Fully Buffered and DDR3 DIMM Soldertail Sockets

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics Fully Buffered and DDR3 Dual In-Line Memory Module (DIMM) Soldertail Sockets to determine their conformance to the requirements of Product Specification 108-2214, Revision B.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Fully Buffered and DDR3 DIMM Soldertail Sockets. Testing was performed at the Engineering Assurance Product Testing Laboratory between 13Dec04 and 09Feb05. The test file numbers for this testing are CTLB053705-019 for test groups 1 through 12, and CTLB053705-020 for test group 13. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The Fully Buffered and DDR3 DIMM Soldertail Sockets listed in paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2214, Revision B.

1.4. Product Description

The Fully Buffered and DDR3 DIMM Soldertail Sockets are primarily used in desktop and server applications where soldering is acceptable.

1.5. Test Specimens

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

Test Groups 1, 2 and 9:
- Five (5) each 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Five (5) each printed circuit boards part number 60-474508-1, Rev. 0 with one (1) connector mounted on each board
- Five (5) each module boards (cards) part number 60-474509-1, Rev. A, Date code 0451

Test Group 3:
- Six (6) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Six (6) printed circuit boards part number 60-474508-1, Rev. 0 with one (1) connector mounted on each board
- Twelve (12) module boards (cards) part number 60-474509-1, Rev. A, Date codes 0422 and 0451

Test Group 4:
- Six (6) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Six (6) printed circuit boards part number 60-474508-1, Rev. 0 with one (1) connector mounted on each board
- Six (6) module boards (cards) part number 60-474509-1, Rev. A, Date code 0451

* Trademark
| Indicates change

Test Group 5:
- Five (5) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Two (2) printed circuit boards part number 60-474512-1, Rev, O with a maximum of three (3) connectors mounted on each board

Test Group 6:
- Ten (10) 240 position solder tail FB DIMM connectors part numbers 1-1761024-1, Date code 1 1 04503

Test Group 7:
- Five (5) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503

Test Group 8:
- Five (5) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Two (2) printed circuit boards part number 60-474512-1, Rev. O with a maximum of three (3) connectors mounted on each board
- One (1) DDR2 module card part number 60-474475-1, Rev. O, modified by the requestor with an additional keying slot

Test Group 10:
- Five (5) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Two (2) printed circuit boards part number 60-474512-1, Rev. O with a maximum of three (3) connectors mounted on each board
- Five (5) module boards (cards) part number PN 60-474508-1, Rev. A, Date code 0422

Test Group 11:
- Four (4) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503

Test Group 12:
- Twelve (12) 240 position solder tail FB DIMM connectors part number 1-1761024-1, Date code 1 1 04503
- Four (4) printed circuit boards part number 60-474512-1, Rev. O with a maximum of three (3) connectors mounted on each board

Test Group 13:
- Three (3) 240 position solder tail FB DIMM connectors part number 1-1761024-3, Date code 04492 L
- Three (3) printed circuit boards part number 60-474508-1, Rev. O with one (1) connector mounted on each board
- Three (3) module boards (cards) part number PN 60-474509-1, Rev. A, Date code 0451

NOTE *All of the above listed FB DIMM connectors were lubricated with HM-15 and the board mounted specimens were wave soldered using RF800 "no-clean" flux.*

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	5	6	7	8	9	10	11	12	13
	Test Sequence (b)												
Initial examination of product	1	1	1	1	1	1	1	1	1	1	1	1	1
Low level contact resistance	2,6,8	2,7,9,13	2,4,7	2,5,7,9,11									2,5,7,9,11
Insulation resistance		3,10											
Withstanding voltage		4,11											
Current carrying capacity									2				
Reseating	7	12		10									10
Solderability						2(c)							
Vibration, random			5										
Mechanical shock			6										
Durability	4(d)	5(d)	3	3(d)									3(d)
Mating force					2							2	
Wrong card insertion								2					
Latch opening force					3								
Unmating force per pin pair										3			
Contact retention							3						
Fork lock retention (where applicable)							2						
Connector insertion force into PCB										2			
Maximum force on connector					4								
Contact backout wipe	3												
Solvent resistance											2		
Thermal shock		6											
Humidity-temperature cycling		8											
Temperature life	5			4(e)									4(e)
Mixed flowing gas				6(f)									6(g)
Thermal disturbance				8									8
Final examination of product	9	14	8	12	5	3	4		3	4	3	3	12

NOTE

(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.
(c) Test to both tin-lead and lead free methods.
(d) Durability preconditioning only 5 cycles required same card, all cycles.
(e) Temperature life preconditioning, 120 hour duration.
(f) Three specimens unmated for 5 days, mated for 5 days. Three specimens mated for 10 days.
(g) Three specimens mated for 10 days.

