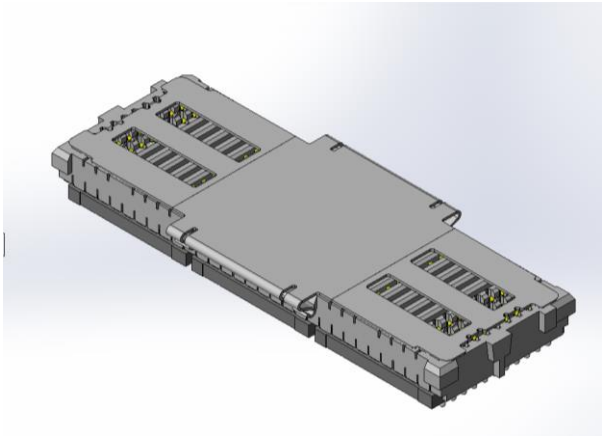
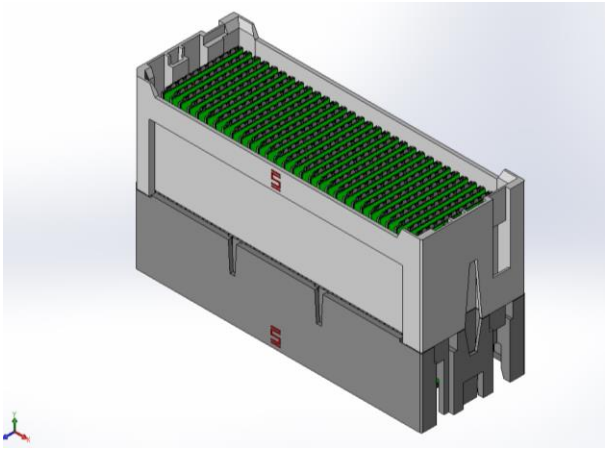
Project Number:	Tracking Code: 396940_Report_Rev_1
Requested by: Neal Patterson	Date: 5/25/2015
Part #: TPAF-D-H-H-H-0-S-2/TPAR-H-H-H-35-S IT5D-300S-BGA/IT5-300P-35H TPAF-D-H-H-H-0-S-2/IT5-300P-35H IT5D-300S-BGA/TPAR-H-H-H-35-S	Tech: Craig Ryan
Part description: TPAF/TPAR	Qty to test: 24
Test Start: 11/10/2014	Test Completed: 1/25/2015





Samtec/Hirose Intermateability Test Report

TPAF/TPAR
TPAF-D-H-H-H-0-S-2/TPAR-H-H-H-35-S
IT5D-300S-BGA/IT5-300P-35H
TPAF-D-H-H-H-0-S-2/IT5-300P-35H
IT5D-300S-BGA/TPAR-H-H-H-35-S

REVISION HISTORY

DATE	REV.NUM.	DESCRIPTION	ENG
05/25/2015	**1**	**Initial Issue**	**PC**

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to IS0 10012-l and ANSI/NCSL 2540-1, as applicable.

SCOPE

To perform the following tests: Design Qualification test. Please see test plan.

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the part to be used for LLCR testing was cleaned according to TLWI-0001.
4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
5) The automated procedure is used with aqueous compatible soldering materials.
6) Parts not intended for testing LLCR is visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Solder Information: Lead free
9) Samtec Test PCBs used: PCB-106760-TST-XX

