EVB-USB5537 Evaluation Board User's Guide

© 2014 Microchip Technology Inc.

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in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.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, FlashFlex, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC32 logo, rfPIC, SST, SST Logo, SuperFlash 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, MTP, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

Analog-for-the-Digital Age, Application Maestro, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICkit, PICtail, REAL ICE, rfLAB, Select Mode, SQI, Serial Quad I/O, Total Endurance, TSHARC, UniWinDriver, WiperLock, ZENA and Z-Scale 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.

GestIC and ULPP are registered trademarks of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

A more complete list of registered trademarks and common law trademarks owned by Standard Microsystems Corporation ("SMSC") is available at: www.smsc.com. The absence of a trademark (name, logo, etc.) from the list does not constitute a waiver of any intellectual property rights that SMSC has established in any of its trademarks.

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

© 2014, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-63276-194-1

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
═ ISO/TS 16949 ═

Microchip received ISO/TS-16949:2009 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.

© 2014 Microchip Technology Inc.

Object of Declaration: EVB-USB5537 Evaluation Board

EU Declaration of Conformity

This declaration of conformity is issued by the manufacturer.
The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).
This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.
For information regarding the exclusive, limited warranties applicable to Microchip products, please see Microchip's standard terms and conditions of sale, which are printed on our sales documentation and available at www.microchip.com.
Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

16-July-2013
Date

NOTES:

Table of Contents

© 2014 Microchip Technology Inc.

NOTES:

© 2014 Microchip Technology Inc.

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 EVB-USB5537 Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the EVB-USB5537 Evaluation Board. The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the EVB-USB5537 Evaluation Board.
- **Chapter 2. "Getting Started"** – Includes instructions on how to get started with the EVB-USB5537 Evaluation Board.
- **Appendix A. "EVB-USB5537 Evaluation Board"** – This appendix shows the EVB-USB5537 Evaluation Board.
- **Appendix B. "EVB-USB5537 Evaluation Board Schematics"** – This appendix shows the EVB-USB5537 Evaluation Board schematics.
- **Appendix C. "Bill of Materials (BOM)"** – This appendix includes the EVB-USB5537 Evaluation Board Bill of Materials (BOM).

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

© 2014 Microchip Technology Inc.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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 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, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM assembler); all MPLAB linkers (including MPLINK object linker); and all MPLAB librarians (including MPLIB object librarian).
- **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 MPLAB ICD 3 in-circuit debuggers and PICkit 3 debug express.
- **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 production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART Plus and PIC-kit 2 and 3.

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://www.microchip.com/support

DOCUMENT REVISION HISTORY

Revision A (May 2014)

- Initial release of this document.

© 2014 Microchip Technology Inc.

Chapter 1. Overview

1.1 INTRODUCTION

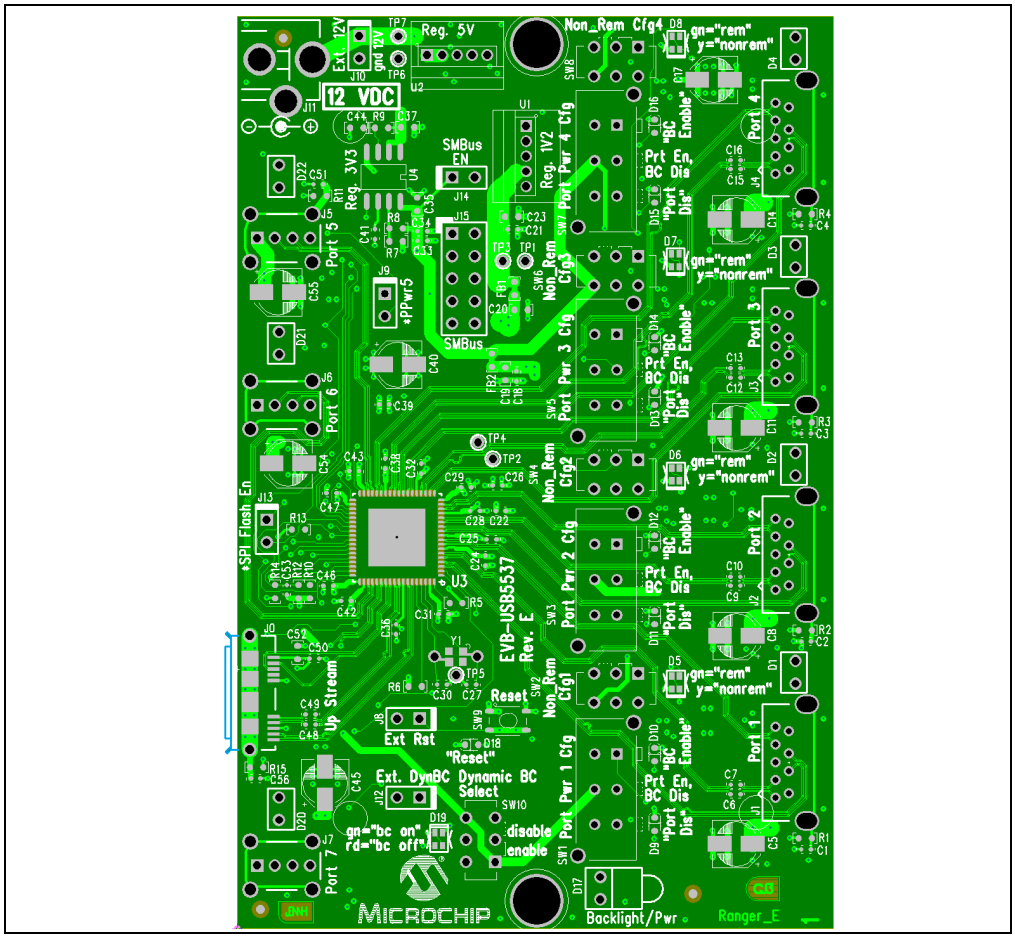
The EVB-USB5537 revision E is a demonstration and evaluation platform that provides the necessary requirements and interface options for evaluating the USB5537B-60xx Ultra Fast seven port battery charging hub on a 4-layer RoHS-compliant Printed Circuit Board (PCB). This will allow the user to gain an understanding of the product and accelerate the integration of the USB5537B-60xx into the user's design. The USB5537B-60xx is compliant with the *USB 3.0 USB Specification* and supports SuperSpeed (SS), High-Speed (HS), Full-Speed (FS), and Low-Speed (LS) USB signaling for complete coverage of all defined USB operation speeds. The evaluation platform supports four downstream USB 3.0 ports, three downstream USB 2.0 ports and also supports battery charging on all seven downstream ports (maximum of 5A at any one time). The USB5537B-60xx is configured for operation through internal default settings and supports custom configurations through SMBus or through the external 64-Mbit SPI Flash device, U11. The EVB-USB5537 demonstrates driver compatibility with Microsoft® Windows® 8x, Windows 7, Windows XP, Mac OS® X 10.4+, and Linux® hub drivers.

