EVB-USB4604BCH Evaluation Board User's Guide

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Object of Declaration: EVB-USB4604BCH 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).
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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

Preface **7**
Introduction 7
Document Layout 7
Conventions Used in this Guide 8
The Microchip Web Site 9
Development Systems Customer Change Notification Service 9
Customer Support 9
Document Revision History 10

Chapter 1. Overview
1.1 Introduction 11

Chapter 2. Getting Started
2.1 EVB-USB4604BCH Setup 15
2.2 Configuration Source – Internal Default 17
2.3 Configuration Source – External SPI Flash and SMBus 17
2.4 Clock Source – 24 MHz Crystal 17
2.5 Power Source and Reset – Self-Powered 17
2.6 Downstream Port Power Control (Battery Charging) 18

Chapter 3. Battery Charging Support
3.1 Battery Charging Modes 19
3.2 Charging Port Roles 19
3.2.1 BC1.2 Charging Downstream Port (CDP) Description 20
3.2.2 Dedicated Charger Emulation Port (DCP) Description 20

Appendix A. EVB-USB4604BCH Evaluation Board
A.1 Introduction 23

Appendix B. EVB-USB4604BCH Evaluation Board Schematics
B.1 Introduction 25

Appendix C. Bill of Materials (BOM)
C.1 Introduction 29

Worldwide Sales and Service **35**

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 "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-USB4604BCH 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-USB4604BCH Evaluation Board as a development tool for the USB4604 4-port USB 2.0 hub with battery charging features. The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the EVB-USB4604BCH Evaluation Board.
- **Chapter 2. "Getting Started"** – Includes instructions on how to get started with the EVB-USB4604BCH Evaluation Board.
- **Chapter 3. "Battery Charging Support"** – Provides information about the EVB-USB4604BCH Evaluation Board battery charging features.
- **Appendix A. "EVB-USB4604BCH Evaluation Board"** – This appendix shows the EVB-USB4604BCH Evaluation Board.
- **Appendix B. "EVB-USB4604BCH Evaluation Board Schematics"** – This appendix shows the EVB-USB4604BCH Evaluation Board schematics.
- **Appendix C. "Bill of Materials (BOM)"** – This appendix includes the EVB-USB4604BCH 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) { ... }`

THE MICROCHIP WEB SITE

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- **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

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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 (September 2013)

- Initial Release of this Document.

Chapter 1. Overview

1.1 INTRODUCTION

The USB4604 hub controller is a 4-port high-speed, low-power and configurable, Multi-Transaction Translator (MTT) hub controller. It is fully compliant with the USB 2.0 Specification, USB 2.0 Link Power Management (LPM) Addendum and High-Speed Inter-Chip (HSIC) USB Electrical Specification Revision 1.0. The 4-port hub supports 480 Mbps High-Speed (HS), 12 Mbps Full-Speed (FS) and 1.5 Mbps Low-Speed (LS) USB signaling. It also supports a High-Speed Inter-Chip (HSIC) Upstream host. The USB4604 has four USB 2.0 downstream ports that all support battery charging. On these battery charging enabled ports, the device provides automatic USB data line handshaking. The handshaking supports USB BC1.2 Charging Downstream Port (CDP), Dedicated Charging Port (DCP) and legacy devices.

The EVB-USB4604BCH is a 4-layer RoHS-compliant evaluation board that utilizes the USB4604 to provide a fully functional 4-port high-speed hub with battery charging capabilities. The EVB-USB4604BCH also features the UCS1002 programmable USB port power controller. The USB4604 is configured for operation through internal default settings and supports custom configurations through the ProTouch and ProLink tools, and optionally through an external 2-Mbit SPI Flash socketable device, U13. To allow maximum operational flexibility, all LED and port control signal pins are under firmware control and are available as GPIOs for customer-specific use. The EVB-USB4604BCH demonstrates driver compatibility with Microsoft® Windows® 7, Windows XP, Mac OS® X 10.4+ and Linux® hub drivers.

The EVB-USB4604BCH provides the following features:

- USB4604 in a 48-pin QFN RoHS compliant package
- UCS1002 in a 20-pin QFN RoHS compliant package
- USB 2.0 compliant (HS, FS and LS operation); USB pins are 5V tolerant
- One HSIC upstream hub port
- Self-Powered operation
- Four USB 2.0 downstream ports
- Battery Charging support (BC1.2 CDP and DCP)
- Optional socketable SPI Flash for external downloadable firmware
- Low-Cost, 4-Layer space saving design
- Operates from one single voltage (+12.0V, regulated) external DC power supply
- Single 24 MHz crystal or external clock input
- Single on board +3.3V, 1 Amp regulator
- Single on board +1.2V, 1 Amp regulator
- Single on board +5.0V, 6 Amp switching regulator module
- +3.3V and port power LED indicators
- UCS1002 Alert LED indicator
- Reset and VBUS Detect LED indicators
- SPI Chip Enable LED indicator
- External GPIO pin headers

Figure 1-1 shows the top and bottom level silk screen and copper layers.

