

TUSB1002 Evaluation Module

This is the user guide for the evaluation module (EVM) of the TUSB1002. The purpose of this user guide is to facilitate an easy evaluation process of our TUSB1002 USB 3.1 SuperSpeed (5 Gbps) and SuperSpeed Plus (10 Gbps) Re-Driver.

The contents of this user's guide are meant to provide an overview of the TUSB1002, 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 TUSB1002 EVM also serves as a reference design that can be easily modified for any intended application. Target applications include cell phones, computers, docking stations, TVs, and active cables. The schematics and layout information is included at the end of this manual.

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1 Introduction

The TUSB1002 is a dual-channel, USB 3.1 SuperSpeed Plus re-driver and signal conditioner supporting data rates of 10.0 Gbps. The device complies with USB 3.1 specification revision 1.0, supporting electrical idle condition and low-frequency periodic signals (LFPS) for USB 3.1 power management modes.

The device offers programmable equalization that extends the interconnect distance between two devices. Also, the device supports low-power modes when unplugged. The device can also function in USB-compliance mode to test the transmitter for compliance to voltage and timing specifications per USB 3.1 compliance specification.

This EVM is 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 the figure below:

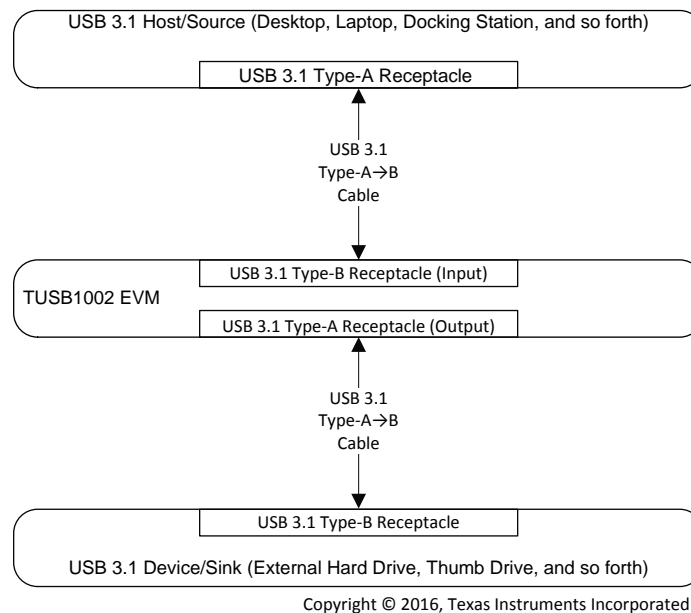


Figure 1. TUSB1002 Functional System Level Block Diagram

2 TUSB1002 EVM Configuration

2.1 TUSB1002 EVM Kit Contents

This EVM kit contains the following items:

- TUSB1002 EVM board
- This user's manual

2.2 Description of EVM Board

The TUSB1002 EVM is designed to provide easy evaluation of the TUSB1002 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.

