TUSB212 Evaluation Module

This is the user guide for the evaluation module (EVM) of the TUSB212. The purpose of this user guide is to facilitate an easy evaluation process of our TUSB212 USB High-Speed signal conditioner.

The contents of this user's guide are meant to provide an overview of the TUSB212, 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 TUSB212 EVM also serves as a reference design that can be 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 is included at the end of this manual.

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1 Introduction

The TUSB212 is a USB high-speed (HS) signal conditioner, designed to compensate for ISI signal loss in a transmission channel.

The TUSB212 design is agnostic to USB low and full-speed signals and does not affect full-speed (FS) and low-speed (LS) signaling. High-speed signals are compensated along with programmable DC gain to fine-tune device performance to optimize the HS 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, in order to connect the EVM to your system set up, you will most likely need 2 USB 3.1 Standard Type A → B cables. Your test setup should look similar to Figure 1:

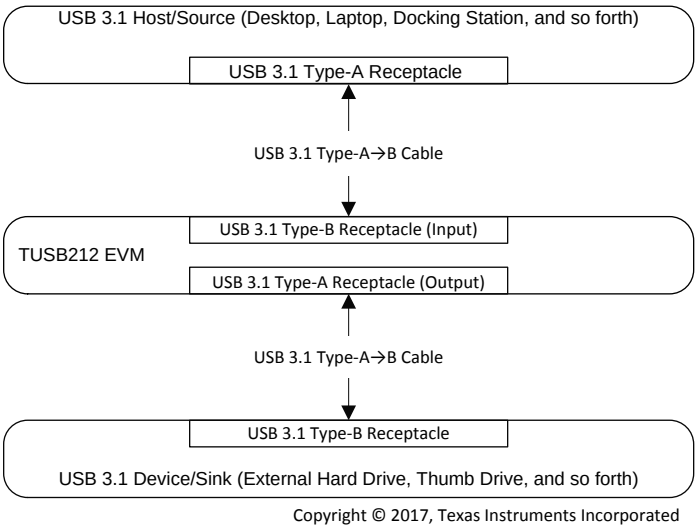

Figure 1. Functional System Level Block Diagram

2 TUSB212 EVM Configuration

2.1 TUSB212 EVM Kit Contents

This EVM kit contains the following items:

- TUSB212 EVM board
- This user's manual

2.2 Description of EVM Board

The TUSB212 EVM is designed to provide easy evaluation of the 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 and Table 1 highlights their functionality and configuration.

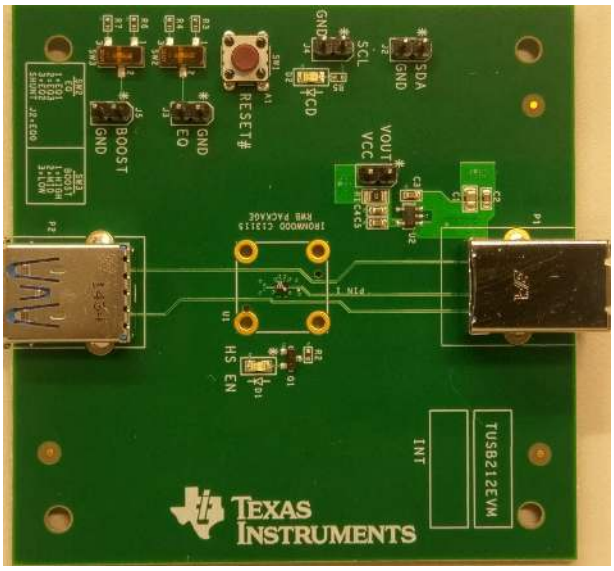

Figure 2. TUSB212 EVM

2.3 Configuration Switches

The TUSB212 has three switches to facilitate configuration changes. Changing these switch settings without a complete understanding of the result is not recommended. Configuration inputs are only read by the TUSB212 during power on reset or after de-asserting the RSTN pin, changing these switch settings while the EVM is powered on will have no effect. Please 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:

