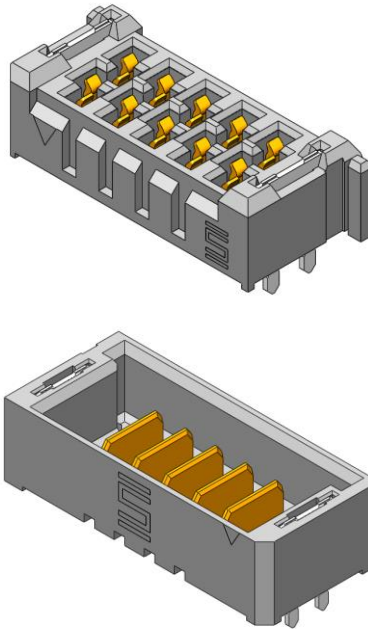




Project Number: Design Qualification Test Report	Tracking Code: 2050886_Report_Rev_2
Requested by: Leo Lee	Date: 11/18/2022
Part #: UMPS-05-03.5-G-V-S-W-XR/UMPT-05-01.5-G-V-S-W-XR	
Part description: UMPS/UMPT	Tech: Kason He
Test Start: 7/9/2019	Test Completed: 7/30/2019



DESIGN QUALIFICATION TEST REPORT

UMPS/UMPT

UMPS-05-03.5-G-V-S-W-XR/UMPT-05-01.5-G-V-S-W-XR

Tracking Code: 2050886_Report_Rev_2	Part #: UMPS-05-03.5-G-V-S-W-XR/UMPT-05-01.5-G-V-S-W-XR
Part description: UMPS/UMPT	

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
12/12/2019	1	Initial Issue	KH
11/18/2022	2	Update the part number	PC

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to ISO 10012-1 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) After soldering, the parts to be used for LLCR and DWV/IR testing were 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 and DWV/IR are 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-109409-TST/PCB-109410-TST/PCB-109419-TST/PCB-109420-TST/

FLOWCHARTS

Gas Tight

Group 1

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

8 Assemblies

Step	Description
------	-------------

- | | |
|----|---|
| 1. | LLCR ⁽²⁾ |
| 2. | Gas Tight ⁽¹⁾ |
| 3. | LLCR ⁽²⁾
Max Delta = 1 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

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

8 Contacts Minimum

Signal Without Thermals

Step	Description
------	-------------

- | | |
|----|---|
| 1. | Contact Gaps |
| 2. | Normal Force ⁽¹⁾
Deflection = 0.006 "
Expected Force at Max Deflection = 150 g |

Group 2

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

8 Contacts Minimum

Signal With Thermals

Step	Description
------	-------------

- | | |
|----|---|
| 1. | Contact Gaps |
| 2. | Thermal Age ⁽²⁾ |
| 3. | Contact Gaps |
| 4. | Normal Force ⁽¹⁾
Deflection = 0.006 "
Expected Force at Max Deflection = 150 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**Thermal Aging****Group 1**

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating/Unmating Force ⁽²⁾
3.	LLCR ⁽¹⁾
4.	Thermal Age ⁽³⁾
5.	LLCR ⁽¹⁾ Max Delta = 1 mOhm
6.	Mating/Unmating Force ⁽²⁾
7.	Contact Gaps

(1) LLCR = EIA-364-23

Open Circuit Voltage = 20 mV Max

Test Current = 100 mA Max

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

(3) Thermal Age = EIA-364-17

Test Condition = 4 (105°C)

Time Condition = B (250 Hours)

FLOWCHARTS Continued**Mating/Unmating/Durability**Group 1

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

8 Assemblies

Step	Description
1.	Contact Gaps
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 = 1 mOhm
14.	Thermal Shock ⁽⁴⁾
15.	LLCR ⁽²⁾ Max Delta = 1 mOhm
16.	Humidity ⁽¹⁾
17.	LLCR ⁽²⁾ Max Delta = 1 mOhm
18.	Mating/Unmating Force ⁽³⁾

Group 2

UMPS-02-03.5-G-V-S-W-XR

UMPT-02-01.5-G-V-S-W-XR

8 Assemblies

Step	Description
1.	Contact Gaps
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⁾

(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**

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

2 Assemblies

Group 2

UMPS-05-03.5-G-V-S-W-XR

2 Assemblies

Group 3

UMPT-05-01.5-G-V-S-W-XR

2 Assemblies

Group 4

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

2 Assemblies

Step	Description
1.	DWV Breakdown ⁽²⁾

Step	Description
1.	DWV Breakdown ⁽²⁾

Step	Description
1.	DWV Breakdown ⁽²⁾

Step	Description
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**Group 1

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

1 Pins Powered

Power

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

Group 2

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

2 Pins Powered

Power

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

Group 3

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

3 Pins Powered

Power

Step	Description
1.	CCC ⁽¹⁾ Rows = 1 Number of Positions = 3

Group 4

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

4 Pins Powered

Power

Step	Description
1.	CCC ⁽¹⁾ Rows = 1 Number of Positions = 4

Group 5

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

5 Pins Powered

Power

Step	Description
1.	CCC ⁽¹⁾ Rows = 1 Number of Positions = 5

(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

FLOWCHARTS Continued**Mechanical Shock/Random Vibration/LLCR**Group 1

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

8 Assemblies

Step Description

1. LLCR ⁽¹⁾
2. Mechanical Shock ⁽²⁾
3. Random Vibration ⁽³⁾
4. LLCR ⁽¹⁾
Max Delta = 1 mOhm

(1) LLCR = EIA-364-23

Open Circuit Voltage = 20 mV Max

Test Current = 100 mA Max

(2) Mechanical Shock = EIA-364-27

Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)

Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(3) Random Vibration = EIA-364-28

Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

Mechanical Shock/Random Vibration/Event DetectionGroup 1

UMPS-05-03.5-G-V-S-W-XR

UMPT-05-01.5-G-V-S-W-XR

32 Points

Step Description

1. Nanosecond Event Detection
(Mechanical Shock) ⁽¹⁾
2. Nanosecond Event Detection
(Random Vibration) ⁽²⁾

(1) Nanosecond Event Detection (Mechanical Shock)

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 = C (100 G Peak, 6 milliseconds, Half Sine)

Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(2) Nanosecond Event Detection (Random Vibration)

Use EIA-364-87 for Nanosecond Event Detection:

Test Condition = F (50 nanoseconds at 10 ohms)

Use EIA-364-28 for Random Vibration:

Condition = VB (7.56 gRMS 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 G² / 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

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 TC², computer controlled test stand with a deflection measurement system accuracy of 5.0 μ m (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 TC² software in order to acquire and record the test data.
- 10) The permanent set of each contact shall be measured within the TC² 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.

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. $\leq +0.33$ mOhms: -----Stable
 - b. $+0.33$ to $+0.66$ mOhms: -----Minor
 - c. $+0.67$ to $+1.00$ mOhms: -----Acceptable
 - d. $+1.01$ 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.

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° C
 - c. 95° C
 - d. 115° 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.

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. $\leq +0.33$ mOhms: -----Stable
 - b. $+0.33$ to $+0.66$ mOhms: -----Minor
 - c. $+0.67$ to $+1.00$ mOhms: -----Acceptable
 - d. $+1.01$ 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 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° 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-----17.5 A per contact with 1 contact (1x1) powered.
- CCC for a 30°C Temperature Rise-----16.3 A per contact with 2 contacts (1x2) powered.
- CCC for a 30°C Temperature Rise-----13.9 A per contact with 3 contacts (1x3) powered.
- CCC for a 30°C Temperature Rise-----13.2 A per contact with 4 contacts (1x4) powered.
- CCC for a 30°C Temperature Rise-----13.2 A per contact with 5 contacts (1x5) powered.

