# Z-PACK TinMan* 85 Ohm Connector System

## 1. INTRODUCTION

### 1.1. Purpose

Testing was performed on the Z-PACK TinMan* 85 Ohm Connector System to determine its conformance to the requirements of Product Specification 108-2303-1 Revision B.

### 1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Z-PACK TinMan 85 Ohm Connector System. Testing was performed at the Harrisburg Electrical Components Test Laboratory between10Nov09 and 25Aug10. The test file numbers for this testing are EA20090962T and EA20090956T. Additional testing was performed between 13Dec10 and 15Jan11. The test file number for this testing is EA20100923T. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

### 1.3. Conclusion

The Z-PACK TinMan 85 Ohm Connector System listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2303-1 Revision B.

### 1.4. Product Description

The Z-PACK TinMan 85 Connector System uses a modular concept to interconnect two printed circuit boards. Both receptacle and pin connectors are connected to the printed circuit board with plated thru-hole compliant press-fit leads.

### 1.5. Test Specimens

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

A. Test Reports EA20090962T and EA20090956T

| Test Group | Quantity | Part Number | Description |
|---|---|---|---|
| 1,2A,2B,3,4,5 | 3 each | 2065797-1 | Right angle header assembly with 15 µin Au and post lube |
| 1,2A,3,4 | 3 each | 2065797-1 | Right angle header assembly with 15 µin PdNi and post lube |
| 1,2A,2B,3,5 | 3 each | 2065792-1 | Vertical receptacle with 15 µin Au |
| 1,2A,3 | 3 each | 2065792-2 | Vertical receptacle with 15 µin PdNi |
| 4 | 3 | 1934890 | Vertical receptacle with 15 µin Au |
| 4 | 3 | 1934890 | Vertical receptacle with 15 µin PdNi |
| 1,2A,3,5 | 42 | 60-1042198-1 | Vertical receptacle PCB |
| 1,2A,3,5 | 42 | 60-1042199-1 | Right angle header PCB |

**NOTE** *Right angle header assemblies were post lubed using part number 977395-2.*

Figure 1

B. Test Report EA20100923T

| Test Set | Test Group | Quantity | Part Number | Description |
|---|---|---|---|---|
| 1 | 1 | 3 | 2065838 | 8 column vertical header, 30 µin gold sequenced 5 pair, post lube |
| 1 | 1 | 3 | 2065792 | 8 column vertical receptacle, 30 µin gold 5 pair |
| 1 | 1 | 6 | 60-104198-1 | TinMan backplane PCB |

Figure 2

## 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

A. Test Reports EA20090962T and EA20090956T

| Test or Examination | Test Group (a) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2A | 2B | 3 | 4 | 5 |
| | Test Sequence (b) | | | | | |
| Initial examination of product | 1 | 1 | 1 | 1 | 1 | 1 |
| Low Level Contact Resistance (LLCR) | 3,6,8,10,12 | 3,5,7,9,11 | | 4(c),6 | 2,4,6,8,10,12,14,16 | |
| Low Level Compliant Pin Resistance (LLCPR) | | 2,12 | | 3,7 | | |
| Insulation resistance | | | 6 | | | |
| Withstanding voltage | | | 7 | | | |
| Temperature rise vs current | | | | | | 2 |
| Random vibration | 9 | | | | | |
| Mechanical shock | 11 | | | | | |
| Durability | 5 | 4 | 2 | | 3(d),15(d) | |
| Mating force | 2,14 | | | | | |
| Unmating force | 4,13 | | | | | |
| Compliant pin insertion force | | | | 2 | | |
| Compliant pin retention force | | | | 8 | | |
| Minute disturbance | | | | | 13 | |
| Thermal shock | | 8 | 4 | | | |
| Humidity/temperature cycling | | 10 | 5 | | | |
| Temperature life | | | | 5 | | |
| Mixed flowing gas (mated) | | | | | 9(e),11(e) | |
| Mixed flowing gas (unmated) | | | | | 5(e),7(e) | |
| Dust contamination | 7 | 6 | 3 | | | |
| Final examination of product | 15 | 13 | 8 | 9 | 17 | 3 |

