EVB-USB7216 Evaluation Kit User's Guide

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Preface

NOTICE TO CUSTOMERS

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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-USB7216 Evaluation Kit. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- The Microchip Website
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the EVB-USB7216 Evaluation Kit as a demonstration platform optimized for portable applications. The manual layout is as follows:

- **Chapter 1. "Overview"** – This chapter shows a brief description of the EVB-USB7216 Evaluation Kit.
- **Chapter 2. "Getting Started"** – This chapter provides information about the setup and operation of the EVB-USB7216 Evaluation Kit.
- **Chapter 3. "Hardware Configuration"** – This chapter includes information about the hardware configuration of the EVB-USB7216 Evaluation Kit.
- **Appendix A. "USB7216 Schematics"** – This appendix shows the EVB-USB7216 Evaluation Kit schematics.
- **Appendix B. "Bill of Materials"** – This appendix includes the EVB-USB7216 Evaluation Kit Bill of Materials (BOM).
- **Appendix C. "PCB Silk Screens"** – This appendix includes the EVB-USB7216 Evaluation Kit silk screens.

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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	`%fghkpg"UVCTV`
	Filenames	`cwvqgzge0dcv`
	File paths	`e<^oee3:^j`
	Keywords	`acuo."agpfcuo."uvcvke`
	Command-line options	`-Qrc-."-Qrc/`
	Bit values	`2."3`
	Constants	`2zHH."ÈCÍ`
Italic Courier New	A variable argument	*`hkng`*`0q`, where *`hkng`* can be any valid filename
Square brackets [ ]	Optional arguments	`oee3:"]qrvkqpu_"`*`hkng`*`"]qrvkqpu_`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`gttqtngxgn"}2~3¡`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

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- **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 non-production development programmers such as PICSTART® Plus and PICkit 2 and 3.

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- Field Application Engineer (FAE)
- Technical Support

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Technical support is available through the web site at:
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DOCUMENT REVISION HISTORY

Revisions	Section/Figure/Entry	Correction
DS50002970A (03-20-2020)	Initial release	

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Chapter 1. Overview

1.1 INTRODUCTION

The EVB-USB7216 Evaluation Kit is a demonstration and evaluation platform that provides the necessary requirements and interface options for evaluating the USB7216, which is a six-port Hi-Speed (HS) USB smart hub on a four-layer RoHS-compliant Printed Circuit Board (PCB). This allows users to gain an understanding of the product and accelerate the integration of the USB7216 into their designs.

The EVB-USB7216 is compliant with USB 3.2 Gen2 on the upstream port and on downstream ports 1 to 4. The EVB-USB7216 is also compliant with the USB 2.0 HS, Full-Speed (FS), and Low-Speed (LS) USB signaling.

The evaluation platform supports six downstream ports: one single Type-C port, four Gen2 ports, and one USB2.0 port with Type-A connectors. The EVB-USB7216 platform also supports battery charging on all six downstream ports (maximum of 10A [Note 1] at any one time). The EVB-USB7216 supports FlexConnect role reversal for any of the downstream ports with the upstream port.

The EVB-USB7216 has four configurations for operation through internal default settings and supports custom configurations through I^2C or through the external 16-Mbit SPI Flash device.

The EVB-USB7216 demonstrates driver compatibility with Microsoft Windows® 10, Windows 8.x, Windows 7, Windows XP, Mac OS® X 10.4+, and Linux® hub drivers.

For more information about EVB-USB7216, see **Section 1.2 "Features"**.

Note 1:	Requires a 12V, 85W supply

1.2 FEATURES

Below are the features of the EVB-USB7216 Evaluation Kit:

- Microchip's PortSwap, PHYBoost™, and VariSense™ technologies
- USB7216 in a 100-pin QFN RoHS compliant package
- USB 3.2 compliant (Gen2 operation)
- USB 2.0 compliant (HS, FS, and LS operations)
- 5V-tolerant USB pins
- Self-powered operation
- USB Gen2 Type-uB upstream port
- Six downstream USB ports:
  - Five Gen2 downstream ports (One Type-C Port)
  - One USB 2.0-only downstream port
- 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 J10 and J14. (BC1.2 or SE1, 2.1A maximum per port)
- Onboard SPI Flash for external downloadable firmware
- Operates from a single voltage (+12.0V, regulated) external power supply
- Onboard 25 MHz crystal or oscillator input

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- Single onboard +5.2V, 15A regulator
- Single onboard +3.3V, 0.5A regulator
- Single onboard +1.2V, 2A regulator
- Port Power LED indicators
- SPI Flash activity blue LED indicator
- Reset red LED indicator
- Green LED indicators for 5V, 3.3V, and 1.2V regulator outputs
- Terminal block connector for use with an external 12 VDC bench supply
- Barrel connector for use with a Microchip 12V power supply
- Removable or non-removable downstream port options can be configured with select shunt on J13.
- Bridge peripheral functions:
  - USB-to-UART (CDC)
  - USB-to-I^{2}S™ Audio Codec
  - USB-to-I^{2}C

1.3 BLOCK DIAGRAM

Figure 1-1 shows the block diagram of EVB-USB7216.

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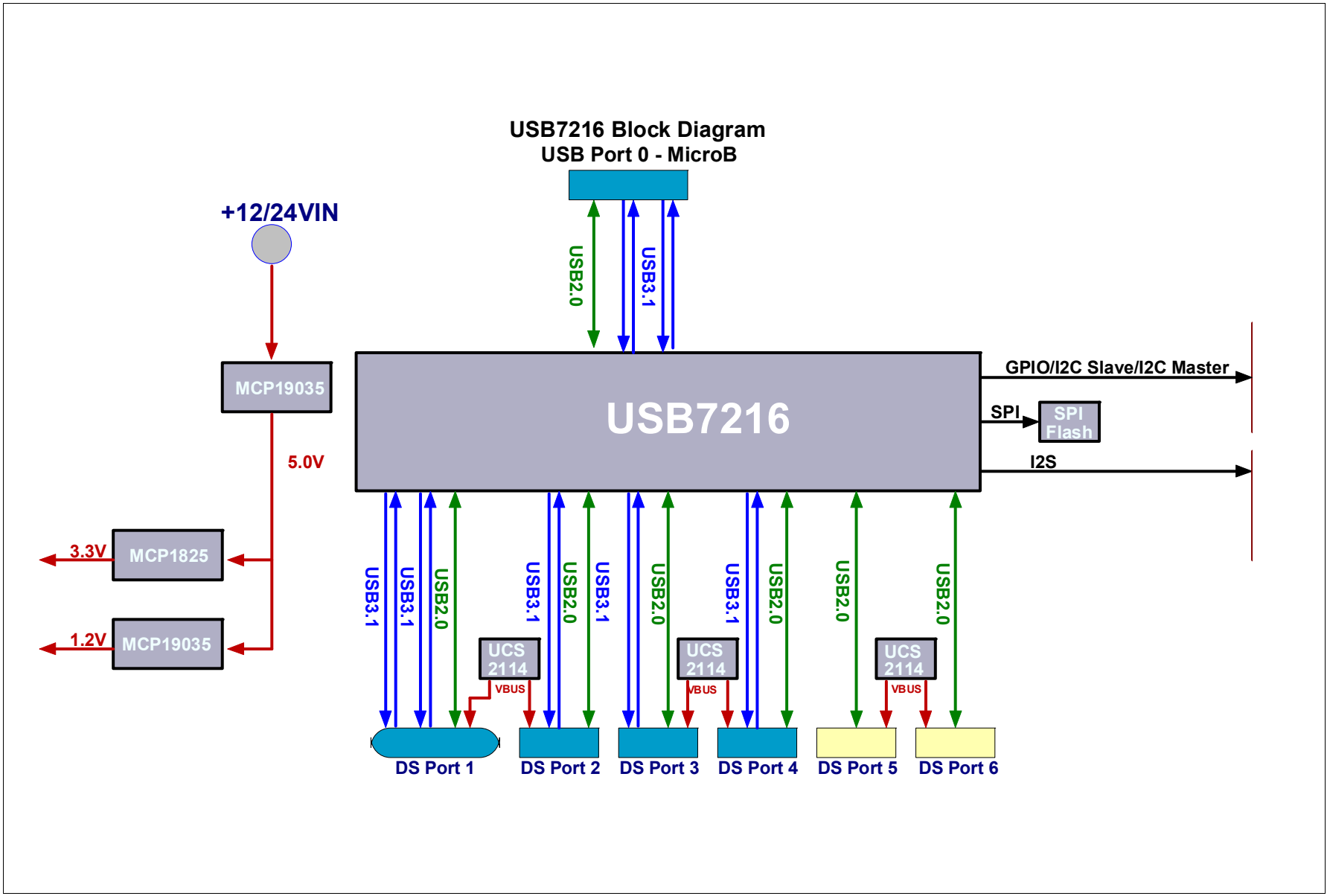
FIGURE 1-1: EVB-USB7216 BLOCK DIAGRAM



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1.4 REFERENCES

Concepts and materials available in the following documents may be helpful when reading this document. Visit www.microchip.com for the latest documentation.

- *USB7216 Data Sheet*
- *AN2810 Configuration of USB7002/USB705x*
- *AN2932 USB-to-GPIO Bridging with Microchip USB72xx Hubs*
- *AN2935 Configuration of USB7202/USB7206/USB725x*
- *AN2936 USB-to-UART Bridging with Microchip USB7202, USB7250, USB7251, and USB7252 Hubs*
- *AN3020 USB-to-SPI Bridging with Microchip USB72xx Hubs*
- *AN3240 USB-to-I^2C Bridging with Microchip USB720x and USB725x Hubs Application Note*

1.5 ACRONYMS AND DEFINITIONS

TABLE 1-1: ACRONYMS AND DEFINITIONS

Acronym	Definition
BC1.2	Latest USB-IF specified USB battery charging standard
CDP	Charging Downstream Port, a BC1.2-compliant port that 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
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) that sets the USB D+/D– to specific DC voltages to communicate charging capability
Type-C	Reversible USB Connector
USB-IF	USB Integrators Forum, a collection of corporate sponsored members responsible for developing USB specifications
Gen2	USB Specification 3.2 Gen2

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Chapter 2. Getting Started

2.1 INTRODUCTION

The Microchip EVB-USB7216 Evaluation Kit is designed for flexible configuration solutions. It can be configured via default internal register settings, via a downloadable external firmware to an onboard SPI Flash (OTP memory), via SMBus, or via the onboard configuration switches. When configured with the default internal register settings, the device operates as a USB 3.2 Gen2 hub with one upstream Gen2 port, one downstream-facing USB Type-C® port, three downstream Gen2 ports, and two downstream USB 2.0 ports with Microchip's standard VID/PID/DID settings.

