

# **TUSB216EVM User's Guide**

This is the user guide for the evaluation module (EVM) of the TUSB216. The purpose of this user guide is to facilitate an easy evaluation process of our TUSB216 USB High-Speed signal conditioner

This user's guide provides an overview of the TUSB216, which includes highlighting its key features, operating conditions, and how to setup this EVM for use in a system level evaluation.

The construction of the TUSB216 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. Schematic and layout information are available on TI.com.

### **Contents**

1	TUSB216EVM.....	2
2	TUSB216 EVM Kit Contents .....	2
3	Description of EVM Board .....	3
4	TUSB216EVM Jumper and Switch Configuration .....	3
5	Selecting Equalization / Boost Level for TUSB216.....	4
6	EVM Operation.....	4
7	TUSB216EVM Schematics .....	5
8	TUSB216EVM BOM.....	9

### **List of Figures**

1	TUSB216 Functional System Level Block Diagram.....	2
2	TUSB216EVM.....	3
3	TUSB216EVM Schematic .....	5

### **List of Tables**

1	EQ/Boost Setting Based on Cable Length .....	4
---	--	---

### **Trademarks**

All trademarks are the property of their respective owners.

## 1 TUSB216EVM

The TUSB216 is a USB High-Speed signal conditioner, designed to compensate for ISI signal loss in a transmission channel.

The TUSB216 design is agnostic to USB Low and Full-Speed signals and does not affect FS and LS signaling. High-Speed signals are compensated along with programmable DC gain to fine-tune device performance to optimize the High-Speed signals at the connector.

This EVM was designed to be used as a medium 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 interface to the EVM consists of three input connectors: a USB 3.1 Mini-B Receptacle, a USB 3.1 Type B Receptacle, and a USB 3.1 Type-A Plug. The interface to the EVM consists of three a 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 in a similar fashion in [Figure 1](#).