FIGURE 1-1: TOP AND BOTTOM LEVEL SILK SCREEN AND COPPER LAYERS

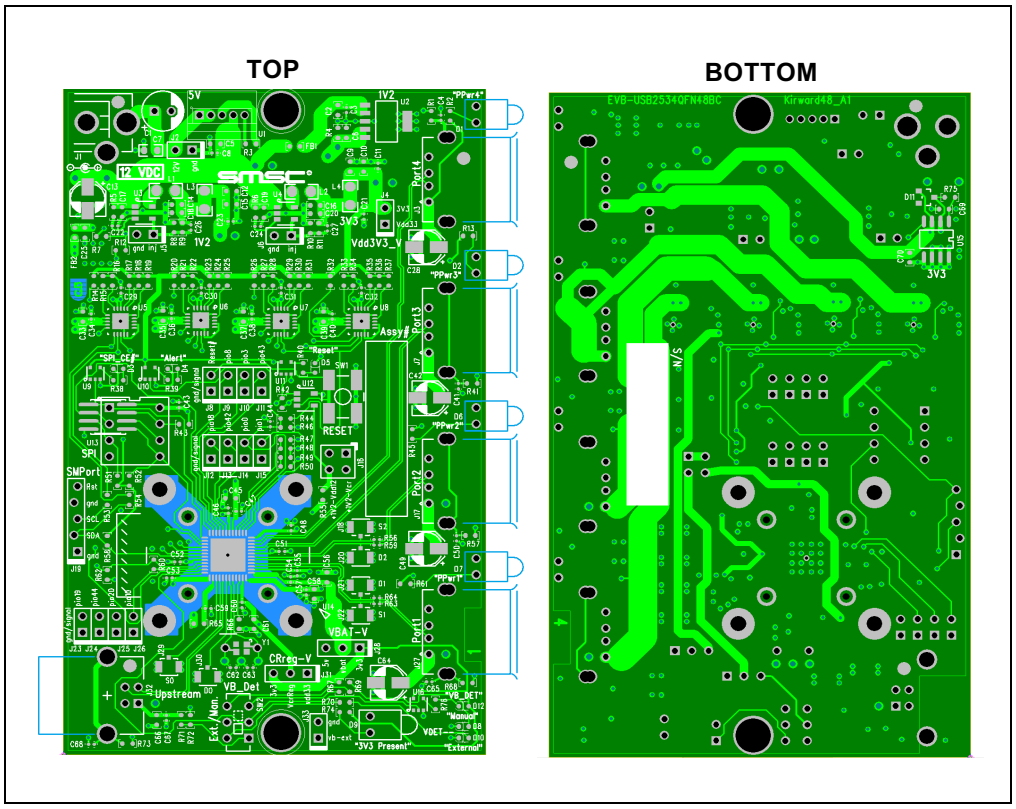
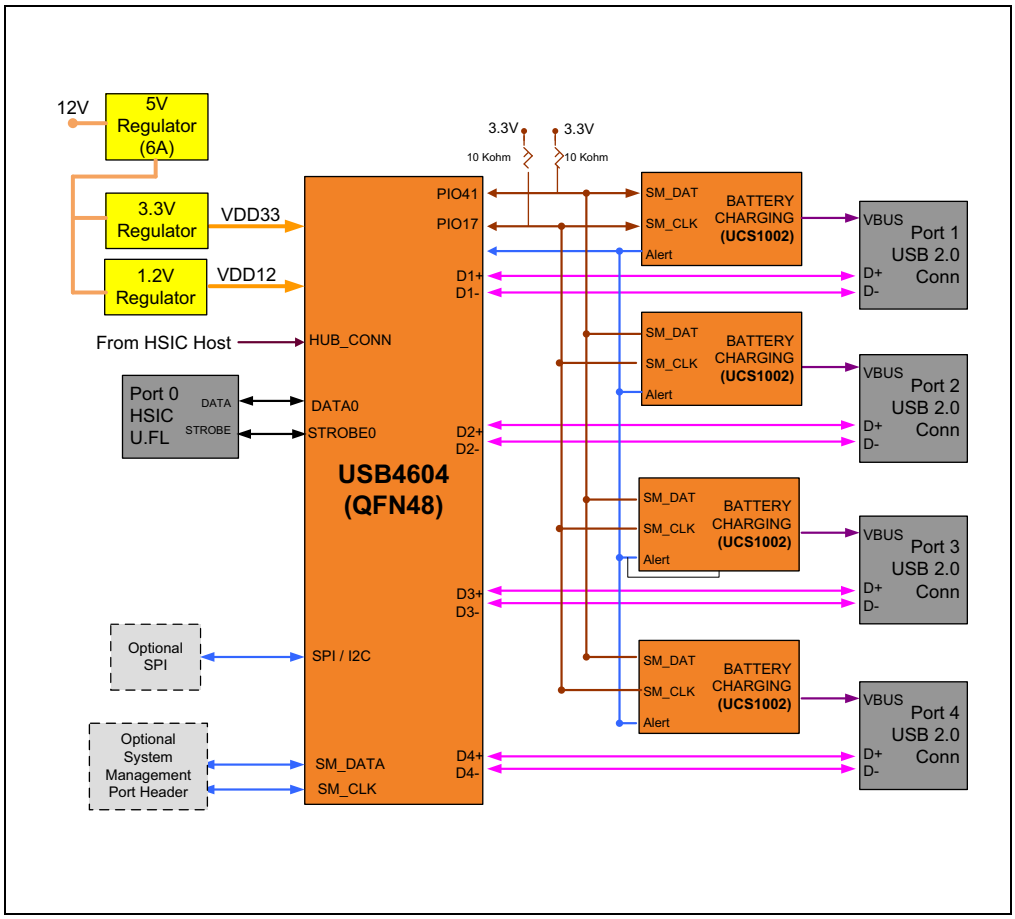


Figure 1-2 shows the block diagram of the EVB-USB4604BCH.

FIGURE 1-2: BLOCK DIAGRAM OF EVB-USB4604BCH



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Chapter 2. Getting Started

2.1 EVB-USB4604BCH SETUP

The EVB-USB4604BCH must be connected to an HSIC upstream host via the Data0 (J30) and Strobe0 (J29) connectors using the provided U.FL coaxial cables. When removing these cables from the EVB for any reason, the provided HSIC Extraction tool must be used. Figure 2-1 shows the recommended usage of the HSIC extraction tool per the Hirose U.FL data sheet on proper use of the plugs.

