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**EVB-USB4715
Evaluation Kit
User's Guide**

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Object of Declaration: EVB-USB4715

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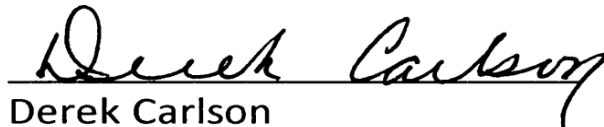
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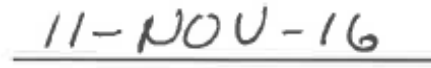
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VP Development Tools


Date

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NOTES:

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXA”, where “XXXX” is the document number and “A” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the EVB-USB4715. 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-USB4715 as a demonstration platform optimized for portable applications. The manual layout is as follows:

- **Chapter 1. “Overview”** – Shows a brief description of the EVB-USB4715
- **Chapter 2. “Getting Started”** – Provides information about set-up and operation of the EVB-USB4715.
- **Chapter 3. “Hardware Configuration”** – Includes information about the hardware configuration of the EVB-USB4715.
- **Appendix A. “Schematics”**
- **Appendix B. “EVB-USB4715 BOM”**
- **Appendix C. “EVB-USB4715 PCB Silk Screens”**

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB® IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
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	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [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) { ... }

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- 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 (October 2017)

- Initial Release of this Document.

NOTES:

Chapter 1. Overview

1.1 EVB-USB4715 OVERVIEW

The EVB-USB4715 is a demonstration and evaluation platform that provides the necessary requirements and interface options for evaluating the USB4715, a 4-Port HS USB Smart 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 USB4715 into the user's design. The USB4715 is compliant with USB 2.0 High-Speed (HS), Full-Speed (FS), and Low-Speed (LS) USB signaling. The evaluation platform supports four downstream ports; two USB 2.0 ports with Type-C™ connectors and two standard Type-A USB 2.0 ports. The EVB-USB4715 platform also supports battery charging on all four ports (maximum of 10A* at any one time). The EVB-USB4715 is configured for operation through internal default settings and supports custom configurations through SMBus or through the external 16-Mbit SPI Flash device. The EVB-USB4715 supports FlexConnect role reversal for any of the four downstream ports with the upstream port. The EVB-USB4715 demonstrates driver compatibility with Microsoft® Windows® 10, Windows 8.x, Windows 7, Windows XP, Mac OS® X 10.4+, and Linux® hub drivers.

See [Section 1.2 “Features”](#) for more information.

Note: *Requires a 12V, 85W supply.

