User's Guide

TUSB216IEVM User's Guide

ABSTRACT

This user guide for the evaluation module (EVM) of the TUSB216I devices is available to provide an easy evaluation process of our TUSB216I USB High-Speed signal conditioners.

This user's guide provides an overview of the EVMs, which includes highlighting key features, operating conditions, and how to setup for use in system-level evaluation.

The construction of the EVM also serves as a reference design that is easily modified for any intended application. Target applications include Cell Phones, Desktop or Notebook Computers, Docking Stations, TVs, and active Cables. Additional schematic and layout information is available on TI.com.

Table of Contents

List of Figures

List of Tables

Trademarks

1 TUSB216IEVM

The TUSB216I is a USB High-Speed signal conditioner designed to compensate both AC loss (due to capacitive load) and DC loss (due to resistive loss) in the transmission channel

The TUSB216I speeds up the transition edges of USB 2.0 high-speed signal with an edge booster and increases static levels with a DC boost function. The TUSB216I includes a pre-equalization function to improve the receiver sensitivity and compensate the inter-symbol interference (ISI) jitter. USB low-speed and full-speed signal characteristics are unaffected by the TUSB216I. The integrated CDP mode BC 1.2 battery charging controller can be enabled via a control pin.

The TUSB216IEVM was designed to be used in path connection between a USB host and a USB device. The EVM is designed to provide multiple connector options to help eliminate the use of adapters. The upstream interface to the EVM consists of three possible input connectors: a USB 2.0 Mini-B Receptacle, a USB 3.1 Type B Receptacle, and a USB 3.1 Type-A Plug. The downstream interface to the EVM consists of three USB 3.1 Type-A Receptacle output connectors. Each section of the EVM is detachable from the main board along the board perforations. The EVM can be connected to the system using various cable lengths to verify system operation under different conditions.

2 TUSB216EVM Board Description

The TUSB216IEVM is designed to provide easy evaluation of the redriver device for various types of applications. The TUSB216IEVM is also meant to serve as a reference design to show a practical example of how to use the device in a mass-production system.