FLOWCHARTS

Mating/Unmating/Durability

Group 1 TPAF-D-H-H-H-0-S-2 TPAR-H-H-H-35-S 8 Assemblies		Group 2 IT5D-300S-BGA IT5-300P-35H 8 Assemblies		Group 3 TPAF-D-H-H-H-0-S-2 IT5-300P-35H 8 Assemblies		Group 4 IT5D-300S-BGA TPAR-H-H-H-35-S 8 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**	**Step**	**Description**
1.	Contact Gaps	1.	Contact Gaps	1.	Contact Gaps	1.	Contact Gaps
2.	LLCR (2)	2.	LLCR (2)	2.	LLCR (2)	2.	LLCR (2)
3.	Mating/Unmating Force (3)	3.	Mating/Unmating Force (3)	3.	Mating/Unmating Force (3)	3.	Mating/Unmating Force (3)
4.	Cycles Quantity = 25 Cycles	4.	Cycles Quantity = 25 Cycles	4.	Cycles Quantity = 25 Cycles	4.	Cycles Quantity = 25 Cycles
5.	Mating/Unmating Force (3)	5.	Mating/Unmating Force (3)	5.	Mating/Unmating Force (3)	5.	Mating/Unmating Force (3)
6.	Cycles Quantity = 25 Cycles	6.	Cycles Quantity = 25 Cycles	6.	Cycles Quantity = 25 Cycles	6.	Cycles Quantity = 25 Cycles
7.	Mating/Unmating Force (3)	7.	Mating/Unmating Force (3)	7.	Mating/Unmating Force (3)	7.	Mating/Unmating Force (3)
8.	Cycles Quantity = 25 Cycles	8.	Cycles Quantity = 25 Cycles	8.	Cycles Quantity = 25 Cycles	8.	Cycles Quantity = 25 Cycles
9.	Mating/Unmating Force (3)	9.	Mating/Unmating Force (3)	9.	Mating/Unmating Force (3)	9.	Mating/Unmating Force (3)
10.	Cycles Quantity = 25 Cycles	10.	Cycles Quantity = 25 Cycles	10.	Cycles Quantity = 25 Cycles	10.	Cycles Quantity = 25 Cycles
11.	Mating/Unmating Force (3)	11.	Mating/Unmating Force (3)	11.	Mating/Unmating Force (3)	11.	Mating/Unmating Force (3)
12.	Contact Gaps	12.	Contact Gaps	12.	Contact Gaps	12.	Contact Gaps
13.	LLCR (2) Max Delta = 15 mOhm	13.	LLCR (2) Max Delta = 15 mOhm	13.	LLCR (2) Max Delta = 15 mOhm	13.	LLCR (2) Max Delta = 15 mOhm
14.	Thermal Shock (4)	14.	Thermal Shock (4)	14.	Thermal Shock (4)	14.	Thermal Shock (4)
15.	LLCR (2) Max Delta = 15 mOhm	15.	LLCR (2) Max Delta = 15 mOhm	15.	LLCR (2) Max Delta = 15 mOhm	15.	LLCR (2) Max Delta = 15 mOhm
16.	Humidity (1)	16.	Humidity (1)	16.	Humidity (1)	16.	Humidity (1)
17.	LLCR (2) Max Delta = 15 mOhm	17.	LLCR (2) Max Delta = 15 mOhm	17.	LLCR (2) Max Delta = 15 mOhm	17.	LLCR (2) Max Delta = 15 mOhm
18.	Mating/Unmating Force (3)	18.	Mating/Unmating Force (3)	18.	Mating/Unmating Force (3)	18.	Mating/Unmating Force (3)

(1) Humidity = EIA-364-31
Test Condition = B (240 Hours)
Test Method = III (+25°C to +65°C @ 90% RH to 98% RH)
Test Exceptions: ambient pre-condition and delete steps 7a and 7b

(2) LLCR = EIA-364-23
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max

(3) Mating/Unmating Force = EIA-364-13

(4) Thermal Shock = EIA-364-32
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +85°C)
Test Duration = A-3 (100 Cycles)

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition 1: -55°C to +85°C
3) Test Time: ½ hour dwell at each temperature extreme
4) Number of Cycles: 100
5) All test samples are pre-conditioned at ambient.
6) All test samples are exposed to environmental stressing in the mated condition.

HUMIDITY:

1) Reference document: EIA-364-31, *Humidity Test Procedure for Electrical Connectors.*
2) Test Condition B, 240 Hours.
3) Method III, +25° C to + 65° C, 90% to 98% Relative Humidity excluding sub-cycles 7a and 7b.
4) All samples are pre-conditioned at ambient.
5) All test samples are exposed to environmental stressing in the mated condition.

MATING/UNMATING:

1) Reference document: EIA-364-13, *Mating and Unmating Forces Test Procedure for Electrical Connectors*.
2) The full insertion position was to within 0.003" to 0.004" of the plug bottoming out in the receptacle to prevent damage to the system under test.
3) One of the mating parts is secured to a floating X-Y table to prevent damage during cycling.

