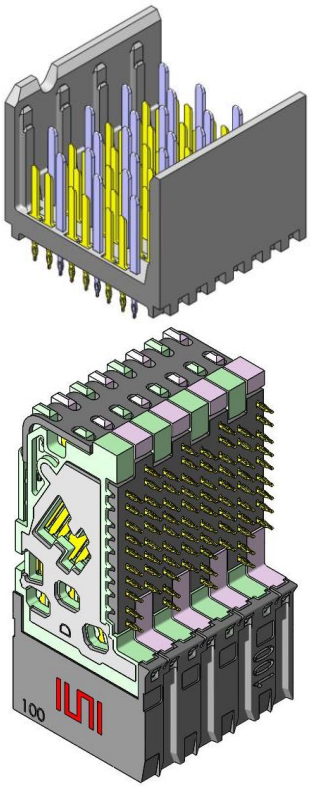
Project Number: Design Qualification Test Report	Tracking Code: 1549497_Report_Rev_1
Requested by: Corey Rose	Date: 1/6/2020
Part #: HDTF-3-08-S-RA-HS-100/ HDTM-3-08-1-S-VT-0-2	
Part description: HDTF/HDTM	Tech: Tony Wagoner
Test Start: 5/24/2018	Test Completed: 6/19/2018



DESIGN QUALIFICATION TEST REPORT

HDTF/HDTM
HDTF-3-08-S-RA-HS-100/HDTM-3-08-1-S-VT-0-2

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
1/6/2020	**1**	**Initial Issue**	**KH**

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) Parts not intended for testing LLCR are visually inspected and cleaned if necessary.
4) Any additional preparation will be noted in the individual test sequences.
5) Samtec Test PCBs used: PCB-108355-TST/PCB-108356-TST

FLOWCHARTS

Gas Tight

Group 1
HDTF-3-08-S-RA-HS-100
HDTM-3-08-1-S-VT-0-2
8 Assemblies
Tin (IMMERSION) .016" PTH

Step	Description
1.	LLCR (2)
2.	Gas Tight (1)
3.	LLCR (2) Max Delta = 15 mOhm

(1) Gas Tight = EIA-364-36

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

Normal Force

Group 1
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Signal Without Thermals Wafer A

Step	Description
1.	Normal Force (1) Deflection = 0.0233 " Expected Force at Max Deflection = 100 g

Group 2
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Ground Without Thermals Wafer A

Step	Description
1.	Normal Force (1) Deflection = 0.0260 " Expected Force at Max Deflection = 100 g

Group 3
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Signal With Thermals Wafer A

Step	Description
1.	Thermal Age (2)
2.	Normal Force (1) Deflection = 0.0233 " Expected Force at Max Deflection = 100 g

Group 4
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Ground With Thermals Wafer A

Step	Description
1.	Thermal Age (2)
2.	Normal Force (1) Deflection = 0.0260 " Expected Force at Max Deflection = 100 g

Group 5
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Signal Without Thermals Wafer B

Step	Description
1.	Normal Force (1) Deflection = 0.0233 " Expected Force at Max Deflection = 100 g

Group 6
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Ground Without Thermals Wafer B

Step	Description
1.	Normal Force (1) Deflection = 0.0260 " Expected Force at Max Deflection = 100 g

Group 7
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Signal With Thermals Wafer B

Step	Description
1.	Thermal Age (2)
2.	Normal Force (1) Deflection = 0.0233 " Expected Force at Max Deflection = 100 g

Group 8
HDTF-3-08-S-RA-HS-100
8 Contacts Minimum
Ground With Thermals Wafer B

Step	Description
1.	Thermal Age (2)
2.	Normal Force (1) Deflection = 0.0260 " Expected Force at Max Deflection = 100 g

(1) Normal Force = EIA-364-04

(2) Thermal Age = EIA-364-17
Test Condition = 4 (105°C)
Time Condition = B (250 Hours)

FLOWCHARTS Continued

Mating/Unmating/Durability

Group 1
HDTF-3-08-S-RA-HS-100
HDTM-3-08-1-S-VT-0-2
8 Assemblies
Tin (IMMERSION) .016" PTH

Step	Description
1.	LLCR (2)
2.	Mating/Unmating Force (3)
3.	Cycles Quantity = 25 Cycles
4.	Mating/Unmating Force (3)
5.	Cycles Quantity = 25 Cycles
6.	Mating/Unmating Force (3)
7.	Cycles Quantity = 25 Cycles
8.	Mating/Unmating Force (3)
9.	Cycles Quantity = 25 Cycles
10.	Mating/Unmating Force (3)
11.	LLCR (2) Max Delta = 15 mOhm
12.	Thermal Shock (4)
13.	LLCR (2) Max Delta = 15 mOhm
14.	Humidity (1)
15.	LLCR (2) Max Delta = 15 mOhm
16.	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)

FLOWCHARTS Continued

IR/DWV

Pin-to-Pin

Group 1	Group 2	Group 3	Group 4
HDTF-3-08-S-RA-HS-100 HDTM-3-08-1-S-VT-0-2 2 Assemblies Tin (IMMERSION) .016" PTH	HDTF-3-08-S-RA-HS-100 2 Assemblies Tin (IMMERSION) .016" PTH	HDTM-3-08-1-S-VT-0-2 2 Assemblies Tin (IMMERSION) .016" PTH	HDTF-3-08-S-RA-HS-100 HDTM-3-08-1-S-VT-0-2 2 Assemblies Tin (IMMERSION) .016" PTH
Step **Description**	**Step** **Description**	**Step** **Description**	**Step** **Description**
1. DWV Breakdown (2)	1. DWV Breakdown (2)	1. DWV Breakdown (2)	1. IR (4) 2. DWV at Test Voltage(1) 3. Thermal Shock (5) 4. IR (4) 5. DWV at Test Voltage(1) 6. Humidity (3) 7. IR (4) 8. DWV at Test Voltage(1)

Pin-to-Ground

Group 9	Group 10	Group 11	Group 12
HDTF-3-08-S-RA-HS-100 HDTM-3-08-1-S-VT-0-2 2 Assemblies Tin (IMMERSION) .016" PTH	HDTF-3-08-S-RA-HS-100 2 Assemblies Tin (IMMERSION) .016" PTH	HDTM-3-08-1-S-VT-0-2 2 Assemblies Tin (IMMERSION) .016" PTH	HDTF-3-08-S-RA-HS-100 HDTM-3-08-1-S-VT-0-2 2 Assemblies Tin (IMMERSION) .016" PTH
Step **Description**	**Step** **Description**	**Step** **Description**	**Step** **Description**
1. DWV Breakdown (2)	1. DWV Breakdown (2)	1. DWV Breakdown (2)	1. IR (4) 2. DWV at Test Voltage(1) 3. Thermal Shock (5) 4. IR (4) 5. DWV at Test Voltage(1) 6. Humidity (3) 7. IR (4) 8. DWV at Test Voltage(1)

(1) DWV at Test Voltage = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(2) DWV Breakdown = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(3) 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

(4) IR = EIA-364-21
Test Condition = 500 Vdc, 2 Minutes Max

(5) 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)

FLOWCHARTS Continued

Current Carrying Capacity

Note: Tin (IMMERSION) .016" SIG PTH, .016" GND PTH

Group 1		Group 2		Group 3	
HDTF-3-08-S-RA-HS-100		HDTF-3-08-S-RA-HS-100		HDTF-3-08-S-RA-HS-100	
HDTM-3-08-1-S-VT-0-2		HDTM-3-08-1-S-VT-0-2		HDTM-3-08-1-S-VT-0-2	
1 Pins Powered		6 Pins Powered		18 Pins Powered	
Signal		Signal		Signal	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	CCC (1) Rows = 1 Number of Positions = 1 *Note: Center of connector location*	1.	CCC (1) Rows = 1 Number of Positions = 6 *Note: All signal pins combined carry supply while all grounds on that wafter carry return*	1.	CCC (1) Rows = 2 Number of Positions = 9 *Note: Center wafer carries supply while adjacent wafer carries return*

(1) CCC = EIA-364-70
Method 2, Temperature Rise Versus Current Curve
(TIN PLATING) - Tabulate calculated current at RT, 65°C, 75°C and 95°C after derating 20% and based on 105°C
(GOLD PLATING) - Tabulate calculated current at RT, 85°C, 95°C and 115°C after derating 20% and based on 125°C

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL:

1) EIA-364-17, *Temperature Life with or without Electrical Load Test Procedure for Electrical Connectors.*
2) Test Condition at 105° C.
3) Test Time Condition B for 250 hours.
4) All test samples are pre-conditioned at ambient.
5) All test samples are exposed to environmental stressing in the mated condition.