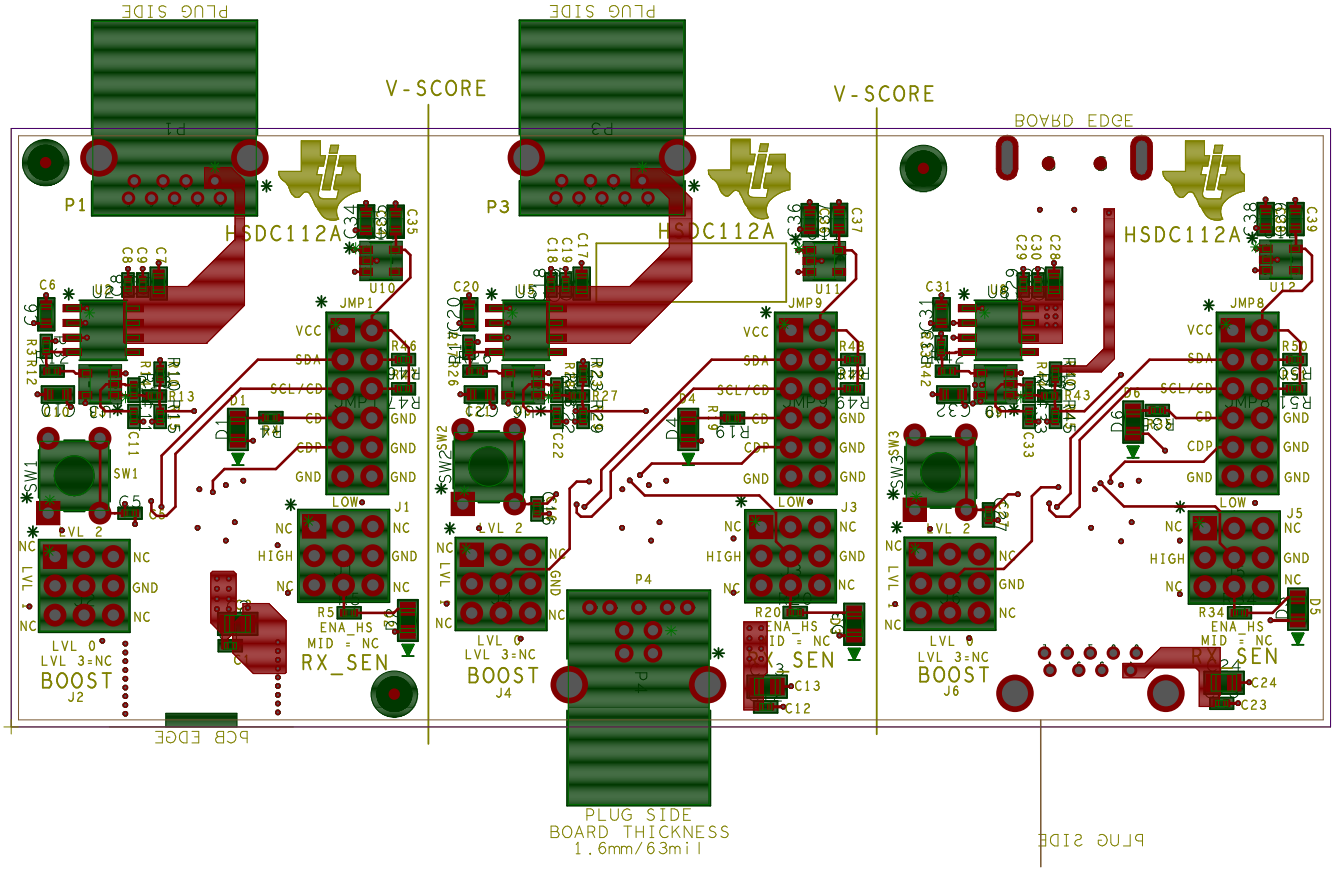


Figure 2-1. TUSB216IEVM

2.1 TUSB216IEVM Kit Contents

This EVM kit contains the following items:

- TUSB216IEVM board
- This user's manual

3 EVM Jumper and Switch Configuration

The TUSB216IEVM has two 3x3 headers and a 6x2 header in each board partition to facilitate configuration changes. The *BOOST* and *RX_SEN* 3x3 headers are arranged to allow for all possible device configurations, including connecting RX_SEN to a LED so that the ENA_HS status output can be viewed easily. The corner pins of the 3x3 headers are not connected.

The 6x2 header adds the ability to connect on-board pullups to the SDA and SCL pins to support I2C operation. If I2C mode is not needed, the SCL/CD pin can be connected to a LED so the CD status can be easily checked. Also, the 6x2 header provides connections for ground and to supply power manually to EVM. In addition, the header adds the ability to enable CDP mode on the TUSB216I.

Table 3-1. 6x2 Configuration Header Pinout

Row 1	Row 2
EVM Power Input - use if 0 Ohm resistor connected to VBUS is removed.	3.3V Power for I2c
SDA	4.7 kOhm I2C pullup - can be jumpered to SDA
SCL/CD	4.7 kOhm I2C pullup - can be jumpered to SCL/CD
CD LED - can be jumpered to SCL/CD	GND
CDP_ENZ - BC 1.2 Mode configuration	GND
GND	GND

Changing these switch and jumpers settings without a complete understanding of the result is not recommended. Configuration inputs are only read by the TUSB216I during power on reset or after de-asserting the RSTN pin, changing these switch settings while the EVM is powered on has no effect. Refer to the device data sheet for detailed pin descriptions and functionality along with EVM schematic for additional information.

The switch definitions are as follows:

RSTN Push button Switch (SW1, SW2, SW3):

- Push button to place redriver device in RESET
- Release to de-assert RESET

Table 3-2 includes the *BOOST* Jumper Settings.

