IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
SHERMAN DIVISION

COMARCO WIRELESS SYSTEMS LLC, Plaintiff, v. **LOWE'S COMPANIES, INC.,** Defendant.	C.A. No. 4:24-cv-299 **JURY TRIAL DEMANDED** **PATENT CASE**

ORIGINAL COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Comarco Wireless Systems LLC files this Original Complaint for Patent Infringement against Lowe's Companies, Inc., and would respectfully show the Court as follows:

I. THE PARTIES

1. Plaintiff Comarco Wireless Systems LLC ("Comarco" or "Plaintiff") is a Texas limited liability company, having a principal place of business located at 5511 Parkcrest Dr., Ste 103, Austin, TX 78731.

2. On information and belief, Defendant Lowe's Companies, Inc., ("Defendant") is a corporation organized and existing under the laws of North Carolina with a place of business at 2801 N Hwy 75, Sherman, TX 75090. Defendant has a registered agent at Corporation Service Company 211 E. 7th Street, Suite 620, Austin, TX 78701.

II. JURISDICTION AND VENUE

3. This action arises under the patent laws of the United States, Title 35 of the United States Code. This Court has subject matter jurisdiction of such action under 28 U.S.C. §§ 1331 and 1338(a).

4. On information and belief, Defendant is subject to this Court's specific and general personal jurisdiction, pursuant to due process and the Texas Long-Arm Statute, due at least to its

business in this forum, including at least a portion of the acts of infringement alleged herein. Furthermore, Defendant is subject to this Court's specific and general personal jurisdiction because Defendant maintains places of business at 2801 N Hwy 75, Sherman, TX 75090, 910 E End Blvd N, Marshall, TX 75670, 1220 Lakewood Drive, Mt Pleasant, TX 75455, 5720 S Broadway Ave, Tyler, TX 75703, and many more.

5. Without limitation, on information and belief, within this state, Defendant committed and continues to commit, acts of patent infringement, as alleged herein. In addition, on information and belief, Defendant has derived revenues from its infringing acts occurring within Texas. Further, on information and belief, Defendant is subject to the Court's general jurisdiction, including from regularly doing or soliciting business, engaging in other persistent courses of conduct, and deriving substantial revenue from services provided to persons or entities in Texas. Further, on information and belief, Defendant is subject to the Court's personal jurisdiction at least due to its providing services within Texas. Defendant has committed such purposeful acts and/or transactions in Texas such that it reasonably should know and expect that it could be haled into this Court as a consequence of such activity.

6. Venue is proper in this district under 28 U.S.C. § 1400(b). On information and belief, Defendant maintains places of business at 2801 N Hwy 75, Sherman, TX 75090, 910 E End Blvd N, Marshall, TX 75670, 1220 Lakewood Drive, Mt Pleasant, TX 75455, 5720 S Broadway Ave, Tyler, TX 75703 and many more locations. On information and belief, from and within this District, Defendant has committed and continues to commit at least a portion of the acts of infringement at issue in this case.

7. For these reasons, personal jurisdiction exists and venue is proper in this Court under 28 U.S.C. § 1400(b).

III. FACTUAL ALLEGATIONS UNDERLYING ALL CLAIMS

8. Plaintiff incorporates the above paragraphs herein by reference.

9. The patents at issue in this matter arose from the pioneering work of Thomas W. Lanni, an accomplished electrical engineer. Mr. Lanni began working in the field of power supply and conversion in the early 1980s. In 1994, Mr. Lanni joined Comarco, Inc. as Vice President and Chief Technology Officer.

10. Through his work at Comarco, Inc., Mr. Lanni recognized that the increasing use of a variety of portable devices and myriad power sources (e.g., automobile outlets and wall sockets) created the problem of a given device receiving the wrong level of power from a given power source. This mismatch could result in a failure to charge, or could cause damage to the device being charged by causing the battery to overheat or even catch fire.

11. To address this shortcoming in the prior art, Mr. Lanni invented a charging system whereby a charger and a portable electronic device engage in a "handshake" process in order to determine the appropriate level of power to be delivered to the portable electronic device. Mr. Lanni's system includes a charger that comprises power circuitry to provide power along with data circuitry to receive a signal from the portable electronic device to be charged and to provide a signal in response. Conductors are configured to transfer DC power and a ground reference voltage to the portable electronic device. During operation, a third conductor receives the signal from the portable electronic device and a fourth conductor transmits the response signal to the portable electronic device. The portable electronic device is able to use this response signal to determine a power level of the power supply system. This system enables the portable electronic device to receive the appropriate power level from the charger.

12. Mr. Lanni's work led to a large family of patent applications (and resulting issued patents) claiming priority to U.S. Patent Application No. 10/758,933 ("the '933 Application") filed on January 15, 2004. Mr. Lanni is the sole named inventor on these patents.

13. On July 16, 2013, U.S. Patent Application No. 13/943,453 was filed, claiming priority to U.S. Patent Application No 13/300,376. After examination, the USPTO issued U.S. Patent No. 9,413,187 ("the '187 Patent"), entitled "Power Supply System Providing Power and Analog Data Signal for Use by Portable Electronic Device to Control Battery Charging" on August 9, 2016. The term of the '187 patent has been adjusted by 381 days. A true and correct copy of the '187 Patent is attached as Exhibit 1.

14. On August 12, 2020, U.S. Patent Application No. 16/991,295 was filed, claiming priority to the '933 Application. After examination, the USPTO issued U.S. Patent No. 10,855,087 ("the '087 Patent"), entitled "Power Supply Systems" on December 1, 2020. A true and correct copy of the '087 Patent is attached as Exhibit 2.

15. On October 22, 2020, U.S. Patent Application No. 17/077,699 was filed, claiming priority to the '933 Application. After examination, the USPTO issued U.S. Patent No. 10,951,042 ("the '042 Patent"), entitled "Power Supply Systems" on March 16, 2021. A true and correct copy of the '042 Patent is attached as Exhibit 3.

16. Comarco is the assignee of all right, title, and interest in the '087 Patent, the '042 Patent, and the '187 Patent, (collectively "the Patents-in-Suit") including all rights to enforce and prosecute actions for infringement and to collect damages for all relevant times against infringers of the Patents-in-Suit. Accordingly, Comarco possesses the exclusive right and standing to prosecute the present action for infringement of the Patents-in-Suit by Defendant.

IV. COUNT I
(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 9,413,187)

17. Upon information and belief, Defendant has directly infringed claims 8 and 9, of the ‘187 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering for sale and/or importing products including a power supply system, the power supply system being external to a portable electronic device and providing DC power, such products including, but not limited to, the following: Mobile Pixels 8-in-1 USB-C Dongle (Item #5194286, Model #MPX1041001P01); Urban Factory HUBEE Plus USB-C Multi-Stream Mobile Station with 100-Watt Power Delivery (Item #5232138,Model #UBFTCM16UF); Urban Factory HUBEE mini USB-C Multi-Display 4K Docking Station with 100-Watt Power Delivery (Item #5232136, Model #UBFTCD45UF); Micro Connectors 1-ft USB-C White Cable (Item #3662609, Model #USB31-UCHDMIU3); Micro Connectors 1-ft USB-C White Cable (Item #3662610, Model #USB31-UCVGAU3); Just Wireless Portable Power Bank 15K USB-C/A - 15000mAh (Item #3351754, Model #06175); Just Wireless 20,000mAh Power Bank with Fast Charge and 3 USB Ports (Item #3351755, Model #06177); Just Wireless Portable Power Bank 5K USB-C/A - 5200mAh (Item #3351752, Model #06171); DEWALT Type C USB A Wall Outlet Charger 2 (Item #1299595, Model #131 0851 DW2); DEWALT Type C USB A Car Charger 4 (Item #1299597, Model #141 9009 DW2); DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2); Eaton 20-Amp Tamper Resistant Residential/Commercial Decorator USB Outlet Dual Type C, Gray (Item #4110024, Model #TRUSBC20GY-K-L); Eaton 15-Amp Tamper Resistant Residential/Commercial Decorator USB Outlet Type A/C (Item #1614069, Model #TRUSBAC15W-KB-LW); miLink Micro USB USB-C Lightning Combination Charger 3 (Item #4666486, Model #CC3-J241); Trexonic 4-Port USB Charger with Quick Charge Technology, Silver, Type C and USB A Connectors, 1000mAh Battery Power (Item #1646379; Model

#849105170M); Trexonic Micro USB USB-C Lightning Combination Charger 4 (Item #1646374, Model #849105163M); Trexonic Micro USB USB-C Lightning Combination Charger 4 (Item #1646491, Model #849111674M); Promounts Lightning USB A USB Charger 5 (Item #877321, Model #OPT061); Top Greener TU22036A2C 20-Amp 125-volt Tamper Resistant Residential/Commercial Decorator Outlet/USB Dual Type C with Wall Plate (3-Pack) (Item #4828747, Model #TU22036A2C-WWP3P); Top Greener TU21558AC3 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Type A/C with Wall Plate, White (3-Pack) (Item #4828749; Model #TU21558AC3-WWP3P); Top Greener TU21536A2C 15-Amp 125-volt Tamper Resistant Residential Decorator USB Outlet Dual Type C with Wall Plate, White (3-Pack) (Item #4828746; Model #TU21536A2C-WWP3P); Top Greener TU22036AC3 20-Amp 125-volt Tamper Resistant Residential/Commercial Decorator Outlet/USB Type A/C with Wall Plate, White (3-Pack) (Item #4828751, Model #TU22036AC3-WWP3P); Top Greener TU21536A2C 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Dual Type C with Wall Plate, Black (3-Pack) (Item #4828753; Model #TU21536A2C-BKWP3P); Top Greener TU21536AC3 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Type A/C with Wall Plate, Black (3-Pack) (Item #4828745; Model #TU21536AC3-BKWP3); Naztech Type C; USB A Wall Outlet Charger 2 (Item #5264434; Model #HPL15520); Naztech Micro USB USB-C Lightning Car Charger 2 (Item #3637774; Model #14390); RoadKing Type C USB A Combination Charger 2 (Item #3722750; Model #RK03430); and Accell Type C USB A Combination Charger (Item #3245139; Model #D233B-001B) ("'187 Accused Chargers").

18. Claim 8 of the '187 patent states:

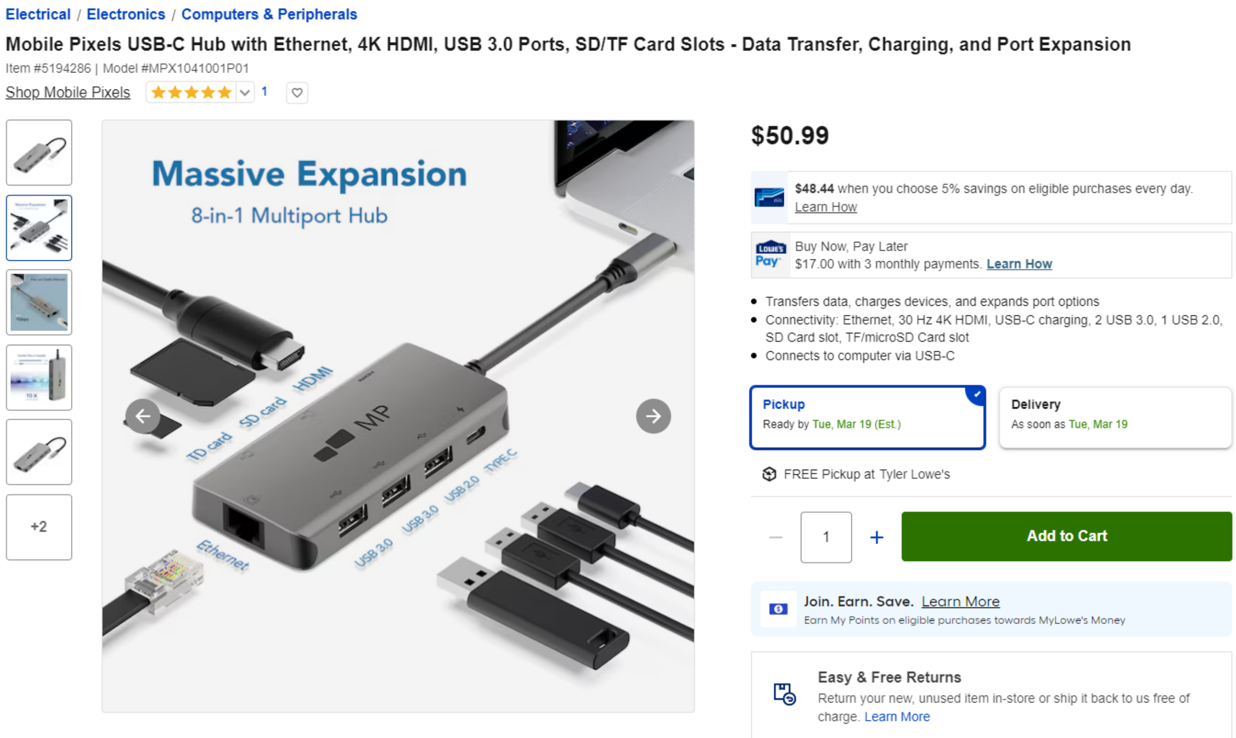
> A power supply system for providing DC power to a portable electronic device, the power supply system being external to the portable electronic device and comprising:
>
> power circuitry to provide the DC power;

> data circuitry to receive a first signal originating from the portable electronic device and to provide a second signal to the portable electronic device; and
>
> a connector disposed on a cable end, the connector having four conductors for detachably mating with a power input opening of the portable electronic device, the first and second conductors transferring the DC power and its ground reference to the portable electronic device, the third conductor transferring the first signal from the portable electronic device to the data circuitry, and the fourth conductor transferring the second signal from the data circuitry to the portable electronic device,
>
> wherein the data circuitry, in response to the first signal, provides the second signal to the portable electronic device, the second signal being an analog signal having a parameter level to indicate to the portable electronic device the potential power output level of the power supply system.

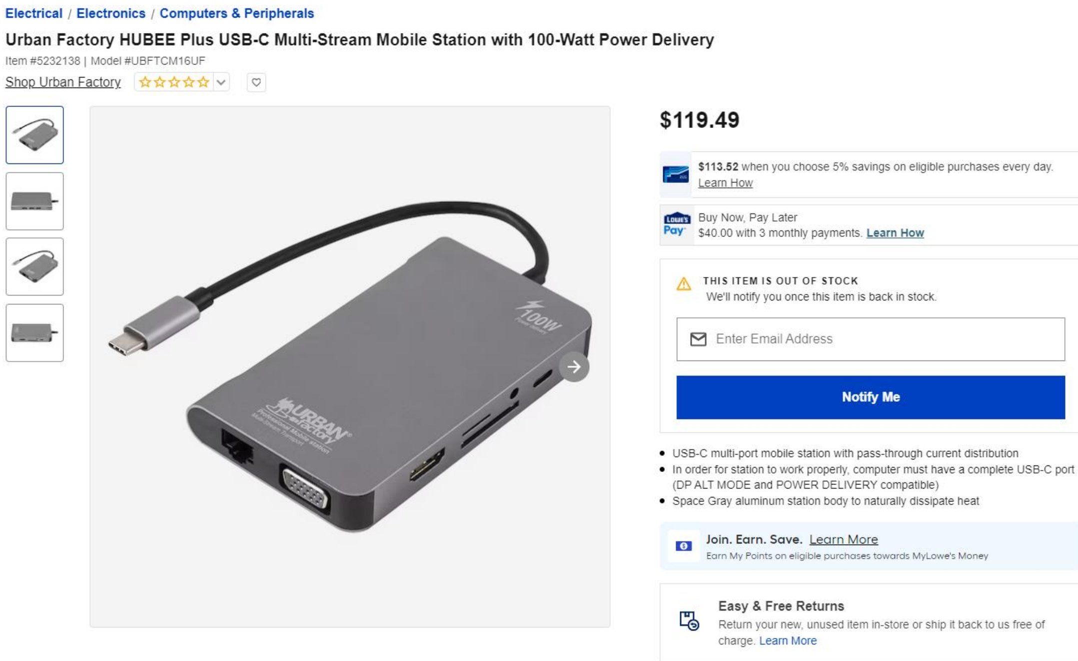
(Ex. A at 11:6-12:7).

A. Infringement for Compliance with the Battery Charging (BC) 1.2 specification

19. Defendant makes, uses, sells, offers for sale and/or imports products, such as the ’187 Accused Chargers, that are or include a power supply system for providing DC power to a portable electronic device, the power supply system (*e.g.*, the ’187 Accused Chargers) being external to the portable electronic device. Upon information and belief, the ’187 Accused Chargers include circuitry compliant with the Battery Charging (BC) 1.2 specification to charge the portable electronic device. The Table 2-1 (https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36) and the diagram depicting the power consumed by different USB specifications (https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5) disclose that BC 1.2 is used to output 5V voltage, 1.5A current, and 7.5W power. USB-compliant devices at USB 3.0 or above are compatible with the USB BC 1.2 specification.

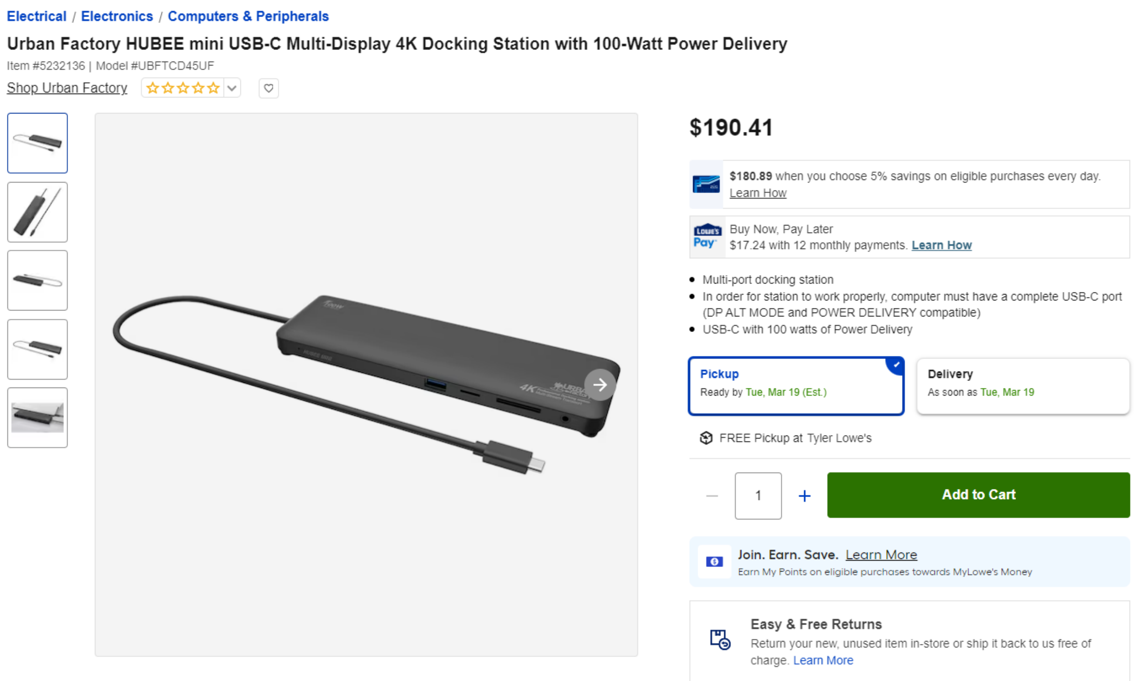


(*E.g.*, https://www.lowes.com/pd/Mobile-Pixels-USB-C-Hub-with-Ethernet-4K-HDMI-USB-3-0-Ports-SD-TF-Card-Slots-Data-Transfer-Charging-and-Port-Expansion/5013702029?idProductFound=false&idExtracted=true).



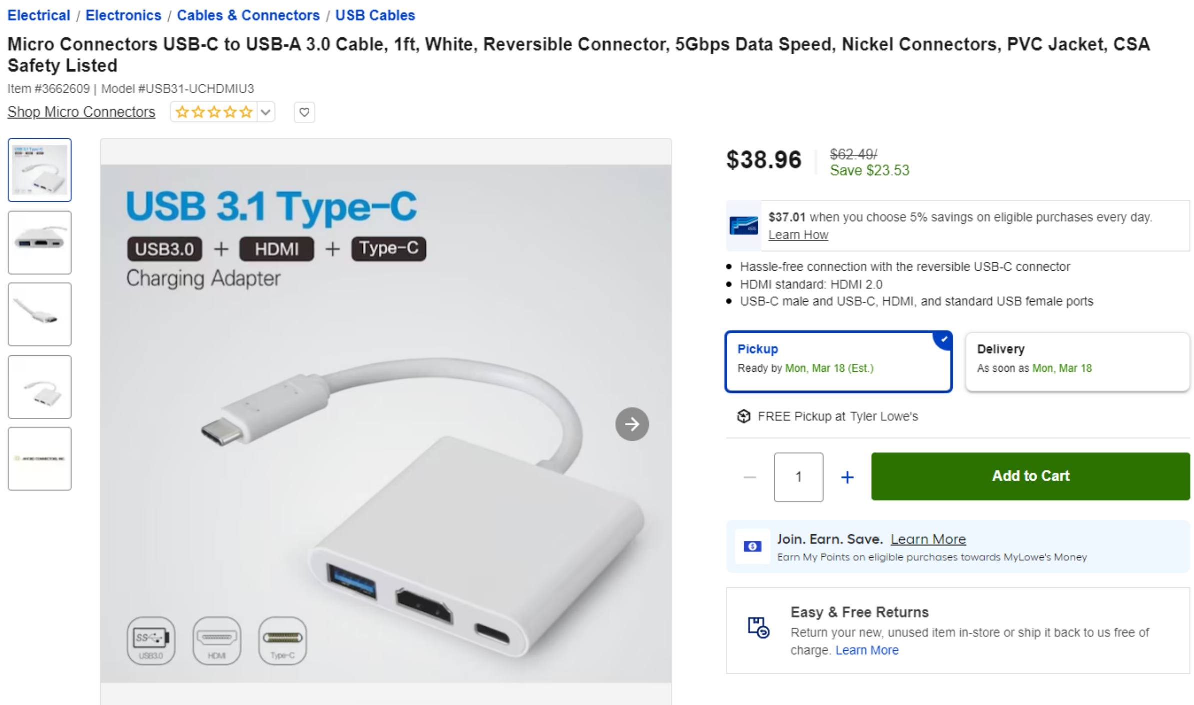
- USB-C multi-port mobile station with pass-through current distribution
- In order for station to work properly, computer must have a complete USB-C port (DP ALT MODE and POWER DELIVERY compatible)
- Space Gray aluminum station body to naturally dissipate heat
- 100-watt USB-C 3.1 cable to link station to computer
- USB-C 3.1 input to connect USB-C power supply
- 4K HDMI at 30 Hz; VGA Full HD 1080p at 60 Hz
- 3 USB 3.0 inputs with data flow of up to 5 Gbps
- SD/microSD Card readers
- 1,000 Mbps RJ45 port

(*E.g.*, https://www.lowes.com/pd/Urban-Factory-HUBEE-Plus-USB-C-Multi-Stream-Mobile-Station-with-100-Watt-Power-Delivery/5013839387?idProductFound=false&idExtracted=true).



- Multi-port docking station
- In order for station to work properly, computer must have a complete USB-C port (DP ALT MODE and POWER DELIVERY compatible)
- USB-C with 100 watts of Power Delivery
- DisplayPort: 4K/30 Hz max
- HDMI port: 4K/30 Hz max
- VGA port: 2K/60 Hz max
- 2 USB-A 2.0 ports: 480 Mbps
- USB-A 3.0 port: 5 Gbps
- RJ45: Gigabit Ethernet 1,000 Mbps max

(*E.g.*, https://www.lowes.com/pd/Urban-Factory-HUBEE-mini-USB-C-Multi-Display-4K-Docking-Station-with-100-Watt-Power-Delivery/5013839417?idProductFound=false&idExtracted=true).


Electrical / Electronics / Cables & Connectors / USB Cables

Micro Connectors USB-C to USB-A 3.0 Cable, 1ft, White, Reversible Connector, 5Gbps Data Speed, Nickel Connectors, PVC Jacket, CSA Safety Listed

Item #3662609 | Model #USB31-UCHDMIU3

Shop Micro Connectors

$38.96 | ~~$62.49/~~ Save $23.53

$37.01 when you choose 5% savings on eligible purchases every day. Learn How

- Hassle-free connection with the reversible USB-C connector
- HDMI standard: HDMI 2.0
- USB-C male and USB-C, HDMI, and standard USB female ports

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Delivery
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Return your new, unused item in-store or ship it back to us free of charge. Learn More

(*E.g.*, https://www.lowes.com/pd/Micro-Connectors-USB-C-Digital-AV-HDMI-Multiport-Adapter-USB3-0-HDMI-USB-Type-C-9-in/5001459801?idProductFound=false&idExtracted=true).

Micro Connectors USB-C to USB-A Cable, 1ft, White, Reversible Connector, 5Gbps Data Speed, Nickel Connector, PVC Jacket, USB 3.0, CSA Safety Listed

Item #3662610 | Model #USB31-UCVGAU3

Shop Micro Connectors

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- Hassle-free connection with the reversible USB-C connector
- USB-C male and USB-C, VGA and standard USB female ports
- Supports USB-C and thunderbolt 3 ports

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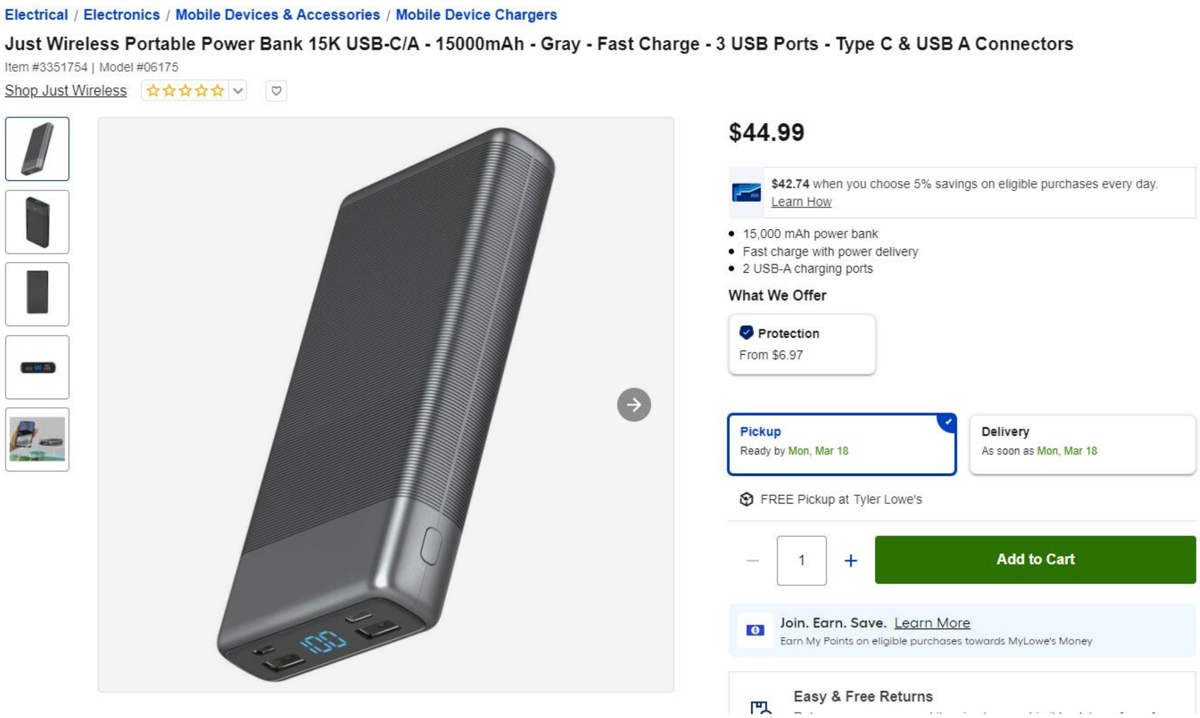
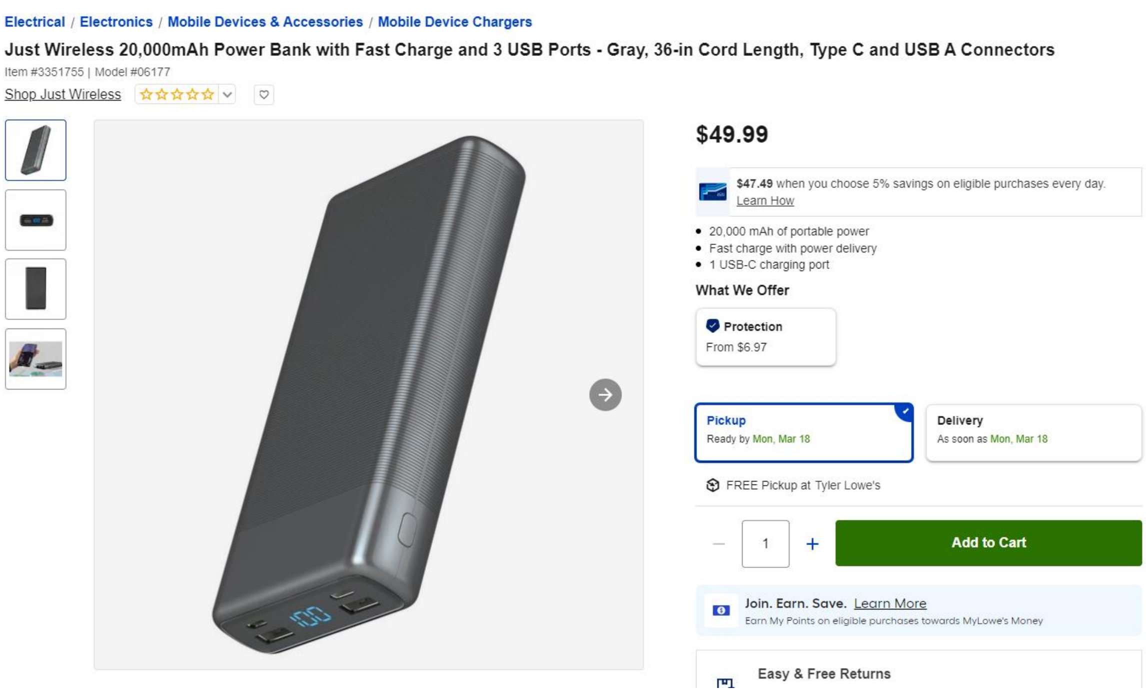
Easy & Free Returns

Return your new, unused item in-store or ship it back to us free of charge. Learn More

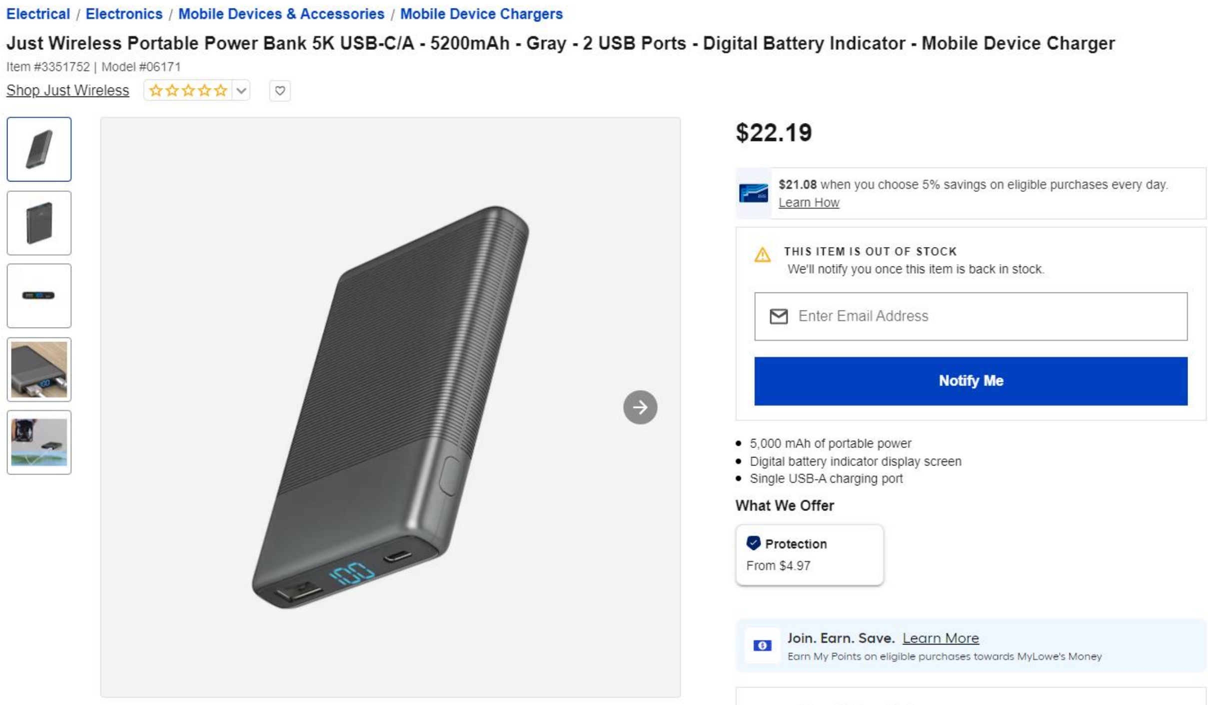
(*E.g.*, https://www.lowes.com/pd/Micro-Connectors-USB-C-to-VGA-Multiport-Adapter-USB-3-0-VGA-USB-Type-C-9-in/5001459803?idProductFound=false&idExtracted=true).



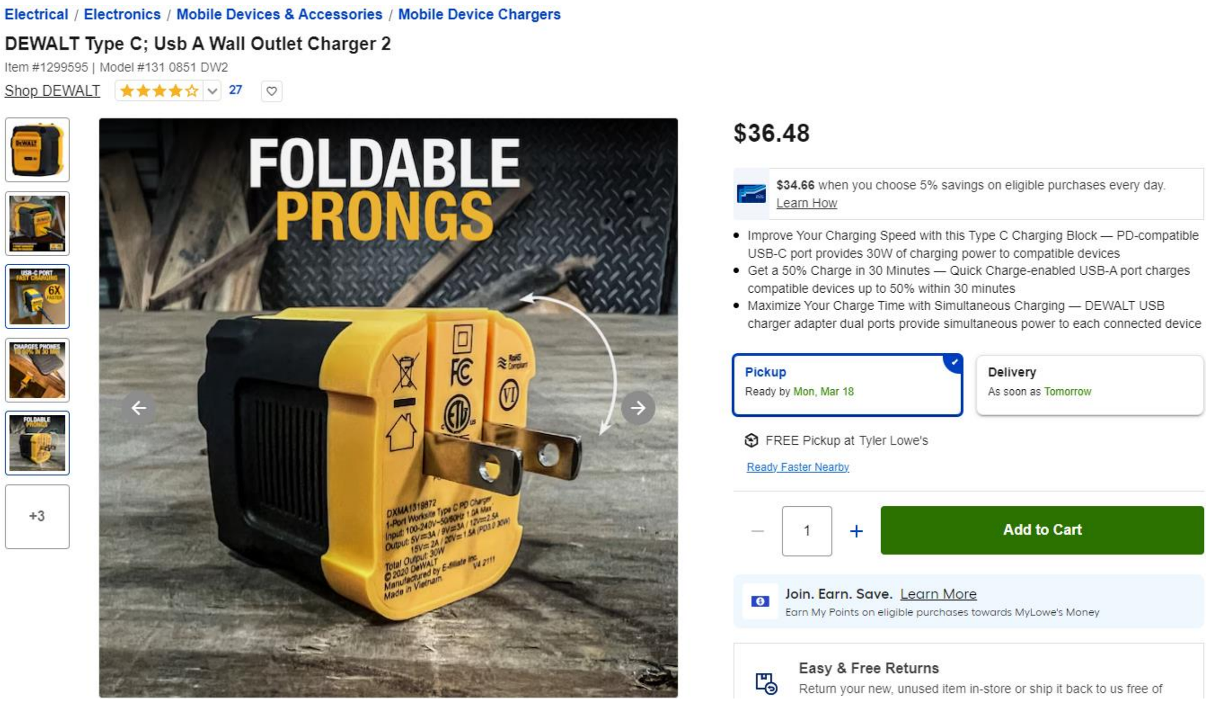
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



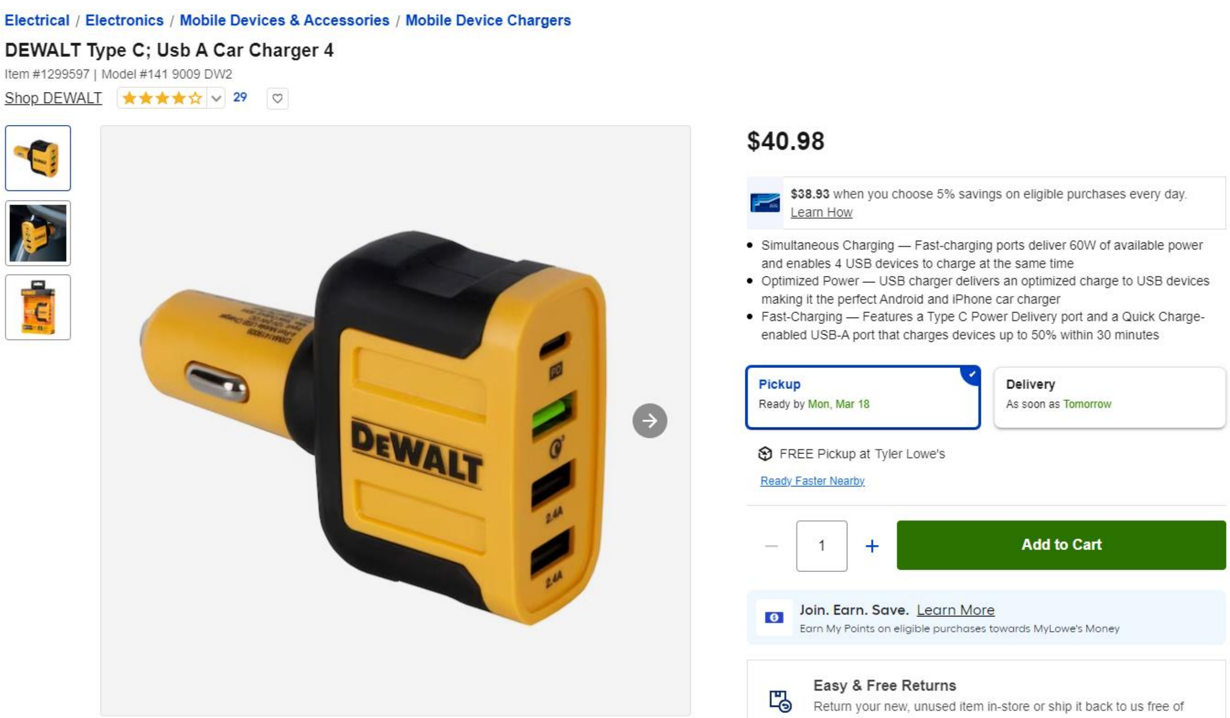
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-5K-USB-C-A/5001606727?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Wall-Outlet-Charger/1001435122?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Car-Charger/1000976132?id

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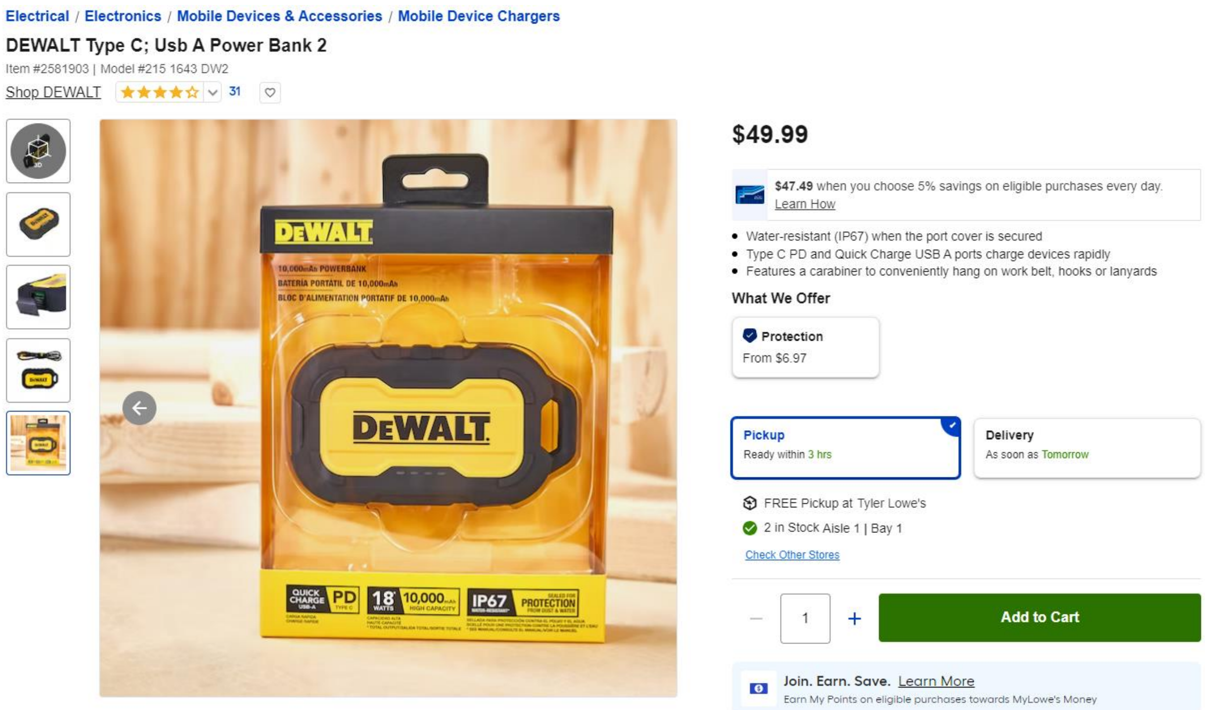

(*E.g.*, https://www.lowes.com/pd/DEWALT-10-000-mAh-Powerbank/1003242934?idProductFound=false&idExtracted=true).

Eaton 20-Amp 125-volt Tamper Resistant Residential/CoMMercial Decorator USB Outlet Type A/C, Gray

Item #4110024 | Model #TRUSBC20GY-K-L

Shop Eaton 106

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$59.46

$56.49 when you choose 5% savings on eligible purchases every day. Learn How

Buy Now, Pay Later
$20.00 with 3 monthly payments. **Learn How**

- Charges electronic devices without a special adapter
- Dual 5A Type-C charging capacity
- Quick and easy access for both USB charging and electrical outlets

Manufacturer Color/Finish: Gray

$59.46 Out of Stock $59.51 $59.42 Out of Stock $59.48

Amperage: 20

15 20

Pickup
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As soon as Sat, Mar 16

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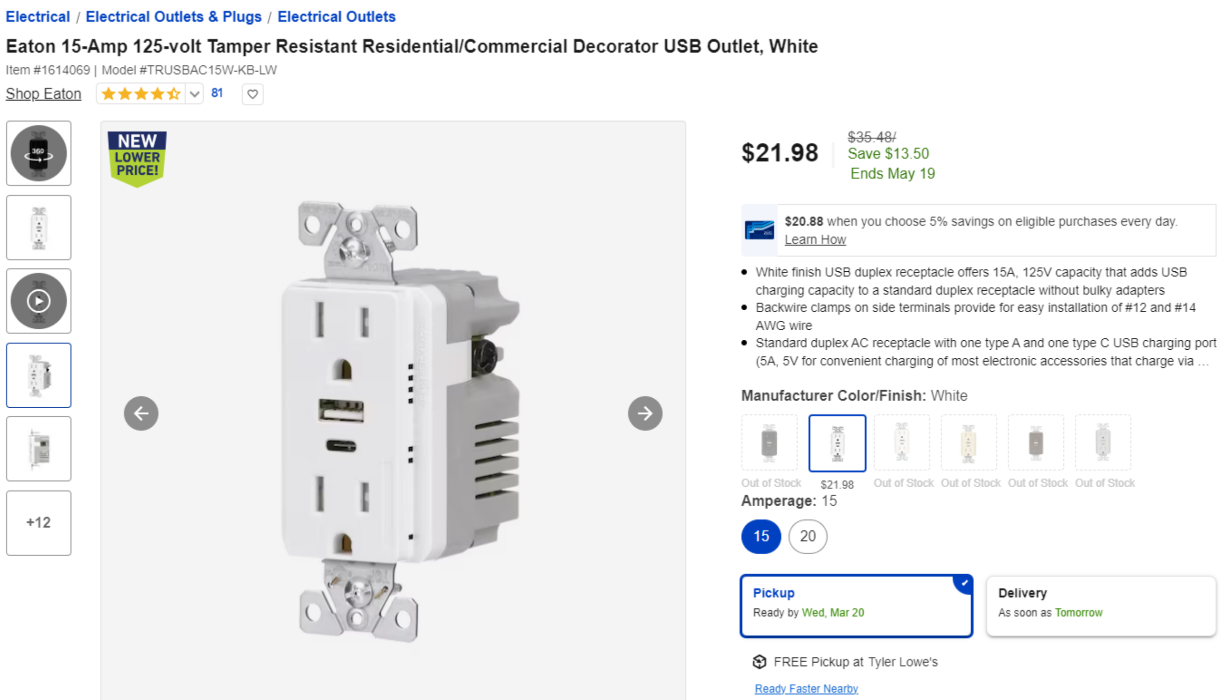
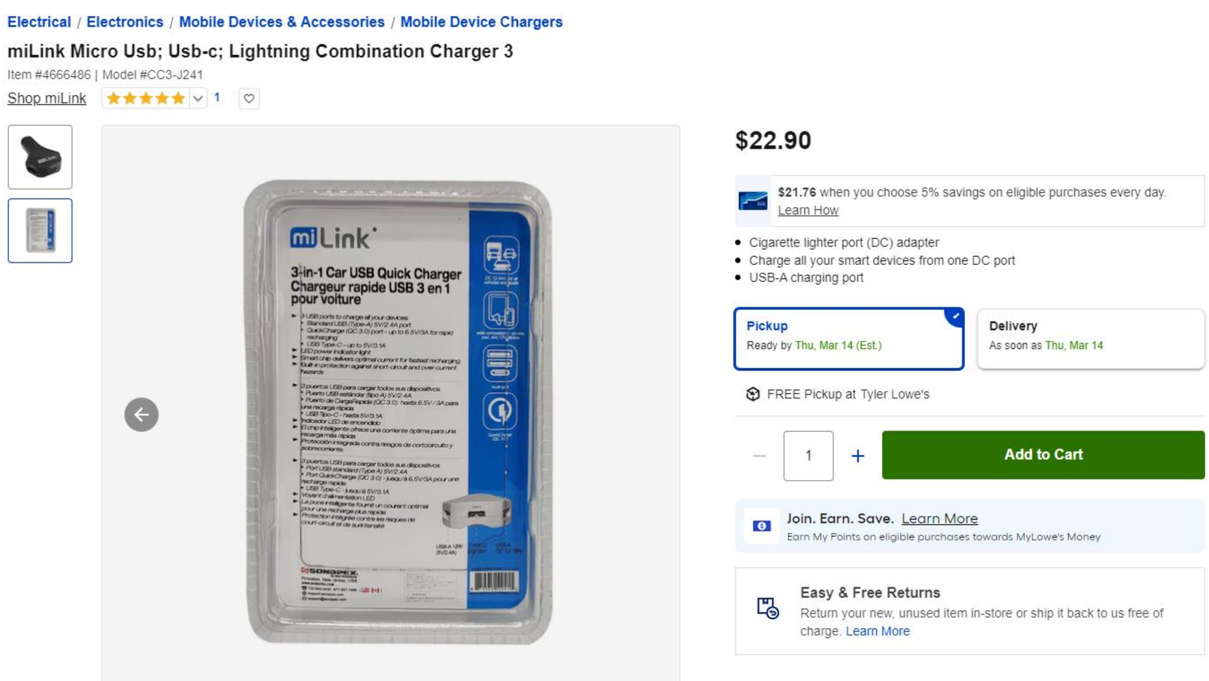
Eaton's USB charging receptacles offer fast, convenient and efficient charging of portable electronic devices directly from a standard outlet without bulky adapters or powered computers. Ideal for the home office, bedroom or kitchen, USB devices replace the electrical receptacle of any standard wall outlet, so you can virtually charge smart phones, tablets, e-readers and cameras. Eaton's USB charging solutions eliminate clutter in residential and commercial environments and is compatible with USB Type C electronics.

- Charges electronic devices without a special adapter
- Dual 5A Type-C charging capacity
- Quick and easy access for both USB charging and electrical outlets
- Reversible ports allow for consistent charging regardless of plug-in orientation
- Standard duplex receptacle with two USB-C ports rated at a combined 5.0A
- Compatibility with USB Type C electronics, including smart phones, tablets, e-readers, cameras, MP3 players and more
- Ideal for home offices, kitchens, bedrooms and more
- Replaces a standard duplex receptacle and uses a decorator style wallplate
- Black tamper resistant shutters nearly disappear from view, creating a seamless, contemporary look

(*E.g.*, https://www.lowes.com/pd/Eaton-20A-TR-Receptacle-5A-USB-Type-C-GY/5003062945?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Eaton-White-15-Amp-Decorator-Tamper-Resistant-USB-Outlet-Residential-Commercial-USB-Outlet/1002943626).



(*E.g.*, https://www.lowes.com/pd/miLink-3-in-1-Car-USB-Charger-Type-C-USB-A-and-QC-3-0/5005469221?idProductFound=false&idExtracted=true).

Trexonic 4-Port USB Charger with Quick Charge Technology, Silver, Type C and USB A Connectors, 1000mAh Battery Power

Item #1646379 | Model #849105170M

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$28.55

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We'll notify you once this item is back in stock.

Enter Email Address

Notify Me

- Can charge up to 5 devices simultaneously
- Quick charge technology for time saving
- Power indicator light

Join. Earn. Save. Learn More
Earn My Points on eligible purchases towards MyLowe's Money

Easy & Free Returns
Return your new, unused item in-store or ship it back to us free of charge. Learn More

Trexonic's 5 Port Universal USB Compact Charging Station is staple for any home or office space. This 35.5 watts smart USB charging port allows you to charge 5 devices simultaneously at full speed. Powered for 2 tablets and 3 smartphones, charging station will quickly and effectively charge your devices to save you time. Its compact design makes it a perfect ally for organizing your working space or taking it with you on the go. EXCEPTIONAL PERFORMANCE: Intelligent charging station with a 2.1A port for faster charge. It detects connected devices and delivers the optimal charging current for safe and fast charging. It features a blue LED light to indicate whenever it is on. SPACE SAVING: With its several docks, this charging station allows to keep your space nice and tidy by keeping all your organized charging devices together NO ADAPTER NEEDED: Charge up to 5 devices at full speed all at once without ever needing an extra adapter or power strip. REFINED SILVER FINISH: Perfect mix of practicality, functionality and great design with the modern silver finish that'll add style and class to your space. UNIVERSAL COMPATIBILITY: The charging station features 100 to 240V input and is perfectly compatible with virtually all iOS, Android and Windows smartphones, tablets or any other devices with a USB charge port. WARRANTY and SERVICE: We stand behind every product by offering 90days warranty and extensive customer service. Please contact us with any question or concern you may have. Includes One 5 Port USB Charging Station (3.75-in x 2.6-in x 2.6-in - 0.35-lbs)Very compact charging station, ideal to carry from home to offices, school, during vacation travels or business trips.. Item Dimensions: 3.75-in x 2.6-in x 2.6-in, Item Weight: 0.35-lbs

- Can charge up to 5 devices simultaneously
- Quick charge technology for time saving
- Power indicator light
- Compatible with most Android and IOS devices
- Input: 100V-240V
- Max total output: 5V 7.1A
- Max output at port: 2.1A

Prop65 Warning Label
PDF

(*E.g.*, https://www.lowes.com/pd/Trexonic-Type-C-USB-A-USB-Charger/1001571060?idProductFound=false&idExtracted=true).

Electrical / Electronics / Mobile Devices & Accessories / Mobile Device Chargers

Trexonic Micro Usb Usb-c Lightning Combination Charger 4

Item #1646374 | Model #849105163M

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$45.10

$42.85 when you choose 5% savings on eligible purchases every day. Learn How

- Input: AC-100-240V (50-60Hz)
- Max total output: 5V 10.2A
- Max output at port: 5V 2.4A

Pickup Ready by Wed, Mar 20 (Est.)

Delivery As soon as Wed, Mar 20

FREE Pickup at Tyler Lowe's

1

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Easy & Free Returns

Return your new, unused item in-store or ship it back to us free of charge. Learn More

This intelligent charging dock allows you to save time and space efficiently and in style. Powerful and smart, it'll distribute the appropriate current to up to 6 devices for fast and effective charge. Its small and sleek design with brackets make this charging station a great companion for organizing your space. FAST INTELLIGENT CHARGE: Intelligent charging station with 2.4A ports for faster charge. Detects connected devices and delivers the optimal charging current for safe and fast charging.It also features a overheat and overload circuit protection for a worry free experience. SPACE SAVING: The multi-device docking station allows to you to organize up to 6 devices for a clean and neat space. NO ADAPTER NEEDED: Charge up to 6 devices at full speed all at once without ever needing an extra adapter or power strip. CLASSIC SILVER AND CLEAR FINISH: Perfect mix of practicality, functionality and great design with the everlasting silver finish with clear dividers that'll add style and class to your space and easily blend with any decor. UNIVERSAL COMPATIBILITY : The charging station features 100 to 240V input and is perfectly compatible with virtually all iOS, Android and Windows smartphones, tablets or any other devices with a USB charge port. TRAVEL FRIENDLY: Very lightweight and compact charging station with removable dividers, ideal to carry from home to office/school, during vacation travels or business trips. WARRANTY and SERVICE: We stand behind every product by offering 90days warranty and extensive customer service. Please contact us with any question or concern you may have.. Item Dimensions: 7.50-in x 4.75-in x 4.00-in, Item Weight: 0.80-lbs

- Input: AC-100-240V (50-60Hz)
- Max total output: 5V 10.2A
- Max output at port: 5V 2.4A
- Circuit protection to prevent overheating and overloading
- Holds up to 6 devices

Prop65 Warning Label

PDF

(*E.g.*, https://www.lowes.com/pd/Trexonic-Micro-USB-USB-C-Lightning-Combination-Charger/1001737352?idProductFound=false&idExtracted=true).

Trexonic Micro Usb Usb-c Lightning Combination Charger 4

Item #1646491 | Model #849111674M

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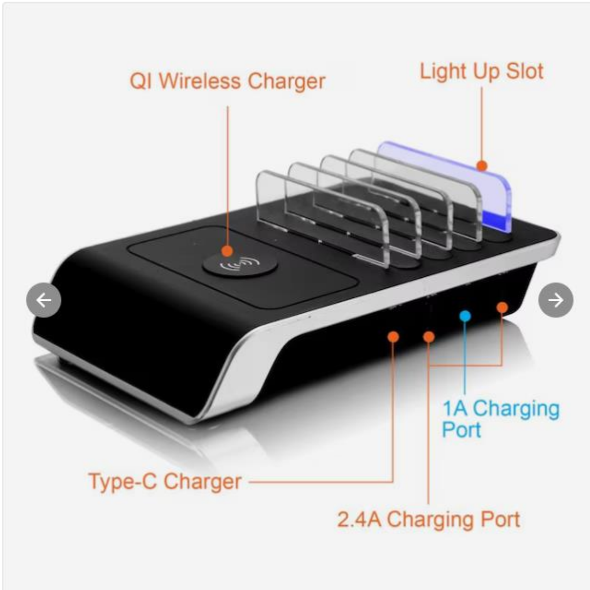

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- Charging station
- Charges up to 5 devices
- 4 Light up slots

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The Trexonic wireless charger with fast charging station dock and wireless charging station is the perfect household charger that can charge multiple devices at once! This wireless phone charger is designed with rapid charging for up to 5 devices with 4 smart IX USB light up charging port slots and 1 wireless charging station. This charging station is a great way to keep clutter off your desk and organize all of your charging devices into one neat little area. This efficient and sleek station offers dual 2.4A USB ports, one 1A USB port, one type C USB port and one wireless charging pad.

- Charging station
- Charges up to 5 devices
- 4 Light up slots
- 1 Wireless charging dock
- Dual 2.4A USB ports
- 1A USB port
- Type C USB Port
- One Charging Station

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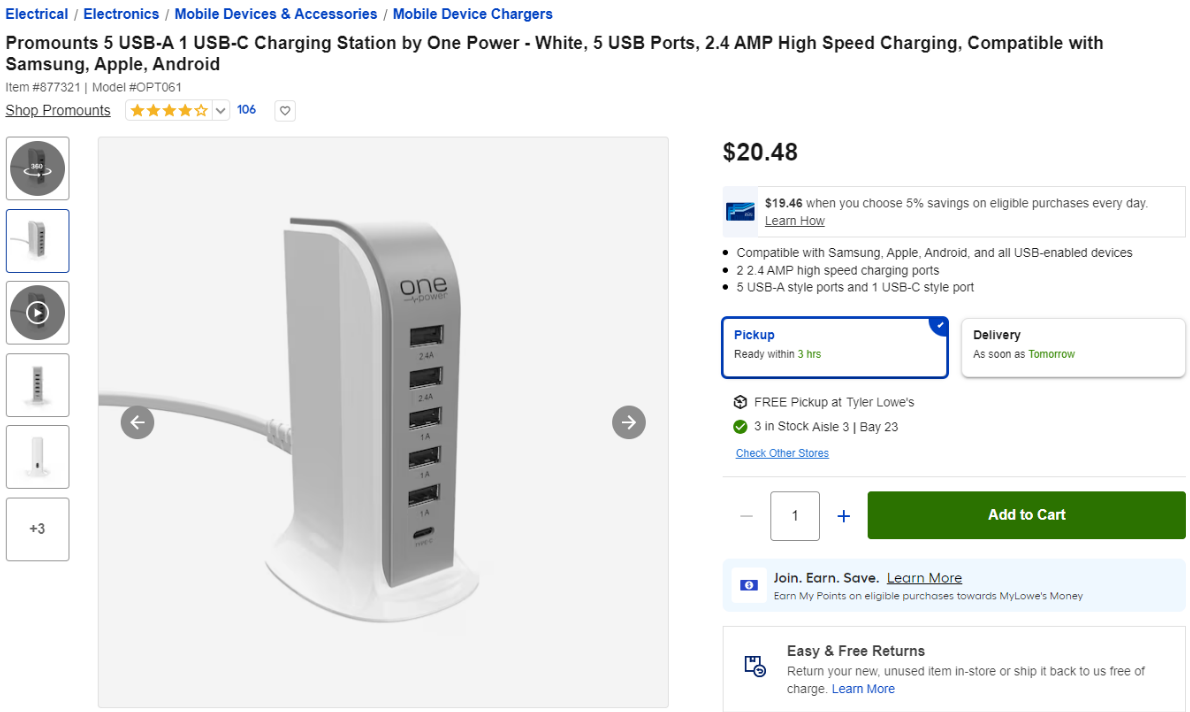
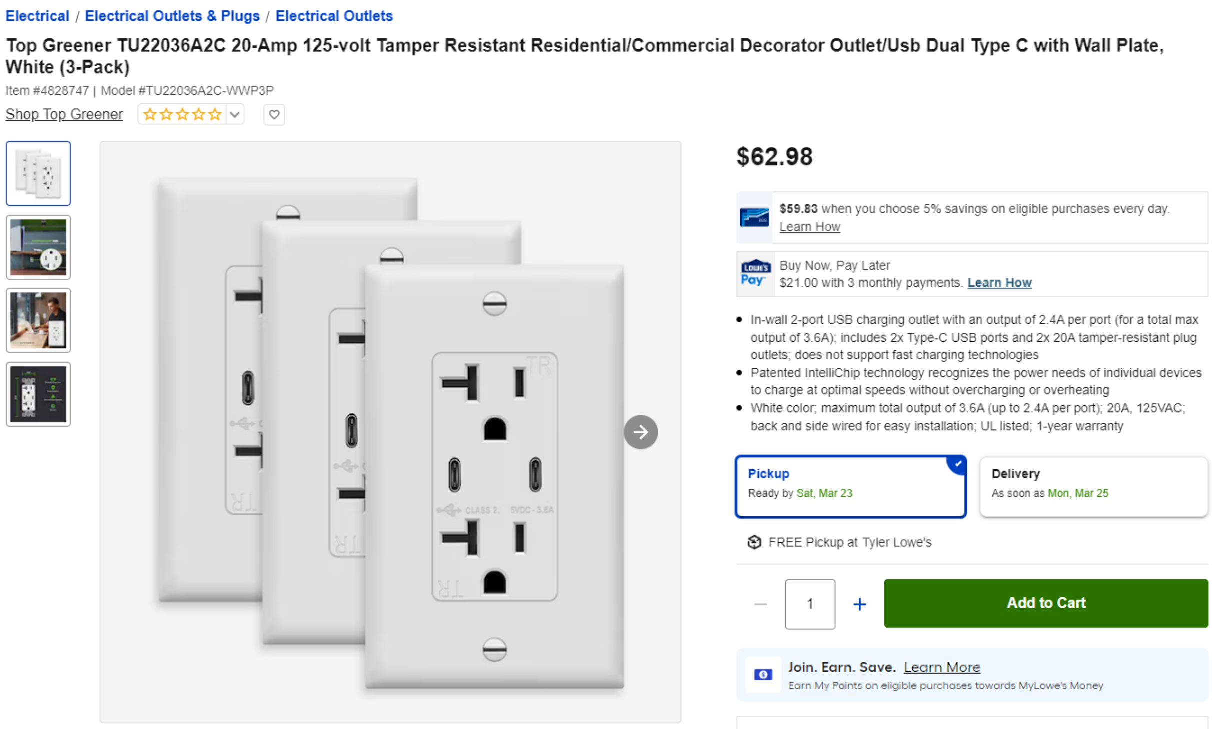
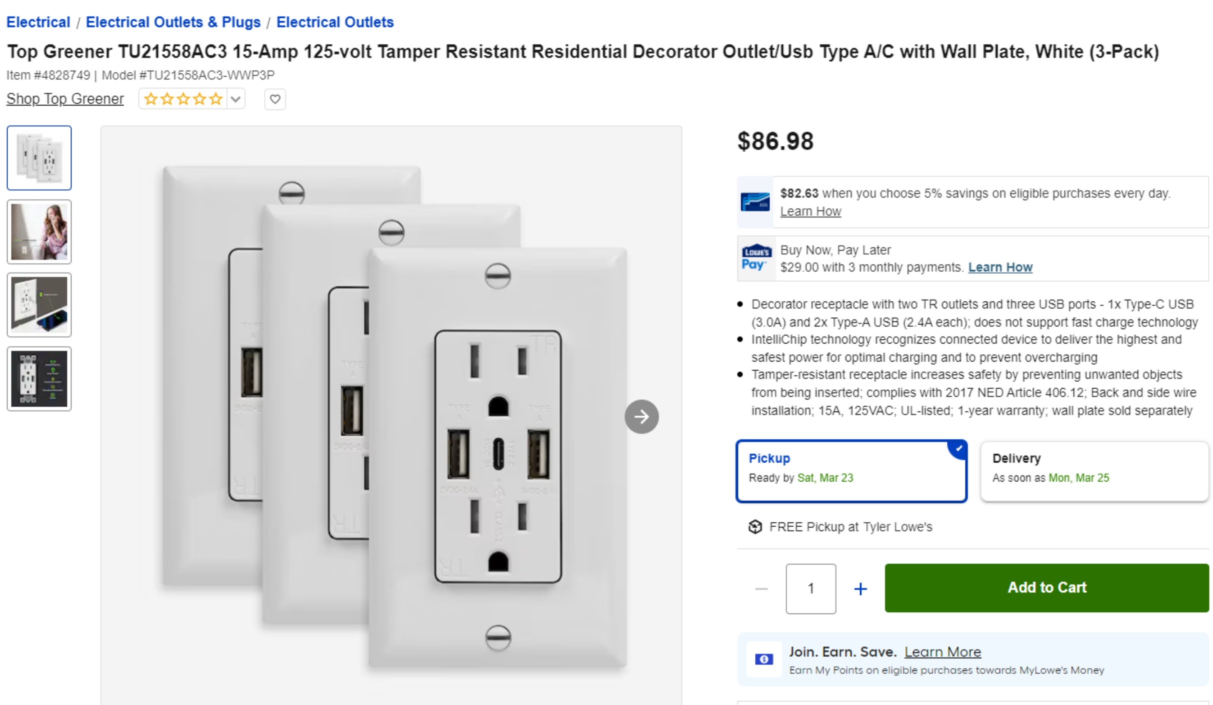
(*E.g.*, https://www.lowes.com/pd/Trexonic-Micro-USB-USB-C-Lightning-Combination-Charger/1001394898?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Promounts-6-USB-Ports-Multiple-Colors-Finishes-Power-Strip/1001218992?idProductFound=false&idExtracted=true).

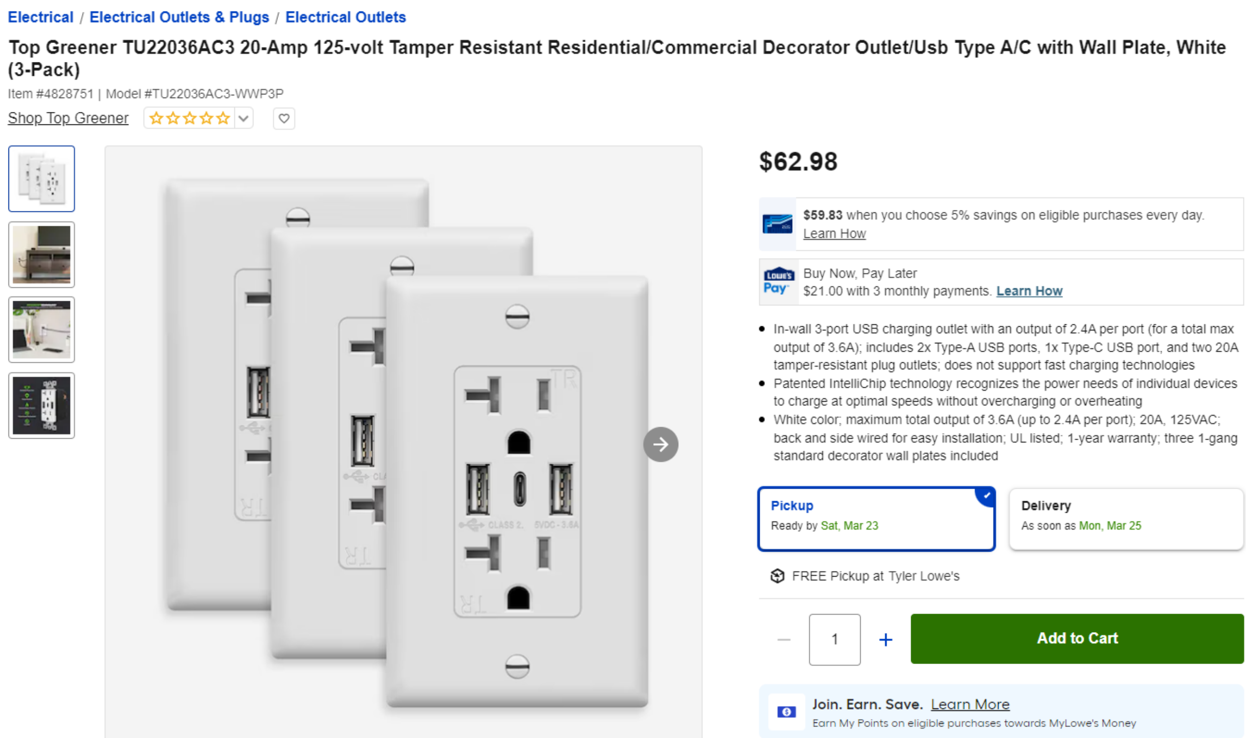


(*E.g.*, https://www.lowes.com/pd/Top-Greener-20-Amp-Tamper-Resistant-Receptacle-2-Port-USB-C-Wall-Outlet-White-3-Pack/5014128997?idProductFound=false&idExtracted=true).

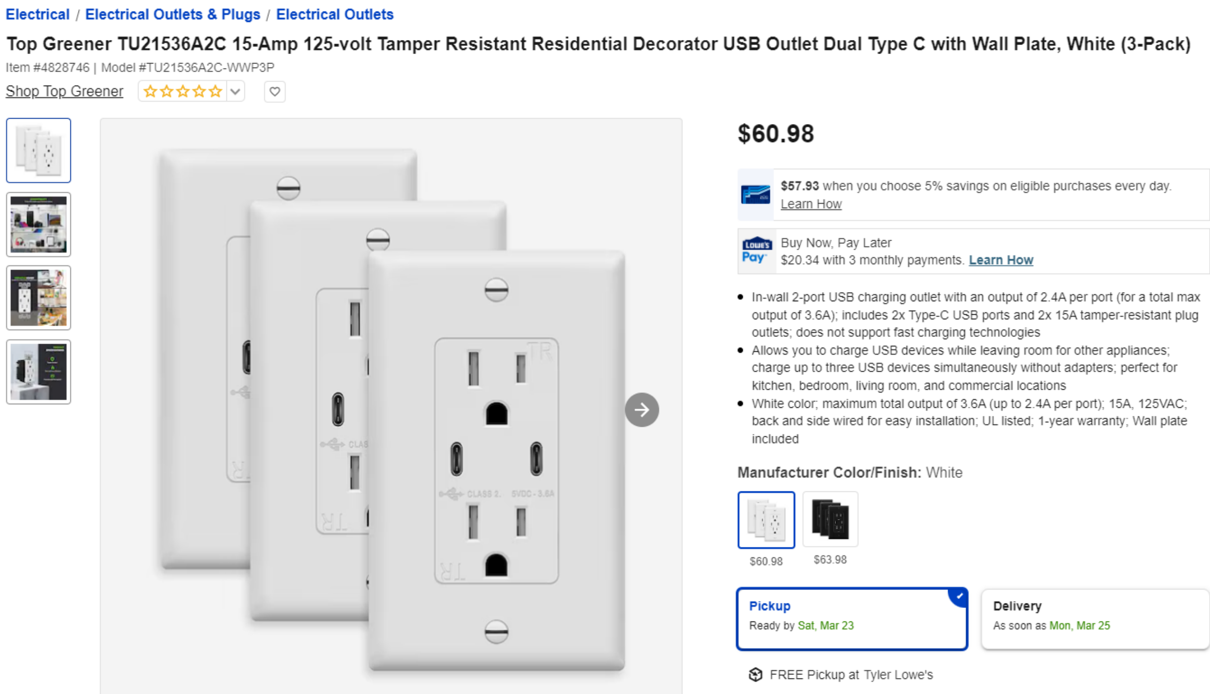


(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Decorator-TR-Receptacle-3-Port-USB-

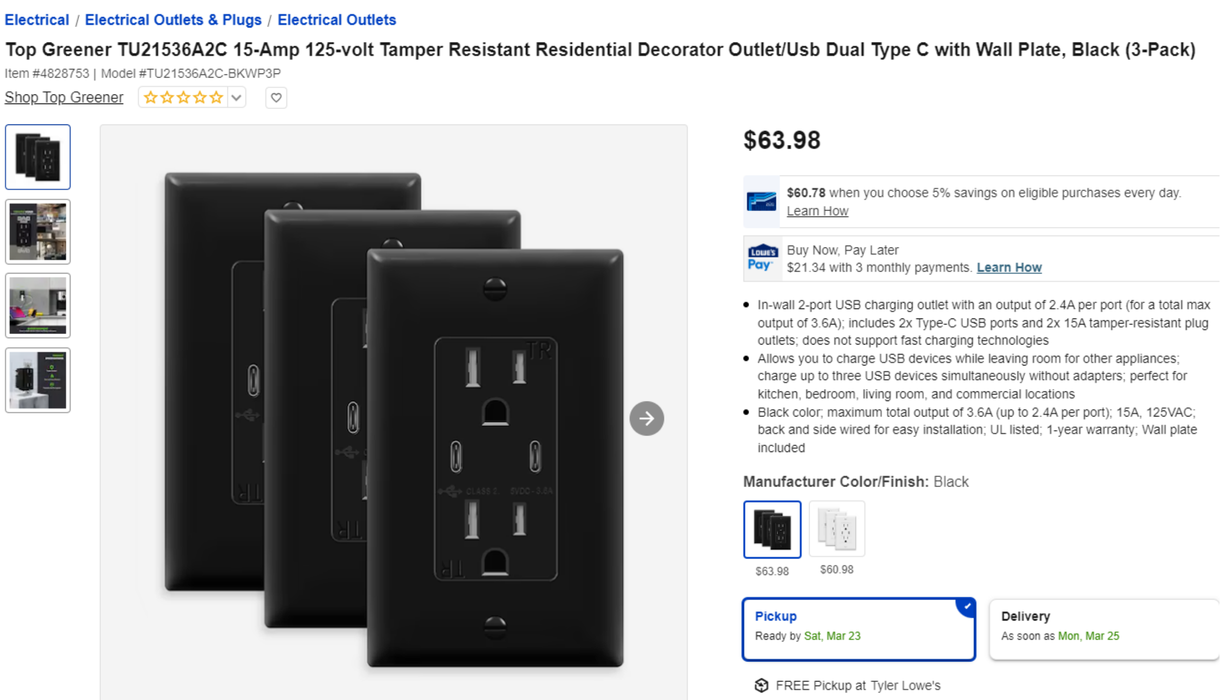
Type-C-A-5-8A-Output-White-3-Pack/5014129007?idProductFound=false&idExtracted=true).



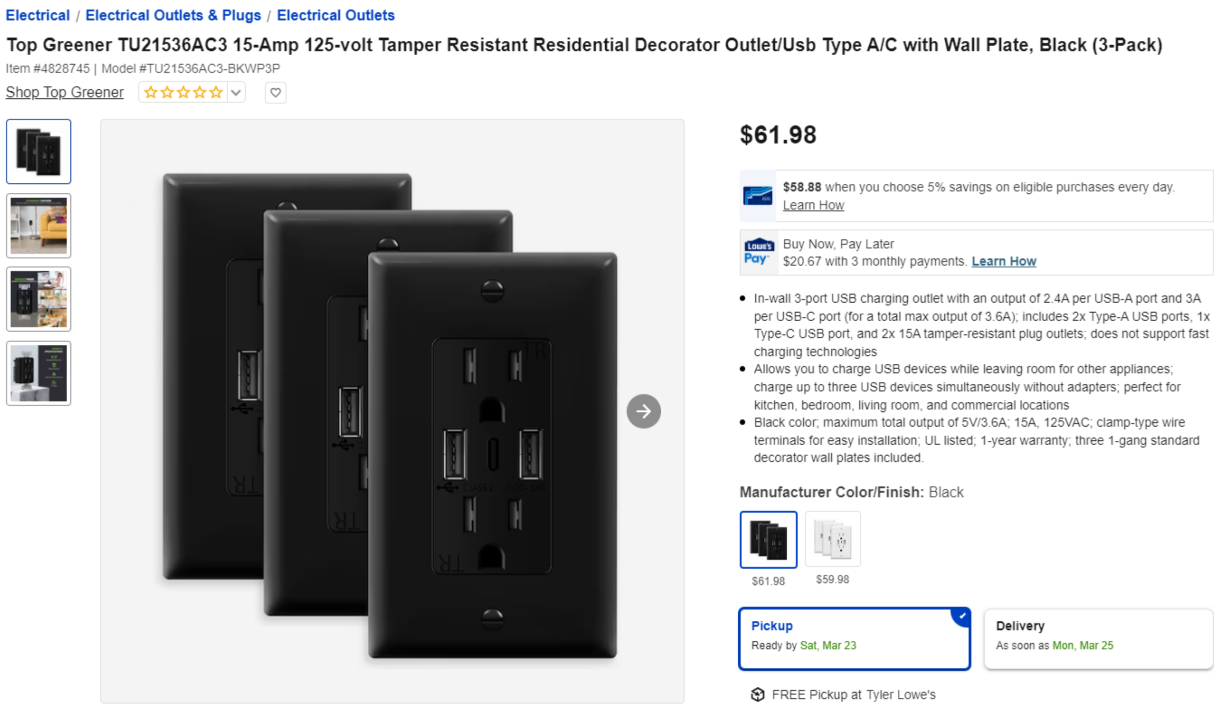
(*E.g.*, https://www.lowes.com/pd/Top-Greener-20-Amp-Tamper-Resistant-Receptacle-3-Port-USB-Type-C-A-Wall-Outlet-White-3-Pack/5014128993?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Tamper-Resistant-Receptacle-2-Port-USB-C-Wall-Outlet-White-3-Pack/5014129005?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Tamper-Resistant-Receptacle-2-Port-USB-C-Wall-Outlet-Black-3-Pack/5014128999?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Tamper-Resistant-Receptacle-3-Port-Type-C-A-USB-Wall-Outlet-Black-3-Pack/5014128991?idProductFound=false&idExtracted=true).

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- 4,000 mAh portable power bank
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- Charges 2 devices at once
- Output: 15 watt USB-C; 10 watt USB
- Ultra-slim and lightweight
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- LED battery indicator
- Up to 2 hours rapid recharge
- Up to 13 hours extra battery life

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SDS
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Warranty Guide
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(*E.g.*, https://www.lowes.com/pd/Naztech-Type-C-USB-A-Wall-Outlet-Charger-2/5013960091?idProductFound=false&idExtracted=true).

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- 30 watt USB-C PD output

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Need fast charging power on the road for your newest USB-C gear? The Naztech Turbo 30-Watt USB-C PD + USB-C Car Charger features 2 USB-C ports that are engineered to each deliver a powerful 3 amp maximum output! The bottom port is enhanced even further with a specialized power delivery chipset which offers up to 30 watts of high voltage charging power! With over 9x the power of standard chargers, this one charger works with even the most power-hungry devices. You can even fast charge the Galaxy Note 10/Note 10+, and Galaxy S10/10+, or the iPhone 11/iPhone 11 Pro/iPhone Pro Max, XS/XS, Max/XR from 0 to 50% in just 30 minutes! Now you can enjoy the latest in high-speed technology and always arrive fully charged!

- Power delivery technology
- Charge 2 devices simultaneously
- 30 watt USB-C PD output
- Total 45 watt maximum output
- USB-C, micro USB, and Lightning device compatible
- IntelliQ smart chip technology
- Sleek low profile design
- Durable construction
- Glossy black finish

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(*E.g.*, https://www.lowes.com/pd/Naztech-Turbo-30-Watt-USB-C-PD-USB-C-Car-Charger/5001541923?idProductFound=false&idExtracted=true).

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- Heavy-duty DC charger
- Heavy-duty vinyl construction: Standard level charging
- USB-C compatible: Safely charge and sync devices

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This heavy-duty charger features a 6-foot coiled cable with a USB-C(TM) connection. Featuring two USB ports, this charger allows three devices to charge simultaneously while on-the-go. Have your devices ready to go when you arrive at your destination.

