Z-PACK* HS3 Dual Beam Connector System

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Z-PACK* HS3 Dual Beam Connector System to determine its conformance to the requirements of Product Specification 108-1957 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Z-PACK HS3 Dual Beam Connector System. Testing was performed at the Engineering Assurance Test Laboratory between 15Aug00 and 12Jan01. The test file number for this testing is CTL 2957-011. This documentation is on file at and available from the Engineering Assurance Test Laboratory.

1.3. Conclusion

The Z-PACK HS3 Dual Beam Connector System listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1957 Revision A.

1.4. Product Description

The Z-PACK HS3 Dual Beam Connector System is a two piece device designed to interconnect a backplane board to a daughtercard. The connector system utilizes press-fit terminations on both the backplane (header) and daughtercard (receptacle) connectors.

1.5. Test Specimens

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

Test Group	Quantity	Part Number	Description
1,2,3,4	12	120789-1	6 row, 30 position right angle left receptacle module, palladium-nickel plated contacts
	12	120788-1	6 row, 30 position right angle right receptacle module, palladium-nickel plated contacts
	16	120787-1	6 row, 30 position right angle center receptacle module, palladium-nickel plated contacts
	29	120786-1	6 row, 60 position right angle full receptacle module, palladium-nickel plated contacts
	12	120678-1	6 row, 30 position left plug module, gold plated signal contacts
	12	120677-1	6 row, 30 position right plug module, gold plated signal contacts
	16	120732-1	6 row, 30 position center plug module, gold plated signal contacts
	29	120674-1	6 row, 60 position full plug module, gold plated signal contacts
	8	120795-1	10 row, 50 position right angle left receptacle module, palladium-nickel plated contacts
	8	120794-1	10 row, 50 position right angle right receptacle module, palladium-nickel plated contacts
	16	120791-1	10 row, 50 position right angle center receptacle module, palladium-nickel plated contacts
	25	120790-1	10 row, 100 position right angle full receptacle module, palladium-nickel plated contacts
	8	120672-1	10 row, 50 position left plug module, gold plated signal contacts
	8	120670-1	10 row, 50 position right plug module, gold plated signal contacts
	16	120747-1	10 row, 50 position center plug module, gold plated signal contacts
	25	120658-1	10 row, 100 position full plug module, gold plated signal contacts

Figure 1

* Trademark
I Indicates change

1.6. Environmental Conditions

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

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

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Initial examination of product	1	1	1	1
Dry circuit resistance	3	5	5	4
Change in resistance	6,8,10,12,14	9,11,13,17,21	7	6,8,10,12,14,16,18
Insulation resistance		6,14,18		
Dielectric withstanding voltage		7,15,19		
Compliant pin resistance	4,16	3,22	3,8	2,19
Vibration	9			
Mechanical shock	11			
Durability	5,13	8,20		5,17
Mating force	2	4	4	3
Unmating force	15	23	9	20
Compliant pin insertion force		2	2	
Compliant pin retention force		24	10	
Minute disturbance				15
Thermal shock		12		
Humidity-temperature cycling		16		
Temperature life			6	
Mixed flowing gas (unmated				7,9
Mixed flowing gas (mated)				11,13
Dust contamination	7	10		
Final examination of product	17	25	11	21

NOTE *(a) See paragraph 1.5.*
(b) Numbers indicate sequence in which tests are performed.

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. Dry Circuit Resistance - Test Groups 1, 2, 3 and 4

All dry circuit resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 20 milliohms initially.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1	660	Initial (palladium-nickel, 6 row, signal)	6.740	12.417	9.681
	718	Initial (palladium-nickel, 10 row, signal)	6.568	15.733	11.087
2	660	Initial (palladium-nickel, 6 row, signal)	6.856	12.411	9.665
	720	Initial (palladium-nickel, 10 row, signal)	6.734	15.489	11.132
3	660	Initial (palladium-nickel, 6 row, signal)	6.825	12.424	9.730
	720	Initial (palladium-nickel, 10 row, signal)	6.542	15.429	11.203
4	660	Initial (palladium-nickel, 6 row, signal)	7.025	12.339	9.759
	720	Initial (palladium-nickel, 10 row, signal)	6.905	16.380	11.526
1,2,3,4	800	Initial (all grounds)	2.472	4.453	3.483

NOTE *All values in milliohms.*

Figure 3

2.3. Change In Resistance - Test Groups 1, 2, 3 and 4

All positive change in resistance (ΔR) values were less than 10 milliohms at subsequent measurement intervals after initial and the average change in resistance for each subgroup was less than 5 milliohms.

