PCI Express Gen4 Connector

1. INTRODUCTION

1.1. Purpose

Testing was performed on the TE Connectivity PCI Express Gen4 Card Edge Connector to determine its conformance to the requirements of Product Specification 108-60121-1 Rev A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the PCI Express Gen4 Card Edge Connector. Testing was performed at TE Shanghai test Laboratory. The test file numbers for this testing are TP-19-00713-record.

1.3. Conclusion

The PCI Express Gen4 Card Edge Connector listed in paragraph 1.4, conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-60121-1 Rev A.

1.4. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the part number 4-2337939-4 with 15u" gold plating.

1.5. Environmental Conditions

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

- Temperature: 15 to 35°C
- Relative Humidity: 25 to 75%

1.6. Qualification Test Sequence

Test or Examination	Test Group								
	A	B	C	D	E	F	G	H	I
	Test Sequence (a)								
Examination of product.	1, 9	1, 8	1, 9	1, 9	1, 8	1, 3	1, 11	1, 3	1, 3
Low level contact resistance.	3, 7	2, 5, 7	2, 5, 8	2, 5, 8			2,5,7,9		
Dielectric withstanding voltage.					2, 6				
Insulation resistance.					3, 7				
Mating force.	2, 6								
Unmating force.	4, 8								
Durability.	5	3							
Durability (preconditioning)			3	3			3		
Reseating.		6	7				10		
Vibration, random.				6					
Physical Shock				7					
Solderability.						2			
MFG							6		
Resistance to reflow soldering heat									2
Temperature life.		4							
Thermal disturbance							8		
Temperature life (Preconditioning).				4			4		
Thermal shock.			4		4				
Humidity-temperature cycling.			6		5				
Contact current rating/ Temperature rise.								2	

NOTE

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

Figure 1

2. SUMMARY OF TESTING

2.1. Visual Examination - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Contact Resistance - Test Groups A, B, C, D and G

All contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage, were less than 30 milliohms initially and had a change in resistance (ΔR) of less than 20 milliohms after testing.

Condition	Initial (R)	After Durability (50 cycles, ΔR)
Test Group A		
Maximum	20.21	10.51
Minimum	8.74	-4.04
Average	15.58	0.17
Std Dev	1.07	1.12

Condition	Initial (R)	After Temperature life (ΔR)	After Reseating (ΔR)
Test Group B			
Maximum	20.35	7.93	4.78
Minimum	11.02	-5.57	-5.21
Average	15.72	0.33	0.47
Std Dev	1.04	1.07	1.07

Condition	Initial (R)	After Thermal shock (ΔR)	After Humidity-temp and Reseating (ΔR)
Test Group C			
Maximum	18.95	6.15	4.80
Minimum	10.62	-2.67	-4.41
Average	15.66	0.09	0.19
Std Dev	1.01	0.81	1.12

Condition	Initial (R)	After Temperature life (Preconditioning) (ΔR)	After Physical Shock (ΔR)
Test Group D			
Maximum	21.76	10.23	7.53
Minimum	10.46	-4.94	-5.85
Average	15.88	0.44	0.70
Std Dev	1.08	1.09	1.23

Condition	Initial (R)	After Temperature life (Preconditioning) (ΔR)	After MFG (ΔR)	After Thermal disturbance (ΔR)
Test Group G				
Maximum	19.92	9.47	10.47	14.86
Minimum	11.66	-3.02	-4.26	-3.29
Average	15.64	0.52	0.73	1.67
Std Dev	1.03	1.03	1.31	2.14

Note: All values in miniohms

2.3. Insulation Resistance - Test Group E

All insulation resistance measurements were greater than 1000 megohms in both initially and after testing.

2.4. Dielectric Withstanding Voltage - Test Group E

No dielectric breakdown or flashover occurred.

2.5. Current Carrying Capacity - Test Group H

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 1.1 ampere per pin.

2.6. Random Vibration - Test Group D

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

2.7. Mechanical Shock - Test Group D

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

2.8. Mechanical Durability - Test Groups A and B

No physical damage occurred as a result of mating and unmating the specimens 50 cycles.

2.9. Mating/unmating Forces - Test Groups A

All mating force measurements were less than 1.15N per contact pair, all unmating force measurements were larger than 0.15N per contact pair.

2.10. Resistance to Reflow Soldering Heat - Test Group I

No physical damage occurred as a result of resistance to reflow soldering heat.

2.11. Thermal Shock - Test Group C and E

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

2.12. Humidity/temperature Cycling - Test Group C and E

No evidence of physical damage was visible as a result of humidity/temperature cycling.

2.13. Temperature Life, 92 Hour - Test Group D and G

No evidence of physical damage was visible as a result of 92 hours of temperature life testing.

