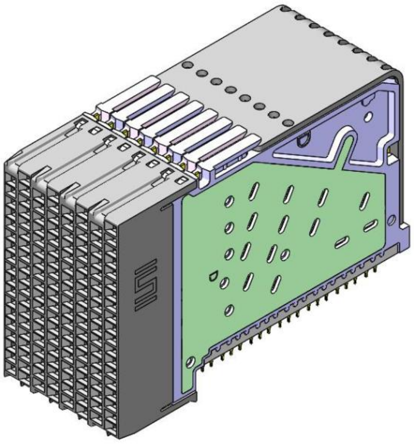
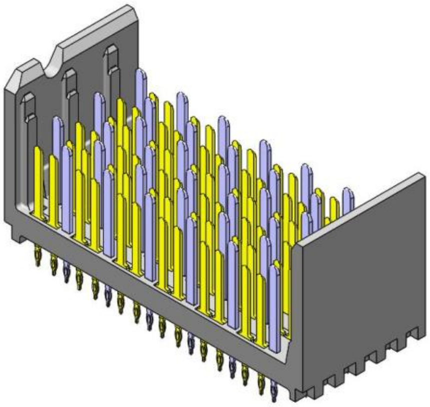
Project Number: Design Qualification Test Report	Tracking Code: 1922151_Report_Rev_1
Requested by: Corey Rose	Date: 3/9/2021
Part #: HDTF-6-08-S-RA-HS-100/HDTM-6-08-1-S-VT-0-1	Tech: John Crawford
Part description: HDTF/HDTM	Qty to test: 60
Test Start: 02/03/2020	Test Completed: 02/24/2020





DESIGN QUALIFICATION TEST REPORT

HDTF/HDTM
HDTF-6-08-S-RA-HS-100/HDTM-6-08-1-S-VT-0-1

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
03/05/2020	**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.

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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 and DWV/IR 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-108451-TST, PCB-108453-TST.

FLOWCHARTS

Gas Tight

Group 1
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
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-6-08-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 = 65 g

Group 2
HDTF-6-08-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 = 65 g

Group 3
HDTF-6-08-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 = 65 g

Group 4
HDTF-6-08-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 = 65 g

Group 5
HDTF-6-08-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 = 65 g

Group 6
HDTF-6-08-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 = 65 g

Group 7
HDTF-6-08-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 = 65 g

Group 8
HDTF-6-08-S-RA-HS-100

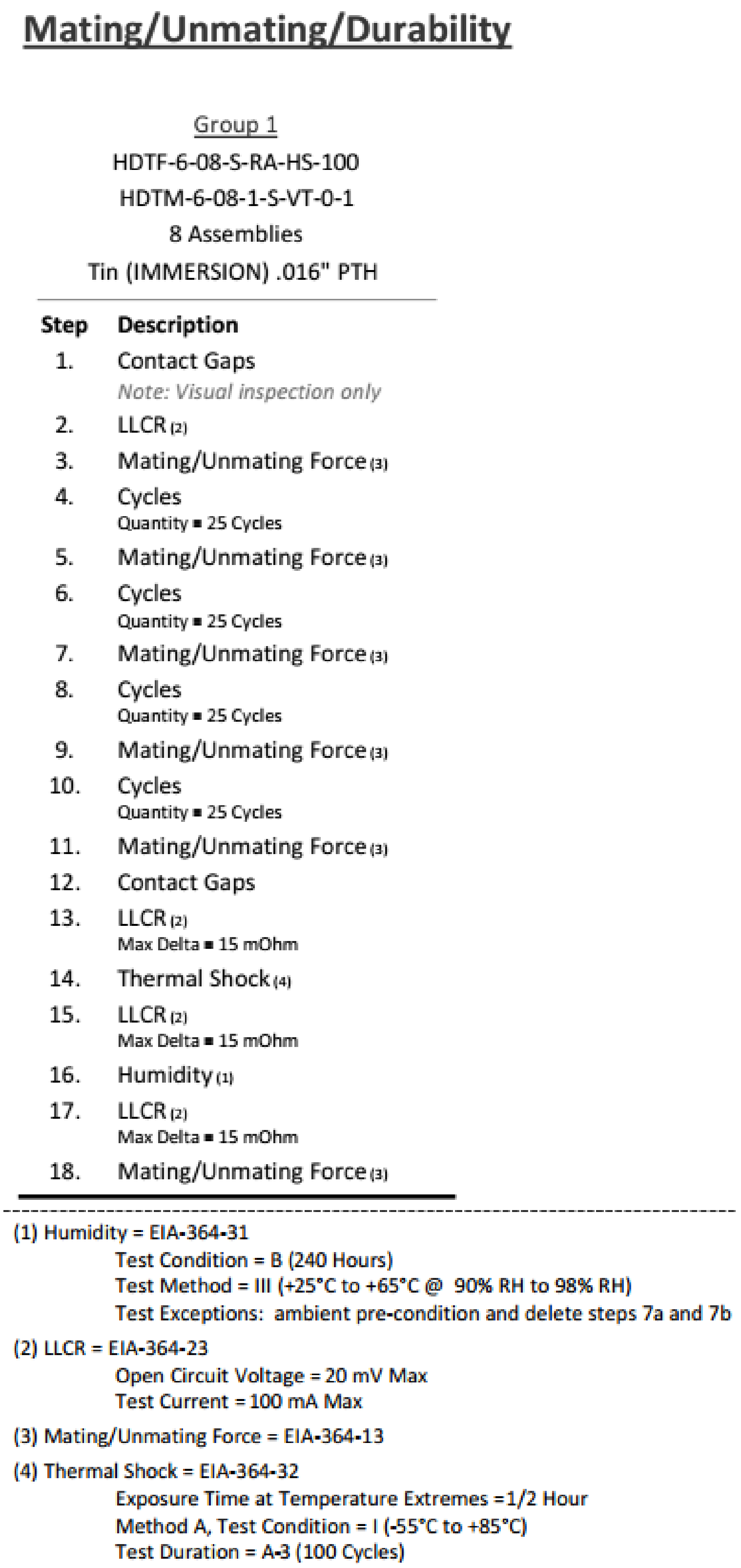
8 Contacts Minimum
Ground With Thermals Wafer B

Step	Description
1.	Thermal Age (2)
2.	Normal Force (1) Deflection = 0.0260 " Expected Force at Max Deflection = 65 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-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
8 Assemblies
Tin (IMMERSION) .016" PTH

Step	Description
1.	Contact Gaps *Note: Visual inspection only*
2.	LLCR (2)
3.	Mating/Unmating Force (3)
4.	Cycles Quantity ■ 25 Cycles
5.	Mating/Unmating Force (3)
6.	Cycles Quantity ■ 25 Cycles
7.	Mating/Unmating Force (3)
8.	Cycles Quantity ■ 25 Cycles
9.	Mating/Unmating Force (3)
10.	Cycles Quantity ■ 25 Cycles
11.	Mating/Unmating Force (3)
12.	Contact Gaps
13.	LLCR (2) Max Delta ■ 15 mOhm
14.	Thermal Shock (4)
15.	LLCR (2) Max Delta ■ 15 mOhm
16.	Humidity (1)
17.	LLCR (2) Max Delta ■ 15 mOhm
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)

FLOWCHARTS Continued

IR/DWV

Pin-to-Pin

Group 1
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
2 Assemblies
Tin (IMMERSION) .016" PTH

Step	Description
1.	IR (3)
2.	DWV at Test Voltage(1) - Non Standard Test Voltage = 750 V
3.	Thermal Shock (4)
4.	IR (3)
5.	DWV at Test Voltage(1) - Non Standard Test Voltage = 750 V
6.	Humidity (2)
7.	IR (3)
8.	DWV at Test Voltage(1) - Non Standard Test Voltage = 750 V

Pin-to-Ground

Group 2
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
2 Assemblies
Tin (IMMERSION) .016" PTH

Step	Description
1.	IR (3)
2.	DWV at Test Voltage(1) - Non Standard Test Voltage = 750 V
3.	Thermal Shock (4)
4.	IR (3)
5.	DWV at Test Voltage(1) - Non Standard Test Voltage = 750 V
6.	Humidity (2)
7.	IR (3)
8.	DWV at Test Voltage(1) - Non Standard Test Voltage = 750 V

