Evaluation Testing of 40 and 80 Microinches of Tin Plating on FASTON* Terminals

1. INTRODUCTION

1.1. Purpose

Testing was performed on FASTON* terminals to determine their performance with 40 and 80 microinches of tin plating.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of FASTON terminals with 40 and 80 microinches of tin plating. Testing was performed at the Harrisburg Electrical Components Test Laboratory between 22Feb10 and 09Jul10. The test file number for this testing is EA20100137T.

1.3. Conclusion

Based on test results, the reduction in plating thickness had no adverse impact on product performance.

1.4. Test Specimens

Specimens with the following part numbers were used for test:

Test Group	Quantity	Part Number	Description
1	10	42400-2	FASTON receptacle, 40 µin tin plating with 14 AWG wire
2	10	42400-2	FASTON receptacle, 80 µin tin plating with 14 AWG wire
3	10	42511-2	FASTON Flag receptacle, 40 µin tin plating with 12 AWG wire
4	10	42511-2	FASTON Flag receptacle, 80 µin tin plating with 12 AWG wire
| 5	10	42511-2	FASTON Flag receptacle, 40 µin tin plating with 18 AWG wire
| 6	10	42511-2	FASTON Flag receptacle, 80 µin tin plating with 18 AWG wire

Figure 1

1.5. Test Sequence

Test or Examination	Test Groups (a)					
	1	2	3	4	5	6
	Test Sequence (b)					
Initial Examination of Product	1					
Low Level Contact Resistance (LLCR)	2,4,6,8,10,12					
Temperature rise vs current	3,11					
Humidity/temperature cycling	5					
Temperature life	7					
Sinusoidal vibration	9					
Final examination of product	13					

NOTE
(a) See paragraph 1.4.
(b) Numbers indicate sequence in which tests are performed.

Figure 2

| Indicates Change

1.6. Environmental Conditions

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

- Temperature: 15 to 35°C
- Relative Humidity: 20 to 80%

2. SUMMARY OF TESTING

2.1. Initial Examination of Product

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

2.2. Low Level Crimp and Friction Resistance

All LLCR measurements were taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. Data summaries (in milliohms) are shown in Figure 3.

Test Group	Number of Data Points	Condition	LLCR		
			Min	Max	Mean
1 Friction	10	Initial	0.291	0.320	0.307
	10	After initial temperature rise vs current (ΔR)	-0.013	0.024	0.009
	10	After humidity/temperature cycling (ΔR)	-0.013	0.069	0.025
	10	After temperature life (ΔR)	-0.005	0.098	0.051
	10	After vibration (ΔR)	0.058	0.272	0.116
	10	After final temperature rise vs current (ΔR)	-0.024	0.300	0.254
1 Crimp	10	Initial	0.641	0.732	0.681
	10	After initial temperature rise vs current (ΔR)	-0.091	0.004	-0.010
	10	After humidity/temperature cycling (ΔR)	-0.010	0.043	0.011
	10	After temperature life (ΔR)	-0.064	0.050	0.008
	10	After vibration (ΔR)	-0.357	0.197	0.047
	10	After final temperature rise vs current (ΔR)	-0.113	0.228	0.080
2 Friction	10	Initial	0.285	0.422	0.330
	10	After initial temperature rise vs current (ΔR)	-0.024	0.030	0.008
	10	After humidity/temperature cycling (ΔR)	-0.025	0.062	0.021
	10	After temperature life (ΔR)	0.008	0.109	0.045
	10	After vibration (ΔR)	0.040	0.169	0.083
	10	After final temperature rise vs current (ΔR)	0.024	0.208	0.094
2 Crimp	10	Initial	0.622	0.750	0.683
	10	After initial temperature rise vs current (ΔR)	-0.038	0.028	0.001
	10	After humidity/temperature cycling (ΔR)	-0.034	0.059	0.014
	10	After temperature life (ΔR)	-0.033	0.043	0.012
	10	After vibration (ΔR)	-0.020	0.215	0.076
	10	After final temperature rise vs current (ΔR)	0.010	0.280	0.094

Figure 3 (continued)

