

USB Type-C™ Mini Dock EVM

This user's guide provides an overview and operating instructions for TI's *USB Type-C Mini Dock EVM*. A quick-start guide section and schematics are also included in the document. Throughout this document, the abbreviations *dock*, *EVM*, *EVM board*, and the term *evaluation module* are synonymous with *USB Type-C Mini Dock EVM*, unless otherwise noted.

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1 What is the TI USB Type-C Dock?

The USB Type-C and Power Delivery (PD) mini-dock evaluation module (EVM) provides a complete reference solution for a USB Type-C dock including audio, USB data, power, and video. The EVM has a small 2 in x 4 in form factor and supports both source and sink power capabilities over the primary USB Type-C PD port. Video output capabilities include both DisplayPort and HDMI

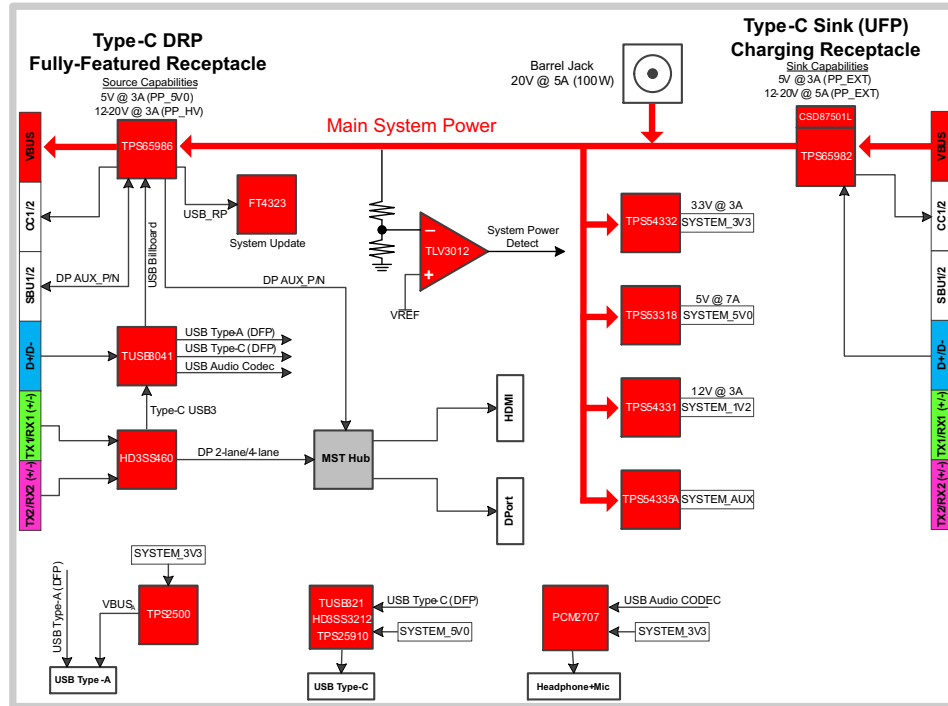


Figure 1. USB Type-C Mini Dock Block Diagram

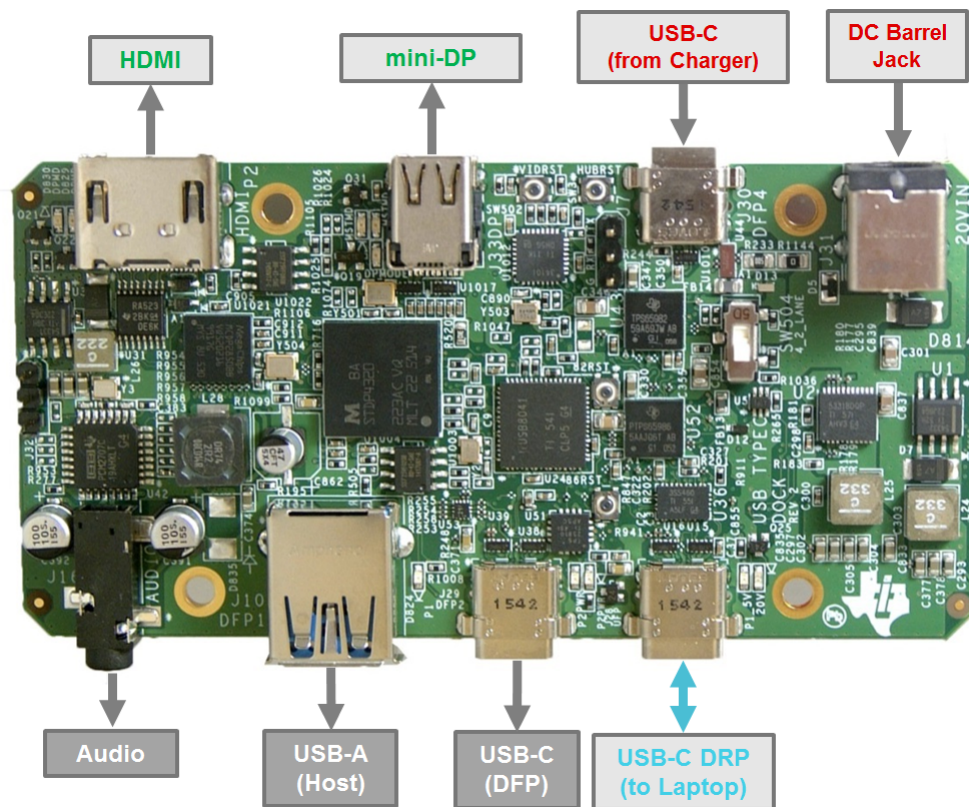


Figure 2. USB Type-C Mini Dock EVM

2 TI USB Type-C Mini Dock Features

This section lists and details supported features of the EVM:

- Power
 - This EVM has the following bi-directional power capabilities:
 - Externally powered by 20-V DC barrel jack (J31). Upon successful power contract negotiation, the dock can source up to 20 V at 3 A.
 - Externally powered by a USB Type-C Charger (J30). Upon successful power contract negotiation, the dock can source 5 V at 3 A or 12–20 V at 5 A.
 - Bus-powered from USB Type-C laptop. Upon successful power contract negotiation, the dock can sink 5 V at 3 A or 12–20 V at 3 A.

D823 or D822 blue LED turns on to indicate if a 20-V or 5-V power input is connected.

- DRP Full-Featured USB-C and PD Port
 - TUSB8041 HUB with upstream connection via HD3SS460 alternate mode switch
 - USB-C DFP using TUSB321 and HD3SS3212
 - USB Type-A DFP
 - 3.5-mm audio jack
- Dual Video (up to 4K) via HDMI or miniDP
- Flash Update Over USB Type-C via USB 2.0 Endpoint

- LEDs
 - [Table 1](#) lists the LEDs provided for easier debug purposes.

Table 1. LEDs for Debug

Reference Designator	LED Name	Description
D820	DP Mode	
D822	5V	Illuminates when 5-V input is present
D823	20V	Illuminates when 20-V input is present
D824	DFP1	Illuminates when Port 1 (J10) is enabled
D825	DFP2	
D826	DFP2	
D827	MS TMD	
D828	MS TMD	
D829	DP MD	
D830	DP MD	

- Firmware (FW) Update
 - Contact Texas Instruments for details on FW updates and see the [USB Type-C Mini Dock Quick-Start Guide](#) section.

3 USB Type-C Mini Dock Quick-Start Guide

The following steps are provided for a quick-start using the EVM:

- Step 1. Connect the *USB Type-C Enabler Board* to the PC with a USB Type-A to USB-B cable and a DisplayPort Cable.
- Step 2. Connect the *USB Type-C Enabler Board* to the *USB Type-C Mini Dock EVM* with a USB Type-C cable.

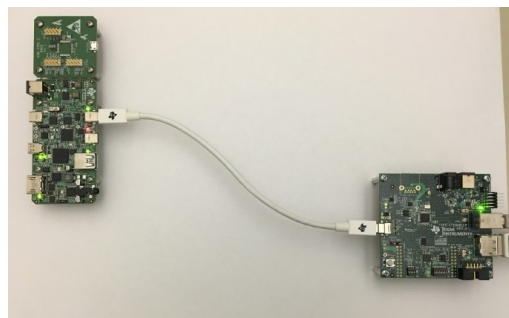


Figure 3. USB Type-C Dock Example Setup

- Step 3. Confirm that D822, D826, D824, D827, D820, D829 are lit.

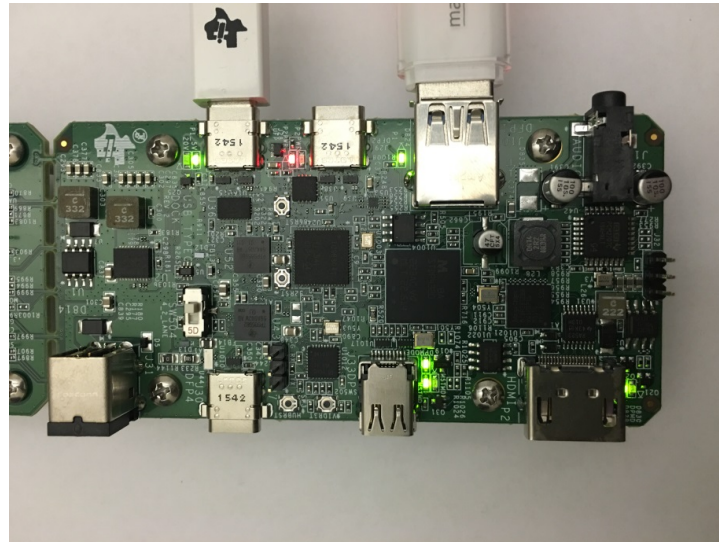


Figure 4. USB Type-C Dock Example Setup

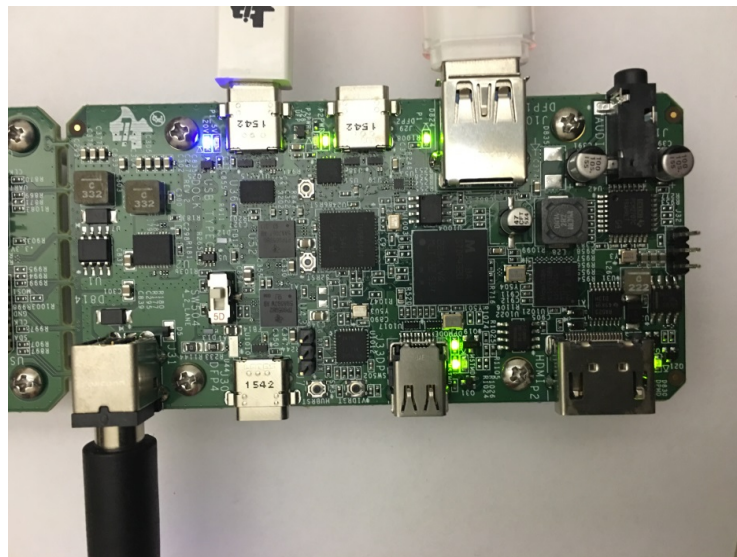


Figure 5. USB Type-C Dock Example Setup

- Step 4. Connect the Dell power adapter and confirm that the D823, D825, D824, D827, D820, D829 are lit.
- Step 5. Connect a USB flash drive to the USB Type-C Mini Dock EVM and confirm that data can be transferred to and from the USB flash drive.
- Step 6. Connect the HDMI cable to the USB Type-C Mini Dock EVM and to a monitor, confirm PC video is displayed on the monitor.
- Step 7. Disconnect the HDMI cable and connect a miniDP cable to the USB Type-C Mini Dock EVM and to a monitor, confirm PC video is displayed on the monitor.