LLCR:

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms:---------- Stable
    b. +5.1 to +10.0 mOhms:---------- Minor
    c. +10.1 to +15.0 mOhms: ---------- Acceptable
    d. +15.1 to +50.0 mOhms: ---------- Marginal
    e. +50.1 to +2000 mOhms: ---------- Unstable
    f. >+2000 mOhms:---------- Open Failure

RESULTS

Mating – Unmating Durability Forces

Group 1 (TPAF-D-H-H-H-0-S-2/TPAR-H-H-H-35-S)

- **Initial**
  - **Mating**
    - **Min ----------15.58 Lbs**
    - **Max----------18.42 Lbs**
  - **Unmating**
    - **Min ----------10.73 Lbs**
    - **Max----------11.89 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------16.74 Lbs**
    - **Max----------21.51 Lbs**
  - **Unmating**
    - **Min ----------12.50 Lbs**
    - **Max----------14.69 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------17.20 Lbs**
    - **Max----------22.17 Lbs**
  - **Unmating**
    - **Min ----------12.33 Lbs**
    - **Max----------16.52 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------17.08 Lbs**
    - **Max----------23.11 Lbs**
  - **Unmating**
    - **Min ----------14.04 Lbs**
    - **Max----------17.97 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------18.26 Lbs**
    - **Max----------22.92 Lbs**
  - **Unmating**
    - **Min ----------14.28 Lbs**
    - **Max----------18.19 Lbs**
- **After humidity**
  - **Mating**
    - **Min ----------13.07 Lbs**
    - **Max----------15.50 Lbs**
  - **Unmating**
    - **Min ----------10.95 Lbs**
    - **Max----------12.96 Lbs**

RESULTS Continued

Group 2 (IT5D-300S-BGA/IT5-300P-35H)

- **Initial**
  - **Mating**
    - **Min ----------17.85 Lbs**
    - **Max----------21.49 Lbs**
  - **Unmating**
    - **Min ----------12.40 Lbs**
    - **Max----------14.49 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------19.70 Lbs**
    - **Max----------22.37 Lbs**
  - **Unmating**
    - **Min ----------13.60 Lbs**
    - **Max----------16.86 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------19.95 Lbs**
    - **Max----------23.49 Lbs**
  - **Unmating**
    - **Min ----------14.94 Lbs**
    - **Max----------18.74 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------20.09 Lbs**
    - **Max----------24.18 Lbs**
  - **Unmating**
    - **Min ----------15.98 Lbs**
    - **Max----------21.01 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------20.52 Lbs**
    - **Max----------24.40 Lbs**
  - **Unmating**
    - **Min ----------17.52 Lbs**
    - **Max----------23.01 Lbs**
- **After humidity**
  - **Mating**
    - **Min ----------14.51 Lbs**
    - **Max----------17.32 Lbs**
  - **Unmating**
    - **Min ----------12.19 Lbs**
    - **Max----------13.78 Lbs**

RESULTS Continued

Group 3 (TPAF-D-H-H-H-0-S-2/IT5-300P-35H)

- **Initial**
  - **Mating**
    - **Min ----------17.53 Lbs**
    - **Max----------20.92 Lbs**
  - **Unmating**
    - **Min ----------12.50 Lbs**
    - **Max----------14.31 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------19.42 Lbs**
    - **Max----------22.27 Lbs**
  - **Unmating**
    - **Min ----------13.96 Lbs**
    - **Max----------16.14 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------20.89 Lbs**
    - **Max----------23.07 Lbs**
  - **Unmating**
    - **Min ----------15.53 Lbs**
    - **Max----------17.64 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------21.22 Lbs**
    - **Max----------23.75 Lbs**
  - **Unmating**
    - **Min ----------16.92 Lbs**
    - **Max----------19.02 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------21.72 Lbs**
    - **Max----------23.82 Lbs**
  - **Unmating**
    - **Min ----------18.11 Lbs**
    - **Max----------20.79 Lbs**
- **After humidity**
  - **Mating**
    - **Min ----------14.03 Lbs**
    - **Max----------18.19 Lbs**
  - **Unmating**
    - **Min ----------12.26 Lbs**
    - **Max----------13.45 Lbs**

RESULTS Continued

Group 4 (IT5D-300S-BGA/TPAR-H-H-H-35-S)