Microchip provides a comprehensive software programming tool, MPLAB® Connect Configurator (MPLABCC), for configuring USB7216 functions, registers, and OTP memory. The USB7216 requires MPLABCC version 2.1.0 or greater.

For additional information on the MPLABCC programming tool, refer to Software Libraries within the Microchip USB7216 product page at www.microchip.com/USB7216.

2.2 KIT CONTENTS

The EVB-USB7216 Evaluation Kit includes the basic equipment necessary for evaluation. The items included in the kit are:

- EVB-USB7216 Evaluation Board
- Type-A to Type-uB USB cable

2.3 QUICK START

Perform the following steps to quickly start using the board:

1. Connect a 12V power supply to the barrel connector (J2) or the terminal block (J4) on the EVB-USB7216.
2. Using a Type-A-to-Type-uB USB cable, connect the EVB-USB7216 to a USB host via the upstream "Port 0" USB Type-B socket (J3).

Devices may now be connected to any of the downstream ports to enumerate and use those devices with the USB host.

To perform additional configuration or evaluate specific features, launch the MPLABCC software on your USB host or manipulate the included hardware configuration options detailed in the next sections.

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NOTES:

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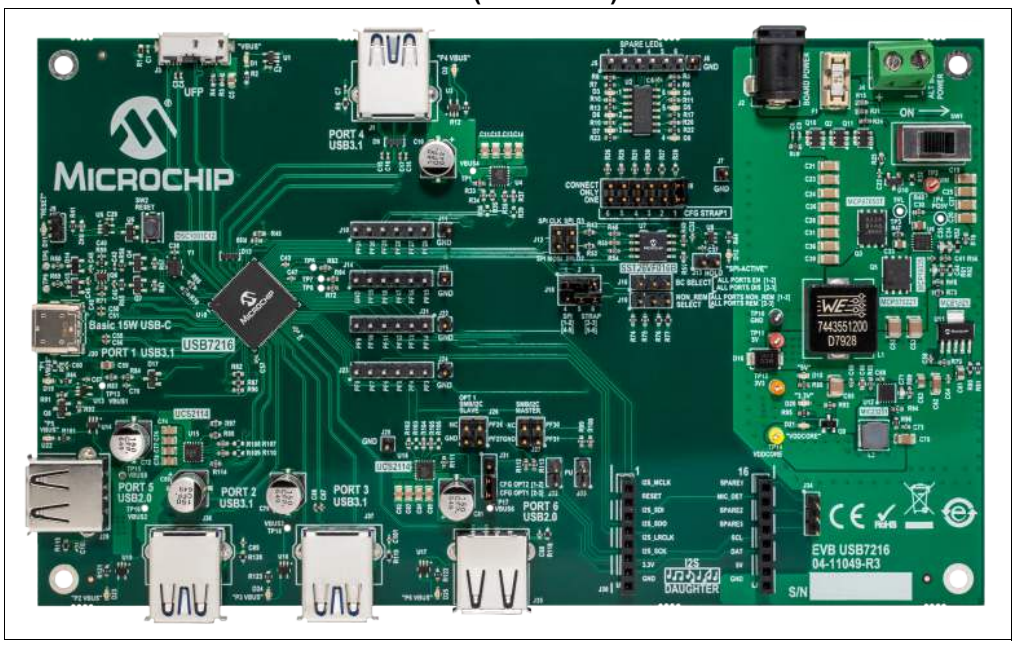
Chapter 3. Hardware Configuration

3.1 HARDWARE CONFIGURATION OPTIONS

Figure 3-1 shows the top view of the EVB-USB7216.

FIGURE 3-1: EVB-USB7216 R1 (TOP VIEW)



3.1.1 Configuration

3.1.1.1 EXTERNAL SPI FLASH

Upon power-up, the USB7216 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 enable operation from the SPI device, install shunts to pins 1 to 2 and 4 to 5 of J18. When code is executing from an SPI ROM device, a blue LED "SPI-ACTIVE" (D12) illuminates.

Note 1:	CFG_BC and CFG_Non-Rem options are deselected when SPI shunts are installed on J18. When operating in SPI mode, all configuration is handled by the code executing from the SPI ROM device.
2:	If the SPI Flash is not properly programmed or has an invalid signature, the USB7216 reverts to internal defaults even if the SPI ROM is selected.

3.1.1.2 INTERNAL DEFAULT CONFIGURATIONS WITH STRAPPING OPTIONS

When the USB7216 does not detect a valid SPI Flash image and does not look for SMBus configuration upon power-up, the USB7216 uses internal default register settings. It also sets the Vendor ID, Product ID, Language ID, and Device ID and additional settings from the internal ROM code.

If configuration is not done through SPI or SMBus, additional configuration is available through two functions: CFG_BC_EN and CFG_NON-REM. The controls are configured by selecting one of the six resistor values for each pin. The EVB-USB7216 demonstrates two of the six possible resistor values for each of CFG_BC_EN and CFG_NON-REM. These straps are sensed by the USB7216 device at power-on to determine the resultant configuration of the device.

To select the CFG_BC_EN and CFG_NON-REM modes, shunts must be connected to J16 and J19 headers.

To use the battery charging strap options, connect a shunt to pins 1 to 2 of J8 and connect a shunt to J15 according to Table 3-1. For the NON_REM strap options, connect a shunt to J19 according to Table 3-2.

TABLE 3-1: BATTERY CHARGING OPTIONS (CFG_BC_EN - J16)

J16 Shunt Position	(J12 is shunted pins 2-3.)
2–3	All ports are BC 1.2-disabled.
1–2	All downstream ports are BC1.2-enabled.

TABLE 3-2: NON-REMOVABLE PORT OPTIONS (CFG_NON-REM - J17)

J17 Shunt Position	(J12 is shunted pins 5-6.)
2–3	All ports are non-removable.
1–2	All ports are removable.

3.1.2 Power Source – Self Powered

The EVB-USB7216 only supports self-powered operation. Power is supplied through one +12.0V regulated external power supply. The power supply is connected to the 2.5 mm connector J1 on the board. Alternatively, an external voltage can be supplied to the screw terminal "12V" (J2). The +12.0V feeds a 15A regulator that outputs +5.2V (nominal) across the board and also supplies the +3.3V regulator and the 1.2V regulator.

CAUTION

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 six downstream ports is controlled via port power controllers with auto-discharge functionality. All downstream ports support BC 1.2 battery charging.

The downstream USB Type-C® port is capable of up to 3A of current at 5V. The downstream USB Type-A ports are capable of up to 2.1A at 5V.

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3.1.4 USB Type-C® Ports

The USB7216 has two USB3.2 Gen 2 PHYs for the Type-C port. This eliminates the need for an external multiplexer. The USB7216 also features integrated Type-C control signal (CC) detection to determine when and in what orientation a USB Type-C® attach has been made. It powers only the USB3.2 Gen 2 PHY needed for USB communication. To reduce power, the USB7216 powers down unused USB3.2 Gen 1 PHYs. In cases where no USB Type-C attach is detected, both USB3.2 Gen 1 PHYs associated with that port are powered down.

3.1.5 LED Indicators

Table 3-3 describes the LED indicators on the EVB-USB7216.

TABLE 3-3: EVB-USB7216 LED INDICATOR DESCRIPTIONS

Ref. Des.	Label	Description
D1	PORT 0 VBUS	Illuminates when 5V to upstream PORT0 VBUS is present
D2	PORT 4 VBUS	Illuminates when 5V to upstream PORT4 VBUS is present
D3	A	GP Indicator A
D4	F	GP Indicator F
D5	E	GP Indicator E
D6	B	GP Indicator B
D7	C	GP Indicator C
D8	D	GP Indicator D
D11	RESET	The RST_N signal is asserted.
D12	SPI-ACTIVE	Indicates SPI Flash Memory activity
D18	5V	Illuminates when 5V is present from the 5V voltage regulator
D19	PORT 1 VBUS	Illuminates when 5V to upstream PORT1 VBUS is present
D20	3V3	Illuminates when 3.3V is present from the 3.3V voltage regulator
D21	1V2	Illuminates when 1.2V is present from the 3.3V voltage regulator
D22	PORT 5 VBUS	Illuminates when 5V to upstream PORT5 VBUS is present
D23	PORT 2 VBUS	Illuminates when 5V to upstream PORT2 VBUS is present
D24	PORT 3 VBUS	Illuminates when 5V to upstream PORT3 VBUS is present
D25	PORT 6 VBUS	Illuminates when 5V to upstream PORT6 VBUS is present

3.1.6 Switches

Table 3-4 describes the switches on the EVB-USB7216.

TABLE 3-4: EVB-USB7216 SWITCH DESCRIPTIONS

Ref. Des.	Label	Description
SW2	RESET	Momentary push-button switch to assert RST_N
SW1	ON/OFF	Connects or disconnects the 12 VDC supply

3.1.7 Connector Descriptions

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

TABLE 3-5: EVB-USB7216 CONNECTOR DESCRIPTIONS

Ref. Des.	Type	Label	Description
J1	USB Type-A Connector	PORT4	Downstream Type-A Gen2 Port 4 USB connection
J2	Barrel Jack	12VDC	12 VDC supply connection (center pin positive)
J3	USB Type-uB Connector	PORT0	Downstream Type-A USB 2.0 Port 0 USB connection
J4	2-pin Terminal Block	—	Alternative 12 VDC supply connection. Pin 1 is positive.
J5	6x1 Header	—	GP indicators for LED drivers
J6	1x1 Header	GND	Circuit ground
J7	1x1 Header	GND	Circuit ground
J8	6x2 Header	CFG_STRAP	Configuration options header
J9	2x1 Header	Ext.Reset	Connection for an external reset switch
J10	6x1 Header	—	Debug header
J11	1x1 Header	GND	Circuit ground
J12	2x2 Header	PF24 PF23 PF25 PF21	SPI data pins provided for debugging SPI memory
J13	1x2 Header	HOLD	When shunted, this disables the SPI memory.
J14	6x1 Header	—	Debug header
J15	1x1 Header	GND	Circuit ground
J16	1x3 Header	BC SELECT	See Table 3-1.
J18	2x3 Header	SPI_DI/CFG_BC_EN SPI_CEn/CFG_NON_REM	Selects between SPI memory capability and BC/NON_REM capability. For SPI, connect pins 1–2 and 4–5. For BC, connect pins 2–3. For NON_REM, connect pins 5–6.
J19	2x3 Header	SPI_DI/CFG_BC_EN SPI_CEn/CFG_NON_REM	Selects between SPI memory capability and BC/NON_REM capability. For SPI, connect pins 1–2 and 4–5. For BC, connect pins 2–3. For NON_REM, connect pins 5–6.

