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Universal serial bus interfaces for data and power - Part 1-2: Common components - USB Power Delivery specification

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English Version

**Universal serial bus interfaces for data and power - Part 1-2:
Common components - USB Power Delivery specification
(IEC 62680-1-2:2016)**

Interfaces bus série universel (USB) pour les données et
l'alimentation électrique - Partie 1-2 : Composants
communs - Spécification USB pour la fourniture de courant
(IEC 62680-1-2:2016)

Schnittstellen des Universellen Seriellen Busses für Daten
und Energie - Teil 1-2: Gemeinsame Komponenten - USB
Stromversorgungs-Spezifikation
(IEC 62680-1-2:2016)

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The text of document 100/2728/CDV, future edition 1 of IEC 62680-1-2, prepared by IEC/TC 100 “Audio, video and multimedia systems and equipment” was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62680-1-2:2017.

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Edition 1.0 2016-11

INTERNATIONAL STANDARD



**Universal serial bus interfaces for data and power –
Part 1-2: Common components – USB Power Delivery specification**



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Part 1-2: Common components – USB Power Delivery specification**

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The text of this standard was prepared by the USB Implementers Forum (USB-IF). The structure and editorial rules used in this publication reflect the practice of the organization which submitted it.

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

CDV	Report on voting
100/2728/CDV	100/2729/RVC

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

A list of all 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.

This standard is the USB-IF publication USB Power Delivery Specification Revision 3.0 V.1.0.

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Universal Serial Bus Power Delivery Specification

Revision 3.0, V1.0. 11 December 2015

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Table of Contents

FOREWORD.....	2
INTRODUCTION.....	4
Contributors.....	6
Revision History.....	12
Table of Contents	13
List of Tables	18
List of Figures.....	22
1 Introduction	29
1.1 Overview	29
1.2 Purpose	30
1.3 Scope	30
1.4 Conventions.....	31
1.4.1 Precedence	31
1.4.2 Keywords	31
1.4.3 Numbering.....	32
1.5 Related Documents.....	32
1.6 Terms and Abbreviations	33
1.7 Parameter Values	39
2 Overview	39
2.1 Introduction.....	39
2.2 Section Overview.....	40
2.3 USB Power Delivery Capable Devices	41
2.4 SOP* Communication	42
2.4.1 Introduction	42
2.4.2 SOP* Collision Avoidance.....	42
2.4.3 SOP Communication	43
2.4.4 SOP*/SOP'' Communication with Cable Plugs.....	43
2.5 Operational Overview	44
2.5.1 Source Operation	44
2.5.2 Sink Operation.....	46
2.5.3 Cable Plugs.....	48
2.6 Architectural Overview	49
2.6.1 Policy	51
2.6.2 Message Formation and Transmission.....	52
2.6.3 Collision Avoidance	52
2.6.4 Power supply.....	53
2.6.5 DFP/UFP	53
2.6.6 VCONN Source	54
2.6.7 Cable and Connectors	54
2.6.8 Interactions between Non-PD, BC and PD devices	54
2.6.9 Power Rules	54
3 USB Type-A and USB Type-B Cable Assemblies and Connectors	54
4 Electrical Requirements.....	54
4.1 Interoperability with other USB Specifications	54
4.2 Dead Battery Detection / Unpowered Port Detection	55
4.3 Cable IR Ground Drop (IR Drop)	55

4.4	Cable Type Detection	55
5	Physical Layer	55
5.1	Physical Layer Overview	55
5.2	Physical Layer Functions	56
5.3	Symbol Encoding	56
5.4	Ordered Sets	57
5.5	Transmitted Bit Ordering	59
5.6	Packet Format	59
5.6.1	Packet Framing	60
5.6.2	CRC	62
5.6.3	Packet Detection Errors	64
5.6.4	Hard Reset	65
5.6.5	Cable Reset	65
5.7	Collision Avoidance	66
5.8	Biphase Mark Coding (BMC) Signaling Scheme	67
5.8.1	Encoding and signaling	67
5.8.2	Transmit and Receive Masks	71
5.8.3	Transmitter Load Model	78
5.8.4	BMC Common specifications	79
5.8.5	BMC Transmitter Specifications	80
5.8.6	BMC Receiver Specifications	84
5.9	Built in Self-Test (BIST)	86
5.9.1	BIST Carrier Mode	86
5.9.2	BIST Test Data	86
6	Protocol Layer	87
6.1	Overview	87
6.2	Messages	87
6.2.1	Message Construction	88
6.3	Control Message	94
6.3.1	GoodCRC Message	95
6.3.2	GotoMin Message	96
6.3.3	Accept Message	96
6.3.4	Reject Message	96
6.3.5	Ping Message	97
6.3.6	PS_RDY Message	97
6.3.7	Get_Source_Cap Message	97
6.3.8	Get_Sink_Cap Message	97
6.3.9	DR_Swap Message	97
6.3.10	PR_Swap Message	98
6.3.11	VCONN_Swap Message	99
6.3.12	Wait Message	99
6.3.13	Soft Reset Message	100
6.3.14	Not_Supported Message	100
6.3.15	Get_Source_Cap_Extended Message	101
6.3.16	Get_Source_Status Message	101
6.3.17	FR_Swap Message	101
6.4	Data Message	102
6.4.1	Capabilities Message	102
6.4.2	Request Message	112

6.4.3	BIST Message	116
6.4.4	Vendor Defined Message	117
6.4.5	Battery_Status Message	141
6.4.6	Source_Alert Message	142
6.5	Extended Message	144
6.5.1	Source_Capabilities_Extended Message	144
6.5.2	Source_Status Message	148
6.5.3	Get_Battery_Cap Message	150
6.5.4	Get_Battery_Status Message	150
6.5.5	Battery_Capabilities Message	151
6.5.6	Get_Manufacturer_Info Message	152
6.5.7	Manufacturer_Info Message	152
6.5.8	Security Messages	153
6.6	Timers	154
6.6.1	CRCReceiveTimer	154
6.6.2	SenderResponseTimer	154
6.6.3	Capability Timers	155
6.6.4	SinkRequestTimer	155
6.6.5	Power Supply Timers	156
6.6.6	NoResponseTimer	157
6.6.7	BIST Timers	158
6.6.8	Power Role Swap Timers	158
6.6.9	Hard Reset Timers	159
6.6.10	Structured VDM Timers	159
6.6.11	VCONN Timers	161
6.6.12	tCableMessage	161
6.6.13	DiscoverIdentityTimer	161
6.6.14	Collision Avoidance Timers	161
6.6.15	tFRSwapInit	162
6.6.16	Time Values and Timers	162
6.7	Counters	164
6.7.1	MessageID Counter	164
6.7.2	Retry Counter	165
6.7.3	Hard Reset Counter	165
6.7.4	Capabilities Counter	165
6.7.5	Discover Identity Counter	166
6.7.6	VDMBusyCounter	166
6.7.7	Counter Values and Counters	166
6.8	Reset	166
6.8.1	Soft Reset and Protocol Error	166
6.8.2	Hard Reset	167
6.8.3	Cable Reset	168
6.9	Collision Avoidance	168
6.10	Message Discarding	169
6.11	State behavior	169
6.11.1	Introduction to state diagrams used in Chapter 6	169
6.11.2	State Operation	170
6.11.3	List of Protocol Layer States	181
6.12	Message Applicability	182

