Function Testing of EP 2.5 SMT header

1. INTRODUCTION

1.1. Purpose

Testing was performed on the TE Connectivity (TE) EP2.5 SMT header to determine its conformance to the requirements of Product Specification 108-2418, Revision H.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of TE Connectivity (TE) EP2.5 SMT header. Testing was performed at the Shanghai Electrical Components Test Laboratory. The test file number for this testing is TP-20-02397-RECORD & TP-20-02908-RECORD. This documentation is available from DMtec.

1.3. Conclusion

All part numbers listed in Paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2418, Revision H.

1.4. Product Description

The EP 2.5 product is a wire-to-board connection consisting of crimp-snap contacts seated in a housing that mates to 0.6 mm diameter post headers on 2.5 mm centerline and is designed to be terminated to 20 to 26 AWG wire

1.5. Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for test:

Test Set	Quantity	Part Number	Description
1,2,3,5,6,7		1-2365497-5	EP2.5 single row SMT header,GWT,15P
		1-1744417-5	EP2.5 single row plug housing, 15P
		2110989-1	EP2.5 socket terminal with 22AWG
4		1-2365497-5	EP2.5 single row SMT header,GWT,15P
		1-1744417-5	EP2.5 single row plug housing, 15P
8,9		1-2365497-5	EP2.5 single row SMT header,GWT,15P

Figure 1

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1.6. Test Sequence

Test or Examination	Test Group (a)									
	1	2	3	4	5	6	7	8	9	
	Test Sequence (b)									
Initial examination of product	1	1	1	1	1	1	1	1	1	
LLCR	3,7	2,4	2,7		2,4	2,4	2,4			
Insulation Resistance			3,8							
Withstanding voltage			4,9							
Temperature rise vs. current		3								
Sinusoidal vibration	5									
Mechanical shock	6									
Durability	4									
Mating force	2									
Unmating force	8									
Connector locking strength				2						
Resistance to soldering heat									2	
Post retention								2	3	
Thermal shock			6							
Humidity/temperature cycling			5							
Salt spray					3					
Hydrogen sulfide						3				
Ammonia							3			
Final examination of product	9	5	10	3	5	5	5	3	4	

NOTE
a) See Paragraph 1.5.
b) Numbers indicate sequence in which tests shall be performed.

Figure 2

1.7. Environmental Conditions

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

- Temperature: 15°C to 35°C

Relative Humidity: 20% to 80%

2. SUMMARY OF TESTING

2.1. Initial examination of product – All Test Groups

A Certificate of Conformance stating that all specimens submitted for testing were representative of normal production lots and met the requirements of the application drawing was provided. Where specified, specimens were visually examined, and no evidence of physical damage detrimental to product performance was observed. Test Result: Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. LLCR – Test Groups 1, 2, 3, 5, 6 and 7

All LLCR measurements recorded were less than 10 milliohms initially and 20 milliohms for final.

Refer to Figure 3 for the summary data.

Test Group	Number of Data points	Low Level Contact Resistance in milliohms					
		Initial			Final		
		Min	Max	Mean	Min	Max	Mean
1	75	2.74	3.36	2.97	3.35	8.01	4.91
2	75	2.55	3.59	2.99	3.68	5.34	4.46
3	75	2.61	3.96	3.15	2.87	3.71	3.35
5	75	2.73	3.28	2.94	3.06	8.49	4.07
6	75	2.87	3.70	3.14	3.29	5.46	4.15
7	75	2.73	3.62	2.98	2.93	3.72	3.42

Figure 3

2.3. Insulation Resistance – Test Group 3

All initial insulation resistance measurements were greater than the minimum requirement of 1000 megohms. All final insulation resistance measurements were greater than the minimum requirement of 500 megohms. Refer to Figure 4 for the summary data.

Test Group	Number of Data points	Insulation Resistance in megohms					
		Initial			Final		
		Min	Max	Mean	Min	Max	Mean
3	25	150000	1860000	940000	49000	559000	176000

Figure 4

2.4. Withstanding voltage – Test Group 3

There were no withstanding voltage breakdowns, or flashover, and the leakage current did not exceed 1.3 milliamperes, when subjected to a test potential of 1000 volts AC for 60 seconds.

2.5. Temperature Rise vs. Current – Test Group 2

All temperature rise vs. current measurements recorded had a temperature rise less than 30 °C when energized at a single current level(3A).

2.6. **Sinusoidal Vibration – Test Group 1**

No discontinuities of 1 microsecond or longer duration were detected during random vibration testing.

2.7. **Mechanical Shock – Test Group 1**

No discontinuities of 1 microsecond or longer duration were detected during mechanical shock testing.

