



MICROCHIP

**EVB-USB4604
Evaluation Board
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in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.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, FlashFlex, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC³² logo, rPIC, 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, Omniscent Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICKit, PICtail, REAL ICE, rLAB, Select Mode, SQL, 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.

flexPWR, JukeBlox, Kleer, KleerNet, MediaLB, and MOST

The preceding is a non-exhaustive list of trademarks in use in the US and other countries. For a complete list of trademarks, email a request to legal.department@microchip.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: 9781620779842

**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.

Object of Declaration: EVB-USB4604 Evaluation Board User's Guide

EU Declaration of Conformity

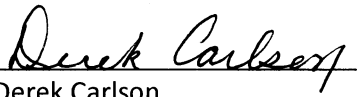
This declaration of conformity is issued by the manufacturer.

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

Table of Contents

Preface	6
Introduction	6
Document Layout	6
Conventions Used in this Guide	7
Warranty Registration	8
The Microchip Web Site	8
Customer Support	8
Document Revision History	8
Chapter 1. Overview	
1.1 EVB-USB4604 Overview and Features	10
1.2 Features	10
1.3 General Description	10
Chapter 2. Hardware Configuration	
2.1 Hardware Description	11
2.1.1 Port Assignment	11
2.1.2 USB4604 Configuration	11
2.1.3 Power Source	13
2.1.4 FlexConnect and Port Power Control	14
2.1.5 Digital Pin Access	15
2.1.6 Connectors	16
2.1.7 Block Diagram	18
Chapter 3. EVB-USB4604 Operation	
3.1 Getting Started	19
3.1.1 Contents of EVB-USB4604 Kit	19
3.1.2 Bringing up the EVB-USB4604 default version	19
3.1.3 Loading a new configuration	20
3.2 Board Operation	21
3.2.1 OTP and SPI Customization	21
3.2.2 Hub Controller	22
3.3 Evaluating Different Part Numbers	22
3.3.1 OTP	22
3.3.2 SPI	22
3.4 FlexConnect	22
3.4.1 SMBus Method	22
3.4.2 GPIO Control	22
3.4.3 USB Packet Control	23
3.5 Frequently Asked Questions	23
3.5.1 Why are the Port Power LEDs always on?	23
3.5.2 Why doesn't the Hub enumerate?	23

Table of Contents

Appendix A. EVB-USB4604 Evaluation Board Schematic & BOM

A.1 Introduction	24
Worldwide Sales and Service	29

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 EVB-USB4604 Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the EVB-USB4604 Evaluation Board as a demonstration platform optimized for portable applications. The manual layout is as follows:

- **Chapter 1. “Overview”** – Shows a brief description of the EVB-USB4604 Evaluation Board
- **Chapter 2. “Hardware Configuration”** – Includes information about the hardware configuration of the EVB-USB4604 Evaluation Board.
- **Chapter 3. “EVB-USB4604 Operation”** – Provides information about installing and operating the EVB-USB4604 Evaluation Board and Evaluation Software.
- **Appendix A. “EVB-USB4604 Evaluation Board Schematic & BOM”** – Provides the EVB-USB4604 schematic and Bill of Materials (BOM) information.

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 device pin	Drive ID high
	A component on the board	Short J5 with a shunt jumper
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	<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	<code>0xFF, 'A'</code>
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> 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>

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

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

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>
<http://www.microchip.com/USB4604>

DOCUMENT REVISION HISTORY

REV A (March 2014)

- Initial Release of this Document.

NOTES:

Chapter 1. Overview

1.1 EVB-USB4604 OVERVIEW AND FEATURES

The USB4604 is an enhanced USB hub that provides additional features to differentiate a product from a traditional USB 2.0 hub. The USB4604 acts as a fully compliant 4-port USB 2.0 hub, but also enumerates an internal microprocessor for added functionality on the 5th hub endpoint. Through this 5th endpoint, the hub can act as a USB bridge to UART or I²C protocols. There are also USB commands to manually control the digital pins. Finally, the EVB-USB4604 is designed to utilize the USB4604 FlexConnect feature. This allows the hub to dynamically change which port is the upstream port. Refer to [Section 1.2 “Features”](#) for more information.

1.2 FEATURES

- USB4604 in a 48-pin QFN RoHS compliant package
- One upstream USB or HSIC port
- Four USB 2.0 downstream ports with individual port power control and overcurrent sense (OCS)
- High-Speed (480 Mbps), Full-Speed (12 Mbps) and Low-Speed (1.5 Mbps) compatible on downstream USB ports
- Multi-Transaction Translator
- Supports internal default hub configuration. Optionally supports external configuration via I²C or SPI.
- OTP configuration available to change the default hub configuration
- Access headers for power, digital pins and USB ports 3 and 4
- Self-Powered operation
- On Board +5 VDC and +3.3 VDC regulators
- Single 24 MHz crystal clock source
- Designed to stack with custom boards for system prototyping
- Schematics, layout and bill of materials are available to minimize new product development time

1.3 GENERAL DESCRIPTION

The EVB-USB4604 is an evaluation and demonstration platform featuring the USB4604 USB 2.0 hub controller on an RoHS compliant Printed Circuit Board (PCB).

The EVB-USB4604 is designed to demonstrate the unique features of this device using a low-cost PCB implementation. The digital pins are exposed to rows of headers such that companion boards can be designed to complete the system prototyping.

The EVB-USB4604 can be used as a stand alone hub, as a FlexConnect enabled hub, or as part of a larger system. The default connectors for the upstream (FLEX) port and the downstream (SWAP) port 1 are uAB connectors to facilitate connecting to either a USB Host or a Device.

The EVB-USB4604 also contains features to communicate with the UCS81001. This smart port power switch can act as an SMBus/I²C slave to configure the current limit and read the current drawn on that particular port.

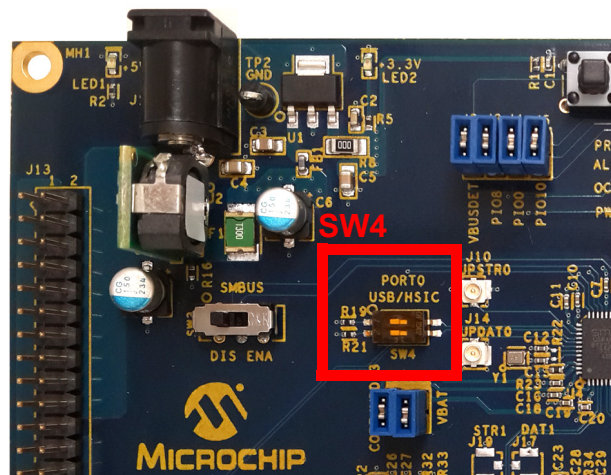
Chapter 2. Hardware Configuration

2.1 HARDWARE DESCRIPTION

2.1.1 Port Assignment

The USB4604 is a 4-port USB hub. The upstream port can be configured to either USB or HSIC. When the Hub is powered up, or when the RESET button is pressed, the USB lines will be sampled. If the USB lines are pulled up during a power up or reset operation (POR), the USB port will be disabled and the HSIC port will be enabled. SW4 on the EVB-USB4604 is used to pull the DP/DM pins on the upstream port, or Port 0.