---

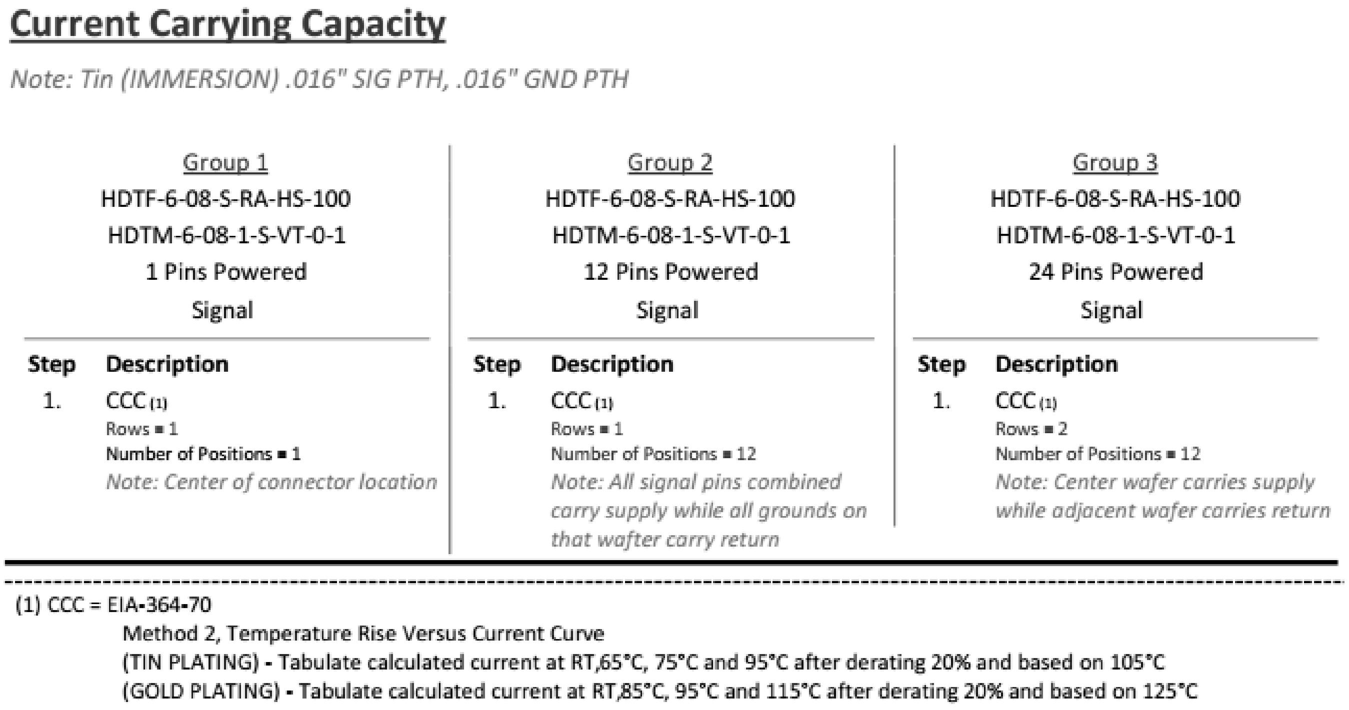
(1) DWV at Test Voltage = Other
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 750V
Test voltage applied for 60 seconds

(2) 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

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

(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



Current Carrying Capacity

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

Group 1
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
1 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 1 *Note: Center of connector location*

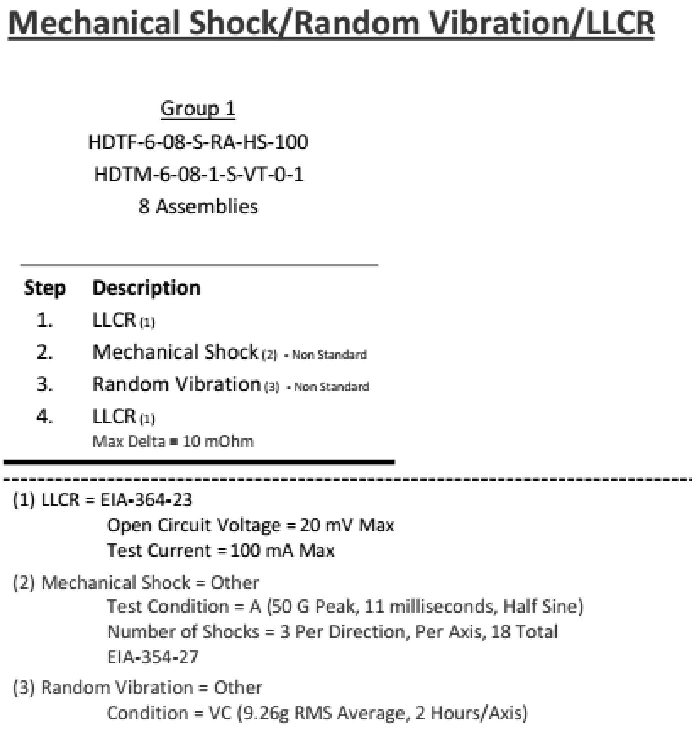
Group 2
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
12 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 12 *Note: All signal pins combined carry supply while all grounds on that wafter carry return*

Group 3
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
24 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 2 Number of Positions = 12 *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



Mechanical Shock/Random Vibration/LLCR

Group 1
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
8 Assemblies

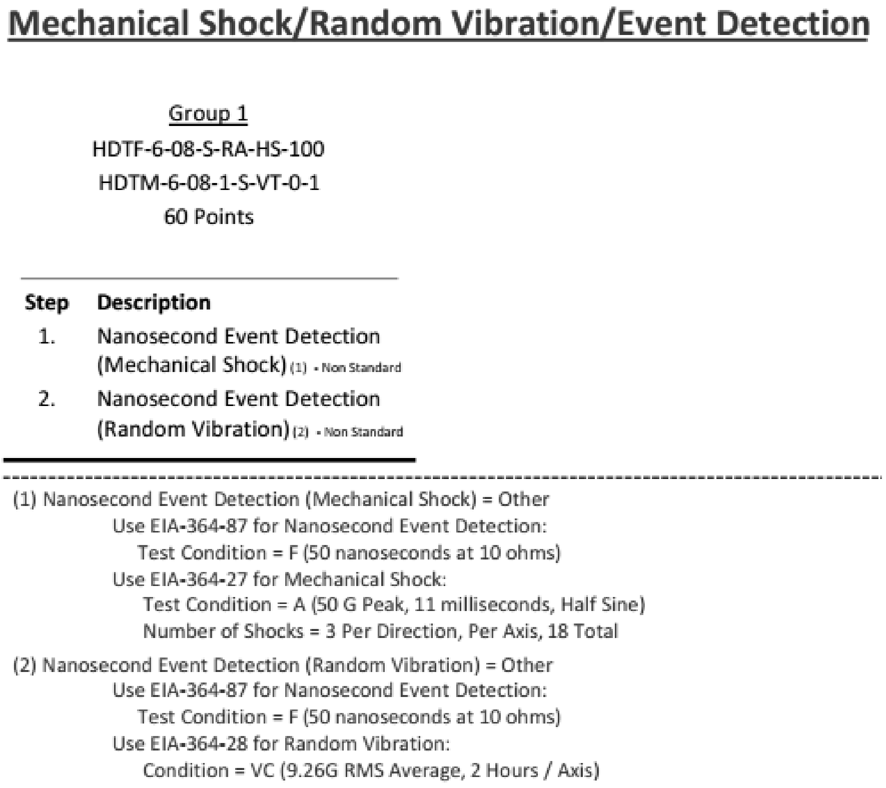
Step	Description
1.	LLCR (1)
2.	Mechanical Shock (2) - Non Standard
3.	Random Vibration (3) - Non Standard
4.	LLCR (1) Max Delta = 10 mOhm

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

(2) Mechanical Shock = Other
Test Condition = A (50 G Peak, 11 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total
EIA-354-27

(3) Random Vibration = Other
Condition = VC (9.26g RMS Average, 2 Hours/Axis)

FLOWCHARTS Continued



Mechanical Shock/Random Vibration/Event Detection

Group 1
HDTF-6-08-S-RA-HS-100
HDTM-6-08-1-S-VT-0-1
60 Points

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (1) - Non Standard
2.	Nanosecond Event Detection (Random Vibration) (2) - Non Standard

(1) Nanosecond Event Detection (Mechanical Shock) = Other
  Use EIA-364-87 for Nanosecond Event Detection:
    Test Condition = F (50 nanoseconds at 10 ohms)
  Use EIA-364-27 for Mechanical Shock:
    Test Condition = A (50 G Peak, 11 milliseconds, Half Sine)
    Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(2) Nanosecond Event Detection (Random Vibration) = Other
  Use EIA-364-87 for Nanosecond Event Detection:
    Test Condition = F (50 nanoseconds at 10 ohms)
  Use EIA-364-28 for Random Vibration:
    Condition = VC (9.26G RMS Average, 2 Hours / Axis)

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.