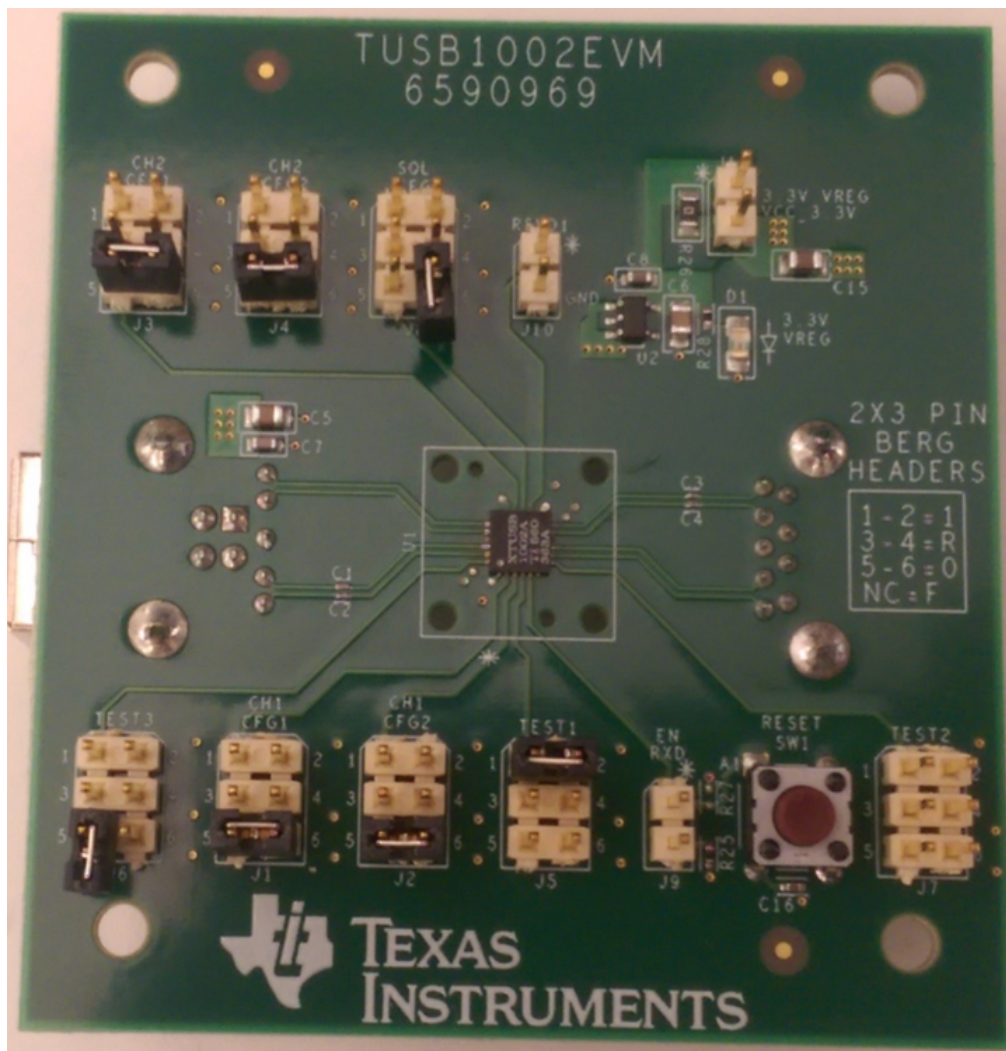


Figure 2. TUSB1002 EVM (Top Side)

Table 1. TUSB1002 EVM Jumper / Switch Description and Settings

Jumper	Functionality and Configuration
J1	CH1_EQ1 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J2	CH1_EQ2 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J3	CH2_EQ1 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J4	CH2_EQ2 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J5	CFG1 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J6	RSVD1 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J7	MODE 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J8	CFG2 1-2 = 1 (1K to VCC) 3-4 = R (20K to GND) 5-6 = 0 (1K to GND) NC = F (No Connect)
J9/SW1	EN (Shutdown Mode) 1-2 = 1K to GND NC = Internal Pull-up (Default) SW1 = Push to Short EN to GND
J10	SLP_S0# 1-2 = 1K to GND NC = Internal Pull-up (Default)
J11	VCC 3.3V 1-2 = VCC_3.3V Provided from U2 (Default) NC = Provide external 3.3V on Pin 2

3 Selecting Equalization Level for TUSB1002

The equalization level of each channel is configured via the CHx_CFG1 and CHx_CFG2 pin states. [Table 2](#) lists all possible equalization levels that can be achieved with the TUSB1002:

Table 2. TUSB1002 Equalization Selection

Equalization Level Selector		
CHx_EQ2 Pin Level	CHx_EQ1 Pin Level	EQ Gain at 5 GHz (dB)
0	0	2.5
0	R	4.2
0	F	5.5
0	1	7
R	0	8
R	R	9
R	F	10
R	1	10.7
F	0	11.4
F	R	12.2
F	F	12.7
F	1	13.2
1	0	13.7
1	R	14.2
1	F	14.7
1	1	15.1

4 Adjustable VOD Linear Range and DC Gain

The CFG1 and CFG2 pins can be used to adjust the TUSB1002 output voltage swing linear range and receiver equalization DC gain. [Table 3](#) details the available options.