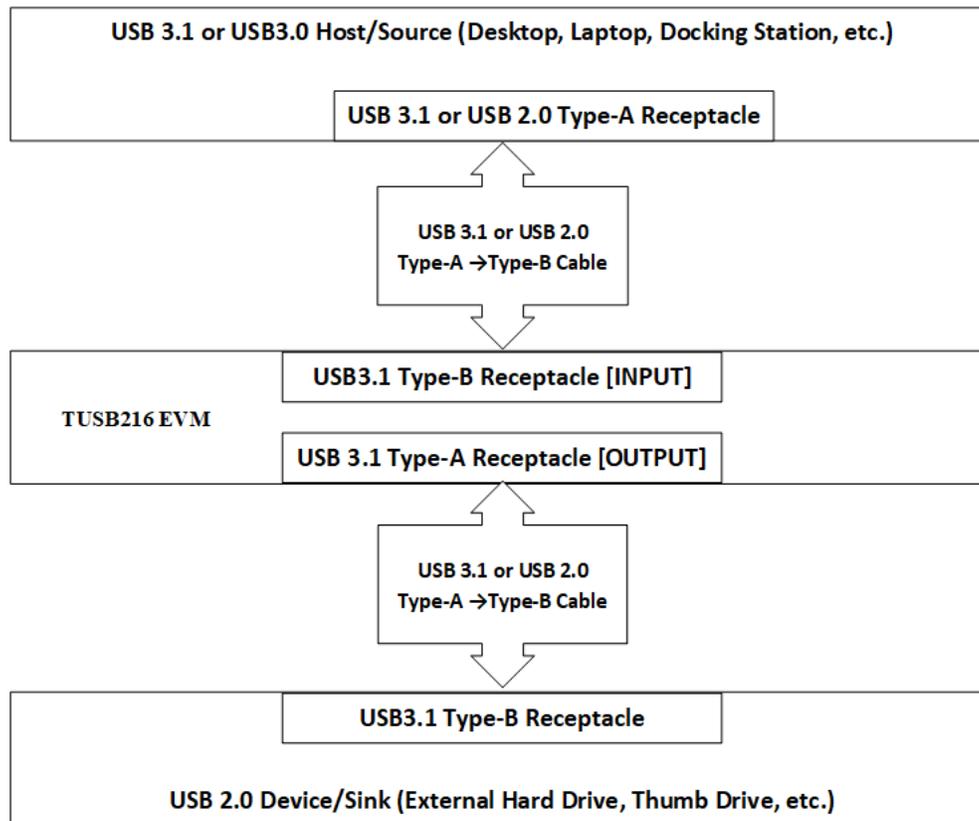


Figure 1. TUSB216 Functional System Level Block Diagram

## 2 TUSB216 EVM Kit Contents

This EVM kit contains the following items:

- TUSB216 EVM board
- This user's manual

### 3 Description of EVM Board

The TUSB216 EVM is designed to provide easy evaluation of the TUSB216 device. It 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](#) highlights the jumpers and switch installed on this EVM .

