

Type-C PD for IPC/EPOS Application

Senior FAE

Eric Lo

The Evolution of USB



USB1.x

USB2.0

USB On-the-Go

USB3.0
USB3.1 Gen 1

USB3.1 Gen 2

USB Type-C

USB3.2

Low Speed
LS: 1.5Mbps
Full Speed
FS: 12Mbps

High Speed
HS: 480Mbps
FS, LS

USB2.0 OTG
Master/Slave
Configurable

SuperSpeed
SS: 5Gbps
HS/FS/LS

SuperSpeed+
SS+: 10Gbps
SS/HS/FS/LS

USB: 10Gbps
DP: 8.1Gbps
Power: 100W

USB: 20Gbps
2 x 10Gbps per
Type-C port



USB
Type-C

USB Type-C/PD Technology Overview



What is Type-C/PD

USB-C/PD (Power Delivery) is a wide-spread interface that is scalable for power & signaling. It is a specification for a reversible-plug connector for USB devices and cabling.

When to use Type-C/PD



Why Now?


- A single USB Type-C connector can deliver functions that several connectors provide today in our electronic gadgets.
- Standard type-c now offer more than twice of existing BC1.2 power and type-c PD now offer up to 100W of power.
- Supports increased demand of video and high data rates through alternate modes.

Why USB Type C ?

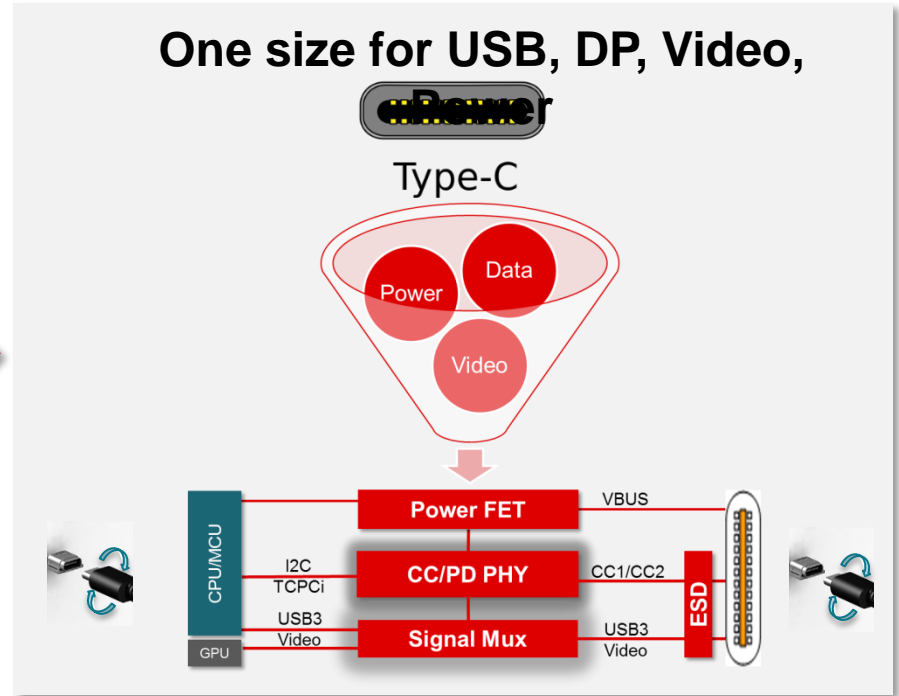


- Smaller size → same size connector as uB
- Richer content → 3.1, DP, TB
- Higher power → 100W
- Better user experience → Flippable, no more host and device specific cable and connector
- More customization with standardized mechanical dimensions

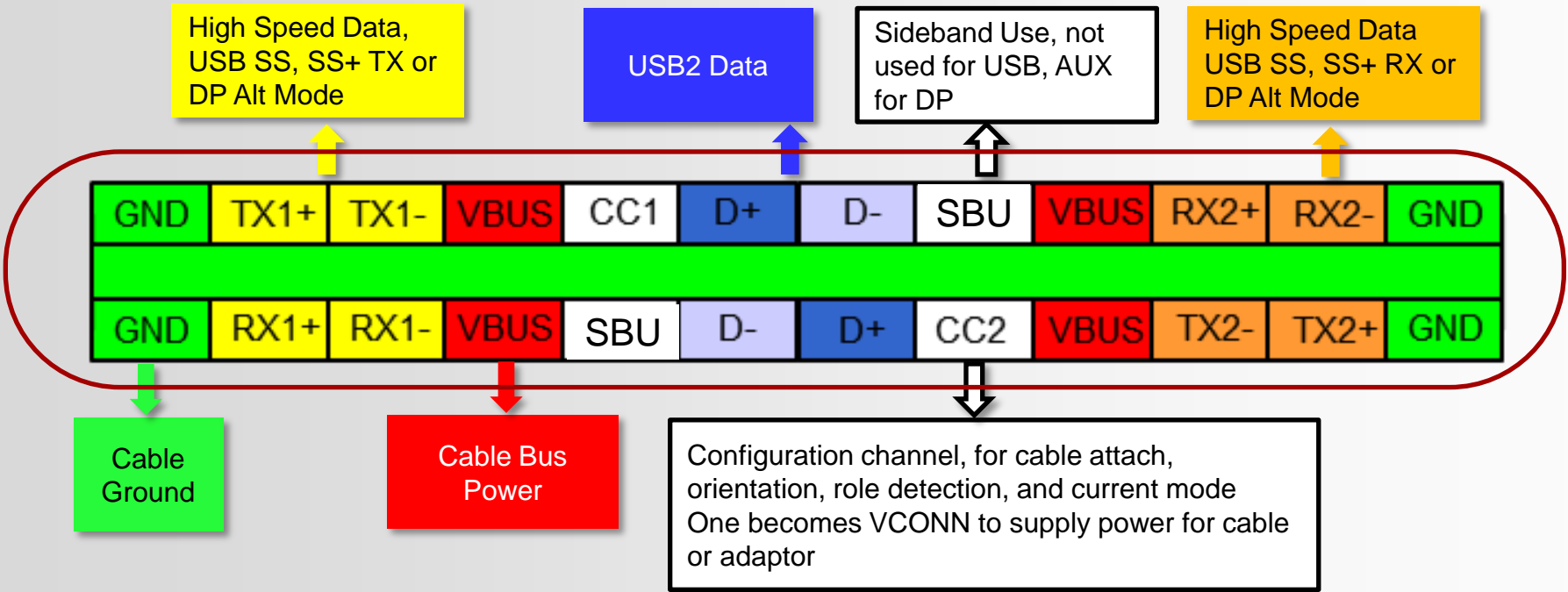
The Evolution of USB PD

Precedence	Mode of Operation	Nominal Voltage	Maximum Current
Highest	USB PD	Up to 20 V	Up to 5 A
	USB Type-C current @ 3A	5 V	3 A
	USB Type-C current @ 1.5A	5 V	1.5 A
	USB BC1.2	5 V	Up to 1.5 A
	USB 3.1	5V	900 mA
	Lowest	USB 2.0	5V

Unified Connector for Data, Video and Power



USB Type-C Flippable Receptacle Interface



Configuration Channel – Analog / Protocol

❑ CC Analog

Detect attach, UFP/DFP role decide

Cable Orientation Detection

Type-C Current Mode (500/900mA, 1.5A, 3A)

Configure VCONN

Audio Accessory

Debug Accessory

❑ CC Protocol – Defined in PD2.0

PD - PowerDelivery(100W)

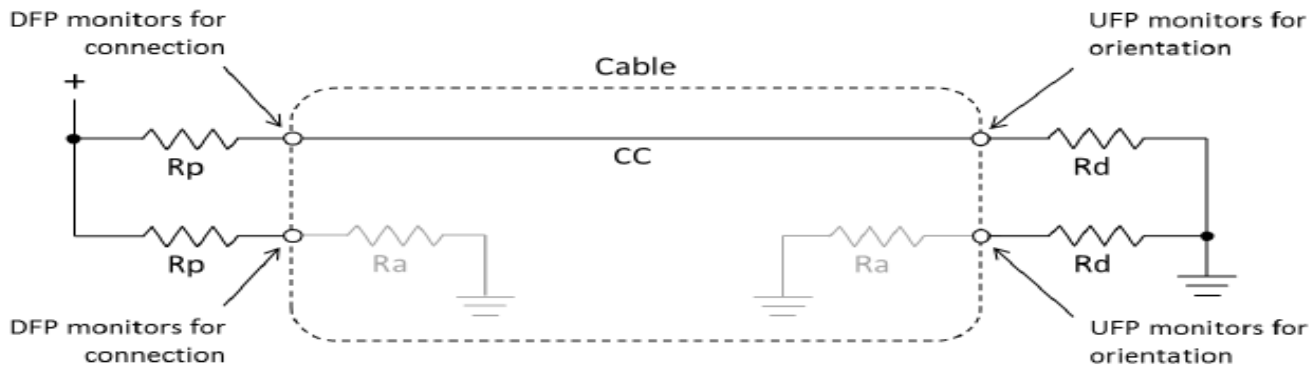
Alternate Mode

DP - DisplayPort

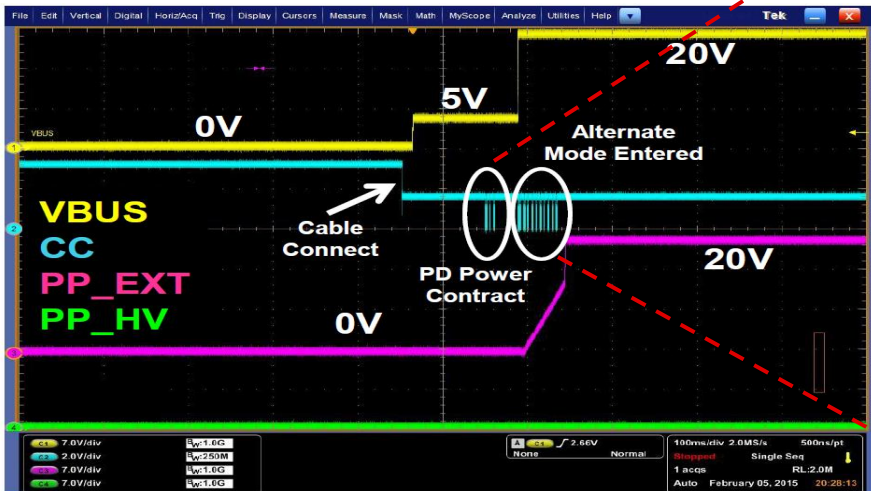
TB – Thunderbolt

MHL

CC Analog Model



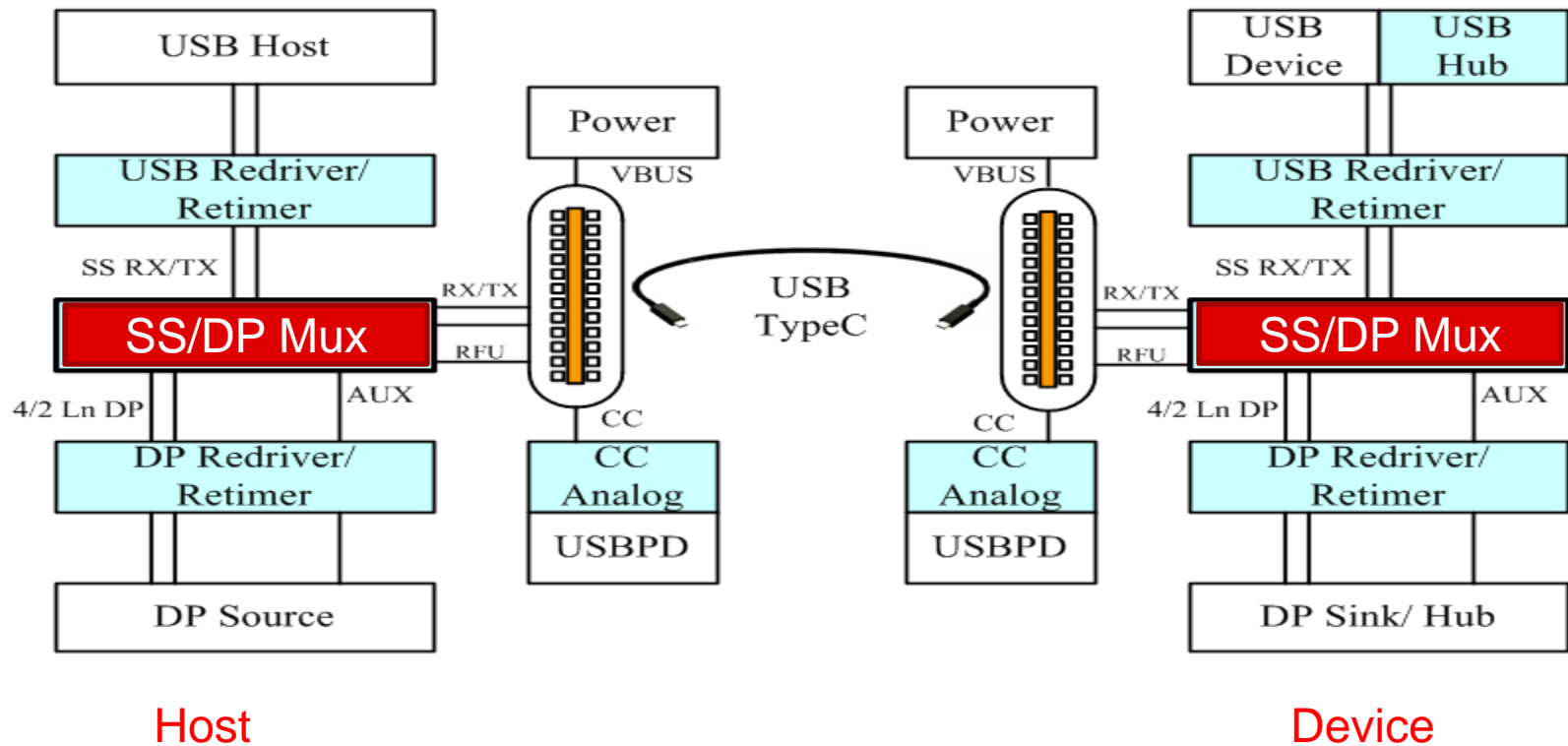
CC Protocol



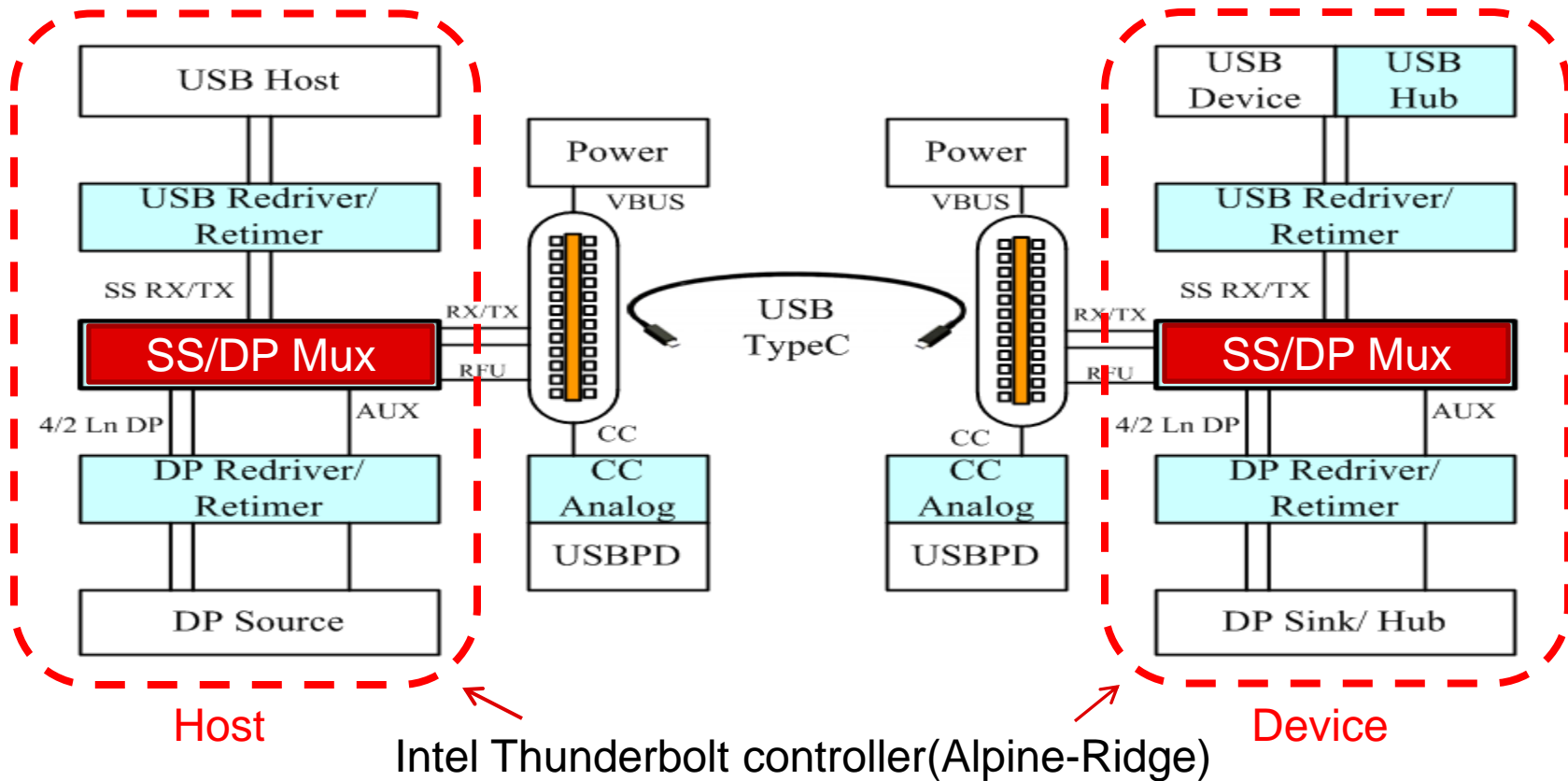
- Default
 - DFP → PD Provider
 - UFP → PD Consumer
- Power Role Swap

Source Capabilities packet (Fixed 5V 3A, Fixed 12V 3A, Fixed 20V 3A)	OUT
GoodCrc packet	IN
Request (Object 3 = Fixed 20V 3A, Requested 3A, Maximum 3A) > Accepted	IN
Request (Object 3 = Fixed 20V 3A, Requested 3A, Maximum 3A)	IN
Request packet (Object 3 = Fixed 20V 3A, Requested 3A, Maximum 3A)	IN
GoodCrc packet	OUT
Accept	OUT
Accept packet	OUT
GoodCrc packet	IN
PsRdy	OUT
PsRdy packet	OUT
GoodCrc packet	IN
Discover Identity > Ack (Undefined)	OUT
Discover Identity	OUT
Discover Identity Ack (Undefined)	IN
Discover SVIDs > Ack (0x8086, 0xFF01)	OUT
Discover SVIDs	OUT
Discover SVIDs Ack (0x8086, 0xFF01)	IN
Discover Modes (SVID = 0x8086) > Ack (0x54425433)	OUT
Discover Modes (SVID = 0x8086)	OUT
Discover Modes (SVID = 0x8086) packet	OUT
GoodCrc packet	IN
Discover Modes (SVID = 0x8086) Ack (0x54425433)	IN
Discover Modes (SVID = 0x8086) Ack packet (0x54425433)	IN
GoodCrc packet	OUT
Discover Modes (SVID = 0xFF01) > Ack (0x00000C05)	OUT
Discover Modes (SVID = 0xFF01)	OUT
Discover Modes (SVID = 0xFF01) packet	OUT
GoodCrc packet	IN
Discover Modes (SVID = 0xFF01) Ack (0x00000C05)	IN
Discover Modes (SVID = 0xFF01) Ack packet (0x00000C05)	IN
GoodCrc packet	OUT
Enter Mode (SVID = 0x8086, Mode = 1) > Ack	OUT
Enter Mode (SVID = 0x8086, Mode = 1)	OUT
Enter Mode (SVID = 0x8086, Mode = 1) packet	OUT
GoodCrc packet	IN
Enter Mode (SVID = 0x8086, Mode = 1) Ack	IN
Enter Mode (SVID = 0x8086, Mode = 1) Ack packet	IN
GoodCrc packet	OUT

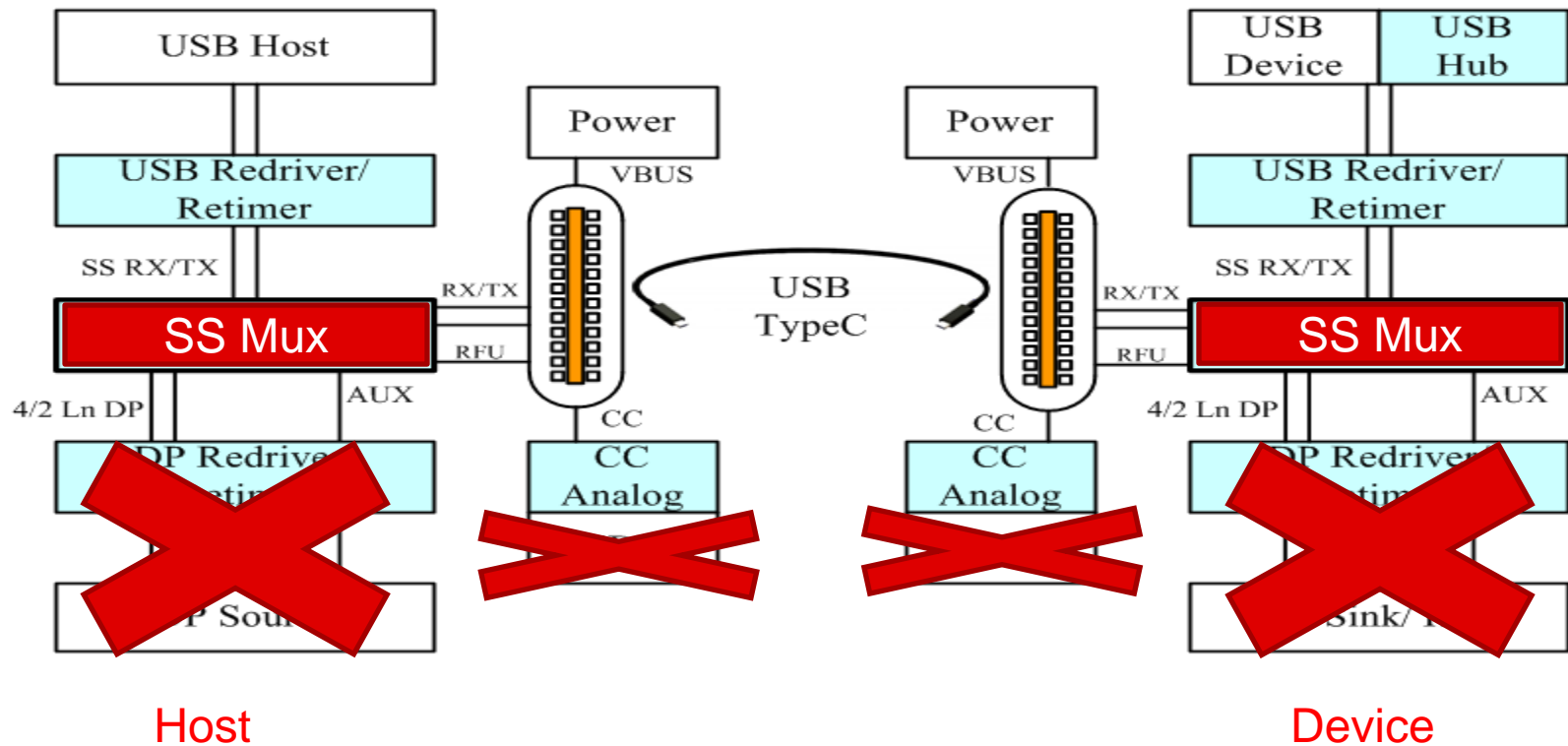
Type C DP + USB (+ PD) Architecture



Type C TB (+ PD) Architecture



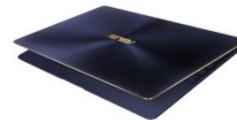
Type C USB Architecture (power < 15W)



TI Released End Products



acer



ASUS



DELL

intel



GIGABYTE™



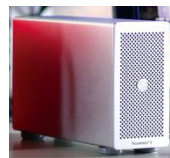
Lenovo™



RAZER



Hisense



AKITIO



hp



Hub-Mirage

eCore



Broad portfolio of TI's USB Type-C/PD products

Standard Type-C 15W Max, No Data

Products

- TPS25810
- TPS25820
- TPD2S300 (CC OVP)

Differentiation

- Turn key solution & smallest solution size in DFP < 15W power provider (TPS25810)
- Turn key solution & smallest solution size & cost in DFP < 7.5W power provider (TPS25820)

Winning Applications

- Set-Top Box
- Laptop/PC
- Powerbank
- Wall Charger
- Car charger



Type-C & PD Power Provider

Products

- TPS25740B
- TPS25741
- TPD2S300 (CC OVP)

Differentiation

- Turn key solution & smallest solution size in DFP power provider (TPS25740/1)
- Integrated 24V Short-to- V_{BUS} OVP protects downstream circuitry and saves up to 75% board space vs discrete

Winning Application

- Wall Charger
- AC/DC Adapter
- Car Charger
- Powerbank



Type-C & Full PD Power + Data/Video

Products

- TPS65987D
- TPS65988
- TPD6S300A (CC/SBU OVP)

Differentiation

- Turn key solution (TPS6598x)
- Reduce solution size and simplify design through fully managed power path
- Integrated 24V Short-to- V_{BUS} OVP protects downstream circuitry and saves up to 75% board space vs discrete

Winning Application

- Laptop/PC
- Monitor
- Tablet
- Dock/Dongle
- Infotainment



Companion Products

Products

- Protection
- MCU
- Data/Video
- Power
- Battery
- FET

Differentiation

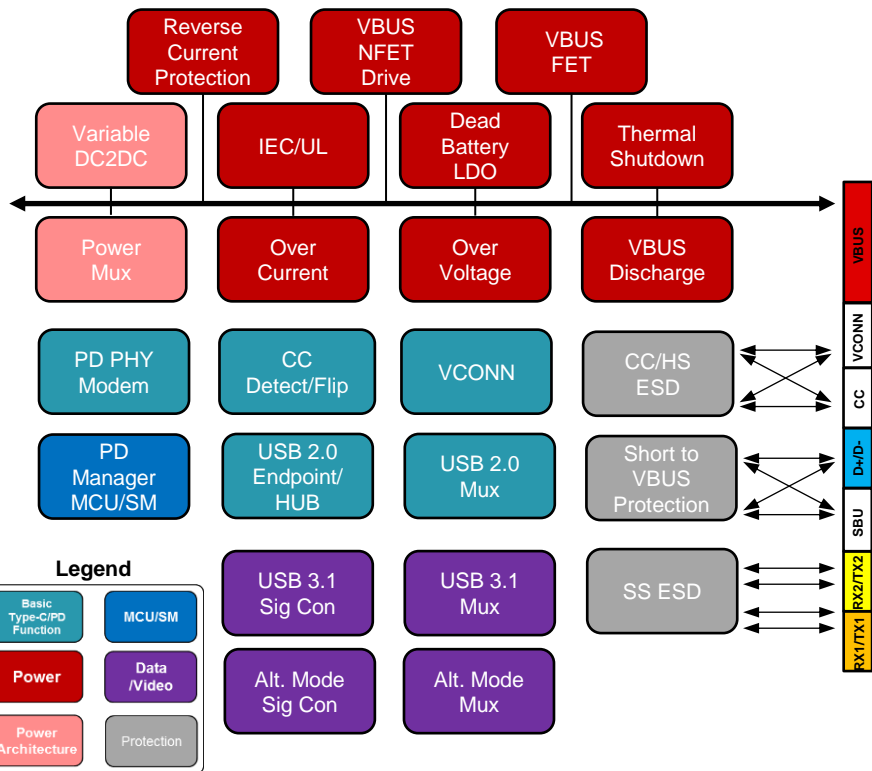
- Integrated 24V Short-to- V_{BUS} OVP protects downstream circuitry and saves up to 75% board space vs discrete
- Only company offering full eco system for total solution

