User's Guide

TUSB2E11 Evaluation Module User's Guide

ABSTRACT

This is the user's guide for the evaluation module (EVM) of the TUSB2E11 single channel eUSB2 to USB 2.0 repeater. The purpose of the user's guide is to facilitate easy set up for validation and development of the TUSB2E11 device. An overview of the TUSB2E11EVM is provided in this user's guide, which includes highlighting its key features, operating conditions, and how to adjust the EVM for use in various systems.

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Trademarks

1 Introduction

The TUSB2E11EVM is designed for the TUSB2E11 device, which is an USB 2.0 compliant eUSB2 to USB 2.0 repeater supporting both device and host modes, as well as dual role applications. The TUSB2E11 repeater supports USB 2.0 low speed (LS) and full speed (FS) signals and high speed (HS) signals.

2 EVM Quick Setup Instructions

To start using the TUSB2E11EVM, the EVM requires power, a USB connection, and an eUSB2 connection:

- The TUSB2E211EVM incorporates a Micro-AB USB 2.0 port that can be used to connect the USB signals of the repeater to a standard USB host, hub, or devices. 5M cable lengths are supported.
- For eUSB2, the EVM has a pair of SMP connectors for connecting eUSB2 signals to eUSB2 SoCs or test equipment.
- Depending on the switch settings, the EVM can be powered from an external 5 V wall supply, bench power supplies, or even through the USB connector.
- The TUSB2E11EVM also incorporates an external reset push button in addition to a regular power reset circuit.

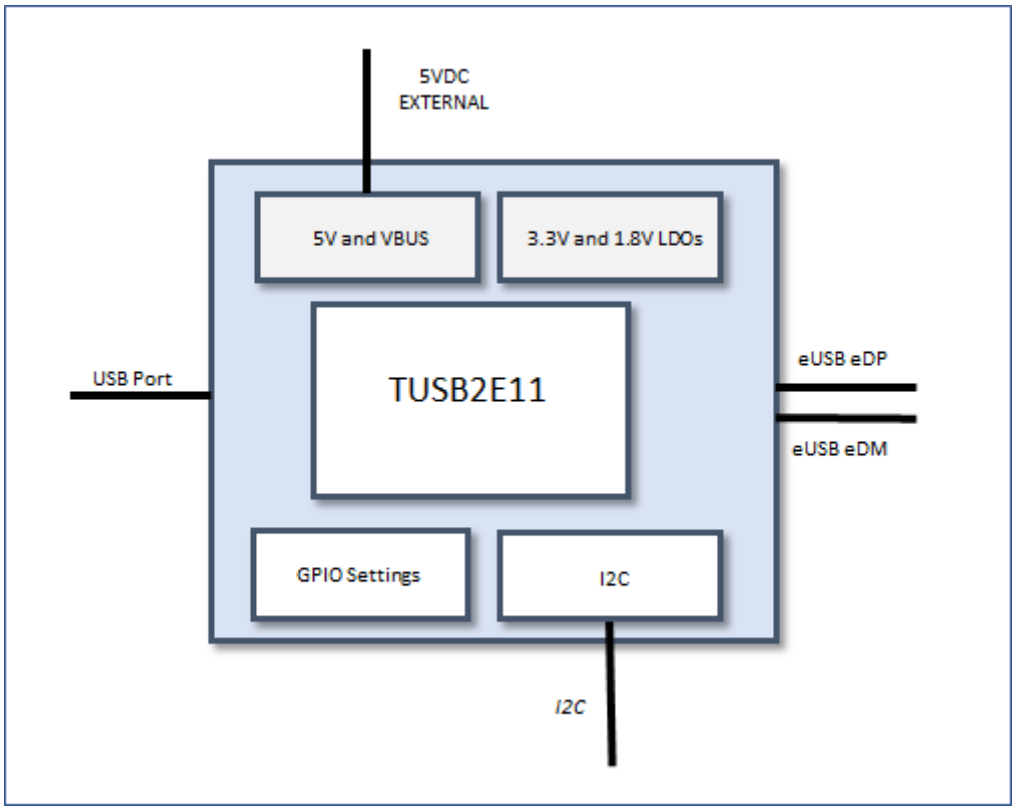

Figure 2-1. TUSB2E11EVM Block Diagram

3 EVM Configuration Using Jumpers

Table 3-1 lists the headers provided for configuration of the TUSB2E11 by default.

