

## USB 3.0 Vertical Receptacle with Locking Collar

### 1. INTRODUCTION

#### 1.1 Purpose

Testing was performed on the TE Connectivity (TE) USB 3.0 Vertical Receptacle with Locking Collar to determine its conformance to the requirements of Product Specification 108-32130, Revision A.

#### 1.2 Scope

This report covers the electrical, mechanical and environmental performance of the TE USB 3.0 Vertical Receptacle with Locking Collar. Testing was performed at the Harrisburg Electrical Components Test Laboratory (HECTL). Documentation for this testing is on file at HECTL under EA20150039T and EA20150232T.

#### 1.3 Conclusion

All part numbers listed in paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-32130, Revision A.

#### 1.4 Product Description

This specification covers the USB 3.0 vertical Type A receptacle with locking collar, which conforms to the USB 3.0 specification. This receptacle is intended for use in high speed interconnect applications at up to 5 gigabits per second. This connector has a vertical form factor with through hole solder pins and is fully compatible with USB 1.0, 1.1, 2.0, 3.0 and 3.1 Type A plugs. It incorporates a locking collar that is used to lock the plug into place.

#### 1.5 Test Specimens

A Certificate of Conformance was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements and were manufactured using the same core manufacturing processes and technologies as production parts. The following part numbers were used for test (See Table 1).

**Table 1 - Test Specimens**

Test Group	Qty	Part Number	Description
1	10	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
	10	1-2117154-5 Rev A	USB 3.0 TYPE A TO TYPE B CABLE (Only end with type A was used)
2	10	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
	10	1-2117154-5 Rev A	USB 3.0 TYPE A TO TYPE B CABLE (Only end with type A was used)
3	10	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
	10	1-2117154-5 Rev A	USB 3.0 TYPE A TO TYPE B CABLE (Only end with type A was used)
4	10	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
	10	1-2117154-5 Rev A	USB 3.0 TYPE A TO TYPE B CABLE (Only end with type A was used)
5	10	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
	10	1-2117154-5 Rev A	USB 3.0 TYPE A TO TYPE B CABLE (Only end with type A was used)
6	10	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
	10	1-2117154-5 Rev A	USB 3.0 TYPE A TO TYPE B CABLE (Only end with type A was used)
7	3	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock
8	5	2274475-3 Rev 2	USB 3.0 A Type, Vertical Connector with Lock

## 1.6 Qualification Test Sequence

**Table 2 - Test Sequence**

Test or Examination	Test Group (a)							
	1	2	3	4	5	6	7	8
	Test Sequence (b)							
LLCR	1,4,6	1,4,6,8	1,4,6	1,4,6,8,10	1,6			
Durability (precondition 50 cycles)	2	2	2	2				
Durability (1500 cycles)					4	4		
Temperature Life (precondition 72 hours)			3	3				
Reseating (3 mate/unmate cycles)	5	7		9				
Temperature Life (120 hours)	3							
Thermal Shock		3						
Humidity/Temperature Cycling		5						
Random Vibration			5					
Mixed Flowing Gas				5				
Thermal Disturbance				7				
Insertion Force					2	2		
Extraction Force					3,5	3,5		
Dielectric Withstanding Voltage						1,6		
Capacitance							1	
Insulation Resistance							2	
Solderability								1

**NOTES:** (a) See paragraph 1.5  
 (b) Numbers indicate sequence which tests were performed.

## 1.7 Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15°C to 35°C  
 Relative Humidity: 20% to 80%

## 2. SUMMARY OF TESTING

### 2.1 LLCR (Groups 1, 2, 3, 4 and 5)

All initial low level contact resistance measurements were less than the 30 milliohm maximum requirement for positions 1, 4 and 7 (VBUS and GND's) and all initial low level contact resistance measurements were less than the 50 milliohm maximum requirement for positions 2, 3, 5, 6, 8 and 9 as specified in Product Specification 108-32161, Revision A. All contacts of all specimens had a positive change in low level contact resistance ( $\Delta R$ ) less than the 20 milliohms maximum requirement as specified in Product Specification 108-32130, Revision A. Refer to Tables 3 through 7 for low level contact resistance summary data.