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TABLE 3-5: EVB-USB7216 CONNECTOR DESCRIPTIONS (CONTINUED)

Ref. Des.	Type	Label	Description
J20	USB Type-C® Connector	PORT1	Downstream Type-C Gen2 Port 1 USB connection
J21	6x1 Header	—	Debug header
J22	1x1 Header	GND	Circuit ground
J23	6x1 Header	—	Debug header
J24	1x1 Header	GND	Circuit ground
J26	2x2 Header	SI2C_CLK SI2C_DAT	Hub slave I^2C header
J27	2x2 Header	MI2C_CLK MI2C_DAT	Hub master I^2C header
J28	1x1 Header	GND	Circuit ground
J29	USB Type-A Connector	PORT5	Downstream Type-A USB 2.0 Port 5 USB connection
J30	1x16 Header	—	Audio Codec Socket
J31	1x3 Header	CFG_OPT1 CFG_OPT2	CFG_OPTIONS
J32	1x2 Header	PU	Pull-up resistors, Slave I^2C
J33	1x2 Header	PU	Pull-up resistors, Slave I^2C
J34	1x3 Header	—	Audio Codec (Spare)
J35	USB Type-A Connector	PORT6	Downstream Type-A USB 2.0 Port 6 USB connection
J36	USB Type-A Connector	PORT2	Downstream Type-A Gen2 Port 2 USB connection
J37	USB Type-A Connector	PORT3	Downstream Type-A Gen2 Port 3 USB connection

3.1.8 Test Points

Table 3-6 describes the test points on the EVB-USB7216. A header may be permanently installed on the through-hole test points if needed.

TABLE 3-6: EVB-USB7216 TEST POINT DESCRIPTIONS

Ref. Des.	Type	Description
TP1	Test Pad	PORT4 VBUS
TP2	Test Pad	VIN
TP3	Test Loop (Red)	5VL
TP4	Test Loop (Blue)	PG5V
TP5	Test Pad	DP1 CC2
TP6	Test Pad	ATEST 3
TP7	Test Pad	ATEST 2
TP8	Test Pad	ATEST 1
TP9	Test Pad	DP1 CC2
TP10	Test Loop (BLACK)	SHDN
TP11	Test Loop (Red)	5V
TP12	Test Loop (Orange)	3V3
TP13	Test Pad	PORT1 VBUS

TABLE 3-6: EVB-USB7216 TEST POINT DESCRIPTIONS (CONTINUED)

Ref. Des.	Type	Description
TP14	Test Loop (Yellow)	LVCORE
TP15	Test Pad	PORT5 VBUS
TP16	Test Pad	PORT2 VBUS
TP17	Test Pad	PORT6 VBUS
TP18	Test Pad	PORT3 VBUS

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Appendix A. USB7216 Schematics

A.1 INTRODUCTION

This appendix shows the EVB-USB7216 Evaluation Kit schematic.

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FIGURE A-1: EVB-USB7216 BLOCK DIAGRAM

EVB-USB7216

Table of Contents

Sheet	Description
1	EVB-USB7216
2	USB7216 Part A
3	USB7216 Part B
4	Memory
5	USB MicroB UFP
6	USB3.1 (Type-C) DFP1
7	USB3.1(Type-A) DFP2-4
8	USB2.0 (Type-A) DFP5-6
9	Voltage Regulators

Revision History

Revision	Date	Revision Summary	Author
1.0	10/02/2019	DevTools Transfer	M. Davis

Notes

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

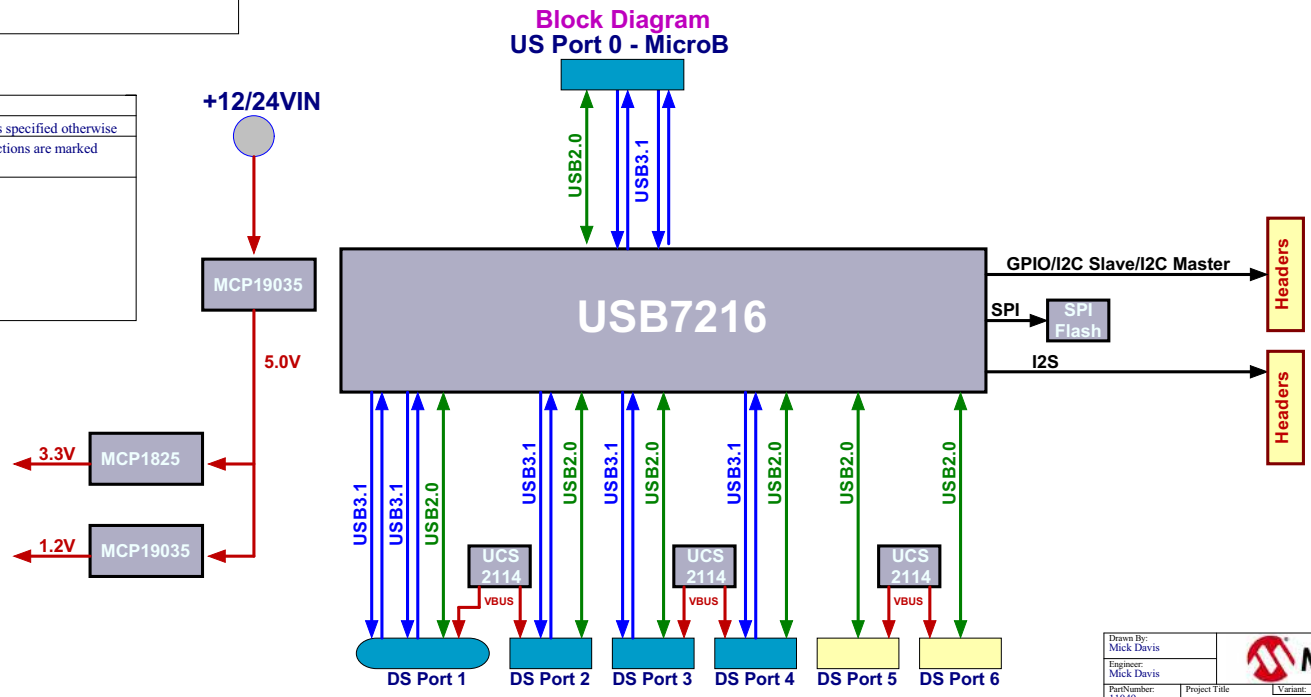

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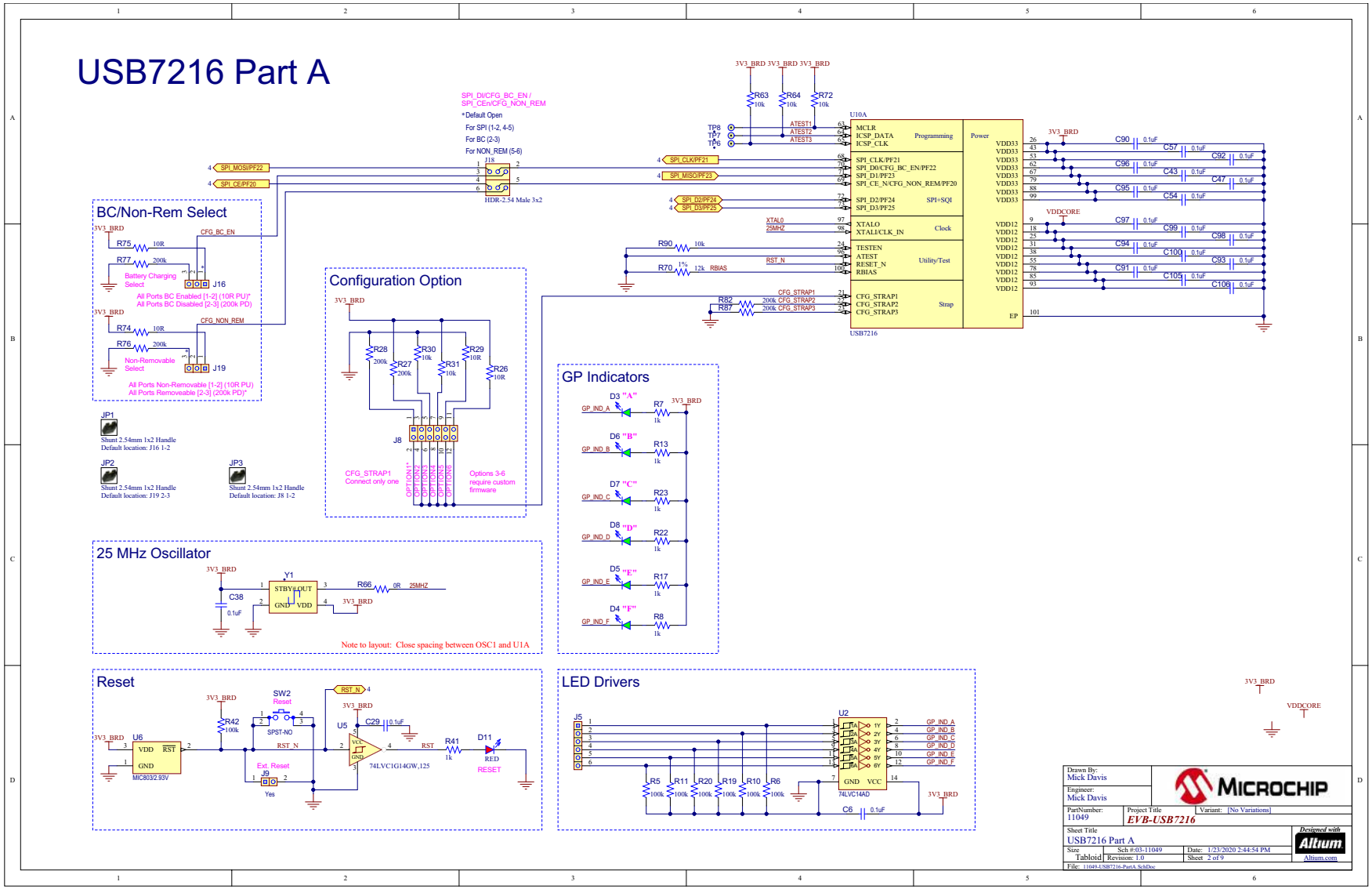
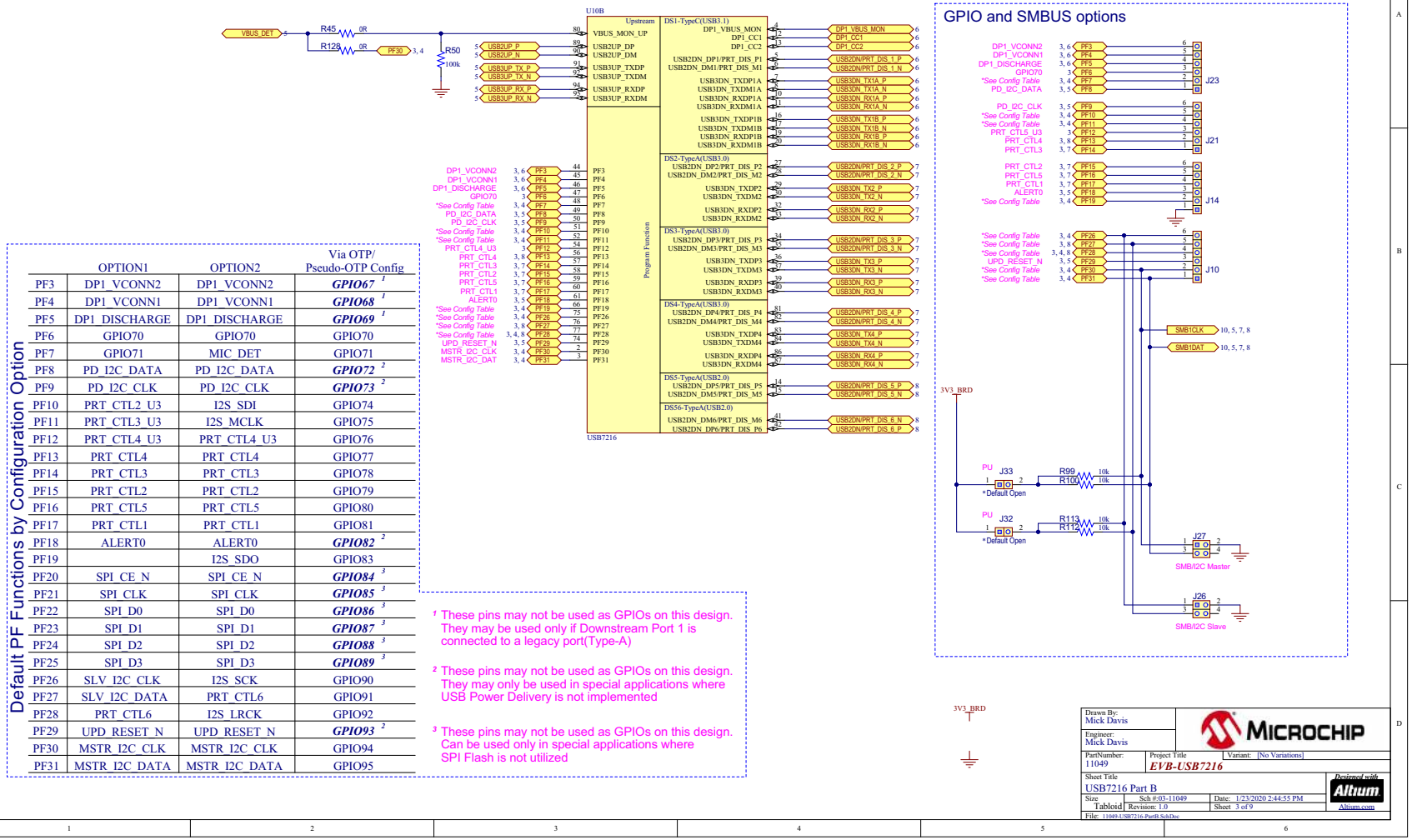
FIGURE A-2: USB7216 PART A