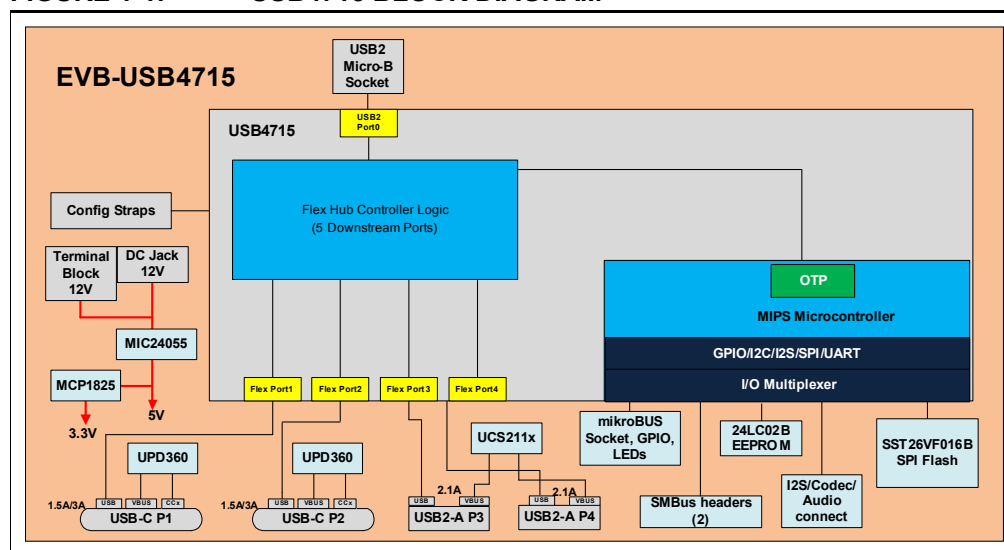
1.2 FEATURES

- Microchip's PortSwap, PHYBoost™, and VariSense™ technologies.
- USB4715 in a 48-pin QFN RoHS compliant package.
- USB 2.0 compliant (HS, FS, and LS operation).
- USB pins are 5 V tolerant.
- Self powered operation.
- USB USB 2.0 micro-AB upstream port.
- Four Downstream USB ports:
 - Two Type-C USB 2.0 downstream ports.
 - Two Type-A USB 2.0-Only downstream ports.
- All downstream ports support individual port power and overcurrent sense.
- All downstream ports can be enabled for battery charging with the battery charging select shunts J1 and J20 (BC1.2 or SE1, 2.1A max per port).
- Onboard SPI Flash for external downloadable firmware.
- Operates from a single voltage (+12.0 V, regulated) external power supply.
- Onboard 25 MHz crystal or external clock input.
- Single onboard +5.2 V, 10 Amp regulator.
- Single onboard +3.3 V, 0.5 Amp regulator.
- Port Power LED indicators.
- Port Connection indicators (in CONFIG3).
- SPI Flash activity blue LED indicator.
- Reset red LED indicator.

- Green LED indicators for 3.3V supply.
- Terminal block connector for use with an external bench supply.
- Barrel connector for use with a Microchip 12V power supply.
- Removable/non-removable downstream ports can be configured with select shunt J1 and J21.
- Bridge peripheral functions:
 - USB-to-UART (CDC)
 - USB-to-I²S Audio Codec
 - USB-to-SMBus
 - USB-to-SPI

1.3 BLOCK DIAGRAM

FIGURE 1-1: USB4715 BLOCK DIAGRAM



1.4 REFERENCES

- Microchip, USB4715 Datasheet. DS00002514A
- USB-IF, Battery Charging Specification. Revision 1.2. December 7, 2010
- USB-IF, Type-C Cable and Connector Specification. Revision 1.1. April 3, 2015

1.5 DEFINITIONS

- **BC1.2** - Latest USB-IF specified USB battery charging standard
- **CDP** - Charging Downstream Port. A BC1.2 compliant port allows simultaneous USB data and USB charging.
- **DCP** - Dedicated Charging Port. A BC1.2 compliant port which is only capable of USB charging (no data).
- **DFP** - Downstream Facing Port
- **EVB** - Evaluation Board
- **HS** - USB 2.0 High-Speed
- **OTP** - One Time Programmable Memory
- **SDP** - Standard Downstream Port. A standard USB port with no high-current battery charging capabilities.
- **SE1** - Type of Battery Charging (non-USB compliant) which sets the USB D+/D- to specific DC voltages to communicate charging capability
- **Type-C** - Reversible USB Connector
- **UFP** - Upstream Facing Port
- **USB-IF** - USB Integrators Forum. Collection of corporate sponsored members responsible for developing USB specifications.

Chapter 2. Getting Started

2.1 CONTENTS OF THE KIT

The EVB-USB4715 evaluation kit includes the basic equipment necessary for evaluation. The items included in the kit are:

1. **EVB-USB4715 Evaluation Board**
2. **12V Power Supply**
3. **USB cable, A to micro-B**

2.2 GETTING STARTED

The Microchip EVB-USB4715 is designed for flexible configuration solutions. It can be configured via default internal register settings, downloadable external firmware to an onboard SPI Flash, through SMBus, or through the onboard configuration switches.

Microchip provides a comprehensive software programming tool, MPLAB® Connect, for configuring USB4715 functions, registers, and OTP memory. When configured with the default internal register settings, the device operates as a USB 2.0 hub with 4 USB ports and Microchip's standard VID/PID/DID settings. For additional information on the MPLAB Connect programming tool, refer to Software Libraries within Microchip USB4715 product page at www.microchip.com/USB4715