- **Initial**
  - **Mating**
    - **Min ----------18.68 Lbs**
    - **Max----------26.16 Lbs**
  - **Unmating**
    - **Min ----------12.52 Lbs**
    - **Max----------14.57 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------21.01 Lbs**
    - **Max----------31.06 Lbs**
  - **Unmating**
    - **Min ----------14.80 Lbs**
    - **Max----------22.30 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------21.58 Lbs**
    - **Max----------33.42 Lbs**
  - **Unmating**
    - **Min ----------16.41 Lbs**
    - **Max----------26.40 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------22.32 Lbs**
    - **Max----------33.34 Lbs**
  - **Unmating**
    - **Min ----------17.73 Lbs**
    - **Max----------29.05 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------22.68 Lbs**
    - **Max----------33.28 Lbs**
  - **Unmating**
    - **Min ----------18.68 Lbs**
    - **Max----------27.64 Lbs**
- **After humidity**
  - **Mating**
    - **Min ----------13.98 Lbs**
    - **Max----------20.87 Lbs**
  - **Unmating**
    - **Min ----------10.82 Lbs**
    - **Max----------14.60 Lbs**

RESULTS Continued

LLCR Durability (176 LLCR test points)

Group 1 (TPAF-D-H-H-H-0-S-2/TPAR-H-H-H-35-S)

Signal pin

- **Initial ---------- 96.42 mOhms Max**

Ground pin

- **Initial ----------9.81 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 157 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 19 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ---------- 157 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 18 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------1 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ---------- 155 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 13 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------8 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

LLCR Durability (176 LLCR test points)

Group 2 (IT5D-300S-BGA/IT5-300P-35H)

Signal pin

- **Initial ---------- 93.36 mOhms Max**

Ground pin

- **Initial ----------9.58 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 171 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------5 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ---------- 162 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 14 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ---------- 169 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------7 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

Group 3 (TPAF-D-H-H-H-0-S-2/IT5-300P-35H)

Signal pin

- **Initial ---------- 93.33 mOhms Max**

Ground pin

- **Initial ----------9.57 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 173 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------3 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ---------- 163 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 13 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ---------- 171 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------5 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

Group 4 (IT5D-300S-BGA/TPAR-H-H-H-35-S)

Signal pin

- **Initial ---------- 94.93 mOhms Max**

Ground pin

- **Initial ---------- 10.01 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 163 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 13 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ---------- 145 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 27 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------4 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ---------- 161 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 12 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------3 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

DATA SUMMARIES

Mating – Unmating Durability Forces

Group 1 (TPAF-D-H-H-H-0-S-2/TPAR-H-H-H-35-S)

Initial				25 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
69.30	15.58	47.73	10.73	74.46	16.74	55.60	12.50
81.93	18.42	52.89	11.89	95.68	21.51	65.34	14.69
73.86	**16.61**	51.15	**11.50**	81.11	**18.24**	59.97	**13.48**
4.39	0.99	1.72	0.39	7.10	1.60	3.58	0.80
8	8	8	8	8	8	8	8
50 Cycles				75 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
76.51	17.20	54.84	12.33	75.97	17.08	62.45	14.04
98.61	22.17	73.48	16.52	102.79	23.11	79.93	17.97
83.67	**18.81**	65.41	**14.71**	85.14	**19.14**	70.14	**15.77**
7.65	1.72	6.11	1.37	8.57	1.93	6.08	1.37
8	8	8	8	8	8	8	8
100 Cycles				After Humidity			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
81.22	18.26	63.52	14.28	58.14	13.07	48.71	10.95
101.95	22.92	80.91	18.19	68.94	15.50	57.65	12.96
87.34	**19.64**	72.81	**16.37**	61.60	**13.85**	51.07	**11.48**
7.39	1.66	6.43	1.45	3.45	0.77	2.83	0.64
8	8	8	8	8	8	8	8

DATA SUMMARIES

Mating – Unmating Durability Forces
Group 2 (IT5D-300S-BGA/IT5-300P-35H)

Initial				25 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
79.40	17.85	55.16	12.40	87.63	19.70	60.49	13.60
95.59	21.49	64.45	14.49	99.50	22.37	74.99	16.86
86.25	**19.39**	59.27	**13.33**	92.80	**20.86**	67.33	**15.14**
5.72	1.29	3.51	0.79	4.52	1.02	5.07	1.14
8	8	8	8	8	8	8	8
50 Cycles				75 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
88.74	19.95	66.45	14.94	89.36	20.09	71.08	15.98
104.48	23.49	83.36	18.74	107.55	24.18	93.45	21.01
95.69	**21.51**	74.40	**16.73**	98.71	**22.19**	82.14	**18.47**
5.97	1.34	6.32	1.42	5.77	1.30	8.71	1.96
8	8	8	8	8	8	8	8
100 Cycles				After Humidity			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
91.27	20.52	77.93	17.52	64.54	14.51	54.22	12.19
108.53	24.40	102.35	23.01	77.04	17.32	61.29	13.78
99.95	**22.47**	88.30	**19.85**	71.05	**15.97**	58.66	**13.19**
5.69	1.28	9.45	2.12	3.49	0.78	2.98	0.67
8	8	8	8	8	8	8	8

