Mini USB Type B Connector

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity Mini USB Type B Connector to determine its conformance to the requirements of Product Specification 108-32049 Rev B.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE Connectivity Mini USB Type B Connector. Testing was performed at the Harrisburg Electrical Components Test Laboratory between May 20, 2013 and June 21, 2013. Original testing data and results are available under EA20130268T.

1.3 Conclusion

The part numbers listed in paragraph 1.4 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-32049, Rev B.

1.4 Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for this test program (See Table 1).

Table 1 – Specimen Identification

Test Set	Quantity	Test Sequence	Part Number	Description
1	5	1	2172034-1	Mini USB, Type B Receptacle
	5		1496476-6	Mini USBType B Plugs
2	5	2	2172034-1	Mini USB, Type B Receptacle
	5		1496476-6	Mini USBType B Plugs
3	5	3	2172034-1	Mini USB, Type B Receptacle
	5		1496476-6	Mini USBType B Plugs
4	5	4	2172034-1	Mini USB, Type B Receptacle
	5		1496476-6	Mini USBType B Plugs
5	5	5	2172034-1	Mini USB, Type B Receptacle
1,2,4	15		60-1824307-1 Rev A	Receptacle PCB

1.5 Qualification Test Sequence

The test sequences are shown in Table 2.

Table 2 – Test Sequence

Test/Examination	Test Group				
	1	2	3	4	5
	Test Sequence (a)				
Examination of Product	1,11	1, 5	1,8	1,3	1,3
Low Level Contact Resistance	3,8	2,4			
Insulation Resistance			2,6		
Dielectric Withstanding Voltage			3,7		
Contact Current Rating				2	
Random Vibration	6				
Physical Shock	7				
Durability	5				
Connector Mating Force	2,10				
Connector Unmating Force	4,9				
Thermal Shock			4		
Humidity			5		
Temperature Life		3			
Resistance to Solder Heat					2

(a) Numbers indicate sequence in which tests are performed.

1.6 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 Visual Examination

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by Product Assurance. Specimens were visually examined initially and at the end of each test sequence. No evidence of physical damage detrimental to product performance was observed.

2.2 Low Level Contact Resistance

All final LLCR measurements had a delta less than the maximum of 5 milliohms. Refer to Table 3 for the resistance summary data.

Table 3 – Low Level Contact Resistance (milliohms)

Sequence 1			Sequence 2		
	Initial	Final		Initial	Temperature Life, 250 Hrs
	Actual	Delta		Actual	Delta
Min	64.83	-3.68	**Min**	38.72	0.21
Max	71.55	3.29	**Max**	42.15	4.41
Avg	67.64	-0.06	**Avg**	40.51	1.80
Std	1.53	1.68	**Std**	0.80	1.10
N	20	20	**N**	20	20
Wire Bulk Included = 8.75”			Wire Bulk Included = 2.75”		

2.3 Insulation Resistance

All insulation resistance measurements were greater than 100 Megohms.

2.4 Dielectric Withstanding Voltage

No dielectric breakdown or flashover occurred when applying 100 VAC between adjacent contacts.

2.5 Contact Current Rating

Refer to Table 4 for maximum temperature rise data in degrees Celsius from both the front of the connector and the solder tails. All specimens were below 30°C temperature rise above ambient when energized to 1.0 Amp DC. See Figure 1 for a chart of the temperature rise values. Refer to Figure 2 for typical IR images.

Table 4 – Temperature Rise Data in Degrees Celsius

Specimen ID	Ambient	Current	Temperature Rise, Front of Connector	Temperature Rise, Solder Tails
	Degrees C	DC Amps	Degrees C	Degrees C
401	22.6	1.0	12.1	15.7
402	22.6	1.0	10.0	13.9
403	22.6	1.0	9.8	13.0
404	22.6	1.0	10.2	14.3
405	22.6	1.0	11.1	16.6

