



MICROCHIP

**PIC32 Starter Kit
User's Guide**

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC³² logo, rPIC and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICKit, PICtail, REAL ICE, rLAB, Select Mode, Total Endurance, TSHARC, UniWinDriver, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2010, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

ISBN: 978-1-60932-722-4

Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949:2002 ==**

Table of Contents

Preface	5
Chapter 1. Introduction	
1.1 Kit Contents	11
1.2 PIC32 Starter Kit Functionality and Features	12
Chapter 2. Hardware	
2.1 Hardware Features	13
Appendix A. Board Layout and Schematics	
A.1 PIC32 (General Purpose) Starter Kit Development Board Block Diagram ..	15
A.2 PIC32 (General Purpose) Starter Kit Board Layout	16
A.3 PIC32 (General Purpose) Starter Kit Board Schematics	17
Appendix B. Bill of Materials	
Index	23
Worldwide Sales and Service	24

PIC32 Starter Kit User's Guide

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 PIC32 Starter Kit. 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 PIC32 (General Purpose) Starter Kit (also referred to as “starter kit”) as a development tool to emulate and debug firmware on a target board. This user’s guide is composed of the following chapters:

- **Chapter 1. “Introduction”** provides a brief overview of the starter kit, highlighting its features and uses.
- **Chapter 2. “Hardware”** provides the hardware descriptions of the starter kit.
- **Appendix A. “Board Layout and Schematics”** provides a block diagram, board layouts, and detailed schematics of the starter kit.

PIC32 Starter Kit 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
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>
<i>Italic Courier New</i>	A variable argument	<i>file.o</i> , 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 starter kit. The following Microchip documents are available and recommended as supplemental reference resources.

PIC32MX3XX/4XX Family Data Sheet (DS61143)

Refer to this document for detailed information on PIC32 devices. Reference information found in this data sheet includes:

- Device memory maps
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included on the devices

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 develop an application.

MPLAB[®] IDE User's Guide (DS51519)

Refer to 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 Implementers Forum. See their web site 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

PIC32 Starter Kit User's Guide

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 **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[®] C compiler; MPASM[™] and MPLAB 16-bit assemblers; MPLINK[™] and MPLAB 16-bit object linkers; and MPLIB[™] and MPLAB 16-bit object librarians.
- **Emulators** – The latest information on the Microchip MPLAB REAL ICE[™] in-circuit emulator.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 3.
- **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 device programmer and the PICKit[™] 3 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 (January 2010)

This is the initial release of the PIC32 Starter Kit User's Guide.

Revision B (December 2010)

This revision includes the following updates:

- All references to the PIC32 Ethernet Starter Kit and PIC32 USB Starter Kit II have been removed. User information on these two starter kits can be found in their respective user's guides, which are available from the Microchip web site.
- Formatting changes and minor text updates have been incorporated throughout the document.

PIC32 Starter Kit User's Guide

NOTES:

Chapter 1. Introduction

Thank you for purchasing a Microchip Technology PIC32 Starter Kit. This board provides a low-cost, modular development system for Microchip's line of 32-bit microcontrollers (MCUs).

The starter kit comes preloaded with demonstration software for the user to explore the new features of the PIC32. It is also expandable through a modular expansion interface, which allows the user to extend its functionality. The starter kit also supplies on-board circuitry for full debug and programming capabilities.

This chapter covers the following topics:

- [Kit Contents](#)
- [PIC32 Starter Kit Functionality and Features](#)

The preprogrammed example code on the PIC32 MCU is available via download from the Microchip web site at: <http://www.microchip.com>. All project files have been included so that the code may be used directly to restore the PIC32 MCU on the starter kit to its original state (i.e., if the sample device has been reprogrammed with another program).

1.1 KIT CONTENTS

The PIC32 Starter Kit contains the following items:

- PIC32 Starter Kit Board
- USB Mini-B cable

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

PIC32 Starter Kit User's Guide

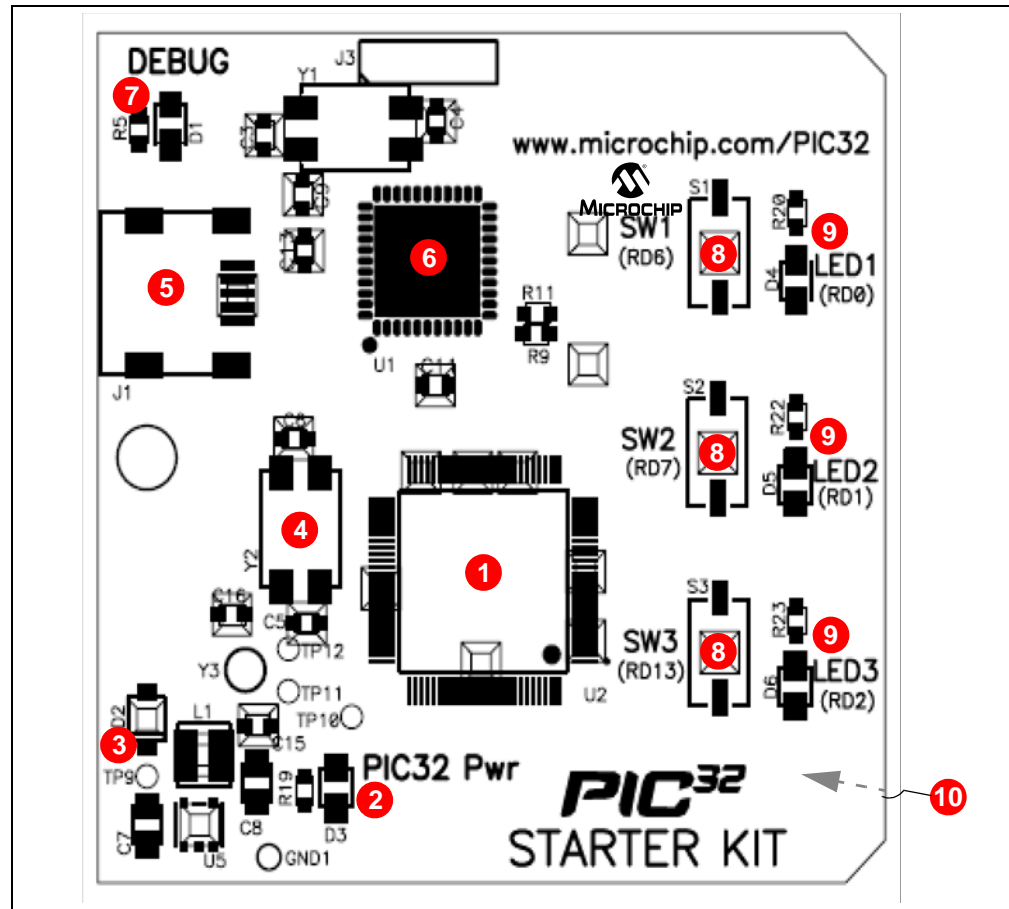
1.2 PIC32 STARTER KIT FUNCTIONALITY AND FEATURES

A representation of the layout of the PIC32 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 2. "Hardware"](#).

FIGURE 1-1: PIC32 STARTER KIT DEMO BOARD LAYOUT



Chapter 2. Hardware

This chapter describes the hardware features of the starter kit.

2.1 HARDWARE FEATURES

The key features of the PIC32 Starter Kit are listed below. They are presented in the order given in [Section 1.2 “PIC32 Starter Kit Functionality and Features”](#). You can refer to [Figure 1-1](#) for their locations on the board.

2.1.1 Processor Support

The PIC32 Starter Kit is designed with a permanently mounted (i.e., soldered) PIC32MX360F512L processor.

2.1.2 Power Supply

There are two ways to supply power to the PIC32 Starter Kit:

- USB bus power connected to J1.
- 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.

Note: The basic PIC32 Starter Kit does not include an application board and is intended to be USB bus powered.

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

2.1.3 USB Connectivity

The PIC32 Starter Kit includes a PIC18LF4550 USB microcontroller, which provides both USB connectivity and support for protocol translation. The PIC18LF4550 is hard-wired to the PIC32MX device to provide two types of connectivity:

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

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

2.1.4 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 debounce techniques. When Idle, the switches are pulled high (+3.3V). When pressed, they are grounded.

PIC32 Starter Kit User's Guide

2.1.5 LEDs

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

2.1.6 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 not required for PIC32 designs. Your design may use the internal oscillator, if desired.

The PIC18LF4550, at the heart of the USB subsystem, is independently clocked and has its own 8 MHz crystal (Y1).

2.1.7 120-Pin Modular Expansion Connector

The PIC32 Starter Kit demo board has been designed with a 120-pin modular expansion interface, which allows the board to provide basic generic functionality now, as well as easy extendability to new technologies as they become available.