Figure 1

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

2.2. Low Level Contact Resistance - Test Groups 1, 2, 3, 4 and 13

All low level contact resistance measurements taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 30 milliohms initially and had a change in resistance (ΔR) of less than 10 milliohms after testing. See Figure 2, all values are in milliohms.

Condition	Min	Max	Mean	Min (Δ)	Max (Δ)	Mean (Δ)
CTLB053705-019						
Test Group 1 N = 998 (see Note)						
Initial	10.809	14.060	11.895	---	---	---
After temperature life	10.738	15.100	12.180	-1.061	2.893	0.284
After reseating	11.018	14.907	12.332	-0.812	2.309	0.436
Test Group 2 N = 998 (see Note)						
Initial	10.819	14.176	11.906	---	---	---
After thermal shock	10.799	13.994	11.948	-1.275	1.379	0.041
After humidity-temperature cycling	10.731	14.508	12.062	-1.210	2.847	0.156
After reseating	10.827	14.206	12.007	-1.084	1.408	0.101
Test Group 3 N = 1200						
Initial	10.798	15.493	12.161	---	---	---
After 20 durability cycles	10.692	16.705	12.175	-1.608	1.722	0.014
After vibration/mechanical shock	10.830	16.953	12.255	-1.242	4.468	0.093
Test Group 4a N = 600						
Initial	10.895	14.655	11.989	---	---	---
After temperature life (120 hours)	11.210	15.342	12.599	-0.490	2.413	0.610
After 5 days mated MFG	11.177	18.460	12.703	-0.500	6.430	0.714
After 10 days mated MFG	11.244	19.798	12.837	-0.563	8.291	0.848
After thermal disturbance	11.356	17.998	12.766	-0.645	4.283	0.777
After reseating	9.917	15.933	12.363	-1.857	2.744	0.373
Test Group 4b N = 600						
Initial	10.919	13.971	12.175	---	---	---
After temperature life (120 hours)	11.157	15.127	12.628	-1.407	2.154	0.453
After 5 days unmated MFG	11.232	15.395	12.532	-1.217	2.116	0.357
After 5 days mated MFG	11.147	18.748	12.690	-1.255	5.691	0.515
After thermal disturbance	11.033	17.766	12.605	-1.278	6.207	0.430
After reseating	11.109	14.612	12.597	-0.799	1.915	0.422
CTLB053705-020						
Test Group 13 N = 600						
Initial	11.206	14.958	12.344	---	---	---
After temperature life (120 hours)	11.365	15.348	13.000	-0.454	2.639	0.656
After 10 days mated MFG	11.670	17.611	13.101	-0.219	4.922	0.757
After thermal disturbance	11.455	15.410	12.969	-0.515	3.498	0.625
After reseating	11.259	15.953	12.995	-0.618	3.550	0.651

NOTE *Two contacts were removed from the data set due to shorted voltage probes on the printed circuit boards.*

Figure 2

2.3. Insulation Resistance - Test Group 2

All insulation resistance measurements were greater than 1000 megohms.

2.4. Withstanding Voltage - Test Group 2

No dielectric breakdown or flashover occurred.

2.5. Current Carrying Capacity - Test Group 9

All specimens had a temperature rise of less than 30˚C above ambient when tested using a current of .5 ampere AC.

2.6. Reseating - Test Groups 1, 2, 4 and 13

No physical damage occurred as a result of manually mating and unmating the specimens 3 times.

2.7. Solderability - Test Group 6

No evidence of physical damage detrimental to product performance was observed.

2.8. Vibration, Random - Test Group 3

Following vibration testing, no cracks, breaks, or loose parts on the specimens were visible. Discontinuity was not monitored.

2.9. Mechanical Shock - Test Group 3

Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible. Discontinuity was not monitored.

2.10. Durability - Test Group 3

No physical damage occurred as a result of manually mating and unmating the specimens 20 times.

2.11. Mating Force - Test Groups 5 and 12

A. 1.37 mm [.054 in] Steel Blade - Test Group 5

All mating force measurements were less than 106.75 N [24 lbf].