2.2.1 Quick Start

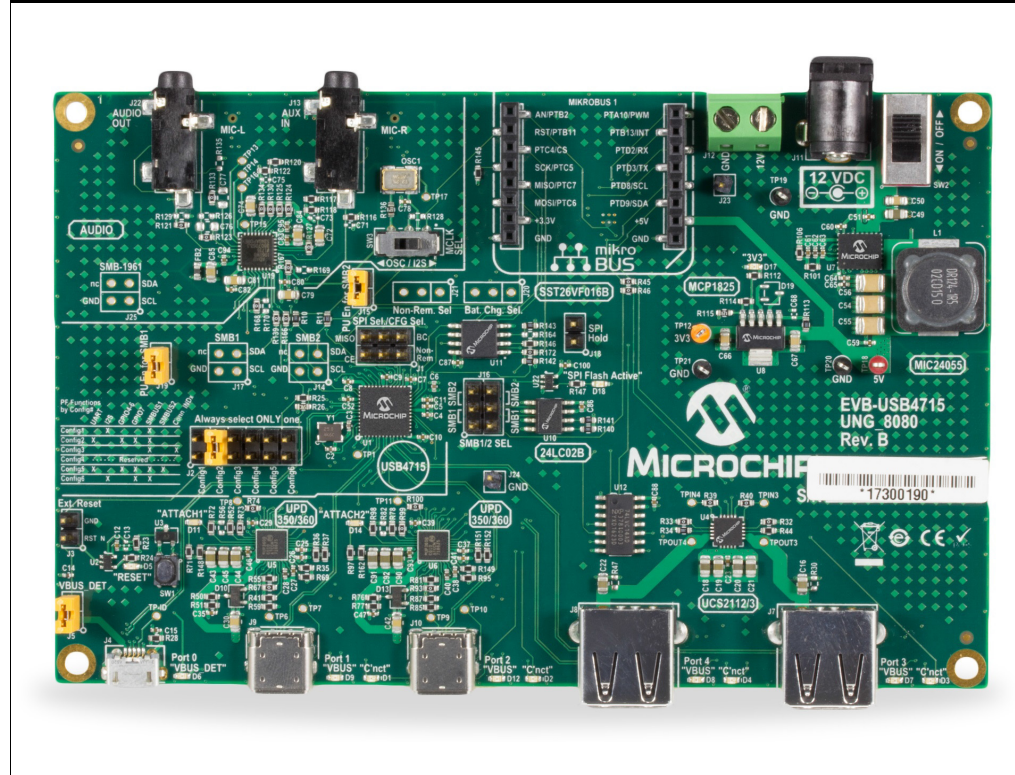
To quickly start using the board, perform the following steps:

1. Connect the included 12V power supply to barrel connector on the EVB-USB4715 (**J11**).
2. Using a USB Type-A plug to USB micro-B plug cable, connect the EVB-USB4715 to a USB host via the upstream "Port 0" USB micro-B socket (**J4**).
3. You may now connect devices to any of the downstream ports to enumerate and use those devices with the USB host.
4. Connect a shunt to jumper "VBUS_DET" (**J4**).
5. Slide the "ON/OFF" switch (**SW2**) to "ON".
6. You can perform additional configuration or evaluate specific features by launching the MPLAB Connect software on your USB host or by manipulating the included hardware configuration options detailed in the next section.

Chapter 3. Hardware Configuration

3.1 HARDWARE CONFIGURATION OPTIONS

FIGURE 3-1: EVB-USB4715 REV B (TOP-SIDE)



3.1.1 Configuration

3.1.1.1 EXTERNAL SPI FLASH

Upon power-up, the USB4715 first looks for an external SPI ROM device and a valid signature in the Flash. If one is found, the external ROM is enabled and code execution is initiated from the external SPI ROM device.

To select the SPI device, install a shunt to short **J18**. Install shunts to pins 2-3 and 5-6 of **J1**. When code is executing from a SPI ROM device, a blue LED (**D18**) will illuminate.

Note: CFG_BC and CFG_Non-Rem options are deselected when a shunt is installed on **J1**. When operating in SPI mode, all configuration is handled by the code executing from the SPI ROM device.

Note: If the SPI Flash is not properly programmed or has an invalid signature, the USB4715 will revert to internal defaults even if the SPI ROM is selected.

3.1.1.2 SMBUS2

If a SPI Flash device is not found, the firmware checks if SMBus2 is enabled.

To select SMBus2 configuration, leave **J18** open to disconnect the SPI ROM and select the CONFIG5 option from the CFG_STRAP header by shunting pins 9-10 of **J2**. Connect the SMBus2 pull-up resistors by connecting a shunt to **J15** pins 1-2. The SMBus2 signals may be accessed at **J14**, pins 1 and 3 (pin2 is ground).

If CONFIG5 is selected and SMBus2 is enabled (that is, SMBus2 clock and data are pulled up), the USB4715 will wait indefinitely for data from the SMBus2 interface and will not enumerate to the USB host until the special USB_ATTACH command is sent.

3.1.1.3 INTERNAL DEFAULT CONFIGURATIONS WITH STRAPPING OPTIONS

When the USB4715 does not detect a valid SPI Flash image or SMBus2 configuration upon power-up, the USB4715 uses internal default register settings. It also sets the Vendor ID, Product ID, Language ID, and Device ID, and additional settings from internal ROM code.

If configuration is not done through SPI or SMBus2, additional configuration is available through two hardware straps: CFG_BC_EN and CFG_NON-REM. The controls are configured by selecting one of six resistor values for each pin. The EVB-USB4715 demonstrates two of the six possible resistor values for each of CFG_BC_EN and CFG_NON-REM. These straps are read by the USB4715 device at power-on to determine the default configuration of the device.