1.2 FEATURES

- USB5537B-60xx in a 72-pin QFN RoHS compliant package
- USB 3.0 compliant (SS, HS, FS, and LS operation)
- USB pins are 5 V tolerant
- Self-Powered operation
- Four downstream USB 2.0/3.0 ports
- Three additional downstream USB 2.0 ports
- All downstream ports support individual port power
- Downstream ports 1-4 support individual overcurrent sense
- Downstream ports 5-7 are configurable for individual overcurrent sense
- All downstream ports are battery charge enabled (2.5A max per port)
- Can support up to 5A downstream Port Power at any one time
- Supports Dynamic Battery Charge Enable/Disable
- Onboard SPI Flash for external downloadable firmware
- Low-Cost, 4-layer space saving design
- Operates from a single voltage (+12.0V, regulated) external power supply
- Onboard 25 MHz crystal by default
- Onboard +5.25 V, 6 Amp regulator
- Onboard +3.3 V, 0.5 Amp regulator
- Onboard +1.25 V, 1 Amp regulator
- +3.3 V, Port Power and Reset LED indicators
- Battery Charge Enable, Dynamic Battery Charge and Port Disable LED indicators
- Port Removable LED indicators
- Supports SMBus interface

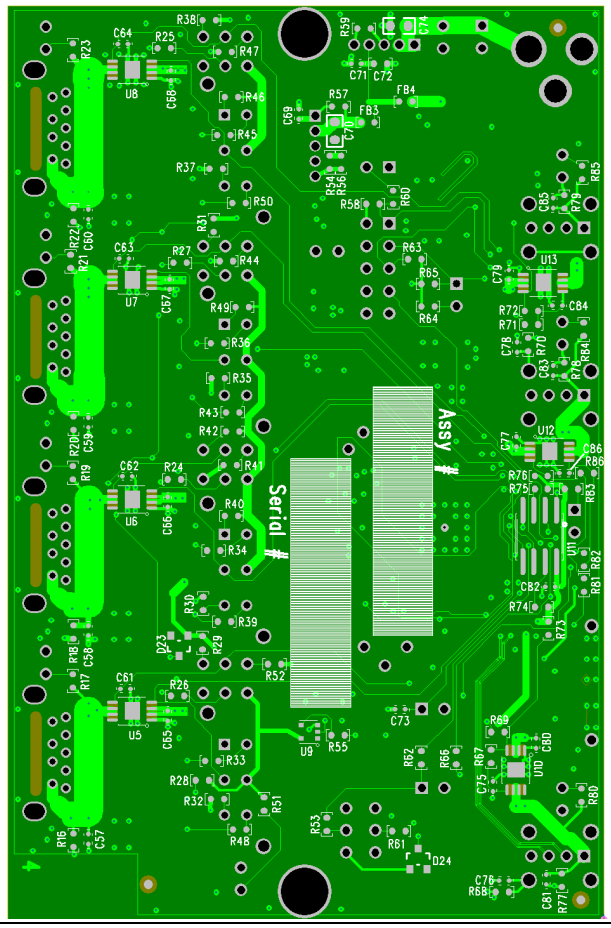
© 2014 Microchip Technology Inc.

FIGURE 1-1: TOP LEVEL SILK SCREEN AND COPPER LAYER



© 2014 Microchip Technology Inc.

FIGURE 1-2: BOTTOM LAYER SILK SCREEN COPPER LAYER



NOTES:

© 2014 Microchip Technology Inc.

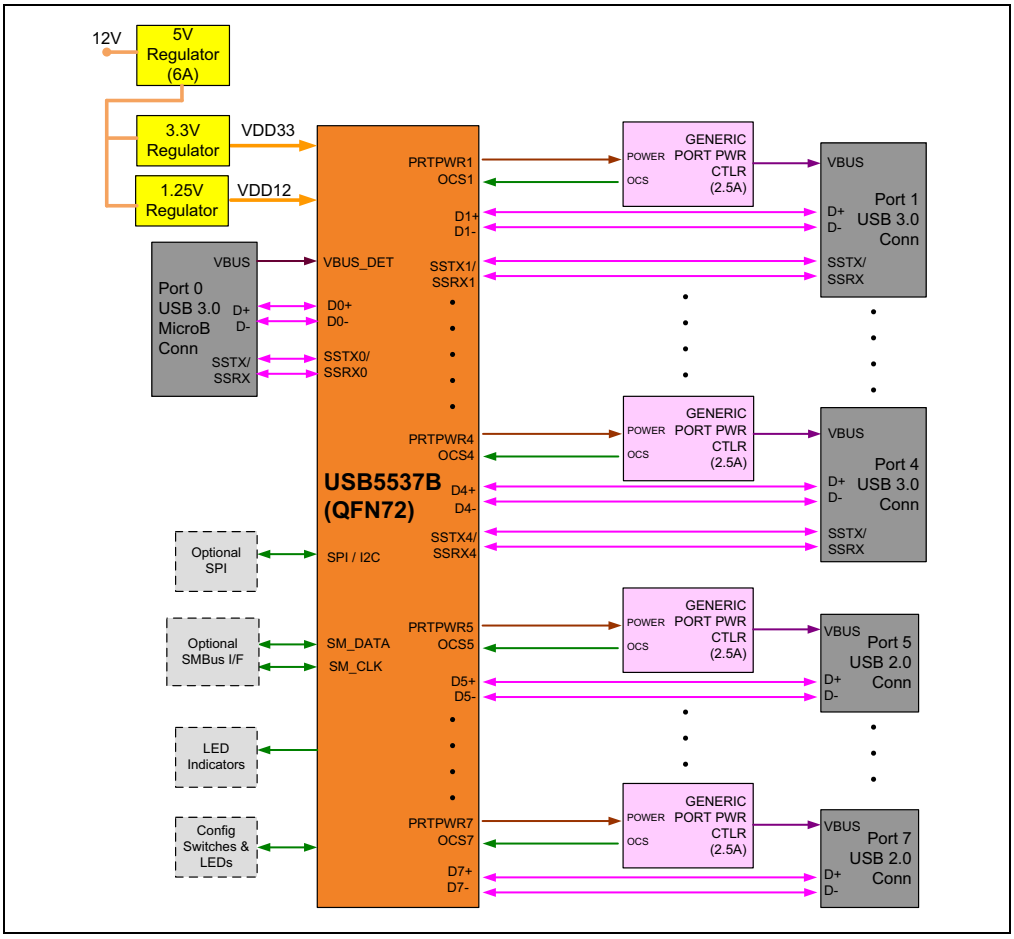
Chapter 2. Getting Started

2.1 EVB-USB5537 CONFIGURATION

The EVB-USB5537 provides different configuration options. It can be configured via default internal register settings, downloadable external firmware to an on board SPI Flash, through SMBus, or through the onboard configuration switches. When configured with the default internal register settings, the device operates as a USB 3.0/2.0 hub with seven battery charge enabled USB ports and Microchip-SMSC's standard VID/PID/DID settings.

A block diagram of the EVB-USB5537 is shown in Figure 2-1.