FIGURE 2-1: U.FL COAXIAL CABLE EXTRACTION GUIDELINES

Usage Precautions

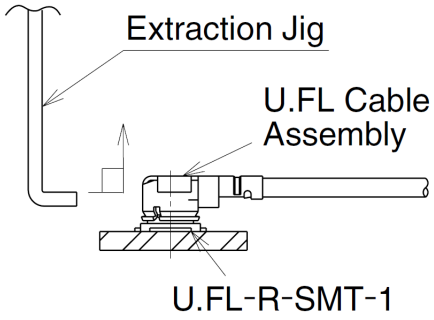
1. Plugs

(1) Mating/Unmating

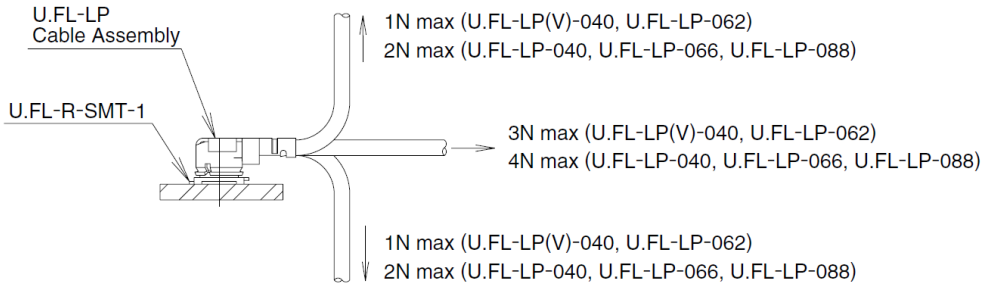
1) To disconnect the connectors, insert the end portion of U.FL-LP-N-2 under the connector flanges and pull off vertically, in the direction of the connector mating axis.

2) To mate the connectors, the mating axes of both connectors must be aligned. The "click" confirms a fully-mated connection. Do not attempt to insert on an extreme angle.

U.FL-LP-N-2 Plug Extraction Tool



(2) Pull forces on the cable after the connectors are mated. Do not apply a load to the cable in excess of the values indicated in the diagram below.



(3) Precautions

Do NOT forcefully twist or deform wires.

An external HUB_CONN port control signal from the host must be wired to the VB-EXT pin on the J33 header. This signal lets the USB4604 know when an HSIC upstream host is ready to attach. The VBUS_DET Select switch (SW2) must be set to the "Manual" position and the yellow LED D8 lights up to display "Manual" mode. Once a host has been attached and detected, the blue "VB_DET" LED D12 lights up.

The EVB-USB4604BCH is designed to allow flexible configuration options. It can be configured with default internal register settings through an SMBus or through a downloadable external firmware to a socketable SPI Flash. It supports "Quad-Page" configuration OTP flash (four consecutive 200-byte configuration pages). The following sections detail the various configuration methods and features.

2.2 CONFIGURATION SOURCE – INTERNAL DEFAULT

When the USB4604 does not detect a valid SPI Flash image or SMBus configuration upon power-up, the EVB-USB4604BCH uses internal default register settings. It also sets the Vendor ID, Product ID, Language ID, Device ID and additional settings from the internal ROM code.

2.3 CONFIGURATION SOURCE – EXTERNAL SPI FLASH AND SMBus

Upon power-up, the USB4604 searches for an external SPI Flash device that contains a valid signature of “2DFU” beginning at address 0xFFFA. If one is present, the external ROM is enabled and code execution is then initiated from the external SPI device. If an SPI Flash device is not present, the firmware checks to see whether SMBus is enabled. If the SMBus is disabled, the USB4604 attempts to load the configuration from an external I^2C™ EEPROM. If no external options are detected, the USB4604 will operate using the internal default and configuration strap settings.

The SMBus interface is disabled by default as SM_CLK is pulled low through a 10 kOhm resistor. To enable SMBus, SM_CLK must be pulled high to +3.3V with a 1 kOhm resistor. This is often embedded within the external SMBus tool (not included). All device configuration must be performed via the Pro-Touch Programming Tool. For information on this tool, contact your local sales representative. When SMBus is enabled, the firmware configures the GPIOs to act as an SMBus slave. As an SMBus slave, the firmware waits indefinitely for the SMBus configuration.

If the USB4604 does not detect an SMBus interface, it will check for an I^2C EEPROM. For I^2C communication, the system management port header J19 can be used to access the SCL and SDA signals on the USB4604. To assure proper operation, the external 10 kOhm pull up resistor R58 on SM_DAT must be populated and SM_CLK must have a 1 kOhm pull up resistor applied via the I^2C interface.

2.4 CLOCK SOURCE – 24 MHZ CRYSTAL

By default, a 2 mm x 1.6 mm Murata 24 MHz crystal, Y1, is populated on the evaluation board as the clock source for the USB4604.

2.5 POWER SOURCE AND RESET – SELF-POWERED

The EVB-USB4604BCH only supports self-powered operation, and is powered through one +12.0V regulated external DC power supply. A +12.0V input is needed to provide enough current to all of the downstream ports in Battery Charging modes. The +12.0V external DC power supply plugs into the on-board 2.5 mm connector J1. Alternatively, an external voltage can be injected onto the J2 Ext.12V header, which is not populated by default. The +12.0V feeds a 6A switching regulator module which outputs +5.0V across the board. Using this switching regulator allows up to 30 W to be delivered across the board. This +5.0V output controls the on board +3.3V and +1.2V step down (buck) converters.

Power to the USB4604 is controlled by the J4, J16, J28 and J31 power headers. These headers are configured by default for an external +3.3V and +1.2V supply, bypassing the USB4604's internal regulators. For alternative power options, please refer to the USB4604 data sheet.

A voltage supervisor circuit is used to provide a system RESET# to the USB4604. The STM6718 device (U12) asserts RESET# to the DUT on power up and release it after 3V3 and 1V2 are stable on the USB4604. If 3V3 falls below +3.08V and/or 1V2 falls below +1.11V, the device asserts RESET# to the DUT for its minimum period after 3V3

and 1V2 have both reached above their voltage trip points. A reset can also be generated to the DUT by pressing the reset switch SW1 or by supplying an external reset via the External Reset header J8.

2.6 DOWNSTREAM PORT POWER CONTROL (BATTERY CHARGING)

All four USB downstream ports support battery charging. Power to each port is controlled through a UCS1002 port power controller. The UCS1002 device is a 20-pin QFN package that provides a USB port power switch for precise control of up to 2.5A of continuous current with over-current limit (OCL), dynamic thermal management, latch or auto-recovery fault handling, selectable active high or low enable, under and over-voltage lockout, back-drive protection and back-voltage protection. It also provides current monitoring and reports back to the USB4604 over SMBus. This allows intelligent management of system power which is especially important for battery operated applications. The PIO17 (UCS_SMCLK) and PIO41 (UCS_SMDATA) pins of the USB4604 are defined by firmware and are completely separate from the SM_DAT and SM_CLK pins on the SMBus interface of the USB4604.

