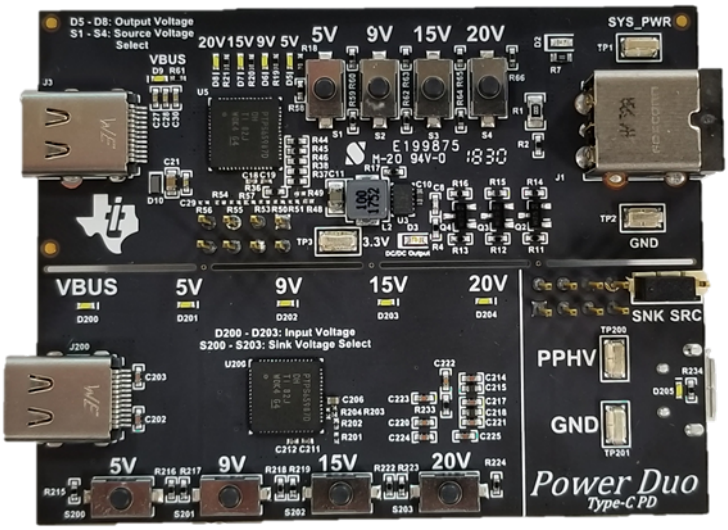
USB-C-PD-DUO-EVM User's Guide

This is the user's guide for the USB-C-PD-DUO-EVM. The USB-C-PD-DUO-EVM user's guide contains an introduction, setup instructions, the EVM schematic, top and bottom board layouts and component views, layout, and a bill of materials (BOM).



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1 Items Required for Operation

The following items are required to use the USB-C-PD-DUO-EVM:

- USB Type-C cable
- Barrel jack adapter or DC power supply

2 Introduction

The USB-C-PD-DUO-EVM allows the TPS65987D to enter Power DUO mode where both VBUS Power Paths are enabled in parallel to allow for half the effective RDSon. The USB-C-PD-DUO-EVM contains both a Source side and Sink side board to allow users to evaluate Power DUO mode for either a source or sink design. The USB-C-PD-DUO-EVM also allows users to select both the source and sink capabilities offered through the use of the push button switches labeled 5 V, 9 V, 15 V, and 20 V respectively.

3 Setup and Connectors, Test Point, and LED Description

3.1 J1 Barrel Jack Input

The J1 connector is meant for a Barrel jack power supply. Many laptop chargers can be used for this power input such as the DA130PE1-00 from Dell. The expected input voltage for J1 is 19.5 V to 20 V.

3.2 TP1 System Power & TP2 Ground

If a compatible Barrel jack power supply is not available, a DC bench supply can be connected to the TP1 and TP2 test points labeled SYS_PWR and GND respectively. 20 V should be provided to these test points if an external DC bench supply is used.

3.2.1 TP3 3.3V

TP3 can be used to measure the output of the 3.3 V regulator present on the USB-C-PD-DUO-EVM. It can also be used to supply an external 3.3 V supply to the USB-C-PD-DUO-EVM.

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3.2.2 Push Button S1 - S4

Push buttons S1, S2, S3, and S4 are used to adjust the Source Capabilities offered by the Source board to 5 V, 9 V, 15 V, and 20 V respectively. When 9 V push button (S2) is selected, the source board will have a 5 V and 9 V Source PDO available. When the 15 V push button (S3) is selected, the source board will have a 5 V, 9 V, and 15 V source PDO available. When the 20 V push button (S4) is selected, the source board will offer 5 V, 9 V, 15 V, and 20 V through its source capabilities. When the 5 V button is pressed (S1), the Source board will reset and return to only a 5 V source capability offering.

3.2.3 LEDs D5 - D8

LEDs D5, D6, D7, and D8 highlight if the Source Board is outputting a 5 V, 9 V, 15 V, or 20 V PD contract respectively.

3.2.4 J2 Programming Header

J2 Can be used to probe the SPI and I^2C lines of the Source board. It can also be used to program the board by connecting an external programmer.

3.2.5 J3 Type-C Connector

J3 is the Type-C Connector for the Source Board. A Type-C Sink device can be connected through a type-c cable to make a PD contract.

3.2.6 J200 Type-C Connector

J200 is the Type-C Connector for the Sink Board. A Type-C Source device can be connected through a type-c cable to make a PD contract.

3.2.7 LEDs D201 - D204

LEDs D201, D202, D203, and D204 highlight if the Sink Board is sinking a 5 V, 9 V, 15 V, or 20 V PD contract respectively.

3.2.8 Push Button S200 - S203

Push buttons S200, S201, S202, and S203 are used to adjust the Sink Capabilities offered by the Sink board to 5 V, 9 V, 15 V, and 20 V respectively. When 9 V push button (S201) is selected, the source board will have a 5 V and 9 V Sink PDO available. When the 15 V push button (S202) is selected, the sink board will have a 5 V, 9 V, and 15 V sink PDO available. When the 20V push button (S203) is selected, the sink board will sink 5 V, 9 V, 15 V, and 20 V through its sink capabilities. When the 5 V button is pressed (S200), the Sink board will reset and return to only a 5V sink capability offering.

3.2.9 TP200 PPHV & TP201 GND

Test points 200 and 201 can be used to connect an external load onto the Sink Board.

3.2.10 J203 Programming Header

J203 Can be used to probe the SPI and I^2C lines of the Source board. It can also be used to program the board by connecting an external programmer.

3.2.11 J201 Micro-USB Connector

J201 is used to connect a micro-USB cable from a windows PC to the USB-C-PD-DUO-EVM. Once this cable is connected, the USB-C-PD-DUO-EVM can be accessed through the TPS6598x Application Customization Tool to read back registers of the TPS65987D or to adjust the configuration of the TPS65987D on the EVM.

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3.2.12 J202 SPI Chip Select Header

The USB-C-PD-DUO-EVM contains an FTDI USB to I²C/SPI programmer that can be used to adjust the settings of the TPS65987D on either source or sink board. Jumper J202 is used to select which TPS65987D is being updated by connecting the SPI Chip Select to either the Source or Sink TPS65987D. The pins are labeled SNK and SRC for the Sink and Source boards respectively.

4 Programming the USB-C-PD-DUO-EVM

The utilities tool can be found by going to the TPS65987D product page on TI.com, which is at the following link. From there click the tools and software tab, and then click the link for the TPS6598x Configuration Tool.

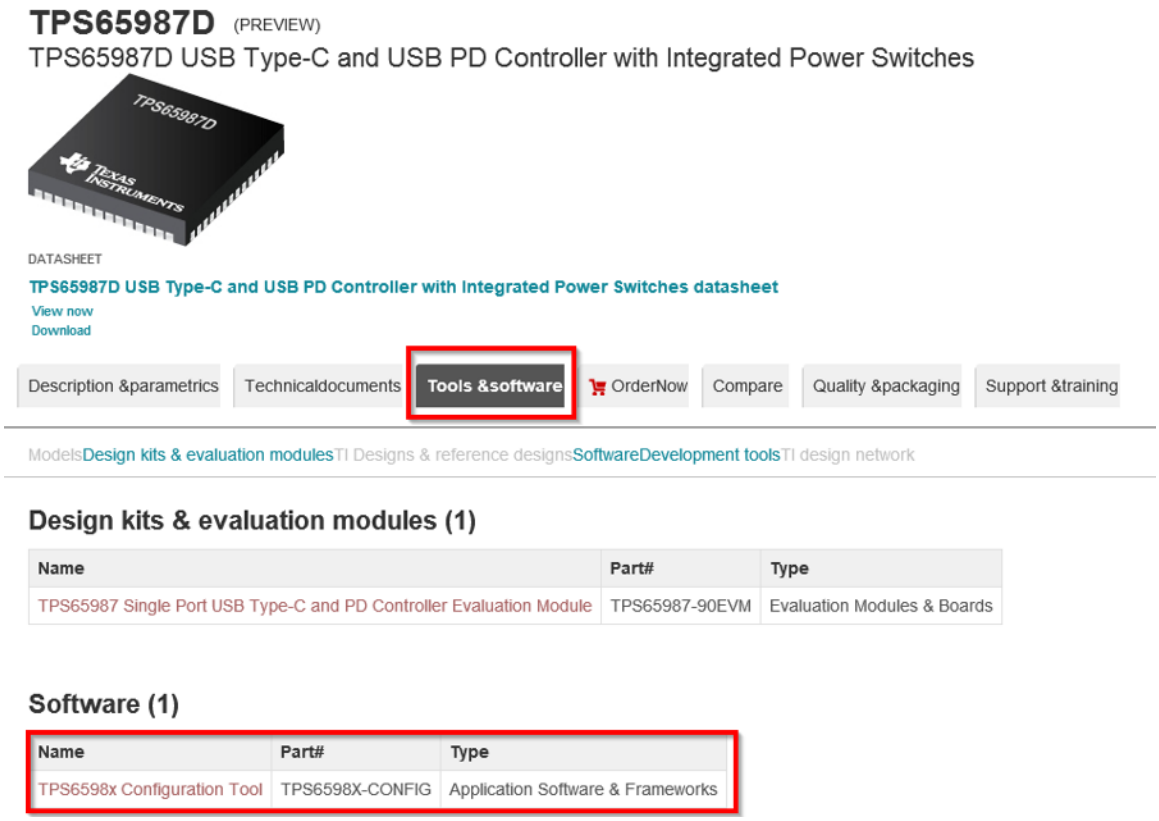

Figure 1. TPS65987D Product Page

From there, click the link next to TPS6598x-CONFIG that says “Get Software”. You will then have to fill out some information to get the link to the software download.

