SMT Hermaphroditic Blade and Receptacle Connector Assembly

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics Surface Mount (SMT) Hermaphroditic Blade and Receptacle Connector to determine its conformance to the requirements of Product Specification 108-2342 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the SMT Hermaphroditic Blade and Receptacle Connector. Testing was performed at the Engineering Assurance Product Testing Laboratory between November 2008 and July 2009. The test file number for this testing is EA20080953T. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The SMT Hermaphroditic Blade and Receptacle Connector listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2342 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:

Test Group	Quantity	Part Number	Description
1,2	10 each	1954289-1	2 position blade and receptacle
		1954289-2	4 position blade and receptacle
		1954289-3	6 position blade and receptacle
3,4	5 each	1954289-1	2 position blade and receptacle
		1954289-2	4 position blade and receptacle
		1954289-3	6 position blade and receptacle

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
	Test Sequence (b)			
Initial examination of product	1	1	1	1
LLCR	3,7	2,7		
Insulation resistance			2,6	
Withstanding voltage			3,7	
Temperature rise vs current		3,8(c)		
Resistance to reflow soldering heat				2
Random vibration	5	6		
Mechanical shock	6			
Durability	4			
Mating force	2(d)			
Unmating force	8(e)			
Thermal shock			4	
Humidity/temperature cycling		4(f)	5(g)	
Temperature life		5		
Final examination of product	9	9	8	3

NOTE

(a) See paragraph 1.4.
(b) Numbers indicate sequence in which tests are performed.
(c) Five specimens of each position (2, 4 and 6) shall be used for initial temperature rise, while the other 5 specimens from each position will run through the entire test sequence.
(d) Mate 5 specimens of each position (2, 4 and 6) in the vertical direction, and 5 specimens of each position (2, 4 and 6) in the horizontal direction.
(e) Unmate 5 specimens of each position (2, 4 and 6) in the vertical direction, and 5 specimens of each position (2, 4 and 6) in the horizontal direction.
(f) Mated specimens.
(g) Unmated specimens.

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 (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. Low Level Contact Resistance (LLCR) - Test Groups 1 and 2

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 18 milliohms initially and had a change in resistance (ΔR) of less than 5 milliohms after testing (see Figure 3).

Test Group	Number of Data Points	Condition	LLCR		
			Minimum	Maximum	Average
1 (horizontal)	10 (2 position)	Initial	1.96	2.11	2.03
		After mechanical (ΔR)	-0.06	0.20	0.10
	20 (4 position)	Initial	2.00	2.16	2.07
		After mechanical (ΔR)	-0.01	0.53	0.14
	30 (6 position)	Initial	1.95	2.19	2.08
		After mechanical (ΔR)	-0.08	0.63	0.22
1 (vertical)	10 (2 position)	Initial	1.95	2.07	2.00
		After mechanical (ΔR)	0.04	0.19	0.09
	20 (4 position)	Initial	1.96	2.14	2.07
		After mechanical (ΔR)	0.01	0.27	0.10
	30 (6 position)	Initial	1.96	2.25	2.08
		After mechanical (ΔR)	-0.01	0.27	0.10
2	10 (2 position)	Initial	1.96	2.11	2.03
		After mechanical and environmental (ΔR)	0.29	0.95	0.51
	20 (4 position)	Initial	1.98	2.18	2.07
		After mechanical and environmental (ΔR)	0.12	0.87	0.36
	30 (6 position)	Initial	1.99	2.20	2.08
		After mechanical and environmental (ΔR)	0.06	0.47	0.19

NOTE *All values in milliohms.*

Figure 3

2.3. Insulation Resistance - Test Group 3

All insulation resistance measurements were greater than 1 megohm.

2.4. Withstanding Voltage - Test Group 3

No dielectric breakdown or flashover occurred.

2.5. Temperature Rise vs Current

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 6 amperes (see Figure 4).

Condition	Specimen Number				
	1	2	3	4	5
	Two Position				
Initial	10.6	10.1	9.9	10.2	9.9
Final	12.6	12.1	11.6	18.5	13.4
	Four Position				
Initial	14.9	14.9	14.7	15.1	15.1
Final	16.3	17.5	16.5	17.6	19.5
	Six Position				
Initial	18.7	18.8	18.1	18.1	18.3
Final	20.7	20.6	18.8	19.2	20.0

NOTE

1. *All values in °C.*
2. *Specimens for initial and final measurements came from two different groups. The initial group specimens had no finial measurements and the final group specimens had no initial measurements.*

Figure 4

2.6. Resistance to Reflow Soldering Heat - Test Group 4

No evidence of blistering, warpage or significant discoloration occurred as a result of exposure to reflow soldering heat.

2.7. Vibration - Test Groups 1 and 2

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

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 Group 1

No physical damage occurred as a result of manually mating and unmating the specimens 10 times.

2.10. Mating Force - Test Group 1

All maximum mating force measurements are shown in Figure 5.