The 33 kOhm pull down resistor on the COMM_SEL/ILIM pin of all of the UCS1002 devices is used to set the current limit to 2.5 Amps as well as to set the UCS1002 devices into SMBus mode (as opposed to Stand-alone mode). The pull down resistors selected for each SEL pin of the UCS1002 devices sets the SMBus address for each UCS port power controller and sets the PWR_EN pins such that they are active high. The UCS1002 on downstream port 1 must have the SMBus address 0x30h. The UCS1002 devices are controlled by the USB4604 through SMBus commands. As a precautionary best practice, the M1, M2 and EM_EN pins are pulled high. The DP/DM input and output pins are tied to ground which allow all UCS1002 devices to act strictly as current sensing battery charging port power devices. For all other possible UCS1002 configurations, consult the UCS100x data sheet. The USB4604 monitors `ALERTn` of the UCS1002 devices via PIO0. If `ALERTn` is asserted for any reason, the affected UCS1002 device(s) is turned off and the red "Alert" LED D4 asserts. The UCS1002 devices stay in this state until the error condition has been removed or until power has been recycled on the evaluation board.

Note: Due to configuration restrictions, if any UCS1002 devices are used with the USB4604, one must be attached to physical Port1.

Chapter 3. Battery Charging Support

3.1 BATTERY CHARGING MODES

The EVB-USB4604BCH supports several different Battery Charging modes, providing an array of flexible configuration solutions. Each downstream port can be separately configured for battery charging via OTP, downloadable external firmware to an on board SPI Flash or through SMBus commands. Each port's configuration is independent of the other ports.

The battery charging mechanism automatically switches ports between states that perform the BC1.2 CDP handshake (which allows full USB communication with a USB host while charging) and states that emulate the dedicated chargers from Charging Device vendors. This allows support for the BC1.2 CDP mode and emulation of dedicated chargers in DCP mode, without interfering with normal USB operation of any USB 2.0 device attached to the port. Battery charging is supported through the use of a UCS1002 port power controller.

Section 3.2 "Charging Port Roles" describes the modes of operation. For more information on battery charging, please refer to the UCS1002 data sheet, Application Note 34.5 and the USB Battery Charging 1.2 specifications.

3.2 CHARGING PORT ROLES

The EVB-USB4604BCH's battery charging enabled downstream ports automatically switch between various roles depending on the USB state of the EVB-USB4604BCH. These roles are:

1. BC1.2 Charging Downstream Port (CDP – 1.5A with data)
2. Dedicated Charging Port (DCP – Power brick without data)

When switching between roles, the EVB-USB4604BCH toggles power to the attached device if appropriate. The power toggle occurs if charger or USB renegotiation is necessary based on the following conditions:

1. If the port is in a CDP role while the hub is disconnected from the host, the port toggles power when switching to a DCP role to allow the downstream device to negotiate with the DCP mechanism.
2. If the port is in a DCP role and the port needs to switch to a CDP role, the port toggles power to allow the device to renegotiate with a CDP handshake and/or USB attach.

When battery charging is disabled for a EVB-USB4604BCH port, the port acts as a normal USB hub port.

When a USB port is in a state in which device-host USB communication is not possible, a battery charging enabled port is not required to act as a USB hub port and is therefore free to enter states that emulate dedicated chargers. For the EVB-USB4604BCH, there are two cases where this applies:

1. The EVB-USB4604BCH upstream port is not connected to a USB host (which on this evaluation board, it is tied to an HSIC host).
2. The EVB-USB4604BCH is in USB suspend with remote wake on the USB 2.0 portion of the evaluation board disabled and no USB 2.0 device connected as a

USB device on the downstream port. If USB 2.0 remote wake is disabled, the hub cannot generate resume signaling and does not need to detect a USB 2.0 attach.

In case 2, the EVB-USB4604BCH's charging ports do not enter dedicated charging states when there is a USB 2.0 device attached as a USB device. There are two reasons for this behavior:

1. Entering dedicated charging states may involve changing the state of an attached device due to power toggling and/or USB linestate changing. Because the host system is unaware of the battery charging mechanism of the EVB-USB4604BCH, the host could find the device in an unexpected state when exiting suspend.
2. The attached device will not be able to signal resume signaling to the host when the port is in a dedicated charging state. Hubs must propagate resume signaling from downstream devices even when remote wake generation is disabled for the hub.

If the EVB-USB4604BCH is in USB 2.0 suspend with USB 2.0 remote wake disabled and a USB-attached device is removed from a port, the port switches to the DCP role because possible resume propagation is no longer required.

3.2.1 BC1.2 Charging Downstream Port (CDP) Description

Devices that do not follow the BC1.2 CDP specification behave as they normally would when inserted into a standard USB port. The EVB-USB4604BCH ports in CDP mode allow normal USB operation or communication between normal devices and USB hosts after downstream device detection and absence of a BC1.2 CDP handshake from the device.

Devices that follow the BC1.2 CDP specification are also allowed to communicate normally with the USB host when inserted into the EVB-USB4604BCH ports in CDP mode. Additionally, prior to allowing the normal USB connection between the host and the BC1.2 device, the EVB-USB4604BCH port performs the BC1.2 CDP handshake to inform the BC1.2-compliant device that it may draw current exceeding the USB specified limits. When the handshake is complete, the port is ready for device enumeration.

3.2.2 Dedicated Charger Emulation Port (DCP) Description

The advantage of the EVB-USB4604BCH dedicated charger emulation port over the BC1.2-specified DCP is that it supports BC1.2 compliant charging devices and many non-BC1.2 compliant charging devices. The following paragraphs describe the EVB-USB4604BCH modes of operation when its downstream ports are in dedicated charging states (when normal USB connection is not required as described in previous sections).

Dynamic Mode:

The EVB-USB4604BCH can be configured to dynamically react to devices inserted into the downstream ports and emulate the appropriate type of charger for the inserted device. In this configuration, the port begins in Apple® charger emulation mode and switches to China Charging, Blackberry® or BC1.2 device charger emulation when such devices are detected by the port. When a device is detached, the port starts again in Apple charger emulation mode.

