

TI Designs: TIDA-01627

USB Type-C™ PD Power Bank Reference Design



Description

This power bank reference design offers highly-integrated USB Type-C™ power delivery (PD) for charging notebooks. The key aspect of this design is to reduce the bill of materials (BOM) cost while maintaining the overall functionality. The design implements unique considerations for reducing quiescent current and covers all the required aspects to guide users through the part selection and trade-off considerations.

Resources

TIDA-01627	Design Folder
TPS65987D	Product Folder
BQ25703A	Product Folder
TPD8S300	Product Folder
TPS563200	Product Folder

Features

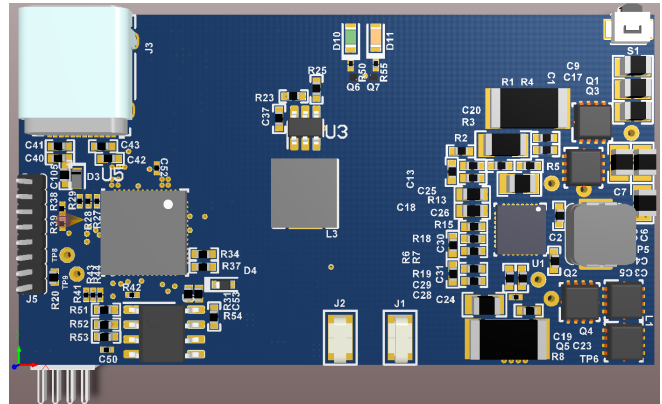
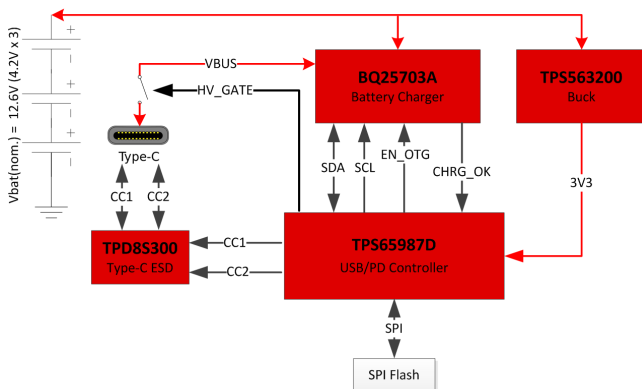
- Supports 5 V at 3 A, 9 V at 3 A, 14.8 V at 2 A, 15 V at 3 A, and 20 V at 2.25 A for Power Data Objects (PDOs)
- Supports up to 45 W of Power to Charge Portable Devices
- Automatically Charges After Connecting to USB PD Source

Applications

- [Charging Notebooks](#)
- [Charging Cell Phones](#)
- [Charging or Powering Other USB Type-C or PD Devices](#)



[ASK Our E2E™ Experts](#)



An IMPORTANT NOTICE at the end of this TI reference design addresses authorized use, intellectual property matters and other important disclaimers and information.

1 System Description

For many, carrying multiple devices is a normal if not necessary part of daily life. The average user's dependency on these gadgets continues to increase while the overall battery life is decreasing. Many users have no choice but to carry an alternate portable source of power to help recharge gadgets while on the move. This reference design offers a power bank solution that can provide 45 W of power to charge a notebook while away from traditional power sources.

1.1 Key System Specifications

Table 1. Key System Specifications

PARAMETER	SPECIFICATIONS
Number of batteries	Three cells
Type of batteries	Lithium-ion cells
Minimum output voltage	5 V
Maximum output voltage	20 V
Maximum power	45 W

2 System Overview

This reference design has been built around two key components: TPS65987D and BQ25703A. TPS65987D is the PD controller which controls all of the USB Type-C™ and PD negotiations, in addition to controlling the BQ25703A battery charger over I²C. This battery charger chip manages all the power and battery charging. The chip also works as a reverse buck-boost to provide power in on-the-go (OTG) mode. TPD8S300 provides protection from electrostatic discharge (ESD) and VBUS to CC short and the TPS563200 generates 3.3 V from the battery to power the PD controller.

