

USB Type-C ENGINEERING CHANGE NOTICE

Title: D+/D- DC Resistance

Applied to: USB Type-C Specification Release 1.2

Brief description of the functional changes:
USB Type C spec has defined D+/D- pair attenuation from 50 MHz to 400 MHz, but does not define the DC loss. The ECR defines the D+/D- maximum DC Resistance (DCR) in cable assemblies so that host and device DC resistance can be budgeted accordingly.

Benefits as a result of the changes:
The USB2 EOP level and load voltage are highly dependent on the voltage swing and the DCR in the channel. Defining the maximum value allowed in the cable helps budget the DCR in hosts and devices and determine the proper USB2 disconnect threshold in silicon.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
No existing cable is expected to have higher DCR than the proposed value. The proposed value is larger than the value extrapolated from the cable loss at 64 KHz defined in USB 2.0 spec.

An analysis of the hardware implications:
None

An analysis of the software implications:
None

An analysis of the compliance testing implications:
D+ and D- DC resistance measurement shall be added.

USB Type-C ENGINEERING CHANGE NOTICE

Actual Change

(a). From, Section 3.7.2.4, Page 87

**Table 3-25 USB D+/D– Signal Integrity Requirements for USB Type-C to USB Type-C
Passive Cable Assemblies**

Items	Descriptions and Procedures	Requirements
Differential Impedance	EIA 364-108 This test ensures that the D+/D– lines of the cable assembly have the proper impedance. For the entire cable assembly.	75 ohms min and 105 ohms max. 400 ps rise time (20%-80%)
Propagation Delay	EIA 364-103 The purpose of the test is to verify the end-to-end propagation of the D+/D– lines of the cable assembly.	26 ns max. 400 ps rise time (20%-80%)
Intra-pair Skew	EIA 364 – 103 This test ensures that the signal on both the D+ and D– lines of cable assembly arrive at the receiver at the same time.	100 ps max. 400 ps rise time (20%-80%)
D+/D– Pair Attenuation	EIA 364 – 101 This test ensures the D+/D– pair of a cable assembly is able to provide adequate signal strength to the receiver in order to maintain a low error rate.	≥ –1.02 dB @ 50 MHz ≥ –1.43 dB @ 100 MHz ≥ –2.40 dB @ 200 MHz ≥ –4.35 dB @ 400 MHz

(a). To, Section 3.7.2.4, Page 87

**Table 3-25 USB D+/D– Signal Integrity Requirements for USB Type-C to USB Type-C
Passive Cable Assemblies**

Items	Descriptions and Procedures	Requirements
Differential Impedance	EIA 364-108 This test ensures that the D+/D– lines of the cable assembly have the proper impedance. For the entire cable assembly.	75 ohms min and 105 ohms max. 400 ps rise time (20%-80%)
Propagation Delay	EIA 364-103 The purpose of the test is to verify the end-to-end propagation of the D+/D– lines of the cable assembly.	26 ns max. 400 ps rise time (20%-80%)
Intra-pair Skew	EIA 364 – 103 This test ensures that the signal on both the D+ and D– lines of cable assembly arrive at the receiver at the same time.	100 ps max. 400 ps rise time (20%-80%)
D+/D– Pair Attenuation	EIA 364 – 101 This test ensures the D+/D– pair of a cable assembly is able to provide adequate signal strength to the receiver in order to maintain a low error rate.	≥ –1.02 dB @ 50 MHz ≥ –1.43 dB @ 100 MHz ≥ –2.40 dB @ 200 MHz ≥ –4.35 dB @ 400 MHz
D+ or D– DC Resistance	This test ensures the D+/D– has the proper DC resistance range in order to predict the EOP level and set the USB2 disconnect level.	3.5 ohms max.

