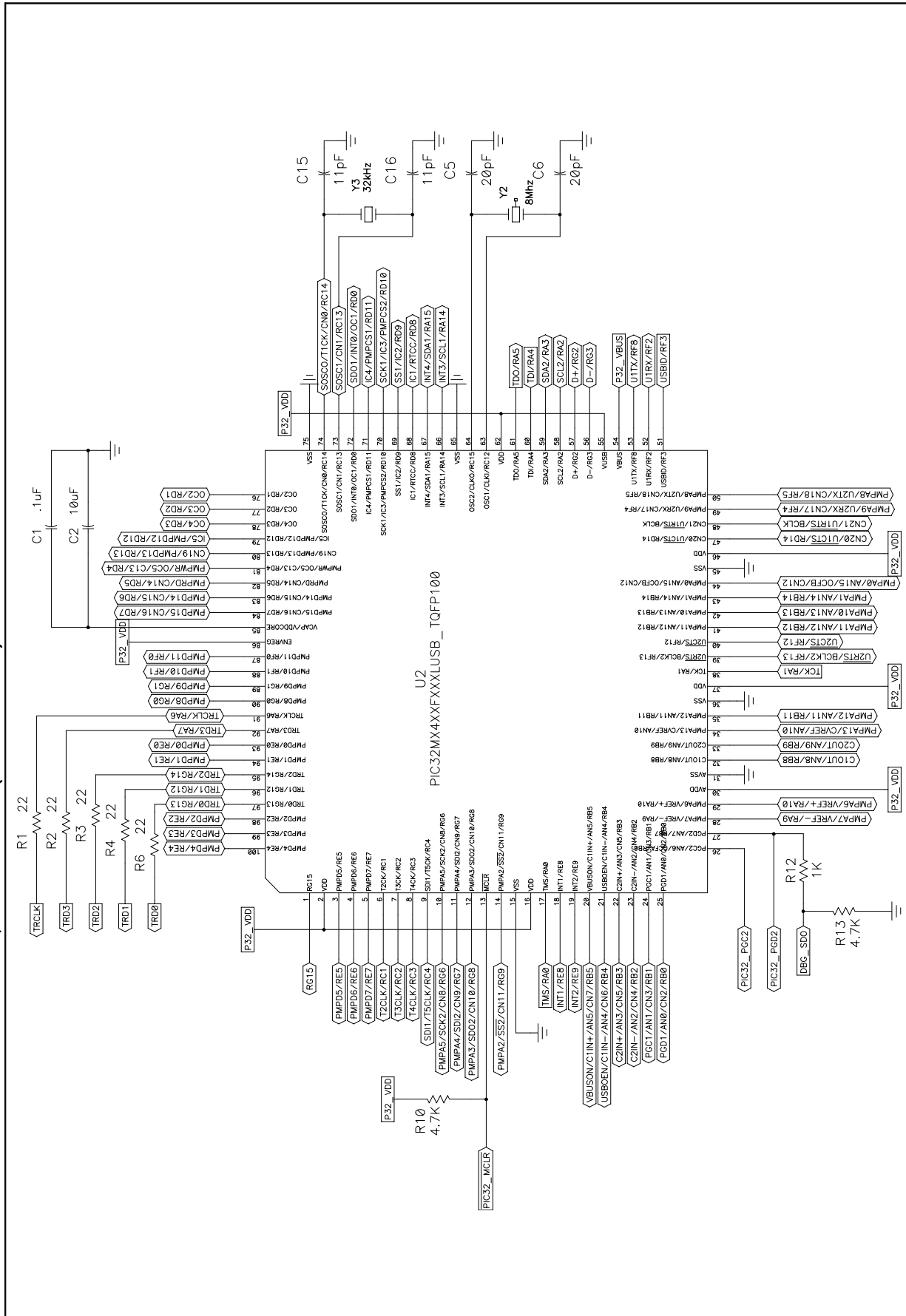


A.3 STARTER BOARD SCHEMATICS

- 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. +3.3V Power Supply
- USB HOST Power Supply
- USB Device/OTG Power Supply

