Evaluation Testing of UPM High Current Header and Receptacle Assemblies

1. INTRODUCTION

1.1. Purpose

Testing was performed on TE Connectivity (TE) Universal Power Module (UPM) High Current Header and Receptacle Assemblies to determine their performance characteristics by using aged contacts to simulate end of life condition.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the UPM High Current Assemblies. Testing was performed at the Harrisburg Electrical Components Test Laboratory between 07Dec10 and 11Mar11. The test file number for this testing is EA20101060T, Revision B. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

1.3. Conclusion

The UPM High Current Assemblies listed in paragraph 1.4. conformed to the selected electrical, mechanical, and environmental performance requirements of Product Specification 108-1651 Revision D.

1.4. Test Specimens

Specimens were representative of normal production lots, specimens identified with the following part numbers were used for test:

Test Set	Quantity	Part Number	Description
1	3	120953-1	4 position high current vertical receptacle
	3	120953-5	8 position high current vertical receptacle
	3	120962-1	12 position high current right angle header
2	3	5-5223955-2	3 position high current vertical receptacle
	3	5-5223961-1	3 position high current right angle header
3	3	120962-1	12 position high current right angle header
	6	5223995-3	6 position standard current vertical receptacle
4	2	1-120943-0	12 position high current coplanar right angle receptacle
	2	120962-1	12 position high current right angle header
1,2,3,4	9	60-1042107-2	Coplanar header PCB
1,2,3	7	60-1042834-1	Vertical receptacle PCB
4	2	60-1042107-1	Right angle coplanar receptacle PCB

Figure 1

| Indicates Change

1.5. Environmental Conditions

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

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

1.6. Test Sequence

Test or Examination	Test Sets (a)			
	1	2	3	4
	Test Sequence (b)			
Initial examination of product	1			
Low Level Contact Resistance (LLCR)	2,6,8,10,12			
Temperature rise vs current	3,13			
Sinusoidal vibration	11(c)			
Durability	4			
Temperature life	9			
Mixed flowing gas	5,7			
Final examination of product	14			

NOTE
(a) See paragraph 1.4.
(b) Numbers indicate sequence in which tests were performed.
(c) Discontinuities not measured, specimens were energized at 18°C temperature rise.

Figure 2

2. SUMMARY OF TESTING

2.1. Initial Examination of Product

Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. LLCR

All LLCR measurements were less than 5 milliohms initially and after testing.

Condition	Initial (R)	After 10 Days Mixed Flowing Gas, Unmated (ΔR)	After 10 Days Mixed Flowing Gas, Mated (ΔR)	After Temperature Life (ΔR)	After Vibration ΔR)
Test Set 1					
Minimum	0.76	-0.31	-0.42	-0.29	-0.41
Maximum	1.64	0.64	0.68	0.58	0.61
Average	1.31	-0.04	-0.07	-0.05	-0.04
Standard Deviation	0.21	0.23	0.25	0.20	0.24
Data Points	36	36	36	36	36

Figure 3 (continued)

Condition	Initial (R)	After 10 Days Mixed Flowing Gas, Unmated (ΔR)	After 10 Days Mixed Flowing Gas, Mated (ΔR)	After Temperature Life (ΔR)	After Vibration ΔR)
Test Set 2					
Minimum	0.85	-0.15	-0.25	-0.19	-0.13
Maximum	1.33	0.17	0.15	0.29	0.31
Average	1.10	-0.03	-0.08	0.06	0.14
Standard Deviation	0.14	0.09	0.12	0.14	0.15
Data Points	9	9	9	9	9
Test Set 3					
Minimum	1.14	-0.72	-0.67	-0.36	-0.33
Maximum	2.34	0.70	0.41	0.89	1.16
Average	1.83	-0.14	-0.16	0.06	0.15
Standard Deviation	0.30	0.32	0.28	0.31	0.36
Data Points	36	36	36	36	36
Test Set 4					
Minimum	0.78	-0.30	-0.29	-0.36	-0.34
Maximum	1.43	0.69	1.25	0.58	0.64
Average	1.08	0.09	0.16	0.10	0.07
Standard Deviation	0.17	0.25	0.35	0.21	0.22
Data Points	24	24	24	24	24

Figure 3 (end)

2.3. Temperature Rise vs Current

The current that produced a 30°C temperature rise for each of the specimens tested in the configurations shown in Figure 1 can be seen in Figure 4. Initial and final temperature rise vs current plots are shown in Figures 5 and 6.