To select the CFG_BC_EN and CFG_NON-REM modes, shunts must be connected to **J20** and **J21** headers.

To use the battery charging options, connect a shunt to pins 4-5 of **J1**. For NON_REM options, connect a shunt to pins 1-2 of **J1**. Select the desired CFG_BC_EN option by connecting a shunt to **J20**. Select the desired CFG_NON-REM option by connecting a shunt to **J21**.

TABLE 3-1: BATTERY CHARGING OPTIONS (CFG_BC_EN - J20)

Shunt Position	Configuration
1-2	Ports 1-4 are BC1.2 enabled
2-3	Port 1 is BC1.2 enabled

TABLE 3-2: NON-REMOVABLE PORT OPTIONS (CFG_NON-REM - J21)

Shunt Position	Configuration
1-2	All ports are removable
2-3	Port 1 is non-removable

3.1.2 Power Source - Self Powered

The EVB-USB4715 only supports self-powered operation, and is powered through one +12.0V regulated 'wall wart' external power supply. The power supply plugs into the 2.5 mm connector **J11** on the board. Alternatively, an external voltage can be supplied to the screw terminal TERM_BLOCK_2P (**J12**). The +12.0V feeds a 10A regulator which outputs +5.2V to devices on the board and also supplies the +3.3V regulator.

Note: The supplied 12.0V external power supply cannot support simultaneous battery charging on all downstream ports. Use a higher power supply if the required test use case exceeds the power capability of the supply. Failure to heed to this warning could result in damage to the 12.0V external power supply.

3.1.3 Downstream Port Power Control

USB power to the four downstream ports is controlled via port power controllers with auto-discharge function.

The two downstream Type-C ports are capable of up to 3A of USB Type-C battery charging. Downstream port 1 is configured for 3A charging by default. The two downstream USB Type-A ports are capable of up to 2.1A of USB battery charging.

3.1.4 USB Type-C Ports

The EVB-USB4715 has two Type-C ports. These are USB 2.0 HS ports. The USB Type-C ports utilize the Microchip UPD360 Type-C port controller in order to detect USB Type-C attachment and plug orientation. The UPD360 monitors the voltage on the USB Type-C CC wires in order to detect USB Type-C attach events. The downstream ports 1 and 2 use UPD360s configured for 3A operation by default.

3.1.5 LED Indicators on EVB-USB4715

[Table 3-3](#) describes the LED indicators included on the EVB-USB4715.

TABLE 3-3: LED INDICATOR DESCRIPTIONS

REF. DES.	LABEL	DESCRIPTION
D1	"C'nct3"	PORT3 is connected (enumerated)
D2	"C'nct2"	PORT2 is connected (enumerated)
D3	"C'nct1"	PORT1 is connected (enumerated)
D4	"C'nct4"	PORT4 is connected (enumerated)
D5	"RESET"	The RST_N signal is asserted.
D6	"PORT0 VBUS"	Illuminates when 5V to upstream PORT0 VBUS is present.
D7	"PORT3 VBUS"	Illuminates when 5V to upstream PORT3 VBUS is present.
D8	"PORT4 VBUS"	Illuminates when 5V to upstream PORT4 VBUS is present.
D9	"PORT1 VBUS"	Illuminates when 5V to upstream PORT1 VBUS is present.
D11	"ATTACH1"	Illuminates when a device is detected by CC signals on PORT1.
D12	"PORT2 VBUS"	Illuminates when 5V to upstream PORT2 VBUS is present.
D14	"ATTACH2"	Illuminates when a device is detected by CC signals on PORT2.
D17	"3V3"	Indicates 3.3V is present from the 3.3V voltage regulator.
D18	"SPI Flash Active"	Indicates SPI Flash Memory activity.

3.1.6 Switches on EVB-USB4715

Table 3-4 describes the switches included on the EVB-USB4715.

TABLE 3-4: SWITCH DESCRIPTIONS

REF. DES.	LABEL	DESCRIPTION
SW1	"RESET"	Momentary push-button switch to assert RST_N.
SW2	"ON/OFF"	Connects or disconnects the 12VDC supply
SW3	"OSC/I2S"	Selects the clock source for the audio codec. The default selection is 12S.

3.1.7 Connector Descriptions for EVB-USB4715

Table 3-5 describes the connectors included on the PCB.