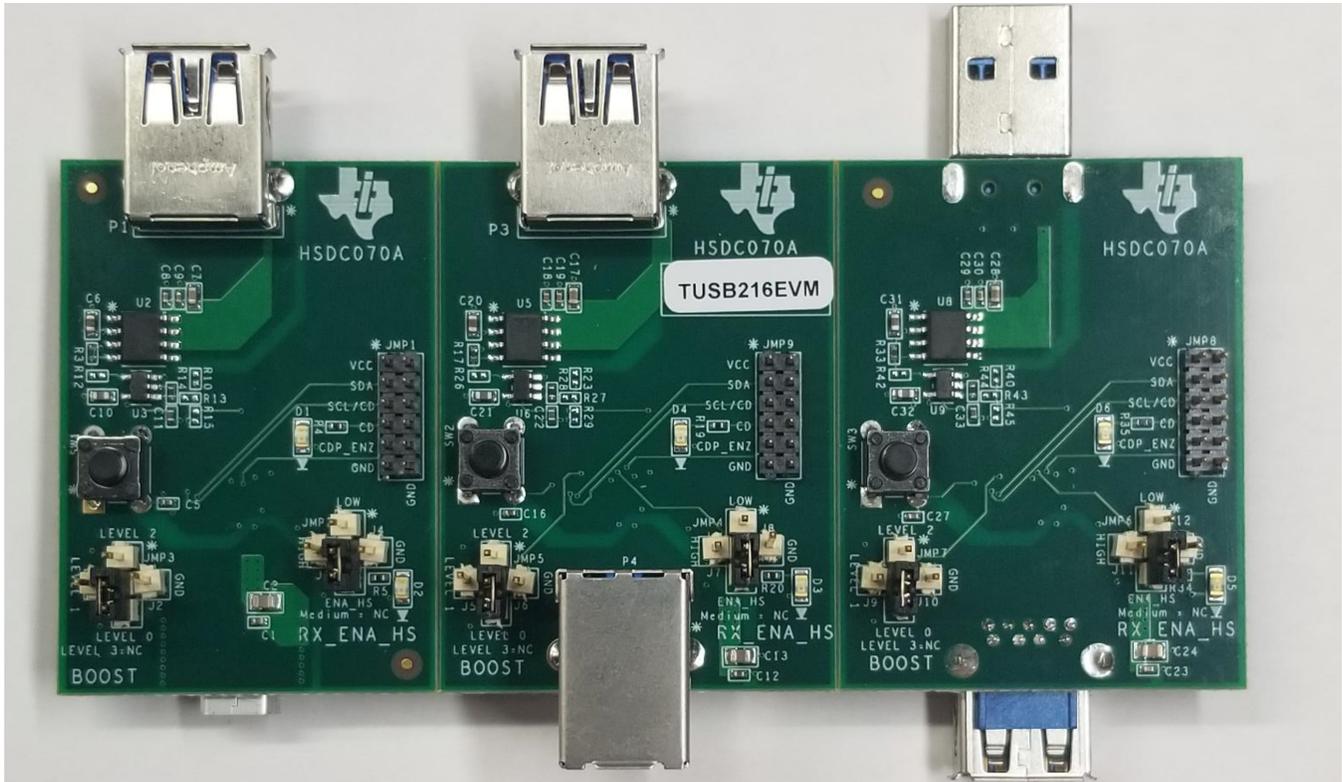


Figure 2. TUSB216EVM

### 4 TUSB216EVM Jumper and Switch Configuration

The TUSB216 has three switches and six set of jumpers to facilitate configuration changes. The "BOOST" and EX\_ENA\_HS jumpers are arranged in a plus shape to allow for easy configuration. Changing these switch and jumpers settings without a complete understanding of the result is not recommended. Configuration inputs are only read by the TUSB216 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 datasheet 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 TUSB216 device in RESET
- Release to de-assert RESET

"BOOST" Jumper Settings:

1. Bottom position sets TUSB216 BOOST Level 0
  2. Left position sets TUSB216 to BOOST Level 1
  3. Top position sets TUSB216 to BOOST Level 2
  4. No connect "BOOST" jumper sets TUSB216 to BOOST Level 3
- Right Position of BOOST Jumper is short to GND.

"RX\_ENA\_HS" Jumper Settings:

1. Top position sets low RX sensitivity.
2. No connect RX\_ENA\_HS jumper sets mid RX sensitivity
3. Left position sets high RX sensitivity
4. Bottom position must be set to use ENA\_HS LED indicator.

Right Position of RX\_ENA\_HS jumper is short to GND.

## 5 Selecting Equalization / Boost Level for TUSB216

The primary purpose of the TUSB216 is to restore the signal integrity of a USB High-Speed channel up to the USB connector. The platform goal is to pass the USB Near-End or Far-End Eye Mask with the TUSB216 in the best location.

A typical use case is to place the TUSB216 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 EQ and Boost recommendations based on cable length (28 AWG USB Cable).

**Table 1. EQ/Boost Setting Based on Cable Length**

CABLE LENGTH	TUSB216 BOOST	TUSB216 RX SEN
0m - 1m	EQ1	MID
1m – 2m	EQ2	MID
2m – 3m	EQ2	HIGH
3m – 5m	EQ3	HIGH

## 6 EVM Operation

To install the EVM, perform the following steps:

1. Attach a USB2 or USB3 cable from a Host PC Type A connector to the Type B connector (P4) of the TUSB216 EVM.
2. Attach a USB device either via cable or directly plugged into the Type A receptacle connector (P3) on the TUSB216 EVM.