Mating – Unmating Forces

Thermal Aging Group

- Initial
 - Mating
 - Min ----- 3.55 Lbs
 - Max----- 4.22 Lbs
 - Unmating
 - Min ----- 2.27 Lbs
 - Max----- 2.91 Lbs
- After Thermal
 - Mating
 - Min ----- 1.72 Lbs
 - Max----- 2.11 Lbs
 - Unmating
 - Min ----- 1.34 Lbs
 - Max----- 1.80 Lbs

RESULTS Continued**Mating – Unmating Forces****Mating-Unmating Durability Group**

UMPS-05-03.5-G-V-S-W-XR/UMPT-05-01.5-G-V-S-W-XR

- **Initial**
 - **Mating**
 - **Min** ----- 3.03 Lbs
 - **Max** ----- 4.01 Lbs
 - **Unmating**
 - **Min** ----- 2.13 Lbs
 - **Max** ----- 2.52 Lbs
- **After 25 Cycles**
 - **Mating**
 - **Min** ----- 3.31 Lbs
 - **Max** ----- 4.12 Lbs
 - **Unmating**
 - **Min** ----- 2.66 Lbs
 - **Max** ----- 3.20 Lbs
- **After 50 Cycles**
 - **Mating**
 - **Min** ----- 3.43 Lbs
 - **Max** ----- 4.19 Lbs
 - **Unmating**
 - **Min** ----- 2.95 Lbs
 - **Max** ----- 3.59 Lbs
- **After 75 Cycles**
 - **Mating**
 - **Min** ----- 3.52 Lbs
 - **Max** ----- 4.45 Lbs
 - **Unmating**
 - **Min** ----- 3.16 Lbs
 - **Max** ----- 3.94 Lbs
- **After 100 Cycles**
 - **Mating**
 - **Min** ----- 3.64 Lbs
 - **Max** ----- 4.54 Lbs
 - **Unmating**
 - **Min** ----- 3.60 Lbs
 - **Max** ----- 4.31 Lbs
- **Humidity**
 - **Mating**
 - **Min** ----- 2.02 Lbs
 - **Max** ----- 2.38 Lbs
 - **Unmating**
 - **Min** ----- 1.62 Lbs
 - **Max** ----- 1.72 Lbs

RESULTS Continued**Mating-Unmating Basic Group**

UMPS-02-03.5-G-V-S-W-XR/UMPT-02-01.5-G-V-S-W-XR

- **Initial**
 - **Mating**
 - **Min** ----- **0.88 Lbs**
 - **Max** ----- **1.00 Lbs**
 - **Unmating**
 - **Min** ----- **0.42 Lbs**
 - **Max** ----- **0.55 Lbs**
- **After 25 Cycles**
 - **Mating**
 - **Min** ----- **0.80 Lbs**
 - **Max** ----- **0.87 Lbs**
 - **Unmating**
 - **Min** ----- **0.45 Lbs**
 - **Max** ----- **0.61 Lbs**
- **After 50 Cycles**
 - **Mating**
 - **Min** ----- **0.79 Lbs**
 - **Max** ----- **0.88 Lbs**
 - **Unmating**
 - **Min** ----- **0.45 Lbs**
 - **Max** ----- **0.66 Lbs**
- **After 75 Cycles**
 - **Mating**
 - **Min** ----- **0.80 Lbs**
 - **Max** ----- **0.90 Lbs**
 - **Unmating**
 - **Min** ----- **0.46 Lbs**
 - **Max** ----- **0.64 Lbs**
- **After 100 Cycles**
 - **Mating**
 - **Min** ----- **0.79 Lbs**
 - **Max** ----- **0.90 Lbs**
 - **Unmating**
 - **Min** ----- **0.47 Lbs**
 - **Max** ----- **0.64 Lbs**

RESULTS Continued**Normal Force at 0.0033-inch deflection**

- **Initial**
 - **Min**----- 119.80 gf **Set** ---- 0.0000 inch.
 - **Max**----- 154.50 gf **Set** ---- 0.0003 inch.
- **Thermal**
 - **Min**----- 51.00 gf **Set** ---- 0.0013 inch.
 - **Max**----- 122.10 gf **Set** ---- 0.0026 inch.

Insulation Resistance minimums, IR

- **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**----- 1285 VAC
 - **Test Voltage**----- 965 VAC
 - **Working Voltage**----- 320 VAC
- **Initial DWV** ----- Passed
- **Thermal DWV**----- Passed
- **Humidity DWV**----- Passed

RESULTS Continued**LLCR Thermal Aging Group (40 LLCR test points)**

- Initial ----- 1.09 mOhms Max
- Thermal
 - <= +0.33 mOhms ----- 40 Points ----- Stable
 - +0.34 to +0.66 mOhms ----- 0 Points ----- Minor
 - +0.67 to +1.0 mOhms ----- 0 Points ----- Acceptable
 - +1.01 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure

LLCR Gas Tight Group (40 LLCR test points)

- Initial ----- 1.12 mOhms Max
- Gas-Tight
 - <= +0.33 mOhms ----- 40 Points ----- Stable
 - +0.34 to +0.66 mOhms ----- 0 Points ----- Minor
 - +0.67 to +1.0 mOhms ----- 0 Points ----- Acceptable
 - +1.01 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure

LLCR Mating/Unmating Durability Group (40 LLCR test points)

- Initial ----- 1.09 mOhms Max
- Durability, 100 Cycles
 - <= +0.33 mOhms ----- 40 Points ----- Stable
 - +0.34 to +0.66 mOhms ----- 0 Points ----- Minor
 - +0.67 to +1.0 mOhms ----- 0 Points ----- Acceptable
 - +1.01 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure
- Thermal Shock
 - <= +0.33 mOhms ----- 40 Points ----- Stable
 - +0.34 to +0.66 mOhms ----- 0 Points ----- Minor
 - +0.67 to +1.0 mOhms ----- 0 Points ----- Acceptable
 - +1.01 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure
- Humidity
 - <= +0.33 mOhms ----- 40 Points ----- Stable
 - +0.34 to +0.66 mOhms ----- 0 Points ----- Minor
 - +0.67 to +1.0 mOhms ----- 0 Points ----- Acceptable
 - +1.01 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure

RESULTS Continued

LLCR Shock & Vibration (40 LLCR test points)

- Initial -----1.07 mOhms Max
- Shock & Vibration
 - <= +0.33 mOhms ----- 40 Points ----- Stable
 - +0.34 to +0.66 mOhms ----- 0 Points ----- Minor
 - +0.67 to +1.0 mOhms ----- 0 Points ----- Acceptable
 - +1.01 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure