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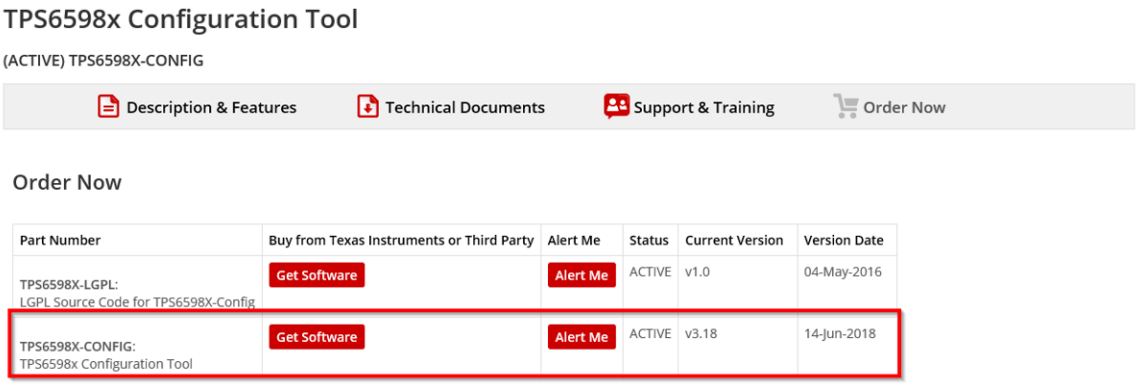

Figure 2. TPS6598x-Config Download Page

Once the download link has been clicked, you will be brought to a window for a 32 bit and 64 bit executable. Depending on the system you are using, click the correct executable. The executable will open, which will look like the following image.

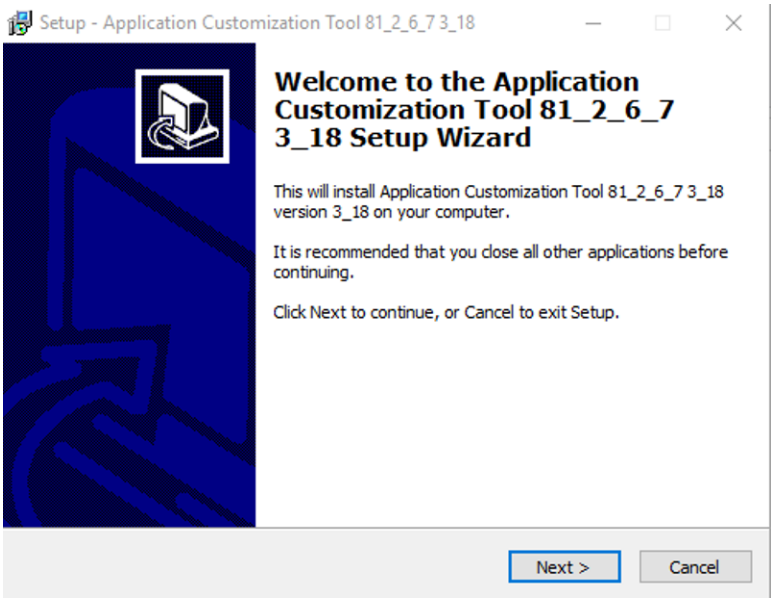

Figure 3. TPS6598x-Config Installation

Once the configuration tool has been downloaded, the program file for the source board will be flashed. This is done by first plugging in the barrel jack to power the source board, and then using a micro-usb to Type-A cable, connect the FTDI to a laptop for programming. Make sure that the jumper J202 is connected to SRC (right two pins). The cable connections and LEDs for this set up are shown below.

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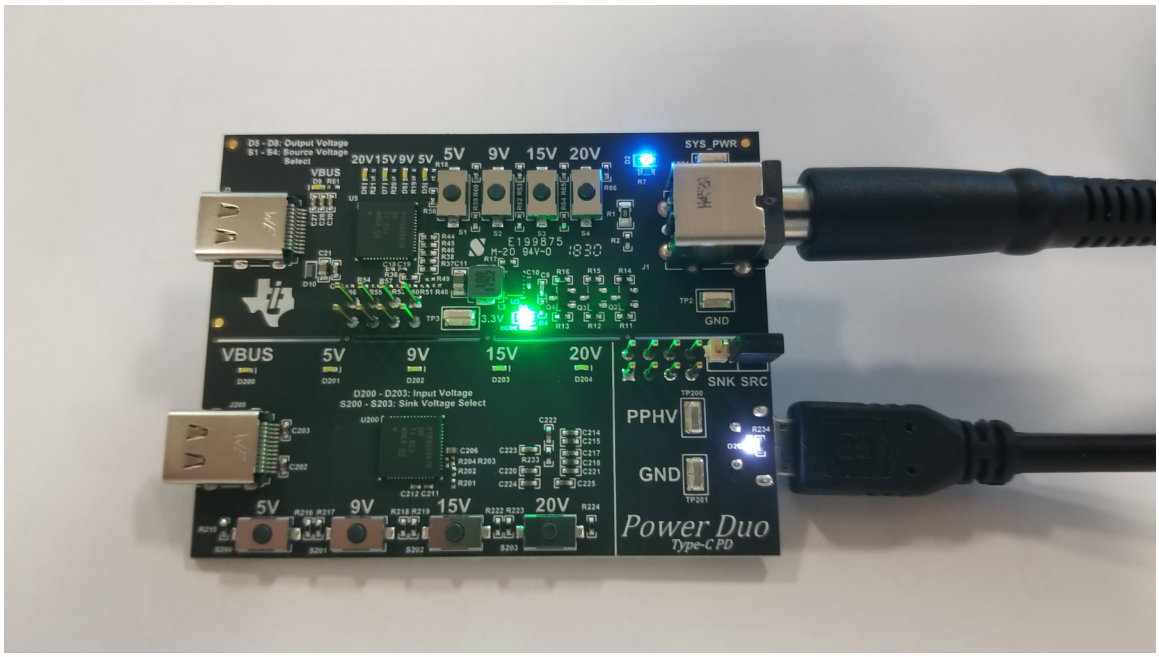

Figure 4. TIDA-050012 Source Board Programming

The next step is to flash the source.bin file onto the TIDA-050012 board. This is done by clicking the Binary tab, and then Flash from Binary File.

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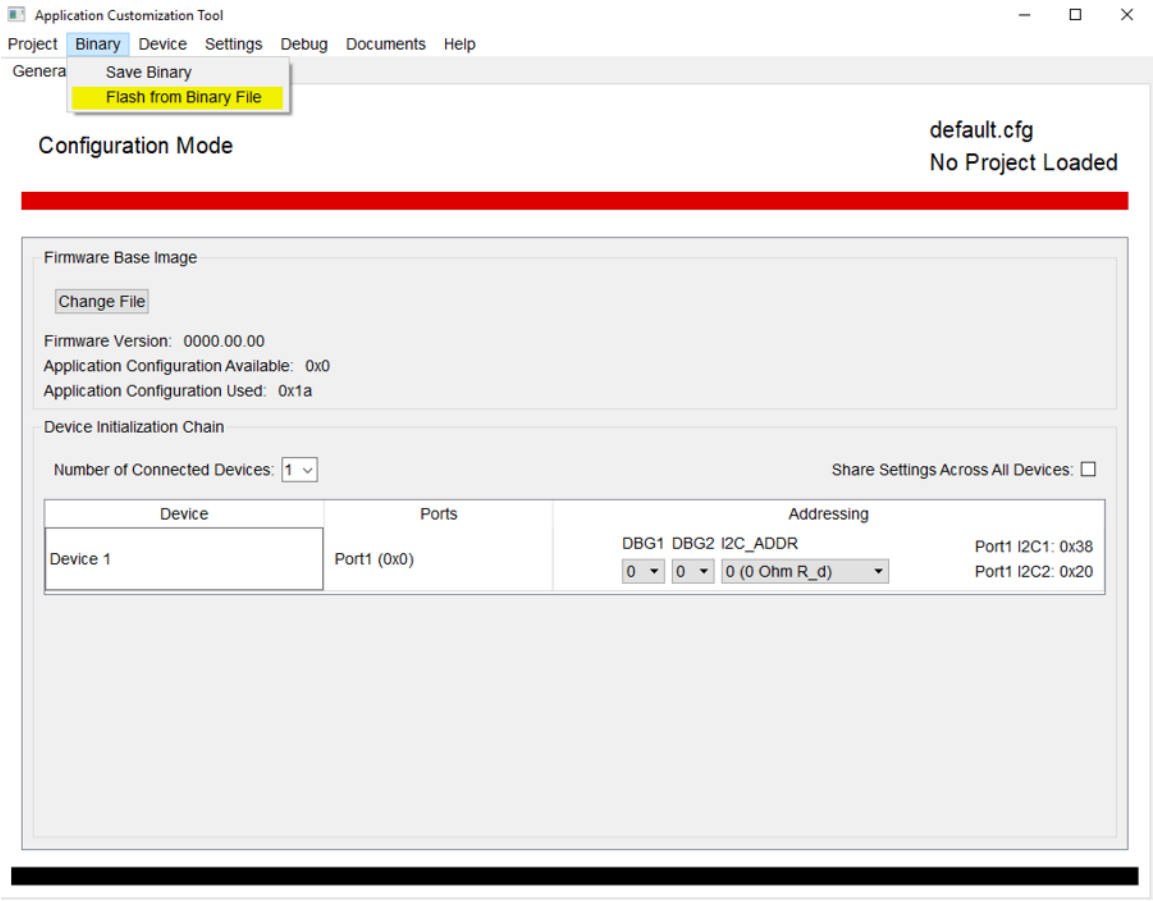

Figure 5. Flash From Binary File

From there, you will have to change the USB SPI Adapter from Aardvark to FTDI. Then click the change file button, and load the sink.bin file to be flashed. Press OK, and the file will begin flashing onto the EVM.