4 Schematics

Figure 6 through Figure 24 illustrate the EVM schematics.

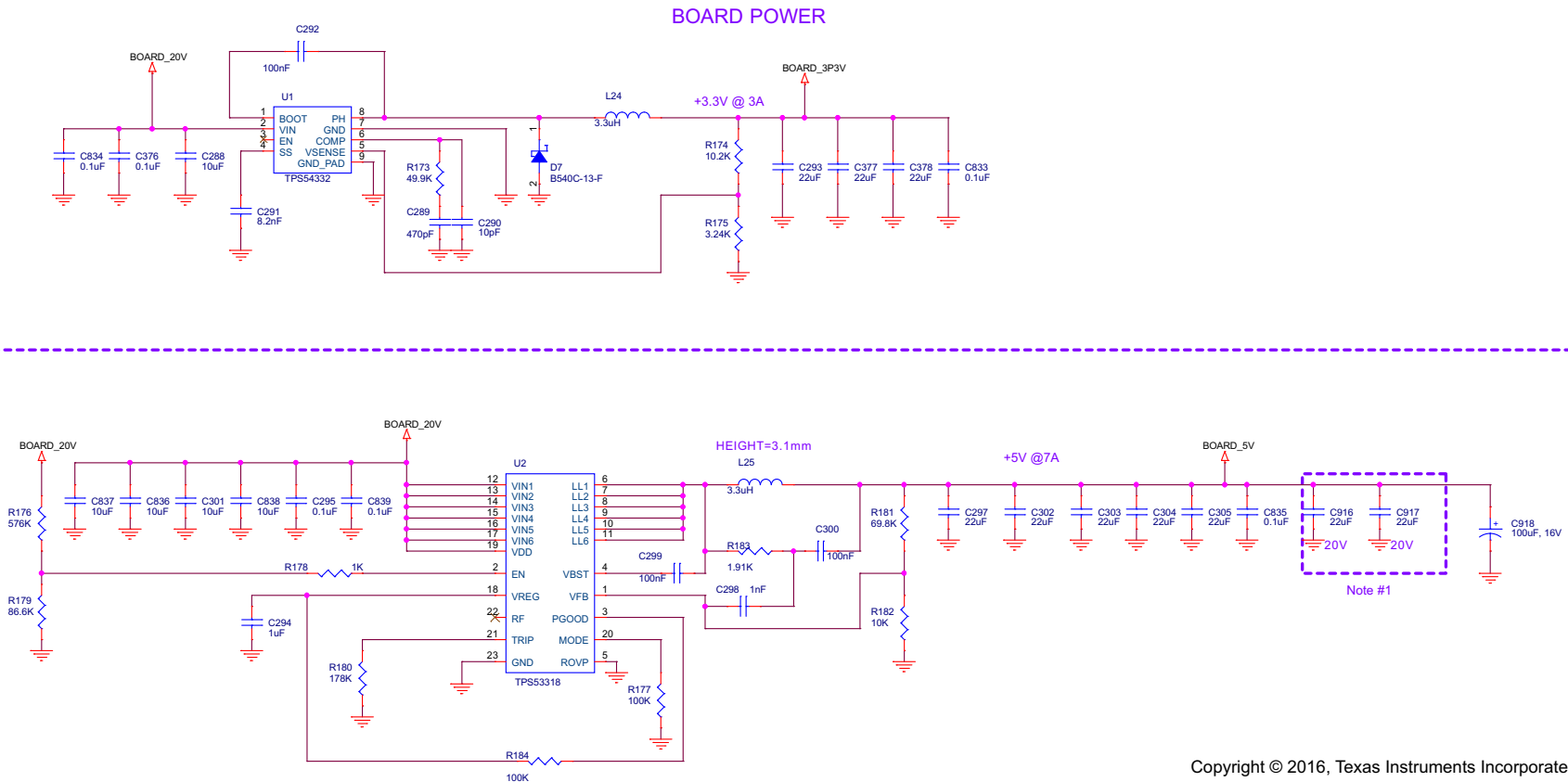
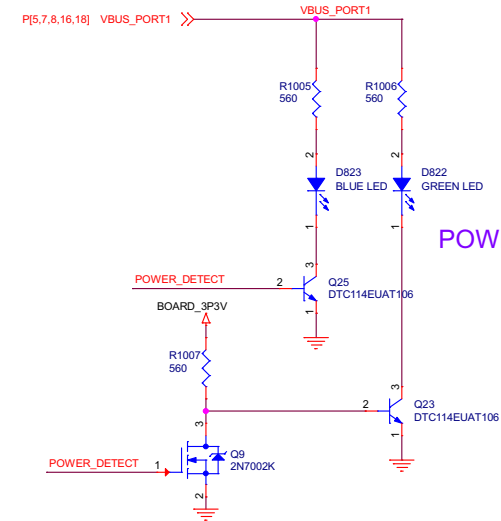
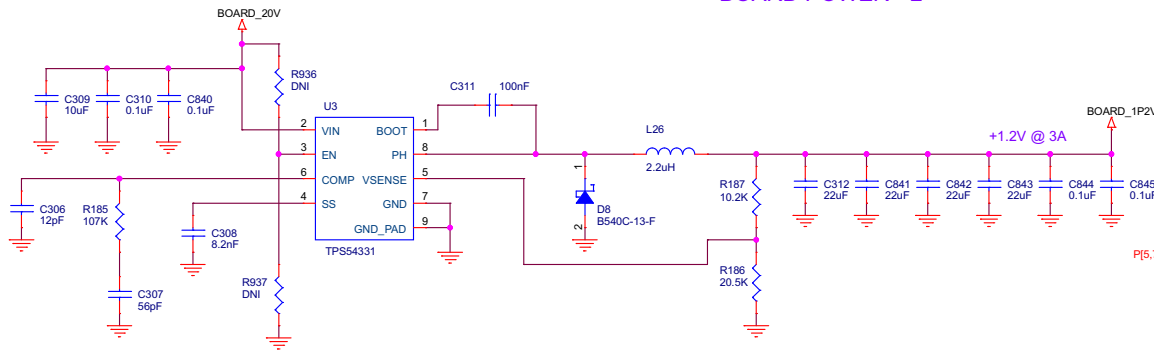


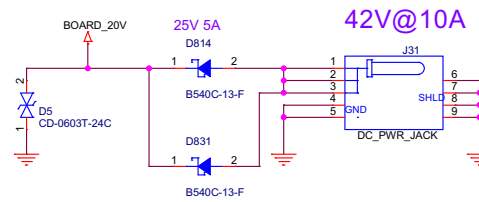
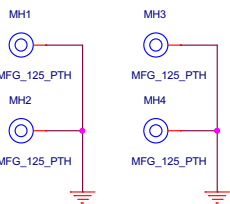
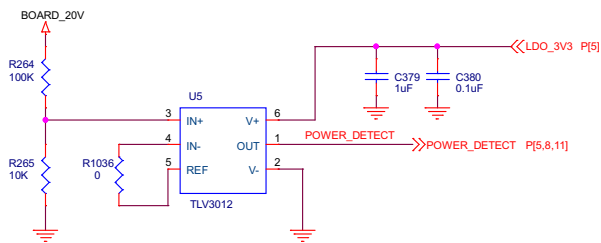
Figure 6. EVM Board Power Schematic

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BOARD POWER - 2



POWER LEDS



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Figure 7. EVM Board Power 2 Schematic

