IEC 62680-1-1

Edition 1.0 2015-09

INTERNATIONAL STANDARD

colour inside

Universal serial bus interfaces for data and power – Part 1-1: Common components – USB Battery Charging Specification, Revision 1.2

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.220; 33.120; 35.200

ISBN 978-2-8322-2844-9

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UNIVERSAL SERIAL BUS INTERFACES FOR DATA AND POWER –

Part 1-1: Common components – USB Battery Charging Specification, Revision 1.2

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The text of this standard is based on the following documents:

CDV	Report on voting
100/2330/CDV	100/2433/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

A list of all the parts in the IEC 62680 series, published under the general title *Universal serial bus interfaces for data and power* can be found on the IEC website.

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The IEC 62680 series is based on a series of specifications that were originally developed by the USB Implementers Forum (USB-IF). These specifications were submitted to the IEC under the auspices of a special agreement between the IEC and the USB-IF.

The USB Implementers Forum, Inc.(USB-IF) is a non-profit corporation founded by the group of companies that developed the Universal Serial Bus specification. The USB-IF was formed to provide a support organization and forum for the advancement and adoption of Universal Serial Bus technology. The Forum facilitates the development of high-quality compatible USB peripherals (devices), and promotes the benefits of USB and the quality of products that have passed compliance testing.

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This series covers the Universal Series Bus interfaces for data and power and consists of the following parts:

IEC 62680-1-1, *Universal Serial Bus interfaces for data and power – Part 1-1: Common components – USB Battery Charging Specification, Revision 1.2*

IEC 62680-2-1, *Universal Serial Bus interfaces for data and power – Part 2-1: Universal Serial Bus Specification, Revision 2.0*

IEC 62680-2-2, *Universal Serial Bus interfaces for data and power – Part 2-2: USB Micro-USB Cables and Connectors Specification, Revision 1.01*

IEC 62680-2-3, *Universal Serial Bus interfaces for data and power – Part 2-3: Universal Serial Bus Cables and Connectors Class Document Revision 2.0*

This part of the IEC 62680 series consists of several distinct parts:

- the main body of the text, which consists of the original specification and all ECN and Errata developed by the USB-IF.

CONTENTS

FOREWORD 2
INTRODUCTION 4
1 Introduction 13
1.1 Scope 13
1.2 Background 13
1.3 Reference Documents 13
1.4 Definitions of Terms 14
1.4.1 Accessory Charger Adaptor 14
1.4.2 ACA-Dock 14
1.4.3 Attach versus Connect 14
1.4.4 Charging Downstream Port 14
1.4.5 Charging Port 14
1.4.6 Dead Battery Threshold 14
1.4.7 Dedicated Charging Port 15
1.4.8 Downstream Port 15
1.4.9 Micro ACA 15
1.4.10 Portable Device 15
1.4.11 Rated Current 15
1.4.12 Standard ACA 15
1.4.13 Standard Downstream Port 15
1.4.14 USB Charger 15
1.4.15 Weak Battery Threshold 15
1.5 Parameter Values 16
1.6 OTG Considerations 16
1.7 Super Speed Considerations 16
2 Dead Battery Provision 16
2.1 Background 16
2.2 DBP – Unconfigured Clause 16
2.3 DBP – Configured Clause 17
3 Charging Port Detection 18
3.1 Overview 18
3.2 Charger Detection Hardware 19
3.2.1 Overview 19
3.2.2 VBUS Detect 20
3.2.3 Data Contact Detect 20
3.2.4 Primary Detection 23
3.2.5 Secondary Detection 30
3.2.6 ACA Detection 32
3.3 Charger Detection Algorithms 34
3.3.1 Weak Battery Algorithm 34
3.3.2 Good Battery Algorithm 35
3.4 Charger Detection Timing 36
3.4.1 Data Contact Detect Timing 36
3.4.2 Detection Timing, CDP 38
3.5 Ground Current and Noise Margins 40
4 Charging Port and Portable Device Requirements 40