THERMAL SHOCK:

1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition: -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.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING):

1) Reference document: EIA-364-04, *Normal Force Test Procedure for Electrical Connectors*.
2) The contacts shall be tested in the connector housing.
3) If necessary, a "window" shall be made in the connector body to allow a probe to engage and deflect the contact at the same attitude and distance (plus 0.05 mm [0.002"]) as would occur in actual use.
4) The connector housing shall be placed in a holding fixture that does not interfere with or otherwise influence the contact force or deflection.
5) Said holding fixture shall be mounted on a floating, adjustable, X-Y table on the base of the Dillon TC^2, computer controlled test stand with a deflection measurement system accuracy of 5.0 µm (0.0002").
6) The nominal deflection rate shall be 5 mm (0.2")/minute.
7) Unless otherwise noted a minimum of five contacts shall be tested.
8) The force/deflection characteristic to load and unload each contact shall be repeated five times.
9) The system shall utilize the TC^2 software in order to acquire and record the test data.
10) The permanent set of each contact shall be measured within the TC^2 software.
11) The acquired data shall be graphed with the deflection data on the X-axis and the force data on the Y-axis and a print out will be stored with the Tracking Code paperwork.

TEMPERATURE RISE (Current Carrying Capacity, CCC):

1) EIA-364-70, *Temperature Rise versus Current Test Procedure for Electrical Connectors and Sockets*.
2) When current passes through a contact, the temperature of the contact increases as a result of I^2R (resistive) heating.
3) The number of contacts being investigated plays a significant part in power dissipation and therefore temperature rise.
4) The size of the temperature probe can affect the measured temperature.
5) Copper traces on PC boards will contribute to temperature rise:
    a. Self heating (resistive)
    b. Reduction in heat sink capacity affecting the heated contacts
6) A de-rating curve, usually 20%, is calculated.
7) Calculated de-rated currents at four temperature points are reported:
    a. Ambient
    b. 65^o C
    c. 75^o C
    d. 95^o C
8) Typically, neighboring contacts (in close proximity to maximize heat build up) are energized.
9) The thermocouple (or temperature measuring probe) will be positioned at a location to sense the maximum temperature in the vicinity of the heat generation area.
10) A computer program, *TR 803.exe*, ensures accurate stability for data acquisition.
11) Hook-up wire cross section is larger than the cross section of any connector leads/PC board traces, jumpers, etc.
12) Hook-up wire length is longer than the minimum specified in the referencing standard.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

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

GAS TIGHT:

To provide method for evaluating the ability of the contacting surfaces in preventing penetration of harsh vapors which might lead to oxide formation that may degrade the electrical performance of the contact system.

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
4) Procedure:
    a. Reference document: EIA-364-36, *Test Procedure for Determination of Gas-Tight Characteristics for Electrical Connectors, Sockets and/or Contact Systems*.
    b. Test Conditions:
        i. Class II--- Mated pairs of contacts assembled to their plastic housings.
        ii. Reagent grade Nitric Acid shall be used of sufficient volume to saturate the test chamber
        iii. The ratio of the volume of the test chamber to the surface area of the acid shall be 10:1.
        iv. The chamber shall be saturated with the vapor for at least 15 minutes before samples are added.
        v. Exposure time, 55 to 65 minutes.
        vi. The samples shall be no closer to the chamber walls than 1 inches and no closer to the surface of the acid than 3 inches.
        vii. The samples shall be dried after exposure for a minimum of 1 hour.
        viii. Drying temperature 50^{o} C
        ix. The final LLCR shall be conducted within 1 hour after drying.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

INSULATION RESISTANCE (IR):

To determine the resistance of insulation materials to leakage of current through or on the surface of these materials when a DC potential is applied.

1) PROCEDURE:
    a. Reference document: EIA-364-21, *Insulation Resistance Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Electrification Time 2.0 minutes
        iii. Test Voltage (500 VDC) corresponds to calibration settings for measuring resistances.
2) MEASUREMENTS:
3) When the specified test voltage is applied (VDC), the insulation resistance shall not be less than 5000 megohms.

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

To determine if the sockets can operate at its rated voltage and withstand momentary over potentials due to switching, surges, and other similar phenomenon. Separate samples are used to evaluate the effect of environmental stresses so not to influence the readings from arcing that occurs during the measurement process.

1) PROCEDURE:
    a. Reference document: EIA-364-20, *Withstanding Voltage Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Barometric Test Condition 1
        iii. Rate of Application 500 V/Sec
        iv. Test Voltage (VAC) until breakdown occurs
2) MEASUREMENTS/CALCULATIONS
    a. The breakdown voltage shall be measured and recorded.
    b. The dielectric withstanding voltage shall be recorded as 75% of the minimum breakdown voltage.
    c. The working voltage shall be recorded as one-third (1/3) of the dielectric withstanding voltage (one-fourth of the breakdown voltage).

RESULTS

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise----------4.0 A with 1 contact powered.**
- **CCC for a 30°C Temperature Rise----------8.6 A with 6 contacts powered (Signals Carry Supply/Grounds Carry Return).**
- **CCC for a 30°C Temperature Rise----------11.7 A with 18 contacts powered (One Wafer Carries Supply/Adjacent Wafer Carries Return).**

Mating – Unmating Forces

Mating/Unmating Durability Group

- **Initial**
  - **Mating**
    - **Min ---------- 5.26 lbs**
    - **Max---------- 6.30 lbs**
  - **Unmating**
    - **Min ---------- 3.17 lbs**
    - **Max---------- 4.62 lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 6.25 lbs**
    - **Max---------- 7.80 lbs**
  - **Unmating**
    - **Min ---------- 4.09 lbs**
    - **Max---------- 5.21 lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 6.35 lbs**
    - **Max---------- 7.91 lbs**
  - **Unmating**
    - **Min ---------- 4.37 lbs**
    - **Max---------- 5.40 lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 6.58 lbs**
    - **Max---------- 7.81 lbs**
  - **Unmating**
    - **Min ---------- 4.45 lbs**
    - **Max---------- 5.60 lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 6.63 lbs**
    - **Max---------- 7.88 lbs**
  - **Unmating**
    - **Min ---------- 4.54 lbs**
    - **Max---------- 5.70 lbs**
- **Humidity**
  - **Mating**
    - **Min ---------- 3.41 lbs**
    - **Max---------- 4.20 lbs**
  - **Unmating**
    - **Min ---------- 2.98 lbs**
    - **Max---------- 3.93 lbs**

RESULTS Continued

Normal Force at 0.0233-inch deflection

Signal Pin Wafer A

- **Initial**
  - **Min ----------51.20 gf Set ----- 0.0023 inch**
  - **Max ----------60.90 gf Set ----- 0.0034 inch**
- **Thermal**
  - **Min ----------35.00 gf Set ----- 0.0047 inch**
  - **Max ----------46.40 gf Set ----- 0.0075 inch**

Signal Pin Wafer B

- **Initial**
  - **Min ----------54.00 gf Set ----- 0.0026 inch**
  - **Max ----------60.00 gf Set ----- 0.0047 inch**
- **Thermal**
  - **Min ----------35.60 gf Set ----- 0.0053 inch**
  - **Max ----------40.80 gf Set ----- 0.0094 inch**