THERMAL:

1) EIA-364-17, *Temperature Life with or without Electrical Load Test Procedure for Electrical Connectors.*
2) Test Condition 4 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.

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.

MECHANICAL SHOCK (Specified Pulse):

1) Reference document: EIA-364-27, *Mechanical Shock Test Procedure for Electrical Connectors*
2) Test Condition C
3) Peak Value: 100 G
4) Duration: 6 Milliseconds
5) Wave Form: Half Sine
6) Velocity: 12.3 ft/s
7) Number of Shocks: 3 Shocks / Direction, 3 Axis (18 Total)

VIBRATION:

1) Reference document: EIA-364-28, *Vibration Test Procedure for Electrical Connectors*
2) Test Condition V, Letter B
3) Power Spectral Density: 0.04 G^2 / Hz
4) G ‘RMS’: 7.56
5) Frequency: 50 to 2000 Hz
6) Duration: 2.0 Hours per axis (3 axis total)

NANOSECOND-EVENT DETECTION:

1) Reference document: EIA-364-87, *Nanosecond-Event Detection for Electrical Connectors*
2) Prior to test, the samples were characterized to assure the low nanosecond event being monitored will trigger the detector.
3) After characterization it was determined the test samples could be monitored for 50 nanosecond events

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes.

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.

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. 85^{o} C
    c. 95^{o} C
    d. 115^{o} C
8) Typically, neighboring contacts (in close proximity to maximize heat buildup) 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.

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 +1000 mOhms: ------------------ Unstable
    f. >+1000 mOhms:---------------------------- Open Failure

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes.

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 +1000 mOhms: ------------------ Unstable
    f. >+1000 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 inch 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.

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 printout will be stored with the Tracking Code paperwork.

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 1000 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 dielectric withstanding voltage shall be recorded as 750VAC.
    b. 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----------4.1 A per contact with 1 contacts (1x1) powered**
- **CCC for a 30°C Temperature Rise----------15.1 A with 12 contacts powered (Signals Carry Supply/Grounds Carry Return)**
- **CCC for a 30°C Temperature Rise---------- 21.3 A with 36 contacts powered (Center Wafer Carries Supply/Adjacent Wafer Carries Return)**

Mating – Unmating Forces

Mating-Unmating Durability Group

- **Initial**
  - **Mating**
    - **Min -------------------------------------12.88 Lbs**
    - **Max-------------------------------------14.62 Lbs**
  - **Unmating**
    - **Min -------------------------------------10.21 Lbs**
    - **Max-------------------------------------12.90 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min -------------------------------------15.22 Lbs**
    - **Max-------------------------------------17.01 Lbs**
  - **Unmating**
    - **Min -------------------------------------11.04 Lbs**
    - **Max-------------------------------------13.78 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min -------------------------------------15.35 Lbs**
    - **Max-------------------------------------16.60 Lbs**
  - **Unmating**
    - **Min -------------------------------------11.42 Lbs**
    - **Max-------------------------------------13.83 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min -------------------------------------14.80 Lbs**
    - **Max-------------------------------------16.34 Lbs**
  - **Unmating**
    - **Min -------------------------------------11.73 Lbs**
    - **Max-------------------------------------14.01 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min -------------------------------------15.21 Lbs**
    - **Max-------------------------------------16.15 Lbs**
  - **Unmating**
    - **Min -------------------------------------11.98 Lbs**
    - **Max-------------------------------------14.20 Lbs**
- **Humidity**
  - **Mating**
    - **Min -------------------------------------- 9.96 Lbs**
    - **Max-------------------------------------11.38 Lbs**
  - **Unmating**
    - **Min -------------------------------------- 7.80 Lbs**
    - **Max-------------------------------------- 9.30 Lbs**

RESULTS Continued

Normal Force deflection

Signal-Wafer A Type at 0.0233 inch

- **Initial**
  - **Min---68.00 gf Set ----- 0.0010 in**
  - **Max --73.80 gf Set ----- 0.0016 in**
- **Thermal**
  - **Min---64.90 gf Set----- 0.0008 in**
  - **Max --69.00 gf Set----- 0.0021 in**

Signal-Wafer B Type at 0.0233 inch

- **Initial**
  - **Min---69.20 gf Set ----- 0.0011 in**
  - **Max --75.50 gf Set ----- 0.0014 in**
- **Thermal**
  - **Min---61.20 gf Set ----- 0.0021 in**
  - **Max --69.20 gf Set ----- 0.0032 in**

Ground-Wafer A Type at 0.026 inch

- **Initial**
  - **Min---58.10 gf Set ----- 0.0002 in**
  - **Max --61.90 gf Set ----- 0.0015 in**
- **Thermal**
  - **Min---54.40 gf Set ----- 0.0012 in**
  - **Max --62.10 gf Set ----- 0.0026 in**

Ground-Wafer B Type at 0.026 inch

- **Initial**
  - **Min---56.10 gf Set ----- 0.0012 in**
  - **Max --69.50 gf Set ----- 0.0018 in**
- **Thermal**
  - **Min---50.90 gf Set ----- 0.0026 in**
  - **Max --58.30 gf Set ----- 0.0046 in**

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 --- 1000 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 ---17700 Meg Ω ------------------------ Passed**
  - **Unmated ---12500 Meg Ω ------------------------ Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **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**

LLCR Gas Tight Group (192 LLCR test points)

Signal Pin:

- **Initial -- 25.91 mOhms Max**

Ground Pin:

- **Initial -- 16.33 mOhms Max**
- **Gas-Tight**
  - **<= +5.0 mOhms ----------------------------------- 192 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 +1000 mOhms --------------------------------0 Points ------------------------ Unstable**
  - **>+1000 mOhms --0 Points ------------------------ Open Failure**

RESULTS Continued

LLCR Mating/Unmating Durability Group (192 LLCR test points)

Signal Pin:

- Initial -- 26.13 mOhms Max

Ground Pin:

- Initial -- 15.68 mOhms Max
- Durability, 100 Cycles
  - <= +5.0 mOhms ------------------------------------ 192 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 +1000 mOhms--------------------------------0 Points ------------------------ Unstable
  - >+1000 mOhms --0 Points ------------------------ Open Failure
- Thermal Shock
  - <= +5.0 mOhms ------------------------------------ 192 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 +1000 mOhms--------------------------------0 Points ------------------------ Unstable
  - >+1000 mOhms --0 Points ------------------------ Open Failure
- Humidity
  - <= +5.0 mOhms ------------------------------------ 169 Points ------------------------ Stable
  - +5.1 to +10.0 mOhms -------------------------------- 23 Points ------------------------ Minor
  - +10.1 to +15.0 mOhms --------------------------------0 Points ------------------------ Acceptable
  - +15.1 to +50.0 mOhms --------------------------------0 Points ------------------------ Marginal
  - +50.1 to +1000 mOhms--------------------------------0 Points ------------------------ Unstable
  - >+1000 mOhms --0 Points ------------------------ Open Failure

LLCR Shock & Vibration Group (192 LLCR test points)

Signal Pin:

- Initial -- 26.56 mOhms Max

Ground Pin:

- Initial -- 15.69 mOhms Max
- Shock &Vibration
  - <= +5.0 mOhms ------------------------------------ 192 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 +1000 mOhms--------------------------------0 Points ------------------------ Unstable
  - >+1000 mOhms --0 Points ------------------------ Open Failure

Mechanical Shock & Random Vibration:

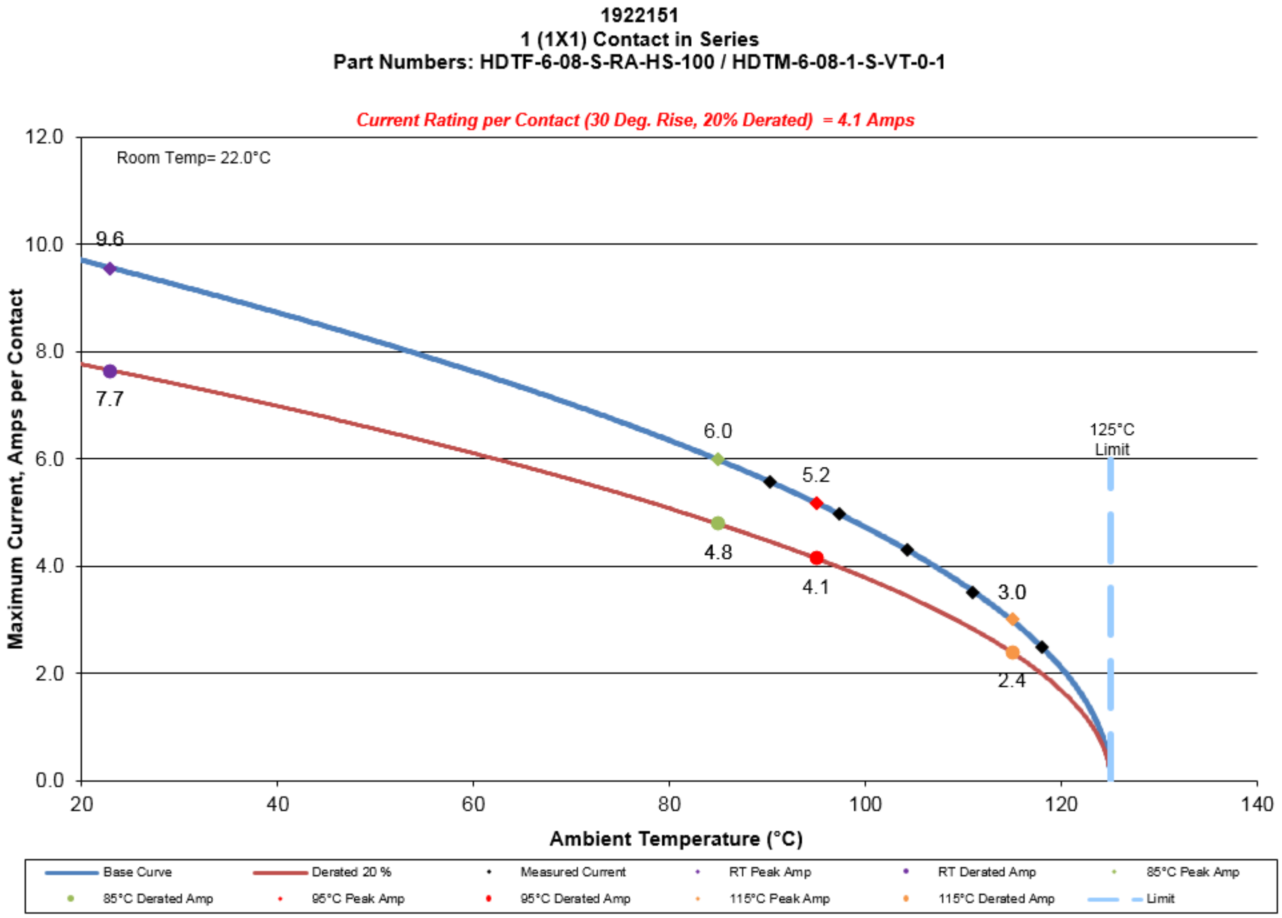
- Shock
  - No Damage----------------------------------- --------------------------------- Passed
  - 50 Nanoseconds----------------------------- --------------------------------- Passed
- Vibration
  - No Damage----------------------------------- --------------------------------- Passed
  - 50 Nanoseconds----------------------------- --------------------------------- Passed

DATA SUMMARIES

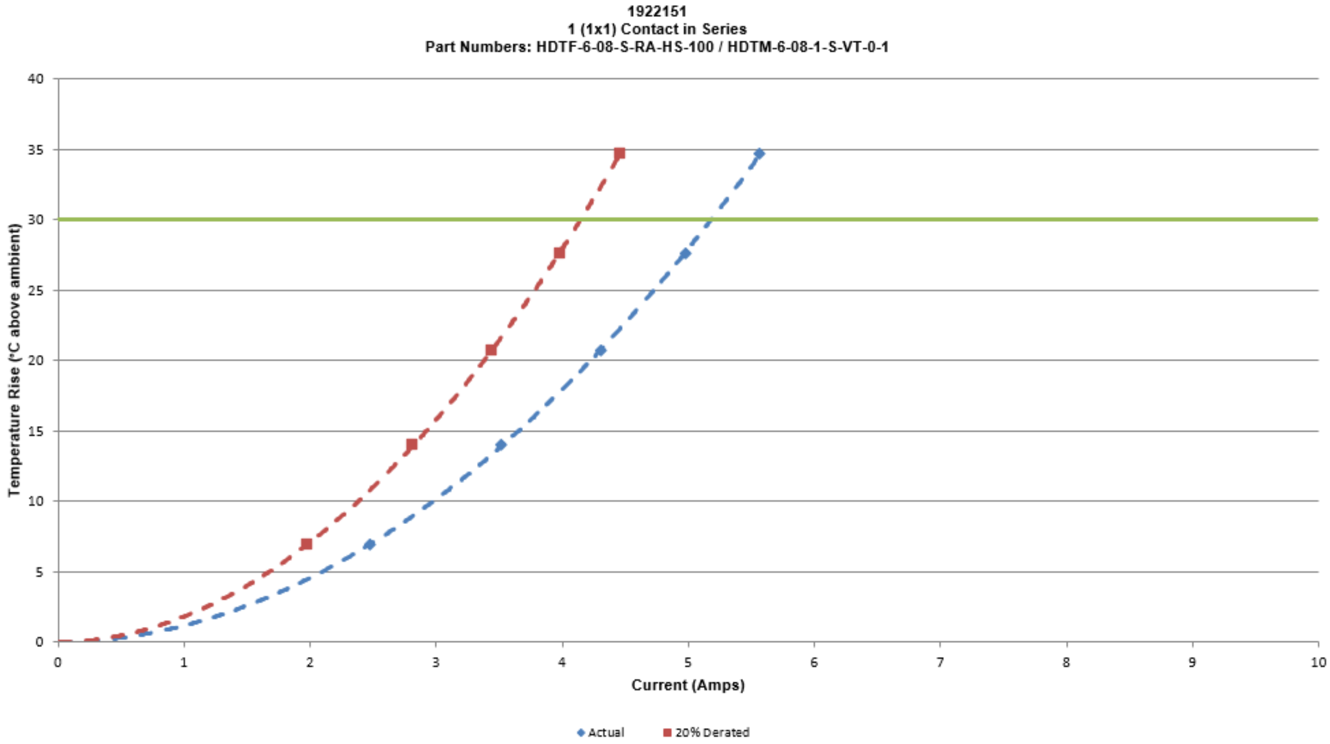
TEMPERATURE RISE (Current Carrying Capacity, CCC):