USB7216 Schematics

FIGURE A-3: USB7216 PART B



Default PF Functions by Configuration Option

	OPTION1	OPTION2	Via OTP/ Pseudo-OTP Config
PF3	DP1_VCONN2	DP1_VCONN2	***GPIO67*** [1]
PF4	DP1_VCONN1	DP1_VCONN1	***GPIO68*** [1]
PF5	DP1_DISCHARGE	DP1_DISCHARGE	***GPIO69*** [1]
PF6	GPIO70	GPIO70	GPIO70
PF7	GPIO71	MIC_DET	GPIO71
PF8	PD_I2C_DATA	PD_I2C_DATA	***GPIO72*** [2]
PF9	PD_I2C_CLK	PD_I2C_CLK	***GPIO73*** [2]
PF10	PRT_CTL2_U3	I2S_SDI	GPIO74
PF11	PRT_CTL3_U3	I2S_MCLK	GPIO75
PF12	PRT_CTL4_U3	PRT_CTL4_U3	GPIO76
PF13	PRT_CTL4	PRT_CTL4	GPIO77
PF14	PRT_CTL3	PRT_CTL3	GPIO78
PF15	PRT_CTL2	PRT_CTL2	GPIO79
PF16	PRT_CTL5	PRT_CTL5	GPIO80
PF17	PRT_CTL1	PRT_CTL1	GPIO81
PF18	ALERT0	ALERT0	***GPIO82*** [2]
PF19		I2S_SDO	GPIO83
PF20	SPI_CE_N	SPI_CE_N	***GPIO84*** [3]
PF21	SPI_CLK	SPI_CLK	***GPIO85*** [3]
PF22	SPI_D0	SPI_D0	***GPIO86*** [3]
PF23	SPI_D1	SPI_D1	***GPIO87*** [3]
PF24	SPI_D2	SPI_D2	***GPIO88*** [3]
PF25	SPI_D3	SPI_D3	***GPIO89*** [3]
PF26	SLV_I2C_CLK	I2S_SCK	GPIO90
PF27	SLV_I2C_DATA	PRT_CTL6	GPIO91
PF28	PRT_CTL6	I2S_LRCK	GPIO92
PF29	UPD_RESET_N	UPD_RESET_N	***GPIO93*** [2]
PF30	MSTR_I2C_CLK	MSTR_I2C_CLK	GPIO94
PF31	MSTR_I2C_DATA	MSTR_I2C_DATA	GPIO95

[1] These pins may not be used as GPIOs on this design. They may be used only if Downstream Port 1 is connected to a legacy port(Type-A)

[2] These pins may not be used as GPIOs on this design. They may only be used in special applications where USB Power Delivery is not implemented

[3] These pins may not be used as GPIOs on this design. Can be used only in special applications where SPI Flash is not utilized

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FIGURE A-4: EVB-USB7216 MEMORY

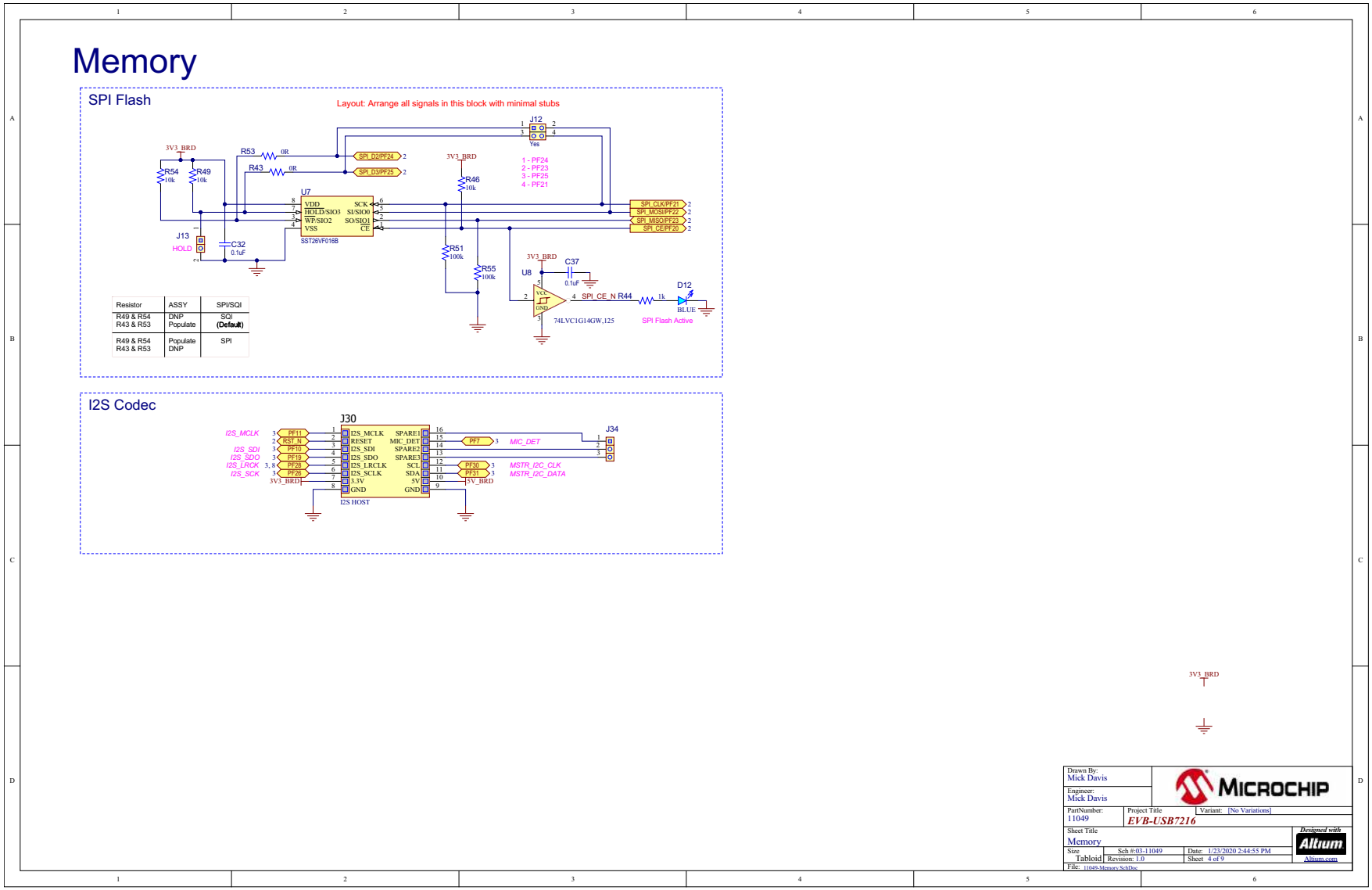

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FIGURE A-5: EVB-USB7216 USB TYPE-B UPSTREAM PORT