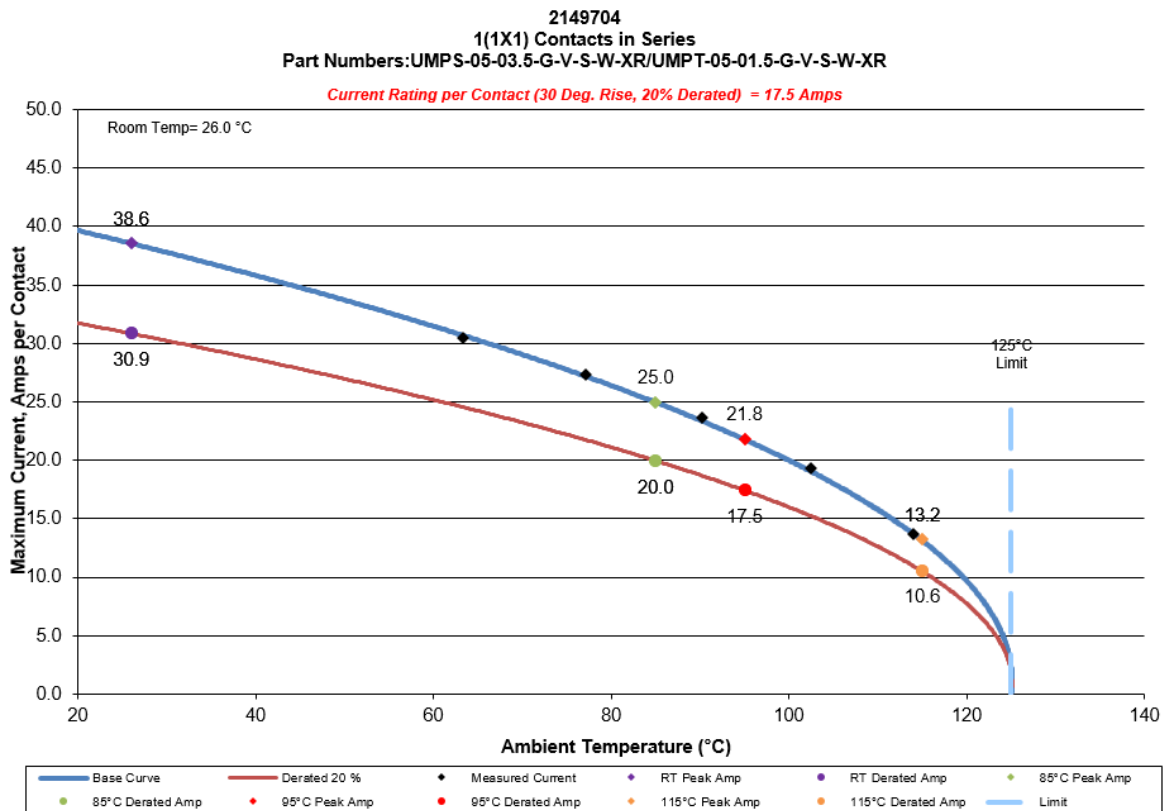
Mechanical Shock & Random Vibration:

- Shock
 - No Damage----- Pass
 - 50 Nanoseconds ----- Pass
- Vibration
 - No Damage----- Pass
 - 50 Nanoseconds ----- Pass

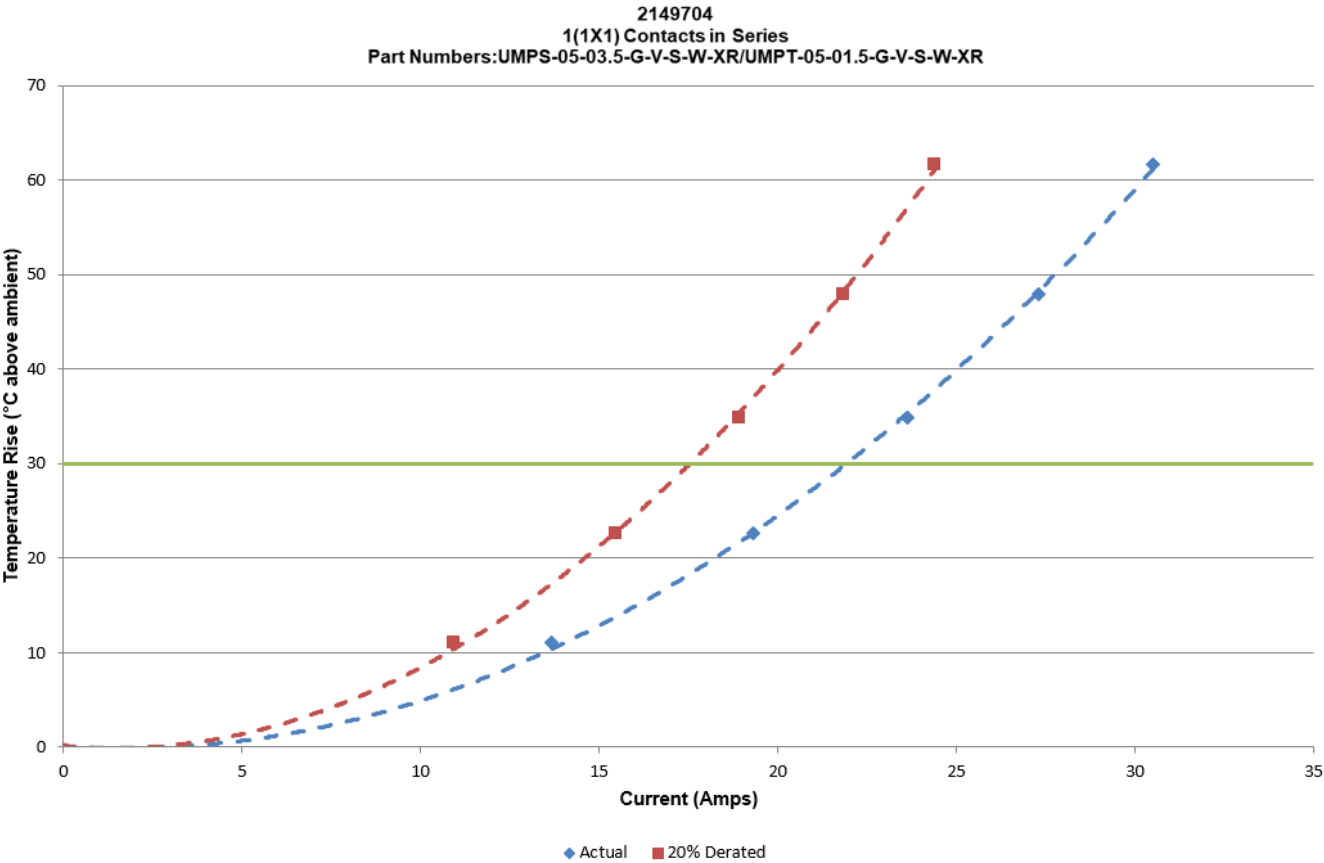
DATA SUMMARIES

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.