Winning Application



Find & Learn more at www.ti.com/usb-c

USB Type-C and PD Ecosystem



TI Part #	Description	Protection Attach
TPS65988	USB-C/PD 3.0 Dual port controller (DRP) w/Pwr FETs up to 10W + BC1.2	TPS6S300A
TPS65987D	USB-C/PD 3.0 Single port controller (DRP) w/Pwr FETs up to 100W + BC1.2	TPD6S300A
TPS65981	Industrial USB-C/PD 2.0 port controller (DRP) w/ Pwr FETs up to 100W and HS Mux	TPD8S300A
TPS65986	USB-C/PD 2.0 port controller (DRP) w/Pwr FETs up to 60W and HS Mux	TPD8S300A
TUSB422	USB-C PD PHY, support 100W and Alt Mode	TPS8S300A
TUSB320	USB-C <15W controller (DRP)	TPD2S300
TPS25740B	USB-C/PD 2.0 controller w/gate driver for ext N-FET < 100W Power provider (DFP)	TPD2S300
TPS25810	USB-C <15W controller w/Pwr FETs, Vbus Discharge & IEC ESD as Power provider (DFP)	TPD2S300
TPS25820	USB-C <7.5W controller w/Pwr FETs, Vbus Discharge & IEC ESD as Power provider (DFP)	TPD2S300

- “USB-C/PD” is a wide-spread scalable interface for power & signaling
- Barrier to entry for a complete solution is high – Type-C & PD specs are ~800 pages and continue to evolve!
- The diagram details elements in a complete system. Semiconductor suppliers are taking different approaches to implement
- TI has process & design expertise in all fundamental blocks - power, digital control, signal chain, ESD

USB Type-C Ecosystems – Power & Data

DFP = Downstream Facing Port
DRD = Dual-Role-Data (DFP or UFP)
DRP = Dual-Role-Power (Source or Sink)
UFP = Upstream Facing Port

Source

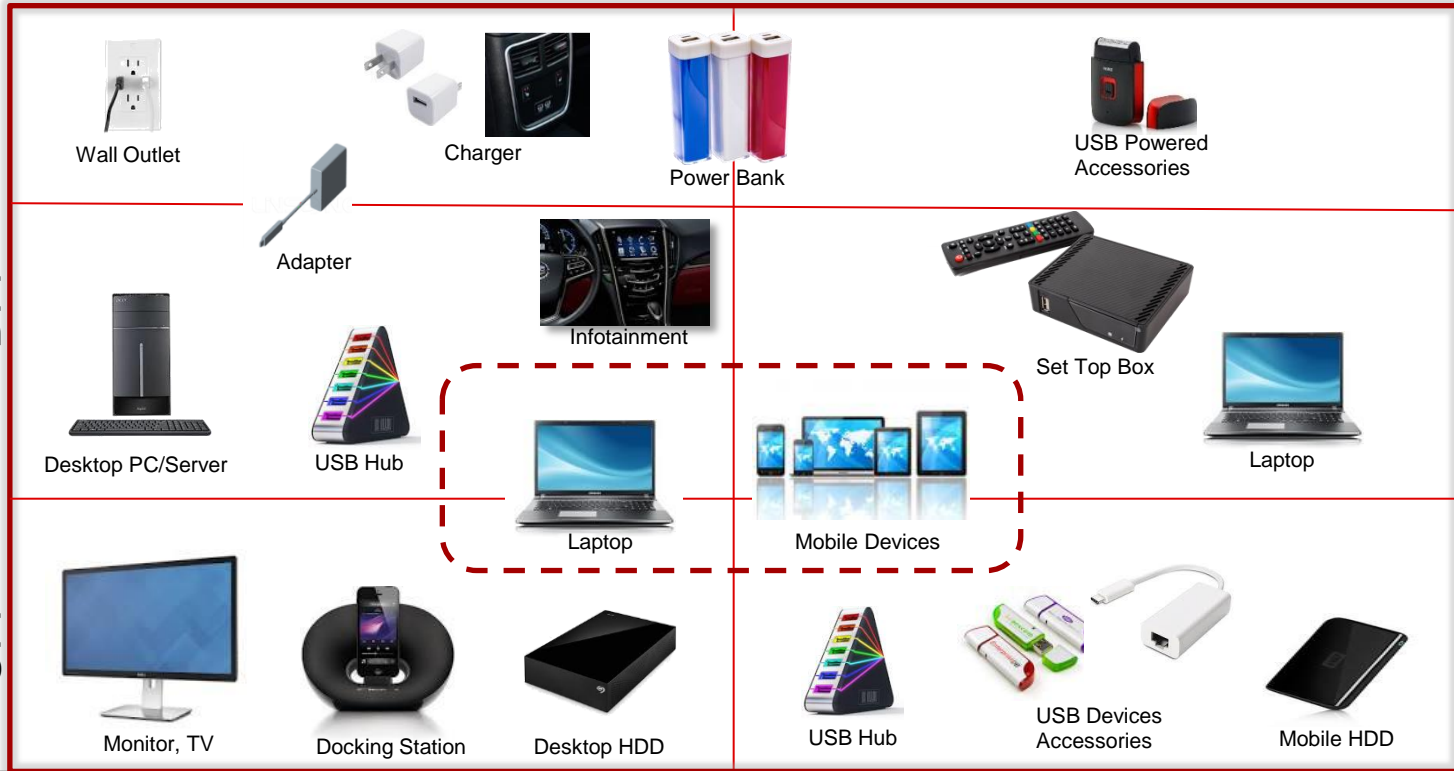
Power Role

Sink

(Known as DRP)

Data Role

No Data
 Host DFP
 DRD
 Device UFP



USB Type-C Ecosystems – Data & Video

DFP = Downstream Facing Port
 DRD = Dual-Role-Data (DFP or UFP)
 DRP = Dual-Role-Power (Source or Sink)
 UFP = Upstream Facing Port

Source

Alternative Mode

Sink

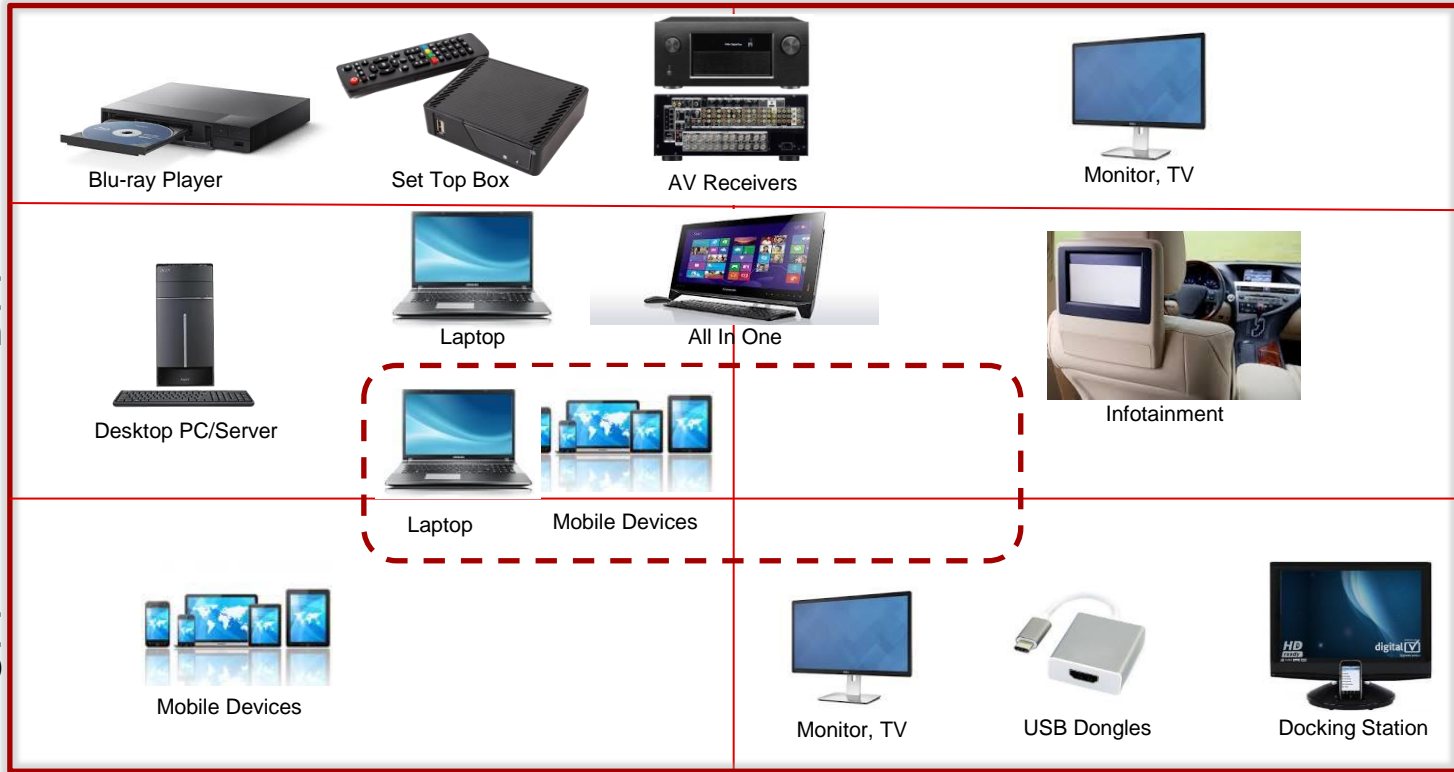
Data Role

No Data

Host DFP

DRD

Device UFP



USB Power Delivery - Full

EXISTING

NEW

ROADMAP

USB Type-C & Power Delivery

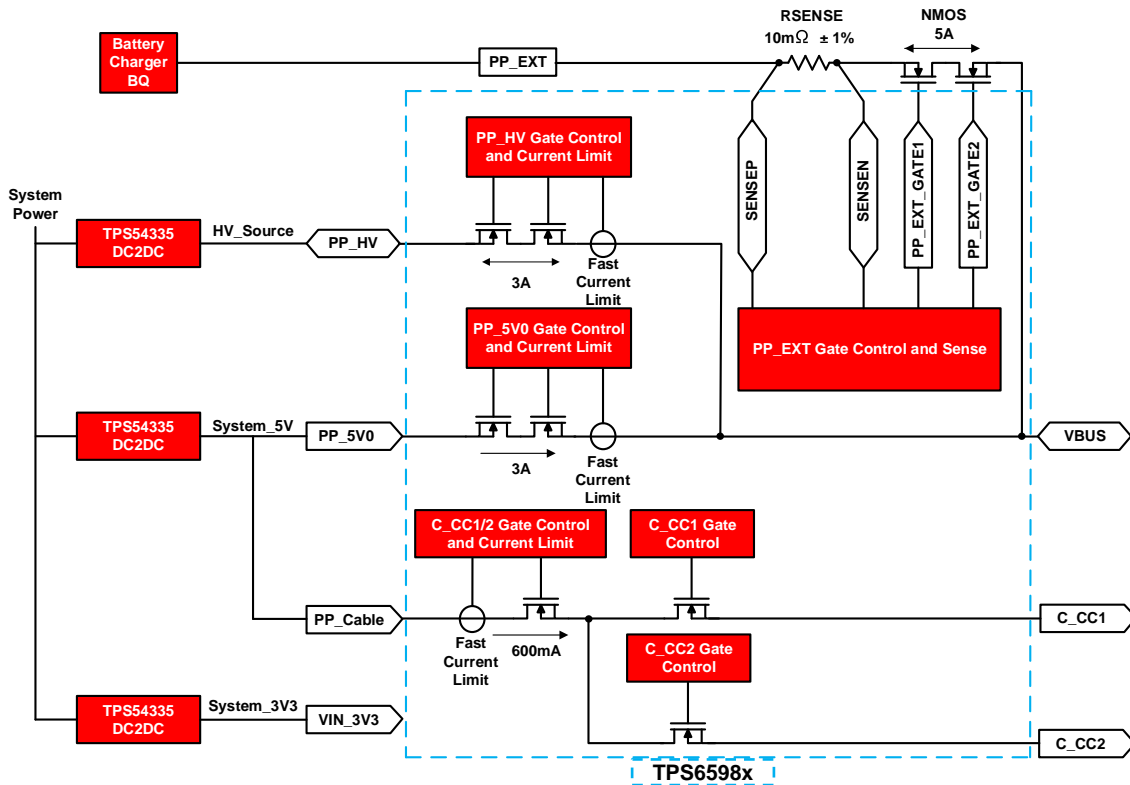
Need more info?

[USB Power Delivery](#)
Features

Features	EXISTING	NEW	ROADMAP	Need more info? USB Power Delivery		
USB PD Power/Video		<p>TPS65982</p> <ul style="list-style-type: none"> Single Port DRP CTRL Integrated PD2 Policy MGR Integrated Power Path (5V3A and 20V3A) Integrated EXT HV gate driver Thunderbolt™ 3 Host-side 6x6mm 0.4mm pitch BGA 	<p>TPS65986</p> <ul style="list-style-type: none"> Single Port DRP CTRL Integrated PD2 Policy MGR Integrated Power Path (5V3A and 20V3A) 6x6mm 0.4mm pitch BGA, P2P with TPS65982 <p>NRND</p>	<p>TPS65981</p> <ul style="list-style-type: none"> Single Port DRP Controller Integrated PD2 Policy MGR Integrated Power Path (5V3A and 20V3A) Integrated EXT HV gate driver Industrial temp range 8x8mm 0.5mm pitch QFN 	<p>TPS65987D</p> <ul style="list-style-type: none"> Single Port DRP Controller Integrated PD3 Policy MGR Two 5V to 20V, 5A Bidirectional Switches I2C Master Write Control for Alt Mode Mux and Var DCDC BC1.2 Support 7x7mm 0.4mm pitch QFN 	<p>TPS65988</p> <ul style="list-style-type: none"> Dual Port DRP Controller Integrated PD3 Policy MGR Two 5V to 20V, 5A Bidirectional Switches I2C Master Write Control for Alt Mode Mux and Var DCDC BC1.2 Support 7x7mm 0.4mm pitch QFN
USB PD Power Source		<p>TPS25740B</p> <ul style="list-style-type: none"> Integrated N-ch gate driver Integrated Policy MGR TPS25740B 5V/9V/12V/15V/20V TPS25740A 5V/9V/15V USB-PB 2.0 Certified and USB PD 3.0 certified provider 10µA quiescent current 4x4mm 0.5mm pitch QFN 	<p>TPS25741A</p> <ul style="list-style-type: none"> Mult. Integrated gate driver Integrated Policy MGR 5V/9V/15V Advt. (Selectable) USB-PB 2.0 Certified 10µA quiescent current 4x4mm 0.4mm pitch QFN 			
USB Type-C 15W Max		<p>TPS25810</p> <ul style="list-style-type: none"> STD/1.5-A/3-A Capability 34-mΩ (typ) High-Side FET 0.7-µA (typ) IDDQ When Port Unattached Port Power Management Vconn application 3x4mm WQFN package 	<p>TPS25820</p> <ul style="list-style-type: none"> STD/1.5-A Capability 64-mΩ (typ) High-Side FET 1.0-µA (typ) Operating Current with Nothing Attached Vconn application 3x2mm WSON package 			
Protection		<p>TPD6S300A</p> <ul style="list-style-type: none"> Improved Dead Battery and OVP performance 4Ch Short-to-Vbus Overvoltage Protection (CC1/CC2, SBU1/ SBU2 or D+/D-): 24V Tolerant 6Ch of IEC 61000-4-2 ESD Protection 3x3mm WQFN package 	<p>TPD8S300A</p> <ul style="list-style-type: none"> Improved Dead Battery and OVP performance 4Ch Short-to-Vbus Overvoltage Protection (CC1/CC2, SBU1/ SBU2 or D+/D-): 24V Tolerant 8Ch of IEC 61000-4-2 ESD Protection 3x3mm WQFN package 	<p>TPD2S300</p> <ul style="list-style-type: none"> 2Ch Short-to-Vbus Overvoltage Protection (CC1, CC2) 2Ch of IEC 61000-4-2 ESD Protection 1.4x1.4mm WCSP package 		

Release Date

TPS6598x | 3 Power Architecture Solutions to Fit Your Need



TPS65981, TPS65982, TPS65983, TPS65983B Full Solution: 3 Power Paths

- 100W (20V, 5A) External Source/Sink
- 60W (20V, 3A) Internal Source/Sink
- 15W (5V, 3A) Internal Source
- 3W (5V, 600mA) Internal VCONN Path
- Optimized for many different applications:
 - Industrial & Automotive – TPS65981
 - Thunderbolt & DP Hosts – TPS65982
 - Thunderbolt Devices – TPS65983
 - PD 3.0 systems – TPS65983B

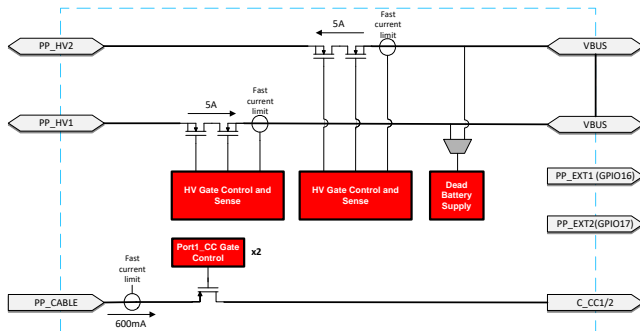
All Solutions Have Integrated Overcurrent, Overvoltage, and Thermal Protection

TPS65987D/88 | 2 Power Architecture Solutions to Fit Your Every Need

TPS65987D

1 Port 100W Power Paths

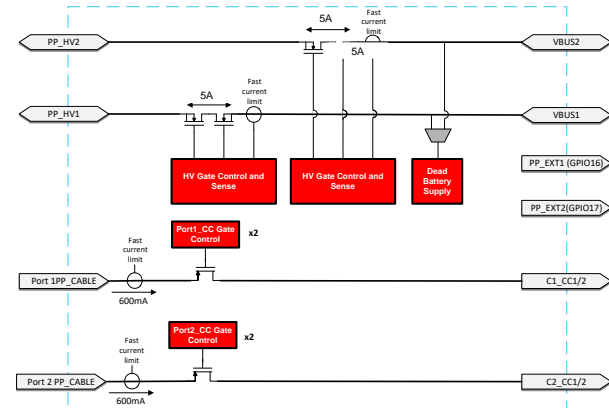
- 2x 100W (20V, 5A) Internal Source/Sink
 - 2x 100W (20V, 5A) External Source/Sink
 - 1x 3W (5V, 600mA) Internal VCONN Path
- Ideal Diode behavior when connected
 - Most flexible solution offering the smallest solution size for single DRP PD applications: notebook pc, docking station, dongle adapters



TPS65988

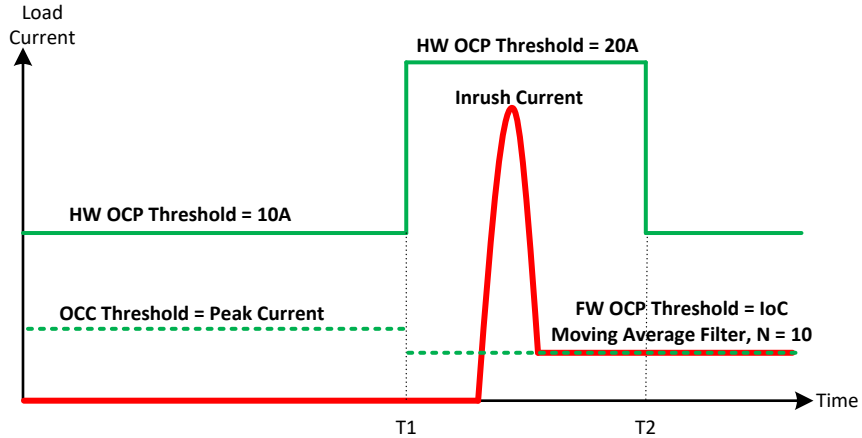
2 Port 100W Power Paths

- 2x 100W (20V, 5A) Internal Source/Sink
 - 2x 100W (20V, 5A) External Source/Sink
 - 2x 3W (5V, 600mA) Internal VCONN Path
- Cost-optimized for dual DRP PD applications: notebook pc, docking station

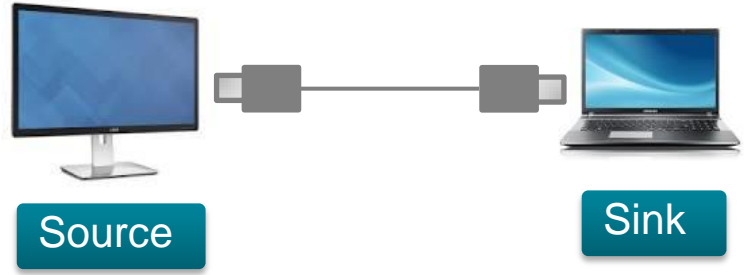
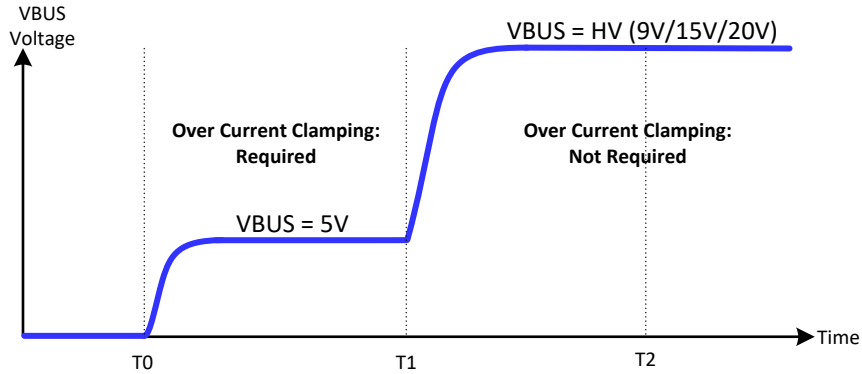


All Solutions Have Integrated Overcurrent, Overvoltage, and Thermal Protection

Multi-level Protection in Over Current Scenario



Protection	Mechanism
Level 1	Hardware Over Current Protection (HW OCP)
Level 2	Firmware Over Current Protection (FW OCP) Over Current Clamping (OCC)
Level 3	Under Voltage Protection (UVP)
Level 4	Thermal Shutdown (TSD)



TPS65988 | Dual USB Type-C Port Power Switch with USB-PD Controller

Features

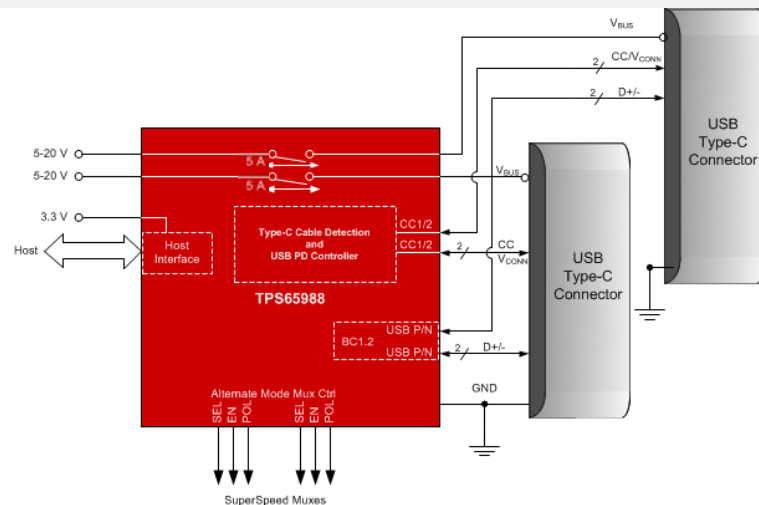
- Supports all Type-C High Current Modes
 - 2 Fully Managed Power Paths
 - Two Integrated Port Power Switch, 20V @ 5A
 - Ideal Diode Reverse Current Protection
 - External Power Path support via GPIO
- Fully compliant USB PD Baseband modem per USB PD3.x
 - Policy and Policy Engine for 2 Ports
 - Physical Layer with CRC
 - Fast Role Swap Support
- Performs all CC pin functions for 2 Ports
 - Cable Detection and Cable Orientation
- Integrated BC1.2 Support
 - CDP/DCP advertisement
 - DCD, Primary, and Secondary Detection
- Flexible system interfaces
 - I2C Slave/Master, SPI, Simple connection to HD3SS460 SS Mux for Display Port/USB3.0
- Easy to use 7 x 7 mm, 0.4mm pitch QFN

Applications

- Notebook / Desktop Computers
- Dock / Camera / Storage / Tablet / TV/ Monitor

Benefits

- Fully Integrated USB Type-C and PD Solution
 - No additional discrete components needed for full CC Function
 - Two Fully Managed Power Paths
 - UL & IEC Certification
- Supports 2 USB-C/PD Ports
- Each Port is configurable as Source, Sink or Dual Role Power
- Industry's smallest solution size



TPS65987D | USB Type-C Port Power Switch with USB-PD Controller

Features

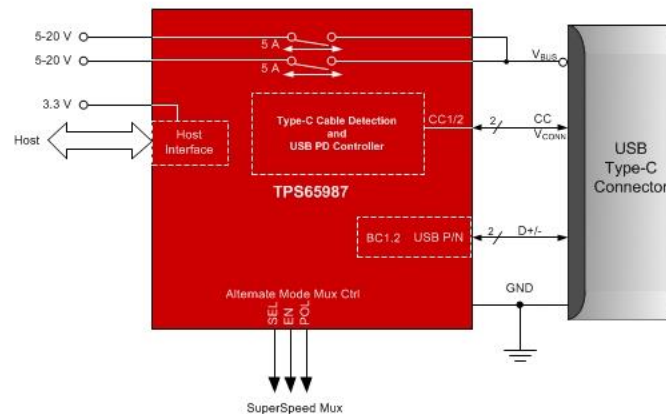
- Supports all Type-C High Current Modes
 - 2 Fully Managed Power Paths
 - Two Integrated Port Power Switch, 20V @ 5A
 - Ideal Diode Reverse Current Protection
 - External Power Path support via GPIO
- Fully compliant USB PD Baseband modem per USB PD3.x
 - Policy and Policy Engine
 - Physical Layer with CRC
 - Fast Role Swap Support
- Performs all CC pin functions
 - Cable Detection and Cable Orientation
- Integrated BC1.2 Support
 - CDP/DCP advertisement
 - DCD, Primary, and Secondary Detection
- Flexible system interfaces
 - I2C Slave/Master, SPI, Simple connection to HD3SS460 SS Mux for Display Port/USB3.0
- Easy to use 7 x 7 mm, 0.4mm pitch QFN

Applications

- Notebook / Desktop Computers
- Dock / Camera / Storage / Tablet / TV/ Monitor

Benefits

- Fully Integrated USB Type-C and PD Solution
 - No additional discrete components needed for full CC Function
 - Two Fully Managed Power Paths
 - UL & IEC Certification
- Compliant to the USB Type-C 1.x and USB PD 3.x Specifications
- Configurable as Source, Sink or Dual Role Power
- Industry's smallest solution size



