USB Power Delivery ENGINEERING CHANGE NOTICE

Title: Deprecate AMA Product Type and Remove AMC Type

Applied to: USB Power Delivery Specification Revision 3.0 Version 2.0

Brief description of the functional changes proposed:
Starting with R3.0 V2.0, UFP VDOs and the DFP VDOs (which are directly used in USB4 discovery) have been mandated for the PD USB* Product Types. However, the AMA and AMC types were not covered. This has led to ambiguity as to how to implement a USB4 host or peripheral with Alternate Mode Adapter or Controller support. This ECN deprecates and removes support for the AMA and AMC types and adds the fields that were previously in the AMA VDO to UFP VDO.

Benefits as a result of the proposed changes:
Unifies all UFPs and DFPs around unambiguous Product Types of PD USB Peripheral, PD USB Host, or PD USB Hub, regardless whether Alternate Modes are supported or not. Simplifies the VDO objects that are returned as part of the Discover Identity response for a SOP to just the UFP and DFP VDOs, without a 3rd type of VDO in the mix.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:

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Legacy Discover Identity initiators which support Alternate Modes (typically a DFP alternate mode controller) should today not gate the Alternate Mode discovery process on the Product Type, as it is common for a product to set a non AMA type but still support Alternate Modes. The “Modal Operation Supported” bit will indicate to the initiator whether to continue to the next phase, Discover SVIDs, so this change will have no effect on mode entry.

A legacy PD 3.0 DFP AMC may look for the Vconn Power, Vconn Required, an VBus Required from an AMA, and in the case of a new AMA which uses one of the PD USB product types, it will not find that information. It is possible that AMAs which can run only on Vconn or only on Vbus may cause DFPs to consume a little bit more power if the DFP is using the response of AMA VDO to decide when to turn those supplies off.

However, we think the number of DFPs which actually consume said fields from AMA VDO are quite small.

An analysis of the hardware implications:
None.

An analysis of the software implications:

An analysis of the compliance testing implications:

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Actual Change Requested

(a). Section 6.4.4.3.1 Discover Identity Page 140-141

From:

The ***Discover Identity*** Command ACK sent back by the Responder ***Shall*** contain an ID Header VDO, a Cert Stat VDO, a Product VDO and the Product Type VDOs defined by the Product Type as shown in Figure 6-15. This specification defines the following Product Type VDOs:

- Passive Cable VDO (see Section 6.4.4.3.1.6)
- Active Cable VDOs (see Section 6.4.4.3.1.7)
- Alternate Mode Adapter VDO (see Section 6.4.4.3.1.8)
- VCONN Powered USB Device VDO (see Section 6.4.4.3.1.9)
- UFP VDO (see Section 6.4.4.3.1.4)
- DFP VDO (see Section 6.4.4.3.1.5)

If the product is a DRD both a Product Type (UFP) and a Product Type (DFP) are declared in the ID Header. These products ***Shall*** set both the PDUSB Host and PDUSB Peripheral bits in the ID Header and ***Shall*** return Product Type VDOs for both the PDUSB Peripheral and PDUSB Host beginning with the UFP VDOs followed by the DFP VDO as shown in Figure 6-16.

To Text:

The ***Discover Identity*** Command ACK sent back by the Responder ***Shall*** contain an ID Header VDO, a Cert Stat VDO, a Product VDO and the Product Type VDOs defined by the Product Type as shown in Figure 6-15. This specification defines the following Product Type VDOs:

- Passive Cable VDO (see Section 6.4.4.3.1.6)
- Active Cable VDOs (see Section 6.4.4.3.1.7)
- ~~Alternate Mode Adapter VDO (see Section 6.4.4.3.1.8)~~
- VCONN Powered USB Device VDO (see Section 6.4.4.3.1.9)
- UFP VDO (see Section 6.4.4.3.1.4)
- DFP VDO (see Section 6.4.4.3.1.5)

If the product is a DRD both a Product Type (UFP) and a Product Type (DFP) are declared in the ID Header. These products ~~***Shall*** set both the PDUSB Host and PDUSB Peripheral bits in the ID Header and~~ ***Shall*** return Product Type VDOs for both ~~the PDUSB Peripheral and PDUSB Host~~ UFP and DFP beginning with the UFP VDO~~s~~, then by a 32-bit Pad Object (defined as all '0's), followed by the DFP VDO as shown in Figure 6-16.