Table 3-1. TUSB2E11 Configuration Pins

Reference Designator	JMP Control	Configuration
J1 [1, 2]	VBUS	Enable USB VBUS
J2 [1, 2] and J7 [1, 2]	SDA. SCL	Enable I2C Mode
J3 [1, 2]	UART	Enable repeater mode
J12 – install	5 V to VBUS	Enable 5 V to VBUS
J13, J14 – install	3.3 V	Enable 3.3 V LDO
J15, J16 – install	1.8 V	Enable 1.8 V LDOs

3.1 Default EVM Configuration

When the TUSB2E11EVM is shipped, it is configured to be either wall powered from a 5 V source connected to J11 or bus powered through the USB connector, J9. The 5 V wall power supply from CUI, Digikey# 102-3584-N, or similar can be used. Please note that if a 5 V supply is connected to J11, VBUS will be supplied on the J9 USB connector unless the jumper on J1[1, 2] is removed.

I2C mode is enabled by default on the EVM. The pullups on SDA and SCL are installed through the jumpers on J2 [1,2] and J7 [1,2]. A 1.8 V I2C master can be connected to the SDA, SCL, and GND connections at J6 and access the TUSB2E11 at address 3Eh. Also, the TUSB2E11EVM is set to repeater mode by J3 [1, 2].

All power jumpers are installed by default (J13, J14, J15, and J16). These can be removed to externally supply power or take current measurements.

3.2 EVM Power Configuration

3.2.1 Power Options

As noted earlier, the TUSB2E11EVM can configured to be either wall powered from a 5 V source connected to J11 or bus powered through the USB connector, J9. The 5 V wall power supply from CUI, Digikey# 102-3584-N, or similar can be used.

3.2.2 Host Mode

When the TUSB2E11EVM is connected to an eUSB2 SoC that is in host mode, it should supply 5 V VBUS on its USB connector. A 5 V source should be connected to J11 or through a bench supply to J12. The J1 jumper should be installed on pins 1 and 2 to route the 5 V VBUS to the USB connector.

3.2.3 Device Mode – Self Powered

When the TUSB2E11EVM is connected to an eUSB2 SoC that is in device mode, it should not supply 5 V VBUS on its USB connector. The TUSB2E11EVM can be powered from the USB connector or it can be self powered. If it is self powered, the jumper on J12 should be removed. A 5 V source should be connected to J11 or through a bench supply to pin 2 of J12. The J1 jumper should be removed from pins 1 and 2.

3.2.4 Device Mode – Bus Powered

When the TUSB2E11EVM is connected to an eUSB2 SoC that is in device mode, it should not supply 5 V VBUS on its USB connector. The TUSB2E11EVM can be powered from the USB connector or it can be self powered. If it is bus powered, the jumper on J12 should be installed and the J1 jumper should be installed on pins 1 and 2 to route the 5 V from the USB connector to the EVM.

3.3 TUSB2E11 Functional Modes

3.3.1 I2C Mode

When SDA and SCL are pulled high at reset, the TUSB2E11 is in I2C Mode, where the TUSB2E11 typically acts as an eUSB2 to USB repeater. The repeater can be further configured using the 1.8 V I2C interface accessible at J6. I2C configuration, however, is not required for the repeater to operate. Please note that GPIO0 must be pulled high for normal I2C repeater mode operation.

3.3.2 GPIO Mode

The TUSB2E11 repeater can also be configured by strap settings instead of I2C. When SCL is low at reset, the TUSB2E11 will use the strap settings on the GPIOs to determine the repeater configuration. Please see the TUSB2E11 data sheet for more information.

3.3.3 UART Mode

In UART mode, the TUSB2E11 acts a UART to UART repeater to support in-system debug. UART mode can be entered by pulling the GPIO0 low when the TUSB2E11 is in I2C mode or by setting SCL high and SDA low at reset, and setting the GPIO0 low. If SCL is high and SDA is low at reset, and GPIO0 is pulled high, then the TUSB2E11 will be in a non-functional state.

4 TUSB2E11EVM Internal Lab Use Only

There are several features of the TUSB2E11EVM that are reserved for internal lab use only.

1. Under normal use conditions, the resistor on R18 should not be installed. In addition, adding the resistors and capacitor, R12, R14, and C3 is not recommended for end users.

2. 1.2 V IO operation is not enabled on the default TUSB2E11EVM.

