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

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 07/21

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EUROPEAN STANDARD

EN IEC 62680-1-2

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EUROPÄISCHE NORM

April 2021

ICS 29.220; 33.120; 35.200

Supersedes EN IEC 62680-1-2:2020 and all of its amendments and corrigenda (if any)

English Version

**Universal serial bus interfaces for data and power - Part 1-2:
Common components - USB Power Delivery specification
(IEC 62680-1-2:2021)**

Interfaces de bus universel en série pour les données et l'alimentation électrique - Partie 1-2: Composants communs
- Spécification de l'alimentation électrique par port USB
(IEC 62680-1-2:2021)

Schnittstellen des Universellen Seriellen Busses für Daten und Energie - Teil 1-2: Gemeinsame Komponenten - Festlegung für die USB-Stromversorgung
(IEC 62680-1-2:2021)

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EN IEC 62680-1-2:2021 (E)**European foreword**

The text of document 100/3440/CDV, future edition 5 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 IEC 62680-1-2:2021.

The following dates are fixed:

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IEC 62680-1-2

Edition 5.0 2021-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Interfaces de bus universel en série pour les données et l'alimentation électrique
Partie 1-2: Composants communs – Spécification de l'alimentation électrique
par port USB**





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Interfaces de bus universel en série pour les données et l'alimentation électrique
Partie 1-2: Composants communs – Spécification de l'alimentation électrique
par port USB

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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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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 International Standard is based on the following documents:

CDV	Report on voting
100/3440/CDV	100/3505/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.

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This standard is the USB-IF publication Universal Serial Bus Power Delivery Specification Revision 3.0, Version 2.0.

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Universal Serial Bus Power Delivery Specification

Revision: **3.0**
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Table of Contents

INTELLECTUAL PROPERTY DISCLAIMER.....	6
Chairs.....	7
Editors.....	7
Contributors.....	7
Revision History	13
Table of Contents	14
List of Tables	22
List of Figures	30
1. Introduction	39
1.1 Overview.....	39
1.2 Purpose.....	40
1.3 Scope.....	40
1.4 Conventions.....	41
1.4.1 Precedence.....	41
1.4.2 Keywords.....	41
1.4.3 Numbering.....	42
1.5 Related Documents.....	42
1.6 Terms and Abbreviations	43
1.7 Parameter Values	51
1.8 Changes from Revision 2.0	51
1.9 Compatibility with Revision 2.0.....	51
2. Overview	52
2.1 Introduction	52
2.2 Section Overview.....	53
2.3 Compatibility with Revision 2.0.....	54
2.4 USB Power Delivery Capable Devices.....	54
2.5 SOP* Communication.....	55
2.5.1 Introduction	55
2.5.2 SOP* Collision Avoidance	55
2.5.3 SOP Communication	55

2.5.4	SOP’/SOP’’ Communication with Cable Plugs	55
2.6	Operational Overview	57
2.6.1	Source Operation	57
2.6.2	Sink Operation.....	59
2.6.3	Cable Plugs.....	60
2.7	Architectural Overview.....	61
2.7.1	Policy.....	64
2.7.2	Message Formation and Transmission.....	65
2.7.3	Collision Avoidance.....	65
2.7.4	Power supply.....	66
2.7.5	DFP/UFP.....	66
2.7.6	Cable and Connectors.....	67
2.7.7	Interactions between Non-PD, BC and PD devices	67
2.7.8	Power Rules.....	67
3.	USB Type-A and USB Type-B Cable Assemblies and Connectors	68
4.	Electrical Requirements	69
4.1	Interoperability with other USB Specifications	69
4.2	Dead Battery Detection / Unpowered Port Detection	69
4.3	Cable IR Ground Drop (IR Drop).....	69
4.4	Cable Type Detection.....	69
5.	Physical Layer	70
5.1	Physical Layer Overview.....	70
5.2	Physical Layer Functions	70
5.3	Symbol Encoding.....	71
5.4	Ordered Sets.....	72
5.5	Transmitted Bit Ordering	73
5.6	Packet Format.....	74
5.6.1	Packet Framing.....	74
5.6.2	CRC.....	76
5.6.3	Packet Detection Errors	78
5.6.4	Hard Reset.....	78
5.6.5	Cable Reset.....	79
5.7	Collision Avoidance	79
5.8	Biphase Mark Coding (BMC) Signaling Scheme.....	80
5.8.1	Encoding and signaling.....	80

5.8.2	Transmit and Receive Masks.....	83
5.8.3	Transmitter Load Model	89
5.8.4	BMC Common specifications.....	90
5.8.5	BMC Transmitter Specifications	91
5.8.6	BMC Receiver Specifications	93
5.9	Built in Self-Test (BIST).....	97
5.9.1	BIST Carrier Mode	97
5.9.2	BIST Test Data.....	97
6.	Protocol Layer	98
6.1	Overview.....	98
6.2	Messages.....	98
6.2.1	Message Construction	98
6.3	Control Message.....	108
6.3.1	GoodCRC Message.....	109
6.3.2	GotoMin Message	109
6.3.3	Accept Message.....	109
6.3.4	Reject Message	110
6.3.5	Ping Message.....	110
6.3.6	PS_RDY Message.....	110
6.3.7	Get_Source_Cap Message	110
6.3.8	Get_Sink_Cap Message.....	111
6.3.9	DR_Swap Message.....	111
6.3.10	PR_Swap Message	111
6.3.11	VCONN_Swap Message	112
6.3.12	Wait Message.....	113
6.3.13	Soft Reset Message	114
6.3.14	Data_Reset Message	114
6.3.15	Data_Reset_Complete Message.....	115
6.3.16	Not_Supported Message.....	115
6.3.17	Get_Source_Cap_Extended Message	115
6.3.18	Get_Status Message	115
6.3.19	FR_Swap Message	115
6.3.20	Get_PPS_Status	116
6.3.21	Get_Country_Codes.....	116
6.3.22	Get_Sink_Cap_Extended Message	116

6.4	Data Message.....	116
6.4.1	Capabilities Message.....	117
6.4.2	Request Message.....	126
6.4.3	BIST Message.....	131
6.4.4	Vendor Defined Message	133
6.4.5	Battery_Status Message.....	162
6.4.6	Alert Message	163
6.4.7	Get_Country_Info Message	165
6.4.8	Enter_USB Message.....	165
6.5	Extended Message.....	167
6.5.1	Source_Capabilities_Extended Message	168
6.5.2	Status Message.....	172
6.5.3	Get_Battery_Cap Message	175
6.5.4	Get_Battery_Status Message.....	175
6.5.5	Battery_Capabilities Message	176
6.5.6	Get_Manufacturer_Info Message.....	177
6.5.7	Manufacturer_Info Message	177
6.5.8	Security Messages.....	178
6.5.9	Firmware Update Messages	179
6.5.10	PPS_Status Message	180
6.5.11	Country_Codes Message.....	181
6.5.12	Country_Info Message.....	182
6.5.13	Sink_Capabilities_Extended Message.....	182
6.6	Timers.....	186
6.6.1	CRCReceiveTimer	186
6.6.2	SenderResponseTimer.....	186
6.6.3	Capability Timers.....	186
6.6.4	Wait Timers and Times	187
6.6.5	Power Supply Timers.....	188
6.6.6	NoResponseTimer	189
6.6.7	BIST Timers.....	190
6.6.8	Power Role Swap Timers.....	190
6.6.9	Soft Reset Timers	190
6.6.10	Data Reset Timers.....	191
6.6.11	Hard Reset Timers.....	191
6.6.12	Structured VDM Timers	192