Configurable 1A and 2A Apple modes are available depending on the capabilities of each port's port power controller.

An EVB-USB4604BCH port with a UCS1002 port power controller also supports Samsung® Galaxy Tab™ charger emulation in addition to the above modes.

Static Mode:

The EVB-USB4604BCH can be configured to keep the downstream ports in a fixed charger emulation state. Currently, Apple and Samsung Galaxy Tab or China Charging fixed charger emulation modes are available.

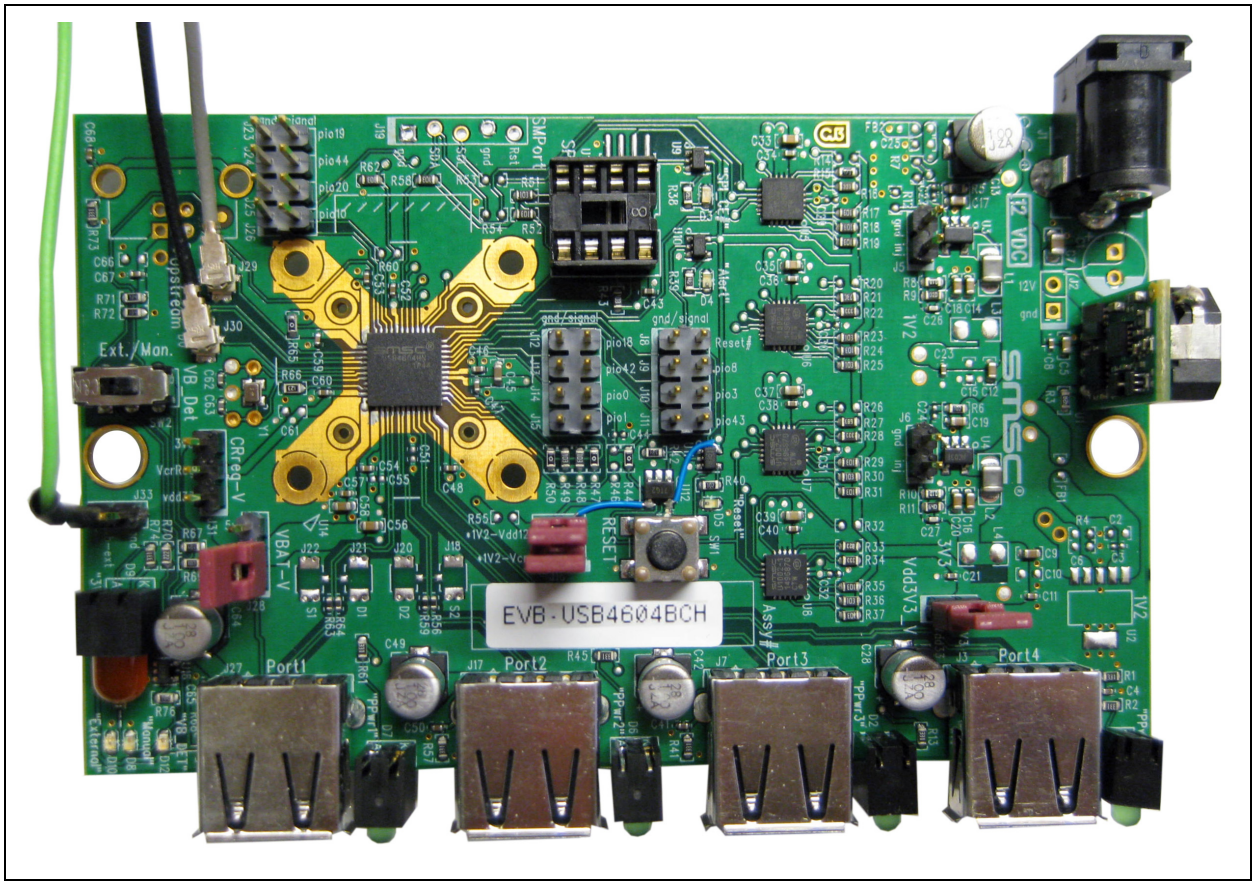
NOTES:

Appendix A. EVB-USB4604BCH Evaluation Board

A.1 INTRODUCTION

This appendix shows the EVB-USB4604BCH Evaluation Board.

FIGURE A-1: EVB-USB4604BCH EVALUATION BOARD



NOTES:

Appendix B. EVB-USB4604BCH Evaluation Board Schematics

B.1 INTRODUCTION

This appendix shows the EVB-USB4604BCH Evaluation Board schematics.