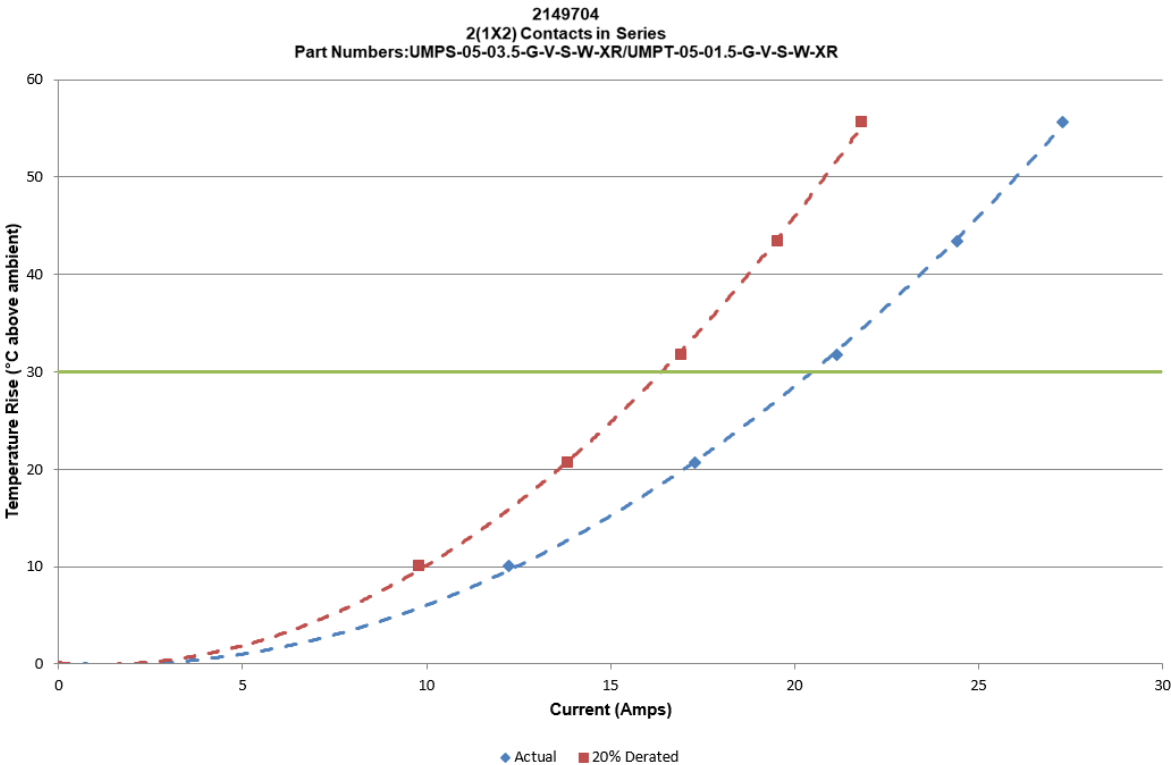
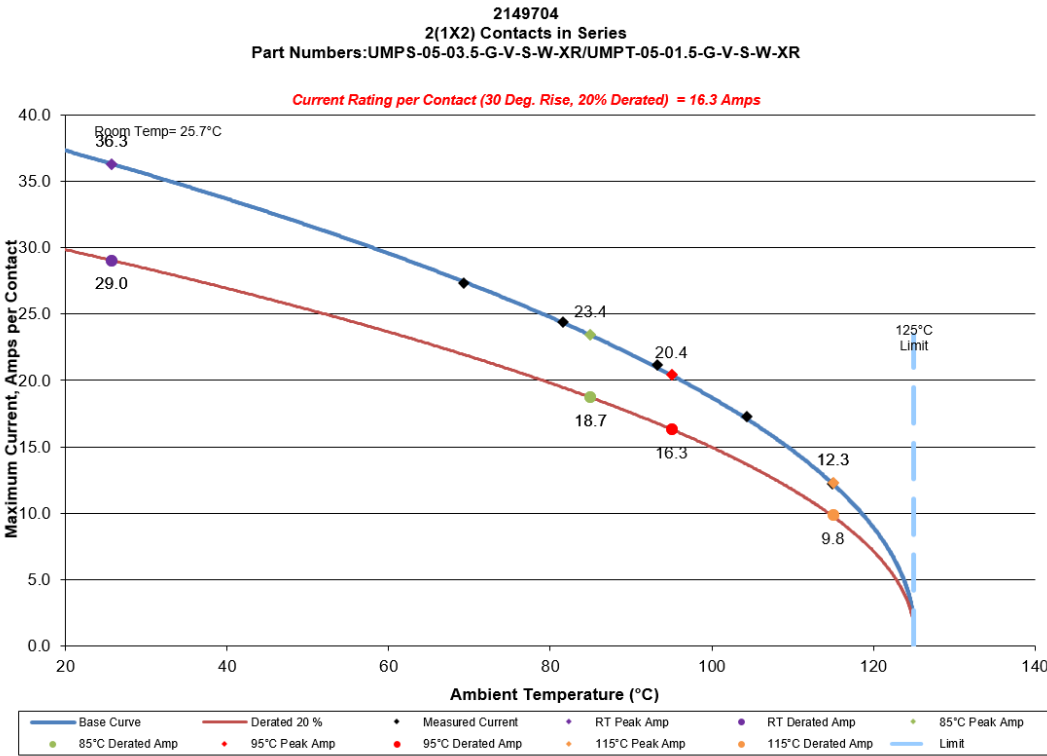


DATA SUMMARIES Continued



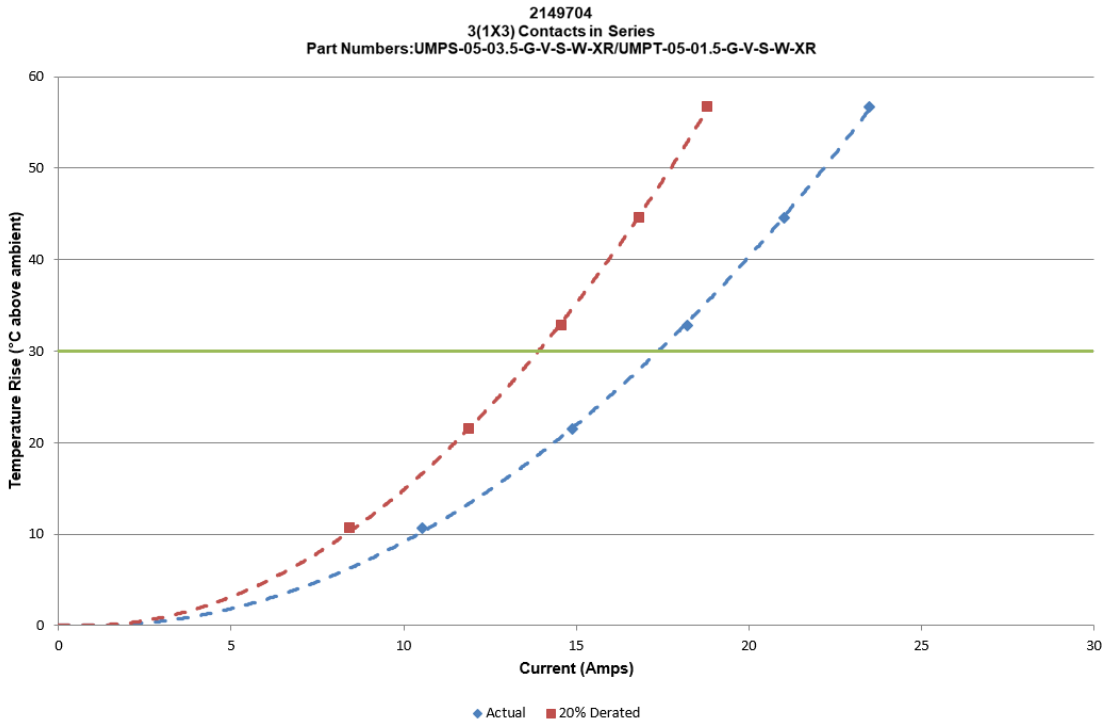
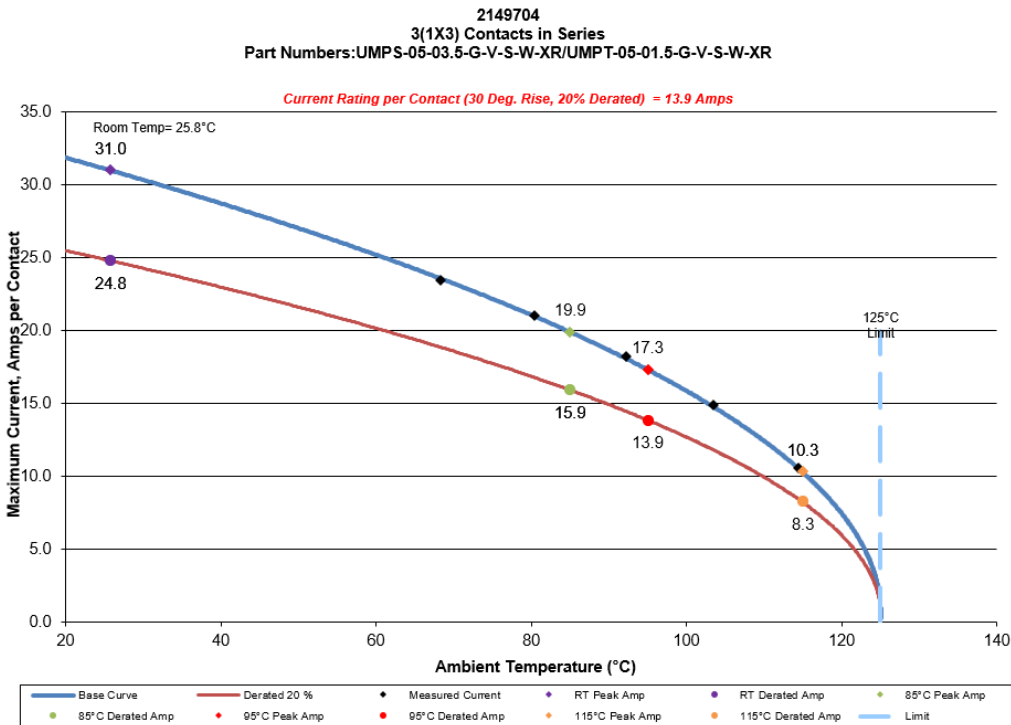
DATA SUMMARIES Continued

