
QC - Quick Charge standard vs. USB-PD Common External P.S.

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Power Delivery (PD)

See also: List of 60W/100W USB chargeable laptops

USB PD rev. 1 source profiles[103]

Profile +5 V +12 V +20 V

0

Reserved

1

2.0 A, 10 W[a]

No

No

2

1.5 A, 18 W

3

3.0 A, 36 W

4

3.0 A, 60 W

5

5.0 A, 60 W

5.0 A, 100 W

USB PD rev. 2 source power rules[104]

Source output
power (W) Current, at: (A)

+5 V +9 V +15 V +20 V

0.5–15

0.1–3.0

No

No

No

15–27

3.0

(15 W)

1.7–3.0

27–45

3.0

(27 W)

1.8–3.0

45–60

3.0

(45 W)

2.25–3.0

60–100

3.0–5.0

In July 2012, the USB Promoters Group announced the finalization of the USB Power Delivery (PD) specification, an extension that specifies using certified PD aware USB cables with standard USB Type-A and Type-B connectors to deliver increased power (more than 7.5 W) to devices with larger power demand. Devices can request higher currents and supply voltages from compliant hosts – up to 2 A at 5 V (for a power consumption of up to 10 W), and optionally up to 3 A or 5 A at either 12 V (36 W or 60 W) or 20 V (60 W or 100 W).[105] In all cases, both host-to-device and device-to-host configurations are supported.[106]

The intent is to permit uniformly charging laptops, tablets, USB-powered disks and similarly higher-power consumer electronics, as a natural extension of existing European and Chinese mobile telephone charging standards. This may also affect the way electric power used for small devices is transmitted and used in both residential and public

The Power Delivery specification defines six fixed power profiles for the power sources. PD-aware devices implement a flexible power management scheme by interfacing with the power source through a bidirectional data channel and requesting a certain level of electrical power, variable up to 5 A and 20 V depending on supported profile. The power configuration protocol uses a 24 MHz BFSK-coded transmission channel on the VBUS line.

The USB Power Delivery revision 2.0 specification has been released as part of the USB 3.1 suite.[109] It covers the Type-C cable and connector with four power/ground pairs and a separate configuration channel, which now hosts a DC coupled low-frequency BMC-coded data channel that reduces the possibilities for RF interference.[110] Power Delivery protocols have been updated to facilitate Type-C features such as cable ID function, Alternate Mode negotiation, increased VBUS currents, and VCONN-powered accessories.

As of USB Power Delivery Revision 2.0 Version 1.2, the six fixed power profiles for power sources have been deprecated.[111] USB PD Power Rules replace power profiles, defining four normative voltage levels at 5V, 9V, 15V, and 20V. Instead of six fixed profiles, power supplies may support any maximum source output power from 0.5W to 100W.[104]

Upcoming USB Power Delivery 3.0 specification defines new power rules based on supplied wattage. Programmable power supply protocol allows granular control over VBUS power in 10 mV steps to facilitate constant current or constant voltage charging. Revision 3.0 also adds extended configuration messages, fast role swap, and deprecates the BFSK protocol.[112]

As of April 2016, there are silicon controllers available from several sources (TI, Cypress) [113][114] and several others. Power supplies bundled with Type-C based laptops from Apple, Google, HP, Dell, and Razer support USB PD.[115] In addition, accessories from third party vendors including Anker,[116] Belkin,[117][118] iVoler[119] and Innergie[120] support USB PD 2.0 at multiple voltages. There are several PD aware projects such as the USB-PD Sniffer[121] that are PD aware. ASUS also make a fully Power Delivery compliant adapter card the USB 3.1 UPD PANEL[122]

Sleep-and-charge ports

A yellow USB port denoting sleep-and-charge

Sleep-and-charge USB ports can be used to charge electronic devices even when the computer is switched off. Normally, when a computer is powered off the USB ports are powered down, preventing phones and other devices from charging. Sleep-and-charge USB ports remain powered even when the computer is off. On laptops, charging devices from the USB port when it is not being powered from AC drains the laptop battery faster; most laptops have a facility to stop charging if their own battery charge level gets too low.[123] This feature has also been implemented on some laptop docking stations allowing device charging even when no laptop is present.[124]

Sleep-and-charge USB ports may be found colored differently than regular ports, mostly red or yellow, though that is not always the case.