6.12.1	Applicability of Control Messages	183
6.12.2	Applicability of Data Messages	185
6.12.3	Applicability of Extended Messages	185
6.12.4	Applicability of VDM Commands	186
6.12.5	Applicability of Reset Signaling	187
6.12.6	Applicability of Fast Role Swap signal	187
6.13	Value Parameters	188
7	Power Supply	188
7.1	Source Requirements	188
7.1.1	Behavioral Aspects	188
7.1.2	Source Bulk Capacitance	188
7.1.3	Types of Sources	189
7.1.4	Positive Voltage Transitions	189
7.1.5	Negative Voltage Transitions	190
7.1.6	Response to Hard Resets	191
7.1.7	Changing the Output Power Capability	192
7.1.8	Robust Source Operation	192
7.1.9	Output Voltage Tolerance and Range	193
7.1.10	Charging and Discharging the Bulk Capacitance on V_{BUS}	194
7.1.11	Swap Standby for Sources	194
7.1.12	Source Peak Current Operation	195
7.1.13	Source Capabilities Extended Parameters	195
7.1.14	Fast Role Swap	197
7.2	Sink Requirements	198
7.2.1	Behavioral Aspects	198
7.2.2	Sink Bulk Capacitance	198
7.2.3	Sink Standby	199
7.2.4	Suspend Power Consumption	199
7.2.5	Zero Negotiated Current	199
7.2.6	Transient Load Behavior	199
7.2.7	Swap Standby for Sinks	200
7.2.8	Sink Peak Current Operation	200
7.2.9	Robust Sink Operation	200
7.2.10	Fast Role Swap	201
7.3	Transitions	202
7.3.1	Increasing the Current	203
7.3.2	Increasing the Voltage	204
7.3.3	Increasing the Voltage and Current	206
7.3.4	Increasing the Voltage and Decreasing the Current	208
7.3.5	Decreasing the Voltage and Increasing the Current	210
7.3.6	Decreasing the Current	212
7.3.7	Decreasing the Voltage	214
7.3.8	Decreasing the Voltage and the Current	216
7.3.9	Sink Requested Power Role Swap	218
7.3.10	Source Requested Power Role Swap	221
7.3.11	GotoMin Current Decrease	223
7.3.12	Source Initiated Hard Reset	224
7.3.13	Sink Initiated Hard Reset	225
7.3.14	No change in Current or Voltage	226

7.3.15	Fast Role Swap	227
7.4	Electrical Parameters.....	229
7.4.1	Source Electrical Parameters.....	229
7.4.2	Sink Electrical Parameters.....	231
7.4.3	Common Electrical Parameters.....	233
8	Device Policy.....	233
8.1	Overview	233
8.2	Device Policy Manager	233
8.2.1	Capabilities	234
8.2.2	System Policy.....	235
8.2.3	Control of Source/Sink.....	235
8.2.4	Cable Detection	235
8.2.5	Managing Power Requirements	236
8.2.6	Use of “Externally Powered” bit with Batteries and AC supplies	238
8.2.7	Interface to the Policy Engine	239
8.3	Policy Engine.....	240
8.3.1	Introduction	240
8.3.2	Atomic Message Sequence Diagrams.....	240
8.3.3	State Diagrams.....	341
9	States and Status Reporting	418
9.1	Overview	418
9.1.1	PDUSB Device and Hub Requirements.....	420
9.1.2	Mapping to USB Device States	420
9.1.3	PD Software Stack.....	423
9.1.4	PDUSB Device Enumeration.....	423
9.2	PD Class Specific Descriptors.....	424
9.2.1	USB Power Delivery Capability Descriptor	425
9.2.2	Battery Info Capability Descriptor	427
9.2.3	PD Consumer Port Capability Descriptor	427
9.2.4	PD Provider Port Capability Descriptor	428
9.3	PD Class Specific Requests and Events	429
9.3.1	Class-specific Requests	429
9.4	PDUSB Hub and PDUSB Peripheral Device Requests	430
9.4.1	GetBatteryStatus	430
9.4.2	SetPDFeature.....	432
10	Power Rules	433
10.1	Introduction.....	433
10.2	Source Power Rules	433
10.2.1	Source Power Rule Considerations.....	433
10.2.2	Normative Voltages and Currents	434
10.2.3	Optional Voltages/Currents.....	437
10.2.4	Power sharing between ports.....	437
10.3	Sink Power Rules.....	437
10.3.1	Sink Power Rule Considerations	437
10.3.2	Normative Sink Rules	437
A.	CRC calculation.....	438
A.1	C code example	438
A.2	Table showing the full calculation over one Message	439

B	PD Message Sequence Examples	439
B.1	External power is supplied downstream	440
B.2	External power is supplied upstream	443
B.3	Giving back power	448
C.	VDM Command Examples	456
C.1	Discover Identity Example	456
C.1.1	Discover Identity Command request	456
C.1.2	Discover Identity Command response – Active Cable	457
C.1.3	Discover Identity Command response – Hub	459
C.2	Discover SVIDs Example	460
C.2.1	Discover SVIDs Command request	460
C.2.2	Discover SVIDs Command response	460
C.3	Discover Modes Example	461
C.3.1	Discover Modes Command request	461
C.3.2	Discover Modes Command response	462
C.4	Enter Mode Example	463
C.4.1	Enter Mode Command request	463
C.4.2	Enter Mode Command response	464
C.4.3	Enter Mode Command request with additional VDO	465
C.5	Exit Mode Example	466
C.5.1	Exit Mode Command request	466
C.5.2	Exit Mode Command response	467
C.6	Attention Example	468
C.6.1	Attention Command request	468
C.6.2	Attention Command request with additional VDO	469