FIGURE 2-1: UPSTREAM USB DISABLE SWITCH



2.1.2 USB4604 Configuration

The USB4604 is a flexible hub that is capable of being reconfigured to meet the needs of system designers. There are multiple ways that the USB4604 can be configured, with each method having their own advantages and disadvantages. The EVB-USB4604 allows three different configuration options, as detailed in the following sub-sections.

2.1.2.1 DEFAULT/OTP OPTION

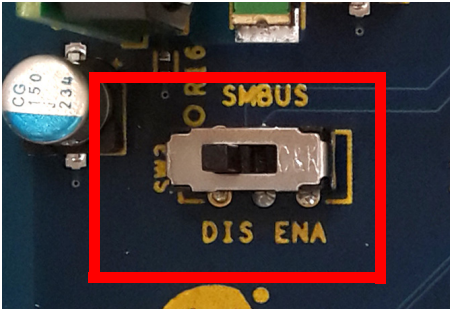
By default, the EVB-USB4604 will load all configuration options from the device's internal ROM. The USB4604 will load the default configuration and then apply any additional OTP commands that have been loaded through the ProTouch tool.

2.1.2.2 I²C/SMBUS OPTION

The USB4604 can also act as an SMBus slave. Systems that have an on-board microcontroller with I²C or SMBus Master control can customize the USB4604 via this interface. For more details on the capabilities of the SMBus slave interface, refer to Application Note 26-19, SMBus Slave Interface for the USB253x/USB3x13/USB46x4.

The EVB-USB4604 can enable and disable the SMBus slave interface via switch SW3. This will connect the SMBus pins to the pull-up resistors of the SMBus lines, or tie them to ground. The SMBus pins are sampled during POR, so the switch must be set before the board is powered up or the nRESET pin is driven low and then high again.

FIGURE 2-2: SMBUS ENABLE SWITCH



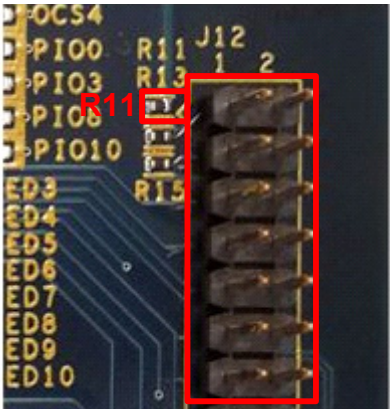
The SMBus lines also connect to the UCS81001 port power controllers to enable an SMBus master to communicate with all devices on the EVB-USB4604. The SMBus addresses are as follows:

TABLE 2-1: SMBUS ADDRESSES

Device	SMBus Address
USB4604 (Configuration)	0101101b (2Dh)
USB4604 (Runtime)	0101100b (2Ch)
UCS Port 0	1010100b (54h)
UCS Port 1	0110000b (30h)
UCS Port 2	0110001b (31h)
UCS Port 3	0110010b (32h)
UCS Port 4	0110011b (33h)

The SMBus pins can be accessed on pins 1 and 3 of the J12 connector. The EVB-USB4604 has the SMBus pins pulled up to the on-board 3.3V regulator. If a different voltage is required, remove R11 and apply the pull-up resistance to pins 4 and 6 of J12. R13 and R15 are 10k Pull-Up resistors used for SMBus communication.

FIGURE 2-3: R11 AND SMBUS PINS

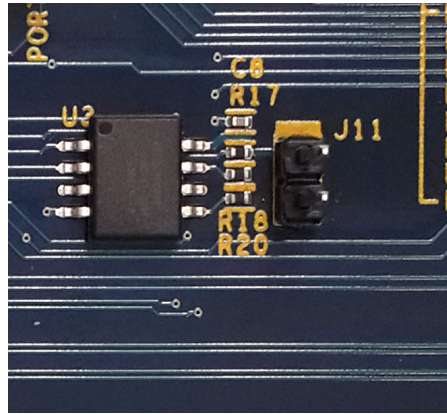


2.1.2.3 SPI OPTION

The USB4604 can also load firmware developed by Microchip to address specific applications, or load the product firmware of a specific part number. The USB4604-1050, USB4604-1080 and USB4604-1090 can all be loaded through the SPI Flash to evaluate each product with the same board.

The SPI flash can be programmed many more times than the OTP registers can, allowing more dynamic use of the EVB. To program the SPI Flash, ensure it is powered and use the ProTouch tool to load the custom firmware. Place a shunt jumper on J11 before powering on the USB4604 to load firmware from the SPI Flash. When the jumper is removed, the USB4604 will use the internal ROM and OTP settings.

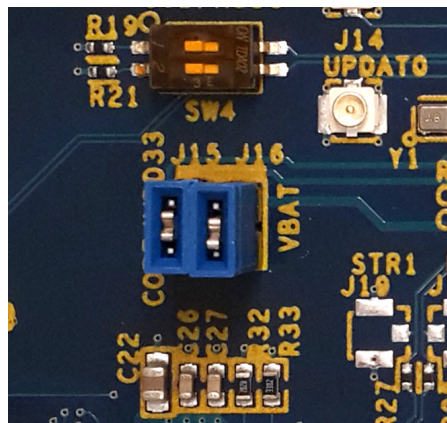
FIGURE 2-4: SPI FLASH AND ENABLE JUMPER



2.1.3 Power Source

The EVB-USB4604 allows access to the VBAT and VDDCOREREG supply pins. To evaluate the current consumption in any particular application, external supplies can be used to supply power to just the USB4604. Headers J15 and J16 are used to access the power pins. Pin 1 of J15 is connected to the VDD33 regulator output of the USB4604, pin 2 of J15 is connected to VDDCOREREG. Pin 1 of J16 is connected to VBAT and pin 2 is connected to the boards 5V supply.

