Multi-Beam XL* Board Mount Receptacle or Plug Connector System

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Multi-Beam XL* Board Mount Receptacle or Plug Connector System to determine its conformance to the requirements of Product Specification 108-1973 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Multi-Beam XL Board Mount Receptacle or Plug Connector System. Testing was performed at the Engineering Assurance Product Testing Laboratory between 31May06 and 21Dec06. The test file numbers for this testing are CTLB055885-006, CTLB055885-008 and CTLB055885-009. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The Multi-Beam XL Board Mount Receptacle or Plug Connector System listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1973 Revision A.

1.4. Test Specimens

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

Part Number	Description
6600330-3	Multi-Beam vertical header, soldertail
6450370-6	Multi-Beam right angle receptacle, soldertail
6600323-1	Multi-Beam vertical header, press-fit

Figure 1

1.5. Environmental Conditions

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

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

* Trademark
| Indicates change

1.6. Qualification Test Sequence

Test or Examination	Test Group (a)						
	1	2	3	4	5	6(b)	7(b)
	Test Sequence (c)						
Initial examination of product	1	1	1	1	1	1	1
Low level contact resistance, signal and power contacts	2,5	3,7		2,4			
Low level contact resistance, power contacts only					2,6,8,10		
Contact resistance at rated current, power contacts					12		
Insulation resistance			2,6				
Withstanding voltage			3,7				
Temperature rise vs current					4,11		
Vibration, random		5			9(d)		
Mechanical shock		6					
Durability	3(e)	4			3(f)		
Mating force		2(g)					
Unmating force		8(g)					
Compliant pin insertion							2
Radial hole distortion							3
Compliant pin retention							4
Component heat resistance to wave soldering						2	
Solderability dip test						3	
Thermal shock			4				
Humidity-temperature cycling			5				
Temperature life				3	7		
Mixed flowing gas	4				5		
Final examination of product	6	9	8	5	13	4	5

NOTE

(a) See paragraph 1.4.
(b) Split into subgroups as needed for on and off board tests.
(c) Numbers indicate sequence in which tests are performed.
(d) Energize at current for 18˚C temperature rise.
(e) Precondition specimens with 5 durability cycles.
(f) Precondition specimens with 50 durability cycles.
(g) Power only in housing, signal with gage as shown in 108-2157.

Figure 2

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

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

2.2. Low Level Contact Resistance, Signal and Power Contacts - Test Groups 1, 2 and 4

All low level contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 10 milliohms initially and 20 milliohms after testing for power contacts and less than 15 milliohms initially and 20 milliohms after testing for signal contacts.

2.3. Low Level Contact Resistance, Power Contacts Only - Test Group 5

All low level contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 15 milliohms initially and 20 milliohms after testing.

2.4. Contact Resistance at Rated Current, Power Contacts - Test Group 5

All contact resistance at rated current measurements were less than 0.7 milliohm, end of life.

2.5. Insulation Resistance - Test Group 3

All insulation resistance measurements were greater than 500 megohms for signal contacts and greater than 1000 megohms for power contacts.

2.6. Withstanding Voltage - Test Group 3

No dielectric breakdown or flashover occurred.

2.7. Temperature Rise vs Current - Test Group 5

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 55 amperes for single power contacts on both .250 and .300 inch spacings; 50 amperes for 2 adjacent power contacts on .300 inch spacing; 47 amperes for 4 adjacent power contacts on .300 inch spacing; 42 amperes for 4 adjacent power contacts on .250 inch spacing; and 35 amperes for 8 adjacent power contacts on .250 inch spacing.

2.8. Vibration, Random - Test Groups 2 and 5

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

2.9. Mechanical Shock - Test Group 2

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

2.10. Durability - Test Groups 1, 2 and 5

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

2.11. Mating Force - Test Group 2

All average mating force measurements were less than 7.8 N [28 ozf] per contact for power contacts and less than 1.7 N [6 ozf] per contact for signal contacts.

2.12. Unmating Force - Test Group 2

All unmating force measurements were greater than 2.2 N [8 ozf] per contact for power contacts and greater than 0.2 N [0.7 ozf] per contact for signal contacts.

2.13. Compliant Pin Insertion - Test Group 7

All compliant pin insertion measurements were less than 111.2 N [25 lbf] per pin.

2.14. Radial Hole Distortion - Test Group 7

All radial hole distortion measurements were less than 0.070 mm [0.00276 in] with a minimum of 0.008 mm [0.00032 in] copper wall remaining.

2.15. Compliant Pin Retention - Test Group 7

All compliant pin retention measurements were greater than 6.7 N [1.5 lbf] per pin.

2.16. Component Heat Resistance to Wave Soldering - Test Group 6

No evidence of physical damage was visible as a result of subjecting the specimens to wave soldering.

2.17. Solderability Dip Test - Test Group 6

All solderable areas had a minimum of 95% solder coverage.

2.18. Thermal Shock - Test Group 3

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

2.19. Humidity-temperature Cycling - Test Group 3

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

2.20. Temperature Life - Test Groups 4 and 5

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

2.21. Mixed Flowing Gas - Test Groups 1 and 5

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

2.22. Final Examination of Product - All Test Groups

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

A Certificate of Conformance 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. Low Level Contact Resistance, Signal and Power Contacts

Low level 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. Low Level Contact Resistance, Power Contacts Only

Low level 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.

3.4. Contact Resistance at Rated Current, Power Contacts

Contact resistance measurements at rated current were made using a 4 terminal measuring technique. The test current was maintained at 35 amperes for .250 inch spacing with 8 contacts energized; and 47 amperes for .300 inch spacing with 4 contacts energized.