List of Tables

Table 1-1 – Terms and Abbreviations	33
Table 5-1 – 4b5b Symbol Encoding Table	57
Table 5-2 – Ordered Sets	58
Table 5-3 – Validation of Ordered Sets	58
Table 5-4 – Data Size	59
Table 5-5 – SOP ordered set	60
Table 5-6 – SOP' ordered set	61
Table 5-7 – SOP'' ordered set	61
Table 5-8 – SOP'_Debug ordered set	62
Table 5-9 – SOP''_Debug ordered set	62
Table 5-10 – CRC-32 Mapping	64
Table 5-11 – Hard Reset ordered set	65
Table 5-12 – Cable Reset ordered set	66
Table 5-13 – Rp values used for Collision Avoidance	67
Table 5-14 – BMC Tx Mask Definition, X Values	73
Table 5-15 – BMC Tx Mask Definition, Y Values	73
Table 5-16 – BMC Rx Mask Definition	78

Table 5-17 – BMC Common Normative Requirements.....	80
Table 5-18 – BMC Transmitter Normative Requirements.....	81
Table 5-19 – BMC Receiver Normative Requirements.....	84
Table 6-1 – Message Header.....	89
Table 6-2 – Revision Interoperability.....	91
Table 6-3 – Extended Message Header	92
Table 6-4 – Control Message Types.....	95
Table 6-5 – Data Message Types.....	102
Table 6-6 – Power Data Object	103
Table 6-7 – Fixed Supply PDO – Source.....	106
Table 6-8 – Fixed Power Source Peak Current Capability	108
Table 6-9 – Variable Supply (non-Battery) PDO – Source	108
Table 6-10 – Battery Supply PDO – Source	109
Table 6-11 – Fixed Supply PDO – Sink	110
Table 6-12 – Variable Supply (non-Battery) PDO – Sink	111
Table 6-13 – Battery Supply PDO – Sink.....	111
Table 6-14 –Fixed and Variable Request Data Object.....	112
Table 6-15 – Fixed and Variable Request Data Object with GiveBack Support.....	112
Table 6-16 – Battery Request Data Object.....	113
Table 6-17 – Battery Request Data Object with GiveBack Support.....	113
Table 6-18 – BIST Data Object	117
Table 6-19 – Unstructured VDM Header.....	119
Table 6-20 – Structured VDM Header	120
Table 6-21 – Structured VDM Commands	120
Table 6-22 – SVID Values.....	121
Table 6-23 – Commands and Responses	123
Table 6-24 – ID Header VDO	124
Table 6-25 – Product Types (UFP).....	125
Table 6-26 – Product Types (Cable Plug).....	125
Table 6-27 – Product Types (DFP).....	126
Table 6-28 – Cert Stat VDO	126
Table 6-29 – Product VDO	126
Table 6-30 – Passive Cable VDO.....	127
Table 6-31 – Active Cable VDO	129
Table 6-32 – AMA VDO.....	131
Table 6-33 – Discover SVIDs Responder VDO	132
Table 6-34 – Battery Status Data Object (BSDO)	141
Table 6-35 – Source Alert Data Object.....	142
Table 6-36 – Extended Message Types	144
Table 6-37 – Source Capabilities Extended Data Block (SCEDB).....	145
Table 6-38 – Source Status Data Block (SSDB)	149
Table 6-39 – Get Battery Cap Data Block (GBCDB)	150
Table 6-40 – Get Battery Status Data Block (GBSDB).....	150

Table 6-41 – Battery Capability Data Block (BCDB)	151
Table 6-42 – Get Serial Number Data Block (GSNDB)	152
Table 6-43 – Manufacturer Info Data Block (MIDB)	153
Table 6-44 – Time Values	163
Table 6-45 – Timers	164
Table 6-46 – Counter parameters	166
Table 6-47 – Counters	166
Table 6-48 – Message discarding	169
Table 6-49 – Protocol Layer States	182
Table 6-50 – Applicability of Control Messages	184
Table 6-51 – Applicability of Data Messages	185
Table 6-52 – Applicability of Extended Messages	186
Table 6-53 – Applicability of VDM Commands	187
Table 6-54 – Applicability of Reset Signaling	187
Table 6-55 – Applicability of Fast Role Swap signal	188
Table 6-56 – Value Parameters	188
Table 7-1 – Sequence Description for Increasing the Current	204
Table 7-2 – Sequence Description for Increasing the Voltage	206
Table 7-3 – Sequence Diagram for Increasing the Voltage and Current	208
Table 7-4 – Sequence Description for Increasing the Voltage and Decreasing the Current	210
Table 7-5 – Sequence Description for Decreasing the Voltage and Increasing the Current	212
Table 7-6 – Sequence Description for Decreasing the Current	214
Table 7-7 – Sequence Description for Decreasing the Voltage	216
Table 7-8 – Sequence Description for Decreasing the Voltage and the Current	218
Table 7-9 – Sequence Description for a Sink Requested Power Role Swap	220
Table 7-10 – Sequence Description for a Source Requested Power Role Swap	222
Table 7-11 – Sequence Description for a GotoMin Current Decrease	224
Table 7-12 – Sequence Description for a Source Initiated Hard Reset	225
Table 7-13 – Sequence Description for a Sink Initiated Hard Reset	226
Table 7-14 – Sequence Description for no change in Current or Voltage	227
Table 7-15 – Sequence Description for Fast Role Swap	229
Table 7-16 – Source Electrical Parameters	230
Table 7-17 – Sink Electrical Parameters	232
Table 7-18 – Common Source/Sink Electrical Parameters	233
Table 8-1 – Basic Message Flow	242
Table 8-2 – Potential issues in Basic Message Flow	243
Table 8-3 – Basic Message Flow with CRC failure	245
Table 8-4 – Interruptible and Non-interruptible AMS	246
Table 8-5 – Steps for a successful Power Negotiation	248
Table 8-6 – Steps for a GotoMin Negotiation	251
Table 8-7 – Steps for a Soft Reset	253
Table 8-8 – Steps for Source initiated Hard Reset	255