Table 3-2. 3x3 BOOST Header

NC	3.6 KOhm to GND	NC
1.8 KOhm to GND	BOOST	GND
NC	0 Ohm to GND	NC

1. Center pin to bottom position sets BOOST Level 0
2. Center pin to left position sets BOOST Level 1
3. Center pin to top position sets BOOST Level 2
4. No connect of the center pin sets BOOST Level 3

   Right Position of BOOST Jumper is short to GND.

Table 3-3 includes the *RX_SEN* Jumper Settings.

Table 3-3. RX_SEN 3x3 Header

NC	27 kOhm to GND	NC
13 kOhm / 39 kOhm divider	RX_SEN	GND
NC	ENA_HS LED	NC

1. Top position sets low RX sensitivity.
2. No connect of the center pin sets mid RX sensitivity

3. Center pin to left position sets high RX sensitivity
4. Center pin to bottom position enables the ENA_HS status LED.

   Right Position of RX_SEN jumper is short to GND.

3.1 Selecting Configuration Levels

The primary purpose of the USB 2.0 signal conditioner is to restore the signal integrity of a USB High-Speed channel to USB 2.0 compliant levels. The platform goal is to pass the USB Near-End or Far-End Eye Mask with the device in the best location.

A typical use case is to place the USB 2.0 signal conditioner close to the USB connector on a Host platform to pass Near-End Eye Mask testing. This includes systems where the USB connector may be placed at the Far-End of a cable.

Typical RX Sensitivity and Boost recommendations based on cable length (28 AWG USB Cable) are shown in Table 3-4. We recommend starting with the lower settings first.

Table 3-4. RX_SEN/BOOST Setting Based on Cable Length

Cable Length	Boost	RX SEN
0m - 2m	Level 0	MID
3m-5m	Level 1	MID / HIGH

4 EVM Operation

To install the EVM, perform the following steps:

1. Upstream connection: attach a USB2 or USB3 cable from a Host PC Type A connector to a Type B connector (P2 or P4) of the EVM or connect P6 directly to the Host PC.
2. Downstream connection: attach a USB device directly or via a cable plugged into the Type A receptacle connector (P1, P3 or P5) on the EVM.
3. The upstream connection and downstream connections must be on the same board section of the EVM.