On Dell and Toshiba laptops, the port is marked with the standard USB symbol with an added lightning bolt icon on the right side. Dell calls this feature PowerShare,[125] while Toshiba calls it USB Sleep-and-Charge.[126] On Acer Inc. and Packard Bell laptops, sleep-and-charge USB ports are marked with a non-standard symbol (the letters USB over a drawing of a battery); the feature is simply called Power-off USB.[127] On some laptops such as Dell and Apple MacBook models, it is possible to plug a device in, close the laptop (putting it into sleep mode) and have the device continue to charge.[citation needed]

Mobile device charger standards

In China

The Micro-USB interface is commonly found on chargers for mobile phones

Australian and New Zealand power socket with USB charger socket

As of 14 June 2007, all new mobile phones applying for a license in China are required to use a USB port as a power port for battery charging.[128][129] This was the first standard to use the convention of shorting D+ and D-.[130]

OMTP/GSMA Universal Charging Solution

In September 2007, the Open Mobile Terminal Platform group (a forum of mobile network operators and manufacturers such as Nokia, Samsung, Motorola, Sony Ericsson and LG) announced that its members had agreed on Micro-USB as the future common connector for mobile devices.[131][132]

The GSM Association (GSMA) followed suit on 17 February 2009,[133][133][134][135][136] and on 22 April 2009, this was further endorsed by the CTIA – The Wireless Association,[137] with the International Telecommunication Union (ITU) announcing on 22 October 2009 that it had also embraced the Universal Charging Solution as its "energy-efficient one-charger-fits-all new mobile phone solution," and added: "Based on the Micro-USB interface, UCS chargers will also include a 4-star or higher efficiency rating—up to three times more energy-efficient than an unrated charger." [138]

EU smartphone power supply standard

Main article: Common external power supply

In June 2009, many of the world's largest mobile phone manufacturers signed an EC-sponsored Memorandum of Understanding (MoU), agreeing to make most data-enabled mobile phones marketed in the European Union compatible with a common External Power Supply (common EPS). The EU's common EPS specification (EN 62684:2010) references the USB Battery Charging standard and is similar to the GSMA/OMTP and Chinese charging solutions.[139][140] In January 2011, the International Electrotechnical Commission (IEC) released its version of the (EU's) common EPS standard as IEC 62684:2011.[141]

Common external power supply

From Wikipedia, the free encyclopedia

In 2009 a European Commission initiative resulted in the specification of a common external power supply (common EPS) for use with data-enabled mobile phones sold in the European Union. The external power supply is the AC power adapter that converts household AC electricity voltages to the much lower DC voltages needed to charge a mobile phone's internal battery. Although compliance is voluntary, a majority of the world's largest mobile phone

manufacturers agreed to make their applicable mobile phones compatible with Europe's common external power supply specifications.

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Purpose

According to the European Commission, a common external power supply / "charger" standard is desirable because,

Incompatibility of chargers for mobile phones is a major environmental problem and an inconvenience for users across the EU. Currently specific chargers are sold together with specific mobile phones. A user who wants to change his/her mobile phone must usually acquire a new charger and dispose the current one, even if this is in perfect condition. This unnecessarily generates important amounts of electronic waste... Harmonising mobile phone chargers will bring significant economic and environmental benefits... Consumers will not need to buy a new charger together with every mobile phone...