6.6.13	VCONN Timers.....	193
6.6.14	tCableMessage.....	193
6.6.15	DiscoverIdentityTimer	193
6.6.16	Collision Avoidance Timers.....	193
6.6.17	Fast Role Swap Timers.....	194
6.6.18	Chunking Timers.....	194
6.6.19	Programmable Power Supply Timers	195
6.6.20	tEnterUSB.....	195
6.6.21	Time Values and Timers.....	196
6.7	Counters.....	200
6.7.1	MessageID Counter	200
6.7.2	Retry Counter	200
6.7.3	Hard Reset Counter.....	201
6.7.4	Capabilities Counter.....	201
6.7.5	Discover Identity Counter	201
6.7.6	VDMBusyCounter.....	201
6.7.7	Counter Values and Counters	201
6.8	Reset.....	202
6.8.1	Soft Reset and Protocol Error	202
6.8.2	Data Reset	204
6.8.3	Hard Reset.....	204
6.8.4	Cable Reset.....	205
6.9	Collision Avoidance	205
6.10	Message Discarding.....	205
6.11	State behavior	207
6.11.1	Introduction to state diagrams used in Chapter 6	207
6.11.2	State Operation	207
6.11.3	List of Protocol Layer States.....	229
6.12	Message Applicability.....	231
6.12.1	Applicability of Control Messages.....	232
6.12.2	Applicability of Data Messages.....	233
6.12.3	Applicability of Extended Messages.....	234
6.12.4	Applicability of Structured VDM Commands.....	235
6.12.5	Applicability of Reset Signaling.....	236
6.12.6	Applicability of Fast Role Swap signal.....	236
6.13	Value Parameters	237

7. Power Supply	238
7.1 Source Requirements	238
7.1.1 Behavioral Aspects	238
7.1.2 Source Bulk Capacitance	238
7.1.3 Types of Sources	238
7.1.4 Source Transitions	239
7.1.5 Response to Hard Resets	246
7.1.6 Changing the Output Power Capability	247
7.1.7 Robust Source Operation	247
7.1.8 Output Voltage Tolerance and Range	248
7.1.9 Charging and Discharging the Bulk Capacitance on V_{BUS}	249
7.1.10 Swap Standby for Sources	249
7.1.11 Source Peak Current Operation	250
7.1.12 Source Capabilities Extended Parameters	251
7.1.13 Fast Role Swap	253
7.1.14 Non-application of V_{BUS} Slew Rate Limits	254
7.1.15 V_{CONN} Power Cycle	255
7.2 Sink Requirements	256
7.2.1 Behavioral Aspects	256
7.2.2 Sink Bulk Capacitance	256
7.2.3 Sink Standby	257
7.2.4 Suspend Power Consumption	257
7.2.5 Zero Negotiated Current	257
7.2.6 Transient Load Behavior	257
7.2.7 Swap Standby for Sinks	258
7.2.8 Sink Peak Current Operation	258
7.2.9 Robust Sink Operation	258
7.2.10 Fast Role Swap	259
7.3 Transitions	261
7.3.1 Increasing the Current	262
7.3.2 Increasing the Voltage	264
7.3.3 Increasing the Voltage and Current	266
7.3.4 Increasing the Voltage and Decreasing the Current	268
7.3.5 Decreasing the Voltage and Increasing the Current	270
7.3.6 Decreasing the Current	272

7.3.7	Decreasing the Voltage	274
7.3.8	Decreasing the Voltage and the Current.....	276
7.3.9	Sink Requested Power Role Swap.....	278
7.3.10	Source Requested Power Role Swap	281
7.3.11	GotoMin Current Decrease.....	284
7.3.12	Source Initiated Hard Reset.....	286
7.3.13	Sink Initiated Hard Reset.....	288
7.3.14	No change in Current or Voltage.....	290
7.3.15	Fast Role Swap	292
7.3.16	Increasing the Programmable Power Supply Voltage	294
7.3.17	Decreasing the Programmable Power Supply Voltage.....	296
7.3.18	Changing the Source PDO or APDO	298
7.3.19	Increasing the Programmable Power Supply Current	300
7.3.20	Decreasing the Programmable Power Supply Current	302
7.3.21	Same Request Programmable Power Supply	304
7.4	Electrical Parameters	305
7.4.1	Source Electrical Parameters.....	305
7.4.2	Sink Electrical Parameters.....	309
7.4.3	Common Electrical Parameters	310
8.	Device Policy	312
8.1	Overview.....	312
8.2	Device Policy Manager	312
8.2.1	Capabilities	313
8.2.2	System Policy.....	313
8.2.3	Control of Source/Sink	314
8.2.4	Cable Detection.....	314
8.2.5	Managing Power Requirements.....	314
8.2.6	Use of “Unconstrained Power” bit with Batteries and AC supplies.....	316
8.2.7	Interface to the Policy Engine.....	318
8.3	Policy Engine.....	319
8.3.1	Introduction	319
8.3.2	Atomic Message Sequence Diagrams.....	319
8.3.3	State Diagrams	479
9.	States and Status Reporting.....	567
9.1	Overview.....	567

9.1.1	PDUSB Device and Hub Requirements	569
9.1.2	Mapping to USB Device States	569
9.1.3	PD Software Stack.....	572
9.1.4	PDUSB Device Enumeration.....	572
9.2	PD Specific Descriptors.....	574
9.2.1	USB Power Delivery Capability Descriptor	574
9.2.2	Battery Info Capability Descriptor.....	575
9.2.3	PD Consumer Port Capability Descriptor	576
9.2.4	PD Provider Port Capability Descriptor	576
9.3	PD Specific Requests and Events	578
9.3.1	PD Specific Requests.....	578
9.4	PDUSB Hub and PDUSB Peripheral Device Requests.....	579
9.4.1	GetBatteryStatus	579
9.4.2	SetPDFeature	580
10.	Power Rules	582
10.1	Introduction	582
10.2	Source Power Rules.....	582
10.2.1	Source Power Rule Considerations	582
10.2.2	Normative Voltages and Currents.....	583
10.2.3	Optional Voltages/Currents.....	586
10.2.4	Power sharing between ports.....	588
10.3	Sink Power Rules.....	588
10.3.1	Sink Power Rule Considerations	588
10.3.2	Normative Sink Rules.....	588
A.	CRC calculation	590
A.1	C code example.....	590
A.2	Table showing the full calculation over one Message.....	592
B.	PD Message Sequence Examples	593
B.1	External power is supplied downstream	593
B.2	External power is supplied upstream.....	597
B.3	Giving back power	604
C.	VDM Command Examples.....	616
C.1	Discover Identity Example	616
C.1.1	Discover Identity Command request.....	616
C.1.2	Discover Identity Command response – Active Cable	616