b. Linear configuration with 2 adjacent conductors/contacts powered.



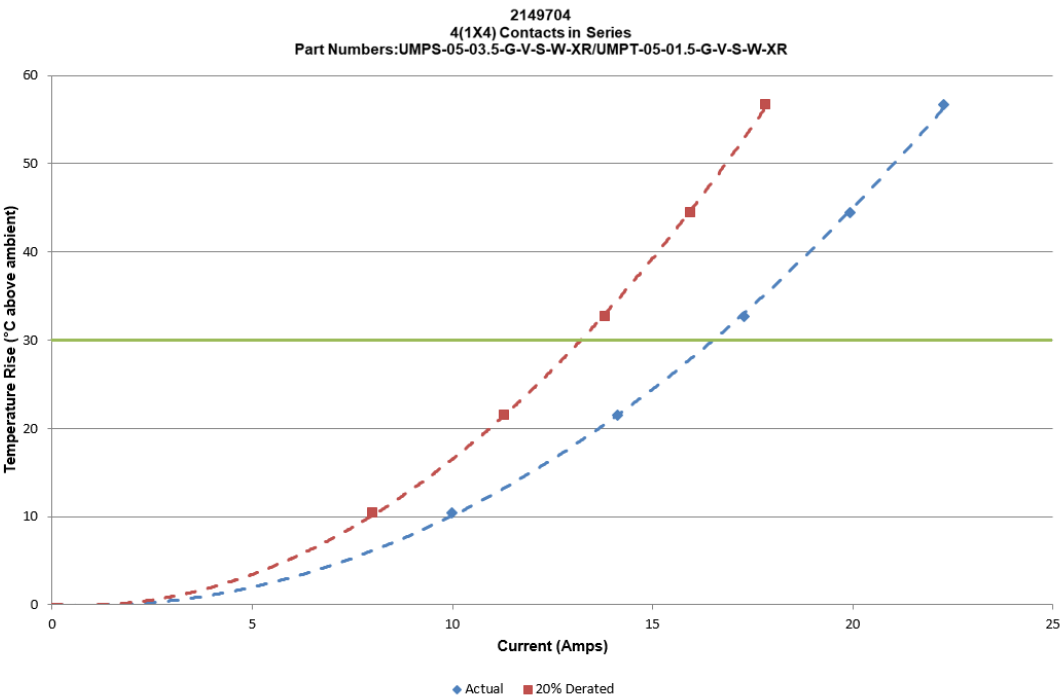
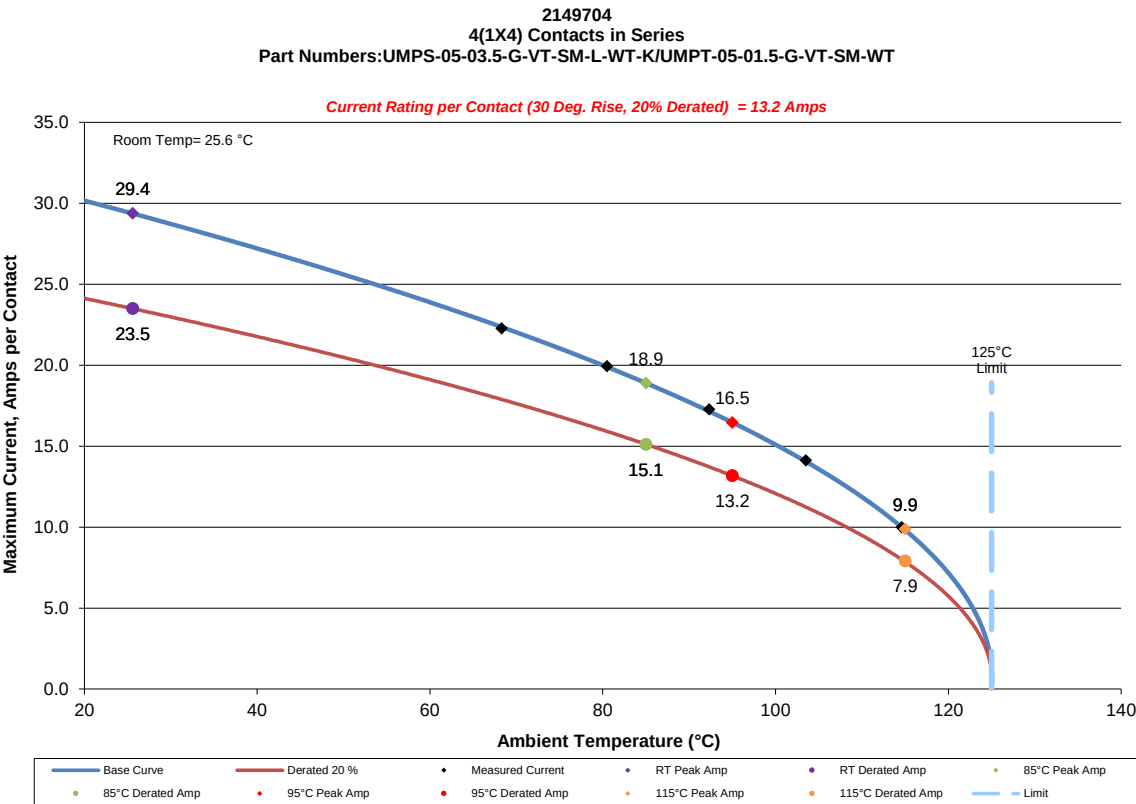
DATA SUMMARIES Continued

c. Linear configuration with 3 adjacent conductors/contacts powered.