2.8. **Durability – Test Group 1**

No evidence of physical damage detrimental to product performance was visible as a result of durability cycling.

2.9. **Mating force – Test Group 1**

All mating force measurements were less than the maximum requirement of 133.5 N. Refer to Figure 5 for the summary data.

Test Group	Number of Data points	Mating force in N		
		Initial		
		Min	Max	Mean
1	5	84	112.5	98.8

Figure 5

2.10. **Unmating force – Test Group 1**

All unmating force measurements were greater than the minimum requirement of 13.5 N. Refer to Figure 6 for the summary data

Test Group	Number of Data points	Unmating force in N		
		final		
		Min	Max	Mean
1	5	26.6	30.7	28.7

Figure 6

2.11. **Connector locking strength – Test Group 4**

All connector locking strength measurements were greater than the minimum requirement of 25.8 N. Refer to Figure 7 for the summary data

Test Group	Number of Data points	Connector locking strength in N		
		final		
		Min	Max	Mean
4	5	82.8	89.7	86.1

Figure 7

2.12. **Resistance to soldering heat – Test Group 9**

No evidence of physical damage detrimental to product performance was visible as a result of exposure to a reflow soldering heat profile having a peak temperature of 260 ° C.

2.13. **Post retention – Test Group 8 and 9**

All post retention measurements were greater than the minimum requirement of 20 N. Refer to Figure 8 for the summary data

Test Group	Number of Data points	Post retention force in N					
		Initial			Final		
		Min	Max	Mean	Min	Max	Mean
8	25	32.8	40.0	36.0	---	---	---
9	25	---	---	---	47.6	55.7	51.5

Figure 8

2.14. **Thermal shock – Test Group 3**

No evidence of physical damage detrimental to product performance was visible as a result of exposure to a thermal shock environment.

2.15. **Humidity/temperature cycling – Test Group 3**

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

2.16. **Salt spray – Test Group 5**

No evidence of physical damage detrimental to product performance was visible as a result of exposure to a salt spray environment.

2.17. **Hydrogen sulfide – Test Group 6**

No evidence of physical damage detrimental to product performance was visible as a result of exposure to hydrogen sulfide.

2.18. **Ammonia – Test Group 7**

No evidence of physical damage detrimental to product performance was visible as a result of exposure to ammonia.

2.19. **Final examination of product – All Test Groups**

Where specified, 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. LLCR

Low level contact resistance measurements were taken using a four wire measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. Measurements were taken according the method identified in Figure 9. Wire bulk was removed from each resistance value.

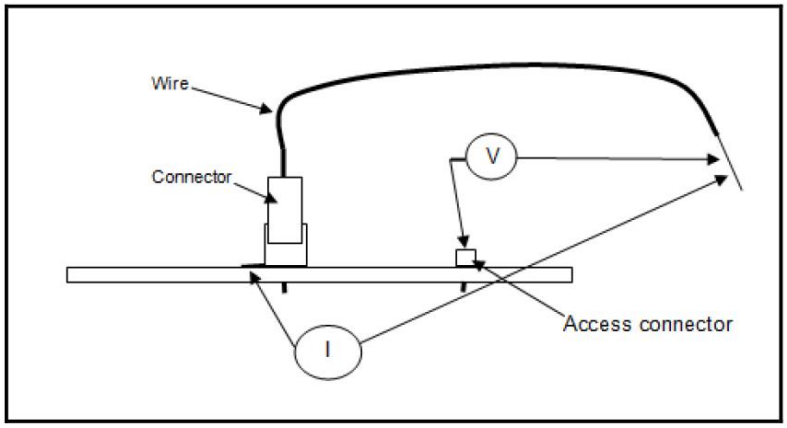


Figure 9 – Low Level Contact Resistance Measurement Points

3.3. Insulation Resistance

A potential of 500 VDC was applied between adjacent contacts of unmounted, mated connectors and held for two minutes. Readings were recorded after two minutes.

3.4. Withstanding voltage

Using a dielectric withstanding voltage test system, a 60 Hz 1000 VAC test voltage was applied between the adjacent contacts of the receptacle. The voltage was applied at a rate of 500 volts per second and maintained for a period of 60 seconds while the leakage current was monitored. The maximum leakage current permissible was 1.3 milliamperes.

3.5. Temperature Rise vs. Current

Temperature rise vs. current testing was performed by welding a 36 AWG type T thermocouple to the contact in the crimp area. The specimens were energized at 5 progressive current levels and the temperatures were recorded at each level. The ambient temperature was subtracted from each measured temperature reading to find the temperature rise. When the temperature rise of 3 consecutive readings taken at 5 minute intervals didnot differ by more than 1 ° C, the temperature measurement was recorded.