2.1 Block Diagram

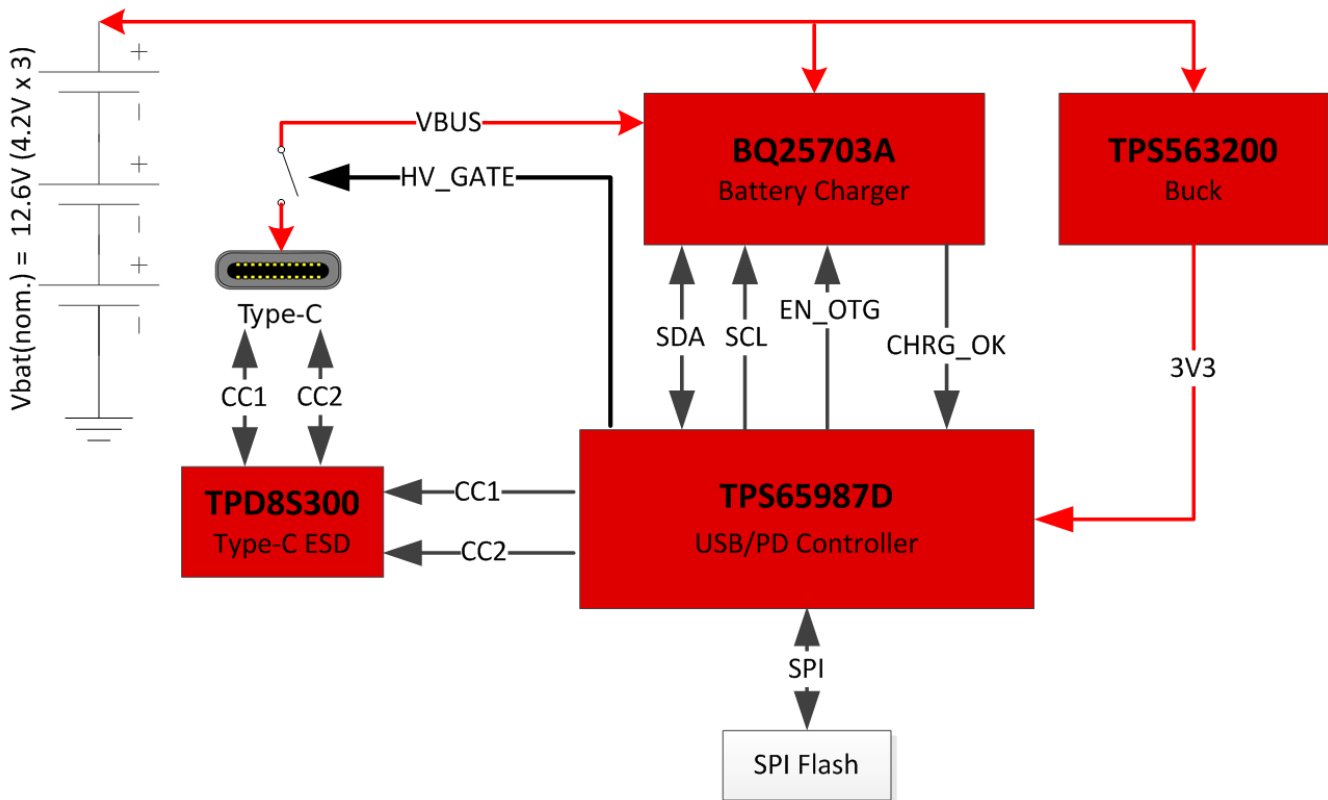


Figure 1. TIDA-01627 Block Diagram

2.2 Design Considerations

This TIDA-01627 system demonstrates how to manufacture reliable power banks using USB-Type-C and PD ports. To achieve this objective, the reference design uses the most-integrated USB-PD controller and battery controller in the market. The unique combination of these two devices ensures the most reliable and cost-effective solution to charge a notebook on the go.

This reference design has been tested with three lithium-ion cells; however, it can support one to four cells by simply changing the values of R12 and R14. For more details on this custom setting, see [bq25703A I2C Multi-Chemistry Battery Buck-Boost Charge Controller With System Power Monitor and Processor Hot Monitor](#). Note that the batteries must be sized properly to support the PD load, which the power bank must also support.

The following subsections show the various parts of this design and the devices which they use.

2.2.1 TPS65987D USB Type-C™ and PD Controller With Firmware Upgrade Capability

The TPS65987D is a highly-integrated USB Type-C and PD controller. This device is the brain of this system and is responsible for negotiating contract with the connected device, controlling various settings of the BQ25703A device. This device was chosen as it provides I²C master functionality, which can be configured to control any I²C slave by just using its configuration utility.

Figure 2 shows the TPS65987D signals schematic. Figure 3 shows the TPS65987D power lines schematic.