TABLE 3-5: USB4715 CONNECTOR DESCRIPTIONS

REF. DES.	TYPE	LABEL	DESCRIPTION
J1	2x3 Header	"SPI_DI/CFG_BC_EN" "SPI_CEn/CFG_NON_REM"	Selects the between SPI memory capability and BC/NON_REM capability. For SPI, connect pins 2-3, 5-6. For BC, connect pins 4-5. For NON_REM, connect pins 1-2.
J2	2x6 Header	"CFG_STRAP1"	Selects the CONFIGx configuration mode for EVB-USB4715 if no valid SPI memory image was detected. CONFIG1: I2S CONFIG2: UART, GPIO 4-6 CONFIG3: CONN_INDx CONFIG4: (Reserved) CONFIG5: UART, GPIO 4-7, SMBUS2 CONFIG6: I2S, GPIO 7
J3	2x1 Header	"Ext.Reset"	Connection for an external reset switch.
J4	USB2 Micro-AB Connector	"PORT0"	Upstream USB2 connection
J5	1x2 Header	"VBUS_DET"	Connects VBUS from host to VBUS_DET
J7	USB2 Type-A Connector	"PORT3"	Downstream Port 3 USB connection
J8	USB2 Type-A Connector	"PORT4"	Downstream Port 4 USB connection
J9	USB Type-C Connector	"PORT1"	Downstream Port 1 connection
J10	USB Type-C Connector	"PORT2"	Downstream Port 2 connection
J11	Barrel Jack	"12VDC"	12 VDC supply connection (center pin positive)
J12	2-pin terminal block	-	Alternative 12 VDC supply connection. Pin 1 is positive.
J13	Audio Jack, 3.5mm	"AUX IN"	Audio input for I ² S codec
J14	2x2 Header	"SMB2"	Connection for SMBus2 (slave)
J15	1x2 Header	"SMB2 PU"	Connects the pull-up resistors for SMB2
J16	2x3 Header	"SMB1/SMB2"	Selects SMBus1 or SMBus2 to the EEPROM. No connection if EEPROM is unused.

TABLE 3-5: USB4715 CONNECTOR DESCRIPTIONS (CONTINUED)

REF. DES.	TYPE	LABEL	DESCRIPTION
J17	2x2 Header	"SMB1"	Connection for SMBus1 (master, bridge)
J18	1x2 Header	"HOLD"	When shunted, disables the SPI memory.
J19	1x2 Header	"SMB1 PU"	Connects the pull-up resistors for SMB1
J20	1x2 Header	"Battery Charging Select"	See Table 3-1 .
J21	1x2 Header	"Non-Removable Select"	See Table 3-2 .
J22	Audio Jack, 3.5mm	"AUDIO OUT"	Audio output from the I2S
J23	1x1 Header	"GND"	Ground
J24	1x1 Header	"GND"	Ground
J25	2x2 Header	"SMB-1961"	SMB1 connection for the audio codec

3.1.8 Test Points on USB4715

[Table 3-6](#) describes the test points included on the EVB-USB4715. A header may be permanently installed on the through-hole test points if needed.

TABLE 3-6: USB4715 TEST POINT DESCRIPTIONS

REF. DES.	TYPE	DESCRIPTION
TP1	Test Pad	PRT_CTL_GANG
TP6	Test Pad	PORT1 CC1
TP7	Test Pad	PORT1 CC2
TP8	Test Pad	PRTCTL1
TP9	Test Pad	PORT2 CC1
TP10	Test Pad	PORT2 CC2
TP11	Test Pad	PRTCTL2
TP12	Test Loop (Orange)	3.3V regulator output
TP13	Test Pad	Audio Codec LOU TP
TP14	Test Pad	Audio Codec LOU TN
TP15	Test Pad	Audio Codec ROU TP
TP16	Test Pad	Audio Codec ROU TN
TP17	Test Pad	Audio Codec Oscillator Output Enable
TP18	Test Loop (Red)	5V regulator output. Nominally 5.2V
TP19	Test Loop (Black)	Ground
TP20	Test Loop (Black)	Ground
TP21	Test Loop (Black)	Ground

Appendix A. Schematics

A.1 INTRODUCTION

This appendix includes the EVB-USB4715 schematics.

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EVB-USB4715

Table of Contents	
Sheet	Description
1	Table of Contents, Block Diagram
2	USB4715, Reset, Configuration
3	Memory
4	USB A and B Ports
5	USB C Ports
6	Voltage Regulators
7	Audio Codec

Notes	
1	All resistors are 1% unless specified otherwise
2	Shunt jumper default selections are marked with an asterisk [*].