Test Group	Number of Data Points	Condition	Change In Resistance (mΩ)		
			Min	Max	Mean
1 Palladium-Nickel 6 Row	660	Initial Durability	-0.455	0.260	-0.047
		After Dust	-0.643	0.859	-0.128
		After Vibration	-0.483	1.500	-0.109
		After Shock	-0.548	1.558	-0.113
		After Durability, Final	-0.456	0.523	-0.058
1 Palladium-Nickel 10 Row	718	Initial Durability	-0.255	0.497	0.028
		After Dust	-0.625	0.520	-0.079
		After Vibration	-0.517	0.440	-0.064
		After Shock	-0.493	0.814	-0.073
		After Durability, Final	-0.451	0.788	-0.009
1 All Grounds	200	Initial Durability	-0.235	0.094	-0.035
		After Dust	-0.220	0.598	0.062
		After Vibration	-0.264	0.194	-0.040
		After Shock	-1.068	0.150	-0.054
		After Durability, Final	-0.256	0.662	0.033

Figure 4 (cont)

Test Group	Number of Data Points	Condition	Change In Resistance (mΩ)		
			Min	Max	Mean
2 Palladium-Nickel 6 Row	660	Initial Durability	-0.311	1.111	-0.016
		After Dust	-0.428	1.187	-0.089
		After Thermal Shock	-0.512	1.332	-0.122
		After Humidity-Temperature Cycling	-0.515	1.260	-0.087
		After Durability, Final	-1.594	2.222	0.030
2 Palladium-Nickel 10 Row	720	Initial Durability	0.474	0.422	-0.007
		After Dust	-0.426	1.004	0.004
		After Thermal Shock	-0.639	1.096	-0.131
		After Humidity-Temperature Cycling	-0.576	1.964	-0.070
		After Durability, Final	-0.404	1.972	-0.007
2 All Grounds	200	Initial Durability	-0.199	0.136	-0.035
		After Dust	-0.179	1.231	0.137
		After Thermal Shock	-0.202	0.212	0.001
		After Humidity-Temperature Cycling	-0.205	4.269	0.087
		After Durability, Final	-0.118	1.074	0.207
3	660	Final, Palladium-Nickel, 6 Row	-0.375	2.244	0.107
	720	Final, Palladium-Nickel, 10 Row	-0.386	0.987	-0.125
	200	Final, All Grounds	-0.148	0.691	0.145
4 Palladium-Nickel 6 Row	660	Initial Durability	-0.687	0.323	-0.094
		6 Days Mixed Flowing Gas, Unmated	-0.599	0.969	-0.057
		10 Days Mixed Flowing Gas, Unmated	-0.685	0.577	-0.062
		15 Days Mixed Flowing Gas, 5 Mated	-0.601	0.756	-0.083
		20 Days Mixed Flowing Gas, 10 Mated	-0.701	0.633	-0.033
		Minute Disturbance	-0.681	0.444	-0.092
		Final Durability	-0.756	0.627	-0.091
4 Palladium-Nickel 10 Row	720	Initial Durability	-1.138	0.273	-0.240
		6 Days Mixed Flowing Gas, Unmated	-1.061	3.385	-0.079
		10 Days Mixed Flowing Gas, Unmated	-1.058	1.416	-0.042
		15 Days, Mixed Flowing Gas, 5 Mated	-1.169	0.824	-0.189
		20 Days Mixed Flowing Gas, 10 Mated	-0.863	0.707	-0.168
		Minute Disturbance	-1.008	1.024	-0.177
		Final Durability	-0.953	0.910	-0.180
4 All Grounds	200	Initial Durability	-0.264	0.211	-0.010
		6 Days Mixed Flowing Gas, Unmated	-0.220	0.177	0.010
		10 Days Mixed Flowing Gas, Unmated	-0.237	0.279	0.020
		15 Days Mixed Flowing Gas, 5 Mated	-0.265	0.231	0.011
		20 Days Mixed Flowing Gas, 10 Mated	-0.262	0.284	0.049
		Minute Disturbance	-0.249	0.283	0.031
		Final Durability	-0.254	0.211	0.015

Figure 4 (end)

2.4. Insulation Resistance - Test Group 2

All insulation resistance measurements were greater than 10000 megohms.

2.5. Dielectric Withstanding Voltage - Test Group 2

No dielectric breakdown or flashover occurred.

2.6. Compliant Pin Resistance – Test Groups 1, 2, 3 and 4

All compliant pin resistance measurements taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 1.0 milliohm initially and had less than 1.0 milliohm change finally.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1	25	Initial	0.0055	0.0491	0.0180
		Final	-0.0385	0.0835	0.0088 ΔR
2	25	Initial	0.0155	0.1056	0.0307
		Final	-0.0835	0.1083	0.0068 ΔR
3	25	Initial	0.0120	0.1371	0.0283
		Final	-0.0265	0.1499	0.0114 ΔR
4	25	Initial	0.0070	0.0385	0.0078
		Final	-0.0125	0.3369	0.0816 ΔR

Figure 5

2.7. Vibration - Test Group 1

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

2.8. Mechanical Shock - Test Group 1

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

2.9. Durability - Test Groups 1, 2, and 4

No physical damage occurred as a result of mating and unmating the specimens 125 times.