FIGURE 2-1: BLOCK DIAGRAM



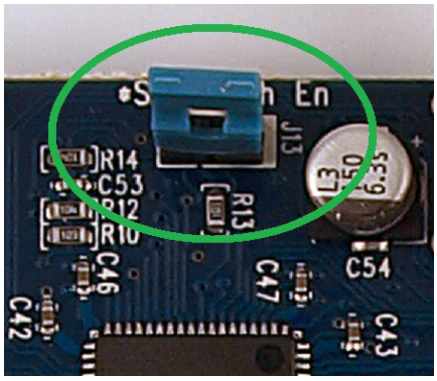
2.2 CONFIGURATION SOURCE – INTERNAL DEFAULT

When the USB5537B-60xx does not detect a valid SPI Flash image or SMBus configuration upon power-up, the EVB-USB5537 uses internal default register settings. It also sets the Vendor ID, Product ID, Language ID, Device ID, and additional settings from internal ROM code.

2.3 CONFIGURATION SOURCE – EXTERNAL SPI FLASH AND SMBUS

Upon power-up, the USB5537B-60xx first looks for an external SPI Flash device with a valid Firmware image loaded. If one is found, the external ROM is enabled and code execution is then initiated from the external SPI device. If a SPI Flash device is not found, the USB5537B-60xx will operate from the internal ROM. After booting to internal or external ROM, the firmware checks to see whether SMBus is enabled. The SMBus can operate in either legacy mode (USB 2.0 only) or advanced mode (access to both USB 2.0 and USB 3.0 registers). Note that the default configuration is for SMBus to operate in advanced mode.

FIGURE 2-2: SPI DEVICE ENABLED (J13)



By default, the SPI Flash chip, U11 is populated. The 10 kOhm pull up resistors (R74 and R75) on the SPI device's Write Protect (nWP) and Hold (nHOLD) pins must also be populated in order to use external flash. The 10 kOhm pull-up resistor (R13) on the SPI_SPD_SEL pin of the USB5537B-60xx must also be populated in order to select 60MHz SPI operation, as opposed to 30MHz operation. Additionally, the J13 *SPI Flash Enable* header is shorted by default in order to enable the SPI device. If the user wanted to disable the SPI device for any reason, the jumper from the J13 *SPI Flash Enable* header would have to be removed. The external flash can be programmed using the Microchip ProTouch MPT software tool which can be downloaded from the Microchip website at http://www.Microchip.com/ProTouch.

SMBus data and clock can be controlled via the onboard SMBus header, J15. The SMBus interface is disabled by default through the 100 kOhm pull-down resistor (R58) on the SM_CLK pin of the USB5537B-60xx. In order to enable SMBus communication, a valid SMBus host must be connected and SM_CLK must be pulled high through a 10 kOhm resistor. This can be achieved by shorting pins 1 and 2 on the J14 *Manual SMBus EN* header. Alternatively, if an Aardvark tool is inserted into the J15 SMBus I/F header, this tool will automatically pull SM_CLK high and then the J14 *Manual SMBus EN* header does not need to be shorted (or installed). When SMBus is enabled, the USB5537B-60xx configures the GPIOs to act as an SMBus slave. As an SMBus slave, the USB5537B-60xx will wait indefinitely for the SMBus configuration. If no external options are detected, the USB5537B-60xx will be configured from the internal default registers.

Note: Refer to the Protouch MPT User Manual on using this software to program the configuration.

© 2014 Microchip Technology Inc.

2.4 POWER SOURCE – SELF-POWERED

The EVB-USB5537 supports only self-powered operation and is powered through one +12.0V regulated external power supply. The +12.0V external DC power supply plugs into the 2.5 mm connector, J11 on the board. Alternatively, an external voltage can be injected onto the J10 *Ext. 12V* header, which is not populated by default. The +12.0V feeds a 6A regulator which outputs +5.25 V across the board. This +5.25 V output is the input to the +3.3 V and +1.25 V onboard regulators as shown in Figure 2-1.

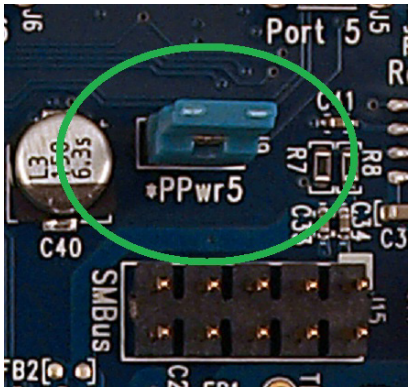
2.5 DOWNSTREAM PORT POWER CONTROL

Each of the seven USB downstream port powers are controlled via a 2.5 A port power device with an auto-discharge function (AP2511). The higher current capabilities of these AP2511 devices allow for all seven downstream ports to support battery charging up to a maximum of 5 A total at any one time.

The AP2511 devices connected to downstream ports 1 through 4 (U5 - U8) are enabled via the PRT_CTL[4:1] pins on the USB5537B-60xx. Downstream ports 1 through 4 also have individual overcurrent sensing available.

The AP2511 devices connected to downstream ports 5 through 7 (U10, U12 and U13) have several options for how they can be controlled. By default, the AP2511 “Enable” pins for these ports are pulled high through 10 kOhm resistors (R64, R73 and R76). Additionally, these enable pins are connected to the PRT_CTL[7:5] pins on the USB5537B-60xx. The PRT_CTL pins can either drive the enable pins of the port power controllers high to enable or low to disable the port power controllers. Note that in order for PRT_CTL5 to control the U13 port power controller, pins 1 and 2 of the J9 *PPwr5* header must be shorted together.

FIGURE 2-3: PORT 5 POWER ENABLE (J9)

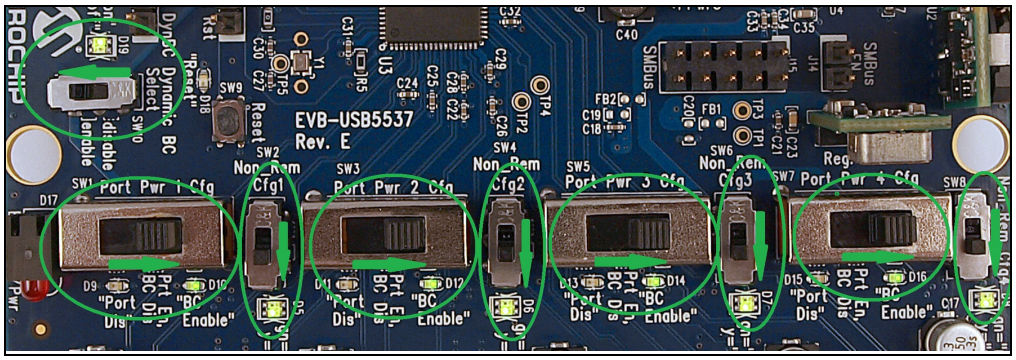


If the user wants to permanently enable these port power controllers for downstream ports 5 through 7, the jumper on J9 can be removed and the 0 Ohm resistors R81 and R69 can be removed. In this configuration, the AP2511 enable pins for these three ports will be permanently pulled high through the 10 kOhm, pull-up resistors mentioned above and therefore will always be turned on. They will no longer be controlled by the USB5537B-60xx. Downstream ports 5 through 7 have their overcurrent sense signals handled differently than from how ports 1 through 4 are handled. The OCS pins on the AP2511 devices for these three ports are connected to the port power control signals of the USB5537B-60xx. In order to view overcurrent sensing on downstream ports 5 through 7, first the PRT_CTL[7:5] pins must be tied to the enable pins of the AP2511 devices. Also, the 0 Ohm resistors R67, R72 and R86 must also be populated (which they are by default). This allows over current sensing capabilities on these three down-stream ports. Another option available for downstream ports 5 through 7 is to gang the over current sense pins so that all OCS pins of the U10, U12 and U13 port power con-

trollers are tied together. In this configuration, the 0 Ohm resistors R67, R72 and R86 would then have to be removed and instead the 0 Ohm resistors R66, R71 and R82 would be installed. When these three resistors are populated, OCS for ports 5 through 7 are all tied together and are monitored on the OCS4 pin of the USB5537B-60xx. This is not the default configuration.