- Heavy-duty DC charger
- Heavy-duty vinyl construction: Standard level charging
- USB-C compatible: Safely charge and sync devices
- Dual USB plus charging cable: Charge up to 3 devices simultaneously
- 6 foot heavy-duty coiled cable: Prevents tangling and makes cable easy to store
- 7.8 AMP total output: Powerful charging
- Qualcomm® Quick Charge(TM) 3.0 technology
- Fastest and most efficient charging for your devices

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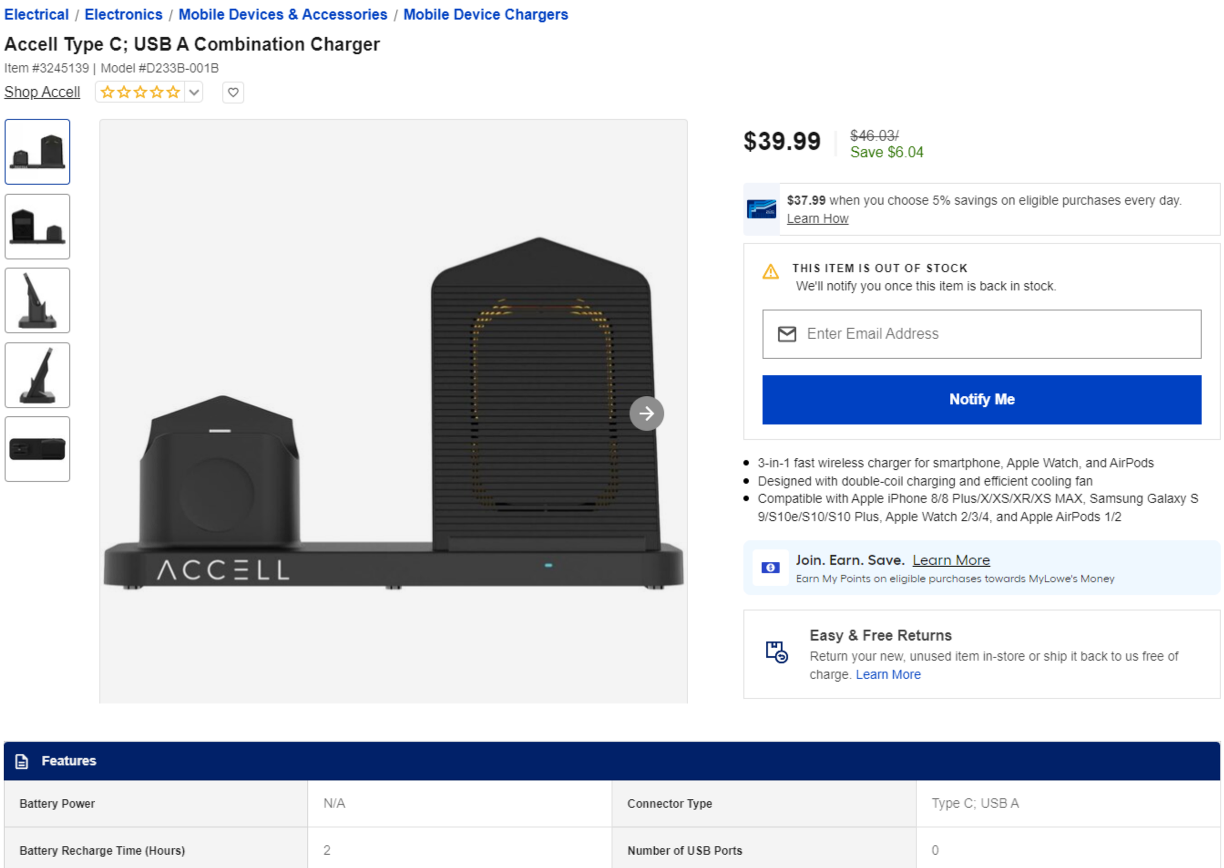
Warranty Guide
PDF

(*E.g.*, https://www.lowes.com/pd/RoadKing-RoadKing-12V-DC-3-0-Charger-with-Dual-USB/5001602165?idProductFound=false&idExtracted=true).

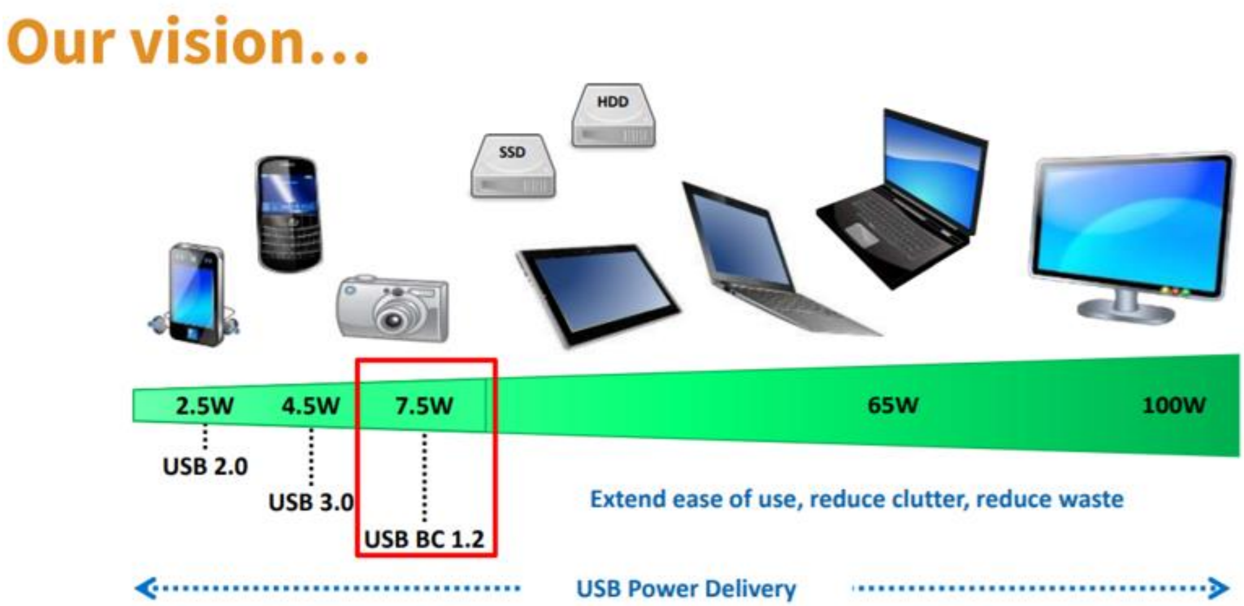


(*E.g.*, https://www.lowes.com/pd/Accell-3-in-1-Fast-Wireless-Charger-Black/5001208577?idProductFound=false&idExtracted=true).

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See USB 2.0	
USB 3.2	5 V	See USB 3.2	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

20. On information and belief, Defendant provides the '187 Accused Chargers which includes power circuitry to provide DC power. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, to charge a portable electronic device, a USB cable is connected to the USB power supply. Further, the other end of the USB cable is connected to the charging port of a portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the USB power supply comprises power circuitry to provide DC power to a portable electronic device.

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

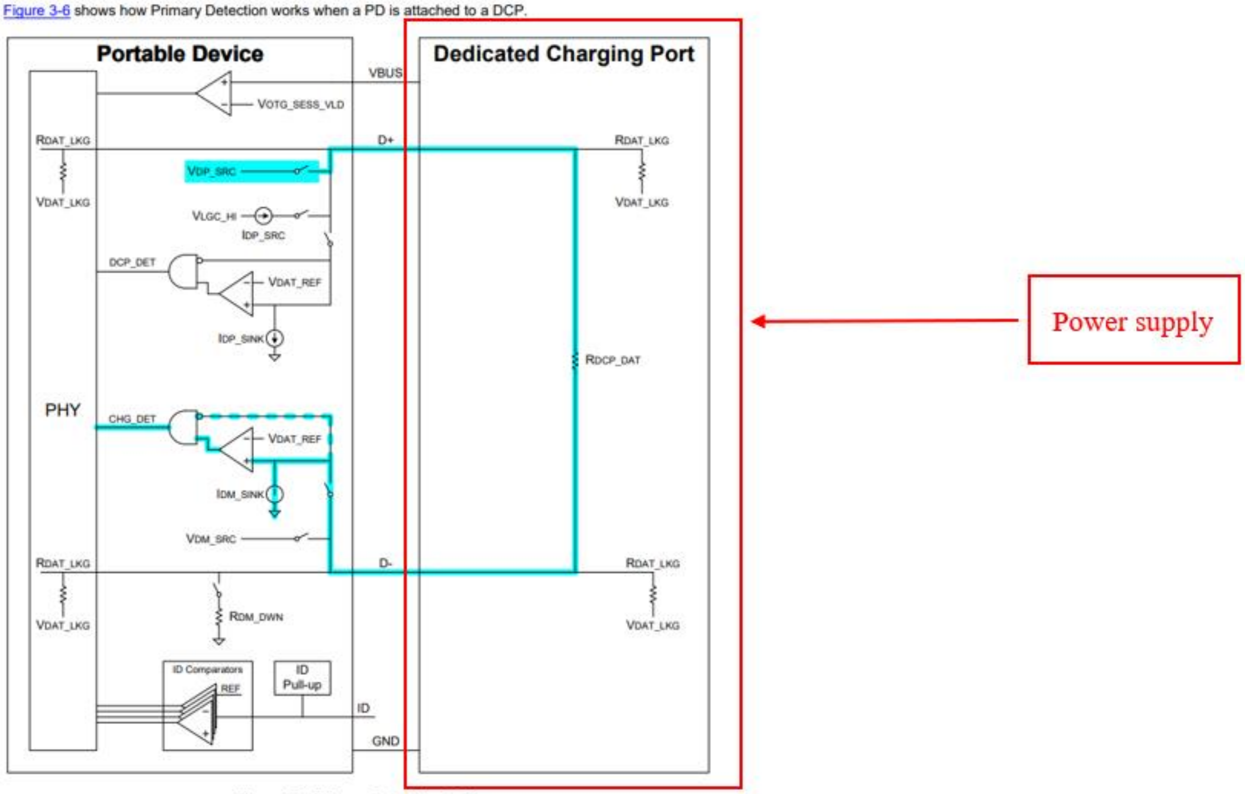


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

21. Defendant provides a product or system, such as the '187 Accused Chargers, that include data circuitry to receive a first signal originating from the portable electronic device and to provide a second signal to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the USB power supply comprises data circuitry configured to use the Primary Detection method as described in the USB BC 1.2 specification. For example, during Primary Detection, when a portable electronic device is connected with the power supply through the USB cable, the portable electronic device generates a D+ signal ("first signal"). Data circuitry of the USB power supply receives a D+ signal ("first signal") and provides a D- signal ("second signal") to the portable electronic device to detect the type of connected power supply (standard downstream port or charging port). The D+ signal and D- signal are separate signals. The D+ signal originates at the portable electronic device and is received by the power supply. When the D+ signal passes through the resistor R_{DCP_DAT}, the resistance causes the voltage to drop, creating a new D- signal to be transmitted to the portable electronic device via the D- pin. Thus, the D+ signal is received by the power supply at one voltage and the D- signal is transmitted to the portable electronic device at a second voltage. To the extent the D- signal (*i.e.*, "second signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of

charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

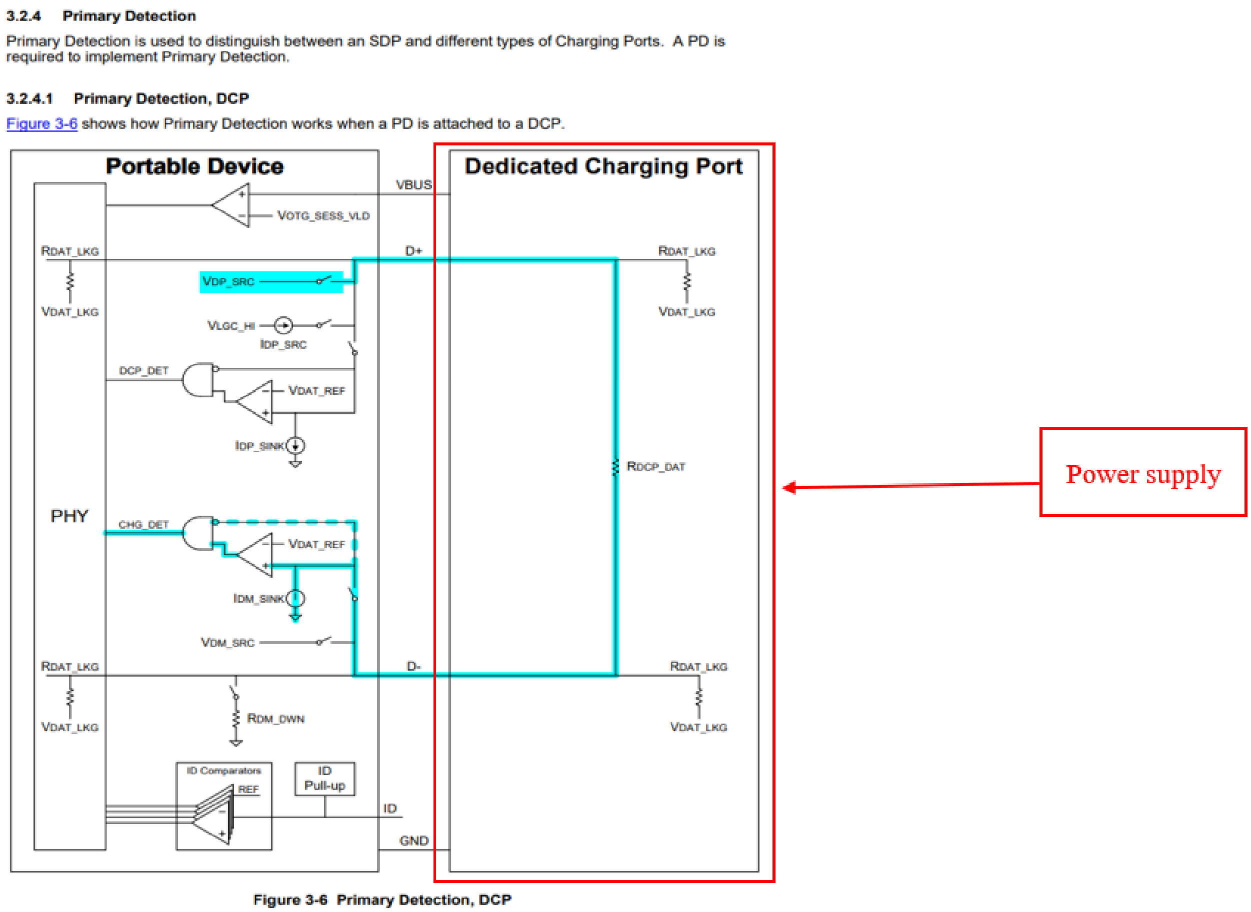
- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw IDEV_CHG without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).



(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

22. Defendant provides a product or system, such as the '187 Accused Chargers, that include a connector disposed on a cable end, the connector having four conductors for detachably mating with a power input opening of the portable electronic device, the first and second conductors transferring the DC power and its ground reference to the portable electronic device, the third conductor transferring the first signal from the portable electronic device to the data circuitry, and the fourth conductor transferring the second signal from the data circuitry to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the USB power supply connects to the portable electronic device through a USB cable. The USB cable has a USB-C connector at one end to detachably mate with the charging port of a portable electronic device. The connector comprises VBUS ("first conductor"), GND ("second conductor"), D+ ("third conductor") and D- ("fourth conductor") pins. The VBUS pin is the voltage line that provides DC power to the portable electronic device and

GND pin provides a ground reference to the portable electronic device. The D+ pin provides the D+ signal ("first signal") from the portable electronic device to the data circuitry of the USB power supply and the D- pin provides the D- signal ("second signal") from the data circuitry of the USB power supply to the portable electronic device. To the extent the D- signal (*i.e.*, "second signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

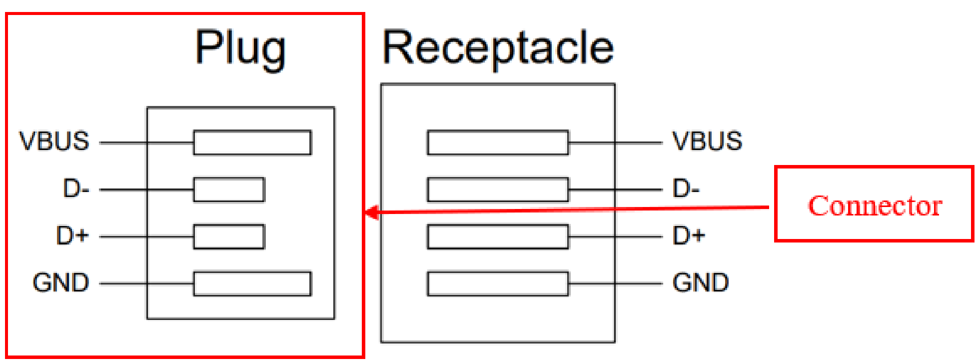


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

Figure 3-1 shows several examples of a PD attached to an SDP or Charging Port.

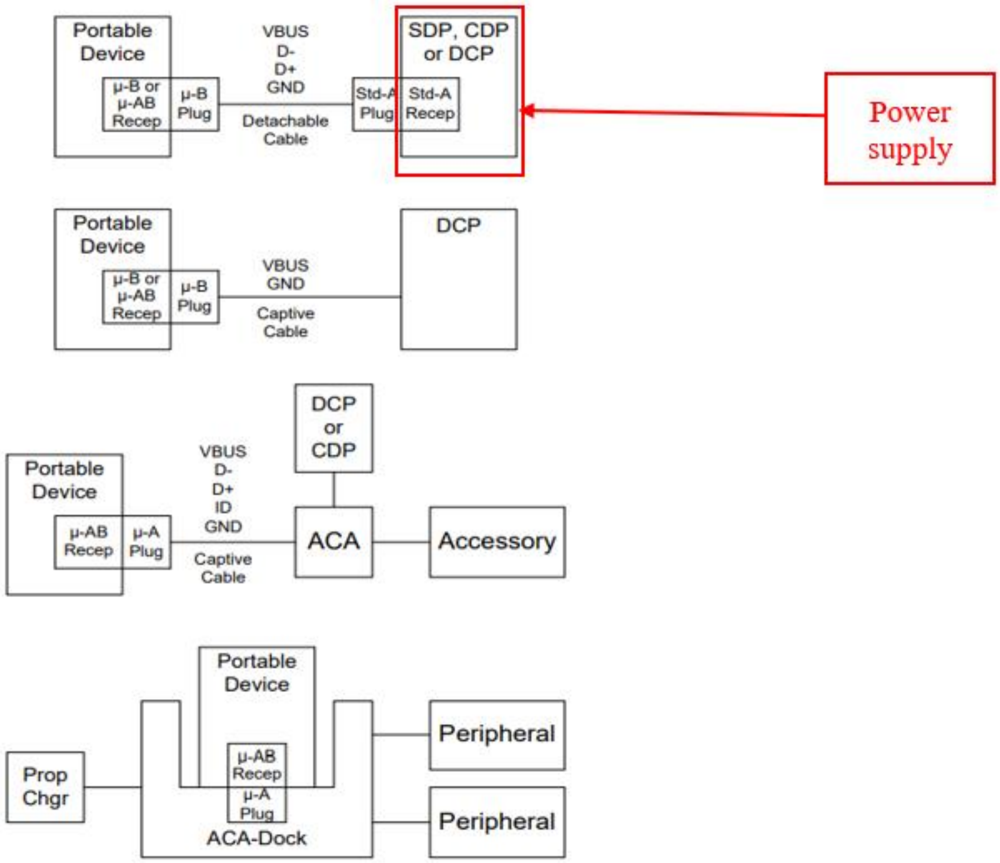


Figure 3-1 System Overview

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

3.5 Ground Current and Noise Margins

As shown in Figure 7-47 of the USB 2.0 specification, a current of 100 mA through the ground wire of a USB cable can result in a voltage difference of 25 mV between the host ground and the device ground. This ground difference has the effect of reducing noise margins for both signaling and charger detection.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 36).

Acronyms

ACA	Accessory Charger Adapter
CDP	Charging Downstream Port
DBP	Dead Battery Provision
DCD	Data Contact Detect
DCP	Dedicated Charging Port
FS	Full Speed
HS	High-Speed
LS	Low-Speed
OTG	On-The-Go
PC	Personal Computer
PD	Portable Device
PHY	Physical Layer Interface for High-Speed USB
PS2	Personal System 2
SDP	Standard Downstream Port
SRP	Session Request Protocol
TPL	Targeted Peripheral List
USB	Universal Serial Bus
USBCV	USB Command Verifier
USB-IF	USB Implementers Forum
VBUS	Voltage line of the USB interface

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page xi).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

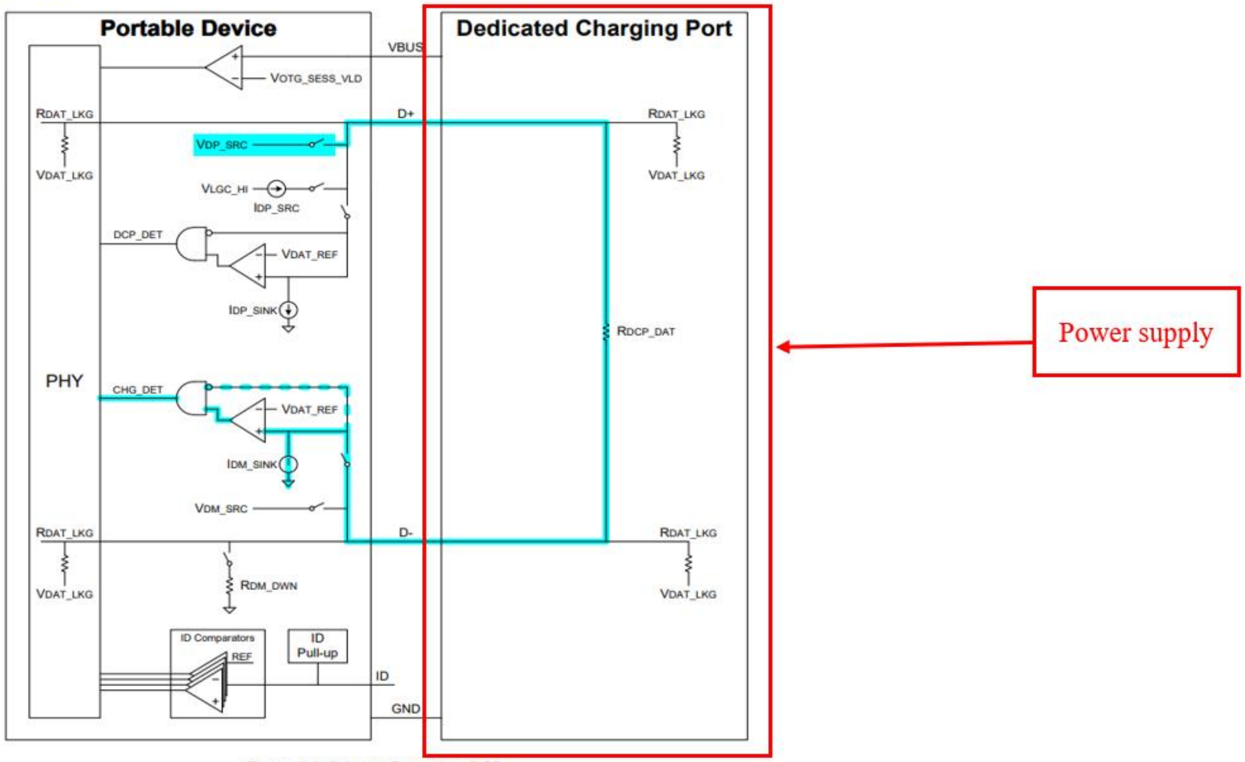


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

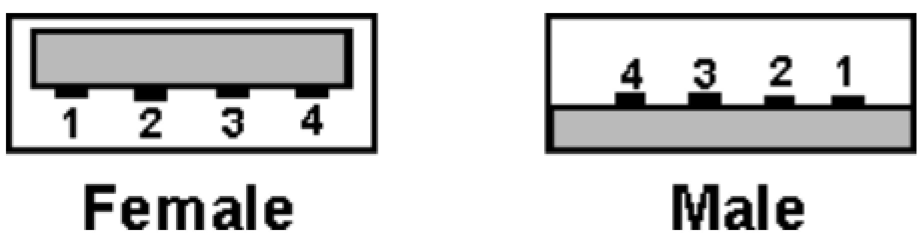
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

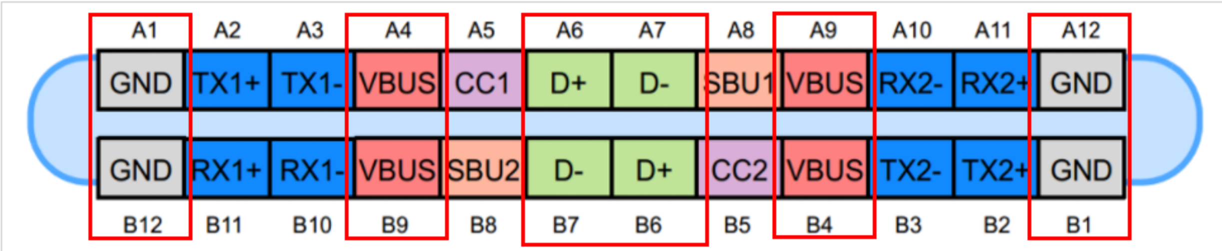


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

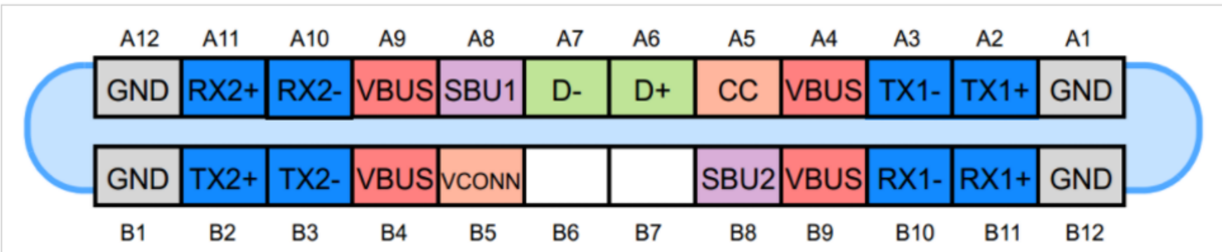


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

23. Defendant provides a product or system with data circuitry, such as in '187 Accused Chargers, that in response to the first signal, provides the second signal to the portal electronic device, the second signal being an analog signal having a parameter level to indicate to the portable electronic device the potential power output level of the power supply system. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, as described above, the USB power supply comprises data circuitry configured to use the Primary Detection method of the USB BC 1.2 specification. The USB power supply shorts the D+ to D- through a resistance of RDCP_DAT, such that in response to the D+ signal ("first signal"), the data circuitry of the power supply provides the D- signal ("second signal") to the portable electronic device. The portable electronic device compares the D- signal's voltage ("parameter") level with a reference voltage to indicate the potential power output level of the connected power supply. Therefore, the

D- signal is an analog signal. To the extent the D- signal (*i.e.*, “second signal”) is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

USB battery charging specifications

<u>Battery Charging Specification Revision 1.2 (BC1.2)</u>

The different port types described in the above section were first defined in the *Battery Charging Specification Revision 1.2* (BC1.2) published in 2010. In addition to the port definitions, BC1.2 specifies primary and secondary charge port detection sequences and port specific performance requirements. These include required operating range, undershoot, detection signaling, and connectors for each port type. Also included are dead, weak, and good battery charge conditions, port shutdown procedures, and other details associated with battery charging.

BC1.2 was published after USB 2.0 but before USB 3.1 and so the information in BC1.2 refers to USB 2.0. The specification is, however, consistent and compatible with USB 3.1.

(*E.g.*, https://www.lightingglobal.org/wp-content/uploads/2017/12/Issue-24_USB-smartphone-charging-final.pdf, page 4).

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw IDEV_CHG without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

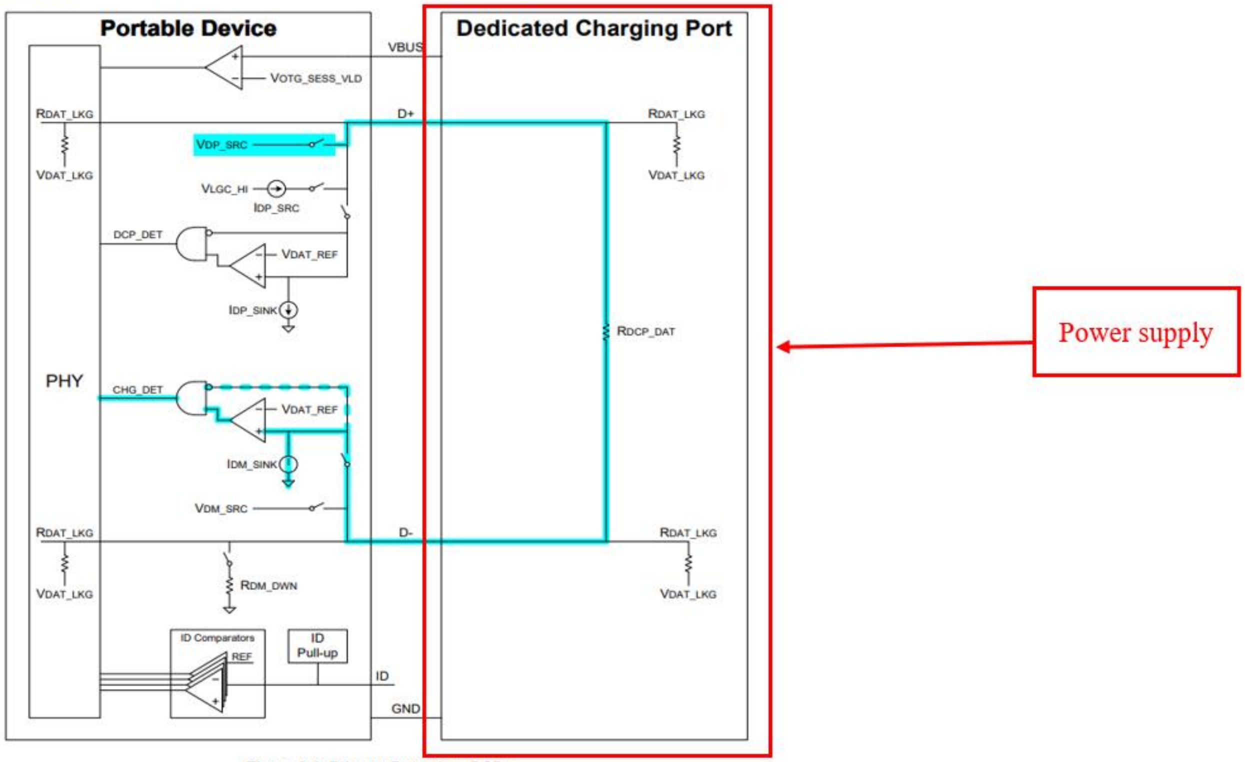


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

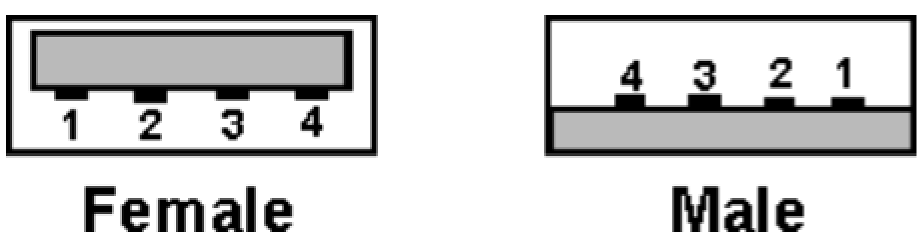
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

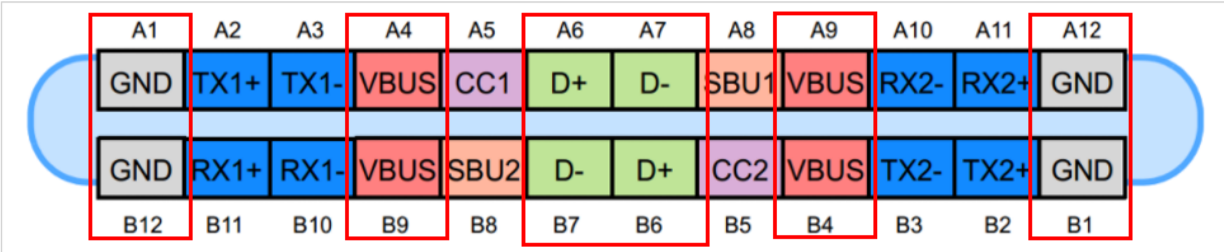


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

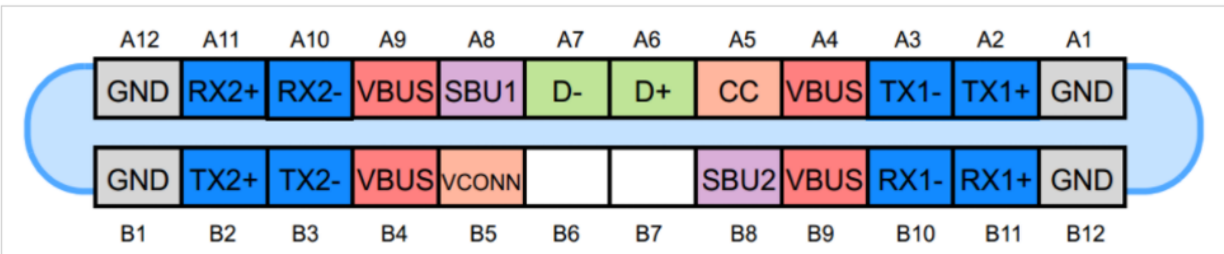


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

24. Defendant provides a product or system, including the '187 Accused Chargers, in which the power circuitry of the power supply system converts power from an external power source to DC power. For example, to charge a portable electronic device, a USB cable is connected to the external USB power supply. Further, the other end of a USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the external USB power supply system comprises power circuitry to provide DC power to the portable electronic device.

B. Infringement for Compliance with Power Delivery Standard

25. Upon information and belief, Defendant has directly infringed claims 8 and 9, of the '187 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering for sale and/or importing products including a power supply system, the power supply system being external to a portable electronic device and providing DC power, such products including, but not limited to, the following: Urban Factory HUBEE Plus USB-C Multi-Stream Mobile Station with 100-Watt Power Delivery (Item #5232138,Model #UBFTCM16UF); Urban Factory HUBEE mini USB-C Multi-Display 4K Docking Station with 100-Watt Power Delivery (Item #5232136, Model #UBFTCD45UF); Just Wireless Portable Power Bank 15K USB-C/A - 15000mAh (Item #3351754, Model #06175); Just Wireless 20,000mAh Power Bank with Fast Charge and 3 USB Ports (Item #3351755, Model #06177); DEWALT Type C USB A Wall Outlet Charger 2 (Item #1299595, Model #131 0851 DW2); DEWALT Type C USB A Car Charger 4 (Item #1299597, Model #141 9009 DW2); DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2); and Naztech Micro USB USB-C Lightning Car Charger 2 (Item #3637774; Model #14390) which comply with Universal Serial Bus Power Delivery Specification, Revision 2.0 January 2017. ("'187 Accused PD Chargers").

26. Defendant makes, uses, sells, offers for sale and/or imports products including the '187 Accused PD Chargers, that are or include a power supply system for providing DC power to a portable electronic device, the power supply system (*e.g.*, the '187 Accused PD Chargers) being external to the portable electronic device. Upon information and belief, the '187 Accused PD Chargers include circuitry that is compliant with at least Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014 (along with other subsequent revisions of Type-C specification), and Universal Serial Bus Power Delivery Specification, Revision 2.0 January 2017.

27. On information and belief, Defendant provides the '187 Accused PD Chargers which includes power circuitry to provide DC power. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, to charge a portable electronic device,

a USB cable is connected to the USB power supply. Further, the other end of the USB cable is connected to the charging port of a portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the USB power supply comprises power circuitry to provide DC power to a portable electronic device.

28. Defendant provides a product or system, such as the '187 Accused PD Chargers, that include data circuitry to receive a first signal originating from the portable electronic device and to provide a second signal to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, a portable device provides a CC1/CC2 signal ("first signal") through the USB-C port to configure the device and transfer data. For example, in response to the CC1/CC2 signal ("first signal"), the data circuitry of the '187 Accused PD Charger provides RX signal ("second signal") to the portable electronic device to configure the device and transfer data. The RX signal is an analog signal such that the signals are able to assume a plurality of voltages.

> The USB Type-C receptacle, plug and cable designs are intended to support future USB functional extensions. As such, consideration was given to frequency scaling performance, pin-out arrangement and the configuration mechanisms when developing this solution. The definition of future USB functional extensions is not in the scope of this specification but rather will be provided in future releases of the base USB Specification, i.e., beyond the existing *USB 3.1 Specification*.
>
> Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both *USB 2.0* (D+ and D−) and *USB 3.1* (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1–	VBUS	CC1	D+	D–	SBU1	VBUS	RX2–	RX2+	GND
GND	RX1+	RX1–	VBUS	SBU2	D–	D+	CC2	VBUS	TX2–	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

To establish the proper routing of the active USB data bus from DFP to UFP, the standard USB Type-C cable is wired such that a single CC wire is position aligned with the first USB SuperSpeed signal pairs (SSTXp1/SSTXn1 and SSRXp1/SSRXn1) – in this way, the CC wire and USB SuperSpeed data bus wires that are used for signaling within the cable track with regard to the orientation and twist of the cable. By being able to detect which of the CC pins (CC1 or CC2) at the receptacle is terminated by the UFP, the DFP is able to determine which SuperSpeed USB signals are to be used for the connection and the DFP can use this to control the functional switch for routing the SuperSpeed USB signal pairs. Similarly in the UFP, detecting which of the CC pins at the receptacle is terminated by the DFP allows the UFP to control the functional switch that routes its SuperSpeed USB signal pairs.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

5.2 Physical Layer Functions

The USB PD Physical Layer consists of a pair of transmitters and receivers that communicate across a single signal wire (V_{BUS} or CC). All communication is half duplex. The PHY Layer practices collision avoidance to minimize communication errors on the channel.

(*E.g.*, https://usb.org/sites/default/files/USB%20Power%20Delivery%2020210706.zip, Universal Serial Bus Power Delivery Specification, Revision 2.0 Release January 2017, Page 104).

2.3 Configuration Process

The USB Type-C receptacle, plug and cable solution incorporates a configuration process to detect a downstream facing port to upstream facing port (DFP-to-UFP) connection for VBUS management and host-to-device connected relationship determination.

The configuration process is used for the following:

- DFP-to-UFP attach/detach detection
- Plug orientation/cable twist detection
- Initial DFP-to-UFP (host-to-device) and power relationships detection
- USB Type-C VBUS current detection and usage
- USB PD communication
- Discovery and configuration of functional extensions

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 20).

2.3.1 DFP-to-UFP Attach/Detach Detection

Initially, DFP-to-UFP attach is detected by a host or hub port (DFP) when one of the CC pins at its USB Type-C receptacle senses a specified resistance to GND. Subsequently, DFP-to-UFP detach is detected when the CC pin that was terminated at its USB Type-C receptacle is no longer terminated to GND.

Power is not applied to the USB Type-C host or hub receptacle (VBUS or VCONN) until the DFP detects the presence of an attached device (UFP) port. When a DFP-to-UFP attach is detected, the DFP is expected to enable power to the receptacle and proceed to normal USB operation with the attached device. When a DFP-to-UFP detach is detected, the port sourcing VBUS removes power.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

2.3.2 Plug Orientation/Cable Twist Detection

The USB Type-C plug can be inserted into a receptacle in either one of two orientations, therefore the CC pins enable a method for detecting plug orientation in order to determine which SuperSpeed USB data signal pairs are functionally connected through the cable. This allows for signal routing, if needed, within a DFP or UFP to be established for a successful connection.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-

Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

2.3.3 Initial DFP-to-UFP (host-to-device) and Power Relationships Detection

Unlike existing USB Type-A and Type-B receptacles and plugs, the mechanical characteristics of the USB Type-C receptacle and plug do not inherently establish the relationship of USB host and device ports. The CC pins on the receptacle also serve to establish an initial DFP-to-UFP and power relationships prior to the normal USB enumeration process.

For the purpose of defining how the CC pins are used to establish the initial DFP-to-UFP relationship, the following port behavior modes are defined.

1. Host-only – for this mode, the port exclusively behaves as a DFP
2. Device-only – for this mode, the port exclusively behaves as a UFP
3. Dual-role – for this mode, the port can behave either as a DFP or UFP

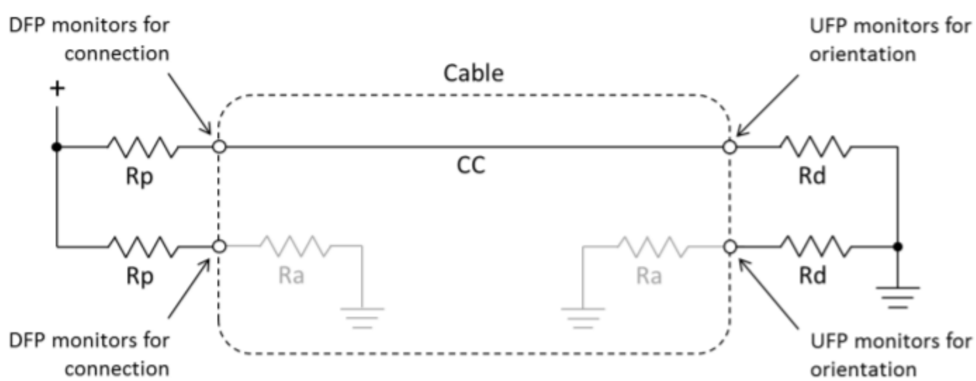
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2	SSTXp1	Positive half of first SuperSpeed TX differential pair	Second	B11	SSRXp1	Positive half of first SuperSpeed RX differential pair	Second
A3	SSTXn1	Negative half of first SuperSpeed TX differential pair	Second	B10	SSRXn1	Negative half of first SuperSpeed RX differential pair	Second
A4	VBUS	Bus Power	First	B9	VBUS	Bus Power	First
A5	CC1	Configuration Channel	Second	B8	SBU2	Sideband Use (SBU)	Second
A6	Dp1	Positive half of the USB 2.0 differential pair – Position 1	Second	B7	Dn2	Negative half of the USB 2.0 differential pair – Position 2	Second
A7	Dn1	Negative half of the USB 2.0 differential pair – Position 1	Second	B6	Dp2	Positive half of the USB 2.0 differential pair – Position 2	Second
A8	SBU1	Sideband Use (SBU)	Second	B5	CC2	Configuration Channel	Second
A9	VBUS	Bus Power	First	B4	VBUS	Bus Power	First
A10	SSRXn2	Negative half of second SuperSpeed RX differential pair	Second	B3	SSTXn2	Negative half of second SuperSpeed TX differential pair	Second
A11	SSRXp2	Positive half of second SuperSpeed RX differential pair	Second	B2	SSTXp2	Positive half of second SuperSpeed TX differential pair	Second
A12	GND	Ground return	First	B1	GND	Ground return	First

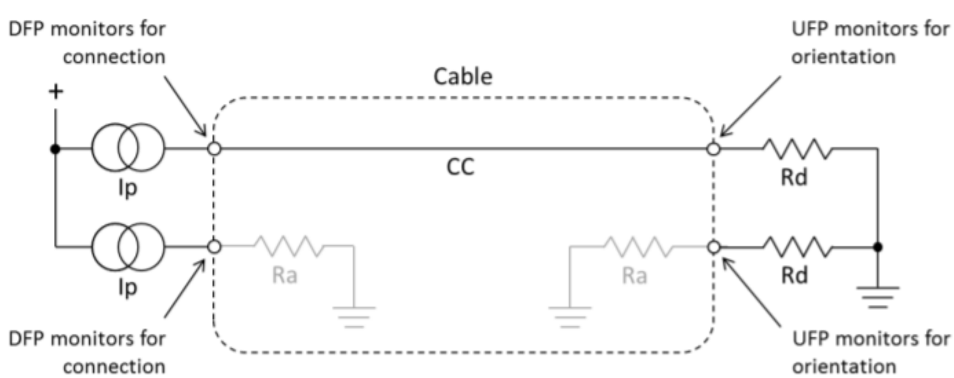
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 49).

Figure 4-5 Pull-Up/Pull-Down CC Model



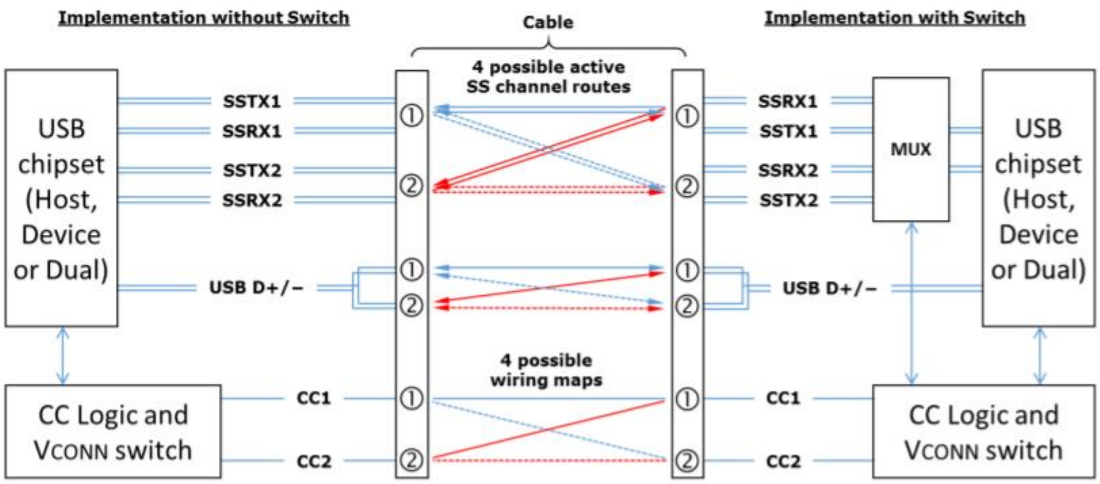
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 107).

Figure 4-6 Current Source/Pull-Down CC Model



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 107).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 104).

2.4 VBUS

VBUS provides a path to deliver power between a host and a device, and between a charger and a host/device. A simplified high-current supply capability is defined for hosts and chargers that optionally support current levels beyond the *USB 2.0* and *USB 3.1* specifications. The *USB Power Delivery Specification* is supported.

Table 2-1 summarizes the power supply options available from the perspective of a device with the USB Type-C connector. Not all options will be available to the device from all host

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-

Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 22).

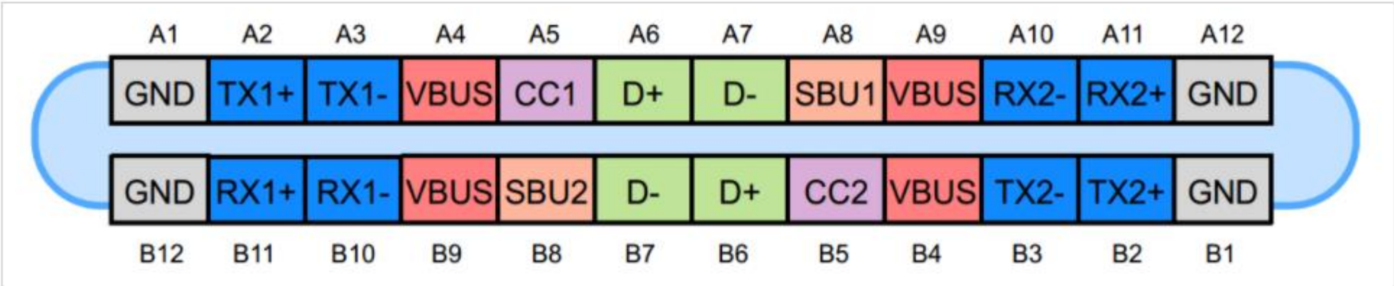


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

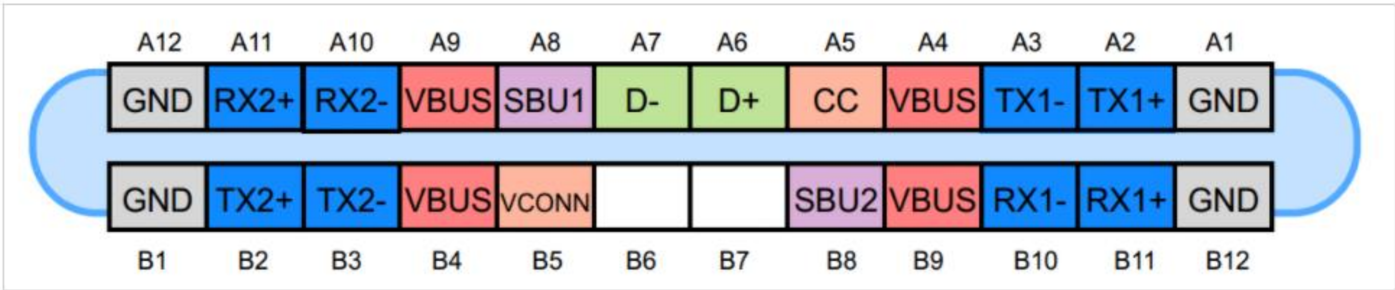


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

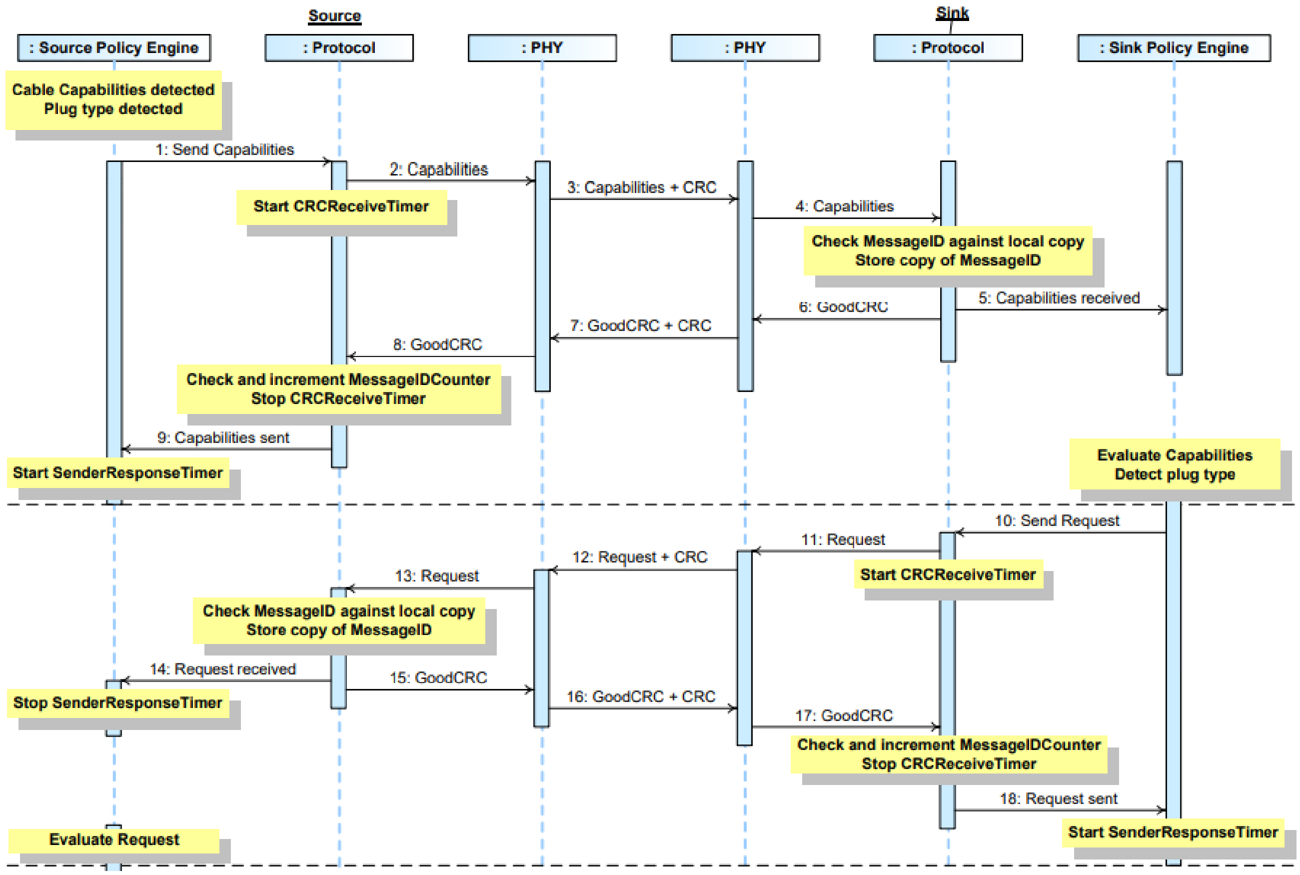
8.3.2.3 **Power Negotiation**

Figure 8-5 illustrates an example of a successful Message flow during Power Negotiation. The negotiation goes through 5 distinct phases:

- The Source sends out its power capabilities in a ***Source_Capabilities*** Message.
- The Sink evaluates these capabilities and in the request phase selects one power level by sending a ***Request*** Message.
- The Source evaluates the request and accepts the request with an ***Accept*** Message.
- The Source transitions to the new power level and then informs the Sink by sending a ***PS_RDY*** Message.
- The Sink starts using the new power level.

(*E.g.*, https://usb.org/sites/default/files/USB%20Power%20Delivery%2020210706.zip, Universal Serial Bus Power Delivery Specification, Revision 2.0 Release January 2017, Page 297)

Figure 8-5 Successful Power Negotiation



(*E.g.*, https://usb.org/sites/default/files/USB%20Power%20Delivery%2020210706.zip, Universal Serial Bus Power Delivery Specification, Revision 2.0 Release January 2017, Page 298)

> To establish the proper routing of the active USB data bus from DFP to UFP, the standard USB Type-C cable is wired such that a single CC wire is position aligned with the first USB SuperSpeed signal pairs (SSTXp1/SSTXn1 and SSRXp1/SSRXn1) – in this way, the CC wire and USB SuperSpeed data bus wires that are used for signaling within the cable track with regard to the orientation and twist of the cable. By being able to detect which of the CC pins (CC1 or CC2) at the receptacle is terminated by the UFP, the DFP is able to determine which SuperSpeed USB signals are to be used for the connection and the DFP can use this to control the functional switch for routing the SuperSpeed USB signal pairs. Similarly in the UFP, detecting which of the CC pins at the receptacle is terminated by the DFP allows the UFP to control the functional switch that routes its SuperSpeed USB signal pairs.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

29. Defendant provides a product or system, such as the '187 Accused PD Chargers, that include a connector disposed on a cable end, the connector having four conductors for detachably mating with a power input opening of the portable electronic device, the first and second conductors transferring the DC power and its ground reference to the portable electronic device, the third conductor transferring the first signal from the portable electronic device to the data circuitry, and the fourth conductor transferring the second signal from the data circuitry to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the adapter connects to the portable electronic device through a USB cable. The USB cable has a connector of the type including but not limited to USB-C at one end to detachably mate with the charging port of a portable electronic device. The connector comprises VBUS ("first conductor"), GND ("second conductor"), CC1/CC2 ("third conductor"), and RX ("fourth conductor") pins. Further, the VBUS (Voltage line of the USB interface) pin is the voltage line that provides DC power to the portable electronic device and the GND pin provides a ground reference to the portable electronic device. Further, the CC1/CC2 pin provides the CC signal ("first signal") from the portable electronic device to the data circuitry of the adapter, and RX pin provides the RX signal ("second signal") from the data circuitry of the adapter to the portable electronic device.

The USB Type-C receptacle, plug and cable designs are intended to support future USB functional extensions. As such, consideration was given to frequency scaling performance, pin-out arrangement and the configuration mechanisms when developing this solution. The definition of future USB functional extensions is not in the scope of this specification but rather will be provided in future releases of the base USB Specification, i.e., beyond the existing *USB 3.1 Specification*.

Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both *USB 2.0* (D+ and D−) and *USB 3.1* (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1−	VBUS	CC1	D+	D−	SBU1	VBUS	RX2−	RX2+	GND
GND	RX1+	RX1−	VBUS	SBU2	D−	D+	CC2	VBUS	TX2−	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

To establish the proper routing of the active USB data bus from DFP to UFP, the standard USB Type-C cable is wired such that a single CC wire is position aligned with the first USB SuperSpeed signal pairs (SSTXp1/SSTXn1 and SSRXp1/SSRXn1) – in this way, the CC wire and USB SuperSpeed data bus wires that are used for signaling within the cable track with regard to the orientation and twist of the cable. By being able to detect which of the CC pins (CC1 or CC2) at the receptacle is terminated by the UFP, the DFP is able to determine which SuperSpeed USB signals are to be used for the connection and the DFP can use this to control the functional switch for routing the SuperSpeed USB signal pairs. Similarly in the UFP, detecting which of the CC pins at the receptacle is terminated by the DFP allows the UFP to control the functional switch that routes its SuperSpeed USB signal pairs.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

5.2 Physical Layer Functions

The USB PD Physical Layer consists of a pair of transmitters and receivers that communicate across a single signal wire (V_{BUS} or CC). All communication is half duplex. The PHY Layer practices collision avoidance to minimize communication errors on the channel.

(*E.g.*, https://usb.org/sites/default/files/USB%20Power%20Delivery%2020210706.zip, Universal Serial Bus Power Delivery Specification, Revision 2.0 Release January 2017, Page 104).

2.3 Configuration Process

The USB Type-C receptacle, plug and cable solution incorporates a configuration process to detect a downstream facing port to upstream facing port (DFP-to-UFP) connection for VBUS management and host-to-device connected relationship determination.

The configuration process is used for the following:

- DFP-to-UFP attach/detach detection
- Plug orientation/cable twist detection
- Initial DFP-to-UFP (host-to-device) and power relationships detection
- USB Type-C VBUS current detection and usage
- *USB PD* communication
- Discovery and configuration of functional extensions

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 20).

2.3.1 DFP-to-UFP Attach/Detach Detection

Initially, DFP-to-UFP attach is detected by a host or hub port (DFP) when one of the CC pins at its USB Type-C receptacle senses a specified resistance to GND. Subsequently, DFP-to-UFP detach is detected when the CC pin that was terminated at its USB Type-C receptacle is no longer terminated to GND.

Power is not applied to the USB Type-C host or hub receptacle (VBUS or VCONN) until the DFP detects the presence of an attached device (UFP) port. When a DFP-to-UFP attach is detected, the DFP is expected to enable power to the receptacle and proceed to normal USB operation with the attached device. When a DFP-to-UFP detach is detected, the port sourcing VBUS removes power.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

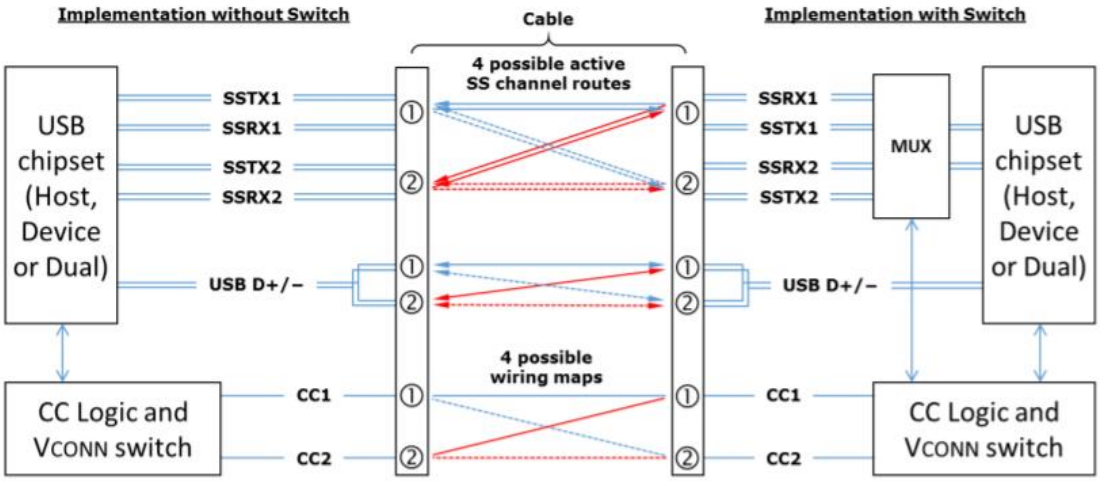
2.3.2 Plug Orientation/Cable Twist Detection

The USB Type-C plug can be inserted into a receptacle in either one of two orientations, therefore the CC pins enable a method for detecting plug orientation in order to determine which SuperSpeed USB data signal pairs are functionally connected through the cable. This allows for signal routing, if needed, within a DFP or UFP to be established for a successful connection.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-

Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D– signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 104).

2.4 VBUS

VBUS provides a path to deliver power between a host and a device, and between a charger and a host/device. A simplified high-current supply capability is defined for hosts and chargers that optionally support current levels beyond the USB 2.0 and USB 3.1 specifications. The USB Power Delivery Specification is supported.

Table 2-1 summarizes the power supply options available from the perspective of a device with the USB Type-C connector. Not all options will be available to the device from all host

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 22).

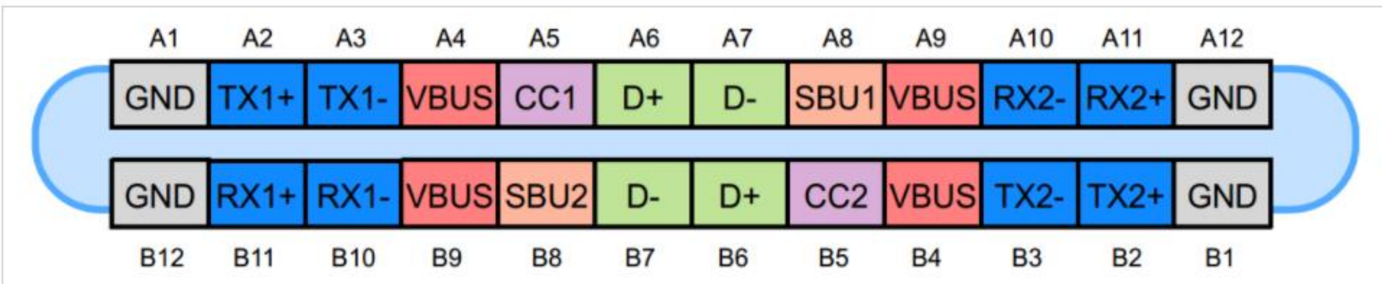


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

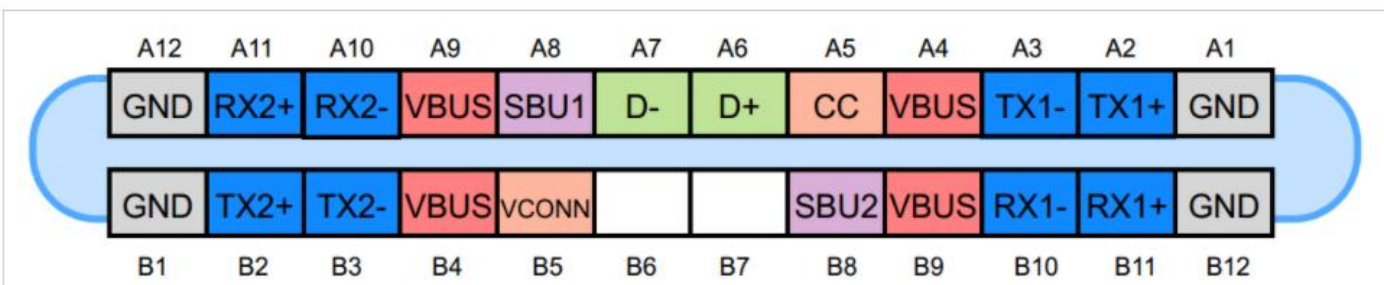


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

30. Defendant provides a product or system with the data circuitry, such as in '187 Accused PD Charger, that in response to the first signal, provides the second signal to the portal electronic device, the second signal being an analog signal having a parameter level to indicate to

the portable electronic device the potential power output level of the power supply system. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, in response to the CC1/CC2 signal ("first signal"), the data circuitry of the adapter provides RX signal ("second signal") to the portable electronic device to configure the device and transfer data. The RX signal is an analog signal such that the signals are able to assume a plurality of voltages.

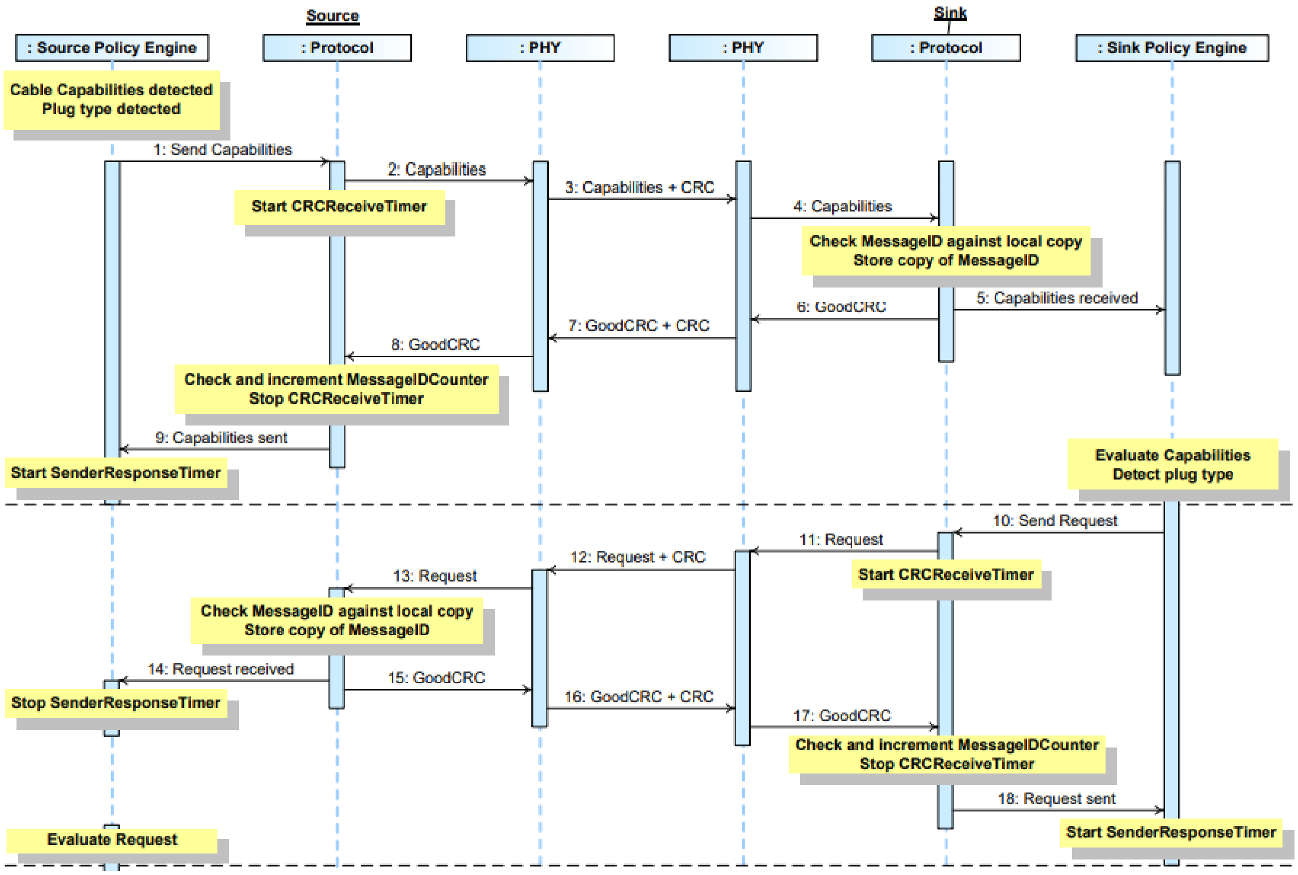
8.3.2.3 **Power Negotiation**

Figure 8-5 illustrates an example of a successful Message flow during Power Negotiation. The negotiation goes through 5 distinct phases:

- The Source sends out its power capabilities in a ***Source_Capabilities*** Message.
- The Sink evaluates these capabilities and in the request phase selects one power level by sending a ***Request*** Message.
- The Source evaluates the request and accepts the request with an ***Accept*** Message.
- The Source transitions to the new power level and then informs the Sink by sending a ***PS_RDY*** Message.
- The Sink starts using the new power level.

(*E.g.*, https://usb.org/sites/default/files/USB%20Power%20Delivery%2020210706.zip, Universal Serial Bus Power Delivery Specification, Revision 2.0 Release January 2017, Page 297).

Figure 8-5 Successful Power Negotiation



(*E.g.*, https://usb.org/sites/default/files/USB%20Power%20Delivery%2020210706.zip, Universal Serial Bus Power Delivery Specification, Revision 2.0 Release January 2017, Page 298).

> To establish the proper routing of the active USB data bus from DFP to UFP, the standard USB Type-C cable is wired such that a single CC wire is position aligned with the first USB SuperSpeed signal pairs (SSTXp1/SSTXn1 and SSRXp1/SSRXn1) – in this way, the CC wire and USB SuperSpeed data bus wires that are used for signaling within the cable track with regard to the orientation and twist of the cable. By being able to detect which of the CC pins (CC1 or CC2) at the receptacle is terminated by the UFP, the DFP is able to determine which SuperSpeed USB signals are to be used for the connection and the DFP can use this to control the functional switch for routing the SuperSpeed USB signal pairs. Similarly in the UFP, detecting which of the CC pins at the receptacle is terminated by the DFP allows the UFP to control the functional switch that routes its SuperSpeed USB signal pairs.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

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- DFP-to-UFP attach/detach detection
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- Initial DFP-to-UFP (host-to-device) and power relationships detection
- USB Type-C VBUS current detection and usage
- *USB PD* communication
- Discovery and configuration of functional extensions

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 20).

2.3.1 DFP-to-UFP Attach/Detach Detection

Initially, DFP-to-UFP attach is detected by a host or hub port (DFP) when one of the CC pins at its USB Type-C receptacle senses a specified resistance to GND. Subsequently, DFP-to-UFP detach is detected when the CC pin that was terminated at its USB Type-C receptacle is no longer terminated to GND.

Power is not applied to the USB Type-C host or hub receptacle (VBUS or VCONN) until the DFP detects the presence of an attached device (UFP) port. When a DFP-to-UFP attach is detected, the DFP is expected to enable power to the receptacle and proceed to normal USB operation with the attached device. When a DFP-to-UFP detach is detected, the port sourcing VBUS removes power.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

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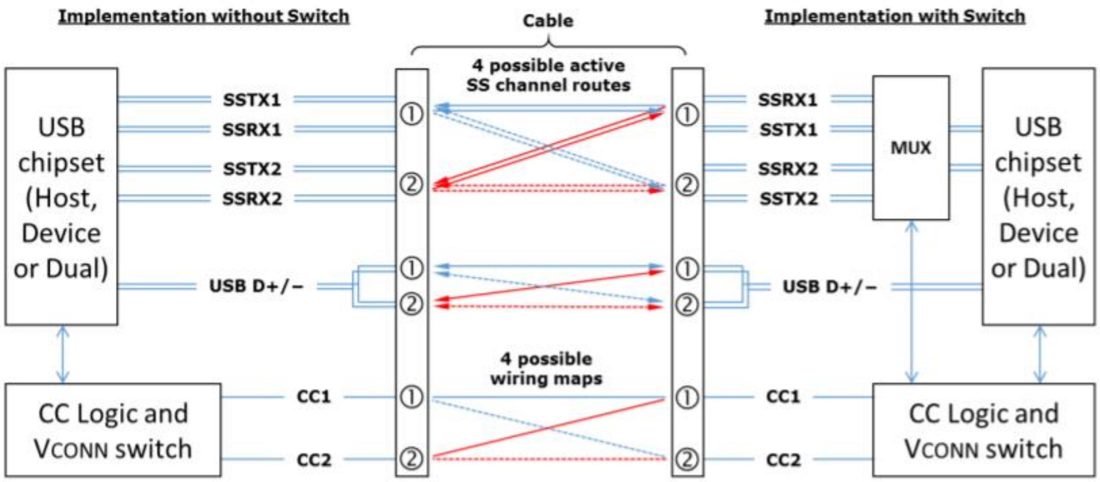
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-

Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 104).

2.3.3 Initial DFP-to-UFP (host-to-device) and Power Relationships Detection

Unlike existing USB Type-A and Type-B receptacles and plugs, the mechanical characteristics of the USB Type-C receptacle and plug do not inherently establish the relationship of USB host and device ports. The CC pins on the receptacle also serve to establish an initial DFP-to-UFP and power relationships prior to the normal USB enumeration process.

For the purpose of defining how the CC pins are used to establish the initial DFP-to-UFP relationship, the following port behavior modes are defined.

1. Host-only – for this mode, the port exclusively behaves as a DFP
2. Device-only – for this mode, the port exclusively behaves as a UFP
3. Dual-role – for this mode, the port can behave either as a DFP or UFP

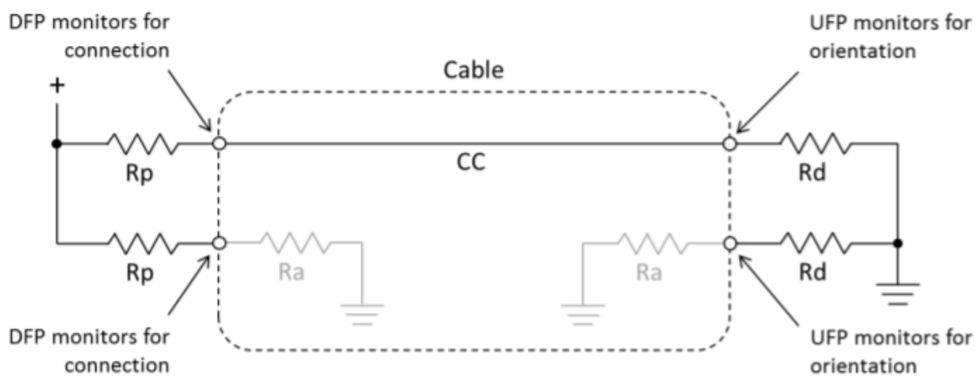
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2	SSTXp1	Positive half of first SuperSpeed TX differential pair	Second	B11	SSRXp1	Positive half of first SuperSpeed RX differential pair	Second
A3	SSTXn1	Negative half of first SuperSpeed TX differential pair	Second	B10	SSRXn1	Negative half of first SuperSpeed RX differential pair	Second
A4	VBUS	Bus Power	First	B9	VBUS	Bus Power	First
A5	CC1	Configuration Channel	Second	B8	SBU2	Sideband Use (SBU)	Second
A6	Dp1	Positive half of the USB 2.0 differential pair – Position 1	Second	B7	Dn2	Negative half of the USB 2.0 differential pair – Position 2	Second
A7	Dn1	Negative half of the USB 2.0 differential pair – Position 1	Second	B6	Dp2	Positive half of the USB 2.0 differential pair – Position 2	Second
A8	SBU1	Sideband Use (SBU)	Second	B5	CC2	Configuration Channel	Second
A9	VBUS	Bus Power	First	B4	VBUS	Bus Power	First
A10	SSRXn2	Negative half of second SuperSpeed RX differential pair	Second	B3	SSTXn2	Negative half of second SuperSpeed TX differential pair	Second
A11	SSRXp2	Positive half of second SuperSpeed RX differential pair	Second	B2	SSTXp2	Positive half of second SuperSpeed TX differential pair	Second
A12	GND	Ground return	First	B1	GND	Ground return	First

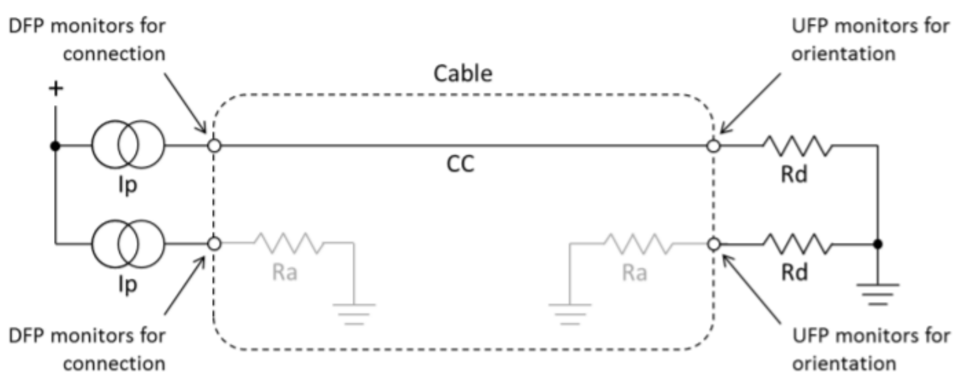
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 49).

Figure 4-5 Pull-Up/Pull-Down CC Model



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 107).

Figure 4-6 Current Source/Pull-Down CC Model



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 107).

