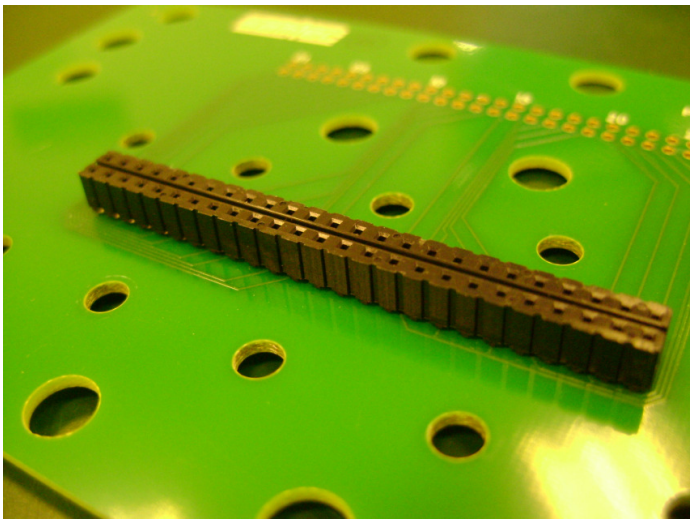
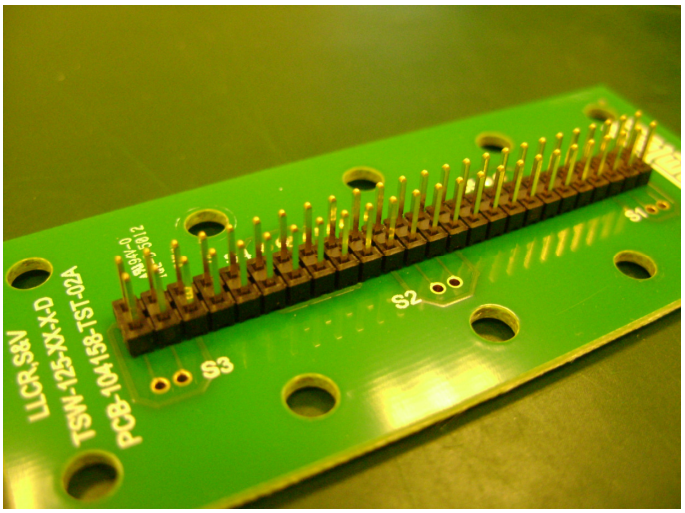
| | | | |
|---|---|---|---|
| Project Number: Design Qualification Test Report | Tracking Code: 231879_Report_Rev_1 | | |
| Requested by: Catie Eichhorn | Date: 6/13/2013 | Product Rev: | |
| Part #: CES-125-01-L-D/TSW-125-07-L-D | | Tech: Peter Chen | Eng: Vico Zhao |
| Part description: CES/TSW | | | Qty to test: 65 |
| Test Start: 03/26/2013 | Test Completed: 04/25/2013 | | |






# Design Qualification Test Report

## CES/TSW
## CES-125-01-L-D/TSW-125-07-L-D

## REVISION HISTORY

| DATA | REV.NUM. | DESCRIPTION | ENG |
|---|---|---|---|
| **6/4/2013** | **1** | **Initial Issue** | **PC** |