C.1.3	Discover Identity Command response – Hub.....	618
C.2	Discover SVIDs Example	619
C.2.1	Discover SVIDs Command request	619
C.2.1	Discover SVIDs Command response	619
C.3	Discover Modes Example	621
C.3.1	Discover Modes Command request.....	621
C.3.2	Discover Modes Command response.....	621
C.4	Enter Mode Example.....	623
C.4.1	Enter Mode Command request	623
C.4.2	Enter Mode Command response	623
C.4.1	Enter Mode Command request with additional VDO.....	624
C.5	Exit Mode Example	625
C.5.1	Exit Mode Command request.....	625
C.5.2	Exit Mode Command response.....	625
C.6	Attention Example	627
C.6.1	Attention Command request.....	627
C.6.2	Attention Command request with additional VDO	627
D.	BMC Receiver Design Examples	629
D.1	Finite Difference Scheme	629
D.1.1	Sample Circuitry	629
D.1.2	Theory.....	629
D.1.3	Data Recovery.....	631
D.1.4	Noise Zone and Detection Zone	632
D.2	Subtraction Scheme.....	632
D.2.1	Sample Circuitry	632
D.2.2	Output of Each Circuit Block	633
D.2.3	Subtractor Output at Power Source and Power Sink.....	633
D.2.4	Noise Zone and Detection Zone	634
E.	FRS System Level Example	635
E.1	Overview.....	635
E.2	FRS Initial Setup.....	637
E.3	FRS Process.....	639

List of Tables

Table 1-1	Terms and Abbreviations.....	43
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Table 5-1 4b5b Symbol Encoding Table	71
Table 5-2 Ordered Sets.....	72
Table 5-3 Validation of Ordered Sets.....	72
Table 5-4 Data Size.....	73
Table 5-5 SOP ordered set	74
Table 5-6 SOP' ordered set	75
Table 5-7 SOP'' ordered set.....	75
Table 5-8 SOP'_Debug ordered set.....	76
Table 5-9 SOP''_Debug ordered set.....	76
Table 5-10 CRC-32 Mapping.....	77
Table 5-11 Hard Reset ordered set.....	78
Table 5-12 Cable Reset ordered set.....	79
Table 5-13 Rp values used for Collision Avoidance	80
Table 5-14 BMC Tx Mask Definition, X Values.....	84
Table 5-15 BMC Tx Mask Definition, Y Values.....	85
Table 5-16 BMC Rx Mask Definition.....	89
Table 5-17 BMC Common Normative Requirements	91
Table 5-18 BMC Transmitter Normative Requirements	91
Table 5-19 BMC Receiver Normative Requirements.....	94
Table 6-1 Message Header.....	99
Table 6-2 Revision Interoperability during an Explicit Contract.....	102
Table 6-3 Extended Message Header.....	103
Table 6-4 Use of Unchunked Message Supported bit.....	105
Table 6-5 Control Message Types.....	108
Table 6-6 Data Message Types.....	116
Table 6-7 Power Data Object.....	118
Table 6-8 Augmented Power Data Object.....	118
Table 6-9 Fixed Supply PDO - Source.....	120
Table 6-10 Fixed Power Source Peak Current Capability.....	122
Table 6-11 Variable Supply (non-Battery) PDO - Source.....	122
Table 6-12 Battery Supply PDO - Source.....	123
Table 6-13 Programmable Power Supply APDO - Source	123
Table 6-14 Fixed Supply PDO - Sink.....	124
Table 6-15 Variable Supply (non-Battery) PDO - Sink.....	126
Table 6-16 Battery Supply PDO - Sink.....	126
Table 6-17 Programmable Power Supply APDO - Sink.....	126
Table 6-18 Fixed and Variable Request Data Object.....	127
Table 6-19 Fixed and Variable Request Data Object with GiveBack Support.....	127

Table 6-20 Battery Request Data Object	127
Table 6-21 Battery Request Data Object with GiveBack Support	128
Table 6-22 Programmable Request Data Object.....	128
Table 6-23 BIST Data Object.....	132
Table 6-24 Unstructured VDM Header	134
Table 6-25 Structured VDM Header	135
Table 6-26 Structured VDM Commands.....	136
Table 6-27 SVID Values.....	136
Table 6-28 Commands and Responses	138
Table 6-29 ID Header VDO	140
Table 6-30 Product Types (UFP)	141
Table 6-31 Product Types (Cable Plug).....	141
Table 6-32 Product Types (DFP)	141
Table 6-33 Cert Stat VDO.....	142
Table 6-34 Product VDO.....	142
Table 6-35 UFP VDO 1	143
Table 6-36 UFP VDO 2	144
Table 6-37 DFP VDO.....	145
Table 6-38 Passive Cable VDO	146
Table 6-39 Active Cable VDO 1	148
Table 6-40 Active Cable VDO 2	150
Table 6-41 AMA VDO.....	152
Table 6-42 VPD VDO.....	153
Table 6-43 Discover SVIDs Responder VDO.....	154
Table 6-44 Battery Status Data Object (BSDO)	162
Table 6-45 Alert Data Object	163
Table 6-46 Country Code Data Object	165
Table 6-47 Enter_USB Data Object.....	166
Table 6-48 Extended Message Types.....	167
Table 6-49 Source Capabilities Extended Data Block (SCEDB).....	168
Table 6-50 SOP Status Data Block (SDB).....	172
Table 6-51 SOP'/SOP'' Status Data Block (SDB).....	175
Table 6-52 Get Battery Cap Data Block (GBCDB)	175
Table 6-53 Get Battery Status Data Block (GBSDB)	176
Table 6-54 Battery Capability Data Block (BCDB).....	176
Table 6-55 Get Manufacturer Info Data Block (GMIDB).....	177
Table 6-56 Manufacturer Info Data Block (MIDB).....	178
Table 6-57 PPS Status Data Block (PPSSDB)	180

Table 6-58 Country Codes Data Block (CCDB)	181
Table 6-59 Country Info Data Block (CIDB).....	182
Table 6-60 Sink Capabilities Extended Data Block (SKEDB).....	183
Table 6-61 Time Values	197
Table 6-62 Timers	198
Table 6-63 Counter parameters.....	201
Table 6-64 Counters	202
Table 6-65 Response to an incoming Message (except VDM)	203
Table 6-66 Response to an incoming VDM.....	204
Table 6-67 Message discarding	206
Table 6-68 Protocol Layer States.....	229
Table 6-69 Applicability of Control Messages.....	232
Table 6-70 Applicability of Data Messages.....	233
Table 6-71 Applicability of Extended Messages	234
Table 6-72 Applicability of Structured VDM Commands	235
Table 6-73 Applicability of Reset Signaling	236
Table 6-74 Applicability of Fast Role Swap signal	236
Table 6-75 Value Parameters	237
Table 7-1 Sequence Description for Increasing the Current.....	263
Table 7-2 Sequence Description for Increasing the Voltage.....	265
Table 7-3 Sequence Diagram for Increasing the Voltage and Current.....	267
Table 7-4 Sequence Description for Increasing the Voltage and Decreasing the Current.....	269
Table 7-5 Sequence Description for Decreasing the Voltage and Increasing the Current.....	271
Table 7-6 Sequence Description for Decreasing the Current.....	273
Table 7-7 Sequence Description for Decreasing the Voltage	275
Table 7-8 Sequence Description for Decreasing the Voltage and the Current.....	277
Table 7-9 Sequence Description for a Sink Requested Power Role Swap.....	279
Table 7-10 Sequence Description for a Source Requested Power Role Swap.....	282
Table 7-11 Sequence Description for a GotoMin Current Decrease.....	285
Table 7-12 Sequence Description for a Source Initiated Hard Reset.....	287
Table 7-13 Sequence Description for a Sink Initiated Hard Reset.....	289
Table 7-14 Sequence Description for no change in Current or Voltage	291
Table 7-15 Sequence Description for Fast Role Swap.....	292
Table 7-16 Sequence Description for Increasing the Programmable Power Supply Voltage	294
Table 7-17 Sequence Description for Decreasing the Programmable Power Supply Voltage	297
Table 7-18 Sequence Description for Changing the Source PDO or APDO	298
Table 7-19 Sequence Description for increasing the Current in PPS mode	301
Table 7-20 Sequence Description for decreasing the Current in PPS mode	303

