User's Guide

TMDS1204 EVM User's Guide

ABSTRACT

How to use and configure the TMDS1204EVM along with recommendations for system hardware implementation is described in this document. These recommendations are only guidelines and it is the designer's responsibility to consider all system characteristics and requirements. For technical details (such as, device operation, terminal description, and so forth), refer to the *12-Gbps, DC/AC-Coupled to TMDS™ and FRL HDMI™ Hybrid Redriver* data sheet.

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Trademarks

1 Overview

1.1 What is the TMDS1204 EVM?

The TMDS1204EVM is a PCB that helps customers evaluate the TMDS1204 for video applications with HDMI™ interfaces. This EVM can also be used as a hardware reference design for implementations of the TMDS1204. PCB design or layout files are available upon request to provide PCB design illustrations of the routing or placement rules with a TMDS1204 component.

1.2 What is Included in the TMDS1204EVM?

The major components of the EVM are as follows:

- TMDS1204 device
- Standard HDMI source connector (receptacle)
- Standard HDMI sink connector (receptacle)
- DC power regulators
- I2C programming interface for external I2C host connections
- USB interface
- Headers for configuring various TMDS1204 features

1.3 What Does the EVM Look Like?

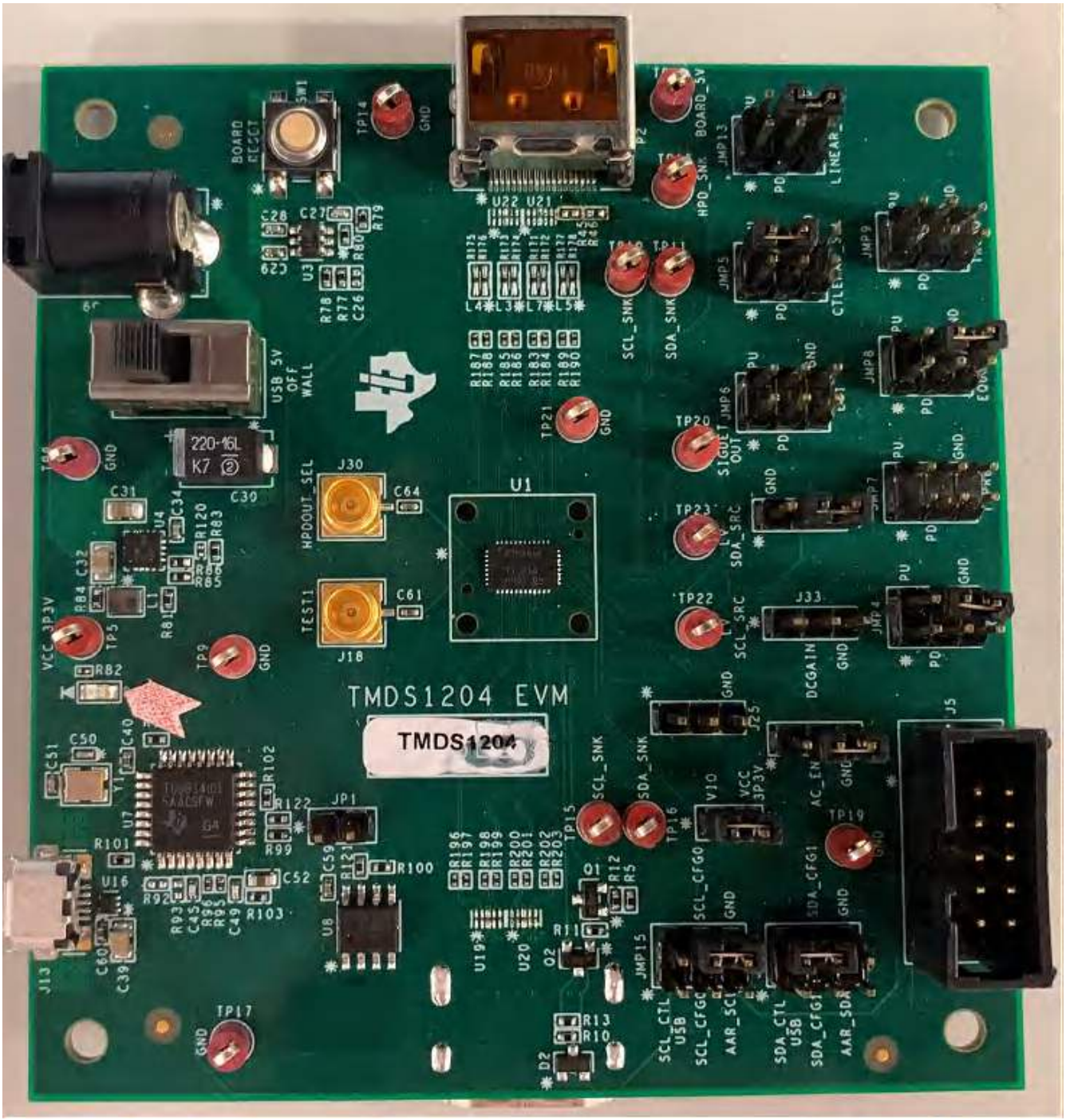

Figure 1-1. EVM Board

2 Hardware Configuration

2.1 Power

A DC barrel jack (J9) to accept a 5-V wall power adapter is provided on the EVM. The DC barrel jack (CUI Inc.™ PJ-202AH) has an inner diameter of 2.1 mm and an outer diameter of 5.5 mm. The tip of the +5 V power supply must be positive. A +5 V power supply of at least 1.5 amps that meets the above requirements can be used to power the TMDS1204 EVM. Power is provided to the EVM when SW2 is set to position 1.

