

# USB Power Delivery ENGINEERING CHANGE NOTICE FORM

**Title: Robust EPR Source Operation**

**Applied to: USB Power Delivery Specification Revision 3.1**

**Version 1.2**

<b>Brief description of the functional changes proposed:</b>
The behavior upon disconnect detection for an EPR source is changed from under-voltage protection to disabling the power supply and disconnecting the source bulk cap.

<b>Benefits as a result of the proposed changes:</b>
The intention of the original text was to mitigate arcing. The new text gives a better way for an EPR source to mitigate arcing.

<b>An assessment of the impact to the existing revision and systems that currently conform to the USB specification:</b>
Source should already have been disabling upon detecting disconnect as fast as is practical.

<b>An analysis of the hardware implications:</b>
None

<b>An analysis of the software implications:</b>
None

<b>An analysis of the compliance testing implications:</b>
The original requirement was not testable. The new requirement may lead to additional compliance tests.

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## Actual Change Requested

### (a). Section 7.1.7.1, Page 293

#### From Text:

Sources operating in SPR mode *shall* implement over current protection to prevent damage from output current that exceeds the current handling capability of the Source. The definition of current handling capability is left to the discretion of the Source implementation and *shall* take into consideration the current handling capability of the connector contacts. If the over current protection implementation does not use a Hard Reset or Error Recovery, it *shall Not* interfere with the negotiated  $V_{BUS}$  current level.

Sources operating in EPR mode need to avoid creating large differential Voltages at the connector when their over current protection mechanisms engage. See Appendix G in the *[USB Type-C 2.0]* specification for background information. To achieve this, Sources operating in EPR mode *shall* implement a circuit that removes power from  $V_{BUS}$  (e.g., a circuit breaker like function) that activates when one or more of the following occur:

- Output current exceeds the current handling capability of the Source.
- $V_{BUS}$  Voltage drops below  $v_{AVSNew}$  (min) when operating in EPR AVS mode
- $V_{BUS}$  Voltage drops below  $v_{SrcNew}$ (min) when operating in EPR mode.

#### To Text:

Sources operating in SPR mode *shall* implement over current protection to prevent damage from output current that exceeds the current handling capability of the Source. The definition of current handling capability is left to the discretion of the Source implementation and *shall* take into consideration the current handling capability of the connector contacts. If the over current protection implementation does not use a Hard Reset or Error Recovery, it *shall Not* interfere with the negotiated  $V_{BUS}$  current level.

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- Output current exceeds the current handling capability of the Source.
- $V_{BUS}$  Voltage drops below  $v_{AVSNew}$  (min) when operating in EPR AVS mode
- $V_{BUS}$  Voltage drops below  $v_{SrcNew}$ (min) when operating in EPR mode.

### (b). Section 7.1.7.4, Page 294

#### From Text:

A USB Detach is detected electrically using CC detection on the USB Type-C® connector. When the Source is Detached the Source *shall* transition to  $v_{Safe0V}$  by  $t_{Safe0V}$  relative to when the Detach event occurred. During the transition to  $v_{Safe0V}$  the  $V_{BUS}$  Voltage *shall* be below  $v_{Safe5V}$  max by  $t_{Safe5V}$  relative to when the Detach event occurred and *shall Not* exceed  $v_{Safe5V}$  max after this time.

#### To Text:

A USB Detach is detected electrically using CC detection on the USB Type-C® connector. When the Source is Detached the Source *shall* transition to  $v_{Safe0V}$  by  $t_{Safe0V}$  relative to when the Detach event occurred. During the transition to  $v_{Safe0V}$  the  $V_{BUS}$  Voltage *shall* be below  $v_{Safe5V}$  max by  $t_{Safe5V}$  relative to when the Detach event occurred and *shall Not* exceed  $v_{Safe5V}$  max after this time.

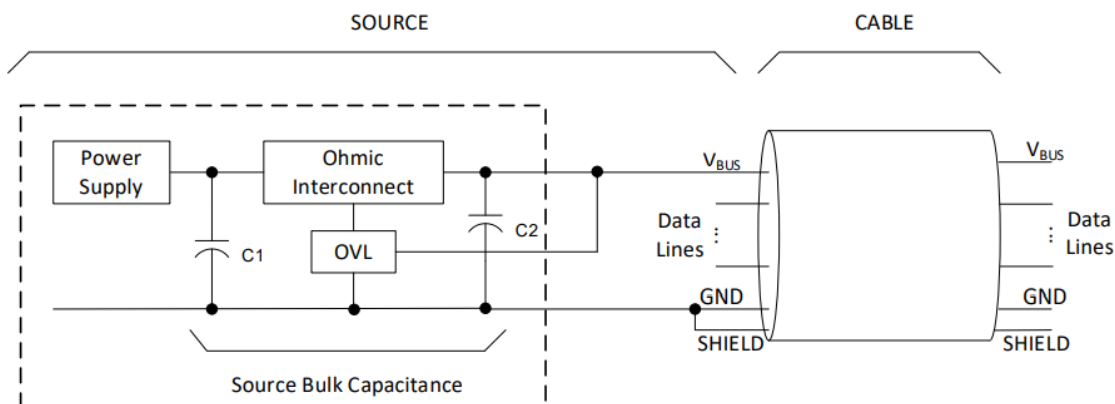
Sources operating in EPR mode need to avoid creating large differential Voltages at the connector. See Appendix G in the *[USB Type-C 2.0]* specification for background information. To achieve this, Sources operating in EPR mode, upon detecting a disconnect, *shall* stop sourcing current and minimize  $V_{BUS}$  capacitance. There may continue to be current sourced from the Source Bulk Capacitance, but that should also be minimized by

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disconnecting as much of the Source Bulk Capacitance as possible. For example, the Source can stop sourcing from the Power Supply and the C1 portion of the Source Bulk Capacitance in Figure 7-1 by disabling the Ohmic Interconnect switch. The Source *Should* detect the disconnect, stop sourcing current, and minimize the  $V_{BUS}$  capacitance as quickly as practical. If this is done after the CC contacts disconnect and before the  $V_{BUS}$  contacts disconnect there is less risk of large differential Voltages at the connector. Note that a USB-PD transmission by the Source during a disconnect event will delay disconnect detection by the Source.

## For Reference only:

Figure 7-1 Placement of Source Bulk Capacitance



Parameter	Description	MIN	TYP	MAX	UNITS	Reference
<b>cSrcBulk'</b>	Source bulk capacitance when a Port is powered from a dedicated supply.	10			μF	Section 7.1.2
<b>cSrcBulkShared'</b>	Source bulk capacitance when a Port is powered from a shared supply.	120			μF	Section 7.1.2

Table 4-2 **VBUS Source** Characteristics

	Minimum	Maximum	Notes
<b>VBUS Leakage Impedance</b>	72.4 kΩ		Leakage between VBUS pins and GND pins on receptacle when VBUS is not being sourced.
<b>VBUS Capacitance</b>		3000 μF	Capacitance for source-only ports between VBUS and GND pins on receptacle when VBUS is not being sourced.
		10 μF	Capacitance for DRP ports between VBUS and GND pins on receptacle when VBUS is not being sourced.