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

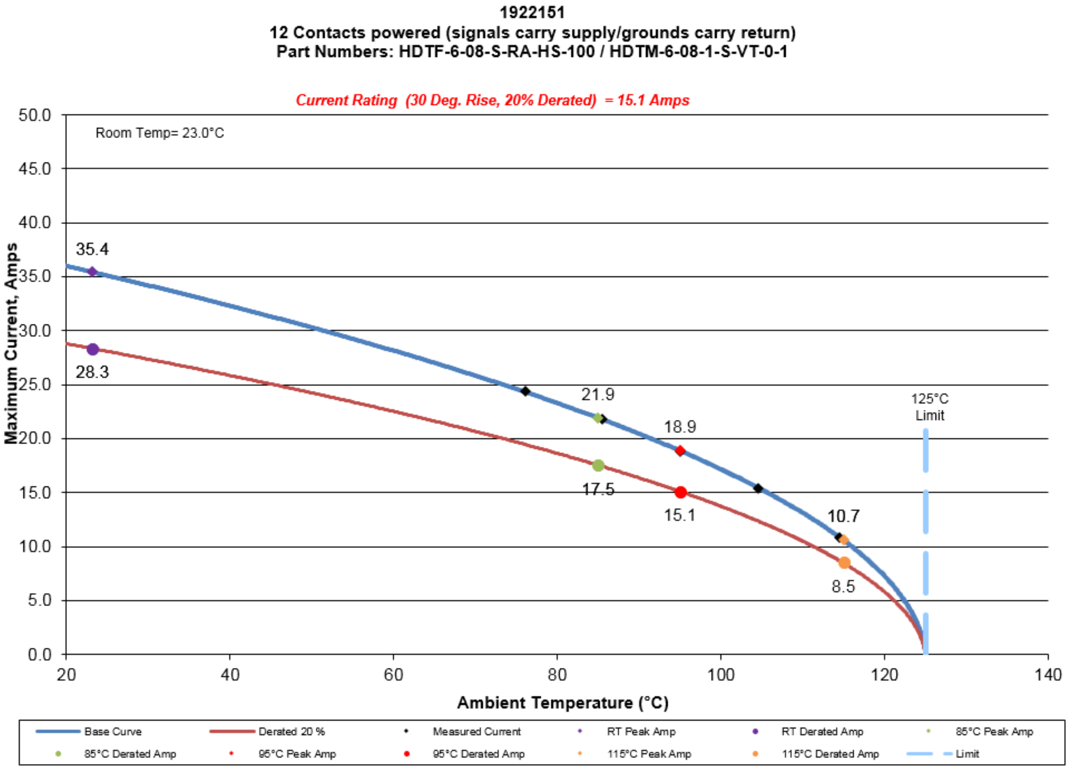


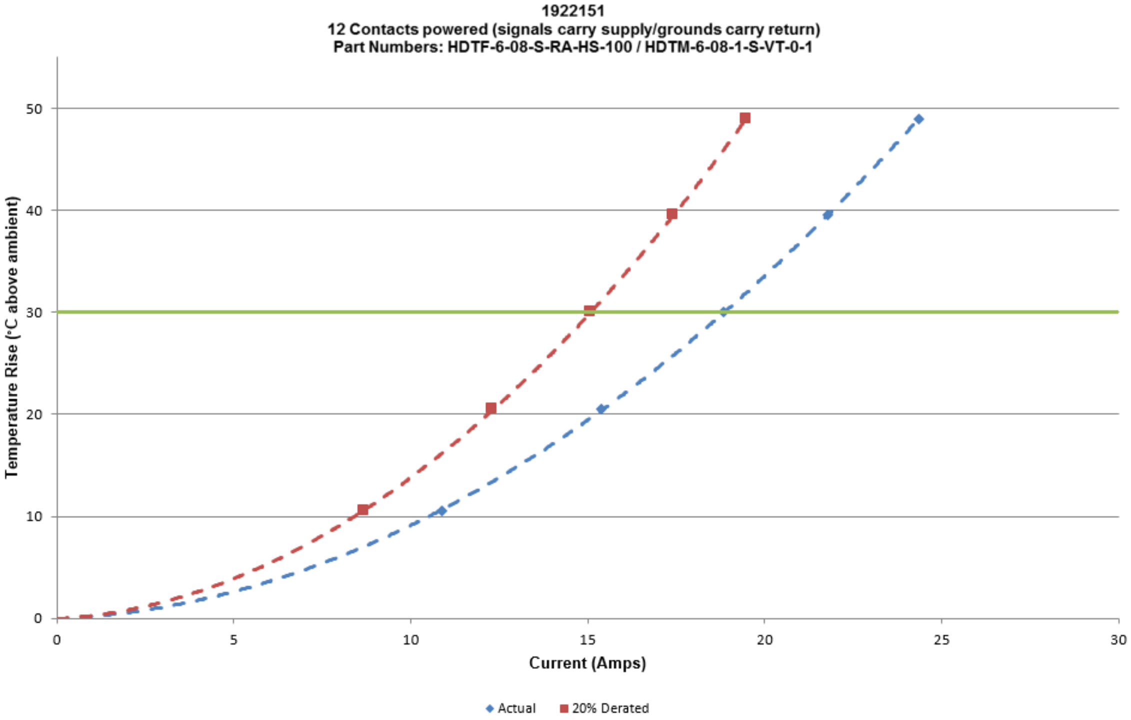
DATA SUMMARIES Continued



DATA SUMMARIES Continued

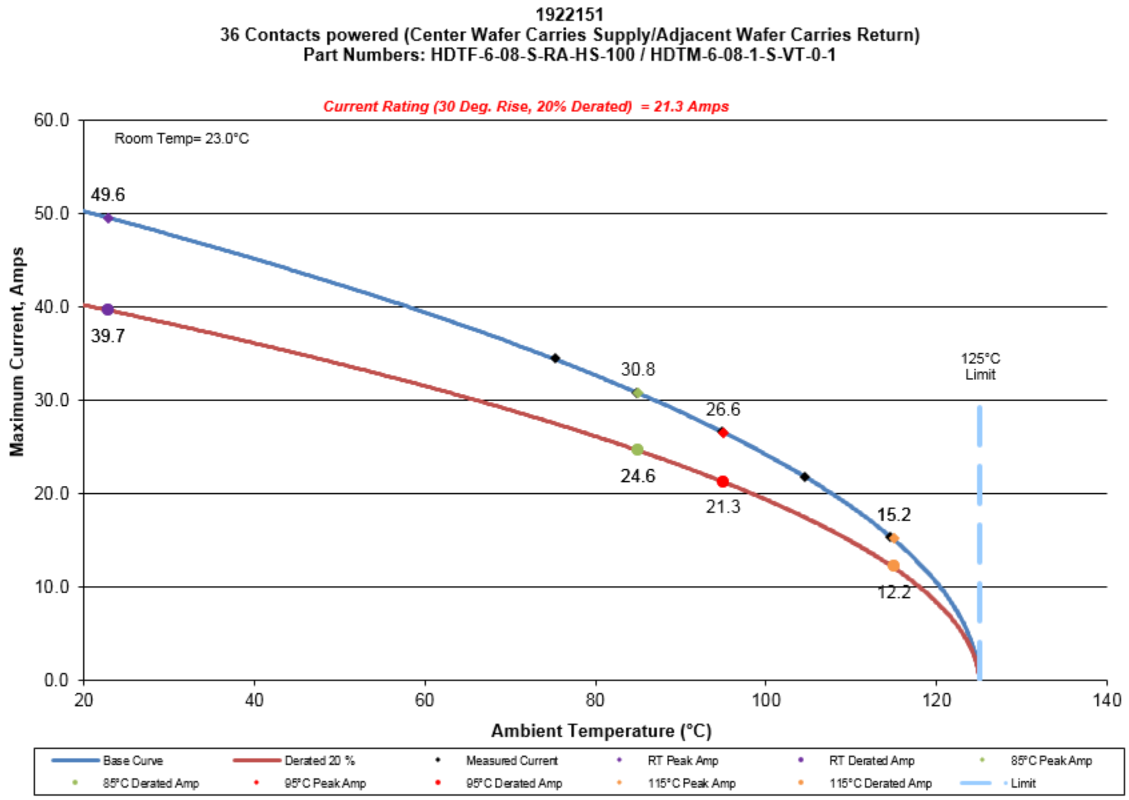
b. 12 Contacts powered (signals carry supply/grounds carry return)


1922151
12 Contacts powered (signals carry supply/grounds carry return)
Part Numbers: HDTF-6-08-S-RA-HS-100 / HDTM-6-08-1-S-VT-0-1

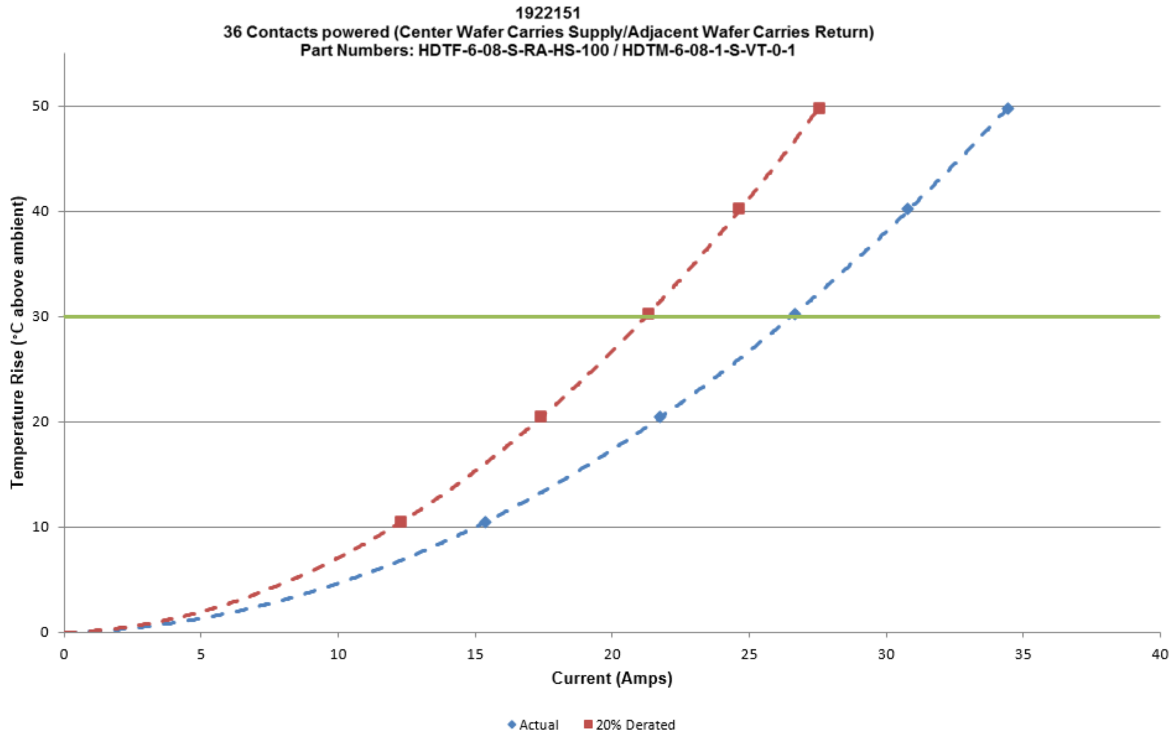

1922151
12 Contacts powered (signals carry supply/grounds carry return)
Part Numbers: HDTF-6-08-S-RA-HS-100 / HDTM-6-08-1-S-VT-0-1