Normal Force at 0.0260-inch deflection

Ground Pin Wafer A

- **Initial**
  - **Min ----------48.50 gf Set ----- 0.0018 inch**
  - **Max ----------54.40 gf Set ----- 0.0027 inch**
- **Thermal**
  - **Min ----------35.80 gf Set ----- 0.0038 inch**
  - **Max ----------41.70 gf Set ----- 0.0143 inch**

Ground Pin Wafer B

- **Initial**
  - **Min ----------46.80 gf Set ----- 0.0017 inch**
  - **Max ----------54.30 gf Set ----- 0.0026 inch**
- **Thermal**
  - **Min ----------34.30 gf Set ----- 0.0015 inch**
  - **Max ----------39.70 gf Set ----- 0.0106 inch**

RESULTS Continued

Insulation Resistance minimums, IR

Pin to Pin

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**

Pin to Ground

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 1000 VAC**
  - **Test Voltage ---------- 750 VAC**
  - **Working Voltage ---------- 250 VAC**

Pin to Pin

- **Initial DWV ---------- Passed**
- **Thermal DWV ---------- Passed**
- **Humidity DWV ---------- Passed**

Pin to Ground

- **Initial DWV ---------- Passed**
- **Thermal DWV ---------- Passed**
- **Humidity DWV ---------- Passed**

RESULTS Continued

LLCR Gas Tight (104 signal and 88 ground LLCR test points)

Signal Pin

- **Initial ---------- 18.46 mOhms Max**
- **Gas-Tight**
  - **<= +5.0 mOhms ---------- 104 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------0 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**

Ground Pin

- **Initial ---------- 12.68 mOhms Max**
- **Thermal Aging**
  - **<= +5.0 mOhms ----------88 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------0 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

LLCR Durability (104 signal and 88 ground LLCR test points)

Signal Pin

- **Initial ---------- 17.81 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 104 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------0 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 ---------- 104 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------0 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 ----------98 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------5 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**

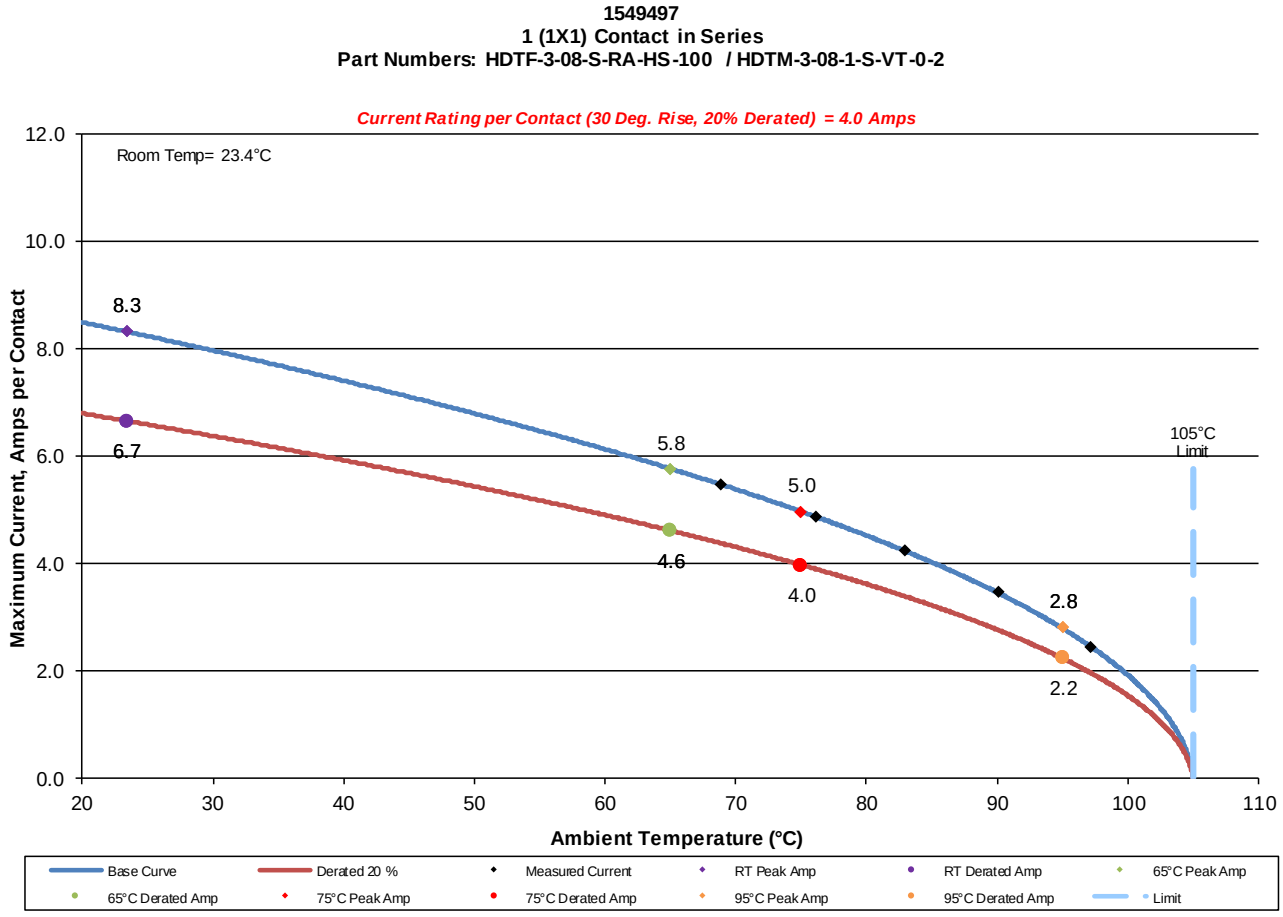
Ground Pin

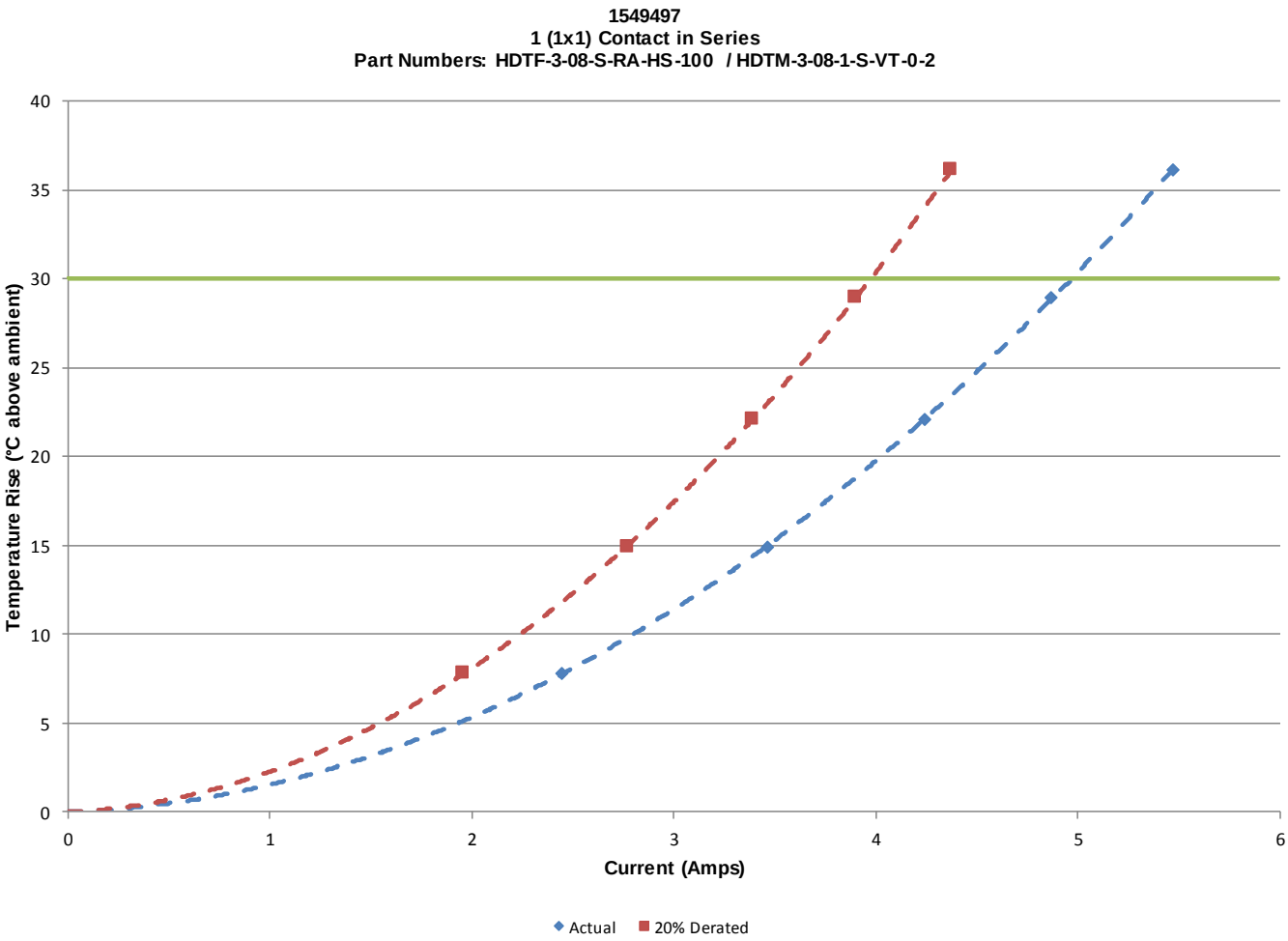
- **Initial ---------- 11.88 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ----------88 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ----------87 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------1 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 ----------82 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------5 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**

DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):

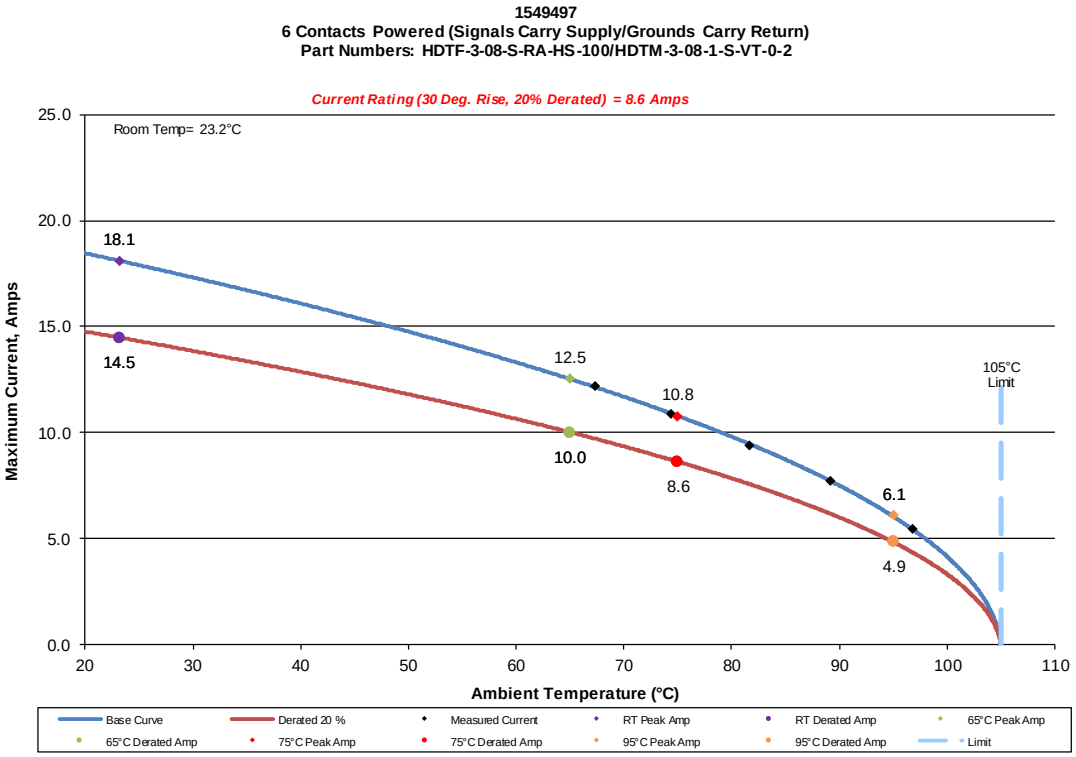
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes apart, differ less than 1° C (computer controlled data acquisition).
4) Adjacent contacts were powered:
    a. Linear configuration with 1 adjacent conductors/contacts powered

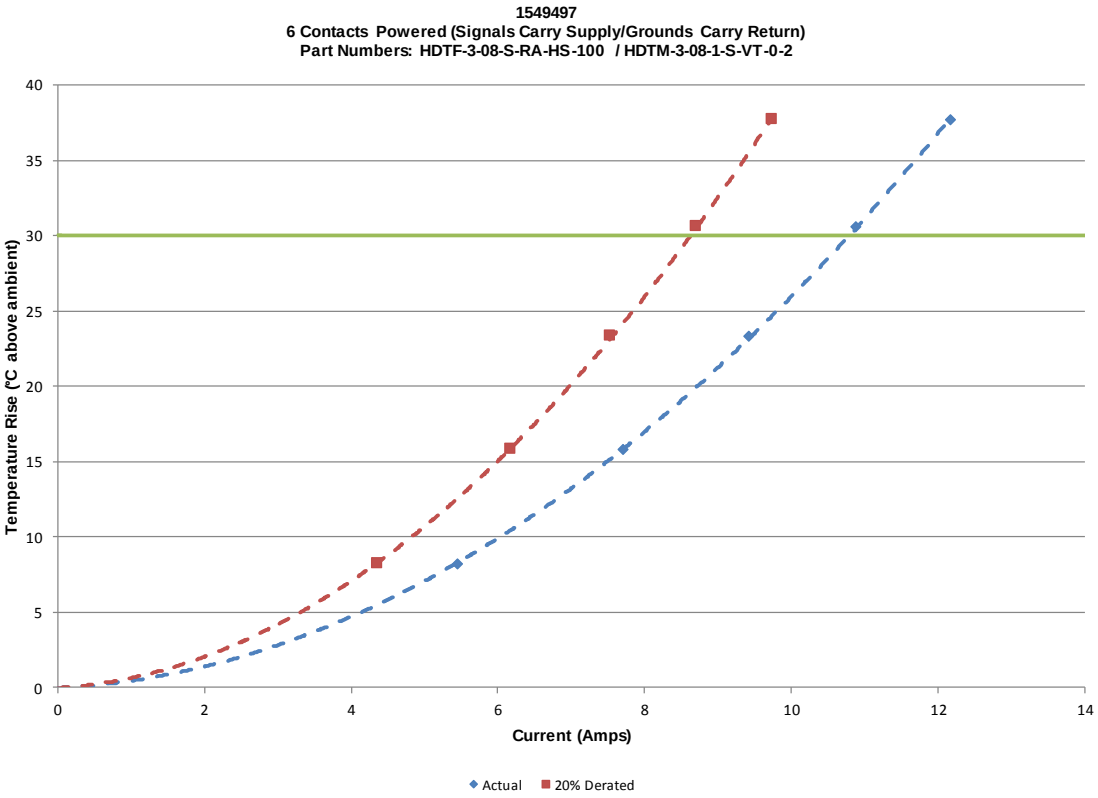



1549497
1 (1x1) Contact in Series
Part Numbers: HDTF-3-08-S-RA-HS-100 / HDTM-3-08-1-S-VT-0-2
Temperature Rise (°C above ambient)
Current (Amps)
0
5
10
15
20
25
30
35
40
0
1
2
3
4
5
6
Actual
20% Derated