Table 8-9 – Steps for Sink initiated Hard Reset.....	258
Table 8-10 – Steps for Source initiated Hard Reset – Sink long reset.....	261
Table 8-11 – Steps for a Successful Source Initiated Power Role Swap Sequence	264
Table 8-12 – Steps for a Successful Sink Initiated Power Role Swap Sequence	268
Table 8-13 – Steps for a Successful Fast Role Swap Sequence.....	272
Table 8-14 – Steps for Data Role Swap, UFP operating as Sink initiates	276
Table 8-15 – Steps for Data Role Swap, UFP operating as Source initiates	278
Table 8-16 – Steps for Data Role Swap, DFP operating as Source initiates	280
Table 8-17 – Steps for Data Role Swap, DFP operating as Sink initiates	282
Table 8-18 – Steps for Source to Sink VCONN Source Swap.....	284
Table 8-19 – Steps for Sink to Source VCONN Source Swap.....	287
Table 8-20 – Steps for Source Alert to Sink	289
Table 8-21 – Steps for a Sink getting Source status Sequence	291
Table 8-22 – Steps for a Sink getting Source capabilities Sequence	293
Table 8-23 – Steps for a Dual-Role Source getting Dual-Role Sink's capabilities as a Source Sequence	295
Table 8-24 – Steps for a Source getting Sink capabilities Sequence	297
Table 8-25 – Steps for a Dual-Role Sink getting Dual-Role Source capabilities as a Sink Sequence.....	299
Table 8-26 – Steps for a Sink getting Source extended capabilities Sequence	301
Table 8-27 – Steps for a Dual-Role Source getting Dual-Role Sink extended capabilities Sequence	303
Table 8-28 – Steps for a Sink getting Source Battery capabilities Sequence	305
Table 8-29 – Steps for a Source getting Sink Battery capabilities Sequence	307
Table 8-30 – Steps for a Source getting Sink's Port Manufacturer information Sequence	309
Table 8-31 – Steps for a Source getting Sink's Port Manufacturer information Sequence	311
Table 8-32 – Steps for a Source getting Sink's Battery Manufacturer information Sequence	313
Table 8-33 – Steps for a Source getting Sink's Battery Manufacturer information Sequence	315
Table 8-34 – Steps for a Source getting Sink's Port Manufacturer information Sequence	317
Table 8-35 – Steps for a Source requesting a security exchange with a Sink Sequence.....	319
Table 8-36 – Steps for a Sink requesting a security exchange with a Source Sequence.....	321
Table 8-37 – Steps for a Vconn Source requesting a security exchange with a Cable Plug Sequence	323
Table 8-38 – Steps for DFP to UFP Discover Identity.....	325
Table 8-39 – Steps for Source Port to Cable Plug Discover Identity	327
Table 8-40 – Steps for DFP to Cable Plug Discover Identity.....	329
Table 8-41 – Steps for DFP to UFP Enter Mode.....	331
Table 8-42 – Steps for DFP to UFP Exit Mode	333
Table 8-43 – Steps for DFP to Cable Plug Enter Mode.....	335
Table 8-44 – Steps for DFP to Cable Plug Exit Mode	337
Table 8-45 – Steps for UFP to DFP Attention	339

Table 8-46 – Steps for BIST Eye Pattern Test.....	341
Table 8-47 – Policy Engine States	414
Table 9-1 – USB Power Delivery Type Codes	424
Table 9-2 – USB Power Delivery Capability Descriptor.....	425
Table 9-3 – Battery Info Capability Descriptor	427
Table 9-4 – PD Consumer Port Descriptor	428
Table 9-5 – PD Provider Port Descriptor	429
Table 9-6 – PD Class Requests	429
Table 9-7 – PD Class Request Codes	430
Table 9-8 – PD Class Feature Selectors	430
Table 9-9 – Battery Status Structure	431
Table 9-10 – Battery Wake Mask	432
Table 9-11 – Charging Policy Encoding	433
Table 10-1 – Considerations for Sources	434
Table 10-2 – Normative Voltages and Currents.....	434
Table 10-3 – Fixed Supply PDO – Source 5V.....	436
Table 10-4 – Fixed Supply PDO – Source 9V.....	436
Table 10-5 – Fixed Supply PDO – Source 15V.....	436
Table 10-6 – Fixed Supply PDO – Source 20V.....	437
Table B-1 – External power is supplied downstream.....	441
Table B-2 – External power is supplied downstream.....	444
Table B-3 – Giving back power.....	449
Table C-1 – Discover Identity Command request from Initiator Example.....	457
Table C-2 – Discover Identity Command response from Active Cable Responder Example	458
Table C-3 – Discover Identity Command response from Hub Responder Example.....	459
Table C-4 – Discover SVIDs Command request from Initiator Example	460
Table C-5 – Discover SVIDs Command response from Responder Example.....	461
Table C-6 – Discover Modes Command request from Initiator Example.....	462
Table C-7 – Discover Modes Command response from Responder Example	463
Table C-8 – Enter Mode Command request from Initiator Example.....	464
Table C-9 – Enter Mode Command response from Responder Example	465
Table C-10 – Enter Mode Command request from Initiator Example	466
Table C-11 – Exit Mode Command request from Initiator Example	467
Table C-12 – Exit Mode Command response from Responder Example	468
Table C-13 – Attention Command request from Initiator Example	469
Table C-14 – Attention Command request from Initiator with additional VDO Example	470

List of Figures

Figure 2-1 – Logical Structure of USB Power Delivery Capable Devices	41
Figure 2-2 – Example SOP' Communication between VCONN Source and Cable Plug(s)	44
Figure 2-3 – USB Power Delivery Communications Stack	49