5 TUSB216IEVM Schematic

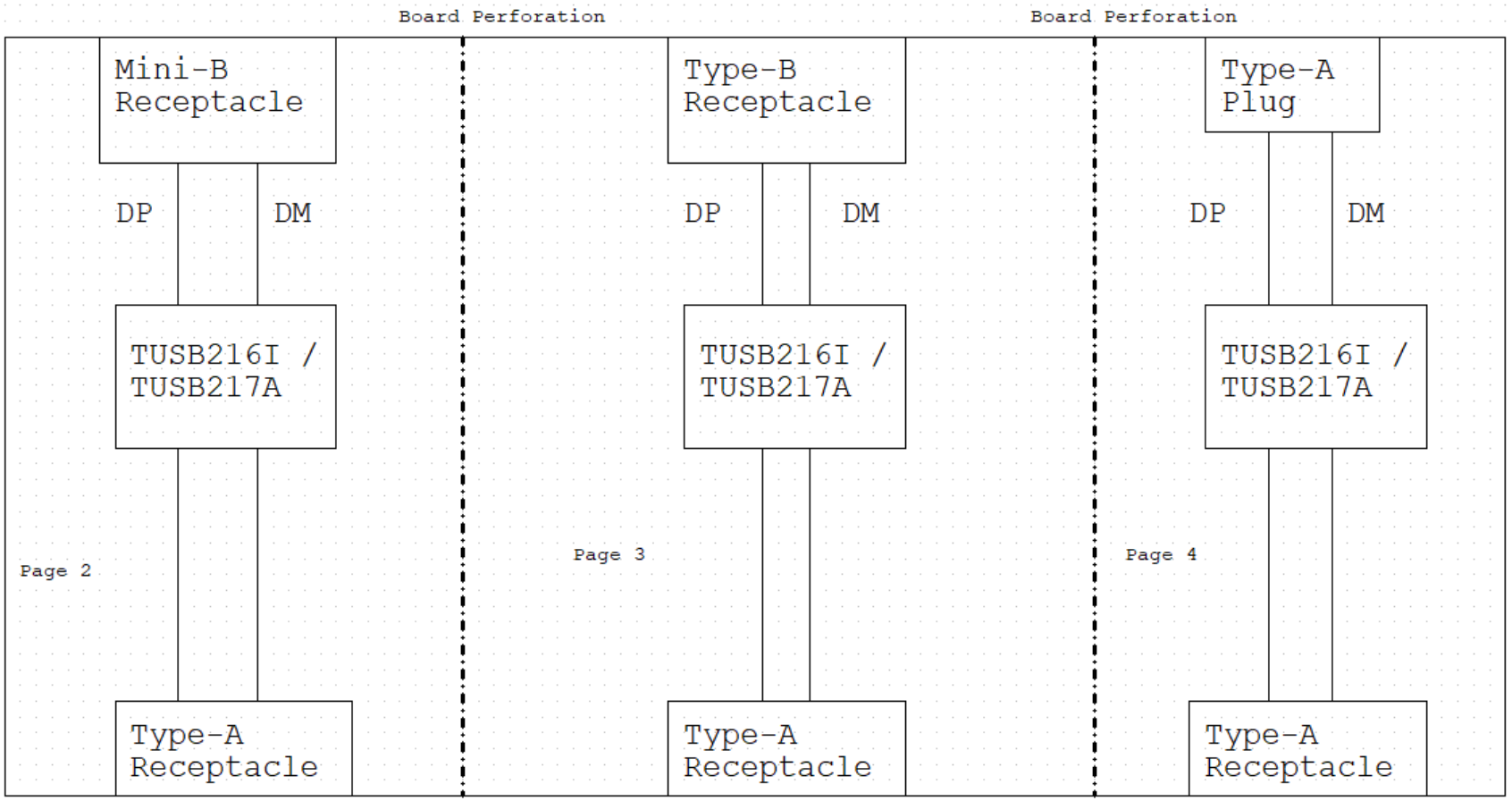