Table 3. TUSB1002 Adjustable VOD and DC Gain

Setting #	CFG1 Pin Level	CFG2 Pin Level	CH1 DC Gain (dB)	CH2 DC Gain (dB)	CH1 VOD Linear Range (mVpp)	CH2 VOD Linear Range (mVpp)
1	0	0	+1	0	900	900
2	0	R	0	+1	900	900
3	0	F	0	0	900	900
4	0	1	+1	+1	900	900
5	R	0	0	0	1000	1000
6	R	R	+1	0	1000	1000
7	R	F	0	-1	1000	1000
8	R	1	+2	+2	1000	1000
9	F	0	-1	-1	1200	1200
10	F	R	-2	-2	1200	1200
11	F	F	0	0	1200	1200
12	F	1	+1	+1	1200	1200
13	1	0	-1	0	1200	1200
14	1	R	0	-1	1200	1200
15	1	F	0	+1	1200	1200
16	1	1	+1	0	1200	1200

5 Monitoring the Device Current

The TUSB1002 EVM includes the option of monitoring the current draw of the device. In order to enable this feature, the following steps must be taken:

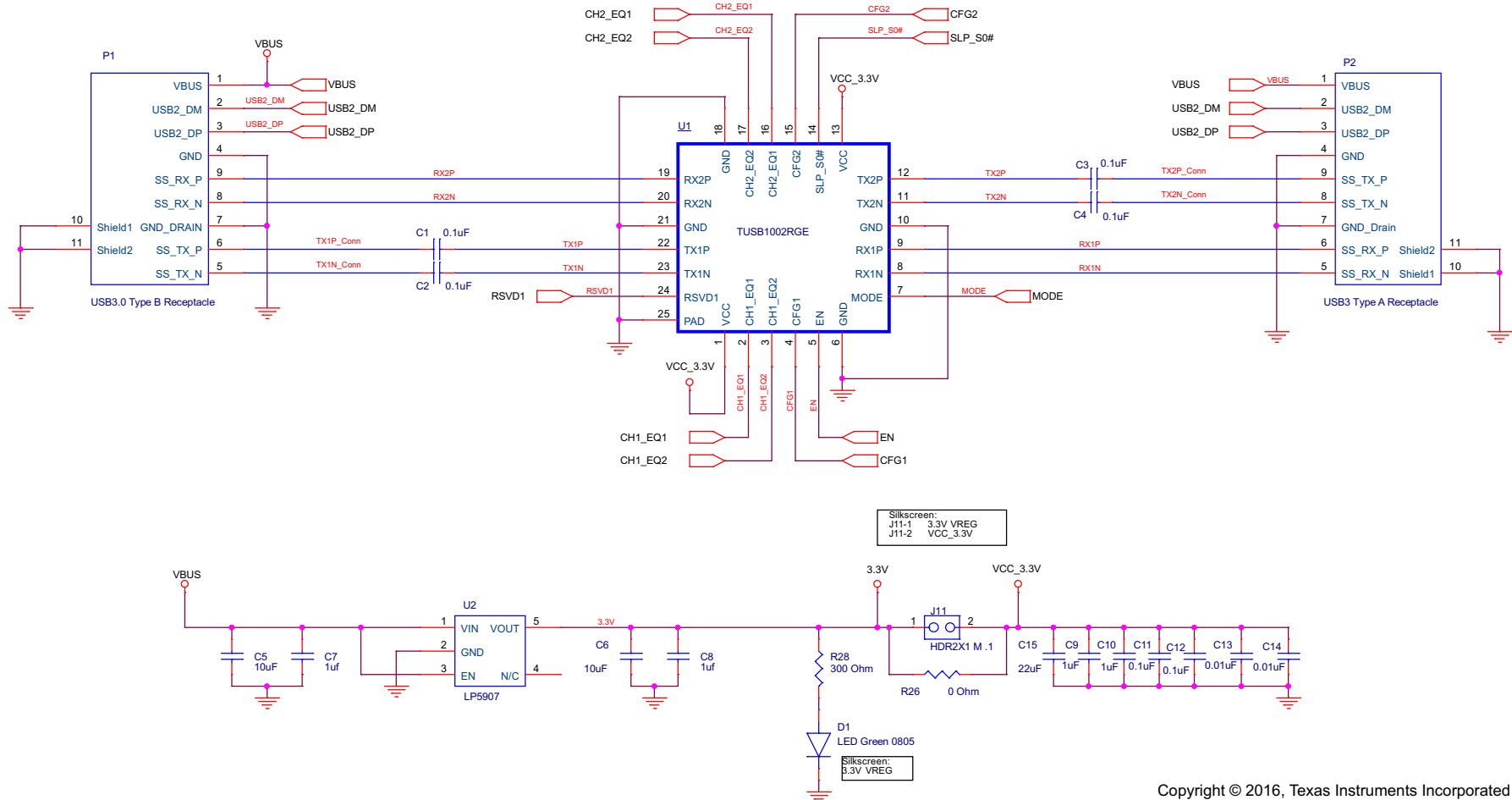
1. Un-install the shunt located at JMP11 and remove R26.
2. Obtain a power supply with the ability to display its current draw (or connect a current meter in series to the power supply).
3. Connect to 3.3 V of external power source to VCC_3.3V (J11-2) and GND of the external supply to a convenient GND location on the EVM (J10-2).
4. Turn on your power supply and observe the measured current on your power supply display (or current meter).