FIGURE 2-5: VBAT AND VDDCORE ACCESS

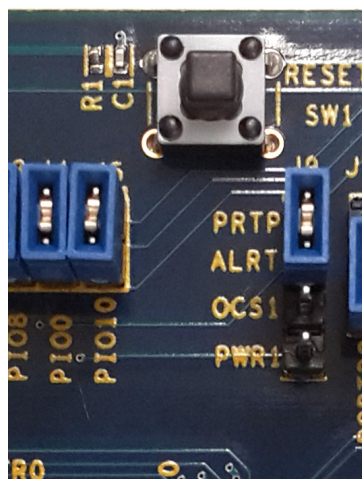


2.1.4 FlexConnect and Port Power Control

To use the FlexConnect feature, the following pins need to be routed to the correct control lines:

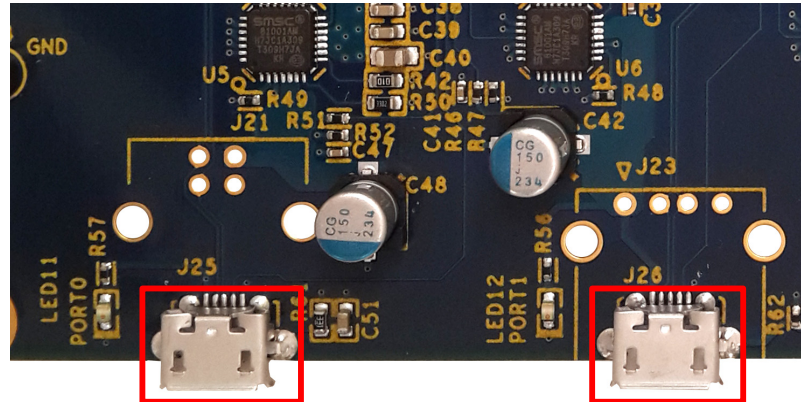
- **SUSP/PIO0** controls the **FLEX** or Port0 power controller. When in the Flex state, the **PIO0** pin will enable a pull-up to 3.3V and report an over current event on Downstream Port 1 if this is pulled low. Placing a shunt jumper on **J4** makes this connection.
- **VBUS_DET** is used to tell the hub to enumerate. If this pin is low, the Hub will not attempt to communicate with the Host controller. **J2** connects this pin to the VBUS of Port0 through a voltage divider.
- **PIO8** is used to drive the ID pin of the uAB connector on the EVB-USB4604. USB devices that support OTG use the ID pin to determine whether to act as the Host, or as a Device. In normal applications, the USB cable terminates the ID pin by shorting it to GND, or by floating the pin. The OTG port will then provide VBUS and act as a USB Host if ID is grounded, and it will act as a device if ID is floated. The EVB-USB4604 takes advantage of this signaling by routing the digital outputs of the USB4604 to the ID pins of the connector, allowing the USB4604 to manage the direction control. If the Host system would rather manage the direction control, the digital pins can be isolated. **J3** connects this pin to the ID of Port0.
- **PRTPWR1** changes to the PRTCTL1 role. This controls the SWAP or Port1 power controller. When in the default state, the PRTCTL1 pin will pull-up to 3.3V and report an over current event on Downstream Port 1 if this pin is pulled low. Placing a shunt resistor on pins 1 and 2 of **J9** will connect the **ALERT#** of the UCS81001 to register an over current event on the **PRTCTL1** pin.
- **OCS1_N** will tell the hub to enumerate when in the Flex state. Placing a shunt resistor between pins 3 and 4 of **J9** will connect this pin to the VBUS of Port1.
- **PIO10** is used to drive the ID pin of Port1. This pin functions similar to **PIO8** only it will pull high in the default state, and drive low in the Flex state.

FIGURE 2-6: PIO PIN CONTROL



To implement FlexConnect with supported technology, uAB connectors are used on the FLEX and SWAP ports. These enable uA or uB cables to be used for static role reversal, or custom USB cables that pass the ID pin up to the other connector rather than terminating it internally.

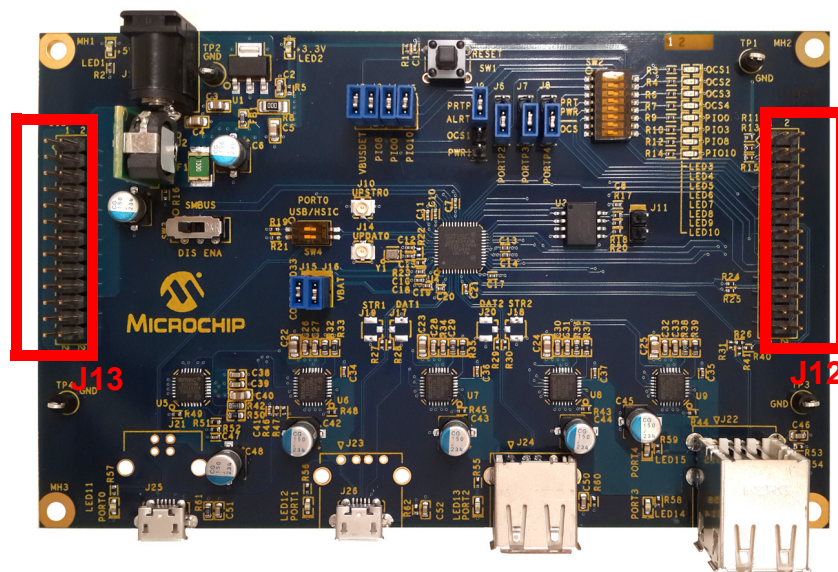
FIGURE 2-7: USB CONNECTORS FOR FLEXCONNECT



2.1.5 Digital Pin Access

The USB4604 also has the ability to act as a USB bridge to control other components in a system. The USB2530 SDK allows the USB host to send SMBus/I²C or UART commands that can access other devices that don't support the USB protocol. There are also pins that can be configured as general purpose digital pins (PIO) for static control. **J12** and **J13** provide access to the digital pins as well as access to the DP/DM pins of ports 3 and 4. These headers are designed to allow system designers to create cables or PCBs that can mate with the EVB-USB4604 to evaluate how the USB4604 will function in their system.

FIGURE 2-8: SYSTEM ACCESS HEADERS



Because of the speed of the USB signals, branching of the DP/DM lines can affect the communication. It is necessary to change 0 Ohm resistors according to the following table:

TABLE 2-2: USB PORT RESISTORS

Populate	Remove	Destination
R31, R41	R26, R40	Port 3 J22 Connector
R26, R40	R31, R41	Port 3 J12 Connector
R63, R64	R24, R25	Port 4 J22 Connector
R24, R25	R63, R64	Port 4 J12 Connector

2.1.6 Connectors

Table 2-3 provides a list of EVB-USB4604 LEDs, headers, and switches along with descriptions of their default usage.