USB TYPE C FRONT END

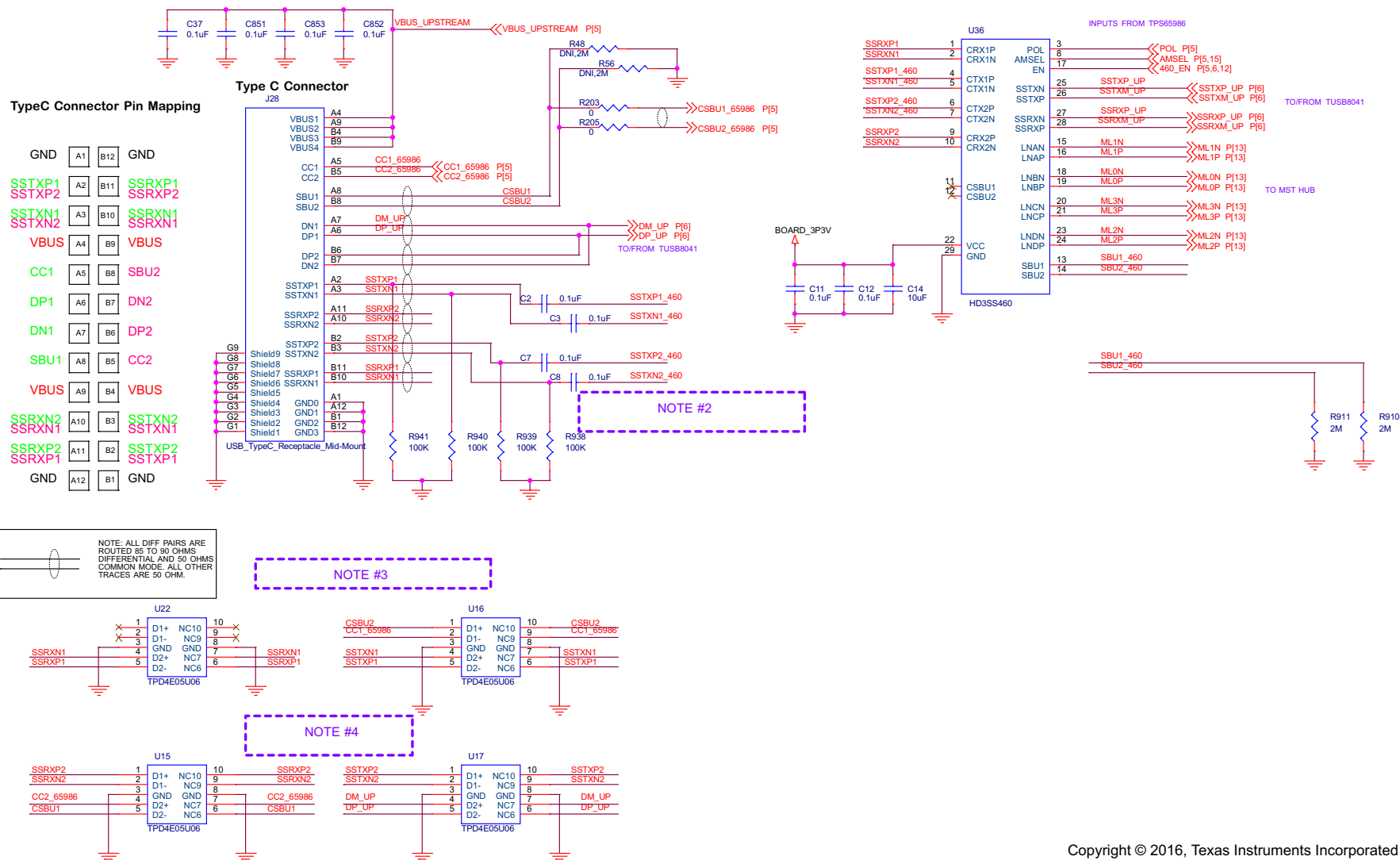
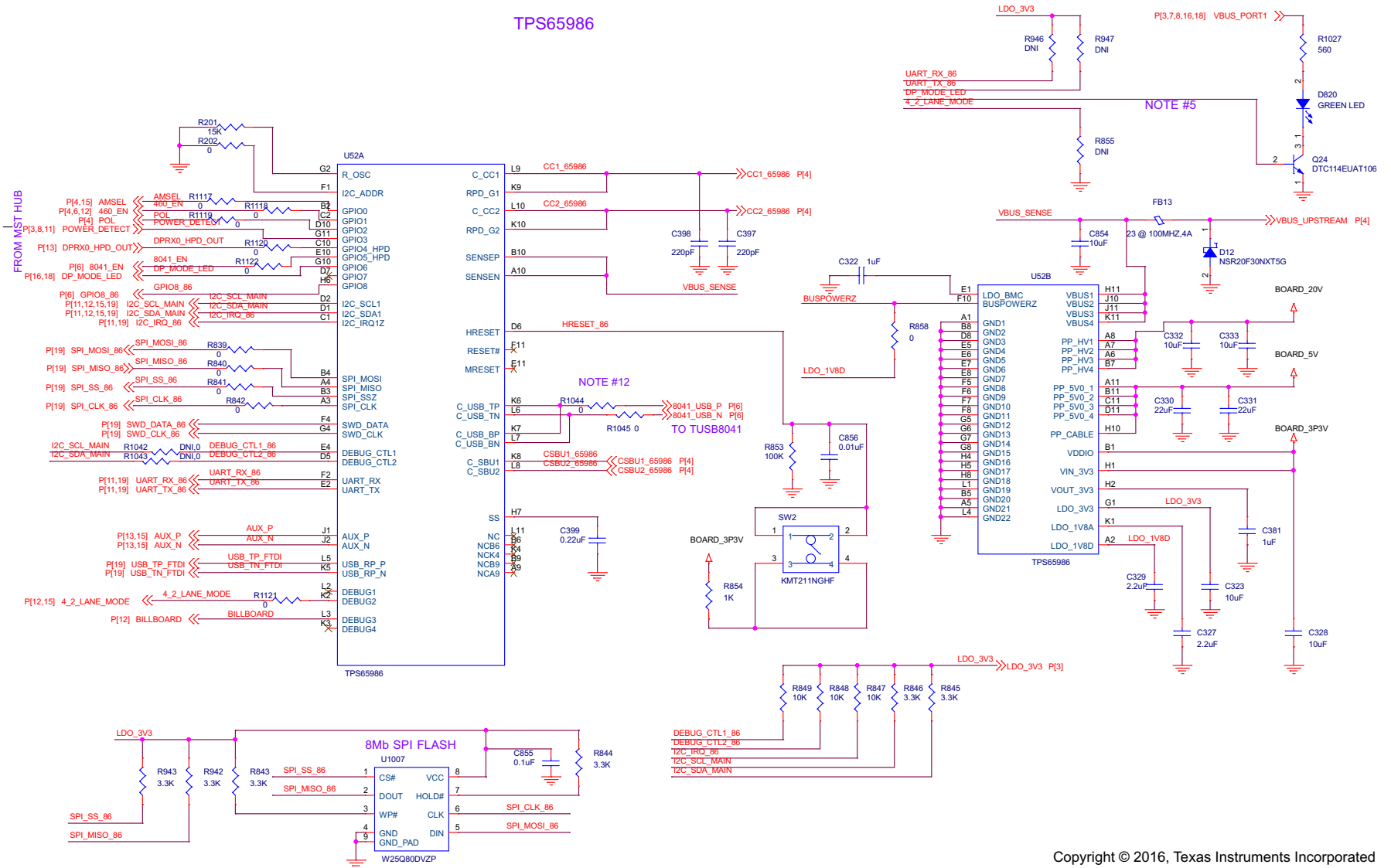


Figure 8. USB Type-C Front End Schematic

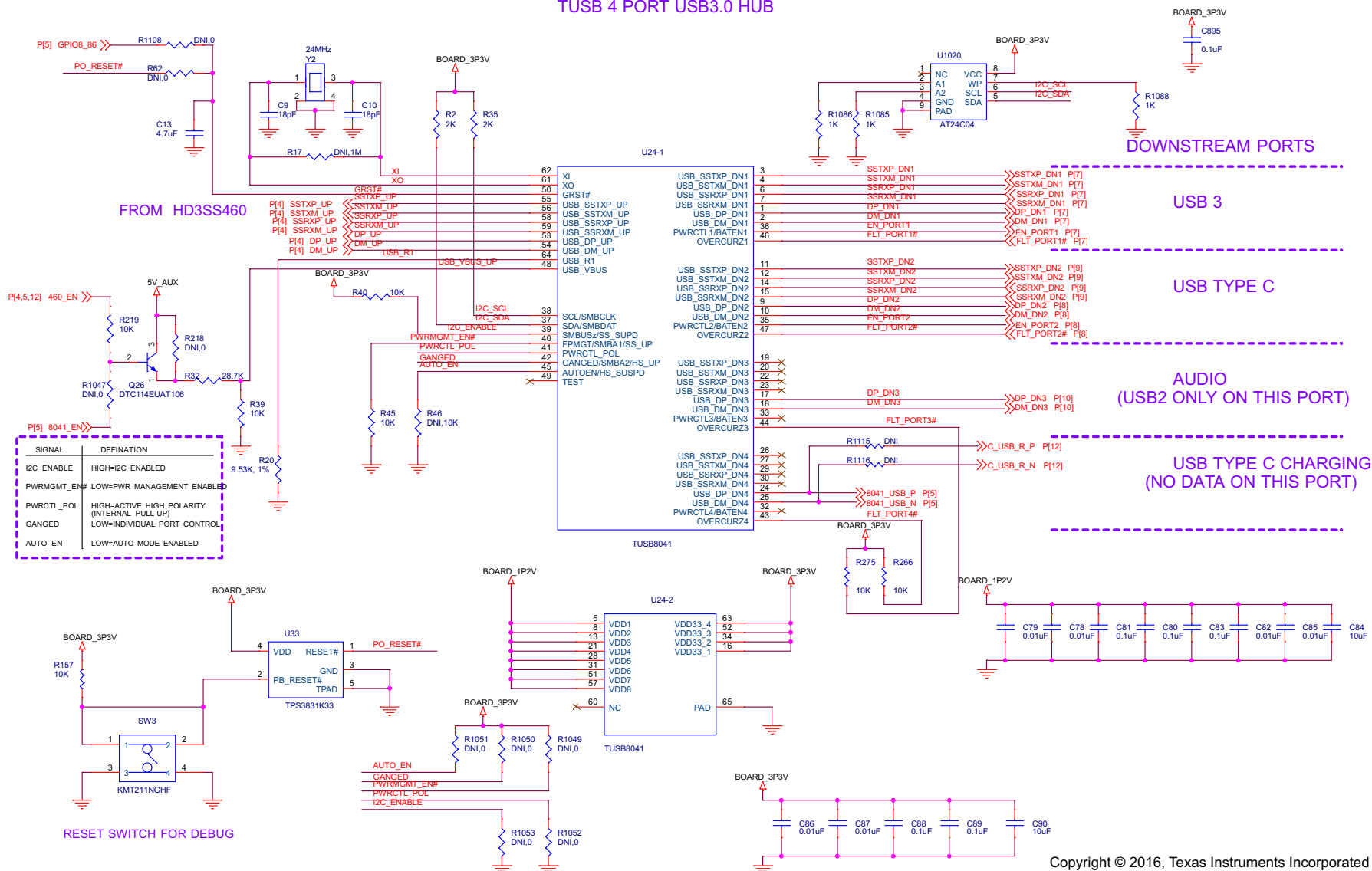
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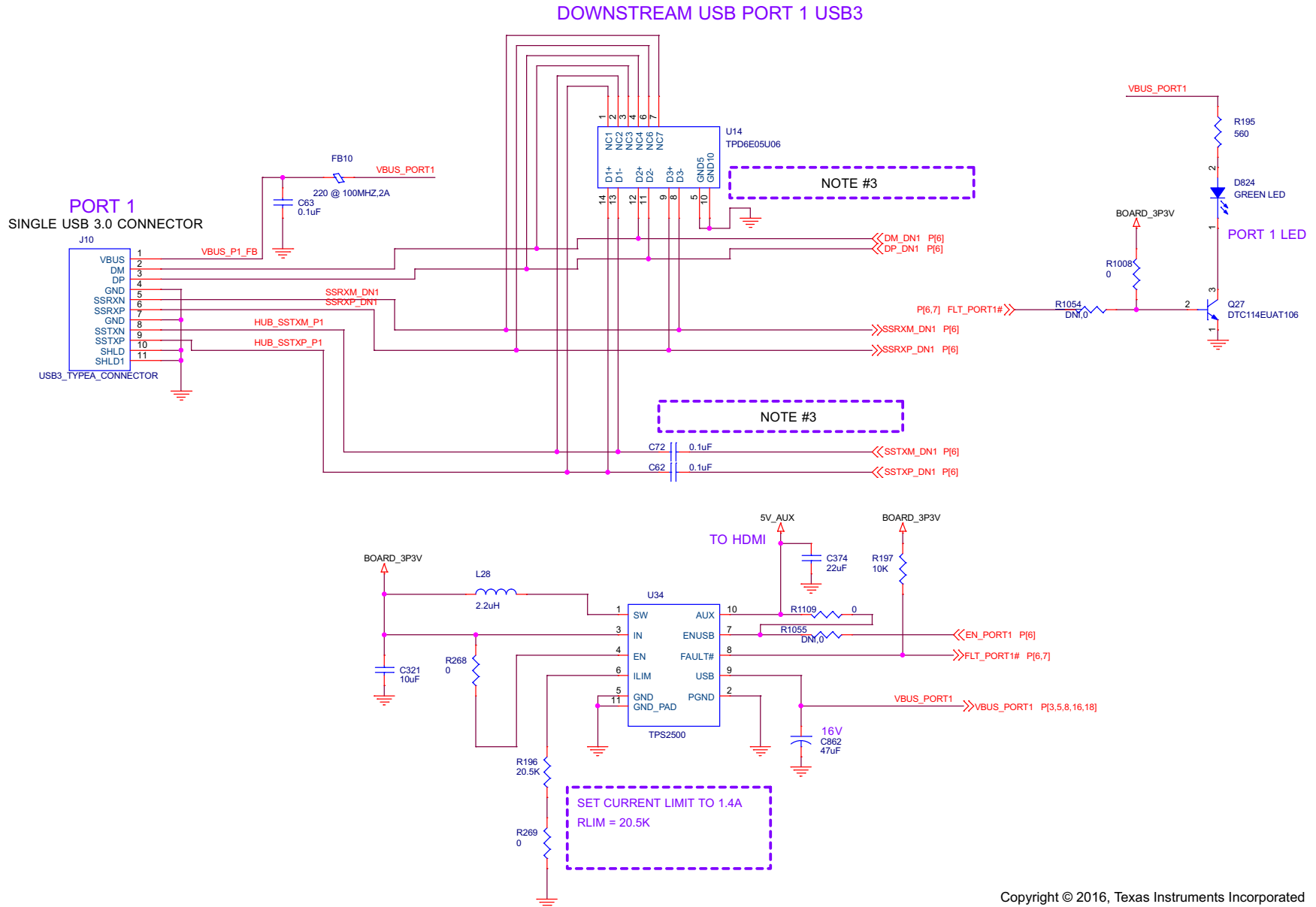
Figure 9. TPS65986 Schematic