6 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.

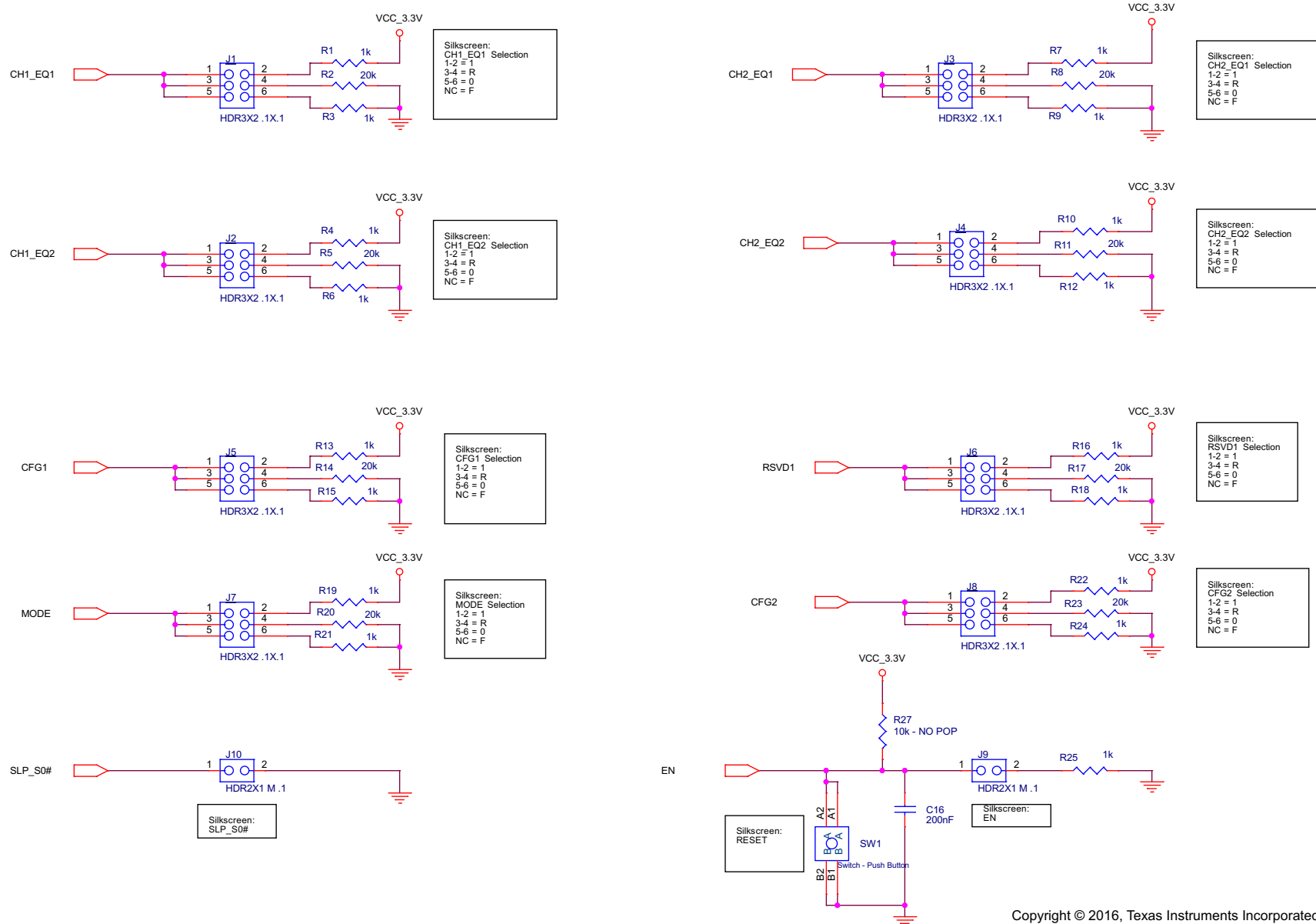
6.1 TUSB1002 EVM Board Schematics

Figure 3 and Figure 4 illustrate the EVM schematics.