—?European Commission – FAQ[1]

History

In June 2009, many of the world's largest mobile phone manufacturers signed an EC-sponsored memorandum of understanding (MoU), agreeing to make most new data-enabled mobile phones marketed in the European Union compatible with a to-be-specified common EPS. All signatories agreed to develop a common specification for the EPS "to allow for full compatibility and safety of chargers and mobile phones." [1] 14 mobile phone manufacturers and technology providers signed the MoU – the original 10 signatories, Apple, LG, Motorola, NEC, Nokia, Qualcomm, RIM, Samsung, Sony Ericsson, and Texas Instruments as well as Atmel, Emblaze Mobile, Huawei Technologies and TCT Mobile (Alcatel). [2]

To develop and formalize the needed technical standards, the Commission issued a standardisation mandate to CEN, CENELEC and ETSI on a common "charging capability for mobile telephones." In response, CENELEC created a task force to develop the interoperability specifications of a common external power supply. In line with the Dresden agreement signed in 1996 by both CENELEC and the International Electrotechnical Commission (IEC), work was transferred into the IEC. The aim was to develop the IEC International Standard, IEC 62684:2011. [3]

The standard was published in December 2010 as EN 62684:2010 "Interoperability specifications of common EPS for use with data-enabled mobile telephones" by CENELEC and in January 2011 by the IEC as IEC 62684:2011 [4] (international publication was slightly delayed due to French translation).

The original Common EPS memorandum of understanding expired at the end of 2012. The Commission reported at the time that all of the fourteen MoU signatories, "have met their obligations under the MoU." [5] Eight of the original MoU signatories signed a 2013 Letter of Intent (LoI) to extend the 2009 MoU another year and, in 2014, five of those companies (Apple, Blackberry, Huawei, Samsung and Sony) again signed a second Letter of Intent, effectively extending the MoU through the end of 2014.

Technical specifications

Reference to USB battery-charging specification

The common EPS specification relies heavily on existing USB electro-mechanical standards – especially the USB Battery Charging Specification. By the mid-2000s, many mobile phone manufacturers (as well as manufacturers of other small battery-powered devices) had already begun designing their products with the ability to use a USB port's 5 V DC power to recharge batteries. The USB Implementers Forum, recognizing this trend, updated the USB standard in 2007 to better accommodate this popular battery-charging application of USB ports, primarily by defining "charging ports" which can provide more current allowing faster re-charging of batteries. [6] [7] In November 2010, the IEC signed an agreement with the USB Implementers Forum, which led to the IEC incorporating USB specifications into the IEC 62684:2011 International Standard.

In March 2011, the USB Implementers Forum agreed to allow CENELEC "... to make reference to USB technology in its European Standard EN 62684:2010 and ... to grant download access to USB technical specifications free of charge and at any time to manufacturers implementing this European [common EPS] Standard." [8]

Cabling, connectors and adapters

EU common external power supply components

EU common external power supply with captive cable

A common EPS must include a cable with a micro USB-B connector for connecting to a mobile phone. This cable can be either captive (permanently attached to the power supply) or detachable. If detachable, the cable must connect to the power supply via a standard USB type-A plug.[9]

The MoU which defines the common external power supply as well as the related EC standardisation mandate both allow for the use of the common external power supply also with phones not equipped with a micro-USB receptacle. "... [MoU] 4.2.1 ... if a manufacturer makes available an Adaptor from the Micro-USB connector of a Common EPS to a specific non-Micro-USB socket in the Mobile Phone, it shall constitute compliance to this article" and, "... An Adaptor can also be a detachable cable."[10][11]

The type of AC "plug" provided on a common EPS can vary depending on the intended market of use. "Per regulatory requirements for each market. ... preferred supplied input voltage range should be at least 90–264 V" (100–240 V $\pm$ 10%).[9]

Reception

The common EPS initiative was generally well received by the public, although at least one European consumer group bemoaned the voluntary nature and narrow scope of the initiative (as it applies only to mobile phones and only those that are "handheld" and "data-enabled") and the fact that the EU's EPS specification does not set aggressive energy efficiency no-load consumption requirements.[12][13]