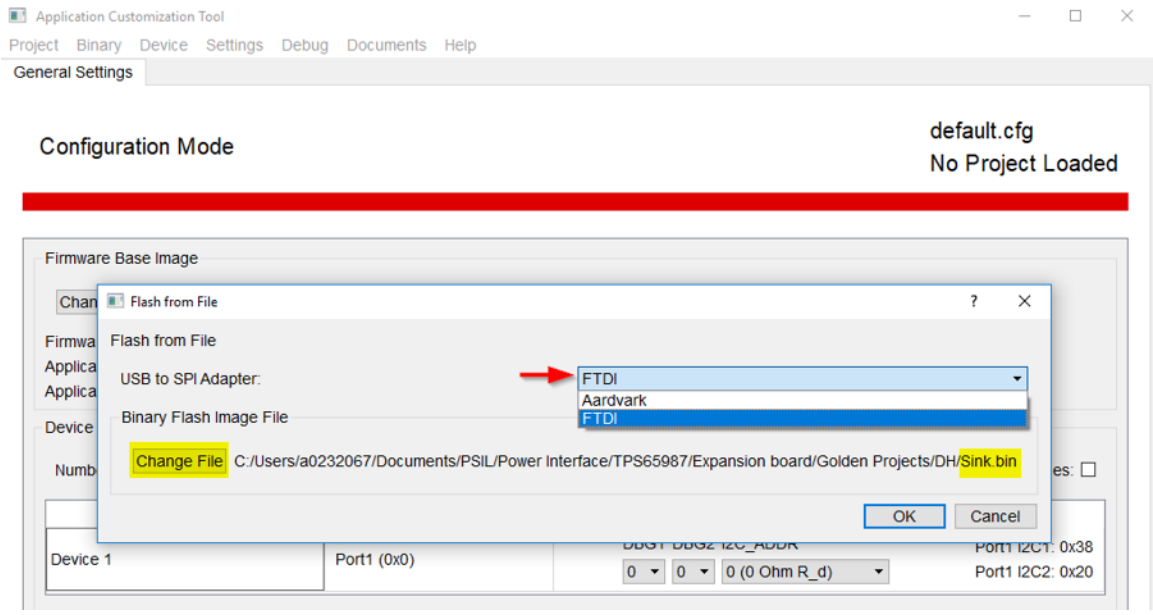

Figure 6. USB to SPI Adapter

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Once this file has been flashed onto the source board, unplug the Micro-USB cable and then the barrel jack from the PCB. Move the jumper on J202 from the SRC setting to the SNK setting. Plug the barrel jack back in, and the image should be loaded onto the TIDA-050012 PD controller. Next, using a Type-C to Type-C cable, power the sink board from the source board. The cable connections and LEDs for this set up are shown in Figure 7.

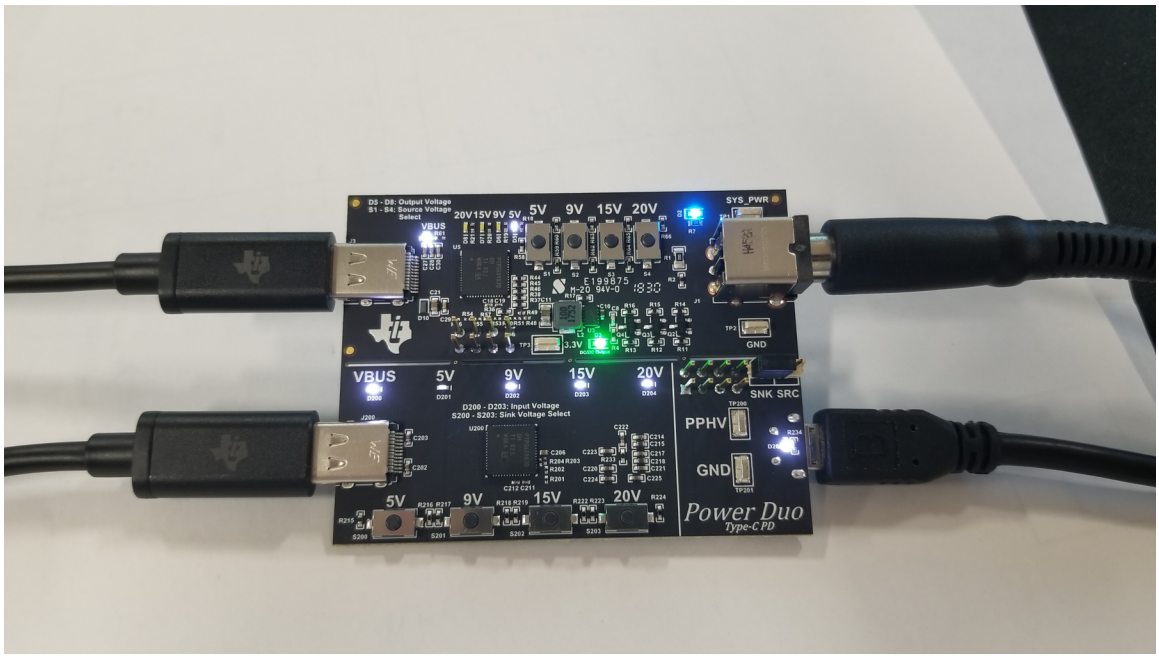

Figure 7. TIDA-050014 Programming

Next, the sink board program file needs to be flashed. You will follow the same setup as with the Source board, but instead of flashing source.bin you will flash sink.bin. Make sure that the header on J202 is now the SNK side (left two pins).

Once the binary file has been flashed, unplug the micro-usb and the barrel jack. Plug the barrel jack back in, and the image should not be loaded onto the TIDA-050014 PD controller. The LEDs should look similar to the image below.

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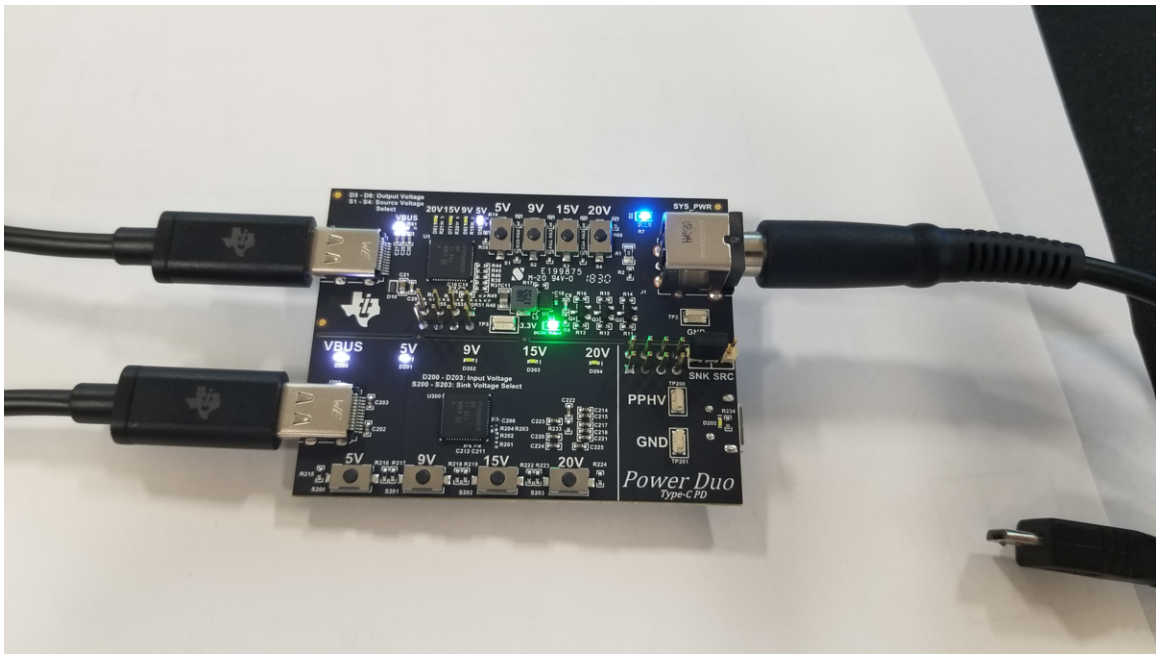

Figure 8. TIDA-050012 and TIDA-050014 Boards Programmed

NOTE: The USB-C-PD-DUO-EVM boards will come preprogrammed out of the box. If you would like to change any of the configurations, you can do so by using the TPS6598x Application Customization Tool and following the above mentioned steps.

5 How To Use USB-C-PD-DUO-EVM

To use this EVM, please first connect the Barrel jack power supply to J1. Next, connect a USB Type-C cable from J3 to J200.

