Qualification Test Report

501-115141-2

Product Design Objective : 108-115129-2

Date : 02APR2018

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TITLE: TYPE C RECEPTACLE ON BOARD

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 Product Design Objective 108-115129-2.

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, meets the electrical, mechanical and environmental performance requirements of Product Specification

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 nickel plating in contact area, gold flash 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-6, C-1,C-2	Refer to test result.	2305018-2	Receptacle Assembly (IPX8)
A-1,A-2,A-3,A-4,A-7, B-1,B-6, C-1	Refer to test result.	1-2305018-2	Receptacle Assembly (NONE WATER PROOF)

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. Test Method

Test requirement and Procedures summary

Test Item	Procedures	Requirements
Visual Inspection	EIA 364-18B	Visual inspection samples shall be free from defect such as damage, deformation, blister and burrs that are detrimental to the function and appearance.
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. See Figure 1 Measure at 20mV (max) open circuit at 100 mA	40 mΩ (Max) initial for VBUS, GND and all other contacts. 50 mΩ Maximum after initial measurement.
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 1 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 1.0 A applied to the SBU1/SBU2 pin (i.e., A8/B8 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°C above ambient temperature.

Test Item	Procedures	Requirements
Mechanical		
Insertion Force	EIA-364-13 Maximum rate 12.5mm/min	Between 5N and 20N
Extraction Force	EIA-364-13 Maximum rate 12.5mm/min	Initial: 8 N to 20 N; After test: 6 N to 20 N
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 unplug/plug the connector. Perform 3 such cycles	No evidence of physical damage
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.
Environmental		
Temperature Life	EIA-364-17,Method A 105°C without applied voltage for 120hrs	Low level contact resistance meets spec before and after the Temperature Life test.
Temperature Life (Preconditioning)	EIA-364-17, Method A 105°C, 72hrs	Low level contact resistance meets spec before and after the Temperature Life test.
Thermal Shock	EIA-364-32, Method A, Condition I, duration A-4 (-55°-+85°C, 10 cycles)	No evidence of any physical damage. Low level contact resistance meets spec before and after the Thermal Shock test.
Cyclic Temperature and Humidity	EIA-364-31, Method III, w/o optional cold shock and vibration. Exceptions per EIA-364-1000: - Cycle between 25°C/80%RH and 65°C/50%RH. - Ramp 0.5hr, dwell 1hr, dwell starts when conditions are stabilized. - 24 cycles total - Allowable variation ±3°C and ±3%RH	No evidence of any physical damage. Low level contact resistance meets spec before and after the Thermal Shock test.
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 0.02g2/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).	No evidence of any physical damage. Low level contact resistance meets spec before and after the Thermal Shock test.
Thermal Disturbance	Cycle the mated connector pair 10 times between 15°C and 85°C. - ramp > 2°C/min - dwell > 5 mins (ensure contacts reach temperature) - Humidity not controlled	Low level contact resistance meets spec before and after the test.

Test Item	Procedures	Requirements
Other		
Solderability	Category 3 Steam Age RMA Class 1 flux immerse in molten solder at a temperature of +255°C ± 5°C 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.
Water Ingression (selective for different P/N)	IEC 60529 – IPX8	1.5m/30 minutes, No water is allowed to enter the enclosure. Use water contact detection paper or color liquid.

3. Qualifications Test Sequence

Test	A-1	A-2	A-3	A-4	A-7	B-1	B-6	C-1	C-2
Visual Inspection	1,8	1,10	1,8	1,12	1,13	1,3	1,3	1,3	1,3
Low Level Contact Resistance	2,5,7	2,5,7,9	2,5,7	2,5,7,9,11	3,10				
Dielectric Withstanding Voltage					2,11				
Insulation Resistance					12				
Durability					7				
Durability (Preconditioning)	3	3	3	3					
Insertion Force					5,8				
Extraction Force					6,9				
Temperature Life	4			4					
Temperature Life (Preconditioning)			4						
Reseating	6	8		10	4				
Thermal Shock		4							
Cyclic Temperature and Humidity		6							
Vibration			6						
Mixed Flowing Gas				6					
Thermal Disturbance				8					
Current Rating							2		
4-Axis Continuity Test						2			
Solderability								2	
Water Ingression									2

C-1: Additional test, not part of USB Type C Compliance Requirements
C-2: Additional test, selection item for water proof product.