USB Type-C ENGINEERING CHANGE NOTICE

(b). From, Section 3.7.4.1, Page 92

Table 3-27 USB D+/D– Signal Integrity Requirements for USB Type-C to Legacy USB Cable Assemblies

Items	Descriptions and Procedures	Requirements
Differential Impedance	EIA 364-108 This test ensures that the D+/D– lines of the cable assembly have the proper impedance. For the entire cable assembly.	75 ohms min and 105 ohms max. 400 ps rise time (20%-80%)
Propagation Delay	EIA 364-103 The purpose of the test is to verify the end-to-end propagation of the D+/D– lines of the cable assembly.	10 ns max for USB Type-C to Micro-B cable assembly; 20 ns max for all other USB Type C to legacy USB cable assemblies. 400 ps rise time (20%-80%)
Intra-pair Skew	EIA 364 – 103 This test ensures that the signal on both the D+ and D– lines of cable assembly arrive at the receiver at the same time.	100 ps max. 400 ps rise time (20%-80%)
D+/D– Pair Attenuation	EIA 364 – 101 This test ensures the D+/D– pair of a cable assembly is able to provide adequate signal strength to the receiver in order to maintain a low error rate.	≥ –1.02 dB @ 50 MHz ≥ –1.43 dB @ 100 MHz ≥ –2.40 dB @ 200 MHz ≥ –4.35 dB @ 400 MHz

(b). To, Section 3.7.4.1, Page 92

Table 3-27 USB D+/D– Signal Integrity Requirements for USB Type-C to Legacy USB Cable Assemblies

Items	Descriptions and Procedures	Requirements
Differential Impedance	EIA 364-108 This test ensures that the D+/D– lines of the cable assembly have the proper impedance. For the entire cable assembly.	75 ohms min and 105 ohms max. 400 ps rise time (20%-80%)
Propagation Delay	EIA 364-103 The purpose of the test is to verify the end-to-end propagation of the D+/D– lines of the cable assembly.	10 ns max for USB Type-C to Micro-B cable assembly; 20 ns max for all other USB Type C to legacy USB cable assemblies. 400 ps rise time (20%-80%)
Intra-pair Skew	EIA 364 – 103 This test ensures that the signal on both the D+ and D– lines of cable assembly arrive at the receiver at the same time.	100 ps max. 400 ps rise time (20%-80%)
D+/D– Pair Attenuation	EIA 364 – 101 This test ensures the D+/D– pair of a cable assembly is able to provide adequate signal strength to the receiver in order to maintain a low error rate.	≥ –1.02 dB @ 50 MHz ≥ –1.43 dB @ 100 MHz ≥ –2.40 dB @ 200 MHz ≥ –4.35 dB @ 400 MHz
D+ or D– DC Resistance	This test ensures the D+/D– has the proper DC resistance range in order to predict the EOP level and set the USB2 disconnect level.	3.5 ohms max.

USB Type-C ENGINEERING CHANGE NOTICE

(c). From, Section 3.7.5.1, Page 95

Table 3-30 USB D+/D– Signal Integrity Requirements for USB Type-C to Legacy USB Adapter Assemblies (Normative)

Items	Descriptions and Procedures	Requirements
Differential Impedance	EIA 364-108 This test ensures that the D+/D– lines of the cable assembly have the proper impedance. For the entire cable assembly.	75 ohms min and 105 ohms max. 400 ps rise time (20%-80%)
Intra-pair Skew	EIA 364 – 103 This test ensures that the signal on both the D+ and D– lines of cable assembly arrive at the receiver at the same time.	20 ps max. 400 ps rise time (20%-80%)
Differential Insertion Loss	EIA 364 – 101 This test ensures the D+/D– pair of an adapter assembly can provide adequate signal strength to the receiver.	–0.7 dB max @ 400 MHz

(c). To, Section 3.7.5.1, Page 95

Table 3-30 USB D+/D– Signal Integrity Requirements for USB Type-C to Legacy USB Adapter Assemblies (Normative)

Items	Descriptions and Procedures	Requirements
Differential Impedance	EIA 364-108 This test ensures that the D+/D– lines of the cable assembly have the proper impedance. For the entire cable assembly.	75 ohms min and 105 ohms max. 400 ps rise time (20%-80%)
Intra-pair Skew	EIA 364 – 103 This test ensures that the signal on both the D+ and D– lines of cable assembly arrive at the receiver at the same time.	20 ps max. 400 ps rise time (20%-80%)
Differential Insertion Loss	EIA 364 – 101 This test ensures the D+/D– pair of an adapter assembly can provide adequate signal strength to the receiver.	–0.7 dB max @ 400 MHz
D+ or D- DC Resistance	This test ensures the D+/D- has the proper DC resistance range in order to predict the EOP level and set the USB2 disconnect level.	2.5 ohms max.