DATA SUMMARIES Continued

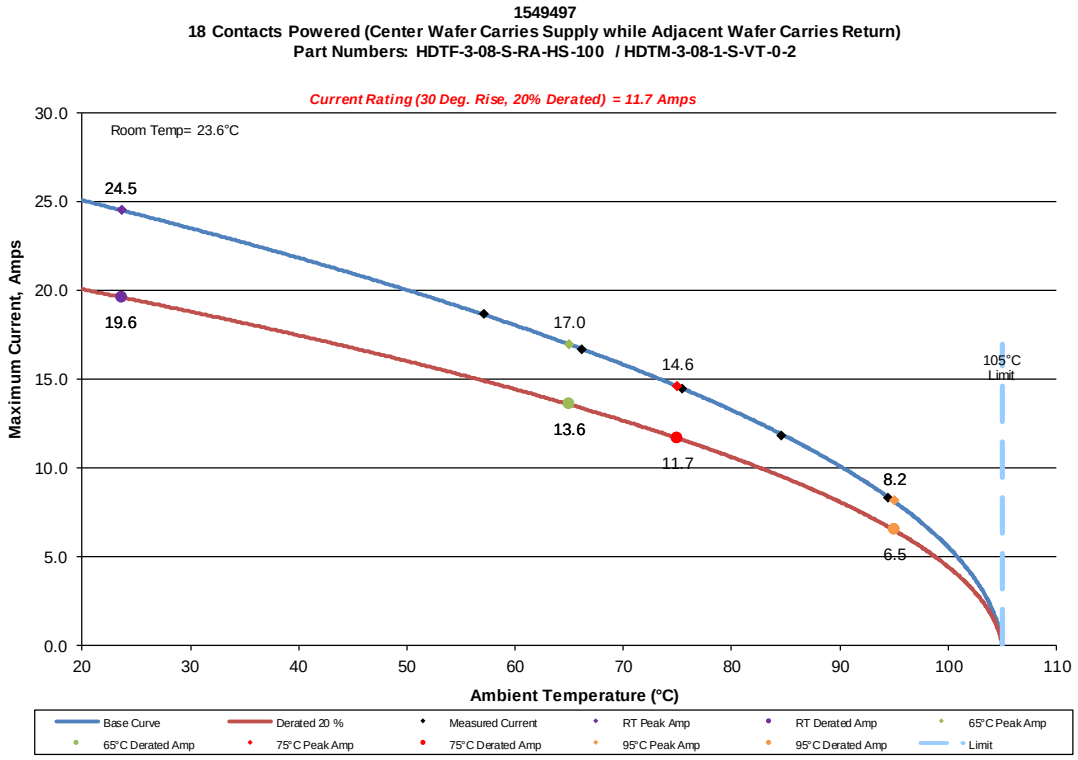
b. Linear configuration with 6 adjacent signals carry supply/grounds carry return powered

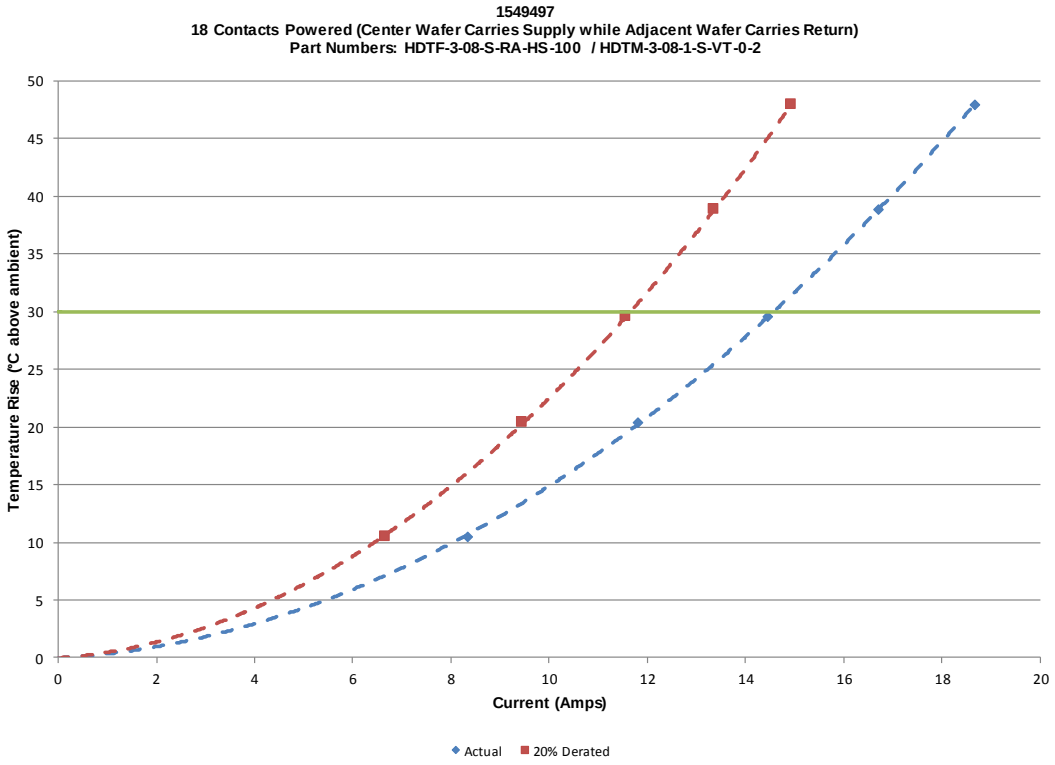




DATA SUMMARIES Continued

c. Linear configuration with center wafer carries supply while adjacent wafer carries return powered





DATA SUMMARIES Continued

MATING/UNMATING:

Mating/Unmating Durability Group

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	23.40	5.26	14.10	3.17	27.80	6.25	18.19	4.09
Maximum	28.02	6.30	20.55	4.62	34.69	7.80	23.17	5.21
Average	26.08	**5.86**	17.44	**3.92**	30.61	**6.88**	20.59	**4.63**
St Dev	1.83	0.41	2.11	0.47	2.05	0.46	1.83	0.41
Count	8	8	8	8	8	8	8	8

	After 50 Cycles				After 75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	28.24	6.35	19.44	4.37	29.27	6.58	19.79	4.45
Maximum	35.18	7.91	24.02	5.40	34.74	7.81	24.91	5.60
Average	31.35	**7.05**	21.69	**4.88**	32.06	**7.21**	22.41	**5.04**
St Dev	1.98	0.44	1.80	0.40	1.56	0.35	1.90	0.43
Count	8	8	8	8	8	8	8	8

	After 100 Cycles				After Humidity			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	29.49	6.63	20.19	4.54	15.16	3.41	13.27	2.98
Maximum	35.05	7.88	25.35	5.70	18.67	4.20	17.46	3.93
Average	32.82	**7.38**	23.19	**5.21**	16.76	**3.77**	15.21	**3.42**
St Dev	1.86	0.42	1.90	0.43	1.19	0.27	1.37	0.31
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued

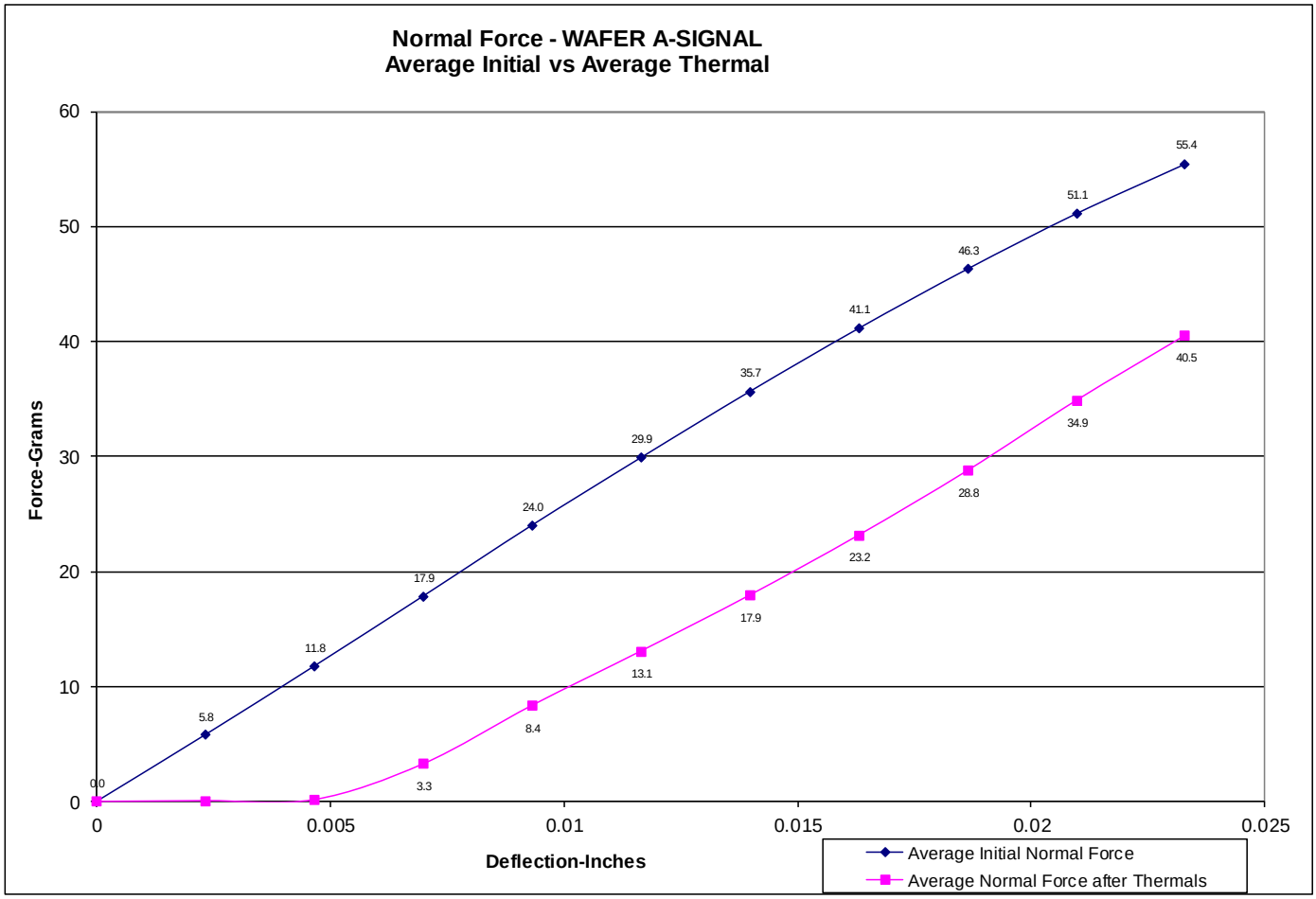
NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING):

1) Calibrated force gauges are used along with computer controlled positioning equipment.
2) For Normal force 8-10 measurements are taken and the averages reported.

Signal Pin Wafer A

Initial	Deflections in inches Forces in Grams										
	0.0023	**0.0047**	**0.0070**	**0.0093**	**0.0117**	**0.0140**	**0.0163**	**0.0186**	**0.0210**	**0.0233**	***SET***
Averages	**5.81**	**11.78**	**17.86**	**24.03**	**29.90**	**35.65**	**41.14**	**46.31**	**51.13**	**55.44**	**0.0029**
Min	5.30	10.60	15.80	20.90	25.60	31.30	36.80	42.20	46.90	51.20	0.0023
Max	6.50	13.40	20.50	27.10	33.50	39.60	45.40	50.80	55.80	60.90	0.0034
St. Dev	0.390	0.878	1.459	1.919	2.379	2.481	2.591	2.654	2.795	3.062	0.0003
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0023	**0.0047**	**0.0070**	**0.0093**	**0.0117**	**0.0140**	**0.0163**	**0.0186**	**0.0210**	**0.0233**	***SET***
Averages	**0.07**	**0.16**	**3.27**	**8.35**	**13.08**	**17.94**	**23.16**	**28.78**	**34.88**	**40.54**	**0.0063**
Min	0.00	0.00	0.10	5.10	9.70	13.70	18.20	23.40	28.80	35.00	0.0047
Max	0.80	1.00	6.10	11.30	16.70	21.80	27.50	33.80	40.50	46.40	0.0075
St. Dev	0.231	0.306	2.040	1.926	2.136	2.490	2.965	3.452	3.802	3.930	0.0009
Count	12	12	12	12	12	12	12	12	12	12	12