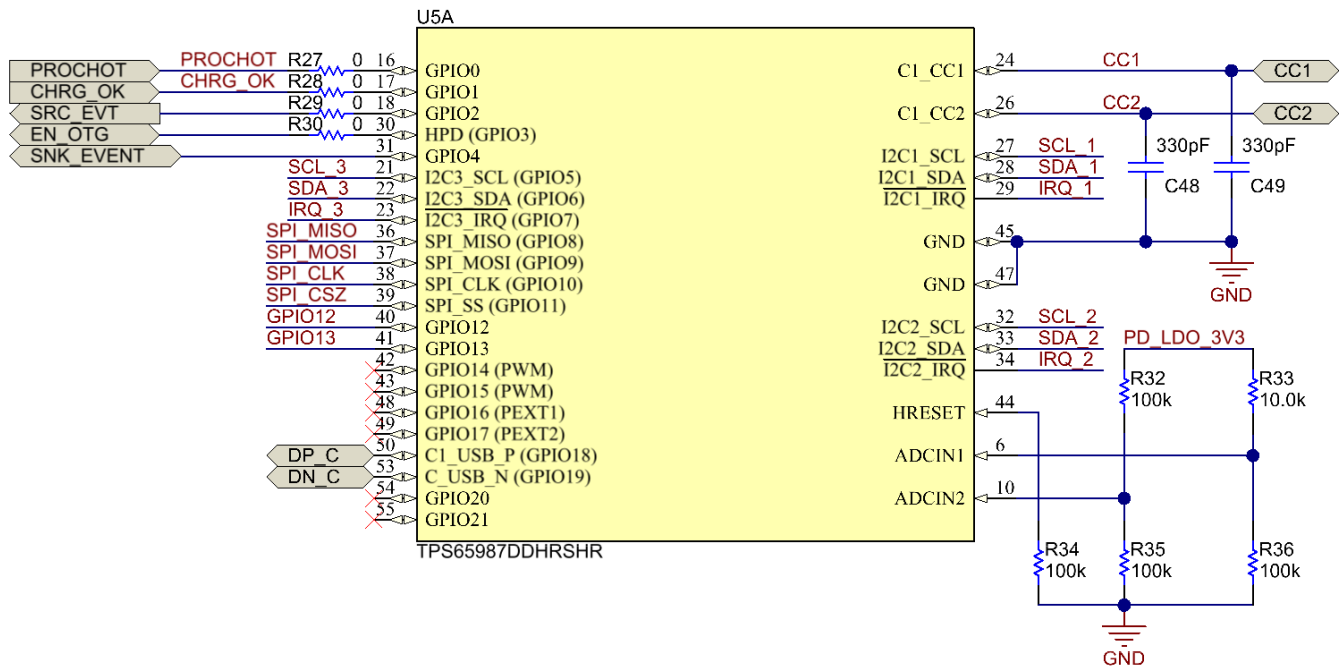


Figure 2. TPS65987D Signals Schematic

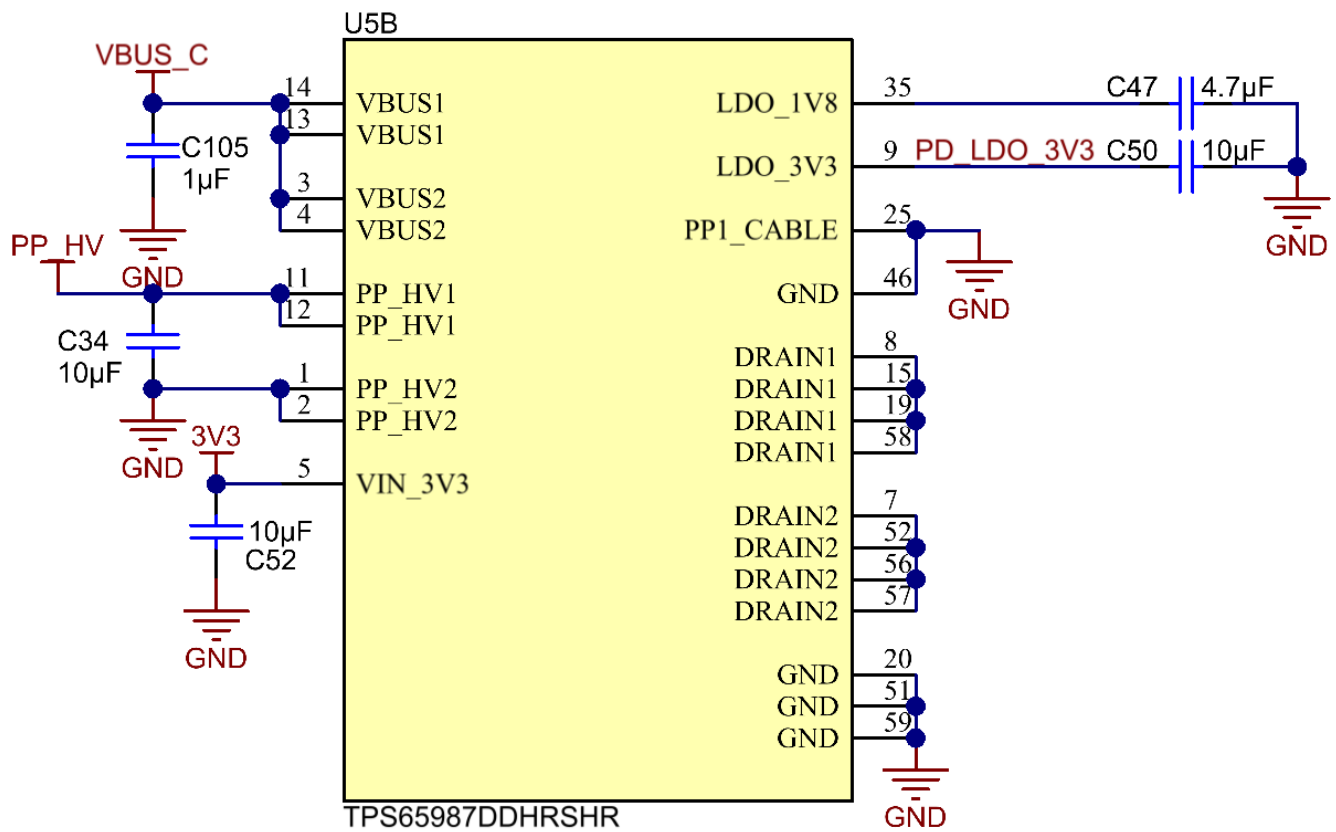


Figure 3. TPS65987D Power Lines Schematic

2.2.2 BQ25703A Multi-Chemistry, Battery Buck-Boost Charge Controller With System Power Monitor

The BQ25703A is a buck-boost, narrow-voltage DC (NVDC) charge controller for multi-chemistry portable applications such as notebooks and other mobile devices with rechargeable batteries. This device provides seamless transition between converter operation modes (buck, boost, or buck-boost), fast transient response, and high light-load efficiency. The BQ25703A takes input voltage from 3.5 V to 24 V and charges one to four batteries in series. The BQ25703A also supports USB On-The-Go (OTG) to provide a 4.48-V to 20.8-V output at the USB port.

This device is perfect for this reference design because it can work as a battery controller as well as a DC-DC converter. When the power bank is a sink and charging its own battery, then this chip assists with charging the batteries, whereas during the power source mode, this chip works as a DC-DC converter to generate the VBUS.

