USB Type-C ENGINEERING CHANGE NOTICE

Title: Mated Connector Electrical Characteristic
Applied to: Universal Serial Bus Type-C Cable and Connector Specification Release 1.1, April 3, 2015

Brief description of the functional changes:

The requirements of mated connector was defined in Section 3.7.2. The feedback is that no mated connector can meet all requirements. Though the requirements are informative, connector vendors and OEM/ODMs still would like to modify the requirements to reflect reality.

Based on measurement data of more than 10 mated connectors and five proposals, Newark electrical work group is proposing changes on Section 3.7.2. The new proposal implements the same methodology used for Type C cable specification definition, which was described in section 3.7.3 (USB Type-C to Type-C Passive Cable Assemblies).

In order to keep Section 3.7.3 unchanged, the proposal is to move mated connector section to a place after the USB Type-C to Type-C Passive Cable Assemblies section, i.e., Section 3.7.2 and Section 3.7.3 will switch places.

Benefits as a result of the changes:

The proposed change on mated connector will make the informative spec on mated connector achievable and more realistic.

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

No impact since this is informative.

An analysis of the hardware implications:

N/A

An analysis of the software implications:

N/A

An analysis of the compliance testing implications:

No impact since this is not part of the compliance testing.

USB Type-C ENGINEERING CHANGE NOTICE

Actual Change

(a). Section 3.7.2 , page 71-75

From:

Section 3.7.2….

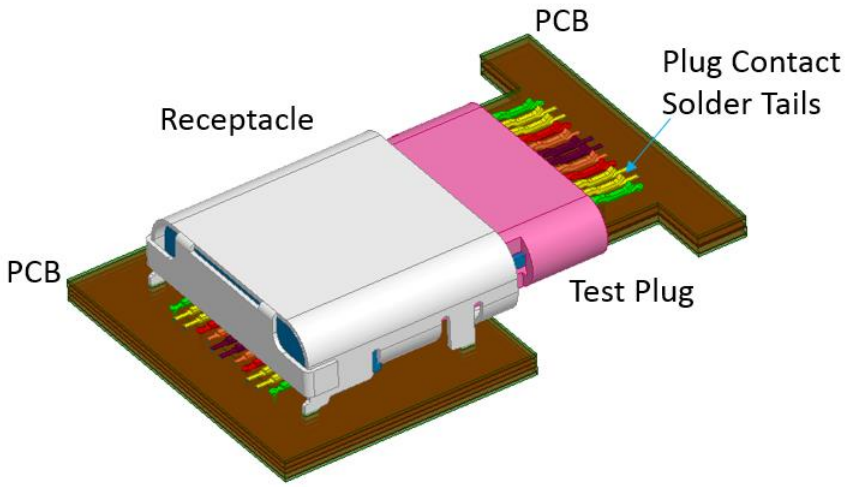
To:

Elevate Section 3.7.3 to 3.7.2 and replace Section 3.7.3 with the following:

3.7.3 Mated Connector (Informative)

The mated connector as defined in this specification for USB Type-C consists of a receptacle mounted on a PCB, representing how the receptacle is used in a product, and a test plug also mounted on a PCB (paddle card) without cable. This is illustrated in Figure **Error! No text of specified style in document.**-1. Note that the test plug is used in host/device TX/RX testing also.

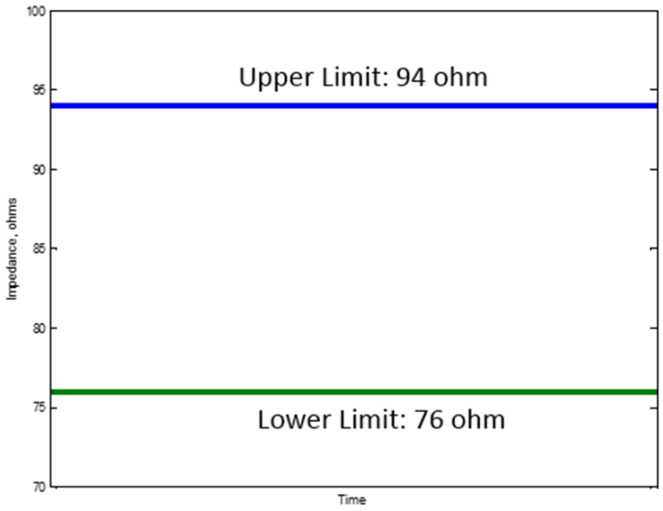
Figure Error! No text of specified style in document.**-1 Illustration of USB Type-C Mated Connector**



