TUSB215 Evaluation Module

This user's guide is for the evaluation module (EVM) of the TUSB215. The purpose of this user's guide is to facilitate an easy evaluation process of the TUSB215 USB high-speed signal conditioner from TI.

The contents of this user's guide are meant to provide an overview of the TUSB215 device, which includes highlighting its key features, operating conditions, and how to set up this EVM for use in system-level evaluation.

The construction of the TUSB215EVM also serves as a reference design that can easily be modified for any intended application. Target applications include the following:

- Cell phones
- Desktop or notebook computers
- Docking stations
- Televisions
- Active cables

Schematic and board layout information is also included at the end of this manual.

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Trademarks

1 Introduction

The TUSB215 device is a USB high-speed signal conditioner, designed to compensate for ISI signal loss in a transmission channel.

The design of the TUSB215 device 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 interface to the EVM consists of a USB 3.1 Type A Receptacle and a USB 3.1 Type B Receptacle. Therefore, to connect the EVM to your system setup, you will likely need two USB 3.1 Standard Type A → B cables. Your test setup should look similar to Figure 1

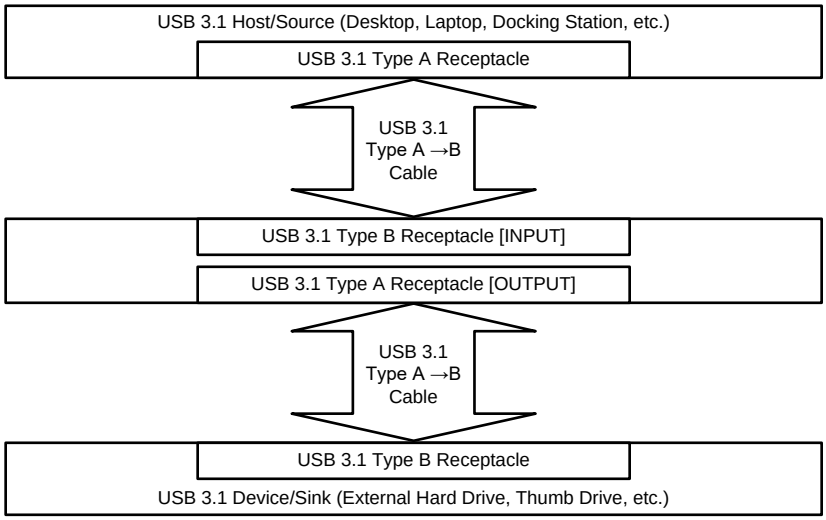

Figure 1. TUSB215 Functional System Level Block Diagram

1.1 TUSB215EVM Kit Contents

This EVM kit contains the following items:

- TUSB215EVM board
- TUSB215EVM user's guide

1.1.1 Description of EVM Board

The TUSB215EVM is designed to provide easy evaluation of the TUSB215 device. The TUSB215EVM 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, and Table 1 lists their functionality and configuration.

