Qualification Test Report

501- 99061 Rev.A

Product Specification : 108-99061

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DIST

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PAGE 1 of 9

TITLE: USB 3.0 Receptacle

1. Introduction

1.1 Objective

Testing was performed on the USB Type-C Receptacle and Plug Lead Free Version connectors to determine if it meets the requirements of Design Objective, 108-99061, Rev. 1.

1.2 Scope

This report covers the electrical, mechanical and environmental performance requirements of the USB Type-C Receptacle and Plug Lead Free Version connectors.

1.3 Conclusion

The USB Type-C Receptacle and Plug Lead Free Version connectors listed in paragraph 1.5, meets the electrical, mechanical and environmental performance requirements of Product Specification, 108-99061, Rev. 1.

1.4 Product Description

The USB Type-C Lead Free Version connectors are cable mounted plugs and printed circuit mounted receptacles. The contacts are made of a copper alloy with gold over palladium nickel plating in contact area, tin plating on solder area all over nickel plating. The housing material is thermoplastic UL94V-0 rated.

1.5 Test Samples

The test samples were representative of normal production lots, and samples identified with the following part numbers were used for test:

Test Group	Quantity	Part Number	Description
A-1, A-2,A-3,A-4,A-7, B-1, B-5[2],B-6,B-7, C-1[3].	Refer to test result.	2129691	Receptacle Assembly

1.6 Environmental Conditions

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

Temperature: 15°C to 35°C

Relative Humidity: 25 to 85%

[2] To be reported in Critical Dimension Inspection Report

[3] Additional test, not part of USB Type C Compliance Requirements

2. Test Method

Test requirement and Procedures summary

Table.1

Test Item	Procedures	Requirements
	Electrical	
Low Level Contact Resistance	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. Measure at 20mV (max) open circuit at 100 mA	40 mΩ (Max) initial for VBUS, GND and all other contacts. Maximum change (delta) of +/-10 mΩ after environmental stresses.
Continuity	See USB Type C Compliance Document Appendix E.	No discontinuities or shorts allowed.
Dielectric Withstanding Voltage	EIA-364-20, Method B. Applicable to both receptacle and plug. 100VAC (rms) for 1 minute at sea level.	No break down shall occur when voltage is applied between adjacent contacts of unmated and mated connectors
Insulation Resistance	EIA 364-21 Applicable to both receptacle and plug. Apply 500V DC Apply the above specified voltage between adjacent contacts for 2 minute.	>100 MΩ insulation resistance between adjacent contacts of unmated and mated connectors
Current Rating	EIA 364-70, Method 2. See USB Type C Compliancy Document Appendix C. A current of 5.0 A shall be applied collectively to VBUS pins (i.e., pins A4, A9, B4, and B9) and 1.25 A applied to the VCONN pin (i.e., B5 of the plug connector) with the return path through the corresponding GND pins (i.e., pins A1, A12, B1, and B12). A minimum current of 0.25 A shall also be applied individually to all the other contacts. Allow to stabilize. Note: special T-rise test boards design per the guidelines in Appendix C of the USB Type C Compliancy Document are to be used.	Temperature rise of the outside shell surface of the mated connector pair above the VBUS and GND contacts shall not exceed 30℃ above ambient temperature.

Table.1 (Cont.)

Test Item	Procedures	Requirements
Mechanical		
Critical Dimension Inspection	See USB Type C Compliancy Document Appendix B.	Meet all critical dimension requirements defined in Appendix B.
Insertion Force	EIA-364-13 Maximum rate 12.5mm/min	Between 5N and 20N
Extraction Force	EIA-364-13 Maximum rate 12.5mm/min	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.
Durability	EIA 364-09 10,000 cycles	No evidence of physical damage
Durability (Preconditioning)	EIA 364-09 50 cycles	No evidence of physical damage
Reseating	Manually unlug/plug the connector. Perform 3 such cycles	No evidence of physical damage
Cable Pull-Out	EIA 364-38, Method A, 40N axial load, >1 min, Clamping one end of the plug	No physical damage to the cable assembly shall occur
Cable Flexing	EIA 364-41, Condition 1, Dimension X = 3.7 times the cable diameter and 100 cycles in each of two planes 120°arc.	No physical damage or discontinuity over 1ms during flexing shall occur to the cable assembly.
4-Axis Continuity Test	See USB Type C Compliancy Document Appendix D for detailed test fixtures and procedures. Plug and Receptacle: Subject the mating interface to the moments defined in USB Type C Compliancy Document Appendix D for at least 10 seconds.	No discontinuities greater than 1 microsecond duration in any of the four orientations tested.