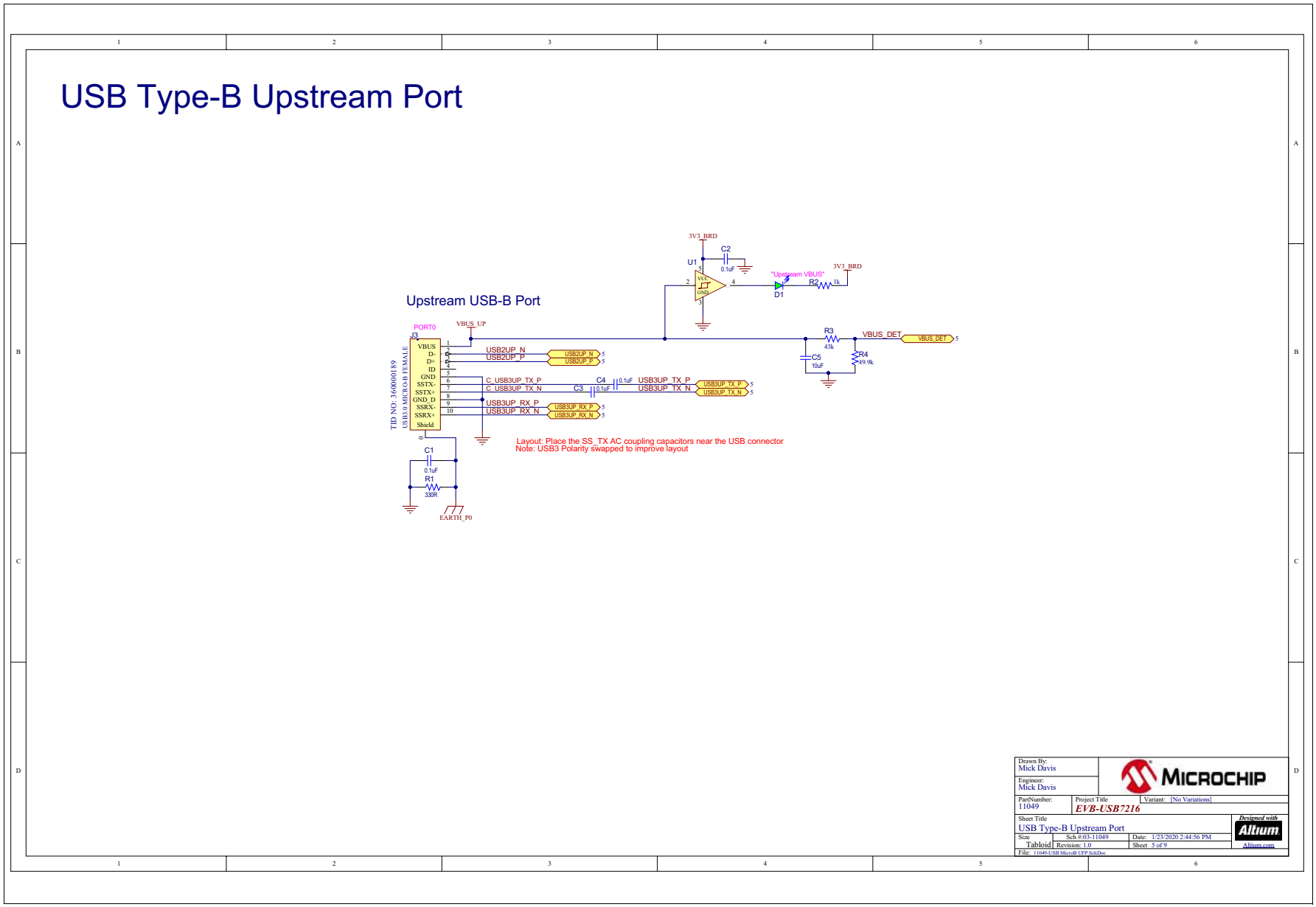

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FIGURE A-6: EVB-USB7216 USB TYPE-C® DOWNSTREAM PORT 1