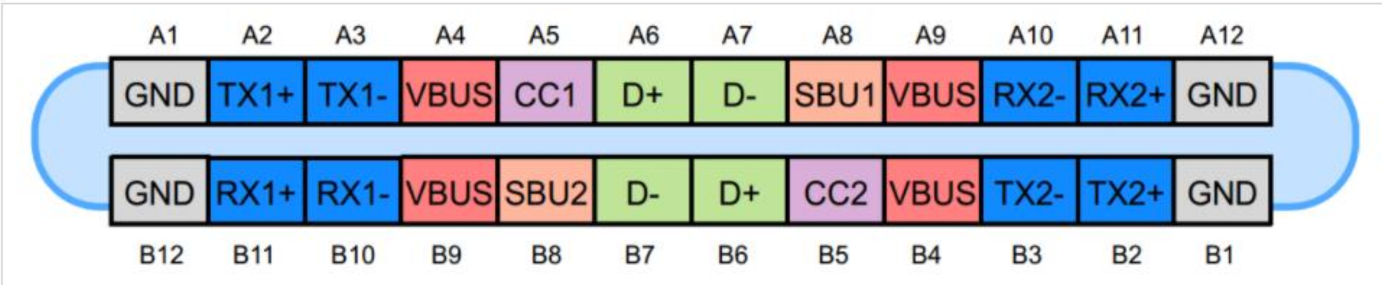


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

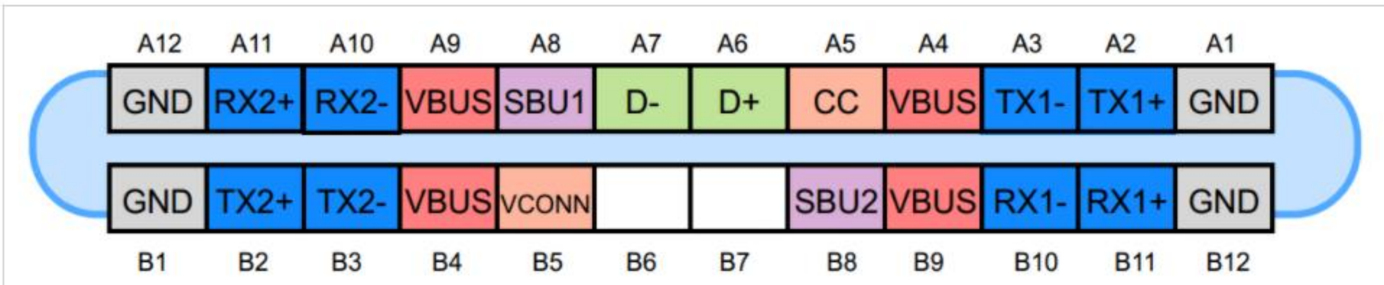


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

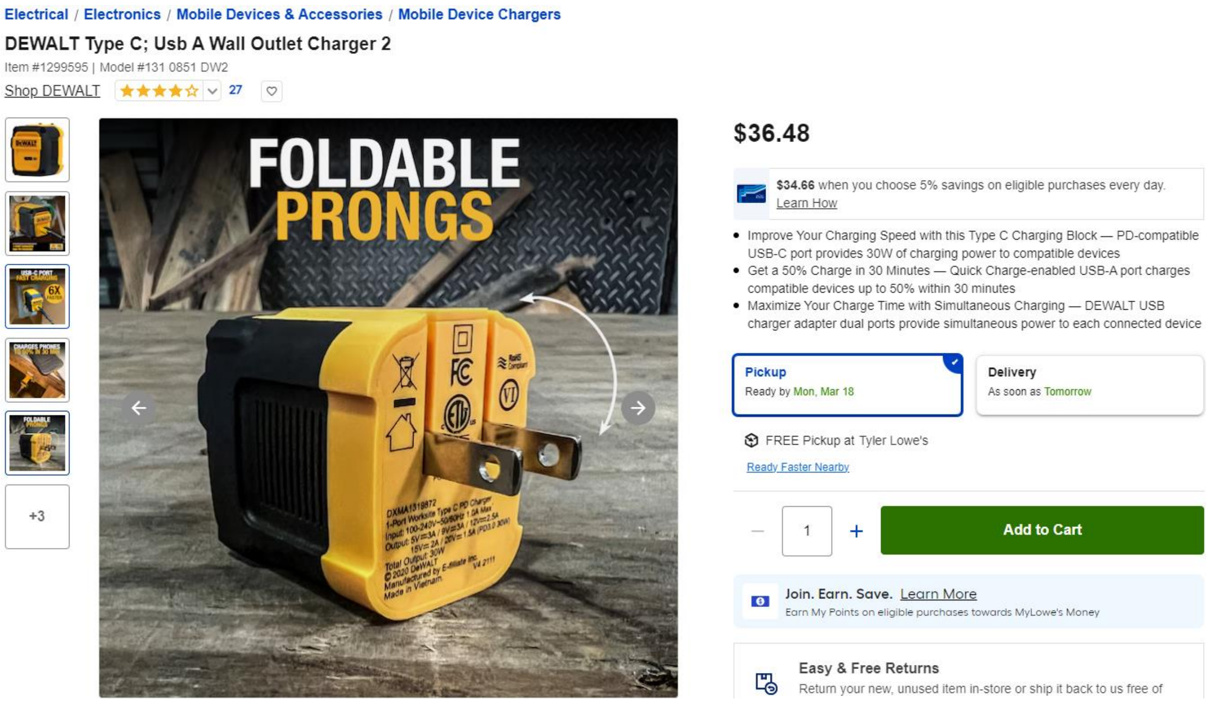
31. Defendant provides a product or system, including the '187 Accused PD Charger in which the power circuitry of the power supply system converts power from an external power source to DC power. For example, to charge a portable electronic device, a USB cable is connected to the external USB power supply. Further, the other end of a USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the external USB power supply system comprises power circuitry to provide DC power to the portable electronic device.

C. Infringement for Compliance with Quick Charge Standard

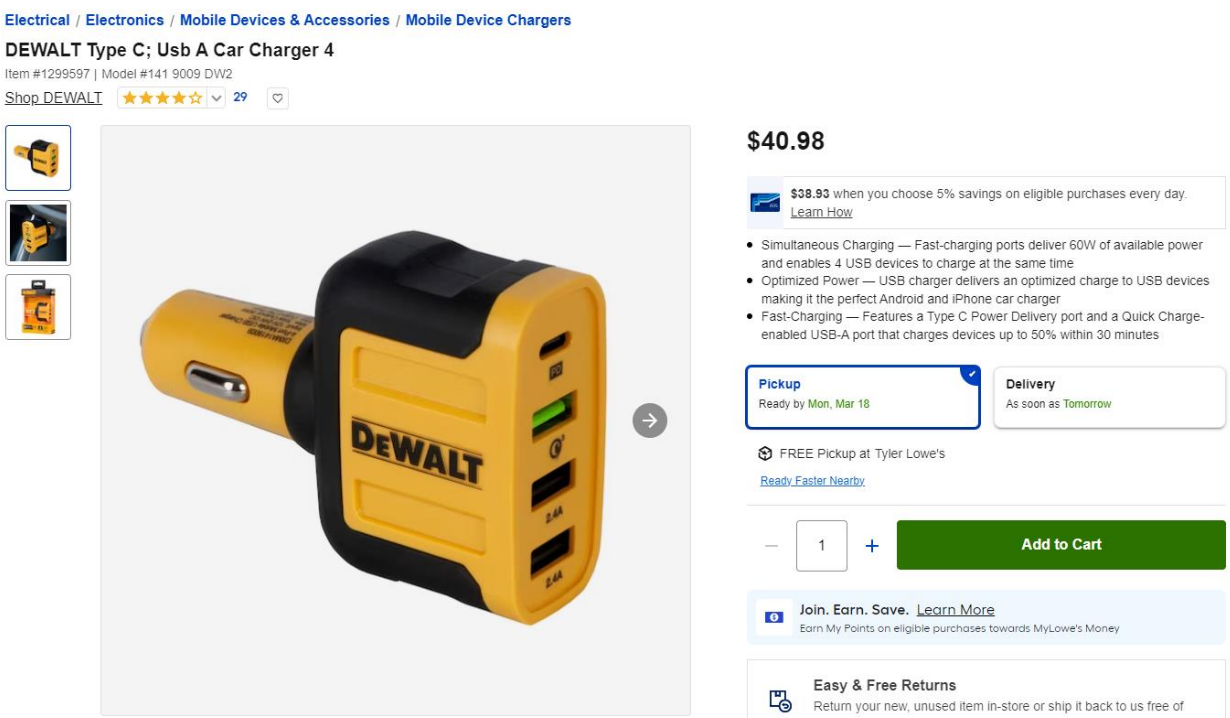
32. Upon information and belief, Defendant has directly infringed claims 8 and 9, of the '187 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering

for sale and/or importing products including a power supply system, the power supply system being external to a portable electronic device and providing DC power, such products including, but not limited to, the following: DEWALT Type C USB A Wall Outlet Charger 2 (Item #1299595, Model #131 0851 DW2); DEWALT Type C USB A Car Charger 4 (Item #1299597, Model #141 9009 DW2); DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2); miLink Micro USB USB-C Lightning Combination Charger 3 (Item #4666486, Model #CC3-J241); Trexonic 4-Port USB Charger with Quick Charge Technology, Silver, Type C and USB A Connectors, 1000mAh Battery Power (Item #1646379; Model #849105170M); and RoadKing Type C USB A Combination Charger 2 (Item #3722750; Model #RK03430) which comply with Qualcomm Quick Charge 3.0 technology ("'187 Accused QC Chargers").

33. Defendant makes, uses, sells, offers for sale and/or imports products including the '187 Accused QC Chargers, that are or include a power supply system for providing DC power to a portable electronic device, the power supply system (*e.g.*, the '187 Accused QC Chargers) being external to the portable electronic device. Upon information and belief, the '187 Accused QC Chargers include circuitry that is compliant with at least Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014 (along with other subsequent revisions of Type-C specification), and Qualcomm Quick Charge 3.0 technology.

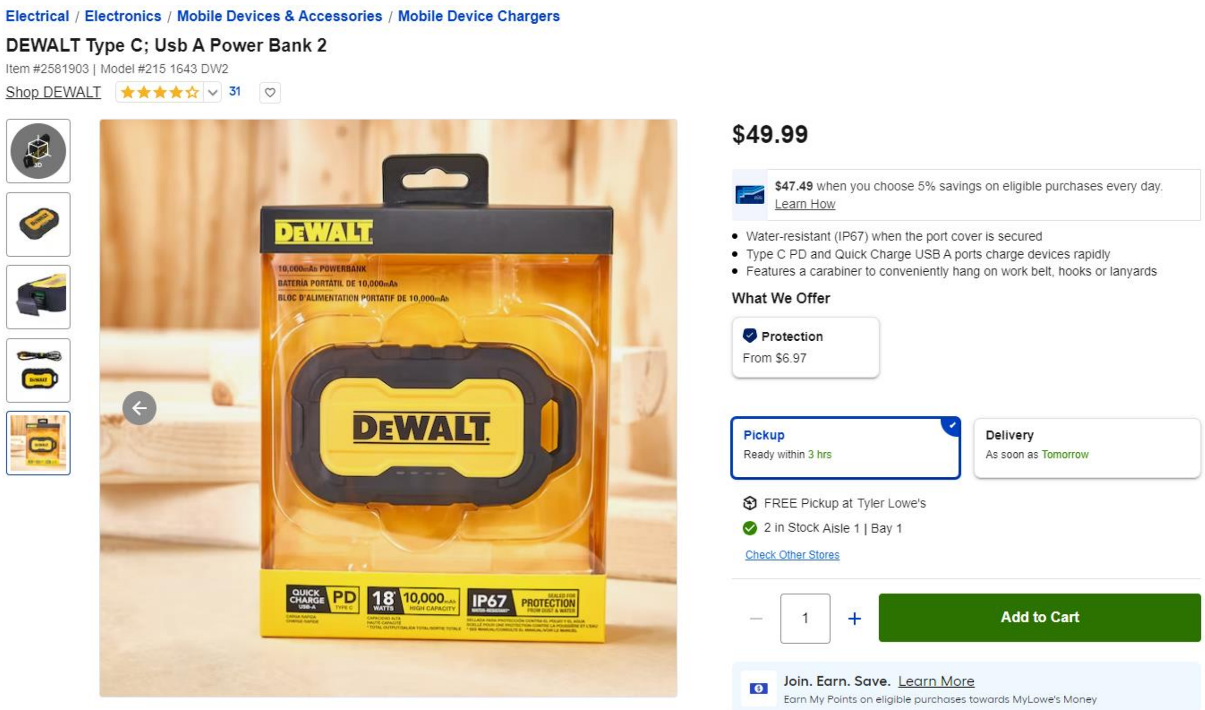


(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Wall-Outlet-Charger/1001435122?idProductFound=false&idExtracted=true).

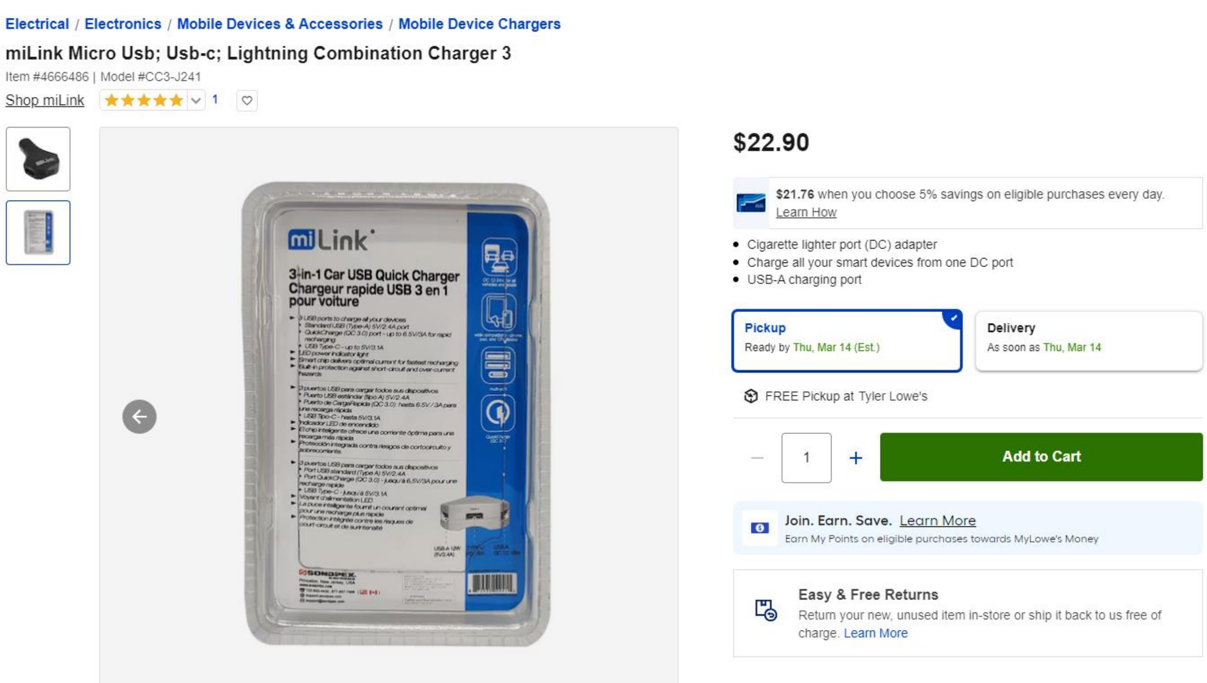


(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Car-Charger/1000976132?id

ProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-10-000-mAh-Powerbank/1003242934?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/miLink-3-in-1-Car-USB-Charger-Type-C-USB-A-and-QC-3-

0/5005469221?idProductFound=false&idExtracted=true).

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Trexonic's 5 Port Universal USB Compact Charging Station is staple for any home or office space. This 35.5 watts smart USB charging port allows you to charge 5 devices simultaneously at full speed. Powered for 2 tablets and 3 smartphones, charging station will quickly and effectively charge your devices to save you time. Its compact design makes it a perfect ally for organizing your working space or taking it with you on the go. EXCEPTIONAL PERFORMANCE: Intelligent charging station with a 2.1A port for faster charge. It detects connected devices and delivers the optimal charging current for safe and fast charging. It features a blue LED light to indicate whenever it is on. SPACE SAVING: With its several docks, this charging station allows to keep your space nice and tidy by keeping all your organized charging devices together NO ADAPTER NEEDED: Charge up to 5 devices at full speed all at once without ever needing an extra adapter or power strip. REFINED SILVER FINISH: Perfect mix of practicality, functionality and great design with the modern silver finish that'll add style and class to your space. UNIVERSAL COMPATIBILITY: The charging station features 100 to 240V input and is perfectly compatible with virtually all iOS, Android and Windows smartphones, tablets or any other devices with a USB charge port. WARRANTY and SERVICE: We stand behind every product by offering 90days warranty and extensive customer service. Please contact us with any question or concern you may have. Includes One 5 Port USB Charging Station (3.75-in x 2.6-in x 2.6-in - 0.35-lbs)Very compact charging station, ideal to carry from home to offices, school, during vacation travels or business trips.. Item Dimensions: 3.75-in x 2.6-in x 2.6-in, Item Weight: 0.35-lbs

- Can charge up to 5 devices simultaneously
- Quick charge technology for time saving
- Power indicator light
- Compatible with most Android and IOS devices
- Input: 100V-240V
- Max total output: 5V 7.1A
- Max output at port: 2.1A

Prop65 Warning Label
PDF

(*E.g.*, https://www.lowes.com/pd/Trexonic-Type-C-USB-A-USB-Charger/1001571060?idProductFound=false&idExtracted=true).

Electrical / Electronics / Mobile Devices & Accessories / Mobile Device Chargers

RoadKing Type C; USB A Combination Charger 2

Item #3722750 | Model #RK03430

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$18.67 with 3 monthly payments. Learn How

THIS ITEM IS OUT OF STOCK
We'll notify you once this item is back in stock.

Enter Email Address

Notify Me

- Heavy-duty DC charger
- Heavy-duty vinyl construction: Standard level charging
- USB-C compatible: Safely charge and sync devices

Join. Earn. Save. Learn More
Earn My Points on eligible purchases towards MyLowe's Money

Easy & Free Returns
Return your new, unused item in-store or ship it back to us free of charge. Learn More

This heavy-duty charger features a 6-foot coiled cable with a USB-C(TM) connection. Featuring two USB ports, this charger allows three devices to charge simultaneously while on-the-go. Have your devices ready to go when you arrive at your destination.

- Heavy-duty DC charger
- Heavy-duty vinyl construction: Standard level charging
- USB-C compatible: Safely charge and sync devices
- Dual USB plus charging cable: Charge up to 3 devices simultaneously
- 6 foot heavy-duty coiled cable: Prevents tangling and makes cable easy to store
- 7.8 AMP total output: Powerful charging
- Qualcomm® Quick Charge(TM) 3.0 technology
- Fastest and most efficient charging for your devices

Prop65 Warning Label
PDF

Warranty Guide
PDF

(*E.g.*, https://www.lowes.com/pd/RoadKing-RoadKing-12V-DC-3-0-Charger-with-Dual-USB/5001602165?idProductFound=false&idExtracted=true).

34. On information and belief, Defendant provides the '187 Accused QC Chargers which includes power circuitry to provide DC power. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, to charge a portable electronic device, a USB cable is connected to the adapter. Further, the other end of the USB cable is connected to the charging port of the portable electronic device and the adapter is plugged into a standard wall socket. Therefore, the adapter comprises a power circuitry to provide DC power to portable electronic devices.

USB	**USB Version:** USB 3.0, USB 2.0
Power Management	**Maximum Input Voltage:** 22 V
Charging	**Qualcomm® Quick Charge™ Technology Support:** Qualcomm® Quick Charge™ 3.0 technology **Maximum Current:** 2.6 A, 4.6 A
Interfaces	**Supported Interfaces:** I^2C
Operating Temperature Range	**Maximum Temperature:** 85 °C **Minimum Temperature:** -30 °C
Package	**Package Type:** WLCSP **Pitch:** 0.4mm Pitch **Size:** 2.96 x 3.31 x 0.55 mm

(*E.g.*, https://www.qualcomm.com/products/quick-charge-30).

35. Defendant provides a product or system, such as the '187 Accused QC Chargers, that include data circuitry to receive a first signal originating from the portable electronic device and to provide a second signal to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the '187 Accused QC Chargers comprise data circuitry as described in the Universal Serial Bus Type-C Cable and Connector Specification and Qualcomm Quick Charge 3.0 technology. For example, the D+ pin (DP pin on the QC 3.0 controller present within the adapter) provides the first signal (D+ signal) from the portable electronic device to the data circuitry of the adapter. The D- pin (DM pin on the QC 3.0 controller present within the adapter) provides the second signal (D- signal) from the data circuitry of the adapter to the portable electronic device. The D+ (DP) and D- (DM) pins are used to

establish communication between the portable electronic device and the adapter. The output voltage and current and consequently the power values are controlled using the DP and DM pins.

Quick Charge 3.0 is engineered to refuel devices up to four times faster than conventional charging. It is designed to charge twice as fast as Quick Charge 1.0 and to be 38 percent more efficient than Quick Charge 2.0. Now consumers can spend even less time charging, and can grab and go more quickly.

How does it work? Quick Charge 3.0 employs Intelligent Negotiation for Optimum Voltage (INOV), an algorithm which allows your portable device to determine what power level to request at any point in time, enabling optimum power transfer while maximizing efficiency. It also supports wider voltage options, allowing a mobile device to dynamically adjust to the ideal voltage level supported by that specific device. Specifically, Quick Charge 3.0 offers a more granular range of voltages: 200mV increments, from 3.6V to 20V. That way your phone can target one of dozens of power levels.

The technology has the same easy-to-implement design for OEMs as previous versions. It's 100 percent backward-compatible with Quick Charge 1.0 and Quick Charge 2.0 devices, and it supports a broad range of connectors: Quick Charge 3.0 can be implemented with USB Type-A, USB micro, USB Type-C, or proprietary connectors. Quick Charge 2.0 is supported by a far-reaching assortment of certified accessories, including wall chargers, car chargers, battery packs, and power controllers; next-generation chargers will support Quick Charge 3.0.

(*E.g.*, https://www.qualcomm.com/news/onq/2015/09/14/introducing-quick-charge-30-next-generation-fast-charging-technology).

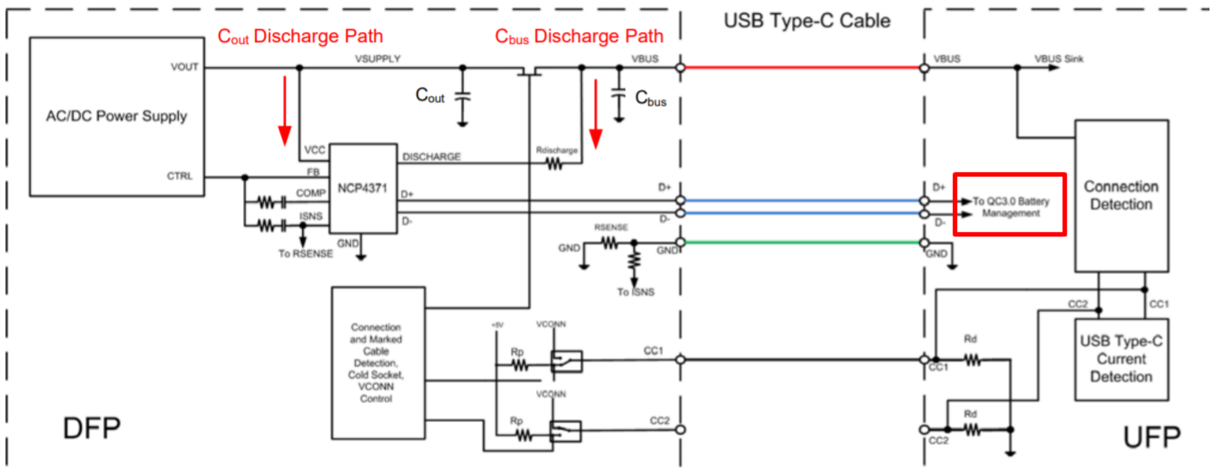


Figure 20. Dual Discharge Path − Application Idea (USB−Type C Adapter)

(*E.g.*, https://www.onsemi.com/pdf/datasheet/ncp4371-d.pdf, page 12).

When a Type C receptacle is used, the CC1/CC2 pair is used for plug attach/detach detection. It is also meant to support the USB-PD communication standard. The DP/DM pair is meant to support:

- Battery Charging 1.2
- Qualcomm® QuickCharge™ QC2.0 and QC3.0

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 7).

8.10 Communication

If a type-C receptacle is used, attach/detach detection and USB-PD communication is provided on the CC pins.

DP and DM provide the communication interface for QC2.0 and QC3.0.

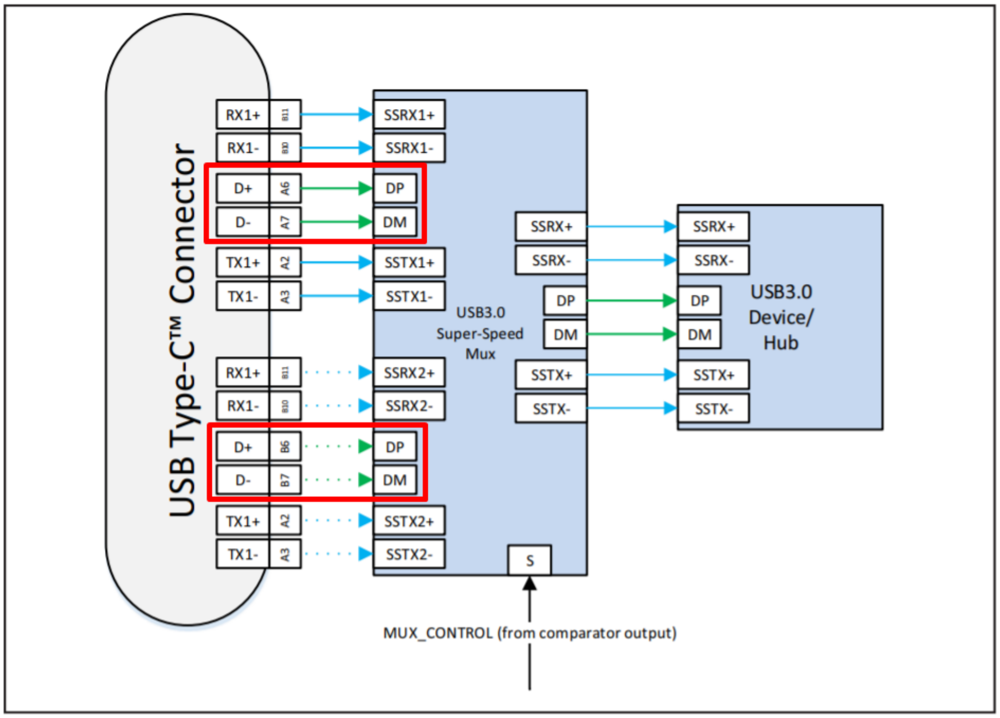
If a type-A receptacle is used, attach/detach detection can be disabled (via MTP). The load switch is closed (when no protection is triggered).

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 15).

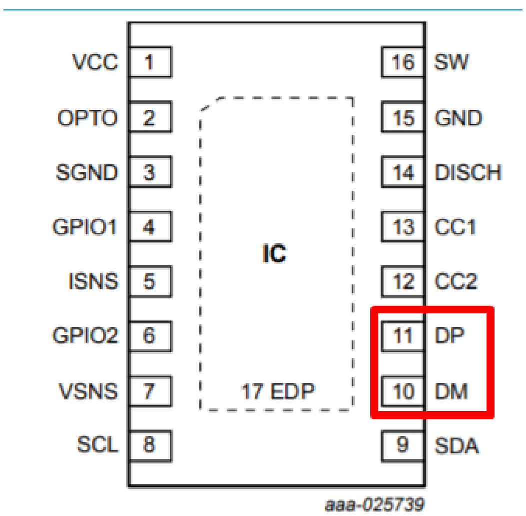
The output voltage and the output current can be controlled via USB-PD using the CC pins. They can also be controlled via QC using the DP and DM pins.

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 7).

FIGURE 6: BLOCK DIAGRAM OF USB3.0/3.1 UFP: SUPER-SPEED MUX



(*E.g.*, http://ww1.microchip.com/downloads/en/Appnotes/00001914B.pdf, page 7).



(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 6).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

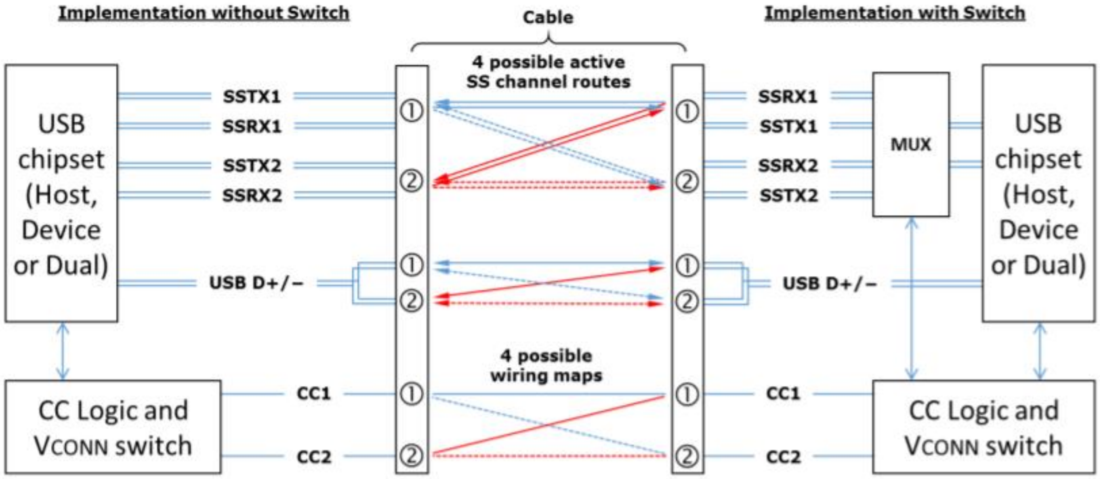
(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 104).

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2	SSTXp1	Positive half of first SuperSpeed TX differential pair	Second	B11	SSRXp1	Positive half of first SuperSpeed RX differential pair	Second
A3	SSTXn1	Negative half of first SuperSpeed TX differential pair	Second	B10	SSRXn1	Negative half of first SuperSpeed RX differential pair	Second
A4	VBUS	Bus Power	First	B9	VBUS	Bus Power	First
A5	CC1	Configuration Channel	Second	B8	SBU2	Sideband Use (SBU)	Second
A6	Dp1	Positive half of the USB 2.0 differential pair – Position 1	Second	B7	Dn2	Negative half of the USB 2.0 differential pair – Position 2	Second
A7	Dn1	Negative half of the USB 2.0 differential pair – Position 1	Second	B6	Dp2	Positive half of the USB 2.0 differential pair – Position 2	Second
A8	SBU1	Sideband Use (SBU)	Second	B5	CC2	Configuration Channel	Second
A9	VBUS	Bus Power	First	B4	VBUS	Bus Power	First
A10	SSRXn2	Negative half of second SuperSpeed RX differential pair	Second	B3	SSTXn2	Negative half of second SuperSpeed TX differential pair	Second
A11	SSRXp2	Positive half of second SuperSpeed RX differential pair	Second	B2	SSTXp2	Positive half of second SuperSpeed TX differential pair	Second

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 49).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

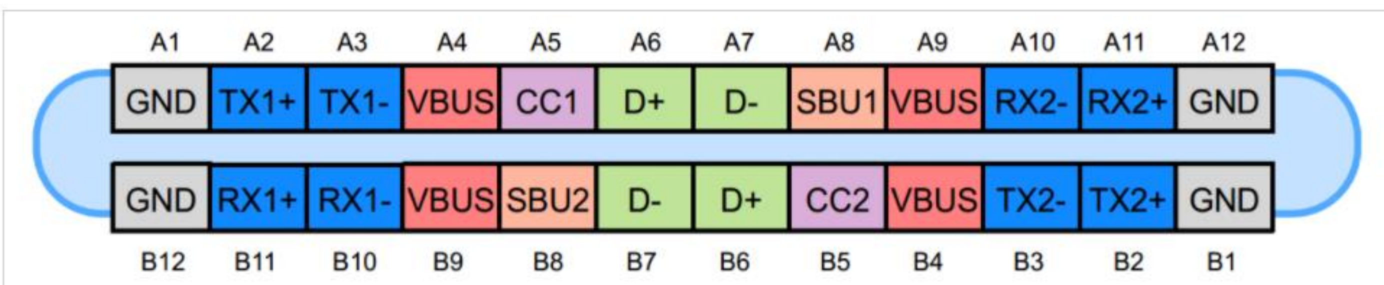


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

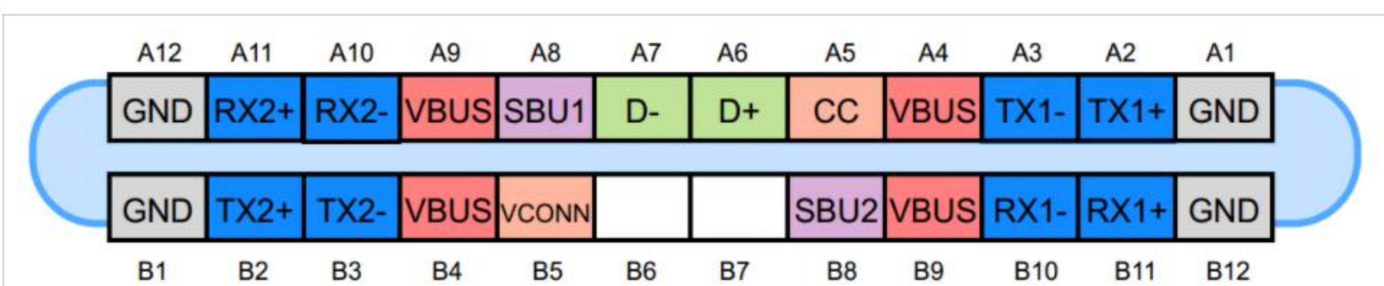


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

36. Defendant provides a product or system, such as the '187 Accused QC Chargers, that include a connector disposed on a cable end, the connector having four conductors for detachably mating with a power input opening of the portable electronic device, the first and second conductors transferring the DC power and its ground reference to the portable electronic device, the third conductor transferring the first signal from the portable electronic device to the data circuitry, and the fourth conductor transferring the second signal from the data circuitry to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the adapter comprises data circuitry as described in the Universal Serial Bus Type-C Cable and Connector Specification and Qualcomm Quick Charge 3.0 technology. For example, the '187 Accused QC Chargers connect to the portable electronic device through a USB cable. The USB cable has a connector of the type including but not limited to USB-C at one end to detachably mate with the charging port of a portable electronic device. The connector comprises VBUS ("first conductor"), GND ("second conductor"), D+ ("third conductor"), and D- ("fourth conductor") pins. The D+ pins connect with the DP/D+ pin and the D- pin connects with the DM/D- pin of the controller (present within the adapter) to support Qualcomm Quick Charge 3.0 technology.

The USB Type-C receptacle, plug and cable designs are intended to support future USB functional extensions. As such, consideration was given to frequency scaling performance, pin-out arrangement and the configuration mechanisms when developing this solution. The definition of future USB functional extensions is not in the scope of this specification but rather will be provided in future releases of the base USB Specification, i.e., beyond the existing *USB 3.1 Specification*.

Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both *USB 2.0* (D+ and D−) and *USB 3.1* (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1−	VBUS	CC1	D+	D−	SBU1	VBUS	RX2−	RX2+	GND
GND	RX1+	RX1−	VBUS	SBU2	D−	D+	CC2	VBUS	TX2−	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

2.3 Configuration Process

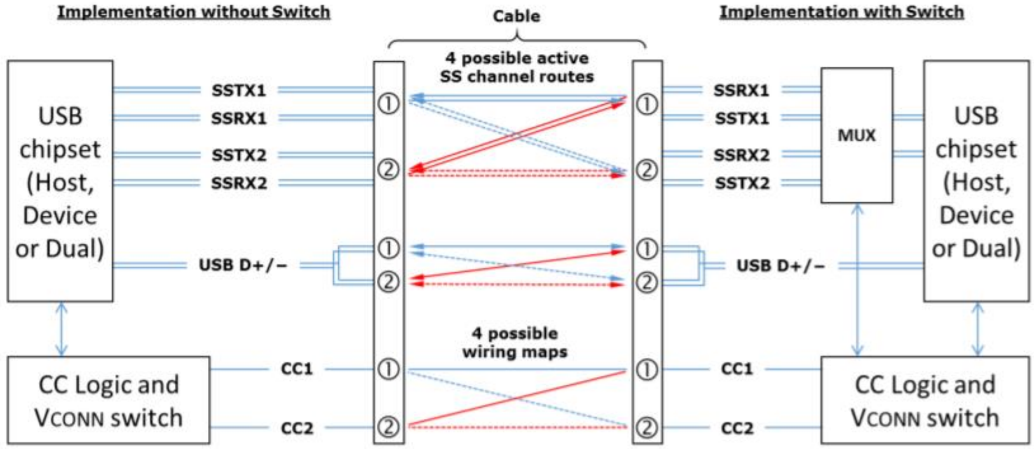
The USB Type-C receptacle, plug and cable solution incorporates a configuration process to detect a downstream facing port to upstream facing port (DFP-to-UFP) connection for VBUS management and host-to-device connected relationship determination.

The configuration process is used for the following:

- DFP-to-UFP attach/detach detection
- Plug orientation/cable twist detection
- Initial DFP-to-UFP (host-to-device) and power relationships detection
- USB Type-C VBUS current detection and usage
- *USB PD* communication
- Discovery and configuration of functional extensions

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 20).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 104).

2.4 VBUS

VBUS provides a path to deliver power between a host and a device, and between a charger and a host/device. A simplified high-current supply capability is defined for hosts and chargers that optionally support current levels beyond the USB 2.0 and USB 3.1 specifications. The USB Power Delivery Specification is supported.

Table 2-1 summarizes the power supply options available from the perspective of a device with the USB Type-C connector. Not all options will be available to the device from all host

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 22).

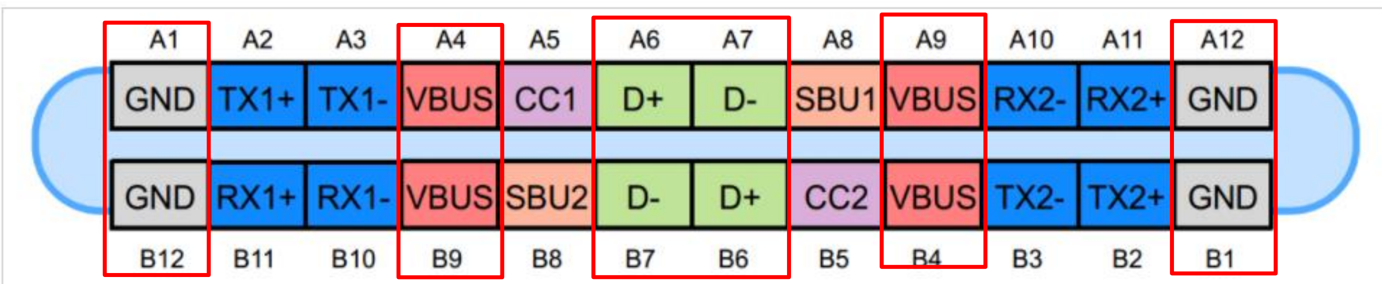


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

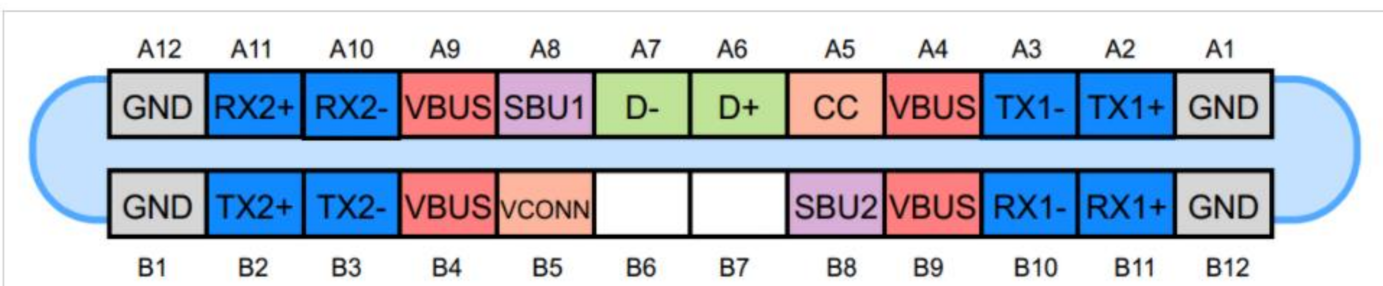


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

USB	**USB Version:** USB 3.0, USB 2.0
Power Management	**Maximum Input Voltage:** 22 V
Charging	**Qualcomm® Quick Charge™ Technology Support:** Qualcomm® Quick Charge™ 3.0 technology **Maximum Current:** 2.6 A, 4.6 A
Interfaces	**Supported Interfaces:** I^2C
Operating Temperature Range	**Maximum Temperature:** 85 °C **Minimum Temperature:** -30 °C
Package	**Package Type:** WLCSP **Pitch:** 0.4mm Pitch **Size:** 2.96 x 3.31 x 0.55 mm

(*E.g.*, https://www.qualcomm.com/products/quick-charge-30).

Quick Charge 3.0 is engineered to refuel devices up to four times faster than conventional charging. It is designed to charge twice as fast as Quick Charge 1.0 and to be 38 percent more efficient than Quick Charge 2.0. Now consumers can spend even less time charging, and can grab and go more quickly.

How does it work? Quick Charge 3.0 employs Intelligent Negotiation for Optimum Voltage (INOV), an algorithm which allows your portable device to determine what power level to request at any point in time, enabling optimum power transfer while maximizing efficiency. It also supports wider voltage options, allowing a mobile device to dynamically adjust to the ideal voltage level supported by that specific device. Specifically, Quick Charge 3.0 offers a more granular range of voltages: 200mV increments, from 3.6V to 20V. That way your phone can target one of dozens of power levels.

The technology has the same easy-to-implement design for OEMs as previous versions. It's 100 percent backward-compatible with Quick Charge 1.0 and Quick Charge 2.0 devices, and it supports a broad range of connectors: Quick Charge 3.0 can be implemented with USB Type-A, USB micro, USB Type-C, or proprietary connectors. Quick Charge 2.0 is supported by a far-reaching assortment of certified accessories, including wall chargers, car chargers, battery packs, and power controllers; next-generation chargers will support Quick Charge 3.0.

(*E.g.*, https://www.qualcomm.com/news/onq/2015/09/14/introducing-quick-charge-30-next-generation-fast-charging-technology).

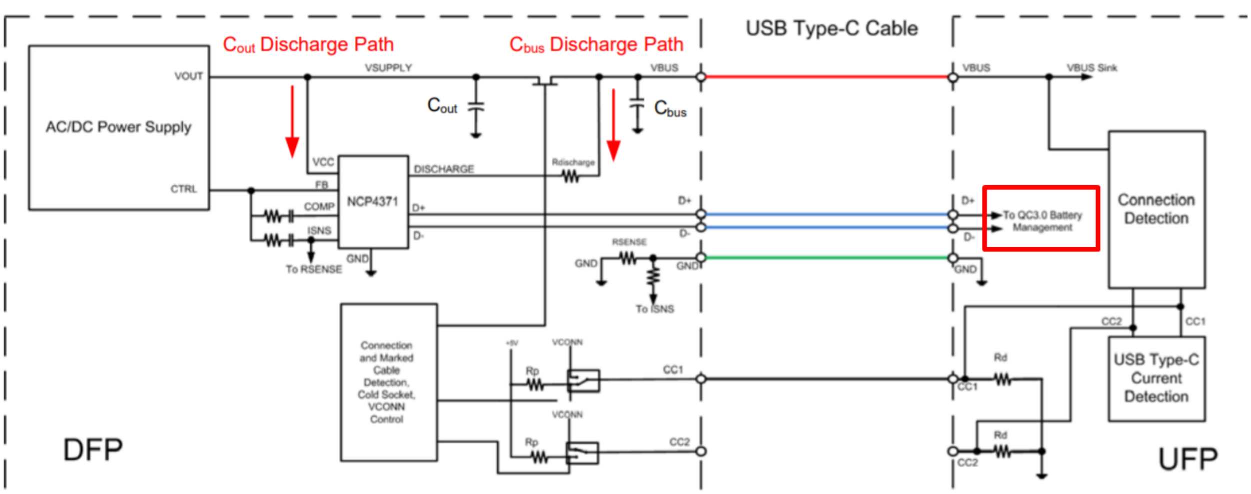
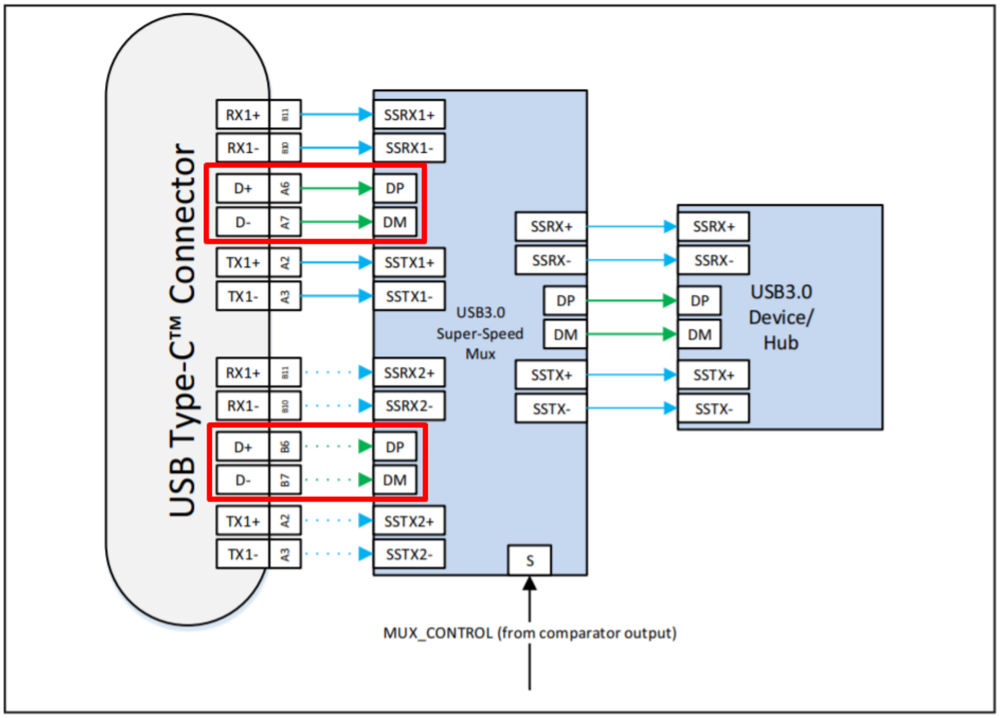


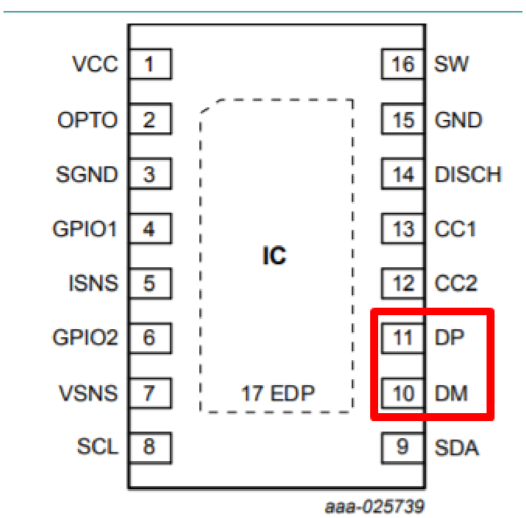
Figure 20. Dual Discharge Path − Application Idea (USB−Type C Adapter)

(*E.g.*, https://www.onsemi.com/pdf/datasheet/ncp4371-d.pdf, page 12).

FIGURE 6: BLOCK DIAGRAM OF USB3.0/3.1 UFP: SUPER-SPEED MUX



(*E.g.*, http://ww1.microchip.com/downloads/en/Appnotes/00001914B.pdf, page 7).



(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 6).

13 Application information

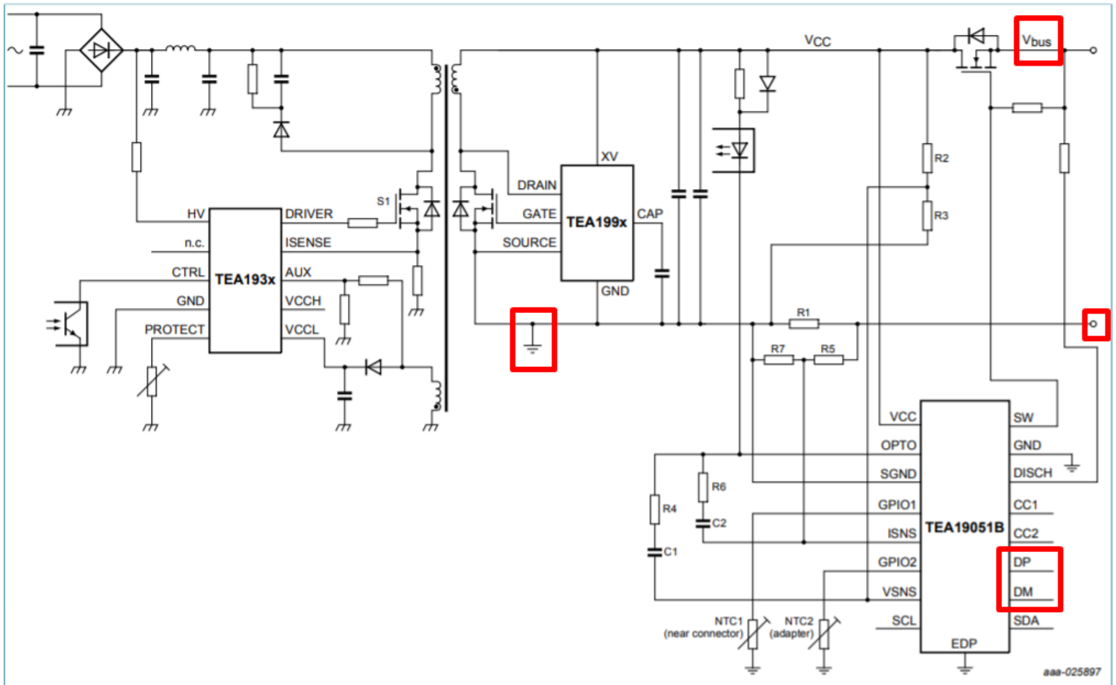


Figure 7. Typical application diagram, including TEA1938, TEA1999 (low-side SR), and TEA19051BTK

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 28).

7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
VCC	1	supply voltage
OPTO	2	OPTO driver
SGND	3	sense ground
GPIO1	4	general-purpose input/output
ISNS	5	current sense input
GPIO2	6	general-purpose input/output
VSNS	7	voltage sense input
SCL	8	I^2C clock line
SDA	9	I^2C data line
DM	10	negative terminal of the data communication line
DP	11	positive terminal of the data communication line
CC2	12	type C CC2 line detection and USB-PD communication
CC1	13	type C CC1 line detection and USB-PD communication
DISCH	14	fast discharge sink
GND	15	ground
SW	16	NMOS gate drive output
EDP	17	exposed die pad

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 6).

When a Type C receptacle is used, the CC1/CC2 pair is used for plug attach/detach detection. It is also meant to support the USB-PD communication standard. The DP/DM pair is meant to support:

- Battery Charging 1.2
- Qualcomm® QuickCharge™ QC2.0 and QC3.0

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 7).

8.10 Communication

If a type-C receptacle is used, attach/detach detection and USB-PD communication is provided on the CC pins.

DP and DM provide the communication interface for QC2.0 and QC3.0.

If a type-A receptacle is used, attach/detach detection can be disabled (via MTP). The load switch is closed (when no protection is triggered).

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 15).

The output voltage and the output current can be controlled via USB-PD using the CC pins. They can also be controlled via QC using the DP and DM pins.

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 7).

37. Defendant provides a product or system with data circuitry, such as in ‘187 Accused Chargers, that in response to the first signal, provides the second signal to the portal electronic device, the second signal being an analog signal having a parameter level to indicate to the portable electronic device the potential power output level of the power supply system. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, in response to the D+ signal (“first signal”), the data circuitry of the adapter provides D- signal (“second signal”) to the portable electronic device to configure the device voltage and current, and transfer data. The D+ (DP) and D- (DM) pins are used to establish communication between the portable electronic device and the adapter. The output voltage and current and consequently the power values are controlled using the DP and DM pins. The D- signal is an analog signal such that the signals are able to assume a plurality of voltages.

Quick Charge 3.0 is engineered to refuel devices up to four times faster than conventional charging. It is designed to charge twice as fast as Quick Charge 1.0 and to be 38 percent more efficient than Quick Charge 2.0. Now consumers can spend even less time charging, and can grab and go more quickly.

How does it work? Quick Charge 3.0 employs Intelligent Negotiation for Optimum Voltage (INOV), an algorithm which allows your portable device to determine what power level to request at any point in time, enabling optimum power transfer while maximizing efficiency. It also supports wider voltage options, allowing a mobile device to dynamically adjust to the ideal voltage level supported by that specific device. Specifically, Quick Charge 3.0 offers a more granular range of voltages: 200mV increments, from 3.6V to 20V. That way your phone can target one of dozens of power levels.

The technology has the same easy-to-implement design for OEMs as previous versions. It's 100 percent backward-compatible with Quick Charge 1.0 and Quick Charge 2.0 devices, and it supports a broad range of connectors: Quick Charge 3.0 can be implemented with USB Type-A, USB micro, USB Type-C, or proprietary connectors. Quick Charge 2.0 is supported by a far-reaching assortment of certified accessories, including wall chargers, car chargers, battery packs, and power controllers; next-generation chargers will support Quick Charge 3.0.

(*E.g.*, https://www.qualcomm.com/news/onq/2015/09/14/introducing-quick-charge-30-next-generation-fast-charging-technology).

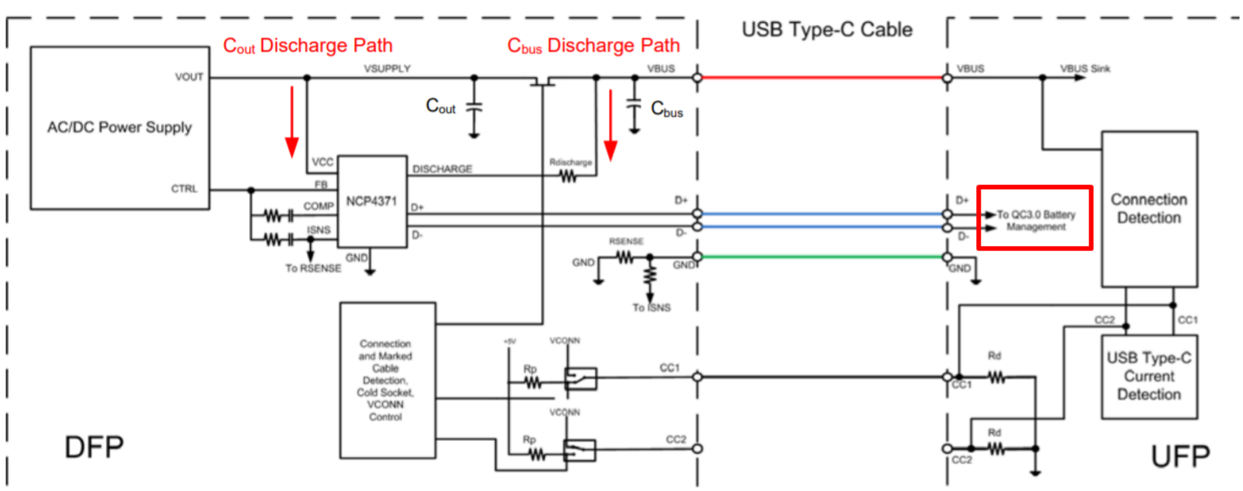
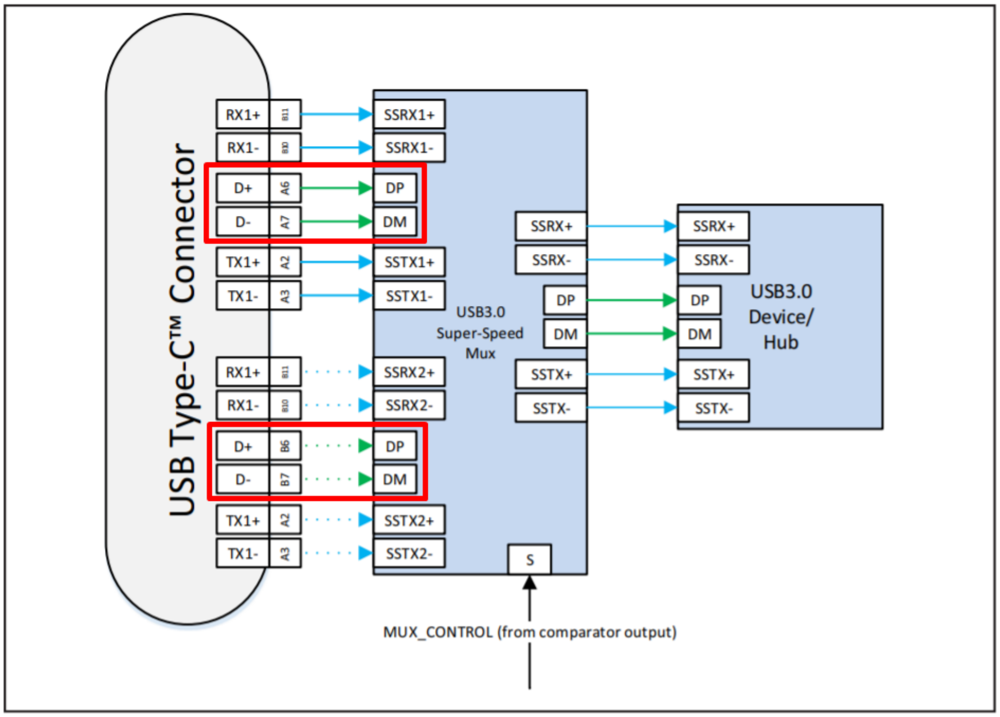


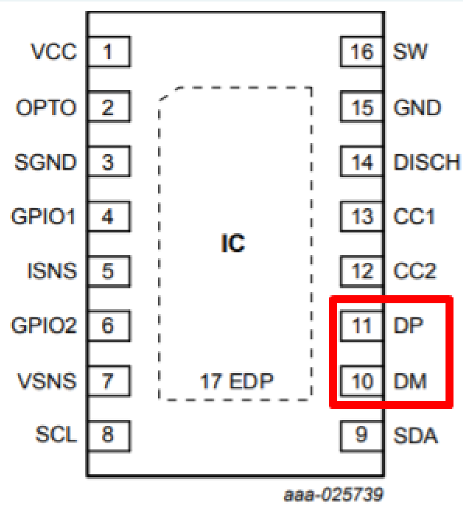
Figure 20. Dual Discharge Path − Application Idea (USB−Type C Adapter)

(*E.g.*, https://www.onsemi.com/pdf/datasheet/ncp4371-d.pdf, page 12).

FIGURE 6: BLOCK DIAGRAM OF USB3.0/3.1 UFP: SUPER-SPEED MUX



(*E.g.*, http://ww1.microchip.com/downloads/en/Appnotes/00001914B.pdf, page 7).



(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 6).

13 Application information

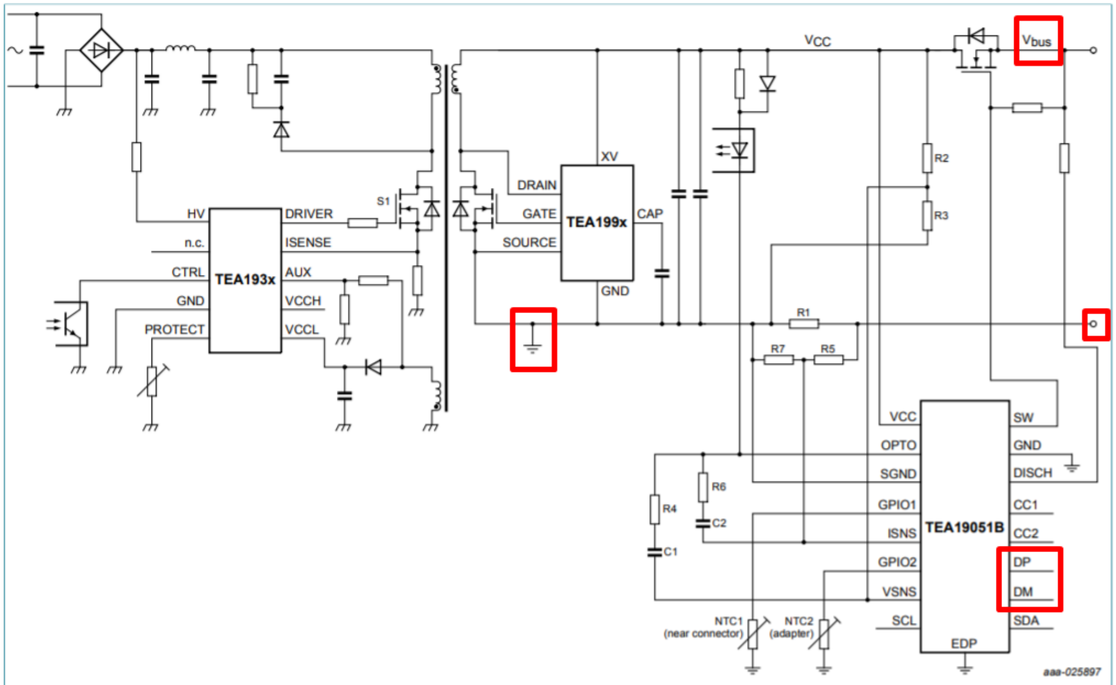


Figure 7. Typical application diagram, including TEA1938, TEA1999 (low-side SR), and TEA19051BTK

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 28).

7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
VCC	1	supply voltage
OPTO	2	OPTO driver
SGND	3	sense ground
GPIO1	4	general-purpose input/output
ISNS	5	current sense input
GPIO2	6	general-purpose input/output
VSNS	7	voltage sense input
SCL	8	I^2C clock line
SDA	9	I^2C data line
DM	10	negative terminal of the data communication line
DP	11	positive terminal of the data communication line
CC2	12	type C CC2 line detection and USB-PD communication
CC1	13	type C CC1 line detection and USB-PD communication
DISCH	14	fast discharge sink
GND	15	ground
SW	16	NMOS gate drive output
EDP	17	exposed die pad

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 6).

When a Type C receptacle is used, the CC1/CC2 pair is used for plug attach/detach detection. It is also meant to support the USB-PD communication standard. The DP/DM pair is meant to support:

- Battery Charging 1.2
- Qualcomm® QuickCharge™ QC2.0 and QC3.0

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 7).

8.10 Communication

If a type-C receptacle is used, attach/detach detection and USB-PD communication is provided on the CC pins.

DP and DM provide the communication interface for QC2.0 and QC3.0.

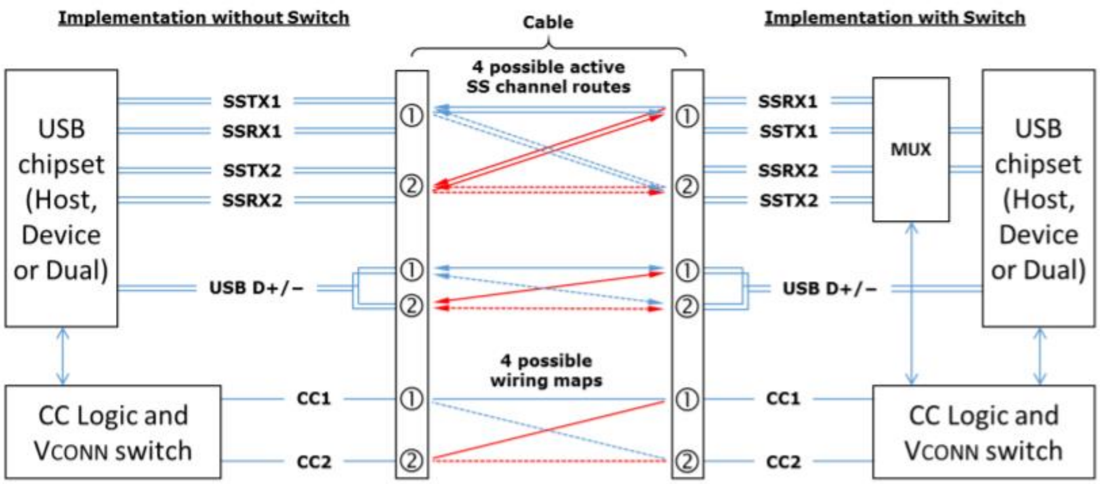
If a type-A receptacle is used, attach/detach detection can be disabled (via MTP). The load switch is closed (when no protection is triggered).

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 15).

The output voltage and the output current can be controlled via USB-PD using the CC pins. They can also be controlled via QC using the DP and DM pins.

(*E.g.*, https://www.nxp.com/docs/en/data-sheet/TEA19051BTK.pdf, page 7).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 105).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 104).

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2	SSTXp1	Positive half of first SuperSpeed TX differential pair	Second	B11	SSRXp1	Positive half of first SuperSpeed RX differential pair	Second
A3	SSTXn1	Negative half of first SuperSpeed TX differential pair	Second	B10	SSRXn1	Negative half of first SuperSpeed RX differential pair	Second
A4	VBUS	Bus Power	First	B9	VBUS	Bus Power	First
A5	CC1	Configuration Channel	Second	B8	SBU2	Sideband Use (SBU)	Second
A6	Dp1	Positive half of the *USB 2.0* differential pair – Position 1	Second	B7	Dn2	Negative half of the *USB 2.0* differential pair – Position 2	Second
A7	Dn1	Negative half of the *USB 2.0* differential pair – Position 1	Second	B6	Dp2	Positive half of the *USB 2.0* differential pair – Position 2	Second
A8	SBU1	Sideband Use (SBU)	Second	B5	CC2	Configuration Channel	Second
A9	VBUS	Bus Power	First	B4	VBUS	Bus Power	First
A10	SSRXn2	Negative half of second SuperSpeed RX differential pair	Second	B3	SSTXn2	Negative half of second SuperSpeed TX differential pair	Second
A11	SSRXp2	Positive half of second SuperSpeed RX differential pair	Second	B2	SSTXp2	Positive half of second SuperSpeed TX differential pair	Second

(*E.g.*, https://www.those.ch/designtechnik/wp-content/uploads/2014/08/USB-Type-C-Specification-Release-1.0.pdf, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 49).

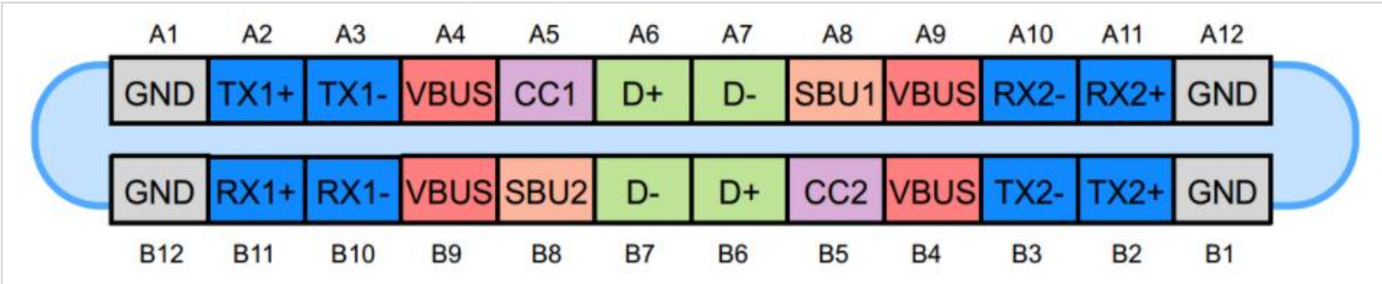


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

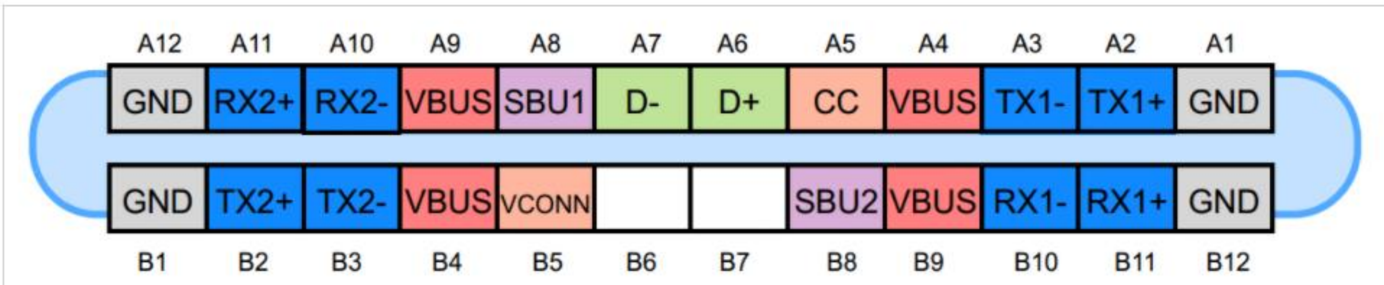


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

38. Defendant provides a product or system, including the '187 Accused QC Chargers, in which the power circuitry of the power supply system converts power from an external power source to DC power. For example, to charge a portable electronic device, a USB cable is connected to the external USB power supply. Further, the other end of a USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the external USB power supply system comprises power circuitry to provide DC power to the portable electronic device.

D. Indirect Infringement

39. Upon information and belief, Defendant has been and now is indirectly infringing by way of inducing infringement and contributing to the infringement of the asserted claims of the

‘187 patent in the State of Texas, in this District, and elsewhere in the United States, by providing the ‘187 Accused Chargers for use as described above by Defendant’s customers. Defendant advertised, offered for sale, and/or sold the ‘187 Accused Chargers (and continues to advertise, offer to sell, and sell) to its customers for use in a manner that Defendant knew infringed at least one claim of the ‘187 patent. For example, Defendant advertises and sells the ‘187 Accused Chargers. Defendant is a direct and indirect infringer, and its customers using the ‘187 Accused Chargers are direct infringers. Defendant had actual knowledge of the ‘187 patent at least as early as when they received a letter from Plaintiff sent on August 1, 2023, asserting that the ‘187 Accused Chargers infringed claims of the ‘187 patent and they were provided a claim chart that provided evidence of the infringement. Defendant has known of its infringement since at least that date as a result of the accusations of infringement in the notice letter. Defendant has therefore also known that the use of the ‘187 Accused Chargers by its customers infringed at least one claim of the ‘187 patent since at least the date they received the letter.

40. On information and belief, since becoming aware of the ‘187 patent and of the infringement through advertising and offering for sale the ‘187 Accused Chargers for use by its customers, Defendant is and has been committing the act of inducing infringement by specifically intending to induce infringement by providing the ‘187 Accused Chargers to its customers and by aiding and abetting its use in a manner known to infringe by Defendant. Since becoming aware of the infringing use of the ‘187 Accused Chargers, Defendant knew that the use of the ‘187 Accused Chargers by its customers as a charger with a portable electronic device (including a rechargeable battery) constituted direct patent infringement. Despite this knowledge, Defendant continued and continues to encourage and induce its customers to use the ‘187 Accused Chargers to infringe as described above and provided instructions (and continues such acts) for using the

‘187 Accused Chargers to infringe, including through advertisements. Defendant therefore knowingly induced infringement (and continues to induce infringement) and specifically intended to (and intends to) encourage and induce the infringement of the ‘187 patent by its customers.

41. On information and belief, since Defendant became aware of the acts of infringement at least as of the date of receipt of the notice letter, Defendant is and has been committing the act of contributory infringement by intending to provide the ‘187 Accused Chargers to its customers knowing that such devices are a material part of the claimed invention, knowing that its use was made and adapted for infringement of the ‘187 patent as described above, and further knowing that the accused aspect of the ‘187 Accused Chargers described above is not a staple article or commodity of commerce suitable for substantially noninfringing use. As described above, Defendant was aware that all material claim limitations are satisfied by the use and implementation of the ‘187 Accused Chargers by Defendant’s customers in the manner described above yet continued to provide the ‘187 Accused Chargers to its customers knowing that it is a material part of the claimed invention. As described above, since learning of the infringement, Defendant knew that the use and implementation of the ‘187 Accused Chargers by its customers was made and adapted for infringement of the ‘187 patent. A new act of direct infringement occurred each time a customer implemented and/or used the ‘187 Accused Chargers in the manner described above. After Defendant became aware that the use of the ‘187 Accused Chargers infringes at least one claim of the ‘187 patent, Defendant knew that each such new use was made and adapted for infringement of at least one claim of the ‘187 patent and Defendant continued to advertise and provide the ‘187 Accused Chargers for such infringing activities. Furthermore, as described more fully above, the ‘187 Accused Chargers have functionality

designed for use in a system in the manner described above and is therefore not a staple article or commodity of commerce suitable for substantially noninfringing use.

42. Upon information and belief, Defendant has been and now is willfully infringing the asserted claims of the '187 patent in Texas, in this District, and elsewhere in the United States. As explained above, Defendant was informed of its infringement of the '187 patent by way of the August 1, 2023, letter sent to Defendant, including claim charts demonstrating Defendant's infringement. As a result of the letter, Defendant should have known that its actions constituted an unjustifiably high risk of infringement. Despite the letter and knowledge that the risk of infringement was either known or so obvious that it should have been known, Defendant continued its infringing actions.

43. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates Plaintiff for such Defendant's infringement of the '187 patent, *i.e.*, in an amount that by law cannot be less than a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

V. COUNT II
(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 10,855,087)

44. Upon information and belief, Defendant has directly infringed claims 1, 5-7, 11, and 15-17 of the '087 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering for sale and/or importing a power supply system comprising power circuitry configured to provide direct current power such products including, but not limited to, the following: Mobile Pixels 8-in-1 USB-C Dongle (Item #5194286, Model #MPX1041001P01); Urban Factory HUBEE Plus USB-C Multi-Stream Mobile Station with 100-Watt Power Delivery (Item #5232138,Model #UBFTCM16UF); Urban Factory HUBEE mini USB-C Multi-Display 4K

Docking Station with 100-Watt Power Delivery (Item #5232136, Model #UBFTCD45UF); Micro Connectors 1-ft USB-C White Cable (Item #3662609, Model #USB31-UCHDMIU3); Micro Connectors 1-ft USB-C White Cable (Item #3662610, Model #USB31-UCVGAU3); Just Wireless Portable Power Bank 15K USB-C/A - 15000mAh (Item #3351754, Model #06175); Just Wireless 20,000mAh Power Bank with Fast Charge and 3 USB Ports (Item #3351755, Model #06177); Just Wireless Portable Power Bank 5K USB-C/A - 5200mAh (Item #3351752, Model #06171); DEWALT Type C USB A Wall Outlet Charger 2 (Item #1299595, Model #131 0851 DW2); DEWALT Type C USB A Car Charger 4 (Item #1299597, Model #141 9009 DW2); DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2); Eaton 20-Amp Tamper Resistant Residential/Commercial Decorator USB Outlet Dual Type C, Gray (Item #4110024, Model #TRUSBC20GY-K-L); Eaton 15-Amp Tamper Resistant Residential/Commercial Decorator USB Outlet Type A/C (Item #1614069, Model #TRUSBAC15W-KB-LW); miLink Micro USB USB-C Lightning Combination Charger 3 (Item #4666486, Model #CC3-J241); Trexonic 4-Port USB Charger with Quick Charge Technology, Silver, Type C and USB A Connectors, 1000mAh Battery Power (Item #1646379; Model #849105170M); Trexonic Micro USB USB-C Lightning Combination Charger 4 (Item #1646374, Model #849105163M); Trexonic Micro USB USB-C Lightning Combination Charger 4 (Item #1646491, Model #849111674M); Promounts Lightning USB A USB Charger 5 (Item #877321, Model #OPT061); Top Greener TU22036A2C 20-Amp 125-volt Tamper Resistant Residential/Commercial Decorator Outlet/USB Dual Type C with Wall Plate (3-Pack) (Item #4828747, Model #TU22036A2C-WWP3P); Top Greener TU21558AC3 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Type A/C with Wall Plate, White (3-Pack) (Item #4828749; Model #TU21558AC3-WWP3P); Top Greener TU21536A2C 15-Amp 125-volt Tamper Resistant Residential Decorator USB Outlet

Dual Type C with Wall Plate, White (3-Pack) (Item #4828746; Model #TU21536A2C-WWP3P); Top Greener TU22036AC3 20-Amp 125-volt Tamper Resistant Residential/Commercial Decorator Outlet/USB Type A/C with Wall Plate, White (3-Pack) (Item #4828751, Model #TU22036AC3-WWP3P); Top Greener TU21536A2C 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Dual Type C with Wall Plate, Black (3-Pack) (Item #4828753; Model #TU21536A2C-BKWP3P); Top Greener TU21536AC3 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Type A/C with Wall Plate, Black (3-Pack) (Item #4828745; Model #TU21536AC3-BKWP3); Naztech Type C; USB A Wall Outlet Charger 2 (Item #5264434; Model #HPL15520); Naztech Micro USB USB-C Lightning Car Charger 2 (Item #3637774; Model #14390); RoadKing Type C USB A Combination Charger 2 (Item #3722750; Model #RK03430); and Accell Type C USB A Combination Charger (Item #3245139; Model #D233B-001B) ("'087 Accused Chargers").

45. Claim 1 of the '087 patent states:

A power supply system comprising:

power circuitry configured to provide direct current power; and

data circuitry configured to receive a first signal that originates from a portable electronic device and to provide a second signal to be sent to the portable electronic device, the data circuitry and the power circuitry configured to be coupled via a connector to the portable electronic device, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be detachably mated with a power input interface of the portable electronic device to:

transfer, via the first conductor, the direct current power to the portable electronic device,

transfer, via the second conductor, a ground reference to the portable electronic device,

transfer, via the third conductor, the first signal from the portable electronic device to the data circuitry, and

> transfer, via the fourth conductor, the second signal from the data circuitry to the portable electronic device,
>
> wherein the data circuitry is further configured, in coordination with the first signal, to provide the second signal having a parament level that is usable by the portable electronic device in connection with control of charging a rechargeable battery of the portable electronic device based on the direct current power provided by the power circuity.

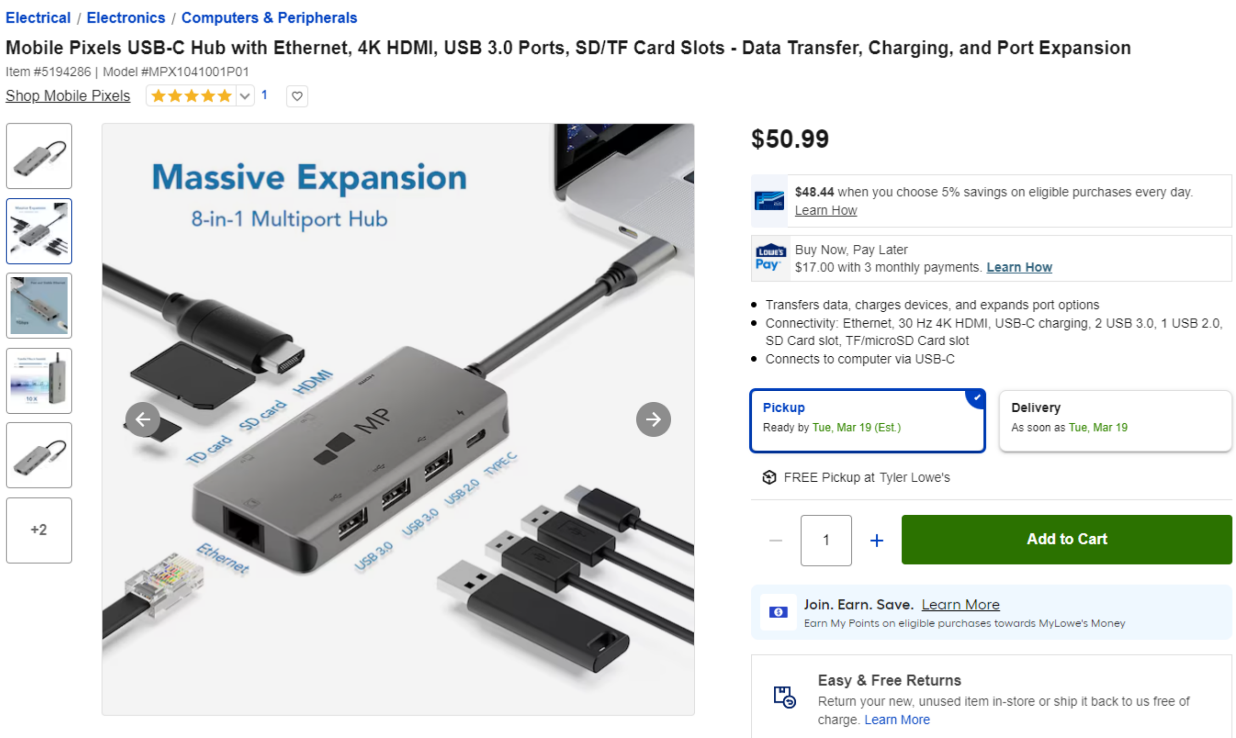
(Ex. B at 10:63-11:24).