Alternatively, it is possible to power the EVM by connecting a USB Micro cable from a host to the J13 USB Micro B connector and setting SW2 to position 3.

Note

Limit VBUS voltage and voltage from barrel jack to no more than 6 V.

2.2 Enable or Reset

There are three device enable or reset options to use with the EVM, and are as follows:

1. Supervisor circuitry option. This is the default configuration on the EVM. The enable (EN) signal is held low until the power good (REG_PG) from the 3.3 V voltage regulator reaches a stable high voltage level then is released high.
2. RC timing option. C26 external capacitor and internal resistor are used on control the EN pin ramp time after the device is powered on. C26 is a DNI (*Do Not Install* option) by default. C26 needs to be installed and R77 needs to be uninstalled to enable this option.
3. External control option. A push button (SW1) is provided to manual control the EN pin.

2.3 Configuration Jumpers

Multiple jumpers are provided on the EVM for configuration of TMDS1204 and also for probe points.

The following is a list of 4-level jumpers which are used to configure the TMDS1204: J33, JMP4, JMP5, JMP6, JMP7, JMP8, JMP9, and JMP13. Table 2-1 provides the jumper position to select between the different levels.

Note

4-level pins are sampled after the rising edge of the EN pin. Therefore, a change in any 4-level pin state will not be applied until after the EN pin is toggled from low to high.

Table 2-1. 4-Level Configuration Jumper Settings

Jumper Position	4-Level State
Short 4 to 6	0
Short 3 to 4	R
Open	F
Short 2 to 4	1

Table 2-2. Jumpers

Jumper	Default Position	Description
JMP4	Short 4 to 6	**MODE.** Default is pin-strap mode. If I2C mode is desired, leave this jumper open or no-connect. Refer to data sheet for more details.
JMP5	Short 2 to 4	**CTLEMAP_SEL.** Refer to data sheet for details on different CTLEMAP options.
JMP6	Open	**EQ1.** In pin-strap mode, this jumper along with JMP8 (EQ0) will select the EQ value for the receiver. The EQ may need to be tuned based on quality of HDMI cable used. Refer to data sheet for details on EQ options.
JMP7	Open	**TXPRE.** Refer to data sheet for details.
JMP8	Short 4 to 6	**EQ0/ADDR.** In pin-strap mode, this jumper along with JMP6 (EQ1) will select the EQ value for the receiver. The EQ may need to be tuned based on quality of HDMI cable used. Refer to data sheet for details.
JMP9	Open	**TXSWG.** Refer to data sheet for details.
JMP13	Short 4 to 6	**LINEAR_EN.** Refer to data sheet for details.

Table 2-2. Jumpers (continued)

Jumper	Default Position	Description
JMP15	Short 4 to 6	**SCL and CFG0.** **Short 1 to 3:** I2C clock from TUSB3410 (U7). **Short 3 to 5:** I2C clock from Aardvark connector (J5). **Short 2 to 4:** CFG0 pulled up to VIO (3.3 V). Refer to data sheet for details on CFG0. **Short 4 to 6:** CFG0 pull-down to GND. Refer to data sheet for details on CFG0.
JMP16	Short 2 to 4	**SDA and CFG1.** **Short 1 to 3:** I2C data from TUSB3410 (U7). **Short 3 to 5:** I2C data from Aardvark™ connector (J5). **Short 2 to 4:** CFG1 pulled up to VIO (3.3 V). Refer to data sheet for details on CFG1. **Short 4 to 6:** CFG1 pull-down to GND. Refer to data sheet for details on CFG1.
J27	Short 2 to 3	**AC_EN** **Short 1 to 2:** OUT_D[2:0] and OUT_CLK is AC-coupled. Make sure R171, R172, R173, R174, R175, R176, R177, and R178 are populated with 100 nF capacitor or make sure AC capacitor is external to EVM board. **Short 2 to 3:** OUT_D[2:0] and OUT_CLK is DC-coupled. Make sure R171, R172, R173, R174, R175, R176, R177, and R178 are populated with 0-Ω resistor.
J31	Short 2 to 3	**DDC Level Shifter enable/disable** **Short 1 to 2:** Discrete DDC level shifter (U23) disabled. **Short 2 to 3:** Discrete DDC level shifter (U23) enabled.
J32	Short 1 to 2	**VIO Voltage.** **Short 1 to 2:** VIO connected to board 3.3 V. **OPEN:** VIO is from an external supply.
J33	Open	DC Gain. Refer to data sheet for details.

2.4 Rx EQ Configuration

There are sixteen EQ settings with 0 being the lowest and Fh being the highest. Refer to data sheet for specific EQ value.