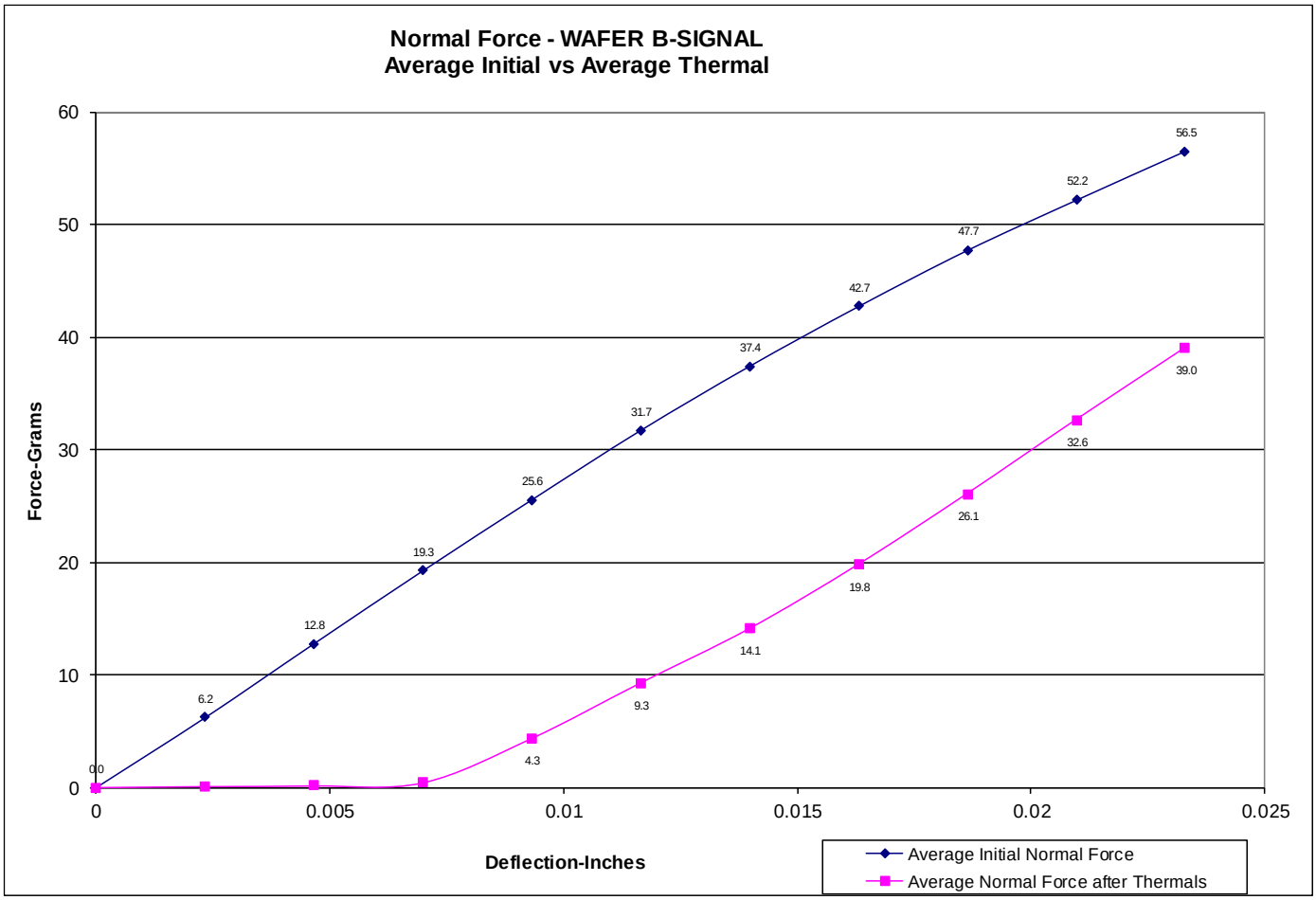


DATA SUMMARIES Continued

Signal Pin Wafer B

Initial	Deflections in inches Forces in Grams										
	0.0023	**0.0047**	**0.0070**	**0.0093**	**0.0117**	**0.0140**	**0.0163**	**0.0186**	**0.0210**	**0.0233**	***SET***
Averages	**6.21**	**12.78**	**19.25**	**25.55**	**31.72**	**37.42**	**42.73**	**47.71**	**52.17**	**56.51**	**0.0034**
Min	5.40	11.30	16.80	23.20	29.30	34.90	40.10	44.80	49.50	54.00	0.0026
Max	6.80	13.60	20.70	27.40	33.80	39.90	45.50	50.90	55.80	60.00	0.0047
St. Dev	0.456	0.801	1.077	1.151	1.145	1.267	1.397	1.580	1.763	1.644	0.0006
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0023	**0.0047**	**0.0070**	**0.0093**	**0.0117**	**0.0140**	**0.0163**	**0.0186**	**0.0210**	**0.0233**	***SET***
Averages	**0.09**	**0.15**	**0.42**	**4.34**	**9.27**	**14.09**	**19.78**	**26.06**	**32.62**	**38.99**	**0.0078**
Min	0.00	0.00	0.00	0.70	6.20	11.30	16.30	22.30	28.80	35.60	0.0053
Max	0.70	0.80	2.50	8.20	12.60	17.20	22.40	27.90	34.50	40.80	0.0094
St. Dev	0.223	0.294	0.770	1.860	1.618	1.794	1.582	1.601	1.538	1.415	0.0011
Count	12	12	12	12	12	12	12	12	12	12	12

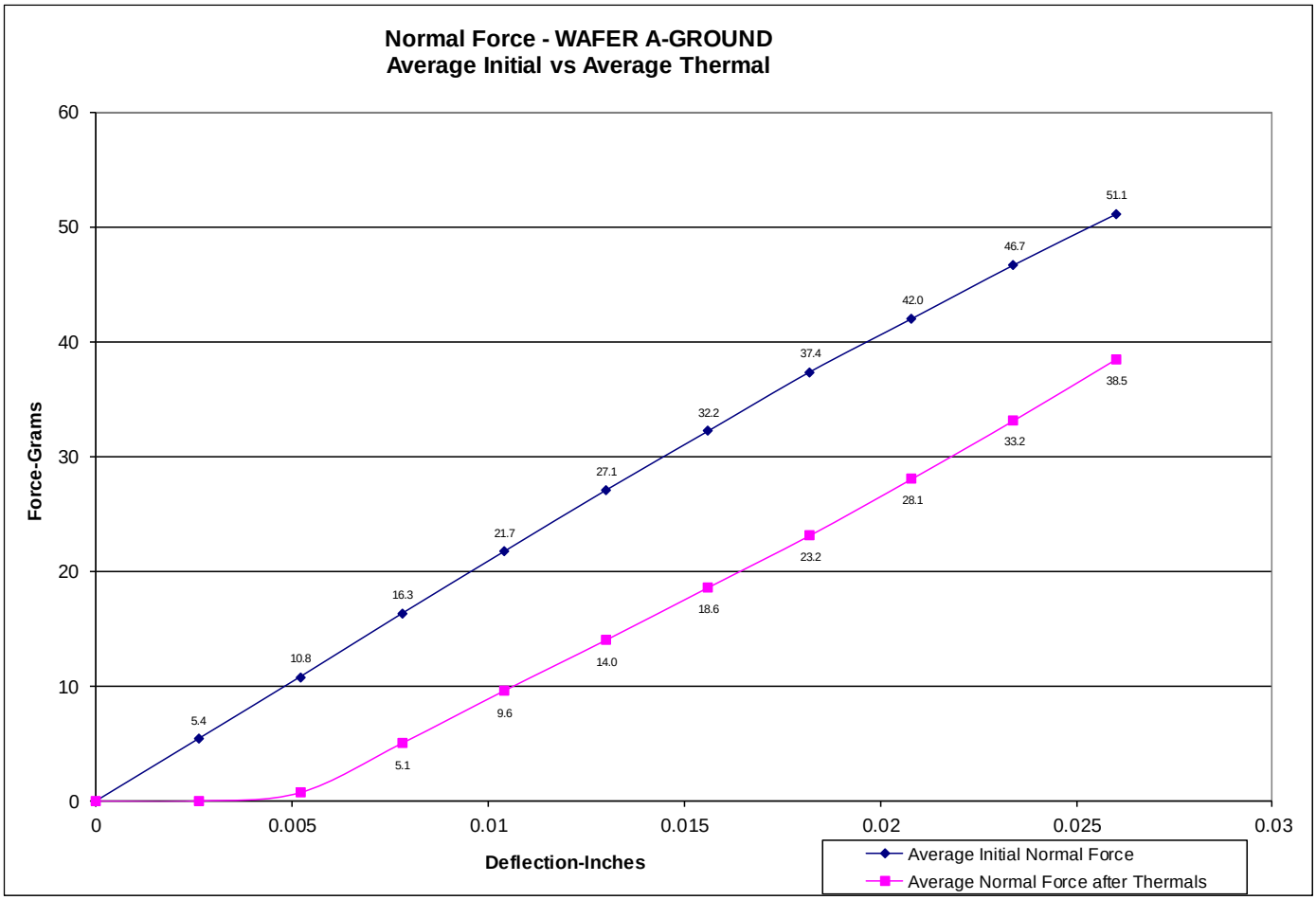


DATA SUMMARIES Continued

Ground Pin Wafer A

Initial	Deflections in inches Forces in Grams										
	0.0026	**0.0052**	**0.0078**	**0.0104**	**0.0130**	**0.0156**	**0.0182**	**0.0208**	**0.0234**	**0.0260**	***SET***
Averages	**5.39**	**10.80**	**16.33**	**21.72**	**27.06**	**32.20**	**37.36**	**42.00**	**46.68**	**51.08**	**0.0023**
Min	5.10	9.90	15.00	20.30	25.40	30.50	35.40	40.00	44.40	48.50	0.0018
Max	6.00	12.00	18.20	23.70	29.30	34.70	40.10	45.20	49.90	54.40	0.0027
St. Dev	0.300	0.640	0.898	1.054	1.204	1.331	1.423	1.494	1.439	1.488	0.0003
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0026	**0.0052**	**0.0078**	**0.0104**	**0.0130**	**0.0156**	**0.0182**	**0.0208**	**0.0234**	**0.0260**	***SET***
Averages	**0.03**	**0.75**	**5.05**	**9.62**	**14.04**	**18.61**	**23.16**	**28.09**	**33.18**	**38.50**	**0.0065**
Min	0.00	0.00	2.20	7.00	10.50	15.50	20.00	25.10	30.50	35.80	0.0038
Max	0.30	3.00	7.70	12.00	17.30	22.10	27.20	31.80	36.50	41.70	0.0143
St. Dev	0.087	1.053	1.815	1.772	2.148	2.161	2.352	2.283	2.197	1.961	0.0029
Count	12	12	12	12	12	12	12	12	12	12	12