TUSB 4 PORT USB3.0 HUB



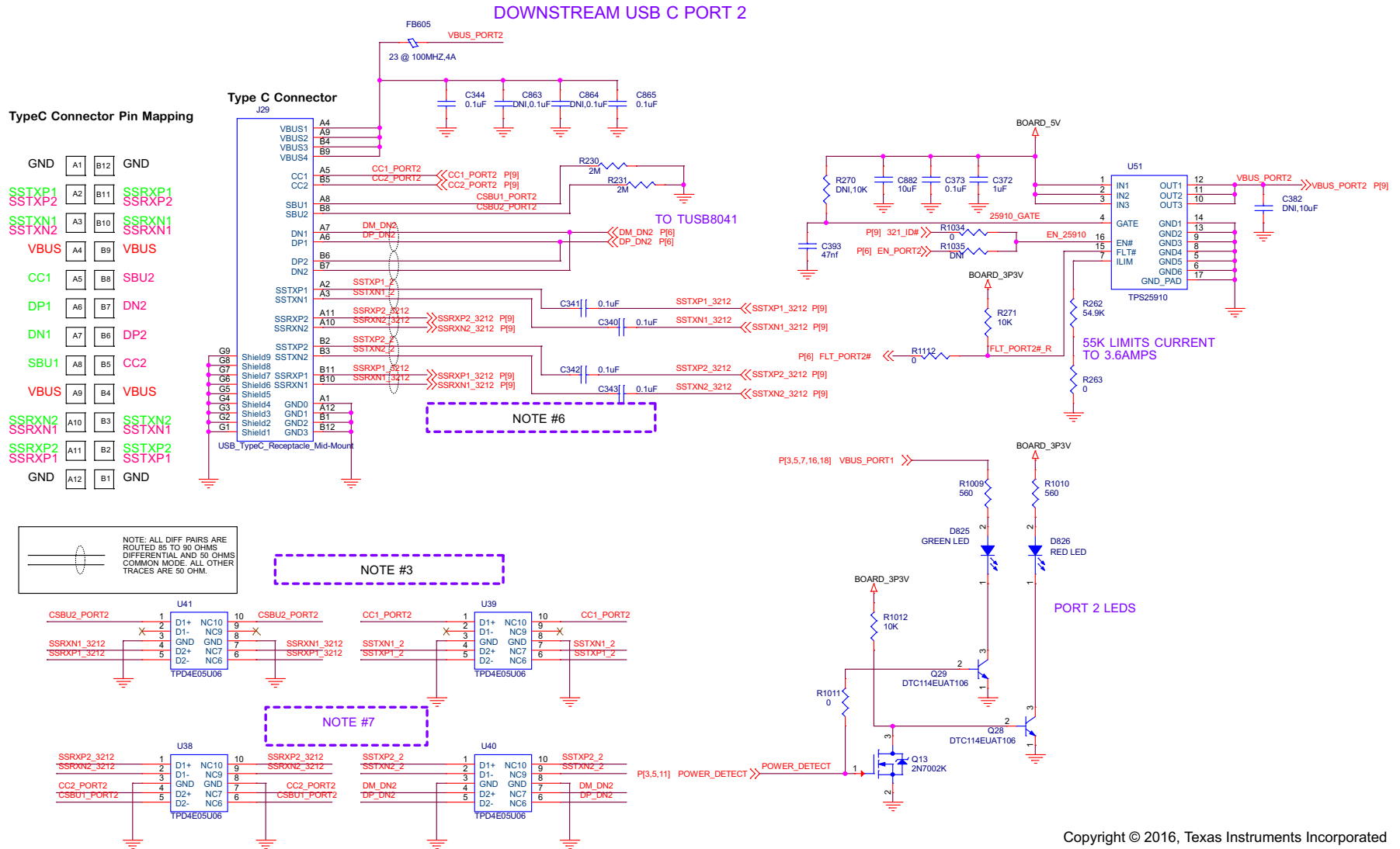
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Figure 10. TUSB8041 Schematic



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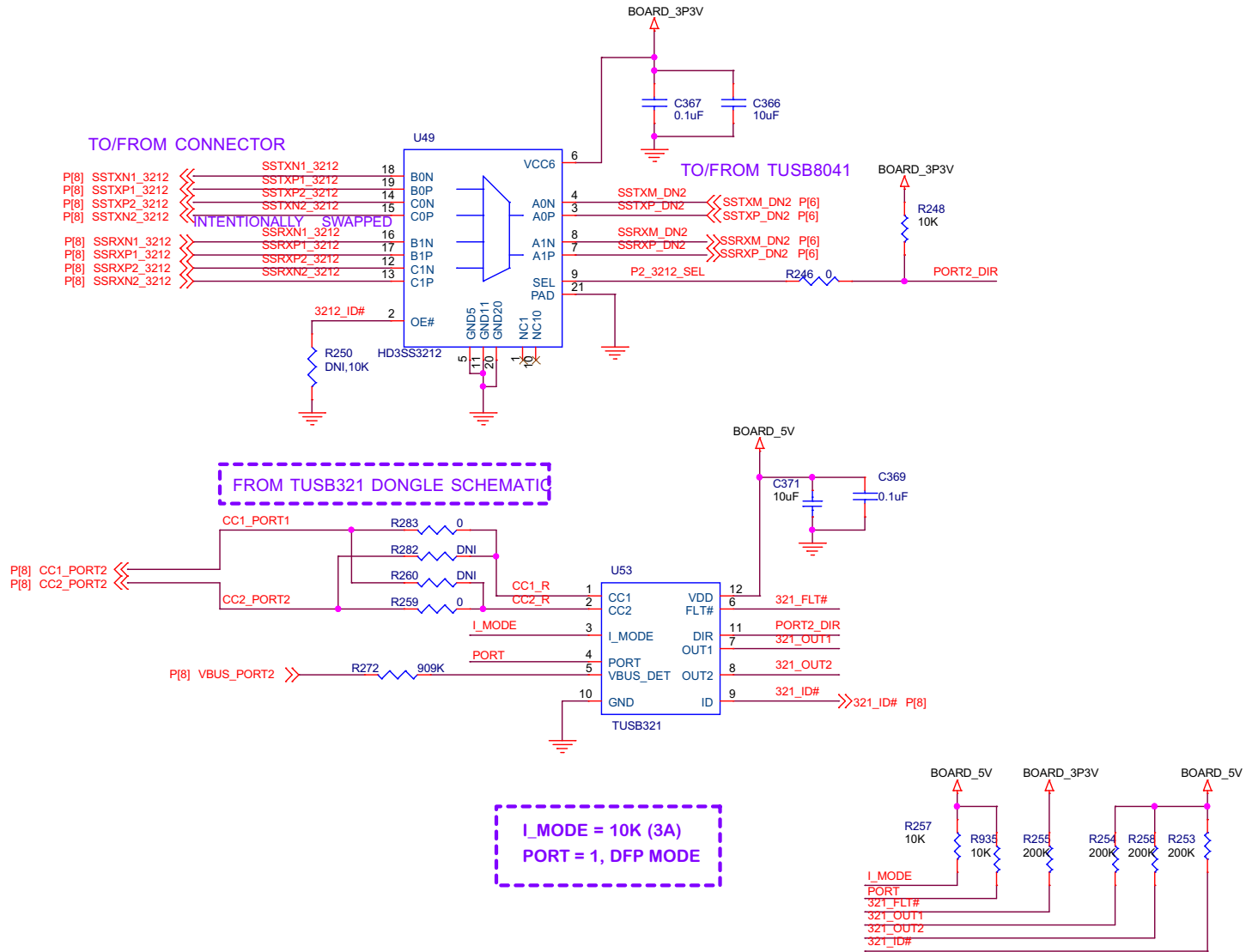
Figure 11. Port 1 Downstream USB Schematic