**Table 3 - Test Group 1 LLCR Summary (milliohms)**

	Positions 1,4 and 7 (VBUS and GND)			Positions 2,3,5,6,8 and 9		
	Initial	After Temp Life (Delta R)	After Reseating (Delta R)	Initial	After Temp Life (Delta R)	After Reseating (Delta R)
<b>Min</b>	11.55	-8.82	-9.72	13.88	-7.23	-6.68
<b>Max</b>	25.51	11.48	2.15	26.32	6.86	11.79
<b>Avg</b>	14.79	0.47	-0.24	17.77	0.88	0.58
<b>Std. Dev.</b>	3.60	2.83	2.19	2.80	2.27	2.84
<b>N</b>	30			60		
<b>Max. Req.</b>	30 m $\Omega$	+20 m $\Omega$ $\Delta R$		50 m $\Omega$	+20 m $\Omega$ $\Delta R$	

Table 4 - Test Group 2 LLCR Summary (milliohms)

	Positions 1,4 and 7 (VBUS and GND's)				Positions 2,3,5,6,8 and 9			
	Initial	After Thermal Shock (Delta R)	After Temp Humidity (Delta R)	After Reseating (Delta R)	Initial	After Thermal Shock (Delta R)	After Temp Humidity (Delta R)	After Reseating (Delta R)
<b>Min</b>	11.10	-1.89	-2.52	-2.67	13.03	-5.65	-5.38	-4.80
<b>Max</b>	20.66	2.68	2.68	0.91	24.26	2.93	2.93	2.95
<b>Avg</b>	14.22	0.37	0.27	0.08	17.42	-0.53	-0.35	-0.66
<b>Std. Dev.</b>	2.94	0.89	1.10	0.92	2.91	1.67	1.54	1.73
<b>N</b>	30				60			
<b>Max. Req.</b>	30 mΩ	+20 mΩ ΔR			50 mΩ	+20 mΩ ΔR		

Table 5 - Test Group 3 LLCR Summary (milliohms)

	Positions 1,4 and 7 (VBUS and GND's)			Positions 2,3,5,6,8 and 9		
	Initial	After Temp Life (precondition) (Delta R)	After Vibration (Delta R)	Initial	After Temp Life (precondition) (Delta R)	After Vibration (Delta R)
<b>Min</b>	11.39	-5.32	-6.54	13.25	-5.26	-6.89
<b>Max</b>	24.27	4.67	1.53	24.81	4.99	8.04
<b>Avg</b>	14.39	0.48	0.26	18.18	-0.30	-0.65
<b>Std. Dev.</b>	3.33	1.67	1.78	3.24	1.80	2.39
<b>N</b>	30			60		
<b>Max. Req.</b>	30 mΩ	+20 mΩ ΔR		50 mΩ	+20 mΩ ΔR	

Table 6 - Test Group 4 LLCR Summary (milliohms)

	Positions 1,4 and 7 (VBUS and GND's)				Positions 2,3,5,6,8 and 9			
	Initial	After Temp Life (precondition) (Delta R)	After MFG (Delta R)	After Thermal Disturbance (Delta R)	Initial	After Temp Life (precondition) (Delta R)	After MFG (Delta R)	After Thermal Disturbance (Delta R)
<b>Min</b>	11.56	-3.93	-3.01	-3.52	13.27	-4.70	-3.84	-4.66
<b>Max</b>	20.25	2.90	3.67	2.06	22.11	5.72	4.41	6.89
<b>Avg</b>	14.50	0.34	0.27	0.28	17.28	0.48	-0.06	0.24
<b>Std. Dev.</b>	3.08	1.33	1.42	1.34	2.39	1.82	1.66	1.87
<b>N</b>	30				60			
<b>Max. Req.</b>	30 mΩ	+20 mΩ ΔR			50 mΩ	+20 mΩ ΔR		

Table 7 - Test Group 5 LLCR Summary (milliohms)

	Positions 1,4 and 7 (VBUS and GND's)		Positions 2,3,5,6,8 and 9	
	Initial	After Durability (Delta R)	Initial	After Durability (Delta R)
<b>Min</b>	11.12	-6.64	13.19	-5.64
<b>Max</b>	22.77	1.04	25.24	1.61
<b>Avg</b>	14.83	-0.49	18.45	-0.87
<b>Std. Dev.</b>	3.52	1.48	3.00	1.45
<b>N</b>	30		60	
<b>Max. Req.</b>	30 mΩ	+20 mΩ ΔR	50 mΩ	+20 mΩ ΔR

## 2.2 Durability - Precondition 50 Cycles (Groups 1, 2, 3 and 4)

The specimens showed no evidence of physical damage after 50 cycles of mating and unmating.