Before applying power to the EVB-USB5537, the first four USB 3.0 downstream ports must be properly configured through the onboard switches. All four downstream ports can be configured in a variety of ways described below. All of the OCS pins as well as the PRTCTL pins have configuration options available through these configuration switches. After the board has been powered, changing the position of these switches will not affect the current configuration. Any changes to the switches will require the EVB-USB5537 to have its power recycled or RESETn asserted before the changes can take affect. The sections below describe the different configuration options available for these USB5537B-60xx strap pins.

FIGURE 2-4: INITIAL CONFIGURATION



OCS Strap Options: Non-Removable Select

The OCS[4:1] pins of the USB5537B-60xx have strap options that are selectable through a 2-Position Double Pole Double Throw (DPDT) switch which are labeled "Non_Rem Cfg". The OCS1 pin is associated with downstream Port 1 and is tied to SW2. When SW2 is in the default position, pins 1 and 2 are shorted together as well as pins 4 and 5 on the switch. This switch position pulls the OCS1 pin high to +3.3 V through a 10 kOhm resistor which configures downstream port 1 to be in the "Removable" state and its associated dual LED (D5) will be turned on green. To change this configuration, SW2 should be switched to the opposite position which will short pins 2 and 3 together as well as pins 5 and 6 on the switch. Once the switch position has been changed, power must be recycled on the EVB-USB5537. This switch position pulls the OCS1 pin low to ground through a 1 kOhm resistor which configures downstream port 1 to be in the "Non-Removable" state and the dual LED (D5) will now be turned on yellow.

This same selection process can be made to the OCS pins and switches that are tied to the downstream ports 2 through 4. The table below describes the different OCS strap options available for each of the first four OCS pins on the USB5537B-60xx.

© 2014 Microchip Technology Inc.

Downstream Port	Assosciated Switch	Switch Position	OCS Config	LED
1	SW2	1-2, 4-5 = Removable (Default)	OCS1 Pulled High	D5 = Green
		2-3, 5-6 = Non Removable	OCS1 Pulled Low	D5 = Yellow
2	SW4	1-2, 4-5 = Removable (Default)	OCS2 Pulled High	D6 = Green
		2-3, 5-6 = Non Removable	OCS2 Pulled Low	D6 = Yellow
3	SW6	1-2, 4-5 = Removable (Default)	OCS3 Pulled High	D7 = Green
		2-3, 5-6 = Non Removable	OCS3 Pulled Low	D7 = Yellow
4	SW8	1-2, 4-5 = Removable (Default)	OCS4 Pulled High	D8 = Green
		2-3, 5-6 = Non Removable	OCS4 Pulled Low	D8 = Yellow

FIGURE 2-5: REMOVABLE STATE (DEFAULT)

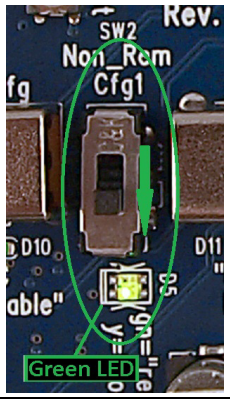
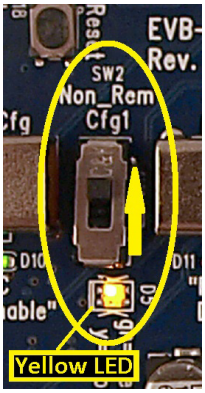


FIGURE 2-6: NON-REMOVABLE STATE



Port Power Strap Options: Battery Charge Enable and Port Disable Select

The PRTCTL[4:1] pins of the USB5537B-60xx also have strap options that are selectable through a 3-Position Double Pole Double Throw (DPDT) switch which are labeled “Port Pwr Cfg”. The PRT_CTL1 pin is associated with downstream Port 1 and is tied to SW1. When SW1 is in the default position, pins 1 and 2 are shorted together as well as pins 4 and 5 on the switch. This switch position pulls the PRT_CTL1 pin high to +3.3 V through a 10 kOhm resistor which configures downstream port 1 to be in the “Battery Charge Enabled” state and its associated LED (D10) will be turned on green. Alternatively SW1 can be positioned all the way down to the “Port Dis” position. This switch position short pins 2 and 3 together as well as pins 5 and 6 on the switch. This switch

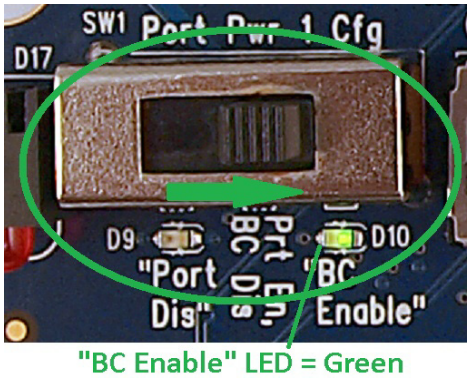
© 2014 Microchip Technology Inc.

position pulls the PRT_CTL1 pin low to ground through a 1 kOhm resistor which configures downstream port 1 to be disabled and therefore no power will be applied to VBUS on this downstream port. Also the "Port 1 Disable" LED (D9) will turn on red. If SW1 is switched into the middle OFF position, labeled as "Prt En, BC Dis" on the EVB-USB5537, the port power controller on downstream port 1 will act as a standard non-battery charging Port Power Controller (PPC). Note again that any time the switch position has been changed, power must be recycled on the EVB-USB5537.

This same selection process can be made to the PRTCTL pins and switches that are tied to downstream ports 2 through 4. Note that in either configuration mode, as long as the switch is not in the OFF position, the downstream port power LEDs (D1-D4) will light up green whenever power is being applied to VBUS on the associated downstream port. Additionally, whenever power is being applied to VBUS on downstream ports 5 through 7 (which do not have switchable strap options available), the downstream port power LEDs (D20-D22) will also light up green. When the "Port Pwr Cfg" switch is switched into the middle OFF position, the associated downstream port power LED will be turned off which shows that no power is applied to that particular downstream port. The table below describes the different PRTCTL strap options available for each of the first four PRTCTL pins on the USB5537B-60xx.