Table.1 (End)

Test Item	Procedures	Requirements
Environmental		
Temperature Life	EIA-364-17, Method A 105℃, 120hrs	
Temperature Life (Preconditioning)	EIA-364-17, Method A 105℃, 72hrs	
Thermal Shock	EIA-364-32, Method A, Condition I, duration A-4 (-55°-+85℃, 10 cycles)	
Cyclic Temperature and Humidity	EIA-364-31, Method III, w/o optional cold shock and vibration. Exceptions per EIA-364-1000: - Cycle between 25℃/80%RH and 65℃/50%RH. - Ramp 0.5hr, dwell 1hr, dwell starts when conditions are stabilized. - 24 cycles total - Allowable variation ±3℃ and ±3%RH	
Vibration	EIA-364-28, Condition VII-D, 15min in each of 3 mutually perpendicular directions. Both mating halves should be fixed rigidly. (Power Spectral Density 0.02g^2/Hz, Overall rms 3.10g)	No evidence of physical damages and no discontinuity longer than 1 microsecond.
Mixed Flowing Gas	EIA-364-65, class IIA, 112hrs unmated, 56hrs mated (168hrs total).	
Thermal Disturbance	Cycle the mated connector pair 10 times between 15℃ and 85℃. - ramp > 2℃/min - dwell > 5 mins (ensure contacts reach temperature) - Humidity not controlled	
Other		
Solderability	Category 3 Steam Age RMA Class 1 flux immerse in molten solder at a temperature of +255℃ ± 5℃ at rate of 25.4 mm ± 6.35 mm per second. Hold in solder for 5 +0/-0.5 seconds. To include solder pins and mounting pads.	Solderable area shall have a minimum of 95% solder coverage.

NOTE: (1) Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Prequalification Test Sequence shown in table 2.

3. Qualifications Test Sequence

Table.2

Test	A-1	A-2	A-3	A-4	A-7	B-1	B-5[2]	B-6	B-7	C-1[3]
Critical Dimensions							1			
Low Level Contact Resistance	1,4,6	1,4,6,8	1,4,6	1,4,6,8,	2,6					
Durability					3					
Durability (Preconditioning)	2	2	2	2						
Insertion Force					4					
Extraction Force					5,					
Temperature Life	3			3						
Temperature Life (Preconditioning)			3							
Reseating	5	7								
Thermal Shock		3								
Cyclic Temperature and Humidity		5								
Vibration			5							
Mixed Flowing Gas				5						
Thermal Disturbance				7						
Continuity									1	
Dielectric Withstanding Voltage					1,7				2	
Insulation Resistance					8					
Current Rating								1		
Cable Pull-Out						1				
Cable Flexing						2				
4-Axis Continuity Test						3				
Solderability										1

Signal Integrity Testing

The following cable assembly specific test groups are to be reported in a separate test report:

- Test Group B-2: USB 2.0 and Low Speed Signal Tests of Type-C Cable and Adaptor Assemblies
- Test Group B-3: USB SuperSpeed Signal Tests of Type-C Cable and Adaptor Assemblies
- Test Group B-4: USB Type-C Cable and Adaptor Assembly Shielding Effectiveness

Test Requirements and Test Sequence as per USB Type C Compliance Document.