Upon initial connection, the 5 V LED will be on for both the source and the sink side. The 9 V, 15 V, and 20 V buttons can be pushed to change the VBUS voltage. Keep in mind that if the 20 V button on the Source board is pressed, the sink board will not go to 20 V until the 20 V button on the sink board is also pressed. The Source capabilities on the source board must match the sink capabilities of the sink board before the VBUS voltage increases.

6 USB-C-PD-DUO-EVM Schematic

This section shows the schematics for the USB-C-PD-DUO-EVM.

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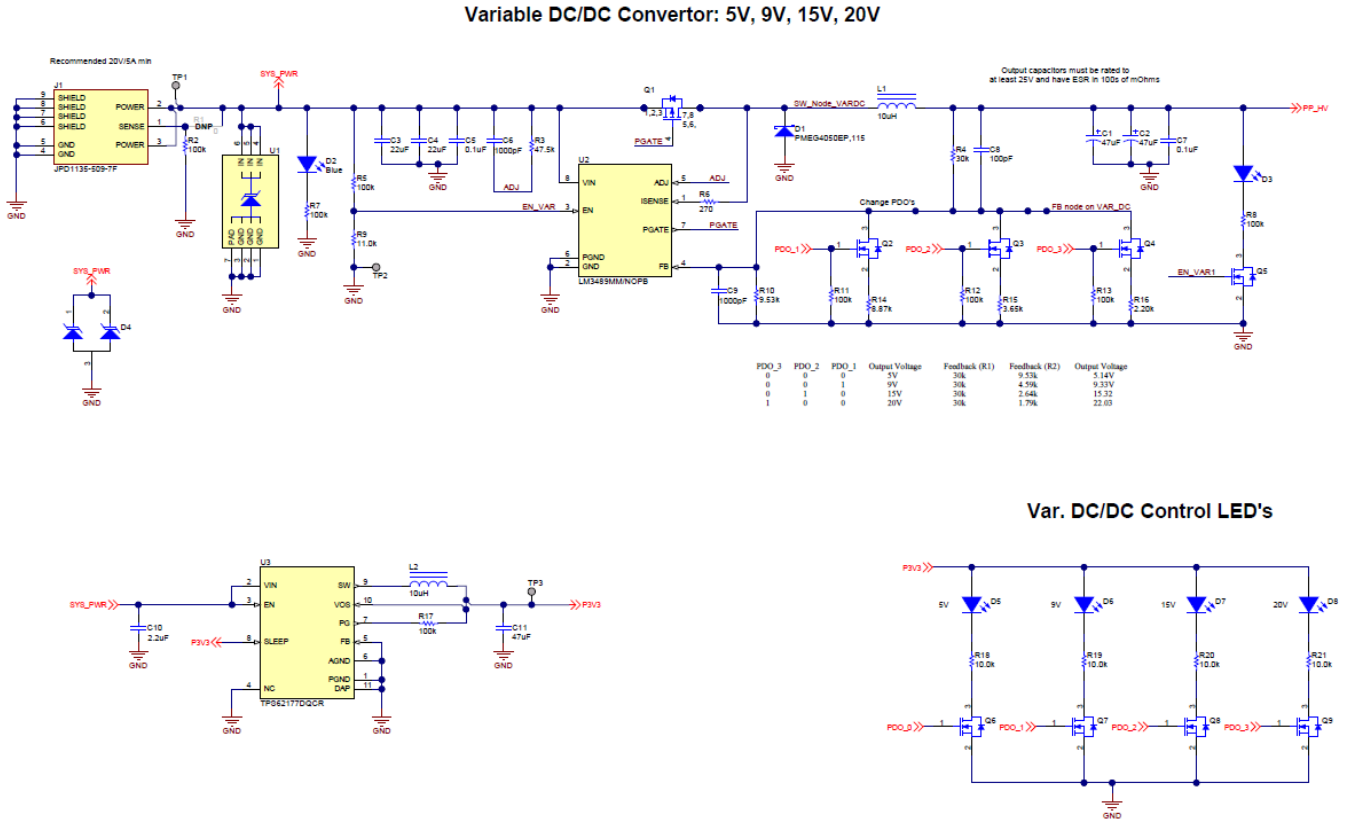

Figure 9. Power Supplies

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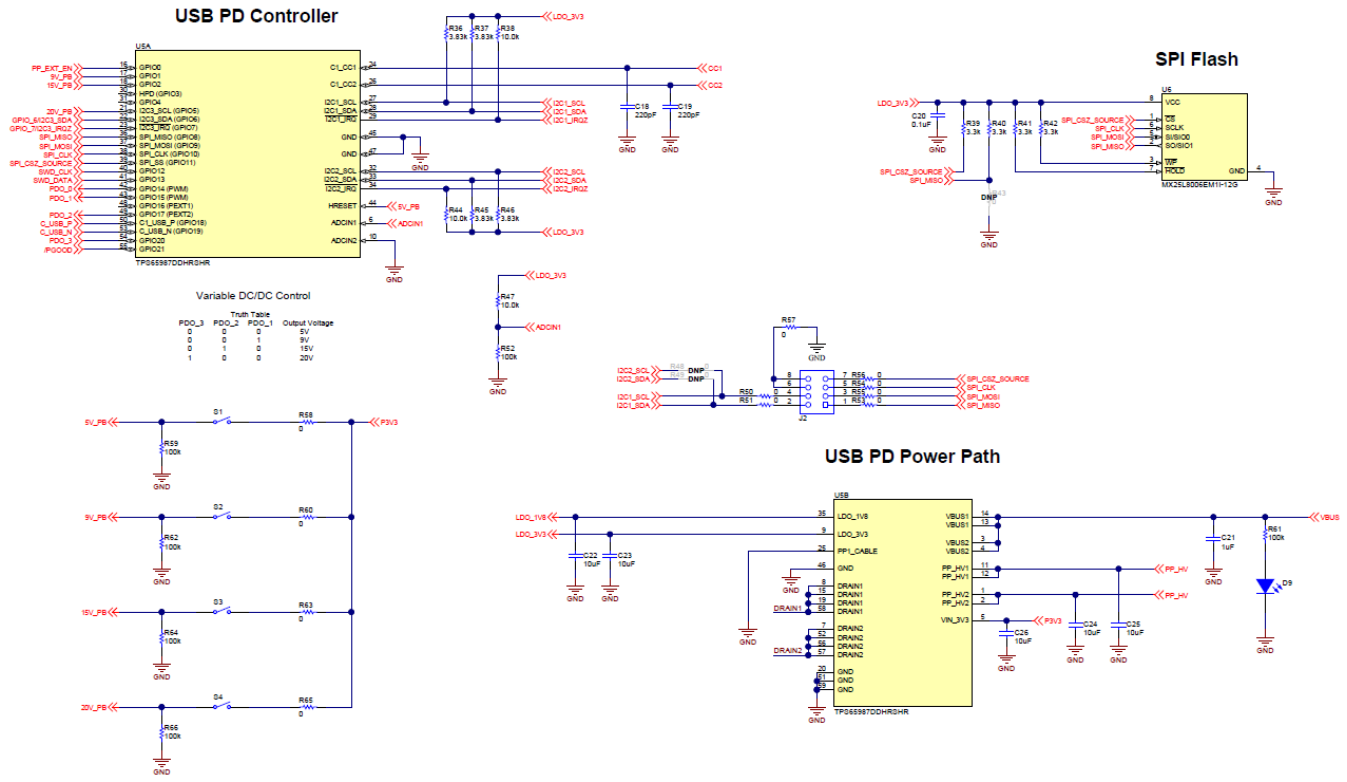