FIGURE B-1: EVB-USB4604BCH EVALUATION BOARD SCHEMATIC 1

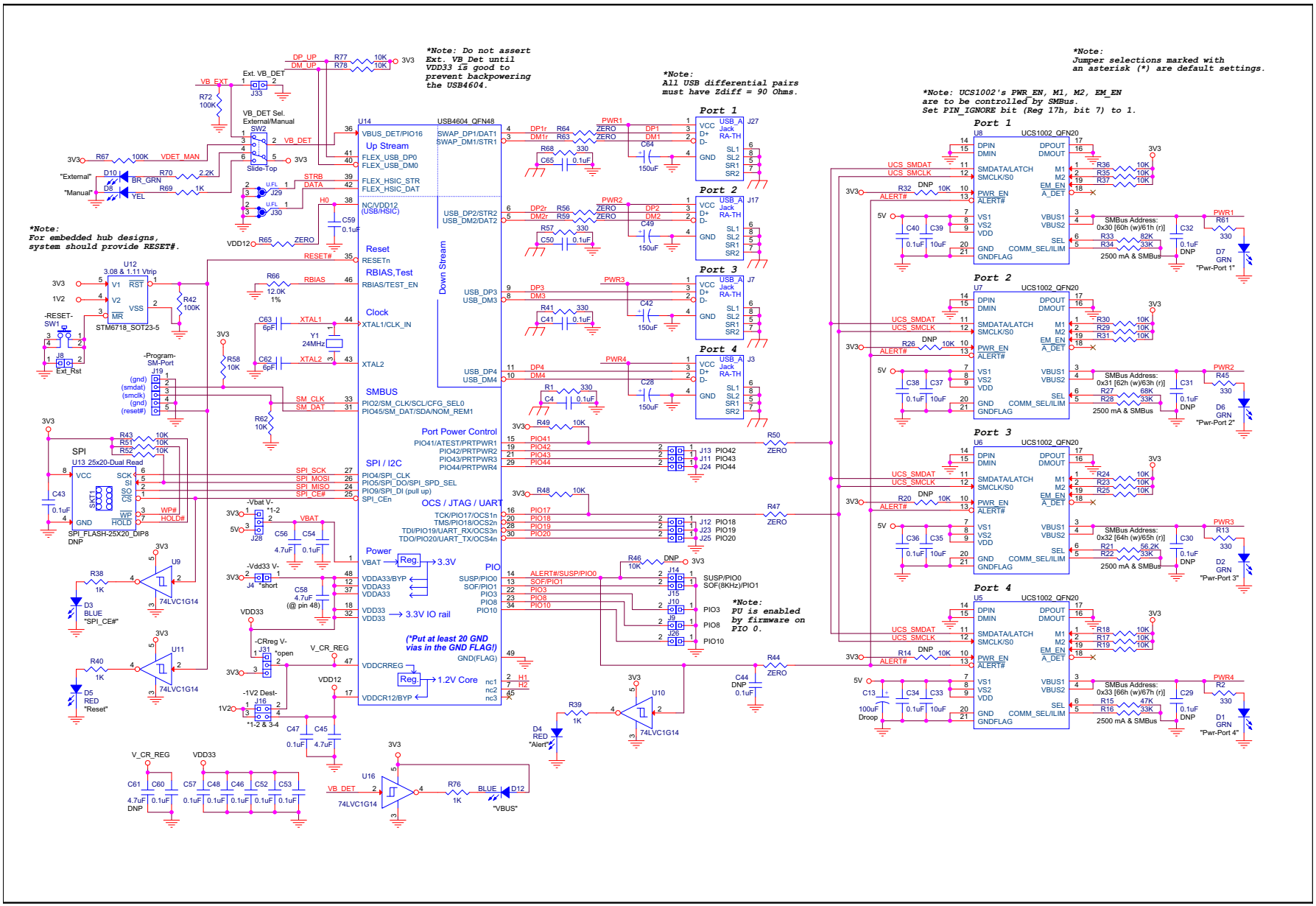
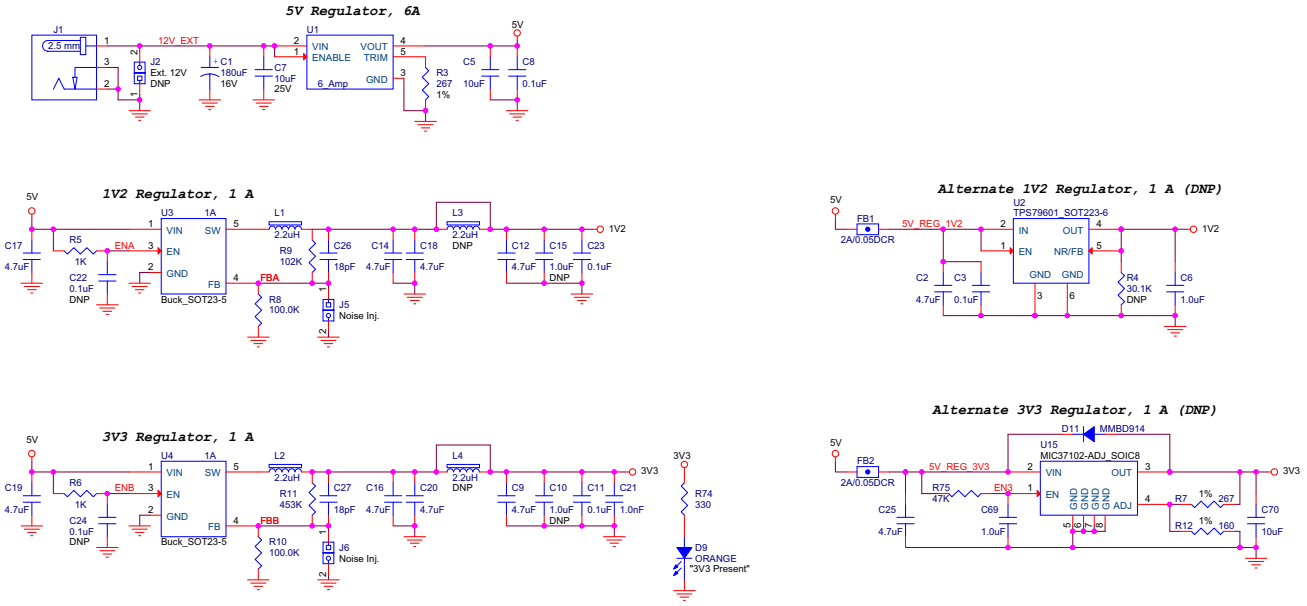


FIGURE B-2: EVB-USB4604BCH EVALUATION BOARD SCHEMATIC 2



NOTES:

Appendix C. Bill of Materials (BOM)

C.1 INTRODUCTION

This appendix includes the EVB-USB4604BCH Evaluation Board Bill of Materials (BOM).