Figure 2-4 – USB Power Delivery Communication Over USB	50
Figure 2-5 – High Level Architecture View	51
Figure 5-1 – Interpretation of ordered sets	58
Figure 5-2 – Transmit Order for Various Sizes of Data	59
Figure 5-3 – USB Power Delivery Packet Format	60
Figure 5-4 – CRC 32 generation	63
Figure 5-5 – Line format of Hard Reset	65
Figure 5-6 – Line format of Cable Reset	66
Figure 5-7 – BMC Example	67
Figure 5-8 – BMC Transmitter Block Diagram	68
Figure 5-9 – BMC Receiver Block Diagram	68
Figure 5-10 – BMC Encoded Start of Preamble	69
Figure 5-11 – Transmitting or Receiving BMC Encoded Frame Terminated by Zero with High-to-Low Last Transition	69
Figure 5-12 – Transmitting or Receiving BMC Encoded Frame Terminated by One with High-to-Low Last Transition	70
Figure 5-13 – Transmitting or Receiving BMC Encoded Frame Terminated by Zero with Low to High Last Transition	70
Figure 5-14 – Transmitting or Receiving BMC Encoded Frame Terminated by One with Low to High Last Transition	71
Figure 5-15 – Waiting for idle after a BMC Encoded Frame Terminated by Zero with High-to-Low Last Transition	71
Figure 5-16 – BMC Tx 'ONE' Mask	72
Figure 5-17 – BMC Tx 'ZERO' Mask	72
Figure 5-18 – BMC Rx 'ONE' Mask when Sourcing Power	75
Figure 5-19 – BMC Rx 'ZERO' Mask when Sourcing Power	75
Figure 5-20 – BMC Rx 'ONE' Mask when Power neutral	76
Figure 5-21 – BMC Rx 'ZERO' Mask when Power neutral	76
Figure 5-22 – BMC Rx 'ONE' Mask when Sinking Power	77
Figure 5-23 – BMC Rx 'ZERO' Mask when Sinking Power	77
Figure 5-24 – Transmitter Load Model for BMC Tx from a Source	78
Figure 5-25 Transmitter Load Model for BMC Tx from a Sink	79
Figure 5-26 – Transmitter diagram illustrating zDriver	82
Figure 5-27 – Inter-Frame Gap Timings	83
Figure 5-28 – Example Multi-Drop Configuration showing two DRPs	85
Figure 5-29 – Example Multi-Drop Configuration showing a DFP and UFP	85
Figure 5-30 – Test Data Frame	87
Figure 6-1 – USB Power Delivery Packet Format including Control Message Payload	88
Figure 6-2 – USB Power Delivery Packet Format including Data Message Payload	88
Figure 6-3 – USB Power Delivery Packet Format including an Extended Message Header and Payload	88
Figure 6-4 – Example Security_Request sequence Unchunked	93
Figure 6-5 – Example Security_Request sequence Chunked	94
Figure 6-6 – Example Capabilities Message with 2 Power Data Objects	103
Figure 6-7 – BIST Message	116

Figure 6-8 – Vendor Defined Message	118
Figure 6-9 – Discover Identity Command response	124
Figure 6-10 – Example Discover SVIDs response with 3 SVIDs	132
Figure 6-11 – Example Discover SVIDs response with 4 SVIDs	133
Figure 6-12 – Example Discover SVIDs response with 12 SVIDs followed by an empty response.....	133
Figure 6-13 – Example Discover Modes response for a given SVID with 3 Modes.....	133
Figure 6-14 – Successful Enter Mode sequence	135
Figure 6-15 – Enter Mode sequence Interrupted by Source Capabilities and then Re-run.....	135
Figure 6-16 – Unsuccessful Enter Mode sequence due to NAK.....	136
Figure 6-17 – Exit Mode sequence.....	137
Figure 6-18 – Attention Command request/response sequence.....	137
Figure 6-19 – Command request/response sequence.....	138
Figure 6-20 – Enter/Exit Mode Process.....	140
Figure 6-21 – Battery_Status Message	141
Figure 6-22 – Source_Alert Message	142
Figure 6-23 – Source_Capabilites_Extended Message.....	144
Figure 6-24 Source_Status Message	148
Figure 6-25 – Get_Battery_Cap Message	150
Figure 6-26 – Get_Battery_Status Message.....	150
Figure 6-27 – Battery_Capabilities Message	151
Figure 6-28 – Get_Manufacturer_Info Message	152
Figure 6-29 – Manufacturer_Info Message.....	152
Figure 6-30 – Security_Request Message.....	154
Figure 6-31 – Security_Response Message	154
Figure 6-32 – Outline of States	169
Figure 6-33 – References to states	170
Figure 6-34 – Common Protocol Layer Message transmission State Diagram	171
Figure 6-35 – Source Protocol Layer Message transmission State Diagram.....	174
Figure 6-36 – Sink Protocol Layer Message transmission State Diagram	176
Figure 6-37 – Protocol layer Message reception	177
Figure 6-38 – Hard/Cable Reset.....	179
Figure 7-1 – Placement of Source Bulk Capacitance.....	189
Figure 7-2 – Transition Envelope for Positive Voltage Transitions	190
Figure 7-3 – Transition Envelope for Negative Voltage Transitions	191
Figure 7-4 – Source V_{BUS} Response to Hard Reset.....	192
Figure 7-5 – Application of v_{SrcNew} and $v_{SrcValid}$ limits after $t_{SrcReady}$	194
Figure 7-6 – Source Peak Current Overload.....	195
Figure 7-7 – Holdup Time Measurement	196
Figure 7-8 – V_{BUS} Power during Fast Role Swap.....	198
Figure 7-9 – Placement of Sink Bulk Capacitance	199
Figure 7-10 – Transition Diagram for Increasing the Current.....	203
Figure 7-11 – Transition Diagram for Increasing the Voltage.....	205