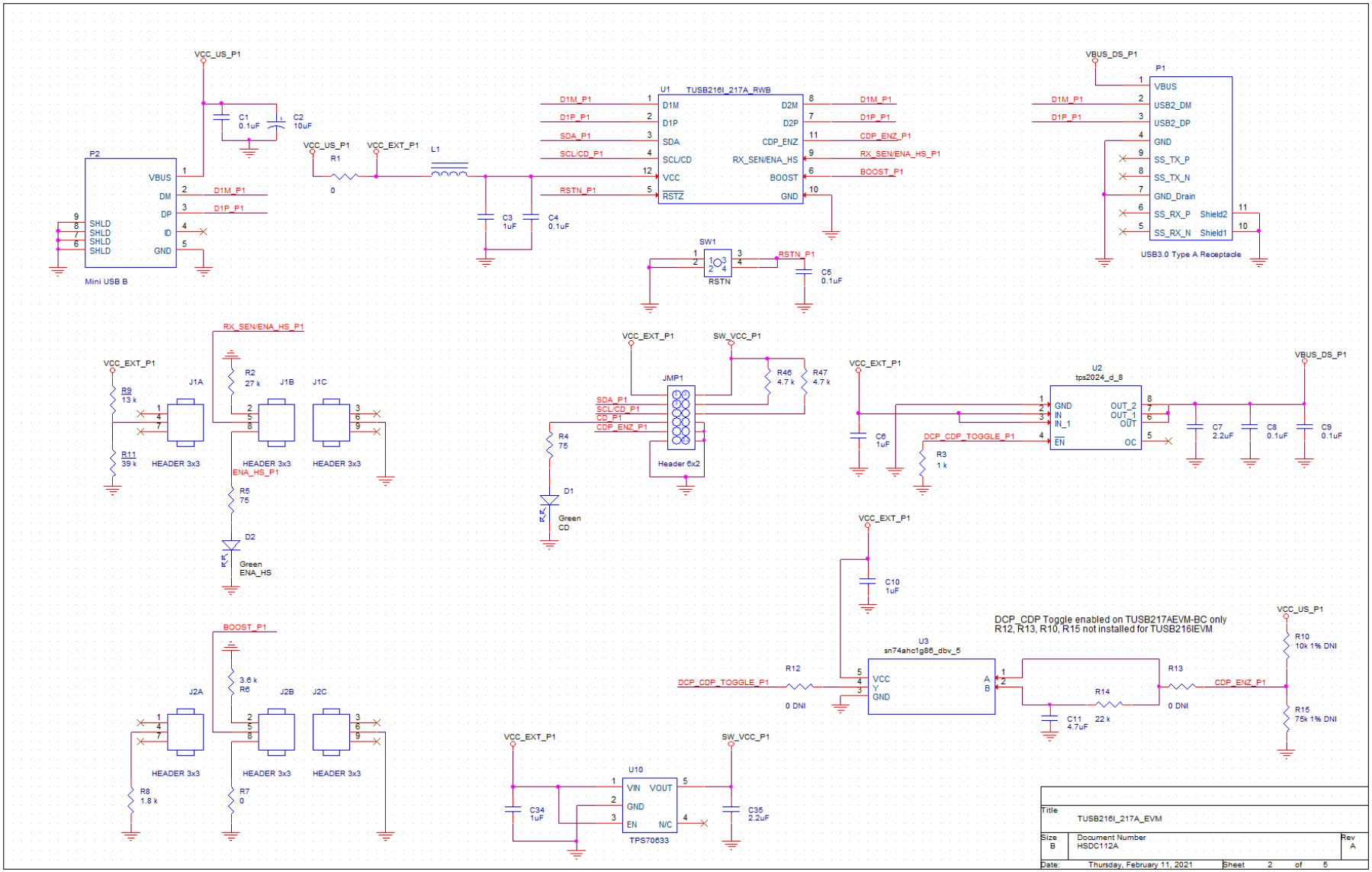