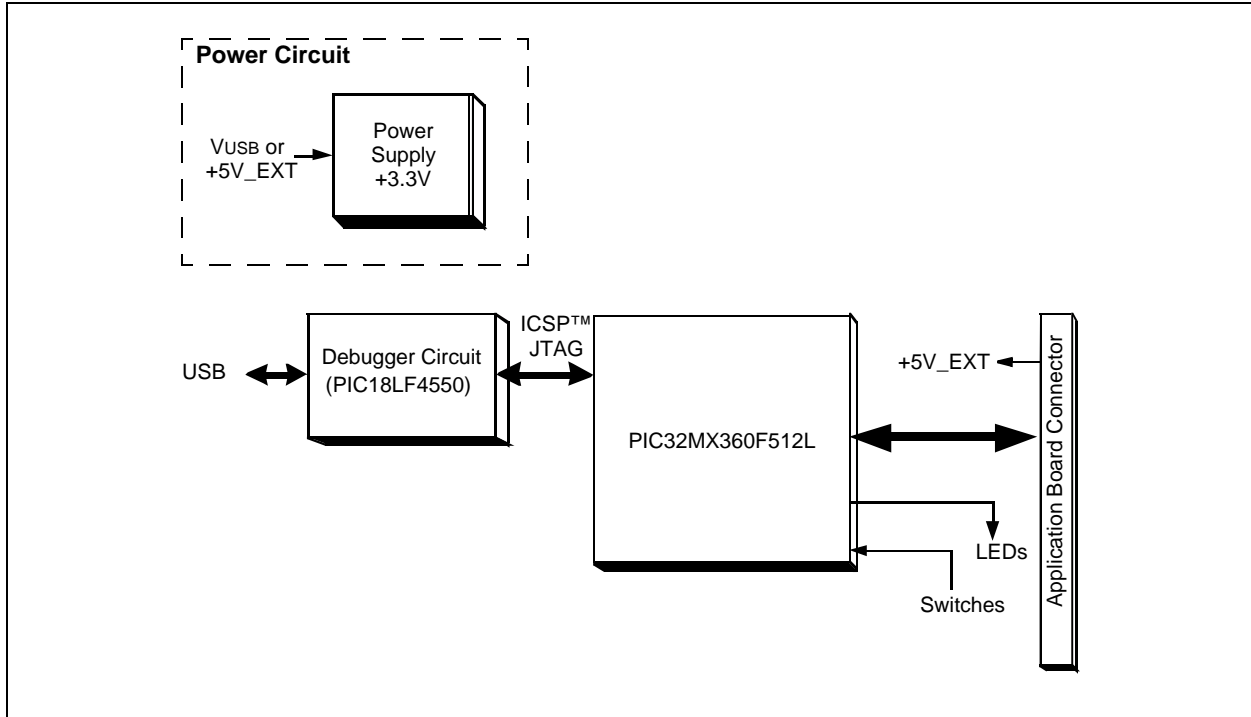
TABLE 2-1: STARTER BOARD CONNECTOR PART NUMBERS