Some observers, noting Apple's continued use of proprietary, non-micro USB charging ports on their smartphones, suggested Apple was not in compliance with the 2009 Common EPS Memorandum of Understanding. The European Commission however, confirmed that all MoU signatories, "have met their obligations under the MoU,"[5] stating specifically, "Concerning Apple's previous and present proprietary connectors and their compatibility with the agreement, the MoU allows for the use of an adaptor without prescribing the conditions for its provision"[14] and "The Commission does not have evidence that Apple has breached the [MoU] agreement. The iPhone 5 can be used with an adaptor allowing it to be connected to the common charger."[15]

Pending/future European legislation

In a 2013 amendment to a "Proposal for a Directive of the European Parliament ... relating to the making available on the market of radio equipment", the European Committee on the Internal Market and Consumer Protection included a recommendation for "... A renewed effort to develop a common charger ... [being] highly desirable and consequently ... beneficial in particular for consumers and other end-users." The parliamentary proposal applies to all radio equipment (any "product which intentionally emits or receives radio waves for communication") including mobile phones, tablet computers, car door openers, modems, etc.[16][17] Yet, the draft law, approved overwhelmingly by the European Parliament on 13 March 2014, stipulates that it will be up to the European Commission to decide which specific types of radio equipment will have to be compatible with common chargers.[18] Once formally approved by the Council of Ministers, member states will have two years to transpose the new regulations into national laws and manufacturers will have an additional year after that to comply.[19][20]

Similar regional and global industry initiatives for mobile phone charging

Other mobile phone power supply and charging standards have been implemented in other parts of the world (e.g., Korea and China). Proposals for a global/industry-wide mobile phone charging solution have also been promoted by the International Telecommunication Union (ITU) and by industry organizations GSMA and OMTP. The ITU and the GSMA/OMTP proposals are very similar to the European and Chinese charger standards although the GSMA/OMTP proposal is less flexible and has not been adopted by as many phone manufacturers as has the EU standard.

Charger and interface standard in South Korea

In March 2001, the Korean Telecommunications Technology Association (TTA) released a "Standard on I/O Connection Interface of Digital Cellular Phone".[21] This standard describes the electromechanical interface specifications for cellular phone charging, wired data communication, analog audio, etc. and was released together with related test and certification specifications.[22][23] The main feature of the standard is the specification of a 24-pin connector/socket for mobile phones to handle connections for power input (battery charging) and output, data communication (USB and other digital signals), analog audio inputs and outputs (for hands-free microphone, earphone) and other signals. The 2007 revision of the standard[24] specified a smaller 20-pin connector to succeed the 24-pin connector and added analog (composite) video output support, among other changes. Chargers with the new 20-pin connectors started appearing in 2008 and phone manufacturers were urged to include 24-to-20-pin adapters with new phones sold in Korea to enable the charging of new phones with the older 24-pin chargers.[25]

Charger and interface standard in China

In December 2006, the Chinese Ministry of Industry and Information Technology (MII) released a new China Communications Standards Association (CCSA) standard, "Technical Requirements and Test Method of Charger and Interface for Mobile Telecommunication Terminal Equipment".[26] This standard describes the electromechanical requirements for a common mobile device battery charger equipped with a USB type-A socket providing power at 5 V DC. All new mobile phones requesting network access approval in China from June 2007 are required to support charging from the new common chargers. The original 2006 regulation is flexible regarding the interface on the mobile phone itself, allowing for the use of adapter cables if the mobile device is not equipped with a standard USB connector.[27] Among other things, the 2009 update adds references to USB On-The-Go (OTG) support and the use of USB micro-B, micro-AB, mini-B; and Mini-10-pin and cylindrical ("barrel") type connectors on the terminal (phone) for charging.[28]

GSMA universal charging solution (UCS) and OMTP common charging solution (CCS)

OMTP's common charging solution (CCS) components

In February 2009, the GSM Association (GSMA), together with six mobile phone manufacturers and technology providers, and eleven mobile service providers, announced their commitment to implementing a cross-industry standard for a common/universal charging solution for new mobile phones and chargers. The aim of the GSMA initiative is "...to ensure that the mobile industry adopts a common format for mobile phone charger connections and energy-efficient charger...". Universal charging solution (UCS) chargers are required to use micro-USB as the common universal charging interface and have a four-star or higher efficiency rating (standby energy use ≤ 0.15 W).[29]