Revision History			
Revision	Date	Revision Summary	Author
A	1/27/2017	Initial release of design	J. Hunt
B	3/27/2017	Corrections of Rev. A errata. See Rev B0 Board Specification for list.	J. Hunt

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Description: EVB-USB4715 Evaluation Board for USB4715 QFN-48

Page Title: Table of Contents, Revision History, Block Diagram

Project Name: Gadir EVB-USB4715 Pcs: UNG_8080

Size: B Date: 6/20/2017 Designer: J. Hunt Sheet 1 of 7 Rev B

FIGURE A-2: EVB-USB4715 SCHEMATIC (PAGE 2)

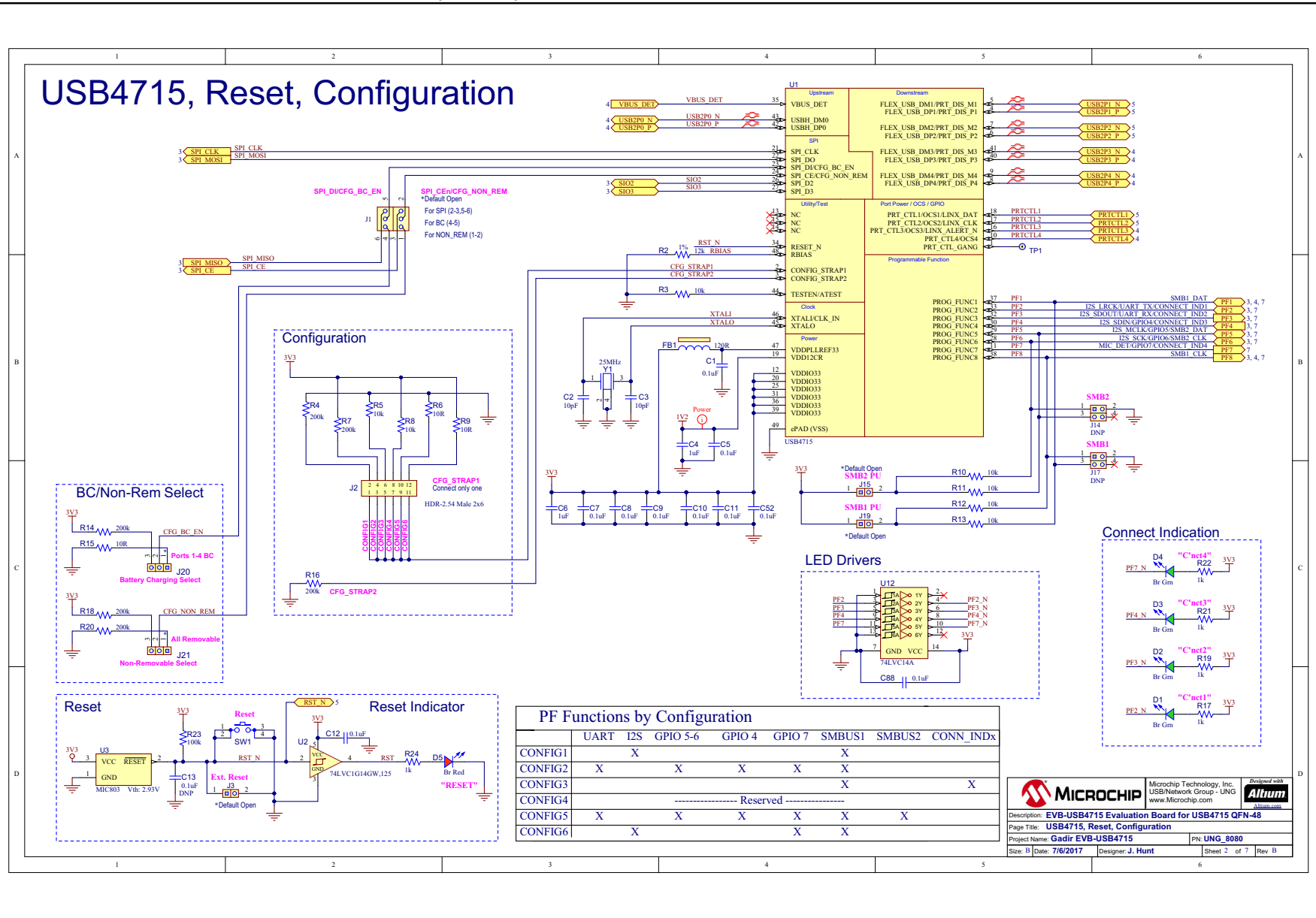


FIGURE A-3: EVB-USB4715 SCHEMATIC (PAGE 3)