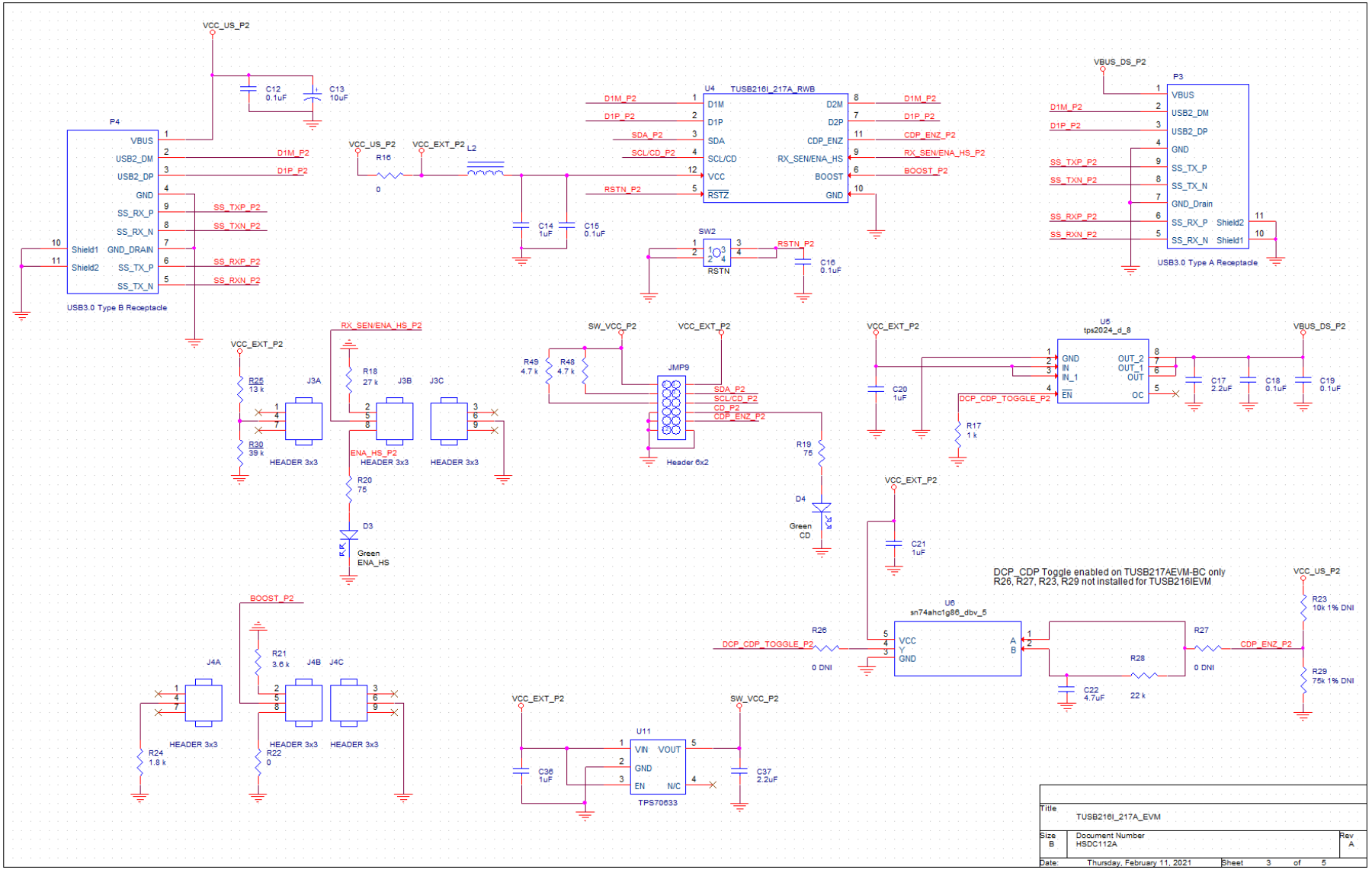
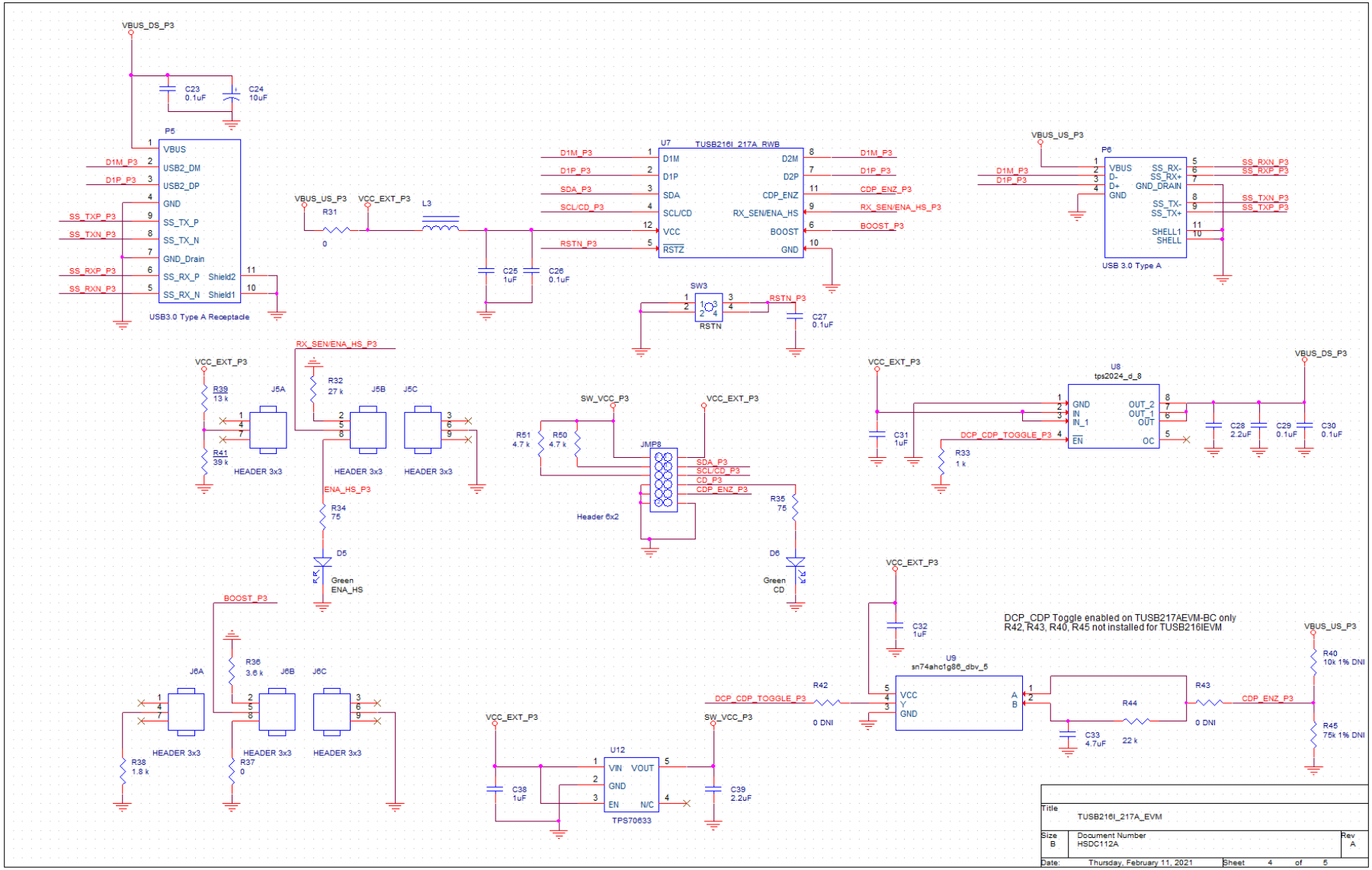