- SW1 RSTN Pushbutton Switch:
  - Pushbutton to place TUSB212 device in RESET
  - Release to de-assert RESET

- SW2 EQ:
  1. Sets TUSB212 to EQ1 Level
  2. Sets TUSB212 to EQ3 Level (Maximum)
  3. Sets TUSB212 to EQ2 Level

  Shunt across J3 Sets TUSB212 to EQ0 Level (Minimum)
- SW3 Boost:
  1. Pull-Up (High Boost)
  2. NC (Mid Boost)
  3. GND (Low Boost)

Table 1. TUSB212 EVM Jumper Descriptions

Jumper	Functionality and Configuration
J1	213_VCC 1 = 3.3-V regulator output 2 = TUSB212 VCC
J2	SDA 1 = SDA 2 = GND
J3	EQ 1 = GND 2 = EQ
J4	SCL and CD 1 = SCL and CD 2 = GND
J5	Boost and ENA_HS 1 = Boost and ENA_HS 2 = GND

2.4 Selecting Equalization and Boost Level for TUSB212

The primary purpose of the TUSB212 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 TUSB212 in the best location.

A typical use case is to place the TUSB212 close to the USB connector on a host platform in order 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 2. EQ and Boost Setting Based on Cable Length

Cable Length	TUSB212 EQ	TUSB212 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

3 EVM Operation

Install the EVM using 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 TUSB212 EVM.
2. Attach a USB device either via cable or directly plugged into the Type A receptacle connector (P2) on the TUSB212 EVM.

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 TUSB212, a scenario can occur where the TUSB212 signal boosting is not enabled. This can occur when the test packets are being transmitted before the USB test fixture is connected to the TUSB212. This scenario does not occur during device compliance eye-diagram testing as 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 in Section 4.1) will 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 TUSB212 detects a compliance test set-up.

The following generic procedure can be used to take the USB 2.0 compliance eye-diagrams (refer to Section 4.1 for details):

1. Connect the USB test fixture to the host, downstream HUB (+ TUSB212) port or device under test.
2. Configure the host, or 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 test packet on scope to display 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 TUSB212 using the *EHCI and xHCI High-speed Electrical Test Tool Setup Instruction* document provided by the *USB Implementers Forum*.

4.1 Test Procedure Document Links

Details for setting up and running the application are contained in the *EHCI and xHCI High-speed Electrical Test Tool Setup Instruction* document provided by the USB-IF at the following link:
http://www.usb.org/developers/tools/HSETT_Instruction_0_4_1.pdf

xHCI (USB 3.0 Host) – XHSETT test application:
http://www.usb.org/developers/tools/

EHCI (USB 2.0 Host) – EHSETT test application:
http://www.usb.org/developers/tools/usb20_tools/

Vendor-Specific Test Procedures:
http://www.usb.org/developers/compliance/electrical_tests/

5 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.

5.1 TUSB212 EVM Board Schematics

Figure 3 illustrates the TUSB212 EVM schematics.