Downstream Port	Assosciated Switch	Switch Position	PRTCTL Config	LED
1	SW1	1-2, 4-5 = BC Enabled (Default)	PPWR1 Pulled High	D10 = Green
		Middle = Port Enabled, BC Disabled	Standard PPC	None
		2-3, 5-6 = Port Disabled	PPWR1 Pulled Low	D9 = Red
2	SW3	1-2, 4-5 = BC Enabled (Default)	PPWR2 Pulled High	D12 = Green
		Middle = Port Enabled, BC Disabled	Standard PPC	None
		2-3, 5-6 = Port Disabled	PPWR2 Pulled Low	D11 = Red
3	SW5	1-2, 4-5 = BC Enabled (Default)	PPWR3 Pulled High	D14 = Green
		Middle = Port Enabled, BC Disabled	Standard PPC	None
		2-3, 5-6 = Port Disabled	PPWR3 Pulled Low	D13 = Red
4	SW7	1-2, 4-5 = BC Enabled (Default)	PPWR4 Pulled High	D16 = Green
		Middle = Port Enabled, BC Disabled	Standard PPC	None
		2-3, 5-6 = Port Disabled	PPWR4 Pulled Low	D15 = Red

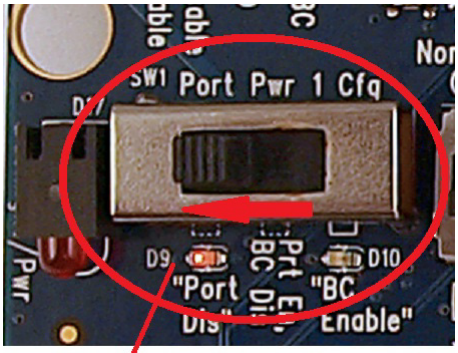
FIGURE 2-7: BATTERY CHARGE ENABLED (DEFAULT)



© 2014 Microchip Technology Inc.

FIGURE 2-8: PORT ENABLED WITH BATTERY CHARGE DISABLED (STANDARD PORT POWER CONTROL FUNCTION)

FIGURE 2-9: PORT DISABLED



Dynamic Battery Charge Select

The final switch to consider when configuring the USB5537B-60xx is the “Dynamic BC Select” switch, SW10. Once each of the first four downstream ports have been configured in one of the options described above, the Dynamic Battery Charge Select switch can then be configured to either turn battery charging on for all BC Enabled ports, or turn battery charging off. To enable battery charging on all BC Enabled downstream ports, SW10 must be in the “Enable” position which shorts pins 1 and 2 and also pins 4 and 5 together on the switch (this is the default position). When battery charging is enabled, the DYNCPDISn (active low) pin on the USB5537B-60xx is pulled high to +3.3 V through two 4.7 kOhm resistors in series and the associated dual LED (D19) will turn on green. To disable battery charging on all downstream ports, SW10 must be in the “Disable” position which shorts pins 2 and 3 and also pins 5 and 6 together on the switch. When battery charging is disabled, the DYNCPDISn pin on the USB5537B-60xx is pulled low to ground through two 4.7 kOhm resistors in series and the associated dual LED (D19) will turn on red. An optional 2-pin *Ext. DYNBC* header is provided as well (J12) so that the user can inject a signal onto the DYNCPDISn pin through an external source.

FIGURE 2-10: DYNAMIC BATTERY CHARGE SELECT ENABLED (DEFAULT)

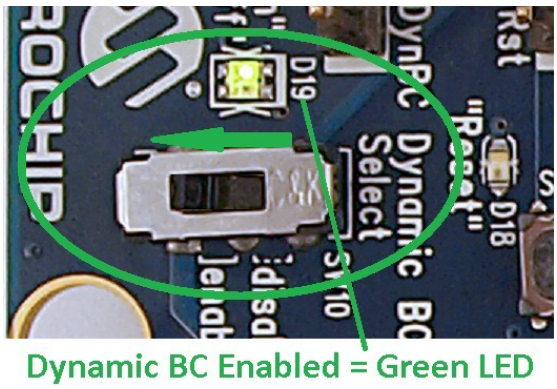
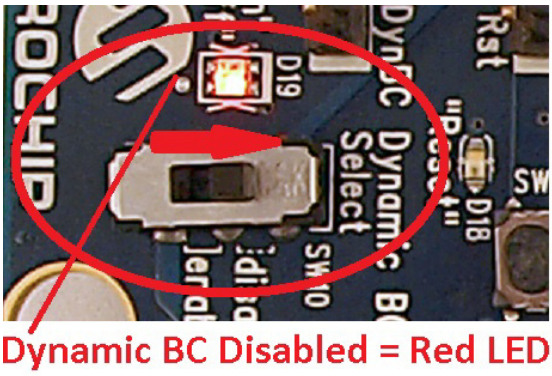


FIGURE 2-11: DYNAMIC BATTERY CHARGE SELECT DISABLED



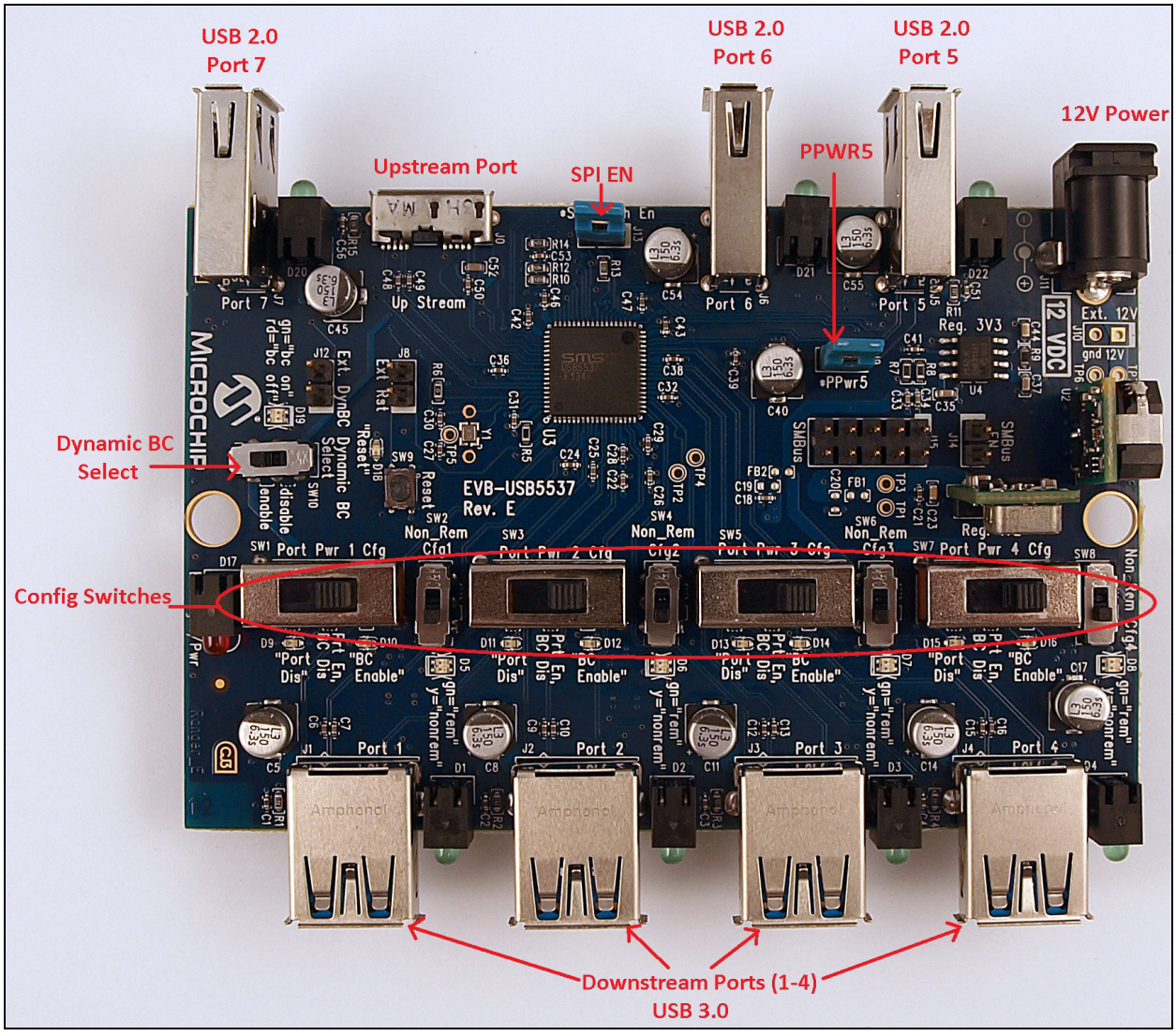
© 2014 Microchip Technology Inc.