DATA SUMMARIES

Group 3 (TPAF-D-H-H-H-0-S-2/IT5-300P-35H)

Initial				25 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
77.97	17.53	55.60	12.50	86.38	19.42	62.09	13.96
93.05	20.92	63.65	14.31	99.06	22.27	71.79	16.14
86.21	**19.38**	60.22	**13.54**	92.95	**20.90**	68.33	**15.36**
4.96	1.11	2.93	0.66	3.96	0.89	3.19	0.72
8	8	8	8	8	8	8	8
50 Cycles				75 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
92.92	20.89	69.08	15.53	94.39	21.22	75.26	16.92
102.62	23.07	78.46	17.64	105.64	23.75	84.60	19.02
97.32	**21.88**	74.09	**16.66**	100.30	**22.55**	80.53	**18.11**
3.24	0.73	3.64	0.82	4.09	0.92	2.78	0.63
8	8	8	8	8	8	8	8
100 Cycles				After Humidity			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
96.61	21.72	80.55	18.11	62.41	14.03	54.53	12.26
105.95	23.82	92.47	20.79	80.91	18.19	59.83	13.45
101.98	**22.93**	87.39	**19.65**	72.06	**16.20**	57.79	**12.99**
3.44	0.77	3.66	0.82	5.98	1.34	1.97	0.44
8	8	8	8	8	8	8	8