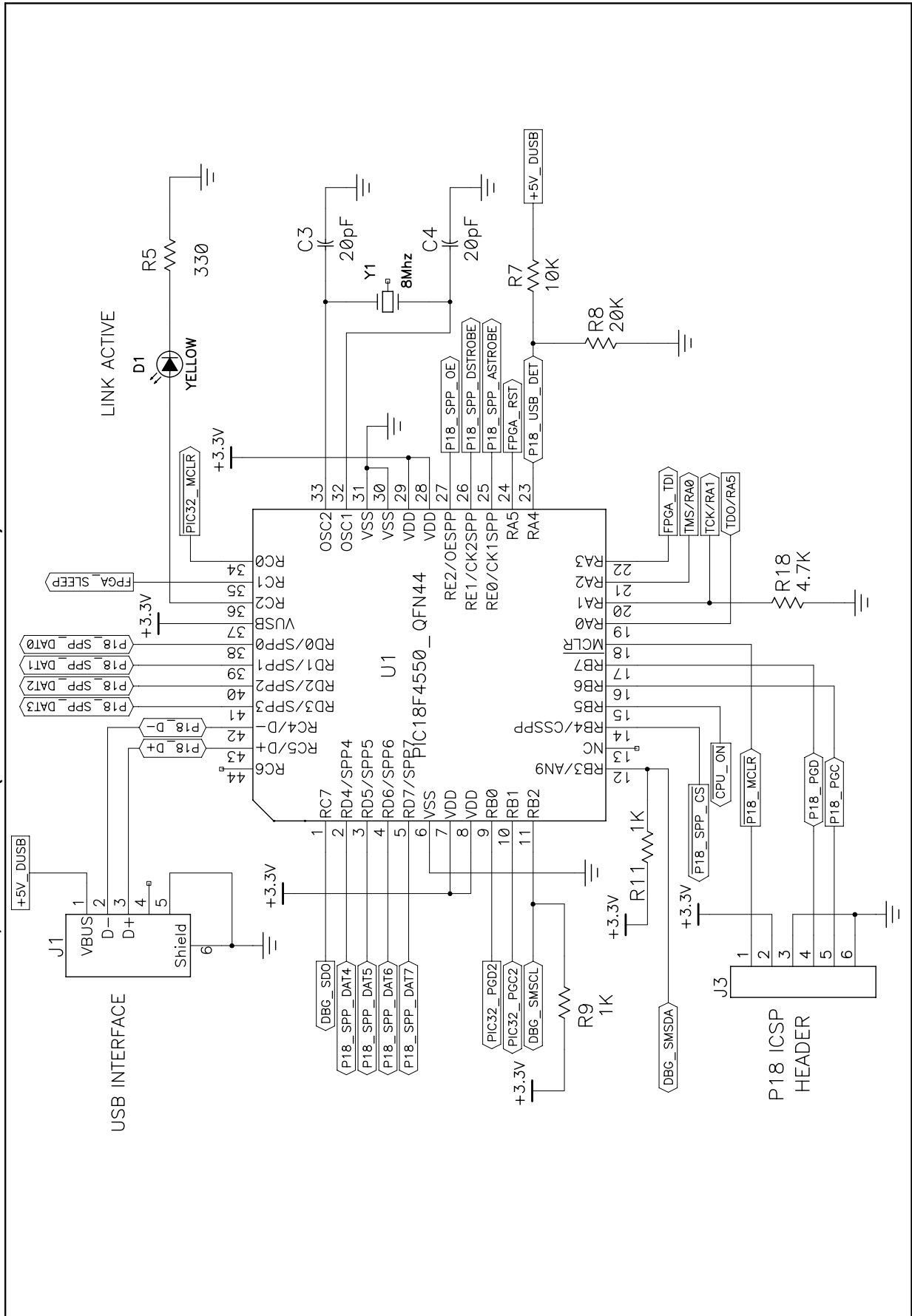
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FIGURE A-2: PIC32MX SCHEMATIC, SHEET 1 OF 6 (PIC32MX CPU)