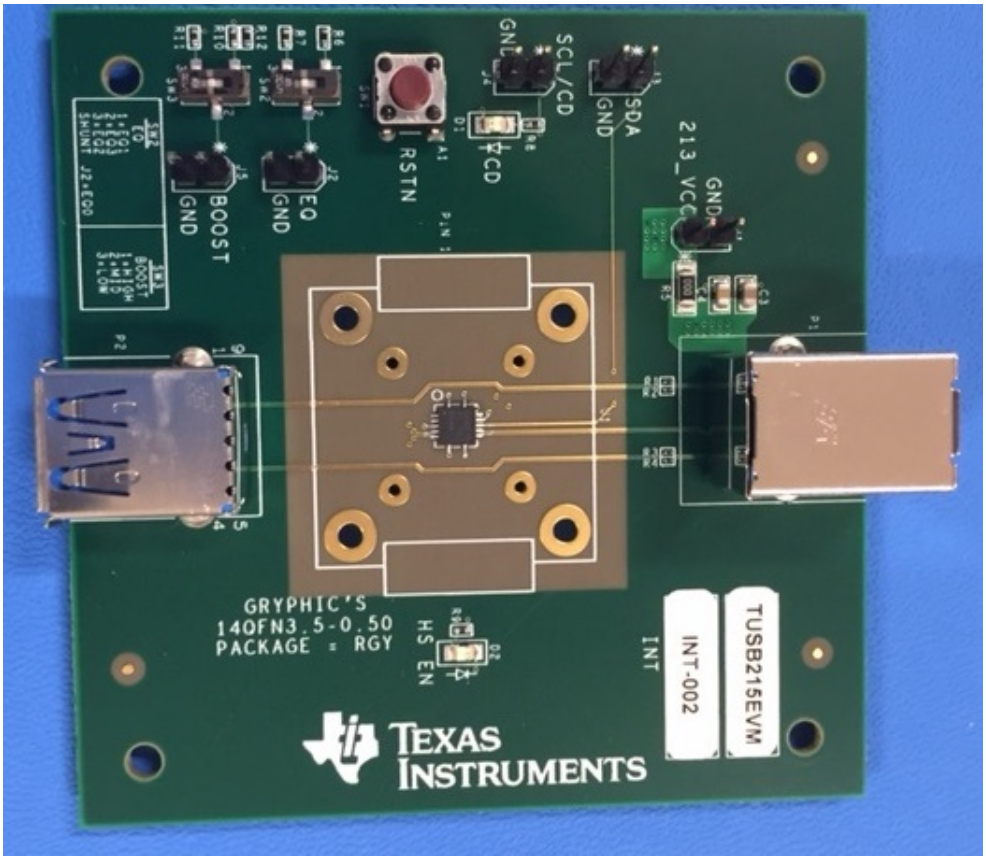

Figure 2. TUSB215EVM Board

2 Test Setup and Results

2.1 Configuration Switches

The TUSB215 device has three switches to facilitate configuration changes. TI does not recommend changing these switch settings without a complete understanding of the result. Configuration inputs are read by the TUSB215 device only during power on reset or after deasserting the RSTN pin. Changing these switch settings while the EVM is powered on has no effect. See the device data sheet for detailed pin descriptions and functionality, along with the EVM schematic for additional information.

The switch definitions are as follows:

- SW1 RSTN Pushbutton Switch:
  1. Push the button to place the TUSB215 device in RESET.
  2. Release the button to deassert RESET.
- SW2 Equalization (EQ):
  - 1: Sets TUSB215 to EQ1 level
  - 2: Sets TUSB215 to EQ3 level (maximum)
  - 3– Sets TUSB215 to EQ2 level
  - Shunt across J3 sets TUSB215 to EQ0 level (minimum)
- SW3 Boost:
  - 1: Pull-up (high boost)
  - 2: NC (mid boost)
  - 3: GND (low boost)

Table 1. TUSB215 EVM Jumper Descriptions

Jumper	Functionality and Configuration	
J1	213_VCC	1 = TUSB215 V_{CC}
		2 = GND
J2	EQ	1 = EQ
		2 = GND
J3	SDA	1 = SDA
		2 = GND
J4	SCL/CD	1 = SCL/CD
		2 = GND
J5	Boost/ENA_HS	1 = Boost/ENA_HS
		2 = GND

2.2 Selecting Equalization and Boost Level for TUSB215

The primary purpose of the TUSB215 device 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 TUSB215 in the best location.

A typical use case is to place the TUSB215 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.

Table 2 lists typical EQ and boost recommendations based on cable length (28AWG USB cable).

Table 2. EQ/Boost Setting Based on Cable Length

Cable Length	TUSB215 EQ	TUSB215 Boost
0 m - 1 m	EQ1	Low
1 m – 2 m	EQ2	Mid
2 m – 3 m	EQ2	Mid
3 m – 5 m	EQ3	High

2.3 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 (P1) of the TUSB215EVM.
2. Attach a USB device, either using cable or directly plugged into the Type A receptacle connector (P2) on the TUSB215EVM.

2.4 USB 2.0 High-Speed Eye Diagram Testing

When performing USB 2.0 compliance eye-diagram testing with a host or the downstream port of a HUB with the TUSB215, a scenario can occur where the TUSB215 signal boosting is not enabled. This can occur when the test packets are being transmitted before the USB test fixture is connected to the TUSB215. This scenario does not occur during device compliance eye-diagram testing, because the USB test fixture must always be connected while testing a device. This scenario only occurs during the compliance testing with the USB test fixtures and does not affect normal operation with a host, HUB, or device.

Closely following the test procedures provided by the scope equipment vendor and USB-If (links provided) helps avoid this scenario. Specifically, the USB HS test fixture should be connected prior to executing the test packets using the HSETT test tool. Alternatively, if the test fixture is hot-plugged to the host or downstream HUB port after the command to send test packets has already been entered using the HSETT tool, it is necessary to select TEST PACKETS and click “Execute” again after the test fixture is connected to ensure the TUSB215 detects a compliance test set-up.

The following generic procedure can be used to take the USB 2.0 compliance eye-diagrams (see the Test Procedure documents referenced for details):

1. Connect the USB test fixture to the host, downstream HUB (+ TUSB215) port, or device under test.
2. Configure the host, HUB, or device using xHSETT or HSETT to send test packets using the procedure detailed in the HSETT documentation.
3. Start sending test packets.
4. Capture the test packet on the scope to display the eye (running compliance software on the scope).

USB 2.0 compliance eye-diagrams can be taken on host, device and HUB platform ports configured with the TUSB215 using the EHCI and xHCI High-Speed Electrical Test Tool application provided by the USB Implementers Forum.