TPS65983B | Thunderbolt™ 3 USB Type-C and USB-PD Port Controller

Features

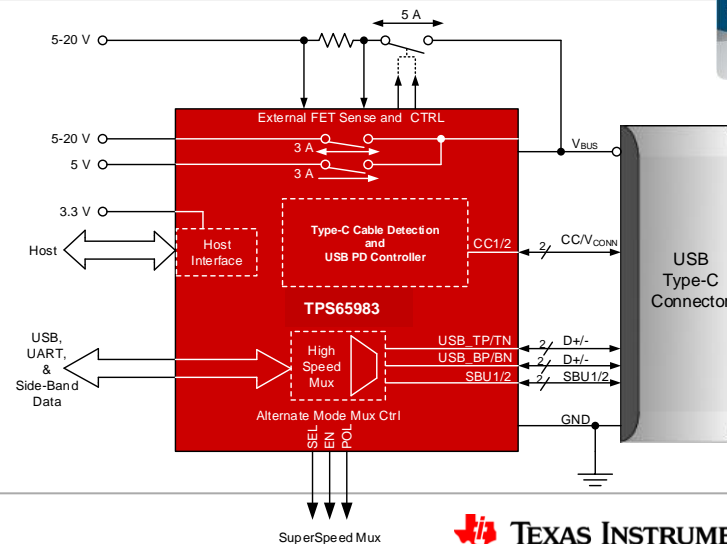
- USB Power Delivery (PD) Controller
 - Mode Configuration for Source (Host), Sink (Device), or Source-Sink.
- USB Type-C Specification Compliant
 - Cable Orientation and Role Detection
- Port Power Switch
 - Supports 100W (20V, 5A), 60W (20V, 3A), and 15W (5V, 3A) of power
 - Meets USB Type- C Slew Rate Control, Hard Reset Support requirements
 - Integrated VCONN
 - Overcurrent, overvoltage, reverse current, and thermal protection
- Port Data Multiplexer
 - Sideband Use Data for Alternate Mode Support
 - DisplayPort, Thunderbolt™, etc.
- Power Management
 - 3.3V LDO Output for Dead Battery Support
 - Supports 100W (20V, 5A) External Power Path
- UL 2367 and IEC 6950 Certified
- 6x6mm, 96 Pin BGA MicroStar Junior Package

Applications

- Notebook / Desktop Computers
- Dock / Camera / Storage / Tablet / TV/ Monitor
- Power Management System

Benefits

- Fully Integrated USB Type-C and PD Solution
 - No additional discrete components needed for full CC Function
 - No additional components needed for Power Paths up to 20V @ 3A
- Pin2Pin & Schematic Compatible with TPS65982/3
- Extended Host Interface & FW Support
- USB-C/PD 3.0
 - Fast Role Swap
 - Extended Messaging & Atomic Messaging
 - Extended GPIO control for PD3.0 power profiles (PDP Profiles)



TPS65981 | USB Type-C Port Power Switch with USB-PD Controller & HS Mux

Features

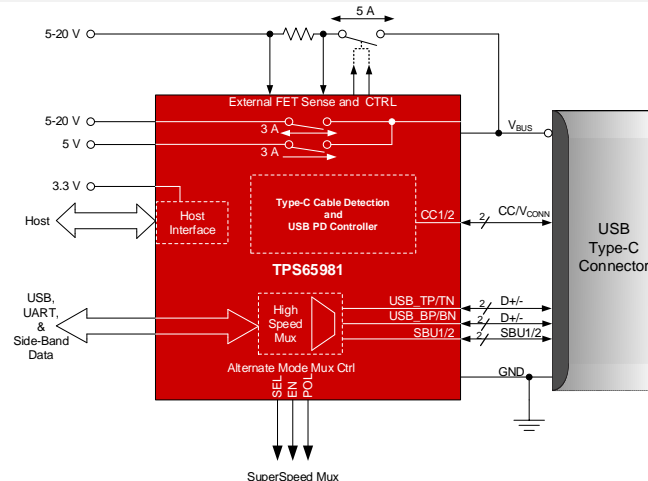
- Supports all Type-C High Current Modes
 - Integrated Port Power Switches up to 20V @ 3A
 - Supports bi-directional external power NMOS FETs
- Fully compliant USB PD Baseband modem per USB PD2.x
 - BMC encoder/decoder
 - Physical Layer with CRC
 - Policy and Policy Engine
- Performs all CC pin functions
 - Cable Detection and Cable Orientation
- Integrated HS Mux & USB 2.0 Endpoint
 - CC/2, SBU1/2, USB TP/TN, USBBP/BN
 - Support for Guest Port Protocols
 - Display Port
- Flexible system interfaces
 - I2C Slave/Master, SPI, Simple connection to HD3SS460 SS Mux for Display Port/USB3.0
- Easy to use 8x8mm 56pin QFN
- Commercial (-40 to 85) and Industrial (-40 to 105) temp ranges

Applications

- TVs and projectors
- EPOS (electronic point of sale)

Benefits

- Fully Integrated USB Type-C and PD Solution
 - No additional discrete components needed for full CC Function
 - No additional components needed for Power Paths up to 20V @ 3A
- Compliant to the USB Type-C 1.x and USB PD 2.x Specifications
- Configurable as either a Downward Facing Port, Upward Facing Port or Dual Role Port
- Advanced Alternate Mode Support
- Industry's smallest solution size



TPS65982 | USB Type-C Port Power Switch with USB-PD Controller & HS Mux

Features

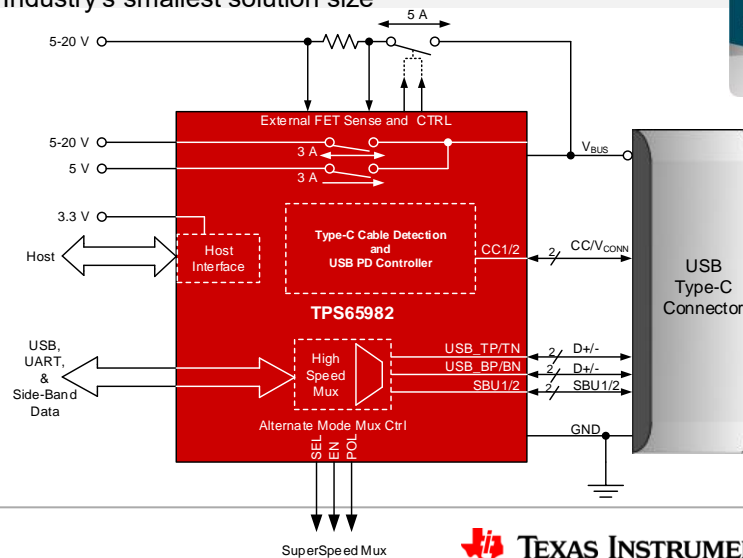
- Supports all Type-C High Current Modes
 - Integrated Port Power Switches up to 20V @ 3A
 - Supports optional bi-directional external power NMOS FETs
 - Integrated Dead Battery LDO
- Fully compliant USB PD Baseband modem per USB PD2.x
 - BMC encoder/decoder, Physical Layer with CRC
 - No external MCU needed includes Port Policy Manager
- Performs all CC pin functions w Integrated Vconn
 - Cable Detection and Cable Orientation
 - No external Vconn components needed
- Integrated HS Mux & Alternate Mode Support
 - CC/2, SBU1/2, USB TP/TN, USBBP/BN
 - USB 2.0 Endpoint for Billboard & Flash Update
 - Display Port, Thunderbolt™, PDIO, QuickSwap, MHL
- Flexible system interfaces
 - I2C Slave/Master, SPI, Simple connection to HD3SS460 SS Mux for Display Port/USB3.0
- Easy to use 6 x 6 mm, non HDI uBGA ZQZ 96pin, 0.5mm pitch

Applications

- Notebook / Desktop Computers
- Dock / Camera / Storage / Tablet / TV/ Monitor
- Power Management System

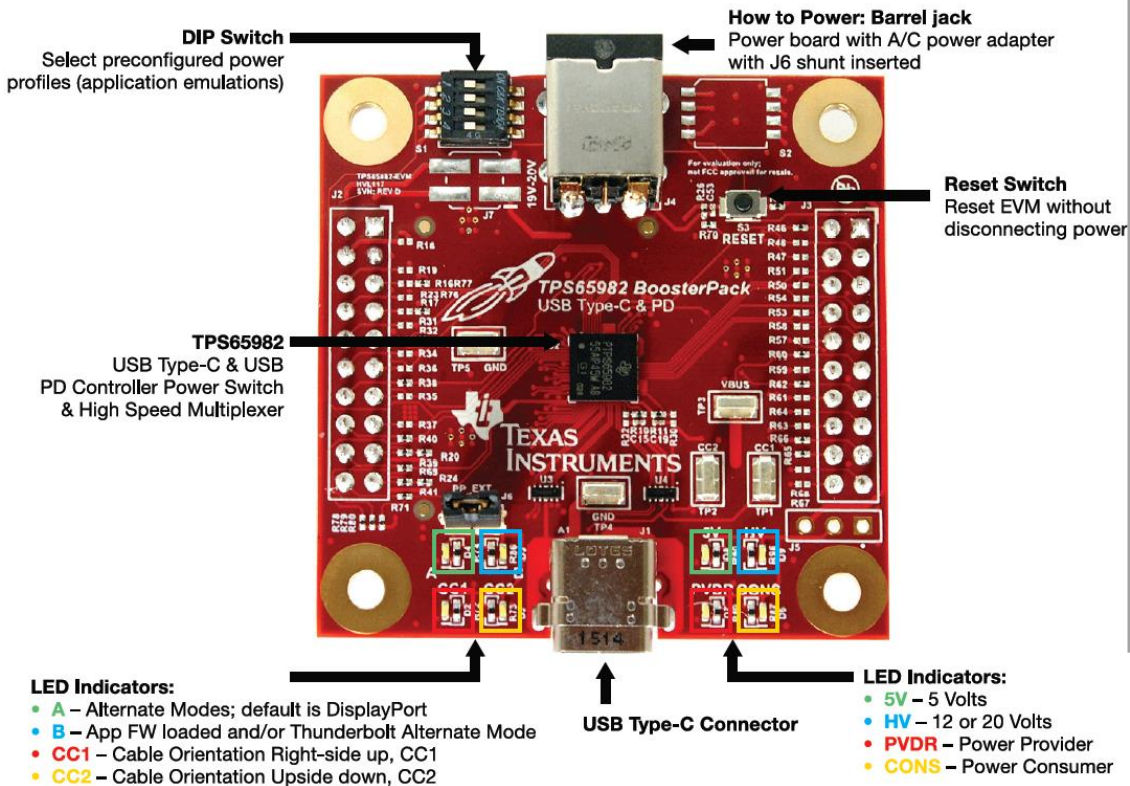
Benefits

- Fully Integrated USB Type-C and PD Solution
 - No additional discrete components needed for full CC Function
 - No additional components needed for Power Paths up to 20V @ 3A
- Compliant to the USB Type-C 1.x and USB PD 2.x Specifications
- Configurable as either a Downward Facing Port, Upward Facing Port or Dual Role Port
- Integrated USB Endpoint w USB2.0 Flash Update & Billboard
- Industry's smallest solution size



USB Power Delivery – Full Tools and Software

TPS65982-EVM

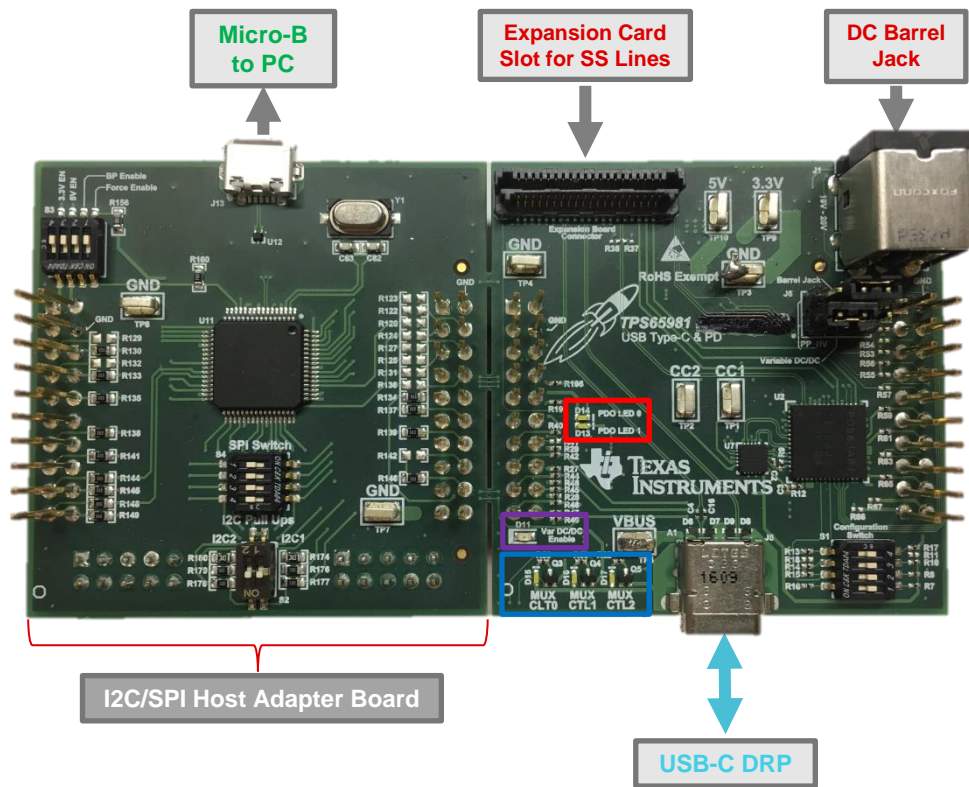


Features:

- USB Type-C™ testing and verification
- USB Power Delivery testing and verification
- Application Emulation (Notebook, Dock, Tablet, Dongle, Charger)
- Powered from single supply and bus-powered capable

Order now on [TI.com](https://www.ti.com) or build your own with these [design files!](#)

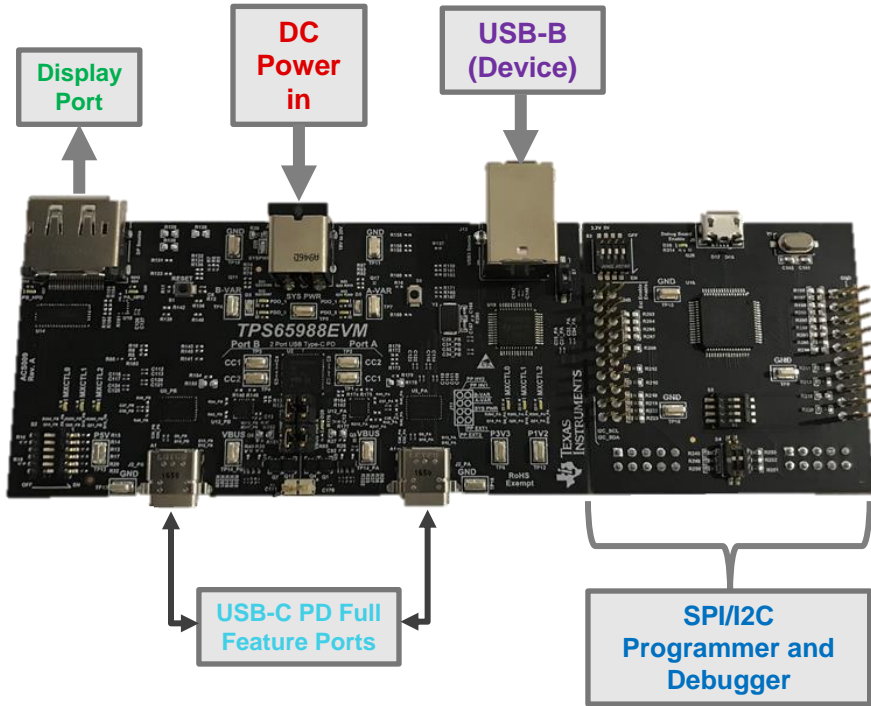
TPS65981EVM



Features:

- Bi-Directional Power Capabilities (20V, 3A max)
 - Externally-powered from 20V DC Barrel Jack or
 - Bus-powered from Type-C port
- DRP Full-Featured USB-C & PD Port
- LED indicators
 - Variable DC/DC Enable when SYS_PWR has 20V
 - PDO LEDs indicate which high-voltage PDO is negotiated (5V/9V/15V/20V)
 - MUX Control LEDs for Type-C connection and HD3SS460 POL/AMSEL
- Expansion Card Slot routes out SS signals to test Video and Data capabilities through DP-EXPANSION-EVM
- I2C/SPI Host Adapter Board enables easy programming and debugging via on-board FTDI, Aardvark headers or any other debugger courtesy of the J2/J3 headers
 - Breaks off for use with any TPS6598X-based EVM

TPS65988EVM – Dual Port USB Type-C and Power Delivery

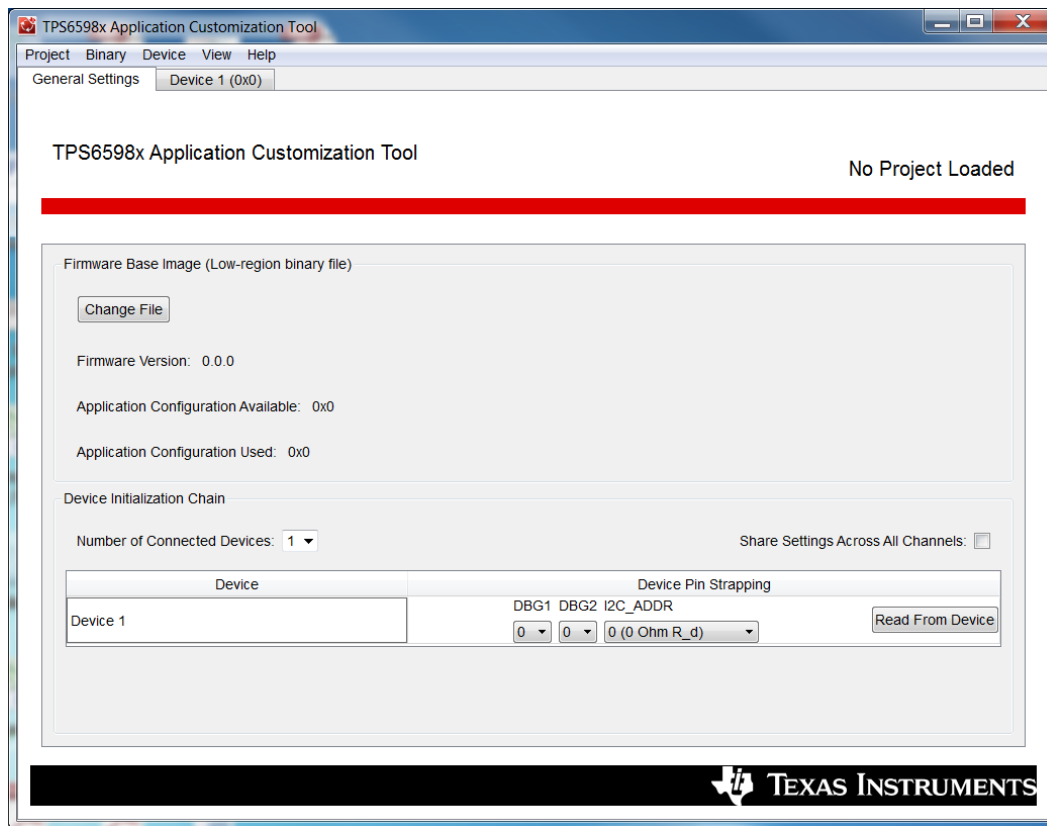


Features:

- Dual Port Notebook Reference Design converting existing **Video**, **Power** and **Data** to USB Type-C
- Two Full Featured USB Type-C and Power Delivery 3.0 Ports
 - Source/Sink up to 60W
 - DisplayPort Alternate Mode
 - Fast Role Swap Capable
- Built-in SPI/I2C break-off board for easy programming and debug

TPS6598X Configuration Tool

- Allows engineer to configure the application binary to meet their specific use case needs
 - 29 preconfigured templates
- Supports:
 - DFP, UFP, DRP profiles
 - Up to 7 Source PDOs
 - Up to 6 Sink PDOs
 - GPIO Mapping
 - Alternate Modes including DisplayPort and Thunderbolt™
- Ability to read device settings or flash firmware onto the device



TI GUI Tool: All PD parameter Configuration

The screenshot displays the 'Application Customization Tool' interface. The title bar reads 'Application Customization Tool'. The menu bar includes 'Project', 'Binary', 'Device', 'Settings', 'Debug', 'Documents', and 'Help'. Below the menu bar are tabs for 'General Settings' and 'Common Settings'. The main window is titled 'Configuration Mode' and shows the configuration for 'TPS65982_HD3SS460_DRP_Host_Advanced_v3_18.tpl' (TPS65982 HD3SS460 DRP, Prefers Host, version 3.18).

A red box highlights the left-hand navigation pane, which lists various configuration categories. 'Control Configuration' is selected and highlighted in blue. Other categories include Customer Use, Interrupt Mask for I2C1, Interrupt Mask for I2C2, System Power State, System Configuration, Transmit Source Capabilities, Transmit Sink Capabilities, Autonegotiate Sink, Alternate Mode Entry Queue, Transmit Identity Data Object, User Alternate Mode Config, Display Port Capabilities, Intel VID Config Register, Texas Instruments VID Config, GPIO Event Map, Miscellaneous Configuration, Sleep Control Register, and Raw View.

The main configuration area is titled 'Control Configuration (0x29)' and contains a table with columns for 'Field' and 'Value'. A red box highlights the 'Value' column, which contains a vertical list of checkboxes and a dropdown menu. The 'PD Mode' dropdown is set to 'Normal PD Behavior'. The checkboxes are as follows:

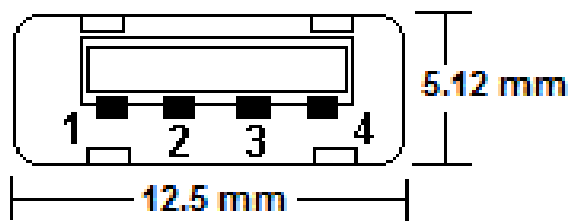
Field	Value
PD Mode	Normal PD Behavior
Externally Powered	<input type="checkbox"/>
Never Sink if Externally Powered	<input checked="" type="checkbox"/>
Process Swap To Sink	<input checked="" type="checkbox"/>
Initiate Swap To Sink	<input type="checkbox"/>
Process Swap To Source	<input checked="" type="checkbox"/>
Initiate Swap To Source	<input type="checkbox"/>
RDO Intrusive Mode	<input type="checkbox"/>
PDO Intrusive Mode	<input type="checkbox"/>
Process VCONN Swap	<input checked="" type="checkbox"/>
Initiate VCONN Swap	<input type="checkbox"/>
Process Swap to UFP	<input type="checkbox"/>
Initiate Swap to UFP	<input type="checkbox"/>
Process Swap to DFP	<input checked="" type="checkbox"/>
Initiate Swap to DFP	<input checked="" type="checkbox"/>
Automatic Sink Capabilities Request	<input type="checkbox"/>
Automatic ID Request	<input checked="" type="checkbox"/>
Intrusive Alternate Mode Support	<input type="checkbox"/>
Force USB Generation 1	<input type="checkbox"/>
I2C Timeout Period	200 ms

Easy to choose the PD Configuration

USB Type-C Protection

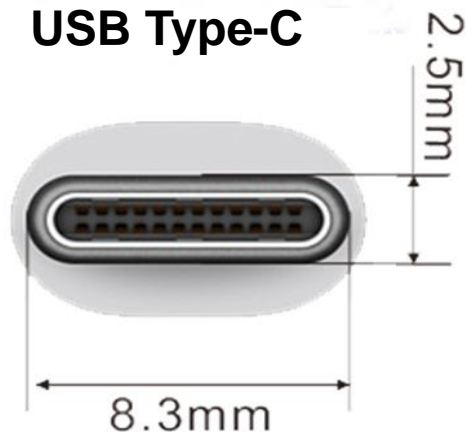
Type-C Protection Needs

USB Type-A



- ~2.3mm Pin Pitch

USB Type-C

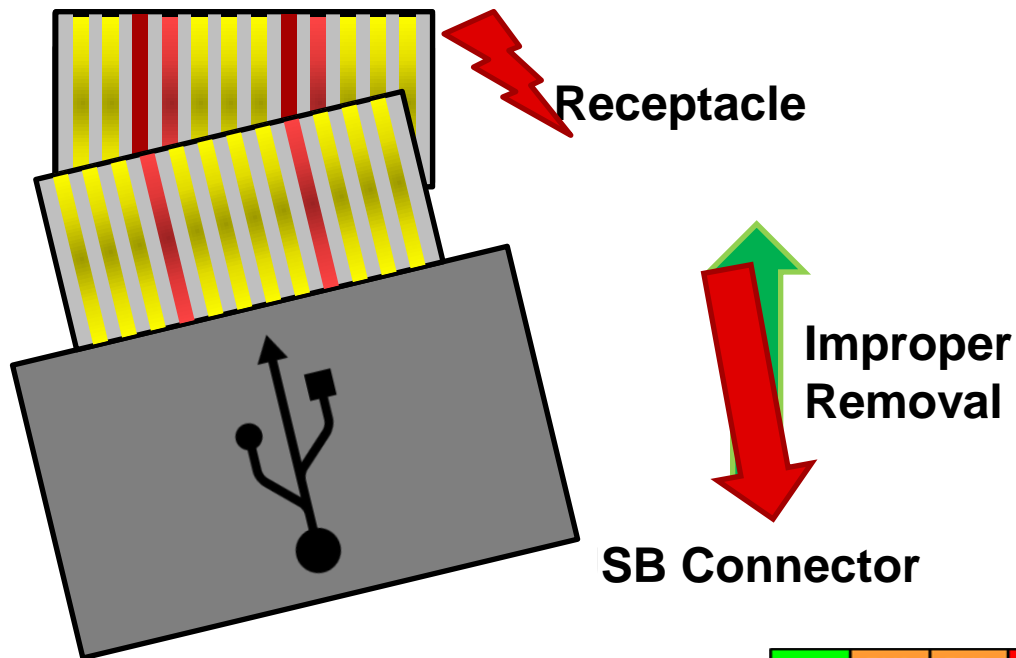


- 0.5mm Pin Pitch

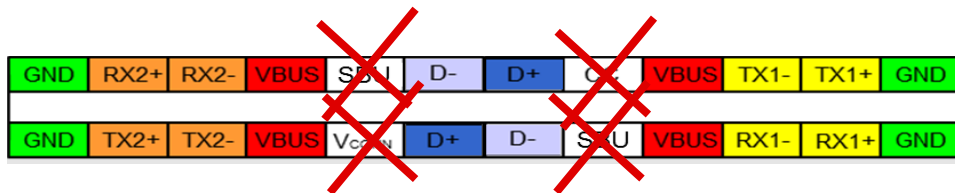


Due to the smaller connector/receptacle size and the reduced pin pitch, USB Type-C presents several new failure scenarios that can damage downstream circuitry.