A. Infringement for Compliance with the Battery Charging (BC) 1.2 specification

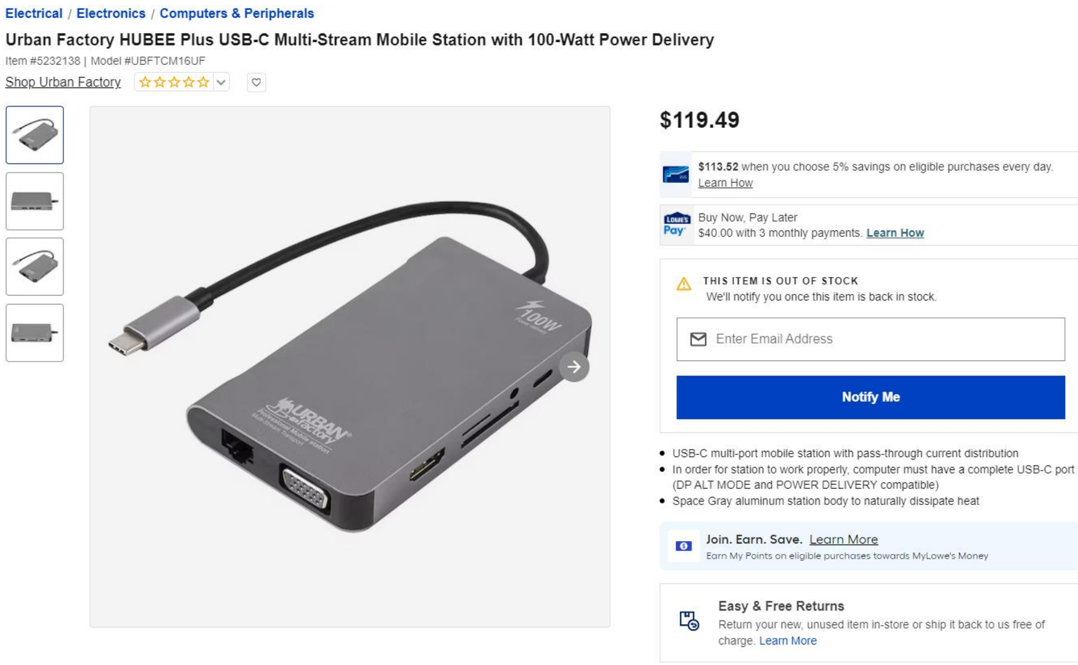
46. Defendant makes, uses, sells, offers for sale and/or imports a USB power supply (*e.g.*, the '087 Accused Chargers) comprising power circuitry configured to provide direct current power. This element is met literally, or in the alternative, under the doctrine of equivalents. Defendant makes, uses, sells, offers for sale and/or imports the '087 Accused Chargers to supply power to portable electronic device. The USB power supply outputs voltage, current, and power values. Upon information and belief, each of the '087 Accused Chargers includes circuitry compliant with the Battery Charging (BC) 1.2 specification to charge the portable electronic device. The Table 2-1 (https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36) and the diagram depicting the power consumed by different USB specifications (https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5) disclose that BC 1.2 is used to output 5V voltage, 1.5A current, and 7.5W power.

47. The USB power supply outputs voltage, current, and power values. USB-compliant devices at USB 3.0 or above are compatible with the USB BC 1.2 specification. Upon information and belief, each of the '087 Accused Chargers includes circuitry compliant with the Battery Charging (BC) 1.2 specification to charge the portable electronic device. The Table 2-1 (https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36) and the diagram depicting the power consumed by different

USB specifications (https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5) disclose that BC 1.2 is used to output 5V voltage, 1.5A current, and 7.5W power. Further, to charge the battery in a portable electronic device, the portable electronic device is connected to the USB power supply. The other end of the USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket or a DC power source. Therefore, the USB power supply comprises power circuitry to provide DC power to the portable electronic device.

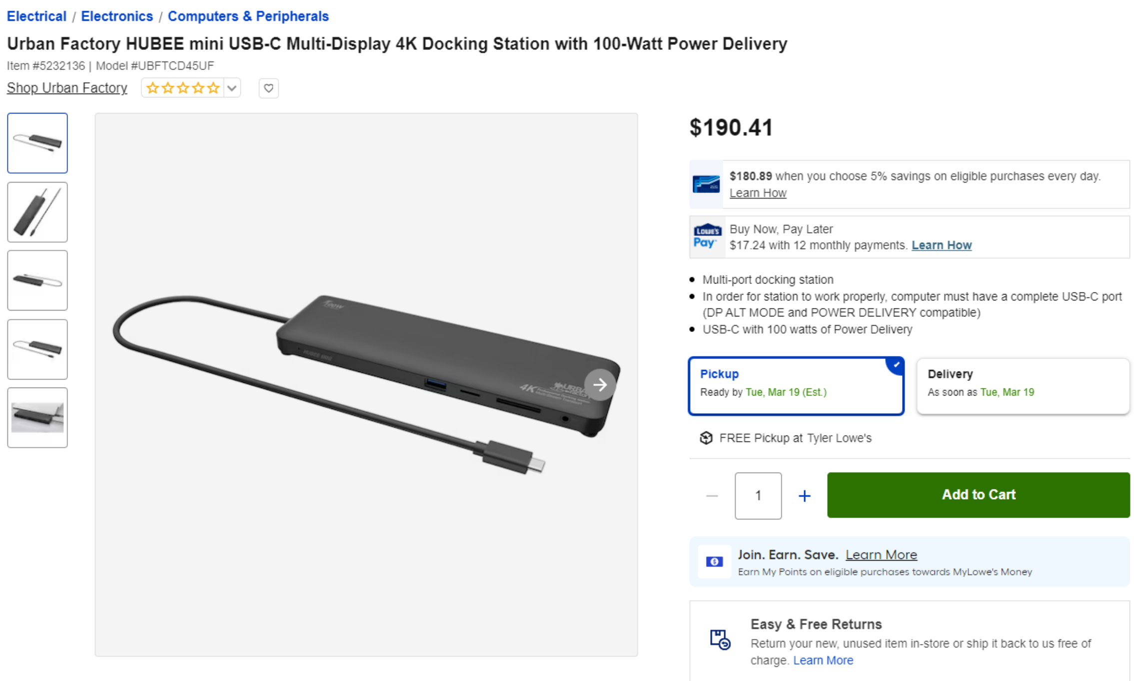


(*E.g.*, https://www.lowes.com/pd/Mobile-Pixels-USB-C-Hub-with-Ethernet-4K-HDMI-USB-3-0-Ports-SD-TF-Card-Slots-Data-Transfer-Charging-and-Port-Expansion/5013702029?idProductFound=false&idExtracted=true).



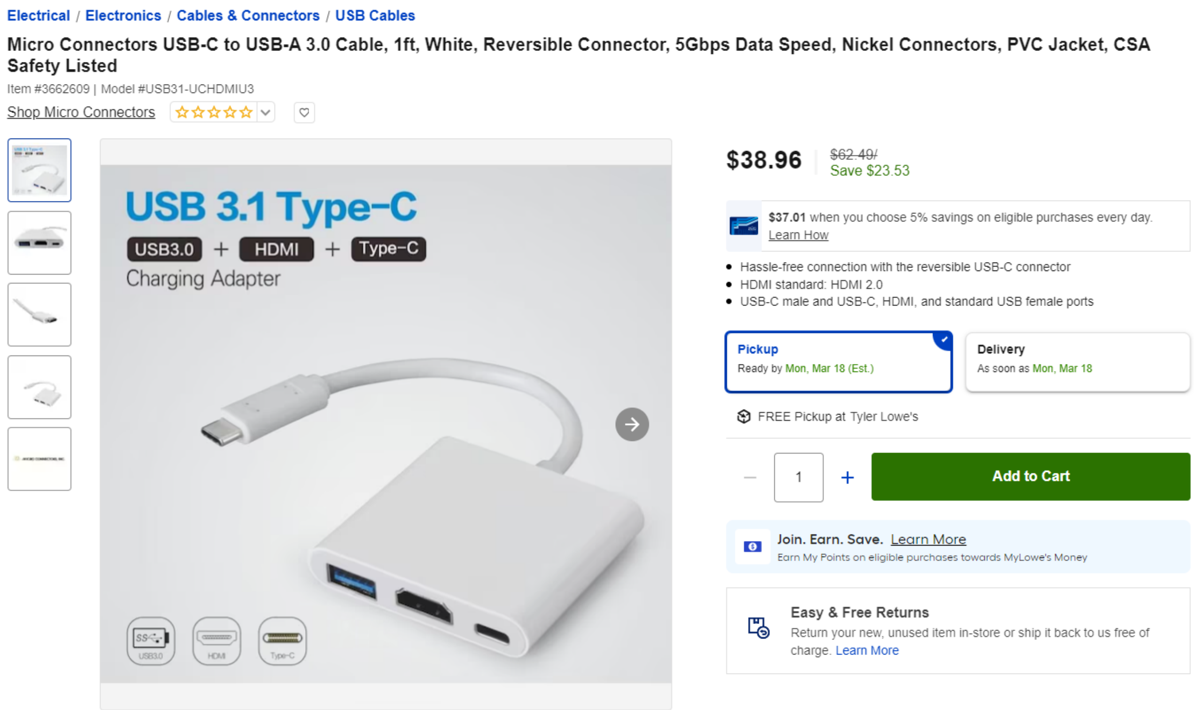
- USB-C multi-port mobile station with pass-through current distribution
- In order for station to work properly, computer must have a complete USB-C port (DP ALT MODE and POWER DELIVERY compatible)
- Space Gray aluminum station body to naturally dissipate heat
- 100-watt USB-C 3.1 cable to link station to computer
- USB-C 3.1 input to connect USB-C power supply
- 4K HDMI at 30 Hz; VGA Full HD 1080p at 60 Hz
- 3 USB 3.0 inputs with data flow of up to 5 Gbps
- SD/microSD Card readers
- 1,000 Mbps RJ45 port

(*E.g.*, https://www.lowes.com/pd/Urban-Factory-HUBEE-Plus-USB-C-Multi-Stream-Mobile-Station-with-100-Watt-Power-Delivery/5013839387?idProductFound=false&idExtracted=true).

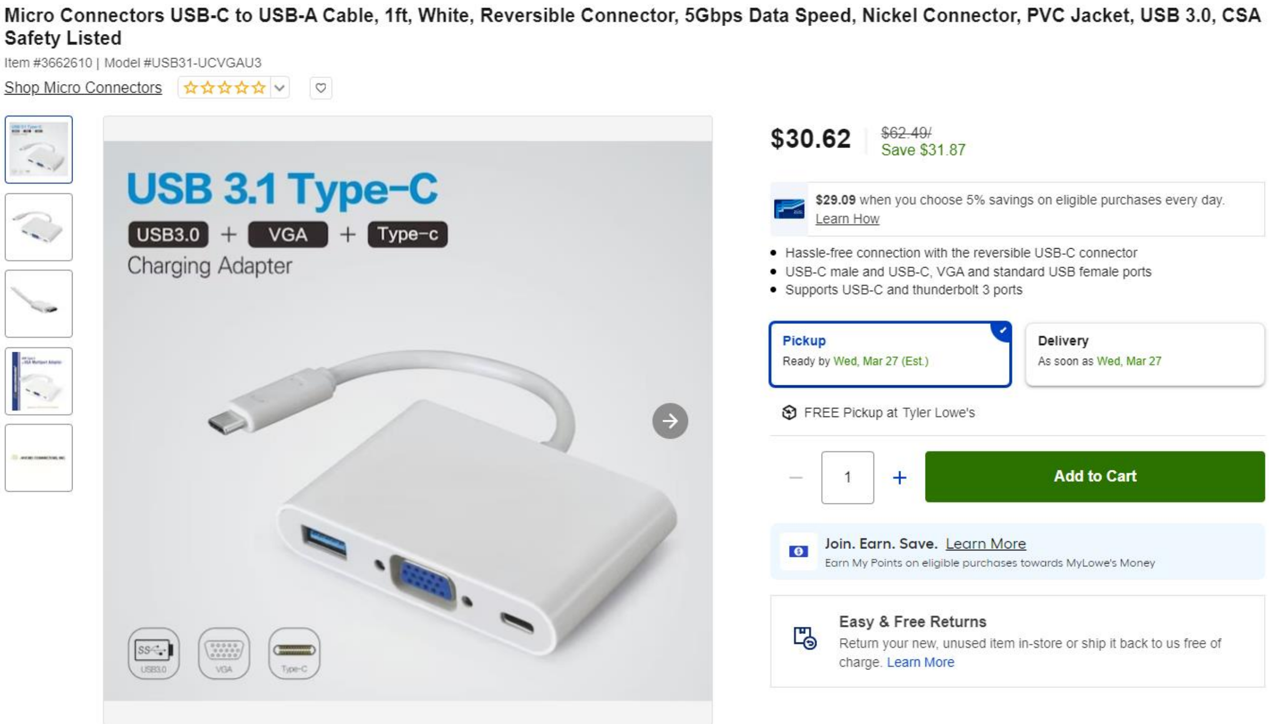


- Multi-port docking station
- In order for station to work properly, computer must have a complete USB-C port (DP ALT MODE and POWER DELIVERY compatible)
- USB-C with 100 watts of Power Delivery
- DisplayPort: 4K/30 Hz max
- HDMI port: 4K/30 Hz max
- VGA port: 2K/60 Hz max
- 2 USB-A 2.0 ports: 480 Mbps
- USB-A 3.0 port: 5 Gbps
- RJ45: Gigabit Ethernet 1,000 Mbps max

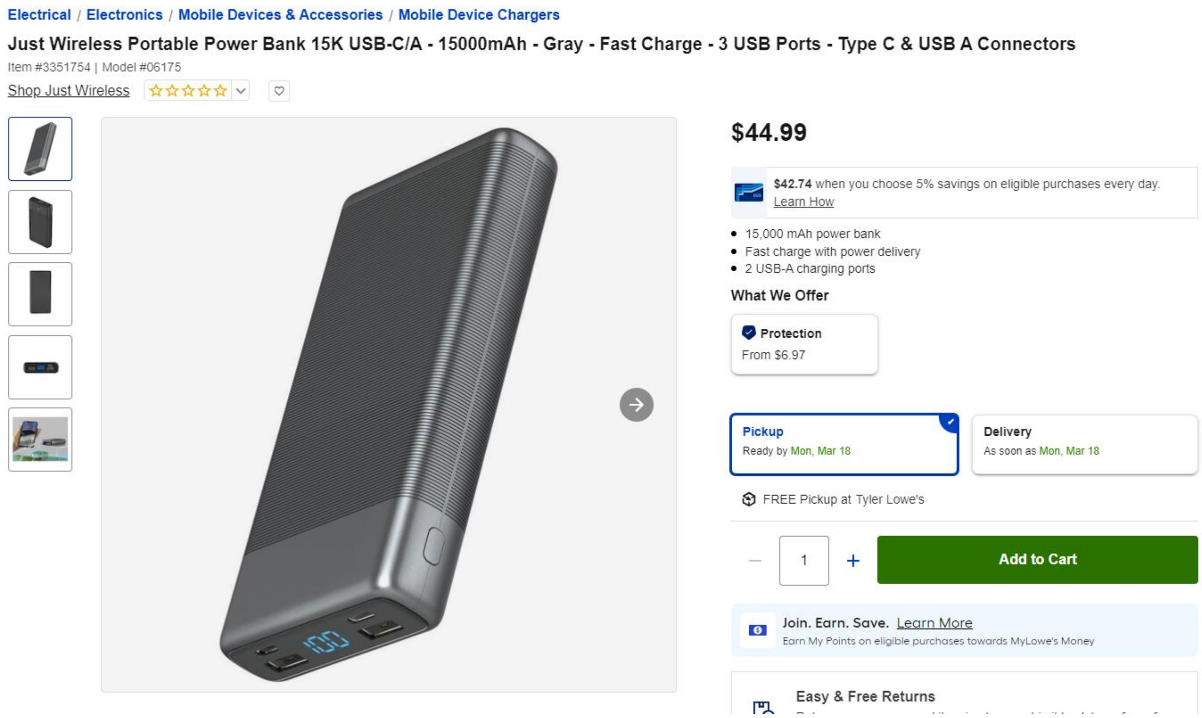
(*E.g.*, https://www.lowes.com/pd/Urban-Factory-HUBEE-mini-USB-C-Multi-Display-4K-Docking-Station-with-100-Watt-Power-Delivery/5013839417?idProductFound=false&idExtracted=true).



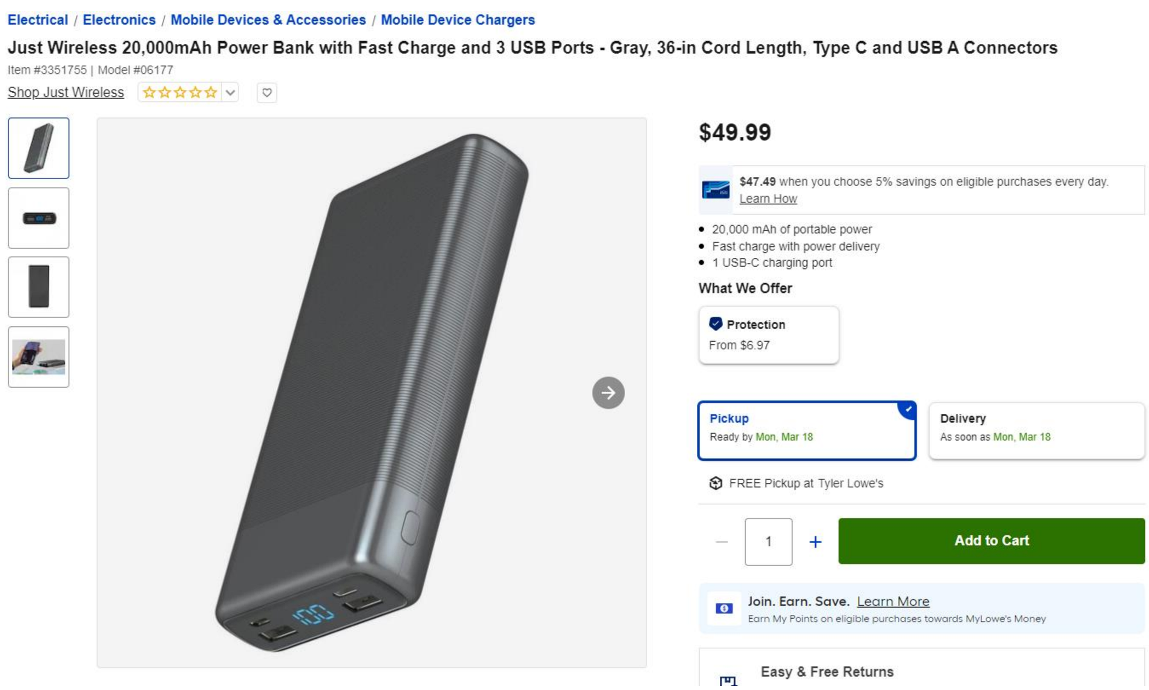
(*E.g.*, https://www.lowes.com/pd/Micro-Connectors-USB-C-Digital-AV-HDMI-Multiport-Adapter-USB3-0-HDMI-USB-Type-C-9-in/5001459801?idProductFound=false&idExtracted=true).



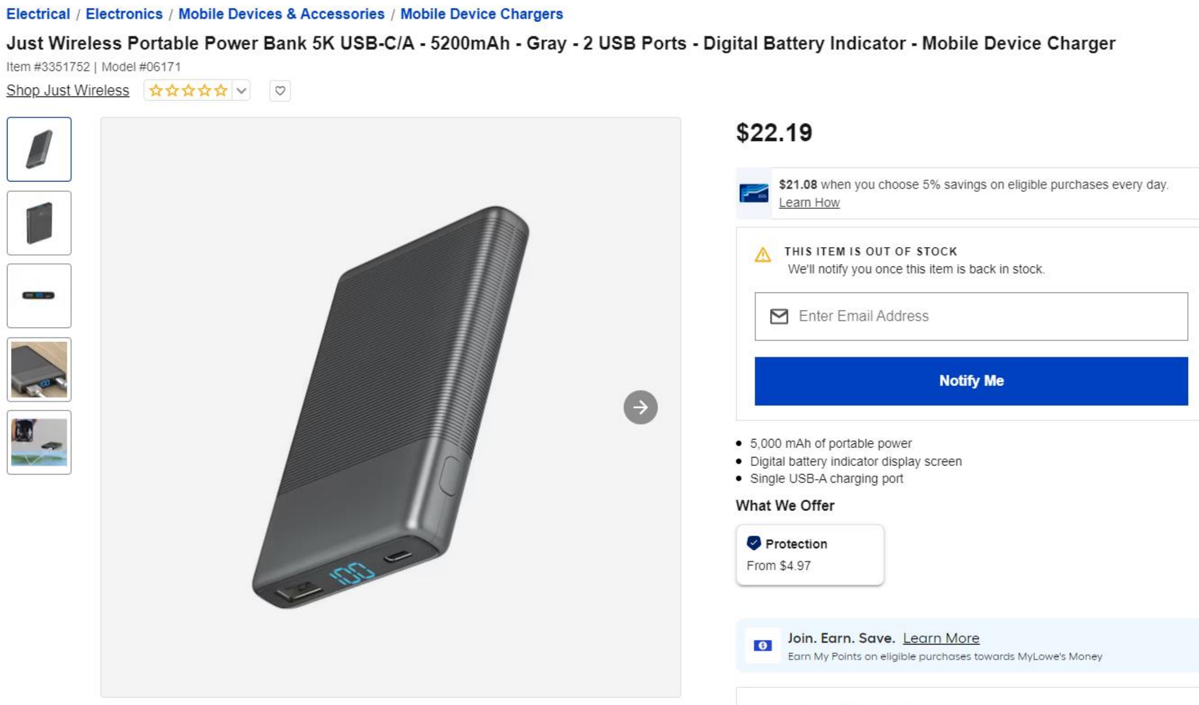
(*E.g.*, https://www.lowes.com/pd/Micro-Connectors-USB-C-to-VGA-Multiport-Adapter-USB-3-0-VGA-USB-Type-C-9-in/5001459803?idProductFound=false&idExtracted=true).



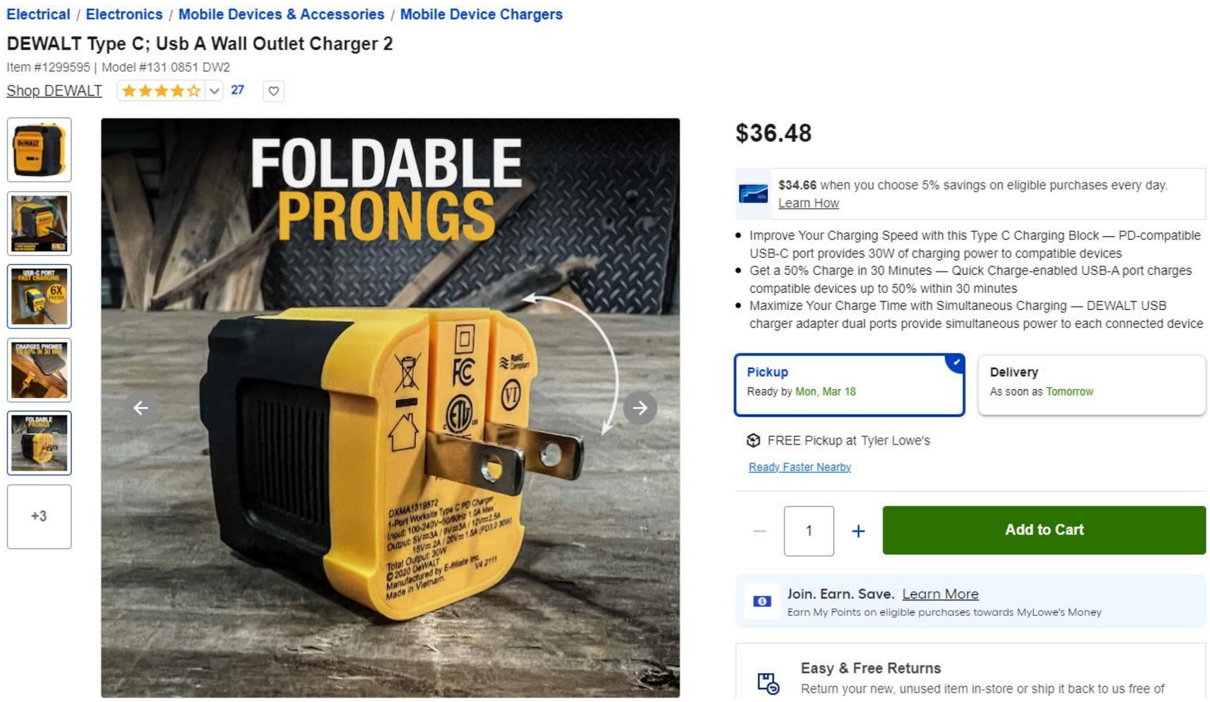
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



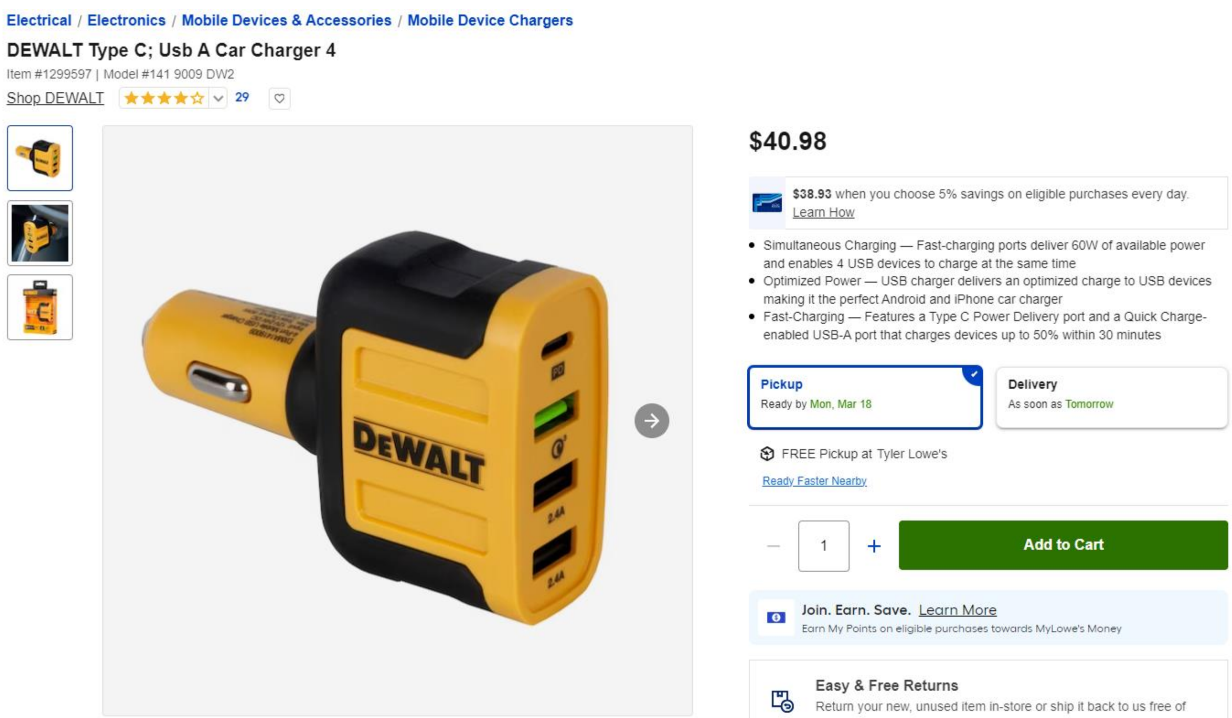
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-5K-USB-C-A/5001606727?idProductFound=false&idExtracted=true).

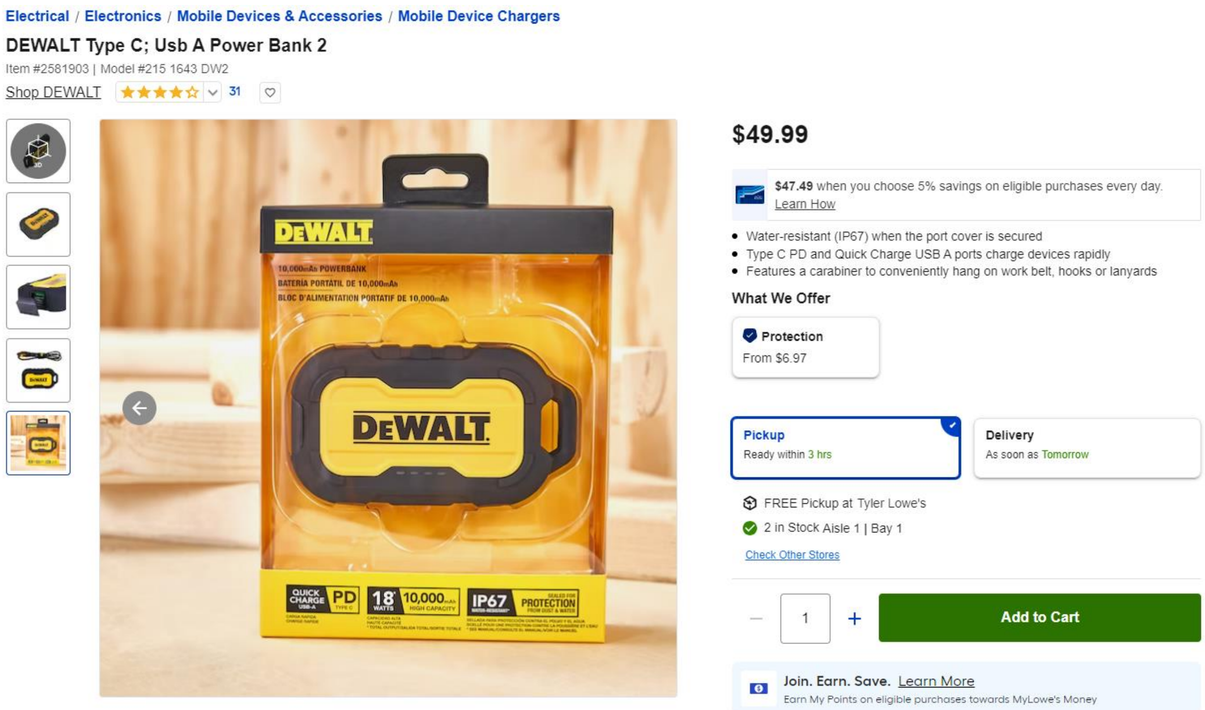


(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Wall-Outlet-Charger/1001435122?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Car-Charger/1000976132?id

ProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-10-000-mAh-Powerbank/1003242934?idProductFound=false&idExtracted=true).

Eaton 20-Amp 125-volt Tamper Resistant Residential/CoMMercial Decorator USB Outlet Type A/C, Gray

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- Dual 5A Type-C charging capacity
- Quick and easy access for both USB charging and electrical outlets

Manufacturer Color/Finish: Gray

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Amperage: 20

15 20

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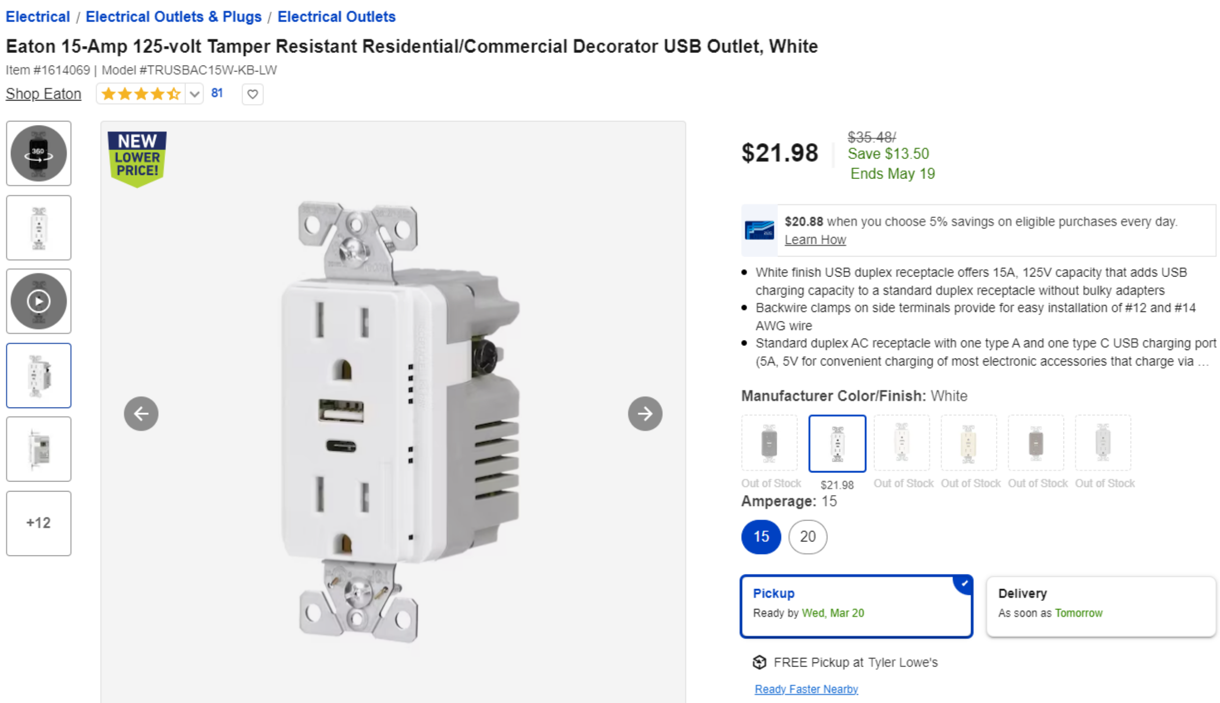
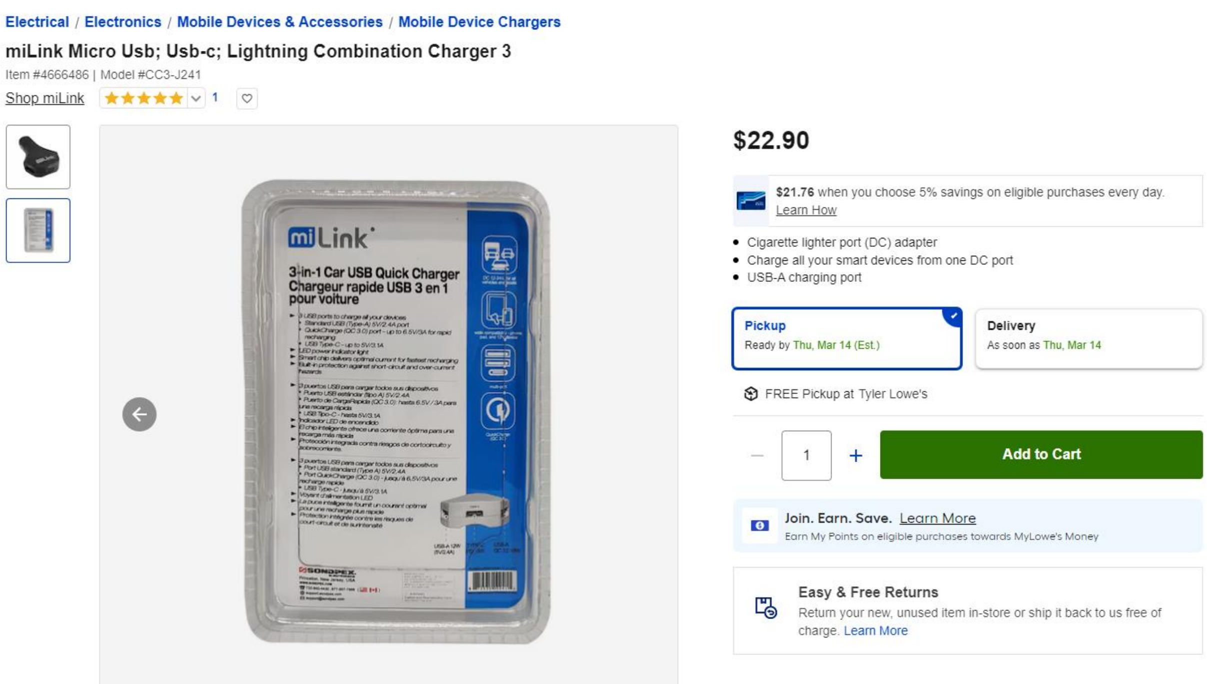
Eaton's USB charging receptacles offer fast, convenient and efficient charging of portable electronic devices directly from a standard outlet without bulky adapters or powered computers. Ideal for the home office, bedroom or kitchen, USB devices replace the electrical receptacle of any standard wall outlet, so you can virtually charge smart phones, tablets, e-readers and cameras. Eaton's USB charging solutions eliminate clutter in residential and commercial environments and is compatible with USB Type C electronics.

- Charges electronic devices without a special adapter
- Dual 5A Type-C charging capacity
- Quick and easy access for both USB charging and electrical outlets
- Reversible ports allow for consistent charging regardless of plug-in orientation
- Standard duplex receptacle with two USB-C ports rated at a combined 5.0A
- Compatibility with USB Type C electronics, including smart phones, tablets, e-readers, cameras, MP3 players and more
- Ideal for home offices, kitchens, bedrooms and more
- Replaces a standard duplex receptacle and uses a decorator style wallplate
- Black tamper resistant shutters nearly disappear from view, creating a seamless, contemporary look

(*E.g.*, https://www.lowes.com/pd/Eaton-20A-TR-Receptacle-5A-USB-Type-C-GY/5003062945?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Eaton-White-15-Amp-Decorator-Tamper-Resistant-USB-Outlet-Residential-Commercial-USB-Outlet/1002943626).



(*E.g.*, https://www.lowes.com/pd/miLink-3-in-1-Car-USB-Charger-Type-C-USB-A-and-QC-3-0/5005469221?idProductFound=false&idExtracted=true).

Trexonic 4-Port USB Charger with Quick Charge Technology, Silver, Type C and USB A Connectors, 1000mAh Battery Power

Item #1646379 | Model #849105170M

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- Can charge up to 5 devices simultaneously
- Quick charge technology for time saving
- Power indicator light

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Trexonic's 5 Port Universal USB Compact Charging Station is staple for any home or office space. This 35.5 watts smart USB charging port allows you to charge 5 devices simultaneously at full speed. Powered for 2 tablets and 3 smartphones, charging station will quickly and effectively charge your devices to save you time. Its compact design makes it a perfect ally for organizing your working space or taking it with you on the go. EXCEPTIONAL PERFORMANCE: Intelligent charging station with a 2.1A port for faster charge. It detects connected devices and delivers the optimal charging current for safe and fast charging. It features a blue LED light to indicate whenever it is on. SPACE SAVING: With its several docks, this charging station allows to keep your space nice and tidy by keeping all your organized charging devices together NO ADAPTER NEEDED: Charge up to 5 devices at full speed all at once without ever needing an extra adapter or power strip. REFINED SILVER FINISH: Perfect mix of practicality, functionality and great design with the modern silver finish that'll add style and class to your space. UNIVERSAL COMPATIBILITY: The charging station features 100 to 240V input and is perfectly compatible with virtually all iOS, Android and Windows smartphones, tablets or any other devices with a USB charge port. WARRANTY and SERVICE: We stand behind every product by offering 90days warranty and extensive customer service. Please contact us with any question or concern you may have. Includes One 5 Port USB Charging Station (3.75-in x 2.6-in x 2.6-in - 0.35-lbs)Very compact charging station, ideal to carry from home to offices, school, during vacation travels or business trips.. Item Dimensions: 3.75-in x 2.6-in x 2.6-in, Item Weight: 0.35-lbs

- Can charge up to 5 devices simultaneously
- Quick charge technology for time saving
- Power indicator light
- Compatible with most Android and IOS devices
- Input: 100V-240V
- Max total output: 5V 7.1A
- Max output at port: 2.1A

Prop65 Warning Label
PDF

(*E.g.*, https://www.lowes.com/pd/Trexonic-Type-C-USB-A-USB-Charger/1001571060?idProductFound=false&idExtracted=true).

Electrical / Electronics / Mobile Devices & Accessories / Mobile Device Chargers

Trexonic Micro Usb Usb-c Lightning Combination Charger 4

Item #1646374 | Model #849105163M

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$45.10

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- Input: AC-100-240V (50-60Hz)
- Max total output: 5V 10.2A
- Max output at port: 5V 2.4A

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This intelligent charging dock allows you to save time and space efficiently and in style. Powerful and smart, it'll distribute the appropriate current to up to 6 devices for fast and effective charge. Its small and sleek design with brackets make this charging station a great companion for organizing your space. FAST INTELLIGENT CHARGE: Intelligent charging station with 2.4A ports for faster charge. Detects connected devices and delivers the optimal charging current for safe and fast charging.It also features a overheat and overload circuit protection for a worry free experience. SPACE SAVING: The multi-device docking station allows to you to organize up to 6 devices for a clean and neat space. NO ADAPTER NEEDED: Charge up to 6 devices at full speed all at once without ever needing an extra adapter or power strip. CLASSIC SILVER AND CLEAR FINISH: Perfect mix of practicality, functionality and great design with the everlasting silver finish with clear dividers that'll add style and class to your space and easily blend with any decor. UNIVERSAL COMPATIBILITY : The charging station features 100 to 240V input and is perfectly compatible with virtually all iOS, Android and Windows smartphones, tablets or any other devices with a USB charge port. TRAVEL FRIENDLY: Very lightweight and compact charging station with removable dividers, ideal to carry from home to office/school, during vacation travels or business trips. WARRANTY and SERVICE: We stand behind every product by offering 90days warranty and extensive customer service. Please contact us with any question or concern you may have.. Item Dimensions: 7.50-in x 4.75-in x 4.00-in, Item Weight: 0.80-lbs

- Input: AC-100-240V (50-60Hz)
- Max total output: 5V 10.2A
- Max output at port: 5V 2.4A
- Circuit protection to prevent overheating and overloading
- Holds up to 6 devices

Prop65 Warning Label
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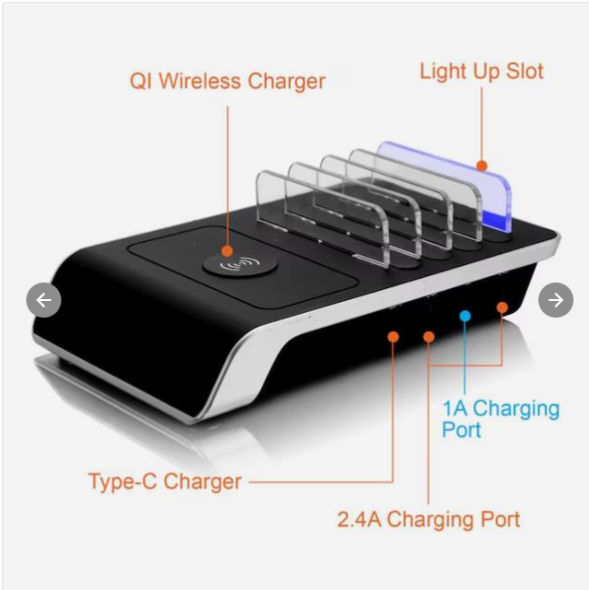
(*E.g.*, https://www.lowes.com/pd/Trexonic-Micro-USB-USB-C-Lightning-Combination-Charger/1001737352?idProductFound=false&idExtracted=true).

Trexonic Micro Usb Usb-c Lightning Combination Charger 4

Item #1646491 | Model #849111674M

Shop Trexonic 1



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- Charging station
- Charges up to 5 devices
- 4 Light up slots

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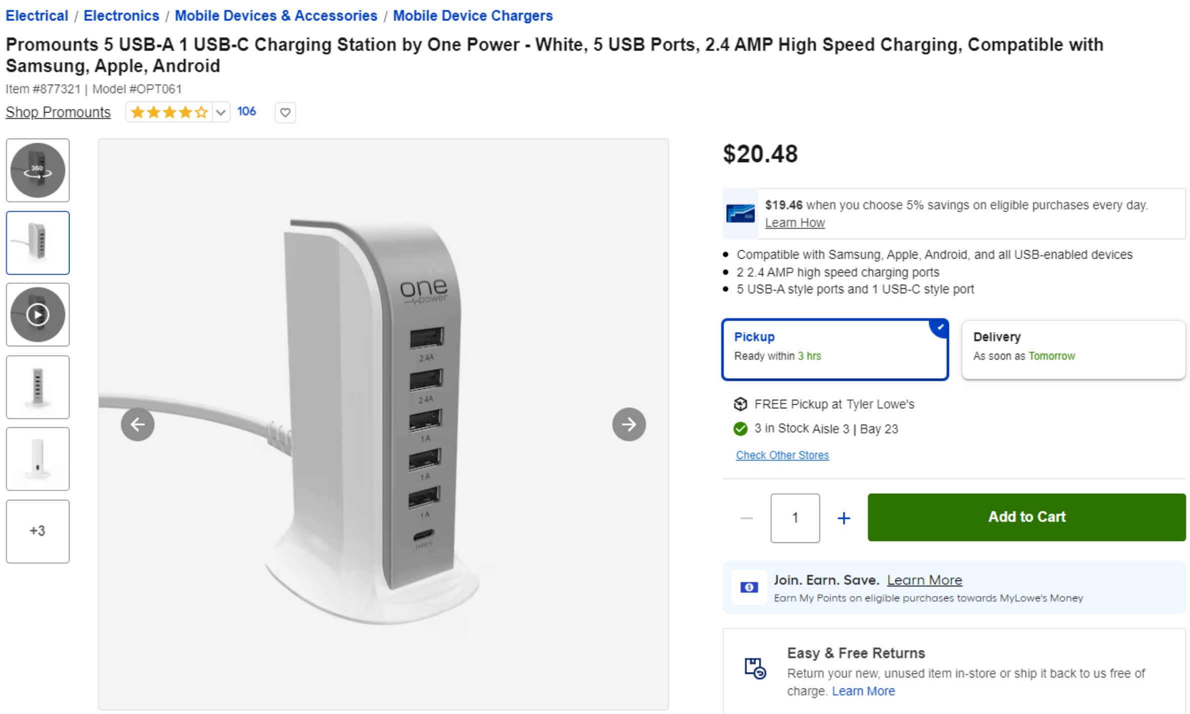
The Trexonic wireless charger with fast charging station dock and wireless charging station is the perfect household charger that can charge multiple devices at once! This wireless phone charger is designed with rapid charging for up to 5 devices with 4 smart IX USB light up charging port slots and 1 wireless charging station. This charging station is a great way to keep clutter off your desk and organize all of your charging devices into one neat little area. This efficient and sleek station offers dual 2.4A USB ports, one 1A USB port, one type C USB port and one wireless charging pad.

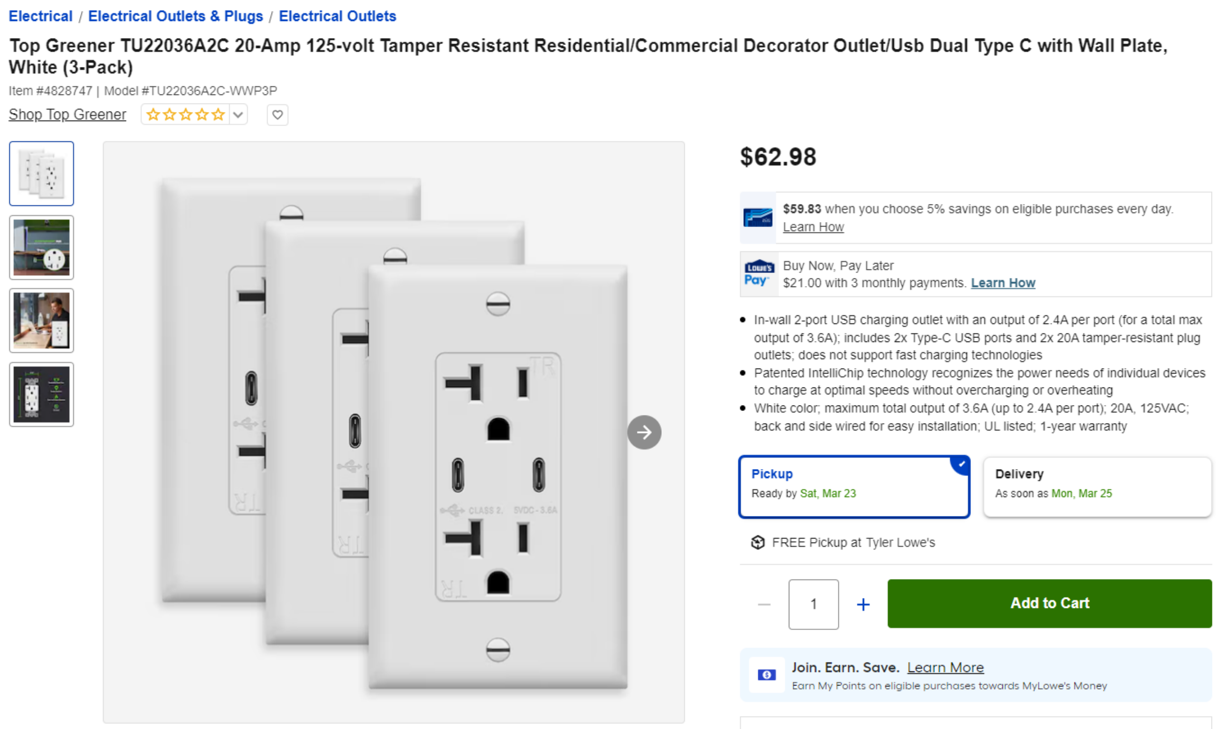
- Charging station
- Charges up to 5 devices
- 4 Light up slots
- 1 Wireless charging dock
- Dual 2.4A USB ports
- 1A USB port
- Type C USB Port
- One Charging Station

Prop65 Warning Label
PDF

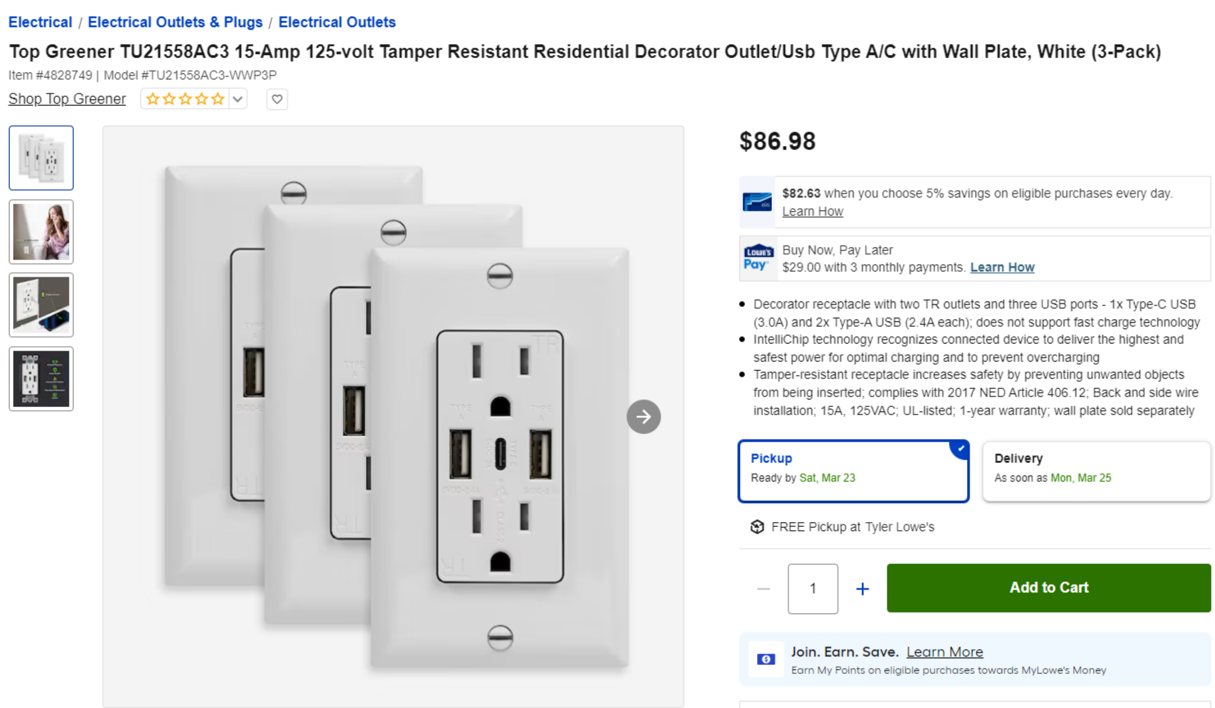
(*E.g.*, https://www.lowes.com/pd/Trexonic-Micro-USB-USB-C-Lightning-Combination-Charger/1001394898?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Promounts-6-USB-Ports-Multiple-Colors-Finishes-Power-Strip/1001218992?idProductFound=false&idExtracted=true).

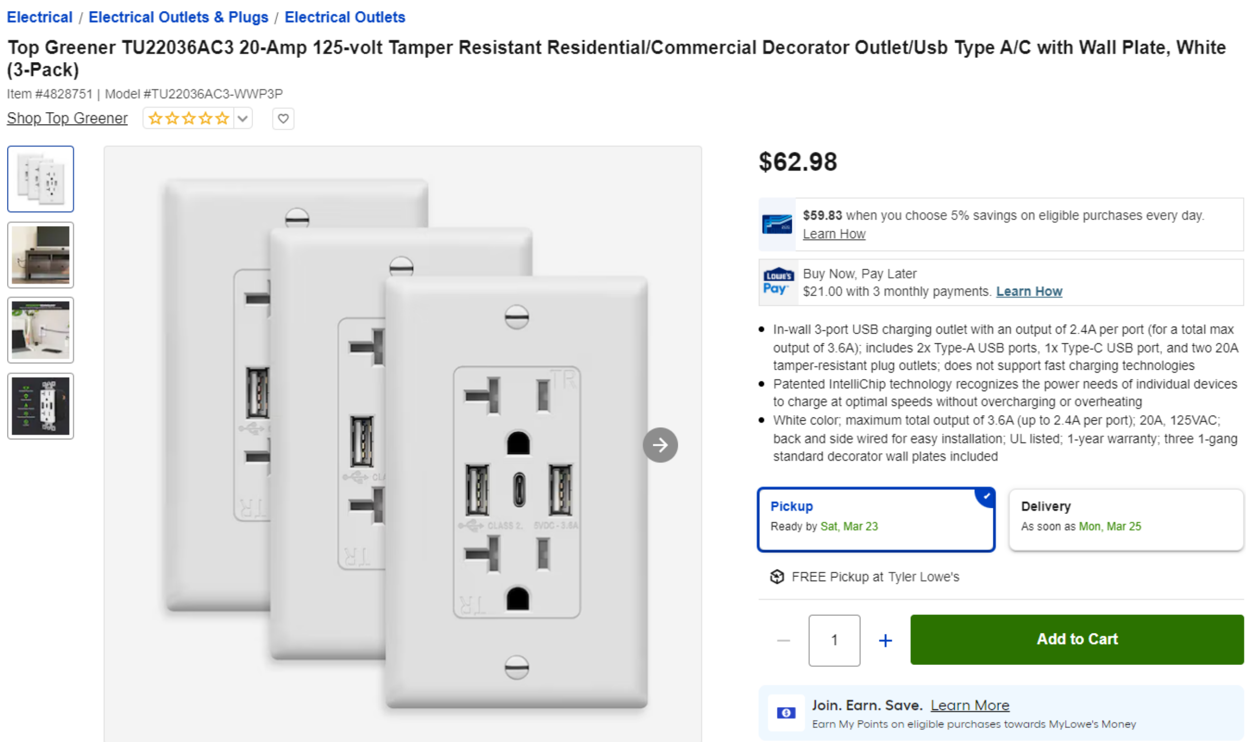


(*E.g.*, https://www.lowes.com/pd/Top-Greener-20-Amp-Tamper-Resistant-Receptacle-2-Port-USB-C-Wall-Outlet-White-3-Pack/5014128997?idProductFound=false&idExtracted=true).

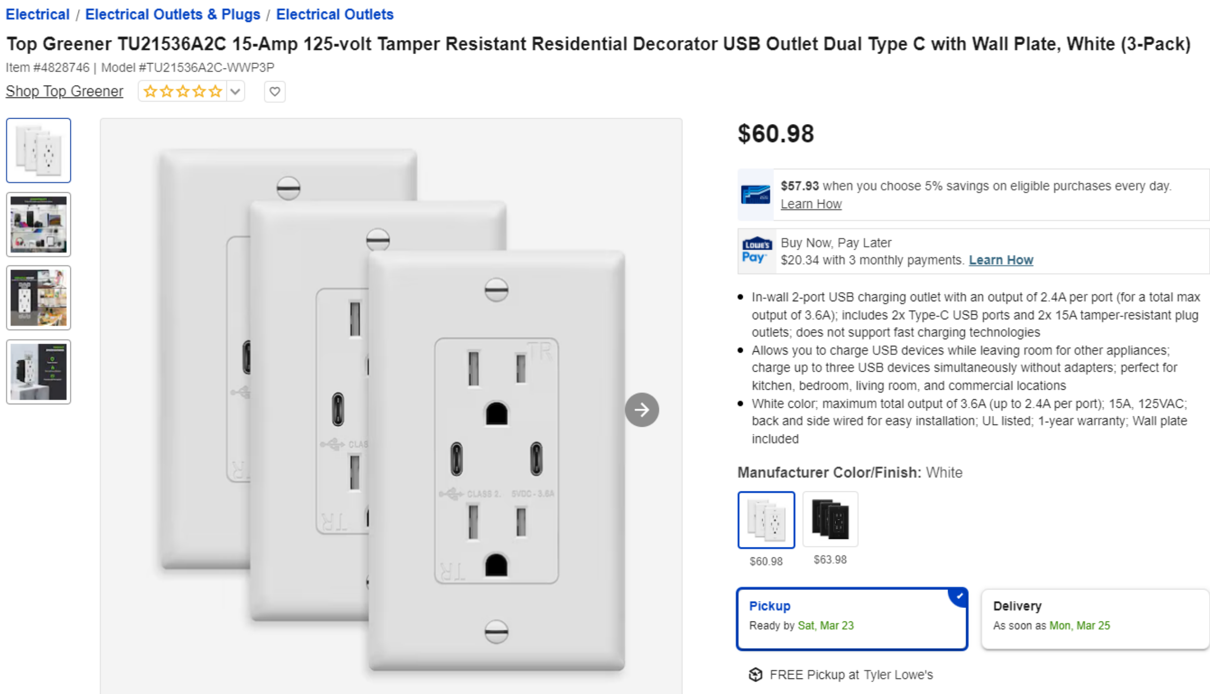


(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Decorator-TR-Receptacle-3-Port-USB-

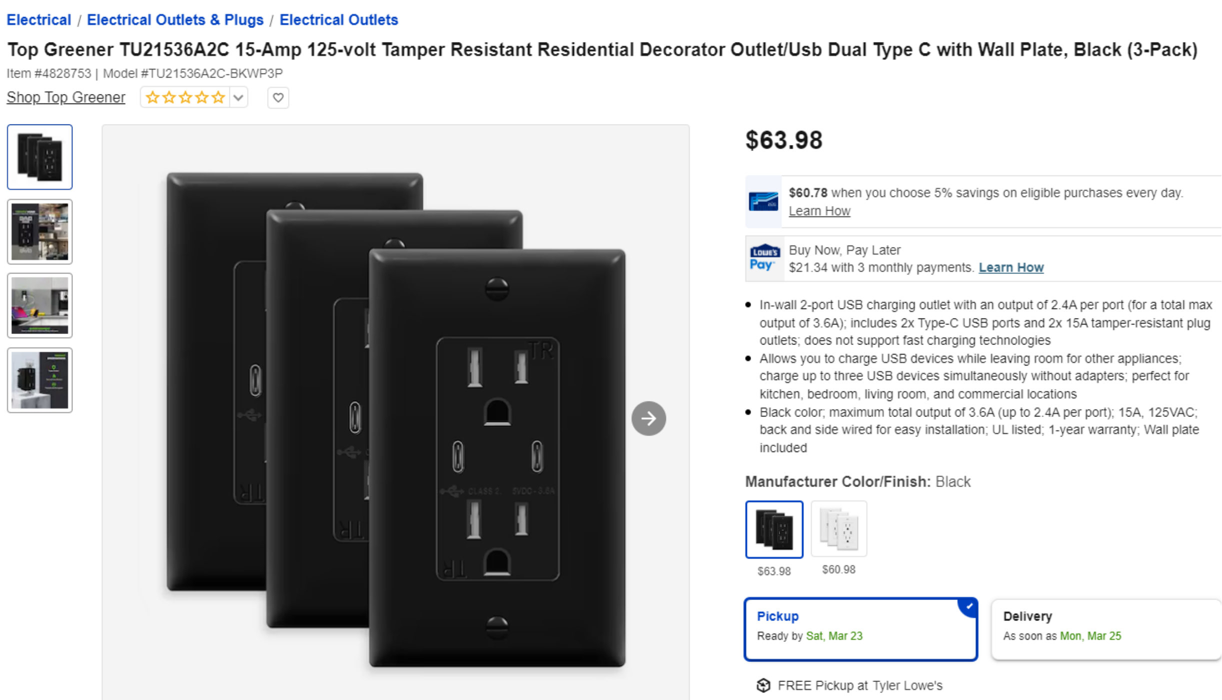
Type-C-A-5-8A-Output-White-3-Pack/5014129007?idProductFound=false&idExtracted=true).



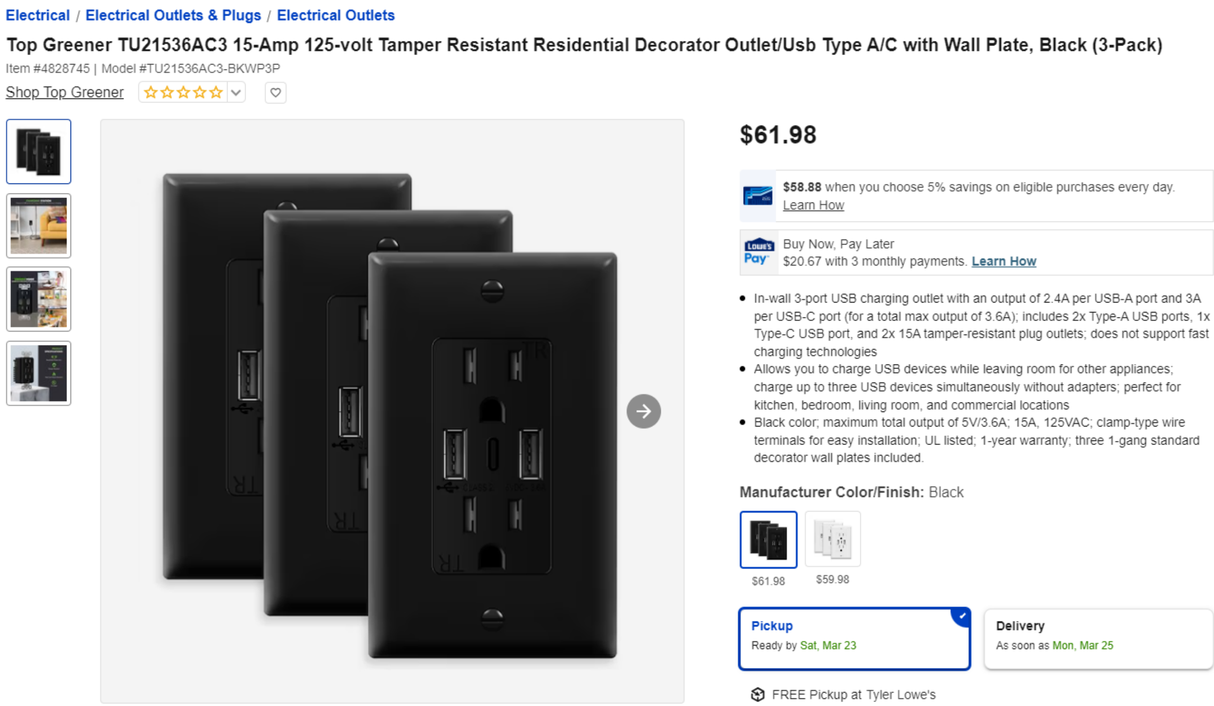
(*E.g.*, https://www.lowes.com/pd/Top-Greener-20-Amp-Tamper-Resistant-Receptacle-3-Port-USB-Type-C-A-Wall-Outlet-White-3-Pack/5014128993?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Tamper-Resistant-Receptacle-2-Port-USB-C-Wall-Outlet-White-3-Pack/5014129005?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Tamper-Resistant-Receptacle-2-Port-USB-C-Wall-Outlet-Black-3-Pack/5014128999?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Top-Greener-15-Amp-Tamper-Resistant-Receptacle-3-Port-Type-C-A-USB-Wall-Outlet-Black-3-Pack/5014128991?idProductFound=false&idExtracted=true).

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- 4,000 mAh portable power bank
- Compatible with all devices featuring USB-C and USB ports
- Charges 2 devices at once

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The Naztech 4,000 mAh Dual Output USB-C and USB Portable Power Bank extends your talk, music, and gaming experiences by up to 13 hours at home or on the go! This high-capacity 4,000 mAh battery can charge 2 devices at once through powerful dual outputs— a USB-C in/output and a USB output with up to 15 watts of pure power. With rapid recharge, get back to full in just 2 hours, so your devices stay powered up! Revolutionize your charging routine indoors and on the go!

- 4,000 mAh portable power bank
- Compatible with all devices featuring USB-C and USB ports
- Charges 2 devices at once
- Output: 15 watt USB-C; 10 watt USB
- Ultra-slim and lightweight
- World-class safety features automatically regulate power bank's charging performance to protect devices from overcurrent, over voltage, short circuit, and over-temperature
- LED battery indicator
- Up to 2 hours rapid recharge
- Up to 13 hours extra battery life

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SDS PDF

Warranty Guide PDF

(*E.g.*, https://www.lowes.com/pd/Naztech-Type-C-USB-A-Wall-Outlet-Charger-2/5013960091?idProductFound=false&idExtracted=true).

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Naztech Micro Usb; Usb-c; Lightning Car Charger 2

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- Power delivery technology
- Charge 2 devices simultaneously
- 30 watt USB-C PD output

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Need fast charging power on the road for your newest USB-C gear? The Naztech Turbo 30-Watt USB-C PD + USB-C Car Charger features 2 USB-C ports that are engineered to each deliver a powerful 3 amp maximum output! The bottom port is enhanced even further with a specialized power delivery chipset which offers up to 30 watts of high voltage charging power! With over 9x the power of standard chargers, this one charger works with even the most power-hungry devices. You can even fast charge the Galaxy Note 10/Note 10+, and Galaxy S10/10+, or the iPhone 11/iPhone 11 Pro/iPhone Pro Max, XS/XS, Max/XR from 0 to 50% in just 30 minutes! Now you can enjoy the latest in high-speed technology and always arrive fully charged!

- Power delivery technology
- Charge 2 devices simultaneously
- 30 watt USB-C PD output
- Total 45 watt maximum output
- USB-C, micro USB, and Lightning device compatible
- IntelliQ smart chip technology
- Sleek low profile design
- Durable construction
- Glossy black finish

Prop65 Warning Label
PDF

(*E.g.*, https://www.lowes.com/pd/Naztech-Turbo-30-Watt-USB-C-PD-USB-C-Car-Charger/5001541923?idProductFound=false&idExtracted=true).

Electrical / Electronics / Mobile Devices & Accessories / Mobile Device Chargers

RoadKing Type C; USB A Combination Charger 2

Item #3722750 | Model #RK03430

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- Heavy-duty DC charger
- Heavy-duty vinyl construction: Standard level charging
- USB-C compatible: Safely charge and sync devices

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This heavy-duty charger features a 6-foot coiled cable with a USB-C(TM) connection. Featuring two USB ports, this charger allows three devices to charge simultaneously while on-the-go. Have your devices ready to go when you arrive at your destination.

- Heavy-duty DC charger
- Heavy-duty vinyl construction: Standard level charging
- USB-C compatible: Safely charge and sync devices
- Dual USB plus charging cable: Charge up to 3 devices simultaneously
- 6 foot heavy-duty coiled cable: Prevents tangling and makes cable easy to store
- 7.8 AMP total output: Powerful charging
- Qualcomm® Quick Charge(TM) 3.0 technology
- Fastest and most efficient charging for your devices

Prop65 Warning Label
PDF

Warranty Guide
PDF

(*E.g.*, https://www.lowes.com/pd/RoadKing-RoadKing-12V-DC-3-0-Charger-with-Dual-USB/5001602165?idProductFound=false&idExtracted=true).

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Accell Type C; USB A Combination Charger

Item #3245139 | Model #D233B-001B

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- 3-in-1 fast wireless charger for smartphone, Apple Watch, and AirPods
- Designed with double-coil charging and efficient cooling fan
- Compatible with Apple iPhone 8/8 Plus/X/XS/XR/XS MAX, Samsung Galaxy S 9/S10e/S10/S10 Plus, Apple Watch 2/3/4, and Apple AirPods 1/2

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Features

Battery Power	N/A	Connector Type	Type C; USB A
Battery Recharge Time (Hours)	2	Number of USB Ports	0

(*E.g.*, https://www.lowes.com/pd/Accell-3-in-1-Fast-Wireless-Charger-Black/5001208577?idProductFound=false&idExtracted=true).

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See *USB 2.0*	
USB 3.2	5 V	See *USB 3.2*	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).

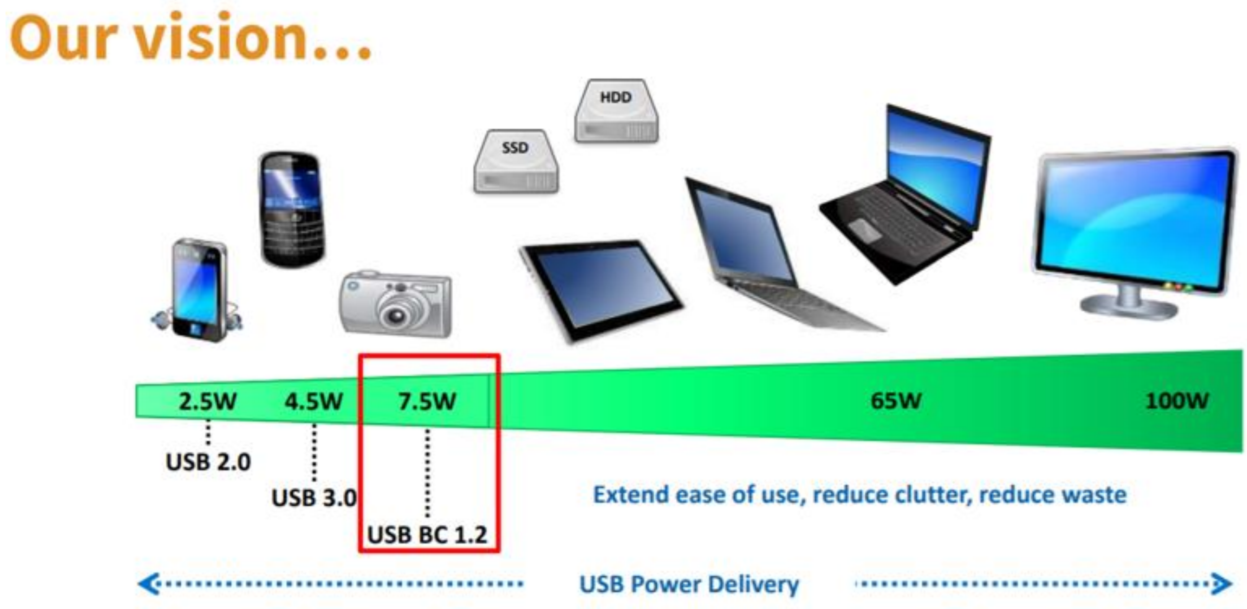
USB battery charging specifications

Battery Charging Specification Revision 1.2 (BC1.2)

The different port types described in the above section were first defined in the *Battery Charging Specification Revision 1.2* (BC1.2) published in 2010. In addition to the port definitions, BC1.2 specifies primary and secondary charge port detection sequences and port specific performance requirements. These include required operating range, undershoot, detection signaling, and connectors for each port type. Also included are dead, weak, and good battery charge conditions, port shutdown procedures, and other details associated with battery charging.

BC1.2 was published after USB 2.0 but before USB 3.1 and so the information in BC1.2 refers to USB 2.0. The specification is, however, consistent and compatible with USB 3.1.

(*E.g.*, https://www.lightingglobal.org/wp-content/uploads/2017/12/Issue-24_USB-smartphone-charging-final.pdf, page 4).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

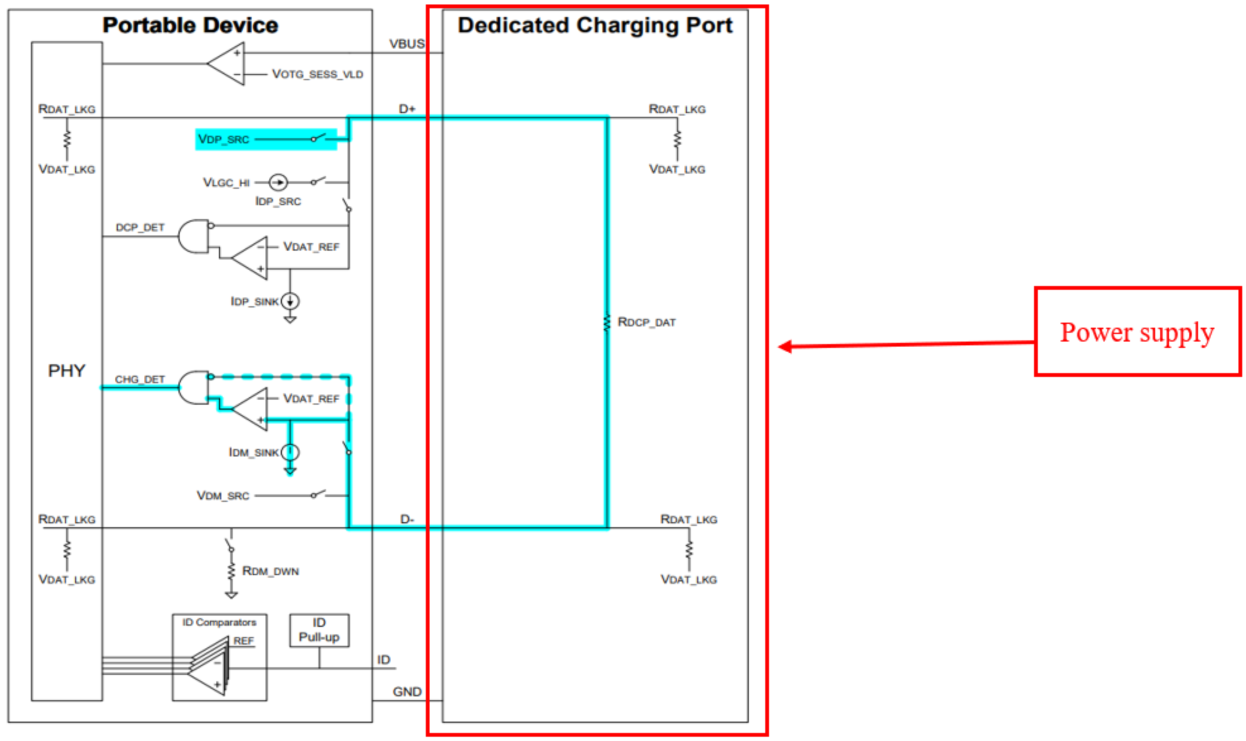


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

48. On information and belief, Defendant provides a product or power supply system, such as the ‘087 Accused Chargers, that comprise data circuitry configured to receive a first signal that originates from a portable electronic device and to provide a second signal to be sent to the portable electronic device, the data circuitry and the power circuitry configured to be coupled via a connector to the portable electronic device, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be detachably mated with a power input interface of the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the USB power supply

comprises data circuitry configured to use the Primary Detection method as described in the USB BC 1.2 specification. The USB power supply connects to the portable electronic device through a USB cable. The USB cable has a USB-C connector at one end to detachably mate with the charging port of portable electronic device. The connector comprises VBUS ("first conductor"), GND ("second conductor"), D+ ("third conductor") and D- ("fourth conductor") pins. Further, during Primary Detection, when a portable electronic device is connected with the USB power supply through the USB cable, the portable electronic device generates a D+ signal ("first signal"). Data circuitry of the USB power supply receives the D+ signal ("first signal") and provides a D- signal ("second signal") to the portable electronic device to detect the type of connected power supply (standard downstream port or charging port). To the extent the D- signal (*i.e.*, "second signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw IDEV_CHG without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

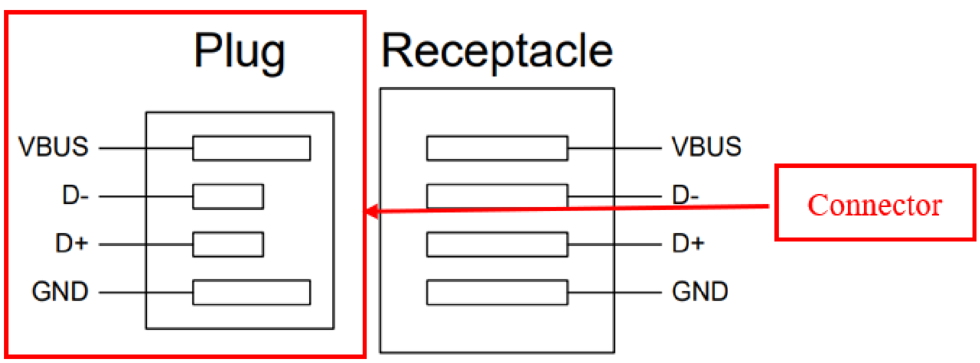


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

Figure 3-1 shows several examples of a PD attached to an SDP or Charging Port.