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

Appendix A. Board Layout and Schematics

**A.1 PIC32 (GENERAL PURPOSE) STARTER KIT DEVELOPMENT BOARD
BLOCK DIAGRAM**

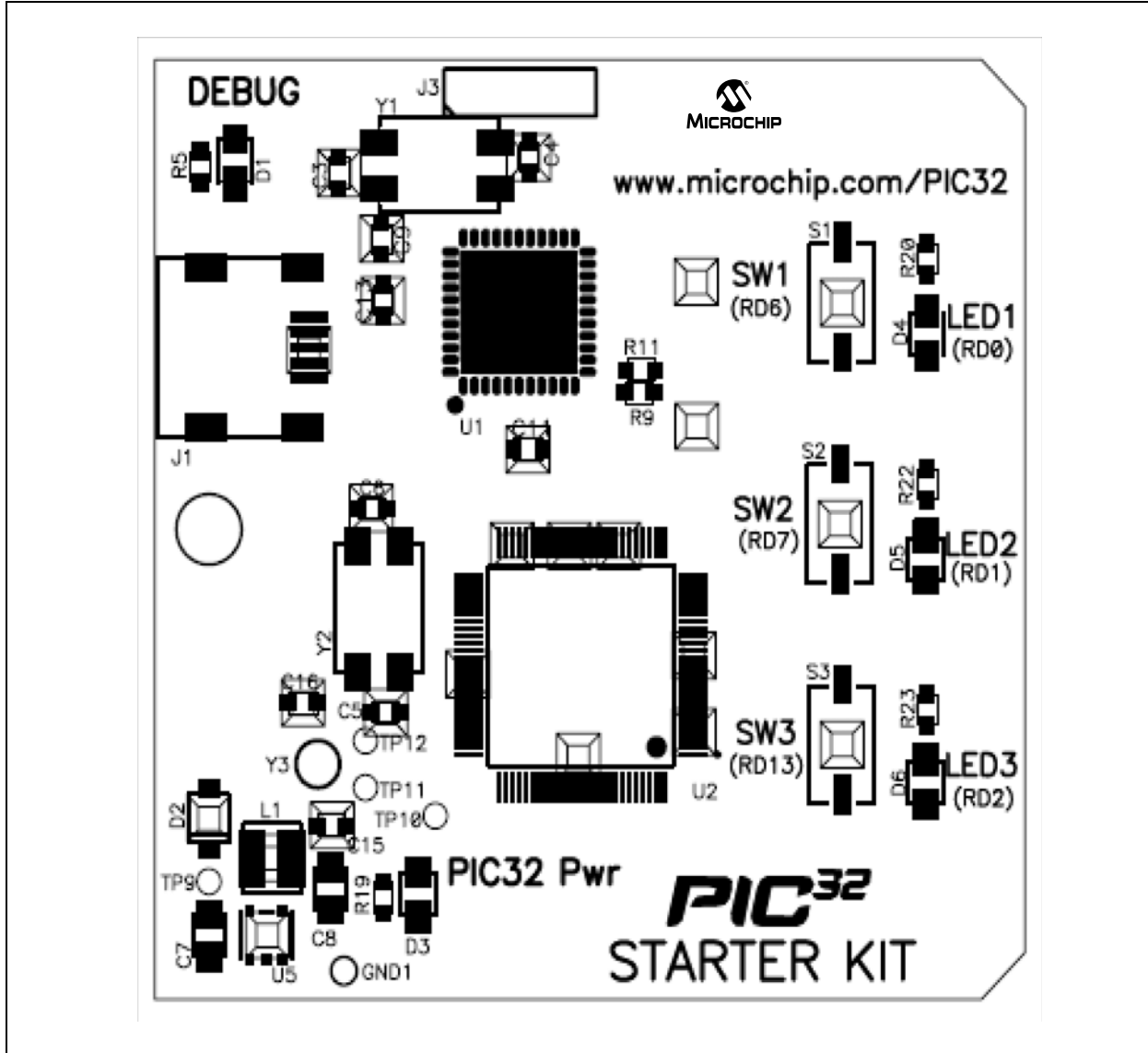