**NOTE**

*(a) See paragraph 1.5.*
*(b) Numbers indicate sequence in which tests are performed.*
*(c) Perform 10 durability cycles prior to initial measurement.*
*(d) Perform 100 durability cycles before, and 100 durability cycles after mixed flowing gas testing.*
*(e) Exposure interval of 5 days.*

Figure 3

B. Test Report EA20100923T

| Test or Examination | Test Group (a) |
|---|---|
| | 1 |
| | Test Sequence (b) |
| Initial examination of product | 1 |
| Mating force | 2,9 |
| Unmating force | 3,8 |
| Durability | 4 |
| Dust | 5 |
| Vibration | 6 |
| Mechanical shock | 7 |
| Final examination of product | 10 |

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

Figure 4

## 2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups, Test Reports EA20090962T, EA20090956T and EA20100923T

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. LLCR - Test Groups 1, 2A, 3 and 4, Test Reports EA20090962T and EA20090956T

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 100 milliohms initially and had a change in resistance (ΔR) of less than 10 milliohms after testing.

| Reading | Initial (R) | LLCR ΔR (milliohms) | | | |
|---|---|---|---|---|---|
| | | After 200 Durability Cycles | After Dust Contamination | After Vibration | After Mechanical Shock |
| Test Group 1, 15 Au Post Lube | | | | | |
| Minimum | 16.04 | -1.14 | -1.09 | -1.18 | -0.80 |
| Maximum | 31.36 | 0.38 | 0.27 | 0.38 | 0.83 |
| Average | 24.80 | -0.23 | -0.34 | -0.27 | -0.09 |
| Standard Deviation | 4.50 | 0.23 | 0.20 | 0.22 | 0.23 |
| Nv[Nr] | 240[240] | 240[240] | 240[240] | 240[240] | 240[240] |
| Test Group 1, 15 PdNi Post Lube | | | | | |
| Minimum | 16.76 | -0.63 | -0.80 | -0.84 | -0.90 |
| Maximum | 33.20 | 0.45 | 0.92 | 0.95 | 0.59 |
| Average | 25.73 | -0.03 | -0.22 | -0.08 | -0.18 |
| Standard Deviation | 4.62 | 0.20 | 0.24 | 0.28 | 0.24 |
| Nv[Nr] | 240[240] | 240[240] | 240[240] | 240[240] | 240[240] |

| Reading | Initial (R) | LLCR ΔR (milliohms) | | | |
|---|---|---|---|---|---|
| | | After 200 Durability Cycles | After Dust Contamination | After Thermal Shock | After Humidity/ temperature Cycling |
| Test Group 2A, 15 Au Post Lube | | | | | |
| Minimum | 15.65 | -0.40 | -0.67 | -0.41 | -0.52 |
| Maximum | 31.03 | 0.84 | 0.63 | 0.98 | 1.08 |
| Average | 24.49 | 0.17 | 0.07 | 0.23 | 0.26 |
| Standard Deviation | 4.49 | 0.20 | 0.22 | 0.22 | 0.28 |
| Nv[Nr] | 240[240] | 240[240] | 240[240] | 240[240] | 240[240] |
| Test Group 2A, 15 PdNi Post Lube | | | | | |
| Minimum | 16.94 | -0.19 | -0.81 | -0.69 | -0.43 |
| Maximum | 33.17 | 1.91 | 2.58 | 3.13 | 3.35 |
| Average | 25.71 | 0.29 | -0.12 | 0.13 | 0.23 |
| Standard Deviation | 4.63 | 0.29 | 0.30 | 0.33 | 0.35 |
| Nv[Nr] | 240[240] | 240[240] | 240[240] | 240[240] | 240[240] |

| Figure 5 (continued)