3. The VBUS control functions implemented by U5 and U6 are not currently supported.

5 Layout Notes

The TUSB2E11EVM was laid out with the following considerations:

- USB signals impedance controlled 90 Ω differential ± 5%
- eUSB signals impedance controlled 45 Ω signal ended ± 5%
- USB 2.0 and eUSB signal pairs routed with matched trace lengths and minimal vias.
- All other signals to be impedance controlled 45 Ω ± 10% or 50 Ω ± 10%

General information about the PCB is provided below:

- Finished board thickness: .062 ± 10% – necessary for socket
- Copper weight: 1 oz start internal, 1/2 oz start external
- Laminate material: FR4 Polyclad 370 or equivalent

A four layer stack-up was used for the TUSB2E11EVM.

Drill notes on board stack up to account for the small BGA breakout:

1. L1 – L2 (laser drill) used for small pitch BGA break out
2. L2 – L3 (mechanical drill) completes the small pitch BGA breakout
3. L3 – L4 (laser drill) for VPP

6 Schematic

Main page schematic of the TUSB2E11EVM

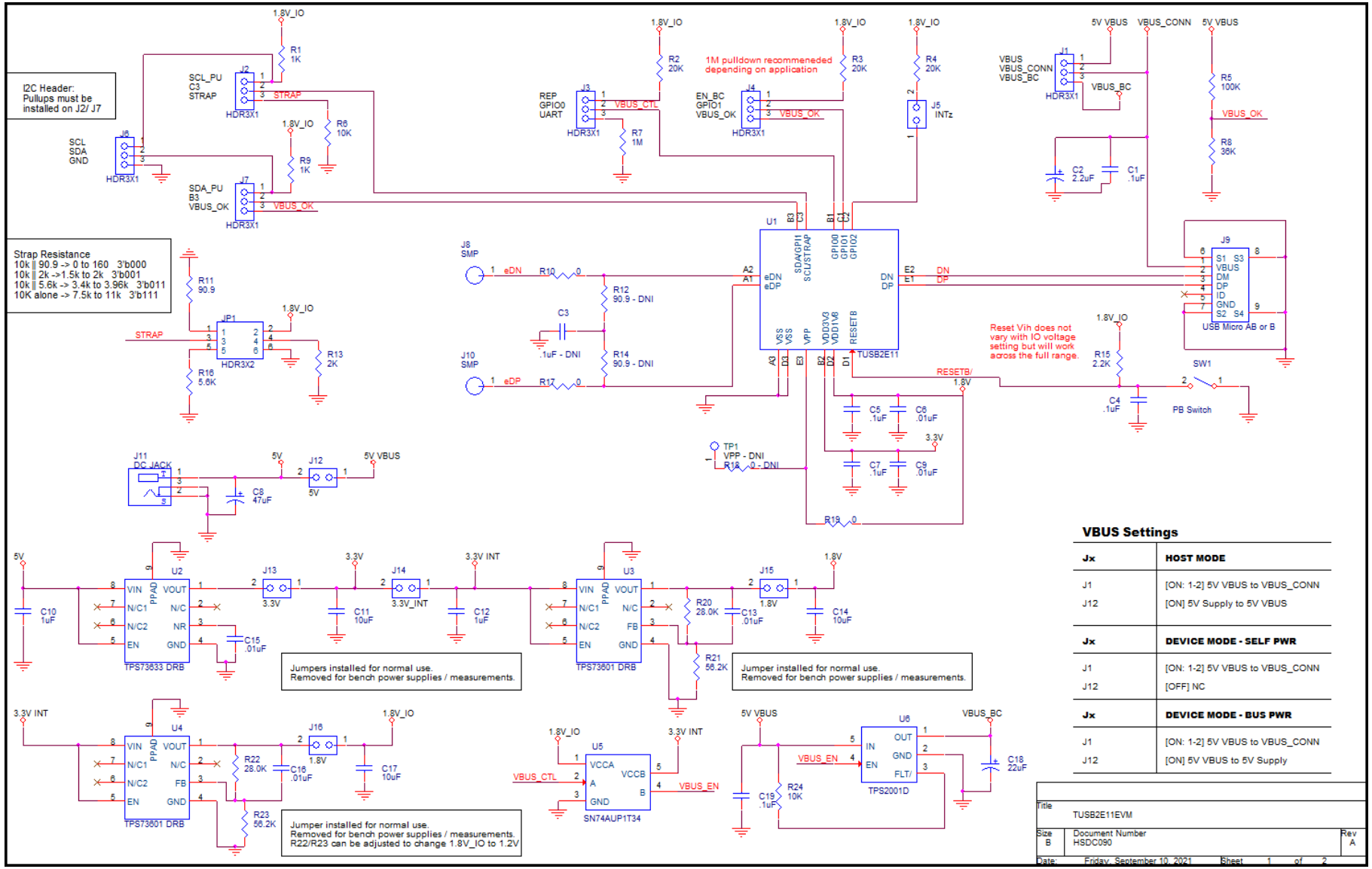

Figure 6-1. TUSB2E11EVM Schematic

7 Bill of Materials

Table 7-1 lists the devices installed on the TUSB2E11EVM. The devices that are in the schematic, but are not installed on the EVM, are still listed in the bill of materials (BOM) and are marked with *DNI* under the Part column.