TABLE C-1: EVB-USB4604BCH EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
1	1	1	C1	Capacitor, Low ESR, 180 uF, 16 VDC, 20% Aluminum, Radial, 6.3 mm x 15 mm	Nichicon	UPW1C181MED	
2	1	1	C13	Capacitor, Low ESR, 100 uF, 6.3 VDC, 20%, Aluminum, Radial-SMT, 5 mm x 5.8 mm	United Chemi-Con	EMZA6R3ADA101ME61G	
3	4	4	C28, C42, C49, C64	Capacitor, Low ESR, 150 uF, 6.3 VDC, 20%, Aluminum, Radial-SMT, 5 mm x 5.7 mm	Lelon	VZS151M0JTR-0506	
4	2	2	C62, C63	Capacitor, 6 pF, 50V, ±0.5 pF, NPO, 0402	Murata Electronics®	GRM1555C1H6R0DZ01D	
5	2	2	C26, C27	Capacitor, 18 pF, 50V, 5%, NPO, 0402	Murata Electronics	GRM1555C1H180JZ01	
6	1	1	C21	Capacitor, 1000 pF, 50V, 10%, X7R, 0402	Murata Electronics	GRM155R71H102KA01D	
7	1	0	C67	Capacitor, 1000 pF, 50V, 10%, X7R, 0402	Murata Electronics	GRM155R71H102KA01D	Do not populate
8	1	0	C3	Capacitor, 0.1 uF, 10V, 10%, X5R, 0402	Murata Electronics	GRM155R71A104KA01D	Do not populate
9	21	21	C4, C8, C11, C23, C34, C36, C38, C40, C41, C43, C46, C47, C48, C50, C52, C53, C54, C57, C59, C60, C65	Capacitor, 0.1 uF, 10V, 10%, X5R, 0402	Murata Electronics	GRM155R71A104KA01D	
10	10	0	C22, C24, C29, C30, C31, C32, C44, C51, C55, C68	Capacitor, 0.1 uF, 10V, 10%, X5R, 0402	Murata Electronics	GRM155R71A104KA01D	Do not populate
11	1	0	C6	Capacitor, 0.1 uF, 16 VDC, 10%, X5R, 0603	Murata Electronics	GRM188R61C105KA93D	Do not populate
12	1	0	C66	Capacitor, 2.2 uF, 6.3 VDC, 10%, X5R, 0603	Murata Electronics	GRM185R60J225KE26D	Do not populate
13	1	0	C69	Capacitor, 0.1 uF, 16 VDC, 10%, X5R, 0603	Murata Electronics	GRM188R61C105KA93D	Do not populate
14	2	0	C10, C15	Capacitor, 0.1 uF, 16 VDC, 10%, X5R, 0603	Murata Electronics	GRM188R61C105KA93D	Do not populate
15	1	0	C2	Capacitor, 4.7 uF, 6.3 VDC, 20%, X5R, 0603	Murata Electronics	GRM188R60J475KE19D	Do not populate
16	11	11	C9, C12, C14, C16, C17, C18, C19, C20, C45, C56, C58	Capacitor, 4.7 uF, 6.3 VDC, 20%, X5R, 0603	Murata Electronics	GRM188R60J475KE19D	
17	1	0	C25	Capacitor, 4.7 uF, 6.3 VDC, 20%, X5R, 0603	Murata Electronics	GRM188R60J475KE19D	Do not populate
18	1	0	C61	Capacitor, 4.7 uF, 6.3 VDC, 20%, X5R, 0603	Murata Electronics	GRM188R60J475KE19D	Do not populate
19	1	0	C70	Capacitor, 10 uF, 6.3 VDC, 20%, X5R, 0603	Murata Electronics	GRM188R60J106ME47D	Do not populate
20	5	5	C5, C33, C35, C37, C39	Capacitor, 10 uF, 6.3 VDC, 20%, X5R, 0603	Murata Electronics	GRM188R60J106ME47D	
21	1	1	C7	Capacitor, 10 uF, 25 VDC, 10%, 0805	Murata Electronics	GRM21BR61E106KA73L	
22	4	4	D1, D2, D6, D7	LED, Green, 3 mm, Diffused, Right Angle	Lumex	SSF-LXH103GD	
23	2	2	D3, D12	LED, Blue, 0603	Stanley Electric	DB1111C-TR	
24	2	2	D4, D5	LED, Red, 0603	Stanley Electric	BR1111C-TR	
25	1	1	D8	LED, Yellow, 0603	Stanley Electric	AY1111C-TR	

TABLE C-1: EVB-USB4604BCH EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
26	1	1	D9	LED, Orange, 5 mm, TH, Right Angle	Dialight	550-2505	
27	1	1	D10	LED, Bright Green, 0603	Rohm	SML-412MWT86	
28	1	0	D11	Diode, MMBD914LT, Fast Switching, 100 VDC, 200 mA, SOT-23	ON Semiconductors®	MMBD914LT1	Do not populate
29	1	0	FB1	Ferrite Bead, 200 Ohm, 2A, 0.05 DCR, 0603	Murata Electronics	BLM18EG221SN1D	Do not populate
30	1	0	FB2	Ferrite Bead, 200 Ohm, 2A, 0.05 DCR, 0603	Murata Electronics	BLM18EG221SN1D	Do not populate
31	2	2	L1, L2	Inductor, 2.2 uH, Power, Shielded, 1.2A, 1008	Murata Electronics	LQM2HPN2R2MG0L	
32	2	0	L3, L4	Inductor, 2.2 uH, Power, Shielded, 1.2A, 1008	Murata Electronics	LQM2HPN2R2MG0L	Do not populate
33	9	9	R1, R2, R13, R41, R45, R57, R61, R68, R74	Resistor, 330, 5%, 1/16W, 0603	Panasonic®	ERJ-3GEYJ331V	
34	1	0	R73	Resistor, 330, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ331V	Do not populate
35	1	1	R3	Resistor, 267, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2670V	
36	1	0	R7	Resistor, 267, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2670V	Do not populate
37	1	0	R4	Resistor, 30.1K, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF3012V	Do not populate
38	1	0	R60	Resistor, 1K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ102V	Do not populate
39	7	7	R5, R6, R38, R39, R40, R69, R76	Resistor, 1K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ102V	
40	2	2	R8, R10	Resistor, 100K, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF1003V	
41	1	1	R9	Resistor, 102K, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF1023V	
42	1	1	R11	Resistor, 453K, 1%, 1/10W, 0603	Rohm	MCR03EZPFX4533	
43	1	0	R12	Resistor, 160K, 1%, 1/10W, 0603	Stackpole	RMCF0603FT160R	Do not populate
44	19	19	R17, R18, R19, R23, R24, R25, R29, R30, R31, R35, R36, R37, R43, R48, R49, R51, R52, R58, R62	Resistor, 10K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ103V	
45	5	0	R14, R20, R26, R32, R46	Resistor, 10K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ103V	Do not populate
46	1	1	R15	Resistor, 47K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ473V	
47	1	0	R75	Resistor, 47K, 5%, 1/16W, 0603	Yageo America	9C06031A4702JLHFT	Do not populate
48	4	4	R16, R22, R28, R34	Resistor, 33K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ333V	
49	1	1	R21	Resistor, 56.2K, 1%, 1/16W, 0603	KOA Speer	RK73H1JLTD5622F	
50	1	1	R27	Resistor, 68K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ683V	
51	1	1	R33	Resistor, 82K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ823V	
52	3	3	R42, R67, R72	Resistor, 100K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ104V	
53	1	0	R71	Resistor, 100K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ104V	Do not populate