Table 7-21 Sequence Description for increasing the Current in PPS mode	304
Table 7-22 Source Electrical Parameters.....	305
Table 7-23 Sink Electrical Parameters.....	309
Table 7-24 Common Source/Sink Electrical Parameters	311
Table 8-1 Basic Message Flow	320
Table 8-2 Potential issues in Basic Message Flow	321
Table 8-3 Basic Message Flow with CRC failure	322
Table 8-4 Interruptible and Non-interruptible AMS.....	324
Table 8-5 Steps for a successful Power Negotiation	326
Table 8-6 Steps for a GotoMin Negotiation	329
Table 8-7 Steps for a successful Power Negotiation	331
Table 8-8 Steps for a Soft Reset.....	334
Table 8-9 Steps for a DFP Initiated Data Reset where the DFP is the Vconn Source.....	337
Table 8-10 Steps for a DFP Receiving a Data Reset where the DFP is the Vconn Source	340
Table 8-11 Steps for a DFP Initiated Data Reset where the UFP is the Vconn Source	343
Table 8-12 Steps for a DFP Receiving a Data Reset where the UFP is the Vconn Source	347
Table 8-13 Steps for Source initiated Hard Reset	351
Table 8-14 Steps for Sink initiated Hard Reset	354
Table 8-15 Steps for Source initiated Hard Reset – Sink long reset.....	357
Table 8-16 Steps for a Successful Source Initiated Power Role Swap Sequence.....	360
Table 8-17 Steps for a Successful Sink Initiated Power Role Swap Sequence.....	366
Table 8-18 Steps for a Successful Fast Role Swap Sequence.....	371
Table 8-19 Steps for Data Role Swap, UFP operating as Sink initiates.....	374
Table 8-20 Steps for Data Role Swap, UFP operating as Source initiates.....	376
Table 8-21 Steps for Data Role Swap, DFP operating as Source initiates.....	378
Table 8-22 Steps for Data Role Swap, DFP operating as Sink initiates.....	380
Table 8-23 Steps for Source to Sink VCONN Source Swap.....	383
Table 8-24 Steps for Sink to Source VCONN Source Swap.....	386
Table 8-25 Steps for Source Alert to Sink.....	389
Table 8-26 Steps for Sink Alert to Source	390
Table 8-27 Steps for a Sink getting Source Status Sequence.....	391
Table 8-28 Steps for a Source getting Sink Status Sequence.....	393
Table 8-29 Steps for a Sink getting Source PPS status Sequence	395
Table 8-30 Steps for a Sink getting Source Capabilities Sequence	397
Table 8-31 Steps for a Dual-Role Source getting Dual-Role Sink’s capabilities as a Source Sequence.....	399
Table 8-32 Steps for a Source getting Sink Capabilities Sequence	401
Table 8-33 Steps for a Dual-Role Sink getting Dual-Role Source capabilities as a Sink Sequence	403
Table 8-34 Steps for a Sink getting Source extended capabilities Sequence	405

Table 8-35 Steps for a Dual-Role Source getting Dual-Role Sink extended capabilities Sequence.....	407
Table 8-36 Steps for a Sink getting Source Battery capabilities Sequence	409
Table 8-37 Steps for a Source getting Sink Battery capabilities Sequence	411
Table 8-38 Steps for a Sink getting Source Battery status Sequence	413
Table 8-39 Steps for a Source getting Sink Battery status Sequence	415
Table 8-40 Steps for a Source getting Sink's Port Manufacturer Information Sequence	417
Table 8-41 Steps for a Source getting Sink's Port Manufacturer Information Sequence	419
Table 8-42 Steps for a Source getting Sink's Battery Manufacturer Information Sequence.....	421
Table 8-43 Steps for a Source getting Sink's Battery Manufacturer Information Sequence.....	423
Table 8-44 Steps for a VCONN Source getting Sink's Port Manufacturer Information Sequence	425
Table 8-45 Steps for a Source getting Country Codes Sequence	427
Table 8-46 Steps for a Source getting Sink's Country Codes Sequence.....	429
Table 8-47 Steps for a VCONN Source getting Sink's Country Codes Sequence.....	431
Table 8-48 Steps for a Source getting Country Information Sequence.....	433
Table 8-49 Steps for a Source getting Sink's Country Information Sequence	435
Table 8-50 Steps for a VCONN Source getting Sink's Country Information Sequence	437
Table 8-51 Steps for a Source requesting a security exchange with a Sink Sequence.....	439
Table 8-52 Steps for a Sink requesting a security exchange with a Source Sequence.....	441
Table 8-53 Steps for a Vconn Source requesting a security exchange with a Cable Plug Sequence.....	443
Table 8-54 Steps for a Source requesting a firmware update exchange with a Sink Sequence	445
Table 8-55 Steps for a Sink requesting a firmware update exchange with a Source Sequence.....	447
Table 8-56 Steps for a Vconn Source requesting a firmware update exchange with a Cable Plug Sequence	449
Table 8-57 Steps for DFP to UFP Discover Identity.....	451
Table 8-58 Steps for Source Port to Cable Plug Discover Identity.....	453
Table 8-59 Steps for DFP to Cable Plug Discover Identity	455
Table 8-60 Steps for DFP to UFP Enter Mode	457
Table 8-61 Steps for DFP to UFP Exit Mode.....	459
Table 8-62 Steps for DFP to Cable Plug Enter Mode	462
Table 8-63 Steps for DFP to Cable Plug Exit Mode.....	464
Table 8-64 Steps for UFP to DFP Attention.....	466
Table 8-65 Steps for BIST Carrier Mode Test.....	468
Table 8-66 Steps for BIST Test Data Test.....	470
Table 8-67 Steps for UFP USB4 Mode Entry (Valid)	472
Table 8-68 Steps for Cable Plug USB4 Mode Entry (Valid)	474
Table 8-69 Steps for UFP USB4 Mode Entry (Invalid).....	476
Table 8-70 Steps for Cable Plug USB4 Mode Entry (Invalid)	478
Table 8-71 Policy Engine States	560