(b). Table 6-29 ID Header VDO

From:

Table 6-29 ID Header VDO

Bit(s)	Description	Reference
B31	USB Communications Capable as USB Host: • ***Shall*** be set to one if the product is capable of enumerating USB Devices. • ***Shall*** be set to zero otherwise	Section 6.4.4.3.1.1.1
B30	USB Communications Capable as a USB Device: • ***Shall*** be set to one if the product is capable of being enumerated as a USB Device. • ***Shall*** be set to zero otherwise	Section 6.4.4.3.1.1.2
B29…27	Product Type (UFP): • 000b – Undefined • 001b – PDUSB Hub • 010b – PDUSB Peripheral • 011b – PSD • 100b – ***Reserved***, ***Shall Not*** be used. • 101b – Alternate Mode Adapter (AMA) • 110b – VCONN-Powered USB Device (VPD) • 111b – ***Reserved***, ***Shall Not*** be used. Product Type (Cable Plug): • 000b – Undefined • 001b…010b – ***Reserved***, ***Shall Not*** be used. • 011b – Passive Cable • 100b – Active Cable • 101b…111b – ***Reserved***, ***Shall Not*** be used.	Section 6.4.4.3.1.1.3

Bit(s)	Description	Reference
B26	Modal Operation Supported: • ***Shall*** be set to one if the product supports Modal Operation (Alternate Modes). • ***Shall*** be set to zero otherwise	Section 6.4.4.3.1.1.4
B25…23	Product Type (DFP): • 000b – Undefined • 001b – PDUSB Hub • 010b – PDUSB Host • 011b – Power Brick • 100b - Alternate Mode Controller (AMC) • 101b…111b – ***Reserved***, ***Shall Not*** be used.	
B22…21	Connector Type: • 00b – Reserved, for compatibility with legacy systems. • 01b – Reserved, Shall Not be used. • 10b – USB Type-C Receptacle • 11b – USB Type-C Plug	
B20…16	***Reserved***. ***Shall*** be set to zero.	
B15…0	USB Vendor ID.	***[USB 2.0]/[USB 3.2]/[USB4]***

To:

Table 6-29 ID Header VDO

Bit(s)	Description	Reference
B31	USB Communications Capable as USB Host: • ***Shall*** be set to one if the product is capable of enumerating USB Devices. • ***Shall*** be set to zero otherwise	Section 6.4.4.3.1.1.1
B30	USB Communications Capable as a USB Device: • ***Shall*** be set to one if the product is capable of being enumerated as a USB Device. • ***Shall*** be set to zero otherwise	Section 6.4.4.3.1.1.2
B29…27	Product Type (UFP): • 000b – Undefined • 001b – PDUSB Hub	Section 6.4.4.3.1.1.3

Bit(s)	Description	Reference
	• 010b – PDUSB Peripheral • 011b – PSD • 100..101b – ***Reserved***, ***Shall Not*** be used. • ~~101b – Alternate Mode Adapter (AMA)~~ • 110b – VCONN-Powered USB Device (VPD) • 111b – ***Reserved***, ***Shall Not*** be used. Product Type (Cable Plug): • 000b – Undefined • 001b…010b – ***Reserved***, ***Shall Not*** be used. • 011b – Passive Cable • 100b – Active Cable • 101b…111b – ***Reserved***, ***Shall Not*** be used.	
B26	Modal Operation Supported: • ***Shall*** be set to one if the product supports Modal Operation (Alternate Modes). • ***Shall*** be set to zero otherwise	Section 6.4.4.3.1.1.4
B25…23	Product Type (DFP): • 000b – Undefined • 001b – PDUSB Hub • 010b – PDUSB Host • 011b – Power Brick • ~~100b – Alternate Mode Controller (AMC)~~ • 100b…111b – ***Reserved***, ***Shall Not*** be used.	
B22…21	Connector Type: • 00b – Reserved, for compatibility with legacy systems. • 01b – Reserved, Shall Not be used. • 10b – USB Type-C Receptacle • 11b – USB Type-C Plug	
B20…16	***Reserved***. ***Shall*** be set to zero.	
B15…0	USB Vendor ID.	***[USB 2.0]***/***[USB 3.2]***/***[USB4]***

