USB Type-C ENGINEERING CHANGE NOTICE

Title: Max DC Resistance of D+ or D- for USB-C Devices and Captive Devices
Applied to: USB Type-C Specification Release 1.3, July 14, 2017

Brief description of the functional changes proposed:
Define the maximum series DC resistance (DCR) of D+ or D- for USB Type-C Devices and USB Type-C Captive Devices. Add a new compliance test specification for high-speed capable USB Type-C Host to check "False Connect" and a test for USB Type-C Device to check "False Disconnect" event. Add "Silicon Design Guide" to help determine a proper disconnect threshold voltage level (VHSDSC) to avoid "False Connect" and "False Disconnect" events.

Benefits as a result of the proposed changes:
The USB Type-C specification doesn't define the DC resistance (DCR) on the USB2 D+/D− connections between the connector and the Host or Device Controller. The lack of a USB2 DCR specification leads to false disconnect and connect events on high-speed capable USB2 Hosts/Devices with excessive DCR on the D+ and D− data path due to the presence of multiples of crossbar switches and/or passive components such as common-mode chokes. A maximum DCR limit should be defined for the D+/D− data path for Hosts and Devices. A variable disconnect threshold should be defined for Host designs to ensure the interoperability with USB2 devices and cables with the maximum DCR channel.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
A DC Resistance (DCR) specification for high-speed capable USB Type-C Devices and USB Type-C Captive Devices is new to the USB Type-C specification. The impact to the existing Devices or Captive Devices is expected to be minimal, as the maximum DCR limit (19ohms for Device, 25ohms for Captive Device) was judiciously estimated to be sufficient for most implementation.

An analysis of the hardware implications:
New high-speed capable USB Type-C Device designs adhering to this ECN will need to meet the 19 ohms DC resistance requirement. New high-speed capable USB Type-C Captive Device designs adhering to this ECN will need to meet the 25 ohms DC resistance requirement. New high-speed capable USB Type-C Host will need to implement a Disconnect Threshold Voltage (V_{HSDSC}) level which interoperates in the USB2 eco-system with the maximum DCR defined in this ECN.

An analysis of the software implications:
None.

An analysis of the compliance testing implications:

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The following tests should be added to the compliance test specification.
- Check DCR of high-speed capable USB Type-C Device by performing "false disconnect" test using a calibrated Golden Host
- Check DCR of high-speed capable USB Type-C Captive Device by performing "false disconnect" test using a calibrated Golden Host
- Perform "false disconnect" and "false connect" test for high-speed capable USB Type-C Host using the calibrated load which has the maximum DCR as defined in this ECN.

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Actual Change Requested

(a). Section 3.7.7
New Section:

3.7.7.5 DC Resistance of D+ and D−

The DC Resistance of the D+ and D− in high-speed capable USB Type-C Device, and high-speed capable USB Type-C Captive Device shall be equal or less than the maximum value specified in Table 3-NEW. The D+ and D− DC Resistance is the series combination of any resistance in switches, MUXes, and the USB PHY.

Table 3-NEW. Maximum DC Resistance Requirement (Normative)

	Maximum DC Resistance
USB Type-C Device (High-speed capable)	19 Ω
USB Type-C Captive Device (High-speed capable)	25 Ω

A USB Type-C Host operating in high-speed mode shall implement a disconnect threshold voltage (VHSDSC) level as defined in the USB 2.0 DCR ECN.