4.1 Charging Port Requirements 40
4.1.1 Overshoot 40
4.1.2 Maximum Current 40
4.1.3 Detection Renegotiation 40
4.1.4 Shutdown Operation 41
4.1.5 Failure Voltage 41
4.1.6 Multiple Ports 41
4.2 Charging Downstream Port 41
4.2.1 Required Operating Range 41
4.2.2 Shutdown Operation 42
4.2.3 Undershoot 42
4.2.4 Detection Signaling 42
4.2.5 Connector 43
4.3 ACA-Dock 43
4.3.1 Required Operating Range 43
4.3.2 Undershoot 43
4.3.3 Detection Signaling 43
4.3.4 Connector 43
4.4 Dedicated Charging Port 43
4.4.1 Required Operating Range 43
4.4.2 Undershoot 44
4.4.3 Detection Signaling 44
4.4.4 Connector 44
4.5 Accessory Charger Adapter 45
4.5.1 Required Operating Range 45
4.5.2 Undershoot 45
4.5.3 Detection Signaling 45
4.5.4 Connector 45
4.6 Portable Device 45
4.6.1 Allowed Operating Range 45
4.6.2 Detection Signaling 46
4.6.3 Detection Renegotiation 46
4.6.4 Connector 47
5 Parameter Values 47
6 Accessory Charger Adapter 50
6.1 Introduction 50
6.2 Micro ACA 52
6.2.1 Micro ACA Ports 52
6.2.2 Micro ACA Connectivity Options 53
6.2.3 Micro ACA Architecture 53
6.2.4 Micro ACA Modes of Operation 54
6.2.5 Implications of not Supporting Micro ACA Detection 56
6.2.6 Micro ACA Requirements 56
6.2.7 Portable Device State Diagram 57
6.3 Standard ACA 59
6.3.1 Standard ACA Ports 59
6.3.2 Standard ACA Architecture 60
6.3.3 Standard ACA Modes of Operation 62
6.3.4 Implications of not Supporting Standard ACA Detection 62

6.3.5 Standard ACA Requirements 62

Figure 3-1 – System Overview 18
Figure 3-2 – Charger Detection Hardware 19
Figure 3-3 – Data Pin Offset 20
Figure 3-4 – Data Contact Detect, Not Attached 21
Figure 3-5 – Data Contact Detect, Standard Downstream Port 22
Figure 3-6 – Primary Detection, DCP 23
Figure 3-7 – Primary Detection, CDP 25
Figure 3-8 – Primary Detection, SDP 26
Figure 3-9 – Primary Detection, ACA-Dock 27
Figure 3-10 – Primary Detection, ACA 29
Figure 3-11 – Secondary Detection, DCP 30
Figure 3-12 – Secondary Detection, CDP 31
Figure 3-13 – ACA Detection 33
Figure 3-14 – Weak Battery Algorithm 34
Figure 3-15 – Good Battery Algorithm 35
Figure 3-16 – DCD Timing, Contact After Start 37
Figure 3-17 – DCD Timing, Contact Before Start 37
Figure 3-18 – DCD Timing, No Contact 38
Figure 3-19 – Detection Timing, CDP 39
Figure 4-1 – CDP Required Operating Range 42
Figure 4-2 – DCP Required Operating Range 44
Figure 4-3 – Portable Device Allowed Operating Range 46
Figure 6-1 – Accessory Charger Adapter 51
Figure 6-2 – Micro ACA Ports 52
Figure 6-3 – Micro ACA Architecture 54
Figure 6-4 – Portable Device State Diagram 58
Figure 6-5 – Standard ACA Ports 59
Figure 6-6 – Standard ACA Architecture 61

Table 5-1 – Voltages 47
Table 5-2 – Currents 48
Table 5-3 – Resistances 49
Table 5-4 – Capacitances 49
Table 5-5 – Times 50
Table 6-1 – Micro ACA Connectivity Options 53
Table 6-2 – Micro ACA Modes of Operation 55
Table 6-3 – Standard ACA Connectivity Options 60
Table 6-4 – Standard ACA Modes of Operation 62

Battery Charging Specification (Including errata and ECNs through March 15, 2012)