# CERTIFICATION

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



## SCOPE

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

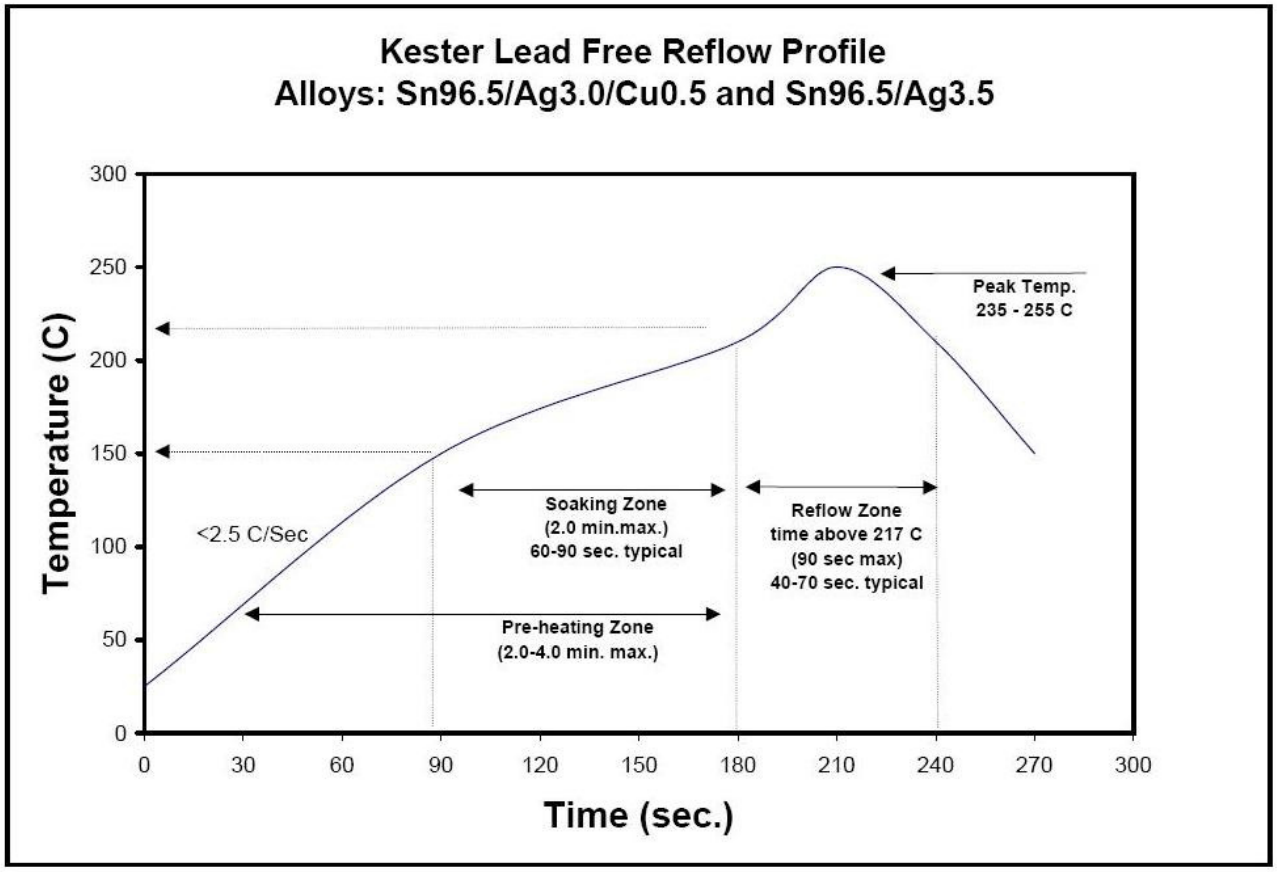
## APPLICABLE DOCUMENTS

Standards: EIA Publication 364

## TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the 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) Re-Flow Time/Temp: See accompanying profile.
10) Samtec Test PCBs used: PCB-104158-TST-XX

**TYPICAL OVEN PROFILE (Soldering Parts to Test Boards)**



# FLOWCHARTS

## Gas Tight

| TEST STEP | GROUP A1 192 Points |
|---|---|
| 01 | LLCR-1 |
| 02 | Gas Tight |
| 03 | LLCR-2 |

**Gas Tight = EIA-364-36A**

**LLCR = EIA-364-23, LLCR**

**20 mV Max, 100 mA Max**

**Use Keithley 580 or 3706 in 4 wire dry circuit mode**

## Thermal Aging

| TEST STEP | GROUP A1 8 Boards Thermal Aging (Mated) |
|---|---|
| 01 | Contact Gaps |
| 02 | Forces - Mating / Unmating |
| 03 | LLCR-1 |
| 04 | Thermal Aging (Mated and Undisturbed) |
| 05 | LLCR-2 |
| 06 | Forces - Mating / Unmating |
| 07 | Contact Gaps |