Figure 10. Source PD Controller

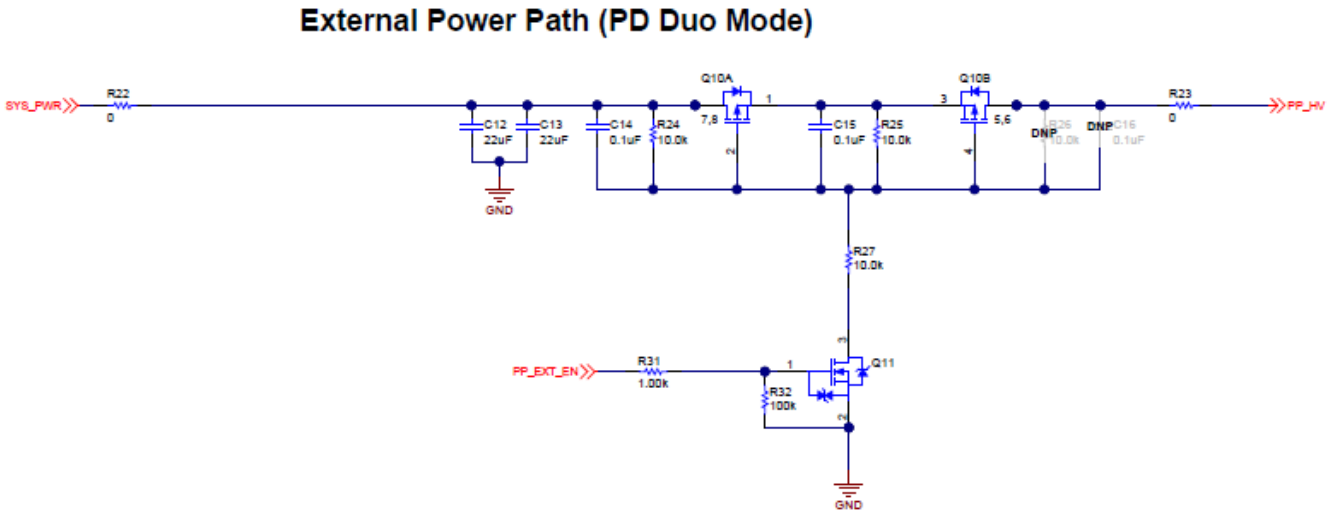

Figure 11. Bypass Power Path

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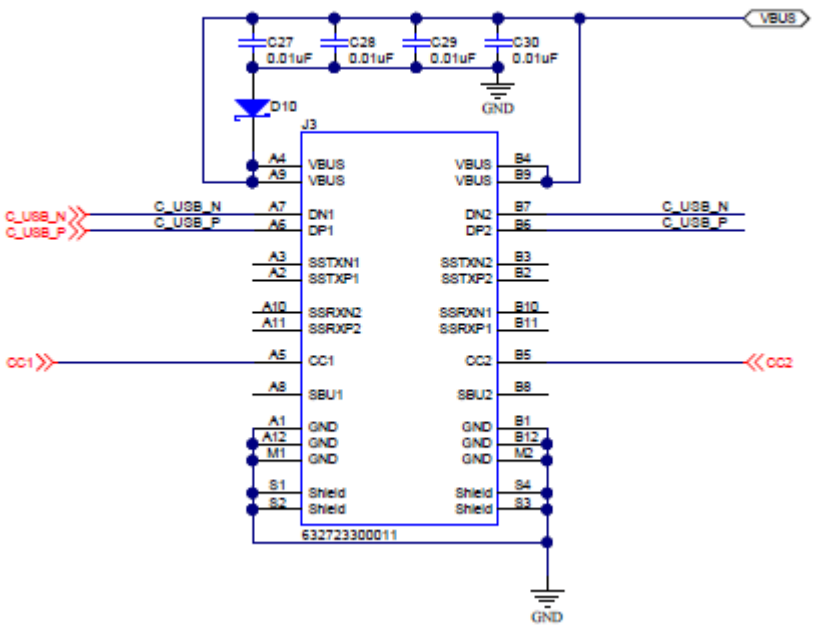

Figure 12. Source Type-C Connector

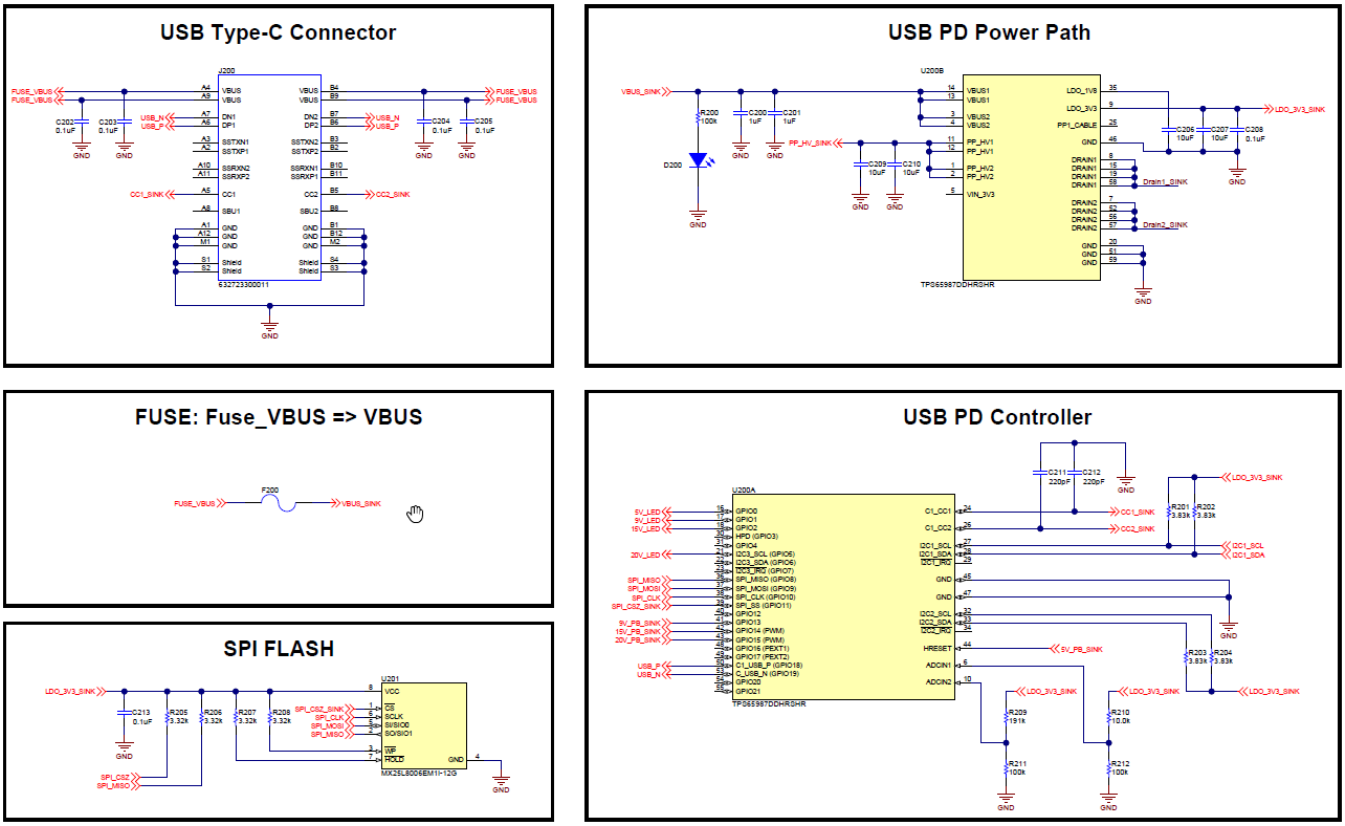

Figure 13. Sink PD Controller

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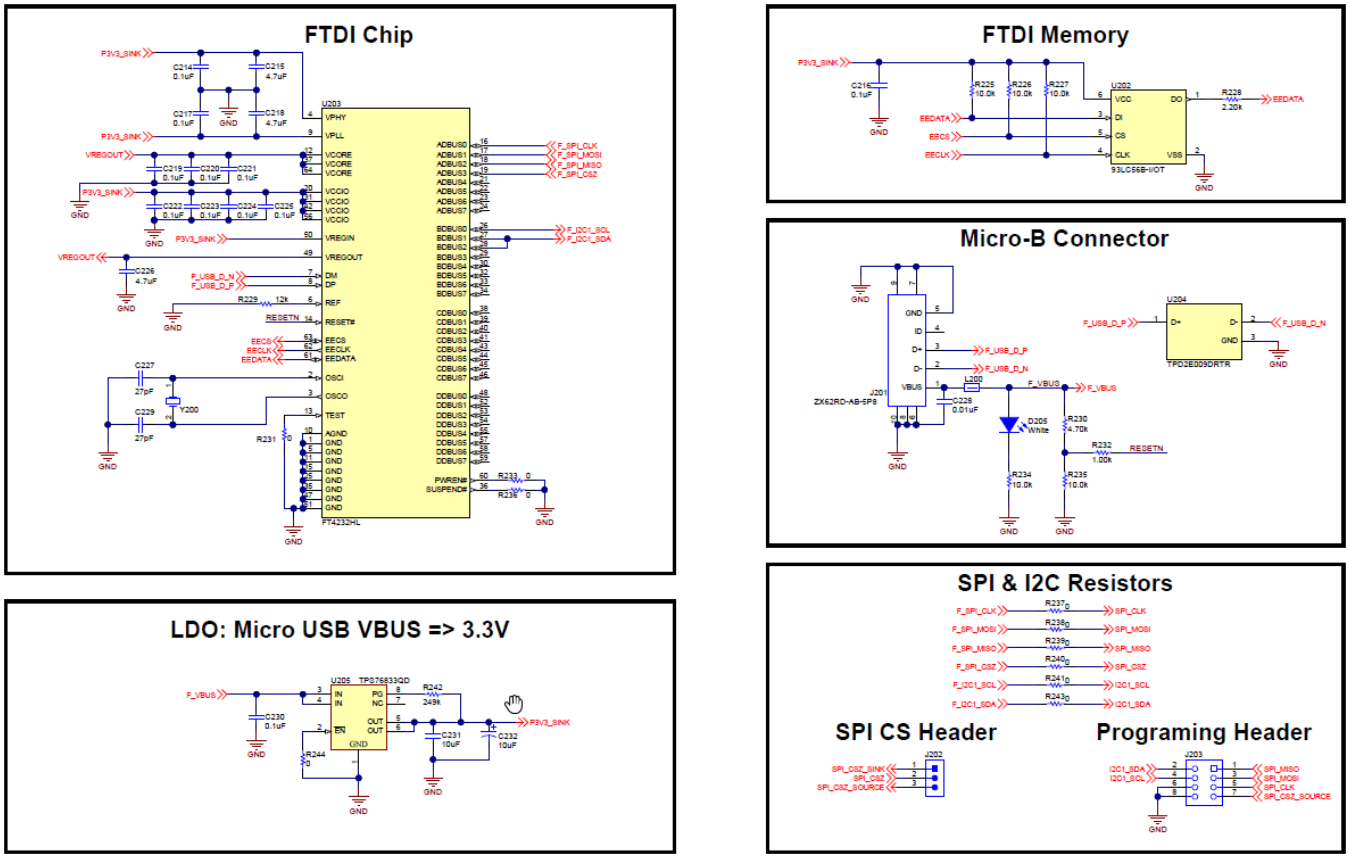