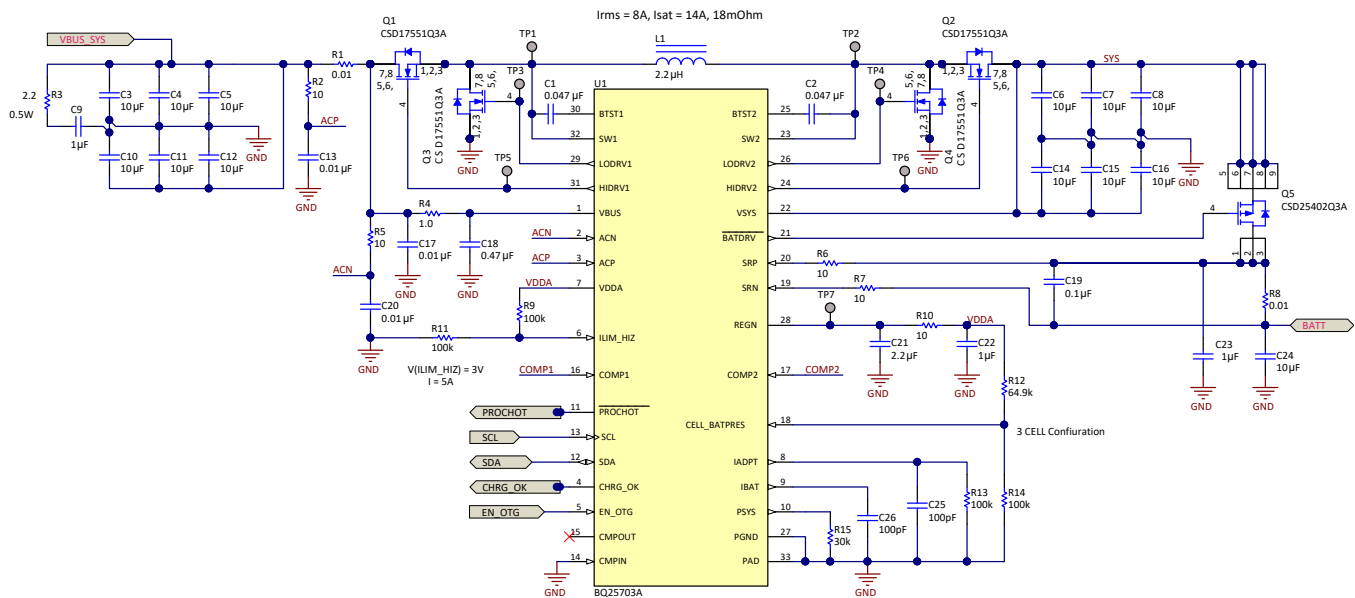


Figure 4. Battery Controller Schematic

2.2.3 TPD8S300 USB Type-C™ Port Protector

The TPD8S300 is a single-chip, USB Type-C, port protection solution that provides 20-V short-to-VBUS overvoltage and IEC ESD protection. The TPD8S300 integrates four channels of 20-V short-to-VBUS overvoltage protection for the CC1, CC2, SBU1, and SBU2 pins of the USB Type-C connector. Additionally, IEC 61000-4-2 system level ESD protection is required to protect a USB Type-C port from ESD strikes generated by end-product users. The TPD8S300 integrates eight channels of IEC61000-4-2 ESD protection for the CC1, CC2, SBU1, SBU2, DP_T (top side D+), DM_T (top side D-), DP_B (bottom side D+), and DM_B (bottom side D-) pins of the USB Type-C connector. This integration means IEC ESD protection is provided for all of the low-speed pins on the USB Type-C connector in a single chip in the TPD8S300 device. Additionally, the CC and SBU lines require high-voltage IEC ESD protection that is 22-V DC tolerant to simultaneously support IEC ESD and short-to-VBUS protection; unfortunately, not many discrete market solutions are available that can provide this kind of protection. The TPD8S300 integrates this high-voltage IEC ESD diode and has been specifically designed to guarantee that it works in conjunction with the overvoltage protection field-effect transistors (FETs) inside the device. This sort of solution is very hard to generate with discrete components.

Figure 5 shows the TPD8S300 schematic.