DATA SUMMARIES Continued

c. 36 Contacts powered (Center Wafer Carries Supply/Adjacent Wafer Carries Return)


1922151
36 Contacts powered (Center Wafer Carries Supply/Adjacent Wafer Carries Return)
Part Numbers: HDTF-6-08-S-RA-HS-100 / HDTM-6-08-1-S-VT-0-1

Current Rating (30 Deg. Rise, 20% Derated) = 21.3 Amps


1922151
36 Contacts powered (Center Wafer Carries Supply/Adjacent Wafer Carries Return)
Part Numbers: HDTF-6-08-S-RA-HS-100 / HDTM-6-08-1-S-VT-0-1

DATA SUMMARIES Continued

MATING-UNMATING FORCE:

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	57.28	12.88	45.43	10.21	67.69	15.22	49.12	11.04
Maximum	65.03	14.62	57.39	12.90	75.64	17.01	61.31	13.78
Average	62.27	**14.00**	51.86	**11.66**	73.03	**16.42**	55.99	**12.59**
St Dev	2.71	0.61	3.89	0.87	2.59	0.58	4.02	0.90
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	68.29	15.35	50.80	11.42	65.82	14.80	52.19	11.73
Maximum	73.84	16.60	61.50	13.83	72.69	16.34	62.30	14.01
Average	70.92	**15.94**	56.74	**12.76**	70.12	**15.76**	57.89	**13.01**
St Dev	2.03	0.46	3.46	0.78	2.28	0.51	3.16	0.71
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	67.64	15.21	53.28	11.98	44.28	9.96	34.68	7.80
Maximum	71.85	16.15	63.14	14.20	50.61	11.38	41.38	9.30
Average	70.50	**15.85**	58.63	**13.18**	48.19	**10.83**	38.96	**8.76**
St Dev	1.54	0.35	3.13	0.70	1.88	0.42	2.12	0.48
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued

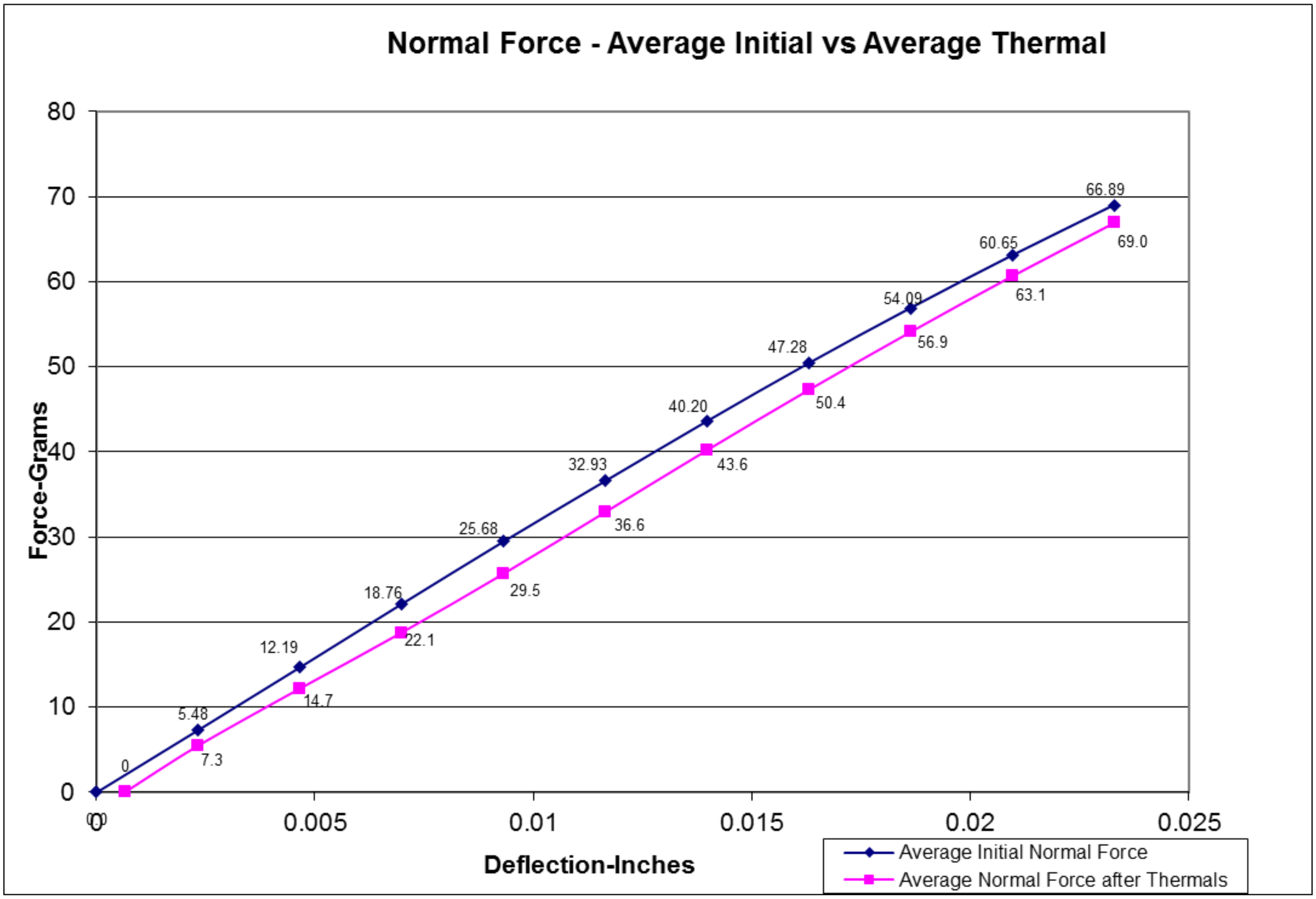
NORMAL FORCE (FOR CONTACTS TESTED OUT THE HOUSING):

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 A Wafer

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	7.33	14.70	22.14	29.46	36.58	43.60	50.41	56.89	63.08	68.98	0.0014
Min	6.70	13.60	21.20	28.70	35.90	43.00	49.70	56.10	62.30	68.00	0.0010
Max	8.20	15.20	22.60	29.90	37.40	45.10	52.50	59.90	66.80	73.80	0.0016
St. Dev	0.480	0.529	0.450	0.389	0.456	0.682	0.881	1.247	1.523	1.965	0.0002
Count	8	8	8	8	8	8	8	8	8	8	8

After Thermals	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	5.48	12.19	18.76	25.68	32.93	40.20	47.28	54.09	60.65	66.89	0.0013
Min	2.30	9.70	16.60	23.10	29.80	37.40	44.60	51.70	58.40	64.90	0.0008
Max	7.50	14.40	21.20	28.60	35.70	42.80	49.80	56.40	62.80	69.00	0.0021
St. Dev	1.986	1.912	1.948	2.058	2.115	1.888	1.753	1.624	1.450	1.399	0.0005
Count	8	8	8	8	8	8	8	8	8	8	8