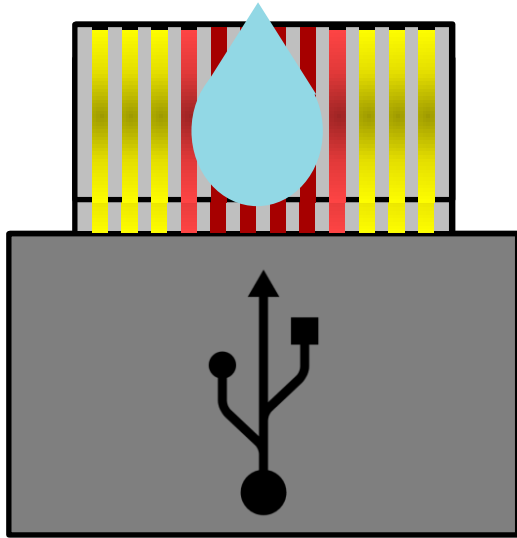
Failure Scenario #1: Mechanical Twist



If the USB plug is removed at an angle, it might cause the V_{BUS} pin to short with SBU or CC/Vconn pins



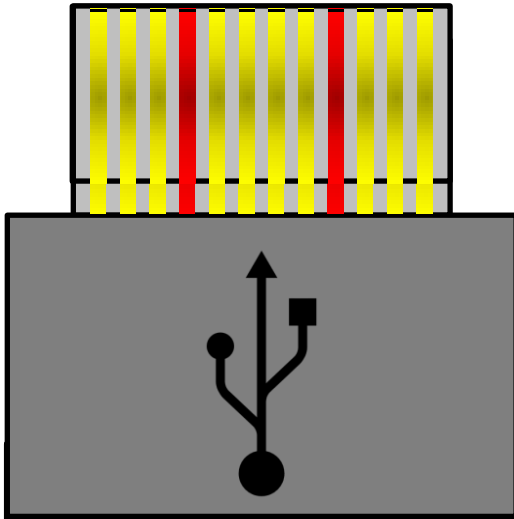
Failure Scenario #2: Debris or Water



Any debris or water that is conductive could short the SBU and CC pins to the 20V V_{BUS} lines



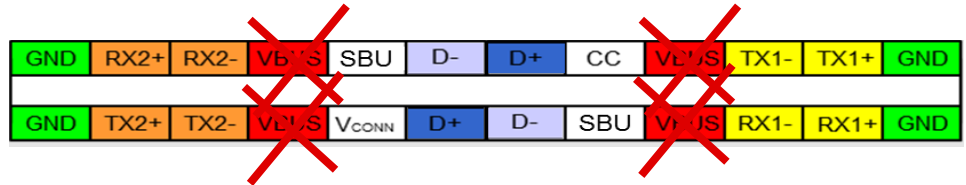
Failure Scenario #3: Noncompliant Cables



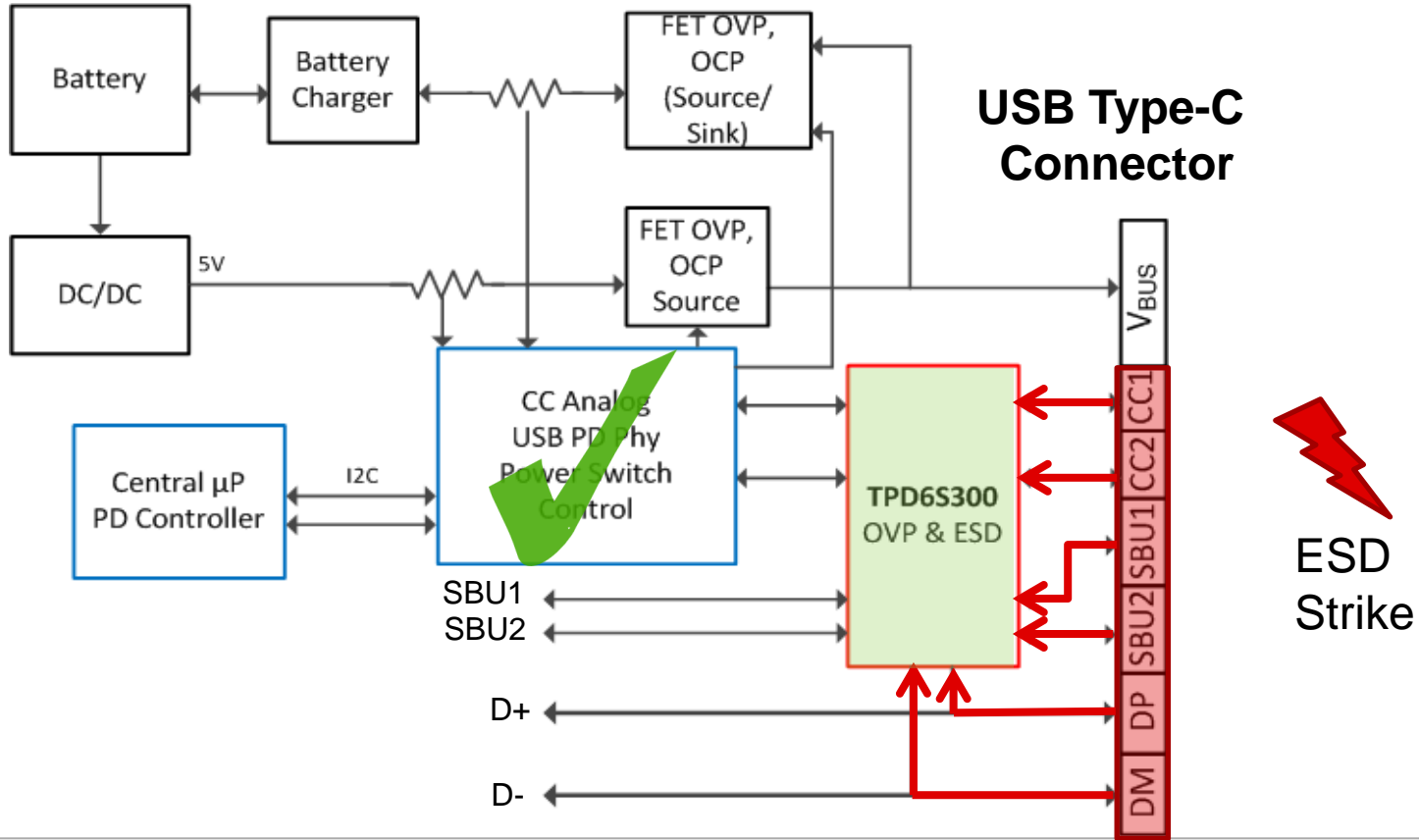
Miswired USB
Type A-C Cable



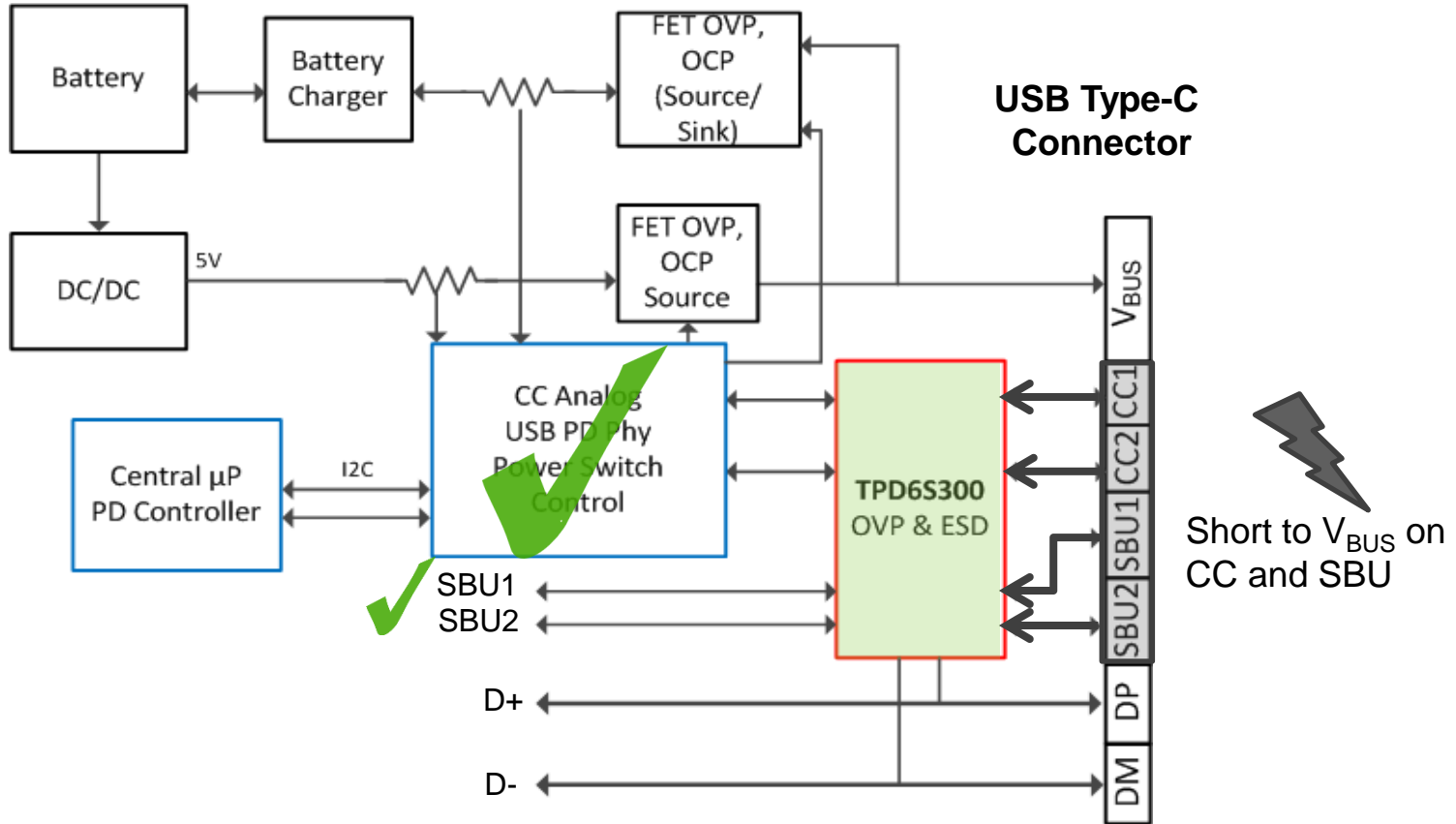
- Even if your system is not using USB PD (you are charging at 5V, 500mA), there are non-compliant cables that output 20V without PD negotiation
- If your system is not designed to handle 20V, then there would be a failure
- In a survey of USB Type-C cables available on Amazon, **28% of cables were not compliant to USB-IF specification.** (*Google Engineer Benson Leung: 20/71 cables out of specification*)
- [Spreadsheet of some known noncompliant cables](#)
- [Noncompliant Cable Video](#)



TPDxS300 Family Integrates all this Protection

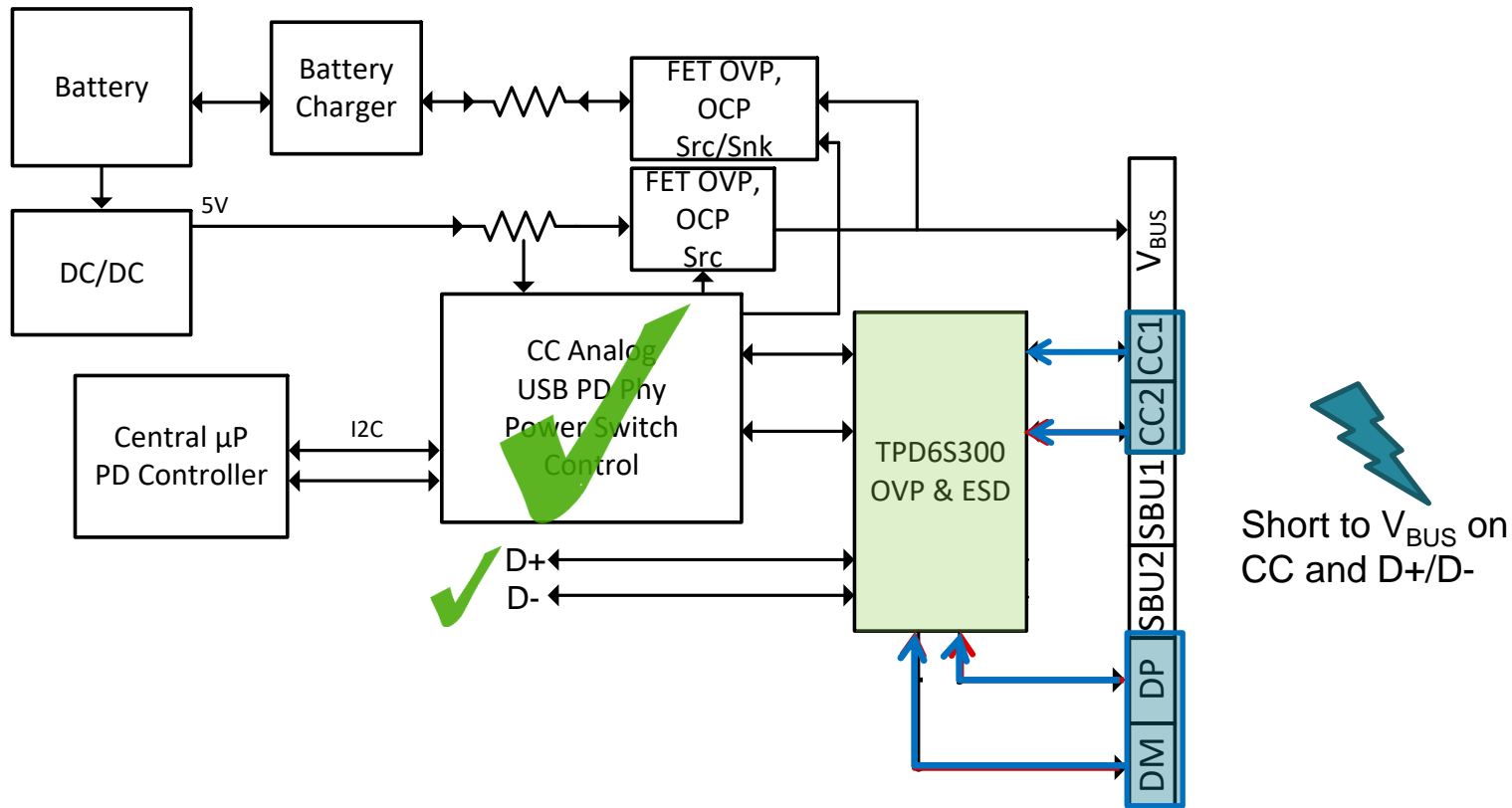


TPDxS300 Family Integrates all this Protection



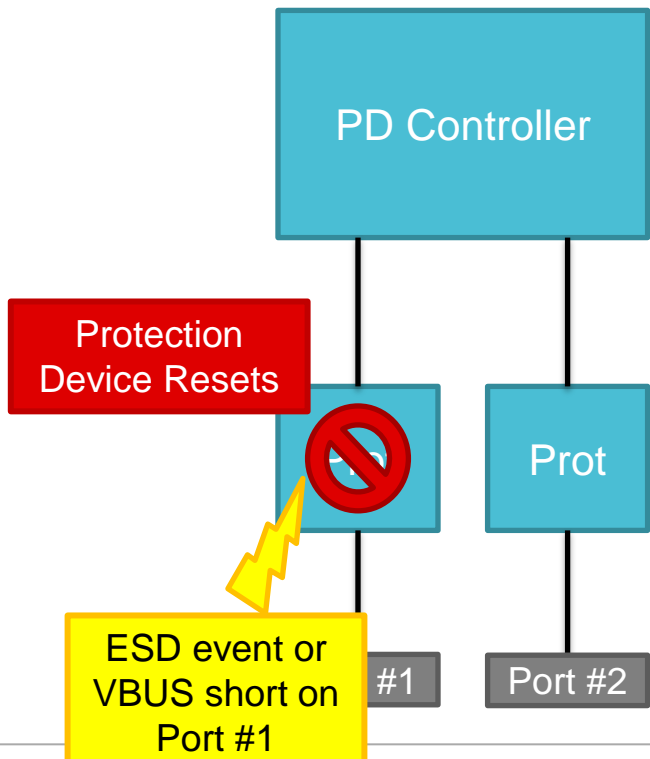
Alternate Application for non-SBU applications

OVP and ESD Protection on CC1, CC2, D+ and D-

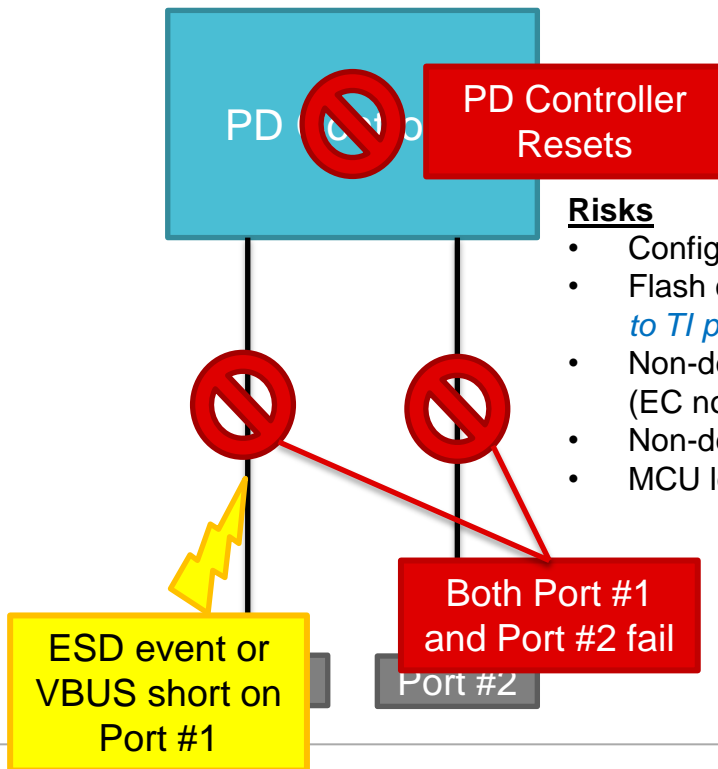


Discrete Protection Offers Fault Isolation

Discrete Protection



Integrated Protection



Risks

- Configuration corrupted
- Flash corrupted (*does not apply to TI parts*)
- Non-deterministic system state (EC not notified of fault)
- Non-deterministic GPIO states
- MCU lockup or watchdog event

TPD6/8S300A | USB-C Port Protector: Short-to-VBUS Overvoltage and IEC ESD Protection

Features

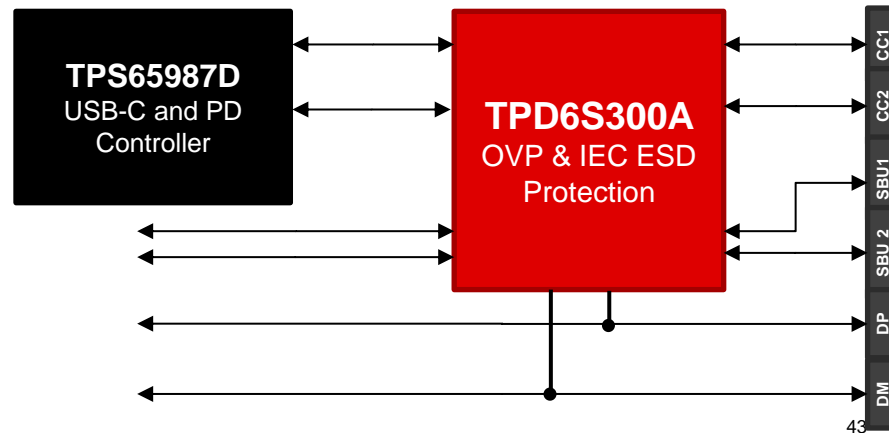
- 4-Channels of Short-to- V_{BUS} Overvoltage Protection (CC1, CC2, SBU1, SBU2 or CC1, CC2, DP, DM): 24-Vdc Tolerant
- 6/8-Channels of IEC 61000-4-2 ESD Protection (CC1, CC2, SBU1, SBU2, DP, DM)
- CC1 and CC2 Overvoltage Protection FETs 600 mA Capable for Passing V_{CONN} Power
- CC Dead Battery Resistors Integrated for Handling Dead Battery Use Case in Mobile Devices
- 3-mm x 3-mm WQFN Package

Applications

- Notebooks/ Laptops
- Smartphones and Tablets
- Monitors and TVs
- Docking Stations

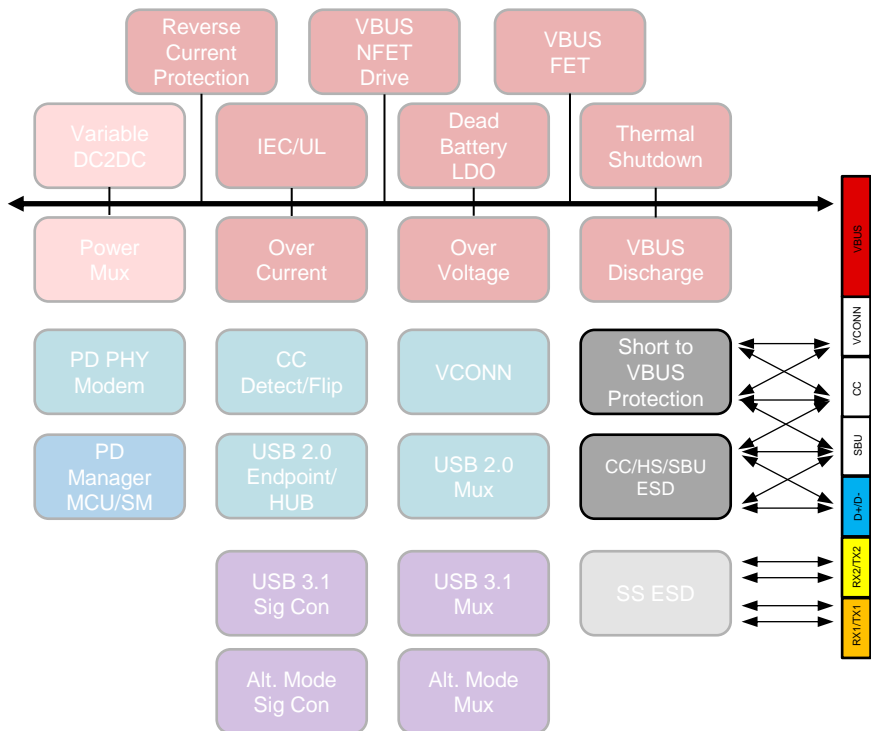
Benefits

- Provides a single chip solution for USB-C Ports protecting CC, SBU and D+/ D- lines.
- Protects end equipment from failure caused by mechanical twist, water or debris, and non-compliant USB-C accessories.
- Advantages over TPD6S300:
 - Improved Dead Battery Performance
 - USB-C Port Stays Connected during an IEC 61000-4-2 ESD Strike



43

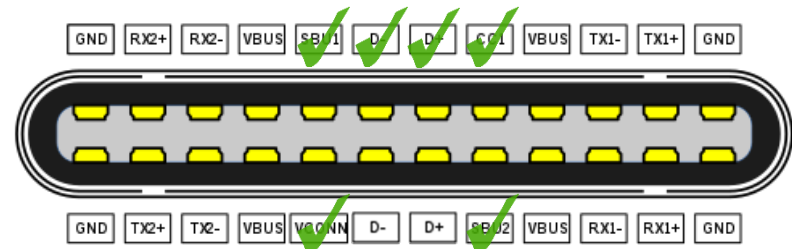
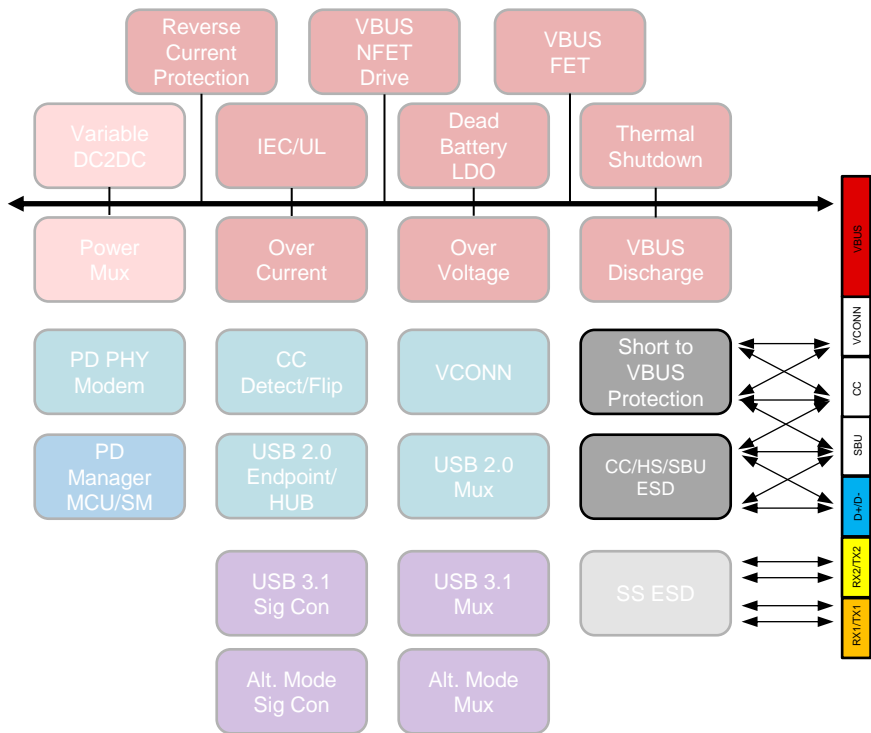
TPD8S300A



TPD8S300 - USB Type-C CC, SBU, D+/D- protector for Short-to-VBUS & IEC ESD Events

- One-Chip protection solution for USB Type-C Ports CC, SBU, and D+/D- lines
- 4-Channels of Short-to-VBUS Over Voltage Protection (CC1, CC2, SBU1, SBU2): 30V Tolerant OVP FETs
- 8-Channels of IEC 61000-4-2 ESD Protection (CC1, CC2, SBU1, SBU2, DP_T, DM_T, DP_B, DM_B)
 - ±8kV Contact, ±15kV Air-Gap
- CC1, CC2 FETs 600mA capable for passing VCONN power
- CC Dead Battery Resistors Integrated
- 3mm x 3mm QFN Package

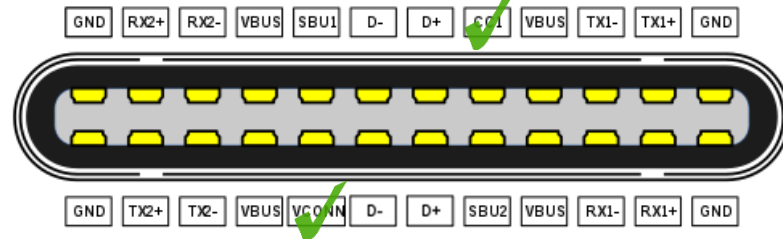
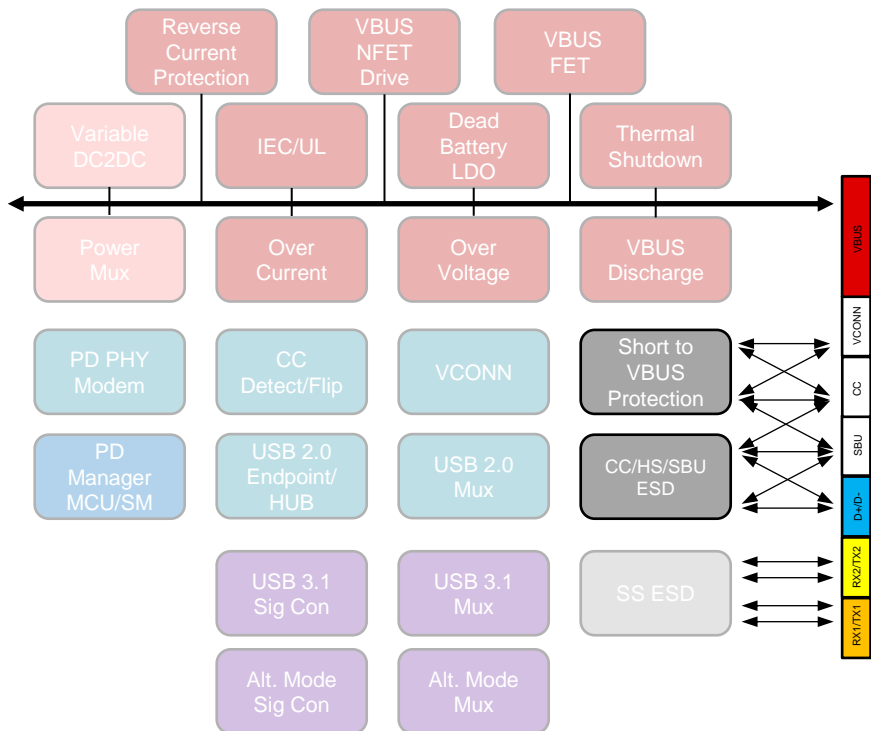
TPD6S300A



TPD6S300 - USB Type-C CC, SBU, D+/D- protector for Short-to-VBUS & IEC ESD Events

- One-Chip protection solution for USB Type-C Ports CC, SBU, and D+/D- lines
- 4-Channels of Short-to-VBUS Over Voltage Protection (CC1, CC2, SBU1, SBU2): 30V Tolerant OVP FETs
- 6-Channels of IEC 61000-4-2 ESD Protection (CC1, CC2, SBU1, SBU2, DP, DM)
 - $\pm 8\text{kV}$ Contact, $\pm 15\text{kV}$ Air-Gap
- CC1, CC2 FETs 600mA capable for passing VCONN power
- CC Dead Battery Resistors Integrated
- 3mm x 3mm QFN Package