Revision 1.2
March 15, 2012

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Revision History

Revision	Date	Author	Description
BC1.0	Mar 8, 2007	Terry Remple	First release
BC1.1	April 15, 2009	Terry Remple	Major updates to all sections. Added Data Contact Detect protocol, and Accessory Charger Adapter.
BC1.2	Oct 5, 2010	Terry Remple Adam Burns	Following items indicate changes from BC1.1 to BC1.2. References below to Section, Figures and Tables refer to BC1.2, unless BC1.1 is specifically indicated. 1. Allow DCPs to output more than 1.5A. Allows Portable Devices (PDs) with switch mode chargers to draw more power. Section 4.4.1. 2. Increase minimum CDP current to 1.5A. Without change, PDs had to draw less than 500mA, to avoid CDP shutdown. Table 5-2. 3. Indicate that ICDP max and IDCP max limits of 5A come from USB 2.0, and are safety limits. Table 5-2 note 1. 4. Allow PDs to draw up to 1.5A during HS chirp and traffic. Remove previous limits of 560mA and 900mA which was based on HS common mode ranges. Section 3.5. 5. Require CDPs to support 1.5A during HS chirp and traffic. Affects CDP common mode range. Section 3.5. 6. Reduce maximum PD current from 1.8A to 1.5A, to avoid shutdown when attached to CDP. Table 5-2. 7. Rename Docking Station to ACA-Dock, to avoid confusion with other types of Docking Stations. 8. Require ACA-Dock to differentiate itself from an ACA, by enabling VDM_SRC during no activity. Section 3.2.4.4. 9. Allow CDP to leave VDM_SRC enabled while peripheral not connected. Section 3.2.4.2. 10. Remove ICHG_SHTDWN. This was a recommended max output current for Charging Ports with VBUS grounded. BC1.1 Section 4.1. 11. Require VDP_SRC to not pull D+ below 2.2V when D+ is being pulled to VDP_UP through RDP_UP. Require VDM_SRC to not pull D- below 2.2V when D- is being pulled high. Required for ACA-Dock support. Table 5-1 notes 1 and 2. 12. Make DCD current source optional for PDs. Section 3.2.3. 13. Make DCD timeout required for PDs. Section 3.2.3. 14. Make Secondary Detection optional for PDs. Section 4.6.2. 15. Make Good Battery Algorithm required behavior for PDs. Section 3.2.4. 16. Remove resistive detection. BC1.1 Section 3.9. 17. Change PD Required Operating Range to include 4.5V at 500mA. Figure 4-3. 18. Allow any downstream port to act as a DCP. Section 4.1.3. 19. Require PDs to enable VDP_SRC or RDP_PU when charging from a DCP. Section 3.3.2.

Revision	Date	Author	Description
			20. Allow chargers to renegotiate current with PD by dropping and reasserting VBUS. Section 4.1.3. 21. Require PDs to discharge their own VBUS input after VBUS drops to support charger port renegotiation request. Section 4.6.3. 22. Allow PDs to disconnect and repeat Charger Detection multiple times while attached, with specified timing. Section 4.6.3. 23. Reduce DCP input impedance between D+, D- to VBUS and ground from 1MΩ to 300kΩ. Section 4.4.3. 24. Require CDPs to recover after over-current condition. Section 4.2.2. 25. Allow greater DCP undershoot for large load current steps, to enable low quiescent current chargers required by Europe. Section 4.4.2. 26. Define ACAs and ACA-Docks as types of Charging Ports. Section 1.4.5. 27. Use session valid voltage range defined in EH and OTG Supplement rev 2.0. Section 3.2.2. 28. Only devices that can operate stand-alone from internal battery power are allowed to use the Dead Battery Provision. Section 2.2. 29. Allow compound PDs to draw ISUSP plus an responsible for protecting themselves against higher voltages on VBUS. BC1.1 Section 6.7. 45. Require ACAs to continue providing power to OTG device from Charging Port, even if ground offsets or USB reset cause D- to go below VDAT_REF. Section 6.2.6. 46. Change charger shutdown recovery time (TSHTDWN_REC) from 2 seconds to 2 minutes. Table 5-5. 47. Indicate that ACA-Dock is required to pull D+ to VDP_UP with RDP_UP when VBUS is asserted. Section 3.2.4.4. 48. Remove statements regarding devices with multiple receptacles. Covered in Multiple Receptacle white paper at http://www.usb.org/developers/docs/. 49. Improve readability by adding and updating drawings, re-structuring sections, and clarifying text.
BC 1.2 plus errata	Oct 12, 2011	Pat Crowe	Includes errata changes from Oct 12, 2011
BC 1.2 plus further errata	Mar 15, 2012	Pat Crowe	Includes errata changes from Mar 15, 2012: 1. Corrections to Micro ACA specification.

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

UNIVERSAL SERIAL BUS INTERFACES FOR DATA AND POWER –

Part 1-1: Common components – USB Battery Charging Specification, Revision 1.2

1 Introduction

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.

If a PD has a Dead or Weak Battery, then the Connect Timing Engineering Change Notice (ECN) issued by the USB-IF on the USB 2.0 spec allows that device to draw up to I_{UNIT} while attached but not connected. The conditions associated with this ECN are contained in Section 2 of this specification, and are referred to as the Dead Battery Provision (DBP).

1.3 Reference Documents

The following specifications contain information relevant to the Battery Charging Specification.

- OTG and Embedded Host Supplement, Revision 2.0
- USB 2.0 Specification
- USB 3.0 Specification