Table 9-1 USB Power Delivery Type Codes.....	574
Table 9-2 USB Power Delivery Capability Descriptor	574
Table 9-3 Battery Info Capability Descriptor	575
Table 9-4 PD Consumer Port Descriptor	576
Table 9-5 PD Provider Port Descriptor	576
Table 9-6 PD Requests.....	578
Table 9-7 PD Request Codes	578
Table 9-8 PD Feature Selectors	578
Table 9-9 Battery Status Structure	579
Table 9-10 Battery Wake Mask	580
Table 9-11 Charging Policy Encoding.....	581
Table 10-1 Considerations for Sources.....	582
Table 10-2 Normative Voltages and Minimum Currents	583
Table 10-3 Fixed Supply PDO – Source 5V	585
Table 10-4 Fixed Supply PDO – Source 9V	585
Table 10-5 Fixed Supply PDO – Source 15V	585
Table 10-6 Fixed Supply PDO – Source 20V	585
Table 10-7 Programmable Power Supply PDOs and APDOs based on the PDP	587
Table 10-8 Programmable Power Supply Voltage Ranges.....	587
Table B-1 External power is supplied downstream.....	594
Table B-2 External power is supplied upstream	597
Table B-3 Giving back power.....	604
Table C-1 Discover Identity Command request from Initiator Example	616
Table C-2 Discover Identity Command response from Active Cable Responder Example	616
Table C-3 Discover Identity Command response from Hub Responder Example	618
Table C-4 Discover SVIDs Command request from Initiator Example.....	619
Table C-5 Discover SVIDs Command response from Responder Example	619
Table C-6 Discover Modes Command request from Initiator Example	621
Table C-7 Discover Modes Command response from Responder Example.....	621
Table C-8 Enter Mode Command request from Initiator Example	623
Table C-9 Enter Mode Command response from Responder Example	623
Table C-10 Enter Mode Command request from Initiator Example	624
Table C-11 Exit Mode Command request from Initiator Example.....	625
Table C-12 Exit Mode Command response from Responder Example	625
Table C-13 Attention Command request from Initiator Example.....	627
Table C-14 Attention Command request from Initiator with additional VDO Example	627
Table E-1: Sequence Table for setup of a Fast Role Swap (Hub connected to Power Adapter first)	637

Table E-2 Sequence Table for setup of a Fast Role Swap (Hub connected to Notebook before Power Adapter).....	638
Table E-3 Sequence Table for slow Vbus discharge (it discharges after FR_Swap message is sent)	640
Table E-4 Vbus discharges quickly after adapter disconnected.	641

List of Figures

Figure 2-1 Logical Structure of USB Power Delivery Capable Devices.....	54
Figure 2-2 Example SOP' Communication between VCONN Source and Cable Plug(s).....	56
Figure 2-3 USB Power Delivery Communications Stack.....	62
Figure 2-4 USB Power Delivery Communication Over USB.....	62
Figure 2-5 High Level Architecture View.....	64
Figure 5-1 Interpretation of ordered sets.....	72
Figure 5-2 Transmit Order for Various Sizes of Data.....	73
Figure 5-3 USB Power Delivery Packet Format.....	74
Figure 5-4 CRC 32 generation.....	77
Figure 5-5 Line format of Hard Reset.....	79
Figure 5-6 Line format of Cable Reset.....	79
Figure 5-7 BMC Example.....	80
Figure 5-8 BMC Transmitter Block Diagram.....	81
Figure 5-9 BMC Receiver Block Diagram.....	81
Figure 5-10 BMC Encoded Start of Preamble.....	81
Figure 5-11 Transmitting or Receiving BMC Encoded Frame Terminated by Zero with High-to-Low Last Transition.....	82
Figure 5-12 Transmitting or Receiving BMC Encoded Frame Terminated by One with High-to-Low Last Transition.....	82
Figure 5-13 Transmitting or Receiving BMC Encoded Frame Terminated by Zero with Low to High Last Transition.....	83
Figure 5-14 Transmitting or Receiving BMC Encoded Frame Terminated by One with Low to High Last Transition.....	83
Figure 5-15 BMC Tx 'ONE' Mask.....	84
Figure 5-16 BMC Tx 'ZERO' Mask.....	84
Figure 5-17 BMC Rx 'ONE' Mask when Sourcing Power.....	86
Figure 5-18 BMC Rx 'ZERO' Mask when Sourcing Power.....	87
Figure 5-19 BMC Rx 'ONE' Mask when Power neutral.....	87
Figure 5-20 BMC Rx 'ZERO' Mask when Power neutral.....	88
Figure 5-21 BMC Rx 'ONE' Mask when Sinking Power.....	88
Figure 5-22 BMC Rx 'ZERO' Mask when Sinking Power.....	89
Figure 5-23 Transmitter Load Model for BMC Tx from a Source.....	90
Figure 5-24 Transmitter Load Model for BMC Tx from a Sink.....	90
Figure 5-25 Transmitter diagram illustrating zDriver.....	92
Figure 5-26 Inter-Frame Gap Timings.....	93
Figure 5-27 Example Multi-Drop Configuration showing two DRPs.....	95
Figure 5-28 Example Multi-Drop Configuration showing a DFP and UFP.....	95
Figure 5-29 Test Data Frame.....	97

Figure 6-1 USB Power Delivery Packet Format including Control Message Payload	98
Figure 6-2 USB Power Delivery Packet Format including Data Message Payload	99
Figure 6-3 USB Power Delivery Packet Format including an Extended Message Header and Payload.....	99
Figure 6-4 Example Security_Request sequence Unchunked (Chunked bit = 0)	105
Figure 6-5 Example byte transmission for Security_Request Message of Data Size 7 (Chunked bit is set to 0).....	105
Figure 6-6 Example byte transmission for Security_Response Message of Data Size 7 (Chunked bit is set to 0).....	106
Figure 6-7 Example Security_Request sequence Chunked (Chunked bit = 1).....	106
Figure 6-8 Example Security_Request Message of Data Size 7 (Chunked bit set to 1)	107
Figure 6-9 Example Chunk 0 of Security_Response Message of Data Size 30 (Chunked bit set to 1).....	107
Figure 6-10 Example byte transmission for a Security_Response Message Chunk request (Chunked bit is set to 1).....	107
Figure 6-11 Example Chunk 1 of Security_Response Message of Data Size 30 (Chunked bit set to 1)	108
Figure 6-12 Example Capabilities Message with 2 Power Data Objects	117
Figure 6-13 BIST Message	131
Figure 6-14 Vendor Defined Message.....	134
Figure 6-15 Discover Identity Command response.....	139
Figure 6-16 Discover Identity Command response for a DRD	139
Figure 6-17 Example Discover SVIDs response with 3 SVIDs	155
Figure 6-18 Example Discover SVIDs response with 4 SVIDs	155
Figure 6-19 Example Discover SVIDs response with 12 SVIDs followed by an empty response	155
Figure 6-20 Example Discover Modes response for a given SVID with 3 Modes	155
Figure 6-21 Successful Enter Mode sequence.....	157
Figure 6-22 Enter Mode sequence Interrupted by Source Capabilities and then Re-run	157
Figure 6-23 Unsuccessful Enter Mode sequence due to NAK	158
Figure 6-24 Exit Mode sequence.....	159
Figure 6-25 Attention Command request/response sequence.....	159
Figure 6-26 Command request/response sequence.....	160
Figure 6-27 Enter/Exit Mode Process.....	161
Figure 6-28 Battery_Status Message.....	162
Figure 6-29 Alert Message.....	163
Figure 6-30 Get_Country_Info Message	165
Figure 6-31 Enter_USB Message	165
Figure 6-32 Source_Capabilities_Extended Message	168
Figure 6-33 SOP Status Message.....	172
Figure 6-34 SOP'/SOP'' Status Message.....	174
Figure 6-35 Get_Battery_Cap Message	175
Figure 6-36 Get_Battery_Status Message.....	176