[2] To be reported in Critical Dimension Inspection Report

[3] Additional test, not part of USB Type C Compliance Requirements

4 Test Result:

	Test Item	No.	Condition	Test Result			Requirement	Judgment
				Max	Min	Ave		
Group A-1	LLCR_PINA	5	Initial	38.65	28.97	32.78	<40 mΩ	Pass
	LLCR_PINB	5	Initial	13.06	5.42	7.18	<40 mΩ	Pass
	Durability (preconditioning)	5	Initial	No physical damage occurred			No abnormalities	Pass
	Temperature life (Heat Aging)	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	6.26	-6.85	0.22	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	1.43	-5.61	-0.45	<10 mΩ	Pass
	Reseating	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.02	-9.30	-1.41	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	2.97	-3.31	-0.20	<10 mΩ	Pass
Group A-2	LLCR _PINA	5	Initial	38.74	26.79	33.12	<40 mΩ	Pass
	LLCR_PINB	5	Initial	12.01	5.88	7.11	<40 mΩ	Pass
	Durability (preconditioning)	5	Initial	No physical damage occurred			No abnormalities	Pass
	Thermal Shock	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	9.30	5.29	6.83	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	7.08	-7.33	-1.13	<10 mΩ	Pass
	Humidity, Steady State	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	7.93	5.42	6.92	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	1.24	-4.53	-0.18	<10 mΩ	Pass
	Reseating	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.32	5.77	6.86	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	7.39	-6.45	-0.76	<10 mΩ	Pass

Group A-3	LLCR _PINA	5	Initial	37.85	24.77	31.81	<40 mΩ	Pass
	LLCR_PINB	5	Initial	9.31	5.55	6.79	<40 mΩ	Pass
	Durability (preconditioning)	5	Initial	No physical damage occurred			No abnormalities	Pass
	Temperature life (Heat Aging)	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.76	5.46	6.62	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	7.04	-5.12	0.07	<10 mΩ	Pass
	Vibration (Random)	5	Initial	No discontinuities of 1 microsecond or longer duration occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.03	5.34	6.68	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	5.91	-6.93	-0.93	<10 mΩ	Pass
Group A-4	LLCR _PINA	5	Initial	38.76	28.52	32.79	<40 mΩ	Pass
	LLCR_PINB	5	Initial	9.04	5.26	7.18	<40 mΩ	Pass
	Durability (preconditioning)	5	Initial	No physical damage occurred			No abnormalities	Pass
	Temperature life (Heat Aging)	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.95	-8.28	1.03	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	2.49	-3.18	0.18	<10 mΩ	Pass
	Mixed Flowing Gas	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.08	-9.98	0.67	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	1.84	-2.25	0.03	<10 mΩ	Pass
	Humidity, Steady State	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	5.77	-7.64	-0.35	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	1.62	-2.04	0.05	<10 mΩ	Pass
	Reseating	5	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA(△R)	5	Final	8.92	6.18	7.28	<10 mΩ	Pass
	LLCR_PINB (△R)	5	Final	2.64	-2.14	0.10	<10 mΩ	Pass

Group A-7	Dielectric withstanding Voltage	10	Initial	No physical damage occurred			No abnormalities	Pass
	LLCR _PINA	10	Initial	38.47	27.35	32.87	<40 mΩ	Pass
	LLCR_PINB	10	Initial	13.03	5.30	7.52	<40 mΩ	Pass
	Durability (No abnormalities)	10	Final	No physical damage occurred			No abnormalities	Pass
	Un-mating Force	10	Initial	17.36	12.03	14.96	8N ~ 20 N	Pass
	Mating Force	10	Initial	18.13	10.09	15.28	5N ~20 N	Pass
	Durability (Repeated mate/unmate)	10	Final	No physical damage occurred			No abnormalities	Pass
	Un-mating Force	10	Final	12.42	6.37	9.64	6N ~ 20 N	Pass
	Mating Force	10	Final	16.76	9.07	12.60	5N ~20 N	Pass
	LLCR _PINA	10	Final	6.44	-8.65	-4.21	<10 mΩ	Pass
	LLCR_PINB	10	Final	2.31	-6.7	-0.6	<40 mΩ	Pass
	Dielectric withstanding Voltage	10	Final	No physical damage occurred			No abnormalities	Pass
	Insulation resistance	10	Final	1109	277	799	>100MΩ	Pass
Group B-1	Cable Pull-Out	10	Initial	No physical damage occurred			No abnormalities	Pass
	Cable Flexing	10	Initial	No physical damage occurred			No abnormalities	Pass
	4-Axis Continuity Test	10	Final	No physical damage occurred			No abnormalities	Pass
Group B-6	Current Rating	5	Initial	21.82	19.50	21.31	ΔT 30℃ Max.	Pass
Group C-1[3]	Solderability	5	Initial	Contact Pin was ok Mounting tab was >80% solder coverage			There are minimum of 95% solder coverage	Pass