**2.3 Durability - 1500 Cycles (Groups 5 and 6)**

The specimens showed no evidence of physical damage after 1500 cycles of mating and unmating.

**2.4 Temperature Life - Precondition 72 Hours (Groups 3 and 4)**

The specimens showed no evidence of physical damage after 72 hours of temperature life preconditioning.

**2.5 Reseating (Groups 1, 2 and 4)**

The specimens showed no evidence of physical damage after mating and unmating the connectors 3 times.

**2.6 Temperature Life-120 Hours (Group 1)**

The specimens showed no evidence of physical damage after 120 hours of temperature life exposure.

**2.7 Thermal Shock (Group 2)**

The specimens showed no evidence of physical damage after thermal shock exposure.

**2.8 Humidity/Temperature Cycling (Group 2)**

The specimens showed no evidence of physical damage after humidity and temperature exposure.

**2.9 Random Vibration (Group 3)**

The specimens showed no apparent physical damage or no discontinuities of one microsecond or greater occurred during testing.

**2.10 Mixed Flowing Gas (Group 4)**

The specimens showed no evidence of physical damage after mixed flowing gas exposure.

**2.11 Thermal Disturbance (Group 4)**

The specimens showed no evidence of physical damage after thermal disturbance exposure.

**2.12 Insertion Force (Groups 5 and 6)**

All specimens met the maximum insertion force requirement of 35N as specified in Product Specification 108-32130, Revision A. See Table 8 and Table 9 for summaries of insertion force data.

**Table 8 – Group 5 Insertion and Extraction Forces (N)**

	Initial Insertion	Initial Extraction	Extraction After Durability
<b>Minimum</b>	12.37	12.20	9.90
<b>Maximum</b>	20.64	17.90	16.07
<b>Mean</b>	15.01	15.33	13.60
<b>Std. Dev.</b>	2.67	1.82	2.02
<b>N</b>	10	10	10
<b>Requirement</b>	35 N max.	10 N min.	8 N min.

**Table 9 – Group 6 Insertion and Extraction Forces (N)**

	Initial Insertion	Initial Extraction	Extraction After Durability
<b>Minimum</b>	11.75	14.18	11.75
<b>Maximum</b>	21.66	18.45	21.66
<b>Mean</b>	15.77	16.24	15.77
<b>Std. Dev.</b>	2.54	1.28	2.54
<b>N</b>	10	10	10
<b>Requirement</b>	35 N max.	10 N min.	8 N min.

### 2.13 Extraction Force (Groups 5 and 6)

All specimens met the minimum initial extraction force requirement of 10 N as specified in Product Specification 108-32130, Revision A. After 1,500 durability cycles all specimens met the minimum extraction force requirement of 8 N as specified in Product Specification 108-32130, Revision A. See Table 8 and Table 9 for summaries of extraction force data.

### 2.14 Dielectric Withstanding Voltage (Group 6)

None of the specimens had any breakdowns or flashover when subjected to 100 VAC (RMS) as specified in Product Specification 108-32130, Revision A. None of the specimens exceeded the 5 mA leakage current maximum requirement.

### 2.15 Capacitance (Group 7)

All specimens met the maximum 2 pF capacitance requirement as specified in Product Specification 108-32161, Revision A.

### 2.16 Insulation Resistance (Group 7)

All specimens met the minimum 100 MΩ insulation resistance requirement as specified in Product Specification 108-32161, Revision A.

### 2.17 Solderability (Group 8)

All specimens met the minimum 95% solder wetting requirement as specified in Product Specification 108-32161, Revision A.