Figure 6-37 Battery_Capabilities Message	176
Figure 6-38 Get_Manufacturer_Info Message.....	177
Figure 6-39 Manufacturer_Info Message	178
Figure 6-40 Security_Request Message	179
Figure 6-41 Security_Response Message	179
Figure 6-42 Firmware_Update_Request Message.....	179
Figure 6-43 Firmware_Update_Response Message.....	180
Figure 6-44 PPS_Status Message.....	180
Figure 6-45 Country_Codes Message.....	181
Figure 6-46 Country_Info Message	182
Figure 6-47 Sink_Capabilities_Extended Message	182
Figure 6-48 Outline of States	207
Figure 6-49 References to states	207
Figure 6-50 Chunking architecture Showing Message and Control Flow	208
Figure 6-51 Chunked Rx State Diagram.....	210
Figure 6-52 Chunked Tx State Diagram.....	213
Figure 6-53 Chunked Message Router State Diagram.....	216
Figure 6-54 Common Protocol Layer Message Transmission State Diagram.....	218
Figure 6-55 Source Protocol Layer Message Transmission State Diagram	221
Figure 6-56 Sink Protocol Layer Message Transmission State Diagram	222
Figure 6-57 Protocol layer Message reception.....	224
Figure 6-58 Hard/Cable Reset.....	226
Figure 7-1 Placement of Source Bulk Capacitance.....	238
Figure 7-2 Transition Envelope for Positive Voltage Transitions.....	239
Figure 7-3 Transition Envelope for Negative Voltage Transitions.....	240
Figure 7-4 PPS Positive Voltage Transitions	241
Figure 7-5 PPS Negative Voltage Transitions.....	242
Figure 7-6 Expected PPS Ripple Relative to an LSB.....	242
Figure 7-7 PPS Programmable Voltage and Current Limit	244
Figure 7-8 iPpsCLOperatingDetail	245
Figure 7-9 PPS Programmable Voltage and Current Limit	246
Figure 7-10 Source V_{BUS} and V_{CONN} Response to Hard Reset	247
Figure 7-11 Application of v_{SrcNew} and $v_{SrcValid}$ limits after $t_{SrcReady}$	249
Figure 7-12 Source Peak Current Overload	250
Figure 7-13 Holdup Time Measurement.....	252
Figure 7-14 V_{BUS} Power during Fast Role Swap	253
Figure 7-15 V_{BUS} detection and timing during Fast Role Swap, initial V_{BUS} (at new source) > v_{Safe5V} (min).....	254

Figure 7-16 V_{BUS} detection and timing during Fast Role Swap, initial V_{BUS} (at new source) < v_{Safe5V} (min).....	254
Figure 7-17 Data Reset UFP V_{CONN} Power Cycle	255
Figure 7-18 Data Reset DFP V_{CONN} Power Cycle	256
Figure 7-19 Placement of Sink Bulk Capacitance	257
Figure 7-20 Transition Diagram for Increasing the Current.....	262
Figure 7-21 Transition Diagram for Increasing the Voltage.....	264
Figure 7-22 Transition Diagram for Increasing the Voltage and Current	266
Figure 7-23 Transition Diagram for Increasing the Voltage and Decreasing the Current.....	268
Figure 7-24 Transition Diagram for Decreasing the Voltage and Increasing the Current.....	270
Figure 7-25 Transition Diagram for Decreasing the Current.....	272
Figure 7-26 Transition Diagram for Decreasing the Voltage	274
Figure 7-27 Transition Diagram for Decreasing the Voltage and the Current.....	276
Figure 7-28 Transition Diagram for a Sink Requested Power Role Swap.....	278
Figure 7-29 Transition Diagram for a Source Requested Power Role Swap.....	281
Figure 7-30 Transition Diagram for a GotoMin Current Decrease	284
Figure 7-31 Transition Diagram for a Source Initiated Hard Reset	286
Figure 7-32 Transition Diagram for a Sink Initiated Hard Reset	288
Figure 7-33 Transition Diagram for no change in Current or Voltage.....	290
Figure 7-34 Transition Diagram for Fast Role Swap	292
Figure 7-35 Transition Diagram for Increasing the Programmable Power Supply Voltage	294
Figure 7-36 Transition Diagram for Decreasing the Programmable Power Supply Voltage.....	296
Figure 7-37 Transition Diagram for Changing the Source PDO or APDO	298
Figure 7-38 Transition Diagram for increasing the Current in PPS mode	300
Figure 7-39 Transition Diagram for decreasing the Current in PPS mode	302
Figure 7-40 Transition Diagram for no change in Current or Voltage in PPS mode.....	304
Figure 8-1 Example of daisy chained displays.....	317
Figure 8-2 Basic Message Exchange (Successful).....	320
Figure 8-3 Basic Message flow indicating possible errors	321
Figure 8-4 Basic Message Flow with Bad CRC followed by a Retry.....	322
Figure 8-5 Successful Fixed, Variable or Battery Power Negotiation.....	326
Figure 8-6 Successful GotoMin operation.....	329
Figure 8-7 PPS Keep Alive.....	331
Figure 8-8 Soft Reset	334
Figure 8-9 DFP Initiated Data Reset where the DFP is the V_{conn} Source.....	336
Figure 8-10 DFP Receives Data Reset where the DFP is the V_{conn} Source.....	339
Figure 8-11 DFP Initiated Data Reset where the UFP is the V_{conn} Source	342
Figure 8-12 DFP Receives a Data Reset where the UFP is the V_{conn} Source	346

Figure 8-13 Source initiated Hard Reset.....	350
Figure 8-14 Sink Initiated Hard Reset.....	353
Figure 8-15 Source initiated reset - Sink long reset.....	356
Figure 8-16 Successful Power Role Swap Sequence Initiated by the Source.....	360
Figure 8-17 Successful Power Role Swap Sequence Initiated by the Sink.....	365
Figure 8-18 Successful Fast Role Swap Sequence.....	370
Figure 8-19 Data Role Swap, UFP operating as Sink initiates.....	374
Figure 8-20 Data Role Swap, UFP operating as Source initiates.....	376
Figure 8-21 Data Role Swap, DFP operating as Source initiates	378
Figure 8-22 Data Role Swap, DFP operating as Sink initiates.....	380
Figure 8-23 Source to Sink VCONN Source Swap	382
Figure 8-24 Sink to Source VCONN Source Swap	385
Figure 8-25 Source Alert to Sink.....	388
Figure 8-26 Sink Alert to Source.....	390
Figure 8-27 Sink Gets Source Status.....	391
Figure 8-28 Source Gets Sink Status.....	393
Figure 8-29 Sink Gets Source PPS Status	395
Figure 8-30 Sink Gets Source's Capabilities.....	397
Figure 8-31 Dual-Role Source Gets Dual-Role Sink's Capabilities as a Source.....	399
Figure 8-32 Source Gets Sink's Capabilities.....	401
Figure 8-33 Dual-Role Sink Gets Dual-Role Source's Capabilities as a Sink.....	403
Figure 8-34 Sink Gets Source's Extended Capabilities.....	405
Figure 8-35 Dual-Role Source Gets Dual-Role Sink's Extended Capabilities	407
Figure 8-36 Sink Gets Source's Battery Capabilities	409
Figure 8-37 Source Gets Sink's Battery Capabilities	411
Figure 8-38 Sink Gets Source's Battery Status.....	413
Figure 8-39 Source Gets Sink's Battery Status.....	415
Figure 8-40 Source Gets Sink's Port Manufacturer Information	417
Figure 8-41 Sink Gets Source's Port Manufacturer Information	419
Figure 8-42 Source Gets Sink's Battery Manufacturer Information.....	421
Figure 8-43 Sink Gets Source's Battery Manufacturer Information.....	423
Figure 8-44 VCONN Source Gets Cable Plug's Manufacturer Information	425
Figure 8-45 Source Gets Sink's Country Codes.....	427
Figure 8-46 Sink Gets Source's Country Codes.....	429
Figure 8-47 VCONN Source Gets Cable Plug's Country Codes.....	431
Figure 8-48 Source Gets Sink's Country Information	433
Figure 8-49 Sink Gets Source's Country Information	435
Figure 8-50 VCONN Source Gets Cable Plug's Country Information	437