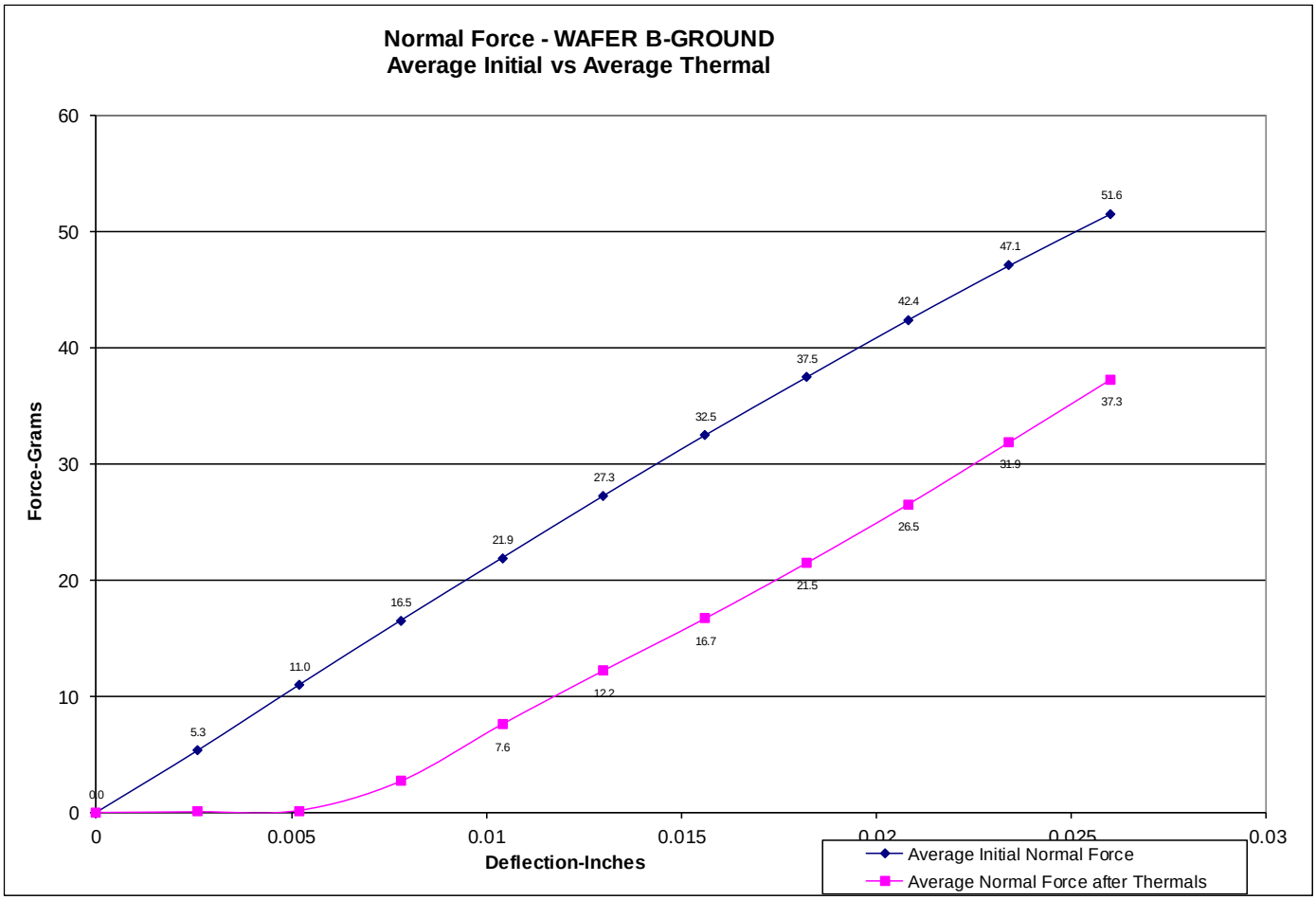


DATA SUMMARIES Continued

Ground Pin Wafer B

Initial	Deflections in inches Forces in Grams										
	0.0026	**0.0052**	**0.0078**	**0.0104**	**0.0130**	**0.0156**	**0.0182**	**0.0208**	**0.0234**	**0.0260**	***SET***
Averages	**5.34**	**10.99**	**16.53**	**21.93**	**27.28**	**32.49**	**37.48**	**42.41**	**47.12**	**51.57**	**0.0021**
Min	4.50	9.90	15.10	19.90	24.70	29.70	34.10	38.70	42.90	46.80	0.0017
Max	6.10	12.00	17.90	23.60	29.30	34.50	39.70	44.90	49.60	54.30	0.0026
St. Dev	0.476	0.856	0.980	1.255	1.438	1.561	1.763	1.914	2.188	2.544	0.0003
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0026	**0.0052**	**0.0078**	**0.0104**	**0.0130**	**0.0156**	**0.0182**	**0.0208**	**0.0234**	**0.0260**	***SET***
Averages	**0.07**	**0.18**	**2.68**	**7.58**	**12.22**	**16.70**	**21.48**	**26.53**	**31.90**	**37.31**	**0.0065**
Min	0.00	0.00	-0.20	4.10	8.80	13.20	17.60	23.40	28.90	34.30	0.0015
Max	0.40	0.60	5.70	11.10	15.60	20.40	24.90	29.90	34.00	39.70	0.0106
St. Dev	0.130	0.249	2.173	2.304	2.245	2.435	2.424	2.137	1.747	1.669	0.0029
Count	12	12	12	12	12	12	12	12	12	12	12



DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**HDTF - Wafer A**	**HDTF - Wafer B**	**HDTM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**HDTF - Wafer A**	**HDTF - Wafer B**	**HDTM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**HDTF(Wafers)/HDTM**
Break Down Voltage	1000
Test Voltage	750
Working Voltage	250

Pin to Pin	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

Pin to Ground	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

DATA SUMMARIES Continued

LLCR Durability:

1) A total of 104 signal and 88 ground 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

LLCR Measurement Summaries by Pin Type				
Date	5/24/2018	5/29/2018	6/4/2018	6/19/2018
Room Temp (Deg C)	23	23	23	23
Rel Humidity (%)	41	45	39	47
Technician	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	13.14	0.53	0.60	1.45
St. Dev.	2.09	0.48	0.61	2.11
Min	10.04	0.01	0.00	0.01
Max	17.81	2.87	3.20	14.49
Summary Count	104	104	104	104
Total Count	104	104	104	104
	Pin Type 2: Ground			
Average	9.61	0.36	0.62	1.59
St. Dev.	1.25	0.32	0.72	1.88
Min	6.91	0.01	0.01	0.02
Max	11.88	1.97	5.95	10.01
Summary Count	88	88	88	88
Total Count	88	88	88	88

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**192**	**0**	**0**	**0**	**0**	**0**
Therm Shck	**191**	**1**	**0**	**0**	**0**	**0**
Humidity	**180**	**10**	**2**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Gas Tight:

1) A total of 104 signal and 88 ground 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

LLCR Measurement Summaries by Pin Type				
Date	5/30/2018	5/30/2018		
Room Temp (Deg C)	23	23	23	
Rel Humidity (%)	47	47		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Acid Vapor**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	13.47	0.38		
St. Dev.	2.20	0.38		
Min	9.94	0.00		
Max	18.46	2.03		
Summary Count	104	104		
Total Count	104	104		
	Pin Type 2: Ground			
Average	10.00	0.31		
St. Dev.	1.25	0.25		
Min	7.24	0.00		
Max	12.68	1.00		
Summary Count	88	88		
Total Count	88	88		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Acid Vapor	**192**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2018, Next Cal: 05/29/2019

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2018, Next Cal: 09/11/2019

Equipment #: THC-05
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 05 23 00 02
Accuracy: See Manual
… Last Cal: 11/14/2018, Next Cal: 11/14/2019

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnati Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 06/30/2018, Next Cal: 06/30/2019

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2018, Next Cal: 05/15/2019

Equipment #: OV-05
Description: Forced Air Oven, 5 Cu. Ft., 120 V (Chamber Room)
Manufacturer: Sheldon Mfg.
Model: CE5F
Serial #: 02008008
Accuracy: +/- 5 deg. C
… Last Cal: 02/05/2018, Next Cal: 02/05/2019

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 09/11/2018, Next Cal: 09/11/2019

Equipment #: PS-02
Description: Power Supply
Manufacturer: Hewlett-Packer
Model: 6033A
Serial #: N/A
Accuracy: See Manual
… Last Cal: NOT CALIBRATED