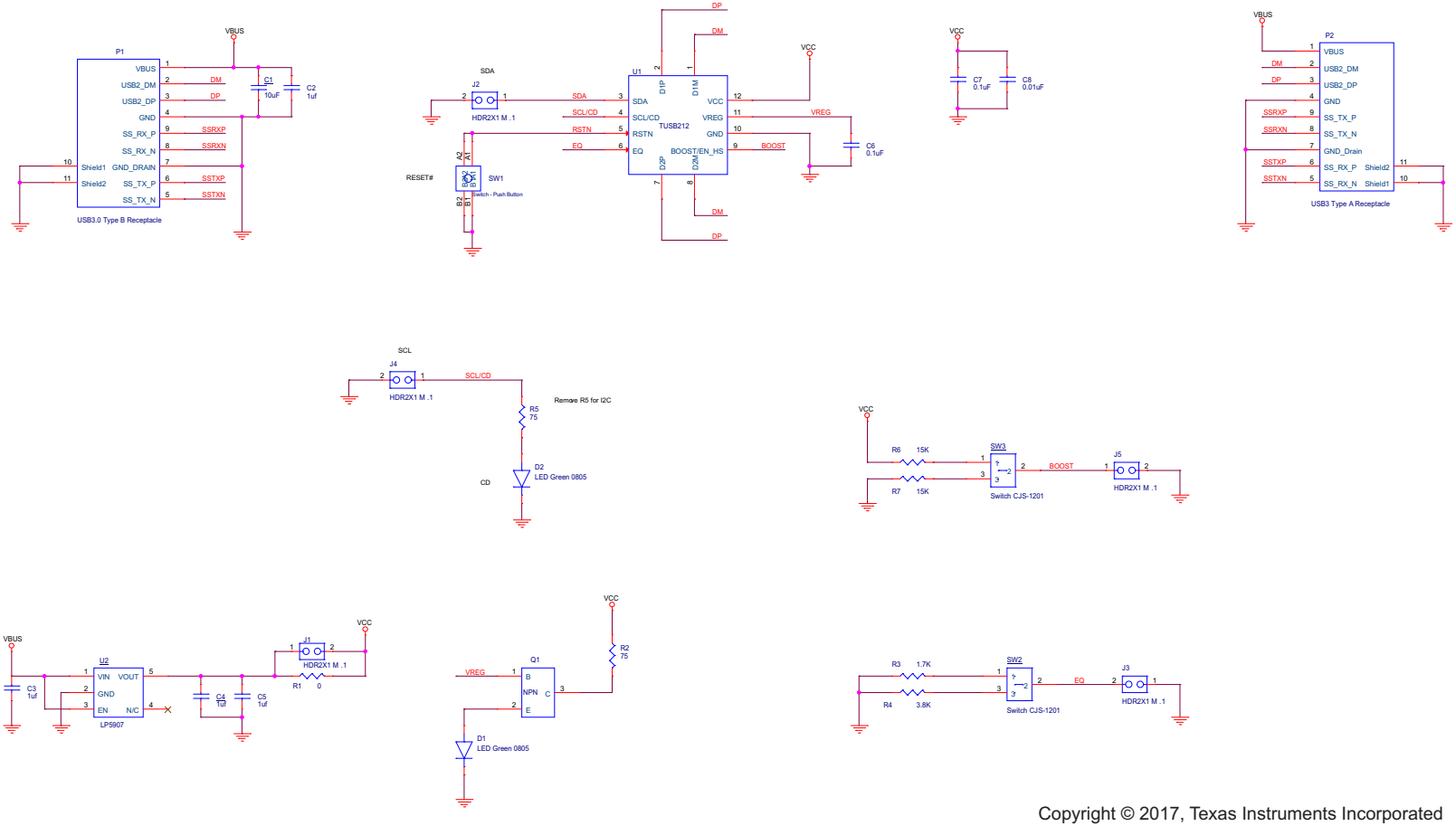

Figure 3. TUSB212 EVM Schematic

5.2 TUSB212 EVM Material Listing

Table 3 lists the complete BOM for the TUSB212 EVM.

Table 3. TUSB212 EVM Bill of Materials

Item	Quantity	Reference	Part
1	1	C1	10uF
2	4	C2,C3,C4,C5	1uf
3	2	C6,C7	0.1uF
4	1	C8	0.01uF
5	2	D1,D2	LED Green 0805
6	5	J1,J2,J3,J4,J5	HDR2X1 M .1
7	1	P1	USB3.0 Type B Receptacle
8	1	P2	USB3 Type A Receptacle
9	1	Q1	NPN
10	1	R1	0
11	2	R2,R5	75
12	1	R3	1.7K
13	1	R4	3.8K
14	2	R6,R7	15K
15	2	SW2,SW3	Switch CJS-1201
16	1	SW1	Switch - Push Button
17	1	U1	TUSB212
18	1	U2	LP5907

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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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http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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