TPD2S300



TPD2S300 - USB Type-C CC protector for Short-to-VBUS & IEC ESD Events

- 2-Channels of Short-to- V_{BUS} Over Voltage Protection (CC1, CC2): 24 V_{DC} Tolerance
- 2-Channels of IEC 61000-4-2 ESD Protection (CC1, CC2)
 - $\pm 8kV$ Contact, $\pm 15kV$ Air-Gap
- Low power mode quiescent current – 10 μA max.
- CC1, CC2 FETs 600mA capable for passing V_{CONN} power
- CC Dead Battery Resistors Integrated
- 1.4mm x 1.4mm WCSP Package

TPDxS300 Comparison

Feature	TPD2S300	TPD6S300A	TPD8S300A
CC1/CC2 20V Short-to-Vbus	✓	✓	✓
SBU1/SBU2 20V Short-to-Vbus		✓	✓
CC1/CC2 IEC ESD	✓	✓	✓
SBU1/SBU2 IEC ESD		✓	✓
D+/D- IEC ESD		2CH	4CH
VCONN		600mA Support	600mA Support
Package	WCSP-9 (1.4mmx1.4mm)	QFN-20 (3mmx3mm)	QFN-20 (3mmx3mm)

USB Type-C

TPS25810 | USB Type-C DFP Controller w/ Integrated FET (15W)

Features

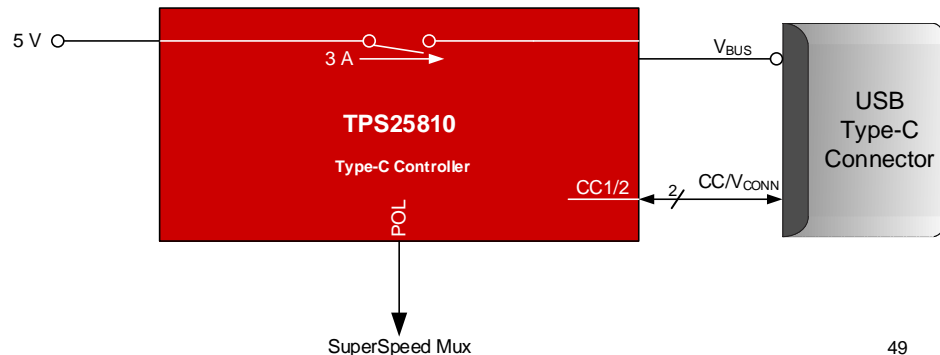
- USB Type-C rev 1.2 DFP Device
 - Connector Attach/Detach Detection
 - STD/1.5A/3A Capability Advertisement on CC Line
 - Super Speed Lines Polarity Determination
 - VBUS Application and Discharge
 - VCONN Application to Active Cable
 - Audio and Debug Accessory Identification
- 0.7 μ A (typ) Operating Current with Nothing Attached
- Integrated 36 m Ω (typ) High-Side MOSFET
- Selectable 3.34 A/1.67 A OUT Current Limit with +/- 7.5% Accuracy
- CC1 and CC2 +/-8 kV Contact and +/-15 kV Air Discharge ESD Rating (IEC 61000-4-2)
- Offered in 3x4, 20-pin QFN Package

Applications

- USB Port/Hubs
- Notebook/Desktop PCs, LCD Monitor
- USB Charger

Benefits

- Compliant to latest USB Type-C rev 1.2 spec
- Industry's smallest (3x4mm) foot-print solution for Type C DFP implementation
- Ultra-Low Iddq extends battery life between charge
- Tight θ limit lowers BOM cost of 5V supply
- UL and CB Certified on three outputs
 - VBUS, CC1, CC2
- Advanced features enables system differentiation
 - Power Wake, PPM, Accessory Modes



TPS25820/21 | USB Type-C DFP Controller w/ Integrated FET (7.5W)

Features

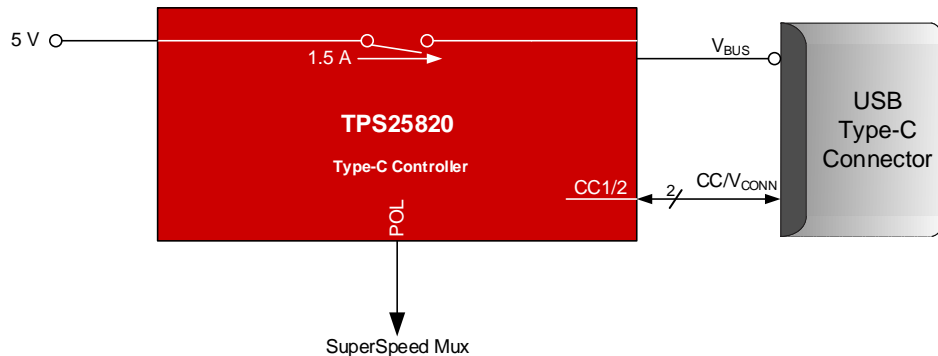
- USB Type-C DFP Interface
 - Connector Attach/Detach Detection
 - STD/1.5A Capability Advertisement on CC Line
 - Super Speed Lines Polarity Determination
 - VBUS Application
 - Vconn Application (only TPS25820)
- <1 uA (typ) Operating Current with Nothing Attached
- Integrated 72 mΩ (typ) High-Side MOSFET
- +10% Current Limit Accuracy
- CC1 and CC2 +/-8 kV Contact and +/-15 kV Air Discharge ESD Rating (IEC 61000-4-2)
- Offered in 3mmx2mm, 12-pin SON Package

Applications

- USB Port/Hubs
- Notebook/Desktop PCs, LCD Monitor
- Automotive Infotainment
- Power Banks and 5V AC/DC Adapters

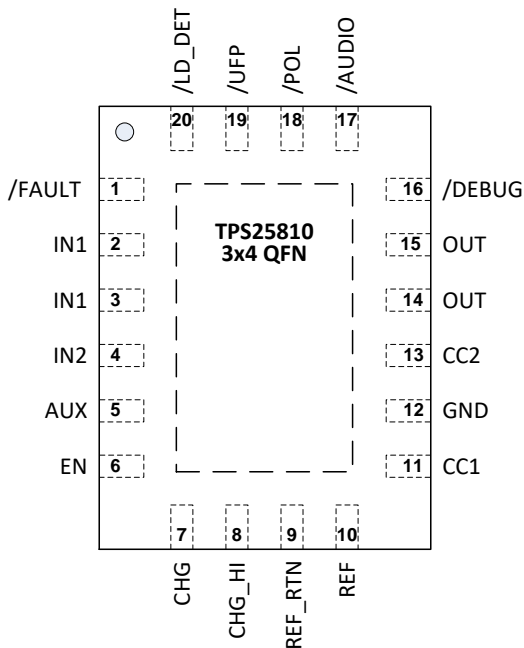
Benefits

- Compliant to latest USB Type-C rev 1.3 spec
- Smallest foot-print USB-C DFP solution in the Industry
 - 3mmx2mm
- Ultra-Low Iddq extends battery life between charge
- <10% current limit accuracy lowers BOM cost of DC-DC converter
- Integrated thermal and over current fault output
- Integrated IEC 8K/15KV protection on CC pins



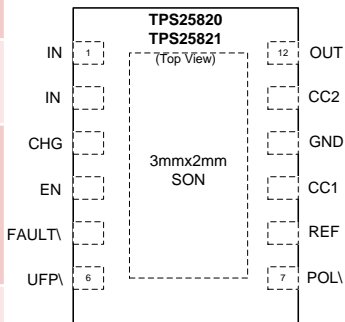
TPS25810 vs TPS25820/21

(Top View)



12mm²

Features	TPS25810	TPS25820 TPS25821
Supply	Three IN1/IN2/AUX	One IN
Accessory Mode Support	Yes Debug Audio	No
Max Ilimit	3.4A Supports 0.9/1.5/3.0A	1.67A Supports 0.9A/1.5A
VCONN	Yes	TPS25820-Yes TPS25821-No
Additional Features	Port Power Management/ PowerWake/ FAULT detection	Only FAULT reporting (ilimit and over temp). No Port Power Management and Power Wake
Port Attach/ Detach and Polarity Detection	Yes (UFP/ Yes (POL/)	Yes (UFP/ Yes (POL/)



6mm²

USB Type-C

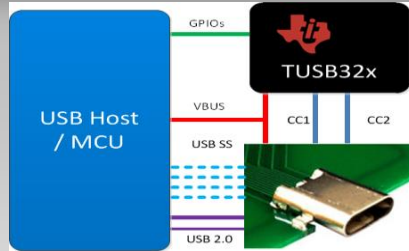
High Speed Interface
TUSB320, TUSB422

Type C Product Innovations

Low Cost Small Footprint Controllers

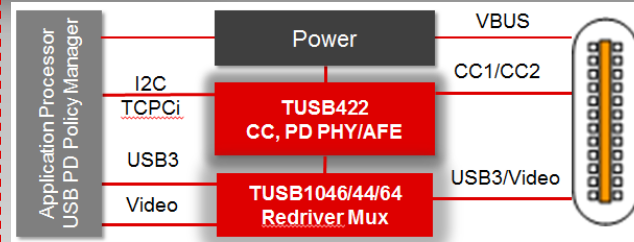
Product Innovations

TUSB32x
1.6x1.6mm
QFN



Type-C CC Logic, Port Control with VCONN

- Compatible to USB Type-C Specification 1.1
- Type-C Mode configuration (DFP, UFP, DRP)
- Channel Configuration (CC) – attach, cable orientation, role detection, and current mode (default, mid, high)



TUSB422
1.3x1.3mm
CSP

USB Type-C Port Controller with PD

- USB PD BMC Phy with I2C TCPC Interface to Microprocessor for Supporting:
 - 5 - 24V Power sourcing and sinking
 - Alt-mode negotiations
- Type-C Mode & Channel Configuration (CC) – DRP/UFP/DRP

Provides maximum flexibility and choice for power and signal path solutions

TUSB320L/H

Type-C CC and Mode Controller



Features

- Optimized for Mobile Applications and Compatible to USB Type-C Specification 1.1
- Mode configuration (DFP, UFP, DRP)
 - Host Only,
 - Device Only,
 - Dual Role Port
 - I2C and GPIO for Configuration
- Channel Configuration (CC)
 - Attach of USB Port Detection
 - Cable Orientation Detection
 - Role Detection
 - Type-C Current Mode (Default, Mid, High)
- ID Emulation
- VBUS detection
- Active High Enable (TUSB320H) and Active Low Enable (TUSB320L)
- Flexible Supply Voltage 2.7-5V
- Low Active Standby Current Consumption
- Industrial Temperature Range -40°C to 85°C
- 1.6x1.6mm QFN package

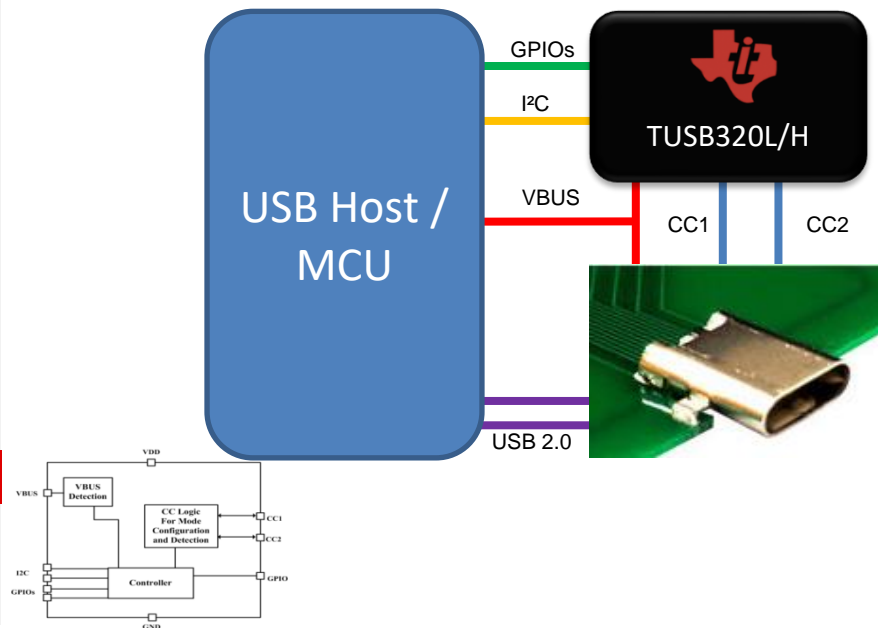
Applications

Mobile applications implementing USB TypeC

- Cellphones, Tablets
- Notebooks, Desktops, All In Ones
- Peripherals

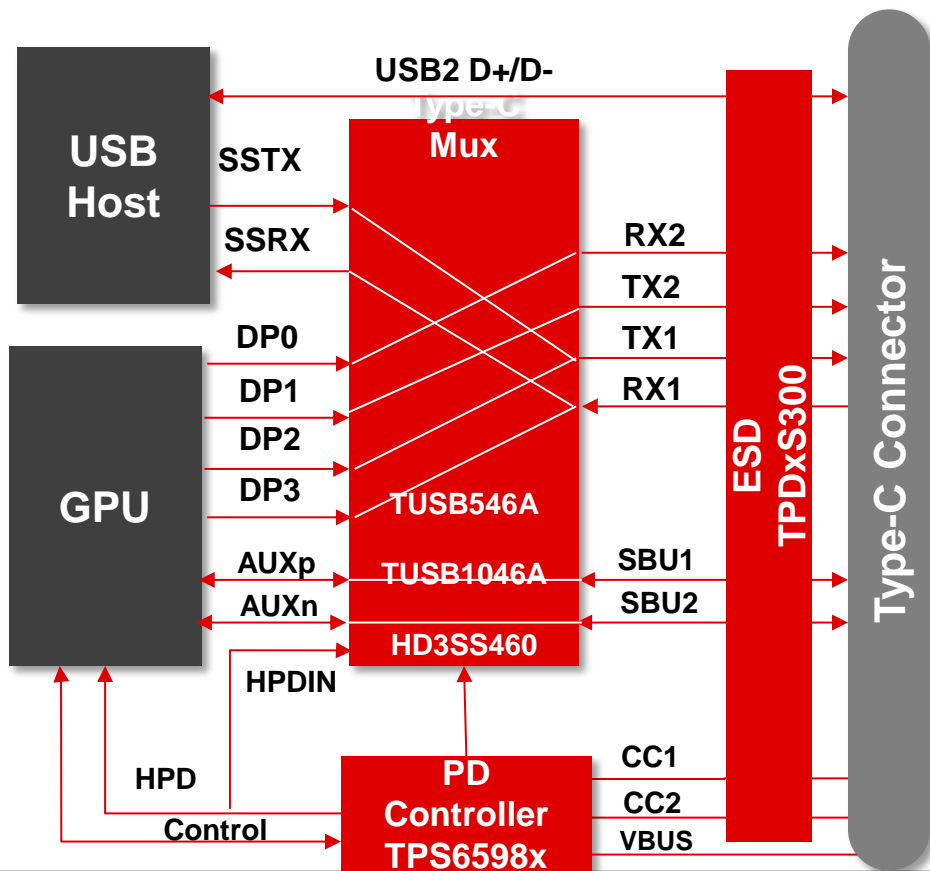
Benefits

- Low Power, small form factor
- Single chip analog front for USB Type-C implementations with USB 2.0



USB Type-C MUX and Signal Conditioner Solution

One Stop Shop for Reliable Type-C Solutions



- Industry most complete end to end Type-C solutions for power, data and video for Type-C ecosystems
- Robust system performance with better signal integrity, interoperability and system protection
- Over 20 years track record with high performance USB-compliant products
- Highly integrated system solution reduce overall system BOM and ease of design

USB Type-C MUX/SW Solution Overview

Signal Conditioners

Products

- USB2 Redrivers
- USB3 Redrivers
- Type-C Redrivers

Applications

- Laptop/PC
- Monitor, Tablet
- Dock/Dongle, Infotainment

• Hero Devices

- TUSB211/2/3/4/5
- TUSB1002A
- TUSB522P
- TUSB1044
- TUSB544

Active Switches

Products

- 5G/10G Type-C Alt Mode Redriver Switch
- 5G/10G Type-C USB Redriver Switch

Applications

- Laptop/PC
- Monitor, Tablet
- Dock/Dongle, Infotainment

• Hero Devices

- TUSB1046A
- TUSB1064
- TUSB1042
- TUSB546A
- TUSB564
- TUSB542

Passive Switches

Products

- Type-C USB passive switch
- Type-C Alt mode passive Switch
- Type-C SBU Mux with MIC/AGND

Applications

- Laptop/PC, Monitor
- Tablet
- Dock/Dongle
- Infotainment

• Hero Devices

- HD3SS3212/3202
- HD3SS3220
- HD3SS460
- TS5USBC402
- TS3USBCA4

Type-C CC Controllers

Products

- Type-C CC Controller
- Type-C PD PHY

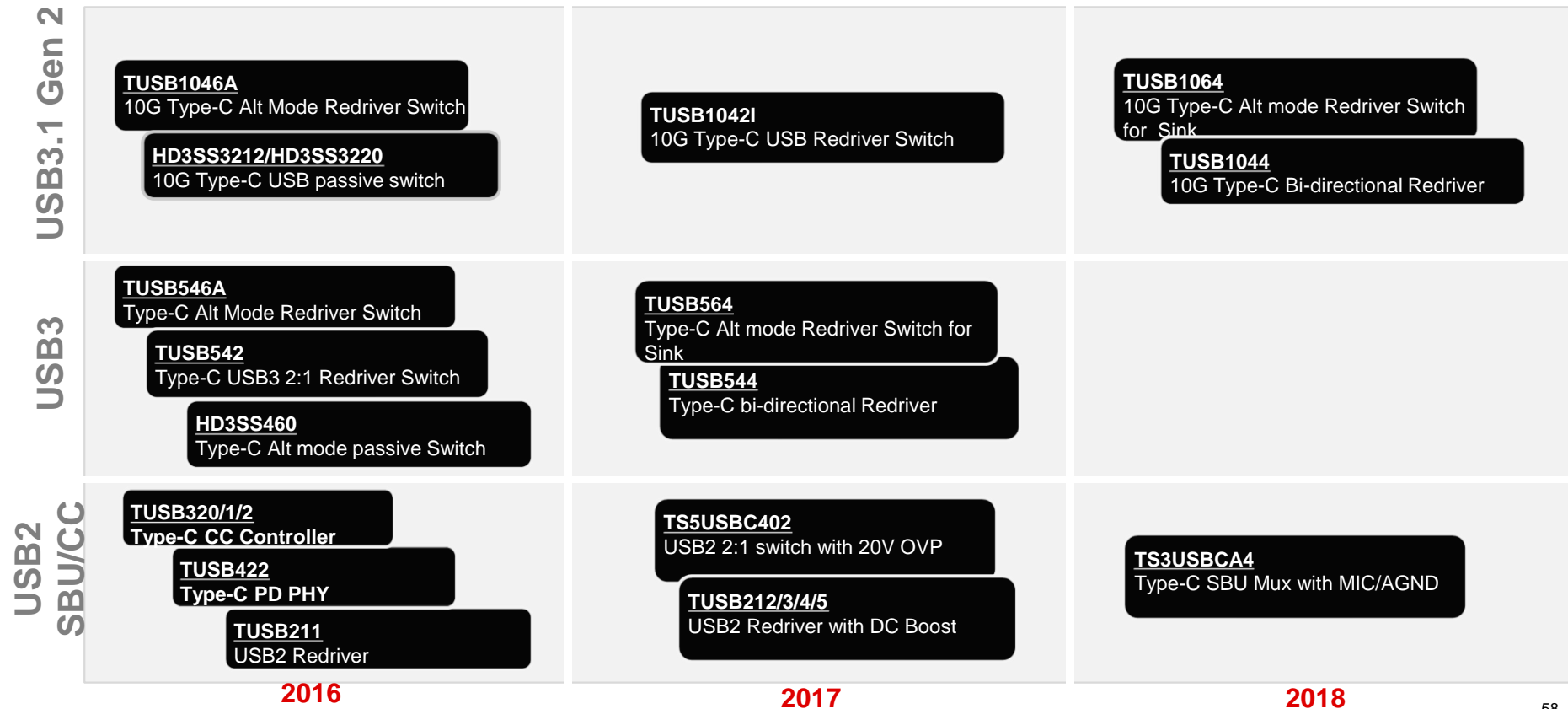
Applications

- Handset, Laptop/PC
- Powerbank
- Wall Charger, Car charger

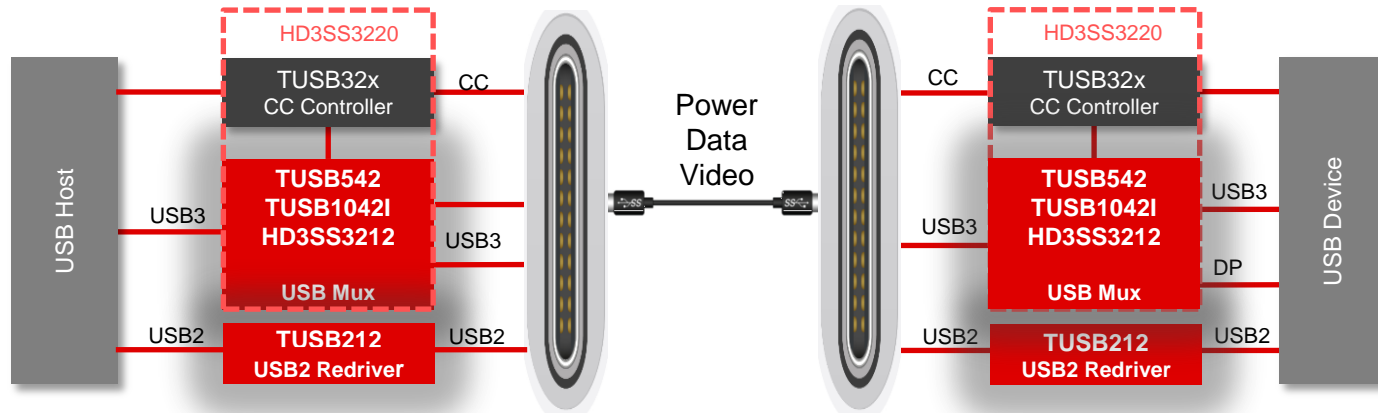
• Hero Devices

- TUSB320
- TUSB321/2
- TUSB422
- HD3SS3220

USB Type-C Roadmap



Type-C Signal Mux Options – USB



Product	Description	Application	Package	Supply	USB	Status
HD3SS3212	2:1 Passive Switch	Source, Sink	1.8x2.6QFN	3.3V	3.1g1/g2	Production
HD3SS3220	2:1 Passive w/ CC controller	Source, Sink	2.5/4.5 QFN	5/3.3V	3.1g1/g2	Production
TUSB542	2:1 Redriver Switch	Source, Sink, Cable	2x2.4 QFN	1.8V	3.1g1	Production
TUSB1042I	2:1 X-Bar linear redriver Switch	Source, Sink	4x6 QFN	3.3V	3.1g1/g2	Production
TUSB212	USB2 Redriver	Source, Sink	1.6x1.6 RWB	3.3V	2.0	Production
TS5USBC402	2:1 Passive w/ 20V protection	Source, Sink	1.6x1.2CSP	2.3-5.5V	2.0	Production