FIGURE A-1: HIGH-LEVEL BLOCK DIAGRAM OF THE PIC32 STARTER KIT



PIC32 Starter Kit User's Guide

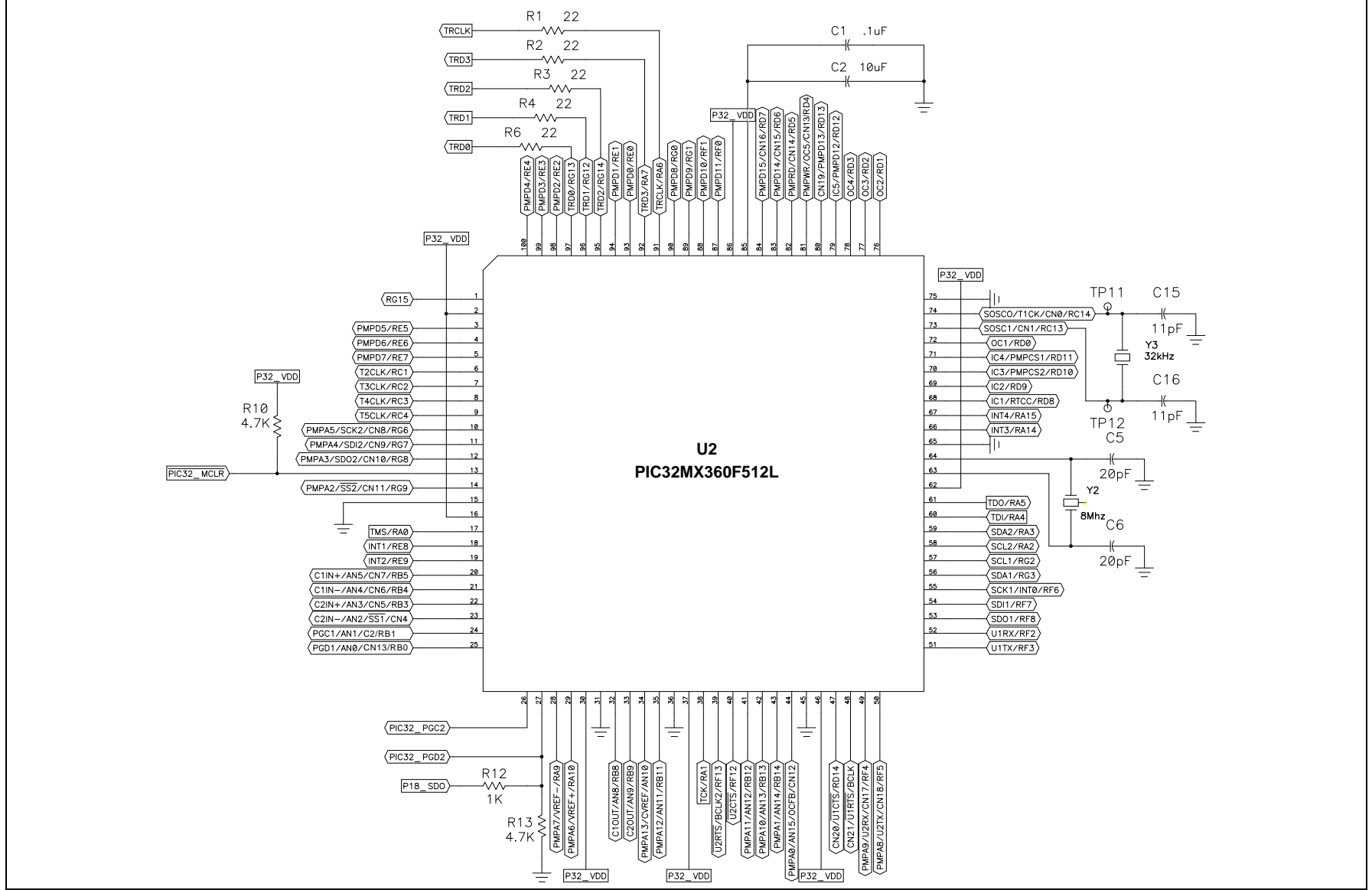
A.2 PIC32 (GENERAL PURPOSE) STARTER KIT BOARD LAYOUT