(c). Section 6.4.4.3.1.1.3 Product Type (UFP) Page 142, Table 6-30

From:

Table 6-30 Product Types (UFP)

Product Type	Description	Product Type VDO	Reference
Undefined	***Shall*** be used where no other Product Type value is appropriate.	None	
PDUSB Hub	***Shall*** be used when the Product is a PDUSB Hub.	UFP VDO	Section 6.4.4.3.1.4
PDUSB Peripheral	***Shall*** be used when the Product is a PDUSB Device other than a PDUSB Hub.	UFP VDO	Section 6.4.4.3.1.4
PSD	***Shall*** be used when the Product is a PSD, e.g. power bank.	None	
Alternate Mode Adapter	***Shall*** be used when the Product is a PDUSB Device that supports one or more Alternate Modes.	AMA VDO	Section 6.4.4.3.1.8
VCONN Powered USB Device	***Shall*** be used when the Product is a PDUSB VCONN Powered USB Device.	VPD VDO	Section 6.4.4.3.1.9

To Text:

Table 6-30 Product Types (UFP)

Product Type	Description	Product Type VDO	Reference
Undefined	***Shall*** be used where no other Product Type value is appropriate.	None	
PDUSB Hub	***Shall*** be used when the Product is a PDUSB Hub.	UFP VDO	Section 6.4.4.3.1.4
PDUSB Peripheral	***Shall*** be used when the Product is a PDUSB Device other than a PDUSB Hub.	UFP VDO	Section 6.4.4.3.1.4
PSD	***Shall*** be used when the Product is a PSD, e.g. power bank.	None	

Product Type	Description	Product Type VDO	Reference
~~Alternate Mode Adapter~~	~~***Shall*** be used when the Product is a PDUSB Device that supports one or more Alternate Modes.~~	~~AMA VDO~~	~~Section 6.4.4.3.1.8~~
VCONN Powered USB Device	***Shall*** be used when the Product is a PDUSB VCONN Powered USB Device.	VPD VDO	Section 6.4.4.3.1.9

(d). Table 6-35 UFP VDO1

From:

Table 6-35 UFP VDO 1

<table>
<tr><th>Bit(s)</th><th>Field</th><th>Description</th></tr>
<tr><td>B31…29</td><td>UFP VDO Version</td><td>Version Number of the VDO (not this specification Version):
• Version 1.1 = 001b
Values 010b…111b are Reserved and Shall Not be used</td></tr>
<tr><td>B28</td><td>Reserved</td><td>Shall be set to zero.</td></tr>
<tr><td>B27…24</td><td>Device Capability</td><td><table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>[USB 2.0] Device Capable</td></tr><tr><td>1</td><td>[USB 2.0] Device Capable (Billboard only)</td></tr><tr><td>2</td><td>[USB 3.2] Device Capable</td></tr><tr><td>3</td><td>[USB4] Device Capable</td></tr></table></td></tr>
<tr><td>B23…22</td><td>Connector Type</td><td>00b = Reserved, Shall Not be used
01b = Reserved, Shall Not be used
10b = USB Type-C Receptacle
11b = USB Type-C Captive Plug</td></tr>
<tr><td>B21…6</td><td>Reserved</td><td>Shall be set to zero.</td></tr>
<tr><td>B5…3</td><td>Alternate Modes</td><td><table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Supports [TBT3] Alternate Mode</td></tr><tr><td>1</td><td>Supports Alternate Modes that reconfigure the signals on the [USB Type-C 2.0] connector – except for [TBT3].</td></tr><tr><td>2</td><td>Supports Alternate Modes that do not reconfigure the signals on the [USB Type-C 2.0] connector</td></tr></table></td></tr>
<tr><td>B2…0</td><td>USB Highest Speed</td><td>000b = [USB 2.0] only, no SuperSpeed support
001b = [USB 3.2] Gen1
010b = [USB 3.2]/[USB4] Gen2
011b = [USB4] Gen3
100b…111b = Reserved, Shall Not be used</td></tr>
</table>