Position	Mating Force (N [lbf]) Maximum		Unmating Force (N [lbf]) Minimum	
	Vertical	Horizontal	Vertical	Horizontal
2	9.96 [2.24]	9.47 [2.13]	6.09 [1.37]	8.18 [1.84]
4	16.81 [3.78]	15.08 [3.39]	11.30 [2.54]	11.39 [2.56]
6	26.60 [5.98]	23.75 [5.34]	18.19 [4.09]	20.42 [4.59]

Figure 5

2.11. Unmating Force - Test Group 1

All minimum unmating force measurements are shown in Figure 5.

2.12. Thermal Shock - Test Group 3

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

2.13. Humidity/temperature Cycling - Test Groups 2 and 3

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

2.14. Temperature Life - Test Group 2

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

2.15. 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 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. LLCR

LLCR measurements were made using a 4 terminal measuring technique (Figure 6). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

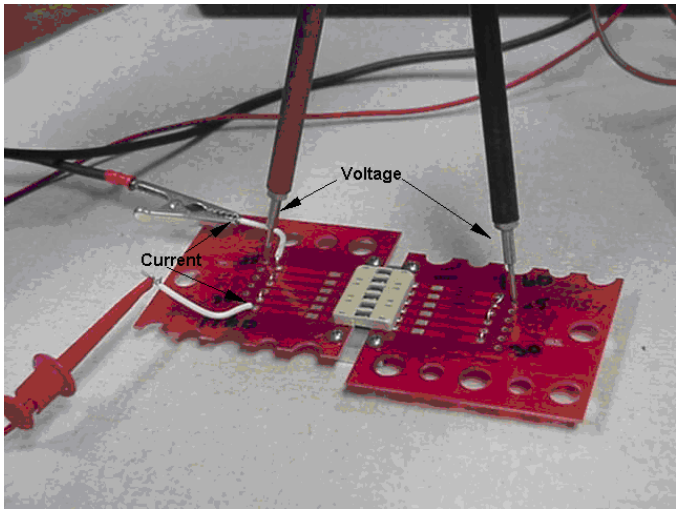


Figure 6
LLCR Measurement Points

3.3. Insulation Resistance

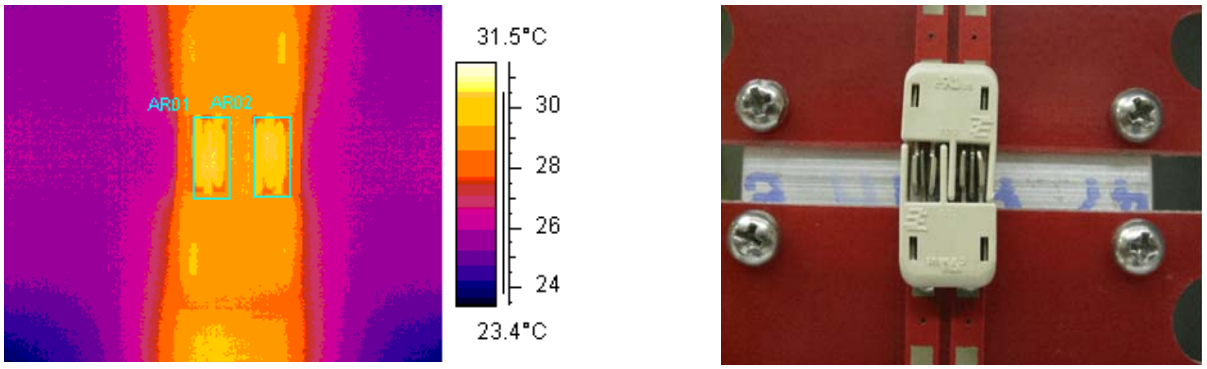
Insulation resistance was measured between adjacent contacts of unmated specimens. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.4. Withstanding Voltage

A test potential of 1500 volts AC was applied between adjacent contacts of unmated specimens. This potential was applied for 1 minute and then returned to zero.

3.5. Temperature Rise vs Current

Infrared temperature measurement points, i.e. mated contacts, were coated with Micatin™ powder, used as an emissivity correction coating. The emissivity correction coating has a known emittance value of 0.93. Raising and knowing the emittance value allows for accurate temperature measurements. The infrared camera was used with a 34/80 mm close up lens attached to the standard optics (24 degree) lens to image the test specimens. ThermaCAM™ Researcher 2001 thermal imaging processing system was used for data analysis. The area tool software feature was used to determine maximum temperature of the exposed contacts. The area tool software feature allows a shape, which can be sized, to be placed on an area of interest. The pixels inside the shape are analyzed giving minimum, maximum, average, and standard deviation measurements of temperature. Test specimens were placed in the temperature rise enclosure and measurements were taken after temperature stabilization (Figure 7).