FIGURE A-2: PIC32 (GENERAL PURPOSE) STARTER KIT BOARD LAYOUT (TOP ASSEMBLY)



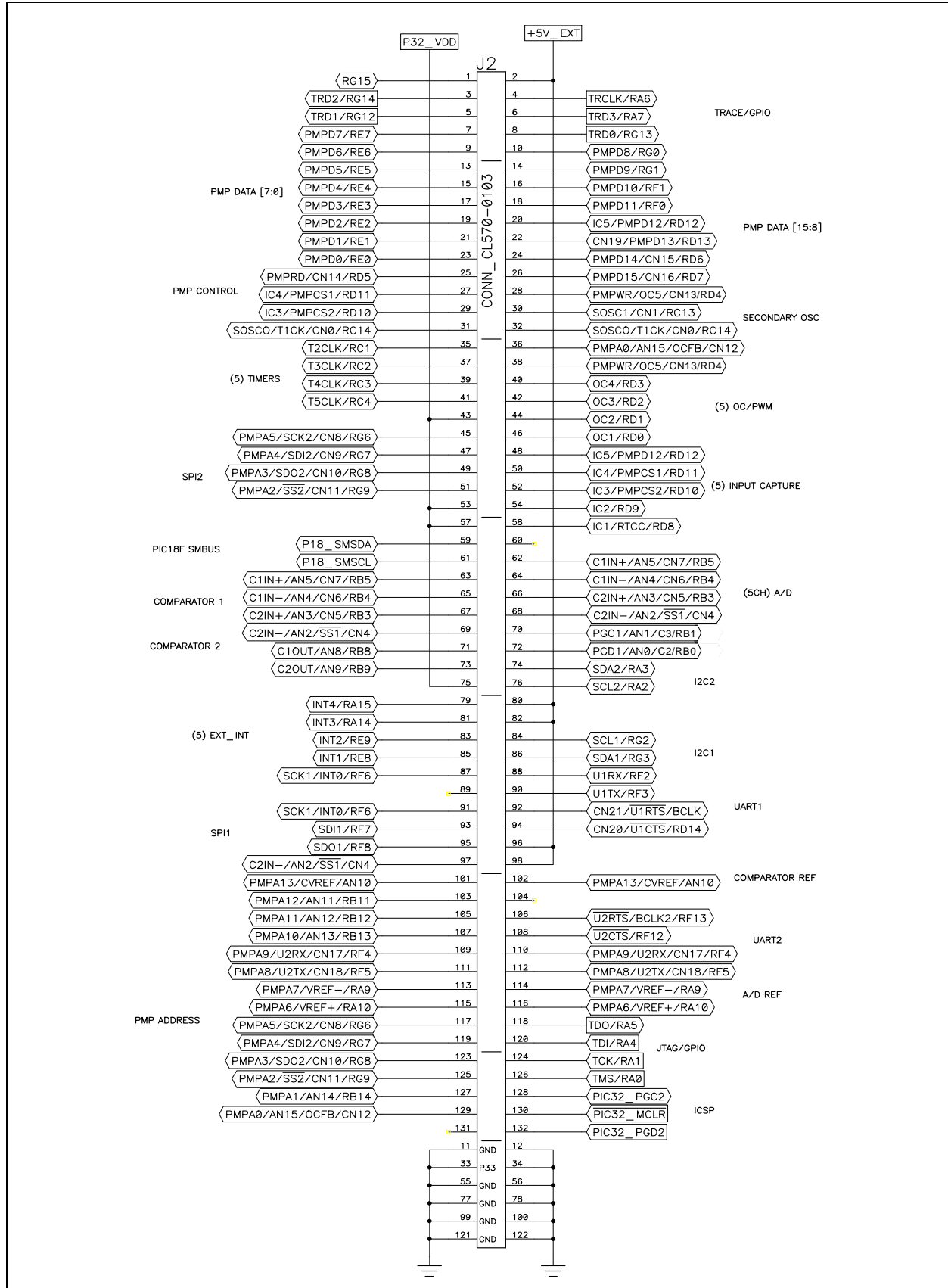
A.3 PIC32 (GENERAL PURPOSE) STARTER KIT BOARD SCHEMATICS