Type-C Port Solutions - USB Only with DRP

USB3 Redriver Switch

- TUSB542, 5Gbps
- TUSB1042, 10Gbps

USB3 Passive Switch

- HD3SS3212, 10Gbps switch only
- HD3SS3220, 10Gbps, Switch + CC

USB2 Redriver

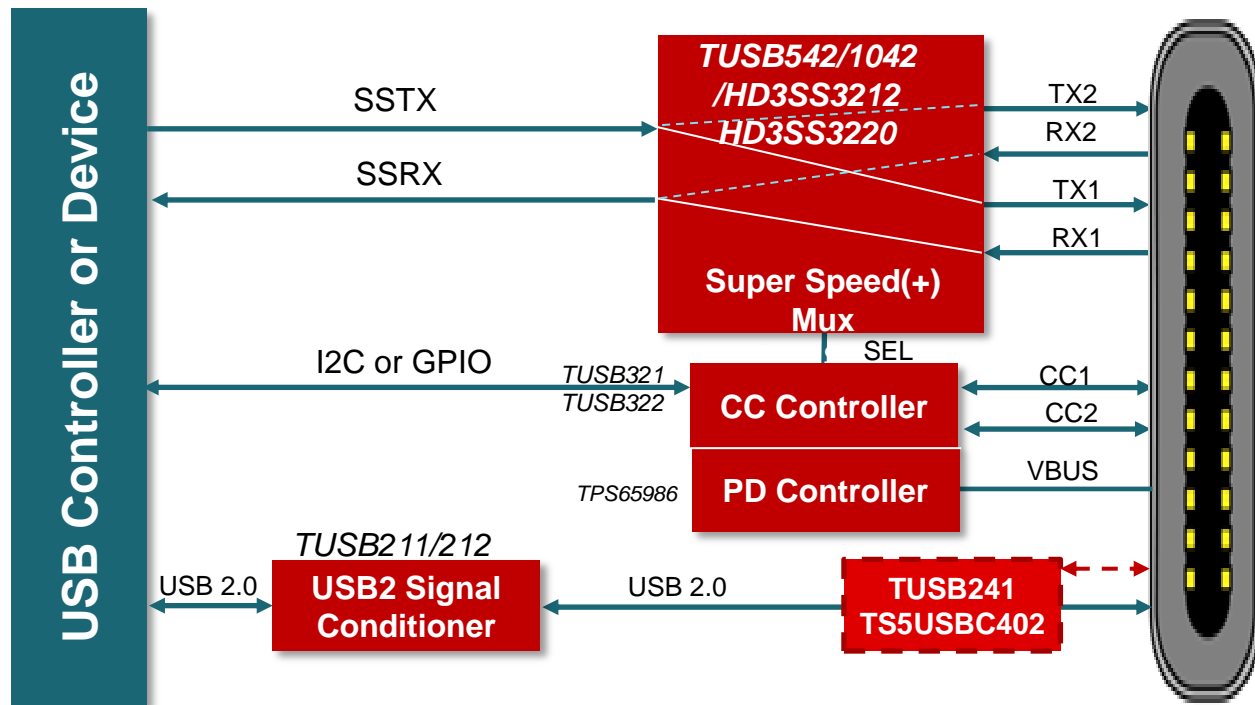
- TUSB21x, 480Mbps

USB2 Redriver Switch

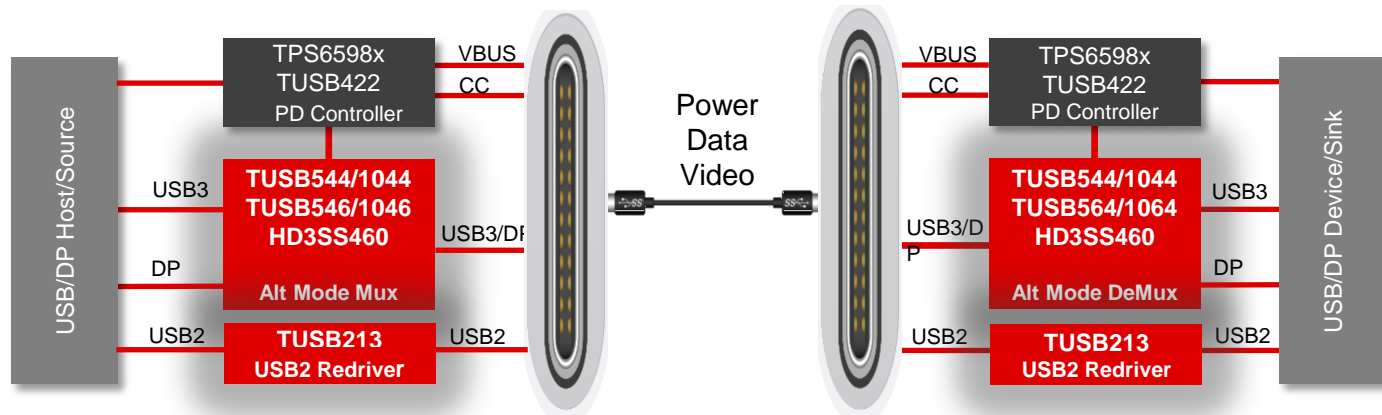
- TUSB241, 480Mbps

USB2 Passive Switch

- TS5USBC402: switch + 20V OVP

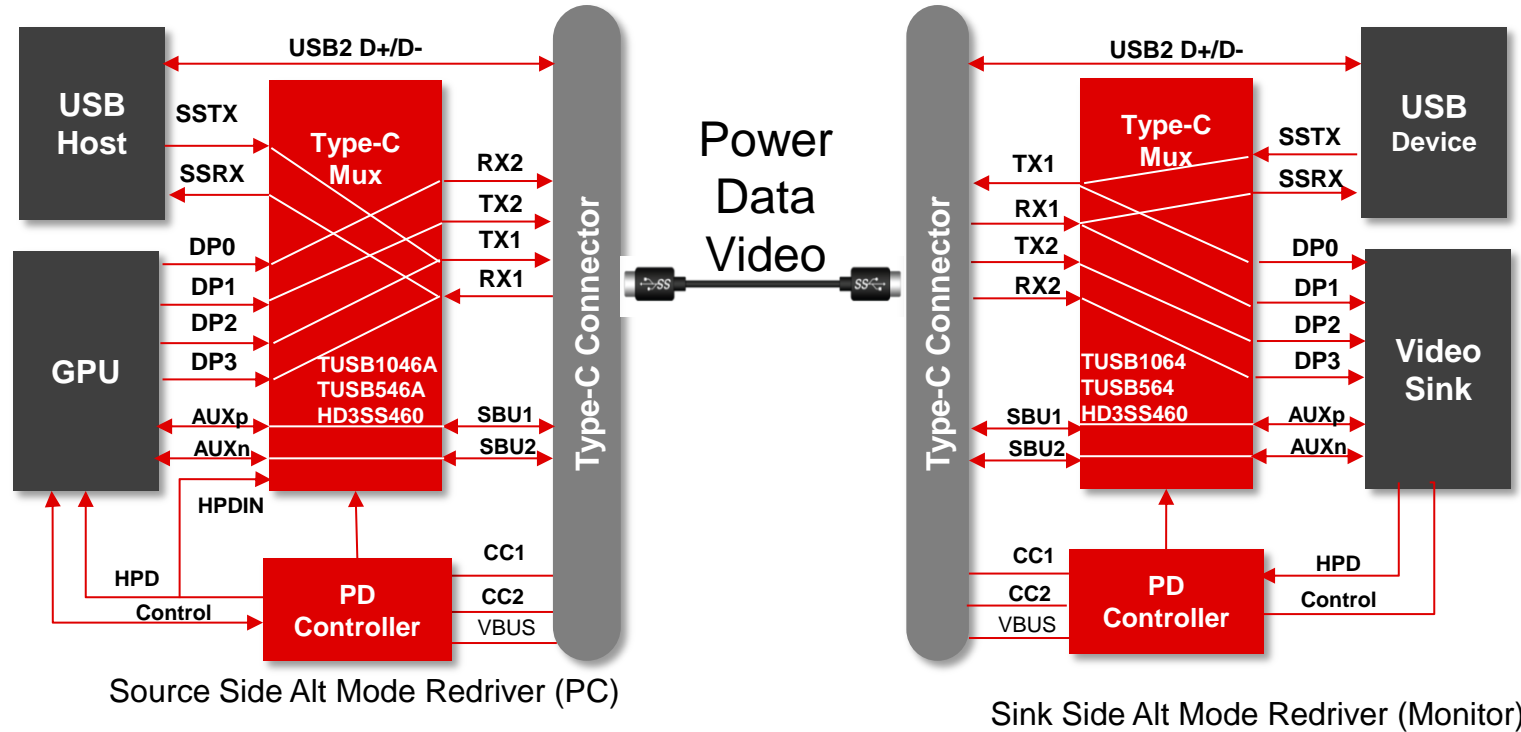


Type-C Signal Mux Options – Alt Mode



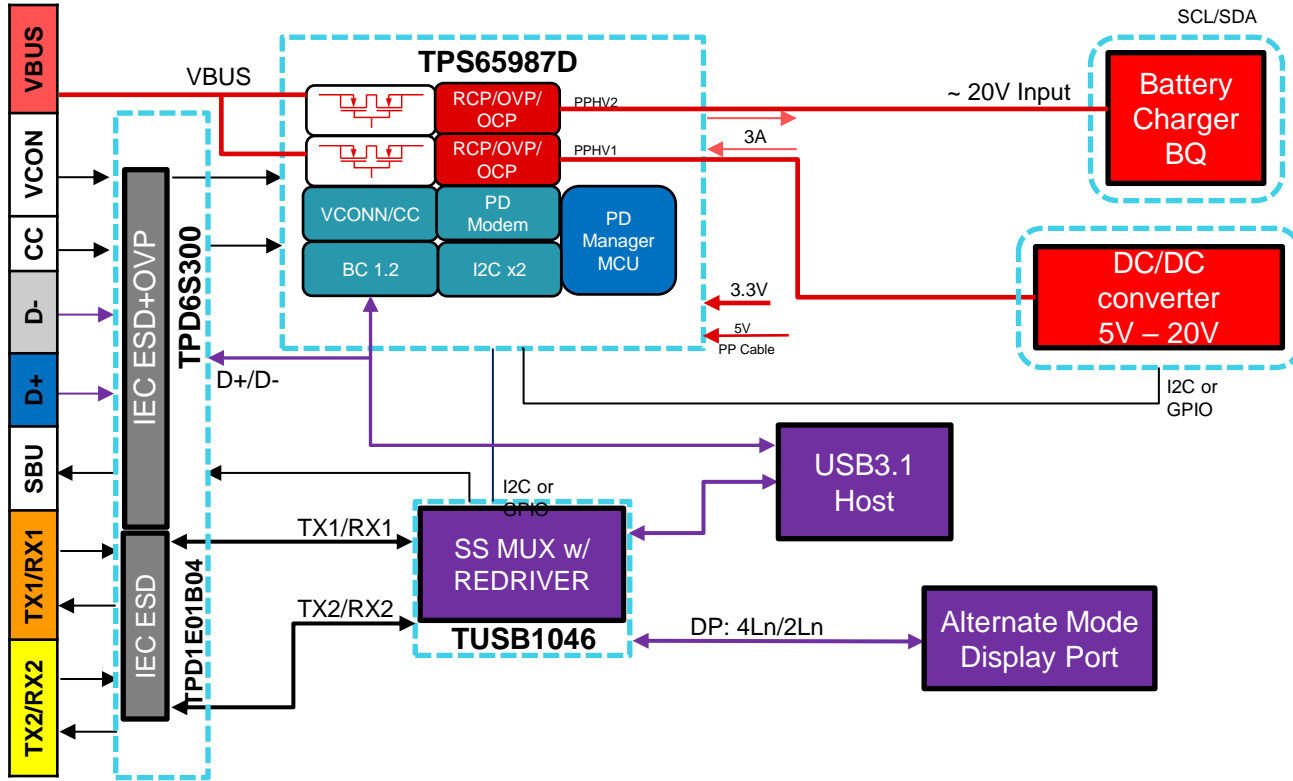
Product	Description	Application	Package	Supply	USB	Alt Mode	Status
HD3SS460	4:6 X-Bar Passive Switch	Source, Sink	2.5/4.5QFN	3.3V	3.1g1	DP1.4HBR2	Production
TUSB546/1046	4:6 X-Bar linear redriver Switch	Source, Sink	4x6 QFN	3.3V	3.1g1/g2	DP1.4HBR3	Production
TUSB544/1044	Bidi linear redriver	Source, Sink, Cable	4x6 QFN	3.3V	3.1g1/g2	DP1.4HBR3	Production
TUSB564/1064	4:6 X-Bar linear redriver Sw	Sink	4x6 QFN	3.3V	3.1g1/g2	DP1.4HBR3	Production
TUSB213	USB2 redriver	Source, Sink, Cable	3.5x3.5 RGY	5V	USB2	DP1.4HBR3	Production

DP Over Type-C End to End Solution

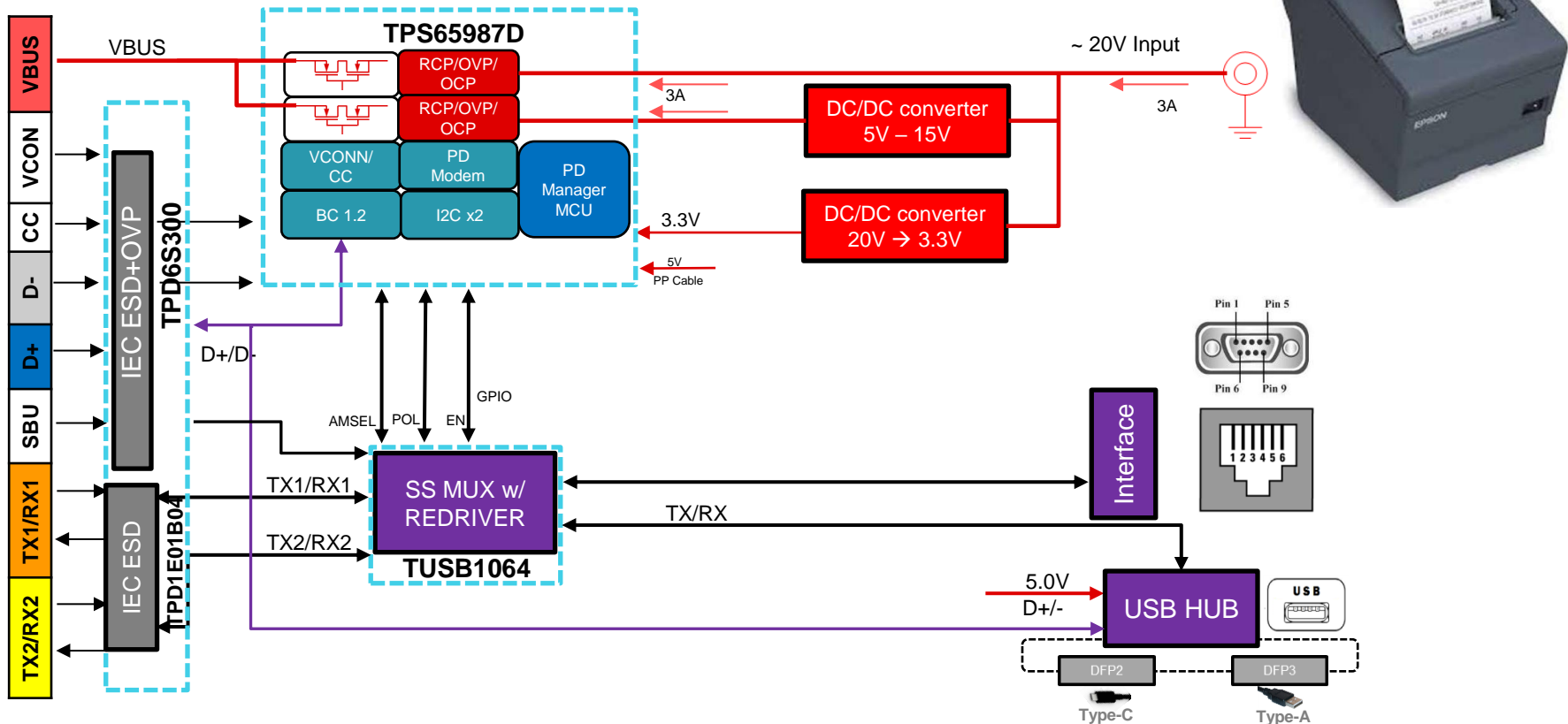


End Application Block Diagrams by Product

TPS65987D USB Type-C – Retail EPOS – Single Port 3A. 2 Power Paths

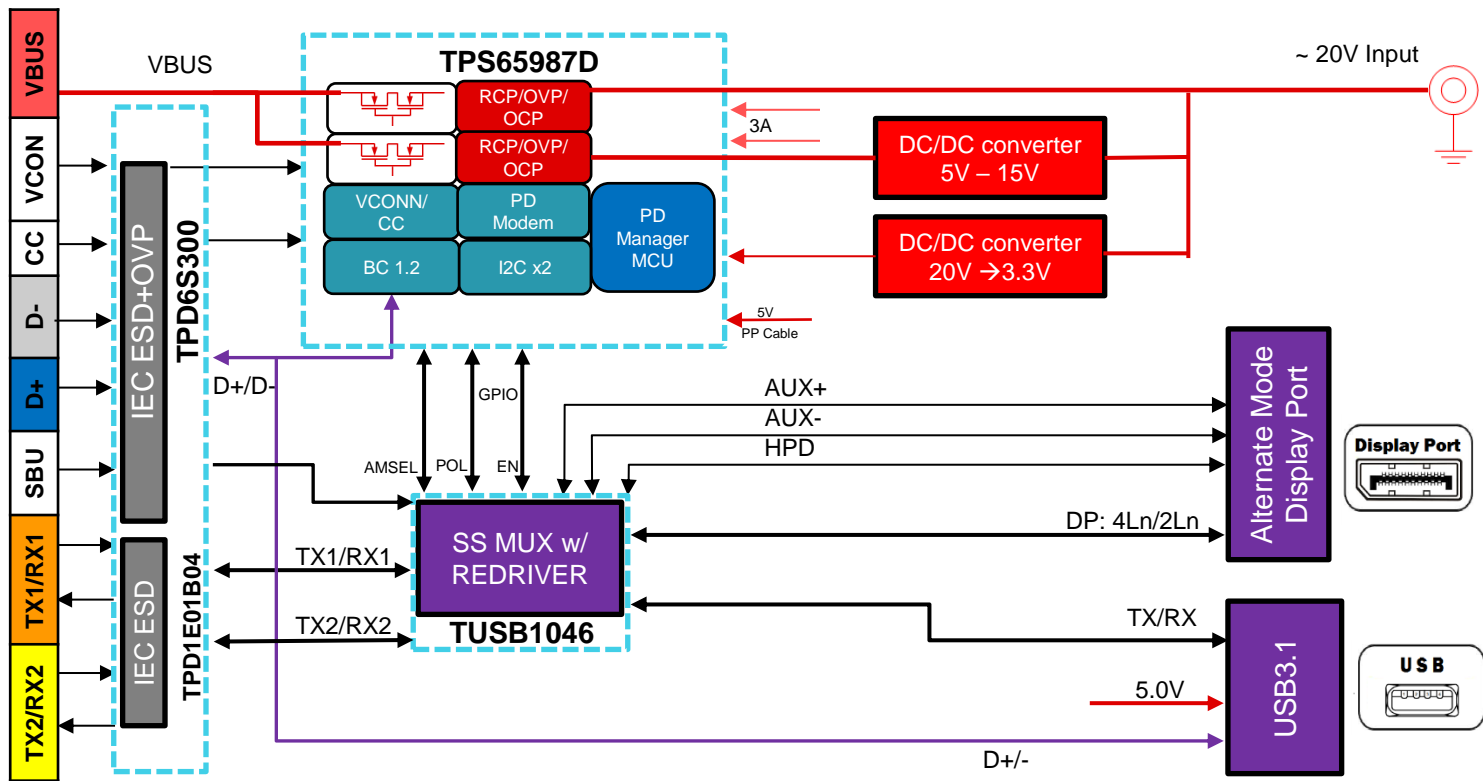


TPS65987D USB Type-C – EPOS Printer

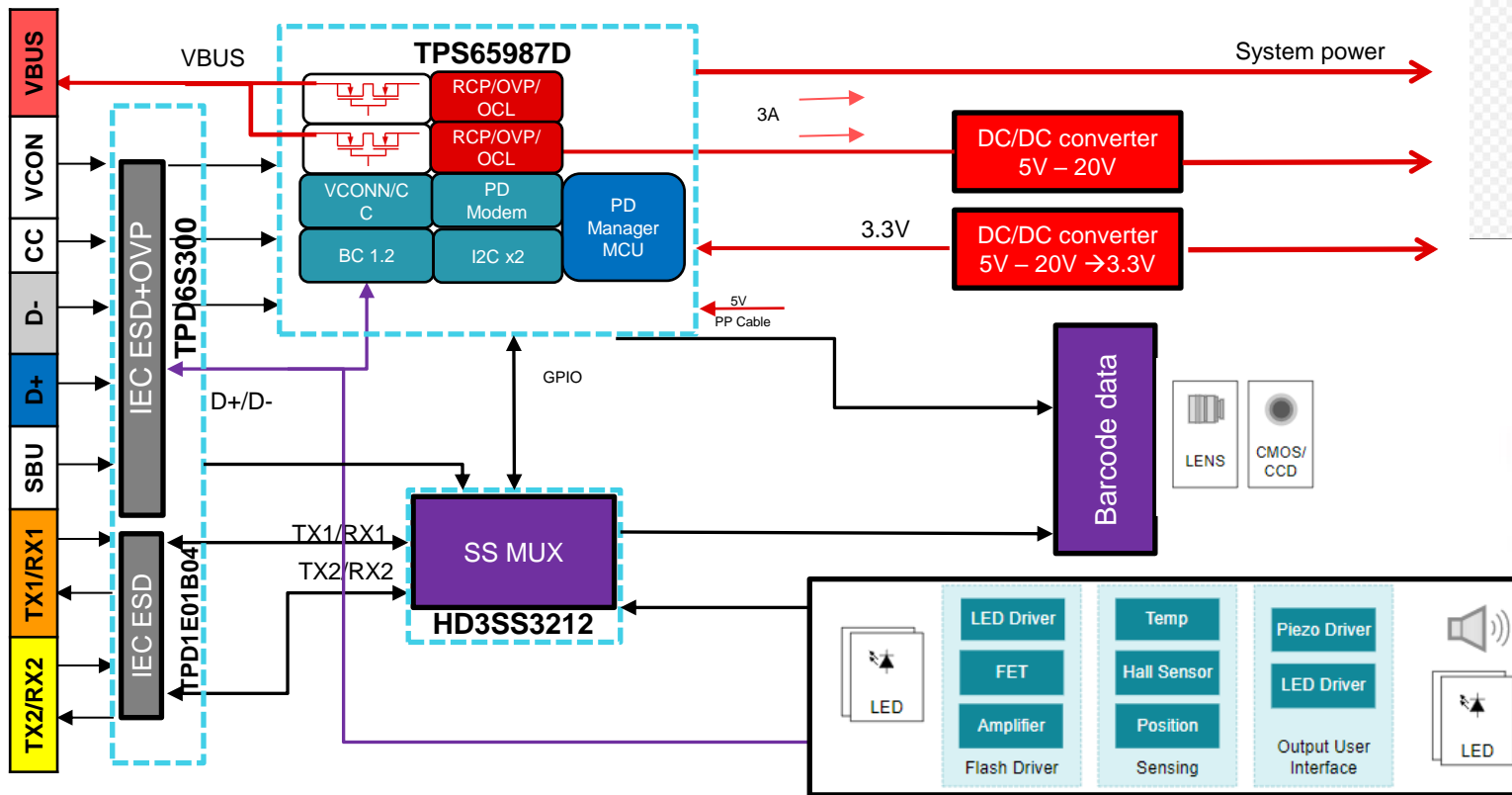


TPS65987D USB Type-C Monitor – DP, USB3.1 & Charger

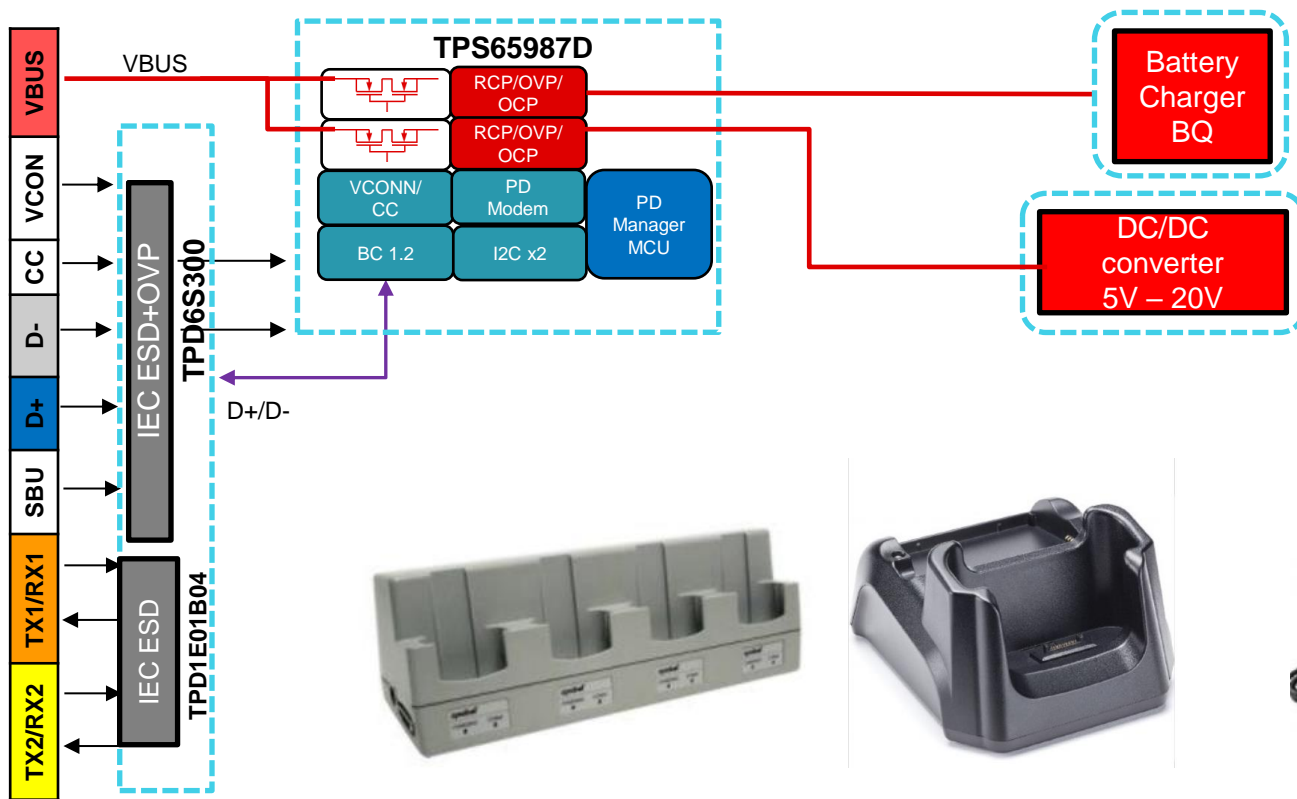
Add Another USB-C/PD Port w TPS65988!



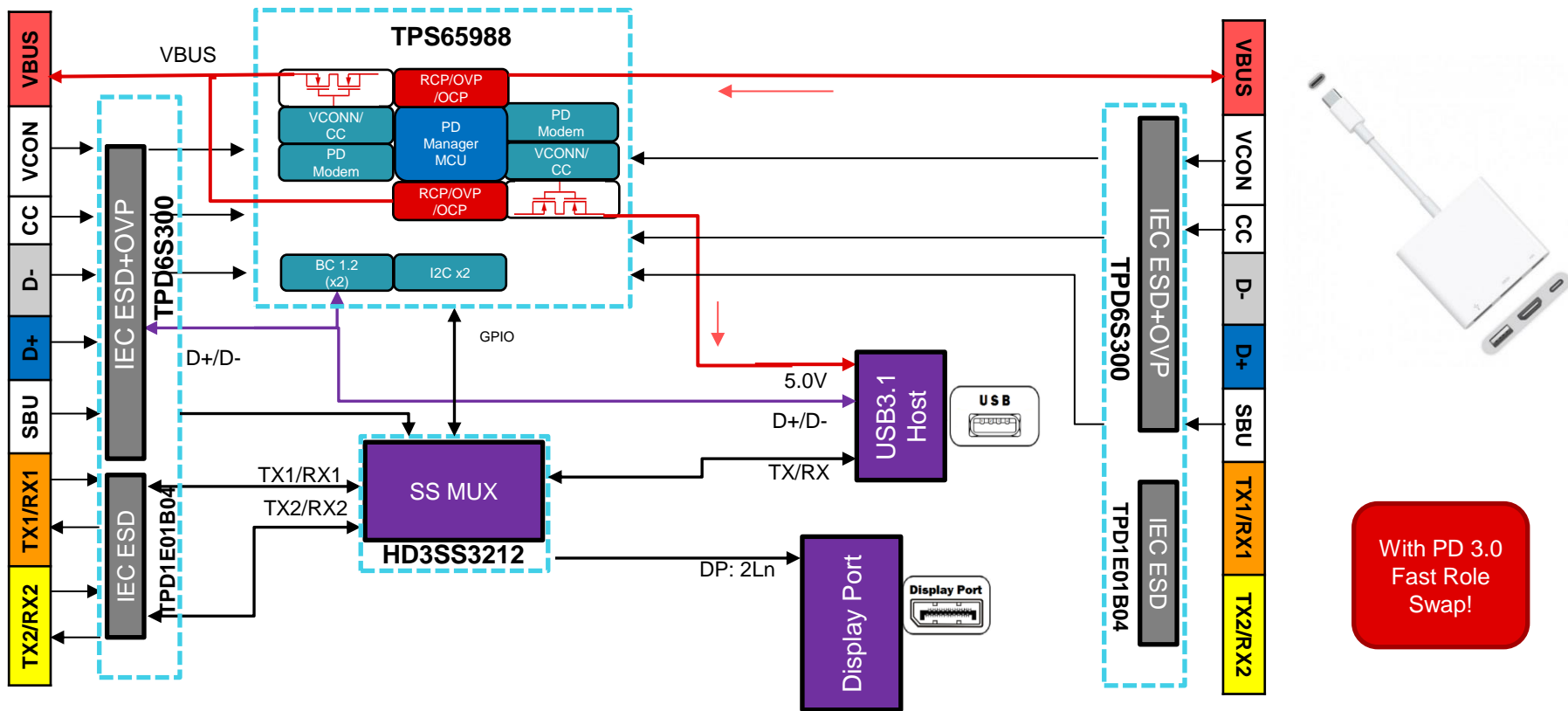
TPS65987D USB Type-C for Barcode Scanner