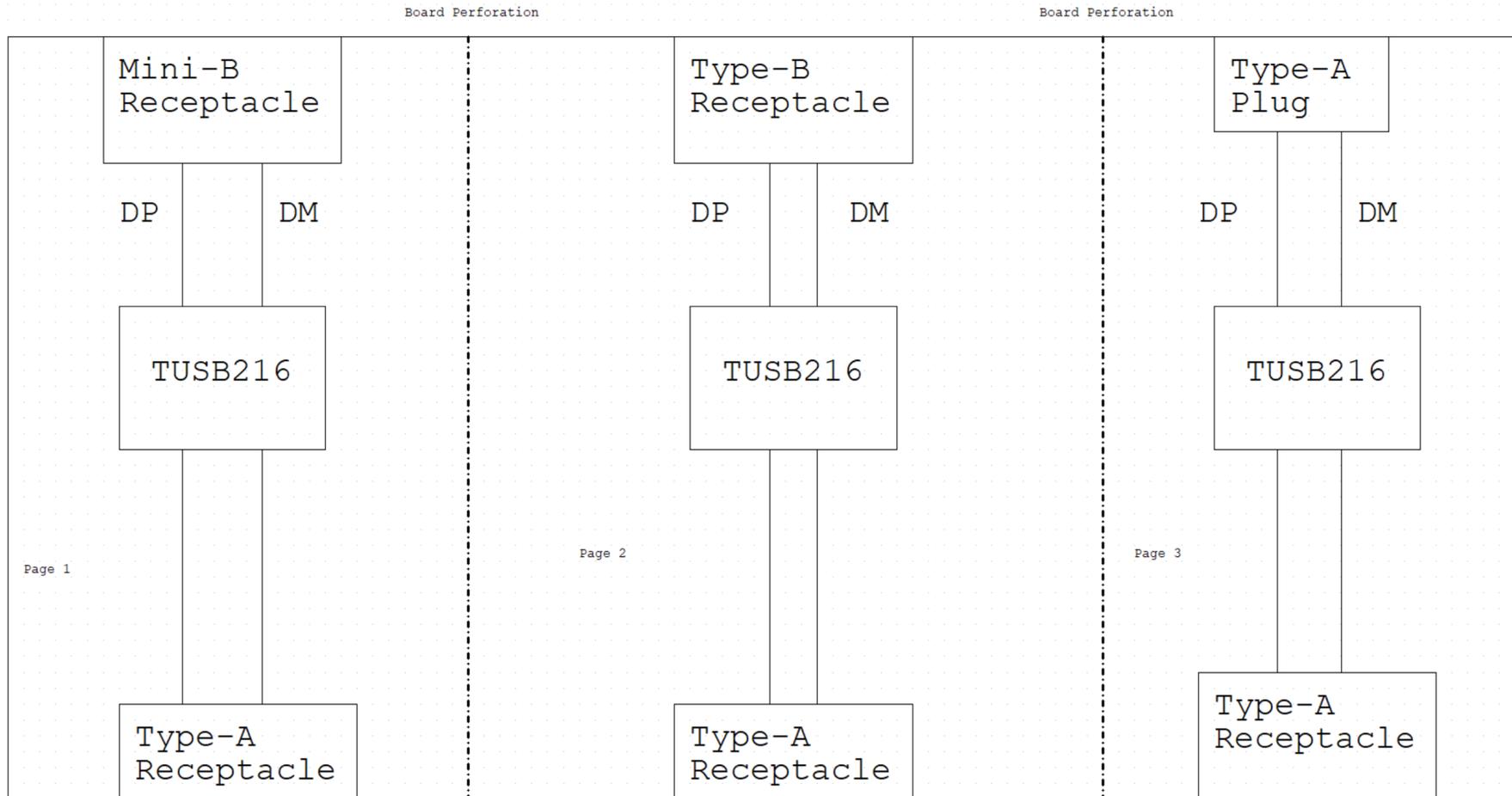
---

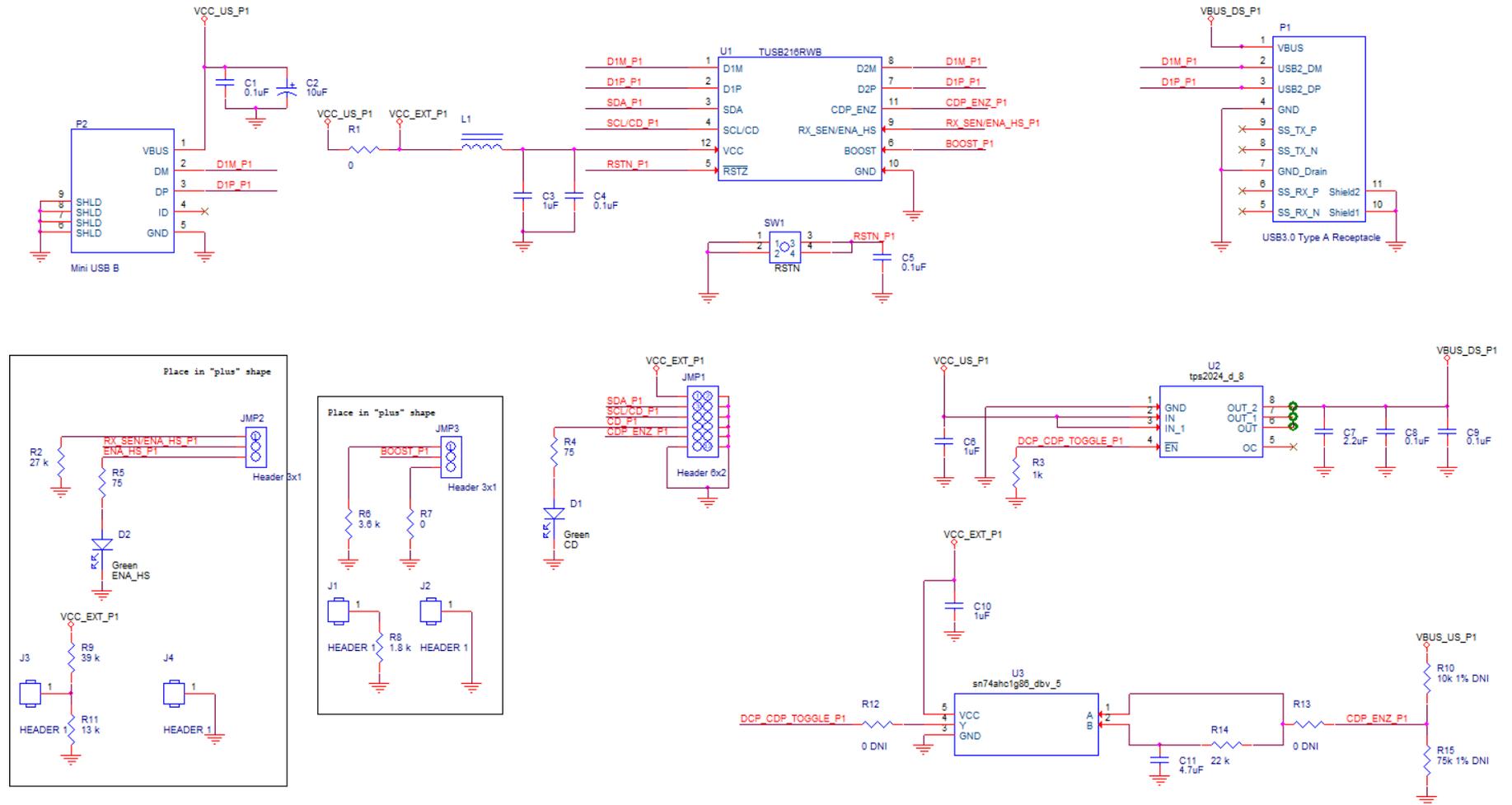
**NOTE:** TUSB216EVM does not include I2C pull-up resistors. If I2C access is desired external pull-up resistor to 3.3V are required.