To:

Table 6-35 UFP VDO 1

Bit(s)	Field	Description
B31…29	UFP VDO Version	Version Number of the VDO (not this specification Version): • Version 1.2 = 010b Values 010b…111b are ***Reserved*** and ***Shall Not*** be used
B28	***Reserved***	***Shall*** be set to zero.
B27…24	Device Capability	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>*[USB 2.0]* Device Capable</td></tr><tr><td>1</td><td>*[USB 2.0]* Device Capable (Billboard only)</td></tr><tr><td>2</td><td>*[USB 3.2]* Device Capable</td></tr><tr><td>3</td><td>*[USB4]* Device Capable</td></tr></table>
B23…22	Connector Type	00b = ***Reserved***, ***Shall Not*** be used 01b = ***Reserved***, ***Shall Not*** be used 10b = USB Type-C Receptacle 11b = USB Type-C Captive Plug
B21…11	***Reserved***	***Shall*** be set to zero.
B10…8	VCONN power	When the VCONN required field is set to "Yes" the VCONN Power Field indicates the VCONN power needed by the AMA for full functionality: • 000b = 1W • 001b = 1.5W • 010b = 2W • 011b = 3W • 100b = 4W • 101b = 5W • 110b = 6W • 111b = ***Reserved***, ***Shall Not*** be used When the VCONN required field is set to "No" the VCONN Power Field is ***Reserved*** and ***Shall*** be set to zero.
B7	VCONN required	Indicates whether the AMA requires VCONN in order to to function. • 0 = No • 1 = Yes When the Alternate Modes field indicates no modes are supported, the VCONN Required field is ***Reserved*** and ***Shall*** be set to zero.
B6	VBUS required	Indicates whether the AMA requires VBUS in order to to function.

<table>
<tr><th>Bit(s)</th><th>Field</th><th>Description</th></tr>
<tr><td></td><td></td><td>• 0 = Yes
• 1 = No
When the Alternate Modes field indicates no modes are supported, the VBUS Required field is Reserved and Shall be set to zero.</td></tr>
<tr><td>B5…3</td><td>Alternate Modes</td><td><table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Supports [TBT3] Alternate Mode</td></tr><tr><td>1</td><td>Supports Alternate Modes that reconfigure the signals on the [USB Type-C 2.0] connector – except for [TBT3].</td></tr><tr><td>2</td><td>Supports Alternate Modes that do not reconfigure the signals on the [USB Type-C 2.0] connector</td></tr></table></td></tr>
<tr><td>B2…0</td><td>USB Highest Speed</td><td>000b = [USB 2.0] only, no SuperSpeed support
001b = [USB 3.2] Gen1
010b = [USB 3.2]/[USB4] Gen2
011b = [USB4] Gen3
100b…111b = Reserved, Shall Not be used</td></tr>
</table>

(e) Section 6.4.4.3.1.4

Additional:

6.4.4.3.1.4.4 VCONN Power Field

When the VCONN required field indicates that VCONN is required the VCONN power field ***Shall*** indicate how much power an AMA needs in order to fully operate. When the VCONN required field is set to "No" the VCONN Power Field is ***Reserved*** and ***Shall*** be set to zero.

6.4.4.3.1.4.5 VCONN Required Field

The VCONN required field ***Shall*** indicate whether VCONN is needed for the AMA to operate. The VCONN required field ***Shall*** only be used if the Alternate Modes fields indicates that an Alternate Mode is supported. If no alternate modes are supported, this field is ***Reserved*** and ***Shall*** be set to 0.

6.4.4.3.1.4.6 VBUS Required Field

The VBUS required field ***Shall*** indicate whether VBUS is needed for the AMA to operate. The VBUS required field ***Shall*** only be used if the Alternate Modes fields indicates that an Alternate Mode is supported. If no alternate modes are supported, this field is ***Reserved*** and ***Shall*** be set to 0.