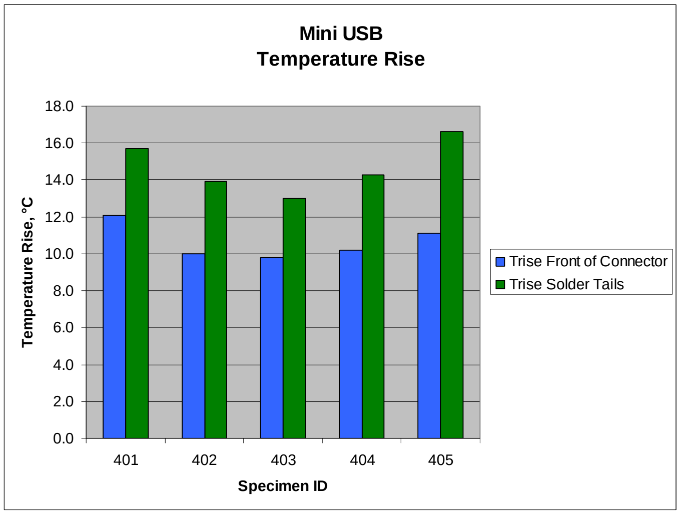

Figure 1 – Temperature Rise Data in Degrees Celsius

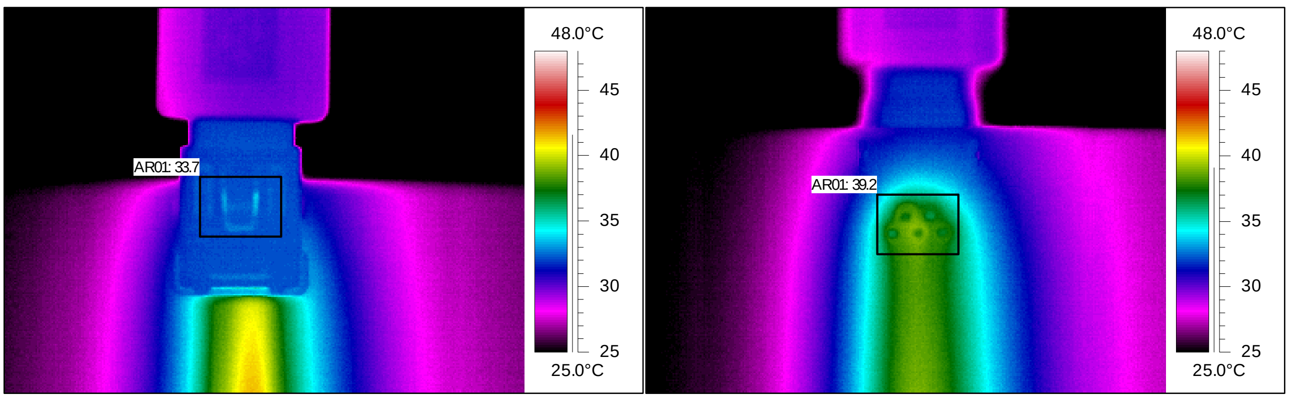

Figure 2 – Typical IR Images, Front of Connector & Solder Tails

2.6 Random Vibration

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

2.7 Physical Shock

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

2.8 Durability

No physical damage occurred to the specimens as a result of mating and unmating the specimens 5000 times.

2.9 Connector Mating Force

All specimens are under the maximum mating force requirement of 35 Newtons. Refer to Table 5 for the mating force summary data.

Table 5 – Mating Force (Newtons)

ID#	Initial	Final
Min	11.3	7.61
Max	15.61	14.99
Avg	13.33	11.54
Std Dev	1.58	3.50

2.10 Connector Unmating Force

All specimens met a minimum initial unmating force requirement of 7 Newtons and a minimum after test unmating force requirement of 3 Newtons. Refer to Table 6 for the unmating force summary data.

Table 6 – Unmating Force (Newtons)

ID#	Initial	Final
Min	11.74	3.91
Max	15.35	9.21
Avg	13.89	5.42
Std Dev	1.57	2.15

2.11 Thermal Shock

No evidence of physical damage was visible as a result of exposure to thermal shock.

2.12 Humidity/Temperature Cycling

No evidence of physical damage was visible as a result of exposure to humidity-temperature cycling.

2.13 Temperature Life

No evidence of physical damage was visible as a result of exposure to temperature life.

2.14 Resistance to Solder Heat

No significant defects or damage to the specimens was observed as a result of the resistance to soldering heat test. Some minor discoloration in the housings was noticed around the contacts.

3. TEST METHODS

3.1 Initial Visual Examination

Specimens were visually examined initially and at the end of each test sequence using the unaided eye.

3.2 Low Level Contact Resistance

Low level contact resistance measurements at low level current were made using a four terminal measuring technique (Figure 3). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

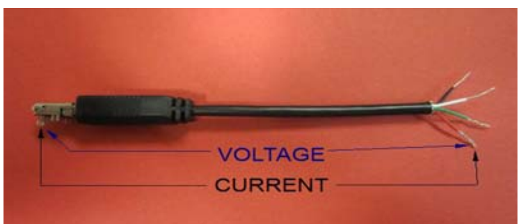

Figure 3 - LLCR Measurement Points

3.3 Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for two minutes before the resistance was measured.

3.4 Dielectric Withstanding Voltage

A test potential of 100 volts AC (rms) was applied at a rate of 500 volts per minute between the adjacent contacts of mated specimens while monitoring for a maximum leakage current of 0.5 mA. This potential was applied for one minute and then returned to zero.

3.5 Contact Current Rating

The infrared temperature measurement point was coated with EQUATE powder, an emissivity correction coating. The emissivity correction coating has a known value which is 0.95. Raising and knowing the emittance value allows for accurate temperature measurements. The infrared camera was used with a close-up lens (34/80mm) attached to the standard optics (24° lens) to image the test specimens.

ThermaCAM Researcher 2001 thermal imaging processing system was used for data analysis. The area tool software feature was used to determine maximum temperature of the exposed contacts. The area tool software feature allows a shape, which can be sized, to be placed on an area of interest. The pixels inside the shape are analyzed giving minimum, maximum, average, and standard deviation measurements of the target temperature.