2.14. Temperature Life, 168 Hour - Test Group B

No evidence of physical damage was visible as a result of 168 hours of temperature life testing.

2.15. Mixed Flowing Gas - Test Group G

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

2.16. Thermal Disturbance - Test Group G

No evidence of physical damage was visible as a result of thermal disturbance testing.

2.17. Solderability – Test Group F

The inspected area of each lead has 95% above solder coverage after Solderability testing.

3. TEST METHODS

3.1. Visual Examination

A C of C 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.

3.2. Contact Resistance

Contact resistance 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. Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for 1 minutes before the resistance was measured.

3.4. Dielectric Withstanding Voltage

A test potential of 500 volts AC was applied between adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.5. Current Carrying Capacity

The temperature was measured on fully energized specimens using thermocouple. Circuits were simultaneously energized at 1.1 ampere. Conduct a temperature rise vs. current test.

3.6. Random Vibration

Per EIA-364-28, Test condition VII, Test letter D, Subject mated connectors to 3.1 g's RMS. 15 minutes in each of three mutually perpendicular planes. Specimens were monitored for discontinuities of 1 microsecond or greater

3.7. Mechanical Shock

The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 50 gravity units (g's peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular axes of the test specimen, for a total of eighteen shocks. Specimens were monitored for discontinuities of 1 microsecond or greater.

3.8. Mechanical Durability

Specimens were mated and unmated total 50 times at a maximum rate of 200 cycles per hour.

3.9. Mating/Unmating Forces

The force required to insert and extract a card was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.5 mm max per minute.

3.10. Resistance to Reflow Soldering Heat

Moisture Soak precondition ： 85°C, 60%RH for 168 hours. Test curve per figure 2 for 3 cycles of Duration.

3.11. Thermal Shock

Mated specimens were subjected to 10 cycles of thermal shock with each cycle consisting of 30 minutes dwells at -55 and 85°C.

3.12. Humidity/temperature Cycling

Mated specimens were exposed to 10 humidity/temperature cycles per EIA-364-31, Method III, Condition B. Consisted of cycling the temperature between 25 and 65°C while maintaining high humidity. Total 10 days.

3.13. Temperature Life, 92 Hour, Preconditioning

Mated specimens were exposed to a temperature of 105°C for 92 hours.

3.14. Temperature Life, 168 Hour

Mated specimens were exposed to a temperature of 105°C for 168 hours.

3.15. Mixed Flowing Gas

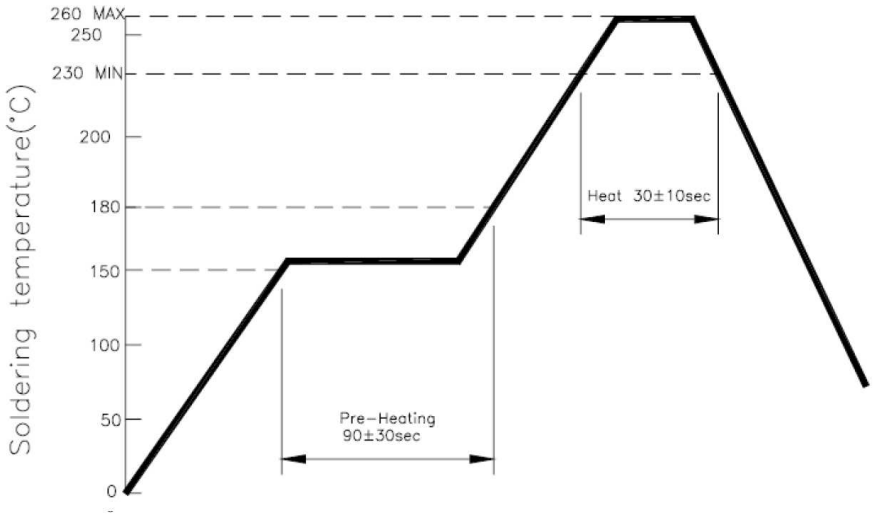
Specimens were exposed for 5 days in mated to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl_2 at 10 ppb, NO_2 at 200 ppb, H_2S at 10 ppb and SO_2 at 100 ppb.

3.16. Reseating

Manually unplug/plug the connector for 3 cycles

3.17. Thermal Disturbance

Cycle the connector or socket between 15 °C ± 3 °C and 85 °C ±3 °C, as measured on the part. Ramps should be a minimum of 2°C per minute, and dwell times should insure that the contacts reach the temperature extremes (a minimum of 5 minutes). Humidity is not controlled. Perform 10 such cycles.



Temperature Profile of Reflow Soldering
Figure 2