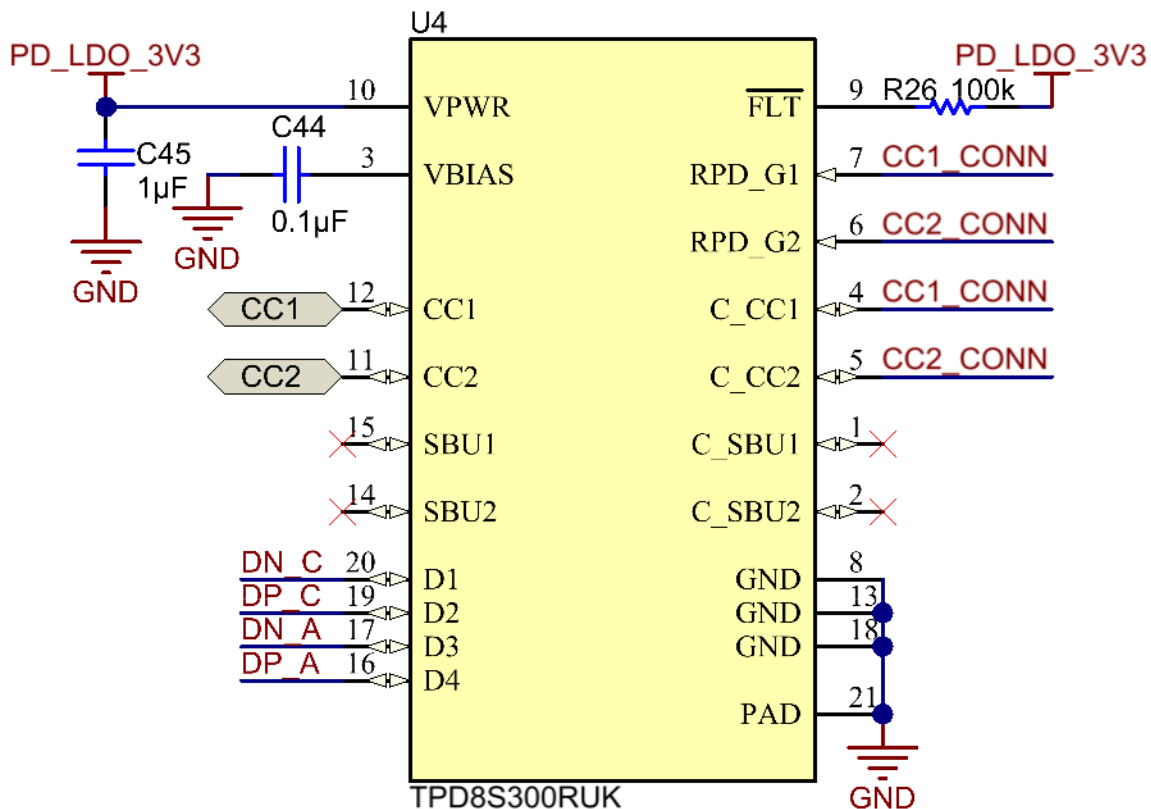


Figure 5. TPD8S300 Schematic

2.2.4 TPS563200 DC-DC Converter

The TPS563200 is an easy-to-use, synchronous step-down, DC-DC converter optimized for low standby current with minimum external components. A high switching frequency of typically 650 KHz allows the use of small inductors and provides fast transient response as well as high output voltage accuracy by using the D-CAP2™ mode control. In this reference design, this DC-DC converter functions to generate the 3.3-V rail to power up the TPS65987D device. If nothing is connected to the power bank, then the enable input goes low and everything shuts down. If any PD power sink is connected to the power bank, then this input remains high for as long as the device is connected.

3 System Powering Scheme

This power bank reference design features two different power modes: power source mode and power sink mode.

3.1 Power Source Mode

In this mode, the power bank works as a source and the device connected to it draws power. To start in this mode, the user must press the S1 switch and then ensure that the device is connected after the LED turn on. The user can release this switch after connecting the device, after which it will no longer respond to further presses. If the device comes up as a sink, then the TPS65987D device drives the “SRC_EVT” node high, which ensures that U3 remains turned on even after S1 is released by maintaining 3.3 V at the SYS_EN node. The TPS65987D device drives the SRC_EVT node low when it detects disconnection, which forces the SYS_EN node down after some time, after which U3 eventually turns off and leads to a system shutdown.

Figure 6 shows a schematic of the 3.3-V power scheme of the power bank.