2.10. Mating Force - Test Groups 1, 2, 3, and 4

All mating force measurements were less than 0.75 N [.17 lb] per contact.

2.11. Unmating Force - Test Groups 1, 2, 3, and 4

All unmating force measurements were greater than 0.15 N [.03 lb] per contact.

2.12. Compliant Pin Insertion Force – Test Groups 2 and 3

All insertion force measurements were less than an average of 31 N [7 lb] per contact.

2.13. Compliant Pin Retention Force – Test Groups 2 and 3

All pin retention measurements were greater than an average of 4.4 N [1 lb] per contact.

2.14. Minute Disturbance – Test Group 4

No evidence of physical damage was visible as a result of subjecting each connector to a minute unmate/remate operation.

2.15. Thermal Shock - Test Group 2

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

2.16. Humidity-temperature Cycling - Test Group 2

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

2.17. Temperature Life - Test Group 3

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

2.18. Mixed Flowing Gas - Test Group 4

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

2.19. Dust Contamination - Test Groups 1 and 2

No evidence of physical damage was visible as a result of exposure to dust contamination.

2.20. 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 Certification of Conformance was issued stating that all specimens in this test package have been produced, inspected, and accepted as conforming to product drawing requirements, and made using the same core manufacturing processes and technologies as production parts.

3.2. Dry Circuit Resistance

Termination resistance measurements at low level current were made using a four terminal measuring technique (Figure 6). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

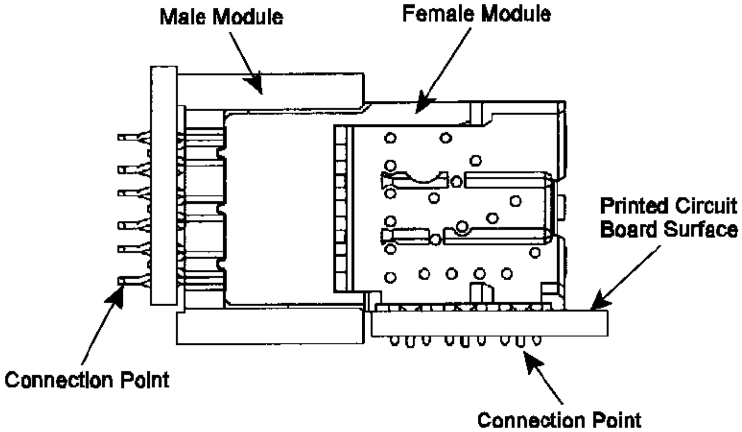

Figure 6
Dry Circuit Resistance Measurement Points

3.3. Change in Resistance

Change in resistance for each contact was determined by algebraically subtracting the initial resistance value from the value measured at the next subsequent measurement interval.

3.4. 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.

3.5. Dielectric Withstanding Voltage

A test potential of 600 volts AC was applied between adjacent signal contacts and between signal and adjacent ground contacts of mated specimens. This potential was applied for one minute and then returned to zero.

3.6. Compliant Pin Resistance

Compliant resistance measurements at low level current were made using a four terminal measuring technique (Figure 7). Current was applied at the interface end of a contact and the pad surrounding the thru-hole. One voltage probe was attached to the end of the contact protruding from the bottom of the thru-hole and the other was attached to the pad surrounding the thru-hole. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

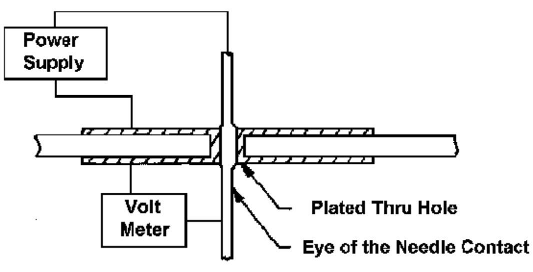

Figure 7
Typical Resistance Measurement Points

3.7. Vibration, Sinusoidal

Mated specimens were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of either 0.06 inch, double amplitude or 10 gravity units, (g's peak) whichever is less. The vibration frequency was varied uniformly between the limits of 10 and 500 Hz and returned to 10 Hz in 15 minutes. This cycle was performed 64 times in each of three mutually perpendicular planes for a total vibration time of 24 hours. Specimens were monitored for discontinuities of one microsecond or greater using a current of 100 milliamperes DC.

3.8. 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 three mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of one microsecond or greater using a current of 100 milliamperes DC.