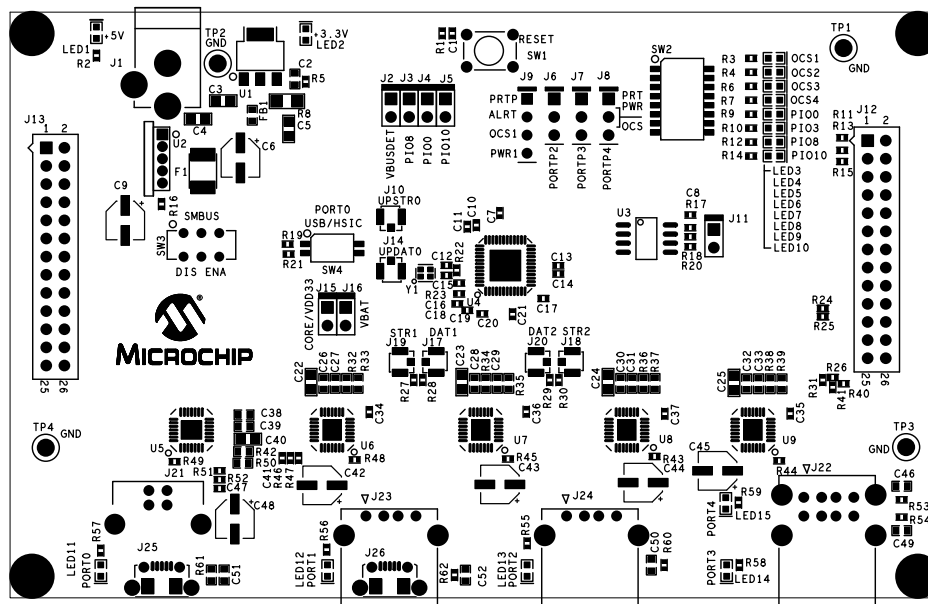
TABLE 2-3: HEADER, SWITCH AND LED LOCATIONS

Component	Location	Description
J1	Top Left	12V Power barrel inserted into this connector.
J2	Top Middle	Connects VBUS_DET voltage divider to FLEX or Port0 VBUS.
J3	Top Middle	Connects PIO8 to the FLEX or Port0 uB connector's ID.
J4	Top Middle	Connects PIO0 to the FLEX port power controller.
J5	Top Middle	Connects PIO10 to the SWAP or Port0 uB connector's ID.
J6	Top Middle	Connects the ALERT# of the UCS81001 to the OCS2_N pin or the P RTPWR2 pin.
J7	Top Middle	Connects the ALERT# of the UCS81001 to the OCS3_N pin or the P RTPWR3 pin.
J8	Top Middle	Connects the ALERT# of the UCS81001 to the OCS4_N pin or the P RTPWR4 pin.
J9	Top Middle	Connects the ALERT# of the UCS81001 to the OCS1_N pin or the P RTPWR1 pin. Also connects the VBUS of the SWAP or Port1 connector to the OCS1_N voltage divider.
J10	Center	Upstream or FLEX HSIC STROBE U.FL connector.
J11	Center Right	Powers the SPI Flash when a shunt resistor is placed between the pins.
J12	Center Right	Breaks out the digital pins and Port3 and Port4 DP/DM pins to a header.
J13	Center Left	Breaks out the PIO8 and PIO10 pins as well as the 12V, 5V and 3.3V regulated supplies.
J14	Center	Upstream or FLEX HSIC DATA U.FL connector.
J15	Center	Connects the VDDCOREREG input of the USB4604 to the VDD33 output. Can also be used to inject an independent supply.
J16	Center	Connects the VBAT input of the USB4604 to the 5V board supply. Can also be used to inject an independent supply.

TABLE 2-3: HEADER, SWITCH AND LED LOCATIONS (CONTINUED)

Component	Location	Description
J17-J20	Center	These are the HSIC connectors for the downstream ports, this only applies to the USB4624 and should not be used with the USB4604.
J21	Bottom Left	The USB Standard B connector for Port0 or the FLEX port. This is not populated by default.
J22	Bottom Right	The stacked USB A connectors for ports 3 and 4.
J23	Bottom Center	The Standard A connector for Port1 or the SWAP port. This is not populated by default.
J24	Bottom Center	The Standard A connector for Port2.
J25	Bottom Left	The uAB connector for Port0 or the FLEX port.
J26	Bottom Center	The uAB connector for Port1 or the SWAP port.
LED1	Top Left	Indicator that the 5V regulator is functional and 5V is present in the system.
LED2	Top Center	Indicator that the 3.3V regulator is functional and 3.3V is present.
LED3-10	Top Right	When used with SW2 these LEDs reflect the state of the digital outputs of the USB4604.
LED11-15	Bottom	Indicates the status of the VBUS on the USB ports. When these are lit, then VBUS is present.
SW1	Top Center	Connects to the nRESET pin of the USB4604, press to assert nRESET low.
SW2	Top Center	Connects GPIO outputs from the USB4604 to the LED indicators. Used to evaluate the USB-GPIO bridging functionality.
SW3	Center Left	Connects the SMBus pins of the USB4604 to the SMBus lines on the rest of the board.
SW4	Center	Used to disable the upstream USB port for HSIC communication.

© 2014 Microchip Technology Inc.



Chapter 3. EVB-USB4604 Operation

3.1 GETTING STARTED

3.1.1 Contents of EVB-USB4604 Kit

The EVB-USB4604 evaluation kit includes the EVB-USB4604 along with the following:

- 12V Power Supply
- USB A to uB cable
- Custom 5-wire USB ID pass through cable

FIGURE 3-1: EVALUATION KIT CONTENTS



3.1.2 Bringing up the EVB-USB4604 default version

The EVB-USB4604 comes with the USB4604-1080 installed by default. The following Jumpers need to be in place for the Hub to function correctly:

- J2 - VBUS_DET is required for the Hub to enumerate.
- J6-9 - Pins 2 and 3 need to be shorted to ensure that the OCS1 pin gets the ALERT signal from the UCS8100x.
- J15 - This connects the CORE input to the VDD33 regulator output.
- J16 - This connects the VBAT pin to the boards 5V supply.

All other jumpers should be left open to get the desired functionality from the hub.



When the 12V supply is connected to J1, the 5V LED will light up and so will all of the Port LEDs. Connect the Hub to a PC and confirm the PC detect the Hub. The PC will also find the USB2530 attached to the 5th port of the hub, this is the Hub Controller and the driver for this can be found with the Software Development Kit, or it is installed with ProTouch.



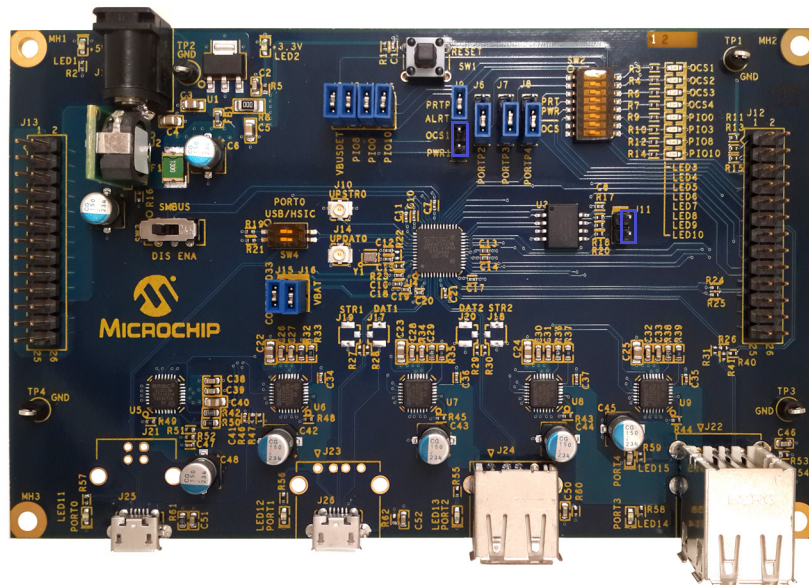
3.1.3 Loading a new configuration

To evaluate a different version, the SPI Flash can be programmed with the configuration options. The ProTouch tool is used to program the SPI Flash. First install the jumper on J11 to power the SPI Flash on the board. The ProTouch tool and different OTP and SPI configuration files can be found on the USB4604 product page at www.microchip.com/usb4604.