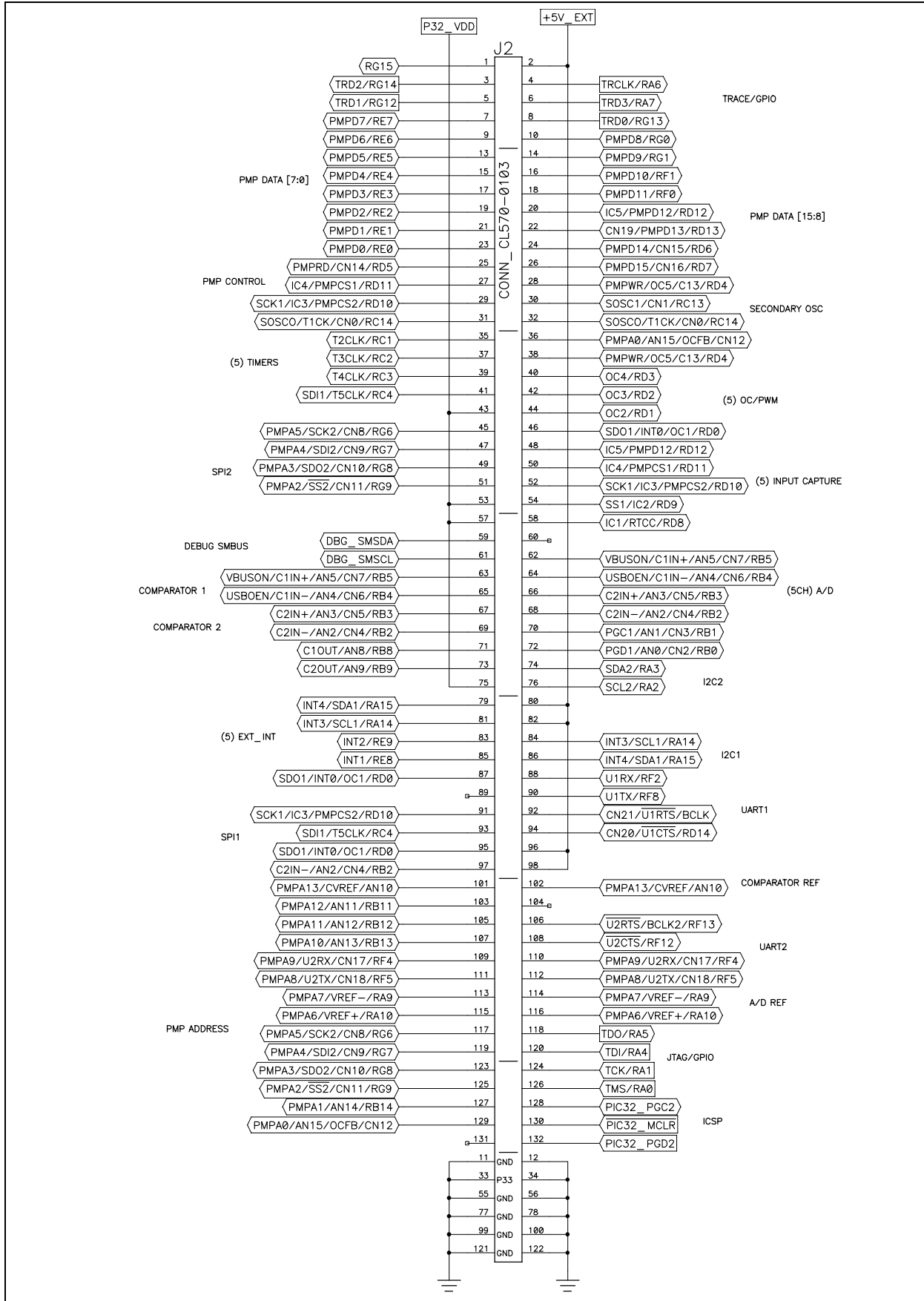
PIC32MX USB Starter Board Schematics

FIGURE A-3: PIC32MX SCHEMATIC, SHEET 2 OF 6 (PIC18LF4550 DEBUG CPU)



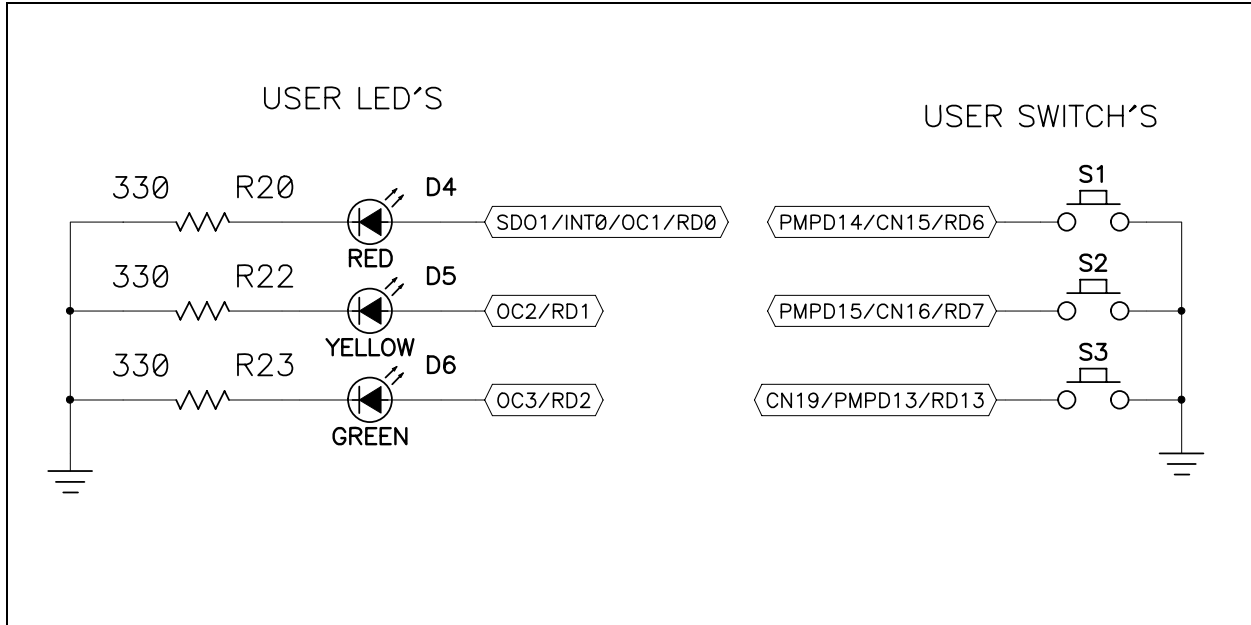
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FIGURE A-4: PIC32MX SCHEMATIC, SHEET 3 OF 6 (APPLICATION BOARD CONNECTOR)



