

USB Type-C ENGINEERING CHANGE NOTICE

Title: Discharge VBUS in Idle

Applied to: USB Type-C Specification Release 2.2, October 2022

Brief description of the functional changes proposed:

Some Sinks experience problems when being disconnected and reconnected.

The mechanism is like this:

As per USB Type-C Spec:

- The Sink device shall disconnect on VBUS threshold. They are not mandated to disconnect on CC lines.
- Source disconnects on CC lines.

When source disconnects, it shall discharge VBUS down to vSafe0 within tVBUSOFF

No requirement on Sink

One example:

- a. Sink is in Idle and draws little current: example $< 1\mu\text{A}$
- b. Sink has $10\mu\text{F}$ cap on VBUS and $100\mu\text{F}$ on system side
- c. Source shall cease to supply Vbus within tVBUSOFF (650ms max) of exiting Attached.SRC
- d. User removes cable between Source and Sink:
- e. Source goes to Unattached.SRC
- f. Vbus needs to be $< 3.67\text{V}$ before Sink sees disconnection and goes into Unattached.SNK
- g. 5V to 3.67V takes 146.3sec with above numbers
- h. User plugs again the cable between Source and Sink in less than 60sec (maybe a different Source)
- i. Source goes to AttachWait.SRC
- j. VBUS on sink side is still $> 3.67\text{V}$ because the charge on $10\mu\text{F} + 100\mu\text{F}$ is now split to also charge the $10\mu\text{F}$ on the source side - the Sink is still not disconnected so it keeps the $100\mu\text{F}$ connected
- k. After 60s VBUS is still $>>> 3.67\text{V}$
- l. As per USB Type-C spec, source shall not drive VBUS in AttachWait.SRC
- m. Sink is not mandated to discharge VBUS
- n. With only Sink Current, it will take more than 400sec to reach 0.8V
- o. Sink will go to Unattached.SNK after VBUS passes 3.67V
- p. Source will go to Attached.SRC only after VBUS voltage passes 0.8V
- q. Connection will have taken way more time than we can allow

This ECR intends to provide a predictable way to avoid this situation.

Benefits as a result of the proposed changes:

No more mysterious non connecting situations.

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

They will function as today or may see better function depending which devices are connected together.

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An analysis of the hardware implications:
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A discharge path has to be implemented as described. This will already exist in order to discharge the Vbus in <650ms

An analysis of the software implications:
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Change to operate the discharge path at one more time.
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An analysis of the compliance testing implications:
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One more function to verify. Existing tests need to be looked at to verify they conform to the new behaviour.

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Actual Change Requested

(a) Table 4-31 VBUS and VCONN Timing Parameters

Add line in table:

	Minimum	Maximum	Description
tVsafe0V	0 ms	650 ms	Time the Source is allowed to use for discharging the Sink capacitors to reach vSafe0V in AttachWait.SRC state in order to progress to Attached.SRC

(a) 4.5.2.2.8.1 AttachWait.SRC Requirements

From Text:

The requirements for this state are identical to [Unattached.SRC](#).

To Text:

The port shall not drive VCONN. The port **shall** apply a load to VBUS to ensure it reaches vSafe0V within tVsafe0V.

Note: The connected Sink port might have charge left in its capacitors at up to vSafe5V that will prevent the Source port from transitioning to Attached.SRC.

The port shall source current on both the CC1 and CC2 pins independently.

The port shall provide a separate [Rp](#) termination on the CC1 and CC2 pins as specified in Table 4-26. Note: A Source with a captive cable or just a plug presents a single [Rp](#) termination on its CC pin (A5).

The Charge-Through [VCONN-Powered USB Device](#) shall isolate its Host-side port from its Charge-Through port, including CCs and VBUS. The Charge-Through [VCONN-Powered USB Device](#) shall ensure that it is powered by VBUS from the Charge-Through port.

Upon entry into this state, the Charge-Through [VCONN-Powered USB Device](#) shall remove its [Rd](#) termination to ground on the Host-side port CC and provide an [Rp](#) termination instead advertising Default USB Power, as specified in Table 4-26, and continue to independently terminate its Charge-Through port's CC1 and CC2 pins to ground through [Rd](#).