The Open Mobile Terminal Platform industry forum (OMTP) specified the requirements of the GSMA's Universal Charging Solution and published these requirements under the title "Common Charging and Local Data Connectivity" in 2009. This document specifies the three components of a common charging solution (CCS): a charging and local data connector (CLD) on the "terminal" (e.g., a mobile phone) consisting of a micro-B or micro-AB receptacle; a common power supply (CPS) with a type-A receptacle; and a detachable type-A to micro-B cable to connect the power supply with the mobile phone.[30] As of early 2011, an additional 10 service providers and one additional mobile phone manufacturer have joined the agreement.[31]

In April 2009, the industry trade group The Wireless Association (CTIA) announced its support of the GSMA's Universal Charging Solution.[32]

ITU Universal power adapter and charger solution

The International Telecommunication Union (ITU, the UN specialized agency in the field of telecommunications, information and communication technologies) announced in October 2009 that it had also embraced the universal charging solution standard—based on input from the GSMA—as its "energy-efficient one-charger-fits-all new mobile phone solution." [33] The ITU published Recommendation ITU-T L.1000, specifying a charger similar in most respects to that of the GSMA/OMTP proposal and of the Chinese charger and the EU's common EPS. The ITU specifies that the OMTP's more aggressive "preferred" no load consumption requirement be mandatory after a three-year "transition period" but is more flexible in allowing the use of captive cables and USB micro-B adapters in its "target solution" — similar to the European common EPS standard. The ITU recommendation was expanded and updated in June 2011.[34]

Other higher power charging standards for mobile devices

USB Power Delivery and Type-C specification

In 2012, the USB Power Delivery (PD) specification was released. Power Delivery provides the ability for 5 V devices to draw more than 7.5 W of power (the limit specified by USB Battery Charging) from USB PD-aware ports when using PD-aware USB cables. The specification also allows PD ports to provide even greater power at higher voltages over PD-aware cables; up to 36 W at 12 V and 60 W at 20 V (for micro-USB connectors) and up to 60 W at 12 V and 100 W at 20 V (for type-A/B connectors).[35]

In August, 2014, the USB 3.0 Promoter Group announced the completion of the USB Type-C connector and cable

specification. Type-C cables and connectors are reversible and are electrically backward compatible, but not physically backward compatible, with previous USB plugs and receptacles. New-to-existing cables and adapters have been defined. Some USB Type-C cables and connectors can support "USB performance at SuperSpeed USB 10 Gbps (USB 3.1) and USB Power Delivery up to 100W"[36][37][38] although USB Type-C cables are only required to support USB 2.0 (non-SuperSpeed) data rates and 3 A (60 W at 20 V) of current.[39] Such minimum-specification USB Type-C cables are sometimes referred to as "charge" cables because, for most mobile device battery charging applications, 60 W is more than sufficient and a higher data transfer speed is less important than minimizing cable cost and maximizing cable length.

IEC 63002:2016, identification and communication interoperability method for external power supplies used with portable computing devices

Main article: IEC 63002:2016

IEC 63002:2016 defines interoperability guidelines for external power supplies used with portable computing devices that implement IEC 62680-1-2: Universal Serial Bus Power Delivery Specification with the IEC 62680-1-3: Universal Serial Bus Interfaces for data and power-Common Components-Type-CTM Type-C Cable and Connector Specification. It was published in October 2016.

IEEE P1823, universal power adapter for mobile devices (UPAMD)

Main article: Universal Power Adapter for Mobile Devices

IEEE P1823 is a proposed global standard for a universal power adapter for mobile devices (UPAMD) that require between 10 W and 240 W. E.g., Laptops, larger tablets and other mobile devices that can require much more power than the (non-Power Delivery) USB battery charging specification limit of 7.5 W at 5 V.[40]

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