Figure 7-12 – Transition Diagram for Increasing the Voltage and Current	207
Figure 7-13 – Transition Diagram for Increasing the Voltage and Decreasing the Current	209
Figure 7-14 – Transition Diagram for Decreasing the Voltage and Increasing the Current	211
Figure 7-15 – Transition Diagram for Decreasing the Current.....	213
Figure 7-16 – Transition Diagram for Decreasing the Voltage	215
Figure 7-17 – Transition Diagram for Decreasing the Voltage and the Current	217
Figure 7-18 – Transition Diagram for a Sink Requested Power Role Swap.....	219
Figure 7-19 – Transition Diagram for a Source Requested Power Role Swap.....	221
Figure 7-20 – Transition Diagram for a GotoMin Current Decrease	223
Figure 7-21 – Transition Diagram for a Source Initiated Hard Reset.....	225
Figure 7-22 – Transition Diagram for a Sink Initiated Hard Reset.....	226
Figure 7-23 – Transition Diagram for no change in Current or Voltage	227
Figure 7-24 – Transition Diagram for Fast Role Swap	228
Figure 8-1 – Example of daisy chained displays.....	239
Figure 8-2 – Basic Message Exchange (Successful)	241
Figure 8-3 – Basic Message flow indicating possible errors.....	242
Figure 8-4 – Basic Message Flow with Bad CRC followed by a Retry.....	244
Figure 8-5 – Successful Power Negotiation.....	247
Figure 8-6 – Successful GotoMin operation.....	250
Figure 8-7 – Soft Reset.....	252
Figure 8-8 – Source initiated Hard Reset	254
Figure 8-9 – Sink Initiated Hard Reset	257
Figure 8-10 – Source initiated reset – Sink long reset	260
Figure 8-11 – Successful Power Role Swap Sequence Initiated by the Source	263
Figure 8-12 – Successful Power Role Swap Sequence Initiated by the Sink.....	267
Figure 8-13 – Successful Fast Role Swap Sequence	271
Figure 8-14 – Data Role Swap, UFP operating as Sink initiates	275
Figure 8-15 – Data Role Swap, UFP operating as Source initiates	277
Figure 8-16 – Data Role Swap, DFP operating as Source initiates	279
Figure 8-17 – Data Role Swap, DFP operating as Sink initiates	281
Figure 8-18 – Source to Sink VCONN Source Swap.....	283
Figure 8-19 – Sink to Source VCONN Source Swap.....	286
Figure 8-20 – Source Alert to Sink	289
Figure 8-21 – Sink Gets Source Status	290
Figure 8-22 – Sink Gets Source's Capabilities	292
Figure 8-23 – Dual-Role Source Gets Dual-Role Sink's Capabilities as a Source	294
Figure 8-24 – Source Gets Sink's Capabilities	296
Figure 8-25 – Dual-Role Sink Gets Dual-Role Source's Capabilities as a Sink	298
Figure 8-26 – Sink Gets Source's Extended Capabilities.....	300
Figure 8-27 – Dual-Role Source Gets Dual-Role Sink's Extended Capabilities	302
Figure 8-28 – Sink Gets Source's Battery Capabilities	304
Figure 8-29 – Source Gets Sink's Battery Capabilities	306

Figure 8-30 – Source Gets Sink's Port Manufacturer Information	308
Figure 8-31 – Sink Gets Source's Port Manufacturer Information	310
Figure 8-32 – Source Gets Sink's Battery Manufacturer Information.....	312
Figure 8-33 – Sink Gets Source's Battery Manufacturer Information.....	314
Figure 8-34 – VCONN Source Gets Cable Plug's Manufacturer Information	316
Figure 8-35 – Source requests security exchange with Sink.....	318
Figure 8-36 – Sink requests security exchange with Source.....	320
Figure 8-37 – Vconn Source requests security exchange with Cable Plug	322
Figure 8-38 – DFP to UFP Discover Identity.....	324
Figure 8-39 – Source Port to Cable Plug Discover Identity.....	326
Figure 8-40 – DFP to Cable Plug Discover Identity	328
Figure 8-41 – DFP to UFP Enter Mode.....	330
Figure 8-42 – DFP to UFP Exit Mode	332
Figure 8-43 – DFP to Cable Plug Enter Mode	334
Figure 8-44 – DFP to Cable Plug Exit Mode.....	336
Figure 8-45 – UFP to DFP Attention.....	338
Figure 8-46 – BIST Carrier Mode Test	340
Figure 8-47 – Outline of States	342
Figure 8-48 – References to states	342
Figure 8-49 – Example of state reference with conditions	342
Figure 8-50 – Example of state reference with the same entry and exit.....	343
Figure 8-51 – Source Port Policy Engine state diagram	345
Figure 8-52 – Sink Port state diagram.....	351
Figure 8-53 – Source Port Soft Reset and Protocol Error State Diagram	355
Figure 8-54 – Sink Port Soft Reset and Protocol Error Diagram	356
Figure 8-55 – Source Port Not Supported Message State Diagram	358
Figure 8-56 – Sink Port Not Supported Message State Diagram	358
Figure 8-57 – Source Port Ping State Diagram.....	359
Figure 8-58 – Source Port Source Alert State Diagram	360
Figure 8-59 – Sink Port Source Alert State Diagram.....	360
Figure 8-60 – Sink Port Get Source Capabilities Extended state diagram.....	361
Figure 8-61 – Source Give Source Capabilities Extended state diagram	361
Figure 8-62 – Sink Port Get Source Status state diagram	362
Figure 8-63 – Source Give Source Status state diagram	362
Figure 8-64 – Get Battery Capabilities state diagram	363
Figure 8-65 – Give Battery Capabilities state diagram.....	363
Figure 8-66 – Get Battery Status state diagram	364
Figure 8-67 – Give Battery Status state diagram	365
Figure 8-68 – Get Manufacturer Information state diagram	365
Figure 8-69 – Give Manufacturer Information state diagram	366
Figure 8-70 – Send security request state diagram	366
Figure 8-71 – Send security response state diagram.....	367
Figure 8-72 – Security response received state diagram	367