Appendix A. EVB-USB5537 Evaluation Board

A.1 INTRODUCTION

This appendix shows the EVB-USB5537 Evaluation Board.

FIGURE A-1: EVB-USB5537 EVALUATION BOARD



NOTES:

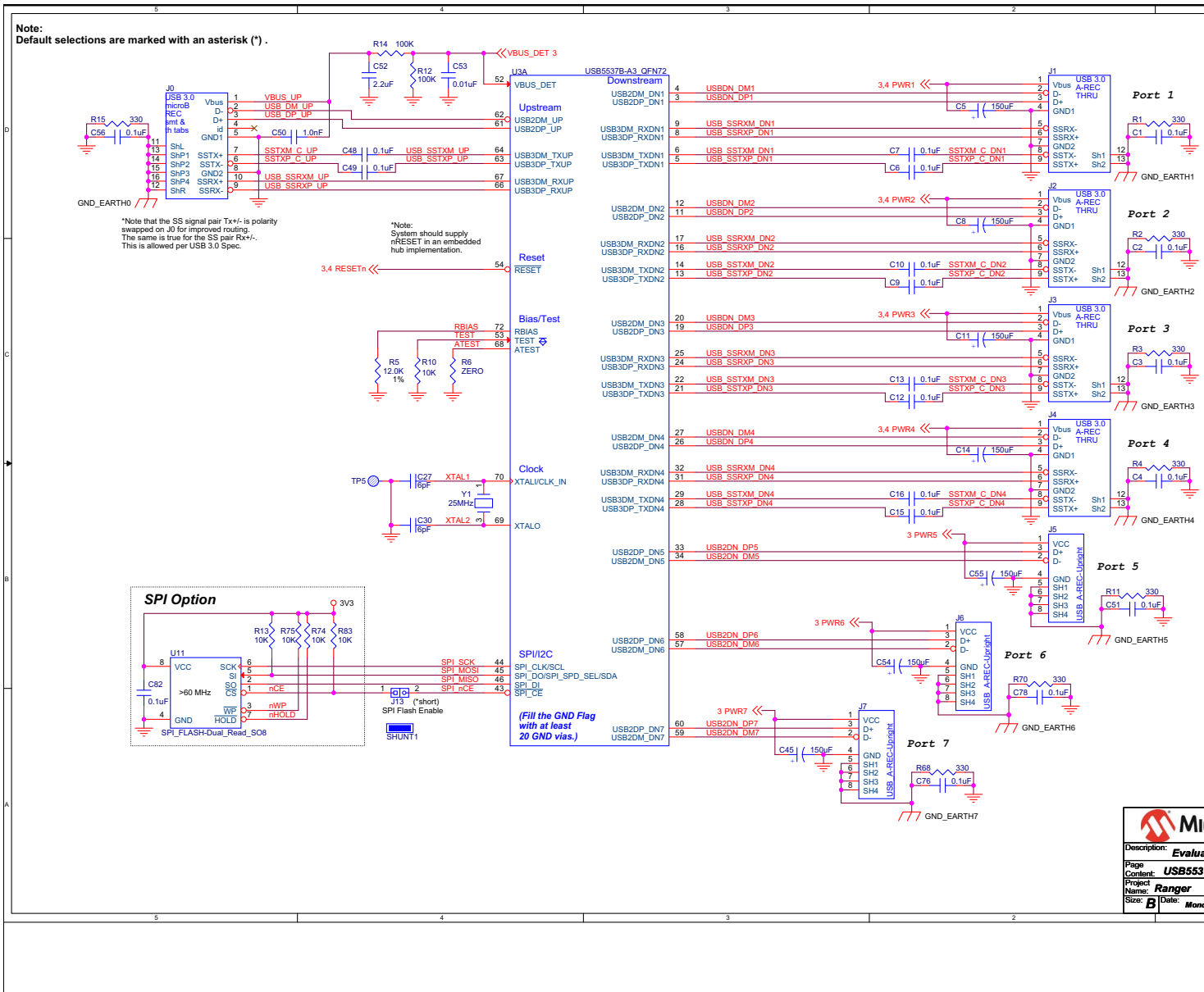
© 2014 Microchip Technology Inc.

Appendix B. EVB-USB5537 Evaluation Board Schematics

B.1 INTRODUCTION

This appendix shows the EVB-USB5537 Evaluation Board schematics.