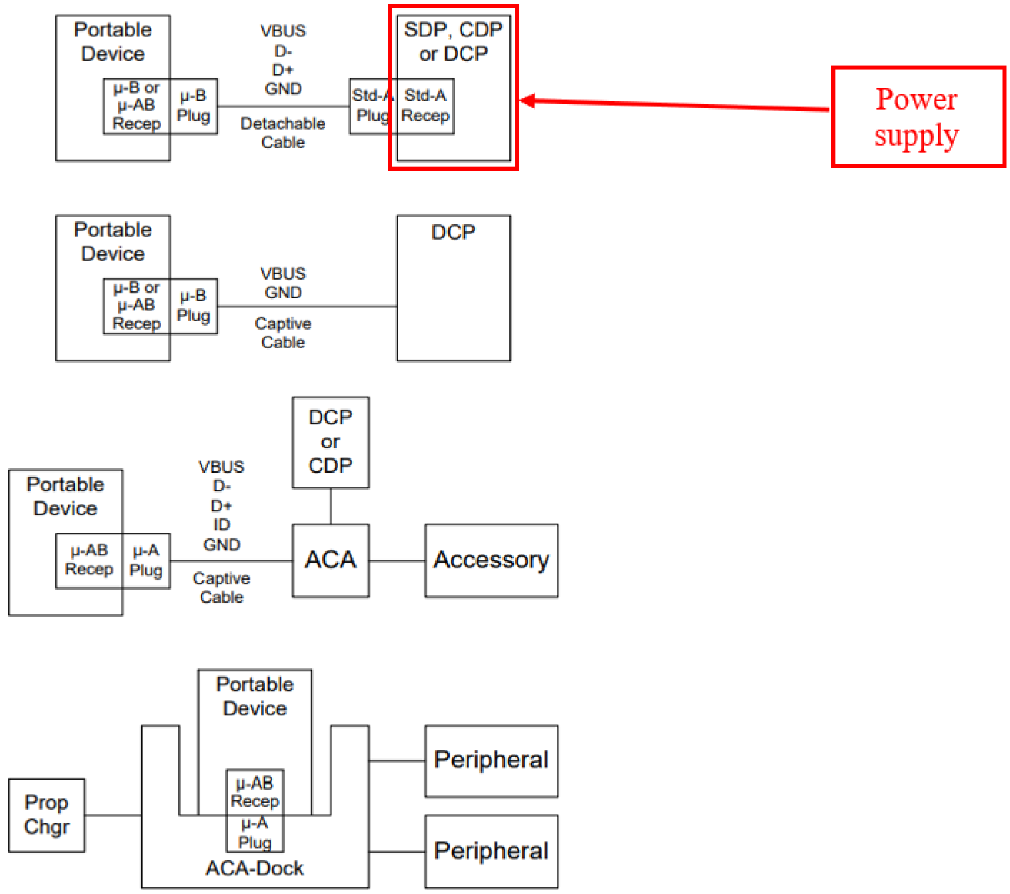


Figure 3-1 System Overview

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

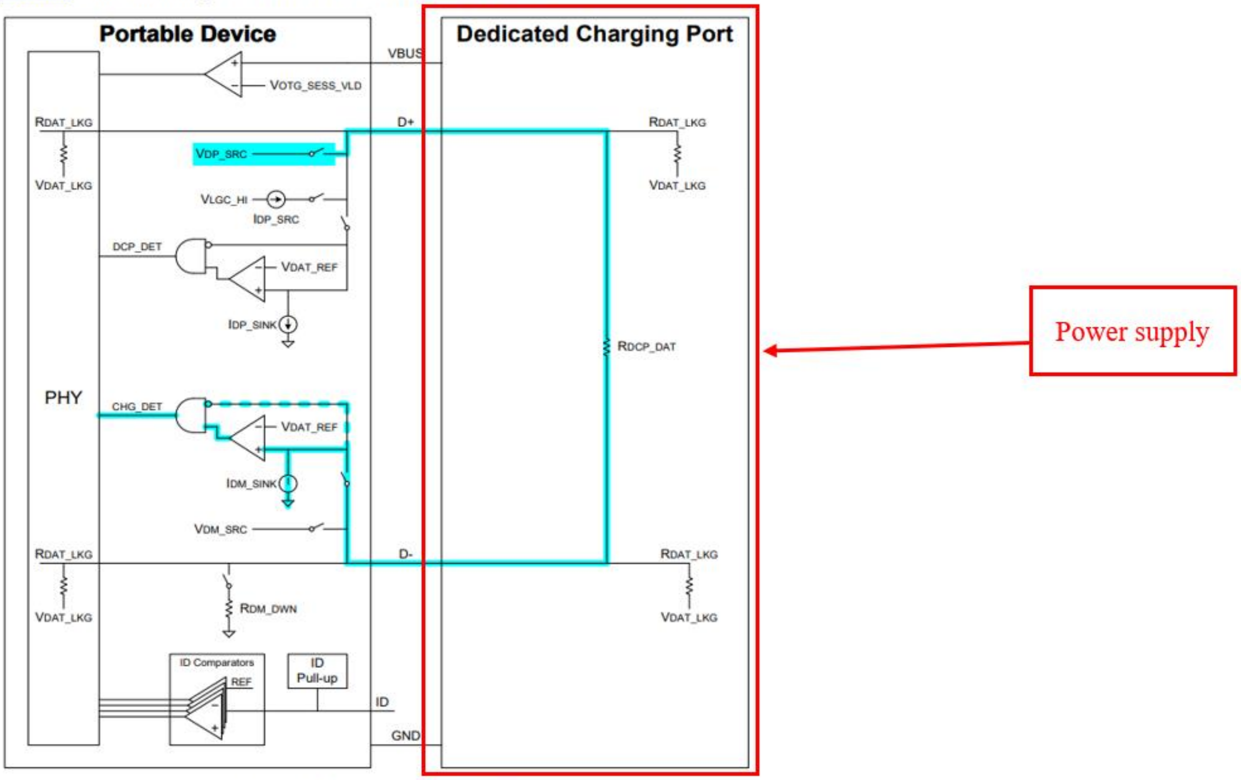


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

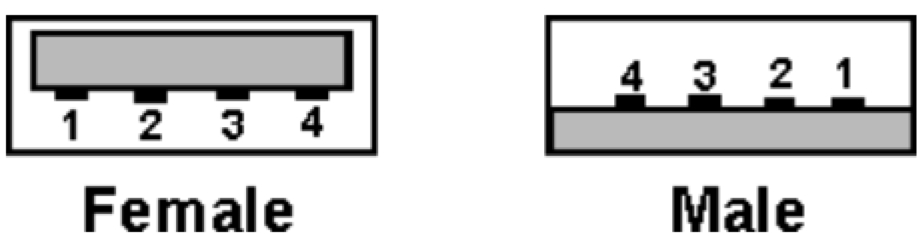
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

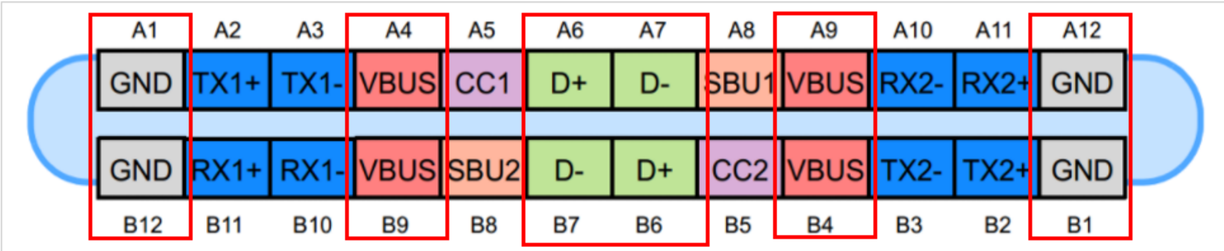


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

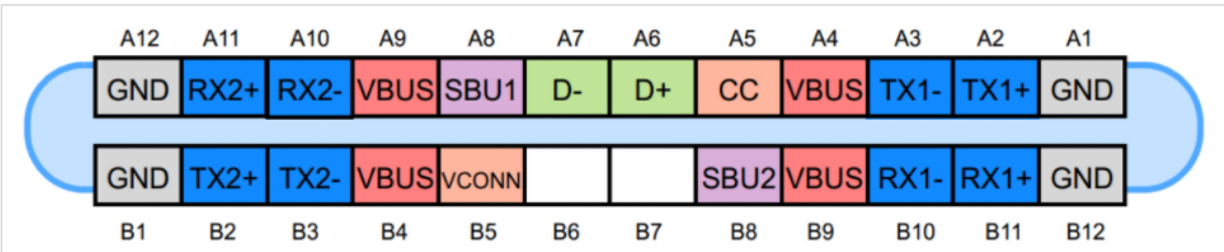


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

49. On information and belief, Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the first conductor, the direct current power to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the VBUS pin provides DC power to a portable electronic device.

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

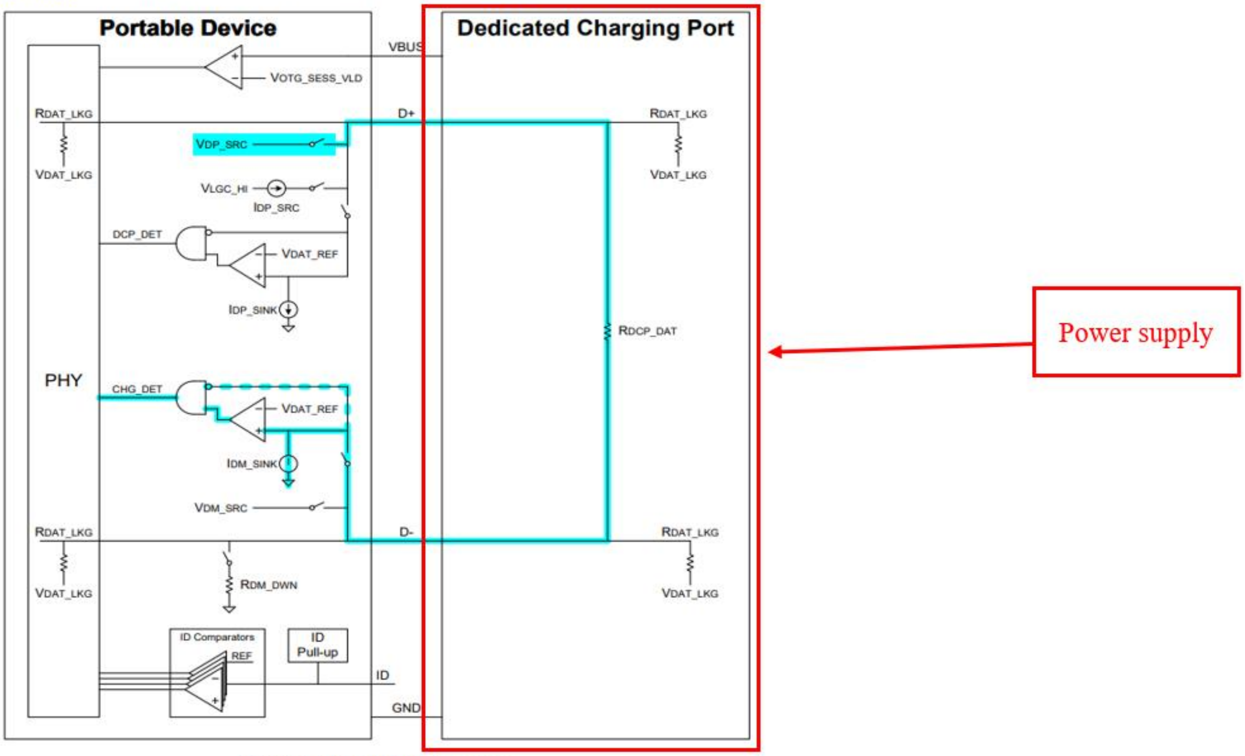


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

Acronyms

ACA	Accessory Charger Adapter
CDP	Charging Downstream Port
DBP	Dead Battery Provision
DCD	Data Contact Detect
DCP	Dedicated Charging Port
FS	Full Speed
HS	High-Speed
LS	Low-Speed
OTG	On-The-Go
PC	Personal Computer
PD	Portable Device
PHY	Physical Layer Interface for High-Speed USB
PS2	Personal System 2
SDP	Standard Downstream Port
SRP	Session Request Protocol
TPL	Targeted Peripheral List
USB	Universal Serial Bus
USBCV	USB Command Verifier
USB-IF	USB Implementers Forum
VBUS	Voltage line of the USB interface

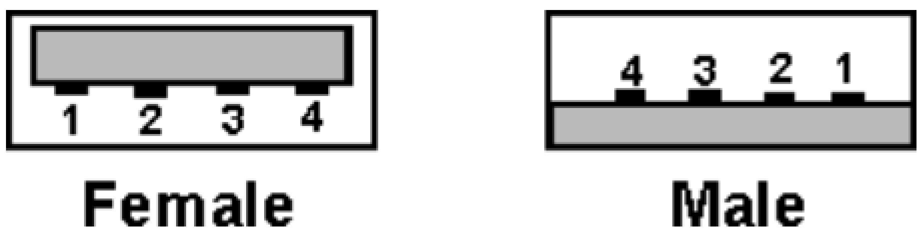
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page xi).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

50. Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the second conductor, a ground reference to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the GND pin provides a ground reference to the portable electronic device.

3.5 Ground Current and Noise Margins

As shown in Figure 7-47 of the USB 2.0 specification, a current of 100 mA through the ground wire of a USB cable can result in a voltage difference of 25 mV between the host ground and the device ground. This ground difference has the effect of reducing noise margins for both signaling and charger detection.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 36).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

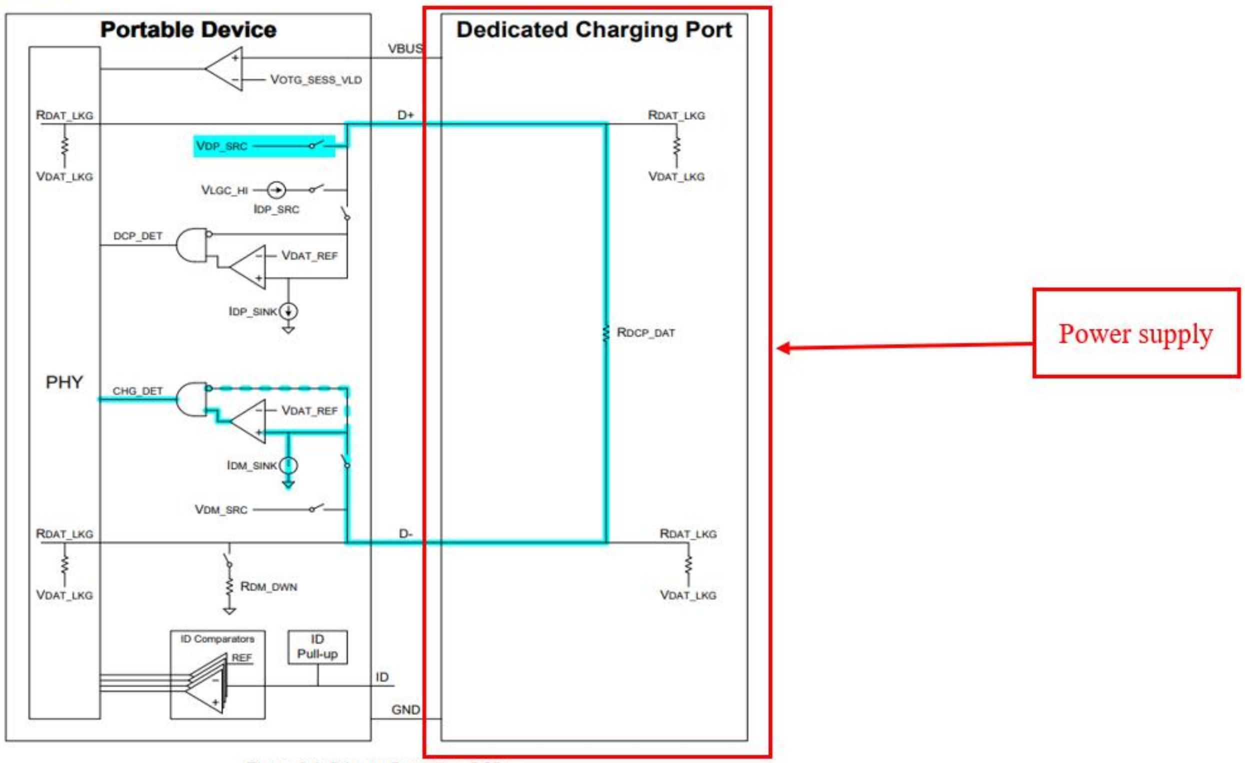


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

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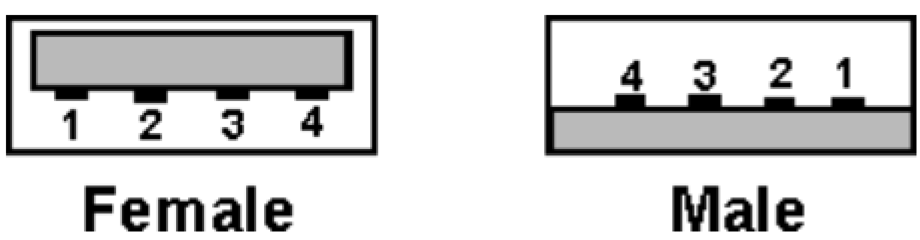
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

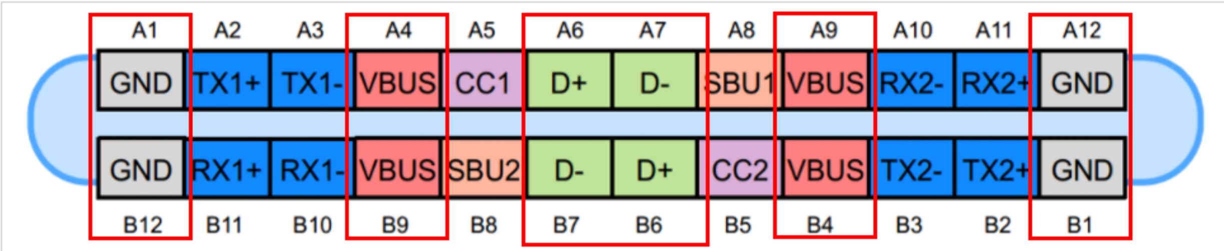


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

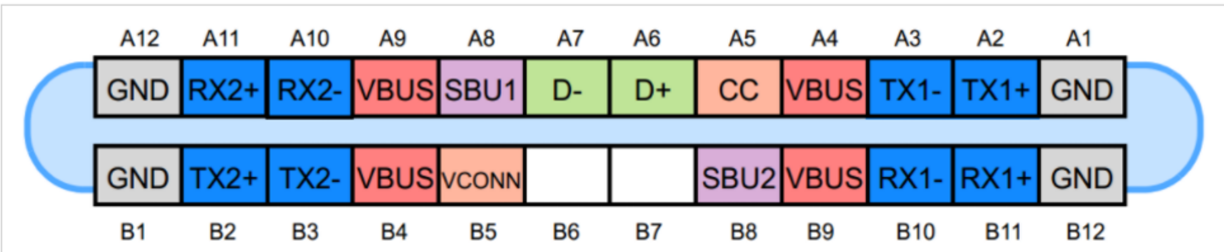


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

51. Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the third conductor, the first signal from the portable electronic device to the data circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the D+ pin provides the D+ signal ("first signal") from the portable electronic device to the data circuitry of the USB power supply.

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

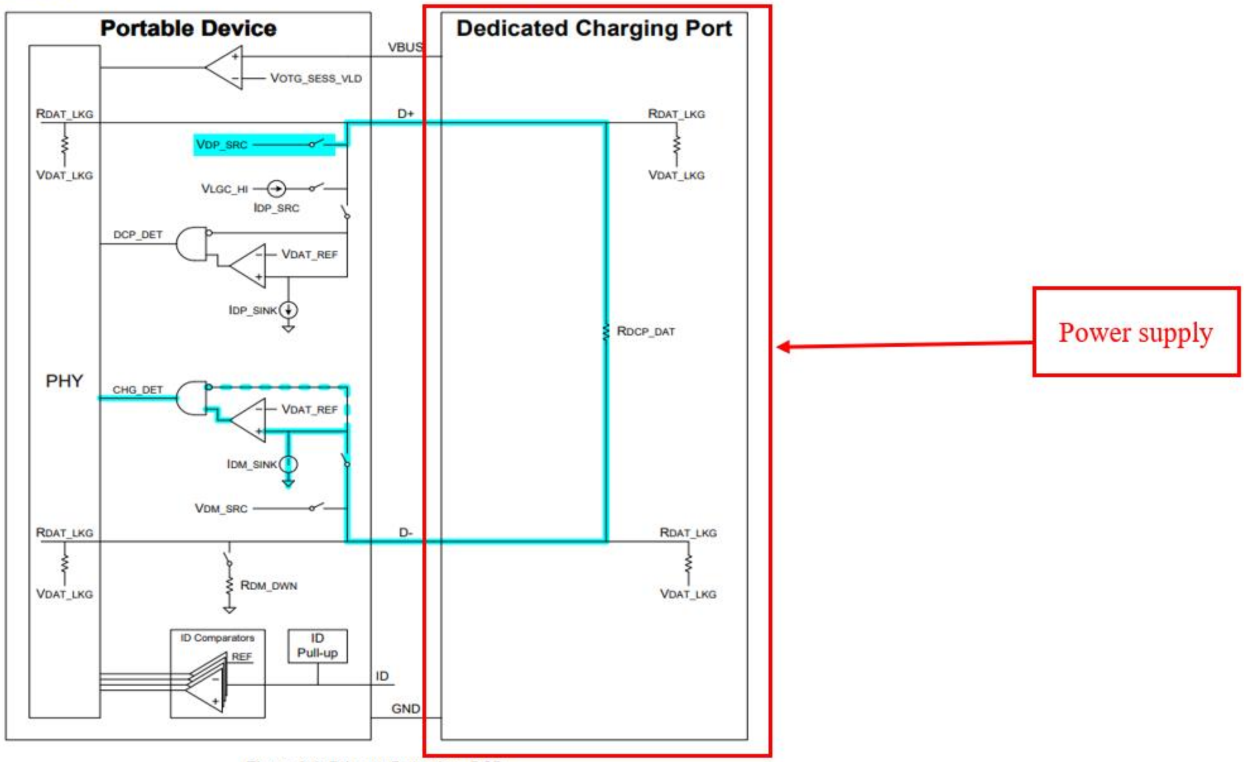


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

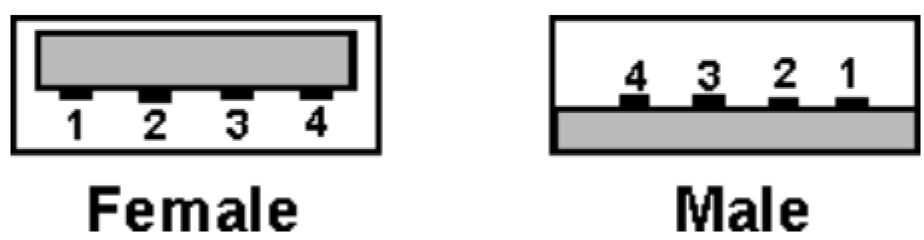
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

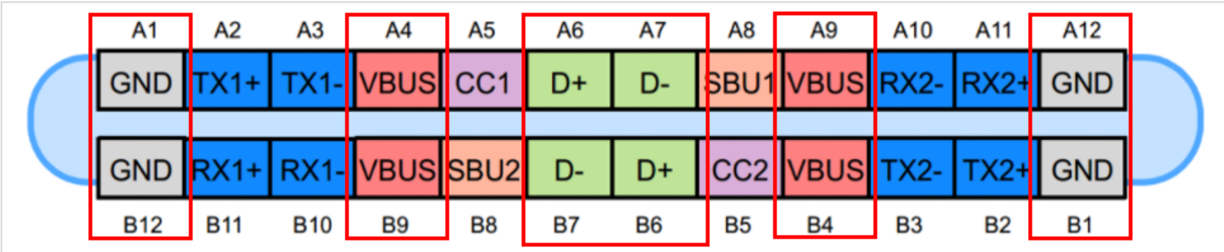


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

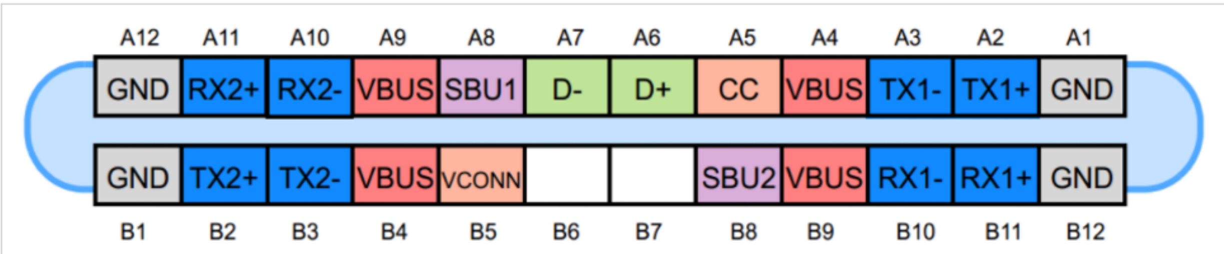


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

52. Defendant provides a product or power supply system, such as '087 Accused Chargers, to transfer, via the fourth conductor, the second signal from the data circuitry to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the D- pin provides the D- signal ("second signal") from the data circuitry of the USB power supply to the portable electronic device. To the extent the D- signal (*i.e.*, "second signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial

origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

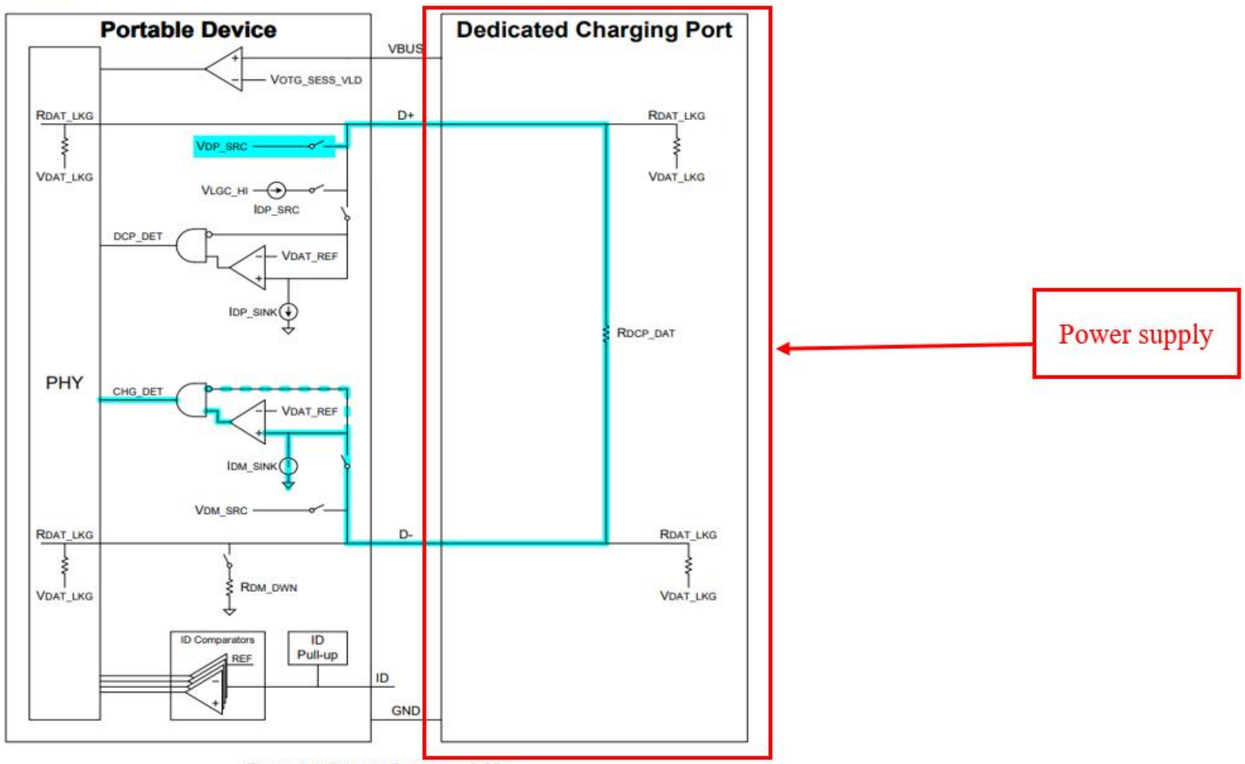


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on V_{DP_SRC} and I_{DM_SINK}. Since a DCP is required to short D+ to D- through a resistance of R_{DCP_DAT}, the PD will detect a voltage on D- that is close to V_{DP_SRC}.

A PD shall compare the voltage on D- with V_{DAT_REF}. If D- is greater than V_{DAT_REF}, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with V_{LGC} as well, and only determine that it is attached to a DCP or CDP if D- is greater than V_{DAT_REF}, but less than V_{LGC}. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than V_{DAT_REF}, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw I_{DEV_CHG}. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than V_{LGC}, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than V_{LGC}, then the PD would determine that it was attached to an SDP, and only be able to draw I_{SUSP}.

The choice of whether or not to compare D- to V_{LGC} depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

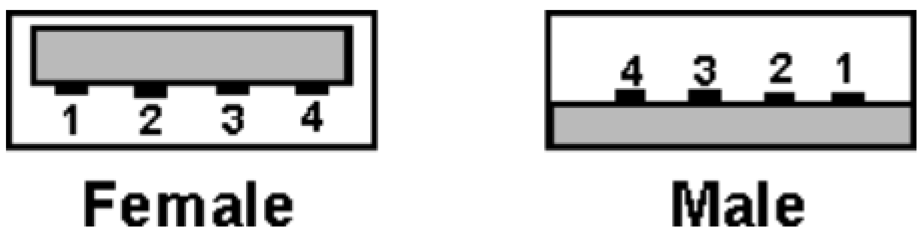
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

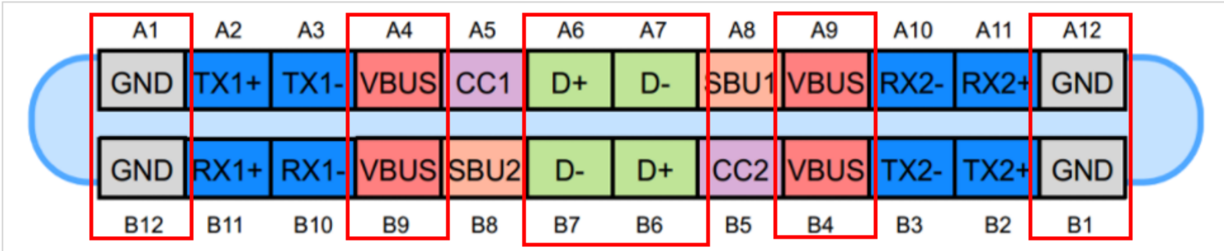


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

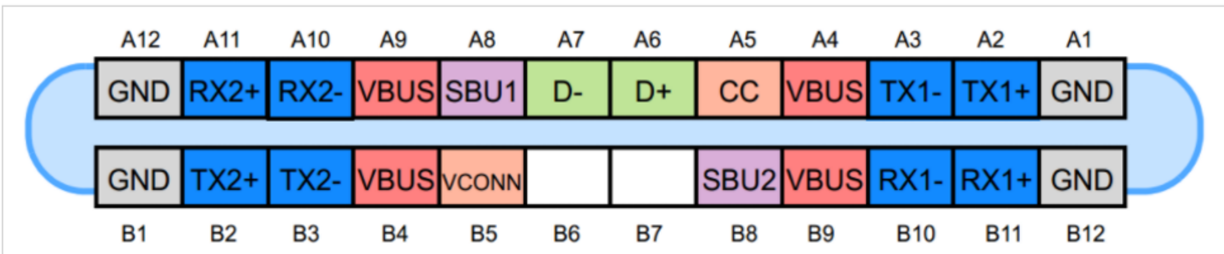


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

53. Defendant provides a product or power supply system with data circuity, such as the '087 Accused Chargers, that is further configured, in coordination with the first signal, to provide the second signal, the second signal having a parameter level that is usable by the portable electronic device in connection with control of charging a rechargeable battery of the portable electronic device based on the direct current power provided by the power circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the USB power supply shorts the D+ to D- through a resistance of R_{DCP_DAT}, such that the portable electronic device detects a voltage on D-. Therefore, the data circuitry of the power supply is configured, in coordination with the D+ signal ("first signal") to provide D- signal ("second signal") to the portable electronic device. The D+ signal and D- signal are separate signals. The D+ signal originates at the portable electronic device and is received by the power supply. When the D+

signal passes through the resistor R_{DCP_DAT}, the resistance causes the voltage to drop, creating a new D- signal to be transmitted to the portable electronic device via the D- pin. Thus, the D+ signal is received by the power supply at one voltage and the D- signal is transmitted to the portable electronic device at a second voltage. Further, the portable electronic device compares the D- signal's voltage ("parameter") level with a reference voltage to detect the type of power supply (standard downstream port or charging port). Based on the type of power supply, the portable electronic devices draw current to charge a rechargeable battery of the portable electronic device from the direct current power provided by the power supply.

1.1 Scope

The Battery Charging Working Group is chartered with creating specifications that define limits as well as detection, control and reporting mechanisms to permit devices to draw current in excess of the USB 2.0 specification for charging and/or powering up from dedicated chargers, hosts, hubs and charging downstream ports. These mechanisms are backward compatible with USB 2.0 compliant hosts and peripherals.

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw I_{DEV_CHG} without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

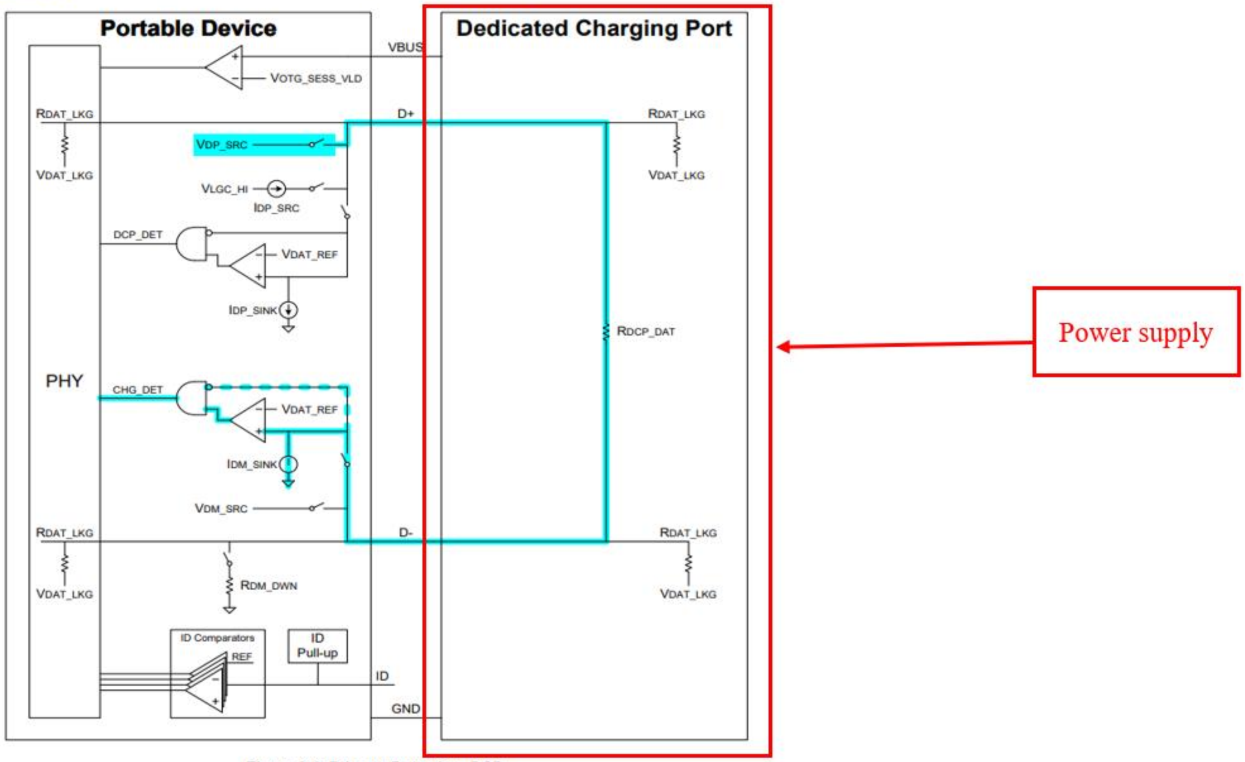


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

54. As discussed above, the '087 Accused Chargers compare the D- signal's voltage ("parameter") level with a reference voltage to detect the type of power supply (standard downstream port or charging port). Based on the type of power supply, the portable electronic devices draw current to charge a rechargeable battery of the portable electronic device from the direct current power provided by the power supply.

55. As discussed above, in the '087 Accused Chargers, the parameter level is the D- signal's voltage.

56. Defendant provides a product or power supply, such as the '087 Accused Chargers, in which the first signal is received by the data circuitry in response to the power circuitry providing the direct current power and the ground reference to the portable electronic device. As explained above in connection with Claim 1, the power supply comprises data circuity and power circuitry configured to use the Primary Detection method of the USB BC 1.2 specification. Using

the VBUS pin and GRN pin, current power and ground reference are provided to and detected by the portable electronic device, respectively. This detection triggers the portable electronic device to send a voltage signal D+, which is the "first signal" received by the data circuitry of the power supply.

57. Defendant makes, uses, sells, offers for sale and/or imports a product or power supply system, such as the '087 Accused Chargers, comprising power circuitry configured to provide direct current power. This element is met literally, or in the alternative, under the doctrine of equivalents. Upon information and belief, Defendant makes, uses, sells, offers for sale, and/or imports a USB power supply (*e.g.*, the '087 Accused Chargers) to supply power to the portable electronic device. USB-compliant devices at USB 3.0 or above are compatible with the USB BC 1.2 specification. Upon information and belief, each of the '087 Accused Chargers includes power circuitry compliant with the Battery Charging (BC) 1.2 specification to charge the portable electronic device. The Table 2-1 (https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36) and the diagram depicting the power consumed by different USB specifications (https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5) disclose that BC 1.2 is used to output 5V voltage, 1.5A current, and 7.5W power. Further, to charge the battery in a portable electronic device, the portable electronic device is connected to the USB power supply. The other end is connected to the charging port of the device and the power supply is plugged into a standard wall socket. Therefore, the USB power supply comprises power circuitry to provide DC power to the electronic device.

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See *USB 2.0*	
USB 3.2	5 V	See *USB 3.2*	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).

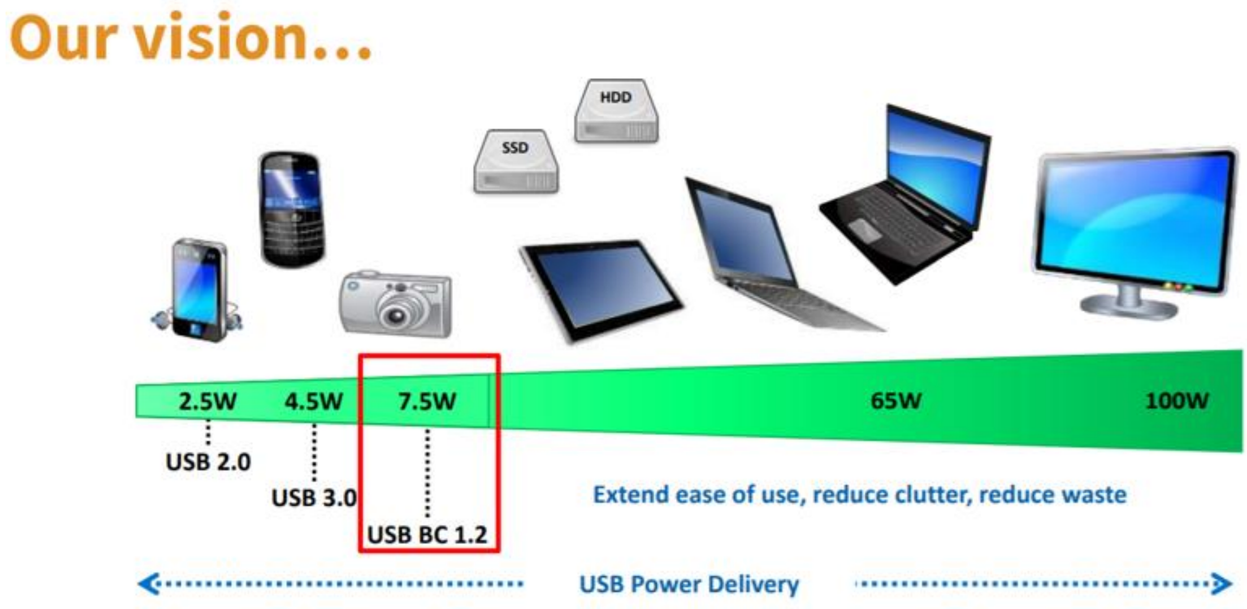
USB battery charging specifications

Battery Charging Specification Revision 1.2 (BC1.2)

The different port types described in the above section were first defined in the *Battery Charging Specification Revision 1.2* (BC1.2) published in 2010. In addition to the port definitions, BC1.2 specifies primary and secondary charge port detection sequences and port specific performance requirements. These include required operating range, undershoot, detection signaling, and connectors for each port type. Also included are dead, weak, and good battery charge conditions, port shutdown procedures, and other details associated with battery charging.

BC1.2 was published after USB 2.0 but before USB 3.1 and so the information in BC1.2 refers to USB 2.0. The specification is, however, consistent and compatible with USB 3.1.

(*E.g.*, https://www.lightingglobal.org/wp-content/uploads/2017/12/Issue-24_USB-smartphone-charging-final.pdf, page 4).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

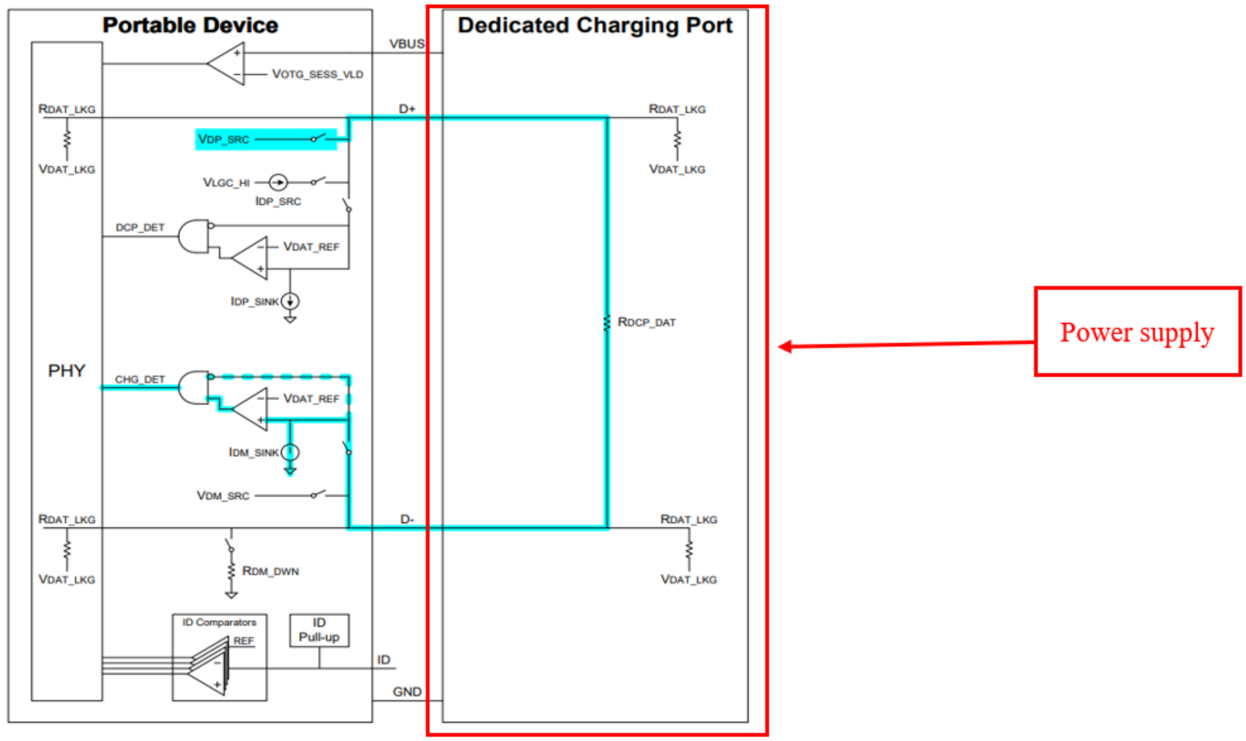


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

58. Defendant provides a product or power supply system, such as the ‘087 Accused Chargers, comprising data circuitry configured to receive an input signal that originates from a portable electronic device and to provide an output signal to be sent to the portable electronic device, the data circuitry and the power circuitry configured to be coupled via a connector to the portable electronic device, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be detachably mated with a power input interface of the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the USB power supply comprises data circuitry

configured to use the Primary Detection method as described in the USB BC 1.2 specification. The USB power supply connects to the portable electronic device through a USB cable. The USB cable has a USB-C connector at one end to detachably mate with the charging port of portable electronic device. The connector comprises VBUS ("first conductor"), GND ("second conductor"), D+ ("third conductor") and D- ("fourth conductor") pins. Further, during Primary Detection, when a portable electronic device is connected with the USB power supply through the USB cable, the portable electronic device generates a D+ signal ("input signal"). Data circuitry of the USB power supply receives the D+ signal ("input signal") and provides a D- signal ("output signal") to the portable electronic device to detect the type of connected power supply (standard downstream port or charging port). To the extent the D- signal (*i.e.*, "output signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw IDEV_CHG without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

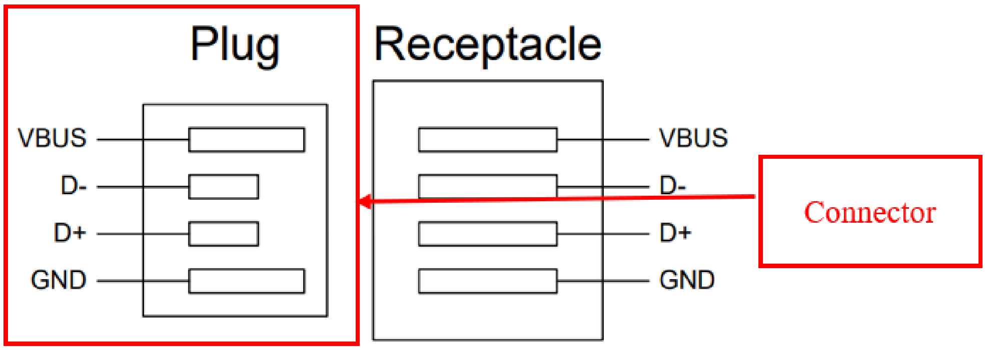


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

Figure 3-1 shows several examples of a PD attached to an SDP or Charging Port.

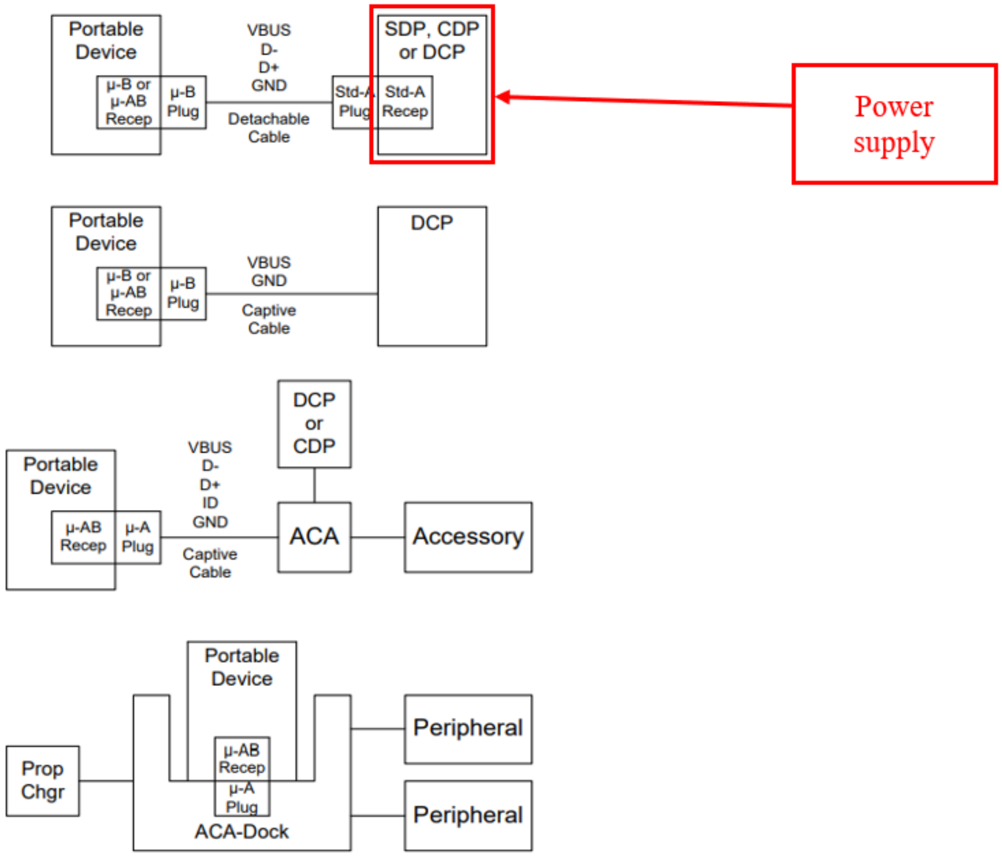


Figure 3-1 System Overview

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

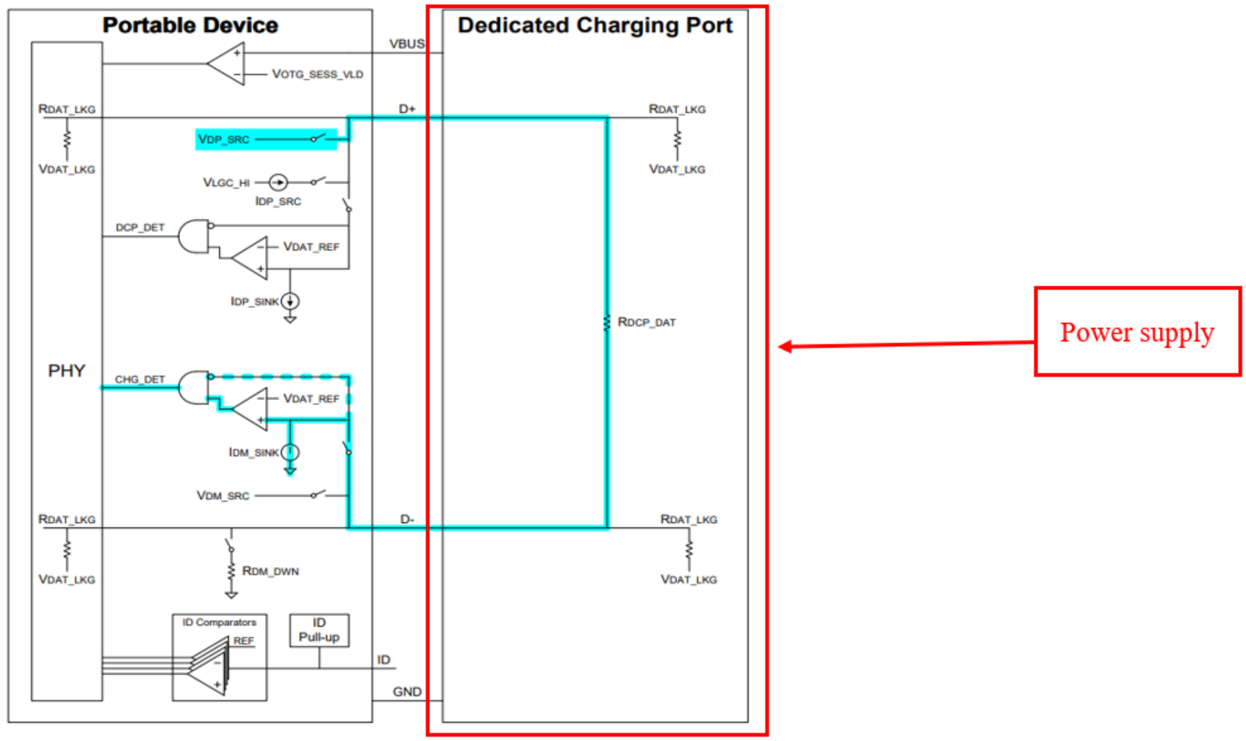


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

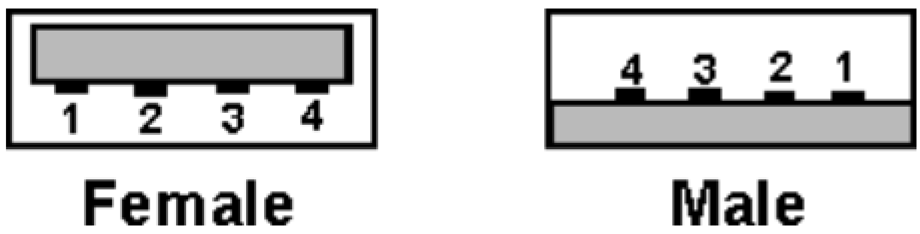
> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

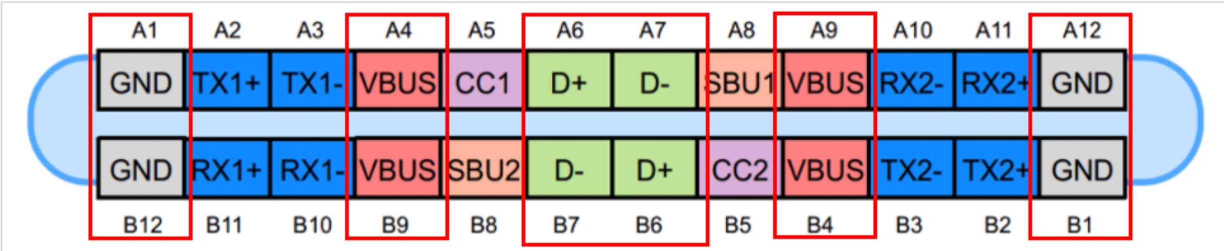


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

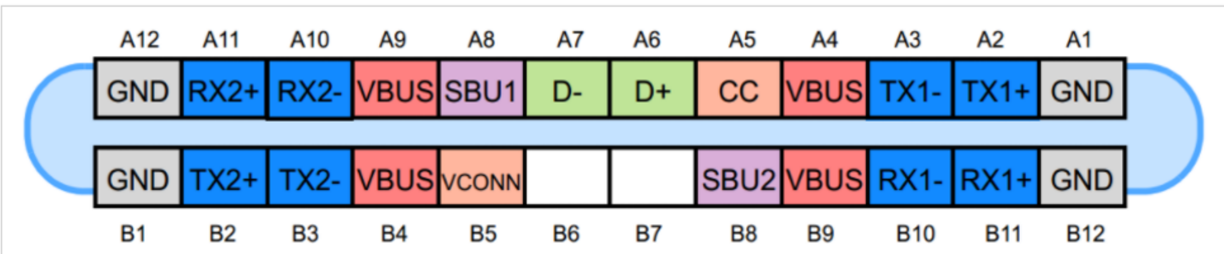


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

59. Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the first conductor, the direct current power to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the VBUS pin provides DC power to the portable electronic device.

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

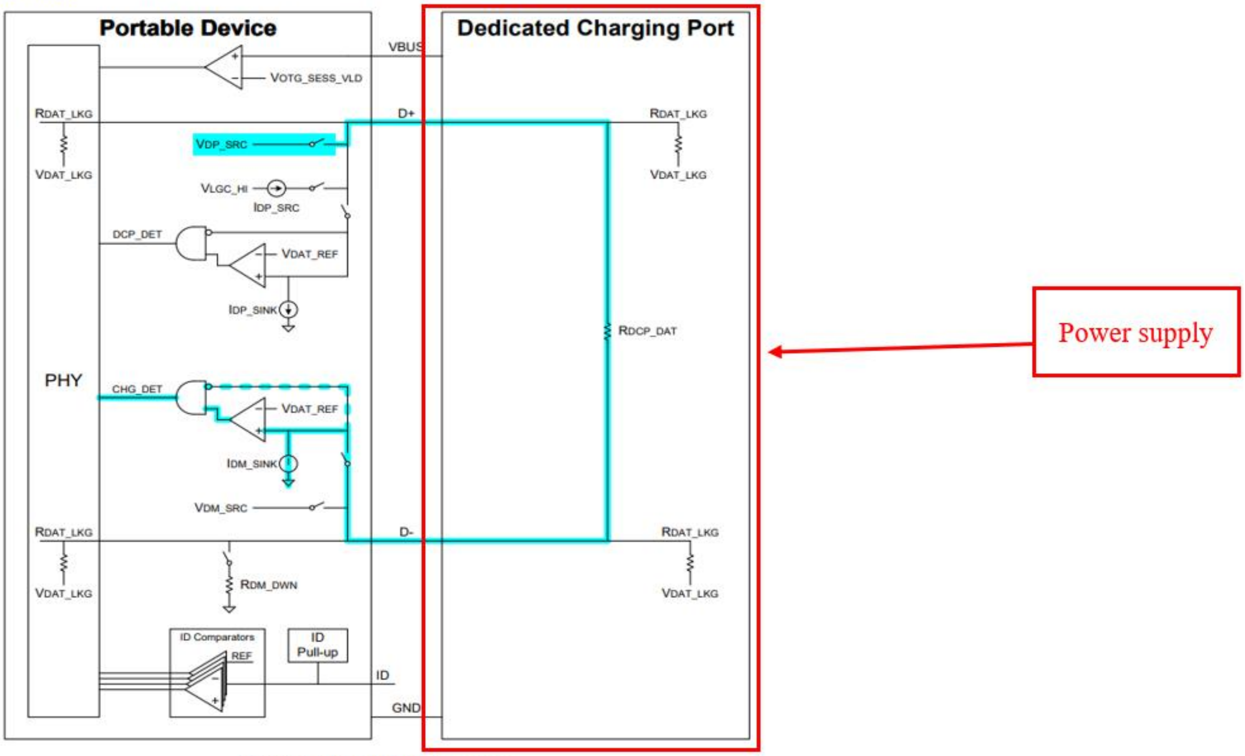


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

Acronyms

ACA	Accessory Charger Adapter
CDP	Charging Downstream Port
DBP	Dead Battery Provision
DCD	Data Contact Detect
DCP	Dedicated Charging Port
FS	Full Speed
HS	High-Speed
LS	Low-Speed
OTG	On-The-Go
PC	Personal Computer
PD	Portable Device
PHY	Physical Layer Interface for High-Speed USB
PS2	Personal System 2
SDP	Standard Downstream Port
SRP	Session Request Protocol
TPL	Targeted Peripheral List
USB	Universal Serial Bus
USBCV	USB Command Verifier
USB-IF	USB Implementers Forum
VBUS	Voltage line of the USB interface

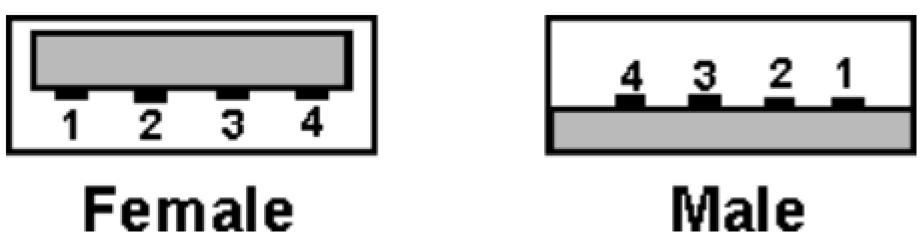
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page xi).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

60. Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the second conductor, a ground reference to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the GND pin provides a ground reference to the portable electronic device.

3.5 Ground Current and Noise Margins

As shown in Figure 7-47 of the USB 2.0 specification, a current of 100 mA through the ground wire of a USB cable can result in a voltage difference of 25 mV between the host ground and the device ground. This ground difference has the effect of reducing noise margins for both signaling and charger detection.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 36).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

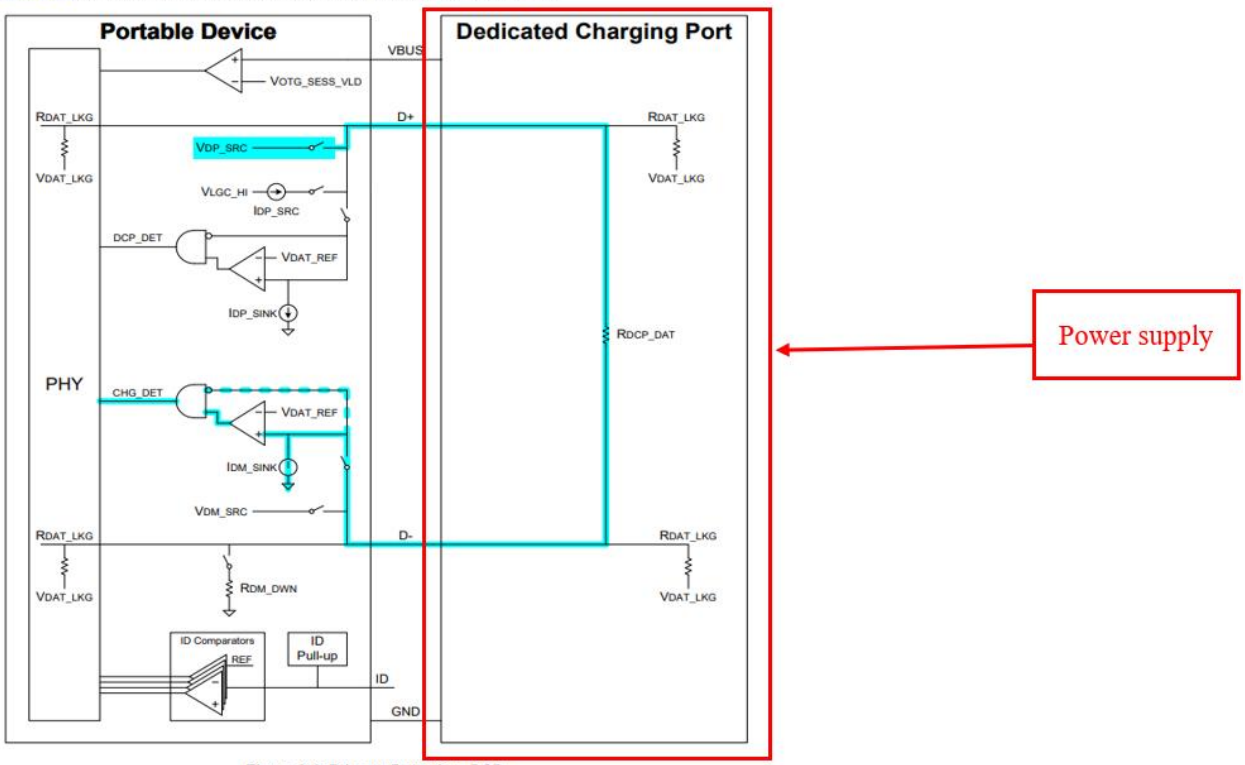


Figure 3-6 Primary Detection, DCP

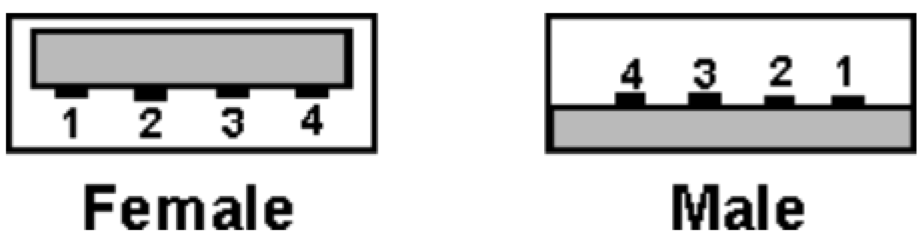
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

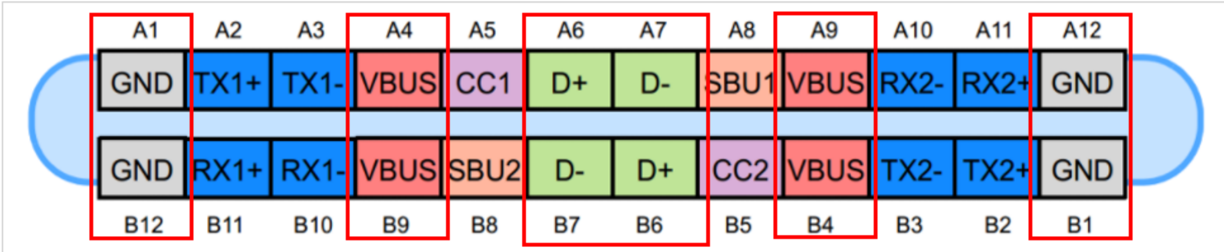


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

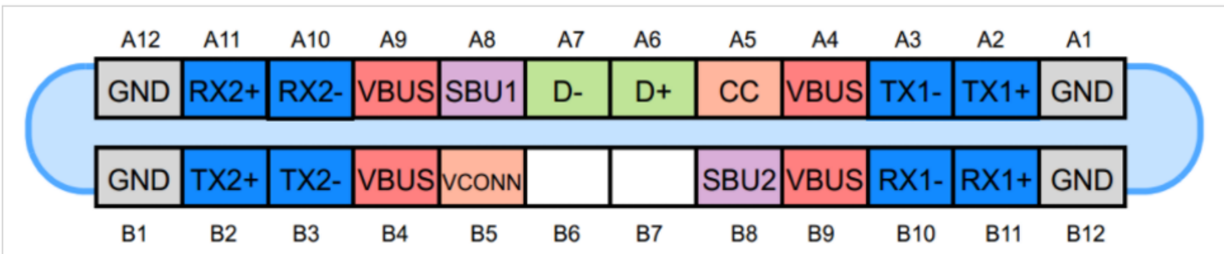


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

61. Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the third conductor, the output signal from the data circuitry to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the D- pin provides the D- signal ("output signal") from the data circuitry of the USB power supply to the portable electronic device.

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

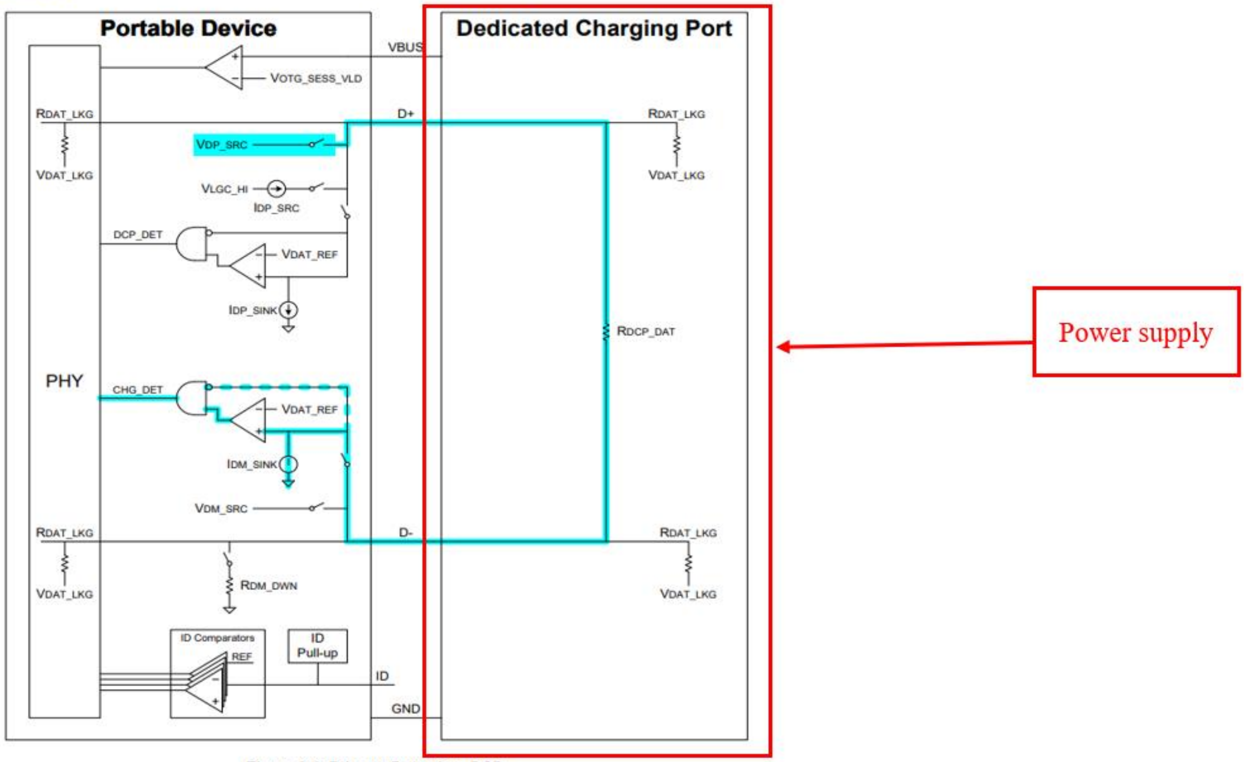


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on V_{DP_SRC} and I_{DM_SINK}. Since a DCP is required to short D+ to D- through a resistance of R_{DCP_DAT}, the PD will detect a voltage on D- that is close to V_{DP_SRC}.

A PD shall compare the voltage on D- with V_{DAT_REF}. If D- is greater than V_{DAT_REF}, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with V_{LGC} as well, and only determine that it is attached to a DCP or CDP if D- is greater than V_{DAT_REF}, but less than V_{LGC}. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than V_{DAT_REF}, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw I_{DEV_CHG}. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than V_{LGC}, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than V_{LGC}, then the PD would determine that it was attached to an SDP, and only be able to draw I_{SUSP}.

The choice of whether or not to compare D- to V_{LGC} depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

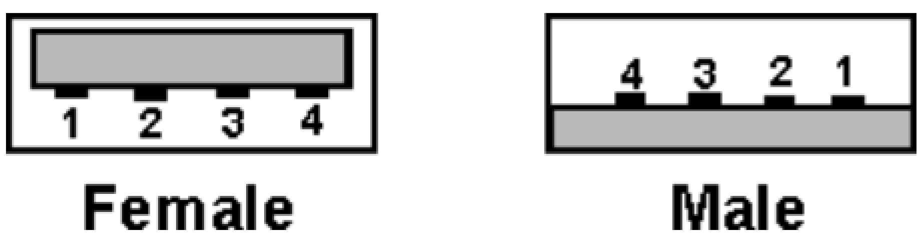
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

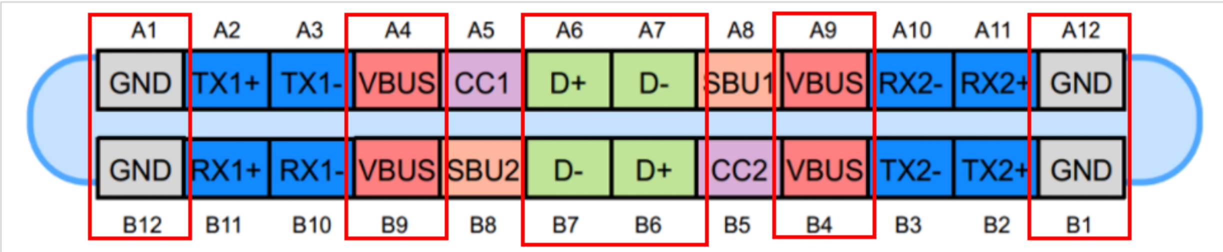


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

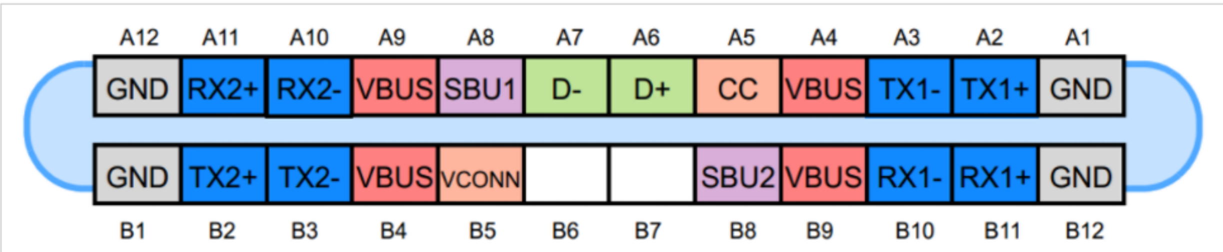


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

62. Defendant provides a product or power supply system, such as the '087 Accused Chargers, to transfer, via the fourth conductor, the input signal from the portable electronic device to the data circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the D+ pin provides the D+ signal ("input signal") from the portable electronic device to the data circuitry of the USB power supply. To the extent the D- signal (*i.e.*, "output signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial

origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

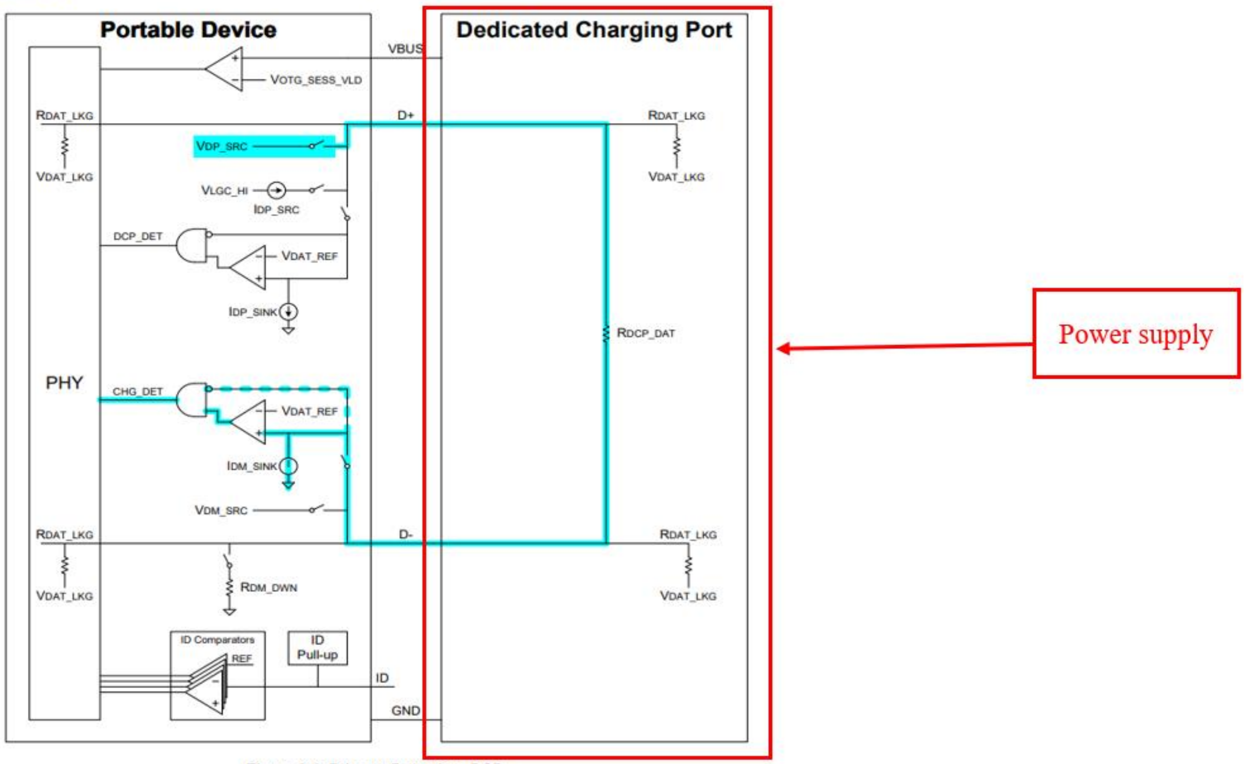


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on V_{DP_SRC} and I_{DM_SINK}. Since a DCP is required to short D+ to D- through a resistance of R_{DCP_DAT}, the PD will detect a voltage on D- that is close to V_{DP_SRC}.

A PD shall compare the voltage on D- with V_{DAT_REF}. If D- is greater than V_{DAT_REF}, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with V_{LGC} as well, and only determine that it is attached to a DCP or CDP if D- is greater than V_{DAT_REF}, but less than V_{LGC}. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than V_{DAT_REF}, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw I_{DEV_CHG}. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than V_{LGC}, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than V_{LGC}, then the PD would determine that it was attached to an SDP, and only be able to draw I_{SUSP}.

The choice of whether or not to compare D- to V_{LGC} depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

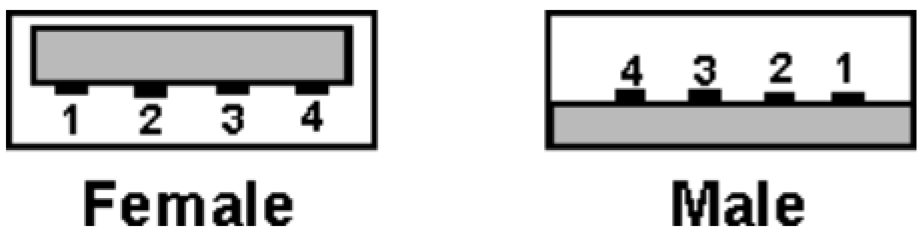
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

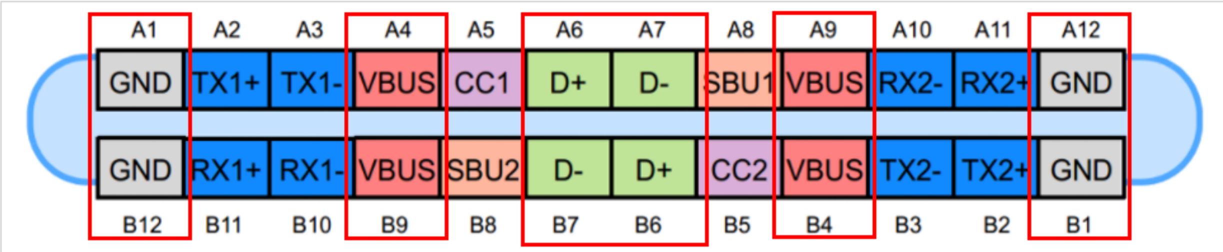


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

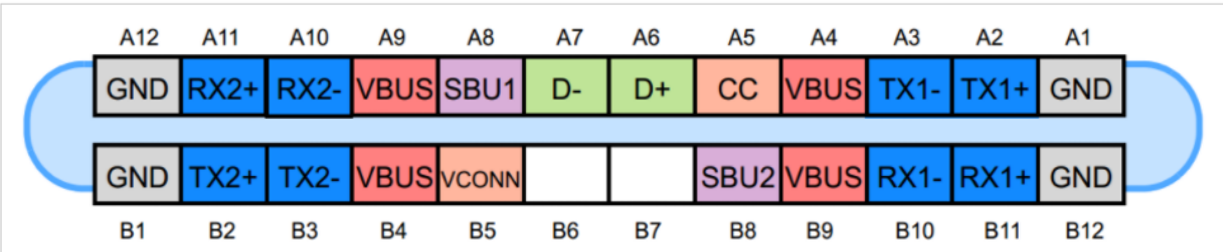


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

63. Defendant provides a product or power supply system, such as the '087 Accused Chargers, that includes data circuitry that is further configured, in coordination with the input signal, to provide the output signal, the output signal usable by the portable electronic device in connection with control of charging a rechargeable battery of the portable electronic device based on the direct current power provided by the power circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the USB power supply shorts the D+ to D- through a resistance of R_{DCP_DAT}, such that the portable electronic device detects a voltage on D-. Therefore, the data circuitry of the power supply is configured, in coordination with the D+ signal ("input signal") to provide D- signal ("output signal") to the portable electronic device. The D+ signal and D- signal are separate signals. The D+ signal originates at the portable electronic device and is received by the power supply. When the D+ signal passes through the

resistor R_{DCP_DAT}, the resistance causes the voltage to drop, creating a new D- signal to be transmitted to the portable electronic device via the D- pin. Thus, the D+ signal is received by the power supply at one voltage and the D- signal is transmitted to the portable electronic device at a second voltage. Further, the portable electronic device compares the D- signal's voltage level with a reference voltage to detect the type of power supply (standard downstream port or charging port). Based on the type of power supply, the portable electronic devices draw current to charge a rechargeable battery of the portable electronic device from the direct current power provided by the power supply.