B. 1.27 mm [.050 in] Module Card - Test Group 12

All mating force measurements were less than 98.7 N [22 lbf].

2.12. Wrong Card Insertion - Test Group 8

All insertion force measurements were greater than 222.4 N [50 lbf].

2.13. Latch Opening Force - Test Group 5

All latch opening force measurements were less than 32.4 N [7.3 lbf] per latch.

2.14. Unmating Force per Pin Pair - Test Group 10

All unmating force per pin pair measurements were greater than 0.14 N [14 gf].

2.15. Contact Retention - Test Group 7

None of the contacts were displaced more than 0.381 mm [.015 in] after being subjected to an axial force of 3 N [300 gf] for 6 seconds.

2.16. Fork Lock Retention - Test Group 7

None of the fork locks were displaced more than 0.381 mm [.015 in] after being subjected to an axial force of 13.3 N [3 lbf] for 6 seconds.

2.17. Connector Insertion Force into PCB - Test Group 10

None of the connector insertion force values were greater than 33.21 N [7.47 lbf] per fork lock.

2.18. Maximum Force On Connector - Test Group 5

There was no blade movement greater than 0.076 mm [.003 in] while being subjected to a 68.1 kg [150 lb] load for 30 seconds.

2.19. Contact Backout Wipe - Test Group 1

None of the specimens exhibited any discontinuities greater than 1 microsecond during testing.

2.20. Solvent Resistance - Test Group 7

No physical damage occurred to the specimens as a result of solvent resistance testing.

2.21. Thermal Shock - Test Group 2

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

2.22. Humidity-temperature Cycling - Test Group 2

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

2.23. Temperature Life - Test Groups 4 and 13

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

2.24. Mixed Flowing Gas - Test Groups 4 and 13

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

2.25. Thermal Disturbance - Test Groups 4 and 13

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

2.26. Final Examination of Product - Test Groups 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12 and 13

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

3. TEST METHODS

3.1. 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 manufactured using the same core manufacturing processes and technologies as production parts.

3.2. Low Level Contact Resistance

Low level contact resistance measurements were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. Only 200 out of 240 contacts were measured on each specimen.

3.3. Insulation Resistance

Insulation resistance was measured between adjacent inner and outer contact rows of each unmated, board mounted specimen. A test voltage of 500 volts DC was applied to for 2 minutes or meter stabilization before the resistance was recorded. A total of 10 inner and 10 outer contacts were measured on each connector.

3.4. Dielectric Withstanding Voltage

A test potential of 500 volts AC was applied between the adjacent inner and outer contact rows of each unmated, board mounted specimen. This potential was applied for 1 minute with a rise time of 500 volts per second and then returned to zero. The leakage current was limited to .5 milliampere and the same contacts were measured as in insulation resistance.

3.5. Current Carrying Capacity

Testing consisted of applying a .5 ampere AC current through a group of 10 series wired contacts on 1 side of each mated assembly. This current was maintained for a minimum of 2 hours prior to taking final temperature measurements. A thermocouple was attached, using thermally conductive epoxy, into each connector housing near the center of the contact group. The ambient temperature was also measured and then subtracted from the measured specimen temperatures to determine the temperature rise.

3.6. Reseating

Testing consisted of subjecting the specimens to 3 cycles of manual durability with the latches enabled.

3.7. Solderability

A. Method One, Tin-Lead

Prior to the application of flux and immersion into solder, the specimens were suspended in closed container 51 mm [2 in] above boiling de-ionized water using a stainless steel holder. The specimens were then exposed to this steam environment for 8 hours. After removing the specimens from this environment, they were subjected to solderability within 24 hours as described below. The areas of the specimens to be evaluated were immersed in a room temperature flux type "R" (non-activated white rosin) for 5 to 10 seconds. The specimens were removed from the flux and the excess was allowed to drain off for 5 to 20 seconds. The specimens were attached to a dipping machine and immersed at 25.4 mm [1 in] per second into the 245˚C solder bath filled with melted 60% tin and 40% lead until the entire surface to be evaluated was coated. They were allowed to remain there for 5 seconds. Next, the specimens were removed from the solder at the same rate and subjected to a 5 minute cleaning in isopropyl alcohol. Finally, the specimens were visually examined under a microscope set at 10X magnification.