(f). 6.4.4.3.1.1.6 Product Type (DFP)

From:

Table 6-32 Product Types (DFP)

Product Type	Description	Product Type VDO	Reference
Undefined	***Shall*** be used where no other Product Type value is appropriate.	None	
PDUSB Hub	***Shall*** be used when the Product is a PDUSB Hub.	DFP VDO	Section 6.4.4.3.1.5
PDUSB Host	***Shall*** be used when the Product is a PDUSB Host.	DFP VDO	Section 6.4.4.3.1.5
Power Brick	***Shall*** be used when the Product is a Power Brick/Wall Wart.	DFP VDO	Section 6.4.4.3.1.5
Alternate Mode Controller	***Shall*** be used when the Product is a PDUSB Host or DFP that supports one or more Alternate Modes.	None	

To:

Table 6-32 Product Types (DFP)

Product Type	Description	Product Type VDO	Reference
Undefined	***Shall*** be used where no other Product Type value is appropriate.	None	

Product Type	Description	Product Type VDO	Reference
PDUSB Hub	***Shall*** be used when the Product is a PDUSB Hub.	DFP VDO	Section 6.4.4.3.1.5
PDUSB Host	***Shall*** be used when the Product is a PDUSB Host or a PDUSB host that supports one or more alternate modes as an AMC.	DFP VDO	Section 6.4.4.3.1.5
Power Brick	***Shall*** be used when the Product is a Power Brick/Wall Wart.	DFP VDO	Section 6.4.4.3.1.5
~~Alternate Mode Controller~~	~~***Shall*** be used when the Product is a PDUSB Host or DFP that supports one or more Alternate Modes.~~	~~None~~	

(g). 6.4.4.3.1.8 Alternate Mode Adapter VDO

From:

The Alternate Mode Adapter (AMA) VDO defined in this section ***Shall*** be sent when the Product Type is given as Alternate Mode Adapter. Table 6-41 defines the AMA VDO which ***Shall*** be sent.

Table 6-41 AMA VDO

Bit(s)	Field	Description
B31…28	HW Version	0000b…1111b assigned by the VID owner
B27…24	Firmware Version	0000b…1111b assigned by the VID owner
B23…21	VDO Version	Version Number of the VDO (not this specification Version): • Version 1.0 = 000b Values 001b…111b are ***Reserved*** and ***Shall Not*** be used
B20…8	***Reserved***.	***Shall*** be set to zero.
B7…5	V_{CONN} power	When the V_{CONN} required field is set to "Yes" V_{CONN} power needed by adapter for full functionality 000b = 1W 001b = 1.5W 010b = 2W 011b = 3W 100b = 4W 101b = 5W 110b = 6W 111b = ***Reserved***, ***Shall Not*** be used When the V_{CONN} required field is set to "No" ***Reserved***, ***Shall*** be set to zero.
B4	V_{CONN} required	0 = No 1 = Yes
B3	V_{BUS} required	0 = No 1 = Yes
B2…0	USB Highest Speed	000b = ***[USB 2.0]*** only 001b = ***[USB 3.2]*** Gen1 and USB 2.0 010b = ***[USB 3.2]*** Gen1, Gen2 and USB 2.0 011b = ***[USB 2.0]*** billboard only 100b…111b = ***Reserved***, ***Shall Not*** be used

HW Version Field

The HW Version field (B31…28) contains a HW Version assigned by the VID owner.

FW Version Field

The FW Version field (B27…24) contains a FW Version assigned by the VID owner.

VDO Version Field

The VDO Version field (B23…20) contains a VDO version for this VDM version number. This field indicates the expected content for this VDO.

VCONN Required Field

When the VCONN required field indicates that VCONN is required the VCONN power field ***Shall*** indicate how much power the AMA needs in order to fully operate.

The VCONN required field ***Shall*** indicate whether VCONN is needed for the AMA to operate.

VBUS Required Field

The V_{BUS} required field ***Shall*** indicate whether V_{BUS} is needed for the AMA to operate.

USB Highest Speed Field

The USB Highest Speed field (B2…0) ***Shall*** indicate whether the AMA supports only ***[USB 2.0]*** , or in addition Supports ***[USB 3.2]*** Gen1, or Gen1 and Gen2 or ***[USB 2.0]*** billboard only.

To:

The Alternate Mode Adapter (AMA) VDO has been deprecated. PD USB Devices which support one or more Alternate Modes Shall set an appropriate Product Type (UFP), and set the Modal Operation Supported bit.