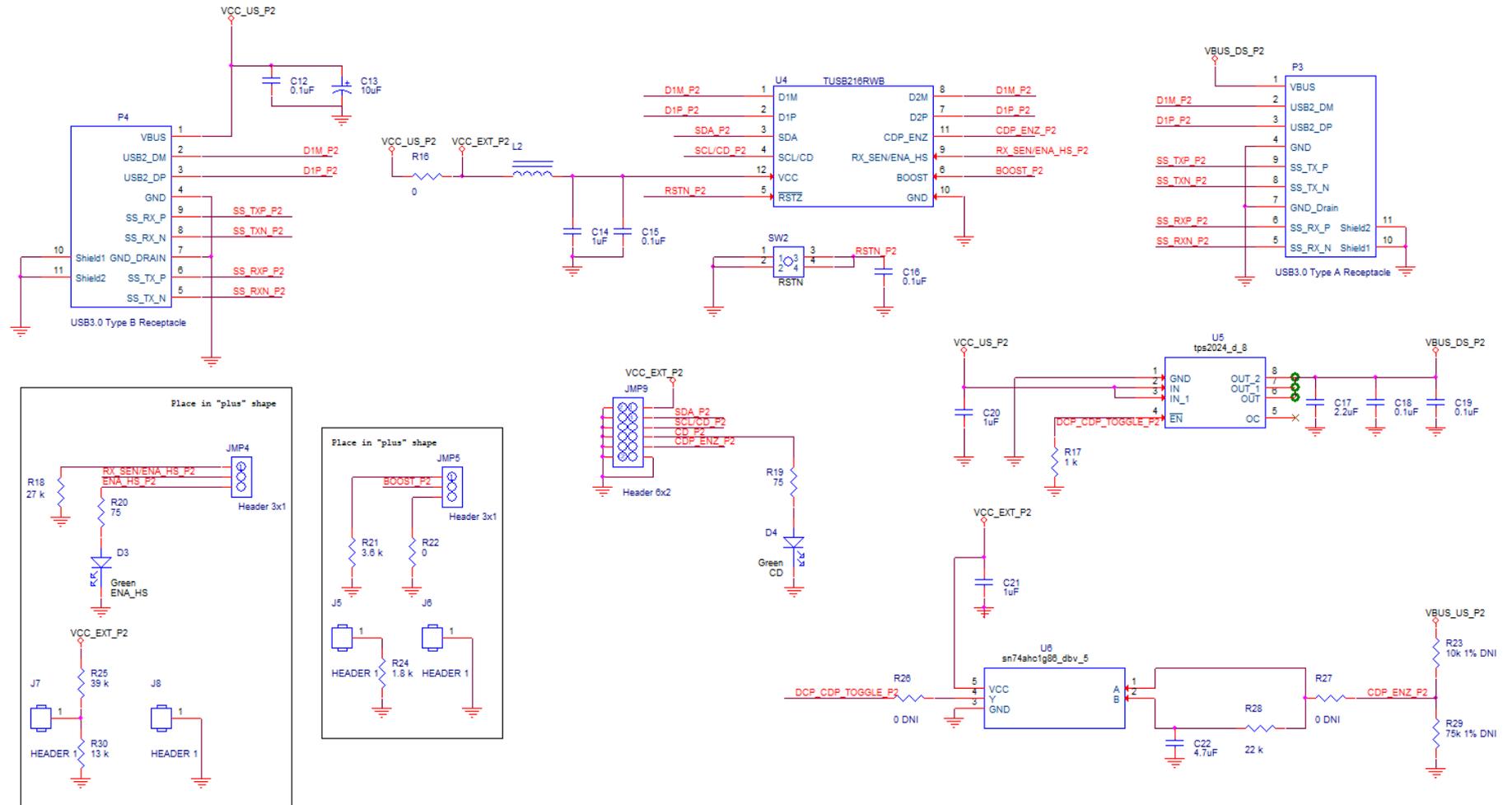
---

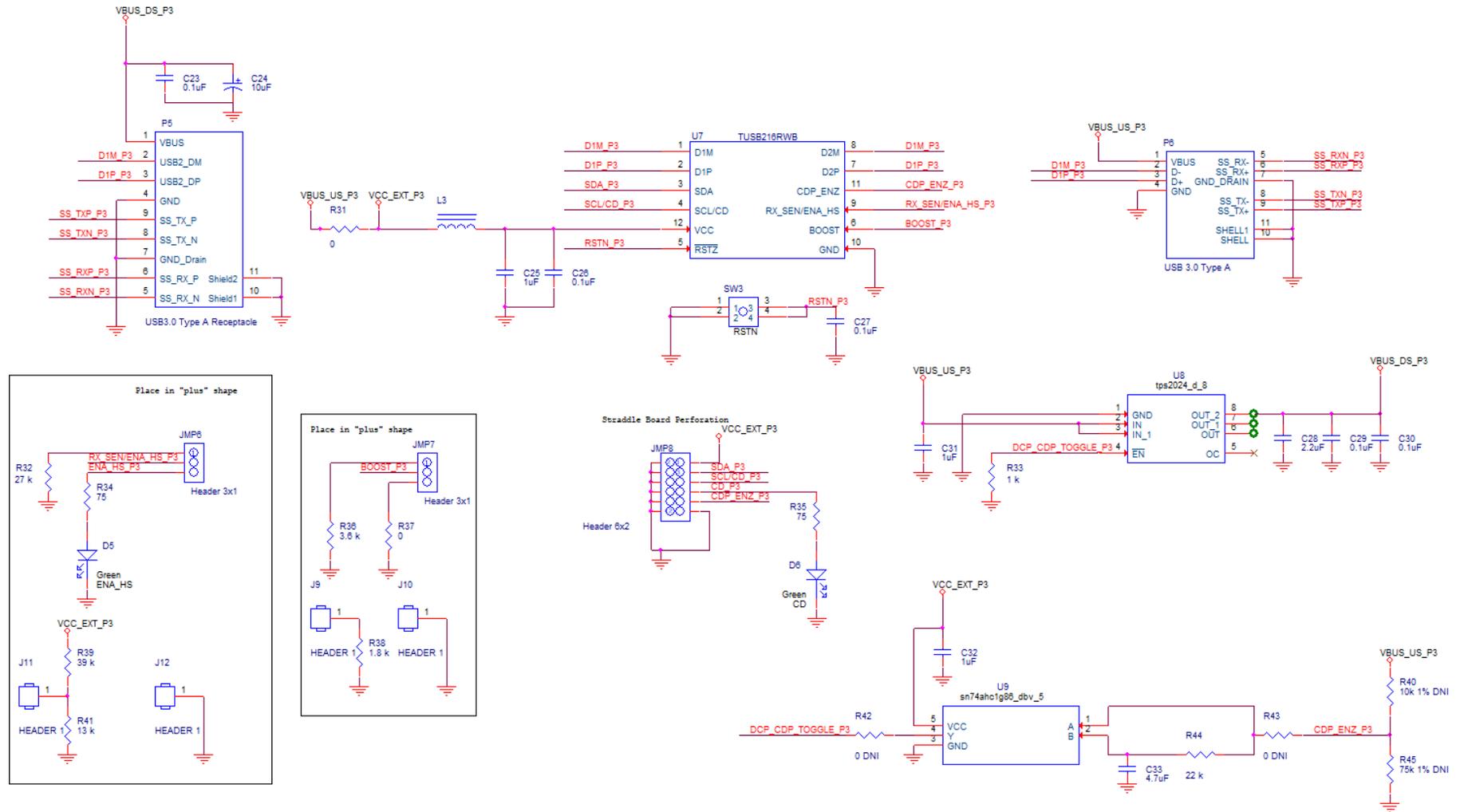
**7 TUSB216EVM Schematics**

**Figure 3. TUSB216EVM Schematic**









## 8 TUSB216EVM 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	9	C3,C6,C10,C14,C20,C21, C25,C31,C32	1uF
4	3	C7,C17,C28	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	JMP2,JMP3,JMP4,JMP5, JMP6,JMP7	Header 3x1
9	12	J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12	HEADER 1
10	1	LBL1	THT-14-423-10
11	3	L1,L2,L3	100ohms
12	1	PCB1	HSDC070
13	3	P1,P3,P5	USB3.0 Type A Receptacle
14	1	P2	Mini USB B
15	1	P4	USB3.0 Type B Receptacle
16	1	P6	USB 3.0 Type A
17	6	R1,R7,R16,R22,R31,R37	0
18	3	R2,R18,R32	27 k
19	1	R3	1k
20	6	R4,R5,R19,R20,R34,R35	75
21	3	R6,R21,R36	3.6 k
22	3	R8,R24,R38	1.8 k
23	3	R9,R25,R39	39 k
24	3	R10,R23,R40	10k 1% DNI
25	3	R11,R30,R41	13 k
26	6	R12,R13,R26,R27,R42,R43	0 DNI
27	3	R14,R28,R44	22 k
28	3	R15,R29,R45	75k 1% DNI
29	2	R17,R33	1 k
30	6	SHNT1,SHNT2,SHNT3, SHNT4,SHNT5,SHNT6	QPC02SXGN-RC
31	3	SW1,SW2,SW3	Switch - Push Button
32	3	U1,U4,U7	TUSB216RWB
33	3	U2,U5,U8	TPS2024D
34	3	U3,U6,U9	SN74AHC1G86DBV

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2022, Texas Instruments Incorporated