Table 7-1. TUSB2E11EVM Bill of Materials

Item	Quantity	Reference	Part	Manufacturer	Manufacturer Part Number
1	5	C1, C4, C5, C7, and C19	.1 µF	Yageo	CC0402KRX5R6BB104
2	1	C2	2.2 µF	TDK	CGA4J3X7R1C225K125AB
3	1	C3	.1 µF – DNI(1)	Yageo	CC0402KRX5R6BB104
4	5	C6, C9, C13, C15, and C16	.01 µF	Kemet	C0402C103K3RACTU
5	1	C8	47 µF	TDK	C3225X5R1A476M250AC
6	2	C10 and C12	1 µF	Kemet	C0805C105K4RACTU
7	3	C11, C14, and C17	10 µF	Kemet	C0805C106K8PACTU
8	1	C18	22 µF	Murata	GRM21BR61A226ME51L
9	1	JP1	HDR3X2	Sullins	PEC03DAAN
10	6	J1, J2, J3, J4, J6, and J7	HDR3X1	Sullins	PEC03SAAN
11	6	J5, J12, J13, J14, J15, and J16	HDR2X1	Sullins	PEC02SAAN
12	2	J8 and J10	SMP	Rosenberger	19S201-40ML5
13	1	J9	USB Micro AB	Amphenol FCI	10104111-0001LF
14	1	J11	DC JACK	CUI	PJ1-022-SMT-TR
15	1	PCB1	HSDC090	Any	HSDC090
16	2	R1 and R9	1K	Yageo	RT0402BRE071KL
17	3	R2, R3, and R4	20K	Yageo	RC0402JR-0720KL
18	1	R5	100K	Yageo	RC0402JR-07100KL
19	2	R6 and R24	10K	Yageo	RC0402FR-0710KP
20	1	R7	1M	Yageo	RC0402FR-071ML
21	1	R8	36K	Yageo	RC0402JR-0736K
22	2	R10 and R17	0	Vishay Dale	CRCW02010000Z0ED
23	1	R11	90.9	Stackpole	RMCF0402FT90R9
24	2	R12 and R14	90.9 – DNI(1)	Stackpole	RMCF0201FT90R9
25	1	R13	2K	Stackpole	RMCF0402FT2K00
26	1	R15	2.2K	Yageo	RC0402FR-072K2L
27	1	R16	5.6K	Stackpole	RMCF0402FT5K60
28	1	R18	0 – DNI(1)	Yageo	RC0402JR-070RL
29	1	R19	0	Yageo	RC0402JR-070RL
30	2	R20 and R22	28.0K	Yageo	RC0402FR-0728KL

Table 7-1. TUSB2E11EVM Bill of Materials (continued)

Item	Quantity	Reference	Part	Manufacturer	Manufacturer Part Number
31	2	R21 and R23	56.2K	Yageo	RT0402BRD0756K2
32	4	SCRW1, SCRW2, SCRW3, and SCRW4	NY PMS 440 005 PH	B&F Fastener	NY PMS 440 0050 PH
33	13	SHNT1, SHNT2, SHNT3, SHNT4, SHNT5, SHNT6, SHNT7, SHNT8, SHNT9, SHNT10, SHNT11, SHNT12, and SHNT13	QPC02SXGN-RC	Sullins	QPC02SXGN-RC
34	4	STDOFF1, STDOFF2, STDOFF3, and STDOFF4	1902E	Keystone	1902E
35	1	SW1	PB Switch	OMRON	B3U-1000P
36	1	TP1	TEST POINT	TE Connectivity	RCU-0C
37	1	U1	TUSB2E11	Texas Instruments	TUSB2E11YCG
38	1	U2	TPS73633	Texas Instruments	TPS73633DRB
39	2	U3 and U4	TPS73601	Texas Instruments	TPS73601DRB
40	1	U5	SN74AUP1T34	Texas Instruments	SN74AUP1T34DCKR
41	1	U6	TPS2001D	Texas Instruments	TPS2001DDBVR

(1) This device is in the schematic, but is not installed on the EVM

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