FIGURE A-3: PIC32 STARTER KIT SCHEMATIC (PIC32MX CPU)



Board Layout and Schematics

FIGURE A-5: PIC32 STARTER KIT SCHEMATIC (APPLICATION BOARD CONNECTOR)



PIC32 Starter Kit User's Guide

FIGURE A-6: PIC32 STARTER KIT SCHEMATIC (SWITCHES AND LEDS)

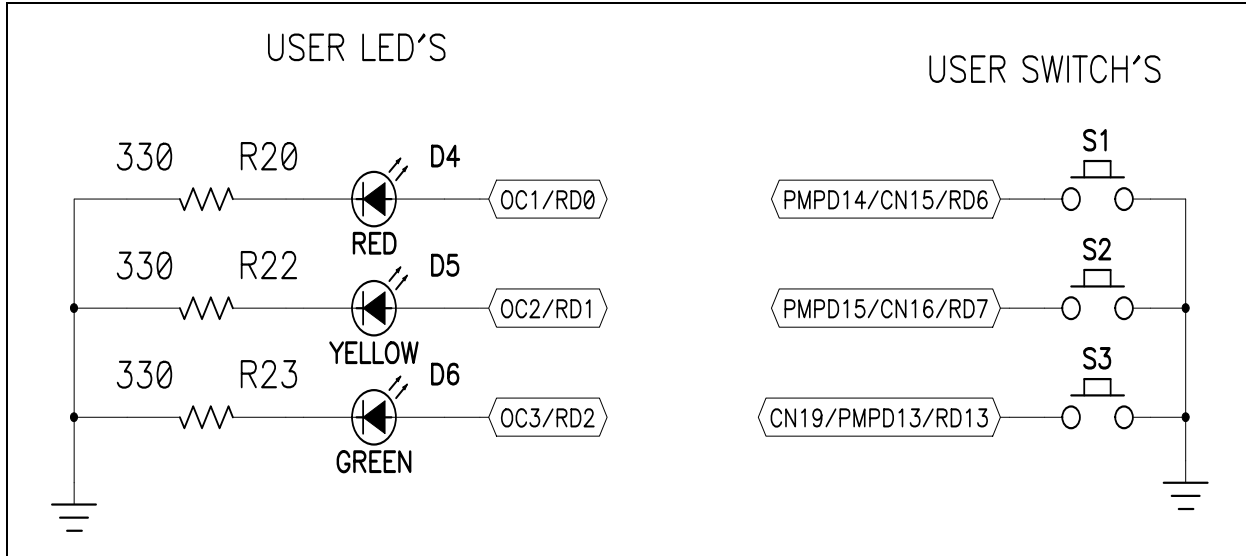
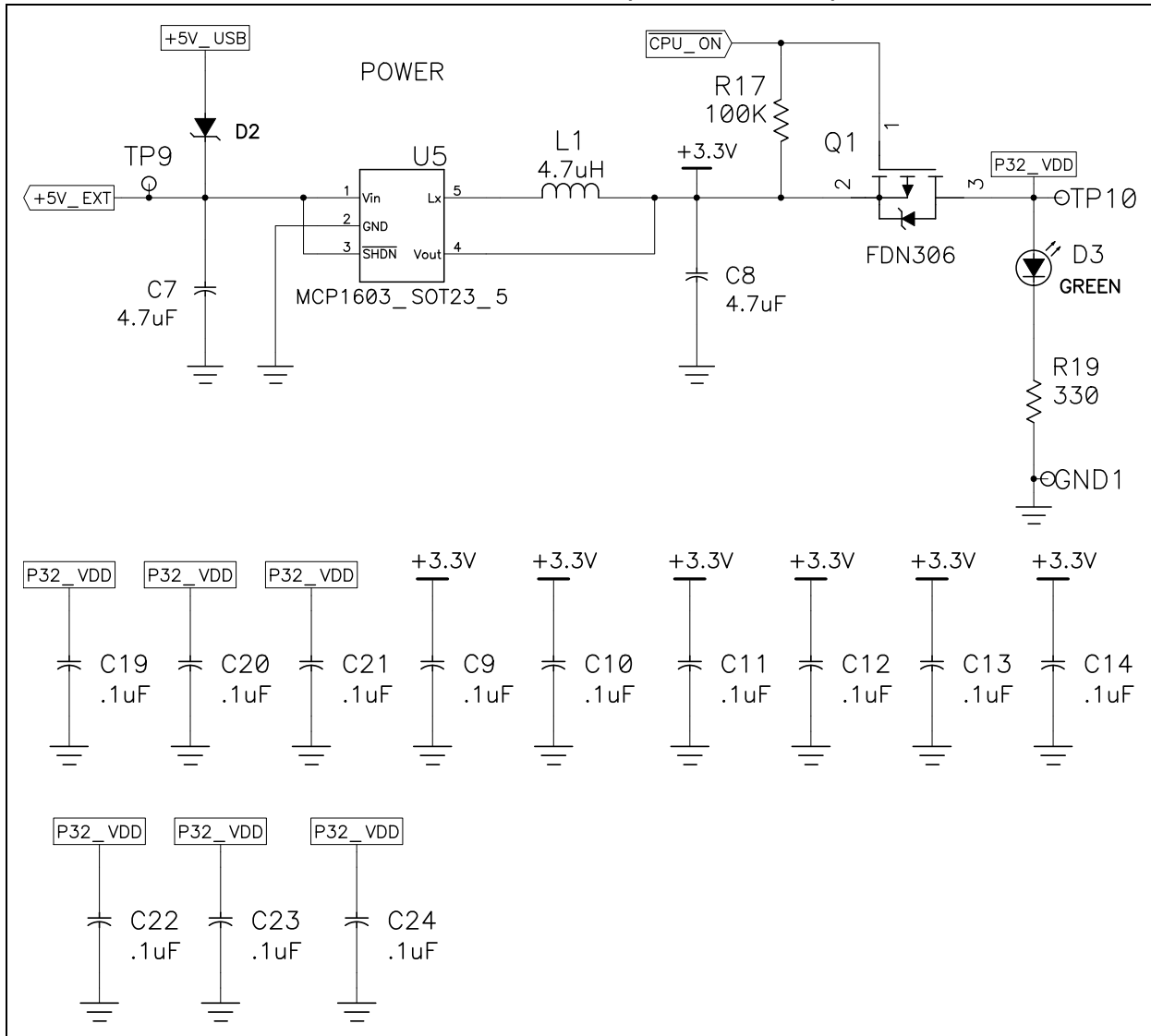


FIGURE A-7: PIC32 STARTER KIT SCHEMATIC (POWER SUPPLY)