3.5. Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.6. Withstanding Voltage

A test potential of 1000 volts DC for signal contacts and 2500 volts DC for power contacts was applied between adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.7. Temperature Rise vs Current

Temperature rise was measured on 5 unstressed and stressed specimens using infrared imaging. Specimens were placed on PCBs 60-474980-1 and 60-474979-1. Temperature rise curves were established for specimens with a single circuit energized, 4 adjacent contacts and 8 adjacent contacts with a .250 inch spacing energized and 2 adjacent and 4 adjacent contacts with a .300 inch spacing energized. All contacts were energized at 5 different current levels. The specimens were allowed to stabilize before the temperature was measured. The specimens were imaged using standard optics after applying an emissivity correction coating (Micatin™ foot powder). The emittance of the emissivity correction factor is 0.93. Raising this emittance value allows for accurate temperature measurements. ThermaCAM™ Researcher 2001 thermal image processing was used for data analysis. The software has a temperature box measurement feature to determine maximum temperature of the contact. This software feature allows a measurement of the area inside the box when placed on an area of interest. The specimens were placed in the stable air environment of a temperature rise enclosure.

3.8. Vibration, Random

Mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 20 and 500 Hz. The spectrum was flat at 0.05 G^2/Hz from 20 to 500 Hz. The root-mean square amplitude of the excitation was 4.90 GRMS. This was performed for 15 minutes in each of 3 mutually perpendicular planes for a total vibration time of 45 minutes. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.9. Mechanical Shock, Half-sine

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 50 gravity units (g peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.10. Durability

Specimens were mated and unmated 250 times at a maximum rate of 500 cycles per hour.

3.11. Mating Force

The force required to mate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute. Power contacts were measured with signal contacts removed, signal contacts were measured with power contacts removed.

3.12. Unmating Force

The force required to unmate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute. Power contacts were measured with signal contacts removed, signal contacts were measured with power contacts removed.

3.13. Compliant Pin Insertion

The force required to correctly apply a specimen to a printed circuit board was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

3.14. Radial Hole Distortion

A total of 10 randomly picked pin/holes from 1 specimen were cross-sectioned horizontally as close as possible to the area of maximum deformation. These cross-sections were used to determine mean and maximum radial deformation/distortion as follows: Using an optical video probe with variable magnification of 100 to 300X, measurements were made using a round template affixed to the screen of the video monitor. The lines were matched to the radius of the plated thru-holes by adjusting the magnification of the probe. This line was placed on the original hole radius, and the difference between the original radius and the maximum and minimum deformation/distorted radius was measured for each of the 10 pin/holes. The same 10 pin/holes that were cross sectioned to measure hole deformation were also used to determine hole damage and minimum copper thickness between the pin and the PCB laminate. The holes were also examined for any evidence of cracks or breaks in the copper wall.

3.15. Compliant Pin Retention

The force required to remove a correctly applied specimen from a printed circuit board was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

3.16. Component Heat Resistance to Wave Soldering - Test Group 6

All specimens were checked dimensionally before and after exposure to heat. The solderable areas of the specimens were immersed in Kester 145 type ROL0 flux for 5 to 10 seconds. This flux is a non-activated rosin flux having a nominal composition of 25% by weight of water white gum rosin in a solvent of 99% isopropyl alcohol. The specific gravity of the flux was between 0.838 and 0.858. The flux was maintained at room temperature. The specimens were then removed from the flux and the excess was allowed to drain off for 5 to 20 seconds. The specimens were attached to a dipping machine and immersed at a maximum rate of 25.4 mm [1 in] per second into a soldering bath filled with melted lead free solder (96.5% Sn, 3.0% Ag and 0.5% Cu) controlled at 265 ± 5˚C [509˚F] until the solderable surface was coated. The specimens were held in the solder bath for 10 seconds. The specimens were then removed from the solder bath at a maximum rate of 25.4 mm [1 in] per second and subjected to a 5 minute cleaning in isopropyl alcohol. The specimens were then given a visual examination using 30X magnification.

3.17. Solderability Dip Test - Test Group 6

The solderable areas of the specimens were immersed in Kester 145 type ROL0 flux for 5 to 10 seconds. This flux is a non-activated rosin flux having a nominal composition of 25% by weight of water white gum rosin in a solvent of 99% isopropyl alcohol. The specific gravity of the flux was between 0.838 and 0.858. The flux was maintained at room temperature. The specimens were then removed from the flux and the excess was allowed to drain off for 5 to 20 seconds. The specimens were immersed at a maximum rate of 25.4 mm [1 in] per second into a soldering bath filled with melted lead free solder (96.5% Sn, 3.0% Ag and 0.5% Cu) controlled at 245 ± 5˚C [473˚F] until the solderable surface was coated. The specimens were held in the solder bath for 4 to 5 seconds. The specimens were then removed from the solder bath at a maximum rate of 25.4 mm [1 in] per second and subjected to a 5 minute cleaning in isopropyl alcohol. The specimens were then given a visual examination using 30X magnification.

3.18. Thermal Shock

Mated specimens were subjected to 36 cycles of thermal shock with each cycle consisting of 30 minute dwells at -20 and 105˚C. The transition between temperatures was less than 1 minute.

3.19. Humidity-temperature Cycling

Mated specimens were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 40˚C twice while maintaining high humidity.

3.20. Temperature Life

Mated specimens were exposed to a temperature of 105˚C for 504 hours (21 days).

3.21. Mixed Flowing Gas, Class IIA

Mated specimens were exposed for 14 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.

3.22. Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.