Specimen	Initial			
	Test Set 1	Test Set 2	Test Set 3	Test Set 4
1	17.54	21.08	14.61	17.92
				18.50
2	16.77	20.25	14.90	18.52
				17.95
3	17.33	20.75	15.18	---

Specimen	Final			
	Test Set 1	Test Set 2	Test Set 3	Test Set 4
1	17.34	21.04	14.46	17.45
				16.96
2	16.96	20.30	14.23	17.38
				16.75
3	17.51	21.12	14.15	---

NOTE *All values in amperes.*

Figure 4

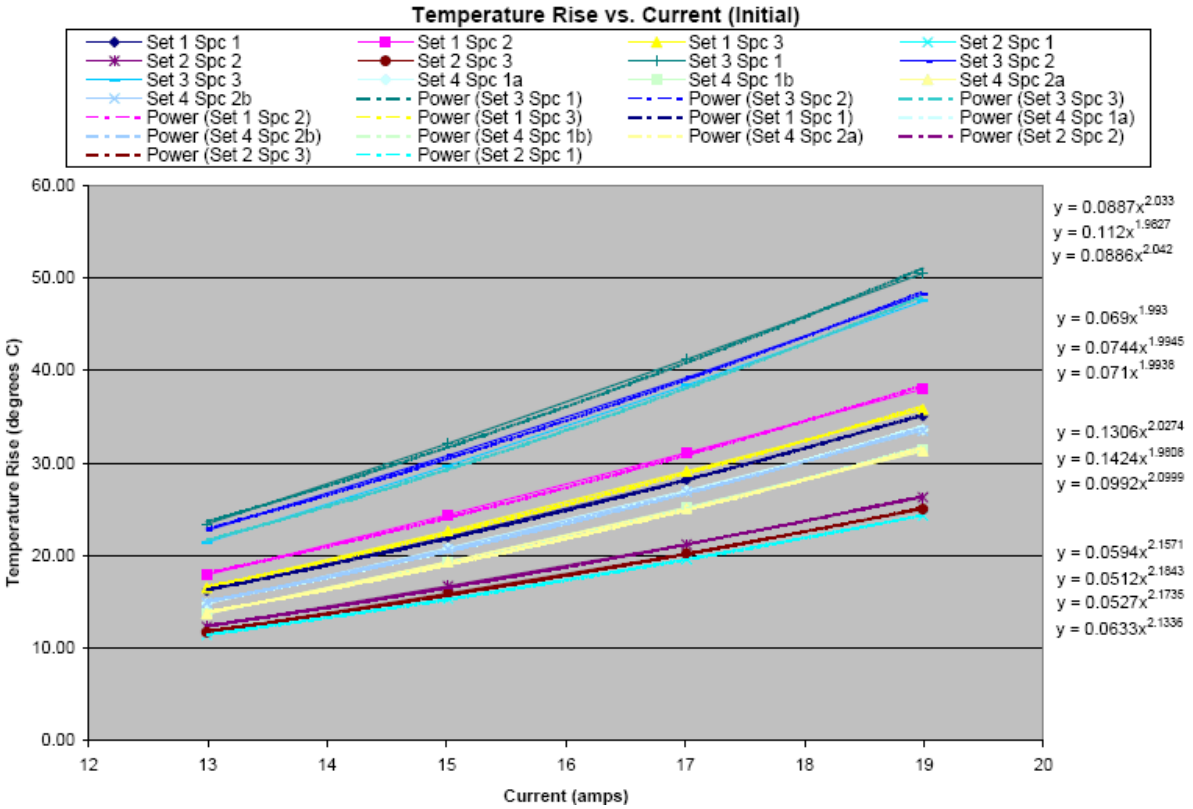

Figure 5

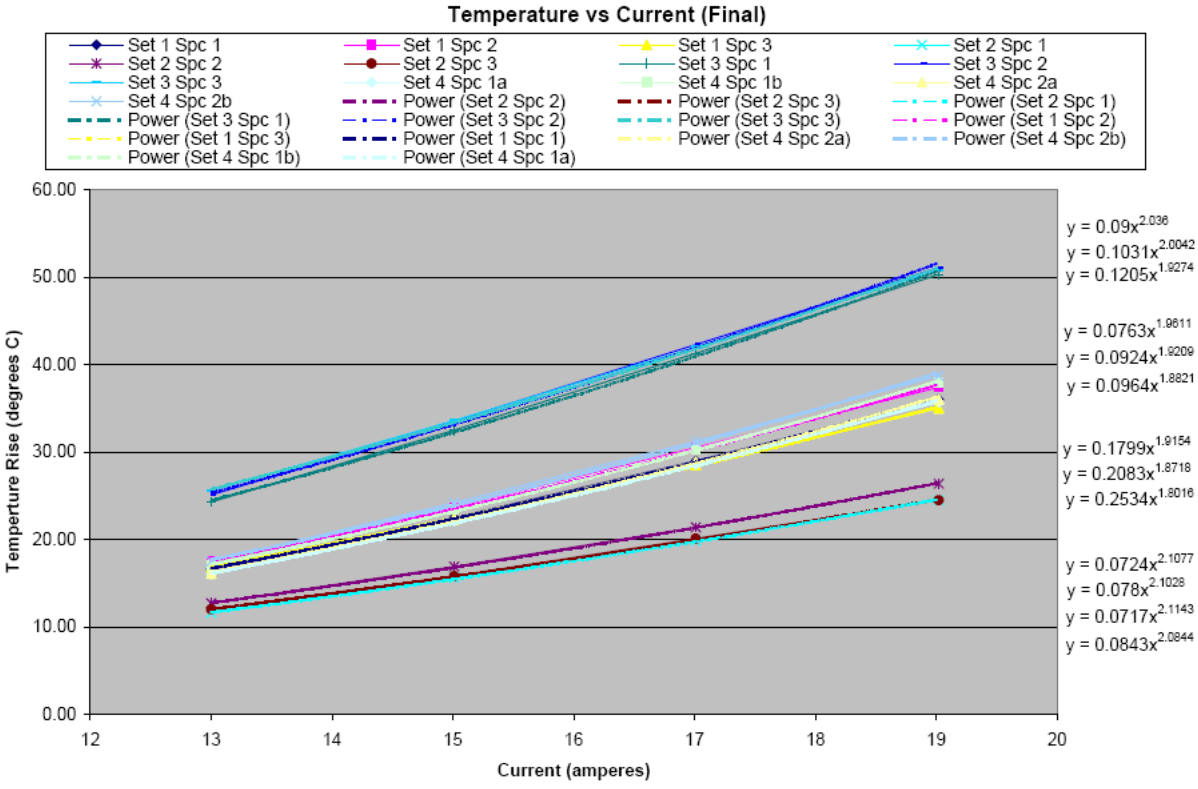

Figure 6

2.4. Sinusoidal Vibration

No discontinuities were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts on the specimens were visible.

2.5. Durability

No physical damage occurred as a result of mating and unmating the specimens 250 times.

2.6. Temperature Life

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

2.7. Mixed Flowing Gas

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.8. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Initial Examination of Product

All specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and manufactured using the same core manufacturing processes and technologies as production parts.

3.2. LLCR

LLCR measurements were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

3.3. Temperature Rise vs Current

Temperature rise curves were produced by measuring individual contact temperatures at multiple current levels. These measurements were plotted to produce a temperature rise vs current curve. Thermocouples were attached to individual contacts with thermally conductive epoxy to measure their temperatures. For specimens in Test Sets 1 through 3, only 1 contact on the receptacle was monitored. For Test Set 4, 1 contact