The USB4604-1090 version has additional pin functionality that requires a different jumper configuration than the default USB4604-1080 version. To evaluate the USB4604-1090 version, the following jumpers need to be added:

- J3 - This connects PIO8 to the upstream ID pin. This becomes the FLEX_OUT pin.
- J4 - This connects PIO0/SUSPEND to the upstream port power controller.
- J5 - This connects PIO10 to the downstream ID pin. This becomes the FLEX_OUT_N pin.
- J11 - This powers the SPI Flash for temporary evaluation.
- Pin 1 and 2 of J9 - This ties PRT-PWR1 to the ALERT pin of the port power controller.
- Pin 3 and 4 of J9 - This ties OCS1 to the VBUS on the downstream port.

FIGURE 3-4: USB4604-1090 JUMPER CONFIGURATION



Once the jumpers have been populated, use the ProTouch tool to load the USB4604-1090 configuration file found on the product page.

3.2 BOARD OPERATION

The EVB-USB4604 will operate as a standard hub by default. Ensure that **SW3** is set to the DIS position to disable the SMBus control. The LEDs for the Port VBUS will all be active because the UCS81001 will generate 5V with a small amount of current for dead battery support. Once the VBUS is loaded, the VBUS will either stay on if PRT-PWR is high, or drop if PRT-PWR is low.

3.2.1 OTP and SPI Customization

When the hub is enumerated to a PC, the ProTouch tool can be used to customize the behavior and new configurations can be loaded. The ProTouch tool can load configuration files into the OTP space or the SPI Flash that is populated on the board. Be aware that each OTP register can only be programmed once, so every configuration file loaded through this method will decrease the amount of remaining OTP space. Once all the OTP registers have been written to, the part can no longer be configured through OTP.

The SPI Flash must be powered on in order to program to and load firmware from the SPI flash. Ensure that the proper jumpers are in place and the right supplies are present on the board before attempting to program.

3.2.2 Hub Controller

The hub will also enumerate with the USB2530 Hub Controller. This enables the SMBus/I²C, UART and GPIO control from the USB Host. The USB2530 SDK provides the necessary drivers and documentation on how to implement these commands. The SDK can be found on the USB4604 product page.

3.3 EVALUATING DIFFERENT PART NUMBERS

The EVB-USB4604 ships with the USB4604-1080 firmware installed. To evaluate the other versions of the USB4604 there are two options.

3.3.1 OTP

To load a different version through OTP:

- Locate the OTP file on the EVB website or your local FAE
- Use the ProTouch tool to program the OTP space. (www.microchip.com/protouch)

More details on the procedure can be found in the ProTouch documentation. This will permanently change the USB4604 installed on the board.

3.3.2 SPI

To load a version temporarily through SPI:

- Locate the desired version SPI binary file through your FAE or the EVB website.
- Short the headers on J11 to power the on-board SPI Flash.
- Connect the EVB-USB4604 to a Windows Host.
- Use the ProTouch tool (www.microchip.com/protouch) to program the Flash.
- Power cycle the EVB-USB4604 and the new configuration will be loaded.

The procedure can be repeated multiple times and will not change the default part installed on the board.

3.4 FLEXCONNECT

There are three ways to implement FlexConnect on this EVB.

3.4.1 SMBus Method

The SMBus method of implementing FlexConnect requires that the SMBus pins be connected to the on-board bus through **SW3**, these pins must be sampled high during POR. The SMBus pins can be access through **J12** and the pull up voltage is set to the on board 3.3V by default. Refer to the FlexConnect application note and SMBus Slave application note for more details on implementing FlexConnect through this method.

3.4.2 GPIO Control

PIO3 is used to control the FlexConnect state. This can be accessed on **J12**. The pin has an internal pull down resistor to prevent this from being sampled incorrectly when the pin is left floating. To change the Flex state, drive the pin high or low. When the pin is high, Port1 or the SWAP port will be the upstream port and OCS1_N will look for VBUS. When OCS1_N is sampled high, the USB4604 will enable the pull up on the SWAP DP pin and wait for a host to initiate enumeration.

3.4.3 USB Packet Control

When using the USB packet, all control of the Hub is lost by the Host once the Flex command is sent. The digital outputs of **PIO8** and **PIO10** can be connected to the uAB connectors on Port0 and Port1 to take advantage of the OTG hardware control over the direction. Otherwise, the ports will switch and Port0 will enable the 15k pull down resistors as it is now a Downstream Port, or Host. Port1 will wait for **OCS1_N** to be high, then enable the pull up on DP.

3.5 FREQUENTLY ASKED QUESTIONS

3.5.1 Why are the Port Power LEDs always on?

The port power LEDs reflect the state of VBUS on each port. There are two cases where the LED would be lit even if the Hub has not enumerated with a USB host. The first case is that the UCS used on the evaluation board provides a low current voltage on the VBUS pin to detect if a device is attached or not. If any load is attached the VBUS voltage would drop to 0V. The second reason is that the USB4604 has been configured with battery charging enabled. That means that the Hub can charge devices, even without a USB host to control it.

3.5.2 Why doesn't the Hub enumerate?

The EVB-USB4604 enables the user to evaluate every feature of the USB4604. Because there are some configurations that require an external processor to configure the hub prior to enumerating, the user should confirm that the settings chosen do provide for the hub to enumerate on its own. If the hub is configured in such a way that it should enumerate immediately, then the following items should be checked to verify that the EVB is functioning properly:

- Check J15 and J16 voltage levels and confirm that power is actually getting to the USB4604. Also, if pin 1 of J15 is at ~3.3V, then the part is at least in a powered state.
- Check C14 for 1.2V
- Check R23, if this is 1.2V, then the USB4604 is in an active state, either connected to a Host or in SMBus Configuration mode. If it is 0V the Hub could be in a suspended state if C14 is 1.2V
- Check SW3, if the switch is in the ENA position then the Hub is waiting for a SMBus master to send it commands.
- Check SW4, if the switches are toward the HSIC part of the silkscreen, then the upstream USB ports are disabled and the Hub is looking for a HSIC Host.
- Check J2, if VBUS_DET is not high, then the Hub will not try to enumerate.



EVB-USB4604 EVALUATION BOARD USER'S GUIDE

Appendix A. EVB-USB4604 Evaluation Board Schematic & BOM

A.1 INTRODUCTION

This appendix shows the EVB-USB4604 Evaluation Board Schematic and Bill of Materials (BOM).