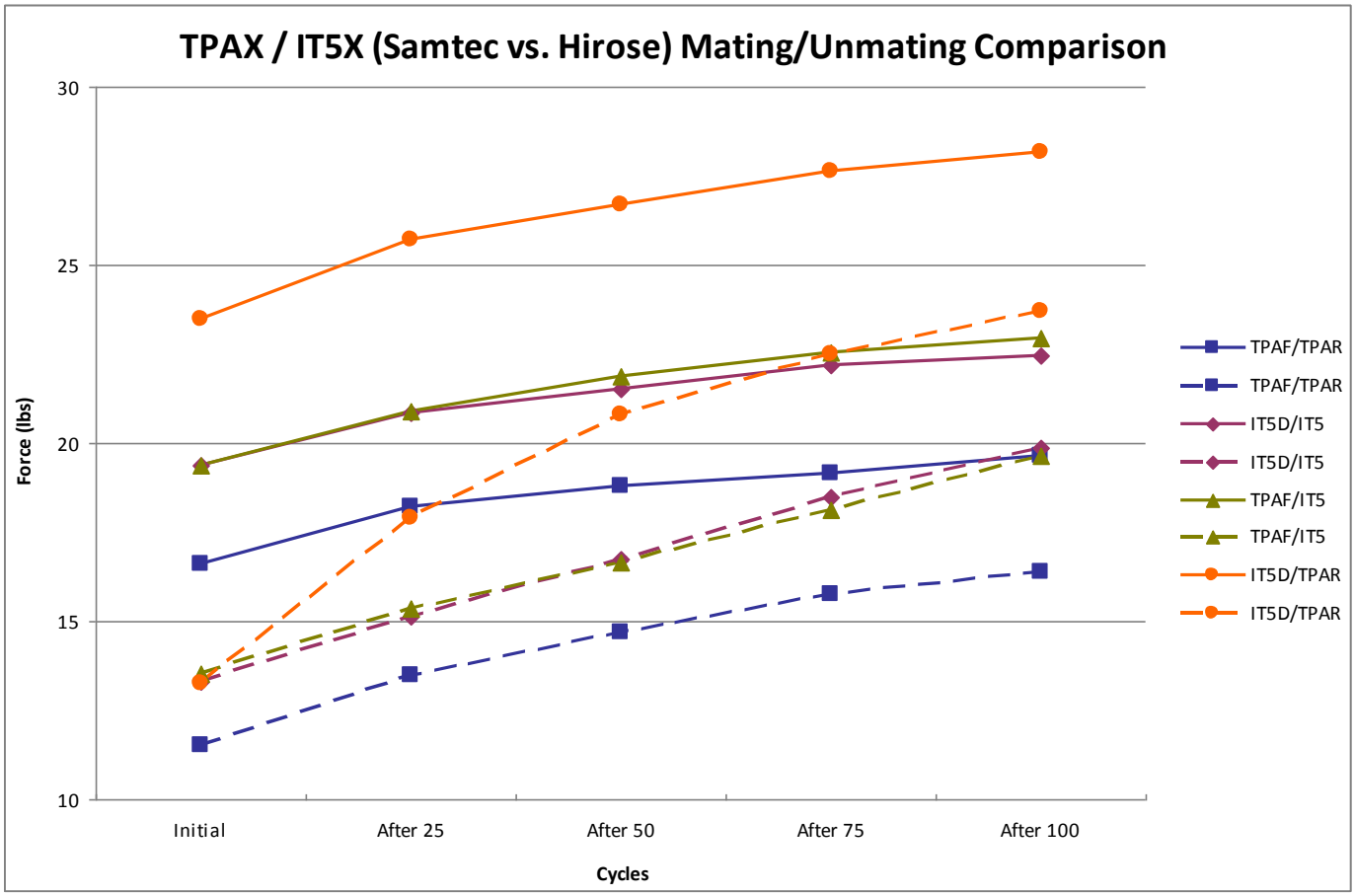
DATA SUMMARIES

Group 4 (IT5D-300S-BGA/TPAR-H-H-H-35-S)

Initial				25 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
83.09	18.68	55.69	12.52	93.45	21.01	65.83	14.80
116.36	26.16	64.81	14.57	138.15	31.06	99.19	22.30
104.52	**23.50**	59.06	**13.28**	114.42	**25.72**	79.56	**17.89**
9.59	2.16	2.73	0.61	13.12	2.95	9.90	2.23
8	8	8	8	8	8	8	8
50 Cycles				75 Cycles			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
95.99	21.58	72.99	16.41	99.28	22.32	78.86	17.73
148.65	33.42	117.43	26.40	148.30	33.34	129.21	29.05
118.83	**26.72**	92.58	**20.81**	122.84	**27.62**	100.10	**22.51**
15.09	3.39	13.48	3.03	14.74	3.31	16.80	3.78
8	8	8	8	8	8	8	8
100 Cycles				After Humidity			
Mating		**Unmating**		**Mating**		**Unmating**	
Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
100.88	22.68	83.09	18.68	62.18	13.98	48.13	10.82
148.03	33.28	122.94	27.64	92.83	20.87	64.94	14.60
125.32	**28.18**	105.47	**23.71**	78.41	**17.63**	53.89	**12.12**
12.87	2.89	13.31	2.99	8.78	1.97	5.11	1.15
8	8	8	8	8	8	8	8

DATA SUMMARIES

TPAX / IT5X (Samtec vs. Hirose) Mating/Unmating Comparison



DATA SUMMARIES

LLCR Mating/Unmating Durability Group

1). A total of 176 points were measured.
2). EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3). A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4). The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms:----------Stable
   b. +5.1 to +10.0 mOhms: ----------Minor
   c. +10.1 to +15.0 mOhms: ----------Acceptable
   d. +15.1 to +50.0 mOhms: ----------Marginal
   e. +50.1 to +2000 mOhms ----------Unstable
   f. > +2000 mOhms:----------Open Failure

Group 1 (TPAF-D-H-H-H-0-S-2/TPAR-H-H-H-35-S)

	LLCR Measurement Summaries by Pin Type			
Date	10/21/2014	10/31/2014	11/5/2014	11/25/2014
Room Temp (Deg C)	21	22	20	22
Rel Humidity (%)	36	39	37	28
Technician	Craig Ryan	Craig Ryan	Craig Ryan	Craig Ryan
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	86.07	2.52	3.09	3.08
St. Dev.	3.91	2.26	2.13	2.88
Min	73.92	0.02	0.04	0.01
Max	96.42	9.45	10.80	12.10
Summary Count	128	128	128	128
Total Count	128	128	128	128
	Pin Type 2: Ground			
Average	8.54	0.21	0.24	0.25
St. Dev.	0.91	0.20	0.18	0.25
Min	5.41	0.01	0.01	0.00
Max	9.81	0.73	0.77	0.88
Summary Count	48	48	48	48
Total Count	48	48	48	48

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**157**	**19**	**0**	**0**	**0**	**0**
Therm Shck	**157**	**18**	**1**	**0**	**0**	**0**
Humidity	**155**	**13**	**8**	**0**	**0**	**0**