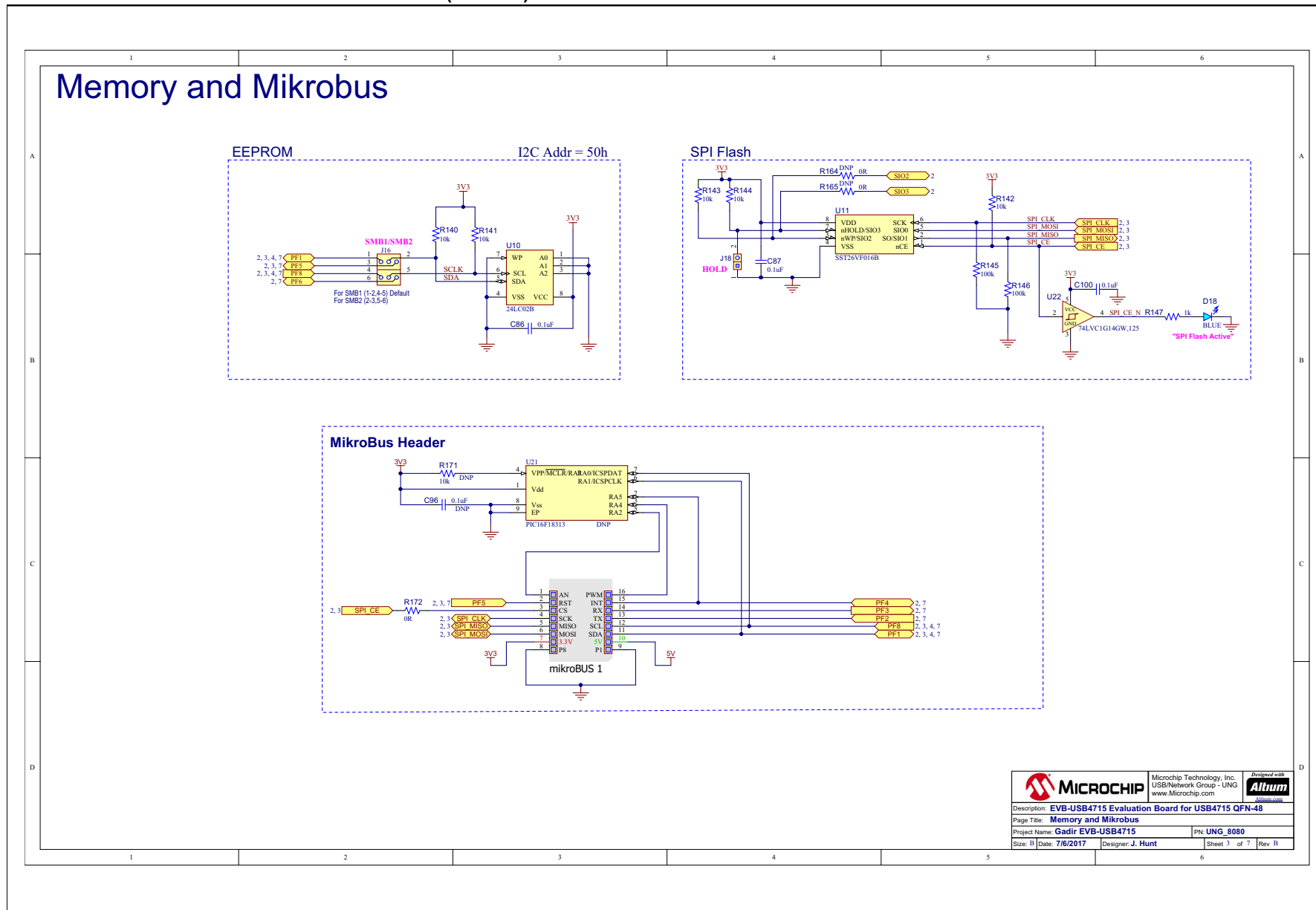
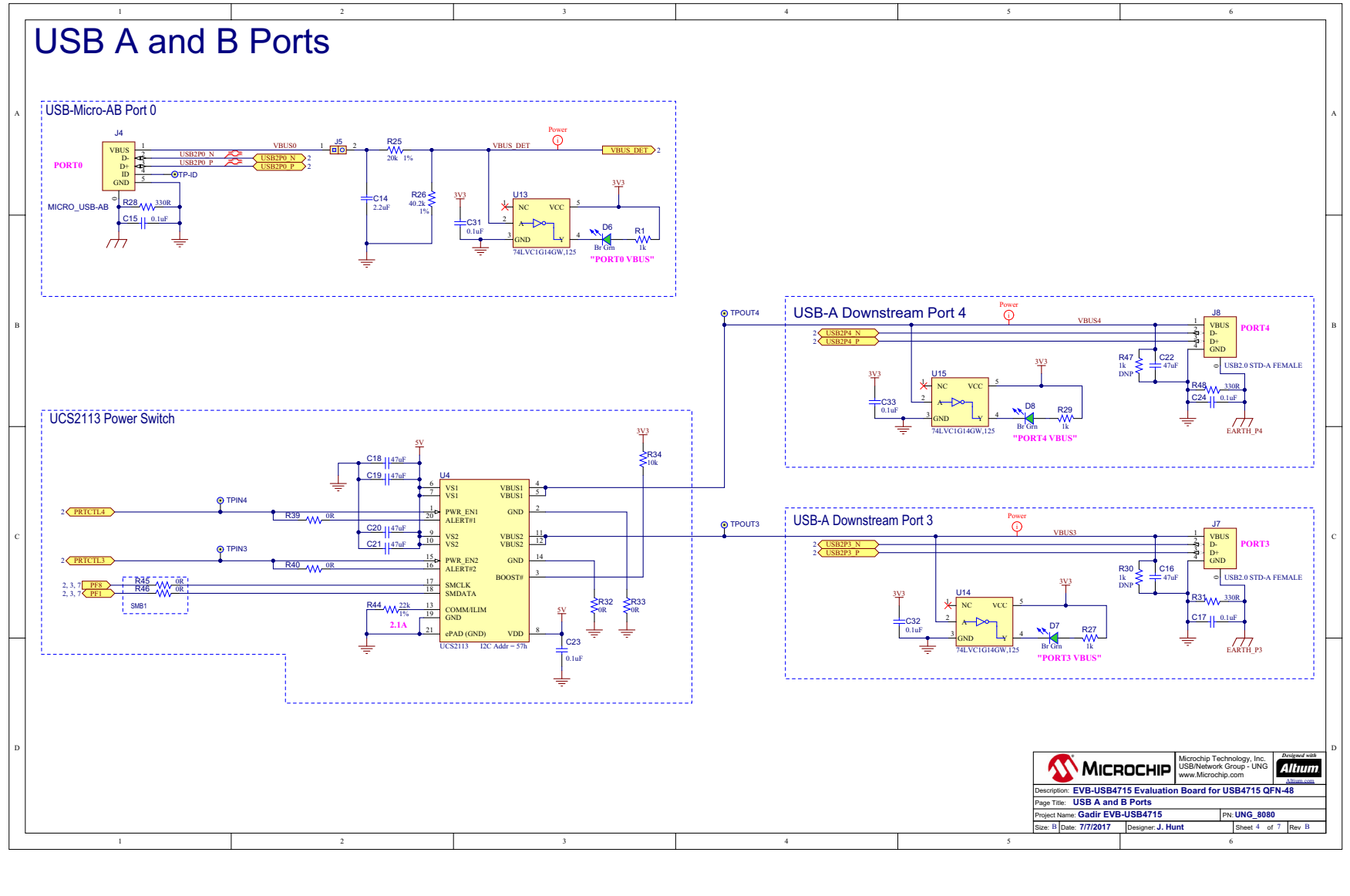