Figure 8-73 – DFP to UFP Data Role Swap State Diagram	368
Figure 8-74 – UFP to DFP Data Role Swap State Diagram	371
Figure 8-75 – Dual-Role Port in Source to Sink Power Role Swap State Diagram	373
Figure 8-76 – Dual-role Port in Sink to Source Power Role Swap State Diagram	376
Figure 8-77 – Dual-Role Port in Source to Sink Fast Role Swap State Diagram	379
Figure 8-78 – Dual-role Port in Sink to Source Fast Role Swap State Diagram	382
Figure 8-79 – Dual-Role (Source) Get Source Capabilities diagram	384
Figure 8-80 – Dual-Role (Source) Give Sink Capabilities diagram	384
Figure 8-81 – Dual-Role (Sink) Get Sink Capabilities State Diagram	385
Figure 8-82 – Dual-Role (Sink) Give Source Capabilities State Diagram	385
Figure 8-83 – Dual-Role (Source) Get Source Capabilities Extended state diagram	386
Figure 8-84 – Dual-Role (Source) Give Sink Capabilities diagram	387
Figure 8-85 – VCONN Swap State Diagram	388
Figure 8-86 – Initiator to Port VDM Discover Identity State Diagram	391
Figure 8-87 – Initiator VDM Discover SVIDs State Diagram	392
Figure 8-88 – Initiator VDM Discover Modes State Diagram	393
Figure 8-89 – Initiator VDM Attention State Diagram	394
Figure 8-90 – Responder Structured VDM Discover Identity State Diagram	395
Figure 8-91 – Responder Structured VDM Discover SVIDs State Diagram	396
Figure 8-92 – Responder Structured VDM Discover Modes State Diagram	397
Figure 8-93 – Receiving a Structured VDM Attention State Diagram	398
Figure 8-94 – DFP VDM Mode Entry State Diagram	399
Figure 8-95 – DFP VDM Mode Exit State Diagram	400
Figure 8-96 – UFP Structured VDM Enter Mode State Diagram	401
Figure 8-97 – UFP Structured VDM Exit Mode State Diagram	402
Figure 8-98 – Cable Ready VDM State Diagram	403
Figure 8-99 – Cable Plug Soft Reset State Diagram	404
Figure 8-100 – Cable Plug Hard Reset State Diagram	405
Figure 8-101 – DFP Soft Reset or Cable Reset of a Cable Plug State Diagram	405
Figure 8-102 – UFP Source Soft Reset of a Cable Plug State Diagram	407
Figure 8-103 – Source Startup Structured VDM Discover Identity State Diagram	408
Figure 8-104 – Cable Plug Structured VDM Enter Mode State Diagram	410
Figure 8-105 – Cable Plug Structured VDM Exit Mode State Diagram	411
Figure 8-106 – BIST Carrier Mode State Diagram	412
Figure 9-1 – Example PD Topology	419
Figure 9-2 – Mapping of PD Topology to USB	420
Figure 9-3 – USB Attached to USB Powered State Transition	421
Figure 9-4 – Any USB State to USB Attached State Transition (When operating as a Consumer)	422
Figure 9-5 – Any USB State to USB Attached State Transition (When operating as a Provider)	422
Figure 9-6 – Any USB State to USB Attached State Transition (After a USB Type-C Data Role Swap)	423
Figure 9-7 – Software stack on a PD aware OS	423

Figure 9-8 – Enumeration of a PDUSB Device	424
Figure 10-1 – Source Power Rule Illustration	435
Figure 10-2 – Source Power Rule Example	435
Figure B-1 – External Power supplied downstream	440
Figure B-2 – External Power supplied upstream	443
Figure B-3 – Giving Back Power	448

1 Introduction

USB has evolved from a data interface capable of supplying limited power to a primary provider of power with a data interface. Today many devices charge or get their power from USB ports contained in laptops, cars, aircraft or even wall sockets. USB has become a ubiquitous power socket for many small devices such as cell phones, MP3 players and other hand-held devices. Users need USB to fulfill their requirements not only in terms of data but also to provide power to, or charge, their devices simply, often without the need to load a driver, in order to carry out “traditional” USB functions.

There are however, still many devices which either require an additional power connection to the wall, or exceed the USB rated current in order to operate. Increasingly, international regulations require better energy management due to ecological and practical concerns relating to the availability of power. Regulations limit the amount of power available from the wall which has led to a pressing need to optimize power usage. The USB Power Delivery Specification has the potential to minimize waste as it becomes a standard for charging devices that are not satisfied by [\[USBBC 1.2\]](#).

Wider usage of wireless solutions is an attempt to remove data cabling but the need for “tethered” charging remains. In addition, industrial design requirements drive wired connectivity to do much more over the same connector.

USB Power Delivery is designed to enable the maximum functionality of USB by providing more flexible power delivery along with data over a single cable. Its aim is to operate with and build on the existing USB ecosystem; increasing power levels from existing USB standards, for example Battery Charging, enabling new higher power use cases such as USB powered Hard Disk Drives (HDDs) and printers.

With USB Power Delivery the power direction is no longer fixed. This enables the product with the power (Host or Peripheral) to provide the power. For example, a display with a supply from the wall can power, or charge, a laptop. Alternatively, USB power bricks or chargers are able to supply power to laptops and other battery powered devices through their, traditionally power providing, USB ports.

USB Power Delivery enables hubs to become the means to optimize power management across multiple peripherals by allowing each device to take only the power it requires, and to get more power when required for a given application. For example battery powered devices can get increased charging current and then give it back temporarily when the user’s HDD requires spinning up. **Optionally** the hubs can communicate with the PC to enable even more intelligent and flexible management of power either automatically or with some level of user intervention.

USB Power Delivery allows Low Power cases such as headsets to negotiate for only the power they require. This provides a simple solution that enables USB devices to operate at their optimal power levels.

The Power Delivery Specification, in addition to providing mechanisms to negotiate power also can be used as a side-band channel for standard and vendor defined messaging. Power Delivery enables alternative modes of operation by providing the mechanisms to discover, enter and exit Alternate Modes. The specification also enables discovery of cable capabilities such as supported speeds and current levels.

1.1 Overview

This specification defines how USB Devices may negotiate for more current and/or higher or lower voltages over the USB cable (using the USB Type-C CC wire as the communications

channel) than are defined in the [\[USB 2.0\]](#), [\[USB 3.1\]](#), [\[USB Type-C 1.2\]](#) or [\[USBBC 1.2\]](#) specifications. It allows Devices with greater power requirements than can be met with today's specification to get the power they require to operate from V_{BUS} and negotiate with external power sources (e.g. wall warts). In addition, it allows a Source and Sink to swap power roles such that a Device could supply power to the Host. For example, a display could supply power to a notebook to charge its battery.

The USB Power Delivery Specification is guided by the following principles:

- 1) Works seamlessly with legacy USB Devices
- 2) Compatible with existing spec-compliant USB cables
- 3) Minimizes potential damage from non-compliant cables (e.g. 'Y' cables etc.)
- 4) Optimized for low-cost implementations

This specification defines mechanisms to discover, enter and exit Modes defined either by a standard or by a particular vendor. These Modes can be supported either by the Port Partner or by a cable connecting the two Port Partners.

The specification defines mechanisms to discover the capabilities of cables which can communicate using Power Delivery.

This specification adds a mechanism to swap the data roles such that the upstream facing Port becomes the downstream facing Port and vice versa. It also enables a swap of the end supplying V_{CONN} to a powered cable.

1.2 Purpose

The USB Power Delivery specification defines a power delivery system covering all elements of a USB system including: Hosts, Devices, Hubs, Chargers and cable assemblies. This specification describes the architecture, protocols, power supply behavior, connectors and cabling necessary for managing power delivery over USB at up to 100W. This specification is intended to be fully compatible and extend the existing USB infrastructure. It is intended that this specification will allow system OEMs, power supply and peripheral developers adequate flexibility for product versatility and market differentiation without losing backwards compatibility.