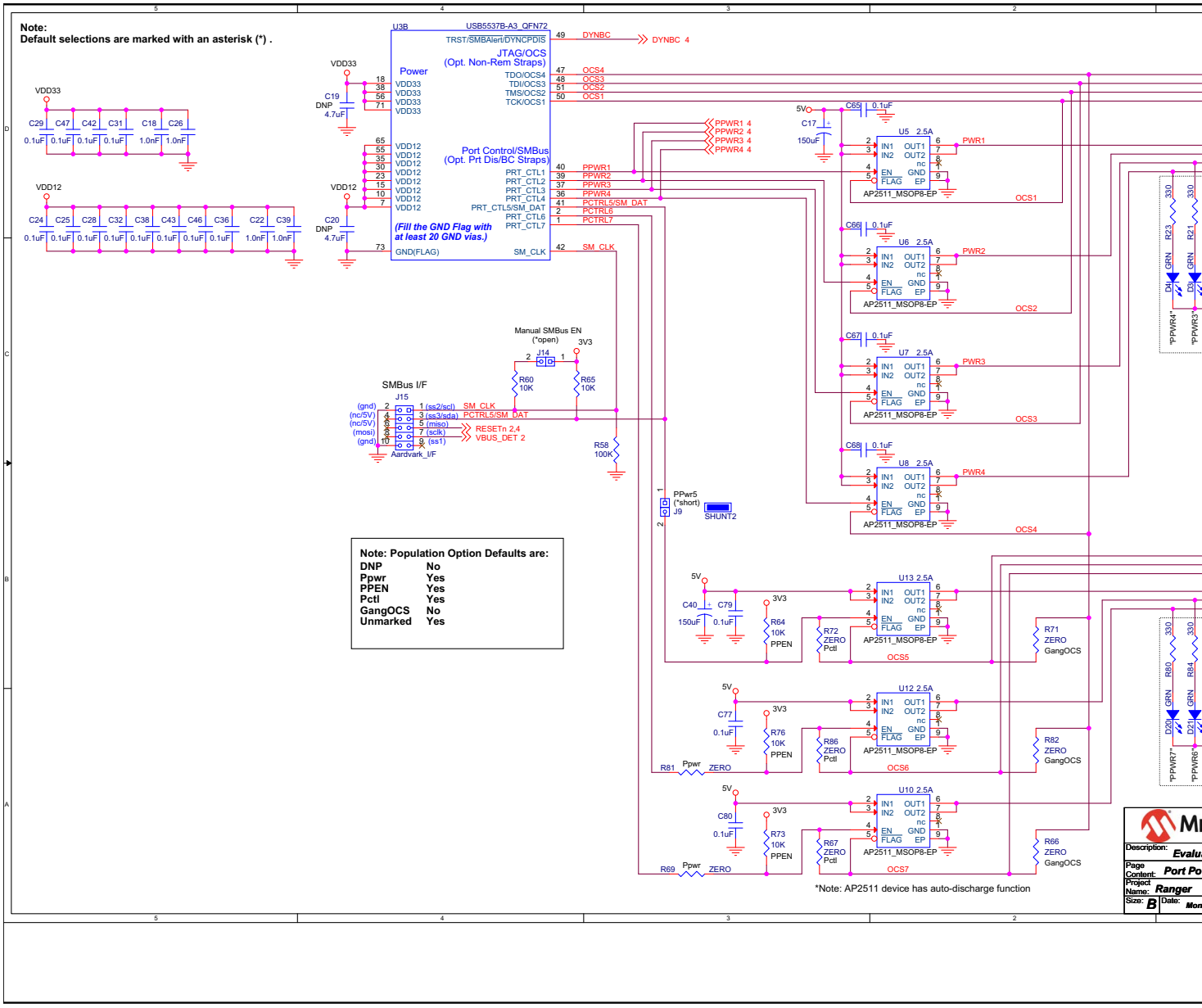
FIGURE B-1: EVB-USB5537 EVALUATION BOARD SCHEMATIC 1



© 2014 Microchip Technology Inc.

© 2014 Microchip Technology Inc.

FIGURE B-2: EVB-USB5537 EVALUATION BOARD SCHEMATIC 2



NOTES:

© 2014 Microchip Technology Inc.

Appendix C. Bill of Materials (BOM)

C.1 INTRODUCTION

This appendix includes the EVB-USB5537 Evaluation Board Bill of Materials (BOM).

TABLE C-1: EVB-USB5537 EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manu
1	9	9	C5,C8,C11,C14,C17,C40,C45,C54,C55	Capacitor, Low ESR, 150uF, 6.3VDC, 20%, Aluminum, Radial-SMT, 5mm x 5.7mm	Lelon	VZS151M0JTR
2	41	41	C1,C2,C3,C4,C6,C7,C9,C10,C12,C13,C15,C16,C21,C24,C25,C28,C29,C31,C32,C34,C36,C38,C42,C43,C46,C47,C48,C49,C51,C56,C65,C66,C67,C68,C71,C76,C77,C78,C79,C80,C82	Capacitor, 0.1uF, 10V, 10%, X5R, 0402	Murata	GRM155R71A1
3	8	8	C18,C22,C26,C33,C39,C41,C50,C73	Capacitor, 1000pF, 50V, 10%, X7R, 0402	Murata	GRM155R71H1
4	2	2	C27,C30	Capacitor, 6pF, 50V, +/-0.5pF, NPO, 0402	Murata	GRM1555C1H6
5	1	1	C53	Capacitor, 0.01uF, 25V, 10%, X7R, 0402	Murata	GRM155R71E1
6	2	2	C35,C37	Capacitor, 4.7uF, 6.3VDC, 20%, X5R, 0603	Murata	GRM188R60J4
7	2	2	C23,C72	Capacitor, 10uF, 6.3VDC, 20%, X5R, 0603	Murata	GRM188R60J1
8	1	1	C44	Capacitor, 1.0uF, 16VDC, 10%, X5R, 0603	Murata	GRM188R61C1
9	1	1	C52	Capacitor, 2.2uF, 6.3VDC, 10%, X5R, 0603	Murata	GRM185R60J2
10	2	2	C70,C74	Capacitor, 10uF, 25 VDC, 10%, 0805	Murata	GRM21BR61E1
11	4	4	D5,D6,D7,D8	LED, Dual, Yellow/Green, SMT-0605	Lite-On	LTST-C195KGJ
12	1	1	D19	LED, Dual, Red/Green, SMT-0605	Lite-On	LTST-C195KGJ
13	5	5	D9,D11,D13,D15,D18	LED, Red, 0603	Stanley Electric	BR1111C-TR
14	4	4	D10,D12,D14,D16	LED, Green, 0603	Stanley Electric	BG1111C-TR
15	7	7	D1,D2,D3,D4,D20,D21,D22	LED, Green, 3mm, Diffused, 0.2" CL-vert, TH, Right Angle	Lumex	SSF-LXH103GI
16	1	1	D17	LED, Red, 3mm, Diffused, 0.2" CL-vert, TH, Right Angle	Lumex	SSF-LXH103ID
17	2	2	D23,D24	Diode, MMBD914LT, Fast Switching, 100VDC, 200mA, SOT-23	On Semiconductors	MMBD914LT1
18	2	2	FB3,FB4	Ferrite Bead, 220 Ohm, 2A, 0.05DCR, 0603	Murata	BLM18EG221S
19	25	25	R1,R2,R3,R4,R11,R15,R17,R19,R21,R23,R24,R25,R26,R27,R33,R34,R36,R45,R51,R61,R68,R70,R80,R84,R85	Resistor, 330, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ331
20	1	1	R5	Resistor, 12.0K, 1%, 1/16W, 0603	Panasonic	ERJ-3EKF1202
21	1	1	R7	Resistor, 21.0K, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2102

© 2014 Microchip Technology Inc.