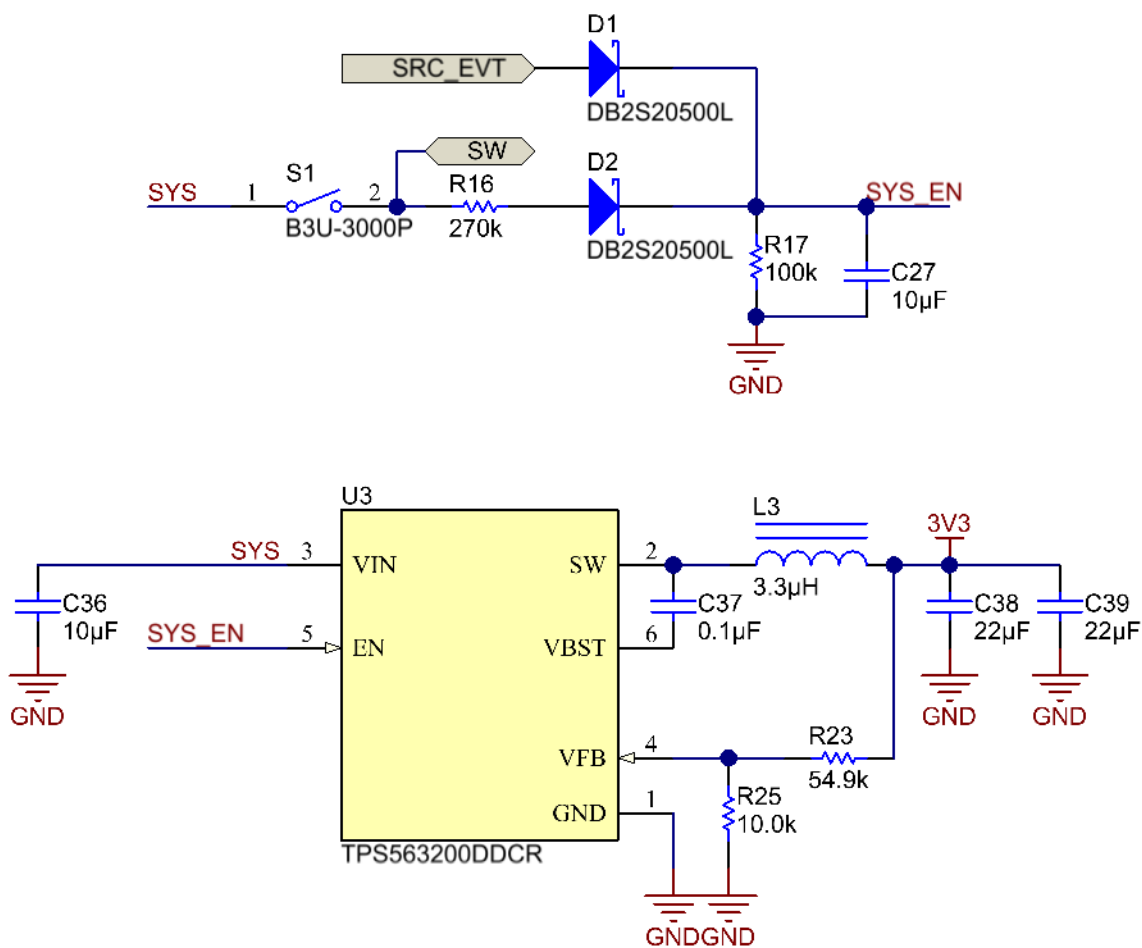


Figure 6. Schematic of 3.3-V Power Scheme of Power Bank

3.2 Power Sink Mode

Whenever the designer connects a PD source, this power bank begins charging in dead battery mode. The LED turn on automatically to indicate the charging status. Pressing the user switch S1 causes a power role swap and, if accepted by the connected device, causes the power bank to enter power source mode.

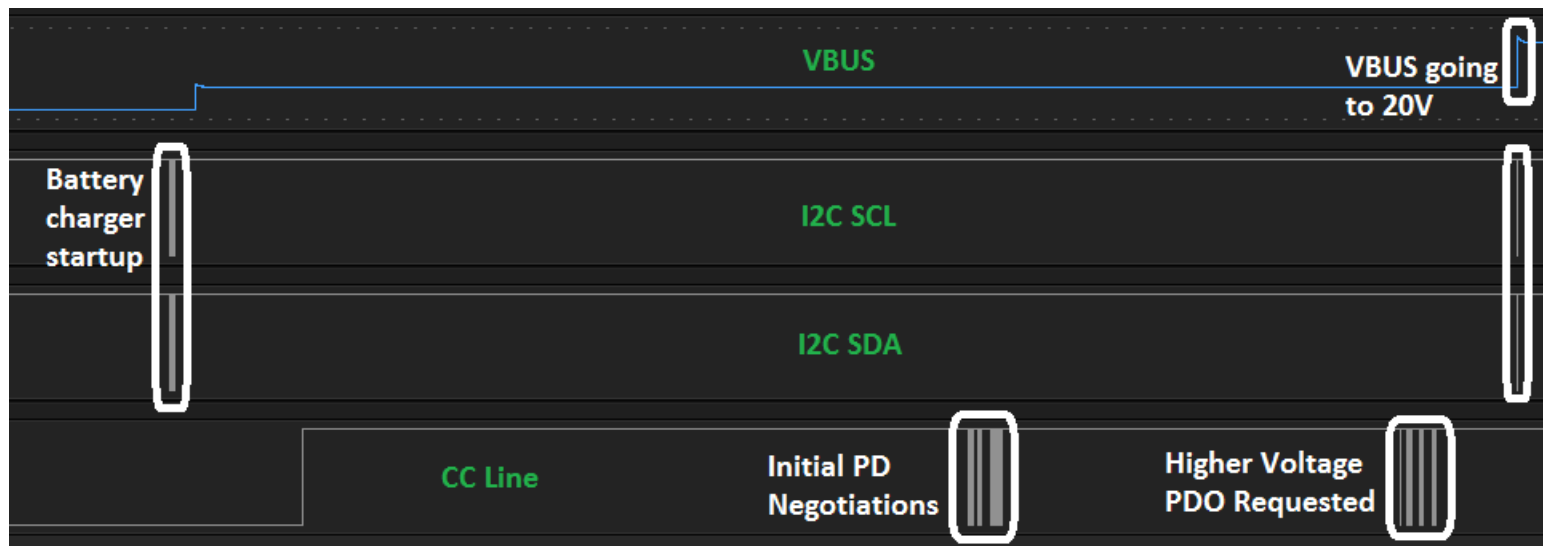
4 Test Data

The following subsections show the PD logs, which were taken during various use cases.

4.1 Power Bank When Charging Notebook

The power bank registers as a power source when the user presses the switch with the power bank connected to a notebook. The power bank sends its source power data object (PDO) and the notebook requests for the suitable PDO from the available options. From the given case in [Figure 8](#), the power bank presents various PDOs, for which the notebook chooses a 20-V PDO.