USB Power Delivery is designed to operate independently of the existing USB bus defined mechanisms used to negotiate power which are:

- [\[USB 2.0\]](#), [\[USB 3.1\]](#) in band requests for high power interfaces.
- [\[USBBC 1.2\]](#) mechanisms for supplying higher power (not mandated by this specification).
- [\[USB Type-C 1.2\]](#) mechanisms for supplying higher power

Initial operating conditions remain the USB Default Operation as defined in [\[USB 2.0\]](#), [\[USB 3.1\]](#), [\[USB Type-C 1.2\]](#) or [\[USBBC 1.2\]](#).

- The DFP sources *vSafe5V* over V_{BUS} .
- The UFP consumes power from V_{BUS} .

1.3 Scope

This specification is intended as an extension to the existing [\[USB 2.0\]](#), [\[USB 3.1\]](#), [\[USB Type-C 1.2\]](#) and [\[USBBC 1.2\]](#) specifications. It addresses only the elements required to implement USB Power Delivery. It is targeted at power supply vendors, manufacturers of [\[USB 2.0\]](#), [\[USB 3.1\]](#), [\[USB Type-C 1.2\]](#) and [\[USBBC 1.2\]](#) Platforms, Devices and cable assemblies.

Normative information is provided to allow interoperability of components designed to this specification. Informative information, when provided, may illustrate possible design implementation.

1.4 Conventions

1.4.1 Precedence

If there is a conflict between text, figures, and tables, the precedence shall be tables, figures, and then text.

1.4.2 Keywords

The following keywords differentiate between the levels of requirements and options.

1.4.2.1 Conditional Normative

Conditional Normative is a keyword used to indicate a feature that is mandatory when another related feature has been implemented. Designers are mandated to implement all such requirements, when the dependent features have been implemented, to ensure interoperability with other compliant Devices.

1.4.2.2 Deprecated

Deprecated is a keyword used to indicate a feature, supported in previous releases of the specification, which is no longer supported.

1.4.2.3 Discarded

Discarded is a keyword indicating that a Packet when received shall be thrown away by the PHY Layer and not passed to the Protocol Layer for processing. No **GoodCRC** Message shall be sent in response to the Packet.

1.4.2.4 Ignored

Ignored is a keyword indicating Messages or Message fields which, when received, shall result in no action by the receiver, aside from returning a **GoodCRC** Message to acknowledge Message receipt.

1.4.2.5 Invalid

Invalid is a keyword when used in relation to a Message indicates that the Message's usage or fields fall outside of the defined specification usage. When **Invalid** is used in relation to an Explicit Contract it indicates that a previously established Explicit Contract which can longer be maintained by the Source.

1.4.2.6 May

May is a keyword that indicates a choice with no implied preference.

1.4.2.7 N/A

N/A is a keyword that indicates that a field or value is not applicable and has no defined value and shall not be checked or used by the recipient.

1.4.2.8 Optional/Optionally/Optional Normative

Optional, **Optionally** and **Optional Normative** are equivalent keywords that describe features not mandated by this specification. However, if an **Optional** feature is implemented, the feature shall be implemented as defined by this specification.

1.4.2.9 Reserved

Reserved is a keyword indicating reserved bits, bytes, words, fields, and code values that are set-aside for future standardization. Their use and interpretation may be specified by future extensions to this specification and shall not be utilized or adapted by vendor implementation. A **Reserved** bit, byte, word, or field shall be set to zero by the sender and shall be **Ignored** by the receiver. **Reserved** field values shall not be sent by the sender and shall be **Ignored** by the receiver.

1.4.2.10 Shall/Normative

Shall and **Normative** are equivalent keywords indicating a mandatory requirement. Designers are mandated to implement all such requirements to ensure interoperability with other compliant Devices.

1.4.2.11 Should

Should is a keyword indicating flexibility of choice with a preferred alternative. Equivalent to the phrase “it is recommended that”.

1.4.3 Numbering

Numbers that are immediately followed by a lowercase “b” (e.g., 01b) are binary values. Numbers that are immediately followed by an uppercase “B” are byte values. Numbers that are immediately followed by a lowercase “h” (e.g., 3Ah) or are preceded by “0x” (e.g. 0xFF00) are hexadecimal values. Numbers not immediately followed by either a “b”, “B”, or “h” are decimal values.

1.5 Related Documents

- **[USB 2.0]** – Universal Serial Bus Specification, Revision 2.0, plus ECN and Errata http://www.usb.org/developers/docs/usb20_docs/.
- **[USB 3.1]** – Universal Serial Bus 3.1 Specification, Revision 1 plus ECN and Errata (this includes the entire document release package including the OTG&EH v3.0 specification). www.usb.org/developers/docs.
- **[USBSECURITY 1.0]**, Universal Serial Bus Specification, Revision 1.0. www.usb.org/developers/docs. Expected publication date H1 2016.
- **[USBBC 1.2]** – Universal Serial Bus Battery Charging Specification, Revision 1.2 plus Errata (referred to in this document as the Battery Charging specification). www.usb.org/developers/devclass_docs#approved.
- **[USBBridge 1.0]** – Universal Serial Bus Bridging specification version 1.0
- **[USBPD 2.0]** – Universal Serial Bus Power Delivery Specification, Revision 2.0, www.usb.org/developers/docs.
- **[USBPDCompliance]** – USB Power Delivery Compliance Plan version 1.0 http://www.usb.org/developers/docs/devclass_docs/.
- **[USB Type-C 1.2]** – USB Type-C Specification Version 1.2 www.usb.org/developers/docs
- **[IEC 60958-1]** IEC 60958-1 Digital Audio Interface Part:1 General Edition 3.0 2008-09 www.iec.ch
- **[IEC 60950-1]** IEC 60950-1:2005 Information technology equipment – Safety – Part 1: General requirements: Amendment 1:2009, Amendment 2:2013
- **[IEC 62368-1]** IEC 62368-1 Audio/Video, information and communication technology equipment – Part 1: Safety requirements
- **[IEC 63002]** Draft CD for IEC 63002 Identification and Communication Interoperability Method for External DC Power Supplies Used With Portable Computing Devices.

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