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Figure 12. Port 2 Downstream USB Type-C Schematic

DOWNSTREAM USB C PORT 2



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Figure 13. Port 2 USB Type-C Schematic

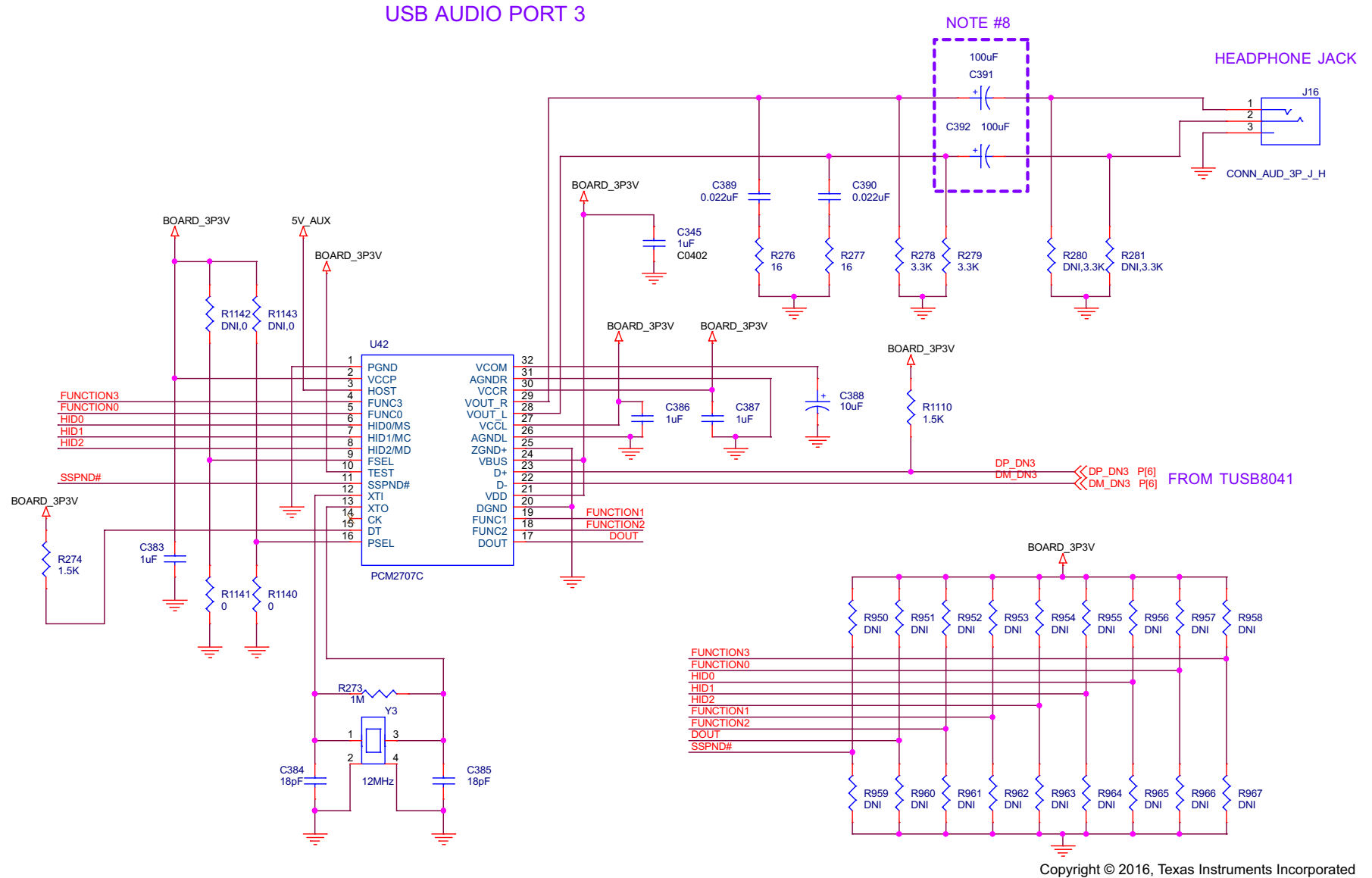
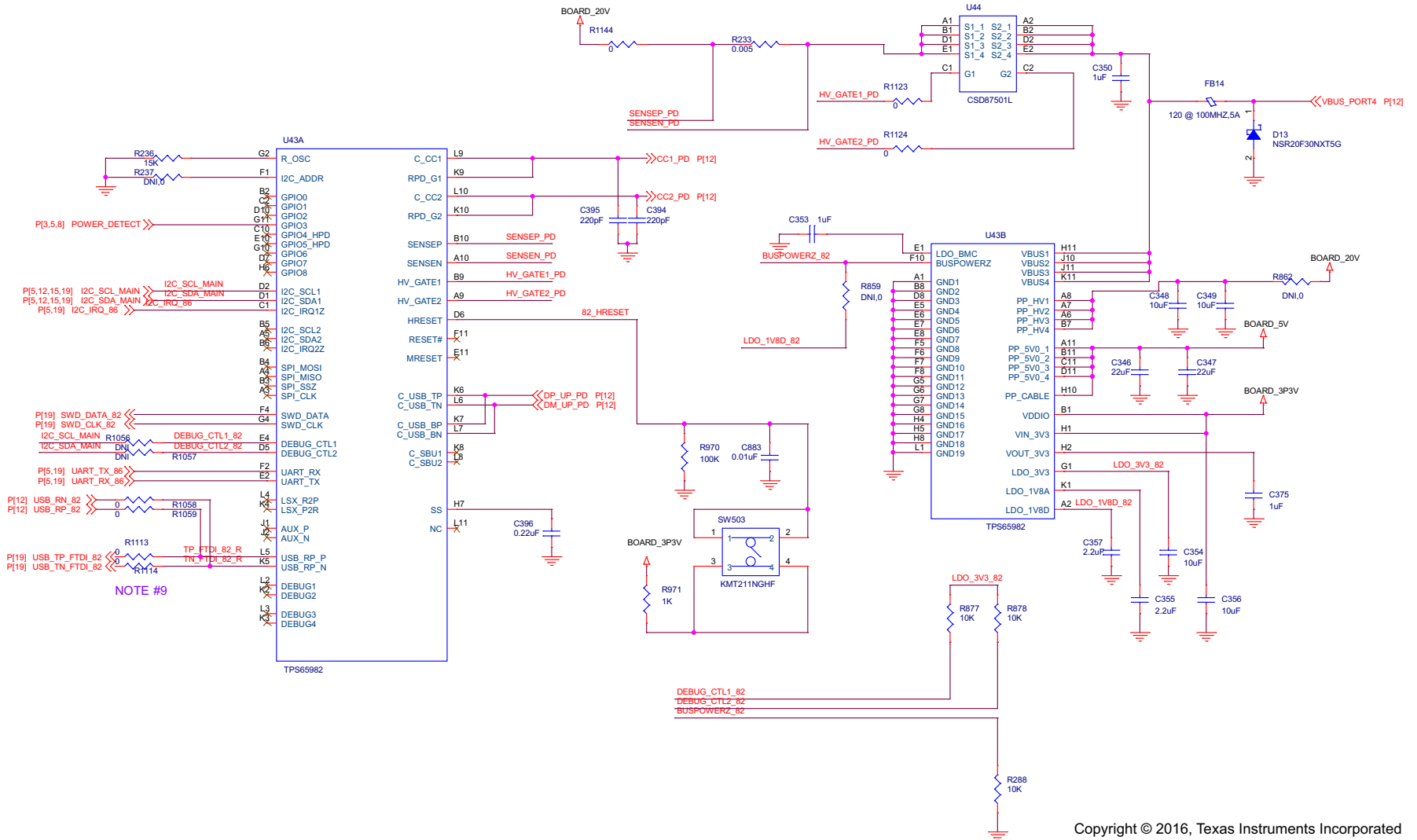


Figure 14. Port 3 USB Audio Schematic

PORT 4 - TPS65982



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Figure 15. Port 4 USB Type-C Charging Schematic