Infrared Image Specimen Image

Figure 7

3.6. Resistance to Reflow Soldering Heat

Specimens were visually examined for evidence of physical damage detrimental to product performance and then measured dimensionally. Specimens were placed in a clean, dry, shallow container in such a manner that they did not overlap or touch and were exposed to 85°C at 85% RH for 168 hours. Within 15 minutes to 4 hours after removal from the moisture soak, specimens were placed on 4 X 6 X 0.0395 inch ceramic substrates and run through a convection air oven. Specimens were exposed to temperatures between 150 and 200°C for 60 to 180 seconds and between 255 and 260°C for 20 to 40 seconds, and above liquidus (217°C) for 60 to 150 seconds. The temperature on the top of the specimen was monitored to enable temperature profiling. Specimens and substrates were allowed to cool to ambient temperatures and then run back through the oven a total of 3 times. Specimens were again visually examined for evidence of physical damage detrimental to product performance and measured dimensionally.

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 spectrum 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 (Figure 8).

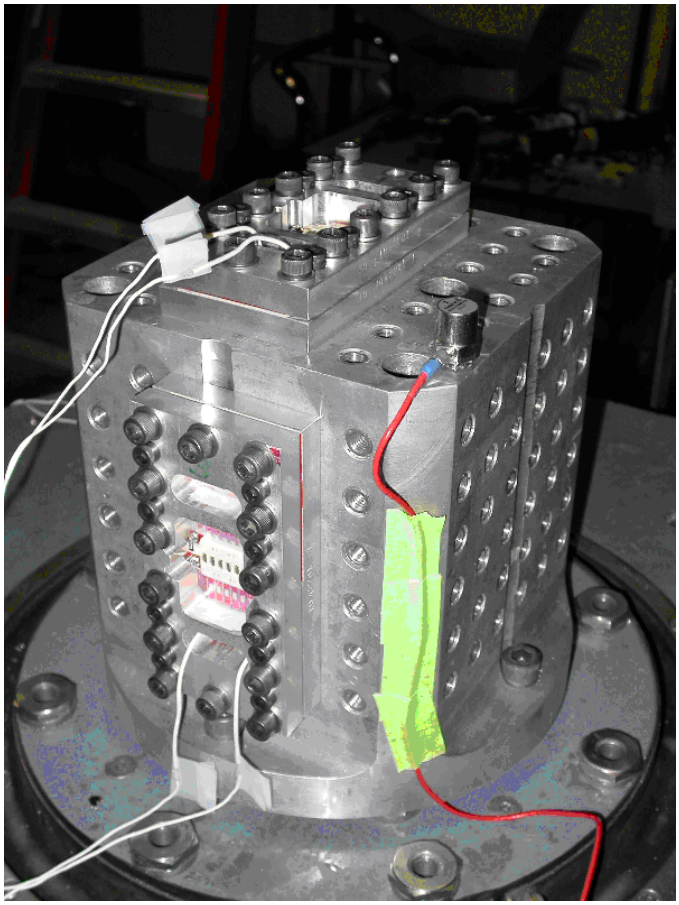


Figure 8
Vibration and Mechanical Shock Mounting Fixture

3.8. Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 30 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 (Figure 8).

3.9. Durability

Specimens were manually mated and unmated 10 times.

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. Thermal Shock

Unmated specimens were subjected to 25 cycles of thermal shock with each cycle consisting of 30 minute dwells at -40 and 105°C with 1 minute transition between temperatures.

3.13. Humidity/temperature Cycling

| Mated specimens (test group 2) and unmated specimens (test group 3) were exposed to 10 humidity/temperature cycles. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65°C twice while maintaining high humidity (Figure 9).

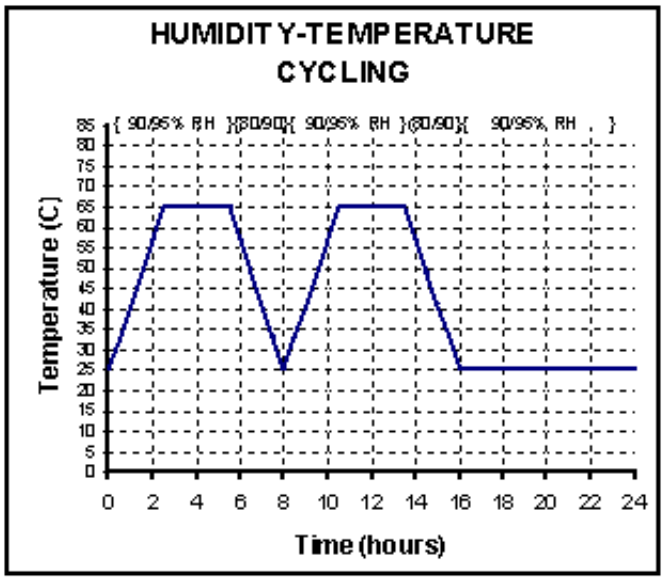


Figure 9
Typical Humidity-Temperature Cycling Profile

3.14. Temperature Life

Mated specimens were exposed to a temperature of 105°C for 548 hours.

3.15. Final Examination of Product

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