FIGURE A-1: EVB-USB4604 EVALUATION BOARD SCHEMATIC: USB4604

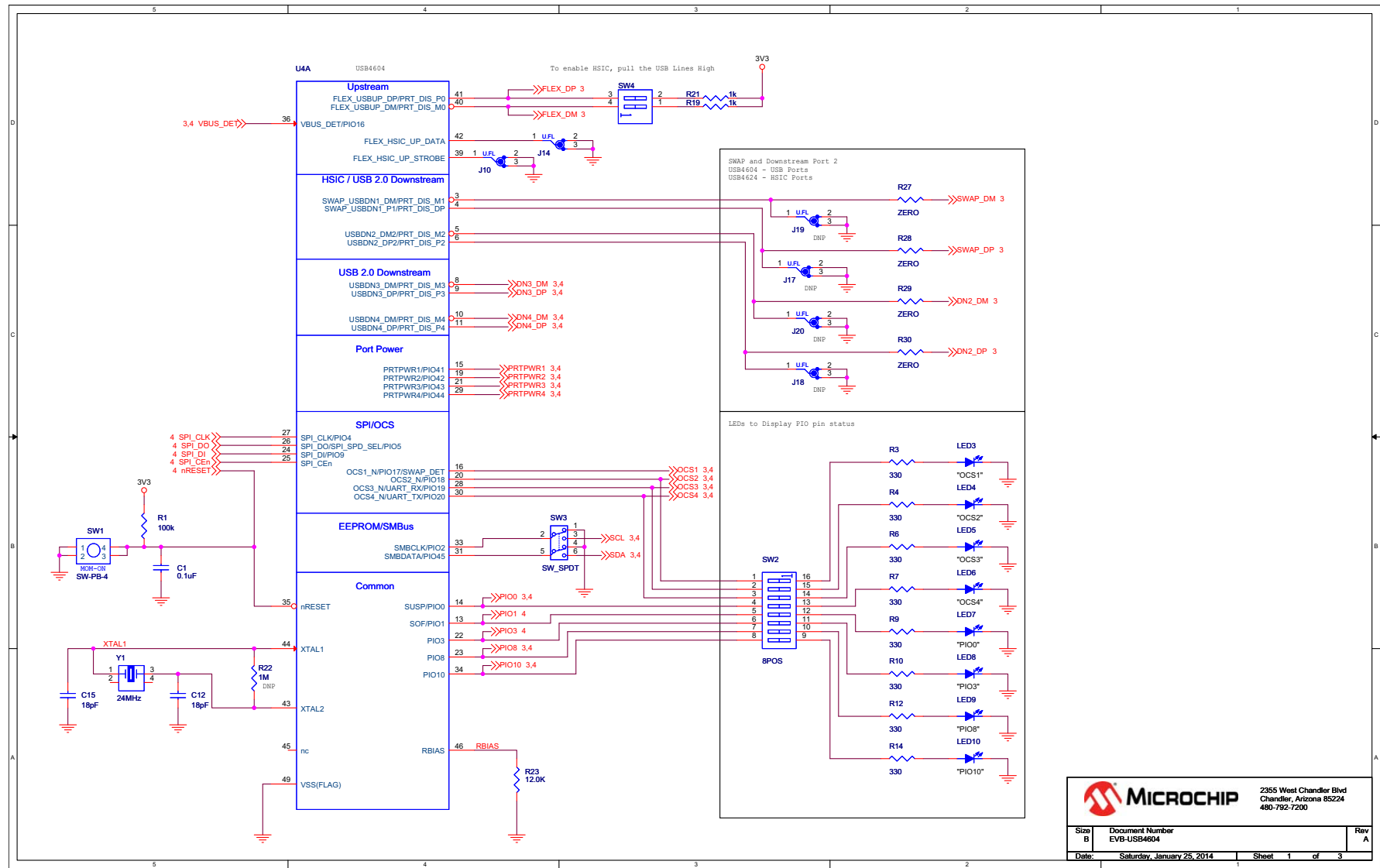


FIGURE A-2: EVB-USB4604 EVALUATION BOARD SCHEMATIC: PORT POWER CONTROLLERS

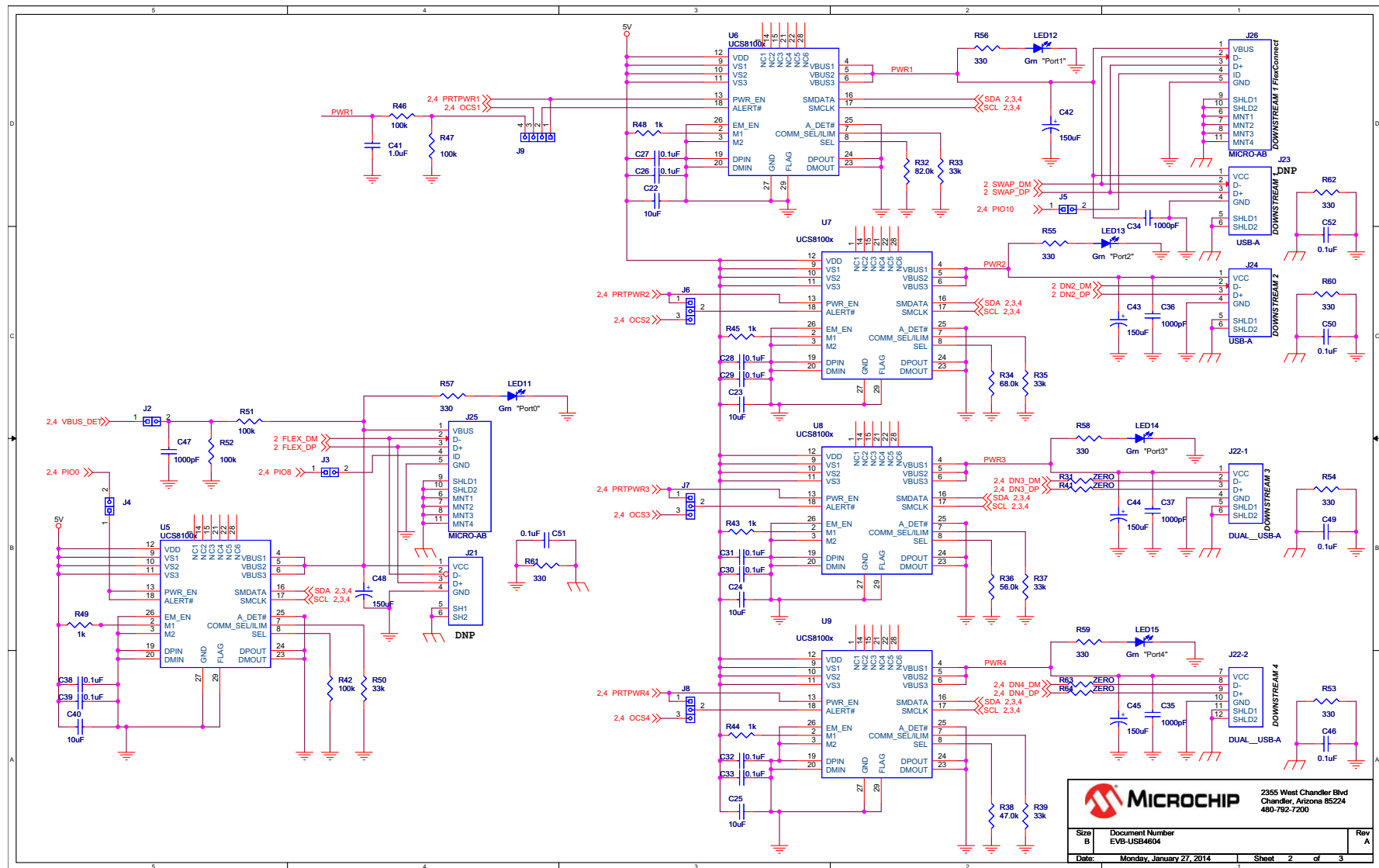


FIGURE A-3: EVB-USB4604 EVALUATION BOARD SCHEMATIC: DIGITAL IO AND POWER

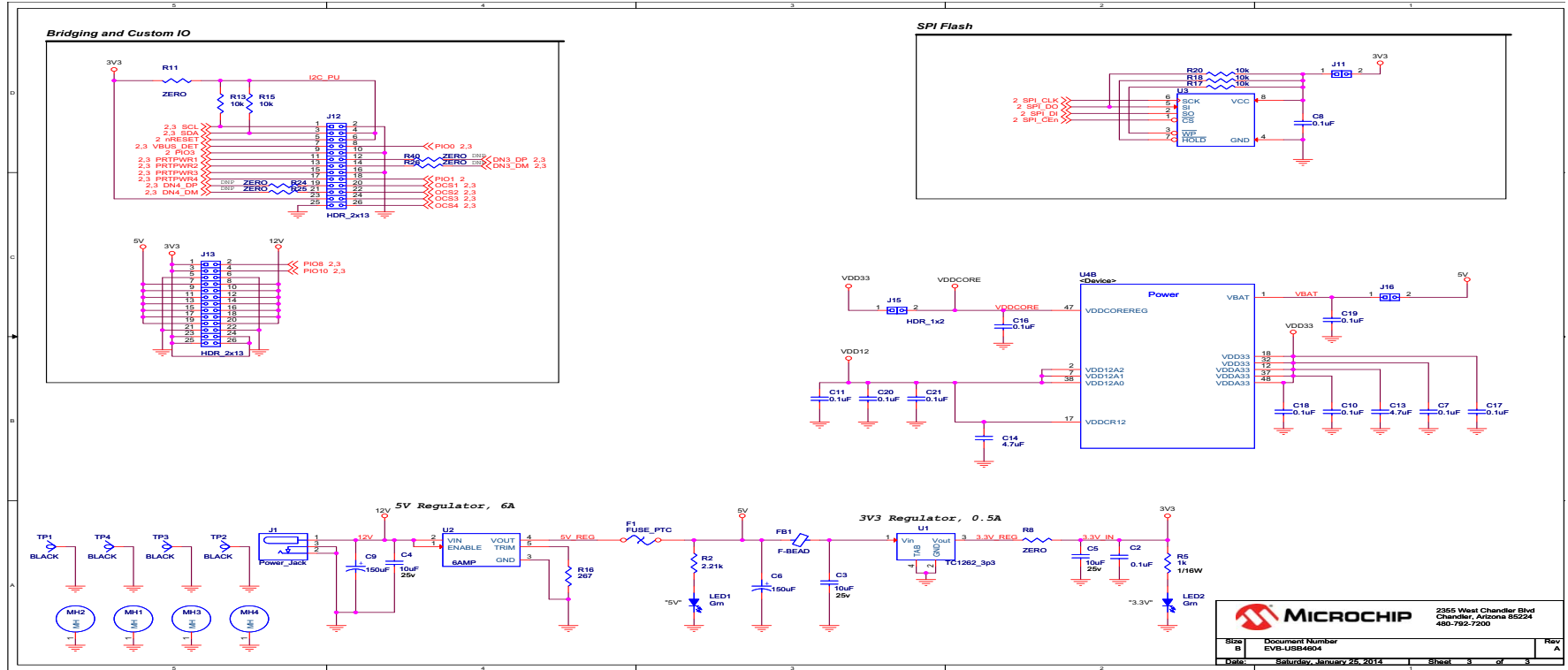


FIGURE A-4: BILL OF MATERIALS

ITEM #	Quantity	Part Reference	Description	Digikey_Number	Manuf	Manuf_PN	DNP	BOM_Comments
1	11	C1 C7 C8 C10 C11 C16 C17 C18 C19 C20 C21	CAPACITOR CERAMIC 0.1UF 10V X5R 0402	PCC2146CT-ND	PANASONIC	ECJ-0EB1A104K		
2	16	C2 C26 C27 C28 C29 C30 C31 C32 C33 C38 C39 C46 C49 C50 C51 C52	CAPACITOR CERAMIC 0.1UF 25V X7R 0603	PCC2277CT-ND	PANASONIC	ECJ-1VB1E104K		
3	3	C3 C4 C5	CAP CER 10UF 25V X5R 0805	490-5523-1-ND	MURATA ELECTRONICS	GRM21BR61E106KA73L		
4	7	C6 C9 C42 C43 C44 C45 C48	CAP ALUM 150UF 6.3V 20% SMD	493-3082-1-ND	NICHICON	PCG0151MCL1G5		
5	2	C12 C15	CAPACITOR CERAMIC 18PF 50V 0402 SMD	PCC180CQCT-ND	PANASONIC	ECJ-0EC1H180J		
6	2	C13 C14	CAP CER 4.7UF 6.3V X5R 0402	490-5408-1-ND	MURATA ELECTRONICS	GRM155R60J475ME87D		
7	5	C22 C23 C24 C25 C40	CAP CER 10UF 16V X5R 0805	490-3886-1-ND	MURATA ELECTRONICS	GRM21BR61C106KE15L		
8	5	C34 C35 C36 C37 C47	CAPACITOR CERAMIC 1000PF 25V 0402	PCC102BQCT-ND	PANASONIC	ECJ-0EB1E102K		
9	1	C41	CAPACITOR CERAMIC 1.0UF 6.3V 20% X5R 040	490-1319-1-ND	MURATA ERIE	GRM155R60J105ME19D		
10	1	F1	PTC RESETTABLE SMD 1812 6V 3.0A	283-3166-1-ND	COOPER BUSSMANN	PTS18126V300		
11	1	FB1	FILTER CHIP 220 OHM 2A 0603	490-3992-1-ND	MURATA ELECTRONICS	BLM18EG2215N1D		
12	1	J1	CONN PWR JACK 2.5X5.5MM HIGH CUR 12V	CP-002BH-ND	CUI STACK	PJ-002BH		
13	7	J2 J3 J4 J5 J11 J15 J16	HEADER, 1 X 2, 0.1 INCH, VERTICAL	WM6402-ND	MOLEX	22-28-4020		
14	3	J6 J7 J8	HEADER, 1 X 3, 0.1 INCH, VERTICAL	WM6403-ND	MOLEX	22-28-4030		