4 Test Result

Group	Test Item	No.	Condition	Test Result				Requirement	Judgment
				Max	Min	Ave	Unit		
A-1	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	LLCR	5	Initial	26.47	21.84	24.08	mΩ	40Max	Pass
	Durability (Preconditioning)	5	Final	No physical damage				No Abnormalities	Pass
	Temperature Life	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	30.97	24.69	28.68	mΩ	50Max	Pass
	Reseating	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	26.44	22.28	25.06	mΩ	50Max	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
A-2	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	LLCR	5	Initial	27.65	16.90	23.74	mΩ	40Max	Pass
	Durability (Preconditioning)	5	Final	No physical damage				No Abnormalities	Pass
	Thermal Shock	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	32.19	27.55	29.58	mΩ	50Max	Pass
	Cyclic Temperature and Humidity	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	27.83	21.19	24.83	mΩ	50Max	Pass
	Reseating	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	27.46	22.70	25.01	mΩ	50Max	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
A-3	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	Dielectric Withstanding Voltage	5	Initial	No breakdown or flashover occurred				No Abnormalities	Pass
	LLCR	5	Initial	31.92	26.52	29.65	mΩ	40Max	Pass
	Durability (Preconditioning)	5	Final	No physical damage				No Abnormalities	Pass
	Temperature Life (Preconditioning)	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	27.54	22.43	25.63	mΩ	50Max	Pass
	Vibration	5	Final	Discontinuity less than 1 μs all contacts in series				No Abnormalities	Pass
	LLCR	5	Final	31.92	26.52	29.65	mΩ	50Max	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass

Group	Test Item	No.	Condition	Test Result				Requirement	Judgment
				Max	Min	Ave	Unit		
A-4	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	LLCR	5	Initial	27.54	22.43	25.63	mΩ	40Max	Pass
	Durability (Preconditioning)	5	Final	No physical damage				No Abnormalities	Pass
	Temperature Life	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	26.42	23.49	24.71	mΩ	50Max	Pass
	Mixed Flowing Gas	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	31.49	25.88	29.40	mΩ	50Max	Pass
	Thermal Disturbance	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	28.29	24.15	25.52	mΩ	50Max	Pass
	Reseating	5	Final	No physical damage				No Abnormalities	Pass
	LLCR	5	Final	27.03	23.70	25.11	mΩ	50Max	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
A-7	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	LLCR	5	Initial	27.52	23.14	25.16	mΩ	40Max	Pass
	Dielectric Withstanding Voltage	5	Initial	No breakdown or flashover occurred				No Abnormalities	Pass
	Reseating	5	Final	No physical damage				No Abnormalities	Pass
	Insertion Force	5	Final	12.67	9.07	10.51	N	5~20	Pass
	Extraction Force	5	Final	19.01	12.43	17.13	N	8~20	Pass
	Durability	5	Final	No physical damage				No Abnormalities	Pass
	Insertion Force	5	Final	11.81	7.63	9.86	N	5~20	Pass
	Extraction Force	5	Final	19.2	11.49	15.66	N	6~20	Pass
	LLCR	5	Final	31.08	26.69	29.31	mΩ	50Max	Pass
	Dielectric Withstanding Voltage	5	Final	No breakdown or flashover occurred				No Abnormalities	Pass
	Insulation Resistance	5	Final	1.13	0.91	1.02	10X11Ω	0.91	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
B-1	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	4-Axis Continuity Test	5	Final	Discontinuity less than 1 μs all contacts in series				No Abnormalities	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
B-6	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	Current Rating	5	Final	28.47	23.98	27.56	℃	30Max	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
C-1	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	Solderability	5	Final	Solderable area have a minimum of 95% solder coverage.				No Abnormalities	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass
C-2	Examination of Product	5	Initial	No physical damage				No Abnormalities	Pass
	Water Ingression	15	Final	No water leakage occurred				No Abnormalities	Pass
	Examination of Product	5	Final	No physical damage				No Abnormalities	Pass