Figure 7. !~Varios signals during negotiations



CC Left AttachWait SRC ==> Attached.SRC @ 06.638.951.000

Packet	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Time	Time Stamp																			
3	Connected		3.0 A	"PowerBank"	Rp	Open	"Notebook"	Rd	Open	7.678 ms	6.638.951.000																			
4 Packets	Port	SOP* CBL		PD Msg	Msg Type	Cable Plug	Msg ID	Obj Cnt	Extended	VDM Header	Cmd	Cmd Type	Obj Pos	Vendor ID	Vendor Defined	Duration	Time	Time Stamp												
4-7	"???"			Vendor Defined	DFP or UFP		0	1	No	Discover Identity	REQ		0	PD SID		633.528 us	7.221 ms	6.646.628.792												
4 Packets	Left	SOP* SRC		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Extended	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role
8-11	"PowerBank"			Source Cap	DFP	SRC		0	5	No		3.00 A	5.00 V	0		3.00 A	9.00 V	0		2.00 A	14.80 V	0		2.25 A	15.00 V	0		2.25 A	20.00 V	0
4 Packets	Port	SOP* CBL		PD Msg	Msg Type	Cable Plug	Msg ID	Obj Cnt	Extended	VDM Header	Cmd	Cmd Type	Obj Pos	Vendor ID	Vendor Defined	Duration	Time	Time Stamp												
12-15	"???"			Vendor Defined	DFP or UFP		0	1	No	Discover Identity	REQ		0	PD SID		633.717 us	7.220 ms	6.840.571.016												
Packet	Left	SOP* SRC		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Extended	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role
16	"PowerBank"			Source Cap	DFP	SRC		0	5	No		3.00 A	5.00 V	0		3.00 A	9.00 V	0		2.00 A	14.80 V	0		3.00 A	15.00 V	0		2.25 A	20.00 V	0
Packet	Right	SOP* SNK		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																		
17	"Notebook"			GoodCRC	UFP	SNK		0	0	493.637 us	7.196 ms	6.849.062.736																		
Packet	Right	SOP* SNK		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Request	Max Opr Cur	Opr Cur	Cap Mismatch	Obj Pos	Duration	Idle	Time Stamp													
18	"Notebook"			Request	UFP	SNK		0	1	1.50A	1.50A	0	5	625.779 us	74.557 us	6.856.752.736														
Packet	Left	SOP* SRC		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																		
19	"PowerBank"			GoodCRC	DFP	SRC		0	0	499.597 us	1.043 ms	6.857.453.072																		
Packet	Left	SOP* SRC		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																		
20	"PowerBank"			Accept	DFP	SRC		1	0	499.597 us	116.483 us	6.858.996.016																		
Packet	Right	SOP* SNK		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																		
21	"Notebook"			GoodCRC	UFP	SNK		1	0	493.935 us	39.042 ms	6.859.612.096																		
Packet	Left	SOP* SRC		PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																		
22	"PowerBank"			PS Ready	DFP	SRC		2	0	499.448 us	115.712 us	6.899.148.096																		

Figure 8. PD Log When Using Power Bank as Source

4.2 Power Swap Upon Switch Press

If the user connects the power bank to a notebook without pressing the switch, then the power bank registers as a sink and starts drawing power from the laptop. In this condition, the user can press the switch and perform a power role reversal to start charging the notebook. The following logs in Figure 9 show the power role sequence after pressing the switch.

Packet	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Time	Time Stamp																	
0	CC Event	Connected	1.5 A	"PowerBank"	Rd	Open	"Notebook"	Rp	Open	2.841 sec	0.00000000																	
1	Left	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"PowerBank"	←	SNK	PR Swap	UFP	SNK	4	0	499.597 us	105.819 us	2.841359136																	
2	Right	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"Notebook"	→	SRC	GoodCRC	DFP	SRC	4	0	493.637 us	142.427 us	2.841964552																	
3	Right	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"Notebook"	→	SRC	Accept	DFP	SRC	6	0	493.637 us	75.299 us	2.842600616																	
4	Left	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Time	Time Stamp																
	"PowerBank"	←	SNK	GoodCRC	UFP	SNK	6	0	499.597 us	2.229 ms	2.843169552																	
5	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Idle	Time Stamp																	
	-	-	-	"PowerBank"	~	~	"Notebook"	~	~	9.681 ms	2.845399000																	
6	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Idle	Time Stamp																	
	-	-	-	"PowerBank"	Rd	Open	"Notebook"	~	~	23.830 ms	2.855080000																	
7	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Time	Time Stamp																	
	-	-	-	"PowerBank"	Rd	Open	"Notebook"	Rd	Open	169.620 ms	2.878910000																	
8	Right	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"Notebook"	→	SRC	PS Ready	DFP	SRC	7	0	473.330 us	80.046 us	3.048530168																	
9	Left	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"PowerBank"	←	SNK	GoodCRC	UFP	SNK	7	0	492.744 us	1.784 ms	3.049083544																	
10	Left	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"PowerBank"	→	SRC	PS Ready	UFP	SRC	5	0	492.744 us	118.964 us	3.051360668																	
11	Right	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Time	Time Stamp																
	"Notebook"	→	SRC	GoodCRC	DFP	SRC	5	0	473.759 us	2.147 ms	3.051972376																	
12	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Idle	Time Stamp																	
	-	-	-	"PowerBank"	Rd	Open	"Notebook"	Rd	Open	1.600 ms	3.054119000																	
13	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Time	Time Stamp																	
	Connected	3.0 A	-	"PowerBank"	Rp	Open	"Notebook"	Rd	Open	50.480 ms	3.055719000																	
14	Left	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Dur		
	"PowerBank"	→	SRC	Source Cap	UFP	SRC	0	5	3.00 A	5.00 V	0	Fixed	3.00 A	9.00 V	0	Fixed	2.00 A	14.80 V	0	Fixed	3.00 A	15.00 V	0	Fixed	2.25 A	20.00 V	0	1.17
15	Right	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"Notebook"	←	SNK	GoodCRC	DFP	SNK	0	0	493.637 us	651.179 us	3.107481496																	
16	Right	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Request	Max Opr Cur	Opr Cur	Cap Mismatch	Obj Pos	Duration	Idle	Time Stamp											
	"Notebook"	←	SNK	Request	DFP	SNK	0	1	626.346 us	1.50A	1.50A	0	5	72.414 us	3.108626312													
17	Left	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"PowerBank"	→	SRC	GoodCRC	UFP	SRC	0	0	499.448 us	1.043 ms	3.109325072																	
18	Left	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"PowerBank"	→	SRC	Accept	UFP	SRC	1	0	499.448 us	115.776 us	3.110867912																	
19	Right	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"Notebook"	←	SNK	GoodCRC	DFP	SNK	1	0	493.786 us	38.941 ms	3.111483136																	
20	Left	SOP	SRC	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																
	"PowerBank"	→	SRC	PS Ready	UFP	SRC	2	0	499.001 us	113.063 us	3.150918312																	
21	Right	SOFF	SNK	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Time	Time Stamp																
	"Notebook"	←	SNK	GoodCRC	DFP	SNK	2	0	493.786 us	3.151530376																		