## 3. TEST METHODS

### 3.1. LLCR

Low level contact resistance measurements were made using a four terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. The wire bulk resistance was subtracted from all measurements. All testing was conducted in accordance with EIA-364-23C.

### 3.2 Durability - Precondition 50 Cycles

Specimens were manually mated and unmated by hand 50 times at a maximum rate of 200 cycles per hour. All testing was conducted in accordance with EIA-364-09C.

### 3.3 Durability - 1500 Cycles

Specimens were mated and unmated 1,500 times on an automated durability machine at a maximum rate of 500 cycles per hour. All testing was conducted in accordance with EIA-364-09C.

### 3.4 Temperature Life - Precondition 72 Hours

The mated specimens were placed in an air-circulating oven for 72 hours at 105°C. All testing was conducted in accordance with EIA-364-17C, Method A.

### 3.5 Reseating

Specimens were mated and unmated 3 times by hand at a maximum rate of 200 cycles per hour. All testing was conducted in accordance with EIA-364-09C.

### 3.6 Temperature Life - 120 Hours

The mated specimens were placed in an air-circulating oven for 120 hours at 105°C. All testing was conducted in accordance with EIA-364-17C, Method A.

### 3.7 Thermal Shock

The mated specimens were subjected to 10 cycles of thermal shock between -55°C and 85°C with 30 minute dwells at each temperature. All testing was conducted in accordance with EIA-364-32G, Method A, Test Condition I, Test Duration A-4.

### 3.8 Humidity/Temperature Cycling

The mated specimens were cycled between 25°C at 80%RH and 65°C at 50% RH with 60 minute dwells at each temperature for a total of 24 cycles. All testing was conducted in accordance with EIA-364-31D, Method IV.

### 3.9 Random Vibration

The test specimens were subjected to a random vibration test as stated in accordance with specification EIA-364-28F, Test Condition VII, Test Condition Letter D. The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 20 and 500 Hertz (Hz). The spectrum remains flat at 0.02 G<sup>2</sup>/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 3.10 GRMS. The test specimens were subjected to this test for 15 minutes in each of the three mutually perpendicular axes, for a total test time of 45 minutes per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

### 3.10 Mixed Flowing Gas

The specimens were subjected to a 4 gas environment in accordance with EIA-364-65B, Class IIA. The USB 3.0 vertical receptacle connectors only, were subjected to mixed flowing gas exposure unmated for a period of 112 hours. Following the unmated exposure, the specimens were mated with plug connectors for an additional 56 hours of exposure for a total of 168 hours (7 days total).

### 3.11 Thermal Disturbance

The mated specimens were subjected to 10 cycles of thermal disturbance between 15°C and 85°C with a minimum dwell of 5 minutes at each temperature.

### 3.12 Insertion Force

The force required to mate the plug and receptacle connectors was measured on a tensile/compression machine at a rate of 12.5 mm per minute. All testing was conducted in accordance EIA-364-13E.

### 3.13 Extraction Force

The force required to unmate the plug and receptacle connectors was measured on a tensile/compression machine at a rate of 12.5 mm per minute. All testing was conducted in accordance EIA-364-13E.

### **3.14 Dielectric Withstanding Voltage**

A test potential of 100 VAC (RMS) was applied between the adjacent contacts of the mated specimens for 60 seconds at a ramp rate of approximately 500 volts per second. Maximum leakage current was set to 5 mA. All testing was conducted in accordance with EIA-364-20E.

### **3.15 Capacitance**

Measurements were taken between the D+ and D- contacts of the unmated specimens. All testing was conducted in accordance with EIA-364-30A.

### **3.16 Insulation Resistance**

A test potential of 100 VDC was applied between the adjacent contacts of the unmated specimens for 2 minutes. Measurements were taken following the 2 minute hold period. All testing was conducted in accordance with EIA-364-21E.

### **3.17 Solderability**

The specimens were immersed in a lead free solder bath controlled at 255°C ±5°C. Prior to the solder bath immersion, the specimens were immersed in RMA flux (a mildly activated flux) for 5 to 10 seconds. Following the solder bath immersion, the specimens were visually examined at 10X magnification. All testing was conducted in accordance with TEC 109-11-12-1, Rev. Y, Method A, with the exception of the solder bath temperature.