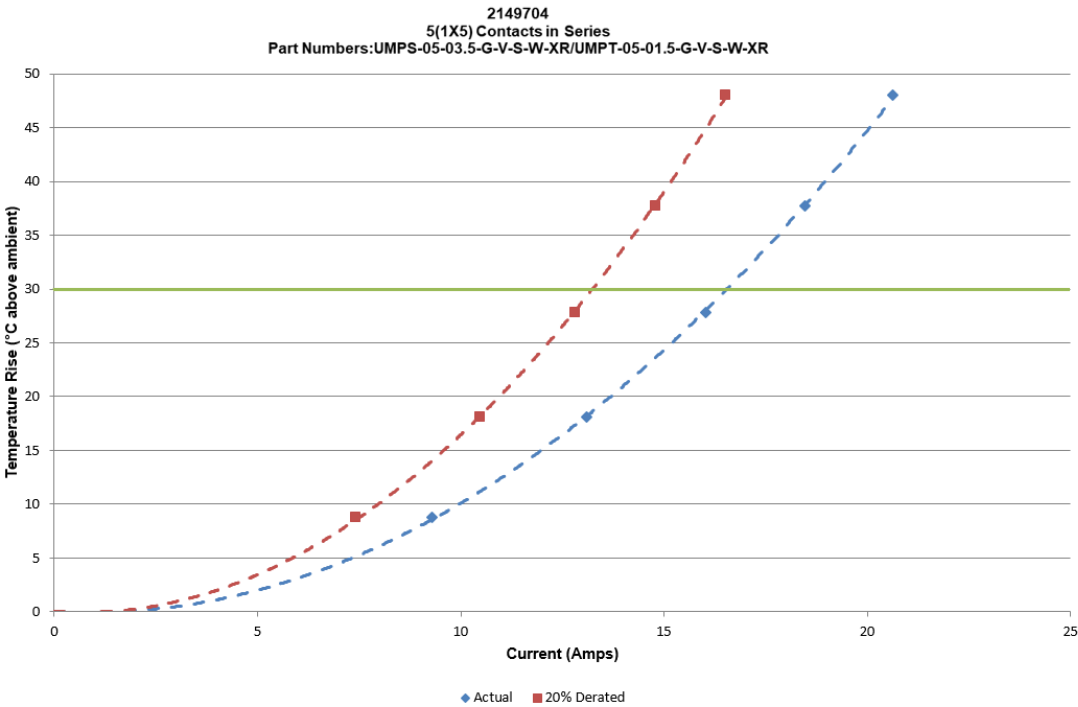
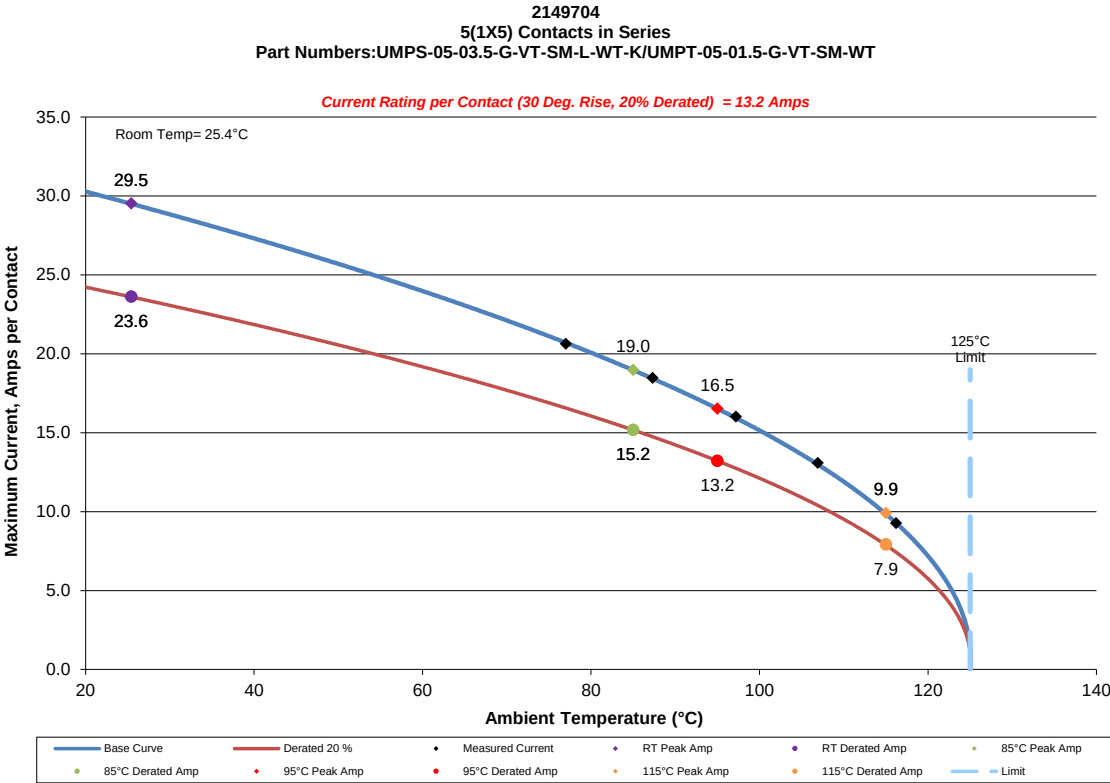
DATA SUMMARIES Continued

d. Linear configuration with 4 adjacent conductors/contacts powered.



DATA SUMMARIES Continued

e. Linear configuration with all adjacent conductors/contacts powered.



DATA SUMMARIES Continued**MATING-UNMATING FORCE:****Thermal Aging Group**

	Initial				After Thermals			
	Mating		Unmating		Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	15.79	3.55	10.10	2.27	7.63	1.72	5.94	1.34
Maximum	18.77	4.22	12.94	2.91	9.37	2.11	8.02	1.80
Average	17.35	3.90	11.57	2.60	8.52	1.92	7.26	1.63
St Dev	1.01	0.23	0.96	0.22	0.62	0.14	0.73	0.16
Count	8	8	8	8	8	8	8	8

Mating-Unmating Durability Group

UMPS-05-03.5-G-V-S-W-XR/UMPT-05-01.5-G-V-S-W-XR

	Initial				After 25 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	13.47	3.03	9.47	2.13	14.70	3.31	11.83	2.66
Maximum	17.85	4.01	11.20	2.52	18.31	4.12	14.25	3.20
Average	15.53	3.49	10.24	2.30	16.38	3.68	13.01	2.92
St Dev	1.48	0.33	0.68	0.15	1.28	0.29	0.81	0.18
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	15.23	3.43	13.12	2.95	15.66	3.52	14.06	3.16
Maximum	18.63	4.19	15.95	3.59	19.77	4.45	17.52	3.94
Average	16.47	3.70	14.71	3.31	17.22	3.87	15.83	3.56
St Dev	1.26	0.28	0.98	0.22	1.32	0.30	1.22	0.27
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	16.21	3.64	16.02	3.60	8.98	2.02	7.18	1.62
Maximum	20.19	4.54	19.16	4.31	10.59	2.38	7.66	1.72
Average	17.64	3.97	17.28	3.89	9.40	2.11	7.49	1.68
St Dev	1.41	0.32	1.05	0.24	0.51	0.11	0.16	0.04
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued**Mating-Unmating Basic Group**