on the header and receptacle was monitored. When the temperature rise of 3 consecutive readings taken at 5 minute intervals did not differ by more than 1°C, the temperature measurement was recorded. The ambient temperature was then subtracted from this measured temperature to find the temperature rise.

3.4. Sinusoidal Vibration

Mated specimens were subjected to a sinusoidal vibration test. The parameters of this test condition are a simple harmonic motion having an amplitude of either 0.06 inch double amplitude (maximum total excursion) or 5 gravity unit (Gs peak) whichever is less. The vibration frequency was varied logarithmically between the approximate limits of 10 to 500 Hz. The entire frequency range of 10 to 500 Hz and return to 10 Hz was traversed in approximately 15 minutes. This cycle was performed 12 times in all 3 mutually perpendicular axes (total of 36 times), so that the motion was applied for a total period of approximately 9 hours. Specimens were energized with a current of 11 amperes DC during testing.

3.5. Durability

Specimens were mated and unmated 250 times at a maximum rate of 300 cycles per hour.

3.6. Temperature Life

Mated specimens were exposed to a temperature of 125°C for 16 hours.

3.7. Mixed Flowing Gas, Class IIA

Unmated specimens were exposed for 10 days to a mixed flowing gas Class IIA exposure. Then mated specimens were exposed for and additional 10 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl_2 at 10 ppb, NO_2 at 200 ppb, H_2S at 10 ppb, and SO_2 at 100 ppb. Specimens were preconditioned with 10 cycles of durability.

3.8. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.