Table 2-3. Rx Equalization Control

Register(s): CLK_EQ, D0_EQ, D1_EQ, D2_EQ Equalization Setting #	EQ1 PIN Level	EQ0 PIN Level	EQ Gain
0	0	0	Lowest EQ setting
1	0	R	
2	0	F	
3	0	1	
4	R	0	
5	R	R	
6	R	F	
7	R	1	
8	F	0	
9	F	R	
10	F	F	
11	F	1	
12	1	0	
13	1	R	
14	1	F	
15	1	1	Highest EQ setting

2.5 HPD Snoop Option

To accommodate systems that do not properly resend DDC commands after HPD goes low, we have implemented an HPD snoop mode on the TMDS1204 EVM. This mode allows the HPD line to be routed around the TMDS1204, but remain connected to the TMDS1204 on the sink side to allow the TMDS1204 to snoop its state.

- Populate R131, no populate R129 for HPD on
- No populate R131, populate R129 for HPD snoop-only

2.6 Local I2C Access

Access to TMDS1204s local I2C signals is provided through the J5 connector. The TMDS1204 supports either 1.2 V, 1.8, and 3.3 V LVCMOS levels. The TMDS1204 VIO pin is used to select which voltage level is used for the following 2-level control pins: SCL/CFG0 and SDA/CFG1. It is important that the I2C signalling levels meet the TMDS1204 LVCMOS levels when I2C interface is accessed through the connector.

A standalone external I2C host can be connected through J5 for debug and control purposes. An example of an external I2C Host controller is the Total Phase Aardvark I2C/SPI Host Adapter (Total Phase Part#: TP240141). Sample scripts for this I2C host controller are provided by request.

The target I2C address for the TMDS1204 can be modified by the EVM jumper JMP8. Please refer to the TMDS1204 ADR/EQ pin setting and its corresponding I2C address. Refer to TMDS1204 data sheet for the 7-bit I2C target address options.

Table 2-4. Aardvark I2C (J5) Pinout

J5 pin #	Description	J5 pin #	Description
1	SCL_CTL	2	GND
3	SDA_CTL	4	NC
5	NC	6	NC
7	NC	8	NC
9	NC	10	GND

3 Quick Start Guide

The following instructions assume the EVM is configured for pin-strap mode and is powered from barrel jack. To start the EVM, do the following:

1. Insert the +5 V DC power source into the barrel jack. Turn on SW2.
2. If using external I2C configuration instead of pin-straps, then please configure TMDS1204 at this step.
3. Insert an HDMI source using a standard HDMI cable into P1 (HDMI receptacle).
4. Insert an HDMI video sink into P2 (HDMI receptacle) using a standard HDMI cable.
5. Video output on HDMI sink should be observed.

4 Schematics

NOTES:

- 100-ohm differential impedance for HDMI differential pairs.