B. Method Two, Lead-Free

Prior to the application of flux and immersion into solder, the specimens were suspended in closed container 51 mm [2 in] above boiling de-ionized water using a stainless steel holder. The specimens were then exposed to this steam environment for 8 hours. After removing the specimens from this environment, they were subjected to pre-heating and solderability within 24 hours as described below. The specimens were placed, 1 at a time, in an air circulating oven set at 190˚C for 30 seconds. The areas of the specimens to be evaluated were then immersed in a room temperature flux type "R" (non-activated white rosin) for 5 to 10 seconds. The specimens were removed from the flux and the excess was allowed to drain off for 5 to 20 seconds. The specimens were attached to a dipping machine and immersed at 25.4 mm [1 in] per second into the 260˚C solder bath filled with melted 96.5% tin, 3% silver, and 0.5% copper until the entire surface to be evaluated was coated. They were allowed to remain there for 5 seconds. Next, the specimens were removed from the solder at the same rate and subjected to a 5 minute cleaning in isopropyl alcohol. Finally, the specimens were visually examined under a microscope set at 10X magnification.

3.8. Vibration, Random

The mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 5 and 500 Hz. The power spectral density at 5 Hz was 0.01 G^2/Hz. The spectrum sloped up to a PSD of 0.02 G^2/Hz at 20 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 3.13 GRMS. This was performed for 10 minutes in each of 3 mutually perpendicular planes for a total vibration time of 30 minutes per specimen. The specimens were not monitored for discontinuities during testing. The module boards had 90 grams of steel weights attached 22 mm [.9 in] above the mating edge of the cards prior to testing.

3.9. Mechanical Shock

The mated specimens were subjected to a mechanical shock test having a trapezoidal waveform of 50 gravity units (g peak) and a duration of 10 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. In addition, the module cards remained weighted as before in vibration. The specimens were not monitored for discontinuities during testing.

3.10. Durability

The specimens were manually mated and unmated 20 times at a maximum cycling rate of 500 cycles per hour with the latches enabled. The original module card was used for the 1st and 20th cycles, a new separate module card was used for the 2nd through 19th cycles.

3.11. Mating Force

A. Test Group 5

The force required to mate individual specimens was measured using a tensile/compression machine and a free floating "X-Y" table. A 1.37 mm [.054 in] steel blade was then inserted into each connector and the maximum insertion force was recorded. The latches remained enabled during the test. Test speed was 5 mm [.2 in] per minute.

B. Test Group 12

The force required to mate individual specimens was measured using a tensile/compression machine and a free floating "X-Y" table. A 1.27 mm [.050 in] FB DIMM module card blade was then inserted into each connector and the maximum insertion force was recorded. After inserting the card into each specimen, the mated assembly was lifted above the base of the table to allow the card to be unmated using the latches. This test was repeated 2 additional times on each specimen for a total of 3 trials per specimen. The latches remained enabled during the test. Test speed was 5 mm [.2 in] per minute.

3.12. Wrong Card Insertion

Testing consisted of fixturing the board mounted, unmated specimens to the base of a tensile machine using an "X-Y" floating table. A loadcell mounted DDR2 1.27 mm [.050 in] modified module card was then fully inserted into each connector until the latches were broken. Test speed was 5 mm [.2 in] per minute.

3.13. Latch Opening Force

The force required to unmate individual specimens using the latches was measured using a tensile/compression machine and a free floating "X-Y' table. After attaching a small wire loop to each latch, the specimen was vertically suspended between a hook attached to the base mounted "X-Y" table and a hook attached to the crosshead. The crosshead was then energized to activate the latches and extract the 1.37 mm [.054 in] steel blade from each specimen. Test speed was 5 mm [.2 in] per minute.

3.14. Unmating Force per Pin Pair

Unmating force per pin pair testing consisted of fixturing the board mounted, mated specimens to the base of a tensile/compression machine using a free floating "X-Y" table. The FB DIMM module card was then attached to a loadcell mounted clamp and extracted from each connector. A new card was mated in each specimen. Test speed was 5 mm [.2 in] per minute. The latches were disabled on the specimens prior to the test.

3.15. Contact Retention

Selected contacts in each housing were initially measured for contact height. Next, an axial load of 3 N [300 gf] was applied to each contact using a "dead-weight" and held for 6 seconds. This force was applied in a direction that would tend to cause removal of the contacts from the housing. Finally, the same contacts were again measured for contact height to determine if there was any contact movement or displacement. Thirty contacts, 15 inner and 15 outer types, were tested.