TPS65987D USB Type-C – Dock System

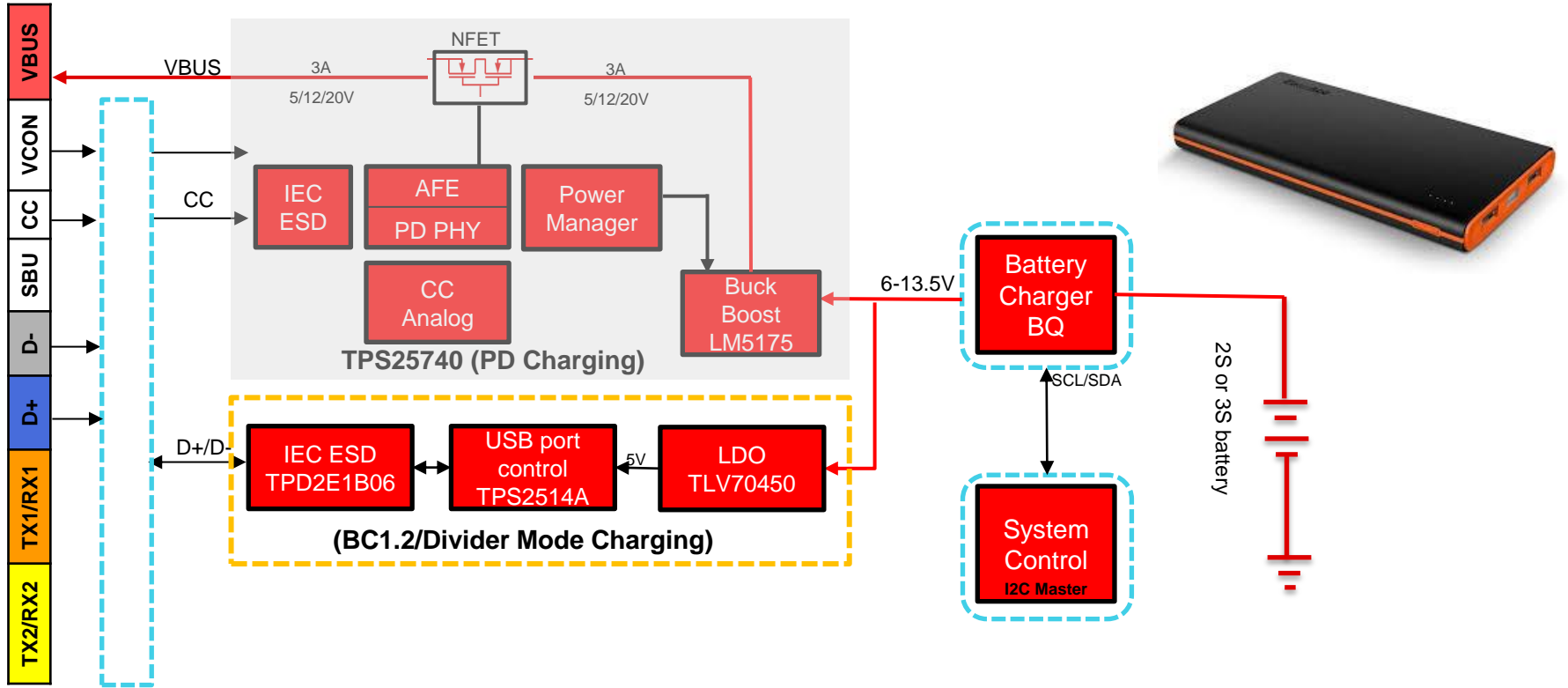


TPS65988 USB Type-C to Type-C Dongle w/ USB 3.1 & DP

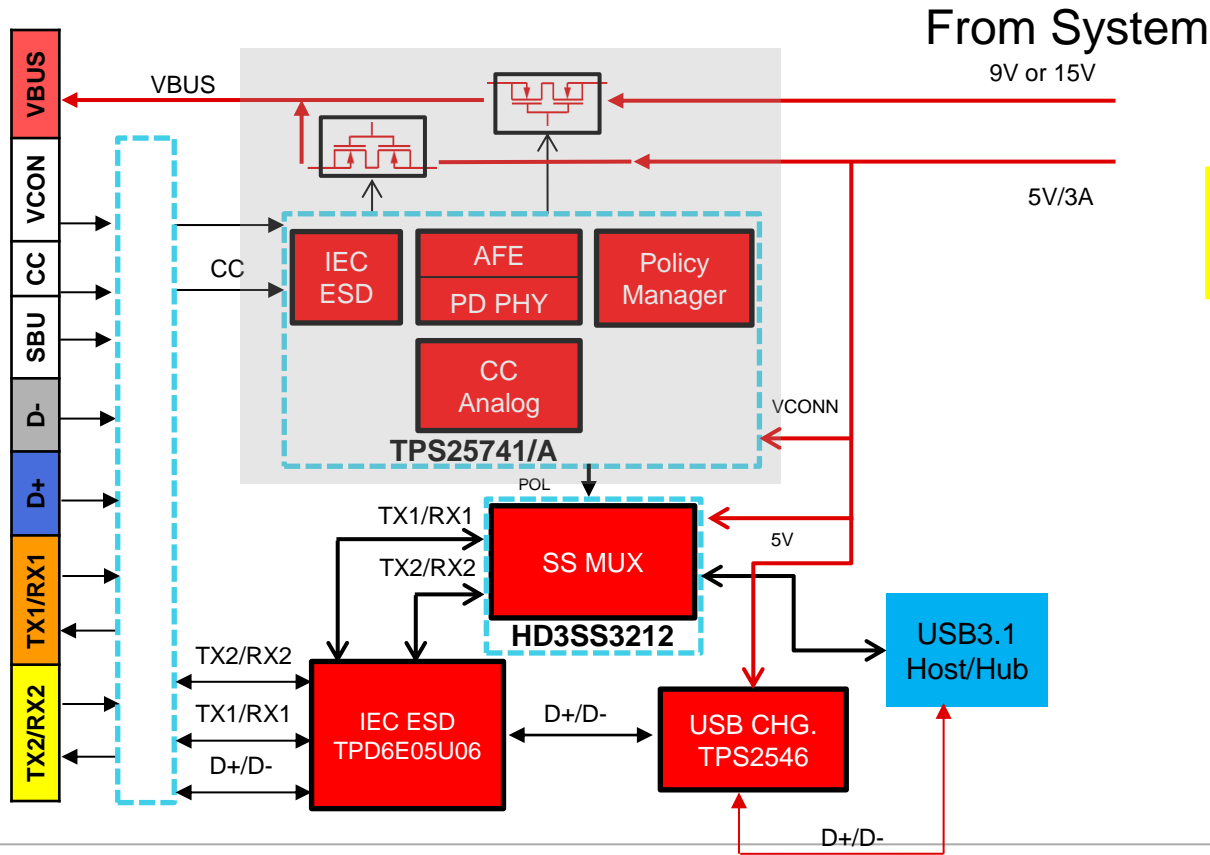


With PD 3.0
Fast Role
Swap!

TPS25740/A USB Type C PD - Source Charging



TPS25741/A USB Type-C PD Source – Dock, Monitor, Desktop



USB Rear/Side Ports



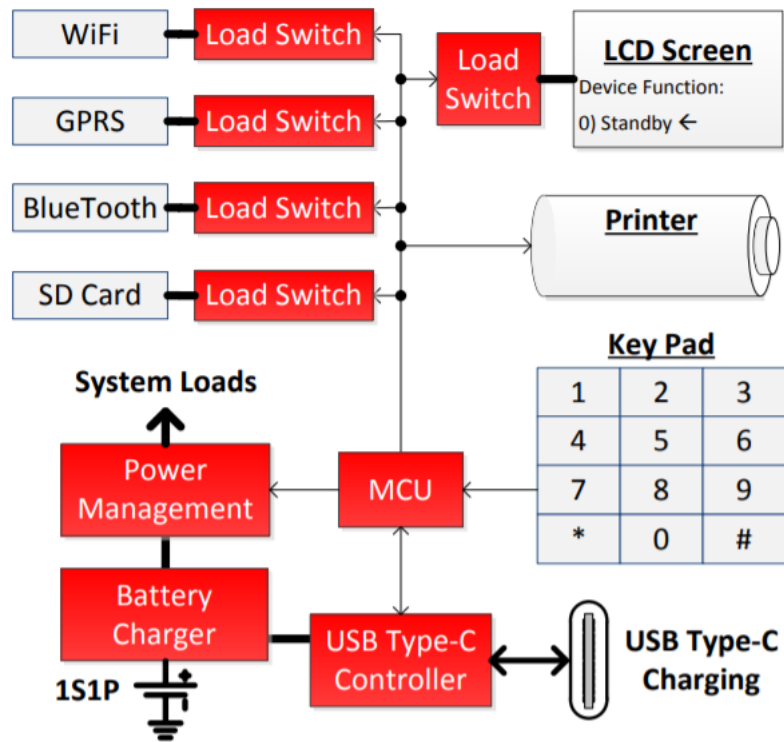
USB Front/Rear Ports



TI Reference Designs

TIDA-00818 Mobile Point of Sale (mPOS) Power Reference Design

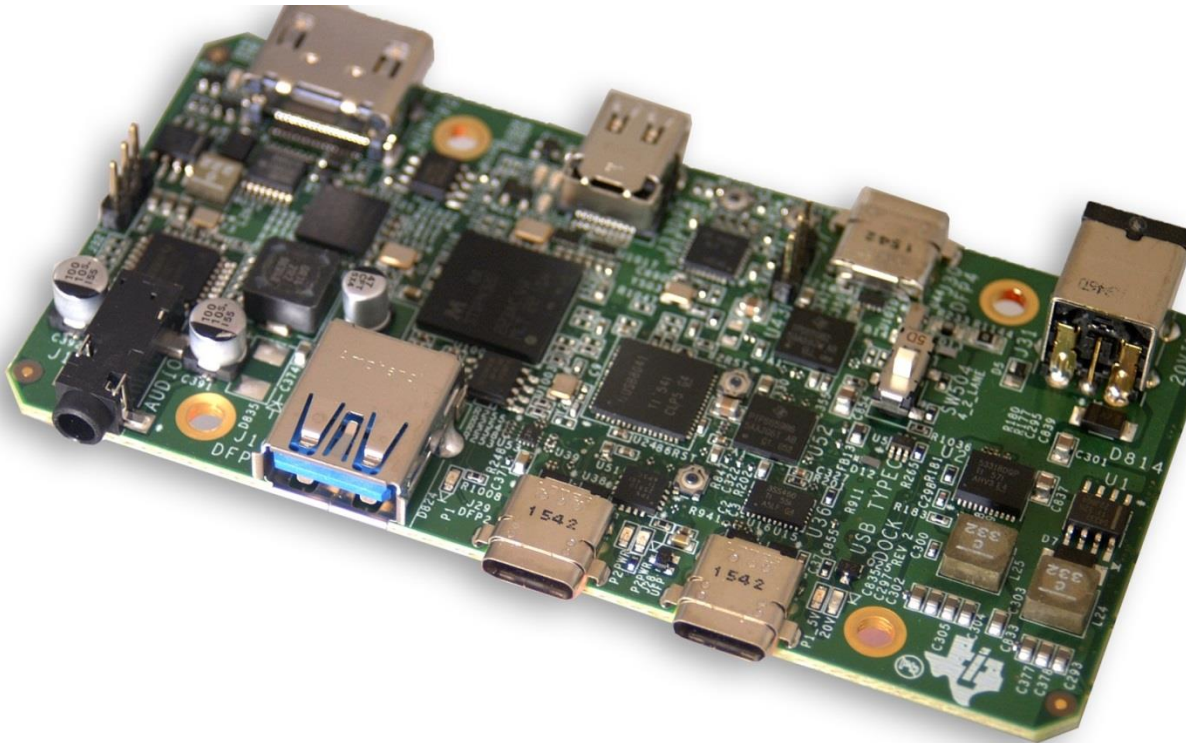
Block Diagram



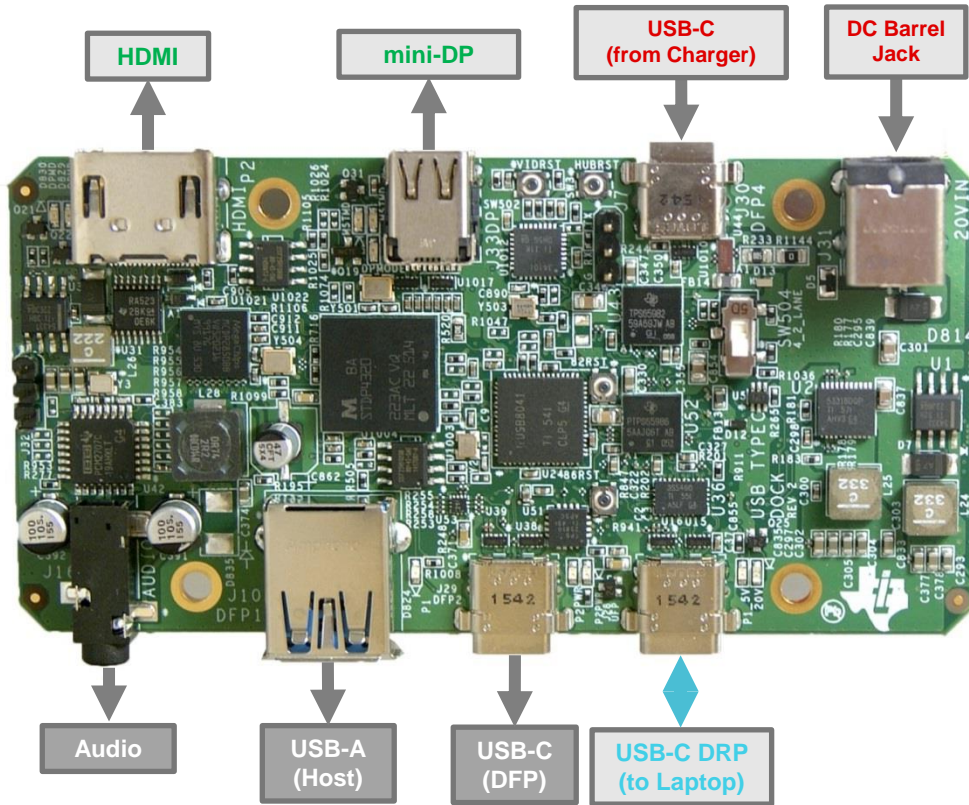
USB-C™-MINIDK-EVM (TIDA-01243)

TPS65982+TPS65986 Mini-Dock → The TI Advantage

- **NO System Controller (EC) required**
 - No code to write for EC FW to control system over I2C
 - All features pre-loaded into TI FW image
- **Turn-key Ref. Design w/ Gerber files**
- **DC Barrel Jack Detection**
 - Automatic, seamless USB-PD *Swap to Source* transition
 - No loss of Data or Video
- **Universally compatible Type-C/PD Charger Input**
 - Automatic detection of PD charger type
 - Automatic, Seamless *Swap to Source* transition
 - No loss of Data or Video



USB-C™-MINIDK-EVM



Features:

- Bi-Directional Power Capabilities
 - Externally-powered from 20V DC Barrel Jack or
 - Externally-powered from Type-C Charger
 - Bus-powered from Type-C Laptop
- DRP Full-Featured USB-C & PD Port
- Three possible power sources:
 - 20V DC IN
 - USB-C/PD Charging Port
- USB2.0/USB3.1 Hub:
 - DRP Full Featured USB-C/PD Port
 - USB-C DFP using TPS25910
 - USB Type-A DFP
 - 3.5mm Audio Jack
- Dual Video (up to 4K) via HDMI or miniDP
- LEDs indicate functioning ports based on available power
- Flash Update over Type-C via USB 2.0 EndPoint

Flexible USB Type-C Dock with TI Solution

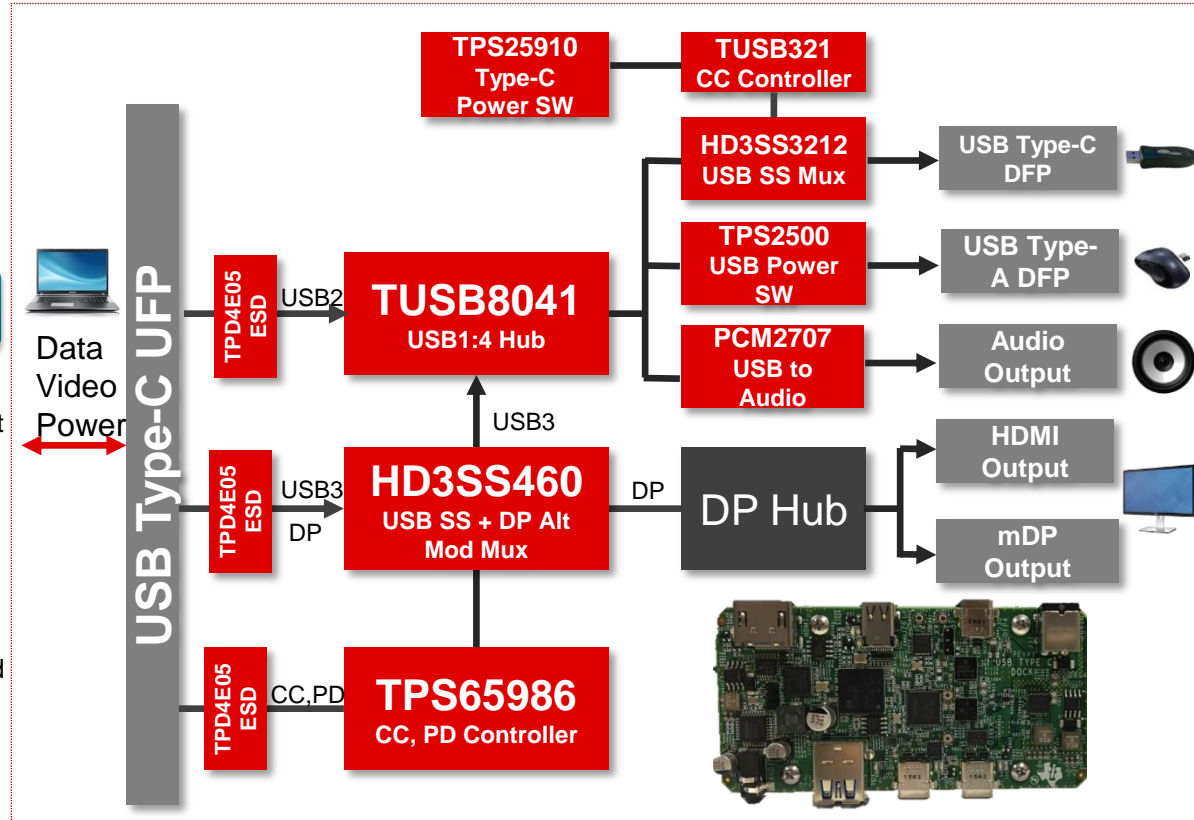
TIDA-01243

Description

- The Type-C Dock offers data and video port expansion and a charging capability for Type-C systems that support USB PD/Alternate mode

Features

- HD3SS460:** USB Type-C Alt Mode Bi-directional 4x6 differential switch supporting USB 3.1 Gen1 5Gbps and DisplayPort 1.2a for 5.4Gbps. Support cross point Mux for low speed SBU pins as well.
- HD3SS3212:** USB 3.1 up to 10G High Performance 2:1/1:2 Bi-directional Differential Switch. Supporting DFP/UFP/DRP
- TUSB321:** Type-C CC Logic, Port Control and VCONN Switch
- TUSB8041:** USB 1 to 4 Hub, port expansion
- TPS65982/6:** USB type-C PD controller. Pre-packaged software, easily configurable and updateable for GUI-based configuration tool. Alt mode support with quick swap



TIDA-01620 Type-C to DP Reversible Active Dongle

Features

- Bi-directional and Reversible USB-C to DisplayPort active dongle
- Support VESA DisplayPort Alt mode to USB-C upto 8.1Gbps
- UFP and DFP configuration with integrated USB billboard
- Operate over entire VCONN range of 2.7V to 5.5V
- Support upto 5 meter DisplayPort cable

Applications

- USB-C to DP active cable
- USB-C to DP active dongle
- Docking

Tools & Resources

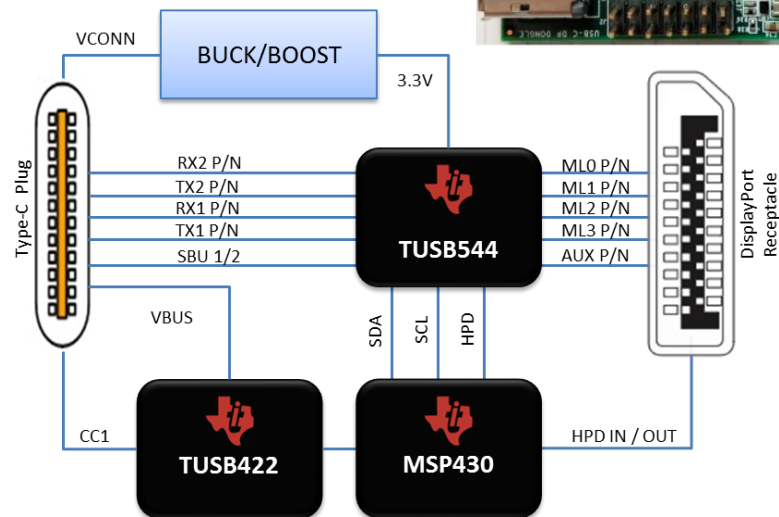
- [TIDA-01620 and/or Tools Folder](#)
- [Design Guide](#)
- [Design Files](#): Schematics, BOM, Gerbers, Software, etc.

• Device Datasheets:

- [TUSB544](#)
- [TUSB422](#)
- [MSP430](#)
- [TPS63051](#)
- [TPD4E02B04](#)
- [TPD4E05U06](#)

Benefits

- Improve and maintain signal quality over long cable
- Enable legacy devices to inter-connect with Type-C devices
- Enable Bi-directional USB-C to DP active cable or converter



TIDA-01602 Tikit Design

Barrel Jack to USB Type-C Power Adapter



Features

- Powered by almost any 19.5V (PC Notebook) or 24V AC/DC Adapter – Barrel Jack Input
- USB Type-C Plug Output
- Output Voltage Options: 5 V, 9 V, 15 V or 20 V
- Multiple Power Profile Options up to 60W
- USB Power Delivery (PD) 2.0 certified (meets PD 3.0 sourcing requirements)
- USB Type-C revision 1.3 compliant

Tools & Resources

- **TIDA-01602 Tools Folder**
 - Design Guide
 - Design Files
- **Device Datasheets:**
 - [TPS25740B](#)
 - [LM3489](#)
 - [LM393-N](#)
 - [CSD17585F5](#)



Applications

- Consumer AC/DC: USB Type-C AC/DC Notebook PC Power Adapters (30W / 45W/ 60W)
- Power Bank

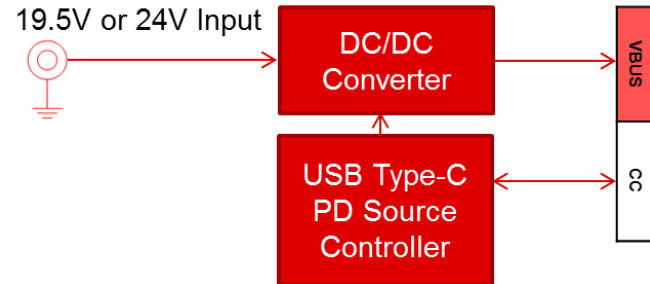
Option 1: Cable



Option 2: No Cable



Block Diagram



TIDA-01602 Tikit Design

USB Type-A to USB Type-C Converter

Features

- Advertise up to 1.5A
- Automatically adjust advertisement based on Type-A port capabilities
- Integrated power switch in Type-C controller
- Detects BC1.2, Apple™, and other non-BC1.2 Compliant charging ports

Tools & Resources

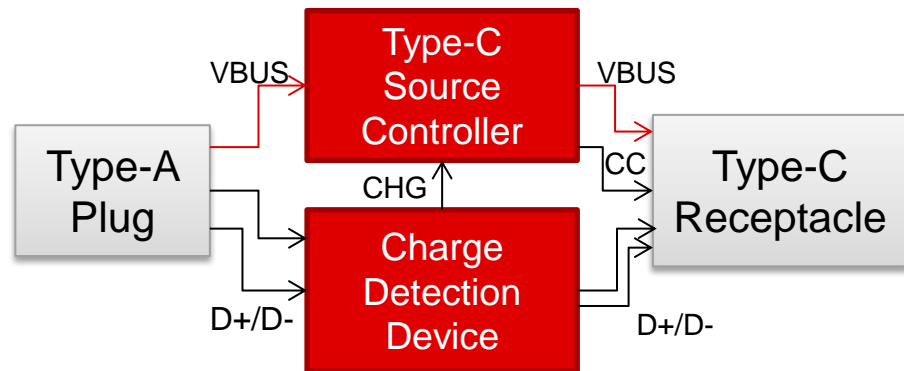
- **TIDA-01602 Tools Folder**
 - Design Guide
 - Design Files
- **Device Datasheets:**
 - [TPS25820](#)
 - [BQ24392](#)



Applications

- Type-C Ports for laptops
- Dongles for Type-A to Type-C conversion

Block Diagram



TIDA - 00890 USB Type-C DFP Dongle EVM

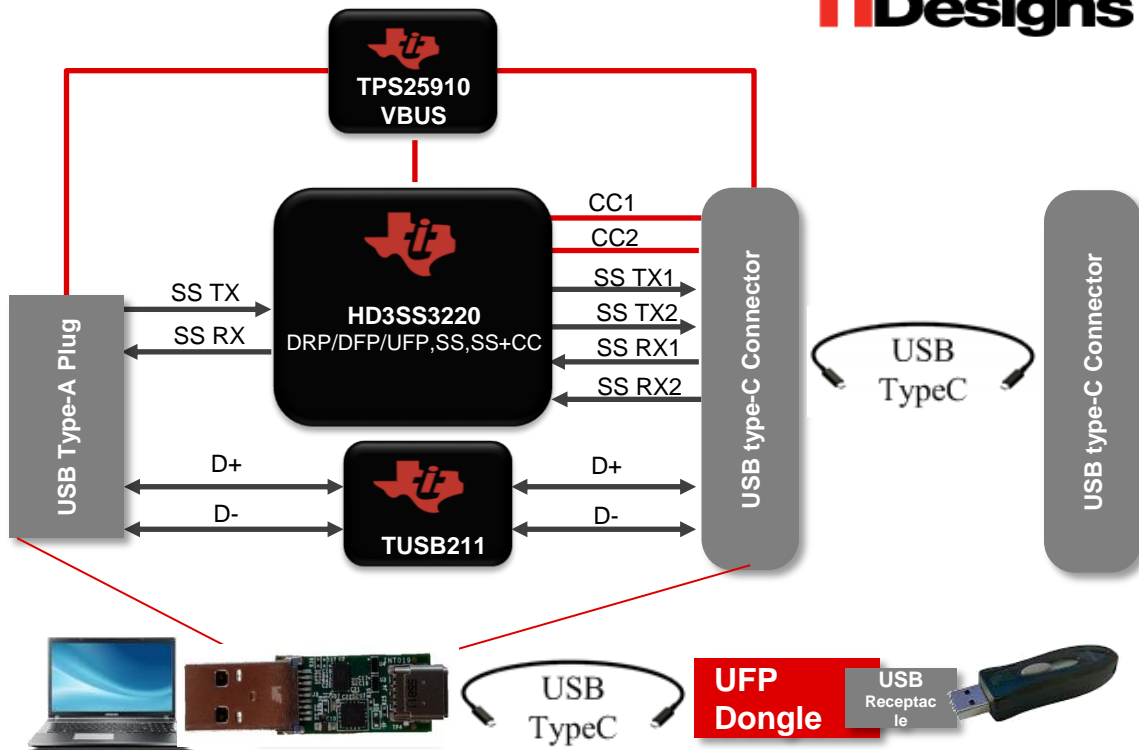


Description

- USB Type-C DFP Dongle enables USB Type-A to Type-C conversion to connect USB Type-C devices with legacy USB Type-A downlink facing port. Together with TUSB211 enables better signal quality and driving long cables for USB2 signals

Features

- **HD3SS3220**: USB 3.1 up to 10Gbps High Performance Differential 2:1 Switch with CC/VCONN and Port Controller, supporting DFP/UFP/DRP, audio and debug accessory as well as Try.SRC and Try.SNK DRP mode
- **TUSB211**: USB2.0 protocol agnostic bi-directional redriver. Compatible with USB2.0, OTG2.0 and BC1.2. Ultra small footprint (1.6mmx1.6mm) and 55mW active power consumption



TIDA - 00882 USB Type-C HDD with USB Power Delivery

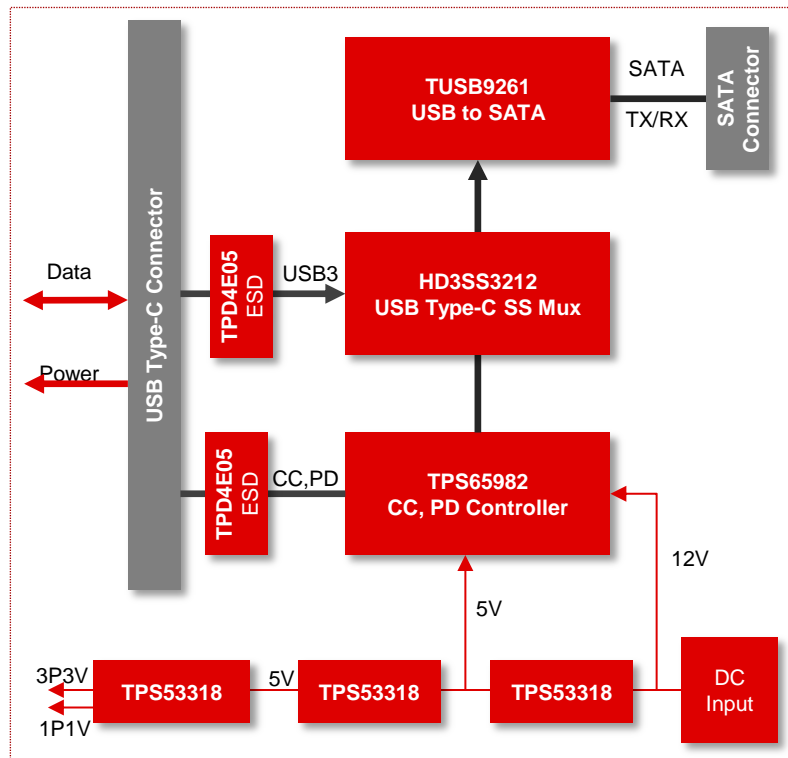
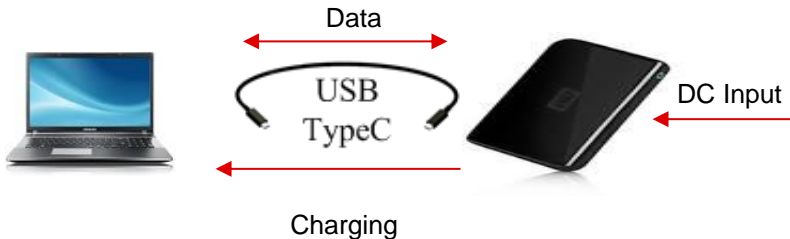