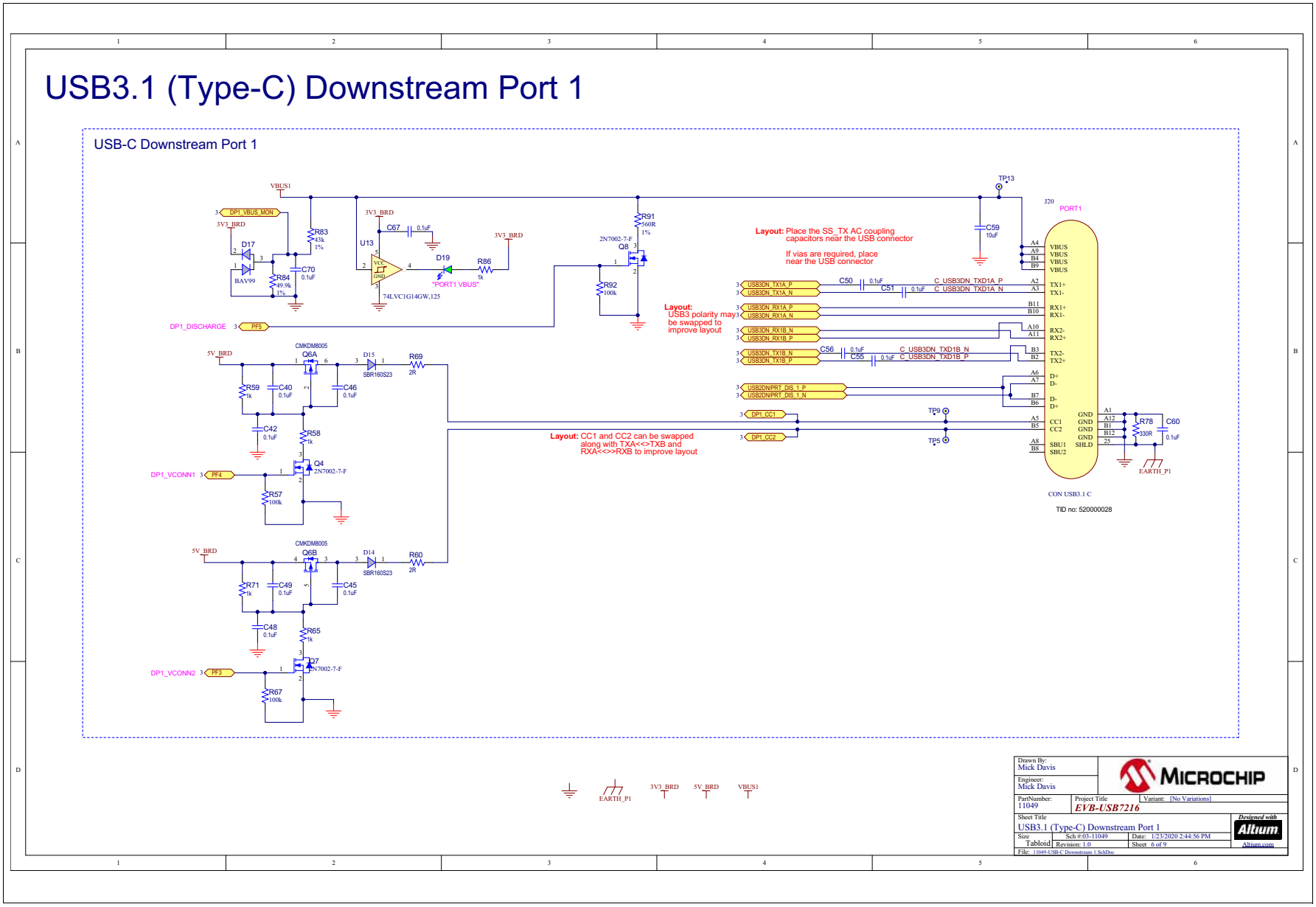

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FIGURE A-7: EVB-USB7216 USB TYPE-A DOWNSTREAM PORTS 2 TO 4

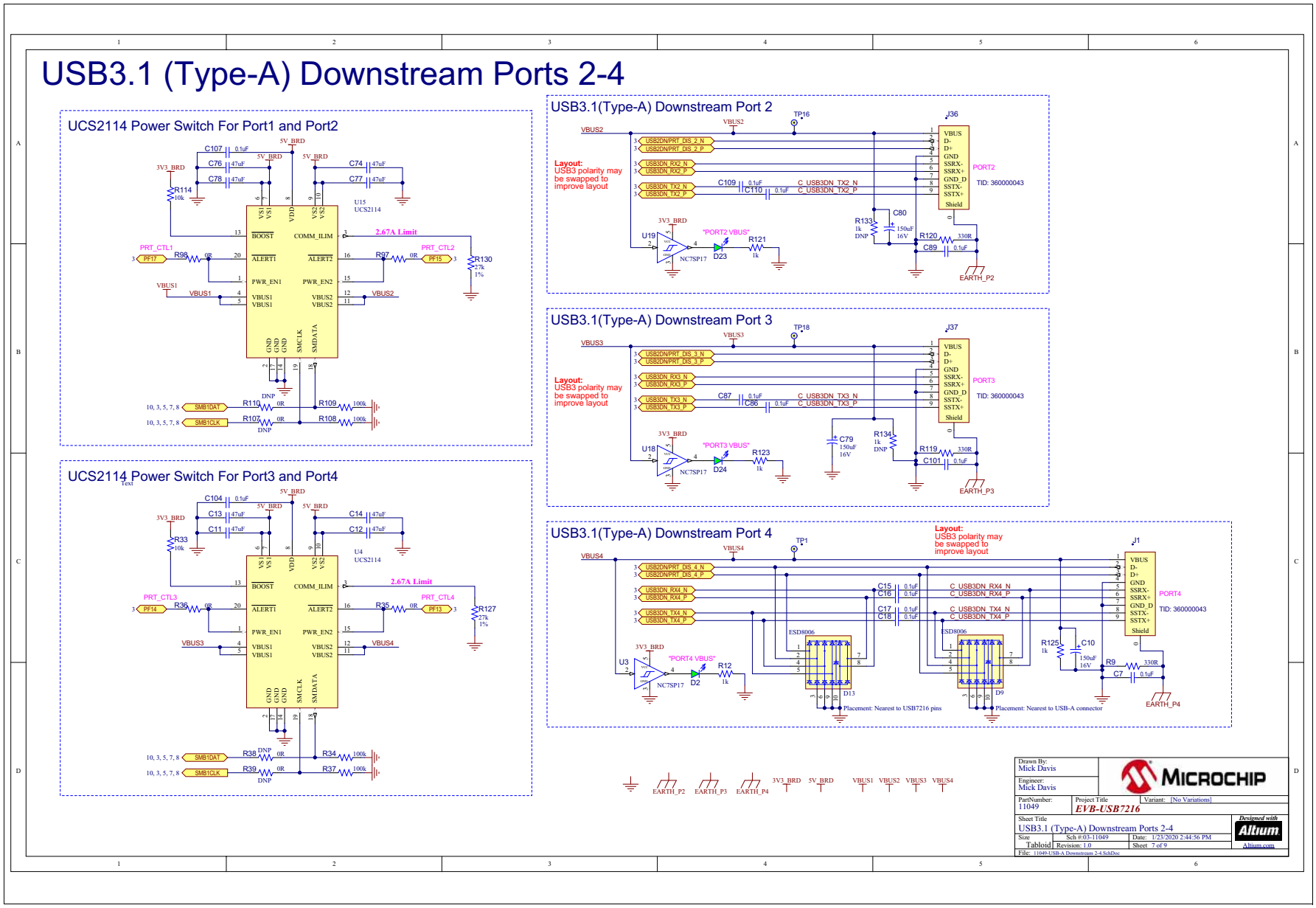

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FIGURE A-8: EVB-USB7216 USB TYPE-A DOWNSTREAM PORTS 5 TO 6

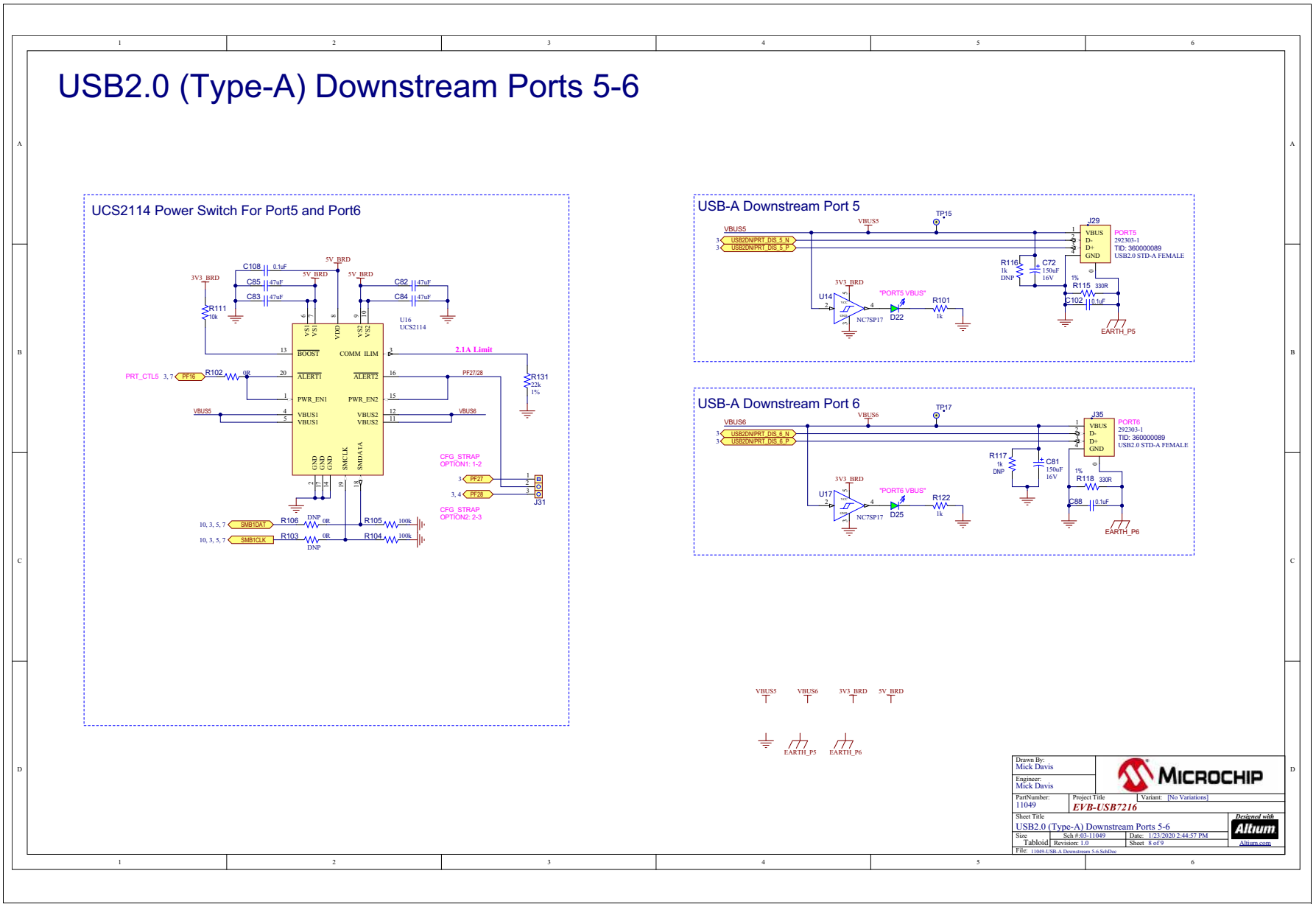

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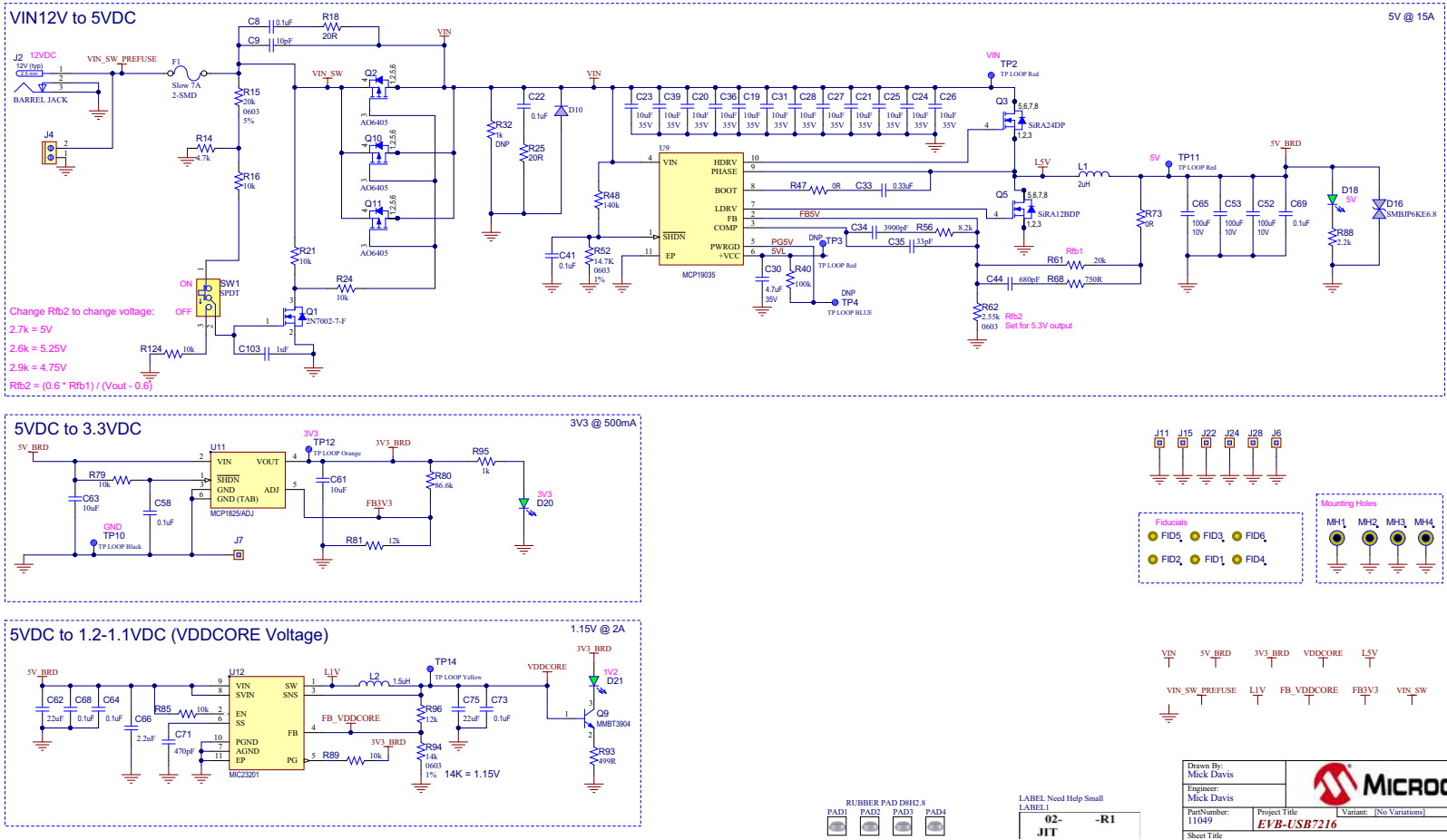
FIGURE A-9: EVB-USB7216 VOLTAGE REGULATORS



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Appendix B. Bill of Materials

B.1 INTRODUCTION

This appendix contains the EVB-USB7216 Evaluation Board Bill of Materials (BOM).

TABLE B-1: EVB-USB7216 BILL OF MATERIALS

Item	Quantity	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
1	63	C1, C2, C3, C4, C6, C7, C8, C15, C16, C17, C18, C22, C29, C32, C37, C38, C40, C41, C42, C43, C45, C46, C47, C48, C49, C50, C51, C54, C55, C56, C57, C58, C60, C64, C67, C68, C69, C70, C73, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100, C101, C102, C104, C105, C106, C107, C108, C109, C110	CAP CER 0.1 µF 35V 10% X7R SMD 0402	Yes	TDK Corporation	CGA2B3X7R1V104K050BB
2	4	C5, C59, C61, C63	CAP CER 10 µF 16V 10% X5R SMD 0805	Yes	Wurth Electronics Inc	885012107014
3	1	C9	CAP CER 10 pF 50V 5% NP0 SMD 0402	Yes	Murata	GRM1555C1H100JZ01D
4	5	C10, C72, C79, C80, C81	CAP ALU 150 µF 16V 20% SMD D8	Yes	Panasonic Electronic Components	EEE-FPC151XAP
5	12	C11, C12, C13, C14, C74, C76, C77, C78, C82, C83, C84, C85	CAP CER 47 µF 6.3V 20% X5R SMD 0805	Yes	Taiyo Yuden	JMK212BJ476MG-T
6	12	C19, C20, C21, C23, C24, C25, C26, C27, C28, C31, C36, C39	CAP CER 10 µF 35V 10% X5R SMD 1206	Yes	Taiyo Yuden	GMK316BJ106KL-T
7	1	C30	CAP CER 4.7 µF 35V 10% X7R SMD 0805	Yes	TDK Corporation	C2012X7R1V475K125AE
8	1	C33	CAP CER 0.33 µF 50V 10% X7R SMD 0805	Yes	TDK Corporation	CGJ4J2X7R1H334K125AA
9	1	C34	CAP CER 3900 pF 50V 5% C0G SMD 0603	Yes	TDK Corporation	C1608C0G1H392J080AA
10	1	C35	CAP CER 33 pF 50V 5% NP0 SMD 0603	Yes	KEMET	C0603C330J5GACTU
11	1	C44	CAP CER 680 pF 50V 5% NP0 SMD 0603	Yes	Panasonic	ECJ-1VC1H681J
12	3	C52, C53, C65	CAP CER 100 µF 10V 20% X5R SMD 1210	Yes	Murata Electronics North America	GRM32ER61A107ME20L
13	2	C62, C75	CAP CER 22 µF 10V 10% X7R SMD 1206	Yes	Samsung Electro-Mechanics America, Inc	CL31B226KPHNNNE
14	1	C66	CAP CER 2.2 µF 10V 10% X7R SMD 0603	Yes	Taiyo Yuden	LMK107B7225KA-T
15	1	C71	CAP CER 470 pF 25V 5% NP0 SMD 0603	Yes	AVX	06033A471JAT2A
16	1	C103	CAP CER 1 µF 16V 10% X5R SMD 0402	Yes	Murata	GRM155R61C105KE01D
17	16	D1, D2, D3, D4, D5, D6, D7, D8, D18, D19, D20, D21, D22, D23, D24, D25	DIO LED GREEN 2V 30 mA 35 mcd Clear SMD 0603	Yes	Lite-On Inc	LTST-C191KGKT
18	2	D9, D13	DIO TVS ESD8006MUTAG 3.3V SMD UDFN-8	Yes	ON Semiconductor	ESD8006MUTAG
19	1	D10	DIO RECT MMBD914-7-F 1.25V 200 mA 75V SMD SOT-23-3	Yes	Diodes Incorporated	MMBD914-7-F