15	1	J9	HEADER, 1 X 4, 0.1 INCH, VERTICAL	WM6404-ND	MOLEX	22-28-4040		
16	6	J10 J14 J17 J18 J19 J20	CONN RECEPT ULTRA-MINI COAX SMD	H9161CT-ND	HIROSE	U.FL-R-SMT(10)	J17 J18 J19 J20	
17	2	J12 J13	CONN HDR BRKWAY .100 26POS VERT	A34268-13-ND	TE CONNECTIVITY	9-146261-0-13		
18	1	J21	RECEPTACLE, USB, STYLE B, RIGHT ANGLE	A31725-ND	TYCO ELECTRONICS	292304-1	J21	
19	1	J22	RECEPTACLE, USB, STYLE A, STACKED	609-1040-ND	FCI	72309-8034BLF		
20	2	J23 J24	RECEPTACLE, USB, STYLE A, RIGHT ANGLE	609-1045-ND	FCI	87520-0010BLF	J23	
21	2	J25 J26	CONNECTOR RECEPT MICRO USB TYPE AB SMT	H11611CT-ND	HIROSE	ZX62RD-AB-5P8		If Hirose part not available Sub OK to use DX4R205JJAR1800 or WM17143CT-ND
22	7	LED1 LED2 LED11 LED12 LED13 LED14 LED15	LED GREEN SMT	404-1005-1-ND	STANLEY	BG1111C-TR		
23	8	LED3 LED4 LED5 LED6 LED7 LED8 LED9 LED10	LED BLUE RECT CLEAR 0603	160-1837-1-ND	LITEON	LTST-C194TBKT		
24	5	R1 R46 R47 R51 R52	RESISTOR 100K OHM 1/10W 5% 0402 SMD	P100KJCT-ND	PANASONIC	ERJ-2GEJ104X		
25	1	R2	RESISTOR 2.21K OHM 1/10W 1% 0402 SMD	P2.21KLCT-ND	PANASONIC	ERJ-2RKF2211X		
26	17	R3 R4 R6 R7 R9 R10 R12 R14 R53 R54 R55 R56 R57 R58 R59 R60 R62	RESISTOR 330 OHM 1/16W 1% 0402 SMD	311-330LRCT-ND	YAGEO	RC0402FR-07330RL		
27	8	R5 R19 R21 R43 R44 R45 R48 R49	RESISTOR 1.0K OHM 1/16W 5% 0402 SMD	P1.0KJCT-ND	PANASONIC	ERJ-2GEJ102X		
28	1	R8	RESISTOR ZERO OHM 1/4W 5% 1206	311-0.0ERCT-ND	YAGEO	RC1206JR-070RL		
29	13	R11 R24 R25 R26 R27 R28 R29 R30 R31 R40 R41 R63 R64	RESISTOR ZERO OHM 1/16W 5% 0402 SMD	311-0.0JRCT-ND	YAGEO	RC0402JR-070RL	R24 R25 R26 R40	
30	5	R13 R15 R17 R18 R20	RESISTOR 10K OHM 1/16W 5% 0402 SMD	P10KJCT-ND	PANASONIC	ERJ-2GEJ103X		
31	1	R16	RES 267 OHM 1/16W 1% 0402 SMD	541-267LCT-ND	VISHAY-DALE	CRCW0402267RKFED		
32	1	R22	RESISTOR 1.00M OHM 1/16W 1% 0402 SMD	311-1.00MLRCT-ND	YAGEO	RC0402FR-071ML	R22	
33	1	R23	RESISTOR 12.0K OHM 1/16W 1% 0402 SMD	311-12.0KLRCT-ND	YAGEO	RC0402FR-0712KL		