| Reading | Initial (R) | LLCR ΔR (milliohms) After 500 Hours Temperature Life |
|---|---|---|
| Test Group 3, 15 Au Post Lube | | |
| Minimum | 15.86 | -0.29 |
| Maximum | 31.34 | 1.36 |
| Average | 24.57 | 0.36 |
| Standard Deviation | 4.49 | 0.25 |
| Nv[Nr] | 240[240] | 240[240] |
| Test Group 3, 15 PdNi Post Lube | | |
| Minimum | 16.83 | 0.12 |
| Maximum | 32.93 | 4.56 |
| Average | 25.51 | 1.22 |
| Standard Deviation | 4.61 | 0.69 |
| Nv[Nr] | 240[240] | 240[240] |

| Test Group | Number of Data Points | Condition | Termination Resistance (milliohms) | | |
|---|---|---|---|---|---|
| | | | Minimum | Maximum | Mean |
| 15 Au and 15 Au Post Lube | | | | | |
| 4 | 240 | Initial | 15.75 | 31.45 | 24.55 |
| | 240 | After 100 durability cycles (ΔR) | -0.64 | 0.55 | -0.11 |
| | 240 | After 5 days unmated mixed flowing gas (ΔR) | -0.64 | 1.25 | -0.11 |
| | 240 | After 10 days unmated mixed flowing gas (ΔR) | -0.64 | 0.66 | 0.02 |
| | 240 | After 15 days unmated mixed flowing gas (ΔR) | -0.35 | 1.19 | 0.13 |
| | 240 | After 20 days unmated mixed flowing gas (ΔR) | -0.42 | 0.78 | 0.10 |
| | 240 | After minute disturbance (ΔR) | -0.52 | 0.84 | 0.06 |
| | 240 | After 100 durability cycles (ΔR) | -0.56 | 0.64 | 0.03 |
| 15 PdNi and 15 PdNi Post Lube | | | | | |
| 4 | 240 | Initial | 16.54 | 33.03 | 25.45 |
| | 240 | After 100 durability cycles (ΔR) | -0.77 | 0.54 | -0.11 |
| | 240 | After 5 days unmated mixed flowing gas (ΔR) | -0.71 | 0.80 | 0.06 |
| | 240 | After 10 days unmated mixed flowing gas (ΔR) | -0.67 | 0.92 | 0.06 |
| | 240 | After 15 days unmated mixed flowing gas (ΔR) | -0.60 | 1.13 | 0.13 |
| | 240 | After 20 days unmated mixed flowing gas (ΔR) | -0.47 | 1.41 | 0.11 |
| | 240 | After minute disturbance (ΔR) | -0.60 | 1.20 | 0.09 |
| | 240 | After 100 durability cycles (ΔR) | -0.51 | 1.29 | 0.17 |

Figure 5 (end)

| 2.3. LLCPR - Test Groups 2A and 3, Test Reports EA20090962T and EA20090956T

All LLCPR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 1 milliohm initially and had a change in resistance (ΔR) of less than 1 milliohm after testing.

| Reading | Initial (R) | LLCPR ΔR (micro-ohms) After 500 Hours Temperature Life |
|---|---|---|
| Test Group 2A, 15 Au Post Lube | | |
| Minimum | 91.50 | -66.80 |
| Maximum | 222.50 | 122.50 |
| Average | 163.43 | 54.61 |
| Standard Deviation | 33.74 | 51.68 |
| Nv[Nr] | 36[36] | 36[36] |

| Reading | Initial (R) | LLCPR ΔR (micro-ohms) After Humidity/temperature Cycling |
|---|---|---|
| Test Group 3, 15 PdNi Post Lube | | |
| Minimum | 62.00 | 62.00 |
| Maximum | 237.00 | 237.00 |
| Average | 172.24 | 172.24 |
| Standard Deviation | 41.91 | 41.91 |
| Nv[Nr] | 36[36] | 36[36] |

| Figure 6

| 2.4. Insulation Resistance - Test Group 2B, Test Reports EA20090962T and EA20090956T

All insulation resistance measurements were greater than 1000 megohms.