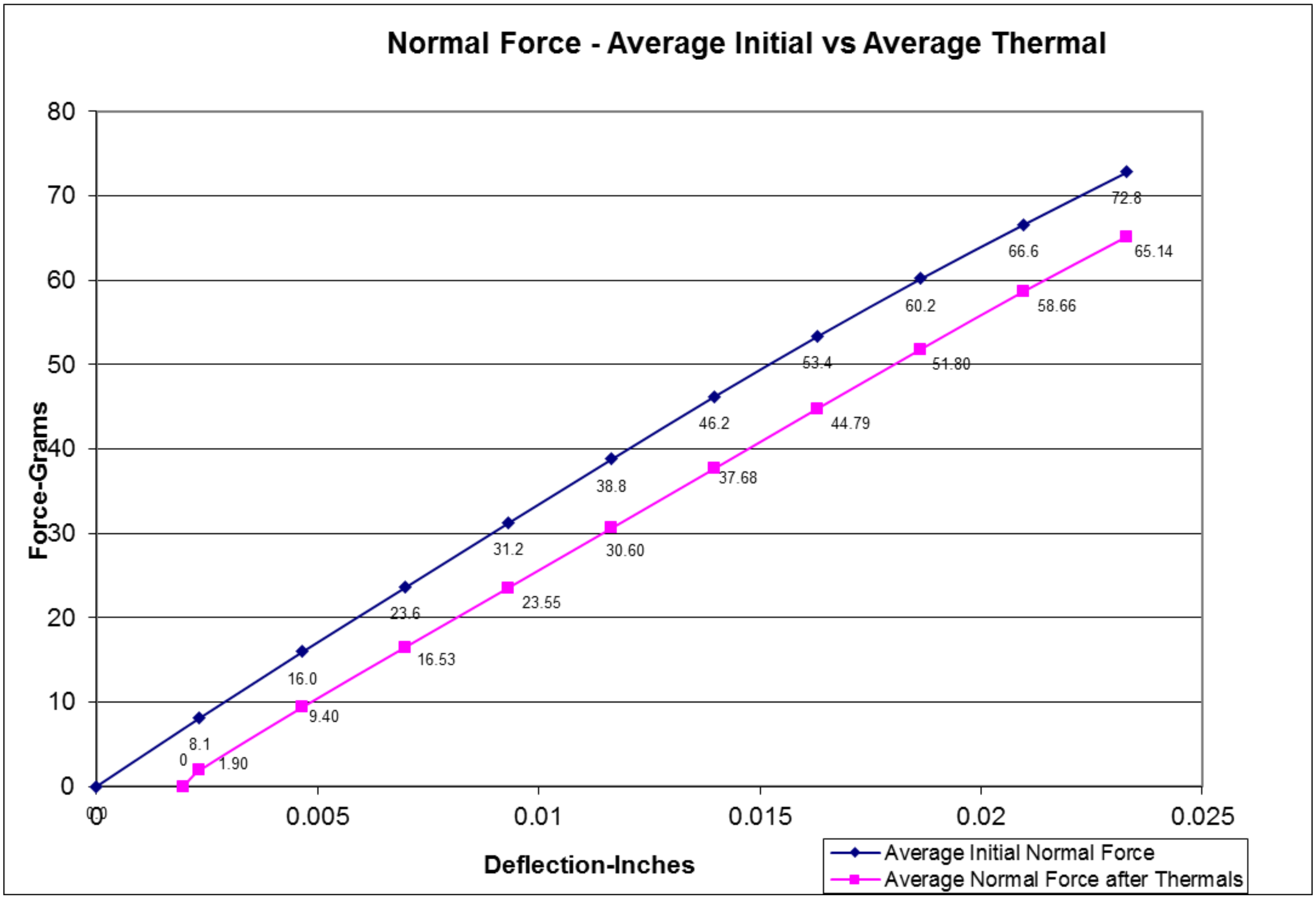


DATA SUMMARIES Continued

Signal B Wafer

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	8.10	15.96	23.60	31.24	38.79	46.24	53.36	60.18	66.61	72.81	0.0012
Min	7.80	15.20	22.50	29.80	36.90	44.00	50.70	57.40	63.40	69.20	0.0011
Max	8.40	16.80	24.50	32.30	40.30	48.00	55.40	62.50	69.20	75.50	0.0014
St. Dev	0.267	0.521	0.741	0.896	1.189	1.359	1.545	1.632	1.826	1.952	0.0001
Count	8	8	8	8	8	8	8	8	8	8	8

After Thermals	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	1.90	9.40	16.53	23.55	30.60	37.68	44.79	51.80	58.66	65.14	0.0025
Min	0.40	7.70	15.00	21.80	28.20	34.40	41.30	48.00	54.90	61.20	0.0021
Max	3.90	11.30	18.90	25.70	32.10	40.20	48.00	55.30	62.50	69.20	0.0032
St. Dev	1.187	1.159	1.202	1.189	1.477	2.039	2.395	2.658	2.743	2.760	0.0004
Count	8	8	8	8	8	8	8	8	8	8	8

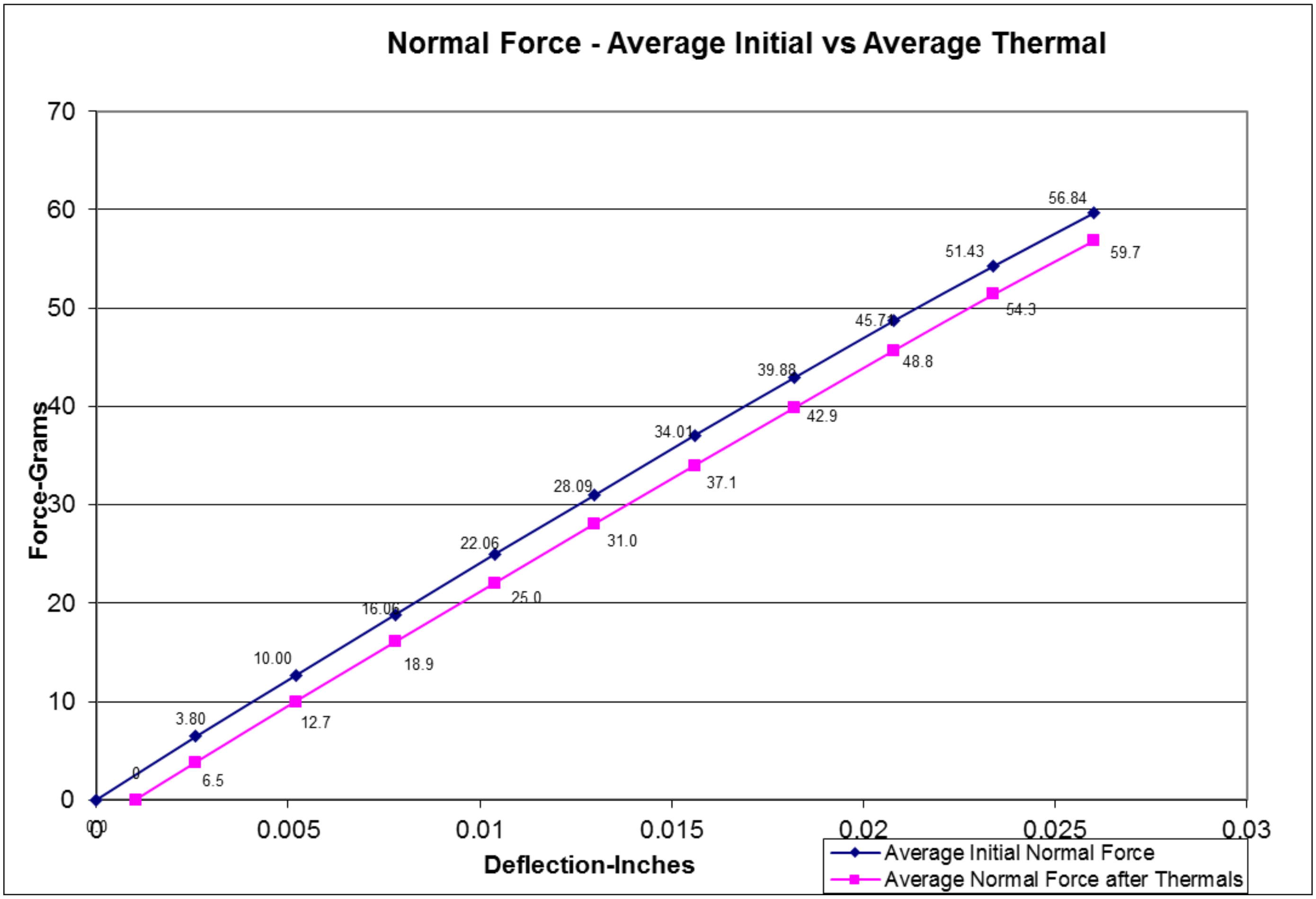


DATA SUMMARIES Continued

Ground A Wafer

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	6.45	12.66	18.86	25.03	31.01	37.09	42.94	48.75	54.30	59.66	0.0011
Min	5.80	11.60	17.50	23.60	29.50	35.70	41.80	47.50	53.00	58.10	0.0002
Max	7.20	13.70	19.90	25.90	32.00	38.10	43.90	50.20	56.10	61.90	0.0015
St. Dev	0.393	0.619	0.847	0.886	0.919	0.931	0.888	0.994	1.192	1.434	0.0006
Count	8	8	8	8	8	8	8	8	8	8	8