Description

- The USB Type-C HDD with USB Power Delivery offers the unique capability for data storage access as well as charging the connected USB Type-C devices through Type-C interface up to 36W

Features

- HD3SS3212**: USB 3.1 up to 10G High Performance 2:1/1:2 Bi-directional Differential Switch. Supporting DFP/UFP/DRP
- TUSB9261**: USB to SATA Bridge
- TPS65982**: USB Type-C PD controller



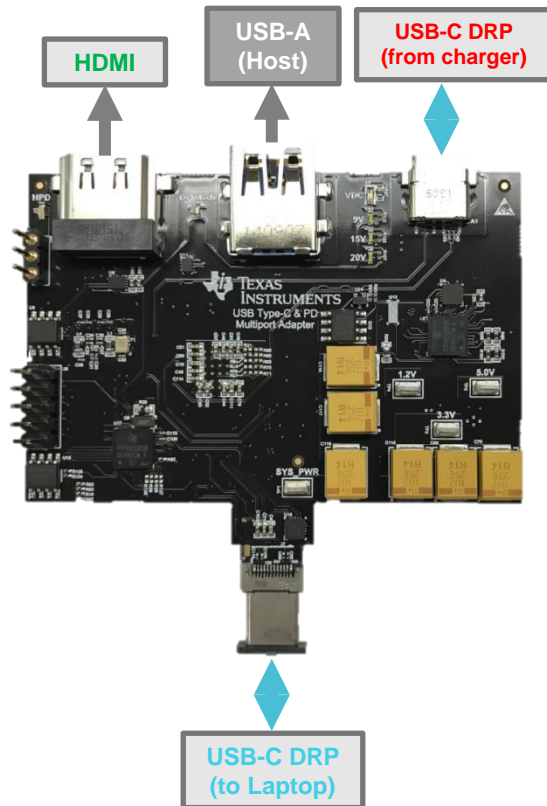
TIDA-01627 - USB Type-C™ and Power Delivery compact power bank reference design with built-in battery control



Features:

- Simplified design with built-in battery control provided by the USB PD controller (TPS65983B) talking directly to the I2C Buck-Boost charger (BQ25703A). No MCU required
- Battery level status and charge mode indicator for source or sink
- USB Type-C Dual Role Power Port Source or Sink up to 45W (20V @ 2.25A)
- Power button to indicate battery level and to force a power role transition from Source to Sink or Sink to Source
- Flash Update over Type-C via USB 2.0 EndPoint

TIDA-03027 – USB Type-C™ and Power Delivery Multiport Adapter



Features:

- USB Type-C and Power Delivery 3.0
 - Fast Role Swap (FRS) capable
- Bi-Directional Power Capabilities
 - Externally-powered from Type-C Charger
 - Bus-powered from Type-C Laptop
- Video (up to 4K) via HDMI
- USB 3.0 data out via USB Type-A or USB Type-C DRP
- LEDs indicate available power levels (5V, 9V, 15V and 20V) and DisplayPort Video Alternate Mode entry
- Flash Update over Type-C (charger port) via USB 2.0 EndPoint

Features

- Fully Integration Solution for USB C DFP Port
- Low Cost for USB C DFP Port
- IEC ESD Protection on CC1/CC2
- USB BC1.2 DCP Charging Protocols Supported
- High Efficiency up to 92% with full load

Applications

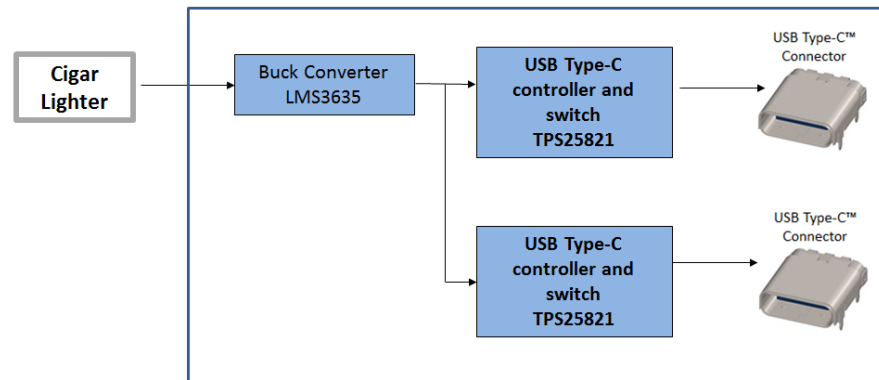
- CLAs

Tools & Resources

- [PMP40270 Tools Folder](#)
- [Design Guide](#)
- [Design Files](#): Schematics, BOM, Gerbers, etc.
- **Device Datasheets:**
 - [LMS3635](#)
 - [TPS25821](#)

Benefits

- Simple USB C Design due to One Chip Solution for Dual USB C DFP outputs
- Short Design Cycle and Low Cost due to High Integration
- Good Thermal Design cause of the High Efficiency



Features

- Fully Integration Solution for USB C DFP Port
- Short-to-VBUS Protection on DP_IN and DM_IN
- IEC ESD Protection on CC1/CC2 and DP_IN/DM_IN
- USB BC1.2 DCP Charging Protocols Supported
- High Efficiency up to 91.7% with full load

Applications

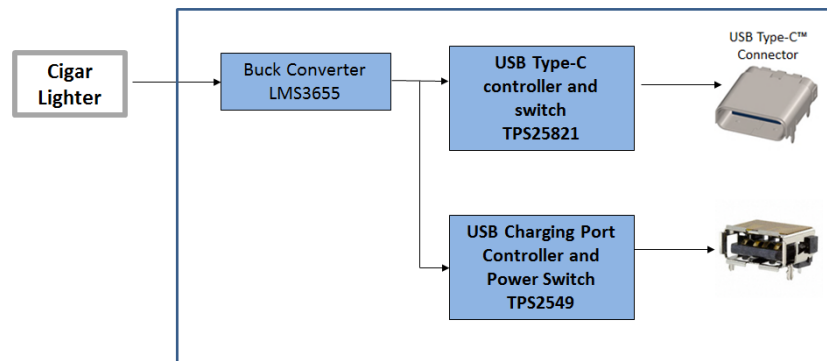
- CLAs

Tools & Resources

- [PMP40269 Tools Folder](#)
- [Design Guide](#)
- [Design Files](#): Schematics, BOM, Gerbers, etc.
- [Device Datasheets](#):
 - [LMS3655](#)
 - [TPS2549](#)
 - [TPS25821](#)

Benefits

- Simple design due to one chip solution for a USB C DFP output
- Built-in IEC ESD Protection and Short-to-VBUS Protection Enhance the System's Reliability
- Good Thermal Design cause of the High Efficiency



Features

- Fully Integration Solution for USB C DFP Port
- IEC ESD Protection on CC1/CC2
- USB BC1.2 DCP Charging Protocols Supported
- Compliant with EN55022 Class B Conducted EMI Standard
- Compliant with COC V5 Tier 2 2016 standard
- Size 47mmx34mmx15mm

Applications

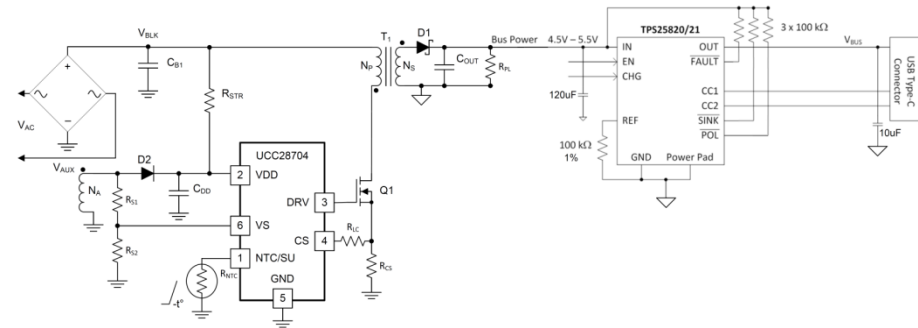
- USB Adaptor

Tools & Resources

- [PMP40260 Tools Folder](#)
- [Design Guide](#)
- [Design Files](#): Schematics, BOM, Gerbers, etc.
- **Device Datasheets:**
 - [UCC28704](#)
 - [TPS25821](#)

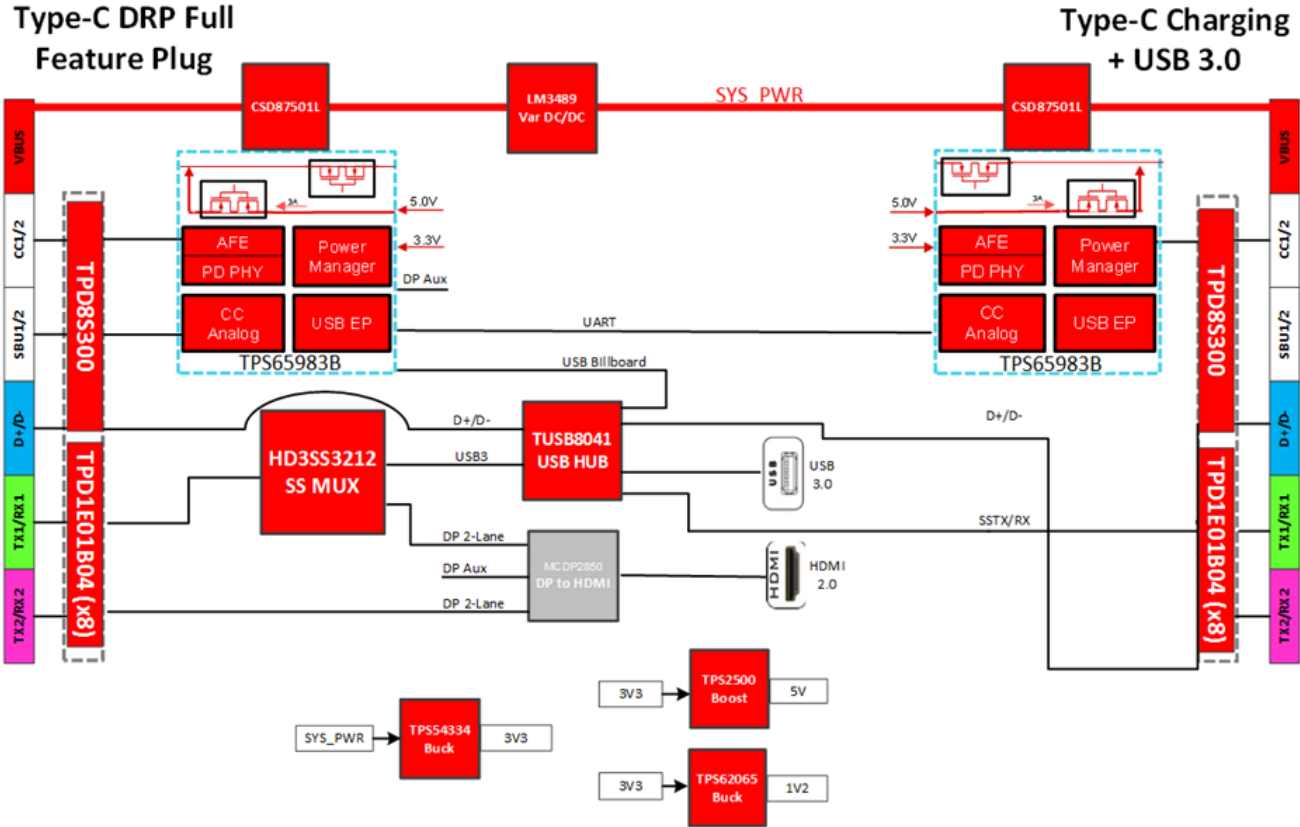
Benefits

- Low Cost due to one chip solution for a USB C DFP output
- Simple Design with Passed Necessary Standards
- Small Size and Good Thermal Design cause of the High Efficiency



TIDA-03027 USB Type-C Multiport Adapter

USB 3.0 + HDMI 2.0 + Type-C (Charging & USB 3.0)



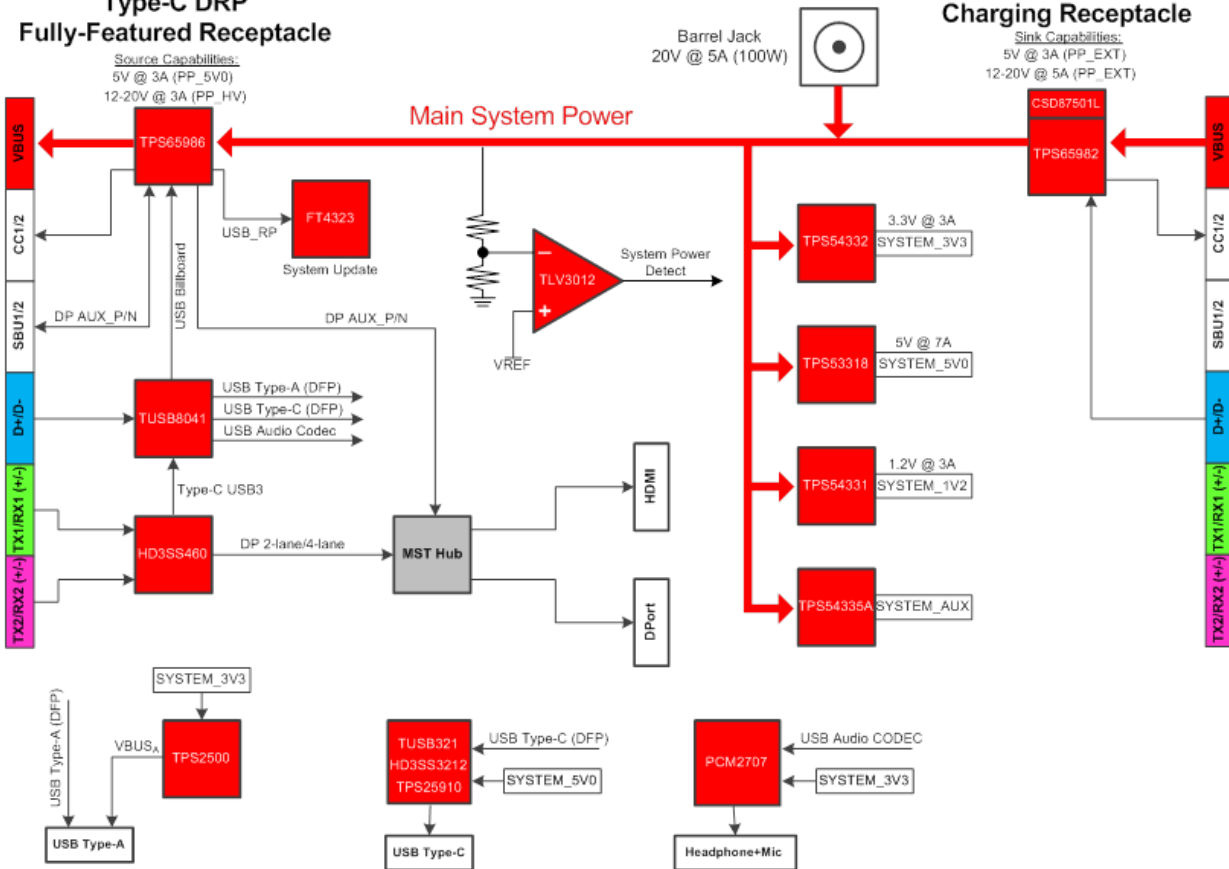
TIDA-01243 USB Type-C™ and Power Delivery Minidock

Type-C DRP Fully-Featured Receptacle

Source Capabilities:
5V @ 3A (PP_5V0)
12-20V @ 3A (PP_HV)

Type-C Sink (UFP) Charging Receptacle

Sink Capabilities:
5V @ 3A (PP_EXT)
12-20V @ 5A (PP_EXT)



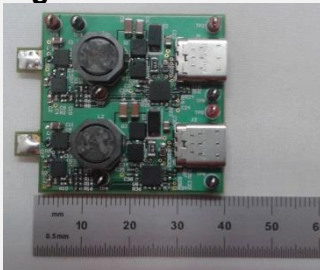
36W USB Type C PD DC/DC Adapter with Port Power Management-*TI Reference Design, PMP20172*

Design Features

- Both ports advertise 36W (5V/3A, 9V/3A, or 15V/2.4A) prior to UFP connection
 - Upon first port valid UFP connection, the second port will update power advertisement to 18W
 - Upon second port valid UFP connection, the first port will also update power advertisement to 18W
- Type C 1.2 compliant & PD2.0 certified
- <350mW standby power consumption
- High Efficiency: 92%@5V, 95%@ 9V, 97%@15V output
- Compact Size of 40mm*40mm*10mm

Tools & Resources

Board Image



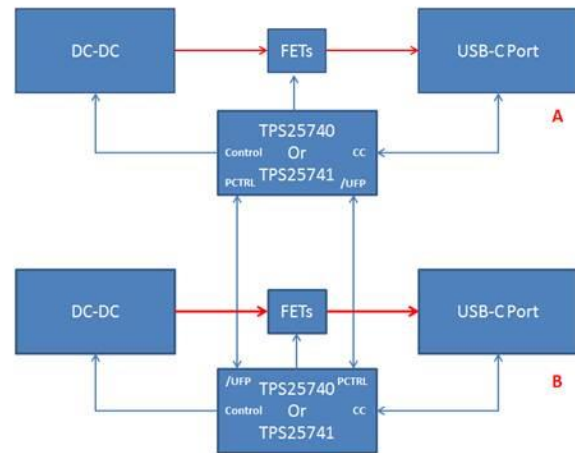
Devices:

- TPS25740A
- TPS40303
- CSD87334Q3D
- CSD17575Q3

Design Benefits

- Pure Analog Configuration for Type C PD Negotiation simplifies the design process significantly for USB Type C PD products
- Small solution size due to the integrated amplifiers, drivers and protection mechanism

Block Diagram



USB Web Collateral – Blogs and White Papers

Content title	Content type	Link to content or more details
Why use a USB Type-C redriver in your personal electronics design?	Technical Blog	http://e2e.ti.com/blogs_/b/analogwire/archive/2016/10/25/the-need-for-usb-type-c-redrivers
How to deliver clean USB Type-C Signal	Technical Blog	http://e2e.ti.com/blogs_/b/analogwire/archive/2017/08/07/how-to-deliver-clean-usb-type-c-signals
How to correct 10Gbps performance issues with a USB Type-C™ active redriver multiplexer	Technical Blog	http://e2e.ti.com/blogs_/b/analogwire/archive/2016/12/01/how-to-correct-10gbps-performance-issues-with-a-usb-type-c-active-redirecter-multiplexer
Create an eye opening experience with 10G USB3 redriver	Technical Blog	http://e2e.ti.com/blogs_/b/analogwire/archive/2018/07/12/eye-opening-experience-10g-usb3-redirecter
How to select the right USB Type-C signal switch	Technical Blog	http://e2e.ti.com/blogs_/b/analogwire/archive/2018/03/20/how-to-select-the-right-usb-type-c-signal-switches
How USB will enable the future of automotive infotainment	Technical Blog	http://e2e.ti.com/blogs_/b/behind_the_wheel/archive/2015/10/08/usb-2-0-automotive-signal-conditioning?DCMP=tusb211&HQS=hpa-int-hsi-tusb211-pr-blog-20151008-wwe
Low-cost implementation of USB Type-C	White Paper	http://www.ti.com/lit/wp/slly016/slly016.pdf
Transitioning existing products from USB 2.0 OTG to USB Type-C	White Paper	http://www.ti.com/lit/wp/slly017/slly017.pdf
Alternative Mode for USB Type-C: Going beyond USB	White Paper	http://www.ti.com/lit/wp/slly021/slly021.pdf
Strengthening the USB Type-C signal chain through redrivers	White Paper	http://www.ti.com/lit/wp/slyy121/slyy121.pdf

USB Web Collateral - Video

Content title	Content type	Link to content or more details
USB2 Redriver solutions	Video	https://training.ti.com/usb2-redriver-solutions
USB2 switch with over voltage protection	Video	https://training.ti.com/ts5usbc41-usb-switch-family-industrys-highest-overvoltage-protection
Enhancing System Performance with Signal Conditioners	Video	https://training.ti.com/enhancing-system-performance-signal-conditioners
Strengthening signal chain through signal conditioners	Video	https://training.ti.com/strengthening-signal-chain-through-signal-conditioners
TUSB211 USB2.0 Eye Diagram Configuration	Video	https://www.youtube.com/watch?v=U7O0Nal-tXI

Design title	Target Applications	Link to design for more details
<ol style="list-style-type: none">1) USB Type-C™ and Power Delivery Minidock With Video and Charging Support Reference Design2) USB Type-C HDD With USB Power Delivery Reference Design	<ul style="list-style-type: none">• Type-C docking stations• Video and Power Delivery over Type-C connection• Type-C HDD	<ol style="list-style-type: none">1) http://www.ti.com/tool/TIDA-012432) http://www.ti.com/tool/TIDA-00882
<ol style="list-style-type: none">1) Type-C and Power Delivery Multiport Adapter	<ul style="list-style-type: none">• Docking, monitor	<ol style="list-style-type: none">1) http://www.ti.com/tool/TIDA-03027
<ol style="list-style-type: none">1) USB Type-C Audio Adapter Accessory Mode Reference Design2) USB Type-A Plug to USB Type-C Receptacle SuperSpeed MUX With DFP Controller Reference Design3) USB Type-C Plug to USB Type-A Receptacle SuperSpeed MUX With UFP Controller Reference Design	<ul style="list-style-type: none">• Smartphones• PC and Notebooks• USB Type-C Audio	<ol style="list-style-type: none">1) http://www.ti.com/tool/TIDA-005652) http://www.ti.com/tool/TIDA-008903) http://www.ti.com/tool/TIDA-00891

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參考設計，原理圖、BOM、
設計文件加速系統設計

透過 TI store

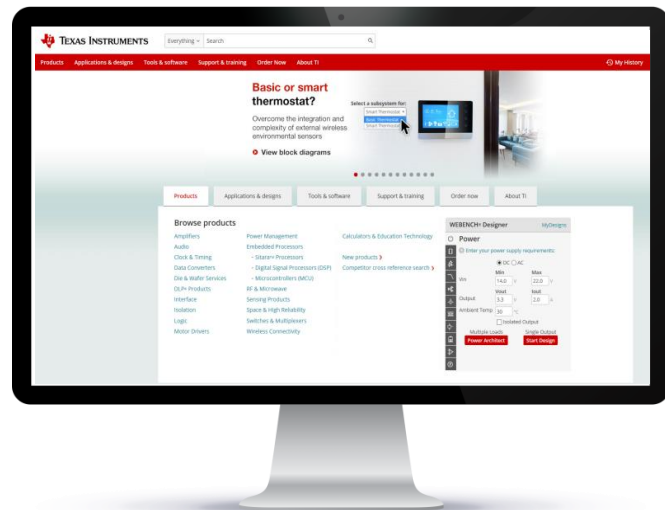
搜尋 **10 萬**多顆 TI 產品與系統
解決方案並輕鬆完成購買

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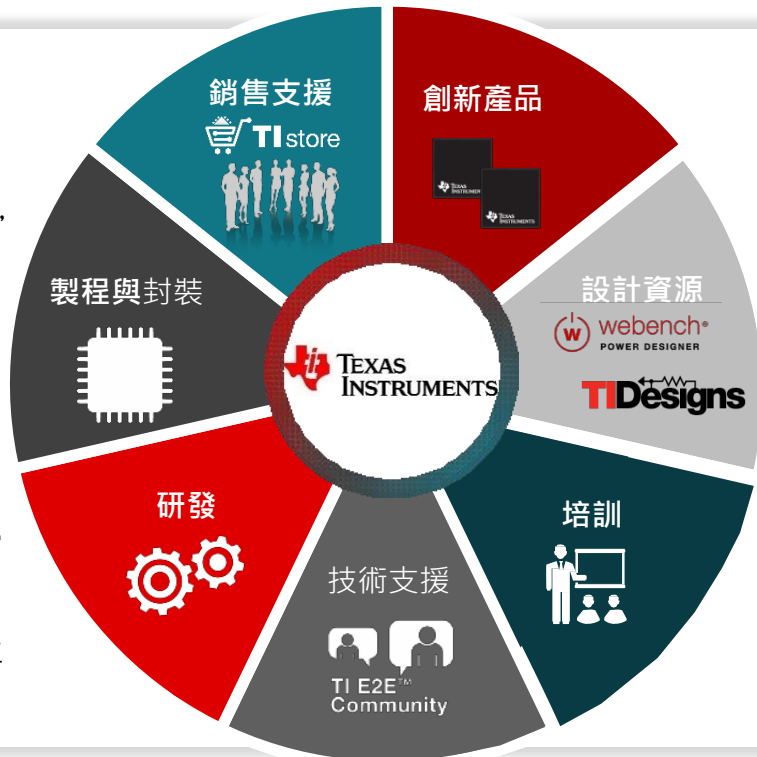
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簡單 4 步驟，輕鬆設計模
擬，完成電路藍圖

TI.com

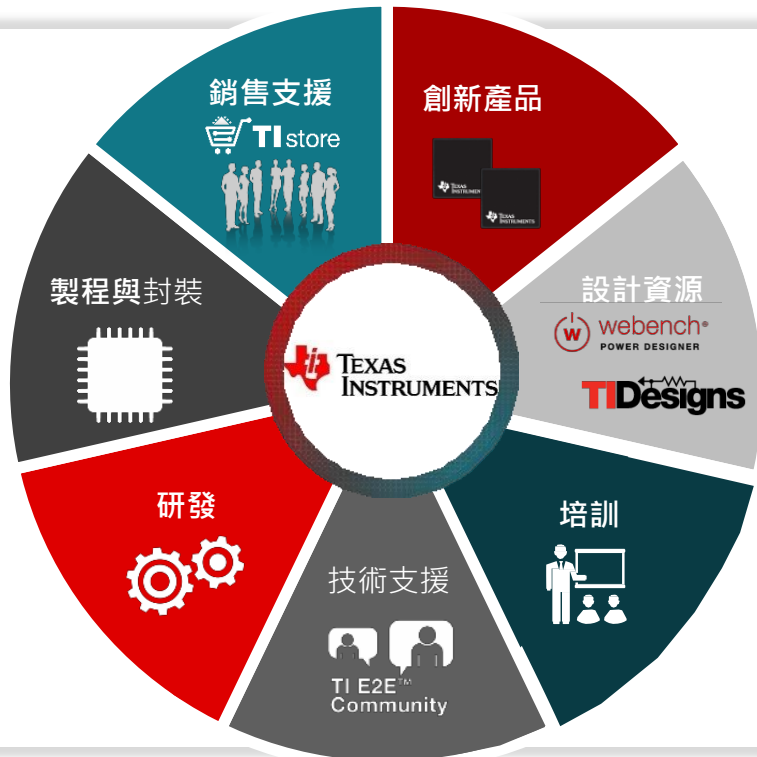
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