| 2.5. Withstanding Voltage - Test Group 2B, Test Reports EA20090962T and EA20090956T

No dielectric breakdown or flashover occurred.

| 2.6. Temperature Rise vs Current - Test Group 5, Test Reports EA20090962T and EA20090956T

All specimens had a temperature rise of less than 30°C above ambient with 100% of the signal contacts energized at 0.5 ampere DC.

| 2.7. Random Vibration - Test Group 1, Test Reports EA20090962T, EA20090956T and EA20100923T

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

| 2.8. Mechanical Shock - Test Group 1, Test Reports EA20090962T, EA20090956T and EA20100923T

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

2.9. Durability - Test Groups 1, 2A, 2B and 4, Test Reports EA20090962T, EA20090956T and EA20100923T

No physical damage occurred as a result of mating and unmating the specimens 200 times.

2.10. Mating Force - Test Group 1

A. Test Reports EA20090962T and EA20090956T

All mating force measurements were less than 0.65 N [.15 lbf] average per mated contact.

B. Test Report EA20100923T

All mating force measurements were less than 0.65 N [.15 lbf] average per mated contact for unsequenced signal pins. All mating force measurements were less than 0.47 N [.105 lbf] average per mated contact for sequenced signal pins.

2.11. Unmating Force - Test Group 1, Test Reports EA20090962T, EA20090956T and EA20100923T

All unmating force measurements were greater than 0.1 N [.022 lbf] average per contact.

2.12. Compliant Pin Insertion Force - Test Group 3, Test Reports EA20090962T and EA20090956T

All compliant pin insertion force measurements were less than 44.5 N [10 lbf] average per pin.

2.13. Compliant Pin Retention Force - Test Group 3, Test Reports EA20090962T and EA20090956T

All compliant pin retention force measurements were greater than 4.4 N [1 lbf] average per pin.

2.14. Minute Disturbance - Test Group 4, Test Reports EA20090962T and EA20090956T

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

2.15. Thermal Shock - Test Groups 2A and 2B, Test Reports EA20090962T and EA20090956T

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

2.16. Humidity/temperature Cycling - Test Groups 2A and 2B, Test Reports EA20090962T and EA20090956T

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

2.17. Temperature Life - Test Group 3, Test Reports EA20090962T and EA20090956T

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

2.18. Mixed Flowing Gas - Test Group 4, Test Reports EA20090962T and EA20090956T

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, 2A and 2B, Test Reports EA20090962T, EA20090956T and EA20100923T

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

2.20. Final Examination of Product - All Test Groups, Test Reports EA20090962T, EA20090956T and EA20100923T

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 C o f 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. LLCR

LLCR measurements were made using a 4 terminal measuring technique (Figure 7). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