TABLE C-1: EVB-USB5537 EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manu
22	1	1	R8	Resistor, 150K, 1%, 1/16W, 0603	Panasonic	ERJ-3EKF1503
23	1	1	R9	Resistor, 47K, 5%, 1/16W, 0603	Yageo America	9C06031A4702
24	15	15	R10,R13,R28,R29,R31,R38,R40,R42,R46,R49,R60,R65,R74,R75,R83	Resistor, 10K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ103
25	3	3	R64,R73,R76	Resistor, 10K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ103
26	4	4	R12,R14,R58,R63	Resistor, 100K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ104
27	13	13	R30,R32,R35,R37,R39,R41,R43,R44,R47,R48, R50,R52,R55	Resistor, 1K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ102
28	2	2	R53,R62	Resistor, 4.7K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ472
29	1	1	R54	Resistor, 29.4K, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2942
30	1	1	R56	Resistor, 1.91K, 1%, 1/10W, 0603	Stackpole Electronics	RMCF0603FT1
31	1	1	R59	Resistor, 255, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2550
32	2	2	R6,R57	Resistor, ZERO, 0.1W, 0603	Panasonic	ERJ-3GEY0R0
33	3	3	R67,R72,R86	Resistor, ZERO, 0.1W, 0603	Panasonic	ERJ-3GEY0R0
34	2	2	R69,R81	Resistor, ZERO, 0.1W, 0603	Panasonic	ERJ-3GEY0R0
35	1	1	J11	Connector, Power Jack, 2.5 mm x 5.5 mm, 12 V, 4 A, Right Angle, TH	Cui Stack	PJ-002BH
36	4	4	J1,J2,J3,J4	Receptacle, USB 3.0, Style A, Right Angle, Through-hole	Amphenol	GSB311131HR
37	1	1	J0	Receptacle, USB 3.0, Style MicroB, Right Angle, SMT	Hirose Electric Co Ltd.	ZX360D-B-10P
38	3	3	J5,J6,J7	Receptacle, USB, Style A, Upright, Right Angle, Through-hole	Samtec	USB-A-S-S-B-V
39	5	5	J8,J9,J12,J13,J14	Header, 1 x 2, 0.1 Inch, Vertical	FCI	68000-236HLF
40	1	1	J15	Header, 2 x 5, 0.1 Inch, Vertical	FCI	67996-272HLF
41	4	4	SW1,SW3,SW5,SW7	Switch, 3POS, DPDT, Slide, Mini, Top Actuator, TH	APEM	MHS223
42	5	5	SW2,SW4,SW6,SW8,SW10	Switch, DPDT, Slide, Sub-Mini, Top Actuator, TH	C&K	JS202011CQN
43	1	1	SW9	Switch, Momentary, SPST, 50mA, J-lead, NO, Micro-Mini	C&K Components	PTS810 SJM 2
44	1	1	U1	IC, DC-DC Converter Module, 0.591-6 Vout, ~12 Vin, 0.591-6 VDC out, 3A, 5 pin SIP, 0.41" Wide	Murata	OKR-T/3-W12-
45	1	1	U2	IC, DC-DC Converter Module, 0.591-6 Vout, ~12 Vin, 0.591-6 VDC out, 6A, 5 pin SIP, 0.41" Wide	Murata	OKR-T/6-W12-

© 2014 Microchip Technology Inc.

TABLE C-1: EVB-USB5537 EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manu
46	1	1	**U3**	**IC, USB5537B, USB 2.0 and 3.0 Hub, 7-port, QFN72**	**SMSC**	**USB5537B_QF**
47	1	1	U4	IC, MCP1725-ADJE/SN, LDO Regulator, Adj., 500 mA, SOIC8	Microchip	MCP1725(T)-A
48	7	7	U5,U6,U7,U8,U10,U12,U13	IC, AP2511MP-13, Power Distribution Switch, MSOP-8EP	Diodes Inc.	AP2511MP-13
49	1	1	U9	IC, 74LVC1G14, Inverter, Shottky, DCK	TI	SN74LVC1G14
50	1	1	U11	IC, Flash, SPI, SST25VF064C, 64Mb (8M x 8), 2.7V-3.3V, 75MHz (Dual Read), SO8	Microchip	SST25VF064C
51	1	1	Y1	Crystal, 25.000MHz, 30ppm, 6pF, SMT 2.0MM X 1.6MM	Murata	XRCGB25M000
52	4	4	-none	Foot, Silicone Rubber, Adhesive, Clear, Cylindrical, .500"x.250"	Bumper Specialties	RBS-6
53	1	1	LBL-ASSY1	Label, Assembly Number, Laminated, 250 x 800, "EVB-USB5537_E"	Brother	1/4" x 0.8"
54	1	1	LBL-SERNO	Label, Serial Number, Laminated, 250 x 800	Brother	1/4" x 0.8"
55	1	1	PCB Fab	PCB, Ranger (EVB-USB5537), Rev. E		Ranger_E
56	15	0	C57,C58,C59,C60,C61,C62,C63,C64,C69,C75,C81,C83,C84,C85,C86	Capacitor, 0.1uF, 10V, 10%, X5R, 0402	Murata	GRM155R71A1
57	2	0	C19,C20	Capacitor, 4.7uF, 6.3VDC, 20%, X5R, 0603	Murata	GRM188R60J4
58	2	0	FB1,FB2	Ferrite Bead, 220 Ohm, 2A, 0.05DCR, 0603	Murata	BLM18EG221S
59	7	0	R16,R18,R20,R22,R77,R78,R79	Resistor, 1K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ102
60	3	0	R66,R71,R82	Resistor, ZERO, 0.1W, 0603	Panasonic	ERJ-3GEY0R0
61	1	0	J10	Header, 1 x 2, 0.1 Inch, Vertical	Samtec	TSW-102-14-L-
62	2	0	SHUNT1,SHUNT2	Shunt, Insulated, 0.1 Inch	TE Connectivity	881545-2

© 2014 Microchip Technology Inc.

NOTES:

Worldwide Sales and Service

GAMERICAS

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

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

Austin, TX
Tel: 512-257-3370

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
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453

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

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110

Canada - Toronto
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: 852-2943-5100
Fax: 852-2401-3431

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

China - Beijing
Tel: 86-10-8569-7000
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 - Hangzhou
Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR
Tel: 852-2943-5100
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: 86-755-8864-2200
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: 91-20-3019-1500

Japan - Osaka
Tel: 81-6-6152-7160
Fax: 81-6-6152-9310

Japan - Tokyo
Tel: 81-3-6880- 3770
Fax: 81-3-6880-3771

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: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600
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 - Dusseldorf
Tel: 49-2129-3766400

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

Germany - Pforzheim
Tel: 49-7231-424750

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

Italy - Venice
Tel: 39-049-7625286

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

Poland - Warsaw
Tel: 48-22-3325737

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

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

03/25/14

© 2014 Microchip Technology Inc.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Interface Development Tools ***category:***

Click to view products by Microchip ***manufacturer:***

Other Similar products are found below :

DP130SSEVM ISO3086TEVM-436 ADP5585CP-EVALZ CHA2066-99F AS8650-DB MLX80104 TESTINTERFACE I2C-CPEV/NOPB ISO35TEVM-434 416100120-3 XR18910ILEVB XR21B1421IL28-0A-EVB EVAL-ADM2491EEBZ MAXREFDES23DB# MAX9286COAXEVKIT# MAX3100EVKIT MAX13235EEVKIT XR21B1424IV64-0A-EVB CMOD232+ MAX13042EEVKIT+ MAX14838EVKIT# MAXCAM705OV635AAA# MAX9205EVKIT DS100BR111AEVK/NOPB DC241C MAX9286RCARH3DB# DC1794A SN65HVS885EVM DFR0257 XR22404CG28EVB ZLR964122L ZLR88822L EVK-U23-01S EVK-W262U-00 DC196A-B DC196A-A DC327A OM13585UL MAX16972AGEEVKIT# MARS1-DEMO3-ADAPTER-GEVB MAX7315EVKIT+ PIM511 PIM536 PIM517 DEV-17512 STR-FUSB3307MPX-PPS-GEVK MAXREFDES177# EVAL-ADM2567EEBZ EVAL-ADN4654EBZ MAX2202XEVKIT# MAX13171EEVKIT+