Figure 14. FTDI

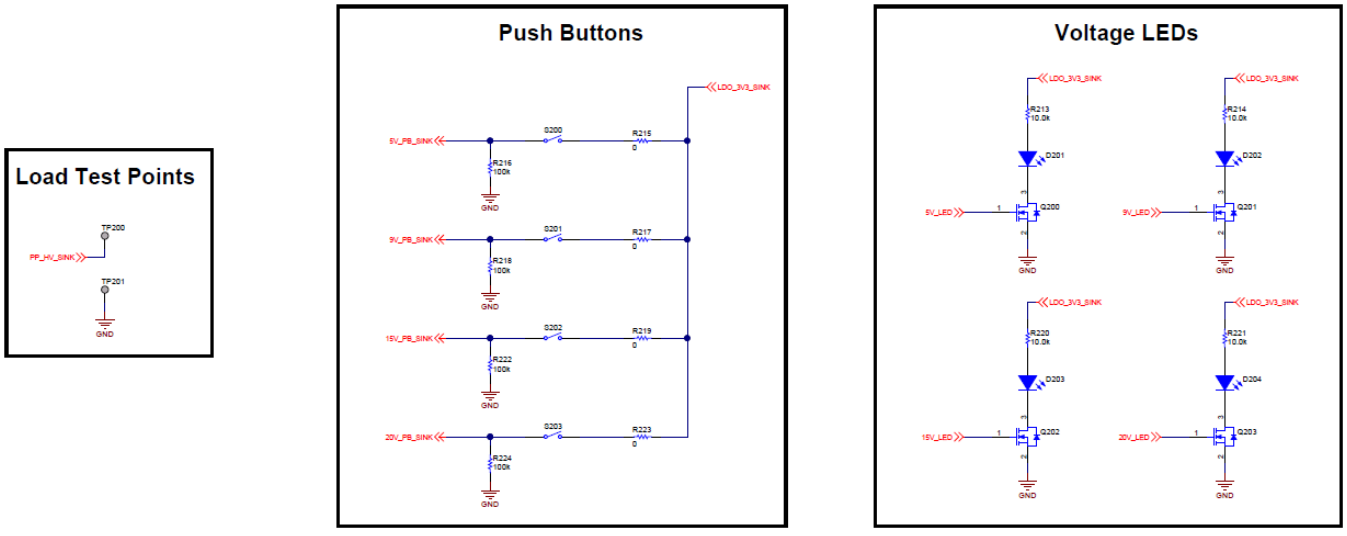

Figure 15. Sink Buttons and LEDs

7 USB-C-PD-DUO-EVM Board Layout

The following figures contain the PCB layouts of the USB-C-PD-DUO-EVM.

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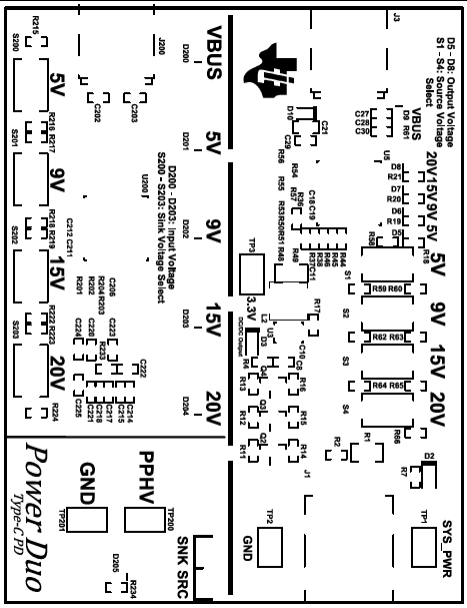

Figure 16. USB-C-PD-DUO-EVM Top Overlay

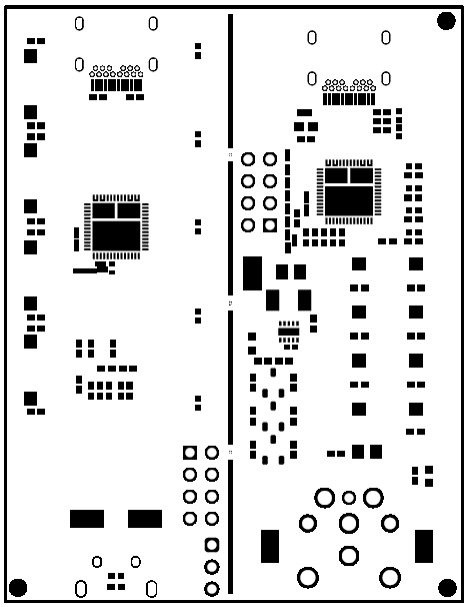

Figure 17. USB-C-PD-DUO-EVM Top Solder

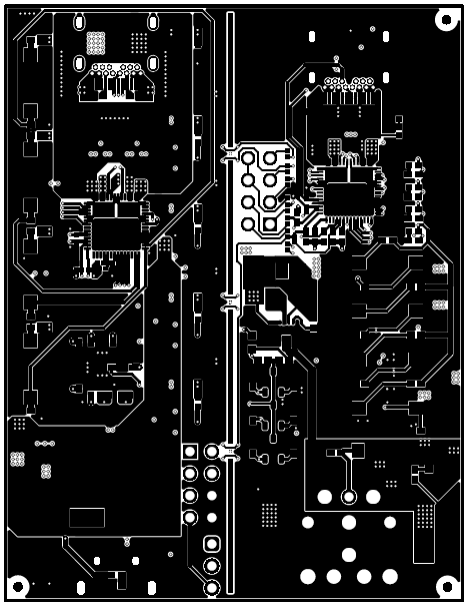

Figure 18. USB-C-PD-DUO-EVM Top Layer

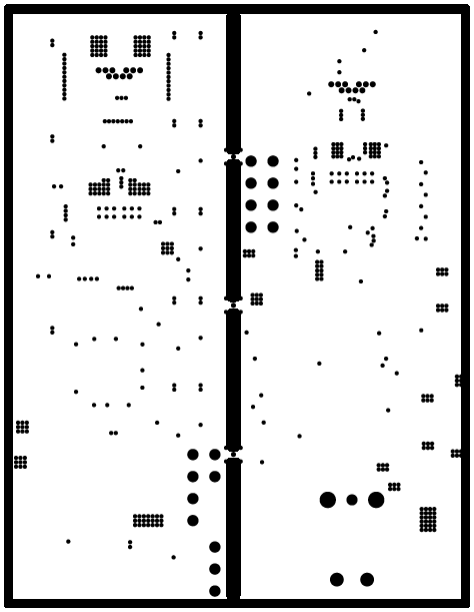

Figure 19. USB-C-PD-DUO-EVM GND Plane 1

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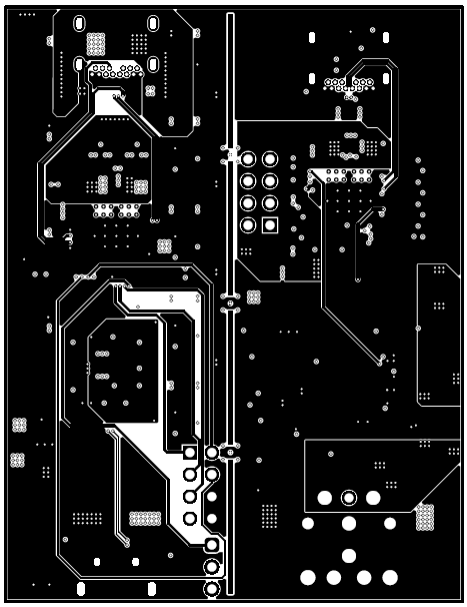