3.9. Durability

Specimens were mated and unmated 125 times at a maximum rate of 600 cycles per hour.

3.10. 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 and a free floating fixture. The average force per contact was calculated.

3.11. 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 and a free floating fixture. The average force per contact was calculated.

3.12. Compliant Pin Insertion Force

The force required to fully seat (insert) the compliant pins of a connector onto a PC board was measured using a tensile/compression device. Insertion was performed at a travel rate of 0.2 inch/minute. The average force per contact was calculated.

3.13. Compliant Pin Retention Force

The force required to fully unseat the compliant pins of a connector from a PC board was measured using a tensile/compression device. Connectors were unseated at a travel rate of 0.2 inch/minute. The average force per contact was calculated.

3.14. Minute Disturbance

The test specimens were subjected to a minute disturbance by manually unmating and mating each connector pair a distance of approximately 0.1 mm.

3.15. Thermal Shock

Mated specimens were subjected to 10 cycles of thermal shock with each cycle consisting of 30 minute dwells at -65 and 125°C. The transition between temperatures was less than one minute.

3.16. Humidity-temperature Cycling

Mated specimens were exposed to 50 cycles of humidity-temperature cycling. Each of the first five cycles lasted 24 hours and consisted of cycling the temperature between 5 and 85°C twice while maintaining high humidity. During each of the five cycles, specimens were exposed to a cold shock at -10°C for 3 hours (Figure 8).

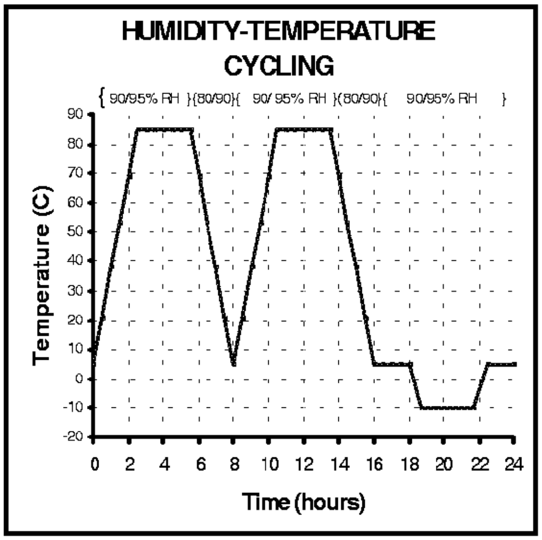

Figure 8
Humidity-Temperature Cycling Profile

Each of the remaining 45 cycles lasted 16 hours and consisted of cycling the temperature between 5 and 85°C twice while maintaining high humidity (Figure 9).

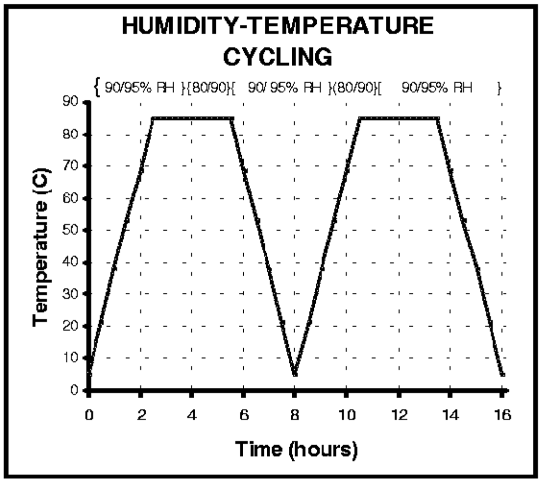

Figure 9
Humidity-Temperature Cycling Profile

3.17. Temperature Life

Mated specimens were exposed to a temperature of 105°C for 1000 hours.

3.18. Mixed Flowing Gas, Class IIIA

Mated specimens were exposed, in 5 day increments, to a mixed flowing gas Class IIIA exposure for a total of 20 days. A Class IIIA exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl_2 at 20 ppb, NO_2 at 200 ppb, H_2S at 100 ppb, and SO_2 at 200 ppb. Specimens were preconditioned with 125 cycles of durability.

3.19. Dust Contamination

Unmated specimens were exposed to a dust mixture which conformed to Composition #1 (benign) as described in EIA Standard TP-91. After drying the dust for one hour at 50°C a quantity of dust equal to 9 grams per cubic foot of chamber area was placed in the dust chamber. The connectors were suspended vertically in the chamber with their long axis parallel to the direction of air flow. The chamber was then sealed and the air and dust within recirculated for 1 hour at a flow rate of 360 cubic feet per minute. The specimens remained in the chamber for an additional hour and when removed were tapped on a wooden surface 5 times at a rate of 1 inch/second to remove excess dust.

3.20. Final Examination of Product

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