FIGURE A-4: EVB-USB4715 SCHEMATIC (PAGE 4)



USB C Ports

USB-C Downstream Port 1

Standalone DFP Settings Straps
USB-C VBUS SRC Current Limit Settings
PWR_CAP1: 0: 1b => 3.0A
100 => 1.5A
01b => 900mA (USB2 Default)
00b => 500mA (USB2 Default)

VBUS/CONN Error Recovery Mode
ERR_RECOVER: 0 => Latch upon error
1 => Auto-Recovery Enabled

USB-C VBUS SRC Current Limit Settings
PWR_CAP1: 0: 1b => 3.0A
100 => 1.5A
01b => 900mA (USB2 Default)
00b => 500mA (USB2 Default)

VBUS/CONN Error Recovery Mode
ERR_RECOVER: 0 => Latch upon error
1 => Auto-Recovery Enabled

USB-C Downstream Port 2

Standalone DFP Settings Straps
USB-C VBUS SRC Current Limit Settings
PWR_CAP1: 0: 1b => 3.0A
100 => 1.5A
01b => 900mA (USB2 Default)
00b => 500mA (USB2 Default)

VBUS/CONN Error Recovery Mode
ERR_RECOVER: 0 => Latch upon error
1 => Auto-Recovery Enabled

USB-C VBUS SRC Current Limit Settings
PWR_CAP1: 0: 1b => 3.0A
100 => 1.5A
01b => 900mA (USB2 Default)
00b => 500mA (USB2 Default)

VBUS/CONN Error Recovery Mode
ERR_RECOVER: 0 => Latch upon error
1 => Auto-Recovery Enabled

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Size: B
Date: 7/6/2017
Designer: J. Hunt

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