34	1	R32	RESISTOR 82.0K OHM 1/10W 1% 0603 SMD	311-82.0KHRCT-ND	YAGEO	RC0603FR-0782KL		
35	5	R33 R35 R37 R39 R50	RESISTOR 33K OHM 1/10W 1% 0603	311-33.0KHRCT-ND	YAGEO	RC0603FR-0733KL		
36	1	R34	RESISTOR 68.0K OHM 1/10W 1% 0603 SMD	311-68.0KHRCT-ND	YAGEO	RC0603FR-0768KL		
37	1	R36	RESISTOR 56K OHM 1/10W 5% 0603 SMD	311-56KGRCT-ND	YAGEO	RC0603JR-0756KL		
38	1	R38	RESISTOR 47.0K OHM 1/10W 1% 0603 SMD	311-47.0KHRCT-ND	YAGEO	RC0603FR-0747KL		
39	1	R42	RESISTOR 100K OHM 1/10W 1% 0603 SMD	311-100KHRCT-ND	YAGEO	RC0603FR-07100KL		
40	1	R61	RESISTOR 330 OHM 1/16W 3300PPM 5% 0603	P330CHCT-ND	PANASONIC	ERA-V3J331V		
41	1	SW1	SWITCH TACTILE 6MM EXTEND ACT 160GF	EG1861-ND	E-SWITCH	TL1105SPF160Q		
42	1	SW2	SWITCH DIP 8POS HALF PITCH 24V	CKN9067-ND	C&K	TDA08H05B1		
43	1	SW3	SW SLIDE DPDT 6VDC 0.3A PCMNT	401-2001-ND	C&K	JS202011CQN		
44	1	SW4	DIPSWITCH 2POS HALF PITCH SMT	CKN9064-ND	C&K	TDA02H05B1		
45	4	TP1 TP2 TP3 TP4	TEST POINT LOOP COMPACT BLACK	5006K-ND	KEYSTONE		5006	
46	1	U1	IC REG LDO 3.3V 0.5A SOT223-3	TC1262-3.3VDBCT-ND	MICROCHIP	TC1262-3.3VDBTR		
47	1	U2	CONV DC/DC 6A 12VIN POL SIP	811-2179-ND	MURATA ELECTRONICS	OKR-T/6-W12-C		
48	1	U3	IC FLASH 64MBIT 80MHZ 8SOIC	SST25VF064C-80-4I-S3AE-ND	MICROCHIP	SST25VF064C-80-4I-S3AE		
49	1	U4	MICROCHIP 4640	CONSIGNED				
50	1	U5 U6 U7 U8 U9	MICROCHIP UCS8100X	CONSIGNED				
51	1	Y1	CRYSTAL HYBRID 24MHZ 6PF SMD	490-5575-1-ND	MURATA ELECTRONICS	XRCGB24M000F0L00R0		

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://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: 852-2401-1200
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: 852-2401-1200
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: 86-755-8864-2200
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

03/21/14

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Microchip:](#)

[EVB-USB4604](#)