3.7.3.1 Differential Impedance (Informative)

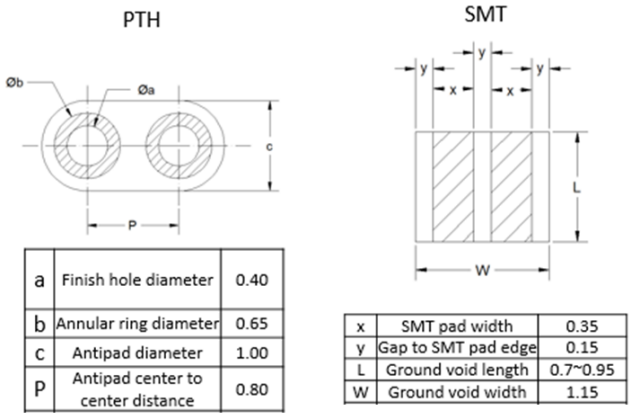
The mated connector impedance target is specified to minimize reflection from the connector. The differential impedance of a mated connector should be within 85 Ω ± 9 Ω, as seen from a 40 ps (20%-80%) rise time. The impedance profile of a mated connector should fall within the limits shown in Figure **Error! No text of specified style in document.**-2.

Figure Error! No text of specified style in document.**-2 Recommended Impedance Limits of a USB Type-C Mated Connector**



The PCB stack up, lead geometry, and solder pad geometry should be modeled in 3D field-solver to optimize electrical performance. Example ground voids under signal pads are shown in Figure **Error! No text of specified style in document.**-3 based on pad geometry, mounting type, and PCB stack-up shown.

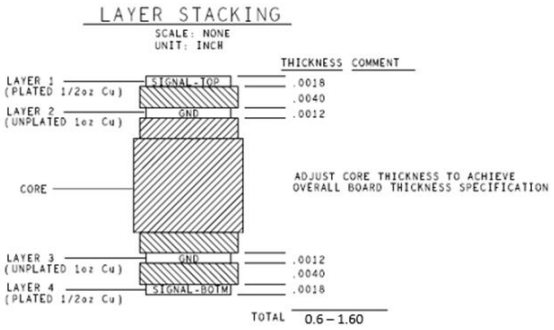
Figure Error! No text of specified style in document.**-3 Recommended Ground Void Dimensions for USB Type-C Receptacle**



a	Finish hole diameter	0.40
b	Annular ring diameter	0.65
c	Antipad diameter	1.00
P	Antipad center to center distance	0.80

x	SMT pad width	0.35
y	Gap to SMT pad edge	0.15
L	Ground void length	0.7~0.95
W	Ground void width	1.15

Unit: mm



3.7.3.2 Mated Connector Recommended Differential S-Parameter and Signal Integrity characteristics (Informative)

The recommended signal integrity characteristics of USB Type-C mated connector pair are listed in Table **Error! No text of specified style in document.**-1.

Table Error! No text of specified style in document.**-1 USB Type-C Mated Connector Recommended Signal Integrity Characteristics (Informative)**

Items	Descriptions and Procedures	Requirements
Differential Insertion Loss Fit at Nyquist Frequencies (ILfitatNq)	ILfitatNq is evaluated at both the SuperSpeed Gen 1, Gen 2 and future 20 Gbps generation Nyquist frequencies.	≥ −0.6 dB @ 2.5 GHz ≥ −0.8 dB at 5.0 GHz ≥ −1.0 dB @ 10 GHz
Integrated Differential Multi-reflection (IMR)	$dB\left(\sqrt{\frac{\int_0^{f_{max}}\lvert ILD(f)\rvert^2\lvert Vin(f)\rvert^2 df}{\int_0^{f_{max}}\lvert Vin(f)\rvert^2 df}}\right)$	≤ −40 dB