UMPS-02-03.5-G-V-S-W-XR/UMPT-02-01.5-G-V-S-W-XR

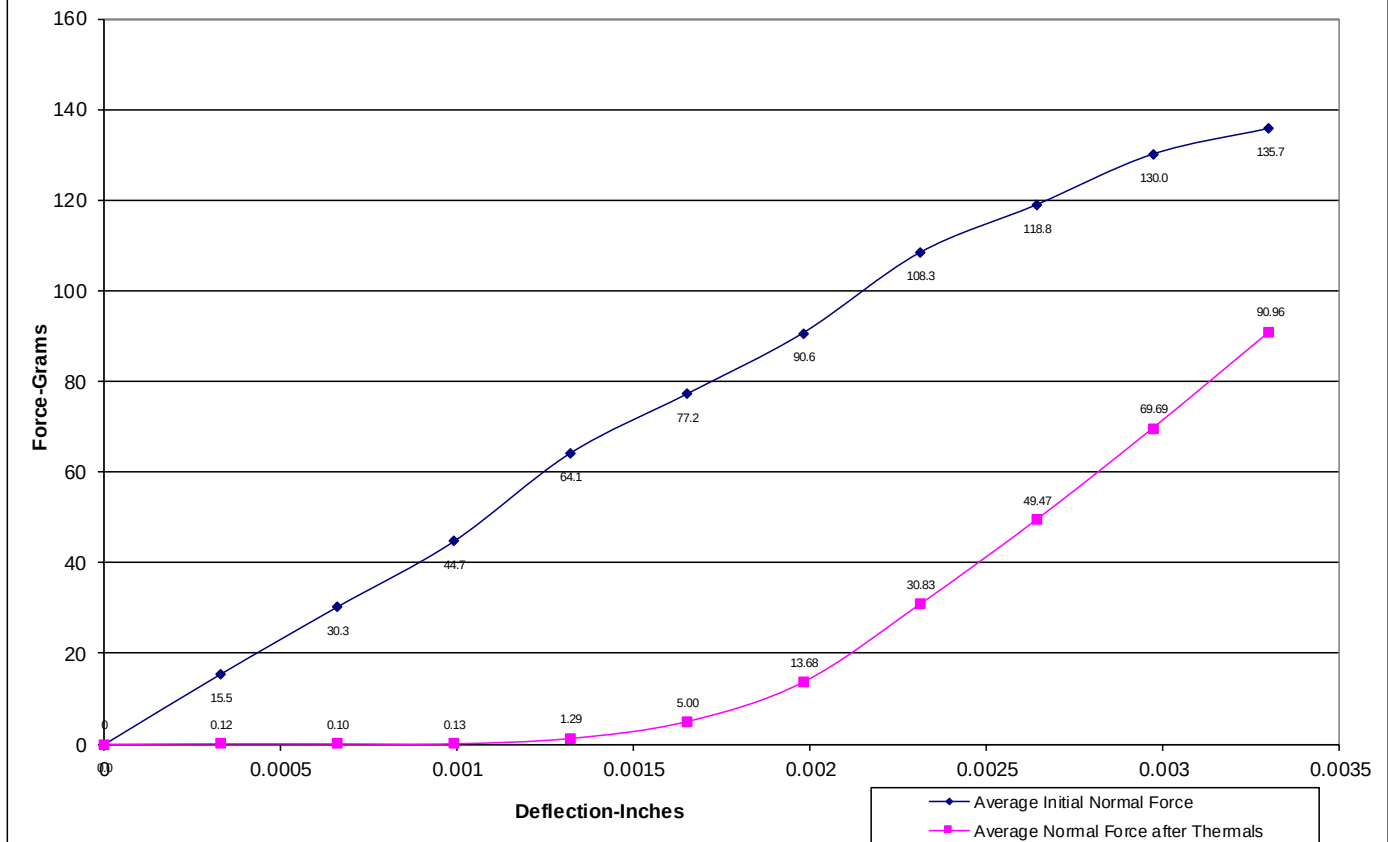
	Initial				After 25 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	3.89	0.88	1.87	0.42	3.55	0.80	1.99	0.45
Maximum	4.44	1.00	2.43	0.55	3.85	0.87	2.71	0.61
Average	4.26	0.96	2.21	0.50	3.65	0.82	2.36	0.53
St Dev	0.18	0.04	0.20	0.04	0.11	0.03	0.23	0.05
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	3.51	0.79	1.99	0.45	3.55	0.80	2.02	0.46
Maximum	3.90	0.88	2.91	0.66	4.01	0.90	2.83	0.64
Average	3.68	0.83	2.46	0.55	3.70	0.83	2.49	0.56
St Dev	0.15	0.03	0.32	0.07	0.15	0.03	0.27	0.06
Count	8	8	8	8	8	8	8	8
	After 100 Cycles							
	Mating		Unmating					
	Newtons	Force (Lbs)	Newtons	Force (Lbs)				
Minimum	3.52	0.79	2.09	0.47				
Maximum	3.99	0.90	2.85	0.64				
Average	3.69	0.83	2.53	0.57				
St Dev	0.16	0.04	0.30	0.07				
Count	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.

Initial	Deflections in inches Forces in Grams										
	0.0003	0.0007	0.0010	0.0013	0.0017	0.0020	0.0023	0.0026	0.0030	0.0033	SET
Averages	15.49	30.28	44.69	64.12	77.18	90.63	108.31	118.83	130.00	135.73	0.0002
Min	12.50	23.00	36.80	51.70	62.00	72.80	90.50	97.50	107.50	119.80	0.0000
Max	18.10	36.60	56.50	79.50	98.00	111.90	132.90	144.50	154.50	154.50	0.0003
St. Dev	1.835	4.608	7.006	8.982	10.792	11.980	14.448	15.367	15.770	14.012	0.0001
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0003	0.0007	0.0010	0.0013	0.0017	0.0020	0.0023	0.0026	0.0030	0.0033	SET
Averages	0.12	0.10	0.13	1.29	5.00	13.68	30.83	49.47	69.69	90.96	0.0018
Min	-0.20	-0.20	-0.20	-0.20	-0.20	-0.10	0.30	16.00	28.70	51.00	0.0013
Max	0.40	0.40	0.40	14.50	31.30	50.50	72.80	91.30	110.60	122.10	0.0026
St. Dev	0.217	0.241	0.226	4.164	9.944	17.102	24.901	25.035	26.886	23.982	0.0005
Count	12	12	12	12	12	12	12	12	12	12	12

Normal Force - Average Initial vs Average Thermal

DATA SUMMARIES Continued**INSULATION RESISTANCE (IR):**

Pin to Pin		
Mated	Unmated	Unmated
UMPS/UMPT	UMPS	UMPT
45000	45000	45000
45000	45000	45000
45000	45000	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	UMPS/UMPT
Break Down Voltage	1285
Test Voltage	965
Working Voltage	320

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

DATA SUMMARIES Continued**LLCR Thermal Aging Group**

- 1) A total of 40 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. $\leq +0.33$ mOhms: -----Stable
 - b. $+0.34$ to $+0.66$ mOhms: -----Minor
 - c. $+0.67$ to $+1.00$ mOhms: -----Acceptable
 - d. $+1.01$ to $+50.0$ mOhms: -----Marginal
 - e. $+50.1$ to $+1000$ mOhms:-----Unstable
 - f. $>+1000$ mOhms:-----Open Failure