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Figure 3. TUSB1002 EVM Schematic (High Speed Pins and Power)



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Figure 4. TUSB1002 EVM Schematic (Device Control Pins)

6.2 TUSB1002 EVM Board Layout

This EVM was designed to show the implementation on a 4-layer board.

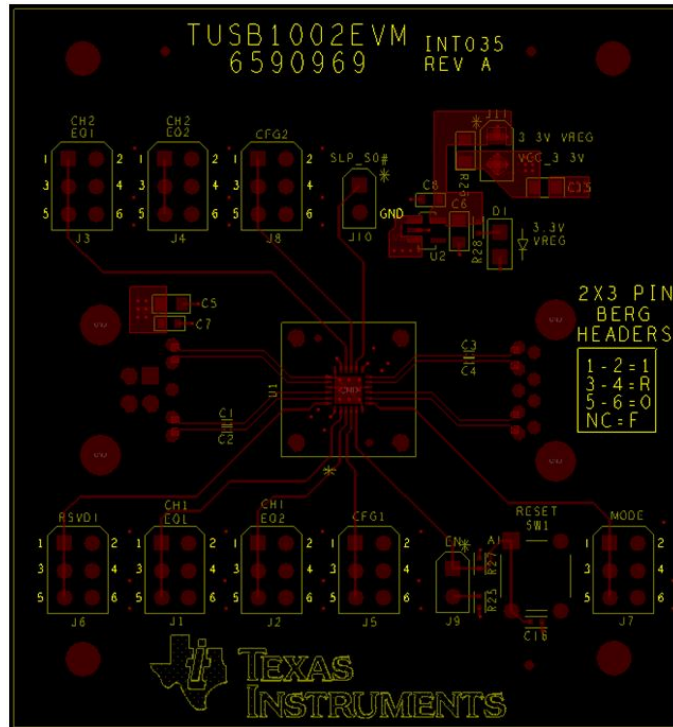


Figure 5. TUSB1002 EVM Layout Layer 1 (Top)

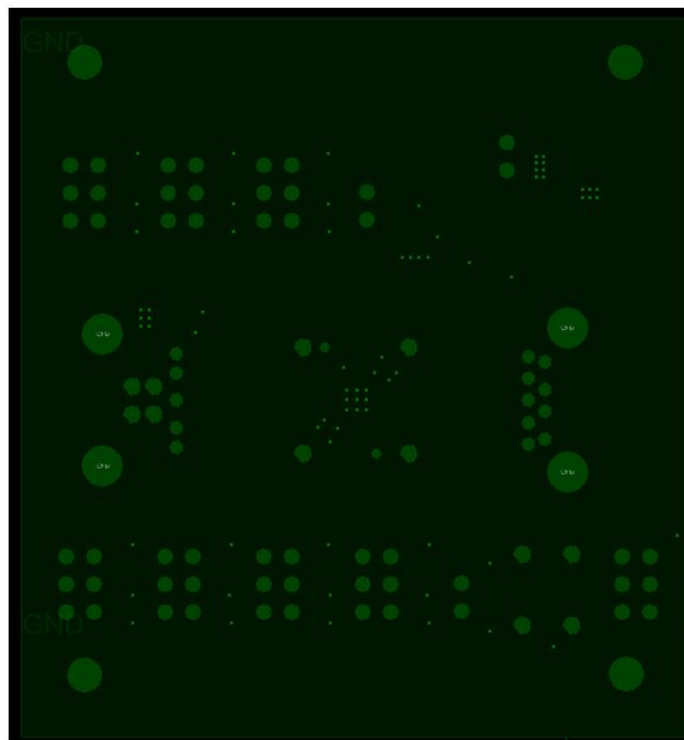


Figure 6. TUSB1002 EVM Layout Layer 2 (GND)