Items	Descriptions and Procedures	Requirements
Integrated Differential Near-end Crosstalk on SuperSpeed (INEXT)	$dB\left(\sqrt{\frac{\int_0^{fmax}\lvert Vin(f)\rvert^2(\lvert NEXT(f)\rvert^2 + 0.125^2 \cdot \lvert C2D(f)\rvert^2)df + \lvert Vdd(f)\rvert^2\ \lvert NEXTd(f)\rvert^2 df}{\int_0^{fmax}\lvert Vin(f)\rvert^2 df}}\right)$ where: $NEXT$ = NEXT between SuperSpeed pairs $NEXTd$ = NEXT between D+/D− and SuperSpeed pairs	≤ −44 dB
Integrated Differential Far-end Crosstalk on SuperSpeed (IFEXT)	$dB\left(\sqrt{\frac{\int_0^{fmax}\lvert Vin(f)\rvert^2(\lvert FEXT(f)\rvert^2 + 0.125^2 \cdot \lvert C2D(f)\rvert^2)df + \lvert Vdd(f)\rvert^2\ \lvert FEXTd(f)\rvert^2 df}{\int_0^{fmax}\lvert Vin(f)\rvert^2 df}}\right)$ where: $FEXT$ = NEXT between SuperSpeed pairs $FEXTd$ = NEXT between D+/D− and SuperSpeed pairs	≤ −44 dB
Differential Crosstalk on D+/D-	The differential near-end and far-end crosstalk between the D+/D− pair and the SuperSpeed pairs in mated connectors.	See Figure Error**! No text of specified style in document.**-4
Integrated Return Loss (IRL)	$dB\left(\sqrt{\frac{\int_0^{fmax}\lvert Vin(f)\rvert^2\lvert SDD21(f)\rvert^2(\lvert SDD11(f)\rvert^2 + \lvert SDD22(f)\rvert^2)df}{\int_0^{fmax}\lvert Vin(f)\rvert^2 df}}\right)$	≤ −18 dB
Differential to Common Mode Conversion (SCD12 and SCD21)	The differential to common mode conversion is specified to control the injection of common mode noise from the cable assembly into the host or device. Frequency range: 100 MHz ~ 10.0 GHz	See Figure Error**! No text of specified style in document.**-5

Note: *fmax* = 12.5 GHz (unless otherwise specified);

Vin(f) is defined in **Error! Reference source not found.** with Tb (UI) = 100 ps;

Vdd(f) is also defined in **Error! Reference source not found.** with Tb (UI) = 2.08 ns.

C2D(f) =measured near-end and far-end crosstalk between USB SuperSpeed pairs, and the common-mode-to-differential conversion, respectively. The factor of 0.125^2 accounts for the assumption that the common mode amplitude is 12.5% of the differential amplitude

Figure Error! No text of specified style in document.**-4 Recommended Differential Near-End and Far-End Crosstalk Limits between D+/D– Pair and SuperSpeed Pairs**

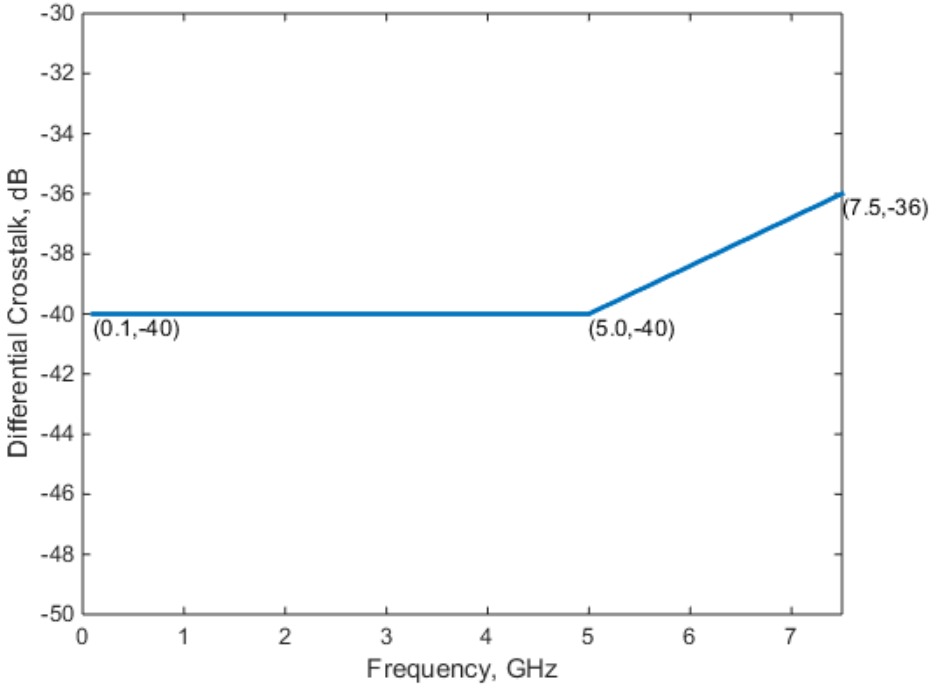


Figure Error! No text of specified style in document.**-5 Recommended Limits for Differential-to-Common-Mode Conversion**