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TABLE B-1: EVB-USB7216 BILL OF MATERIALS (CONTINUED)

Item	Quantity	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
20	1	D11	DIO RED 2V 20 mA 54 mcd CLEAR SMD 0603	Yes	Lite-On Inc.	LTST-C191KRKT
21	1	D12	DIO LED BLUE 2.8V 20 mA 15 mcd Clear SMD 0603	Yes	Lite-On	LTST-C193TBKT-5A
22	2	D14, D15	DIO SBAR SBR160S23-7 SBR 530 mV 900 mA 60V SMD SOT23-3	Yes	Diodes Incorporated	SBR160S23-7
23	1	D16	DIO TVS SMBJP6KE6.8CA 5.8V 600W DO-214AA_SMB	Yes	Micro Commercial Co	SMBJP6KE6.8CA-TP
24	1	D17	DIO RECTARR BAV99 1.25V 200 mA 70V SOT-23-3	Yes	Fairchild	BAV99
25	1	F1	RES FUSE 7A 72VAC 60VDC SLOW 2-SMD	Yes	Littelfuse Inc.	0154007.DRT
26	3	J1, J36, J37	CON USB3.0 STD-A FEMALE TH R/A	Yes	Wurth Electronics Inc	692121030100
27	1	J2	CON JACK Power Barrel Black Male TH RA	Yes	CUI Inc.	PJ-002BH
28	1	J3	CON USB3.0 MICRO-B FEMALE SMD R/A	Yes	Hirose Electric Co Ltd	ZX360D-B-10P
29	1	J4	CON TERMINAL 5.08 mm 1X2 Female 16-30 AWG 13.5A TH RA	Yes	TE Connectivity	282836-2
30	5	J5, J10, J14, J21, J23	CON HDR-2.54 Male 1x6 Tin 5.84 MH TH VERT	Yes	Sullins	PEC06SAAN
31	6	J6, J11, J15, J22, J24, J28	CON HDR-2.54 Male 1x1 Gold 5.84 MH TH VERT	Yes	Samtec Inc.	TSW-101-07-S-S
32	1	J7	CON HDR-2.54 Male 1x1 Gold 5.84 MH TH VERT	Yes	TE Connectivity	5-146280-1
33	1	J8	CON HDR-2.54 Male 2x6 Gold 5.84 MH TH VERT	Yes	Samtec	TSW-106-07-G-D
34	4	J9, J13, J32, J33	CON HDR-2.54 Male 1x2 Gold 5.84 MH TH VERT	Yes	FCI	77311-118-02LF
35	3	J12, J26, J27	CON HDR-2.54 Male 2x2 Gold 5.84 MH TH VERT	Yes	Samtec	TSW-102-07-G-D
36	4	J16, J19, J31, J34	CON HDR-2.54 Male 1x3 Gold 5.84 MH TH VERT	Yes	FCI	68000-103HLF
37	1	J18	CON HDR-2.54 Male 3x2 Gold 5.84 MH TH VERT	Yes	Samtec Inc.	TSW-102-07-G-T
38	1	J20	CON USB3.0 TYPE-C FEMALE SMD R/A	Yes	Advanced-Connectek Inc.	NBR25-AK5322
39	2	J29, J35	CON USB2.0 STD-A FEMALE TH R/A	Yes	TE Connectivity AMP Connectors	292303-1
40	2	J30	SOCKET I^2S™ HOST DIP 16 TH	Yes	Sullins Connector Solutions	PPTC081LFBN-RC
41	3	JP1, JP2, JP3	MECH HW JUMPER 2.54 mm 1x2 w/ Handle	MECH	TE Connectivity AMP Connectors	880584-4
42	1	L1	INDUCTOR 2 µH 23A 20% SMD L12.8W12.8H6.2	Yes	Wurth Electronics Inc.	7443551200
43	1	L2	INDUCTOR 1.5 µH 3A 20% SMD L5W5H2.2	Yes	Murata Electronics North America	LQH5BPN1R5NT0L
44	1	LABEL1	LABEL, ASSY W/REV LEVEL (SMALL MODULES) PER MTS-0002	MECH		
45	4	PAD1, PAD2, PAD3, PAD4	MECH HW RUBBER PAD Cylindrical flat top D8H2.8 Black	MECH	3M	SJ5076BLACK
46	4	Q1, Q4, Q7, Q8	TRANS FET N-CH 2N7002-7-F 60V 170 mA 370 mW SOT-23-3	Yes	Diodes Inc	2N7002-7-F
47	3	Q2, Q10, Q11	TRANS FET P-CH AO6405 30V 5A 0.052R 2W TSOP-6	Yes	Alpha & Omega Semiconductor Inc	AO6405
48	1	Q3	TRANS FET N-CH SiRA24DP-T1-GE3 25V 60A 62.5W PPAK SO-8	Yes	Vishay / Siliconix	SIRA24DP-T1-GE3
49	1	Q5	TRANS FET N-CH SiRA12BDP-T1-GE3 30V 60A 38W PPAK SO-8	Yes	Vishay Siliconix	SIRA12BDP-T1-GE3

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TABLE B-1: EVB-USB7216 BILL OF MATERIALS (CONTINUED)

Item	Quantity	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
50	1	Q6	TRANS FET DUAL P+P CMKDM8005 20V 650 mA 360R 0.350W SOT-363	Yes	Central Semiconductor Corp	CMKDM8005 TR
51	1	Q9	TRANS BJT NPN MMBT3904 40V 200 mA 310 mW SOT-23-3	Yes	Diodes Incorporated	MMBT3904-7
52	7	R1, R9, R78, R115, R118, R119, R120	RES TKF 330R 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF3300V
53	21	R2, R7, R8, R12, R13, R17, R22, R23, R41, R44, R58, R59, R65, R71, R86, R95, R101, R121, R122, R123, R125	RES TKF 1k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF1001V
54	2	R3, R83	RES TKF 43k 1% 1/10W SMD 0603	Yes	Yageo	9C06031A4302FKHFT
55	2	R4, R84	RES TKF 49.9k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF4992V
56	20	R5, R6, R10, R11, R19, R20, R34, R37, R40, R42, R50, R51, R55, R57, R67, R92, R104, R105, R108, R109	RES TKF 100k 1% 1/10W SMD 0603	YES	TE Connectivity	1622827-1
57	1	R14	RES TF 4.7k 0.5% 1/10W SMD 0603	Yes	Yageo	RT0603DRD074K7L
58	1	R15	RES TKF 20k 5% 1/10W SMD 0603	Yes	Panasonic	ERJ-3GSYJ203
59	23	R16, R21, R24, R30, R31, R33, R46, R49, R54, R63, R64, R72, R79, R85, R89, R90, R99, R100, R111, R112, R113, R114, R124	RES TKF 10k 1% 1/10W SMD 0603	Yes	ROHM	MCR03EZPFX1002
60	2	R18, R25	RES TKF 20R 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF20R0V
61	4	R26, R29, R74, R75	RES TKF 10R 5% 1/10W SMD 0603	Yes	Panasonic	ERJ-3GSYJ100V
62	6	R27, R28, R76, R77, R82, R87	RES TKF 200k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF2003V
63	5	R32, R116, R117, R133, R134	RES TKF 1k 1% 1/10W SMD 0603	DNP	Panasonic	ERJ-3EKF1001V
64	12	R35, R36, R43, R45, R47, R53, R66, R73, R97, R98, R102, R128	RES TKF 0R 1/10W SMD 0603	Yes	Panasonic	ERJ-3GSY0R00V
65	6	R38, R39, R103, R106, R107, R110	RES TKF 0R 1/10W SMD 0603	DNP	Panasonic	ERJ-3GSY0R00V
66	1	R48	RES TKF 140k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF1403V
67	1	R52	RES TKF 14.7K 1% 1/10W SMD 0603	Yes	Panasonic Electronic Components	ERJ-3EKF1472V
68	1	R56	RES TKF 8.2k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF8201V
69	2	R60, R69	RES TKF 2R 1% 1/4W SMD 0603	Yes	Vishay Dale	CRCW06032R00FKEAHP
70	1	R61	RES TKF 20k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF2002V

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TABLE B-1: EVB-USB7216 BILL OF MATERIALS (CONTINUED)