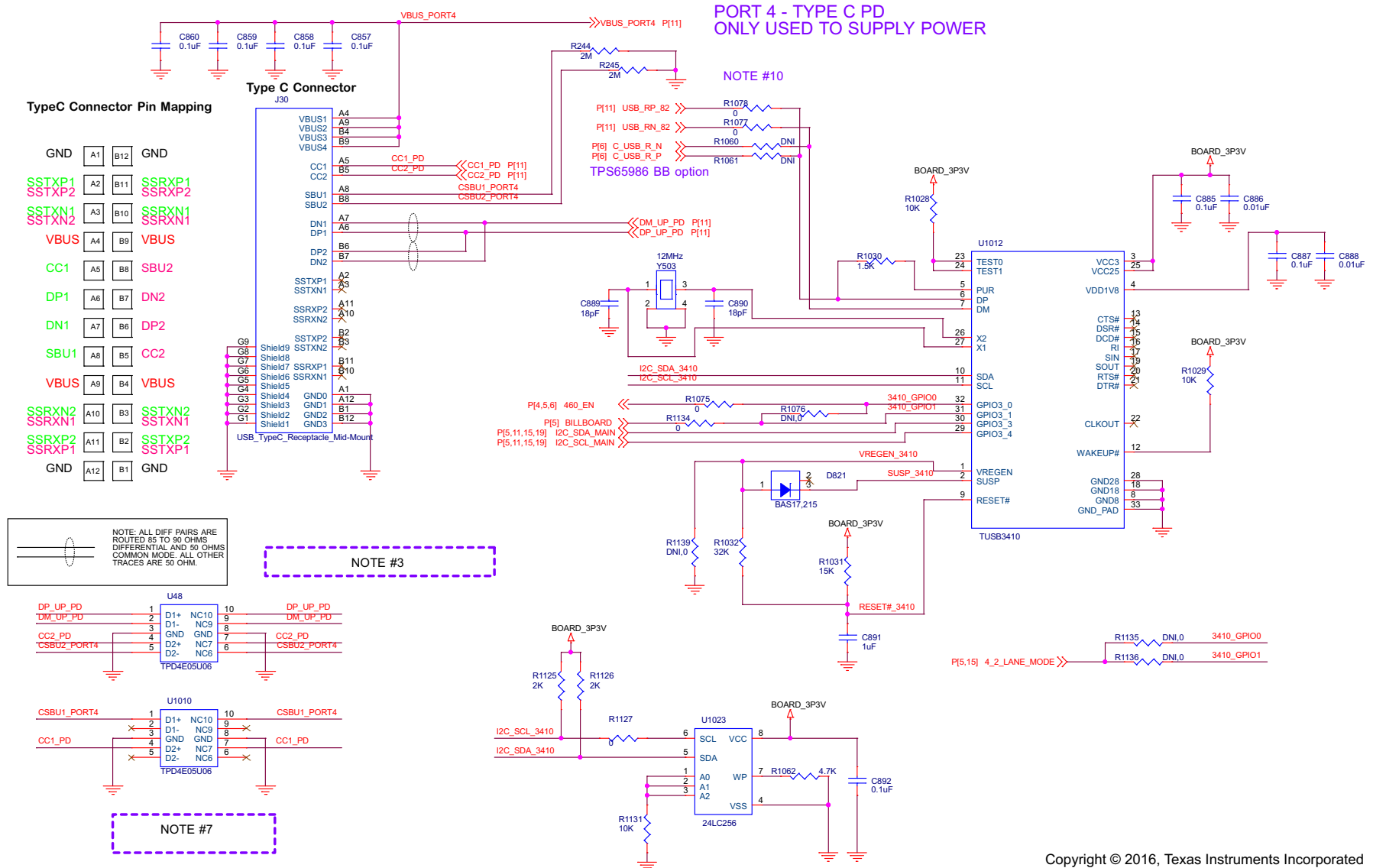


Figure 16. Port 4 USB Type-C Connector Schematic

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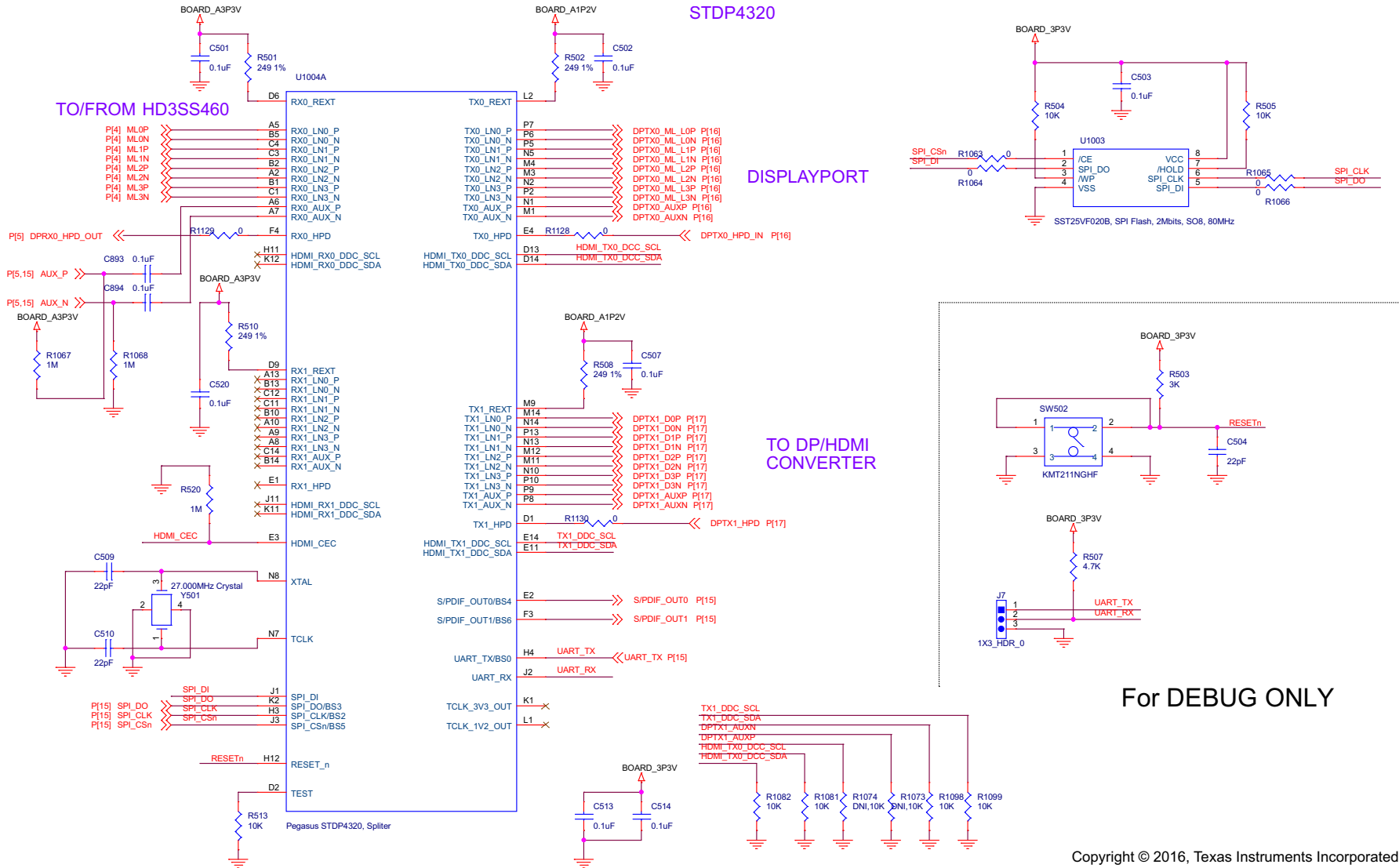
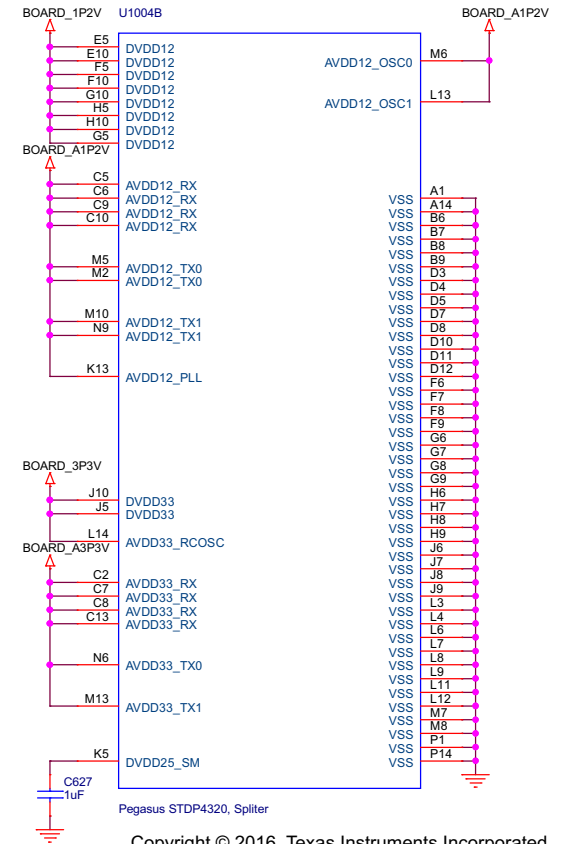
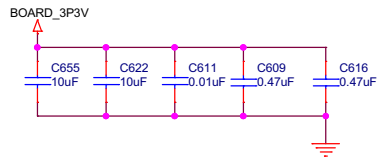
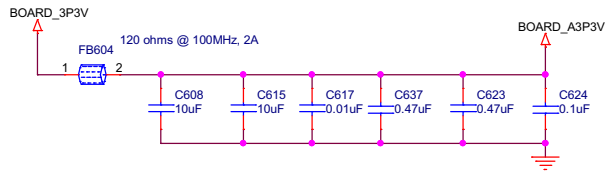
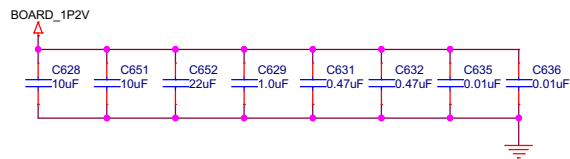
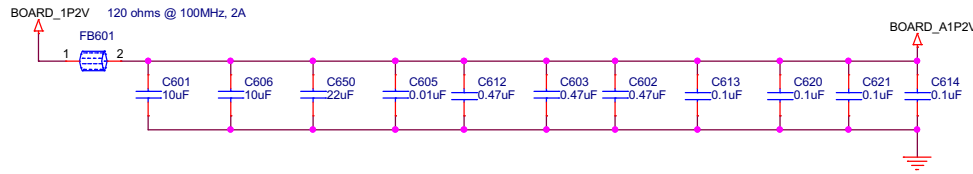