1.1 Scope

The Battery Charging Working Group is chartered with creating specifications that define limits as well as detection, control and reporting mechanisms to permit devices to draw current in excess of the USB 2.0 specification for charging and/or powering up from dedicated chargers, hosts, hubs and charging downstream ports. These mechanisms are backward compatible with USB 2.0 compliant hosts and peripherals.

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw I_{DEV_CHG} without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

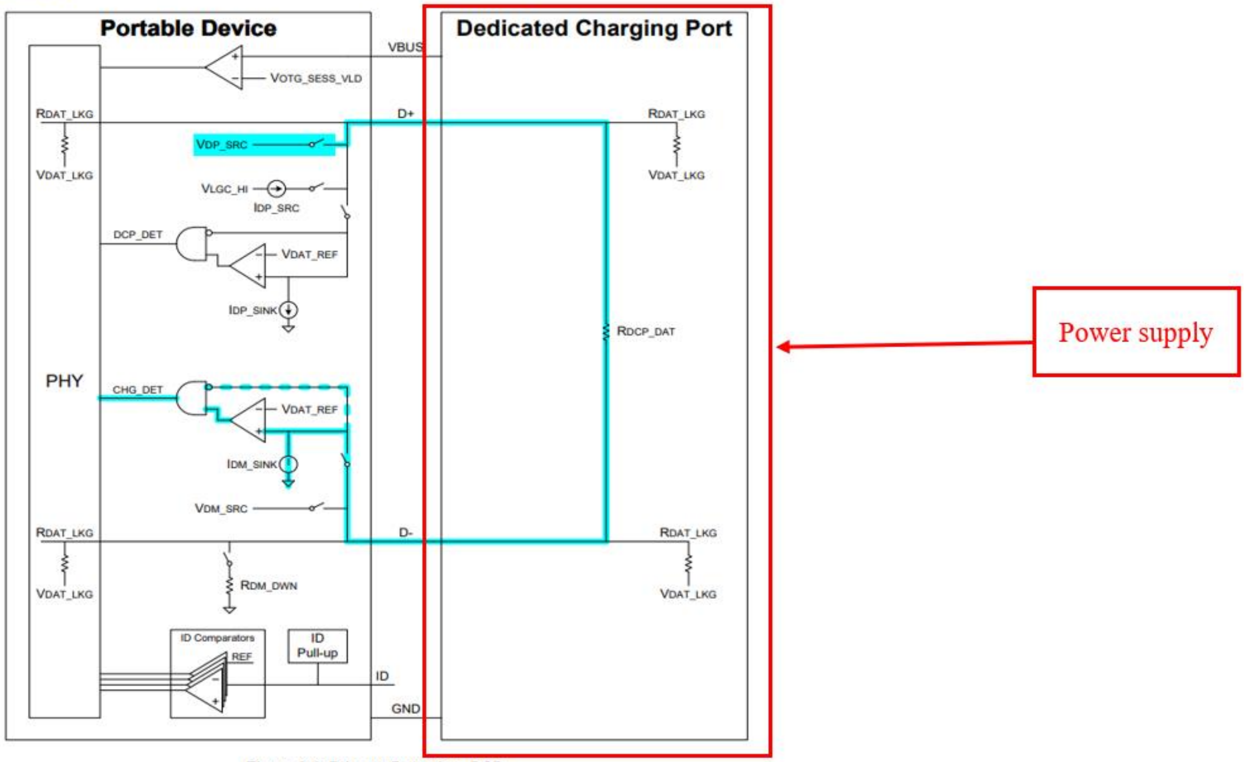


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

64. As discussed above, the USB cable has a USB-C connector at one end to detachably mate with the charging port of portable electronic device.

65. As discussed above, the '087 Accused Chargers compares the D- signal's voltage ("Parameter") level with a reference voltage to detect the type of power supply (standard downstream port or charging port). Based on the type of power supply, the '087 Accused Chargers draw current to charge a rechargeable battery of the portable electronic device from the direct current power provided by the power supply.

66. As discussed above, in the '087 Accused Chargers, the parameter level is the D-signal's voltage.

67. Defendant provides a power supply, such as the '087 Accused Chargers, in which the input signal is received by the data circuitry in response to the power circuitry providing the direct current power and the ground reference to the portable electronic device. As explained

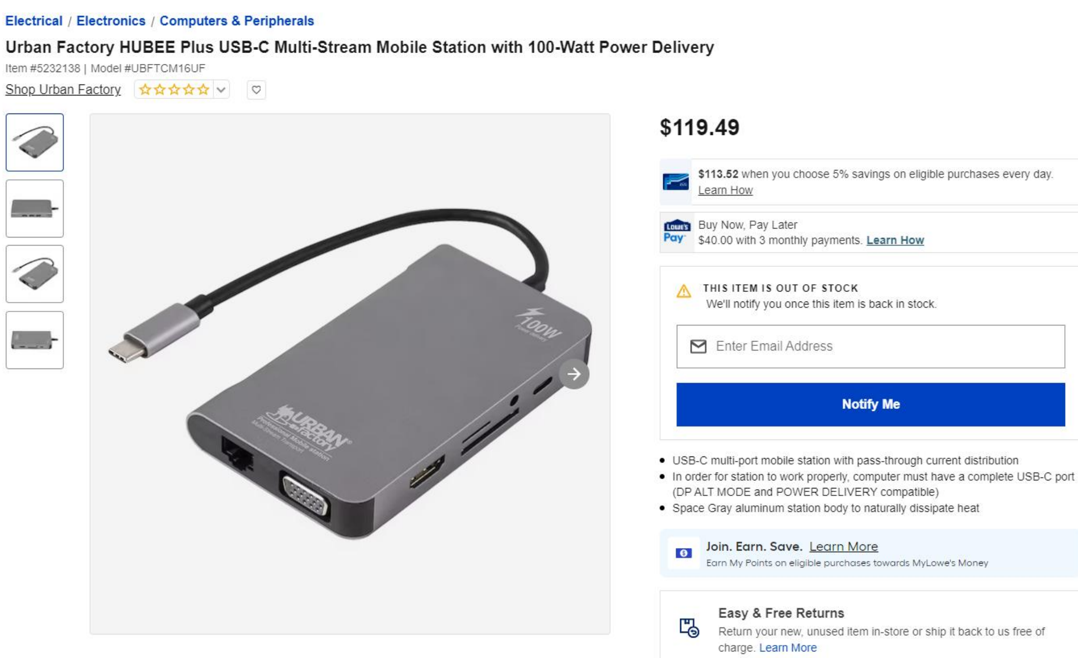
above, the power supply comprises data circuity and power circuitry configured to use the Primary Detection method of the USB BC 1.2 specification. Using the VBUS pin and GRN pin, current power and ground reference are provided to and detected by the portable electronic device, respectively. This detection triggers the portable electronic device to send a voltage signal D+, which is the "input signal" received by the data circuitry of the power supply.

B. Infringement for Compliance with Power Delivery Standard

68. Upon information and belief, Defendant has directly infringed claims 1, 5-7, 11, and 15-17 of the '087 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering for sale and/or importing a power supply system comprising power circuitry configured to provide direct current power such products including, but not limited to, the following: Urban Factory HUBEE Plus USB-C Multi-Stream Mobile Station with 100-Watt Power Delivery (Item #5232138,Model #UBFTCM16UF); Urban Factory HUBEE mini USB-C Multi-Display 4K Docking Station with 100-Watt Power Delivery (Item #5232136, Model #UBFTCD45UF); Just Wireless Portable Power Bank 15K USB-C/A - 15000mAh (Item #3351754, Model #06175); Just Wireless 20,000mAh Power Bank with Fast Charge and 3 USB Ports (Item #3351755, Model #06177); DEWALT Type C USB A Wall Outlet Charger 2 (Item #1299595, Model #131 0851 DW2); DEWALT Type C USB A Car Charger 4 (Item #1299597, Model #141 9009 DW2); DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2); and Naztech Micro USB USB-C Lightning Car Charger 2 (Item #3637774; Model #14390) which comply with Universal Serial Bus Power Delivery Specification, Revision 2.0 January 2017. ("'087 Accused PD Chargers").

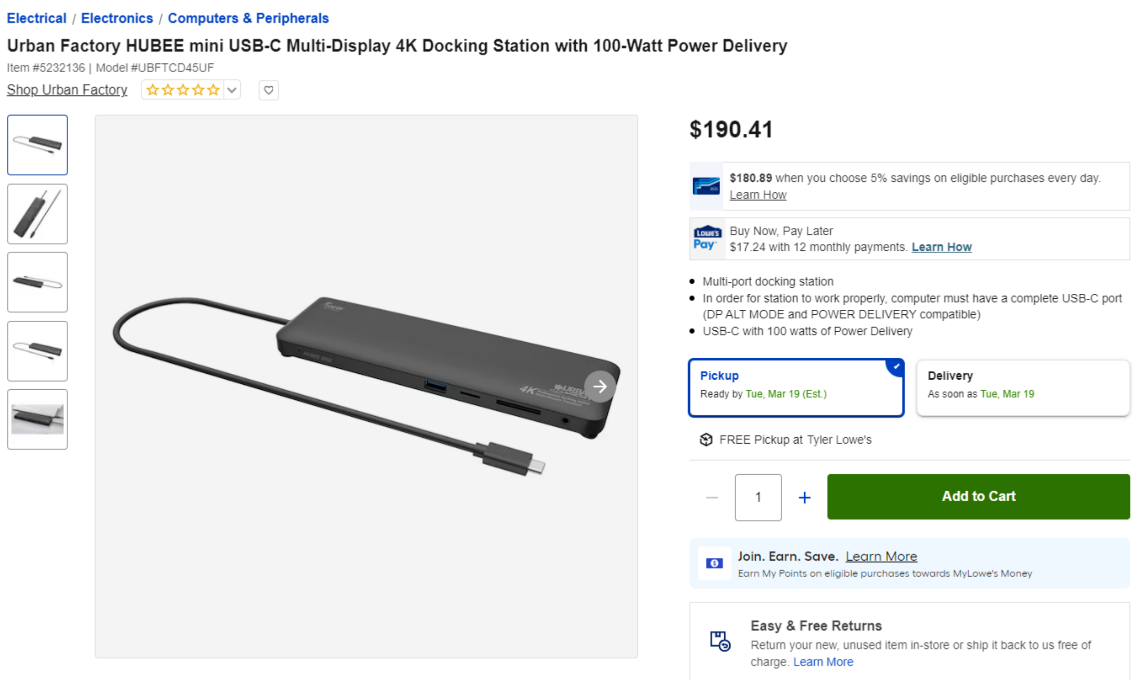
69. Defendant makes, uses, sells, offers for sale and/or imports a USB power supply (*e.g.*, the '087 Accused PD Chargers) comprising power circuitry configured to provide direct

current power. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, Defendant provides '087 Accused PD Chargers. Each '087 Accused PD Charger includes a USB-C port with Power Delivery, through which the '087 Accused PD Charger can charge batteries of portable electronic devices using a full featured USB Type-C cable. The '087 Accused PD Chargers are configured to connect to portable electronic devices through a full featured USB Type-C cable to provide DC power to the portable electronic devices. Further, the USB-C ports of the '087 Accused PD Chargers are compliant with at least Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014 (along with other subsequent revisions of Type-C specification), and Universal Serial Bus Power Delivery Specification, Revision 1.0 January 2017. Further, to charge the battery in a portable electronic device, the portable electronic device is connected to the USB power supply. The other end of the USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket or a DC power source. Therefore, the USB power supply comprises power circuitry to provide DC power to the portable electronic device.



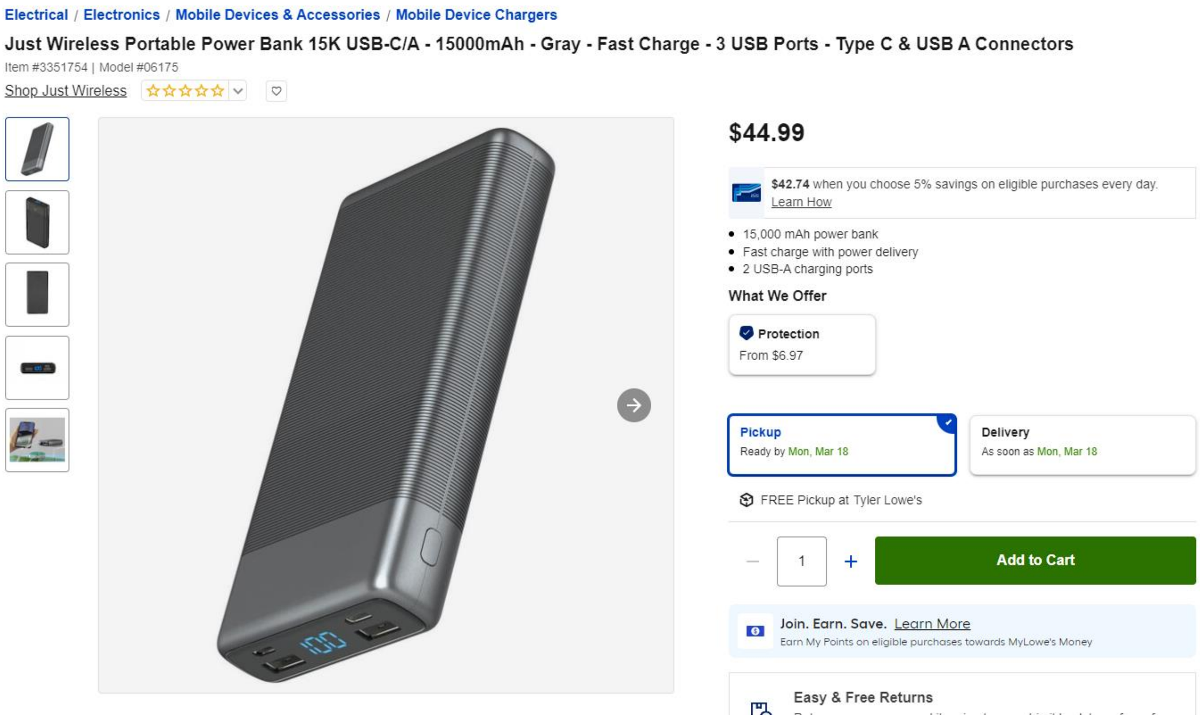
- USB-C multi-port mobile station with pass-through current distribution
- In order for station to work properly, computer must have a complete USB-C port (DP ALT MODE and POWER DELIVERY compatible)
- Space Gray aluminum station body to naturally dissipate heat
- 100-watt USB-C 3.1 cable to link station to computer
- USB-C 3.1 input to connect USB-C power supply
- 4K HDMI at 30 Hz; VGA Full HD 1080p at 60 Hz
- 3 USB 3.0 inputs with data flow of up to 5 Gbps
- SD/microSD Card readers
- 1,000 Mbps RJ45 port

(*E.g.*, https://www.lowes.com/pd/Urban-Factory-HUBEE-Plus-USB-C-Multi-Stream-Mobile-Station-with-100-Watt-Power-Delivery/5013839387?idProductFound=false&idExtracted=true).

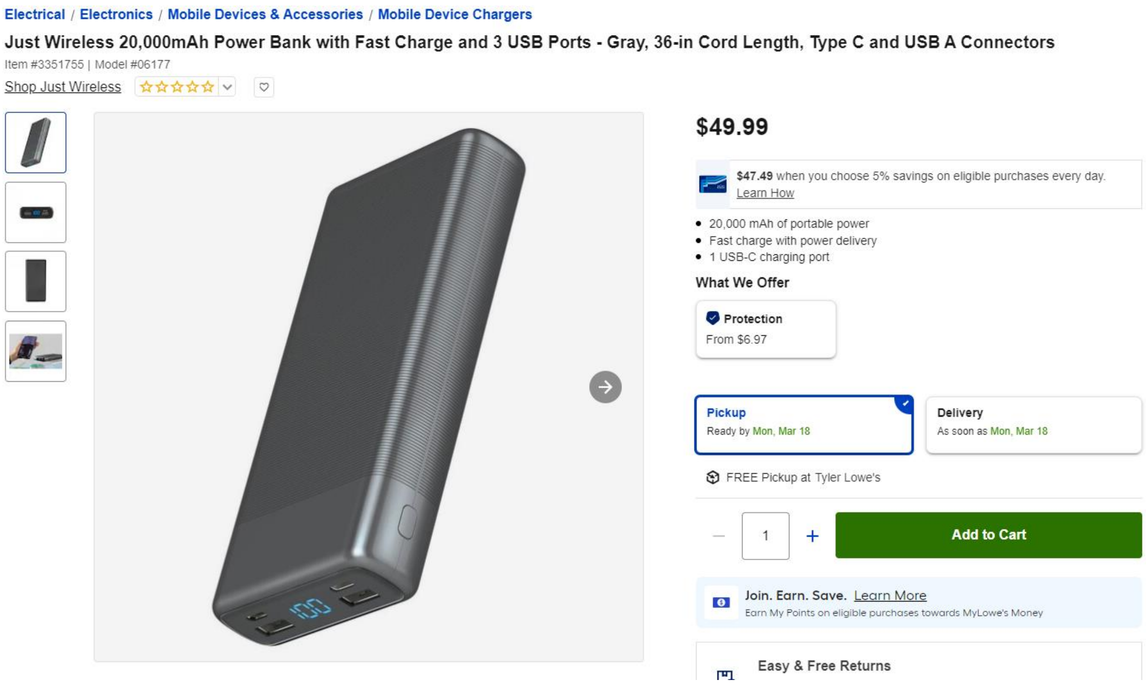


- Multi-port docking station
- In order for station to work properly, computer must have a complete USB-C port (DP ALT MODE and POWER DELIVERY compatible)
- USB-C with 100 watts of Power Delivery
- DisplayPort: 4K/30 Hz max
- HDMI port: 4K/30 Hz max
- VGA port: 2K/60 Hz max
- 2 USB-A 2.0 ports: 480 Mbps
- USB-A 3.0 port: 5 Gbps
- RJ45: Gigabit Ethernet 1,000 Mbps max

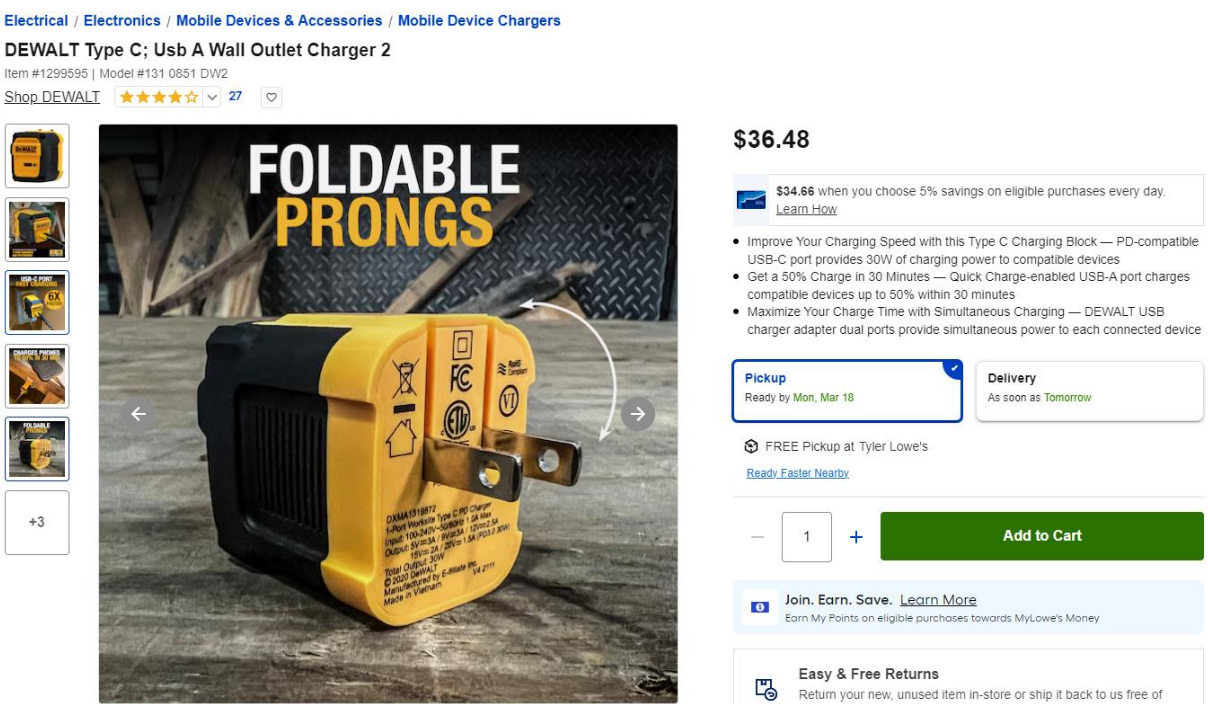
(*E.g.*, https://www.lowes.com/pd/Urban-Factory-HUBEE-mini-USB-C-Multi-Display-4K-Docking-Station-with-100-Watt-Power-Delivery/5013839417?idProductFound=false&idExtracted=true).



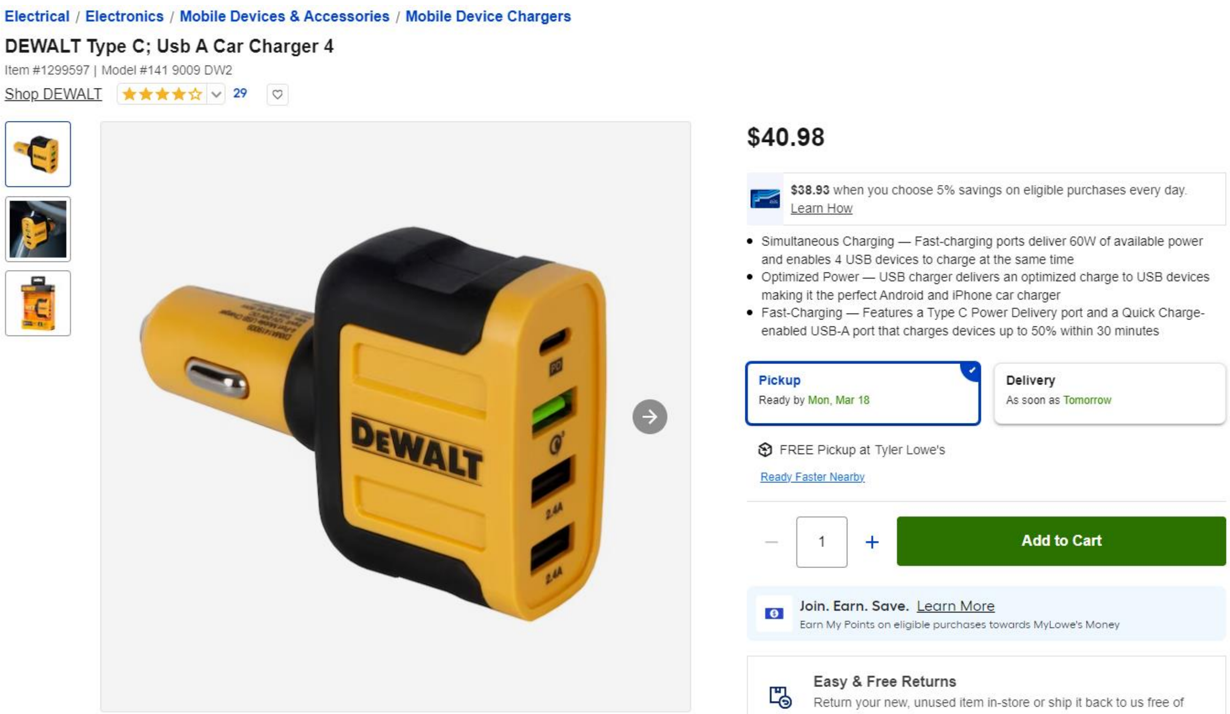
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



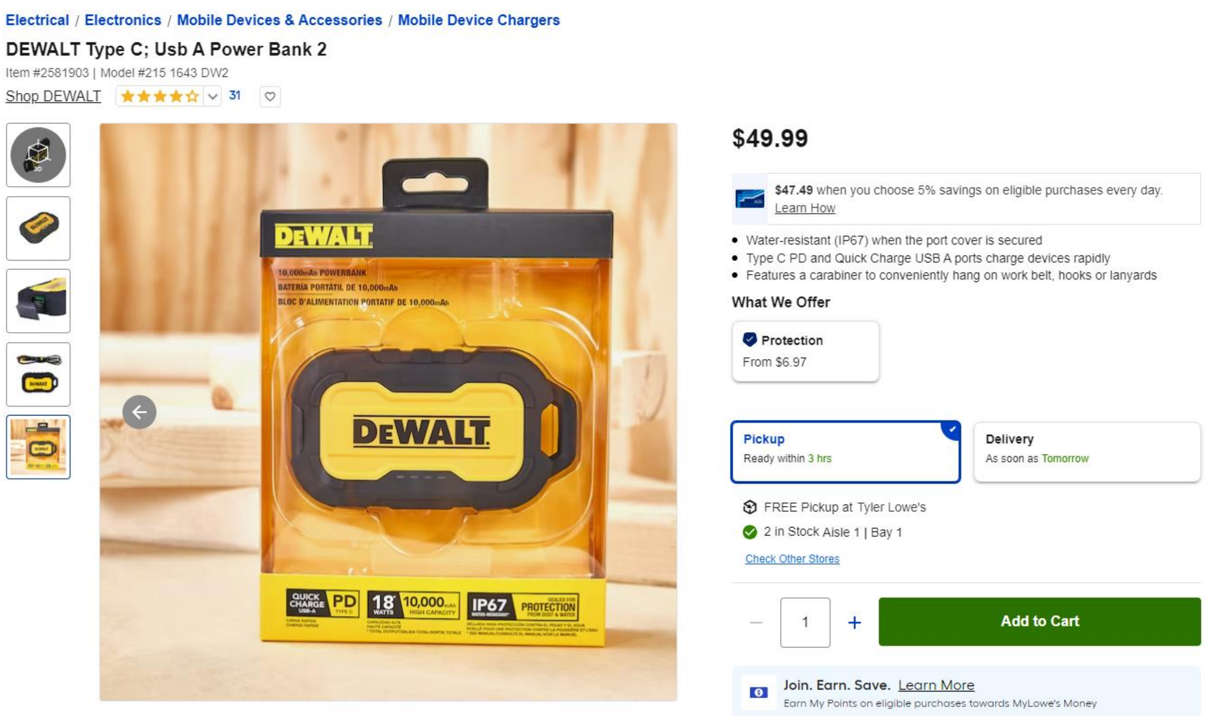
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Wall-Outlet-Charger/1001435122?idProductFound=false&idExtracted=true).

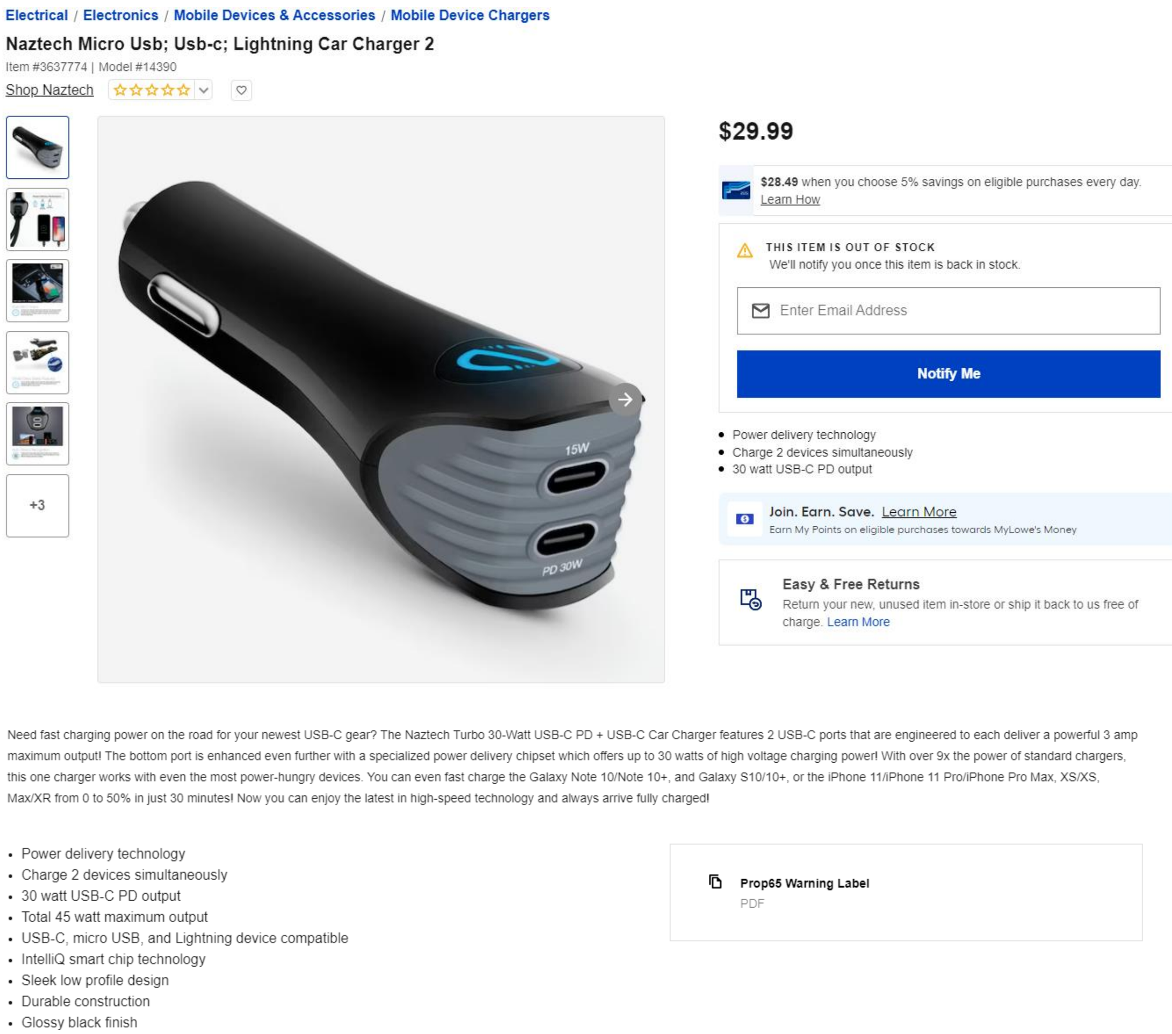


(*E.g.*, https://www.lowes.com/pd/DEWALT-Type-C-USB-A-Car-Charger/1000976132?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-10-000-mAh-Powerbank/1003242934?idProduct

Found=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Naztech-Turbo-30-Watt-USB-C-PD-USB-C-Car-Charger/5001541923?idProductFound=false&idExtracted=true).

70. On information and belief, Defendant provides a product or power supply system, such as the '087 Accused PD Chargers, that comprise data circuitry configured to receive a first signal that originates from a portable electronic device and to provide a second signal to be sent to the portable electronic device, the data circuitry and the power circuitry configured to be coupled via a connector to the portable electronic device, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be

detachably mated with a power input interface of the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the '087 Accused PD Chargers comprise data circuitry as described in the Universal Serial Bus Type-C Cable and Connector Specification and Universal Serial Bus Power Delivery Specification. The '087 Accused PD Chargers are configured to connect to portable electronic devices through a USB cable. The USB cable has a connector of the type including but not limited to USB-C at one end to detachably mate with the charging port of a portable electronic device. The connector comprises VBUS ("first conductor"), GND ("second conductor"), and two Configuration Channel conductors, *i.e.*, CC1/CC2 ("third conductor" / "fourth conductor"). When a portable electronic device is connected to the Accused PD Charger through the full featured USB Type-C cable, the orientation of the connector to the Accused PD Charger is detected first. The Accused PD Chargers detect the proper orientation of the connected USB Type-Cable by checking the voltage signal at the CC1 and CC2 pins. The values of the two resistors, Rp and Rd are fixed such that the voltage signal at one of the two CC pins (*i.e.*, CC1 and CC2) will be lower than the predetermined threshold value. The '087 Accused PD Chargers determine which of the two CC pins are used as a configuration channel by detecting a voltage less than a certain threshold voltage at the CC pin in use. The CC pin used as a configuration channel is the "third conductor" and the voltage signal ("first signal") received at one of the CC pin meeting the threshold requirement from the portable device connected via the full featured USB Type-Cable is determined by the voltage divider signal generated by the Rd resister in the portable electronic devices with the Rp resister in the '087 Accused PD Chargers. The CC pin that is not used as a configuration channel then becomes the Vconn conductor ("the fourth conductor"). The '087 Accused PD Chargers connect to the full-featured USB Type-C cables that are electronically marked. To connect to an electronically marked USB Type-C cable, the '087 Accused PD Chargers utilize the Vconn pin. With the electronically marked USB Type-Cable, the CC pin not used as the configuration channel is used as the Vconn source. Upon providing the Vconn signal to the portable electronic device, the '087 Accused PD Chargers communicate the SOP/SOP'/SOP'' (SOP*) packet with the portable electronic device that is used to control the power delivery from the Accused PD Chargers to the portable electronic device. The SOP* includes the SOP communication from the Accused PD Chargers to the portable electronic devices that are attached. The voltage signal at the Vconn pin sent from the Accused PD Chargers to the portable electronic devices is the "second signal" because the Vconn signal enables the SOP* communication that controls the charging batteries in the portable electronic devices.

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2	SSTXp1	Positive half of first SuperSpeed TX differential pair	Second	B11	SSRXp1	Positive half of first SuperSpeed RX differential pair	Second
A3	SSTXn1	Negative half of first SuperSpeed TX differential pair	Second	B10	SSRXn1	Negative half of first SuperSpeed RX differential pair	Second
A4	VBUS	Bus Power	First	B9	VBUS	Bus Power	First
A5	CC1	Configuration Channel	Second	B8	SBU2	Sideband Use (SBU)	Second
A6	Dp1	Positive half of the USB 2.0 differential pair – Position 1	Second	B7	Dn2	Negative half of the USB 2.0 differential pair – Position 2	Second
A7	Dn1	Negative half of the USB 2.0 differential pair – Position 1	Second	B6	Dp2	Positive half of the USB 2.0 differential pair – Position 2	Second
A8	SBU1	Sideband Use (SBU)	Second	B5	CC2	Configuration Channel	Second
A9	VBUS	Bus Power	First	B4	VBUS	Bus Power	First
A10	SSRXn2	Negative half of second SuperSpeed RX differential pair	Second	B3	SSTXn2	Negative half of second SuperSpeed TX differential pair	Second
A11	SSRXp2	Positive half of second SuperSpeed RX differential pair	Second	B2	SSTXp2	Positive half of second SuperSpeed TX differential pair	Second
A12	GND	Ground return	First	B1	GND	Ground return	First

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 49).

The USB Type-C receptacle, plug and cable designs are intended to support future USB functional extensions. As such, consideration was given to frequency scaling performance, pin-out arrangement and the configuration mechanisms when developing this solution. The definition of future USB functional extensions is not in the scope of this specification but rather will be provided in future releases of the base USB Specification, i.e., beyond the existing USB 3.1 Specification.

Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both USB 2.0 (D+ and D−) and USB 3.1 (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1−	VBUS	CC1	D+	D−	SBU1	VBUS	RX2−	RX2+	GND
GND	RX1+	RX1−	VBUS	SBU2	D−	D+	CC2	VBUS	TX2−	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

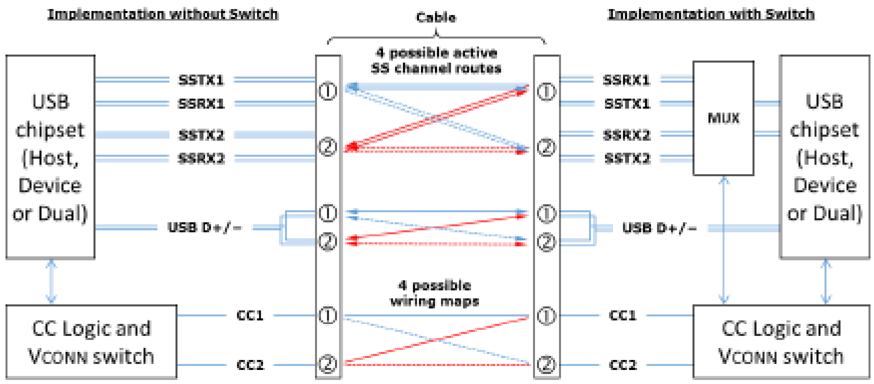
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 18).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 104).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



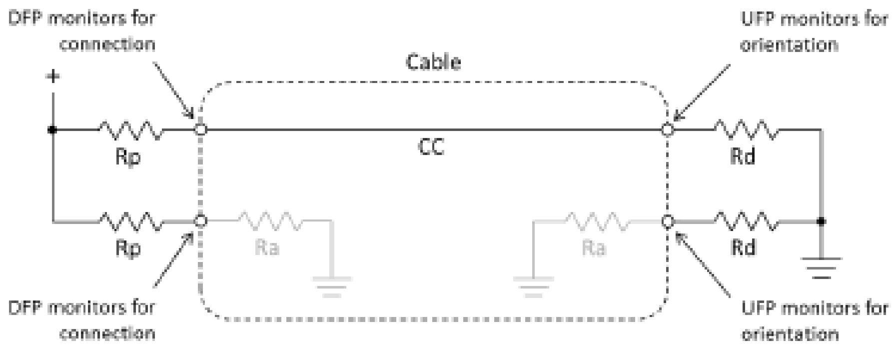
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 105).

4.5.1.2.1 Detecting a Valid DFP-to-UFP Connection

The general concept for setting up a valid connection between a DFP and UFP is based on being able to detect terminations residing in the product being attached.

To aid in defining the functional behavior of CC, a pull-up (Rp) and pull-down (Rd) termination model is used – actual implementation in hosts and devices may vary, for example, the pull-up termination could be replaced by a current source. Figure 4-5 and Figure 4-6 illustrates two models, the first based on a pull-up resistor in the DFP and the second replacing this with a current source.

Figure 4-5 Pull-Up/Pull-Down CC Model



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 107).

Table 4-10 provides the values that shall be used for the DFP's Rp or current source. Other pull-up voltages shall be allowed if they remain less than 5.5 V and fall within the correct voltage ranges on the UFP side – see Table 4-18, Table 4-19 and Table 4-20. Note: when two DFPs are connected together, they may use different termination methods which could result in unexpected current flow.

Table 4-10 DFP CC Termination (Rp) Requirements

DFP Advertisement	Current Source to 1.7 – 5.5 V	Resistor pull-up to 4.75 – 5.5 V	Resistor pull-up to 3.3 V ± 5%
Default USB Power	80 µA ± 20%	56 kΩ ± 20%	36 kΩ ± 20%
1.5 A @ 5 V	180 µA ± 8%	22 kΩ ± 5%	12 kΩ ± 5%
3.0 A @ 5 V	330 µA ± 8%	10 kΩ ± 5%	4.7 kΩ ± 5%

The UFP may find it convenient to implement Rd in multiple ways simultaneously (a wide range Rd when unpowered and a trimmed Rd when powered). Transitions between Rd implementations that do not exceed tCCDebounce shall not be interpreted as exceeding the wider Rd range. Table 4-11 provides the methods and values that shall be used for the UFP's Rd implementation.

Table 4-11 UFP CC Termination (Rd) Requirements

Rd Implementation	Nominal value	Can detect power capability?	Max voltage on pin
± 20% voltage clamp[1]	1.1 V	No	1.32 V
± 20% resistor to GND	5.1 kΩ	No	2.18 V
± 10% resistor to GND	5.1 kΩ	Yes	2.04 V

Note:

1. The clamp implementation inhibits *USB PD* communication although the system can start with the clamp and transition to the resistor once it is able to do *USB PD*.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Pages 149-150).

2.5 VCONN

Once the connection between host and device is established, the CC pin (CC1 or CC2) in the receptacle that is not connected via the CC wire through the standard cable is repurposed to source VCONN to power circuits in the plug needed to implement Electronically Marked Cables (see Section 4.9). Initially, the DFP sources VCONN and the source may be swapped using *USB PD* VCONN_Swap.

Electronically marked cables may use VBUS instead of VCONN as VBUS is available across the cable. VCONN functionally differs from VBUS in that it is isolated from the other end of the cable. VCONN is independent of VBUS and, unlike VBUS which can use *USB PD* to support higher voltages, VCONN voltage is fixed at 5 V.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 23).

4.9 Electronically Marked Cables

All USB Full-Featured Type-C cables shall be electronically marked. USB 2.0 Type-C cables may be electronically marked.

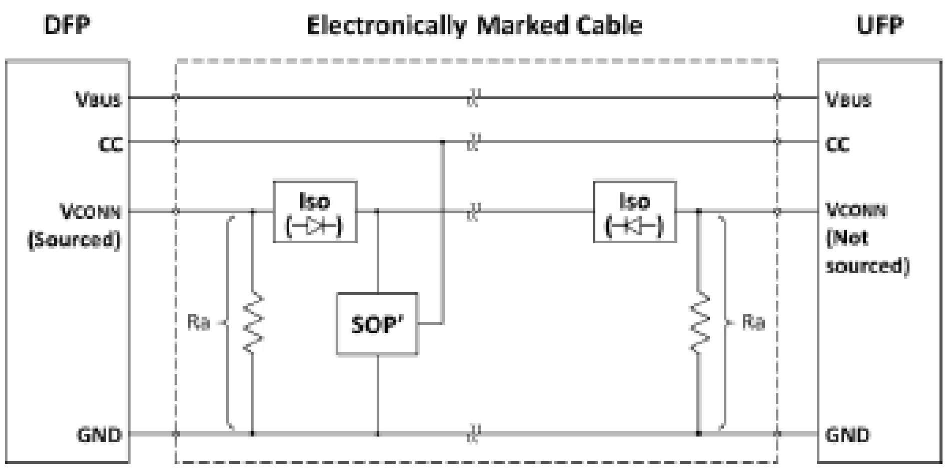
Electronically marked cables shall support *USB Power Delivery* Structured VDM Discover Identity command directed to SOP'. This provides a method to determine the characteristics of the cable, e.g. its current carrying capability, its performance, vendor identification, etc. This may be referred to as the USB Type-C Cable ID function.

Prior to an explicit *USB PD* contract, a Charging UFP is allowed to use SOP' to discover the cable's identity. After an explicit *USB PD* contract has been negotiated, only the DFP shall communicate with SOP'.

An electronically marked cable incorporates electronics that require VCONN, although VBUS or another source may be used. Electronically marked cables that do not incorporate data bus signal conditioning circuits shall consume no more than 70 mW from VCONN. During USB suspend, electronically marked cables shall not draw more than 7.5 mA from VCONN, see Section 4.6.1.2.

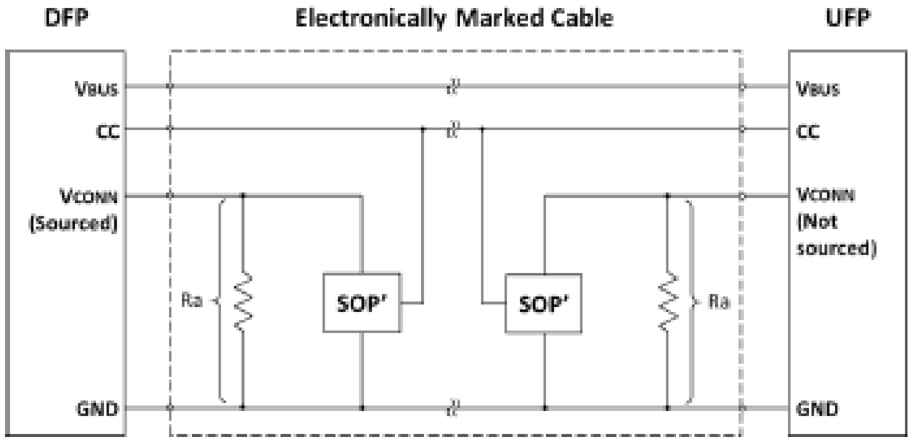
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

Figure 4-34 Electronically Marked Cable with VCONN connected through the cable



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 148).

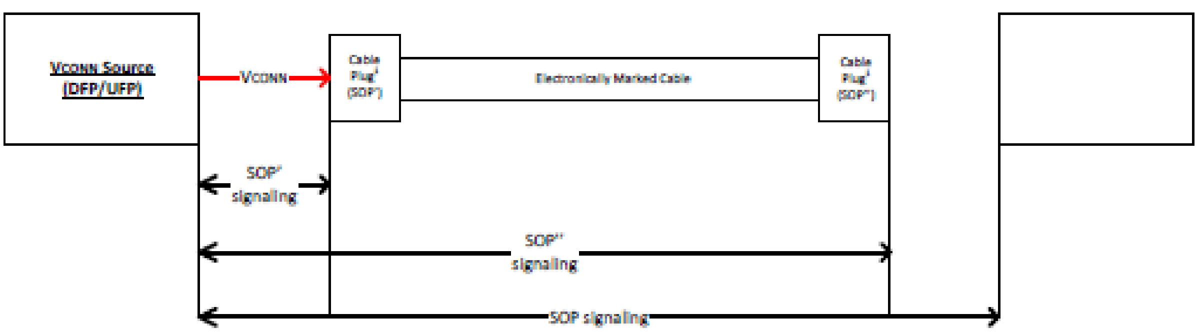
Figure 4-35 Electronically Marked Cable with SOP' at both ends



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

> All SOP* Communications take place over a single wire (CC). This means that the SOP* Communication periods must be coordinated to prevent important communication from being blocked. For a product which does not recognize SOP/SOP' or SOP'' Packets, this will look like a non-idle channel, leading to missed packets and retries. Communications between the Port Partners take precedence meaning that communications with the Cable Plug can be interrupted but will not lead to a Soft or Hard Reset.
>
> When no Contract or an Implicit Contract is in place (e.g., after a Power Role Swap or Fast Role Swap) only the Source port that is supplying VCONN is allowed to send packets to a Cable Plug (SOP') and is allowed to respond to packets from the Cable Plug (SOP') with a GoodCRC in order to discover the Cable Plug's characteristics (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the Source which acts to prevent conflicts between SOP and SOP' Packets. The Sink does not communicate with the Cable Plug and *Discards* any SOP' Packets received.
>
> When an Explicit Contract is in place the VCONN Source (either the DFP or the UFP) can communicate with the Cable Plug(s) using SOP'/SOP'' Packets (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the VCONN Source which acts to prevent conflicts between SOP* Packets. The Port that is not the VCONN Source does not communicate with the Cable Plug and does not recognize any SOP'/SOP'' Packets received. Only the DFP, when acting as a VCONN Source, is allowed to send SOP* in order to control the entry and exiting of Modes and to manage Modal Operation.

Figure 2-2 Example SOP' Communication between VCONN Source and Cable Plug(s)



(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 7).

Term	Description
Sink Directed Charge	A charging scheme whereby the Sink connects the Source to its battery through safety and other circuitry. When the SPR PPS Current Limit feature is activated, the Source automatically controls its output current by adjusting its output Voltage.
Soft Reset	A process that resets the PD communications engine to its default state.
SOP Communication	Communication using SOP Packets also implies that a Message sequence is being followed.
SOP Packet	Any Power Delivery Packet which starts with an *SOP*.
SOP* Communication	Communication with a Cable Plug using SOP* Packets, also implies a Message sequence is being followed.
SOP* Packet	A term referring to any Power Delivery Packet starting with either *SOP*, *SOP'* or *SOP''*.
SOP' Communication	Communication with a Cable Plug using SOP' Packets, also implies that a Message sequence is being followed.
SOP' Packet	Any Power Delivery Packet which starts with an *SOP'* used to communicate with a Cable Plug.
SOP'' Communication	Communication with a Cable Plug using SOP'' Packets, also implies that a Message sequence is being followed.
SOP'' Packet	Any Power Delivery Packet which starts with an *SOP''* used to communicate with a Cable Plug when SOP' Packets are being used to communicate with the other Cable Plug.

(Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 68).

71. On information and belief, Defendant provides a product or power supply system, such as '087 Accused PD Chargers, to transfer, via the first conductor, the direct current power to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the VBUS pin is the voltage line that provides DC power to the portable electronic device.

Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both USB 2.0 (D+ and D−) and USB 3.1 (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1−	VBUS	CC1	D+	D−	SBU1	VBUS	RX2−	RX2+	GND
GND	RX1+	RX1−	VBUS	SBU2	D−	D+	CC2	VBUS	TX2−	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

2.4 VBUS

VBUS provides a path to deliver power between a host and a device, and between a charger and a host/device. A simplified high-current supply capability is defined for hosts and chargers that optionally support current levels beyond the USB 2.0 and USB 3.1 specifications. The USB Power Delivery Specification is supported.

Table 2-1 summarizes the power supply options available from the perspective of a device with the USB Type-C connector. Not all options will be available to the device from all host

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 22).

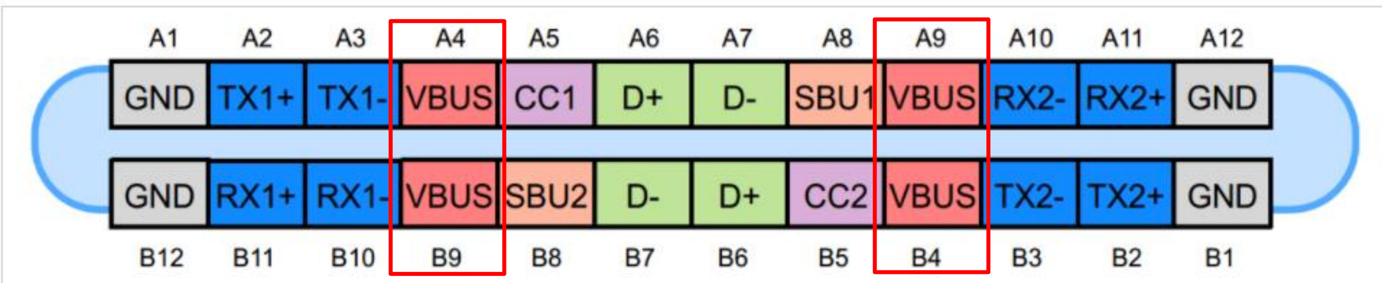


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

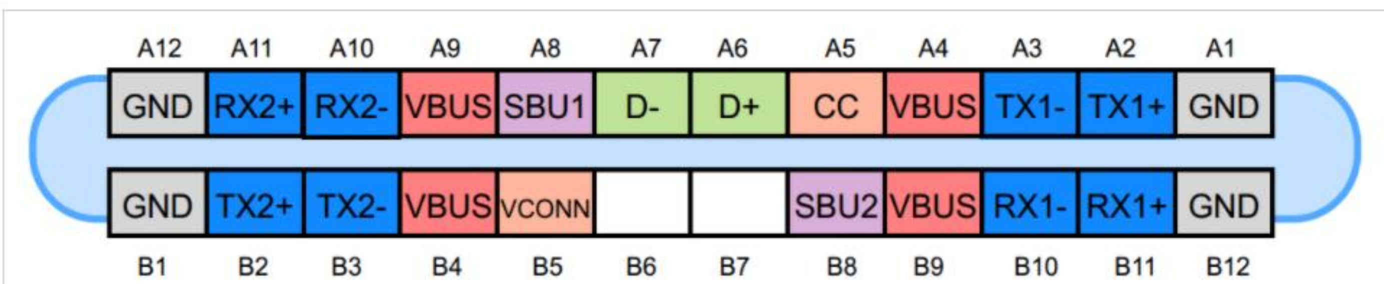


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

72. Defendant provides a product or power supply system, such as '087 Accused PD Chargers, to transfer, via the second conductor, a ground reference to the portable electronic

device. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the GND pin provides a ground reference to the portable electronic device.

2.3.1 DFP-to-UFP Attach/Detach Detection

Initially, DFP-to-UFP attach is detected by a host or hub port (DFP) when one of the CC pins at its USB Type-C receptacle senses a specified resistance to GND. Subsequently, DFP-to-UFP detach is detected when the CC pin that was terminated at its USB Type-C receptacle is no longer terminated to GND.

Power is not applied to the USB Type-C host or hub receptacle (VBUS or VCONN) until the DFP detects the presence of an attached device (UFP) port. When a DFP-to-UFP attach is detected, the DFP is expected to enable power to the receptacle and proceed to normal USB operation with the attached device. When a DFP-to-UFP detach is detected, the port sourcing VBUS removes power.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 49).

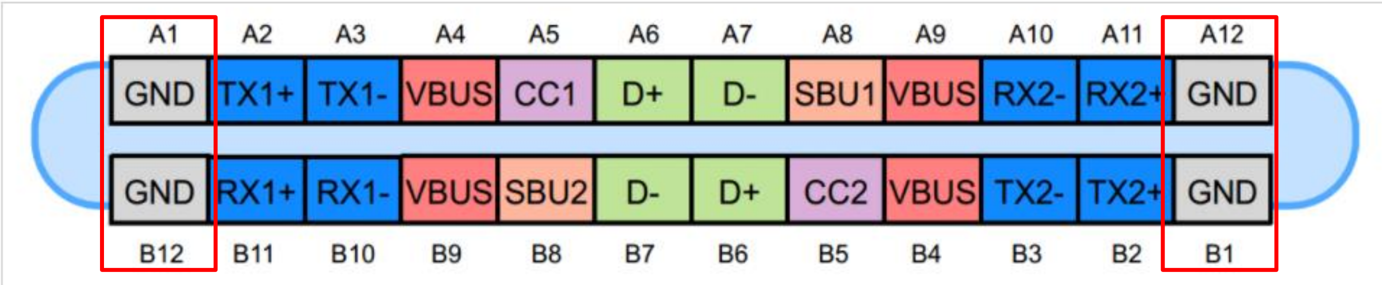


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

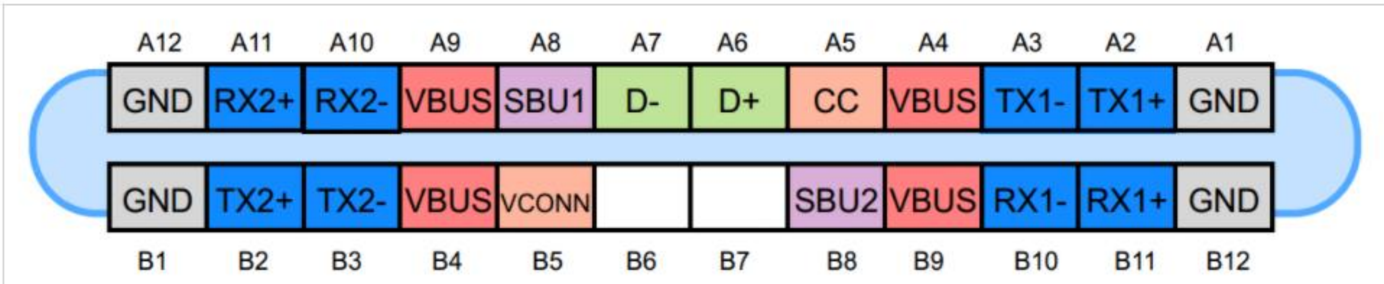


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

73. Defendant provides a product or power supply system, such as '087 Accused PD Chargers, to transfer, via the third conductor, the first signal from the portable electronic device to the data circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. When a portable electronic device is connected to an '087 Accused PD Charger through the USB Type-C cable, the orientation of the connector to the '087 Accused PD Charger is detected first. The '087 Accused PD Chargers detect the proper orientation of the connected USB Type-Cable by checking the voltage signal at the CC1 and CC2 pins. The values of the two resistors, Rp and Rd are fixed such that the voltage signal at one of the two CC pins (*i.e.*, CC1 and CC2) will be lower than the predetermined threshold value. The '087 Accused PD Chargers determine which of the two CC pins are used as the configuration channel by detecting a voltage

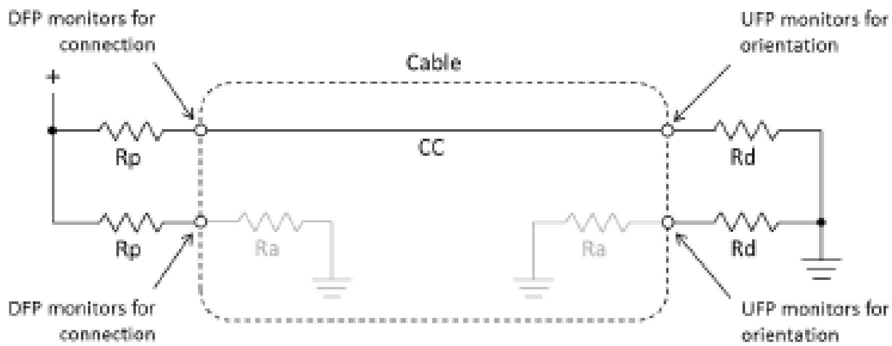
less than a certain threshold voltage at the CC pin in use. The CC pin used as the configuration channel is the "third conductor" and the voltage signal received at one of the CC pins meeting the threshold requirement ("first signal") from the portable electronic device connected via the full featured USB Type-Cable is determined by the voltage divider signal generated by the Rd resister in the portable electronic devices with the Rp resister in the '087 Accused PD Chargers.

4.5.1.2.1 Detecting a Valid DFP-to-UFP Connection

The general concept for setting up a valid connection between a DFP and UFP is based on being able to detect terminations residing in the product being attached.

To aid in defining the functional behavior of CC, a pull-up (Rp) and pull-down (Rd) termination model is used – actual implementation in hosts and devices may vary, for example, the pull-up termination could be replaced by a current source. Figure 4-5 and Figure 4-6 illustrates two models, the first based on a pull-up resistor in the DFP and the second replacing this with a current source.

Figure 4-5 Pull-Up/Pull-Down CC Model



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page107).

Table 4-10 provides the values that shall be used for the DFP's Rp or current source. Other pull-up voltages shall be allowed if they remain less than 5.5 V and fall within the correct voltage ranges on the UFP side – see Table 4-18, Table 4-19 and Table 4-20. Note: when two DFPs are connected together, they may use different termination methods which could result in unexpected current flow.

Table 4-10 DFP CC Termination (Rp) Requirements

DFP Advertisement	Current Source to 1.7 – 5.5 V	Resistor pull-up to 4.75 – 5.5 V	Resistor pull-up to 3.3 V ± 5%
Default USB Power	80 μA ± 20%	56 kΩ ± 20%	36 kΩ ± 20%
1.5 A @ 5 V	180 μA ± 8%	22 kΩ ± 5%	12 kΩ ± 5%
3.0 A @ 5 V	330 μA ± 8%	10 kΩ ± 5%	4.7 kΩ ± 5%

The UFP may find it convenient to implement Rd in multiple ways simultaneously (a wide range Rd when unpowered and a trimmed Rd when powered). Transitions between Rd implementations that do not exceed tCCDebounce shall not be interpreted as exceeding the wider Rd range. Table 4-11 provides the methods and values that shall be used for the UFP's Rd implementation.

Table 4-11 UFP CC Termination (Rd) Requirements

Rd Implementation	Nominal value	Can detect power capability?	Max voltage on pin
± 20% voltage clamp[1]	1.1 V	No	1.32 V
± 20% resistor to GND	5.1 kΩ	No	2.18 V
± 10% resistor to GND	5.1 kΩ	Yes	2.04 V

Note:
1. The clamp implementation inhibits USB PD communication although the system can start with the clamp and transition to the resistor once it is able to do USB PD.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Pages 149-150).

74. Defendant provides a product or power supply system, such as '087 Accused PD Chargers, to transfer, via the fourth conductor, the second signal from the data circuitry to the portable electronic device. This element is met literally, or in the alternative, under the doctrine of equivalents. The CC pin that is not used as a configuration channel then becomes the Vconn conductor ("the fourth conductor"). The Accused PD Chargers connect to the full-featured USB Type-C cables that are electronically marked. To connect to an electronically marked USB Type-C cable, the Accused PD Chargers utilize the Vconn pin. With the electronically marked USB Type-Cable, the CC pin not used for the configuration is used as the Vconn source. Upon providing the Vconn source, the Accused PD Chargers communicate the SOP* packets with the

portable electronic device, which control charging of the batteries in the portable electronic devices. The SOP* includes the SOP communication from the Accused PD Chargers to the portable devices that are attached. The voltage signal sent at the Vconn pin from the Accused PD Chargers to the portable electronic devices is the "second signal" because this voltage signal enables the SOP* communication that controls charging batteries in the portable electronic devices.

2.5 VCONN

Once the connection between host and device is established, the CC pin (CC1 or CC2) in the receptacle that is not connected via the CC wire through the standard cable is repurposed to source VCONN to power circuits in the plug needed to implement Electronically Marked Cables (see Section 4.9). Initially, the DFP sources VCONN and the source may be swapped using *USB PD* VCONN_Swap.

Electronically marked cables may use VBUS instead of VCONN as VBUS is available across the cable. VCONN functionally differs from VBUS in that it is isolated from the other end of the cable. VCONN is independent of VBUS and, unlike VBUS which can use *USB PD* to support higher voltages, VCONN voltage is fixed at 5 V.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 23).

4.9 Electronically Marked Cables

All USB Full-Featured Type-C cables shall be electronically marked. USB 2.0 Type-C cables may be electronically marked.

Electronically marked cables shall support *USB Power Delivery* Structured VDM Discover Identity command directed to SOP'. This provides a method to determine the characteristics of the cable, e.g. its current carrying capability, its performance, vendor identification, etc. This may be referred to as the USB Type-C Cable ID function.

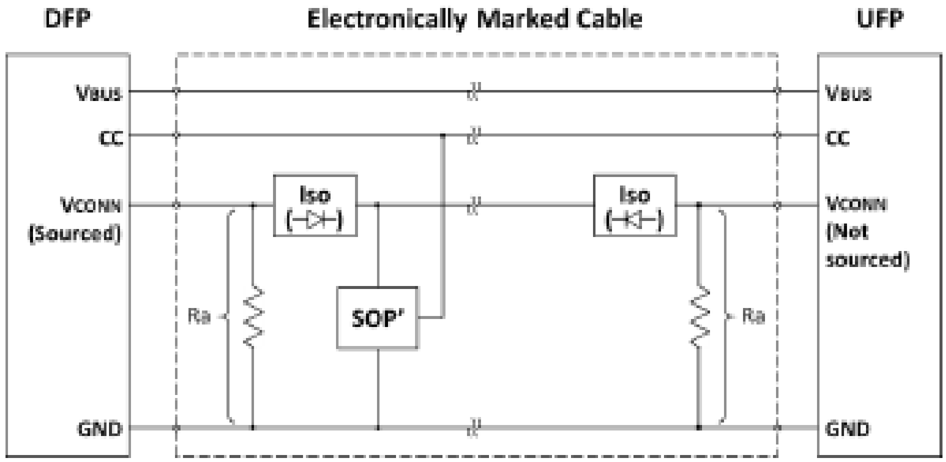
Prior to an explicit *USB PD* contract, a Charging UFP is allowed to use SOP' to discover the cable's identity. After an explicit *USB PD* contract has been negotiated, only the DFP shall communicate with SOP'.

An electronically marked cable incorporates electronics that require VCONN, although VBUS or another source may be used. Electronically marked cables that do not incorporate data bus signal conditioning circuits shall consume no more than 70 mW from VCONN. During USB suspend, electronically marked cables shall not draw more than 7.5 mA from VCONN, see Section 4.6.1.2.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August

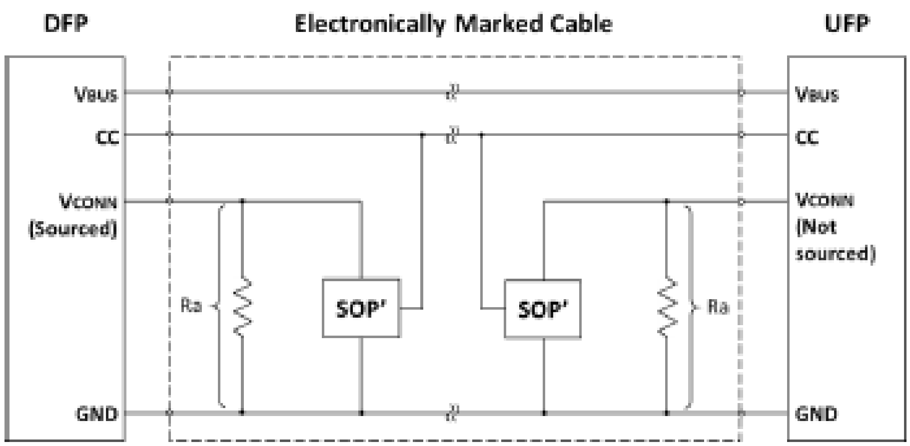
2014, Page 147).

Figure 4-34 Electronically Marked Cable with VCONN connected through the cable



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 148).

Figure 4-35 Electronically Marked Cable with SOP' at both ends



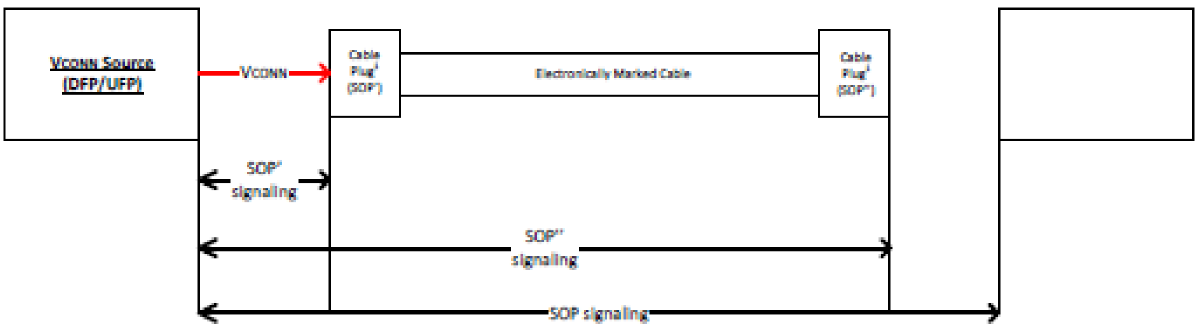
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

All SOP* Communications take place over a single wire (CC). This means that the SOP* Communication periods must be coordinated to prevent important communication from being blocked. For a product which does not recognize SOP/SOP' or SOP'' Packets, this will look like a non-idle channel, leading to missed packets and retries. Communications between the Port Partners take precedence meaning that communications with the Cable Plug can be interrupted but will not lead to a Soft or Hard Reset.

When no Contract or an Implicit Contract is in place (e.g., after a Power Role Swap or Fast Role Swap) only the Source port that is supplying VCONN is allowed to send packets to a Cable Plug (SOP') and is allowed to respond to packets from the Cable Plug (SOP') with a GoodCRC in order to discover the Cable Plug's characteristics (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the Source which acts to prevent conflicts between SOP and SOP' Packets. The Sink does not communicate with the Cable Plug and *Discards* any SOP' Packets received.

When an Explicit Contract is in place the VCONN Source (either the DFP or the UFP) can communicate with the Cable Plug(s) using SOP'/SOP'' Packets (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the VCONN Source which acts to prevent conflicts between SOP* Packets. The Port that is not the VCONN Source does not communicate with the Cable Plug and does not recognize any SOP'/SOP'' Packets received. Only the DFP, when acting as a VCONN Source, is allowed to send SOP* in order to control the entry and exiting of Modes and to manage Modal Operation.

Figure 2-2 Example SOP' Communication between VCONN Source and Cable Plug(s)



(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 7).

Term	Description
Sink Directed Charge	A charging scheme whereby the Sink connects the Source to its battery through safety and other circuitry. When the SPR PPS Current Limit feature is activated, the Source automatically controls its output current by adjusting its output Voltage.
Soft Reset	A process that resets the PD communications engine to its default state.
SOP Communication	Communication using SOP Packets also implies that a Message sequence is being followed.
SOP Packet	Any Power Delivery Packet which starts with an *SOP*.
SOP* Communication	Communication with a Cable Plug using SOP* Packets, also implies a Message sequence is being followed.
SOP* Packet	A term referring to any Power Delivery Packet starting with either *SOP*, *SOP'* or *SOP''*.
SOP' Communication	Communication with a Cable Plug using SOP' Packets, also implies that a Message sequence is being followed.
SOP' Packet	Any Power Delivery Packet which starts with an *SOP'* used to communicate with a Cable Plug.
SOP'' Communication	Communication with a Cable Plug using SOP'' Packets, also implies that a Message sequence is being followed.
SOP'' Packet	Any Power Delivery Packet which starts with an *SOP''* used to communicate with a Cable Plug when SOP' Packets are being used to communicate with the other Cable Plug.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 68).

75. Defendant provides a product or power supply system, such as '087 Accused PD Chargers, that has data circuitry that is further configured, in coordination with the first signal, to provide the second signal, the second signal having a parameter level that is usable by the portable electronic device in connection with control of charging a rechargeable battery of the portable electronic device based on the direct current power provided by the power circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. As explained above, a voltage signal meeting the specified threshold value, i.e., the "first signal," is detected at the CC pin used as the configuration channel. In coordination with this voltage signal, the second signal, *i.e.*, another voltage signal from the Vconn pin is sent from the '087 Accused PD Chargers to the portable electronic devices, which enables the SOP* communication that controls charging a rechargeable battery of the portable electronic device.

2.5.3 SOP Communication

SOP Communication is used for Port-to-Port communication between the Source and the Sink. SOP Communication is recognized by both Port Partners but not by any intervening Cable Plugs. SOP Communication takes priority over other SOP* Communications since it is critical to complete power related operations as soon as possible. Message sequences relating to power are also allowed to interrupt other sequences to ensure that negotiation and control of power is given priority on the bus.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 75).

6.4.1.1 Use of the Capabilities Message

6.4.1.1.1 Use by Sources

Sources send a *Source_Capabilities* Message (see Section 6.4.1) either as part of advertising Port capabilities, or in response to a *Get_Source_Cap* Message.

Following a Hard Reset, a power-on event or plug insertion event, a Source Port *Shall* send a *Source_Capabilities* Message after every *SourceCapabilityTimer* timeout as an Advertisement that *Shall* be interpreted by the Sink Port on Attachment. The Source *Shall* continue sending a minimum of *nCapsCount Source_Capabilities* Messages until a *GoodCRC* Message is received.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 146).

C. Indirect Infringement

76. Upon information and belief, Defendant has been and now is indirectly infringing by way of inducing infringement and contributing to the infringement of the asserted claims of the '087 patent in the State of Texas, in this District, and elsewhere in the United States, by providing the '087 Accused Chargers for use as described above by Defendant's customers. Defendant advertised, offered for sale, and/or sold the '087 Accused Chargers (and continues to advertise, offer to sell, and sell) to its customers for use in a manner that Defendant knew infringed at least one claim of the '087 patent. For example, Defendant advertises and sells the '087 Accused Chargers. Defendant is a direct and indirect infringer, and its customers using the '087 Accused Chargers are direct infringers. Defendant had actual knowledge of the '087 patent at least as early as when they received a letter from Plaintiff sent on August 1, 2023, asserting that the '087 Accused Chargers infringed claims of the '087 patent and they were provided a claim chart that provided evidence of the infringement. Defendant has known of its infringement since at least that date as a result of the accusations of infringement in the notice letter. Defendant has therefore also known that the use of the '087 Accused Chargers by its customers infringed at least one claim of the '087 patent since at least the date they received the letter.

77. On information and belief, since becoming aware of the '087 patent and of the infringement through advertising and offering for sale the '087 Accused Chargers for use by its customers, Defendant is and has been committing the act of inducing infringement by specifically intending to induce infringement by providing the '087 Accused Chargers to its customers and by aiding and abetting its use in a manner known to infringe by Defendant. Since becoming aware of the infringing use of the '087 Accused Chargers, Defendant knew that the use of the '087 Accused Chargers by its customers as a charger with a portable electronic device (including a

rechargeable battery) constituted direct patent infringement. Despite this knowledge, Defendant continued and continues to encourage and induce its customers to use the '087 Accused Chargers to infringe as described above and provided instructions (and continues such acts) for using the '087 Accused Chargers to infringe, including through advertisements. Defendant therefore knowingly induced infringement (and continues to induce infringement) and specifically intended to (and intends to) encourage and induce the infringement of the '087 patent by its customers.

78. On information and belief, since Defendant became aware of the acts of infringement at least as of the date of receipt of the notice letter, Defendant is and has been committing the act of contributory infringement by intending to provide the '087 Accused Chargers to its customers knowing that such devices are a material part of the claimed invention, knowing that its use was made and adapted for infringement of the '087 patent as described above, and further knowing that the accused aspect of the '087 Accused Chargers described above is not a staple article or commodity of commerce suitable for substantially noninfringing use. As described above, Defendant was aware that all material claim limitations are satisfied by the use and implementation of the '087 Accused Chargers by Defendant's customers in the manner described above yet continued to provide the Accused Chargers to its customers knowing that it is a material part of the claimed invention. As described above, since learning of the infringement, Defendant knew that the use and implementation of the '087 Accused Chargers by its customers was made and adapted for infringement of the '087 patent. A new act of direct infringement occurred each time a customer implemented and/or used the '087 Accused Chargers in the manner described above. After Defendant became aware that the use of the '087 Accused Chargers infringes at least one claim of the '087 patent, Defendant knew that each such new use was made and adapted for infringement of at least one claim of the '087 patent and Defendant continued to

advertise and provide the '087 Accused Chargers for such infringing activities. Furthermore, as described more fully above, the '087 Accused Chargers have functionality designed for use in a system in the manner described above and is therefore not a staple article or commodity of commerce suitable for substantially noninfringing use.

79. Upon information and belief, Defendant has been and now is willfully infringing the asserted claims of the '087 patent in Texas, in this District, and elsewhere in the United States. Defendant had actual knowledge of the '087 patent at least as early as when they received a letter from Plaintiff sent on August 1, 2023, asserting that the '087 Accused Chargers infringed claims of the '087 patent and they were provided a chart of the infringement. Defendant has known of its infringement since at least that date as a result of the accusations of infringement in the letter. Defendant has therefore also known that the use of the '087 Accused Chargers by its customers infringed at least one claim of the '087 patent since at least the date they received the letter. Defendant was informed of its infringement of the '087 patent by way of the August 1, 2023, letter sent to Defendant, including claim charts demonstrating Defendant's infringement. As a result of the letter, Defendant should have known that its actions constituted an unjustifiably high risk of infringement. Despite the letter and knowledge that the risk of infringement was either known or so obvious that it should have been known, Defendant continued its infringing actions.

80. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates Plaintiff for such Defendant's infringement of the '087 patent, *i.e.*, in an amount that by law cannot be less than a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

VI. COUNT III
(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 10,951,042)

81. Upon information and belief, Defendant has directly infringed claim 1, 5-6, 11,15-16 of the '042 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering for sale and/or importing a product or power supply system comprising power circuitry configured to provide direct current power, such products including, but not limited to, the following: Just Wireless Portable Power Bank 15K USB-C/A - 15000mAh (Item #3351754, Model #06175); Just Wireless 20,000mAh Power Bank with Fast Charge and 3 USB Ports (Item #3351755, Model #06177); Just Wireless Portable Power Bank 5K USB-C/A - 5200mAh (Item #3351752, Model #06171); DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2); and Naztech Type C USB A Wall Outlet Charger 2 (Item #5264434; Model #HPL15520) ("'042 Accused Chargers").

82. Claim 1 of the '042 patent states:

A portable electronic device comprising:

a rechargeable battery;

power circuitry configured to receive direct current and to charge the rechargeable battery; and

data circuitry configured to provide a first signal to a power supply and to receive a second signal from the power supply, the data circuitry and the power circuitry configured to be coupled via a connector to the power supply, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be detachably mated with an interface of the power supply to:

transfer, via the first conductor, the direct current from the power supply,

provide, via the second conductor, a ground reference from the power supply,

communicate, via the third conductor, the first signal from the data circuitry to the power supply, and

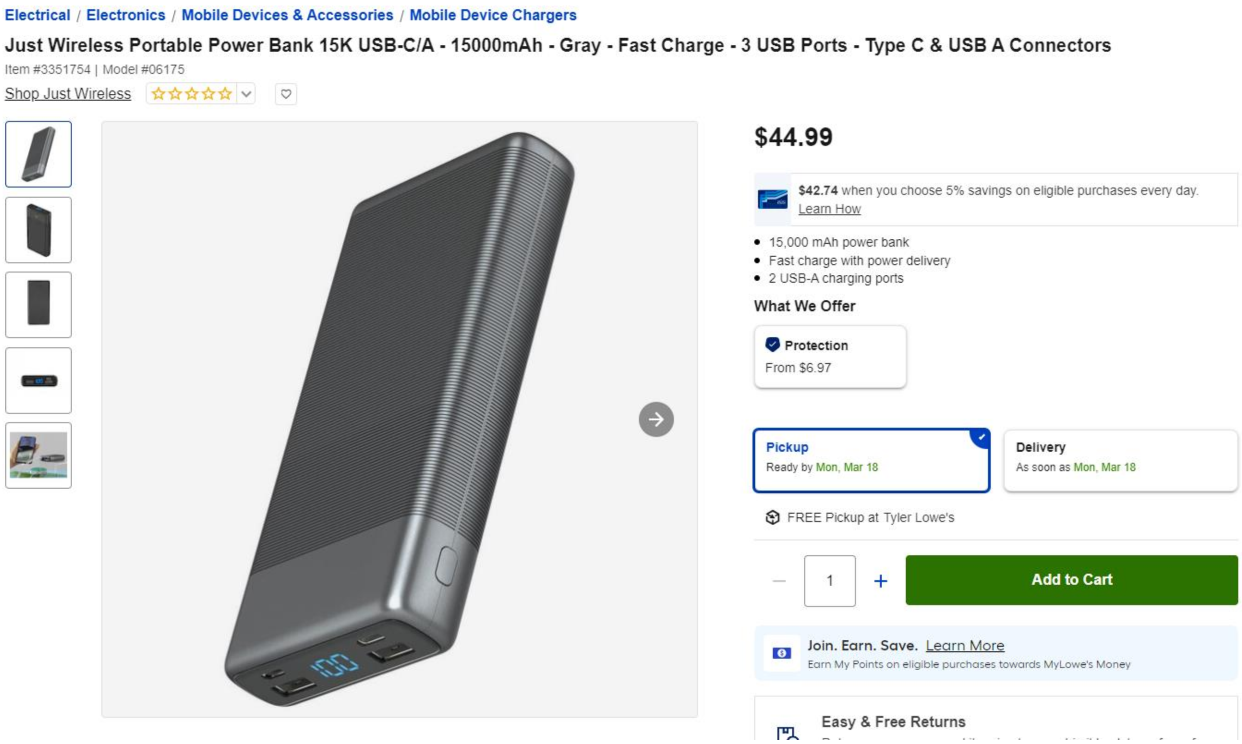
communicate, via the fourth conductor, the second signal from the power supply to the data circuitry;

> wherein the second signal has a parameter level that is usable by the data circuitry in connection with control of charging the rechargeable battery based on the direct current received by the power circuitry.