Figure 8-51 Source requests security exchange with Sink	439
Figure 8-52 Sink requests security exchange with Source	441
Figure 8-53 Vconn Source requests security exchange with Cable Plug	443
Figure 8-54 Source requests firmware update exchange with Sink	445
Figure 8-55 Sink requests firmware update exchange with Source	447
Figure 8-56 Vconn Source requests firmware update exchange with Cable Plug	449
Figure 8-57 DFP to UFP Discover Identity	451
Figure 8-58 Source Port to Cable Plug Discover Identity	453
Figure 8-59 DFP to Cable Plug Discover Identity	455
Figure 8-60 DFP to UFP Enter Mode	457
Figure 8-61 DFP to UFP Exit Mode	459
Figure 8-62 DFP to Cable Plug Enter Mode	461
Figure 8-63 DFP to Cable Plug Exit Mode	464
Figure 8-64 UFP to DFP Attention	466
Figure 8-65 BIST Carrier Mode Test	467
Figure 8-66 BIST Test Data Test	469
Figure 8-67 UFP Entering USB4 Mode (Valid)	472
Figure 8-68 Cable Plug Entering USB4 Mode (Valid)	474
Figure 8-69 UFP Entering USB4 Mode (Invalid)	476
Figure 8-70 Cable Plug Entering USB4 Mode (Invalid)	478
Figure 8-71 Outline of States	479
Figure 8-72 References to states	480
Figure 8-73 Example of state reference with conditions	480
Figure 8-74 Example of state reference with the same entry and exit	480
Figure 8-75 Source Port Policy Engine State Diagram	481
Figure 8-76 Sink Port State Diagram	487
Figure 8-77 Source Port Soft Reset and Protocol Error State Diagram	492
Figure 8-78 Sink Port Soft Reset and Protocol Error Diagram	493
Figure 8-79 DFP Data_Reset Message State Diagram	495
Figure 8-80 UFP Data_Reset Message State Diagram	497
Figure 8-81 Source Port Not Supported Message State Diagram	499
Figure 8-82 Sink Port Not Supported Message State Diagram	500
Figure 8-83 Source Port Ping State Diagram	501
Figure 8-84 Source Port Source Alert State Diagram	501
Figure 8-85 Sink Port Source Alert State Diagram	502
Figure 8-86 Sink Port Sink Alert State Diagram	502
Figure 8-87 Source Port Sink Alert State Diagram	502
Figure 8-88 Sink Port Get Source Capabilities Extended State Diagram	503

Figure 8-89 Source Give Source Capabilities Extended State Diagram	503
Figure 8-90 Sink Port Get Source Status State Diagram.....	504
Figure 8-91 Source Give Source Status State Diagram.....	504
Figure 8-92 Source Port Get Sink Status State Diagram.....	505
Figure 8-93 Sink Give Sink Status State Diagram	505
Figure 8-94 Sink Port Get Source PPS Status State Diagram.....	506
Figure 8-95 Source Give Source PPS Status State Diagram.....	506
Figure 8-96 Get Battery Capabilities State Diagram	507
Figure 8-97 Give Battery Capabilities State Diagram	507
Figure 8-98 Get Battery Status State Diagram	508
Figure 8-99 Give Battery Status State Diagram.....	508
Figure 8-100 Get Manufacturer Information State Diagram.....	509
Figure 8-101 Give Manufacturer Information State Diagram.....	509
Figure 8-102 Get Country Codes State Diagram	510
Figure 8-103 Give Country Codes State Diagram	511
Figure 8-104 Get Country Information State Diagram.....	511
Figure 8-105 Give Country Information State Diagram	512
Figure 8-106 DFP Enter_USB Message State Diagram	512
Figure 8-107 UFP Enter_USB Message State Diagram	513
Figure 8-108 Send security request State Diagram.....	513
Figure 8-109 Send security response State Diagram.....	514
Figure 8-110 Security response received State Diagram.....	514
Figure 8-111 Send firmware update request State Diagram	515
Figure 8-112 Send firmware update response State Diagram	515
Figure 8-113 Firmware update response received State Diagram	516
Figure 8-114: DFP to UFP Data Role Swap State Diagram	517
Figure 8-115: UFP to DFP Data Role Swap State Diagram	519
Figure 8-116: Dual-Role Port in Source to Sink Power Role Swap State Diagram	521
Figure 8-117: Dual-role Port in Sink to Source Power Role Swap State Diagram	524
Figure 8-118: Dual-Role Port in Source to Sink Fast Role Swap State Diagram.....	527
Figure 8-119: Dual-role Port in Sink to Source Fast Role Swap State Diagram	530
Figure 8-120 Dual-Role (Source) Get Source Capabilities diagram	532
Figure 8-121 Dual-Role (Source) Give Sink Capabilities diagram	533
Figure 8-122 Dual-Role (Sink) Get Sink Capabilities State Diagram	533
Figure 8-123 Dual-Role (Sink) Give Source Capabilities State Diagram.....	534
Figure 8-124 Dual-Role (Source) Get Source Capabilities Extended State Diagram	534
Figure 8-125 Dual-Role (Source) Give Sink Capabilities diagram	535
Figure 8-126 VCONN Swap State Diagram.....	536

Figure 8-127 Initiator to Port VDM Discover Identity State Diagram.....	539
Figure 8-128 Initiator VDM Discover SVIDs State Diagram	540
Figure 8-129 Initiator VDM Discover Modes State Diagram.....	541
Figure 8-130 Initiator VDM Attention State Diagram	542
Figure 8-131 Responder Structured VDM Discover Identity State Diagram	543
Figure 8-132 Responder Structured VDM Discover SVIDs State Diagram.....	544
Figure 8-133 Responder Structured VDM Discover Modes State Diagram	545
Figure 8-134 Receiving a Structured VDM Attention State Diagram	546
Figure 8-135 DFP VDM Mode Entry State Diagram	546
Figure 8-136 DFP VDM Mode Exit State Diagram.....	548
Figure 8-137 UFP Structured VDM Enter Mode State Diagram.....	549
Figure 8-138 UFP Structured VDM Exit Mode State Diagram	550
Figure 8-139 Cable Ready VDM State Diagram.....	551
Figure 8-140 Cable Plug Soft Reset State Diagram	551
Figure 8-141 Cable Plug Hard Reset State Diagram.....	552
Figure 8-142 VCONN Source Soft Reset or Cable Reset of a Cable Plug or VPD State Diagram	553
Figure 8-143 Source Startup Structured VDM Discover Identity State Diagram	554
Figure 8-144 Cable Plug Structured VDM Enter Mode State Diagram.....	556
Figure 8-145 Cable Plug Structured VDM Exit Mode State Diagram	557
Figure 8-146 BIST Carrier Mode State Diagram	558
Figure 9-1 Example PD Topology.....	568
Figure 9-2 Mapping of PD Topology to USB.....	569
Figure 9-3 USB Attached to USB Powered State Transition	570
Figure 9-4 Any USB State to USB Attached State Transition (When operating as a Consumer).....	571
Figure 9-5 Any USB State to USB Attached State Transition (When operating as a Provider).....	571
Figure 9-6 Any USB State to USB Attached State Transition (After a USB Type-C Data Role Swap).....	572
Figure 9-7 Software stack on a PD aware OS	572
Figure 9-8 Enumeration of a PDUSB Device.....	573
Figure 10-1 Source Power Rule Illustration.....	584
Figure 10-2 Source Power Rule Example.....	584
Figure B-1 External Power supplied downstream.....	593
Figure B-2 External Power supplied upstream.....	597
Figure B-3 Giving Back Power.....	604
Figure D-1 Circuit Block of BMC Finite Difference Receiver	629
Figure D-2 BMC AC and DC noise from VBUS at Power Sink.....	630
Figure D-3 Sample BMC Signals (a) without [USB 2.0] SE0 Noise (b) with [USB 2.0] SE0 Noise.....	630
Figure D-4 Scaled BMC Signal Derivative with 50ns Sampling Rate	631
Figure D-5 BMC Signal and Finite Difference Output with Various Time Steps	631