Figure 17. DP4320 Schematic

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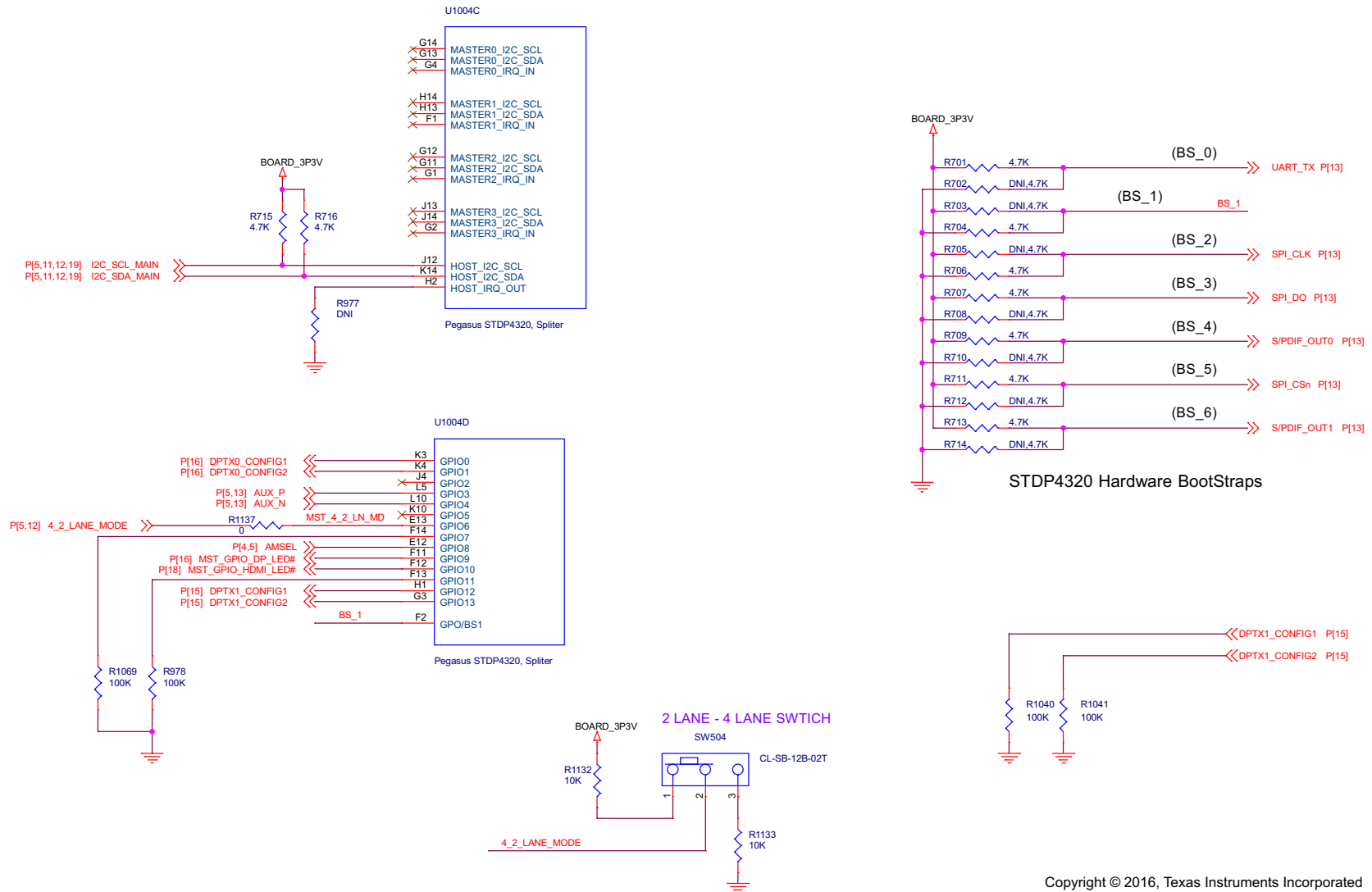
STDP4320 POWER



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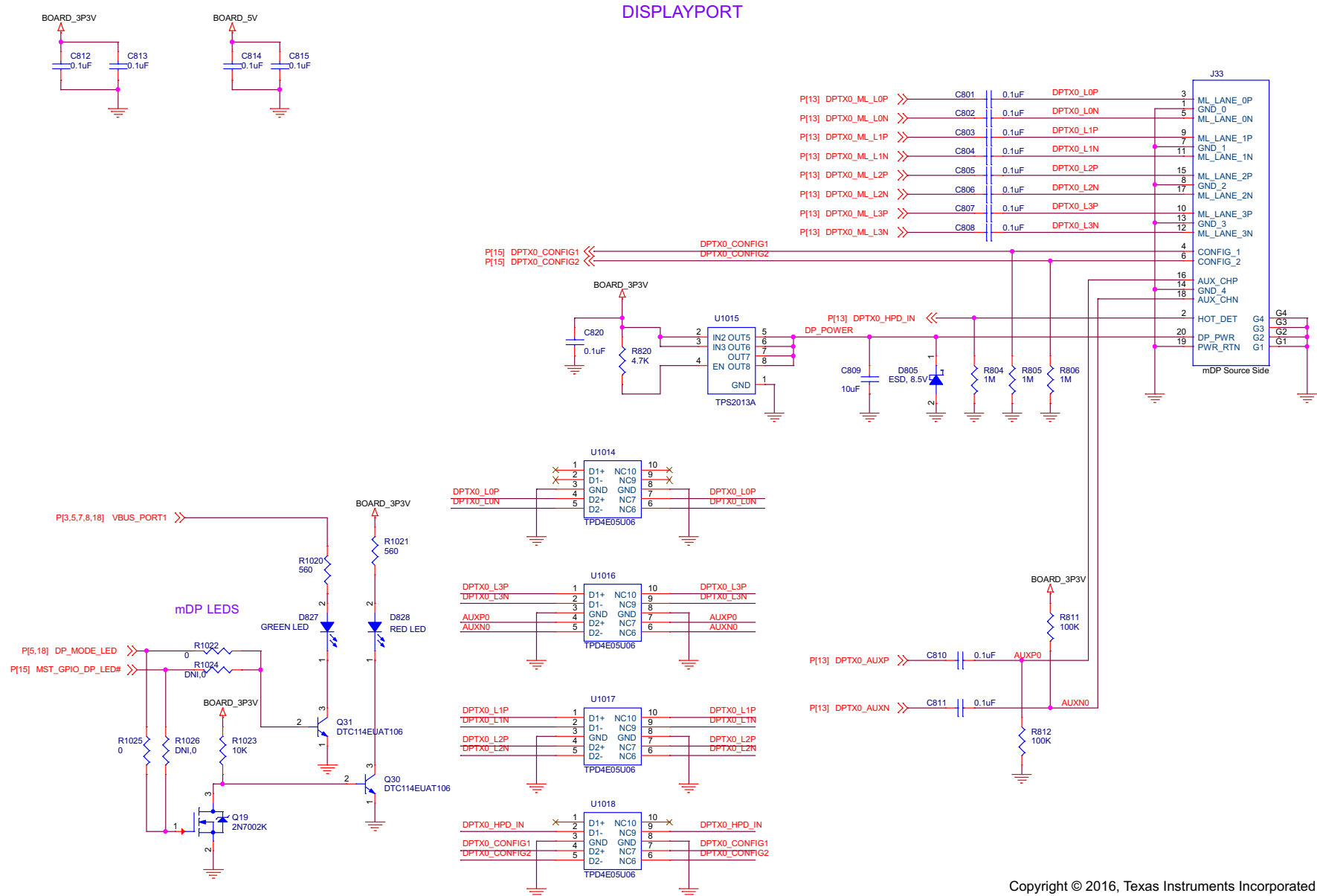
Figure 18. DP4320 Power Schematic

STDP4320 BOOTSTRAPS



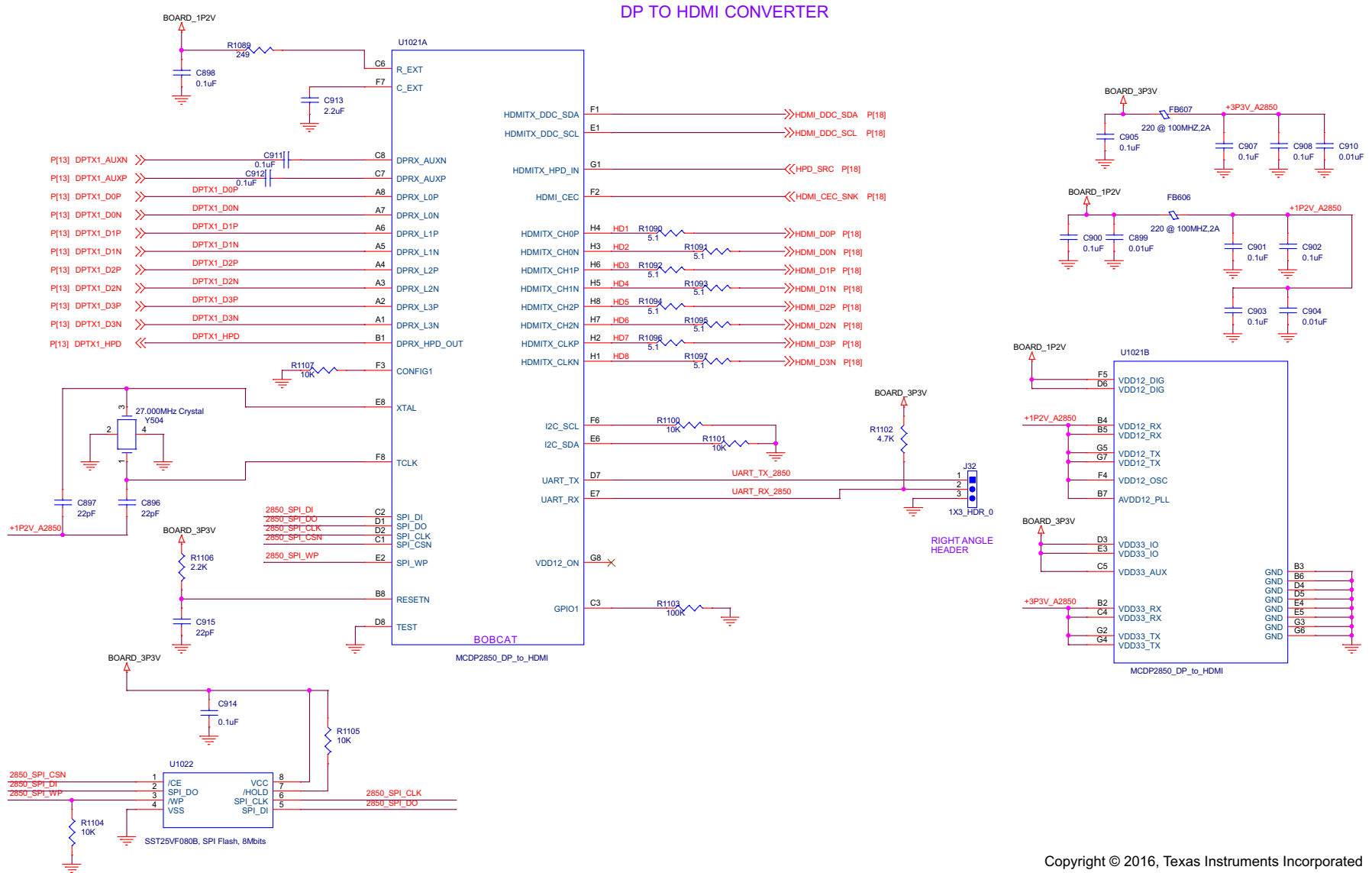
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Figure 19. DP4320 Bootstrap Schematic