Details for setting up and running the application are detailed in the Test Tool Setup Instruction document provided by the USB-IF.

xHCI (USB 3.0 Host) – XHSETT test application

EHCI (USB 2.0 Host) – EHSETT test application

Vendor-Specific Test Procedures

3 PCB Construction

This section discusses the construction of the EVM boards. It includes the board schematics and layout files to show how the board was built.

3.1 TUSB215EVM Board Schematics

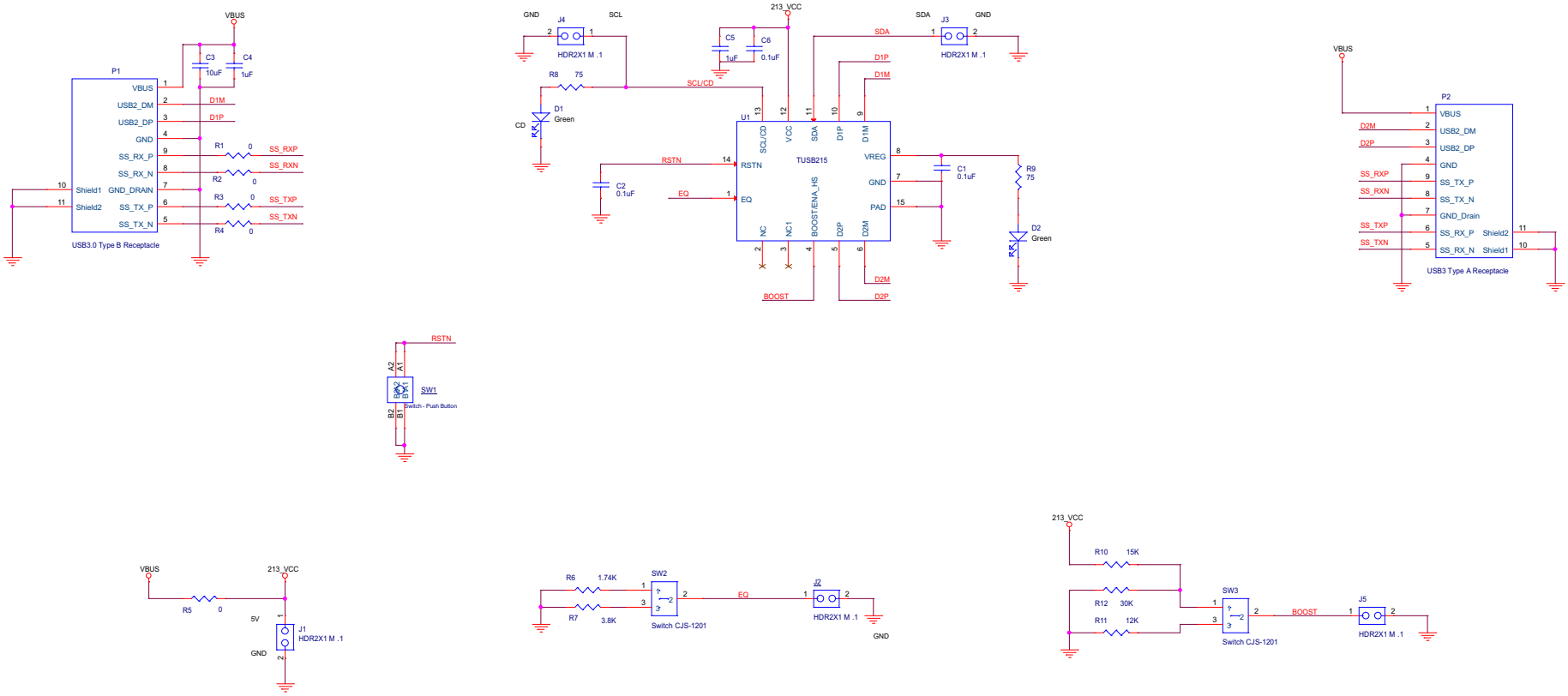

Figure 3. TUSB215EVM Schematic

3.2 TUSB215EVM Material Listing

Table 3 list the complete BOM for the TUSB215EVM.

Table 3. Bill of Materials

Item	Quantity	Reference	Part
1	3	C1, C2, C6	0.1 µF
2	1	C3	10 µF
3	1	C4	1 µF
4	1	C5	1 µF
5	2	D1, D2	LED
6	5	J1, J2, J3, J4, J5	HDR 2 × 1 M .1
7	1	P1	USB3.0 Type B receptacle
8	1	P2	USB3 Type A receptacle
9	4	R1, R2, R3, R4	0
10	1	R5	0
11	1	R6	1.7K
12	1	R7	3.8K
13	2	R8, R9	75
14	1	R10	15K
15	1	R11	12K
16	1	R12	30K
17	1	SW1	Switch - push button
18	2	SW2, SW3	Switch CJS-1201
19	1	U1	TUSB215

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- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
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