DATA SUMMARIES

Group 2 (IT5D-300S-BGA/IT5-300P-35H)

	LLCR Measurement Summaries by Pin Type			
Date	11/4/2014	11/14/2014	11/19/2014	12/5/2014
Room Temp (Deg C)	21	22	22	22
Rel Humidity (%)	31	23	36	36
Technician	Craig Ryan	Craig Ryan	Craig Ryan	Craig Ryan
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	86.65	1.88	2.35	2.06
St. Dev.	2.35	1.40	1.82	1.62
Min	81.58	0.03	0.03	0.02
Max	93.36	5.60	8.40	8.26
Summary Count	128	128	128	128
Total Count	128	128	128	128
	Pin Type 2: Ground			
Average	8.59	0.10	0.12	0.16
St. Dev.	0.70	0.09	0.08	0.22
Min	5.55	0.00	0.00	0.00
Max	9.58	0.37	0.44	1.42
Summary Count	48	48	48	48
Total Count	48	48	48	48

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**171**	**5**	**0**	**0**	**0**	**0**
Therm Shck	**162**	**14**	**0**	**0**	**0**	**0**
Humidity	**169**	**7**	**0**	**0**	**0**	**0**

DATA SUMMARIES

Group 3 (TPAF-D-H-H-H-0-S-2/IT5-300P-35H)

	LLCR Measurement Summaries by Pin Type			
Date	11/5/2014	11/14/2014	11/19/2014	12/5/2014
Room Temp (Deg C)	21	22	21	22
Rel Humidity (%)	38	22	23	40
Technician	Craig Ryan	Craig Ryan	Craig Ryan	Craig Ryan
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	85.34	1.63	2.49	1.88
St. Dev.	4.04	1.23	1.81	1.48
Min	76.67	0.01	0.02	0.01
Max	93.33	5.42	7.73	6.74
Summary Count	128	128	128	128
Total Count	128	128	128	128
	Pin Type 2: Ground			
Average	7.50	0.10	0.15	0.13
St. Dev.	2.08	0.07	0.10	0.11
Min	3.88	0.00	0.01	0.00
Max	9.57	0.26	0.46	0.43
Summary Count	48	48	48	48
Total Count	48	48	48	48

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**173**	**3**	**0**	**0**	**0**	**0**
Therm Shck	**163**	**13**	**0**	**0**	**0**	**0**
Humidity	**171**	**5**	**0**	**0**	**0**	**0**

DATA SUMMARIES

Group 4 (IT5D-300S-BGA/TPAR-H-H-H-35-S)

	LLCR Measurement Summaries by Pin Type			
Date	11/13/2014	11/14/2014	11/19/2014	12/5/2014
Room Temp (Deg C)	22	22	21	22
Rel Humidity (%)	30	22	23	40
Technician	Craig Ryan	Craig Ryan	Craig Ryan	Craig Ryan
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	82.69	2.45	3.85	2.69
St. Dev.	3.80	2.03	2.34	2.33
Min	76.73	0.03	0.09	0.00
Max	94.93	9.58	13.5	14.09
Summary Count	128	128	128	128
Total Count	128	128	128	128
	Pin Type 2: Ground			
Average	9.00	0.25	0.20	0.18
St. Dev.	0.44	0.22	0.11	0.14
Min	7.79	0.03	0.02	0.01
Max	10.01	1.55	0.49	0.57
Summary Count	48	48	48	48
Total Count	48	48	48	48

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**163**	**13**	**0**	**0**	**0**	**0**
Therm Shck	**145**	**27**	**4**	**0**	**0**	**0**
Humidity	**161**	**12**	**3**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: THC-02
Description: Temperature/Humidity Chamber
Manufacturer: Thermotron
Model: SE-1000-6-6
Serial #: 31808
Accuracy: See Manual
… Last Cal: 02/16/2015, Next Cal: 02/16/2016

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnatti Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 05/18/2015, Next Cal: 05/18/2016

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 3706
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 04/30/2015, Next Cal: 04/30/2016

Equipment #: TCT-01
Description: Test Stand
Manufacturer: Chatillon
Model: TCD-1000
Serial #: 05 23 00 02
Accuracy: Speed Accuracy: +/-5% of max speed; Displacement: +/-.5% or +/-.005, whichever is greater.
… Last Cal: 08/24/2014, Next Cal: 08/24/2015