The test specimens were connected to create a series circuit and placed in the temperature rise enclosure. Current was then applied and measurements were taken after temperature stabilization.

Refer to Figure 4 for an image of the typical test setup.

Figure 4 – Typical Test Setup

3.6 Random Vibration

The test specimens were subjected to a random vibration test. See Figure 5 for a vibration setup photograph.

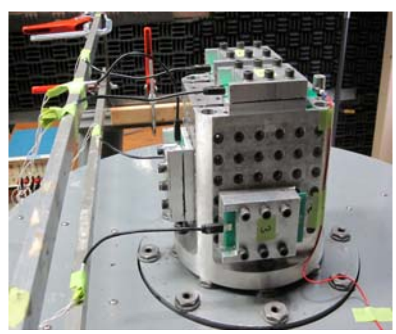

Figure 5 - Vibration Setup

The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 50 and 2000 Hertz (Hz). The power spectral density (PSD) at 50 Hz is 0.005 G^2/Hz. The spectrum slopes up at 6 dB per octave to a PSD of 0.02 G^2/Hz at 100 Hz. The spectrum is flat at 0.02 G^2/Hz from 100 Hz to 1000 Hz. The spectrum slopes down at 6 dB per octave to a PSD of 0.005 G^2/Hz at the upper bound frequency of 2000 Hz. The root-mean square amplitude of the excitation was 5.35 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.

3.7 Physical Shock

The test specimens were subjected to a physical shock test as stated in accordance with specification EIA-364-27C, test condition “H”. See Figure 5 above for a shock setup photograph.

The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 30 gravity units (g's peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the three mutually perpendicular axes of the test specimens, for a total of eighteen shocks.

The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

The Pulse Velocity Change was 79.1 inches/second.

3.8 Durability

Specimens were mated and unmated 5000 times at a maximum rate of 200 cycles per hour using an automated machine. Refer to Figure 6 for specimen set-up.

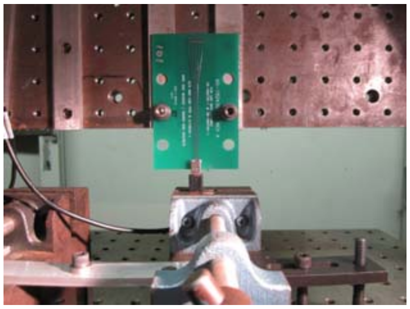

Figure 6 - Durability Set-up

3.9 Connector Mating Force

The force required to mate individual specimens was measured using a tensile/compression device with the rate of travel at 0.5 inch/minute. The board mounted receptacle was held in a vise. After setting the plug on the receptacle an axial force was applied until the connector was fully mated. A slotted fixture attached to a load cell was used to apply the force. Refer to Figure 7 for set-up.

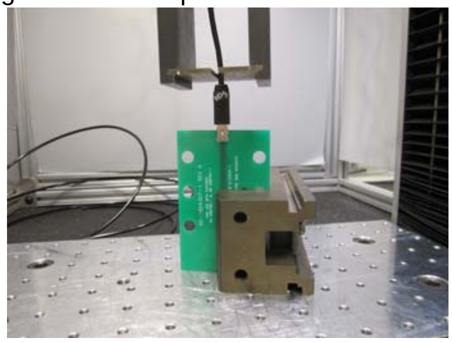

Figure 7 - Mating Force Set-up

3.10 Connector Unmating Force

The force required to unmate individual specimens was measured using a tensile/compression device with the rate of travel at 0.5 inch/minute. The mated specimens, with the plug pointing down, were bolted to a right angle fixture attached to a load cell. A slotted fixture was clamped to the lower plate of the tensile/compression machine. The slotted plate was then placed between the plug and pc board. An axial force was then applied in a direction to unmate the connectors. Refer to Figure 8 for the unmating force set-up.

Figure 8 - Unmating Force Set-up

3.11 Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 85°C. The transition between temperatures was less than one minute.

3.12 Humidity/Temperature Cycling

Mated specimens were exposed to 7 cycles (168Hrs) of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25°C and 65°C twice while maintaining high humidity.

3.13 Temperature Life

Mated specimens were exposed to a temperature of 85°C for 250 hours.

3.14 Resistance to Soldering Heat

Five specimens were subjected to a resistance to soldering heat test in accordance with 109-202 Condition B. Each connector was mounted to a 0.062” thick test board. These boards had the component lead holes drilled out such that the diametrical clearance between the hole and the component terminals was less than 0.015 inch.

The mounted connectors were immersed for 5 seconds in type ROL1 flux, followed by immersion in a lead free solder pot of molten solder so that the bottom of the board floats. The molten solder was maintained at a temperature of 265°C ± 5°C for a duration of 10 seconds.

Following the dip process, specimens were cleaned by placing them in a glass beaker containing isopropyl alcohol. The beaker was then placed in an ultrasonic cleaner for approximately 5 minutes. The specimens were removed from the beaker and evaluated at approximately 10x magnification.