Figure 5-1. TUSB216IEVM Schematic







6 TUSB216IEVM BOM

Item	Quantity	Reference	Part
1	15	C1,C4,C5,C8,C9,C12,C15, C16,C18,C19,C23,C26,C27,C29,C30	0.1uF
2	3	C2,C13,C24	10uF
3	12	C3,C6,C10,C14,C20,C21, C25,C31,C32,C34,C36,C38	1uF
4	6	C7,C17,C28,C35,C37,C39	2.2uF
5	3	C11,C22,C33	4.7uF
6	6	D1,D2,D3,D4,D5,D6	LED
7	3	JMP1,JMP8,JMP9	Header 6x2
8	6	J1,J2,J3,J4,J5,J6	Header 3x3
9	1	LBL1	THT-14-423-10
10	3	L1,L2,L3	100ohms
11	1	PCB1	HSDC112
12	3	P1,P3,P5	USB3.0 Type A Receptacle
13	1	P2	Mini USB B
14	1	P4	USB3.0 Type B Receptacle
15	1	P6	USB 3.0 Type A
16	6	R1,R7,R16,R22,R31,R37	0
17	3	R2,R18,R32	27 k
18	3	R3, R17, R33	1k
19	6	R4,R5,R19,R20,R34,R35	75
20	3	R6,R21,R36	3.6 k
21	3	R8,R24,R38	1.8 k
22	3	R9,R25,R39	39 k
23	0	R10,R23,R40	10k 1% DNI
24	3	R11,R30,R41	13 k
25	0	R12,R13,R26,R27,R42,R43	0 DNI
26	3	R14,R28,R44	22 k
27	0	R15,R29,R45	75k 1% DNI
28	6	R46,R47,R48,R49,R50,R51	4.7 k
29	6	SHNT1,SHNT2,SHNT3, SHNT4,SHNT5,SHNT6	QPC02SXGN-RC
30	3	SW1,SW2,SW3	Switch - Push Button
31	3	U1,U4,U7	TUSB216IRWB
32	3	U2,U5,U8	TPS2024D
33	3	U3,U6,U9	SN74AHC1G86DBV
34	3	U10,U11,U12	TPS70633

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