After Thermals	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	3.80	10.00	16.06	22.06	28.09	34.01	39.88	45.71	51.43	56.84	0.0019
Min	2.10	8.30	13.90	19.60	26.00	32.30	38.20	43.80	49.20	54.40	0.0012
Max	5.90	12.60	19.10	25.40	31.40	37.10	43.60	49.90	56.30	62.10	0.0026
St. Dev	1.254	1.420	1.659	1.912	1.990	1.964	1.996	2.039	2.255	2.411	0.0005
Count	8	8	8	8	8	8	8	8	8	8	8

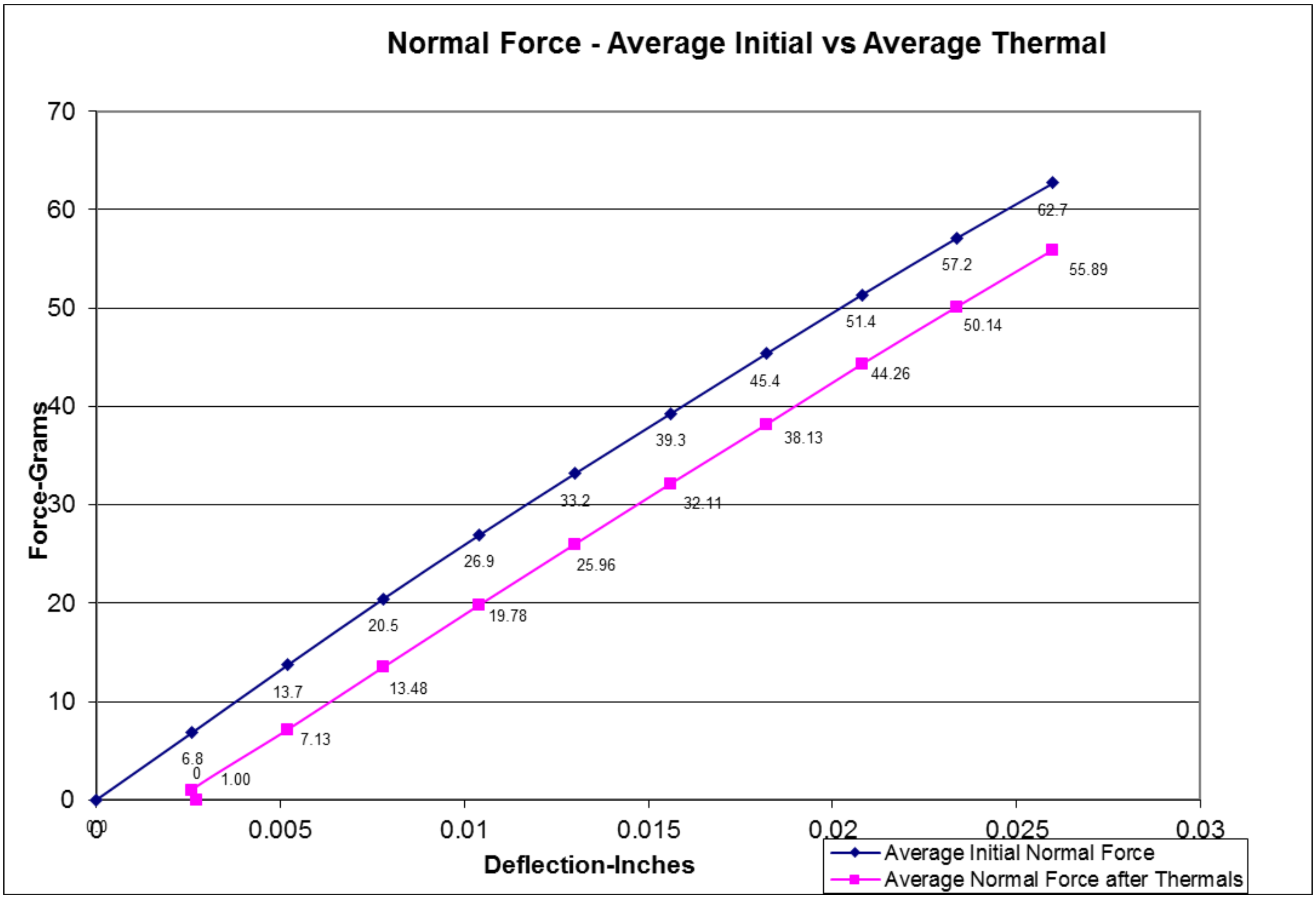


DATA SUMMARIES Continued

Ground B Wafer

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	6.84	13.71	20.45	26.91	33.16	39.26	45.35	51.35	57.16	62.71	0.0016
Min	6.10	12.30	18.40	24.50	30.30	35.80	41.30	46.50	51.40	56.10	0.0012
Max	7.30	14.40	22.00	29.30	36.40	43.50	50.10	56.70	63.40	69.50	0.0018
St. Dev	0.362	0.656	1.036	1.443	1.860	2.405	2.773	3.277	3.754	4.224	0.0002
Count	8	8	8	8	8	8	8	8	8	8	8

After Thermals	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	1.00	7.13	13.48	19.78	25.96	32.11	38.13	44.26	50.14	55.89	0.0032
Min	0.00	2.40	8.50	14.40	20.30	26.60	32.90	39.00	44.80	50.90	0.0026
Max	2.50	9.40	15.90	22.20	28.30	34.40	40.60	46.90	52.80	58.30	0.0046
St. Dev	1.003	2.331	2.602	2.799	2.902	2.766	2.609	2.608	2.591	2.425	0.0007
Count	8	8	8	8	8	8	8	8	8	8	8



DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**HDTF/HDTM**	**HDTF**	**HDTM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	1000	5000	45000

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**HDTF/HDTM**	**HDTF**	**HDTM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	17700	12500	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**A Wafer/B Wafer**
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 Mating/Unmating Durability Group

1). A total of 192 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 +1000 mOhms -------------------------Unstable
    f. > +1000 mOhms:---------------------------------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	4/26/2019	5/2/2019	5/7/2019	5/17/2019
Room Temp (Deg C)	23	23	22	23
Rel Humidity (%)	44	49	44	48
Technician	John Crawford	John Crawford	John Crawford	John Crawford
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	18.86	0.19	0.28	0.36
St. Dev.	5.74	0.21	0.22	0.54
Min	9.19	0.00	0.00	0.01
Max	26.13	1.72	1.00	4.85
Summary Count	128	128	128	128
Total Count	128	128	128	128
	Pin Type 2: Ground			
Average	11.45	0.25	0.26	0.32
St. Dev.	2.95	0.27	0.21	0.37
Min	7.26	0.00	0.02	0.01
Max	15.68	1.50	0.98	2.17
Summary Count	64	64	64	64
Total Count	64	64	64	64

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	**192**	**0**	**0**	**0**	**0**	**0**
Humidity	**192**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Gas Tight Group

1) A total of 192 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 +1000 mOhms: -----------------------Unstable
    f. >+1000 mOhms:---------------------------------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	4/4/2019	4/10/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	38	39		
Technician	John Crawford	John Crawford		
mOhm values	**Actual Initial**	**Delta Acid Vapor**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	18.55	0.43		
St. Dev.	5.70	0.46		
Min	8.81	0.01		
Max	25.91	2.62		
Summary Count	128	128		
Total Count	128	128		
	Pin Type 2: Ground			
Average	11.29	0.29		
St. Dev.	3.01	0.21		
Min	6.70	0.00		
Max	16.33	0.97		
Summary Count	64	64		
Total Count	64	64		

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**

DATA SUMMARIES Continued

LLCR Shock & Vibration Group

1) A total of 192 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 +1000 mOhms --------------------------Unstable
    f. >+1000 mOhms: -----------------------------------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	4/29/2019	5/3/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	46	47		
Technician	John Crawford	John Crawford		
mOhm values	**Actual Initial**	**Delta Shock-Vib**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	18.99	0.21		
St. Dev.	5.69	0.25		
Min	9.30	0.00		
Max	26.56	1.40		
Summary Count	128	128		
Total Count	128	128		
	Pin Type 2: Ground			
Average	11.42	0.23		
St. Dev.	2.98	0.16		
Min	7.04	0.00		
Max	15.69	0.70		
Summary Count	64	64		
Total Count	64	64		

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

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	60
Test Condition	C, 100g's, 6ms, Half-Sine
Shock Events	0
Test Condition	V-B, 7.56 rms g
Vibration Events	0
Total Events	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: 05/29/2019, Next Cal: 05/29/2020

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2019, Next Cal: 09/11/2020

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: 11/14/2019, Next Cal: 05/31/2020

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: 06/30/2019, Next Cal: 06/30/2020

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2019, Next Cal: 05/15/2020

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 04/22/2019, Next Cal: 04/22/2020

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/18/2019, Next Cal: 07/18/2020

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 10/31/2019, Next Cal: 10/31/2020