Test Group	Number of Data Points	Condition	LLCR		
			Min	Max	Mean
3 Friction	10	Initial	0.252	0.292	0.273
	10	After initial temperature rise vs current (ΔR)	0.014	0.045	0.023
	10	After humidity/temperature cycling (ΔR)	0.004	0.100	0.055
	10	After temperature life (ΔR)	0.021	0.191	0.081
	10	After vibration (ΔR)	0.042	0.222	0.123
	10	After final temperature rise vs current (ΔR)	0.088	0.442	0.216
3 Crimp	10	Initial	0.389	0.442	0.426
	10	After initial temperature rise vs current (ΔR)	-0.006	0.026	0.014
	10	After humidity/temperature cycling (ΔR)	0.005	0.088	0.035
	10	After temperature life (ΔR)	0.005	0.044	0.029
	10	After vibration (ΔR)	0.014	0.110	0.062
	10	After final temperature rise vs current (ΔR)	-0.212	0.287	0.068
4 Friction	10	Initial	0.248	0.307	0.272
	10	After initial temperature rise vs current (ΔR)	0.008	0.040	0.021
	10	After humidity/temperature cycling (ΔR)	0.014	0.083	0.046
	10	After temperature life (ΔR)	0.034	0.174	0.080
	10	After vibration (ΔR)	0.045	0.345	0.148
	10	After final temperature rise vs current (ΔR)	0.086	0.458	0.231
4 Crimp	10	Initial	0.384	0.435	0.421
	10	After initial temperature rise vs current (ΔR)	0.005	0.055	0.018
	10	After humidity/temperature cycling (ΔR)	0.011	0.050	0.030
	10	After temperature life (ΔR)	0.012	0.053	0.035
	10	After vibration (ΔR)	-0.008	0.075	0.049
	10	After final temperature rise vs current (ΔR)	0.032	0.085	0.056
5 Friction	10	Initial	0.263	0.388	0.312
	10	After initial temperature rise vs current (ΔR)	-0.025	0.012	0.002
	10	After humidity/temperature cycling (ΔR)	-0.034	0.054	0.011
	10	After temperature life (ΔR)	-0.023	0.044	0.020
	10	After vibration (ΔR)	0.029	0.095	0.061
	10	After final temperature rise vs current (ΔR)	0.016	0.123	0.075
5 Crimp	10	Initial	1.736	1.836	1.785
	10	After initial temperature rise vs current (ΔR)	-0.012	0.054	0.018
	10	After humidity/temperature cycling (ΔR)	0.006	0.236	0.131
	10	After temperature life (ΔR)	0.019	0.455	0.153
	10	After vibration (ΔR)	0.023	1.160	0.488
	10	After final temperature rise vs current (ΔR)	0.060	1.264	0.540

Figure 3 (continued)

Test Group	Number of Data Points	Condition	LLCR		
			Min	Max	Mean
6 Friction	10	Initial	0.255	0.386	0.300
	10	After initial temperature rise vs current (ΔR)	-0.009	0.029	0.007
	10	After humidity/temperature cycling (ΔR)	-0.117	0.028	-0.037
	10	After temperature life (ΔR)	0.005	0.068	0.029
	10	After vibration (ΔR)	0.032	0.121	0.066
	10	After final temperature rise vs current (ΔR)	0.022	0.104	0.066
6 Crimp	10	Initial	1.734	1.785	1.763
	10	After initial temperature rise vs current (ΔR)	-0.026	0.013	-0.005
	10	After humidity/temperature cycling (ΔR)	-0.747	0.039	-0.320
	10	After temperature life (ΔR)	-0.045	0.185	0.064
	10	After vibration (ΔR)	0.035	0.537	0.255
	10	After final temperature rise vs current (ΔR)	0.057	0.564	0.241

Figure 3 (end)

2.3. Temperature Rise vs Current

The currents (in amperes) necessary to produce a 30°C temperature rise above ambient are shown in Figure 4.

Test Group	Number of Data Points	Condition	Current for 30°C Temperature Rise		
			Min	Max	Mean
1	10	Initial	25.86	29.87	27.47
	10	Final	22.66	27.56	24.39
2	10	Initial	25.47	29.52	26.76
	10	Final	22.50	25.77	24.26
3	10	Initial	30.41	32.53	31.23
	10	Final	26.28	30.22	27.84
4	10	Initial	29.63	31.97	30.43
	10	Final	25.87	33.14	27.55
5	10	Initial	17.12	17.53	17.32
	10	Final	13.38	17.34	17.34
6	10	Initial	16.96	18.46	17.60
	10	Final	15.13	17.23	15.94

Figure 4

2.4. Humidity/temperature Cycling

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

2.5. Temperature Life

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

2.6. Sinusoidal Vibration

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

2.7. Final Examination of Product

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

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

3.2. LLCR

LLCR measurements were made using a 4 terminal measuring technique (Figure 5). The copper wire of the thermal couple was used for 1 of the voltage probes for both friction and crimp resistance. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