Item	Quantity	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
71	1	R62	RES TKF 2.55k 1% 1/10W SMD 0603	Yes	Yageo	RC0603FR-072K55L
72	1	R68	RES TKF 750R 1% 1/10W SMD 0603	Yes	Vishay	CRCW0603750RFKEA
73	3	R70, R81, R96	RES TKF 12k 1% 1/10W SMD 0603	Yes	Yageo	RC0603FR-0712KL
74	1	R80	RES TKF 86.6k 1% 1/10W SMD 0603	Yes	Panasonic Electronic Components	ERJ-3EKF8662V
75	1	R88	RES TKF 2.2k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF2201V
76	1	R91	RES TKF 560R 1% 1/10W SMD 0603	Yes	Yageo	RC0603FR-07560RL
77	1	R93	RES TKF 499R 1% 1/10W SMD 0603	Yes	KOA Speer	RK73H1JTTD4990F
78	1	R94	RES TKF 14k 1% 1/10W SMD 0603 AEC-Q200	Yes	Panasonic Electronic Components	ERJ-3EKF1402V
79	2	R127, R130	RES TKF 27k 1% 1/10W SMD 0603	Yes	Yageo	RC0603FR-0727KL
80	1	R131	RES TKF 22k 1% 1/10W SMD 0603	Yes	Panasonic	ERJ-3EKF2202V
81	1	SW1	SWITCH SLIDE SPDT 120V 6A 1101M2S3CQE2 TH	Yes	C&K Components	1101M2S3CQE2
82	1	SW2	SWITCH TACT SPST 16V 50 mA PTS810 SJM 250 SMTR LFS SMD	Yes	C&K Components	PTS810 SJM 250 SMTR LFS
83	2	TP2, TP11	MISC, TEST POINT MULTI PURPOSE MINI RED	Yes	Keystone	5000
84	1	TP3	MISC, TEST POINT MULTI PURPOSE MINI RED	DNP	Keystone	5000
85	1	TP4	CON TP LOOP BLUE Ag TH	DNP	Keystone Electronics	5117
86	1	TP10	MISC, TEST POINT MULTI PURPOSE MINI BLACK	Yes	Keystone	5001
87	1	TP12	CON TP LOOP Orange TH	Yes	Keystone Electronics	5003
88	1	TP14	MISC, TEST POINT PC MINI, 0.040" D YELLOW	Yes	Keystone	5004
89	4	U1, U5, U8, U13	74LVC1G14GW,125 SCHMITT-TRG INVERTER	Yes	NXP	74LVC1G14GW,125
90	1	U2	IC BUFFER 74LVC14AD,118 SOIC-14	Yes	Nexperia USA Inc.	74LVC14AD,118
91	5	U3, U14, U17, U18, U19	IC BUFFER NC7SP17 SC-70-5	Yes	Fairchild Semiconductor	NC7SP17P5X
92	3	U4, U15, U16	MCHP INTERFACE USB Power Controller UCS2114 QFN-20	Yes	Microchip Technology Inc.	UCS2114-1-V/LX
93	1	U6	MCHP ANALOG SUPERVISOR 2.93V MIC803-29D4VM3-TR SOT-23-3	Yes	Microchip Technology Inc.	MIC803-29D4VM3-TR
94	1	U7	MCHP MEMORY SERIAL FLASH 16M 104 MHz SST26VF016B-104I/SM SOIJ-8	Yes	Microchip Technology Inc.	SST26VF016B-104I/SM
95	1	U9	MCHP ANALOG PWM CONTROLLER 600 kHz MCP19035-BAABE/MF DFN-10	Yes	Microchip Technology Inc.	MCP19035-BAABE/MF
96	1	U10	MCHP INTERFACE USB 3.1 TYPE-C HUB CTLR QFN-100	Yes	Microchip Technology Inc.	USB7216
97	1	U11	MCHP ANALOG LDO ADJ MCP1825T-ADJE/DC SOT-223-5	Yes	Microchip Technology Inc.	MCP1825T-ADJE/DC
98	1	U12	MCHP ANALOG SWITCHER Buck 0.95V to 3.6V 2A MIC23201YML-TR MLF-10	Yes	Microchip Technology Inc.	MIC23201YML-TR
99	1	Y1	MCHP CLOCK OSCILLATOR SINGLE 25 MHZ DSC1001CI2-025.0000 CDFN-4	Yes	Microchip Technology Inc.	DSC1001CI2-025.0000

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NOTES:

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Appendix C. PCB Silk Screens

C.1 INTRODUCTION

This appendix shows the top and bottom silk screen images of the EVB-USB7216 PCB.

FIGURE C-1: EVB-USB7216 TOP SILK SCREEN IMAGE

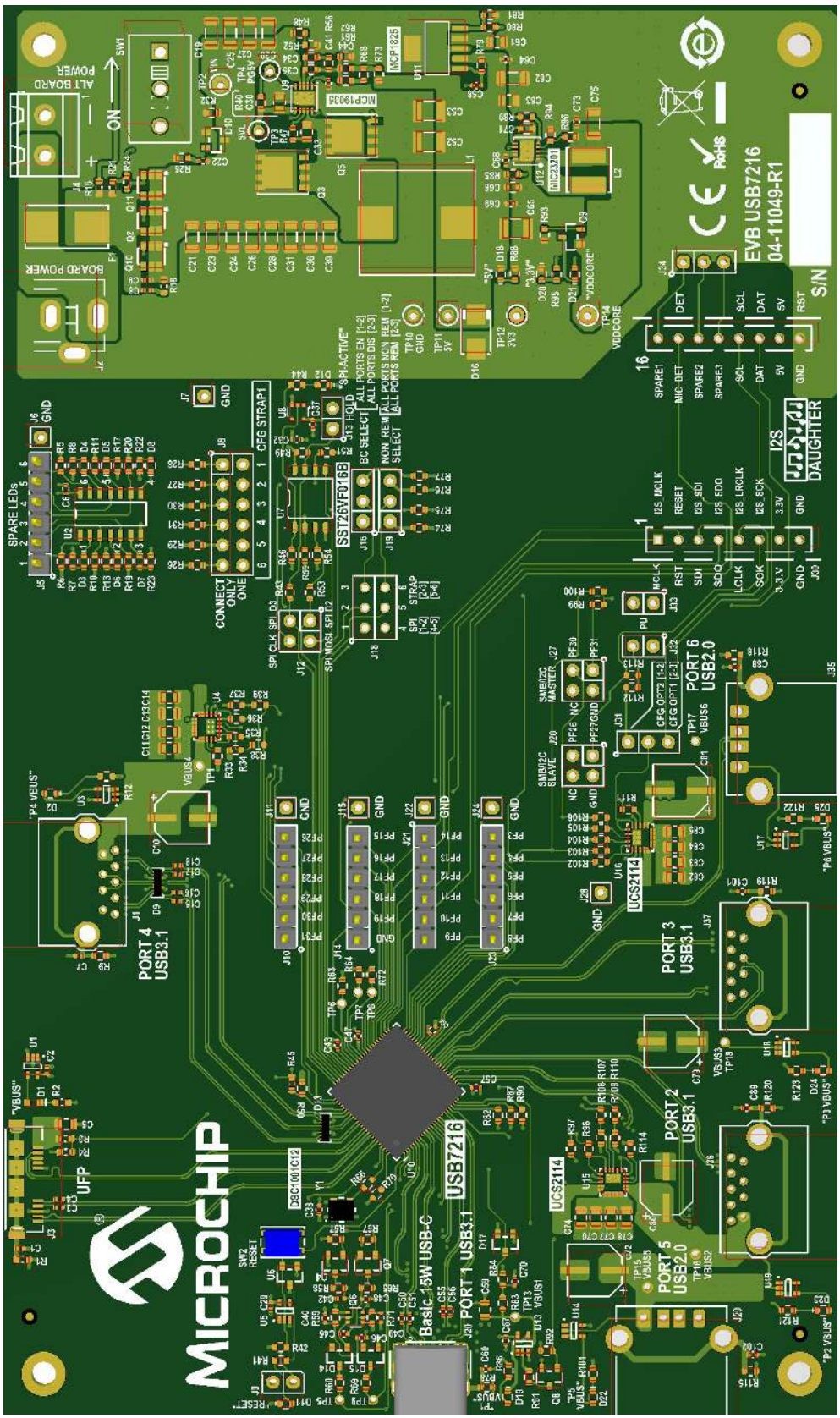

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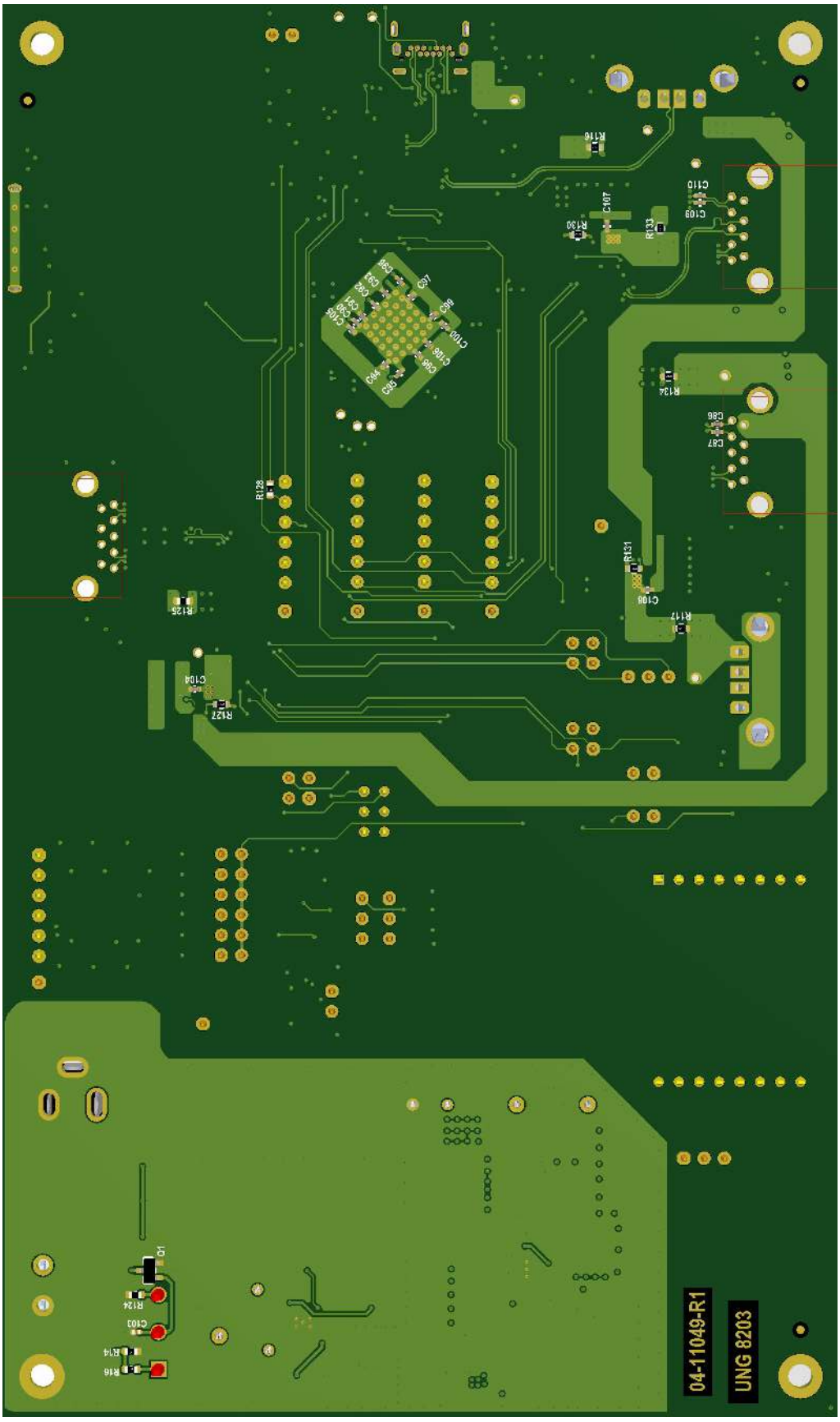
FIGURE C-2: EVB-USB7216 BOTTOM SILK SCREEN IMAGE



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