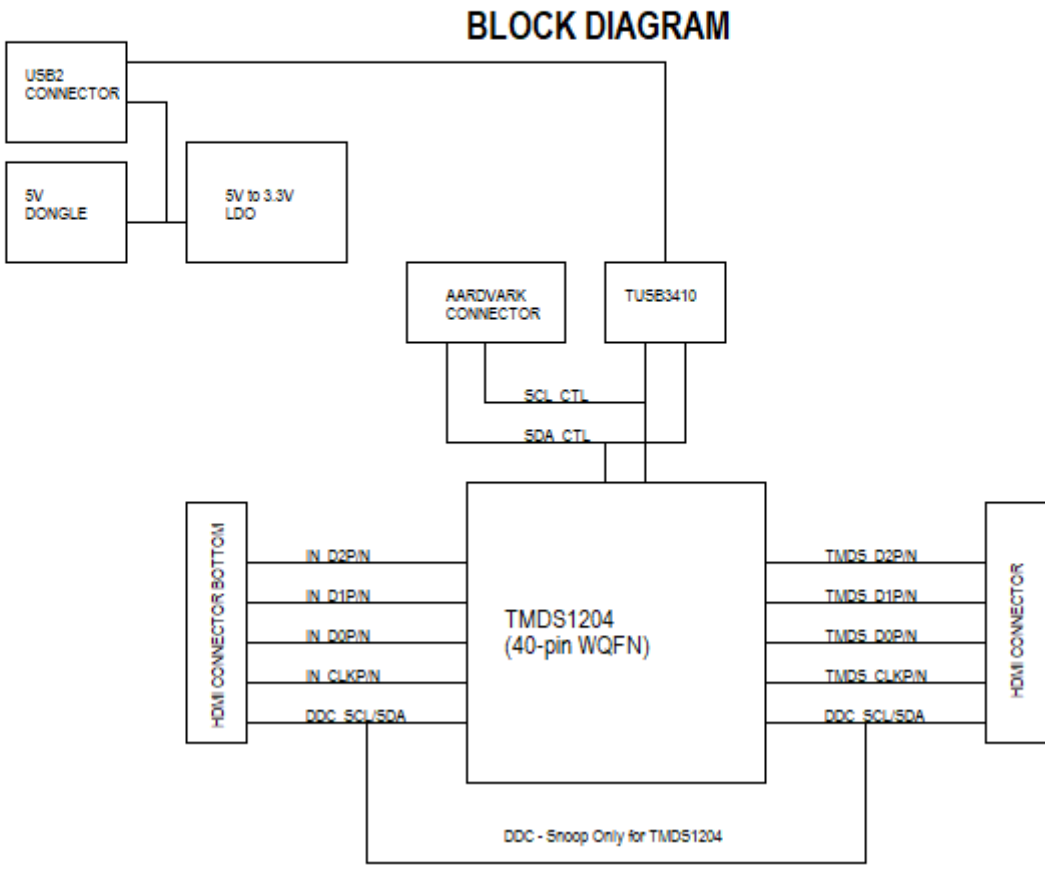

Figure 4-1. Block Diagram

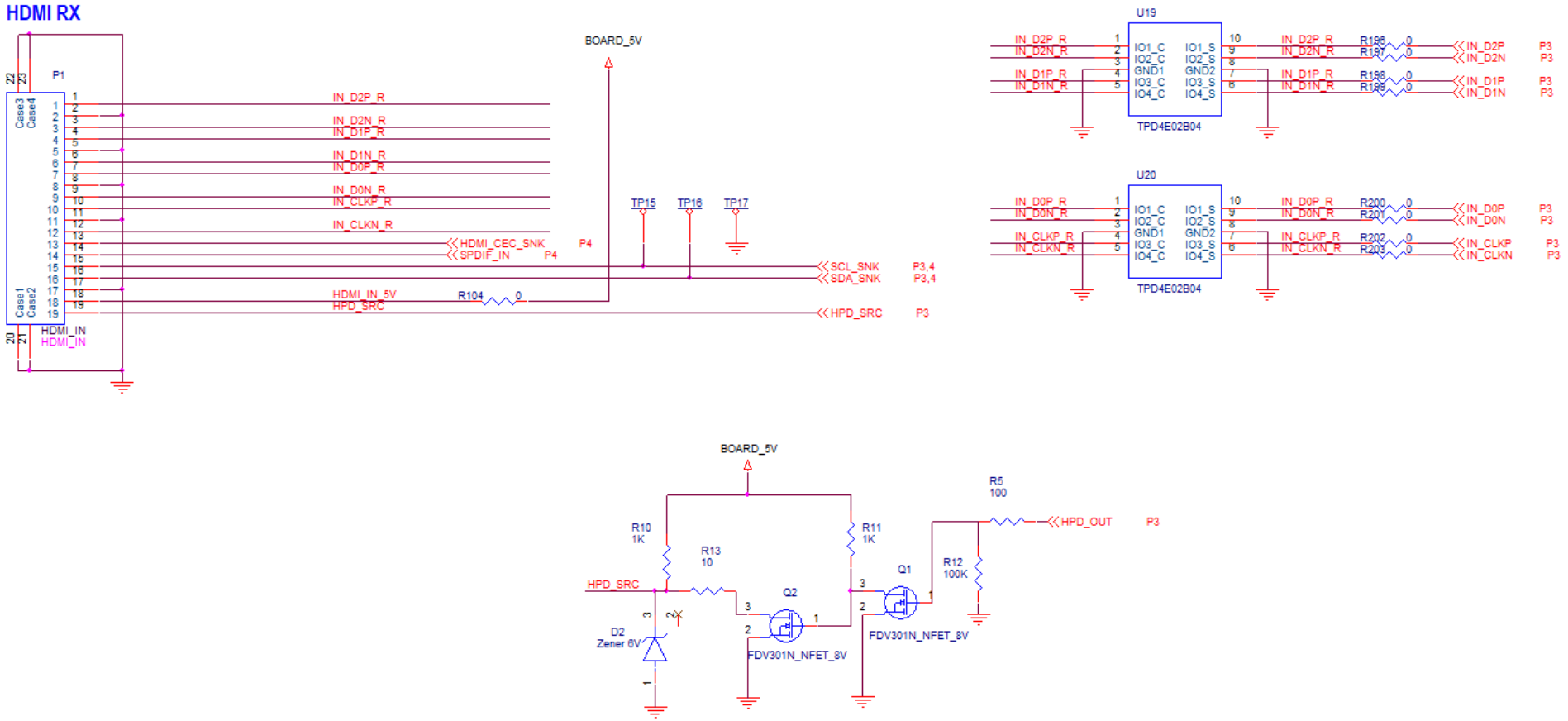

Figure 4-2. HDMI Input Connector

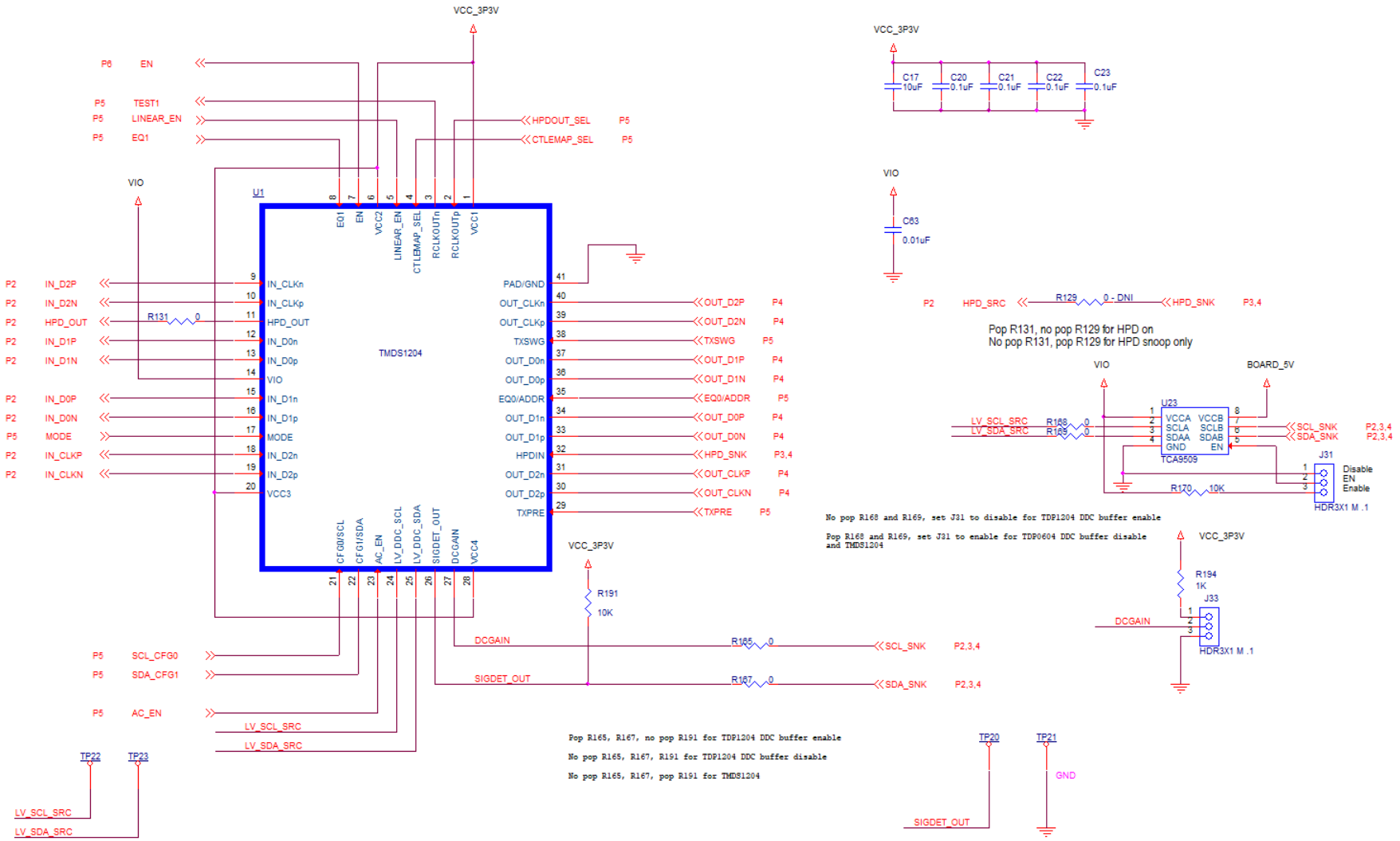

Figure 4-3. TMDS1204

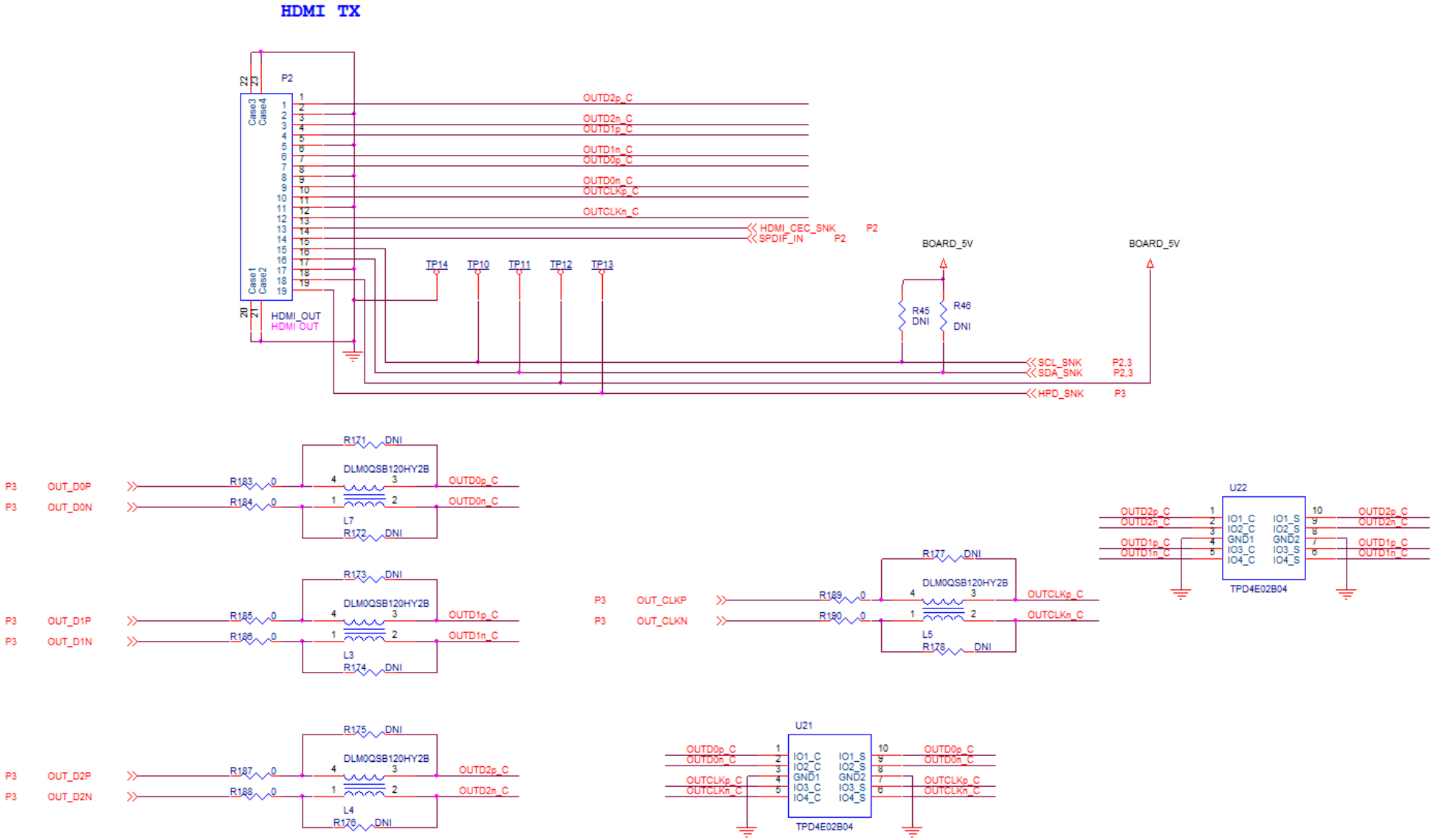