3.6. **Sinusoidal Vibration**

The test specimens were subjected to a simple harmonic motion having an amplitude of 1.5mm double amplitude (maximum total excursion). The vibration frequency was varied uniformly between the approximate limits of 10 to 55 Hertz (Hz). The entire frequency range of 10 to 55 Hz and return to 10 Hz was traversed in approximately 1 minute. The motion was applied for a period of 2 hours in each of the three mutually perpendicular axes, so the motion was applied for a total period of approximately 6 hours. The test specimens for group 1 were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.7. **Mechanical Shock**

The test specimens were subjected to a mechanical shock test with a half-sine waveform with acceleration amplitude of 30 gravity units (g's peak) and duration of 11 milliseconds. Three shocks in each direction were applied along the three mutually perpendicular axes of the test specimens, for a total of eighteen shocks. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes. Refer to Figure 10 for an image of the test setup.

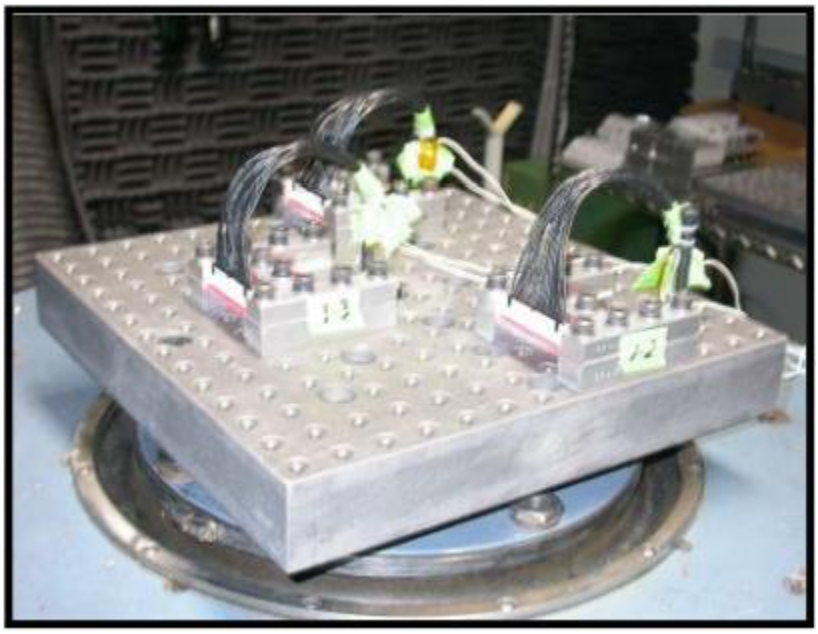


Figure 10 – Mechanical Shock Test Setup

3.8. **Durability**

All Test Group 1 specimens were subjected to 15 cycles of manual durability at a rate not exceeding the maximum rate of 500 cycles per hour.

3.9. **Mating force**

Mating force testing was performed with a tensile machine a distance of 5.08 mm from point of initial contact. The printed circuit board with the header was secured at the base of the machine to a floating x-y table, and the receptacle was aligned with the header. Force was applied to the back of the receptacle in the downward direction at a rate of 12.7 mm per minute. The maximum force was recorded to fully mate the two halves.

3.10. **Unmating force**

Unmating force testing was performed with a tensile machine. The mated connector system was secured to the base of the machine, and a fixture attached to the moveable load cell was placed around the receptacle. Force was applied in the upward direction at a rate of 12.7 mm per minute until the specimen was unmated. The maximum force was recorded.

3.11. **Connector locking strength**

Connector locking strength testing was performed on the mated connector system, without receptacle housing contacts. The printed circuit board with the soldered header was secured at the base of the tensile machine to a floating xy table. The receptacle was clamped in a fixture attached to the load cell. Force was applied in the upward direction at a rate of 100 mm per minute until the connector housing was separated from the header. The maximum force was recorded.