TABLE C-1: EVB-USB4604BCH EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
54	4	4	R44, R47, R50, R65	Resistor, ZERO, 0.1W, 0603	Panasonic	ERJ-3GEY0R00V	
55	3	0	R53, R54, R55	Resistor, ZERO, 0.1W, 0603	Panasonic	ERJ-3GEY0R00V	Do not populate
56	4	4	R56, R59, R63, R64	Resistor, ZERO, 0.1W, 0402	Panasonic	ERJ-2GE0R00X	
57	1	1	R66	Resistor, 12.0K, 1%, 1/16W, 0603	Panasonic	ERJ-3EKF1202V	
58	1	1	R70	Resistor, 2.2K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ222V	
59	1	1	J1	Connector, Power Jack, 2.5 mm x 5.5 mm, 12V, 4A, Right Angle, TH	Cui Stack	PJ-002BH	
60	2	2	J29, J30	Receptacle, Coax, U.FL, SMT, Vertical	Hirose	U.FL-R-SMT-1	
61	4	0	J18, J20, J21, J22	Receptacle, Coax, U.FL, SMT, Vertical	Hirose	U.FL-R-SMT-1	Do not populate
62	1	0	J32	Receptacle, USB, Style B, Right Angle, Through-hole	FCI	61729-x0xxBLF	Do not populate
63	4	4	J3, J7, J17, J27	Receptacle, USB, Style A, Right Angle, Through-hole	AMP	292303-1	
64	1	0	J2	Header, 1x2, 0.1 Inch, Vertical	Samtec	TSW-102-14-L-S	Do not populate
65	16	16	J4, J5, J6, J8, J9, J10, J11, J12, J13, J14, J15, J23, J24, J25, J26, J33	Header, 1x2, 0.1 Inch, Vertical	Samtec	TSW-102-14-L-S	
66	2	2	J28, J31	Header, 1x3, 0.1 Inch, Vertical	Samtec	TSW-103-14-L-S	
67	1	0	J19	Header, 1x5, 0.1 Inch, Vertical	Samtec	TSW-105-14-L-S	Do not populate
68	1	1	J16	Header, 2x2, 0.1 Inch, Vertical	AMP	146256-2	
69	1	1	SKT1 (U13)	Socket, IC, 8-Pin DIP, Leaf Contacts, Through-hole	Assmann	A08-LC-TT-R	
70	1	1	SW1	Switch, Momentary, SPST, 100 mA, J-lead, NO	E-Switch	TL3301xF160QJor-RJ	
71	1	1	SW2	Switch, DPDT, Slide, Sub-Mini, Top Actuator, TH	C&K	JS202011CQN	
72	1	1	U1	IC, DC-DC Converter Module, 0.591-6 Vout, ~12 Vin, 0.591-6 VDC out, 6A, 5-Pin SIP, 0.41 Wide	Murata Electronics	OKR-T/6-W12-C	
73	1	0	U2	IC, TPS79601DCQ, Voltage Regulator, Low Drop-out, Var., 1.0A, SOT223-6	Texas Instruments	TPS79601DCQ	Do not populate
74	2	2	U3, U4	IC, Buck Switching Converter, ~1.6 MHz, 1A, SOT23-5	Exar	XRP6658ISTR-F	
75	4	4	U5, U6, U7, U8	IC, UCS1002, USB PrtPwr Controller, QFN20	SMSC	UCS1002-1-BP-TR	
76	4	4	U9, U10, U11, U16	IC, 74LVC1G14, Inverter, Shottky, DCK	TI	SN74LVC1G14DCKR	
77	1	1	U12	IC, STM6718TG, 3.08V and 1.11V Trips, MPU Supervisor, SOT23-5	STMicroelectronics	STM6718TG	

TABLE C-1: EVB-USB4604BCH EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
78	1	0	U13	IC, 25x40, 4 Mb (512K x 8) SPI Serial FLASH, 2.5V-3.3V, 75 MHz, DIP8 *MUST BE PROGRAMMED and INSTALLED in SKT AFTER ASSY*	Winbond	W25X40BVDAIG	Do not populate
79	1	1	U14	IC, USB4604, USB 2.0 and HSIC, 4-port, QFN48	SMSC	USB4604-1080HN	Supplied by SMSC
80	1	0	U15	IC, MIC37102YM, LDO Regulator, Adj., 1A, SOIC8	Micrel	MIC37102YM	Do not populate
81	1	1	Y1	Crystal, 24.000 MHz, 30 ppm, 6 pF, SMT 2.0 mm x 1.6 mm	Murata Electronics	XRCGB24M000F3M00R0	
82	4	0	SHUNT1, SHUNT2, SHUNT3, SHUNT4	Shunt, Insulated, 0.1 Inch	AMP	881545-2	Do not populate
83	4	4		Foot, Silicone Rubber, Adhesive, Clear, Cylindrical, .375" x .190"	Richco®	RBS-35	
84	1	1		Serial Number Labels, 6 mm x 27 mm	Assembler		
85	1	1		Assy Labels: "EVB-USB4604BCH_A4", 6 mm x 27 mm	Assembler		
86	1	1	PCB Fab	PCB, Kirkward48 (EVB-USB4604BCH), Rev. A1	ViaSystems/DDi	EVB-USB4604BCH	Supplied by SMSC
87	1	1	Assembly	Assembly, Kirkward48 (EVB-USB4604BCH), Rev. A4		EVB-USB4604BCH	

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