

PRODUCT SPECIFICATION

Title: USB Type C to USB 3.1 Legacy Cable Assy

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A	Initial Release	THIS DOCUMENT CONTAINS INFORMATION THAT IS PROPRIETARY TO	
REV.	DESCRIPTION	MOLEX AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION	
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1 Scope

This specification covers the requirements for USB Type C to USB 3.1 Legacy Cable Assy

2 Product Description

USB Type C to USB 3.1 Legacy Cable Assy

See the sales drawing and the other section of this specification for the necessary. In cases where the specification differs from the drawings, the sales drawings take precedence.

3 Ratings

Voltage

Rated Voltage: 30V DC

Current

Vbus and GND, refer to sales drawing

Current of 0.25A shall be applied to all the other contacts.

4 Temperature

Operating temperature: -10 °C to +50 °C

Storage temperature: -20 °C to +60 °C

5. Pin assignment

See sales drawing

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6. Electrical And Signal Integrity Compliance Requirements

Test Description	Test Condition	Performance Requirement
Low Level Contact Resistance (LLCR)	EIA 364-23 The low level contact resistance (LLCR) measurement is made across the plug and receptacle mated contacts and does not include any internal paddle cards or substrates of the plug or receptacle. The test boards shall be provided with the connectors to be tested. • Measure at 20 mV (max) open circuit at 100 mA.	The following requirements apply to the power and signal contacts: Type C plug:40 mΩ (max) initial for VBUS, GND and all other contacts.50 mΩ maximum after initial measurement. USB 3.1 connector:30 mΩ maximum initial for the Power (VBUS) and Ground (GND) contacts and 50 mΩ maximum initial for all other contacts, Maximum change (delta) of +10 mΩ after environmental stresses
Dielectric Withstanding Voltage	Test voltage 100 VAC, 1Min.	No breakdown
Cable Assembly Voltage Drop	The maximum rated VBUS current of the cable assembly shall be used. The measurement includes representative receptacles at both ends of the cable assembly, mounted on test fixtures.	250 mV max for GND and 500 mV max for VBUS.
D+/D- Pair Differential Impedance	Refer to appendix G.4 of Type C connectors and cable assemblies compliance document Measured with a 400 ps rise time (20%-80%).	75 ohms min and 105 ohms max.
D+/D- Pair Propagation Delay	Refer to appendix G.4 of Type C connectors and cable assemblies compliance document Use a 400 ps rise time (20%-80%) at 50% voltage crossing.	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.
D+/D- Pair Intra-pair Skew	Refer to appendix G.4 of Type C connectors and cable assemblies compliance document	100 ps max.
D+/D- Pair Attenuation	Refer to appendix G.4 of Type C connectors and cable assemblies compliance document	≥ -1.02 dB @ 50 MHz ≥ -1.43 dB @ 100 MHz ≥ -2.40 dB @ 200 MHz ≥ -4.35 dB @ 400 MHz
VBUS Capacitance	Refer to appendix G.5 of Type C connectors and cable assemblies compliance document	8 nF to 12 nF located in the Type-C plug.
Rd resistor verification	Measure the resistance between pin A5 and Ground (pin A1, A12, B1, or B12).	Type-C pin A5 resistance to GND for cable assemblies with a USB B plug.
Rp resistor verification	Measure the resistance between pin A5 and VBUS (pin A4, A9, B4, or B9).	Type-C pin A5 to VBUS resistance for cable assemblies with a Standard-A plug.

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Test Description	Test Condition	Performance Requirement
Differential Insertion Loss Fit at Nyquist Frequencies (ILfitatNq)	Refer to appendix G.3 of Type C connectors and cable assemblies compliance document	≥ -4 dB @ 2.5 GHz, except for the USB Type-C plug to USB 3.1 Standard-A plug cable assembly which is: ≥ -3.5 dB @ 2.5 GHz ≥ -6 dB at 5 GHz
Integrated Differential Multi-reflection (IMR)	Refer to appendix G.3 of Type C connectors and cable assemblies compliance document	$\leq 0.126 \cdot \text{ILfitatNq}^2 + 3.024 \cdot \text{ILfitatNq} - 21.392$ (in dB). For SuperSpeed pairs only.
Integrated Differential Crosstalk on SuperSpeed (ISSXT)	Refer to appendix G.3 of Type C connectors and cable assemblies compliance document	≤ -38 dB
Integrated Differential Crosstalk on D+/D- (IDDXT)	Refer to appendix G.3 of Type C connectors and cable assemblies compliance document	≤ -28.5 dB
Integrated Return Loss (IRL)	Refer to appendix G.3 of Type C connectors and cable assemblies compliance document	$\leq 0.046 \cdot \text{ILfitatNq}^2 + 1.812 \cdot \text{ILfitatNq} - 9.784$ (in dB). For SuperSpeed pairs only.
Differential-to -Common-Mode Conversion (SCD12 and SCD21)	Refer to appendix G.3 of Type C connectors and cable assemblies compliance document	≤ -20 dB from 100 MHz to 10 GHz.