Figure 9. PD Log During Power Role Swap

4.3 Power Bank Charging From PD Power Adapter

The power bank registers as a PD sink and makes a PD contract when it is connected to a PD power adapter. The power bank picks up the right PDO from the available options and starts charging (see [Figure 10](#)).

Packet	CC Event	CC1 Pins	Ad Curr	Left	CC1	CC2	Right	CC1	CC2	Idle	Time Stamp																							
0	Disabled @ 00.000 000 000	-	-	"PowerBank"	Open	Open	"Charger"	Rp	Open	3.430 sec	0.000 000 000																							
1	Disabled ==> Unattached.SNK @ 03.430 248 000	-	-	"PowerBank"	Rd	Open	"Charger"	Rp	Open	1.600 ms	3.430 248 000																							
2	Unattached.SNK ==> AttachWait.SNK @ 03.431 848 000	Connected	3.0 A	"PowerBank"	Rd	Open	"Charger"	Rp	Open	126.637 ms	3.431 848 000																							
3	AttachWait.SNK ==> Attached.SNK @ 03.558 485 000	Connected	3.0 A	"PowerBank"	Rd	Open	"Charger"	Rp	Open	106.094 ms	3.558 485 000																							
4 Packets	Right	SRC	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Extended	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Fixed	Max Cur	Voltage	Dual Role	Source Cap			
4-7	"Charger"	50%	50%	Source Cap	DFP	SRC	0	6	No	No	Fixed	3.00 A	5.00 V	0	Fixed	3.00 A	9.00 V	0	Fixed	5.00 A	10.00 V	0	Fixed	5.00 A	12.00 V	0	Fixed	4.33 A	15.00 V	0	Fixed	3.25 A	20.00 V	0
8	"PowerBank"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																						
8	"PowerBank"	50%	50%	GoodCRC	UFP	SNK	0	0	0	498.703 us	2.379 ms	4.115 970 376																						
9	"PowerBank"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Extended	Request	Max Opr Cur	Opr Cur	Cap Mismatch	Obj Pos	Duration	Idle	Time Stamp																
9	"PowerBank"	50%	50%	Request	UFP	SNK	0	1	No	No	0.00A	1.50A	0	6	833.339 us	138.557 us	4.116 848 016																	
10	"Charger"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																						
10	"Charger"	50%	50%	GoodCRC	DFP	SRC	0	0	0	503.769 us	1.405 ms	4.119 619 912																						
11	"Charger"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																						
11	"Charger"	50%	50%	Accept	DFP	SRC	1	0	No	503.769 us	73.511 us	4.121 629 032																						
12	"PowerBank"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																						
12	"PowerBank"	50%	50%	GoodCRC	UFP	SNK	1	0	0	498.852 us	160.611 ms	4.122 106 312																						
13	"Charger"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																						
13	"Charger"	50%	50%	PS Ready	DFP	SRC	2	0	No	503.173 us	73.523 us	4.283 216 616																						
14	"PowerBank"	50%	50%	PD Msg	Msg Type	DR	PR	Msg ID	Obj Cnt	Duration	Idle	Time Stamp																						
14	"PowerBank"	50%	50%	GoodCRC	UFP	SNK	2	0	0	498.852 us	4.283 793 312																							

Figure 10. PD Log During Power Bank Charging

5 Design Files

5.1 Schematics

To download the schematics, see the design files at [TIDA-01627](#).

5.2 Bill of Materials

To download the bill of materials (BOM), see the design files at [TIDA-01627](#).

5.3 Layout Prints

To download the layer plots, see the design files at [TIDA-01627](#).

5.4 Gerber Files

To download the Gerber files, see the design files at [TIDA-01627](#).

5.5 Assembly Drawing

To download the assembly drawings, see the design files at [TIDA-01627](#).

6 Related Documentation

1. Texas Instruments, [bq25703A I2C Multi-Chemistry Battery Buck-Boost Charge Controller With System Power Monitor and Processor Hot Monitor Data Sheet](#)

6.1 Trademarks

E2E, USB Type-C, D-CAP2 are trademarks of Texas Instruments.
USB Type-C is a trademark of USB Implementers Forum, Inc.
All other trademarks are the property of their respective owners.

7 Terminology

BOM— Bill of materials

ESD— Electrostatic discharge

FET— Field-effect transistor

LED— Light-emitting diode

NVDC— Narrow voltage DC

OTG— On-the-go

PD— Power delivery

PDO— Power data object

Revision History

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

Changes from Original (April 2018) to A Revision	Page
• Changed TPS65983B to TPS65987D throughout document.....	1
• Changed TPD6S300 to TPD8S300 throughout document	1
• Changed TPS62170 to TPS563200 throughout document.....	1
• Changed block diagram and board images.....	1
• Changed information in Section 2.2.1	4
• Changed Figure 2	4
• Changed Figure 3	5
• Changed Figure 5	7
• Changed information in Section 2.2.4	7

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