Figure 20. USB-C-PD-DUO-EVM High Speed

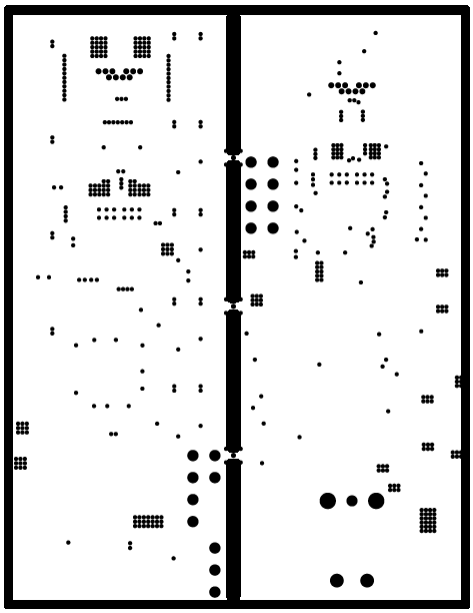

Figure 21. USB-C-PD-DUO-EVM GND Plane 2

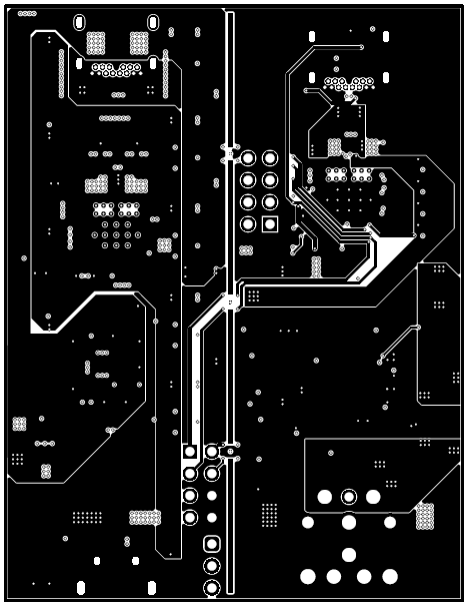

Figure 22. USB-C-PD-DUO-EVM Power 1

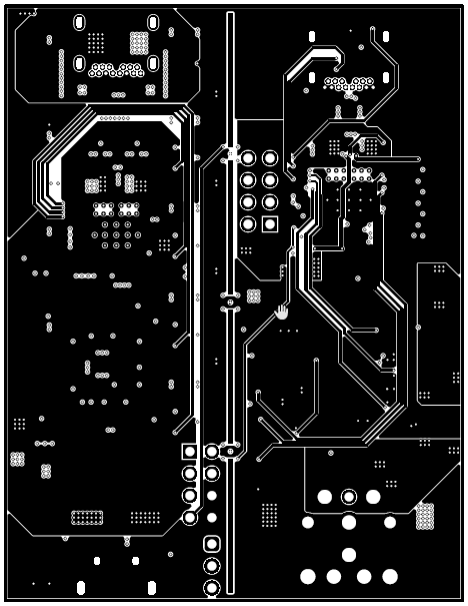

Figure 23. USB-C-PD-DUO-EVM Power 2

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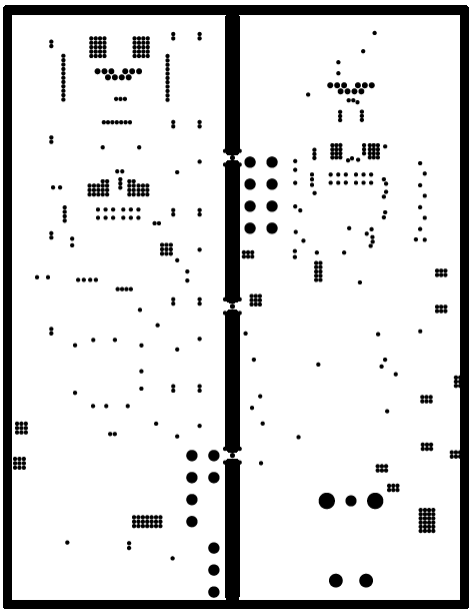

Figure 24. USB-C-PD-DUO-EVM GND Plane 3

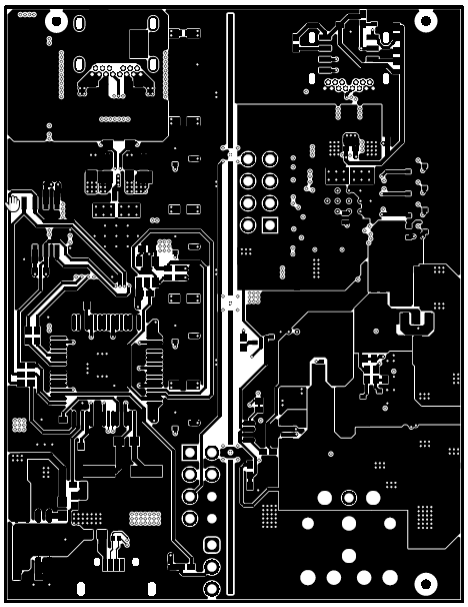

Figure 25. USB-C-PD-DUO-EVM Bottom Layer

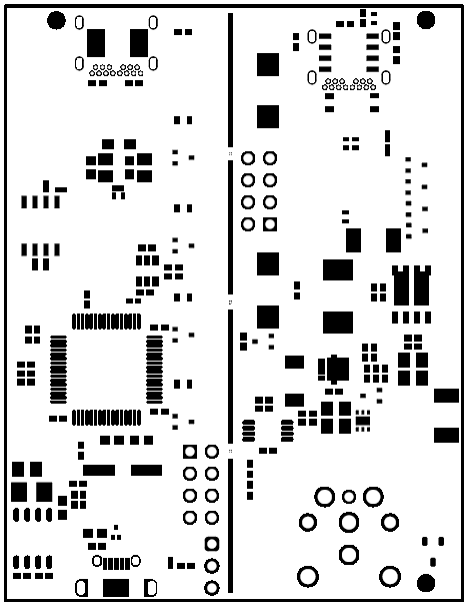

Figure 26. USB-C-PD-DUO-EVM Bottom Solder

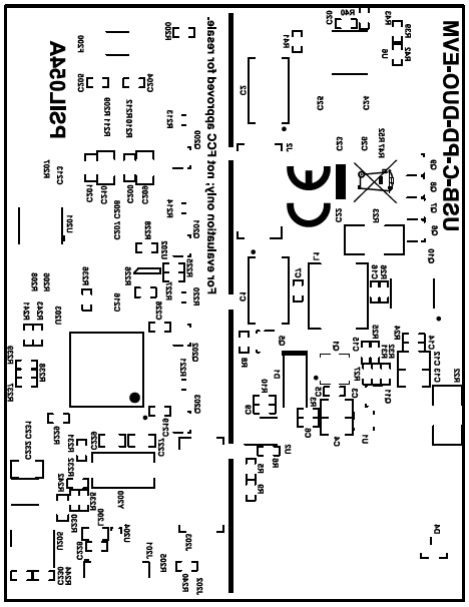

Figure 27. USB-C-PD-DUO-EVM Bottom Overlay

8 USB-C-PD-DUO-EVM Bill of Materials

Table 1 lists the bill of materials (BOM) for the USB-C-PD-DUO-EVM

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Table 1. BOM

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
!PCB1	1		Printed Circuit Board		PSIL054	Any
C1, C2	2	47 uF	CAP, TA, 47 uF, 35 V, +/- 20%, 0.9 ohm, AEC-Q200 Grade 1, SMD	7343-43	TAJE476M035RNJ	AVX
C3, C4, C12, C13	4	22 uF	CAP, CERM, 22 uF, 35 V, +/- 20%, X5R, 0805	0805	C2012X5R1V226M125AC	TDK
C5, C214, C216, C217, C219, C220, C221, C222, C223, C224, C225, C230	12	0.1 uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0402	0402	C1005X7R1H104K050BB	TDK
C6, C9	2	1000 pF	CAP, CERM, 1000 pF, 50 V, +/- 20%, X7R, 0402	0402	C1005X7R1H102M050BE	TDK
C7, C14, C15	3	0.1 uF	CAP, CERM, 0.1 uF, 35 V, +/- 10%, X5R, 0402	0402	GMK105BJ104KV-F	Taiyo Yuden
C8	1	100 pF	CAP, CERM, 100 pF, 50 V, +/- 10%, X7R, 0402	0402	CC0402KRX7R9BB101	Yageo America
C10	1	2.2 uF	CAP, CERM, 2.2 uF, 35 V, +/- 10%, X5R, 0402	0402	C1005X5R1V225K050BC	TDK
C11	1	47 uF	CAP, CERM, 47 uF, 6.3 V, +/- 20%, X5R, 0805	0805	GRM21BR60J476ME15L	MuRata
C18, C19, C211, C212	4	220 pF	CAP, CERM, 220 pF, 25 V, +/- 10%, X7R, 0201	0201	GRM033R71E221KA01D	MuRata
C20	1	0.1 uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	885012205037	Wurth Elektronik
C21, C200, C201	3	1 uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
C22, C23, C26, C206, C207	5	10 uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0402	0402	CL05A106MP5NUNC	Samsung Electro-Mechanics
C24, C25	2	10 uF	CAP, CERM, 10 uF, 25 V, +/- 20%, X5R, 0603	0603	GRM188R61E106MA73D	MuRata
C27, C28, C29, C30	4	0.01 uF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0402	0402	GRM155R71H103KA88D	MuRata
C202, C203, C204, C205	4	0.1 uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71H104KE02D	MuRata
C208, C213	2	0.1 uF	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X5R, 0201	0201	GRM033R61E104KE14J	MuRata
C209, C210, C231	3	10 uF	CAP, CERM, 10 uF, 35 V, +/- 10%, X5R, 0805	0805	C2012X5R1V106K085AC	TDK
C215, C218, C226	3	4.7 uF	CAP, CERM, 4.7 uF, 10 V, +/- 20%, X5R, 0402	0402	C1005X5R1A475M050BC	TDK
C227, C229	2	27 pF	CAP, CERM, 27 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	CL10C270FB8NNNC	Samsung Electro-Mechanics
C228	1	0.01 uF	CAP, CERM, 0.01 uF, 50 V, +/- 5%, X7R, 0402	0402	C0402C103J5RACTU	Kemet
C232	1	10 uF	CAP, TA, 10 uF, 10 V, +/- 10%, 2.5 ohm, SMD	3528-21	293D106X9010B2TE3	Vishay-Sprague
D1	1	40 V	Diode, Schottky, 40 V, 5 A, AEC-Q101, SOD-128	SOD-128	PMEG4050EP,115	Nexperia

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Table 1. BOM (continued)