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Figure 20. EVM Display Port Schematic



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Figure 21. DP to HDMI Schematic

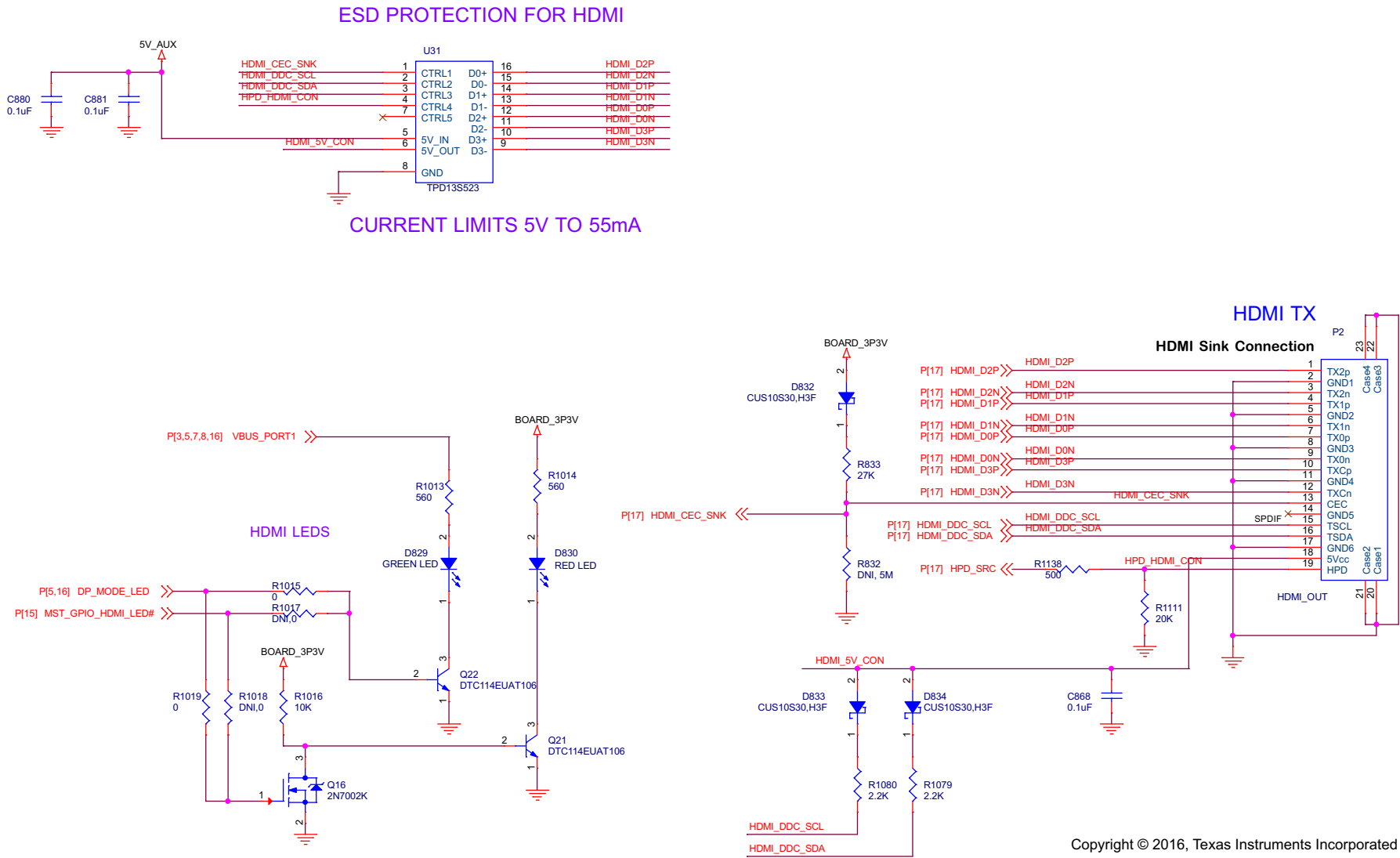
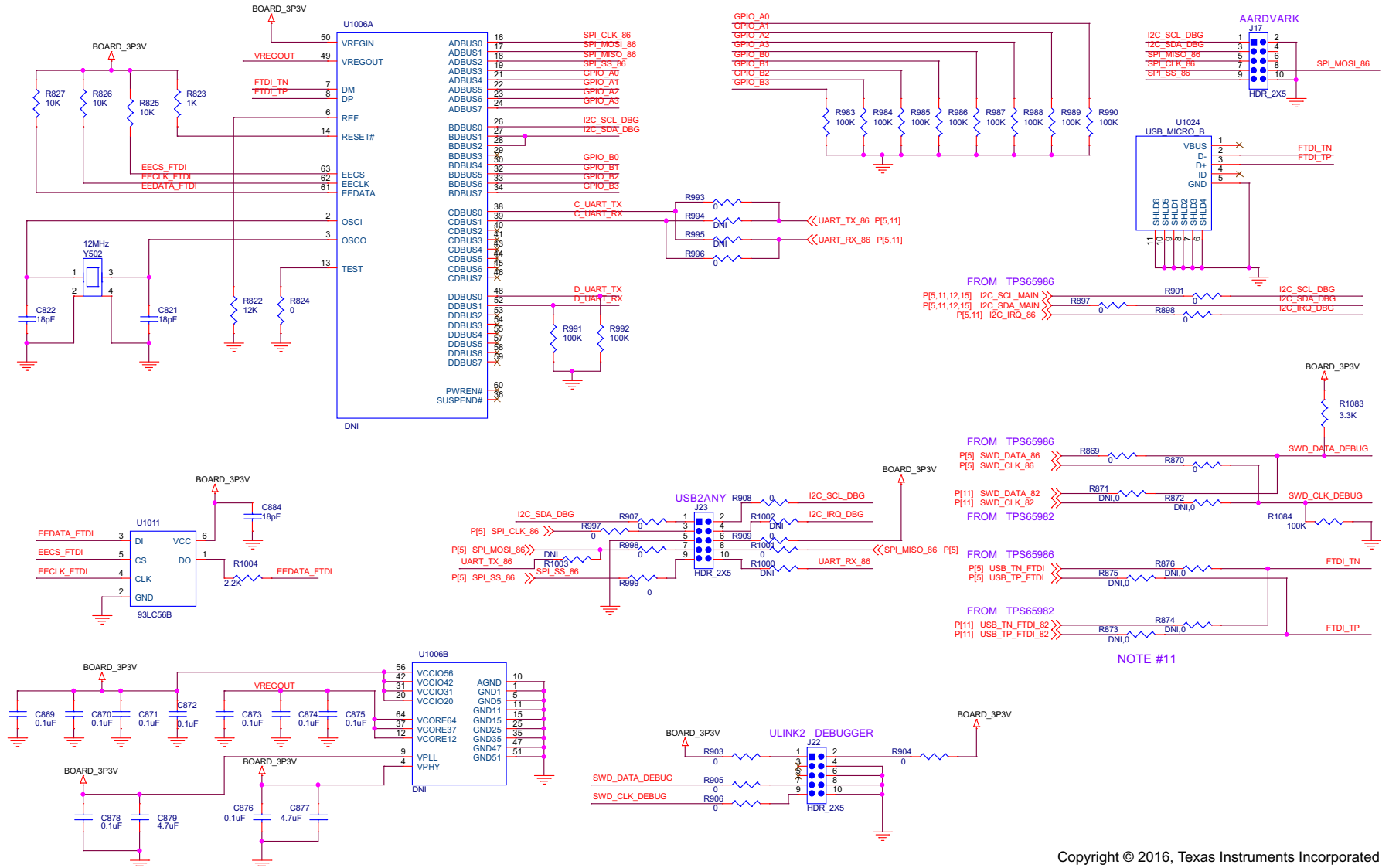


Figure 22. EVM HDMI Connector Schematic

DEBUG BOARD - FTDI - USB - I2C/SPI/UART



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Figure 23. Debug Board Schematic

- 1- PLACE C916 C917 ANY WHERE ON THE BOARD
- 2- KEEP C2, C3, C7, C8 CAPS CLOSE TO CONNECTOR LET RESISTORS SHARE PADS
- 3- KEEP ESD CLOSE TO CONNECTOR
- 4- THESE CONNECTIONS ARE FOR FLOW THROUGH ROUTING
- 5- DP MODE LED PLACE NEAR DP/HDMI
- 6- KEEP C340, C341, C342, C343 CAPS CLOSE TO CONNECTOR LET RESISTORS SHARE PADS
- 7- THESE CONNECTIONS ARE FOR FLOW THROUGH ROUTING
- 8- C291 AND C192 MUST BE 5.4mm TALL
- 9- PAD SHARING R1058 AND R1114, R1059 AND R1113
- 10- Place R1077 and R1078 as close as possible to R1060 and R1061
- 11- PAD SHARING R873 AND R875, R874 AND 876
- 12- Pad sharing with R1060 and R1061 on page 12

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Figure 24. EVM Schematic Fab Notes

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from A Revision (August 2016) to B Revision	Page
• Changed description of USB Type-C Dock.	2

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.
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 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
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 - 2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.
3. *Regulatory Notices:*
 - 3.1 *United States*
 - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 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

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.

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.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

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.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
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 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

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.

4.3 *Safety-Related Warnings and Restrictions:*

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