Figure D-6 Output of Finite Difference in dash line and Edge Detector in solid line.....	632
Figure D-7 Noise Zone and Detect Zone of BMC Receiver.....	632
Figure D-8 Circuit Block of BMC Subtraction Receiver.....	633
Figure D-9 (a) Output of LPF1 and LPF2 (b) Subtraction of LPF1 and LPF2 Output.....	633
Figure D-10 Output of the BMC LPF1 in blue dash curve and the Subtractor in red solid curve.....	634
Figure E-1 Example FRS Capable System.....	635
Figure E-2 Slow V_{BUS} Discharge.....	636
Figure E-3 Fast V_{BUS} Discharge.....	637
Figure E-4 Sequence Diagram for slow V_{BUS} discharge (it discharges after FR_Swap message is sent).....	640

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 can 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 [\[USB 2.0\]](#), [\[USB 3.2\]](#), [\[USB Type-C 2.0\]](#) 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:

- Works seamlessly with legacy USB Devices
- Compatible with existing spec-compliant USB cables
- Minimizes potential damage from non-compliant cables (e.g. ‘Y’ cables etc.)
- 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.

To facilitate optimum charging, the specification defines two mechanisms a USB Charger can advertise for the Device to use:

1. A list of fixed voltages each with a maximum current. The Device selects a voltage and current from the list. This is the traditional model used by Devices that use internal electronics to manage the charging of their battery including modifying the voltage and current actually supplied to the battery. The side-effect of this model is that the charging circuitry generates heat that may be problematic for small form factor devices.
2. A list of programmable voltage ranges each with a maximum current (PPS). The Device requests a voltage (in 20 mV increments) that is within the advertised range and a maximum current. The USB Charger delivers the requested voltage until the maximum current is reached at which time the USB charger reduces its output voltage so as not to supply more than the requested maximum current. During the high current portion of the charge cycle, the USB Charger can be directly connected (through an appropriate safety device) to the battery. This model is used by Devices that want to minimize the thermal impact of their internal charging circuitry.

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:

- [\[USB 2.0\]](#), [\[USB 3.2\]](#) in band requests for high power interfaces.
- [\[USBBC 1.2\]](#) mechanisms for supplying higher power (not mandated by this specification).
- [\[USB Type-C 2.0\]](#) mechanisms for supplying higher power

Initial operating conditions remain the USB Default Operation as defined in [\[USB 2.0\]](#), [\[USB 3.2\]](#), [\[USB Type-C 2.0\]](#) 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 [\[USB 2.0\]](#), [\[USB 3.2\]](#), [\[USB Type-C 2.0\]](#) 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 [\[USB 2.0\]](#), [\[USB 3.2\]](#), [\[USB Type-C 2.0\]](#) 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, illustrates 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

Discard, Discards and **Discarded** are equivalent keywords 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

Ignore, Ignores and **Ignored** are equivalent keywords indicating Messages or Message fields which, when received, **Shall** result in no special action by the receiver. An **Ignored** Message **Shall** only result in returning a **GoodCRC** Message to acknowledge Message receipt. A Message with an **Ignored** field **Shall** be processed normally except for any actions relating to the **Ignored** field.

1.4.2.5 Invalid

Invalid is a keyword when used in relation to a Packet indicates that the Packet'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 no longer be maintained by the Source. When **Invalid** is used in relation to individual K-codes or K-code sequences indicates that the received Signaling falls outside of the defined specification.

1.4.2.6 May

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

1.4.2.7 May Not

May Not is a keyword that is the inverse of **May**. Indicates a choice to not implement a given feature with no implied preference.

1.4.2.8 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.

1.4.2.9 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.

1.4.2.10 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.

1.4.2.11 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.

1.4.2.12 Shall Not

Shall Not is a keyword that is the inverse of **Shall** indicating non-compliant operation.

1.4.2.13 Should

Should is a keyword indicating flexibility of choice with a preferred alternative; equivalent to the phrase "it is recommended that...".

1.4.2.14 Should Not

Should Not is a keyword is the inverse of **Should**; equivalent to the phrase "it is recommended that implementations do not...".

1.4.2.15 Valid

Valid is a keyword that is the inverse of **Invalid** indicating either a Packet or Signaling that fall within the defined specification or an Explicit Contract that can be maintained by the Source.

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 3.2]** – Universal Serial Bus 3.2 Specification, Revision 1.0, September 22, 2017. www.usb.org/developers/docs.
- **[USBTypeCAuthentication 1.0]**, Universal Serial Bus Type-C Authentication Specification, Revision 1.0, March 25, 2016. www.usb.org/developers/docs.
- **[USBPDFirmwareUpdate 1.0]**, Universal Serial Bus Power Delivery Firmware Update Specification, Revision 1.0, September 15, 2016. <http://www.usb.org/developers/powerdelivery/>
- **[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 1.1]** – Universal Serial Bus Type-C Bridge Specification, Revision 1.1, October 10, 2017. www.usb.org/developers/docs.
- **[USBTypeCBridge 1.0]** – Universal Serial Bus Type-C Bridge Specification, Revision 1.0, March 25, 2016. www.usb.org/developers/docs.
- **[USBPD 2.0]** – Universal Serial Bus Power Delivery Specification, Revision 2, Version 1.2, March 25, 2016. www.usb.org/developers/docs.

- **[USBPDCompliance]** – USB Power Delivery Compliance Plan Revision 1.02, Version 2.0, 8 March 2017 http://www.usb.org/developers/docs/devclass_docs/.
- **[USB Type-C 2.0]** – Universal Serial Bus Type-C Cable and Connector Specification, Revision 2.0, TBD August 2019. 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.
- **[ISO 3166]** ISO 3166 international Standard for country codes and codes for their subdivisions. http://www.iso.org/iso/home/standards/country_codes.htm.
- **[USB4]** – Universal Serial Bus 4 Specification (USB4™), Version 1.0, August 2019. www.usb.org/developers/docs.
- **[DPTC1.0]** DisplayPort™ Alt Mode on USB Type-C® Standard, Version 1.0b, 03 November 2017. www.vesa.org.
- **[TBT3]** see **[USB4]** Chapter 13 for Thunderbolt™ 3 device operation.

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