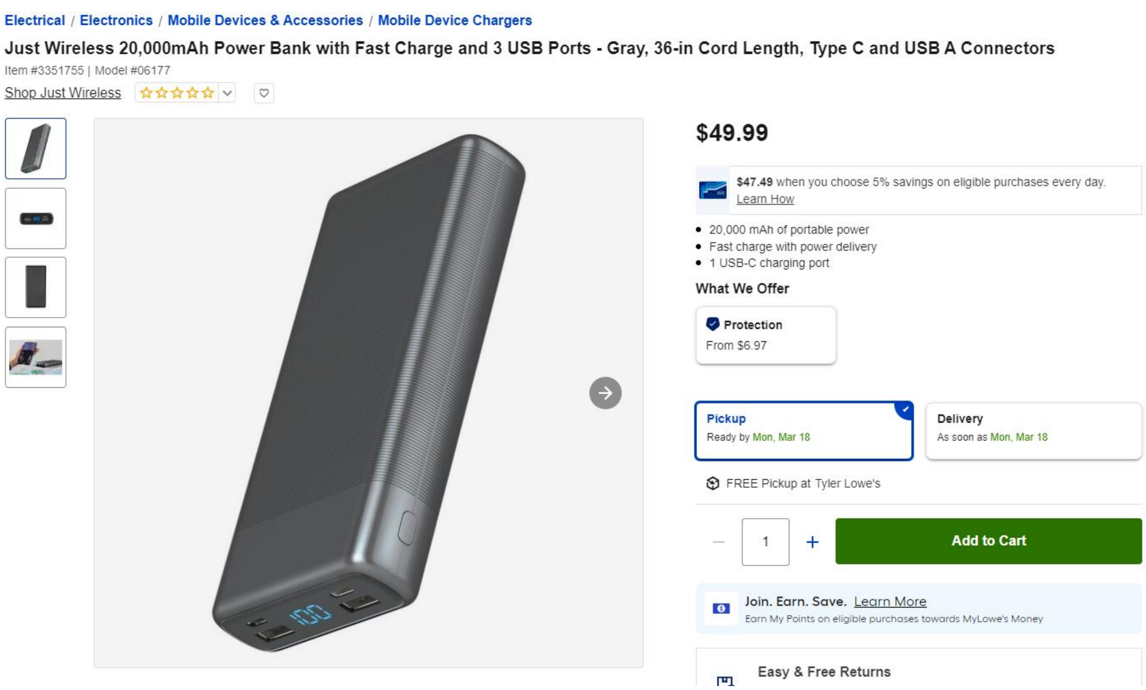
(Ex. C at 11:2-25).

A. Infringement for Compliance with the Battery Charging (BC) 1.2 specification

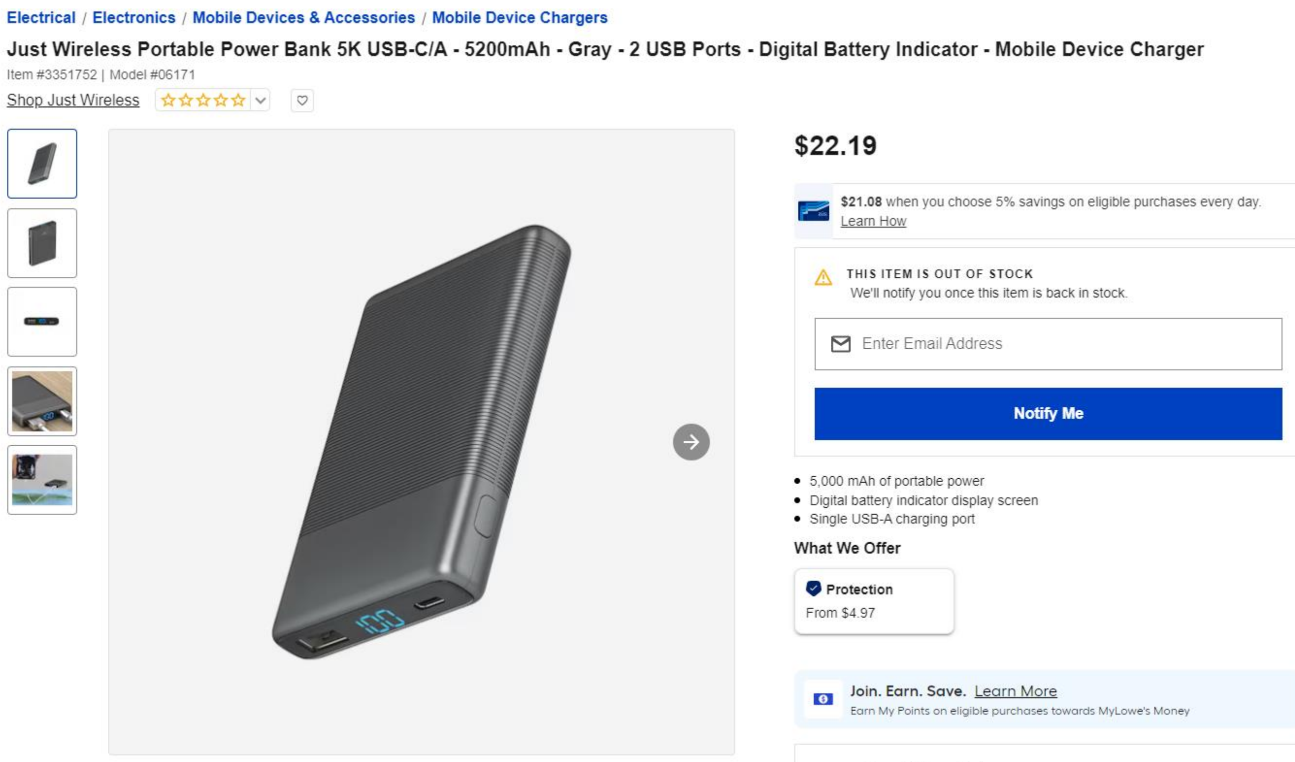
83. Defendant makes, uses, sells, offers for sale and/or imports a portable electronic device, such as the '042 Accused Chargers comprising a rechargeable battery. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, Defendant provides a portable electronic device (*e.g.*, the '042 Accused Chargers) with a rechargeable battery and a USB power supply that ships with the devices and acts as a power supply while charging the device's rechargeable battery. The USB power supply outputs voltage, current, and power values. Upon information and belief, the USB power supply includes circuitry compliant with the Battery Charging (BC) 1.2 specification to charge the portable electronic devices. The Table 2-1 (https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36) and the diagram depicting the power consumed by different USB specifications (https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5) disclose that BC 1.2 outputs 5V voltage, 1.5A current, and 7.5W power. USB-compliant devices at USB 3.0 or above are compatible with the USB BC 1.2 specification. Further, to charge a battery in a portable electronic device, the portable electronic device is connected to the USB power supply. The other end of the USB cable is connected to the charging port of portable electronic device and the power supply is plugged into a standard wall socket.



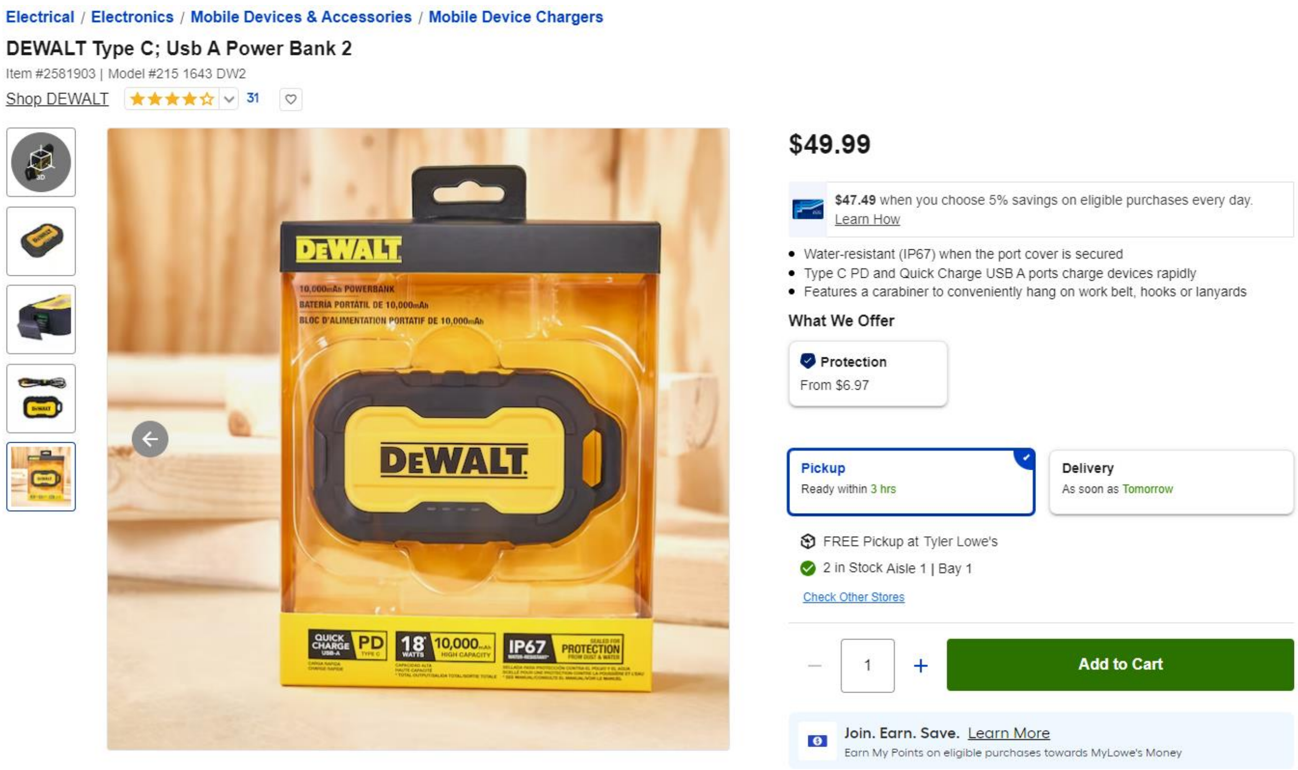
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



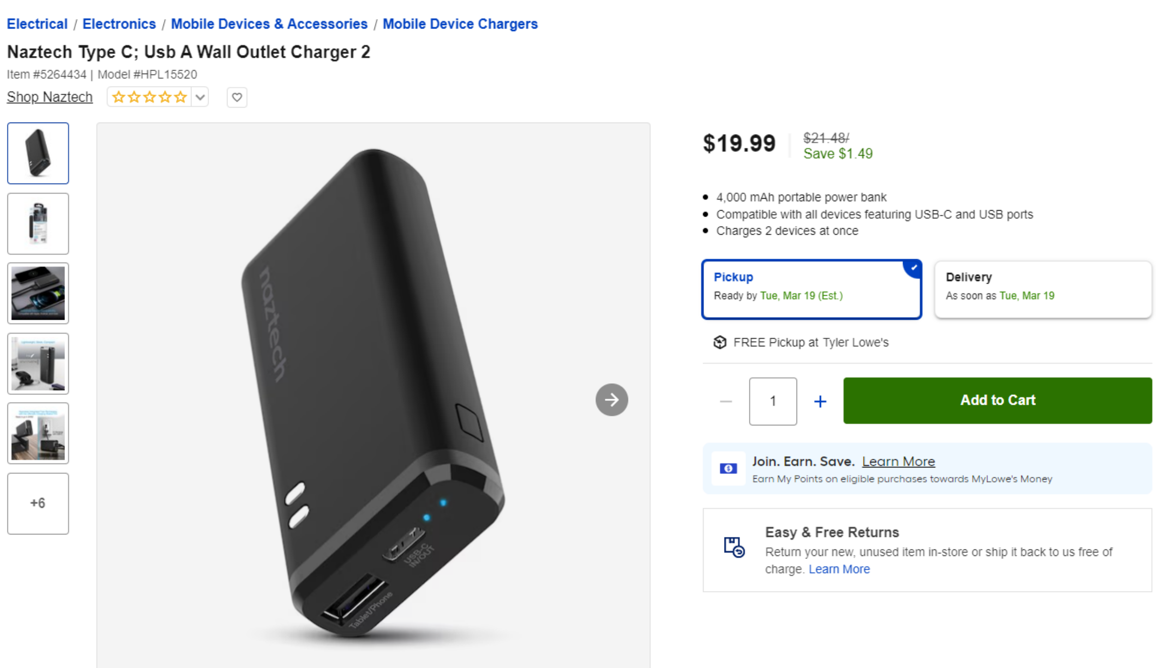
(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-5K-USB-C-A/5001606727?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-10-000-mAh-Powerbank/1003242934?idProductFound=false&id Extracted=true).



The Naztech 4,000 mAh Dual Output USB-C and USB Portable Power Bank extends your talk, music, and gaming experiences by up to 13 hours at home or on the go! This high-capacity 4,000 mAh battery can charge 2 devices at once through powerful dual outputs— a USB-C in/output and a USB output with up to 15 watts of pure power. With rapid recharge, get back to full in just 2 hours, so your devices stay powered up! Revolutionize your charging routine indoors and on the go!

- 4,000 mAh portable power bank
- Compatible with all devices featuring USB-C and USB ports
- Charges 2 devices at once
- Output: 15 watt USB-C; 10 watt USB
- Ultra-slim and lightweight
- World-class safety features automatically regulate power bank's charging performance to protect devices from overcurrent, over voltage, short circuit, and over-temperature
- LED battery indicator
- Up to 2 hours rapid recharge
- Up to 13 hours extra battery life

Prop65 Warning Label
PDF

SDS
PDF

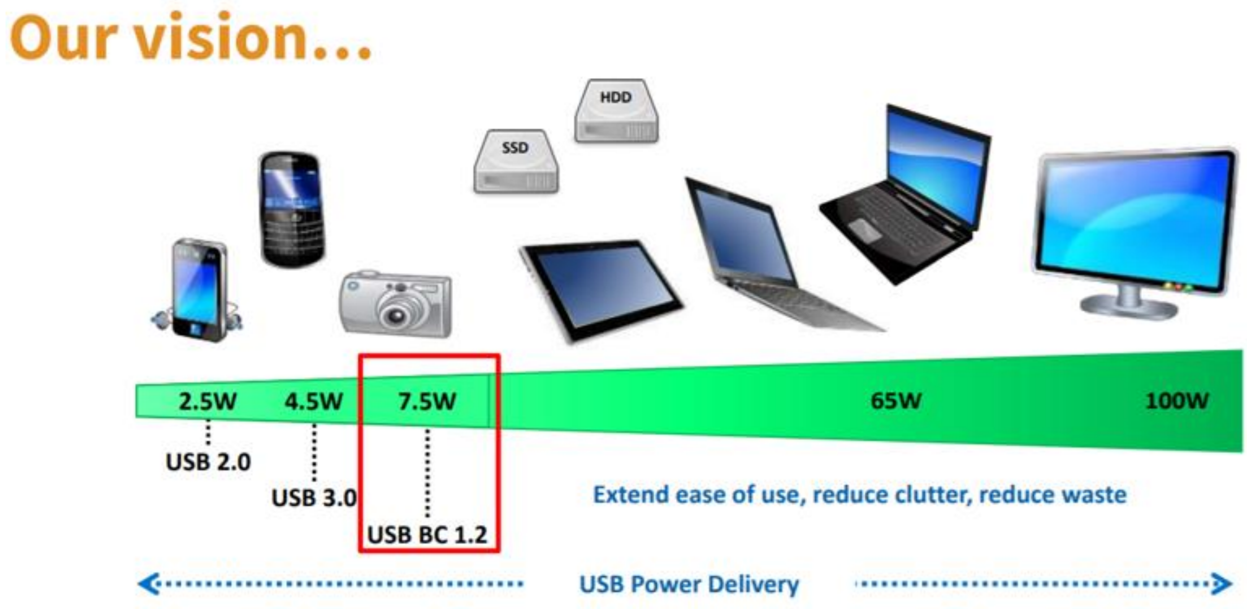
Warranty Guide
PDF

(*E.g.*, https://www.lowes.com/pd/Naztech-Type-C-Usb-A-Wall-Outlet-Charger-2/5013960091?idProductFound=false&idExtracted=true).

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See USB 2.0	
USB 3.2	5 V	See USB 3.2	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

USB battery charging specifications

Battery Charging Specification Revision 1.2 (BC1.2)

The different port types described in the above section were first defined in the *Battery Charging Specification Revision 1.2* (BC1.2) published in 2010. In addition to the port definitions, BC1.2 specifies primary and secondary charge port detection sequences and port specific performance requirements. These include required operating range, undershoot, detection signaling, and connectors for each port type. Also included are dead, weak, and good battery charge conditions, port shutdown procedures, and other details associated with battery charging.

BC1.2 was published after USB 2.0 but before USB 3.1 and so the information in BC1.2 refers to USB 2.0. The specification is, however, consistent and compatible with USB 3.1.

(*E.g.*, https://www.lightingglobal.org/wp-content/uploads/2017/12/Issue-24_USB-smartphone-charging-final.pdf, page 4).

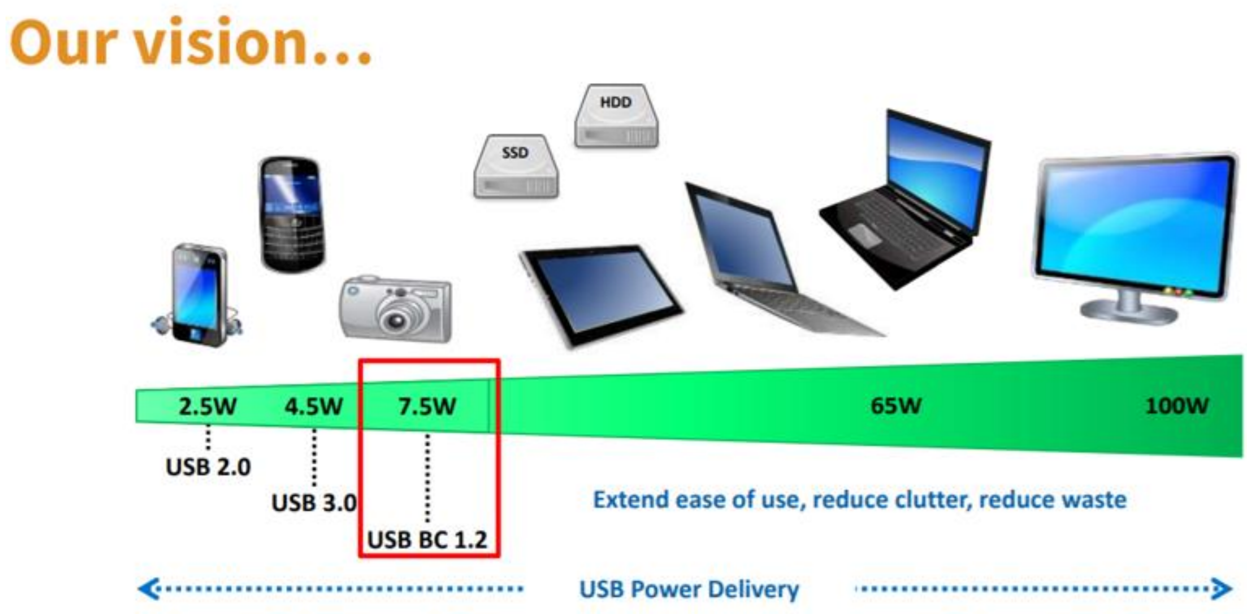
84. On information and belief, Defendant provides a portable electronic device, such as the '042 Accused Chargers, that comprise power circuitry configured to receive direct current and to charge the rechargeable battery. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, to charge the rechargeable battery of a portable electronic device, a USB cable is connected to the USB power supply acting as a power supply. The other

end of the USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the portable electronic device comprises power circuitry to receive DC power from the power supply.

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See USB 2.0	
USB 3.2	5 V	See USB 3.2	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

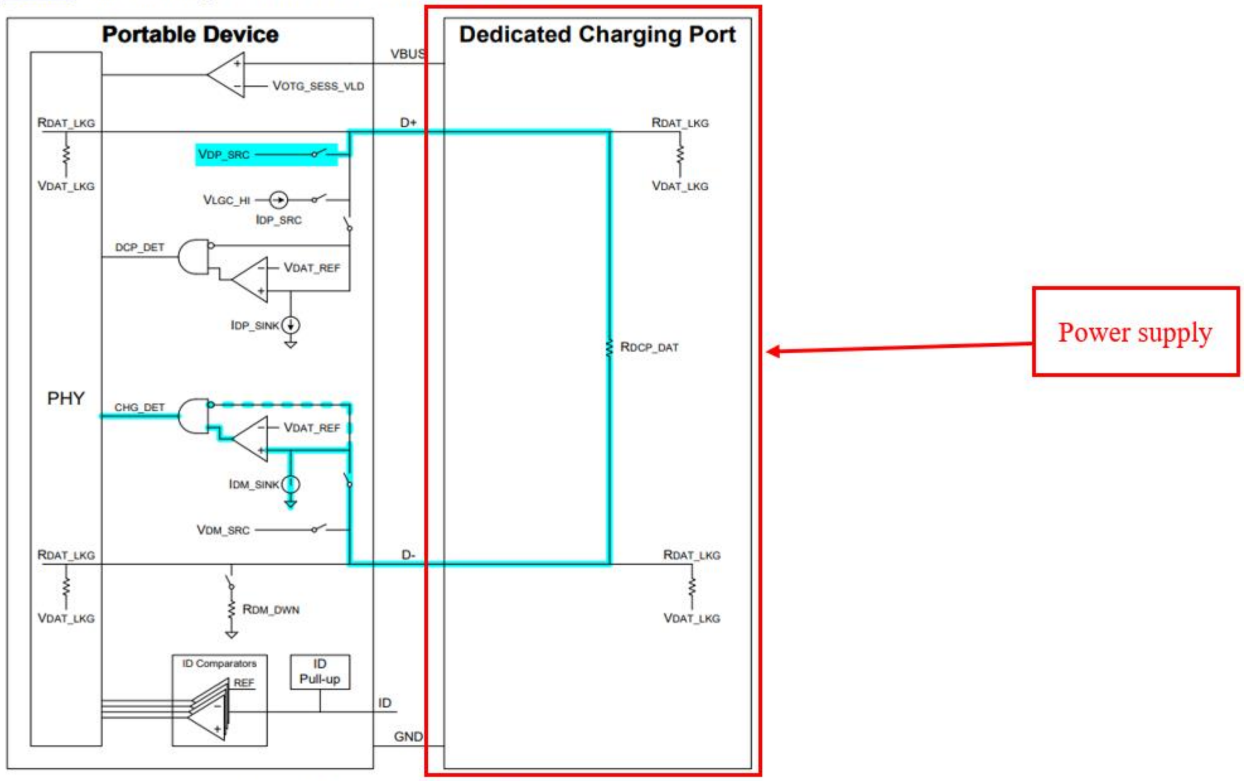


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

85. Defendant provides a portable electronic device, such as the '042 Accused Chargers, that comprise a data circuitry configured to provide a first signal to a power supply and to receive a second signal from the power supply. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the portable electronic device comprises data circuitry configured to use the Primary Detection method as described in the USB BC 1.2 specification. Further, during Primary Detection, when the portable electronic device is connected with the power supply through the USB cable, the portable electronic device generates a D+ signal

("first signal") such that the data circuitry of the portable electronic device provides a D+ signal ("first signal") to a power supply and receives a D- signal ("second signal") from the power supply to detect the type of connected power supply (standard downstream port or charging port).

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw I_{DEV_CHG} without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

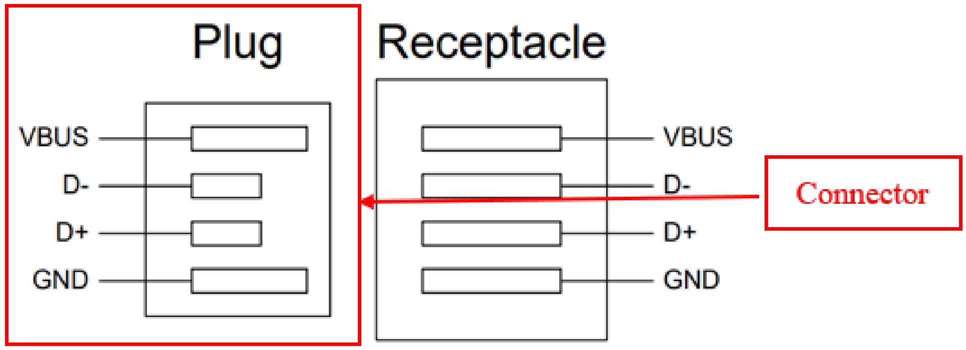


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

Figure 3-1 shows several examples of a PD attached to an SDP or Charging Port.

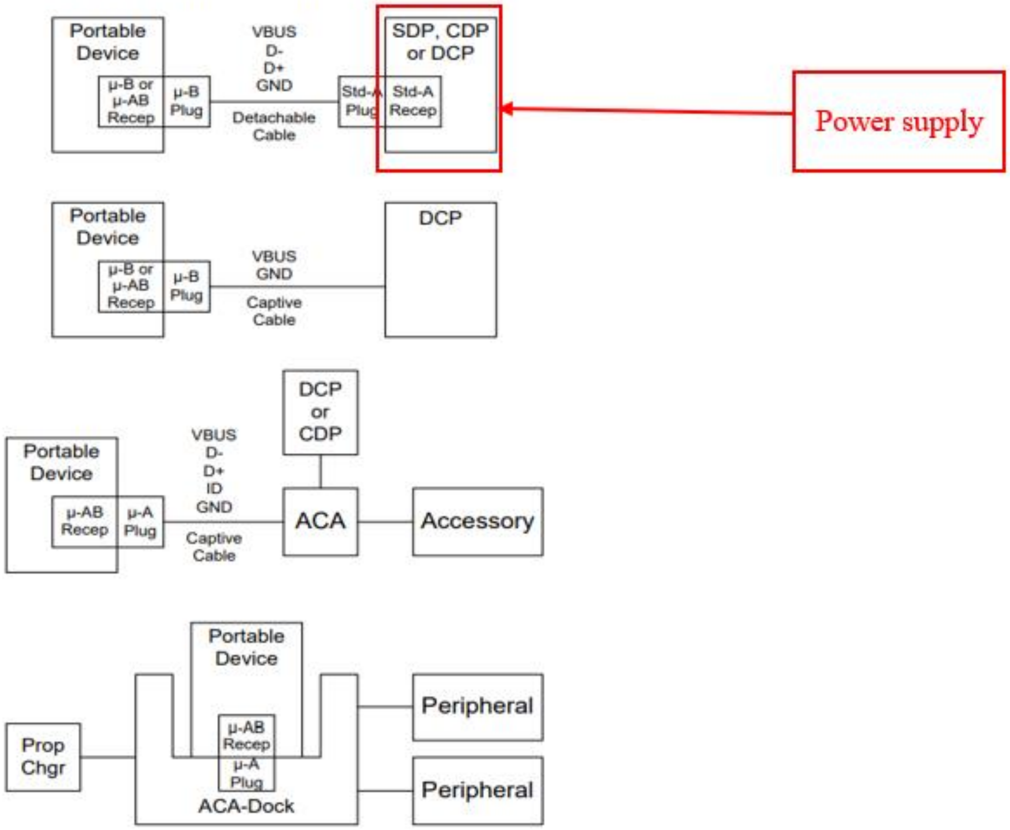


Figure 3-1 System Overview

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

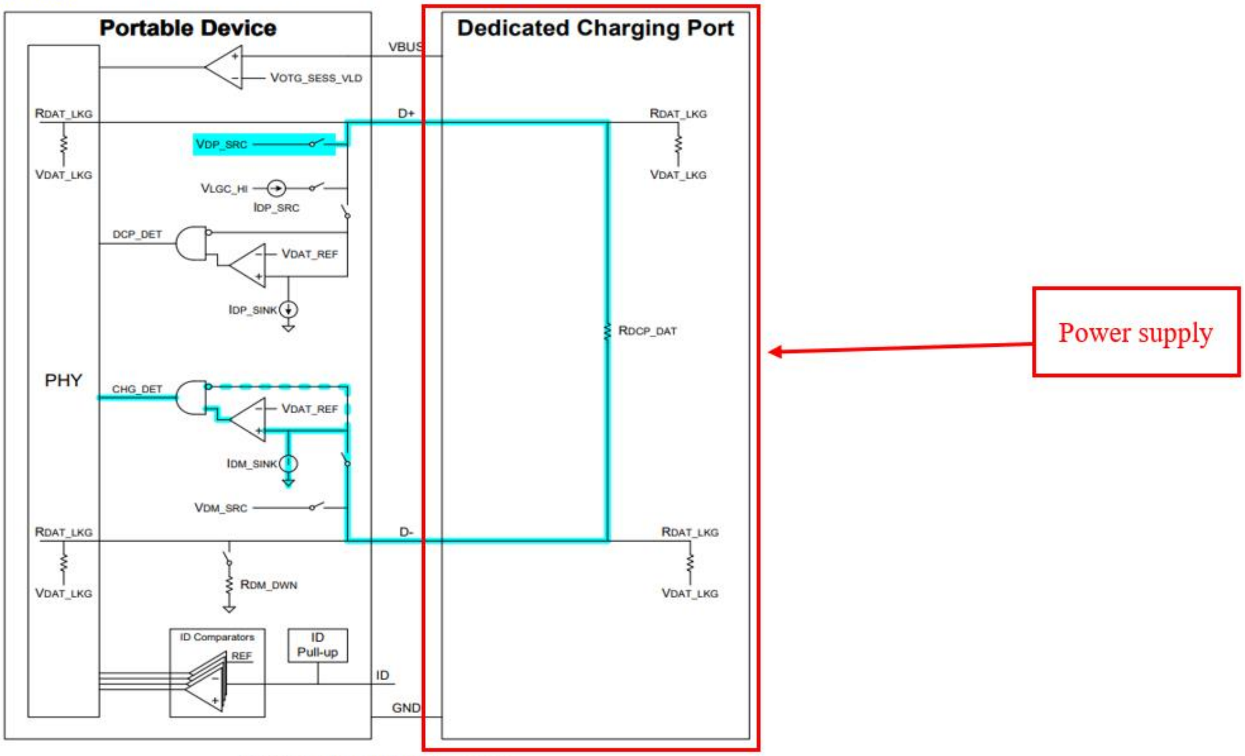


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

86. Defendant provides a portable electronic device, such as the '042 Accused Chargers, comprising the data circuitry and the power circuitry configured to be coupled via a connector to the power supply, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be detachably mated with an interface of the power supply. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the portable electronic device connects to the power supply (USB power supply) through a USB cable. The USB cable has a USB-C connector at one end to detachably mate with the charging port ("power output") of the USB power supply ("power supply"). The connector comprises VBUS ("first conductor"), GND ("second conductor"), D+ ("third conductor") and D- ("fourth conductor") pins.

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

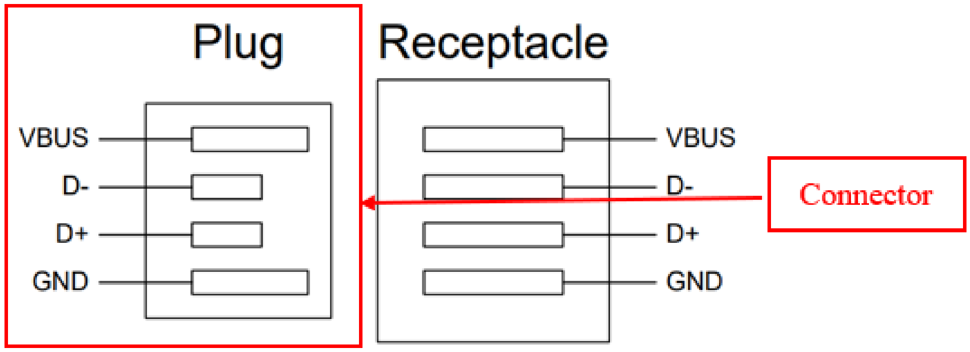


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

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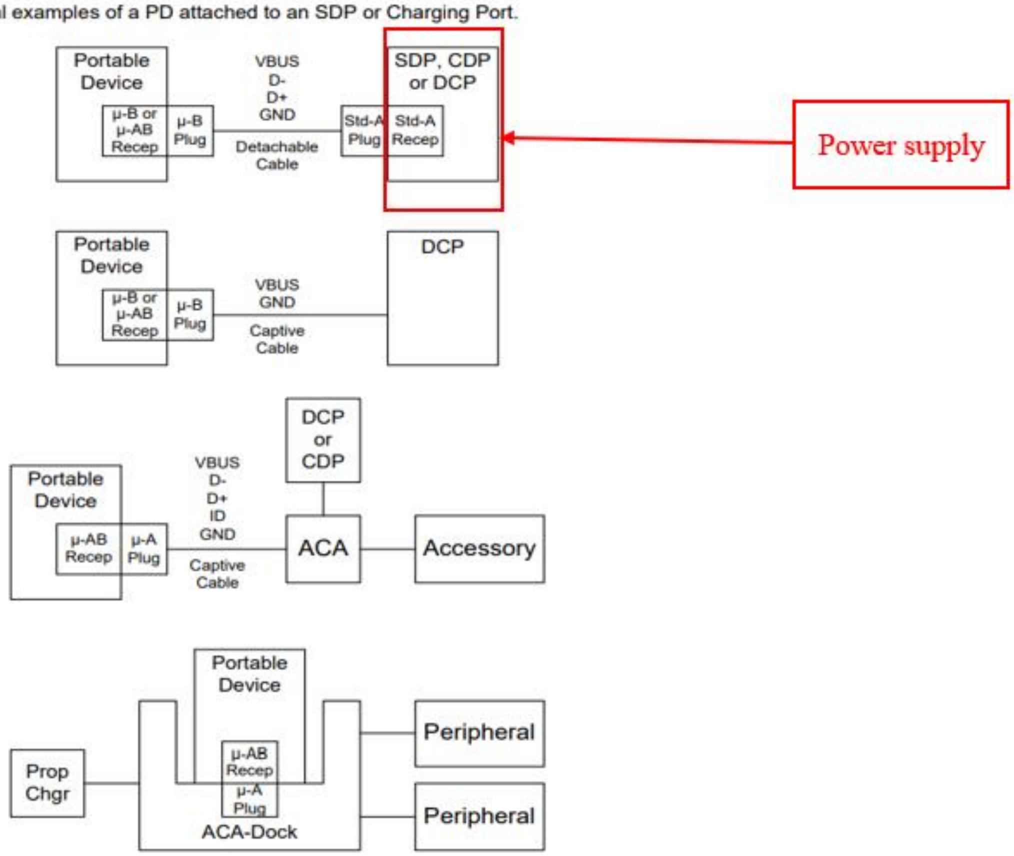


Figure 3-1 System Overview

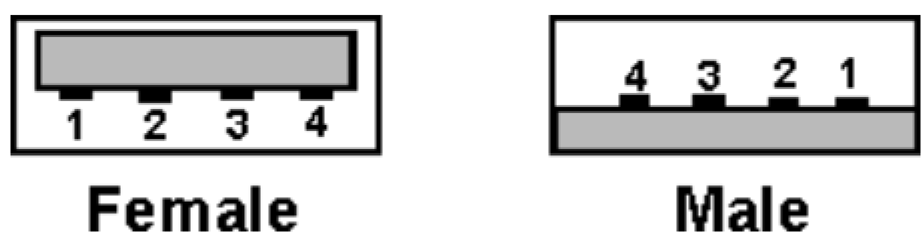
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

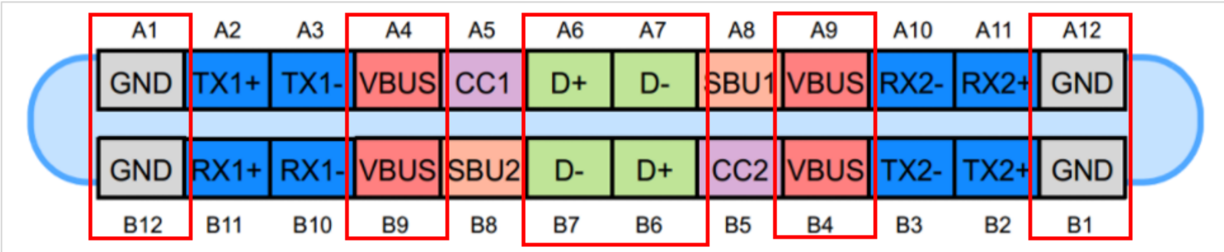


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

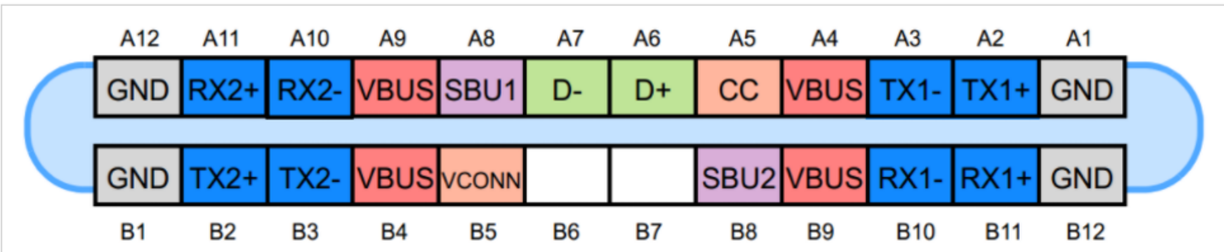


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

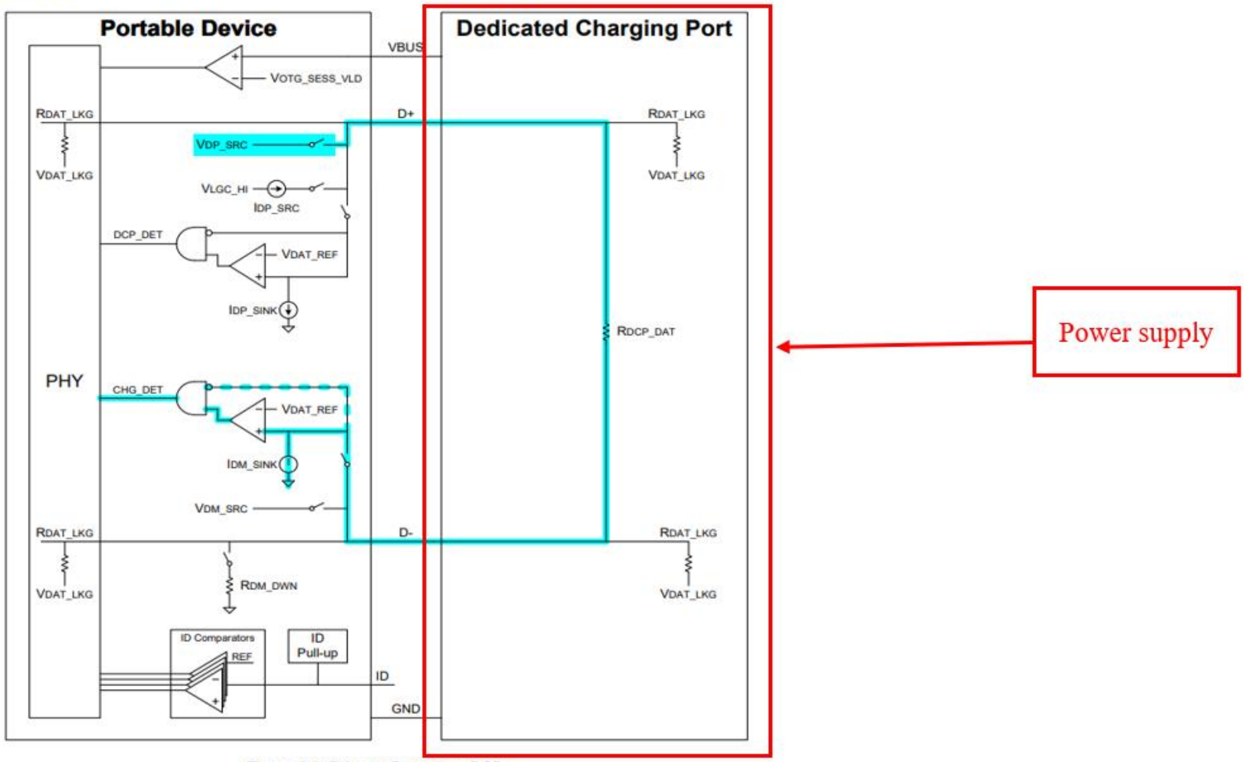


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

87. Defendant provides a portable electronic device, such as the '042 Accused Chargers, to transfer, via the first conductor, the direct current from the power supply, provide, via the second conductor, a ground reference from the power supply, communicate, via the third conductor, the first signal from the data circuitry to the power supply, and communicate, via the fourth conductor, the second signal from the power supply to the data circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the VBUS pin provides DC power to the portable electronic device. For example, the GND pin provides a ground reference to the portable electronic device. For example, the D+ pin provides the D+ signal ("first

signal") from the portable electronic device to the data circuitry of the power supply and passes the D+ signal through a resistor (R_{DCP_DAT}). For example, the D- pin provides the D- signal ("second signal") from the data circuitry of the power supply to the portable electronic device. The D+ signal and D-signal are separate signals. The D+ signal originates at the portable electronic device and is received by the power supply. When the D+ signal passes through the resistor R_{DCP_DAT}, the resistance causes the voltage to drop, creating a new D- signal to be transmitted to the portable device via the D- pin. Thus, the D+ signal is received by the power supply at one voltage and the D- signal is transmitted to the portable electronic device at a second voltage. To the extent the D- signal (*i.e.*, "second signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

Acronyms

ACA	Accessory Charger Adapter
CDP	Charging Downstream Port
DBP	Dead Battery Provision
DCD	Data Contact Detect
DCP	Dedicated Charging Port
FS	Full Speed
HS	High-Speed
LS	Low-Speed
OTG	On-The-Go
PC	Personal Computer
PD	Portable Device
PHY	Physical Layer Interface for High-Speed USB
PS2	Personal System 2
SDP	Standard Downstream Port
SRP	Session Request Protocol
TPL	Targeted Peripheral List
USB	Universal Serial Bus
USBCV	USB Command Verifier
USB-IF	USB Implementers Forum
VBUS	Voltage line of the USB interface

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page xi).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

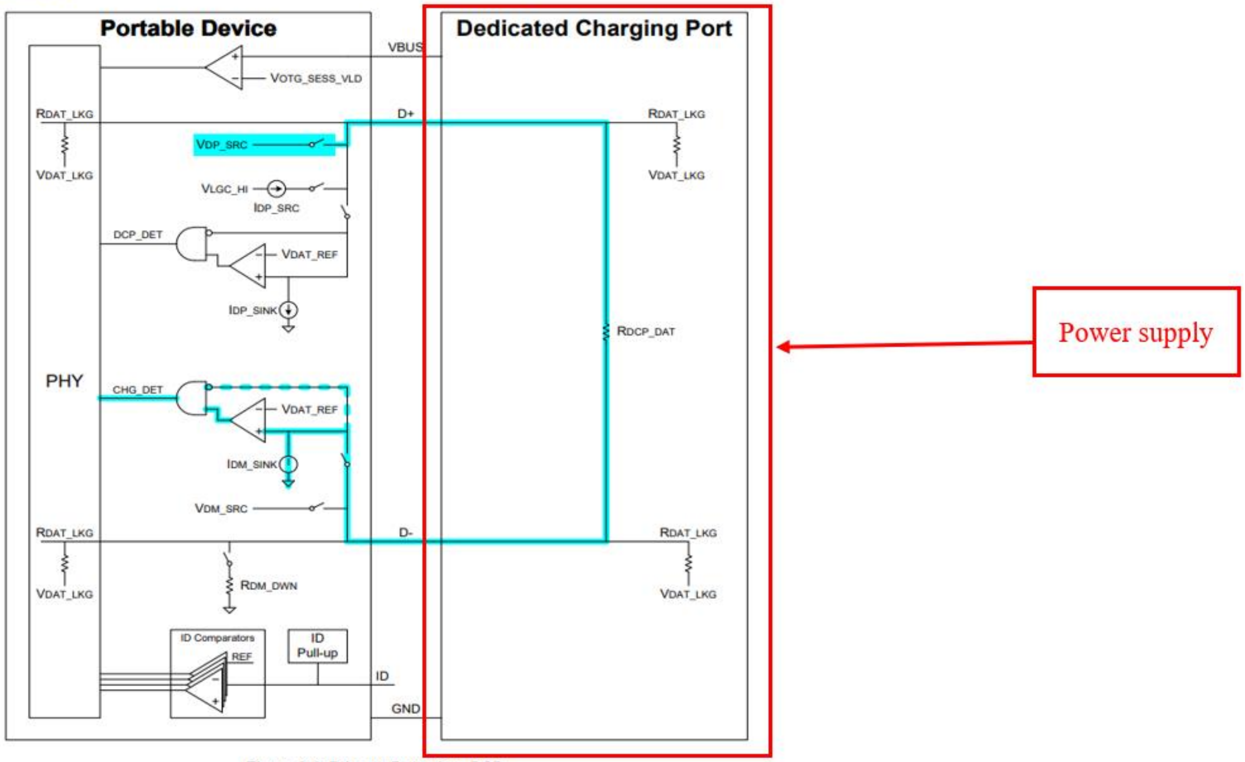


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

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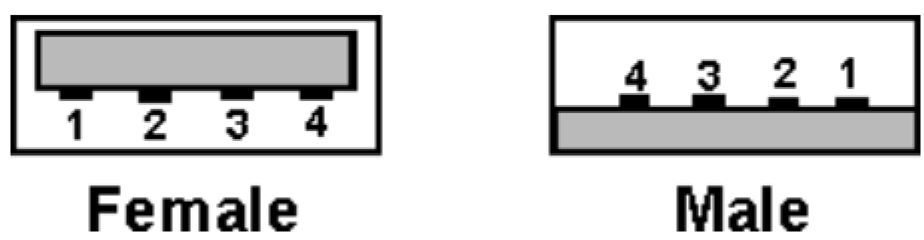
PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

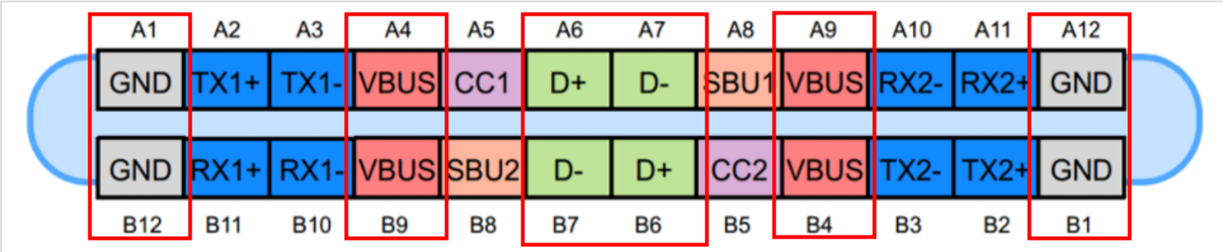


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

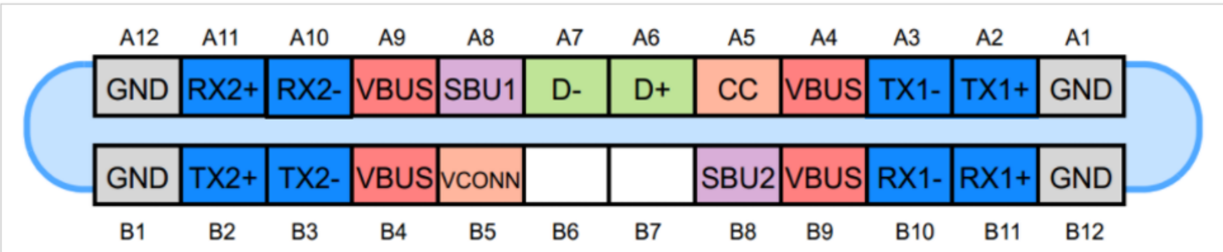


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

88. Defendant provides a portable electronic device, such as the ‘042 Accused Chargers, in which the second signal has a parameter level that is usable by the data circuitry in connection with control of charging the rechargeable battery based on the direct current received by the power circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the portable electronic device compares the D- signal’s voltage (“parameter”) level with a reference voltage to detect the type of power supply (standard downstream port or charging port). The data circuitry of the portable electronic device draws current based on the type of power supply to charge the rechargeable battery.

1.1 Scope

The Battery Charging Working Group is chartered with creating specifications that define limits as well as detection, control and reporting mechanisms to permit devices to draw current in excess of the USB 2.0 specification for charging and/or powering up from dedicated chargers, hosts, hubs and charging downstream ports. These mechanisms are backward compatible with USB 2.0 compliant hosts and peripherals.

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw I_{DEV_CHG} without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

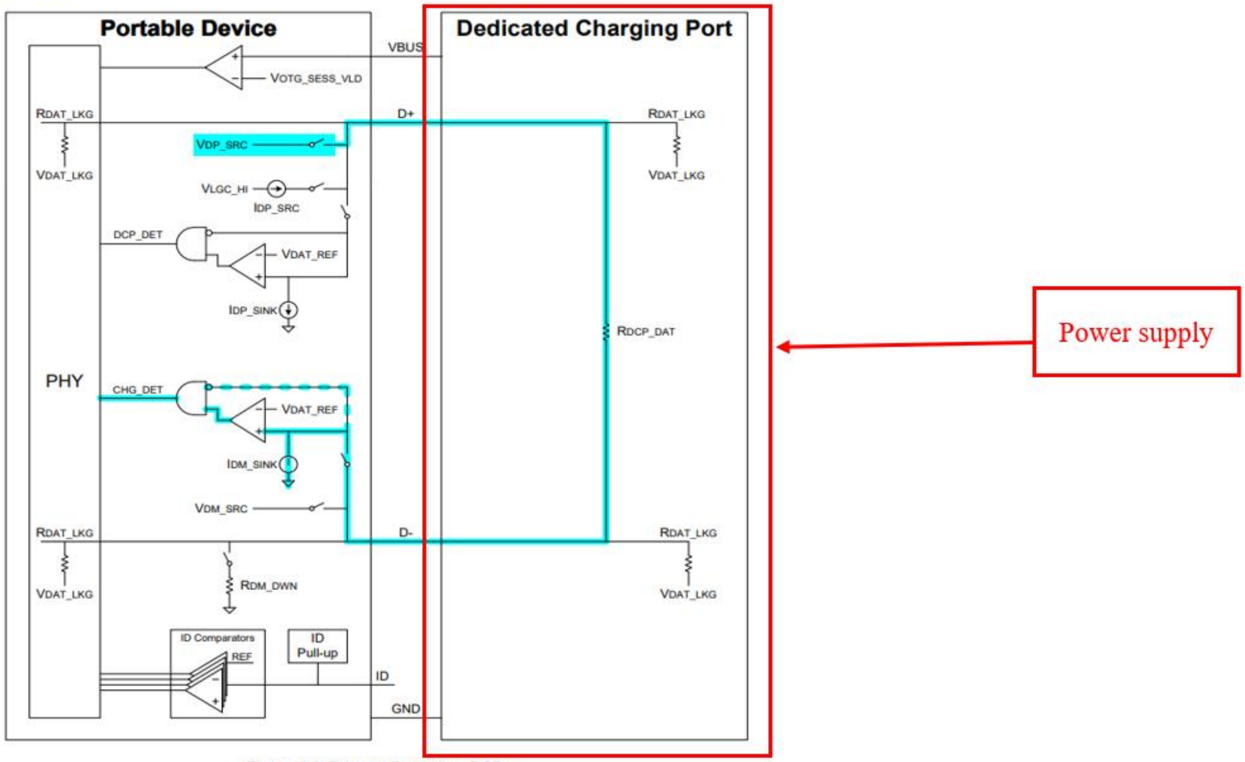


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

89. As discussed above, the '042 Accused Chargers compare the D- signal's voltage ("parameter") level with a reference voltage to detect the type of power supply (standard downstream port or charging port). The data circuitry of the portable electronic device draws current based on the type of power supply to charge the rechargeable battery."

90. As discussed above, in the '042 Accused Chargers, the parameter level is a voltage signal from the D- pin.

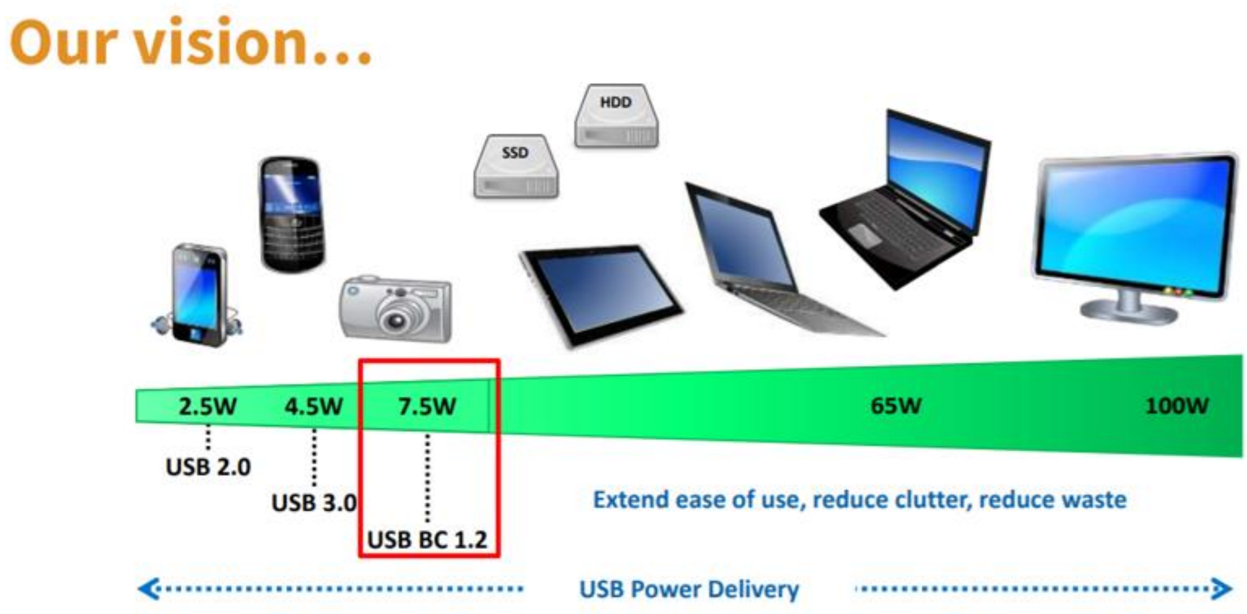
91. Defendant makes, uses, sells, offers for sale and/or imports a portable electronic device, such as the '042 Accused Chargers, comprising a rechargeable battery. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, Defendant provides a portable electronic device with a rechargeable battery. Defendant provides USB power with the devices that acts as a power supply while charging the device's battery. The USB power supply outputs voltage, current, and power values. Upon information and belief, the USB power supply

includes circuitry compliant with the Battery Charging (BC) 1.2 specification to charge the portable electronic devices. The Table 2-1 (https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36) and the diagram depicting the power consumed by different USB specifications (https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5) disclose that BC 1.2 outputs 5V voltage, 1.5A current, and 7.5W power. USB-compliant devices at USB 3.0 or above are compatible with the USB BC 1.2 specification. Further, to charge a battery in a portable electronic device, the portable electronic device is connected to the USB power supply. The other end of the USB cable is connected to the charging port of portable electronic device and the power supply is plugged into a standard wall socket.

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See *USB 2.0*	
USB 3.2	5 V	See *USB 3.2*	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

USB battery charging specifications

Battery Charging Specification Revision 1.2 (BC1.2)

The different port types described in the above section were first defined in the *Battery Charging Specification Revision 1.2* (BC1.2) published in 2010. In addition to the port definitions, BC1.2 specifies primary and secondary charge port detection sequences and port specific performance requirements. These include required operating range, undershoot, detection signaling, and connectors for each port type. Also included are dead, weak, and good battery charge conditions, port shutdown procedures, and other details associated with battery charging.

BC1.2 was published after USB 2.0 but before USB 3.1 and so the information in BC1.2 refers to USB 2.0. The specification is, however, consistent and compatible with USB 3.1.

(*E.g.*, https://www.lightingglobal.org/wp-content/uploads/2017/12/Issue-24_USB-smartphone-charging-final.pdf, page 4).

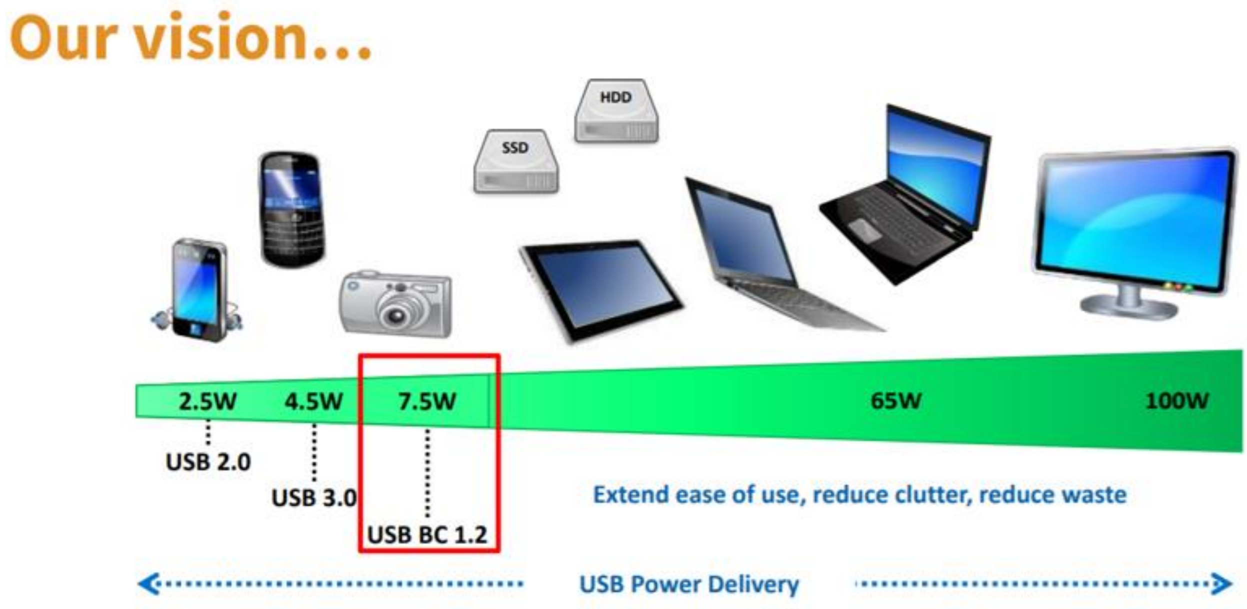
92. Defendant provides a portable electronic device, such as the '042 Accused Chargers, that comprises power circuitry configured to receive direct current and to charge the rechargeable battery. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, to charge the rechargeable battery of a portable electronic device, a USB cable is connected to the USB power supply acting as a power supply. The other end of the USB

cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the portable electronic device comprises power circuitry to receive DC power from the power supply.

Table 2-1 Summary of power supply options

Mode of Operation	Voltage	Current	Notes
USB 2.0	5 V	See USB 2.0	
USB 3.2	5 V	See USB 3.2	
USB4	5 V	1.5 A	See Section 5.3.
USB BC 1.2	5 V	1.5 A[1]	Legacy charging
USB Type-C Current @ 1.5 A	5 V	1.5 A	Supports higher power devices
USB Type-C Current @ 3.0 A	5 V	3 A	Supports higher power devices
USB PD	Configurable up to 20 V	Configurable up to 5 A	Directional control and power level management

(*E.g.*, https://www.usb.org/sites/default/files/USB%20Type-C%20Spec%20R2.0%20-%20August%202019.pdf, page 36).



(*E.g.*, https://usb.org/sites/default/files/D2T2-1%20-%20USB%20Power%20Delivery.pdf, page 5).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

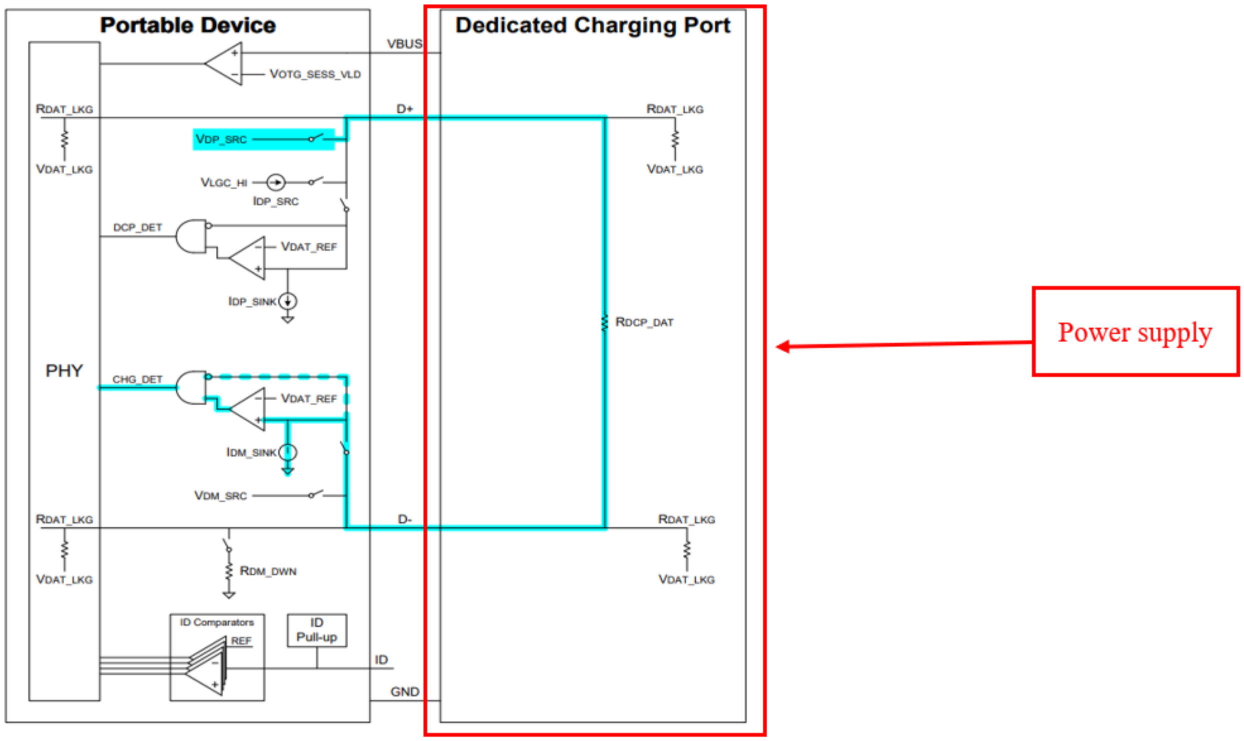


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

93. Defendant provides a portable electronic device, such as the '042 Accused Chargers, that comprises a data circuitry configured to provide an output signal to a power supply and to receive an input signal from the power supply. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the portable electronic device comprises data circuitry configured to use the Primary Detection method as described in the USB BC 1.2 specification. Further, during Primary Detection, when the portable electronic device is connected with the power supply through the USB cable, the portable electronic device generates a D+ signal ("output signal") such that the data circuitry of the portable electronic device provides

a D+ signal ("output signal") to a power supply and receives a D- signal ("input signal") from the power supply to detect the type of connected power supply (standard downstream port or charging port).

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw I_{DEV_CHG} without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

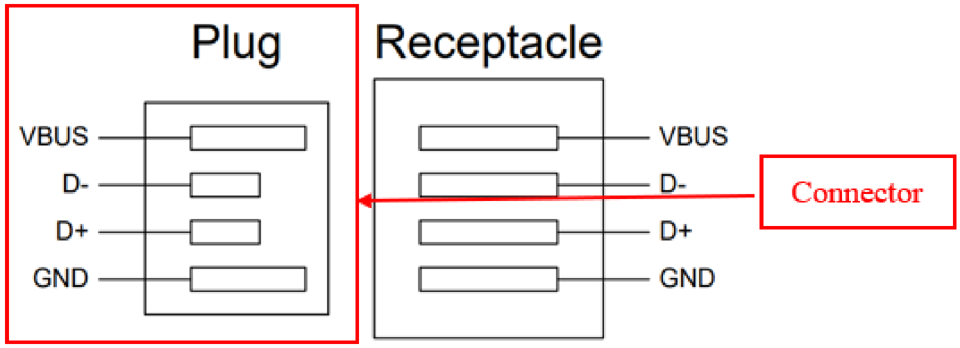


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

Figure 3-1 shows several examples of a PD attached to an SDP or Charging Port.

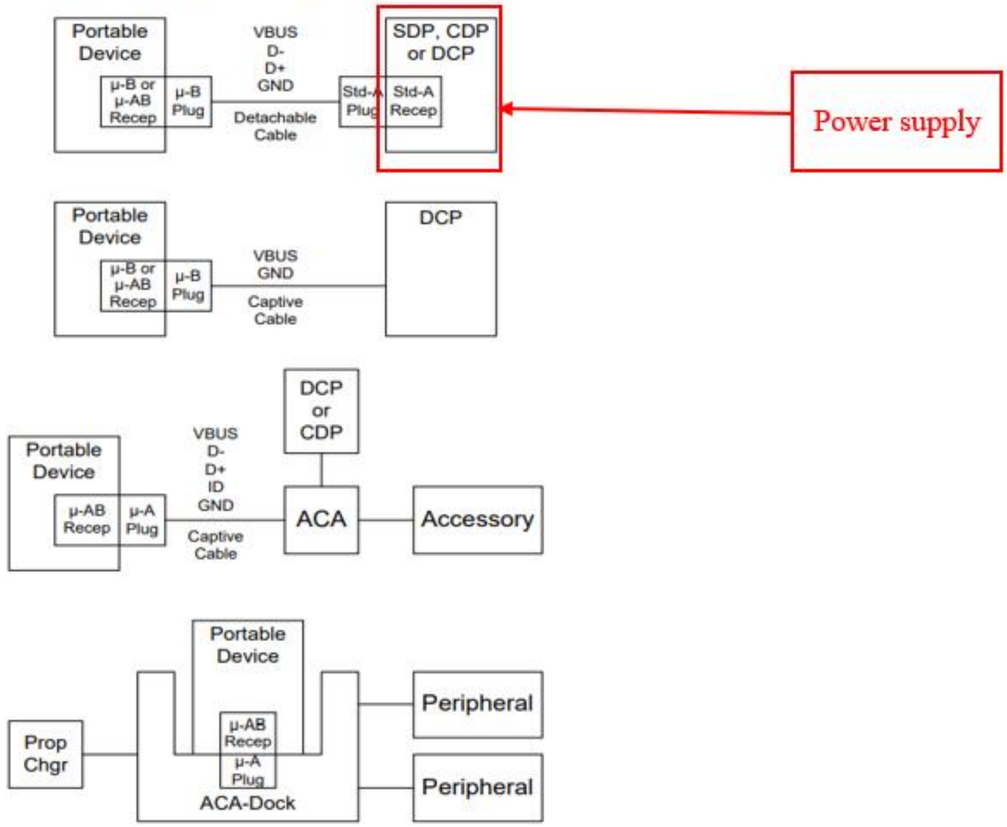


Figure 3-1 System Overview

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

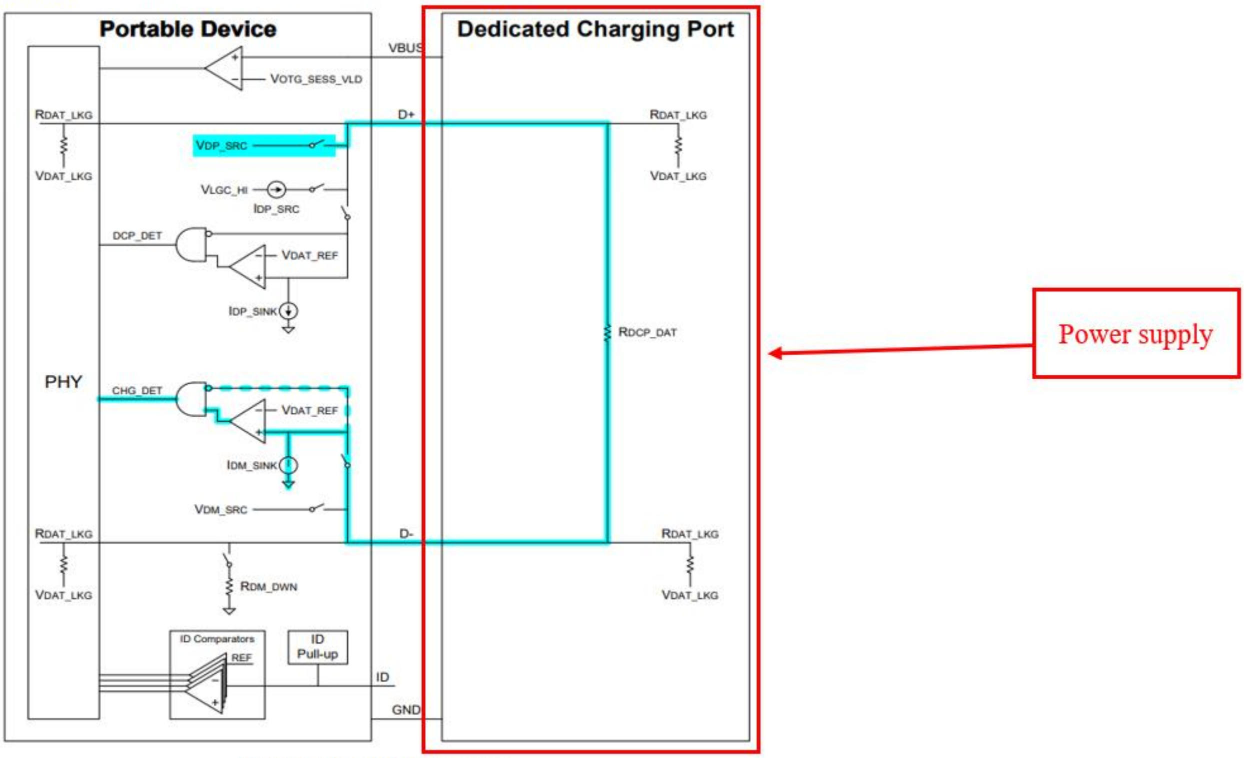


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on V_{DP_SRC} and I_{DM_SINK}. Since a DCP is required to short D+ to D- through a resistance of R_{DCP_DAT}, the PD will detect a voltage on D- that is close to V_{DP_SRC}.

A PD shall compare the voltage on D- with V_{DAT_REF}. If D- is greater than V_{DAT_REF}, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with V_{LGC} as well, and only determine that it is attached to a DCP or CDP if D- is greater than V_{DAT_REF}, but less than V_{LGC}. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than V_{DAT_REF}, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw I_{DEV_CHG}. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than V_{LGC}, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than V_{LGC}, then the PD would determine that it was attached to an SDP, and only be able to draw I_{SUSP}.

The choice of whether or not to compare D- to V_{LGC} depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

94. Defendant provides a portable electronic device, such as the '042 Accused Chargers, that comprises the data circuitry and the power circuitry configured to be coupled via a connector to the power supply, the connector comprising a first conductor, a second conductor, a third conductor, and a fourth conductor, the connector configured to be detachably mated with an interface of the power supply. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the portable electronic device connects to the power supply (USB power supply) through a USB cable. The USB cable has a USB-C connector at one end to detachably mate with the charging port ("power output") of the USB power supply ("power supply"). The connector comprises VBUS ("first conductor"), GND ("second conductor"), D+ ("third conductor") and D- ("fourth conductor") pins.

3.2.3.2 Problem Description

USB plugs and receptacles are designed such that when the plug is inserted into the receptacle, the power pins make contact before the data pins make contact. This is illustrated in Figure 3-3.

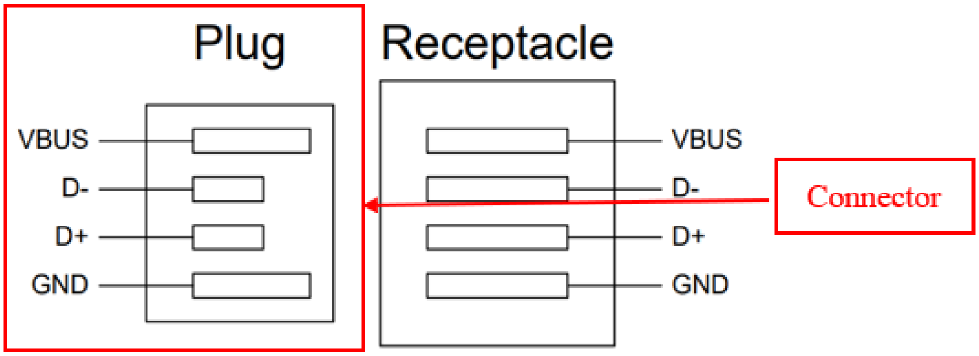


Figure 3-3 Data Pin Offset

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 10).

3. Charging Port Detection

3.1 Overview

Figure 3-1 shows several examples of a PD attached to an SDP or Charging Port.

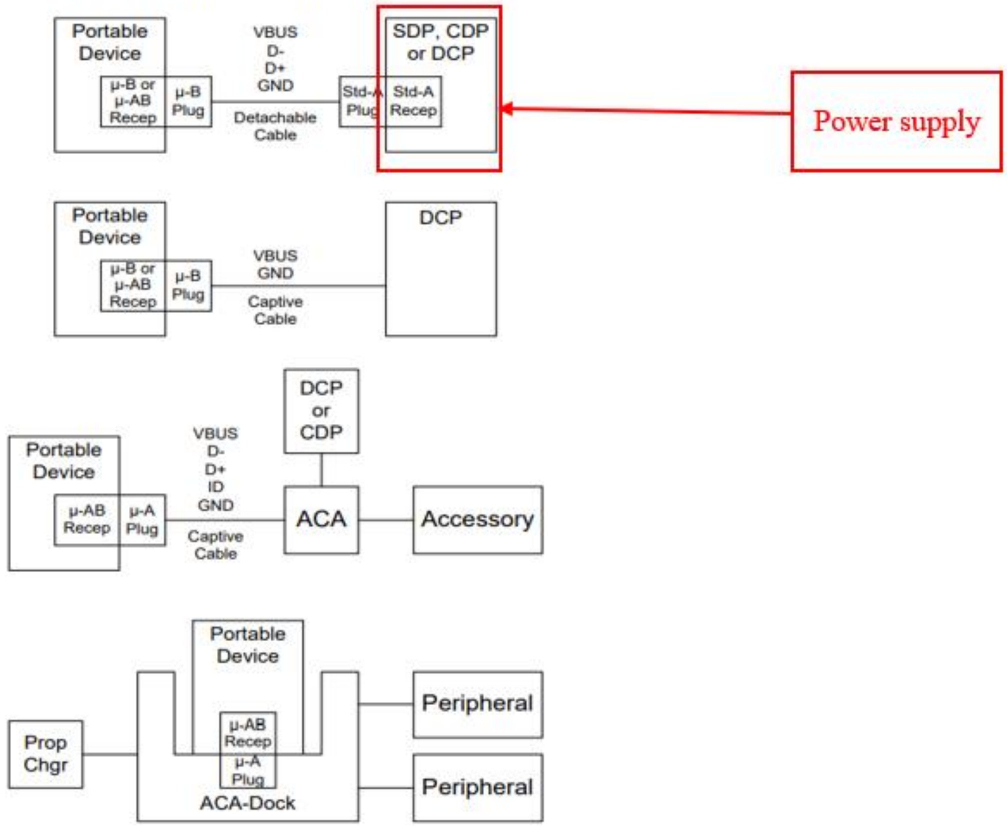


Figure 3-1 System Overview

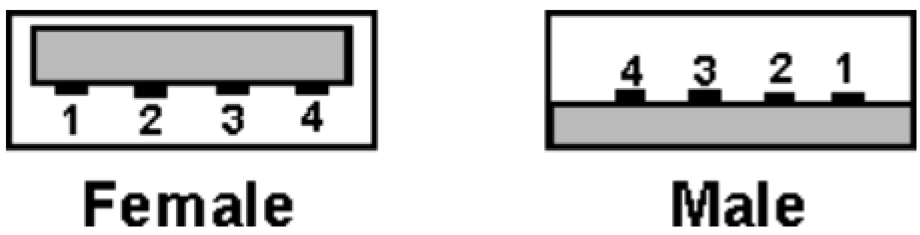
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 6).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

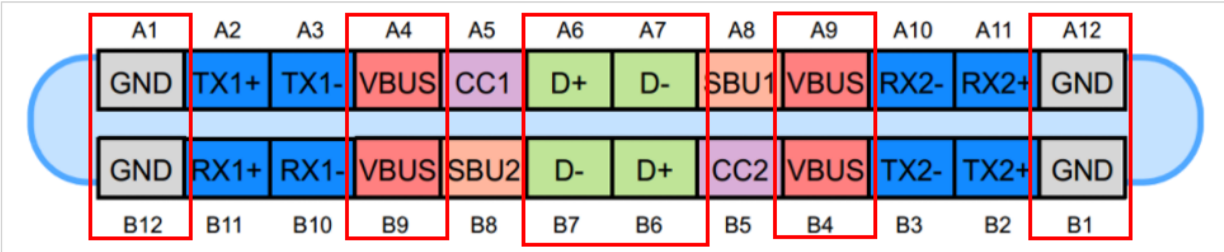


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

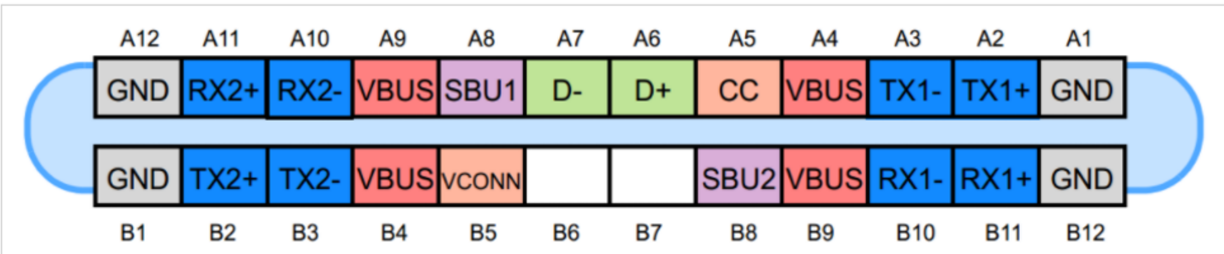


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

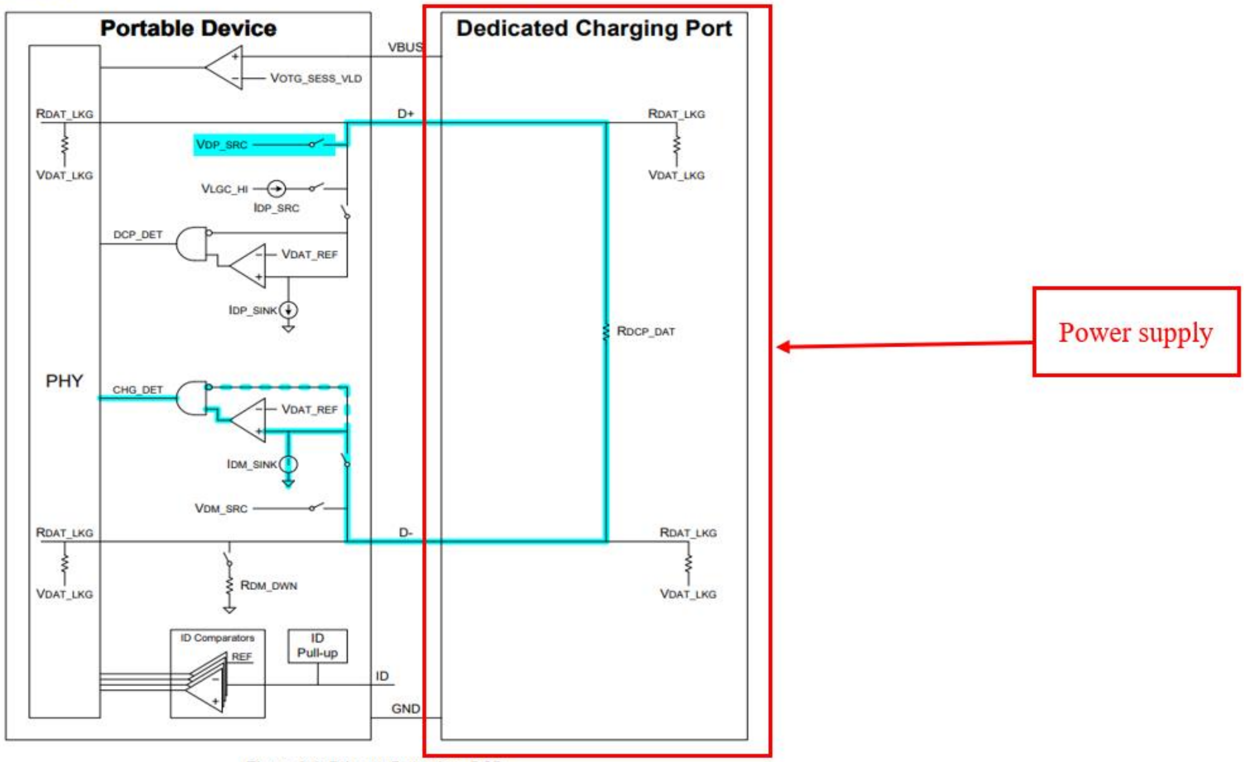


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

95. Defendant provides a portable electronic device, such as the '042 Accused Chargers, to transfer, via the first conductor, the direct current power from the power supply, provide, via the second conductor, a ground reference from the power supply, transmit, via the third conductor, the output signal from the data circuitry to the power supply, and receive, via the fourth conductor, the input signal from the power supply to the data circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the VBUS pin provides DC power to the portable electronic device. For example, the GND pin provides a ground reference to the portable electronic device. For example, the D+ pin provides the D+ signal

("output signal") from the portable electronic device to the data circuitry of the power supply and passes the D+ signal through a resistor (R_{DCP_DAT}). For example, the D- pin provides the D- signal ("input signal") from the data circuitry of the power supply to the portable electronic device. The D+ signal and D-signal are separate signals. The D+ signal originates at the portable electronic device and is received by the power supply. When the D+ signal passes through the resistor R_{DCP_DAT}, the resistance causes the voltage to drop, creating a new D- signal to be transmitted to the portable device via the D- pin. Thus, the D+ signal is received by the power supply at one voltage and the D- signal is transmitted to the portable electronic device at a second voltage. To the extent the D- signal (*i.e.*, "input signal") is not found to literally satisfy this claim element because it is a modified signal originating in the portable electronic device, it satisfies this claim element under the doctrine of equivalents. The function of the D- signal is to inform the portable electronic device that the portable electronic device is to receive current from the power supply and charge its battery. Provided the D- signal is of the appropriate voltage, the portable electronic device interprets the D- signal received from the power supply as enabling battery charging regardless of the initial origin of the D- signal. The D- signal therefore performs the same function (informing the portable electronic device that it can receive current from the power supply for the purpose of charging its battery) in the same way (by receiving a signal from the power supply) with the same result (the portable electronic device is able to charge its battery using the current from the power supply).