LLCR Measurement Summaries by Pin Type				
Date	7/19/2019	7/30/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	48	50		
Technician	Keney Chen	Keney Chen		
mOhm values	Actual Initial	Delta Thermal	Delta	Delta
Pin Type 1: Signal				
Average	0.98	0.06		
St. Dev.	0.06	0.03		
Min	0.84	0.01		
Max	1.09	0.13		
Summary Count	40	40		
Total Count	40	40		

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 0.33	$>0.34 \text{ \& } \leq 0.66$	$>0.67 \text{ \& } \leq 1.00$	$>1.01 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	>1000
Thermal	40	0	0	0	0	0

DATA SUMMARIES Continued**LLCR Mating/Unmating Durability Group**

- 1) A total of 40 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. $\leq +0.33$ mOhms: -----Stable
 - b. $+0.34$ to $+0.66$ mOhms: -----Minor
 - c. $+0.67$ to $+1.00$ mOhms: -----Acceptable
 - d. $+1.01$ to $+50.0$ mOhms: -----Marginal
 - e. $+50.1$ to $+1000$ mOhms:-----Unstable
 - f. $>+1000$ mOhms:-----Open Failure

LLCR Measurement Summaries by Pin Type				
Date	7/9/2019	7/11/2019	7/18/2019	7/30/2019
Room Temp (Deg C)	23	23	23	23
Rel Humidity (%)	50	50	52	50
Technician	Keney Chen	Keney Chen	Keney Chen	Keney Chen
mOhm values	Actual	Delta	Delta	Delta
	Initial	100 Cycles	Therm Shck	Humidity
Pin Type 1: Signal				
Average	0.97	0.02	0.02	0.03
St. Dev.	0.06	0.01	0.02	0.02
Min	0.80	0.00	0.00	0.00
Max	1.09	0.05	0.07	0.11
Summary Count	40	40	40	40
Total Count	40	40	40	40

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 0.33	>0.34 & ≤ 0.66	>0.67 & ≤ 1.0	>1.0 & ≤ 50	>50 & ≤ 1000	>1000
100 Cycles	40	0	0	0	0	0
Therm Shck	40	0	0	0	0	0
Humidity	40	0	0	0	0	0

DATA SUMMARIES Continued**LLCR Gas Tight Group**

- 1) A total of 40 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. $\leq +0.33$ mOhms: -----Stable
 - b. $+0.34$ to $+0.66$ mOhms: -----Minor
 - c. $+0.67$ to $+1.00$ mOhms: -----Acceptable
 - d. $+1.01$ to $+50.0$ mOhms: -----Marginal
 - e. $+50.1$ to $+1000$ mOhms:-----Unstable
 - f. $>+1000$ mOhms:-----Open Failure

LLCR Measurement Summaries by Pin Type				
Date	7/3/2019	7/18/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	50	52		
Technician	Keney Chen	Keney Chen		
mOhm values	Actual Initial	Delta Acid Vapor	Delta	Delta
Pin Type 1: Signal				
Average	0.98	0.04		
St. Dev.	0.06	0.03		
Min	0.84	0.00		
Max	1.12	0.13		
Summary Count	40	40		
Total Count	40	40		

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 0.33	$>0.34 \text{ \& } \leq 0.66$	$>0.67 \text{ \& } \leq 1.0$	$>1.0 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	>1000
Acid Vapor	40	0	0	0	0	0

DATA SUMMARIES Continued**LLCR Shock & Vibration:**

- 1) A total of 40 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. $\leq +0.33$ mOhms: -----Stable
 - b. $+0.34$ to $+0.66$ mOhms: -----Minor
 - c. $+0.67$ to $+1.00$ mOhms: -----Acceptable
 - d. $+1.01$ to $+50.0$ mOhms: -----Marginal
 - e. $+50.1$ to $+1000$ mOhms: -----Unstable
 - f. $>+1000$ mOhms: -----Open Failure

LLCR Measurement Summaries by Pin Type				
Date	8/23/2019	10/17/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	51	38		
Technician	Scott Rollefstad	Scott Rollefstad		
mOhm values	Actual Initial	Delta Shock-Vib	Delta	Delta
Pin Type 1: Signal				
Average	0.93	0.03		
St. Dev.	0.07	0.04		
Min	0.68	0.00		
Max	1.07	0.24		
Summary Count	40	40		
Total Count	40	40		

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 5	$>5 \text{ \& } \leq 10$	$>10 \text{ \& } \leq 15$	$>15 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	>1000
Shock-Vib	40	0	0	0	0	0

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	40
Test Condition	100G, 6ms, Half-Sine (EIA-364-27)
Shock Events	0
Test Condition	7.56 G 'RMS', 5Hz to 2000Hz (EIA-364-28)
Vibration Events	0
Total Events	0

EQUIPMENT AND CALIBRATION SCHEDULES**Equipment #:** HZ-TCT-01**Description:** Normal force analyzer**Manufacturer:** Mecmesin Multitester**Model:** Mecmesin Multitester 2.5-i**Serial #:** 08-1049-04**Accuracy:** Last Cal: 4/25/2019, Next Cal: 4/24/2020**Equipment #:** HZ-OV-01**Description:** Oven**Manufacturer:** Huida**Model:** CS101-1E**Serial #:** CS101-1E-B**Accuracy:** Last Cal: 12/12/2018, Next Cal: 12/11/2019**Equipment #:** HZ-THC-01**Description:** Humidity transmitter**Manufacturer:** Thermtron**Model:** SM-8-8200**Serial #:** 38846**Accuracy:** Last Cal: 2/26/2019, Next Cal: 2/25/2020**Equipment #:** HZ-TSC-01**Description:** Vertical Thermal Shock Chamber**Manufacturer:** Cincinnatti Sub Zero**Model:** VTS-3-6-6-SC/AC**Serial #:** 10-VT14994**Accuracy:** See Manual

... Last Cal: 06/27/2019, Next Cal: 06/26/2020

Equipment #: HZ-MO-05**Description:** Micro-ohmmeter**Manufacturer:** Keithley**Model:** 3706**Serial #:** 1285188**Accuracy:** Last Cal: 11/14/2019, Next Cal: 11/13/2020**Equipment #:** DG-HPT-01**Description:** Hipot Safety Tester**Manufacturer:** Vitrek**Model:** V73**Serial #:** 025866**Accuracy:**

... Last Cal: 04/11/2019, Next Cal: 04/10/2020

EQUIPMENT AND CALIBRATION SCHEDULES Continued**Equipment #:** HZ-MO-01**Description:** Micro-ohmmeter**Manufacturer:** Keithley**Model:** 2700**Serial #:** 1199807**Accuracy:** Last Cal: 04/27/2019, Next Cal: 04/26/2020**Equipment #:** HZ-PS-01**Description:** Power Supply**Manufacturer:** Agilent**Model:** 6031A**Serial #:** MY41000982**Accuracy:** Last Cal: 04/27/2019, Next Cal: 04/26/2020**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

Equipment #: MO-04**Description:** Multimeter /Data Acquisition System**Manufacturer:** Keithley**Model:** 2700**Serial #:** 0798688**Accuracy:** See Manual

... Last Cal: 09/11/2019, Next Cal: 09/11/2020