3.12. **Resistance to soldering heat**

All connector product specimens must be placed on a Printed Wiring Board (PWB) or a | ceramic substrate 1.6mm thick in multiple orientations as in their intended use.The reflow oven atmosphere shall be composed of ambient air (as opposed to nitrogen). Subject the specimens to three (3) cycles of the following reflow profile:

- Average ramp rate: 3°C per second maximum
- Preheat temperature (minimum): 150°C
- Preheat temperature (maximum): 200°C
- Preheat time: 60 to 180 seconds
- Ramp to peak: 3°C per second maximum
- Time over liquidus (217°C): 60 to 150 seconds
- Peak temperature: 245 +0/-5°C
- Time within 5°C of peak: 10 to 30 seconds
- Ramp - Cool Down: 6°C per second maximum
- Time 25°C to Peak: 8 minutes maximum

  Note： *Allow specimens to cool to room ambient between cycles.*

3.13. **Post retention**

The force required to dislodge the post from the housing was measured by placing the header in a vise. A concave tipped pin was attached to the moveable load cell and the pin was aligned with the contact post. Force was applied in the downward direction at a rate of 100 mm per minute until the probe dislodged the contact from the housing. The maximum force was recorded.

3.14. **Thermal shock**

The mated test specimens were subjected to 10 cycles of thermal shock testing. Each cycle consisted of cycling the temperature between -55 and 105 ° C with 30 minute dwells at each temperature extreme. The transition time between temperatures was 1 minute.

3.15. **Humidity/temperature cycling**

The mated test specimens were subjected to 10 cycles of humidity/temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 ° C and 65 ° C twice while maintaining high humidity per the humidity/temperature cycling profile illustrated in Figure 11.

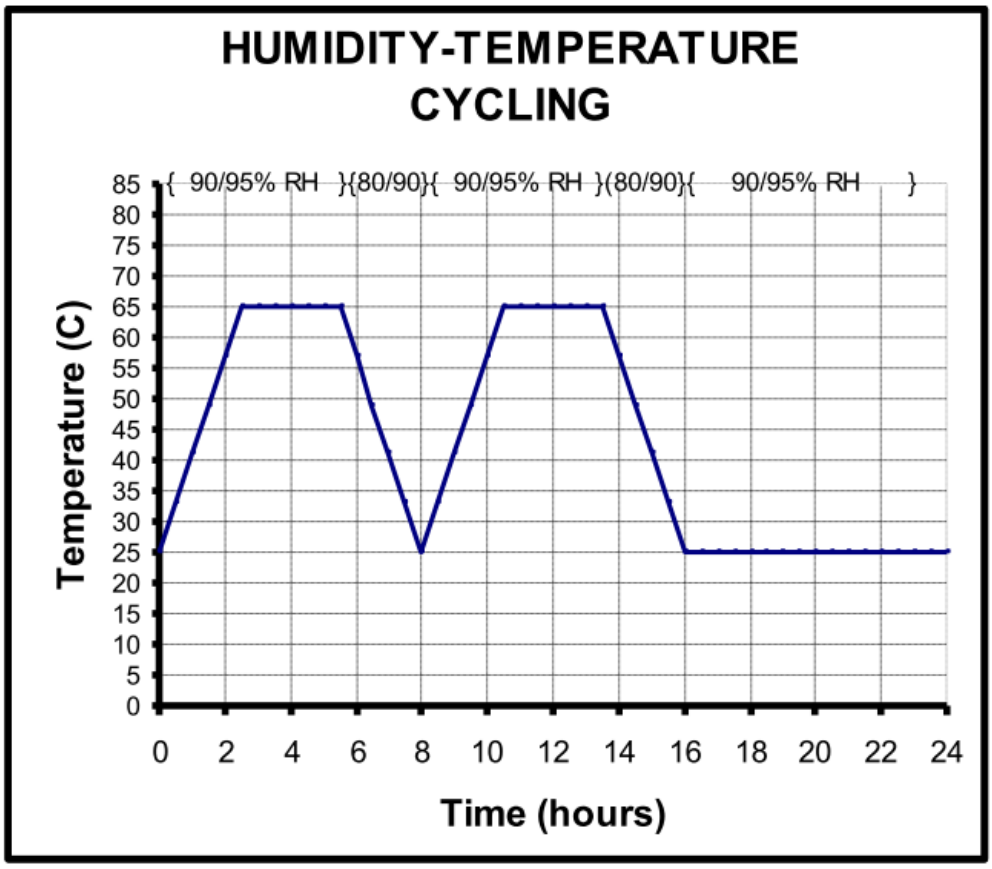


Figure 11 – Humidity Temperature Cycling Profile

3.16. **Salt spray**

The mated test specimens were subjected to 48 hours of salt spray testing with a 5% salt concentration.

3.17. **Hydrogen sulfide**

The mated specimens were subjected to 96 hours of hydrogen sulfide testing with 3 ± 1 ppm H_2S gas concentration maintained at 40 ± 2 ° C.

3.18. **Ammonia**

The mated specimens were subjected to ammonia testing in a 10 liter desiccator with 500 mL of 3% ammonia solution for a duration of 7 hours.

3.19. **Final examination of product**

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

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