3.16. Fork Lock Retention

Each of the 3 fork locks in the housings were initially measured for placement height. Next, an axial load of 13.3 N [3 lbf] was applied to each contact using a "dead-weight" and held for 6 seconds. This force was applied in a direction that would tend to cause removal of the fork locks from the housing. Finally, the same fork locks were again measured for placement height to determine if there was any movement or displacement.

3.17. Connector Insertion Force into PCB

The connectors were pressed onto their respective printed circuit boards using a tensile/compression machine at a maximum speed of 5 mm [.2 in] per minute. This force was applied until each connector was fully seated onto its respective board.

3.18. Maximum Force on Connector

A 1.37 mm [.054 in] steel blade was attached to the loadcell of the Instron tensile/compression machine. The crosshead was then manually energized to fully mate the blade into the connector. After pre-loading the blade to 66.7 N [15 lbf], the dial indicator was then placed on the top of the blade and set to zero. The crosshead was manually energized in a downward direction until the force meter indicated that a 667.2 N [150 lbf] axial load was applied to the connector. When the specified load was reached, it was then held for 30 seconds. The dial indicator was observed for any movement of the steel blade and the displacement was recorded.

3.19. Contact Backout Wipe

The mated, board mounted specimens were tested for contact backout wipe using a discontinuity monitor set at 1 microsecond. The monitor was connected to the 2 series wired 10 contact sets on each mated specimen and energized while the module card was pulled upward against the closed latches.

3.20. Solvent Resistance

Testing consisted of initially placing the unmated, unmounted specimens on a scale and recording their respective weights. After stabilizing each solvent at their specified temperatures, the specimens were subjected to immersion as described below.

- Specimen 1: Ionox FCR (or equivalent), 65.6˚C for 5 minutes
- Specimen 2: Axarel 32 (or equivalent), 60˚C for 10 minutes
- Specimen 3: B10ACT (or equivalent), 71.1˚C for 10 minutes
- Specimen 4: Synergy CCS (or equivalent), 25˚C for 10 minutes

After removing the specimens from their respective solvents, they were allowed to recover to room ambient for a minimum of 5 minutes and then re-weighed to determine any significant weight gain. Finally, they were visually inspected under a 10X scope to determine any damage or deformation.

3.21. Thermal Shock

Mated, board mounted specimens were subjected to 10 cycles of thermal shock with each cycle consisting of the following:

- Low temperature extreme of -55˚C
- High temperature extreme of 85˚C
- 30 minute dwell time at temperature extremes
- One minute transition between temperature extremes

3.22. Humidity-Temperature Cycling

Mated, board mounted specimens were exposed to 24 cycles of humidity-temperature cycling. Each cycle consisted of the following:

- High temperature extreme of 65˚C at 50% RH
- Low temperature extreme of 25˚C at 80% RH
- 60 minutes dwell time at temperature extremes
- 30 minute ramp time between temperature extremes

3.23. Temperature Life

Mated, board mounted specimens were exposed to an environment of dry heat at a temperature of 105˚C for 240 hours.

3.24. Mixed Flowing Gas, Class IIA

Board mounted specimens were exposed to a total of 10 days of Class IIA mixed flowing gas 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. The specimens were subjected to the testing as described below. Test Group 4 was broken down into 2 sub-groups:

- Test Group 4a (CTLB053705-019): 3 specimens with ID 401, 402 and 403; 5 days mated MFG, LLCR, 5 days mated MFG
- Test Group 4b (CTLB053705-019): 3 specimens with ID 404, 405 and 406; 5 days unmated MFG, LLCR, 5 days mated MFG
- Test Group 13 (CTLB053705-020): 3 specimens with ID 201, 202 and 203; 10 days mated MFG, LLCR

The module cards for Test Group 4b were stored at laboratory ambient during the unmated exposure. The copper corrosion rate (average) was 15.0 µg/cm^2 per day. The Class IIA requirement is 12-16 µg/cm^2 per day.

3.25. Thermal Disturbance

Mated, board mounted specimens were subjected to 10 cycles of thermal disturbance. Each cycle was comprised of the following:

- Low temperature extreme of 15˚C
- High temperature extreme of 85˚C
- Minimum ramp time of 2˚C per minute
- Ten minute dwell time at temperature extremes
- Relative humidity at laboratory ambient conditions
- A thermocouple was attached to the connectors during the exposure to verify temperature stability at both extremes.

3.26. Final Examination of Product

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