Acronyms

ACA	Accessory Charger Adapter
CDP	Charging Downstream Port
DBP	Dead Battery Provision
DCD	Data Contact Detect
DCP	Dedicated Charging Port
FS	Full Speed
HS	High-Speed
LS	Low-Speed
OTG	On-The-Go
PC	Personal Computer
PD	Portable Device
PHY	Physical Layer Interface for High-Speed USB
PS2	Personal System 2
SDP	Standard Downstream Port
SRP	Session Request Protocol
TPL	Targeted Peripheral List
USB	Universal Serial Bus
USBCV	USB Command Verifier
USB-IF	USB Implementers Forum
VBUS	Voltage line of the USB interface

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page xi).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

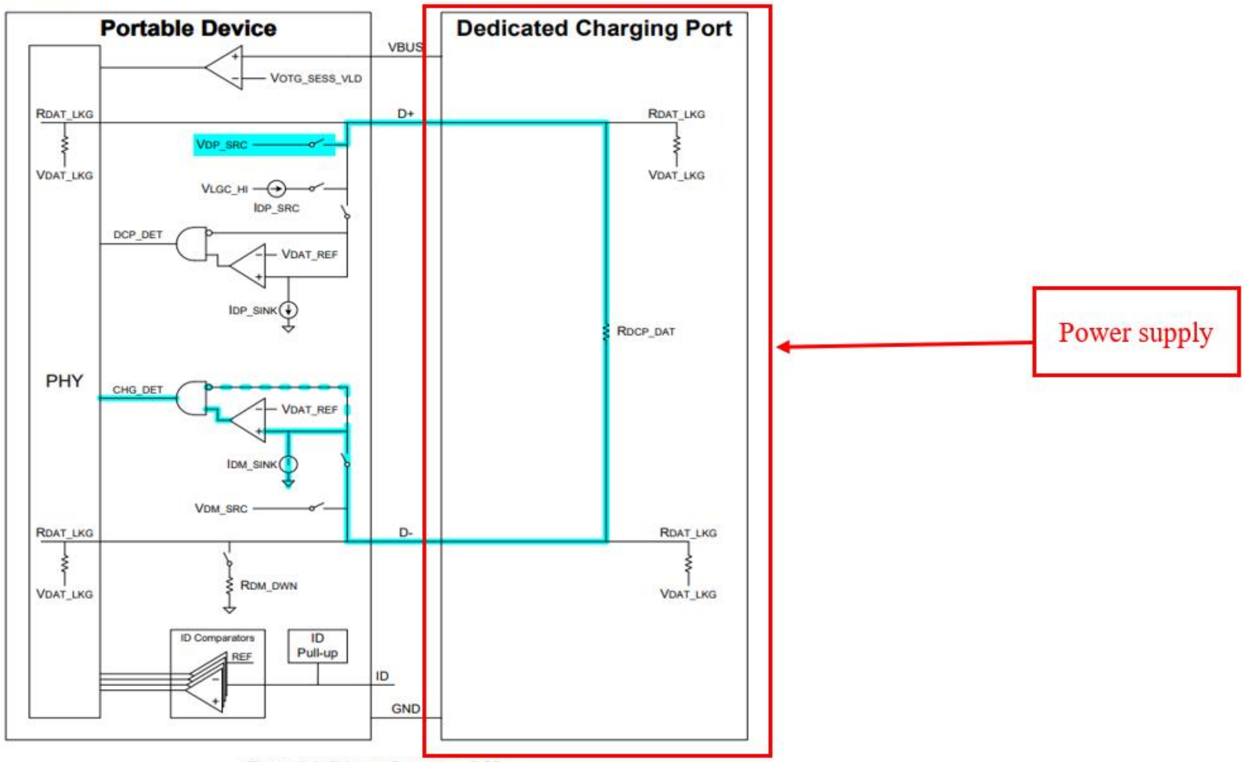


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

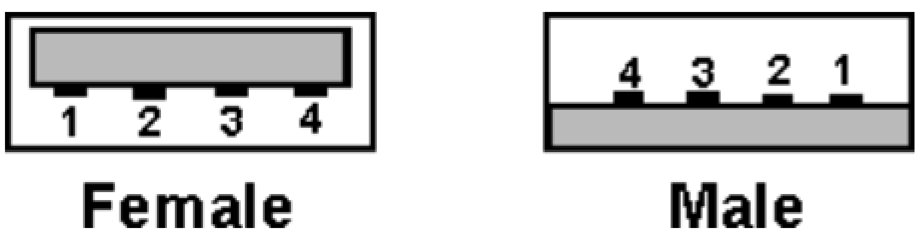
(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

> MINI & MICRO USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4		Not connected, although it can sometimes be ground or used as a presence indicator.
5	Black	Ground
Shell	Drain wire	Shield

TYPE A & B USB CONNECTOR PIN CONNECTIONS

PIN	WIRE COLOUR	SIGNAL NAMES
1	Red	Vbus (4.75 - 5.25 V)
2	White	Data -
3	Green	Data +
4	Black	Ground
Shell	Drain wire	Shield



Type A USB connector pinout

(*E.g.*, https://www.electronics-notes.com/articles/connectivity/usb-universal-serial-bus/connectors-pinouts-cables.php).

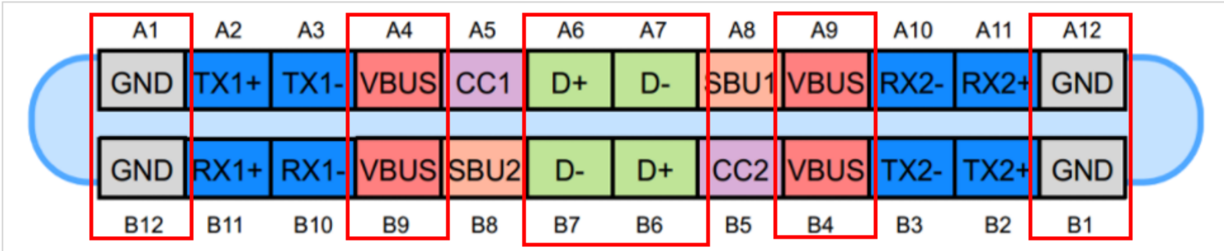


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

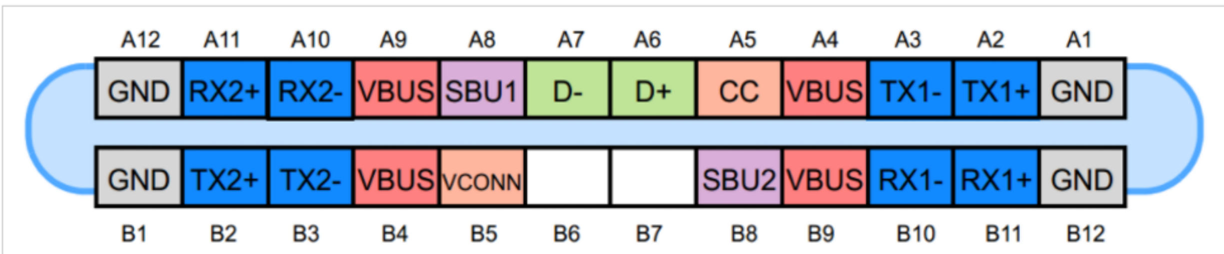


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

96. Defendant provides a portable electronic device, such as the '042 Accused Chargers, that includes an input signal that is usable by the data circuitry in connection with control of charging the rechargeable battery based on the direct current received by the power circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the portable electronic device compares the D- signal's voltage level with a reference voltage to detect the type of power supply (standard downstream port or charging port). The data circuitry of the portable electronic device draws current based on the type of power supply to charge the rechargeable battery.

1.1 Scope

The Battery Charging Working Group is chartered with creating specifications that define limits as well as detection, control and reporting mechanisms to permit devices to draw current in excess of the USB 2.0 specification for charging and/or powering up from dedicated chargers, hosts, hubs and charging downstream ports. These mechanisms are backward compatible with USB 2.0 compliant hosts and peripherals.

1.2 Background

The USB ports on personal computers are convenient places for Portable Devices (PDs) to draw current for charging their batteries. This convenience has led to the creation of USB Chargers that simply expose a USB standard-A receptacle. This allows PDs to use the same USB cable to charge from either a PC or from a USB Charger.

If a PD is attached to a USB host or hub, then the USB 2.0 specification requires that after connecting, a PD must draw less than:

- 2.5 mA average if the bus is suspended
- 100 mA if bus is not suspended and not configured
- 500 mA if bus is not suspended and configured for 500 mA

If a PD is attached to a Charging Port, (i.e. CDP, DCP, ACA-Dock or ACA), then it is allowed to draw I_{DEV_CHG} without having to be configured or follow the rules of suspend.

In order for a PD to determine how much current it is allowed to draw from an upstream USB port, there need to be mechanisms that allow the PD to distinguish between a Standard Downstream Port and a Charging Port. This specification defines just such mechanisms.

Since PDs can be attached to USB chargers from various manufacturers, it is important that all provide an acceptable user experience. This specification defines the requirements for a compliant USB charger, which is referred to in this spec as a USB Charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 1).

3.2.4 Primary Detection

Primary Detection is used to distinguish between an SDP and different types of Charging Ports. A PD is required to implement Primary Detection.

3.2.4.1 Primary Detection, DCP

Figure 3-6 shows how Primary Detection works when a PD is attached to a DCP.

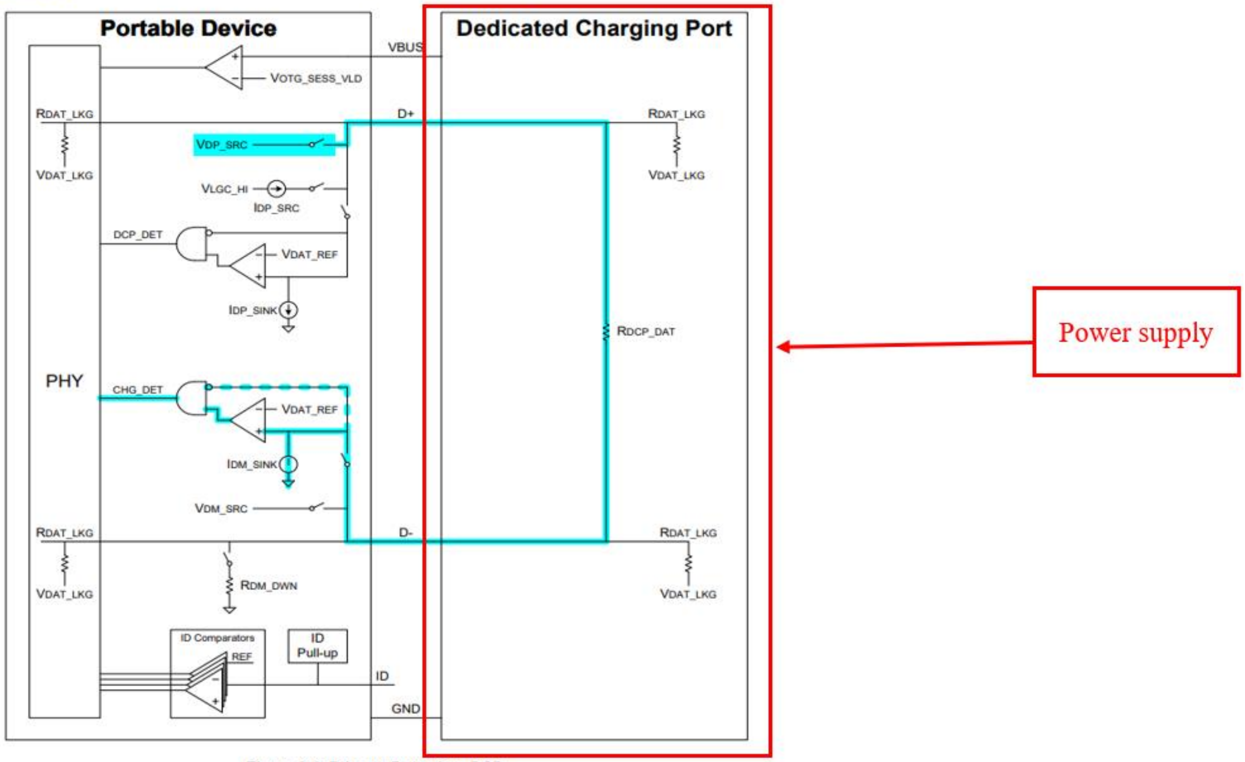


Figure 3-6 Primary Detection, DCP

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 14).

During Primary Detection the PD shall turn on VDP_SRC and IDM_SINK. Since a DCP is required to short D+ to D- through a resistance of RDCP_DAT, the PD will detect a voltage on D- that is close to VDP_SRC.

A PD shall compare the voltage on D- with VDAT_REF. If D- is greater than VDAT_REF, then the PD is allowed to detect that it is attached to either a DCP or CDP. A PD is optionally allowed to compare D- with VLGC as well, and only determine that it is attached to a DCP or CDP if D- is greater than VDAT_REF, but less than VLGC. The reason for this option is as follows.

PS2 ports pull D+/- high. If a PD is attached to a PS2 port, and the PD only checks for D- greater than VDAT_REF, then a PD attached to a PS2 port would determine that it is attached to a DCP or CDP and proceed to draw IDEV_CHG. This much current could potentially damage a PS2 port. By only determining it is attached to DCP or CDP if D- is less than VLGC, the PD can avoid causing damage to a PS2 port.

On the other hand, some proprietary chargers also pull D+/- high. If a PD is attached to one of these chargers, and it determined it was not attached to a charger because D- was greater than VLGC, then the PD would determine that it was attached to an SDP, and only be able to draw ISUSP.

The choice of whether or not to compare D- to VLGC depends on whether the PD is more likely to be attached to a PS2 port, or to a proprietary charger.

(*E.g.*, https://www.usb.org/sites/default/files/BCv1.2_070312_0.zip, USB Battery Charging Specification (Including errata and ECNs through March 15, 2012), Revision 1.2, March 15, 2012, Page 15).

97. As discussed above, the '042 Accused Chargers compare the D- signal's voltage ("parameter") level with a reference voltage to detect the type of power supply (standard downstream port or charging port). The data circuitry of the portable electronic device draws current based on the type of power supply to charge the rechargeable battery.

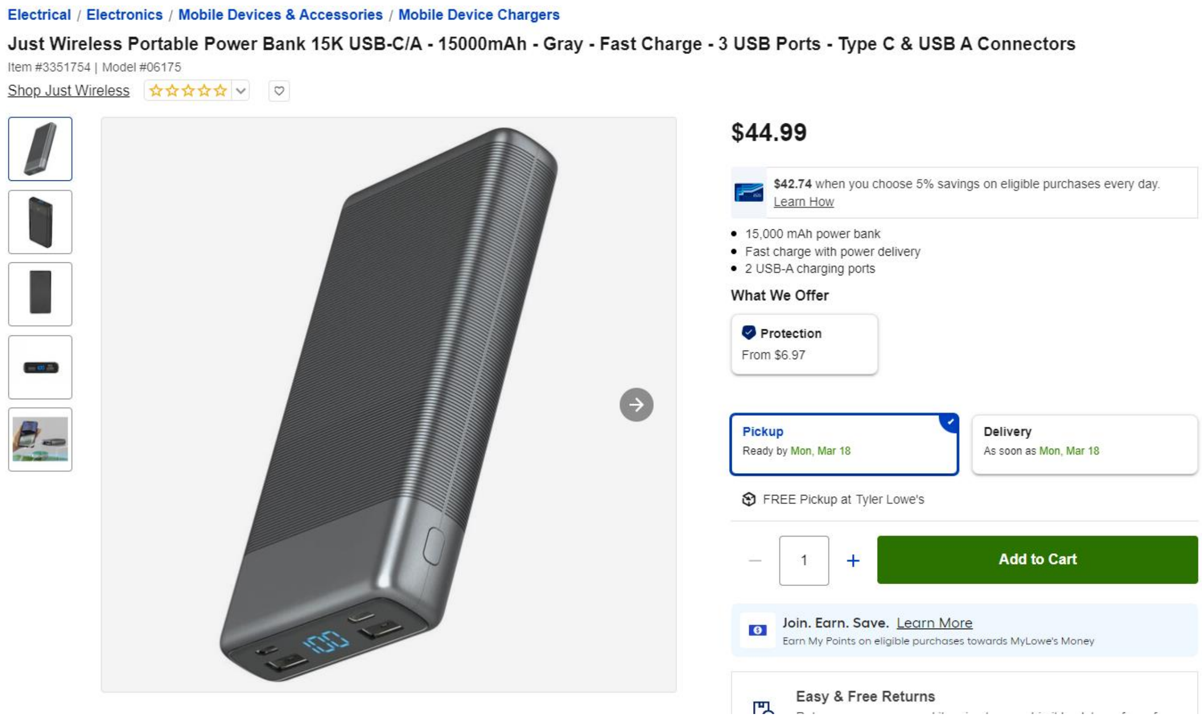
98. As discussed above, in the '042 Accused Chargers, the parameter level is a voltage signal from the D- pin.

B. Infringement for Compliance with the Power Delivery Standard

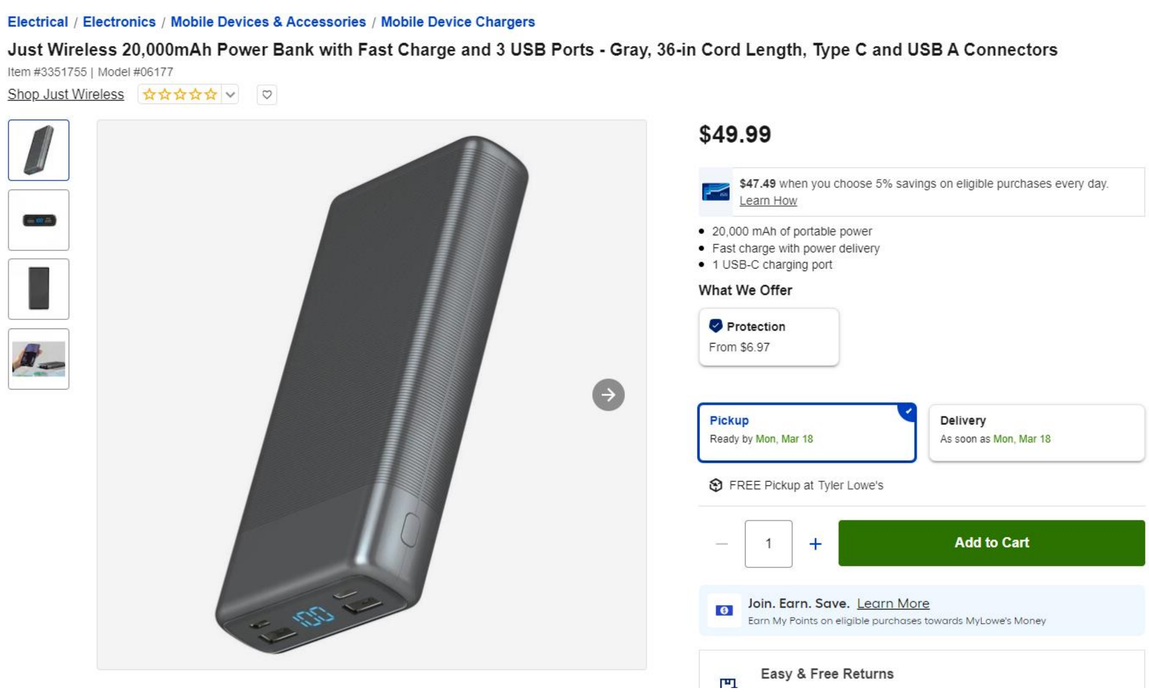
99. Upon information and belief, Defendant has directly infringed claim 1, 5-6, 11,15-16 of the '042 patent (in Texas, and elsewhere in the United States), by making, using, selling, offering for sale and/or importing a product or power supply system comprising power circuitry configured to provide direct current power, such products including: Just Wireless Portable Power Bank 15K USB-C/A - 15000mAh (Item #3351754, Model #06175); Just Wireless 20,000mAh

Power Bank with Fast Charge and 3 USB Ports (Item #3351755, Model #06177); and DEWALT Type C USB A Power Bank 2 (Item #2581903, Model #215 1643 DW2) which comply with Universal Serial Bus Power Delivery Specification, Revision 2.0 January 2017. ("'042 Accused PD Chargers").

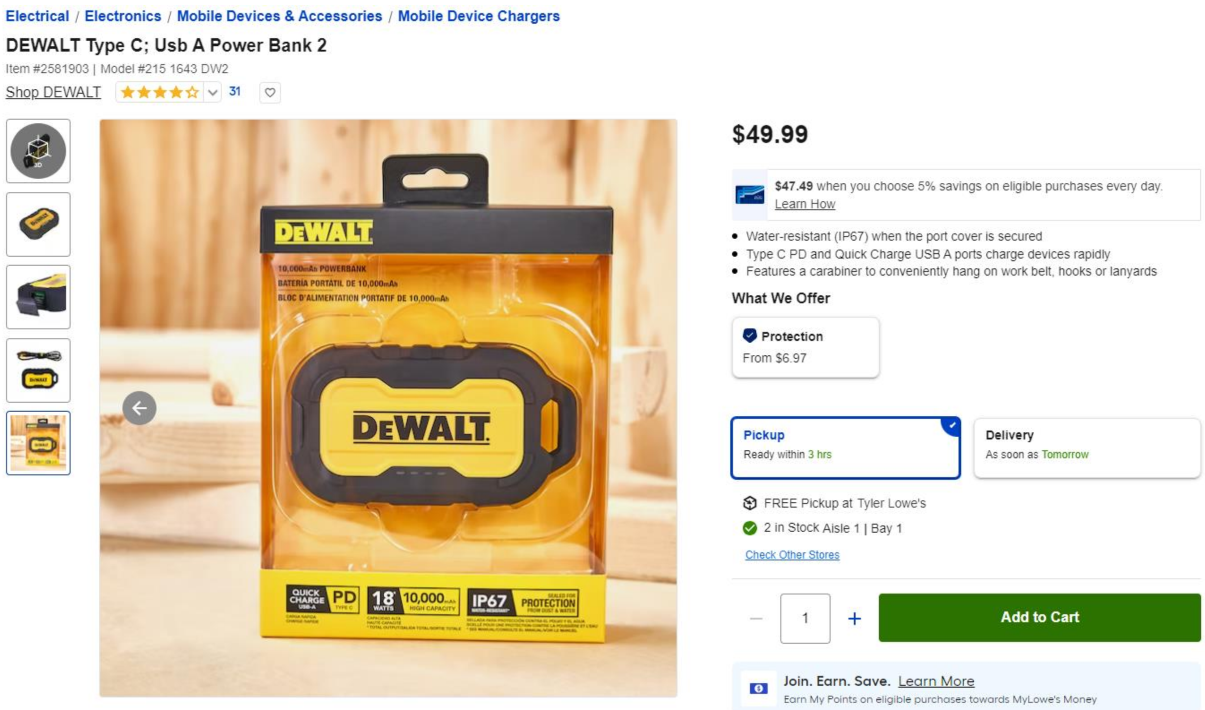
100. Defendant makes, uses, sells, offers for sale and/or imports a portable electronic device, such as the '042 Accused PD Chargers, comprising a rechargeable battery. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, Defendant provides '042 Accused PD Chargers. Each '042 Accused PD Charger includes a USB-C port with Power Delivery, through which the '042 Accused PD Chargers device can charge batteries of portable electronic devices using a full featured USB Type-C cable. The '042 Accused PD Chargers are configured to connect to charging devices through a full featured USB Type-C cable to receive DC power. Further, the USB-C ports of the '042 Accused PD Chargers are compliant with at least Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014 (along with other subsequent revisions of Type-C specification), and Universal Serial Bus Power Delivery Specification, Revision 1.0 January 2017.



(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/Just-Wireless-Portable-Power-Bank-15K-USB-C-A/5001606475?idProductFound=false&idExtracted=true).



(*E.g.*, https://www.lowes.com/pd/DEWALT-10-000-mAh-Powerbank/1003242934?idProductFound=false&idExtracted=true).

101. On information and belief, Defendant provides a portable electronic device, such as the '042 Accused PD Chargers, comprising power circuitry configured to receive direct current and to charge the rechargeable battery. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, to charge the rechargeable battery of a portable electronic device, a USB cable is connected to the USB power supply acting as a power supply. The other end of the USB cable is connected to the charging port of the portable electronic device and the power supply is plugged into a standard wall socket. Therefore, the portable electronic device comprises power circuitry to receive DC power from the power supply.

102. Defendant provides a portable electronic device, such as the '042 Accused PD Chargers, that comprises a data circuitry configured to provide a first signal to a power supply and to receive a second signal from the power supply. This element is met literally, or in the alternative,

under the doctrine of equivalents. For example, the ‘042 Accused PD Chargers comprise data circuitry as described in the Universal Serial Bus Type-C Cable and Connector Specification and Universal Serial Bus Power Delivery Specification. The ‘042 Accused PD Chargers are configured to connect to power supplies through a USB cable. The USB cable has a connector of the type including but not limited to USB-C at one end to detachably mate with the charging port of a power supply. The connector comprises VBUS (“first conductor”), GND (“second conductor”), and two Configuration Channel conductors, *i.e.*, CC1/CC2 (“third conductor” / “fourth conductor”). The USB Type-C connector mating the USB Type-C charging port of the ‘042 Accused PD Chargers are designed to be used without regard to orientation. When an ‘042 Accused PD Charger is connected to a power supply through the full featured USB Type-C cable, the orientation of the connector to the power supply is detected first. The power supply detects the proper orientation of the connected USB Type-Cable by checking the voltage signal at the CC1 and CC2 pins. The values of the two resistors, Rp and Rd are fixed such that the voltage signal at one of the two CC pins (*i.e.*, CC1 and CC2) will be lower than the predetermined threshold value. The power supply determines which of the two CC pins are used as a configuration channel by detecting a voltage less than a certain threshold voltage at the CC pin in use. The CC pin used as a configuration channel is the “third conductor” and the voltage signal (“first signal”) received at one of the CC pin meeting the threshold requirement from the ‘042 Accused PD Charger connected via the full featured USB Type-Cable is determined by the voltage divider signal generated by the Rd resister in the ‘042 Accused PD Charger with the Rp resister in the power supply. The CC pin that is not used as a configuration channel then becomes the Vconn conductor (“the fourth conductor”). The power supply connects to the full-featured USB Type-C cable that is electronically marked. To connect to an electronically marked USB Type-C cable, the power supply utilizes the Vconn pin. With the electronically marked USB Type-Cable, the CC pin not used as the configuration channel is used as the Vconn source. Upon providing the Vconn signal to the '042 Accused PD Charger, the power supply communicates the SOP/SOP'/SOP'' (SOP*) packet with the '042 Accused PD Charger that is used to control the power delivery from the power supply to the '042 Accused PD Charger. The SOP* includes the SOP communication from the power supply to the '042 Accused PD Charger that is attached. The voltage signal at the Vconn pin sent from the power supply to the '042 Accused PD Charger is the "second signal" because the Vconn signal enables the SOP* communication that controls charging the battery in the '042 Accused PD Charger.

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2	SSTXp1	Positive half of first SuperSpeed TX differential pair	Second	B11	SSRXp1	Positive half of first SuperSpeed RX differential pair	Second
A3	SSTXn1	Negative half of first SuperSpeed TX differential pair	Second	B10	SSRXn1	Negative half of first SuperSpeed RX differential pair	Second
A4	VBUS	Bus Power	First	B9	VBUS	Bus Power	First
A5	CC1	Configuration Channel	Second	B8	SBU2	Sideband Use (SBU)	Second
A6	Dp1	Positive half of the USB 2.0 differential pair – Position 1	Second	B7	Dn2	Negative half of the USB 2.0 differential pair – Position 2	Second
A7	Dn1	Negative half of the USB 2.0 differential pair – Position 1	Second	B6	Dp2	Positive half of the USB 2.0 differential pair – Position 2	Second
A8	SBU1	Sideband Use (SBU)	Second	B5	CC2	Configuration Channel	Second
A9	VBUS	Bus Power	First	B4	VBUS	Bus Power	First
A10	SSRXn2	Negative half of second SuperSpeed RX differential pair	Second	B3	SSTXn2	Negative half of second SuperSpeed TX differential pair	Second
A11	SSRXp2	Positive half of second SuperSpeed RX differential pair	Second	B2	SSTXp2	Positive half of second SuperSpeed TX differential pair	Second
A12	GND	Ground return	First	B1	GND	Ground return	First

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 49).

The USB Type-C receptacle, plug and cable designs are intended to support future USB functional extensions. As such, consideration was given to frequency scaling performance, pin-out arrangement and the configuration mechanisms when developing this solution. The definition of future USB functional extensions is not in the scope of this specification but rather will be provided in future releases of the base USB Specification, i.e., beyond the existing USB 3.1 Specification.

Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both USB 2.0 (D+ and D−) and USB 3.1 (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1−	VBUS	CC1	D+	D−	SBU1	VBUS	RX2−	RX2+	GND
GND	RX1+	RX1−	VBUS	SBU2	D−	D+	CC2	VBUS	TX2−	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

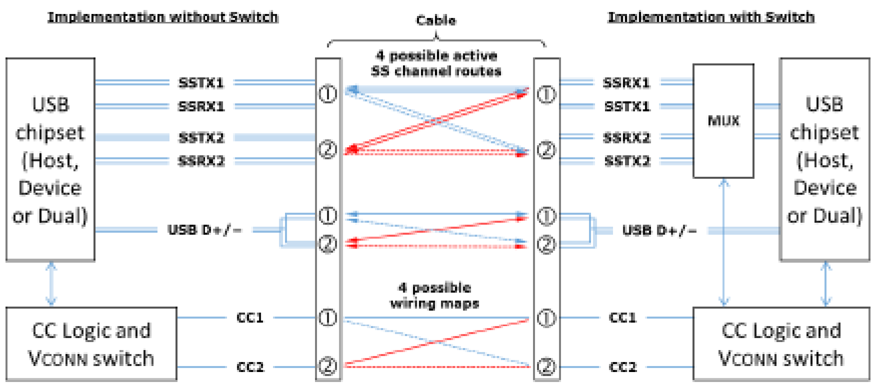
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 18).

4.5.1.1 USB Data Bus Interface and USB Type-C Plug Flip-ability

Since the USB Type-C plug can be inserted in either right-side-up or upside-down position, the hosts and devices that support USB data bus functionality must operate on the signal pins that are actually connected end-to-end. In the case of USB 2.0, this is done by shorting together the two D+ signal pins and the two D− signal pins in the DFP and UFP receptacles. In the case of USB SuperSpeed signals, it requires the functional equivalent of a switch in both the DFP and UFP to appropriately route the SuperSpeed TX and RX signal pairs to the connected path through the cable.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 104).

Figure 4-3 Logical Model for Data Bus Routing across USB Type-C-based Ports



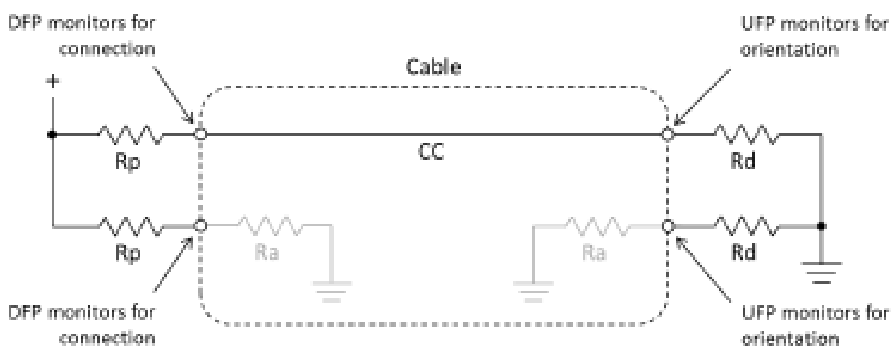
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 105).

4.5.1.2.1 Detecting a Valid DFP-to-UFP Connection

The general concept for setting up a valid connection between a DFP and UFP is based on being able to detect terminations residing in the product being attached.

To aid in defining the functional behavior of CC, a pull-up (Rp) and pull-down (Rd) termination model is used – actual implementation in hosts and devices may vary, for example, the pull-up termination could be replaced by a current source. Figure 4-5 and Figure 4-6 illustrates two models, the first based on a pull-up resistor in the DFP and the second replacing this with a current source.

Figure 4-5 Pull-Up/Pull-Down CC Model



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 107).

Table 4-10 provides the values that shall be used for the DFP's Rp or current source. Other pull-up voltages shall be allowed if they remain less than 5.5 V and fall within the correct voltage ranges on the UFP side – see Table 4-18, Table 4-19 and Table 4-20. Note: when two DFPs are connected together, they may use different termination methods which could result in unexpected current flow.

Table 4-10 DFP CC Termination (Rp) Requirements

DFP Advertisement	Current Source to 1.7 – 5.5 V	Resistor pull-up to 4.75 – 5.5 V	Resistor pull-up to 3.3 V ± 5%
Default USB Power	80 µA ± 20%	56 kΩ ± 20%	36 kΩ ± 20%
1.5 A @ 5 V	180 µA ± 8%	22 kΩ ± 5%	12 kΩ ± 5%
3.0 A @ 5 V	330 µA ± 8%	10 kΩ ± 5%	4.7 kΩ ± 5%

The UFP may find it convenient to implement Rd in multiple ways simultaneously (a wide range Rd when unpowered and a trimmed Rd when powered). Transitions between Rd implementations that do not exceed tCCDebounce shall not be interpreted as exceeding the wider Rd range. Table 4-11 provides the methods and values that shall be used for the UFP's Rd implementation.

Table 4-11 UFP CC Termination (Rd) Requirements

Rd Implementation	Nominal value	Can detect power capability?	Max voltage on pin
± 20% voltage clamp[1]	1.1 V	No	1.32 V
± 20% resistor to GND	5.1 kΩ	No	2.18 V
± 10% resistor to GND	5.1 kΩ	Yes	2.04 V

Note:
1. The clamp implementation inhibits *USB PD* communication although the system can start with the clamp and transition to the resistor once it is able to do *USB PD*.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Pages 149-150).

2.5 VCONN

Once the connection between host and device is established, the CC pin (CC1 or CC2) in the receptacle that is not connected via the CC wire through the standard cable is repurposed to source VCONN to power circuits in the plug needed to implement Electronically Marked Cables (see Section 4.9). Initially, the DFP sources VCONN and the source may be swapped using *USB PD* VCONN_Swap.

Electronically marked cables may use VBUS instead of VCONN as VBUS is available across the cable. VCONN functionally differs from VBUS in that it is isolated from the other end of the cable. VCONN is independent of VBUS and, unlike VBUS which can use *USB PD* to support higher voltages, VCONN voltage is fixed at 5 V.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 23).

4.9 Electronically Marked Cables

All USB Full-Featured Type-C cables shall be electronically marked. USB 2.0 Type-C cables may be electronically marked.

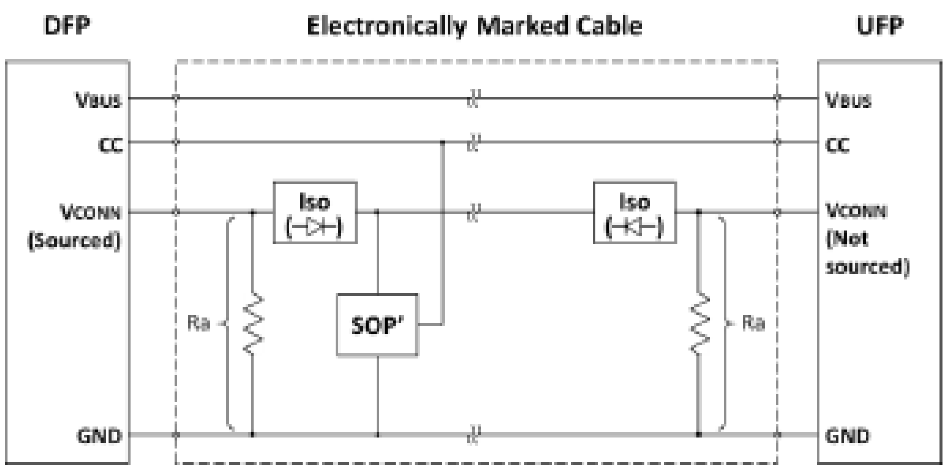
Electronically marked cables shall support USB Power Delivery Structured VDM Discover Identity command directed to SOP'. This provides a method to determine the characteristics of the cable, e.g. its current carrying capability, its performance, vendor identification, etc. This may be referred to as the USB Type-C Cable ID function.

Prior to an explicit USB PD contract, a Charging UFP is allowed to use SOP' to discover the cable's identity. After an explicit USB PD contract has been negotiated, only the DFP shall communicate with SOP'.

An electronically marked cable incorporates electronics that require VCONN, although VBUS or another source may be used. Electronically marked cables that do not incorporate data bus signal conditioning circuits shall consume no more than 70 mW from VCONN. During USB suspend, electronically marked cables shall not draw more than 7.5 mA from VCONN, see Section 4.6.1.2.

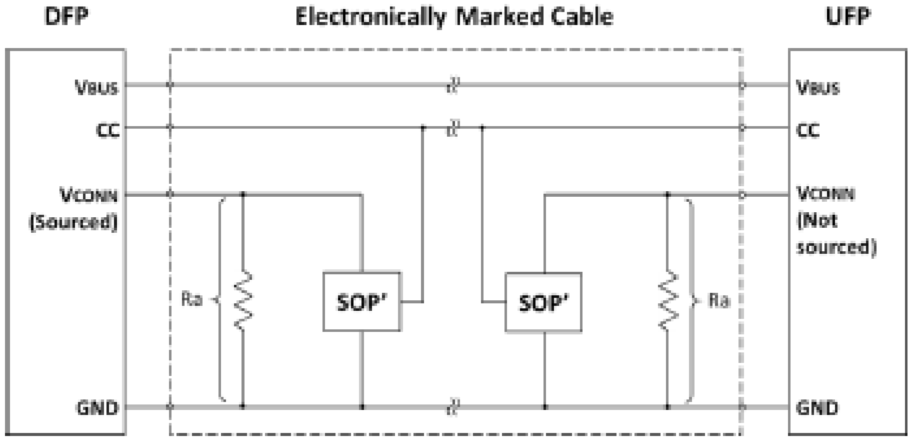
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

Figure 4-34 Electronically Marked Cable with VCONN connected through the cable



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 148).

Figure 4-35 Electronically Marked Cable with SOP' at both ends



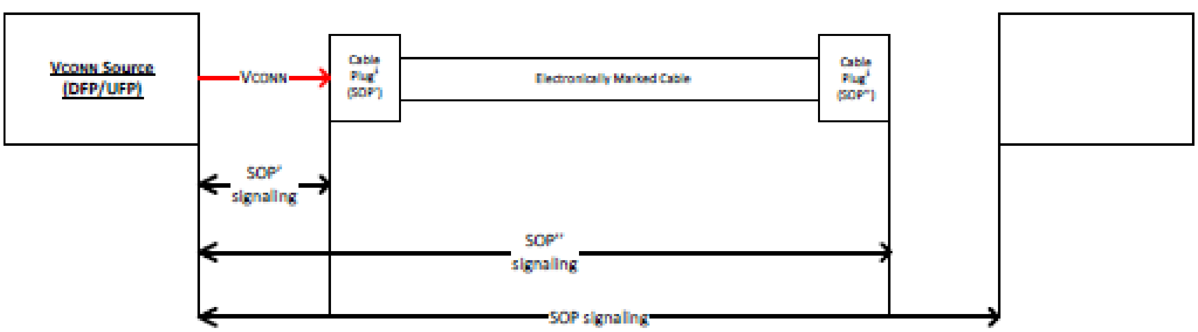
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

All SOP* Communications take place over a single wire (CC). This means that the SOP* Communication periods must be coordinated to prevent important communication from being blocked. For a product which does not recognize SOP/SOP' or SOP" Packets, this will look like a non-idle channel, leading to missed packets and retries. Communications between the Port Partners take precedence meaning that communications with the Cable Plug can be interrupted but will not lead to a Soft or Hard Reset.

When no Contract or an Implicit Contract is in place (e.g., after a Power Role Swap or Fast Role Swap) only the Source port that is supplying VCONN is allowed to send packets to a Cable Plug (SOP') and is allowed to respond to packets from the Cable Plug (SOP') with a GoodCRC in order to discover the Cable Plug's characteristics (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the Source which acts to prevent conflicts between SOP and SOP' Packets. The Sink does not communicate with the Cable Plug and *Discards* any SOP' Packets received.

When an Explicit Contract is in place the VCONN Source (either the DFP or the UFP) can communicate with the Cable Plug(s) using SOP'/SOP" Packets (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the VCONN Source which acts to prevent conflicts between SOP* Packets. The Port that is not the VCONN Source does not communicate with the Cable Plug and does not recognize any SOP'/SOP" Packets received. Only the DFP, when acting as a VCONN Source, is allowed to send SOP* in order to control the entry and exiting of Modes and to manage Modal Operation.

Figure 2-2 Example SOP' Communication between VCONN Source and Cable Plug(s)



(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 7).

Term	Description
Sink Directed Charge	A charging scheme whereby the Sink connects the Source to its battery through safety and other circuitry. When the SPR PPS Current Limit feature is activated, the Source automatically controls its output current by adjusting its output Voltage.
Soft Reset	A process that resets the PD communications engine to its default state.
SOP Communication	Communication using SOP Packets also implies that a Message sequence is being followed.
SOP Packet	Any Power Delivery Packet which starts with an *SOP*.
SOP* Communication	Communication with a Cable Plug using SOP* Packets, also implies a Message sequence is being followed.
SOP* Packet	A term referring to any Power Delivery Packet starting with either *SOP*, *SOP'* or *SOP''*.
SOP' Communication	Communication with a Cable Plug using SOP' Packets, also implies that a Message sequence is being followed.
SOP' Packet	Any Power Delivery Packet which starts with an *SOP'* used to communicate with a Cable Plug.
SOP'' Communication	Communication with a Cable Plug using SOP'' Packets, also implies that a Message sequence is being followed.
SOP'' Packet	Any Power Delivery Packet which starts with an *SOP''* used to communicate with a Cable Plug when SOP' Packets are being used to communicate with the other Cable Plug.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 68).

103. Defendant provides a portable electronic device, such as the ‘042 Accused PD Chargers, to transfer, via the first conductor, the direct current from the power supply, provide, via the second conductor, a ground reference from the power supply, communicate, via the third conductor, the first signal from the data circuitry to the power supply, and communicate, via the fourth conductor, the second signal from the power supply to the data circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. For example, the VBUS pin is the voltage line that provides DC power from the power supply to the ‘042 Accused PD Charger. For example, the GND pin provides a ground reference from the power supply to the ‘042 Accused PD Charger. When an ‘042 Accused PD Charger is connected to a power supply through a USB Type-C cable, the orientation of the connector to the power supply is detected first. The power supply detects the proper orientation of the connected USB Type-Cable by checking the voltage signal at the CC1 and CC2 pins. The values of the two resistors, Rp and Rd are fixed such that the voltage signal at one of the two CC pins (*i.e.*, CC1 and CC2) will be lower than the predetermined

threshold value. The power supply determines which of the two CC pins are used as the configuration channel by detecting a voltage less than a certain threshold voltage at the CC pin in use. The CC pin used as the configuration channel is the "third conductor" and the voltage signal received at one of the CC pins meeting the threshold requirement ("first signal") from the '042 Accused PD Charger connected via the full featured USB Type-Cable is determined by the voltage divider signal generated by the Rd resister in the '042 Accused PD Charger with the Rp resister in the power supply. The CC pin that is not used as a configuration channel then becomes the Vconn conductor ("the fourth conductor"). The power supply connects to the full-featured USB Type-C cable that is electronically marked. To connect to an electronically marked USB Type-C cable, the power supply utilizes the Vconn pin. With the electronically marked USB Type-Cable, the CC pin not used for the configuration is used as the Vconn source. Upon providing the Vconn source, the power supply communicates the SOP* packets with the '042 Accused PD Charger, which control charging of the battery in the '042 Accused PD Charger. The SOP* includes the SOP communication from the power supply to the '042 Accused PD Charger that is attached. The voltage signal sent at the Vconn pin from the power supply to the '042 Accused PD Charger is the "second signal" because this voltage signal enables the SOP* communication that controls charging the battery in the '042 Accused PD Charger.

Figure 2-1 illustrates the comprehensive functional signal plan for the USB Type-C receptacle, not all signals shown are required in all platforms or devices. As shown, the receptacle signal list functionally delivers both USB 2.0 (D+ and D−) and USB 3.1 (TX and RX pairs) data buses, USB power (VBUS) and ground (GND), Configuration Channel signals (CC1 and CC2), and two Sideband Use (SBU) signal pins. Multiple sets of USB data bus signal locations in this layout facilitate being able to functionally map the USB signals independent of plug orientation in the receptacle. For reference, the signal pins are labeled.

Figure 2-1 USB Type-C Receptacle Interface (Front View)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1−	VBUS	CC1	D+	D−	SBU1	VBUS	RX2−	RX2+	GND
GND	RX1+	RX1−	VBUS	SBU2	D−	D+	CC2	VBUS	TX2−	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 18).

2.4 VBUS

VBUS provides a path to deliver power between a host and a device, and between a charger and a host/device. A simplified high-current supply capability is defined for hosts and chargers that optionally support current levels beyond the USB 2.0 and USB 3.1 specifications. The *USB Power Delivery Specification* is supported.

Table 2-1 summarizes the power supply options available from the perspective of a device with the USB Type-C connector. Not all options will be available to the device from all host

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 22).

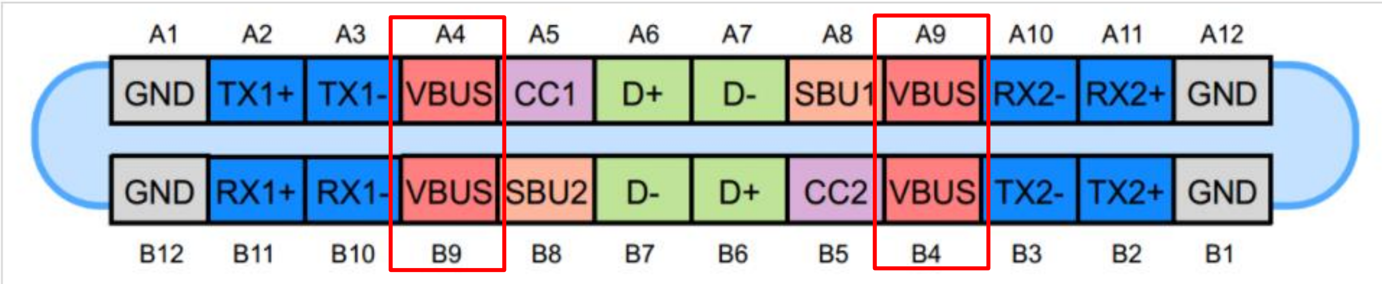


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

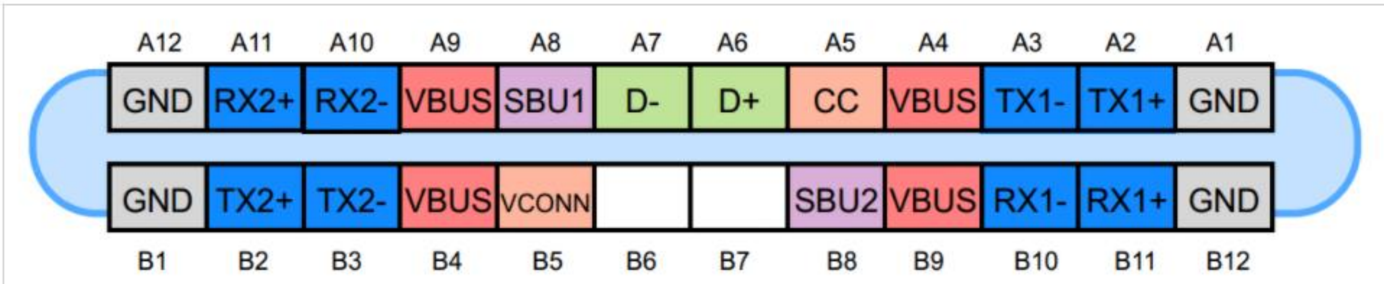


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

2.3.1 DFP-to-UFP Attach/Detach Detection

Initially, DFP-to-UFP attach is detected by a host or hub port (DFP) when one of the CC pins at its USB Type-C receptacle senses a specified resistance to GND. Subsequently, DFP-to-UFP detach is detected when the CC pin that was terminated at its USB Type-C receptacle is no longer terminated to GND.

Power is not applied to the USB Type-C host or hub receptacle (VBUS or VCONN) until the DFP detects the presence of an attached device (UFP) port. When a DFP-to-UFP attach is detected, the DFP is expected to enable power to the receptacle and proceed to normal USB operation with the attached device. When a DFP-to-UFP detach is detected, the port sourcing VBUS removes power.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification, Release 1.0 August 2014, Page 21).

Table 3-4 USB Type-C Receptacle Interface Pin Assignments

Pin	Signal Name	Description	Mating Sequence	Pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 49).

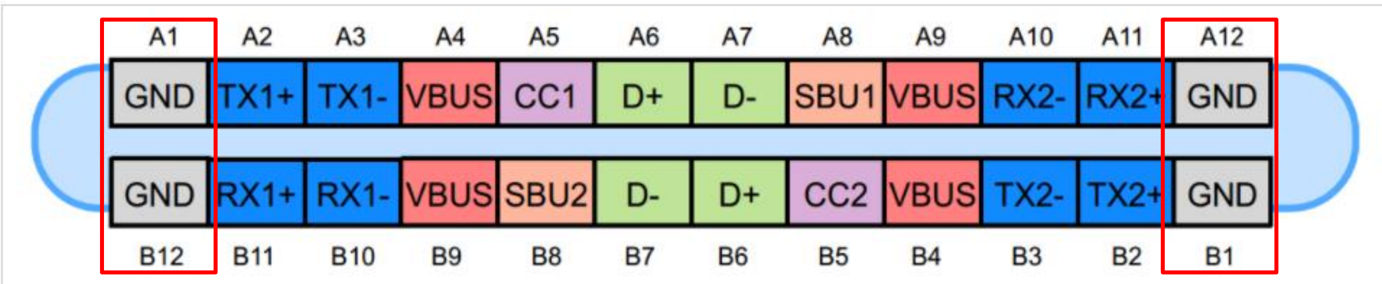


Figure 1. *The USB Type-C receptacle. Image courtesy of Microchip.*

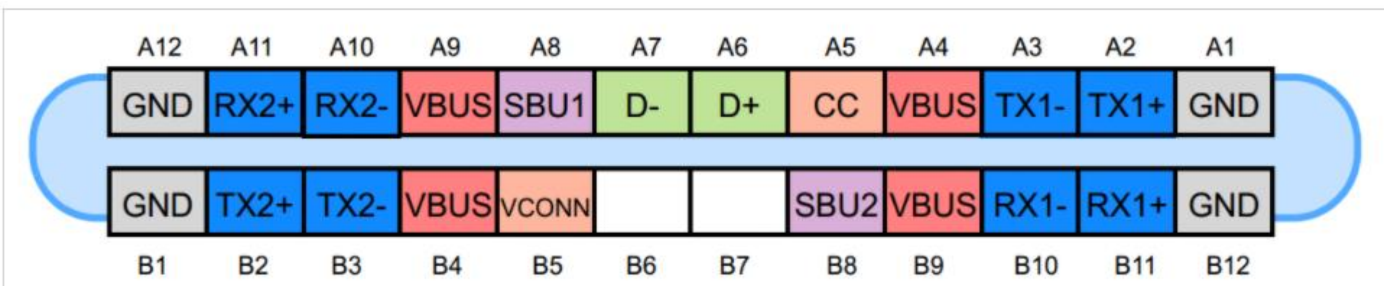


Figure 2. *The USB Type-C plug. Image courtesy of Microchip.*

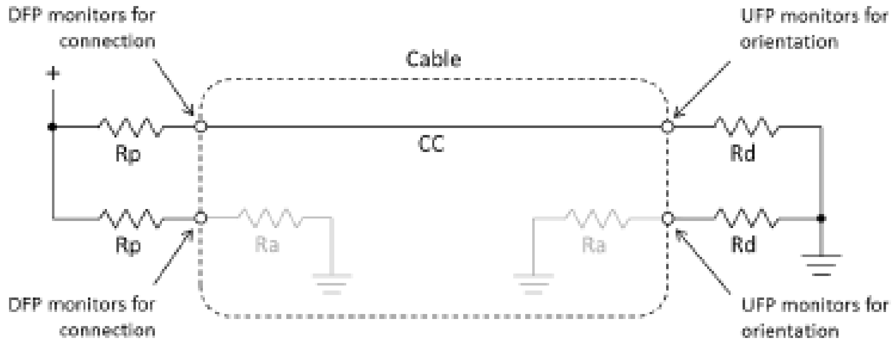
(*E.g.*, https://www.allaboutcircuits.com/technical-articles/introduction-to-usb-type-c-which-pins-power-delivery-data-transfer/).

4.5.1.2.1 Detecting a Valid DFP-to-UFP Connection

The general concept for setting up a valid connection between a DFP and UFP is based on being able to detect terminations residing in the product being attached.

To aid in defining the functional behavior of CC, a pull-up (Rp) and pull-down (Rd) termination model is used – actual implementation in hosts and devices may vary, for example, the pull-up termination could be replaced by a current source. Figure 4-5 and Figure 4-6 illustrates two models, the first based on a pull-up resistor in the DFP and the second replacing this with a current source.

Figure 4-5 Pull-Up/Pull-Down CC Model



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page107).

Table 4-10 provides the values that shall be used for the DFP's Rp or current source. Other pull-up voltages shall be allowed if they remain less than 5.5 V and fall within the correct voltage ranges on the UFP side – see Table 4-18, Table 4-19 and Table 4-20. Note: when two DFPs are connected together, they may use different termination methods which could result in unexpected current flow.

Table 4-10 DFP CC Termination (Rp) Requirements

DFP Advertisement	Current Source to 1.7 – 5.5 V	Resistor pull-up to 4.75 – 5.5 V	Resistor pull-up to 3.3 V ± 5%
Default USB Power	80 µA ± 20%	56 kΩ ± 20%	36 kΩ ± 20%
1.5 A @ 5 V	180 µA ± 8%	22 kΩ ± 5%	12 kΩ ± 5%
3.0 A @ 5 V	330 µA ± 8%	10 kΩ ± 5%	4.7 kΩ ± 5%

The UFP may find it convenient to implement Rd in multiple ways simultaneously (a wide range Rd when unpowered and a trimmed Rd when powered). Transitions between Rd implementations that do not exceed tCCDebounce shall not be interpreted as exceeding the wider Rd range. Table 4-11 provides the methods and values that shall be used for the UFP's Rd implementation.

Table 4-11 UFP CC Termination (Rd) Requirements

Rd Implementation	Nominal value	Can detect power capability?	Max voltage on pin
± 20% voltage clamp[1]	1.1 V	No	1.32 V
± 20% resistor to GND	5.1 kΩ	No	2.18 V
± 10% resistor to GND	5.1 kΩ	Yes	2.04 V

Note:
1. The clamp implementation inhibits USB PD communication although the system can start with the clamp and transition to the resistor once it is able to do USB PD.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Pages 149-150).

2.5 VCONN

Once the connection between host and device is established, the CC pin (CC1 or CC2) in the receptacle that is not connected via the CC wire through the standard cable is repurposed to source VCONN to power circuits in the plug needed to implement Electronically Marked Cables (see Section 4.9). Initially, the DFP sources VCONN and the source may be swapped using USB PD VCONN_Swap.

Electronically marked cables may use VBUS instead of VCONN as VBUS is available across the cable. VCONN functionally differs from VBUS in that it is isolated from the other end of the cable. VCONN is independent of VBUS and, unlike VBUS which can use USB PD to support higher voltages, VCONN voltage is fixed at 5 V.

(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 23).

4.9 Electronically Marked Cables

All USB Full-Featured Type-C cables shall be electronically marked. USB 2.0 Type-C cables may be electronically marked.

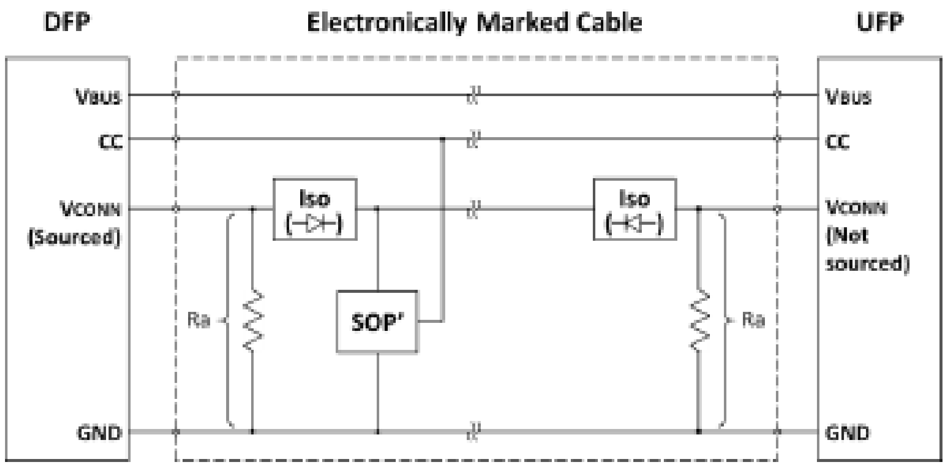
Electronically marked cables shall support USB Power Delivery Structured VDM Discover Identity command directed to SOP'. This provides a method to determine the characteristics of the cable, e.g. its current carrying capability, its performance, vendor identification, etc. This may be referred to as the USB Type-C Cable ID function.

Prior to an explicit USB PD contract, a Charging UFP is allowed to use SOP' to discover the cable's identity. After an explicit USB PD contract has been negotiated, only the DFP shall communicate with SOP'.

An electronically marked cable incorporates electronics that require VCONN, although VBUS or another source may be used. Electronically marked cables that do not incorporate data bus signal conditioning circuits shall consume no more than 70 mW from VCONN. During USB suspend, electronically marked cables shall not draw more than 7.5 mA from VCONN, see Section 4.6.1.2.

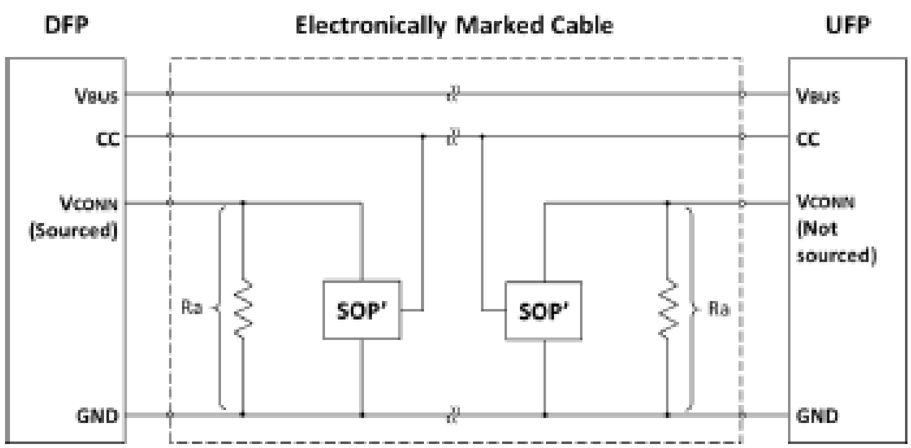
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

Figure 4-34 Electronically Marked Cable with VCONN connected through the cable



(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 148).

Figure 4-35 Electronically Marked Cable with SOP' at both ends



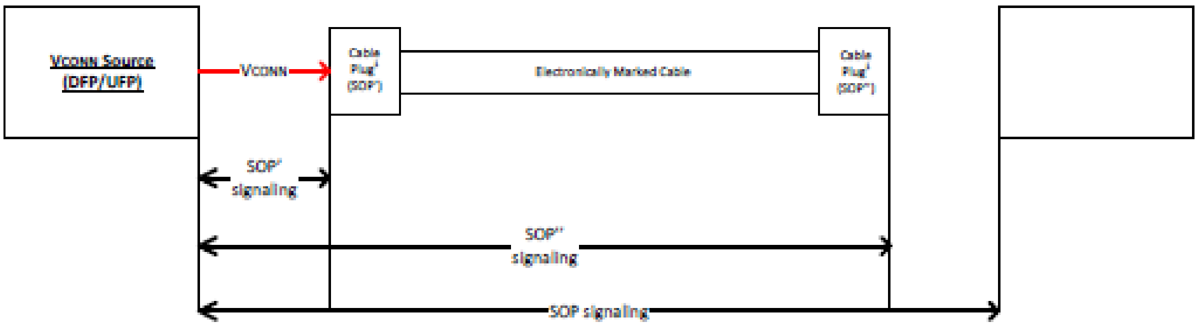
(*E.g.*, Universal Serial Bus Type-C Cable and Connector Specification Revision 1.0 August 2014, Page 147).

All SOP* Communications take place over a single wire (CC). This means that the SOP* Communication periods must be coordinated to prevent important communication from being blocked. For a product which does not recognize SOP/SOP' or SOP'' Packets, this will look like a non-idle channel, leading to missed packets and retries. Communications between the Port Partners take precedence meaning that communications with the Cable Plug can be interrupted but will not lead to a Soft or Hard Reset.

When no Contract or an Implicit Contract is in place (e.g., after a Power Role Swap or Fast Role Swap) only the Source port that is supplying VCONN is allowed to send packets to a Cable Plug (SOP') and is allowed to respond to packets from the Cable Plug (SOP') with a GoodCRC in order to discover the Cable Plug's characteristics (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the Source which acts to prevent conflicts between SOP and SOP' Packets. The Sink does not communicate with the Cable Plug and *Discards* any SOP' Packets received.

When an Explicit Contract is in place the VCONN Source (either the DFP or the UFP) can communicate with the Cable Plug(s) using SOP'/SOP'' Packets (see Figure 2-2). During this phase all communication with the Cable Plug is initiated and controlled by the VCONN Source which acts to prevent conflicts between SOP* Packets. The Port that is not the VCONN Source does not communicate with the Cable Plug and does not recognize any SOP'/SOP'' Packets received. Only the DFP, when acting as a VCONN Source, is allowed to send SOP* in order to control the entry and exiting of Modes and to manage Modal Operation.

Figure 2-2 Example SOP' Communication between VCONN Source and Cable Plug(s)



(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 7).

Term	Description
Sink Directed Charge	A charging scheme whereby the Sink connects the Source to its battery through safety and other circuitry. When the SPR PPS Current Limit feature is activated, the Source automatically controls its output current by adjusting its output Voltage.
Soft Reset	A process that resets the PD communications engine to its default state.
SOP Communication	Communication using SOP Packets also implies that a Message sequence is being followed.
SOP Packet	Any Power Delivery Packet which starts with an *SOP*.
SOP* Communication	Communication with a Cable Plug using SOP* Packets, also implies a Message sequence is being followed.
SOP* Packet	A term referring to any Power Delivery Packet starting with either *SOP*, *SOP'* or *SOP''*.
SOP' Communication	Communication with a Cable Plug using SOP' Packets, also implies that a Message sequence is being followed.
SOP' Packet	Any Power Delivery Packet which starts with an *SOP'* used to communicate with a Cable Plug.
SOP'' Communication	Communication with a Cable Plug using SOP'' Packets, also implies that a Message sequence is being followed.
SOP'' Packet	Any Power Delivery Packet which starts with an *SOP''* used to communicate with a Cable Plug when SOP' Packets are being used to communicate with the other Cable Plug.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 68).

104. Defendant provides a portable electronic device, such as the '042 Accused PD Chargers, in which the second signal has a parameter level that is usable by the data circuitry in connection with control of charging the rechargeable battery based on the direct current received by the power circuitry. This element is met literally, or in the alternative, under the doctrine of equivalents. As explained above, a voltage signal meeting the specified threshold value, *i.e.*, the "first signal," is detected at the CC pin used as the configuration channel. In coordination with this voltage signal, the second signal, *i.e.*, another voltage signal from the Vconn pin is sent from the power supply to the '042 Accused PD Charger, which enables the SOP* communication that controls charging a rechargeable battery of the '042 Accused PD Charger.

2.5.3 SOP Communication

SOP Communication is used for Port-to-Port communication between the Source and the Sink. SOP Communication is recognized by both Port Partners but not by any intervening Cable Plugs. SOP Communication takes priority over other SOP* Communications since it is critical to complete power related operations as soon as possible. Message sequences relating to power are also allowed to interrupt other sequences to ensure that negotiation and control of power is given priority on the bus.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 75).

6.4.1.1 Use of the Capabilities Message

6.4.1.1.1 Use by Sources

Sources send a *Source_Capabilities* Message (see Section 6.4.1) either as part of advertising Port capabilities, or in response to a *Get_Source_Cap* Message.

Following a Hard Reset, a power-on event or plug insertion event, a Source Port *Shall* send a *Source_Capabilities* Message after every *SourceCapabilityTimer* timeout as an Advertisement that *Shall* be interpreted by the Sink Port on Attachment. The Source *Shall* continue sending a minimum of *nCapsCount Source_Capabilities* Messages until a *GoodCRC* Message is received.

(*E.g.*, Universal Serial Bus Power Delivery Specification Revision 3.1, April 2022, Page 146).

C. Indirect Infringement

105. Upon information and belief, Defendant has been and now is indirectly infringing by way of inducing infringement and contributing to the infringement of the asserted claims of the '042 patent in the State of Texas, in this District, and elsewhere in the United States, by providing

the ‘042 Accused Chargers for use as described above by Defendant’s customers. Defendant advertised, offered for sale, and/or sold the ‘042 Accused Chargers (and continues to advertise, offer to sell, and sell) to its customers for use in a manner that Defendant knew infringed at least one claim of the ‘042 patent. For example, Defendant advertises and sells the ‘042 Accused Chargers. In addition, Defendant sells and offers for sale the following additional devices that are advertised as charging batteries and satisfy all limitations of the claim with the exception for the rechargeable battery: Mobile Pixels 8-in-1 USB-C Dongle (Item #5194286, Model #MPX1041001P01); Urban Factory HUBEE Plus USB-C Multi-Stream Mobile Station with 100-Watt Power Delivery (Item #5232138,Model #UBFTCM16UF); Urban Factory HUBEE mini USB-C Multi-Display 4K Docking Station with 100-Watt Power Delivery (Item #5232136, Model #UBFTCD45UF); Micro Connectors 1-ft USB-C White Cable (Item #3662609, Model #USB31-UCHDMIU3); Micro Connectors 1-ft USB-C White Cable (Item #3662610, Model #USB31-UCVGAU3); DEWALT Type C USB A Wall Outlet Charger 2 (Item #1299595, Model #131 0851 DW2); DEWALT Type C USB A Car Charger 4 (Item #1299597, Model #141 9009 DW2); Eaton 20-Amp Tamper Resistant Residential/Commercial Decorator USB Outlet Dual Type C, Gray (Item #4110024, Model #TRUSBC20GY-K-L); Eaton 15-Amp Tamper Resistant Residential/Commercial Decorator USB Outlet Type A/C (Item #1614069, Model #TRUSBAC15W-KB-LW); miLink Micro USB USB-C Lightning Combination Charger 3 (Item #4666486, Model #CC3-J241); Trexonic 4-Port USB Charger with Quick Charge Technology, Silver, Type C and USB A Connectors, 1000mAh Battery Power (Item #1646379; Model #849105170M); Trexonic Micro USB USB-C Lightning Combination Charger 4 (Item #1646374, Model #849105163M); Trexonic Micro USB USB-C Lightning Combination Charger 4 (Item #1646491, Model #849111674M); Promounts Lightning USB A USB Charger 5 (Item #877321, Model #OPT061); Top Greener TU22036A2C 20-Amp 125-volt Tamper Resistant Residential/Commercial Decorator Outlet/USB Dual Type C with Wall Plate (3-Pack) (Item #4828747, Model #TU22036A2C-WWP3P); Top Greener TU21558AC3 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Type A/C with Wall Plate, White (3-Pack) (Item #4828749; Model #TU21558AC3-WWP3P); Top Greener TU21536A2C 15-Amp 125-volt Tamper Resistant Residential Decorator USB Outlet Dual Type C with Wall Plate, White (3-Pack) (Item #4828746; Model #TU21536A2C-WWP3P); Top Greener TU22036AC3 20-Amp 125-volt Tamper Resistant Residential/Commercial Decorator Outlet/USB Type A/C with Wall Plate, White (3-Pack) (Item #4828751, Model #TU22036AC3-WWP3P); Top Greener TU21536A2C 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Dual Type C with Wall Plate, Black (3-Pack) (Item #4828753; Model #TU21536A2C-BKWP3P); Top Greener TU21536AC3 15-Amp 125-volt Tamper Resistant Residential Decorator Outlet/USB Type A/C with Wall Plate, Black (3-Pack) (Item #4828745; Model #TU21536AC3-BKWP3); Naztech Micro USB USB-C Lightning Car Charger 2 (Item #3637774; Model #14390); RoadKing Type C USB A Combination Charger 2 (Item #3722750; Model #RK03430); and Accell Type C USB A Combination Charger (Item #3245139; Model #D233B-001B) (collectively "Additional '042 Accused Chargers"). Defendant is a direct and indirect infringer, and its customers using the '042 Accused Chargers and Additional '042 Accused Chargers are direct infringers. Defendant had actual knowledge of the '042 patent at least as early as when they received a letter from Plaintiff sent on August 1, 2023, asserting that the '042 Accused Chargers and Additional '042 Accused Chargers infringed claims of the '042 patent and they were provided a claim chart that provided evidence of the infringement. Defendant has known of its infringement since at least that date as a result of the accusations of infringement in the notice letter. Defendant has therefore also known that the use of the '042 Accused Chargers and Additional '042 Accused Chargers by its customers infringed at least one claim of the '042 patent since at least the date they received the letter.

106. On information and belief, since becoming aware of the '042 patent and of the infringement through advertising and offering for sale the '042 Accused Chargers and Additional '042 Accused Chargers for use by its customers, Defendant is and has been committing the act of inducing infringement by specifically intending to induce infringement by providing the '042 Accused Chargers and Additional '042 Accused Chargers to its customers and by aiding and abetting its use in a manner known to infringe by Defendant. Since becoming aware of the infringing use of the '042 Accused Chargers and Additional '042 Accused Chargers, Defendant knew that the use of the '042 Accused Chargers and Additional '042 Accused Chargers by its customers as a charger with a portable electronic device (including a rechargeable battery) constituted direct patent infringement. Despite this knowledge, Defendant continued and continues to encourage and induce its customers to use the '042 Accused Chargers and Additional '042 Accused Chargers to infringe as described above and provided instructions (and continues such acts) for using the '042 Accused Chargers and Additional '042 Accused Chargers to infringe, including through advertisements. Defendant therefore knowingly induced infringement (and continues to induce infringement) and specifically intended to (and intends to) encourage and induce the infringement of the '042 patent by its customers.

107. On information and belief, since Defendant became aware of the acts of infringement at least as of the date of receipt of the notice letter, Defendant is and has been committing the act of contributory infringement by intending to provide the '042 Accused Chargers and Additional '042 Accused Chargers to its customers knowing that such devices are a material part of the claimed invention, knowing that its use was made and adapted for infringement

of the ‘042 patent as described above, and further knowing that the accused aspect of the ‘042 Accused Chargers and Additional ‘042 Accused Chargers described above is not a staple article or commodity of commerce suitable for substantially noninfringing use. As described above, Defendant was aware that all material claim limitations are satisfied by the use and implementation of the ‘042 Accused Chargers and Additional ‘042 Accused Chargers by Defendant’s customers in the manner described above yet continued to provide the ‘042 Accused Chargers and Additional ‘042 Accused Chargers to its customers knowing that it is a material part of the claimed invention. As described above, since learning of the infringement, Defendant knew that the use and implementation of the ‘042 Accused Chargers and Additional ‘042 Accused Chargers by its customers was made and adapted for infringement of the ‘042 patent. A new act of direct infringement occurred each time a customer implemented and/or used the ‘042 Accused Chargers and Additional ‘042 Accused Chargers in the manner described above. After Defendant became aware that the use of the ‘042 Accused Chargers and Additional ‘042 Accused Chargers infringe at least one claim of the ‘042 patent, Defendant knew that each such new use was made and adapted for infringement of at least one claim of the ‘042 patent and Defendant continued to advertise and provide the ‘042 Accused Chargers and Additional ‘042 Accused Chargers for such infringing activities. Furthermore, as described more fully above, the ‘042 Accused Chargers and Additional ‘042 Accused Chargers have functionality designed for use in a system in the manner described above and is therefore not a staple article or commodity of commerce suitable for substantially noninfringing use.

108. Upon information and belief, Defendant has been and now is willfully infringing the asserted claims of the ‘042 patent in Texas, in this District, and elsewhere in the United States. Defendant had actual knowledge of the ‘042 patent at least as early as when they received a letter

from Plaintiff sent on August 1, 2023, asserting that the '042 Accused Chargers and Additional '042 Accused Chargers infringed claims of the '042 patent and they were provided a chart of the infringement. Defendant has known of its infringement since at least that date as a result of the accusations of infringement in the letter. Defendant has therefore also known that the use of the '042 Accused Chargers and Additional '042 Accused Chargers by its customers infringed at least one claim of the '042 patent since at least the date they received the letter. Defendant was informed of its infringement of the '042 patent by way of the August 1, 2023, letter sent to Defendant, including claim charts demonstrating Defendant's infringement. As a result of the letter, Defendant should have known that its actions constituted an unjustifiably high risk of infringement. Despite the letter and knowledge that the risk of infringement was either known or so obvious that it should have been known, Defendant continued its infringing actions.

109. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates Plaintiff for such Defendant's infringement of the '042 patent, *i.e.*, in an amount that by law cannot be less than a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

VII. JURY DEMAND

Plaintiff, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by jury of any issues so triable by right.

VIII. PRAYER FOR RELIEF

WHEREFORE, Plaintiff respectfully requests that the Court find in its favor and against Defendant, and that the Court grant Plaintiff the following relief:

a. Judgment that one or more claims of United States Patent No. 9,413,187 have been directly and indirectly infringed, either literally and/or under the doctrine of equivalents, by Defendant;

b. Judgment that one or more claims of United States Patent No. 10,855,087 have been directly and indirectly infringed, either literally and/or under the doctrine of equivalents, by Defendant;

c. Judgment that one or more claims of United States Patent No. 10,951,042 have been directly and indirectly infringed, either literally and/or under the doctrine of equivalents, by Defendant;

d. Judgment that Defendant account for and pay to Plaintiff all damages to and costs incurred by Plaintiff because of Defendant's infringing activities and other conduct complained of herein, and an accounting of all infringements and damages not presented at trial;

e. Adjudging that Defendant's infringement of United States Patent Nos. 9,413,187, 10,855,087, and 10,951,042 was willful and trebling all damages awarded to Comarco for such infringement pursuant to 35 U.S.C. § 284;

f. That Plaintiff be granted pre-judgment and post-judgment interest on the damages caused by Defendant's infringing activities and other conduct complained of herein; and

g. That Plaintiff be granted such other and further relief as the Court may deem just and proper under the circumstances.

April 5, 2024

DIRECTION IP LAW

<u>/s/ David R. Bennett</u>
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