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7. Mechanical Compliance Requirements

Test Description	Test Condition	Performance Requirement
Cable Flexing	EIA 364-41, Condition I with Dimension X = 3.7 times the cable diameter and 100 cycles in each of two planes 120 degree arc.	No physical damage and discontinuity over 1 microsecond during flexing shall occur to the cable assembly
Cable Pull-Out	EIA 364-38 Test Condition A The cable assembly shall be subjected to a 40N axial load for a minimum of 1 minute while clamping one end of the cable plug.	No visible physical damage and no electrical discontinuity over 1 microsecond to the cable assembly.
4-Axes Continuity	Type C:Refer to appendix D of Type C connectors and cable assemblies compliance document. Plug and Receptacle: Subject the mating interface to the moments defined in Appendix D for at least 10 seconds. USB 3.1 Micro Connector Family Only: Refer to 5.7.1.7 of USB 3.1 standard	No discontinuities greater than 1 microsecond duration in any of the four orientations tested.
Insertion Force	EIA 364-13 The insertion force test shall be done at a maximum rate of 12.5 mm (0.492") per minute.	USB Type C: Within the range from 5 N to 20 N. USB 3.1 Type A and B:35 Newtons maximum
Extraction Force	EIA 364-13 The extraction force test shall be done at a maximum rate of 12.5 mm (0.492") per minute.	USB Type C:Within the range of 8 N to 20 N, measured after a preconditioning of five insertion/extraction cycles (i.e., the sixth extraction). After an additional twenty-five insertion/extraction cycles, the extraction force shall be measured again (i.e., the thirty-second extraction) and the extraction force shall be within: a) 33 % of the initial reading, and b) within the range of 8 N to 20 N. The extraction force shall be within the range of 6 N to 20 N after 10,000 insertion/extraction cycles. USB 3.1 Type A and B:The connector extraction force shall not be less than 10 N initial and 8 N after the specified insertion/extraction or durability cycles . Micro Connector Family Only:The connector extraction force shall not be less than 10 N or more than 25 N initial and less than 8 N and more than 25 N after the specified insertion/extraction or durability cycles No burs or sharp edges are allowed on top of locking latches (hook surfaces that will rub against the receptacle shield).
Durability or Insertion/Extraction Cycles	EIA 364-09	USB Type C:10,000 cycles minimum. USB 3.1 Standard-A, Standard-B and Powered-B series: Standard Durability Class:1500 cycles High Durability Class: 5000 cycles USB 3.1 Micro Connector Family:10,000 cycles Conductor resistance and dielectric withstanding voltage shall be checked to be within spec after the durability cycles

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Wrenching Strength (Plug-only)	<p>Type C: Perpendicular forces are applied to the plug in four directions (i.e., left, right, up, and down). A metal fixture with opening and tongue representative of a receptacle shall be used. Refer to Appendix E of Type C connectors and cable assemblies compliance document</p> <p>USB 3.1 Micro Connector Family Only: Refer to 5.7.1.8 of USB 3.1 standard</p>	<p>Type C: A single plug shall be used for this test. Some mechanical deformation may occur. The plug shall be mated with the continuity test fixture after the test forces have been applied to verify no damage has occurred that causes discontinuity or shorting. The Dielectric Withstanding Voltage test shall be conducted after the continuity test to verify plug compliance.</p> <p>A new plug is required for each of the four test directions. The plug shall disengage from the test fixture or demonstrate mechanical failure (i.e., the force applied during the test procedure peaks and drops off) when a moment of 2.0 Nm is applied to the plug in the up and down directions and a moment 3.5 Nm is applied to the plug in the left and right directions.</p> <p>USB 3.1 Micro Connector Family Only: The wrenching strength test shall be performed using virgin parts. Perpendicular forces (Fp) are applied to a plug when inserted at a distance (L) of 15 mm from the edge of the receptacle. Testing conditions and method shall be agreed to by all parties. These forces shall be applied in all four directions (i.e., left, right, up, and down). Compliant connectors shall meet the following force thresholds:</p> <ul style="list-style-type: none"> No plug or receptacle damage shall occur when a force of 0-25 N is applied. <p>The plug may be damaged, but only in such a way that the receptacle does not sustain damage when a force of 25-50 N is applied.</p>
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8. Environmental Compliance Requirements

Test Description	Test Procedure	Performance Requirement
Temperature Life	EIA 364-17, Method A. 105° C without applied voltage for 120 hours. 105° C without applied voltage for 72 hours when used as preconditioning. The object of this test procedure is to detail a standard method to assess the ability of a USB connector to withstand temperature.	Conductor resistance meets spec before and after the Temperature Life test.
Cyclic Temperature and Humidity	EIA 364-31 The object of this test procedure is to detail a standard test method for the evaluation of the designs and materials used in USB connectors as the effects of high humidity and heat influences them.	Subject samples to between 25°C±3°C at 80%±3% RH and 65°C±3°C at 50%±3% RH. Ramp times should be 0.5 hour and dwell times should be 1.0hour. Dwell times start when the temperature and humidity have stabilized within the specified levels. Perform 24 such cycles. Conductor resistance meets spec before and after the Cyclic Temperature and Humidity test.

9. Cable Assembly Shielding Effectiveness Compliance Requirements

Test Description	Test Procedure	Performance Requirement
Cable Shielding Effectiveness	USB Type-C connectors and cable assemblies compliance document	Differential model: ≤ -49 dB for f ≤ 1.6 GHz ≤ -44 dB for 1.6 GHz ≤ f ≤ 4GHz and 5 GHz ≤ f ≤ 6 GHz Common model: ≤ -34 dB for f ≤ 1.6 GHz ≤ -29 dB for 1.6 GHz ≤ f ≤ 4 GHz and 5 GHz ≤ f ≤ 6 GHz

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