Appendix B. Bill of Materials

TABLE B-1: PIC32 STARTER KIT BILL OF MATERIALS

Reference	Description	Manufacturer	Part No.
U1	IC SMT, PIC18LF4550-I/ML, 44P MLF	Microchip	PIC18LF4550-I/ML
U2	IC SMT, PIC32MX360F512L-I/PT, 100P TQFP	Microchip	PIC32MX360F512L-80I/PT
U5	IC SMT, MCP1603-330I/OS, SOT-23-5	Microchip	MCP1603T-330I/OS
Y1, Y2	OSC SMT, 8.0 MHz Crystal 20 pF	Fox Electronics	FQ7050B-8
Q1	TRANS SMT, MOSFET P-CH -2A, -30V, SOT-23	Fairchild	FDN306P
L1	Inductor SMT, 4.7 μ H 800 mA Power Inductor	Coilcraft	ME3220-472MLC
D3, D6	LED SMT, 0805 Green Diff 2x1.25 mm	Lumex	SML-LXT0805GW-TR
D4	LED SMT, 0805 RED DIFF 2x1.25 mm Thin	Lumex	SML-TX0805IW-TR
D1, D5	LED SMT, 0805 YELLOW DIFF 2x1.25 mm Thin	Lumex	SML-LXT0805YW-TR
D2	Diode SMT, Schottky 30V 0.5A SOD-123	On Semiconductor	MBR0530T1G
J1	CONN SMT, RCPT USB Mini-B 5POS RA	Delphi	15430262-110
J2	CONN, SMT, HDR, 120P, W/POST	Hirose Electronics	FX10B-120P/12-SV1(71)
C2	CAP SMT, 10 μ F 0805 CER 6.3V X5R, 10%	Murata Electronics	GRM219R60J106KE19D
C1, C9-C14, C19-C24	CAP SMT, 0.1 μ F 0603 CER 25V X5R, 10%	AVX Corporation	06033D104KAT2A
C3-C6	CAP SMT, 20 pF 0603 CER 50V, 5% C0G	ROHM	MCH185A200JK
C7-C8	CAP SMT, 4.7 μ F 0805 CER 6.3V X5R, 10%	Panasonic	ECJ-2FB0J475K
R14	RES SMT, 0 Ω 1/10W 5% 0603	Vishay/Dale	CRCW06030000Z0EA
R5, R19, R20, R22, R23	RES SMT, 330 Ω 1/10W 5% 0603	Panasonic	ERJ-3GEYJ331V
R9, R11, R12	RES SMT, 1.0 K Ω 1/10W 5% 0603	Panasonic	ERJ-3GSYJ102V
R10, R13, R18	RES SMT, 4.7 K Ω 1/10W 5% 0603	Panasonic	ERJ-3GEYJ472V
R7, R21	RES SMT, 10 K Ω 1/10W 5% 0603	Panasonic	ERJ-3GEYJ103V
R8	RES SMT, 20 K Ω 1/10W 5% 0603	Panasonic	ERJ-3GSYJ203
R1-R4, R6	RES SMT, 22 Ω 1/16W 5% 0603	Panasonic	ERJ-3GSYJ220V
R17	RES SMT, 100 K Ω 1/10W 1% 0603	Panasonic	ERJ-3EKF1003V
S1-S3	Switch, Light Touch 160 gF	Panasonic	EVQ-PPBA25
R15, U3, J3, Y3, TP9-TP12, GND1, C15, C16	Spare Location, Do Not Install	—	—

PIC32 Starter Kit User's Guide

NOTES:

Index

C

Customer Change Notification Service 8
 Customer Support 8

D

Documentation
 Conventions 6

H

Hardware Features
 LEDs 14
 Oscillator Options 14
 PICtail Plus Card Edge Connectors 14
 Power Supply 13
 Processor Support 13
 Switches 13
 USB Connectivity 13

I

Internet Address 7

L

Last Schematic 20

M

Microchip Internet Web Site 7
 MPLAB IDE Simulator, Editor User's Guide 7

P

PIC32MX
 Layout
 32-bit microcontroller 12
 Connector for expansion boards 12
 Debug indicator LED 12
 On-board crystal 12
 PIC18LF4550 USB microcontroller 12
 Power supply 12
 Power-indicator LED 12
 Switches 12
 USB connectivity 12
 User-defined LEDs 12

S

Schematics
 Application Board Connector 19
 PIC18LF4550 Debug CPU 18
 PIC32MX CPU 17
 Power Supply 20
 Switches and LEDs 20
 Starter Kit Board
 Block Diagram 15
 Starter Kit Layout
 Top Assembly 16

U

USB
 Connectivity 13

W

WWW Address 7



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://support.microchip.com>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Farmington Hills, MI
Tel: 248-538-2250
Fax: 248-538-2260

Kokomo
Kokomo, IN
Tel: 765-864-8360
Fax: 765-864-8387

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

Santa Clara
Santa Clara, CA
Tel: 408-961-6444
Fax: 408-961-6445

Toronto
Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon
Hong Kong
Tel: 852-2401-1200
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8528-2100
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Hong Kong SAR
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-2566-1512
Fax: 91-20-2566-1513

Japan - Yokohama
Tel: 81-45-471- 6166
Fax: 81-45-471-6122

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-6578-300
Fax: 886-3-6578-370

Taiwan - Kaohsiung
Tel: 886-7-213-7830
Fax: 886-7-330-9305

Taiwan - Taipei
Tel: 886-2-2500-6610
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

UK - Wokingham
Tel: 44-118-921-5869
Fax: 44-118-921-5820

08/04/10