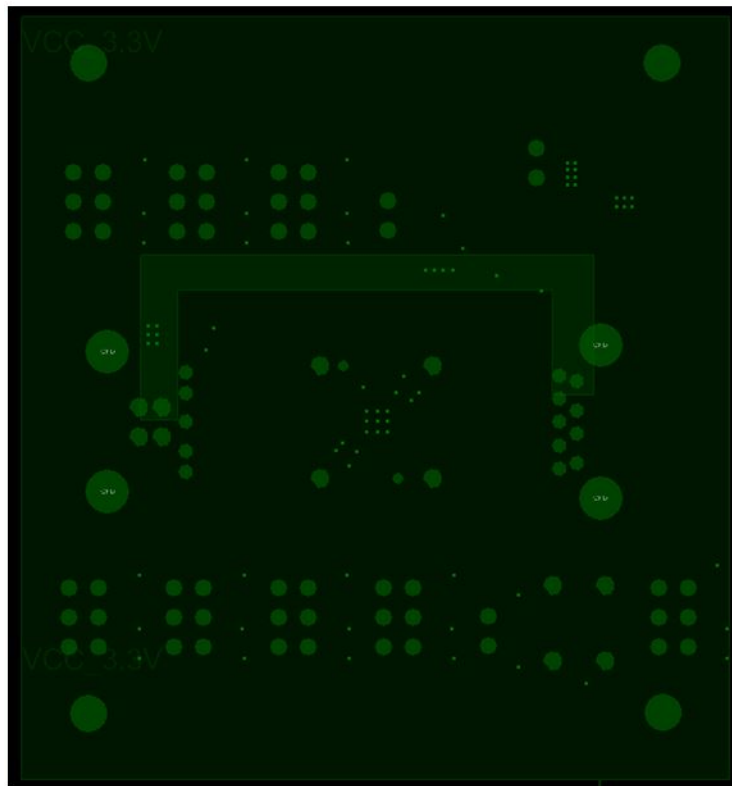


Figure 7. TUSB1002 EVM Layout Layer 3 (VCC)

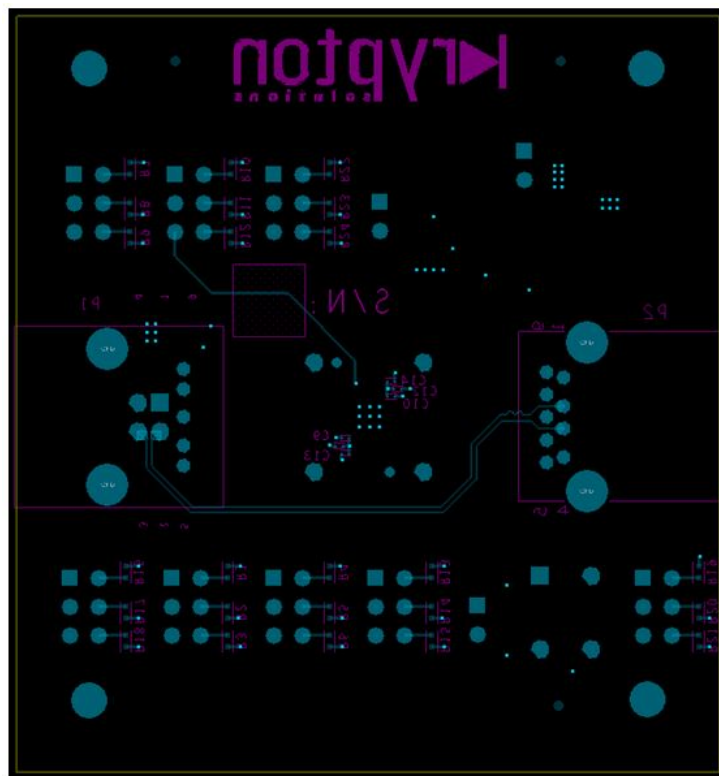


Figure 8. TUSB1002 EVM Layout Layer 4 (Bottom)

6.3 TUSB1002 EVM Material Listing

Table 4 lists the complete BOM for the TUSB1002 EVM.

Table 4. TUSB1002 EVM Bill of Materials

Item	Quantity	Reference	Part
1	6	C1,C2,C3,C4,C11,C12	0.1uF
2	2	C5,C6	10uF
3	4	C7,C8,C9,C10	1uF
4	2	C13,C14	0.01uF
5	1	C15	22uF
6	1	C16	.22uF
7	1	D1	LED Green 0805
8	8	J1,J2,J3,J4,J5,J6,J7,J8	HDR3X2 .1X.1
9	3	J9,J10,J11	HDR2X1 M .1
10	1	P1	USB3.0 Type-B Receptacle
11	1	P2	USB3 Type-A Receptacle
12	17	R1,R3,R4,R6,R7,R9,R10,R12,R13,R15,R16,R18,R19,R21, R22, R24,R25	1k
13	8	R2,R5,R8,R11,R14,R17,R20,R23	20k
14	1	R26	0 Ohm
15	1	R27	10k - NO POP
16	1	R28	300 Ohm
17	1	SW1	Switch - Push Button
18	1	U1	TUSB1002RGE
19	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.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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