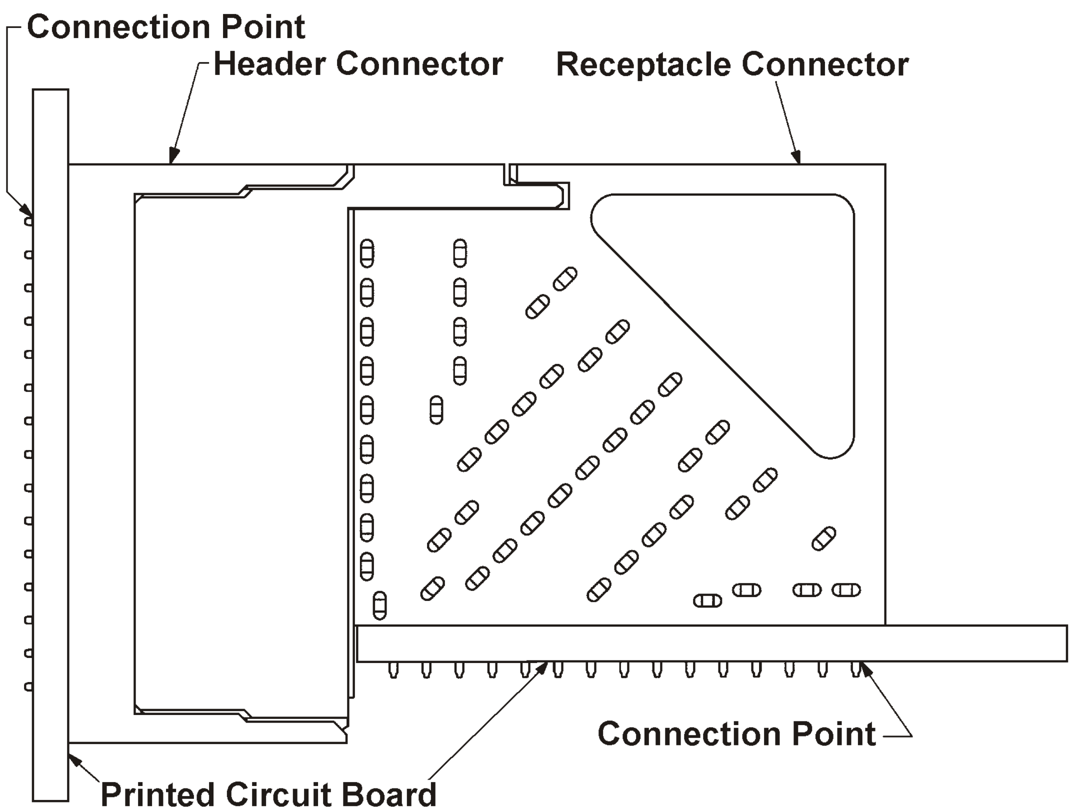


Figure 7
LLCR Measurement Points

3.3. LLCPR

LLCPR measurements at the micro-ohm level were made using a 4 terminal configuration. Current was applied at the interface of each contact and the pad surrounding the thru-hole. The voltage drop was measured by probing the end of the contact protruding from the bottom of the thru-hole and on the pad surrounding the thru-hole.

3.4. Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 100 volts DC was applied for 2 minutes before the resistance was measured.

3.5. Withstanding Voltage

A test potential of 560 volts AC was applied between adjacent contacts of unmated specimens. This potential was applied for 1 minute and then returned to zero.

3.6. Temperature Rise vs Current

Specimen temperature was measured with all signal contacts energized at 0.5 ampere using thermocouples attached between the 2 center chicklets.

3.7. Random Vibration

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 Power Spectral Density (PSD) was flat at 0.02 $G^2$/Hz from 20 to 500 Hz. The root-mean square amplitude of the excitation was 3.10 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.

3.8. Mechanical Shock

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.

3.9. Durability

| A. Test Reports EA20090962T and EA20090956T

Specimens were mated and unmated 200 times at a maximum rate of 600 cycles per hour.

| B. Test Report EA20100923T

| Specimens were mated and unmated 200 times at a maximum rate of 500 cycles per hour.

3.10. 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.

3.11. 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.

3.12. Compliant Pin Insertion Force

The force required to press individual specimens onto the test PCB 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.

3.13. Compliant Pin Retention Force

The force required to remove individual specimens from the test PCB was measured using a tensile/compression device with a free floating fixture and a rate of travel of 5.08 mm [.2 in] per minute.

3.14. Minute Disturbance

Specimens were unmated and mated a distance of approximately 0.1 mm [.004 in].

3.15. Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -65 and 90°C with 1 minute transition between temperatures.

3.16. Humidity/temperature Cycling

Mated specimens were exposed to 50 humidity/temperature cycles. Each cycle lasted 16 hours and consisted of cycling the temperature between 5 and 85°C twice while maintaining high humidity.

3.17. Temperature Life

Mated specimens were exposed to a temperature of 90°C for 500 hours.

3.18. Mixed Flowing Gas

Mated and unmated specimens were exposed for 20 days (unmated for the first 10 days followed by 10 days 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. Specimens were preconditioned with 100 cycles of durability.

3.19. Dust Contamination

Unmated specimens were exposed to benign dust for 1 hour at an air flow rate of 360 cfm.

3.20. Final Examination of Product

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