Figure 4-4. HDMI TX Connector

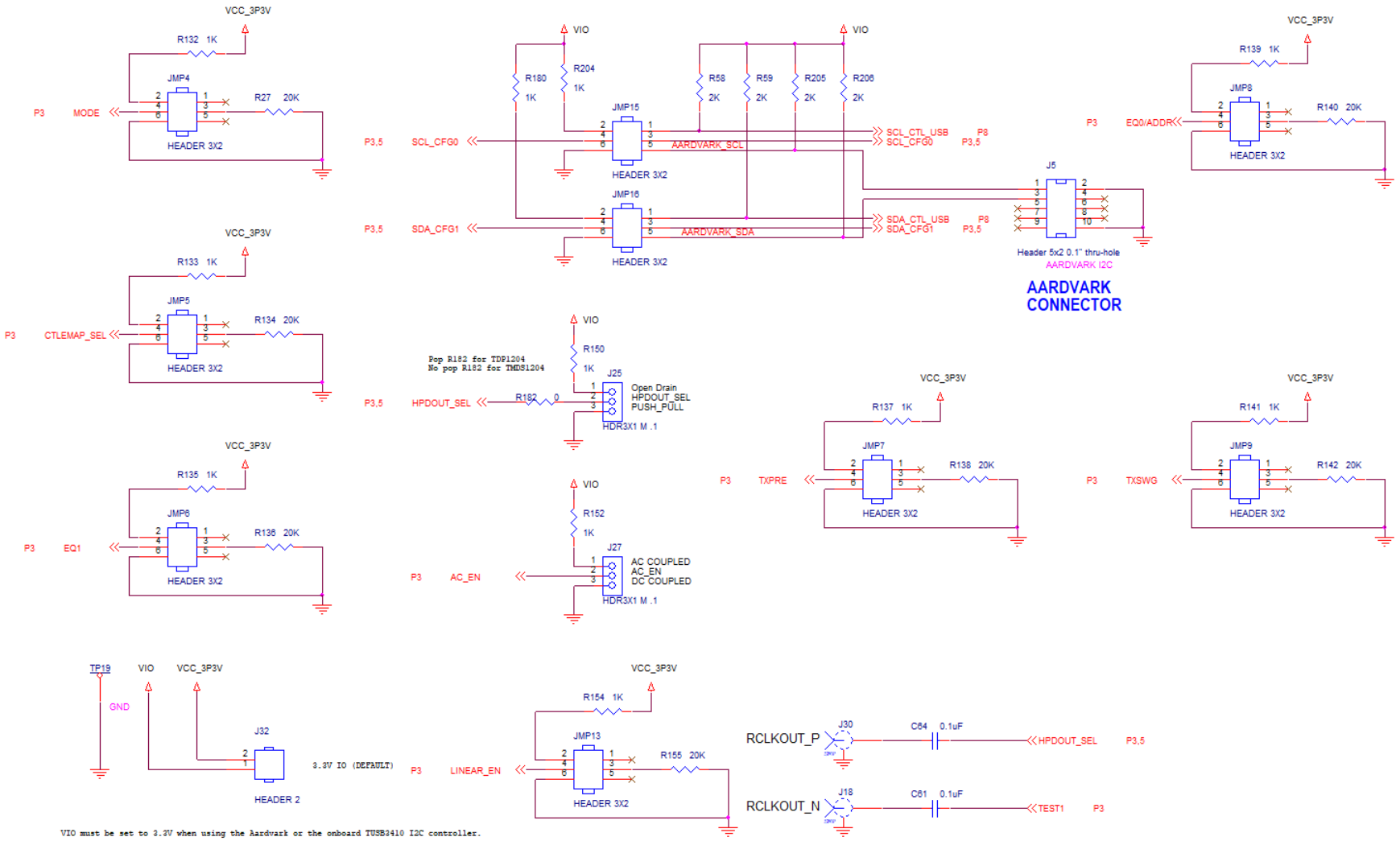

Figure 4-5. Jumper Configuration

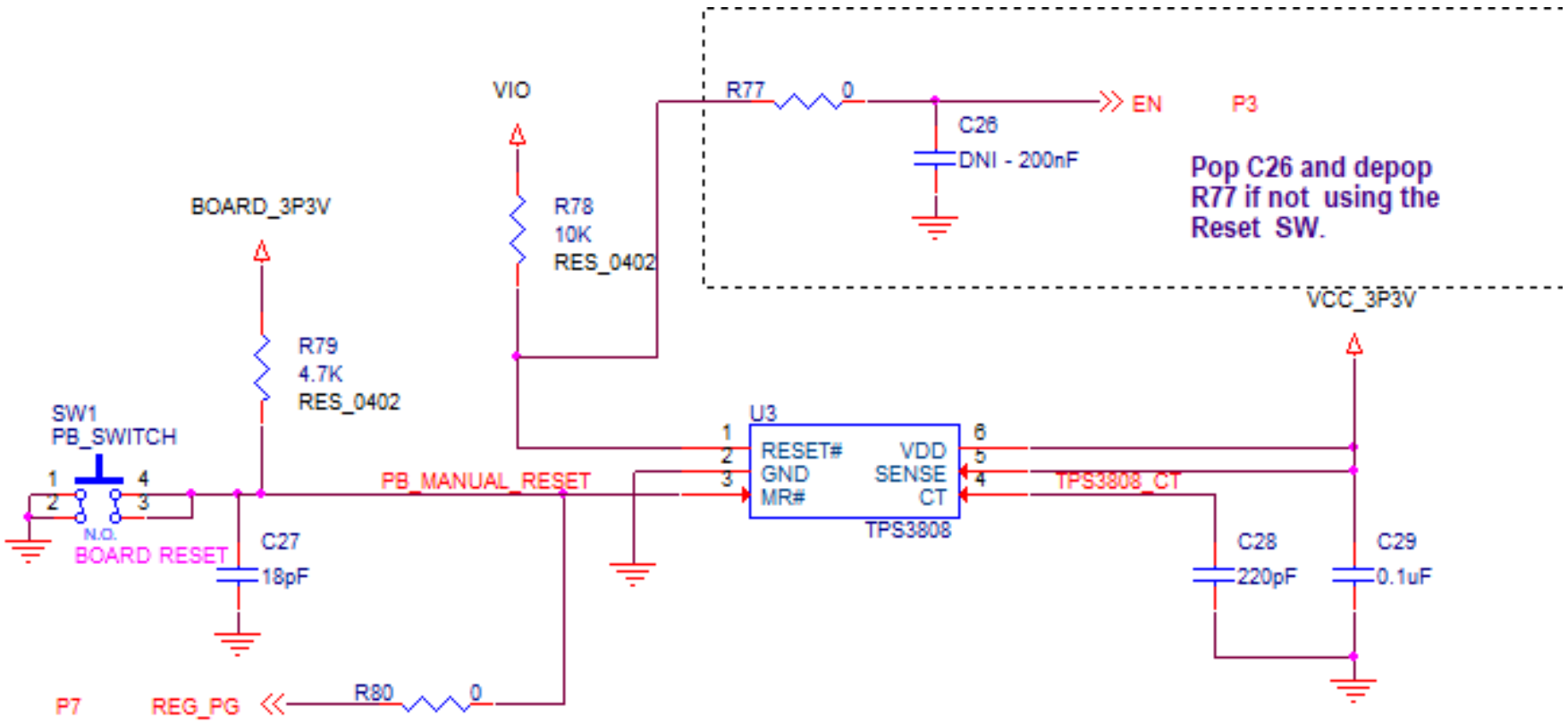

Figure 4-6. Push Button Reset

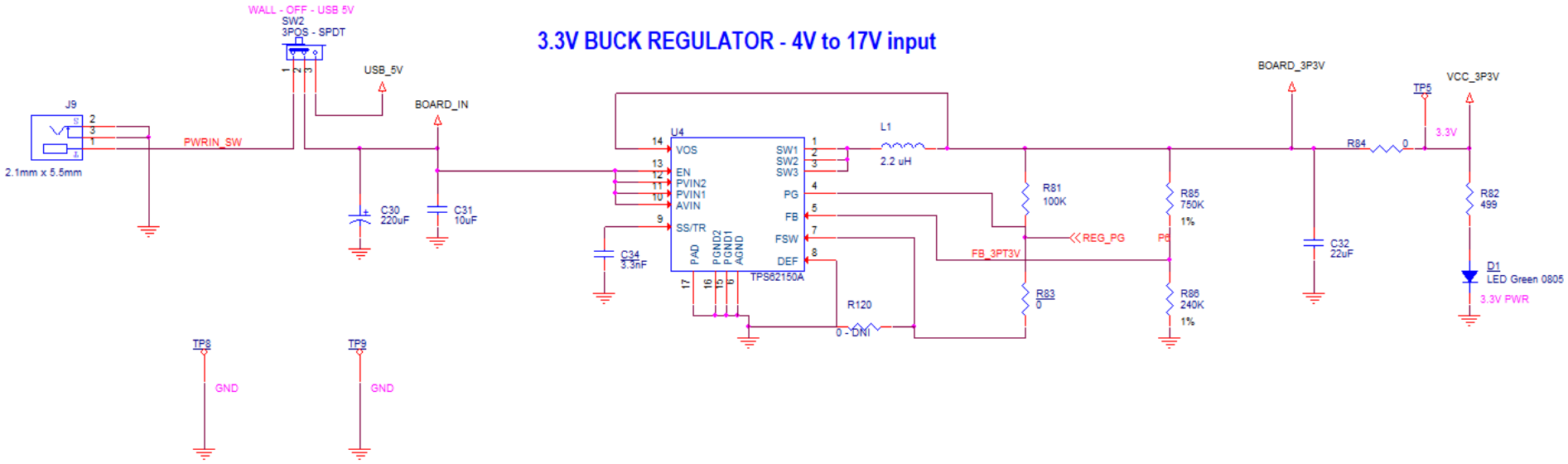

Figure 4-7. 3.3 V Regulator

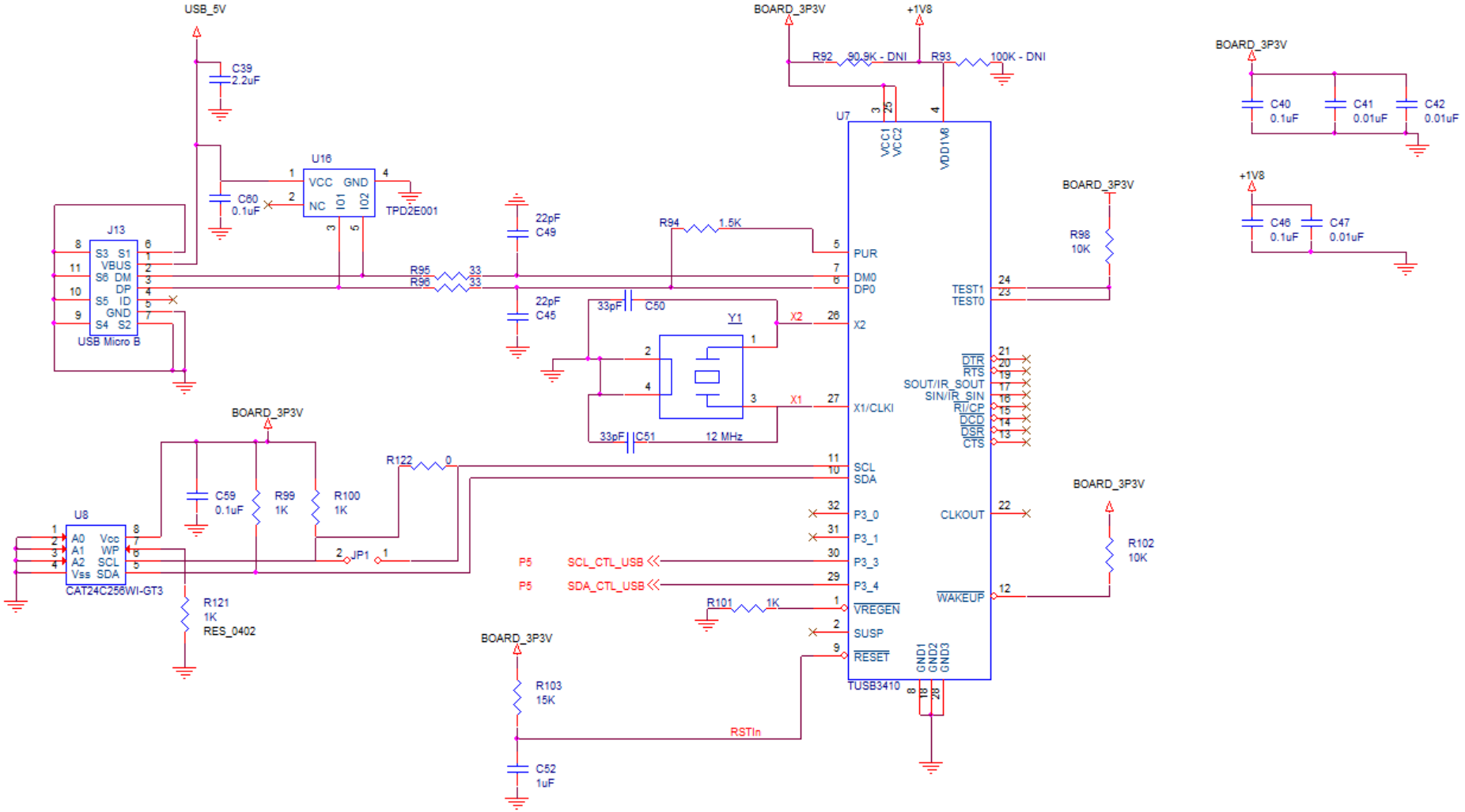

Figure 4-8. TUSB3410 I²C Controller

5 References

- Texas Instruments, *12-Gbps, DC/AC-Coupled to TMDS™ and FRL HDMI™ Hybrid Redriver* data sheet

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3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *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 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

Concernant les EVMs avec appareils radio:

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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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
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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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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