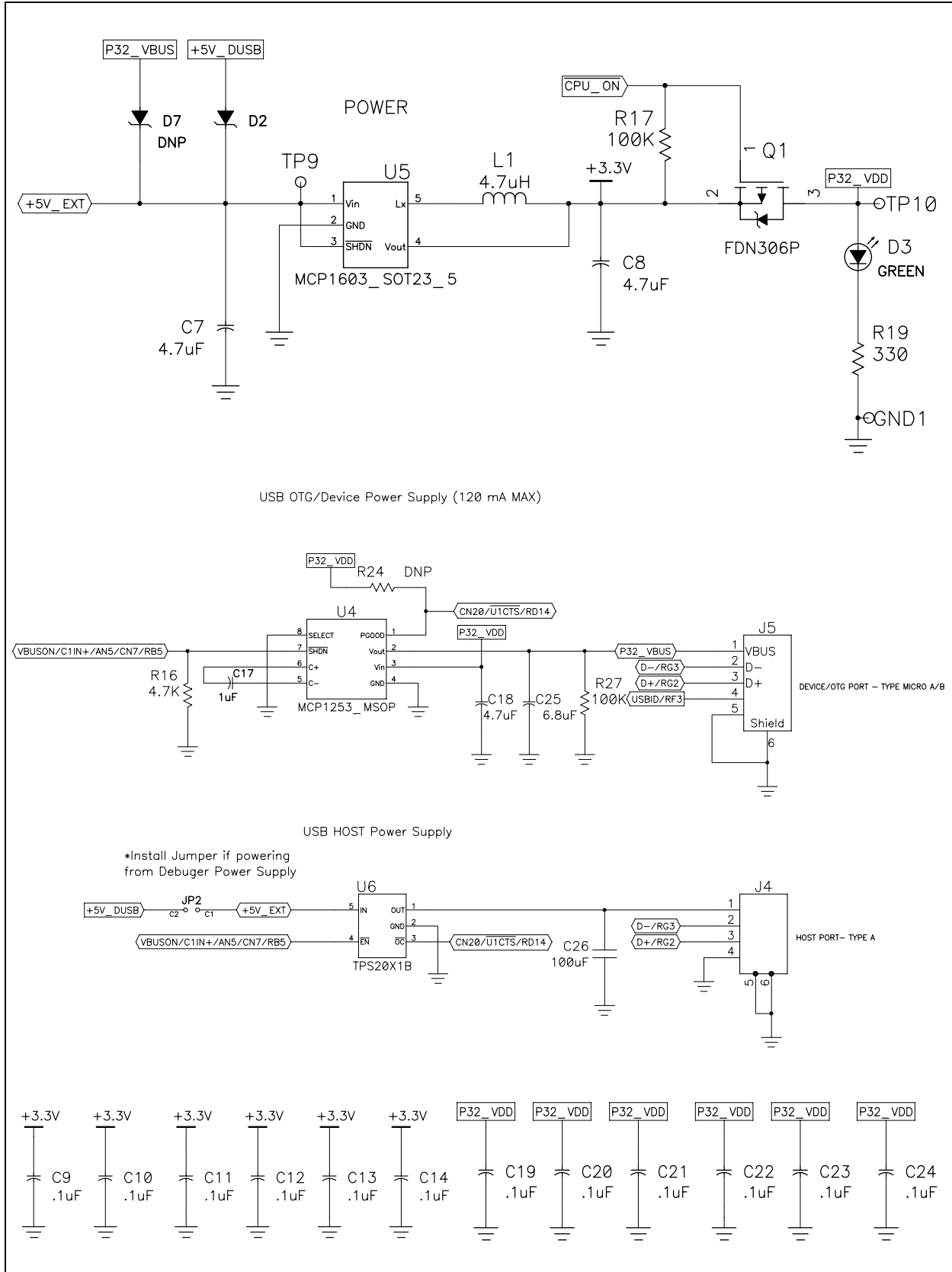
PIC32MX USB Starter Board Schematics

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



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



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