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
D2	1	Blue	LED, Blue, SMD	1.6 x 0.8 mm	LTST-C193TBKT-5A	Lite-On
D3	1	Green	LED, Green, SMD	LED_0603	150060GS75000	Wurth Elektronik
D4	1	24 V	Diode, TVS, Uni, 24 V, 70 Vc, SOT-23	SOT-23	PESD24VS2UT,215	Nexperia
D5, D6, D7, D8, D9, D200, D201, D202, D203, D204, D205	11	White	LED, White, SMD	0402, White	LW QH8G-Q2S2-3K5L-1	OSRAM
D10	1	30 V	Diode, Schottky, 30 V, 2 A, 2-XFDFN	2-XFDFN	NSR20F30NXT5G	ON Semiconductor
F200	1		Fuse, 15 A, SMD	6.1 x 2.54 x 2.54 mm	SSQ 15	Bel Fuse
J1	1		Connector, DC Power Jack, R/A, 3 Pos, TH	Power connector	JPD1135-509-7F	Foxconn
J2, J203	2		Receptacle, 2.54 mm, 4 x 2, Gold, TH	Receptacle, 2.54 mm, 4 x 2, TH	SSQ-104-03-G-D	Samtec
J3, J200	2		Connector, Receptacle, USB Type C, R/A	Connector, Receptacle, USB Type C, R/A, THT/SMT	632723300011	Wurth Elektronik
J201	1		Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	ZX62RD-AB-5P8	Hirose Electric Co. Ltd.
J202	1		Header, 100 mil, 3 x 1, Gold, TH	3 x 1 Header	TSW-103-07-G-S	Samtec
L1	1	10 uH	Inductor, Wirewound, 10 uH, 4 A, 0.068 ohm, SMD	7.2 x 6.65 mm	ASPI-0630LR-100M-T15	Abracon Corporation
L2	1	10 uH	Inductor, Shielded Drum Core, Powdered Iron, 10 uH, 1.5 A, 0.215 ohm, SMD	4.45 x 1.8 x 4.06 mm	74437324100	Wurth Elektronik
L200	1	26 ohm	Ferrite Bead, 26 ohm @ 100 MHz, 6 A, 0603	0603	BLM18SG260TN1D	MuRata
Q1	1	–30 V	MOSFET, P-CH, -30 V, -11 A, FET, 3 x 0.8 x 3 mm	FET, 3 x 0.8 x 3 mm	AON7403	AOS
Q2, Q3, Q4	3	20 V	MOSFET, N-CH, 20 V, 1.05 A, SOT-23	SOT-23	BSH105,215	Nexperia
Q5, Q6, Q7, Q8, Q9	5	30 V	MOSFET, N-CH, 30 V, 0.18 A, SOT-323	SOT-323	NX3020NAKW,115	Nexperia
Q10	1	–30 V	MOSFET, 2-CH, P-CH, -30 V, -60 A, 610 x 604 x 515 mm	610 x 604 x 515 mm	SI7997DP-T1-GE3	Vishay-Siliconix
Q11	1	30 V	MOSFET, N-CH, 30 V, 0.35 A, AEC-Q101, SOT-323	SOT-323	NX3008NBKW,115	Nexperia
Q200, Q201, Q202, Q203	4	50 V	MOSFET, N-CH, 50 V, 0.2 A, SOT-323	SOT-323	BSS138W-7-F	Diodes Inc.
R2, R5, R11, R12, R13, R17, R32	7	100 k	RES, 100 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KFKED	Vishay-Dale
R3	1	47.5 k	RES, 47.5 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040247K5FKED	Vishay-Dale
R4	1	30 k	RES, 30 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040230K0JNED	Vishay-Dale
R6	1	270	RES, 270, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402270RJNED	Vishay-Dale
R7, R8, R61, R200	4	100 k	RES, 100 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KJNED	Vishay-Dale

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Table 1. BOM (continued)

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
R9	1	11.0 k	RES, 11.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040211K0FKED	Vishay-Dale
R10	1	9.53 k	RES, 9.53 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04029K53FKED	Vishay-Dale
R14	1	8.87 k	RES, 8.87 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04028K87FKED	Vishay-Dale
R15	1	3.65 k	RES, 3.65 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04023K65FKED	Vishay-Dale
R16	1	2.20 k	RES, 2.20 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20FKED	Vishay-Dale
R18, R19, R20, R21, R24, R25, R27, R38, R44, R225, R226, R227, R234, R235	14	10.0 k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic
R22, R23	2	0	RES, 0, 5%, 0.75 W, AEC-Q200 Grade 0, 2010	2010	CRCW20100000Z0EF	Vishay-Dale
R31, R232	2	1.00 k	RES, 1.00 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1001X	Panasonic
R36, R37, R45, R46	4	3.83 k	RES, 3.83 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04023K83FKED	Vishay-Dale
R39, R40, R41, R42	4	3.3 k	RES, 3.3 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04023K30JNED	Vishay-Dale
R47	1	10.0 k	RES, 10.0 k, 1%, 0.05 W, 0201	0201	CRCW020110K0FKED	Vishay-Dale
R50, R51, R53, R54, R55, R56, R57	7	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW02010000Z0ED	Vishay-Dale
R52	1	100 k	RES, 100 k, 1%, 0.05 W, 0201	0201	CRCW0201100KFKED	Vishay-Dale
R58, R60, R63, R65, R215, R217, R219, R223	8	0	RES, 0, 0%, 0.2 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0EDHP	Vishay-Dale
R59, R62, R64, R66, R216, R218, R222, R224	8	100 k	RES, 100 k, 0.5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KDHEDP	Vishay-Dale
R201, R202, R203, R204	4	3.83 k	RES, 3.83 k, 1%, 0.05 W, 0201	0201	CRCW02013K83FKED	Vishay-Dale
R205, R206, R207, R208	4	3.32 k	RES, 3.32 k, 1%, 0.05 W, 0201	0201	RC0201FR-073K32L	Yageo America
R209	1	191 k	RES, 191 k, 1%, 0.05 W, 0201	0201	RC0201FR-07191KL	Yageo America
R210	1	10.0 k	RES, 10.0 k, 1%, 0.05 W, 0201	0201	MCR006YRTF1002	Rohm
R211, R212	2	100 k	RES, 100 k, 1%, 0.05 W, 0201	0201	RC0201FR-7D100KL	Yageo America
R213, R214, R220, R221	4	10.0 k	RES, 10.0 k, 0.1%, 0.1 W, AEC-Q200 Grade 1, 0603	0603	TNPW060310K0BEEA	Vishay-Dale
R228	1	2.20 k	RES, 2.20 k, 1%, 0.063 W, 0402	0402	RC0402FR-072K2L	Yageo America
R229	1	12 k	RES, 12 k, 5%, 0.063 W, 0402	0402	CRCW040212K0JNED	Vishay-Dale
R230	1	4.70 k	RES, 4.70 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF4701X	Panasonic

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Table 1. BOM (continued)

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
R231, R233, R236, R237, R238, R239, R240, R241, R243, R244	10	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0ED	Vishay-Dale
R242	1	249 k	RES, 249 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603249KFKEA	Vishay-Dale
S1, S2, S3, S4, S200, S201, S202, S203	8		Switch, Tactile, SPST, 12 V, SMD	SMD, 6 x 3.9 mm	434121025816	Wurth Elektronik
SH-J1	1		Shunt, 2.54mm, Gold, Black	Shunt, 2.54 mm, Black	60900213421	Wurth Elektronik
TP1, TP2, TP3, TP200, TP201	5		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	1		22-V Precision Surge Protection Clamp, DRV0006A (WSON-6)	DRV0006A	TVS2200DRVR	Texas Instruments
U2	1		Hysteretic PFET Buck Controller with Enable Pin, DGK0008A (VSSOP-8)	DGK0008A	LM3489MM/NOPB	Texas Instruments
U3	1		28 V, 0.5 A Step-Down Converter with SNOOZE Mode, DQC0010A (WSON-10)	DQC0010A	TPS62177DQCR	Texas Instruments
U5, U200	2		USB Type-C and USB PD Controller with Integrated Power Switches, RSH0056E (VQFN-56)	RSH0056E	TPS65987DDHRSHR	Texas Instruments
U6, U201	2		8Mb, 86MHz, NOR Flash, SOP-8	8-SOP	MX25L8006EM1I-12G	Macronix International Co., LTD
U202	1		2K Microwire Compatible Serial EEPROM, SOT-23-6	SOT-23-6	93LC56B-I/OT	Microchip
U203	1		Quad High Speed USB to Multipurpose UART/MPSSE IC	LQFP_10x10mm	FT4232HL	FTDI
U204	1		ESD Protection Array for High-Speed Data Interfaces, 2 Channels, -40 to +85 degC, 3-pin SOT (DRT), Green (RoHS & no Sb/Br)	DRT0003A	TPD2E009DRTR	Texas Instruments
U205	1		Single Output Fast Transient Response LDO, 1 A, Fixed 3.3 V Output, 2.7 to 10 V Input, with Low IQ, 8-pin SOIC (D), -40 to 125 degC, Green (RoHS & no Sb/Br)	D0008A	TPS76833QD	Texas Instruments
Y200	1		CRYSTAL, 12 MHz, 20pF, SMD	7x2.3x4.1mm	ECS-120-20-3X-TR	ECS Inc.
C16	0	0.1 uF	CAP, CERM, 0.1 uF, 35 V, +/- 10%, X5R, 0402	0402	GMK105BJ104KV-F	Taiyo Yuden
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
R1	0	0	RES, 0, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	ERJ-6GEY0R00V	Panasonic
R26	0	10.0 k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic
R43	0	0	RES, 0, 5%, 0.063 W, 0402	0402	RC0402JR-070RL	Yageo America
R48, R49	0	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW02010000Z0ED	Vishay-Dale

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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