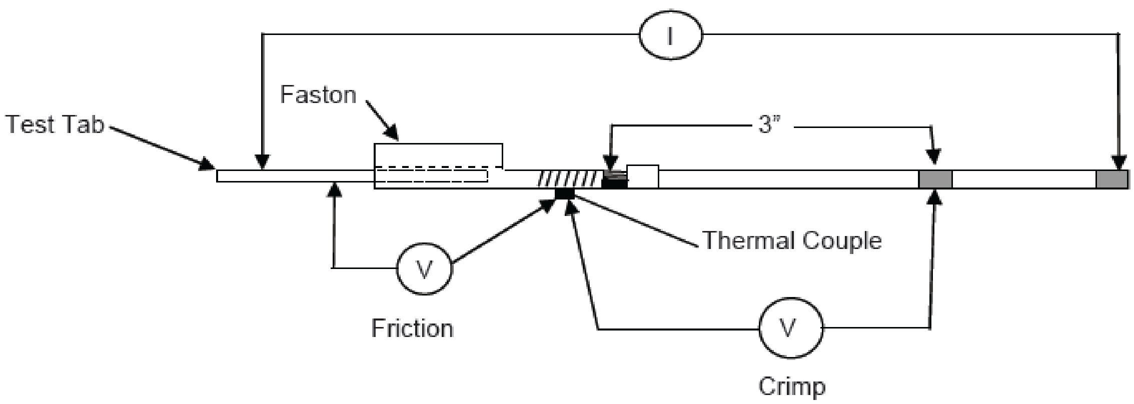

Figure 5
Typical LLCR Measurement Points

3.3. Temperature Rise vs Current

Temperature rise curves were produced by measuring individual contact temperatures at 5 different current levels which were plotted to produce a temperature rise vs current curve. Thermocouples were attached to individual contacts in the crimp area to measure their temperatures. The ambient temperature was then subtracted from this measured temperature to find the temperature rise. When the temperature rise of 3 consecutive readings taken at 5 minute intervals did not differ by more than 1°C, the temperature measurement was recorded.

3.4. Humidity/temperature Cycling

Unmated specimens 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 6).

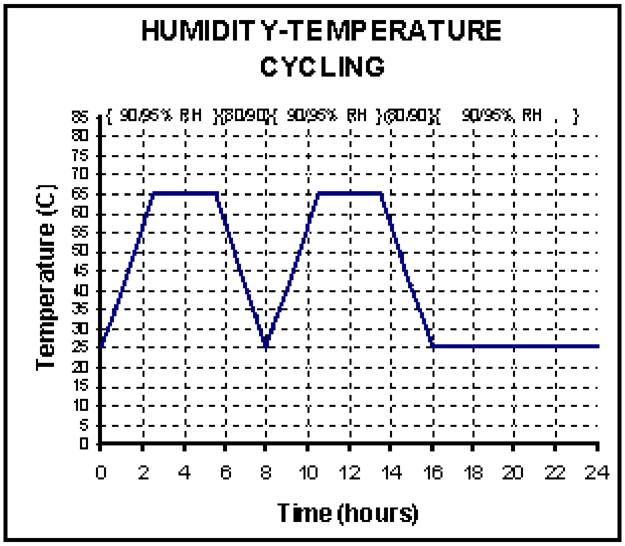

Figure 6
Typical Humidity/temperature Cycling Profile

3.5. Temperature Life

Mated specimens were exposed to a temperature of 105°C for 240 hours.

3.6. Sinusoidal Vibration

The parameters of this test condition are a simple harmonic motion having an amplitude of either .06 inch double amplitude (maximum total excursion) or 10 gravity unit (g's peak) whichever is less. The vibration frequency was varied logarithmically between the approximate limits of 10 to 500 Hz. The entire frequency range of 10 to 500 Hz and return to 10 Hz was traversed in approximately 15 minutes. This cycle was performed 12 times in all 3 mutually perpendicular axes (total of 36 times), so that the motion was applied for a total period of approximately 9 hours. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes (Figure 7).

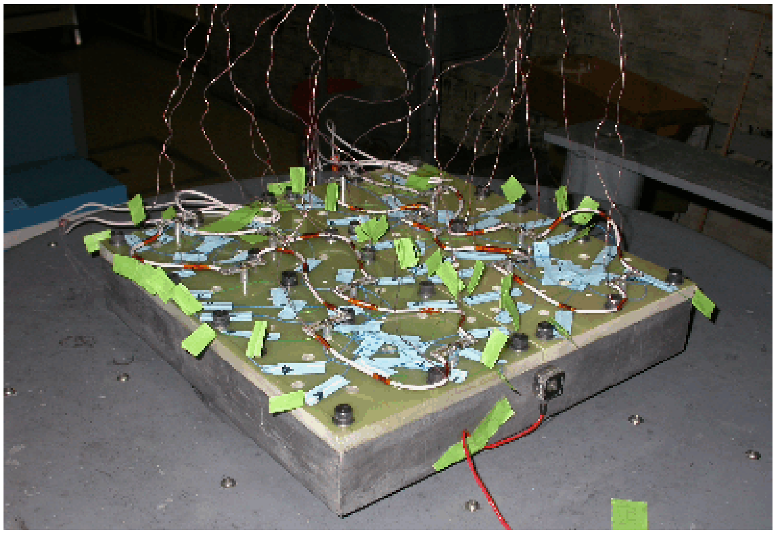

Figure 7
Vibration Set-up

3.7 Final Examination of Product

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