**Thermal Aging = EIA-364-17, Test Condition 4 (105°C)**

**Time Condition 'B' (250 Hours)**

**Mating / Unmating Forces = EIA-364-13**

**Contact Gaps / Height - No standard method. Usually measured optically.**

**Gaps to be taken on a minimum of 20% of each part tested**

**LLCR = EIA-364-23, LLCR**

**20 mV Max, 100 mA Max**

**Use Keithley 580 or 3706 in 4 wire dry circuit mode**

# FLOWCHARTS Continued

**Durability/Mating/Unmating/Gaps**

| TEST STEP | GROUP B1<br>8 Assemblies<br>CES-125-01-L-D | GROUP B2<br>8 Assemblies<br>CES-150-01-L-D | GROUP B3<br>8 Assemblies<br>CES-105-01-L-D |
|---|---|---|---|
| 01 | Contact Gaps | Contact Gaps | Contact Gaps |
| 02 | LLCR-1 | Forces - Mating / Unmating | Forces - Mating / Unmating |
| 03 | Forces - Mating / Unmating | 25 Cycles | 25 Cycles |
| 04 | 25 Cycles | Forces - Mating / Unmating | Forces - Mating / Unmating |
| 05 | Forces - Mating / Unmating | 25 Cycles (50 Total) | 25 Cycles (50 Total) |
| 06 | 25 Cycles (50 Total) | Forces - Mating / Unmating | Forces - Mating / Unmating |
| 07 | Forces - Mating / Unmating | 25 Cycles (75 Total) | 25 Cycles (75 Total) |
| 08 | 25 Cycles (75 Total) | Forces - Mating / Unmating | Forces - Mating / Unmating |
| 09 | Forces - Mating / Unmating | 25 Cycles (100 Total) | 25 Cycles (100 Total) |
| 10 | 25 Cycles (100 Total) | Forces - Mating / Unmating | Forces - Mating / Unmating |
| 11 | Forces - Mating / Unmating | | |
| 12 | Clean w/Compressed Air | | |
| 13 | Contact Gaps | | |
| 14 | LLCR-2 | | |
| 15 | Thermal Shock<br>(Mated and Undisturbed) | | |
| 16 | LLCR-3 | | |
| 17 | Cyclic Humidity<br>(Mated and Undisturbed) | | |
| 18 | LLCR-4 | | |
| 19 | Forces - Mating / Unmating | | |

**Thermal Shock = EIA-364-32, Table II, Test Condition I:**

**-55°C to +85°C 1/2 hour dwell, 100 cycles**

**Humidity = EIA-364-31, Test Condition B (240 Hours)**

**and Method III (+25°C to +65°C @ 90% RH to 98% RH)**

**ambient pre-condition and delete steps 7a and 7b**

**Mating / Unmating Forces = EIA-364-13**

**Contact Gaps / Height - No standard method. Usually measured optically.**

**Gaps to be taken on a minimum of 20% of each part tested**

**LLCR = EIA-364-23, LLCR**

**20 mV Max, 100 mA Max**

**Use Keithley 580 or 3706 in 4 wire dry circuit mode**

# FLOWCHARTS Continued

**IR & DWV**

| TEST STEP | GROUP A1<br>2 Mated Sets<br>Break Down Pin-to-Pin | GROUP A2<br>2 Unmated of Part # Being Tested<br>Break Down Pin-to-Pin | GROUP A3<br>2 Unmated of Mating Part #<br>Break Down Pin-to-Pin | GROUP B1<br>2 Mated Sets<br>Pin-to-Pin |
|---|---|---|---|---|
| 01 | DWV/Break Down Voltage | DWV/Break Down Voltage | DWV/Break Down Voltage | IR & DWV at test voltage (on both mated sets and on each connector unmated) |
| 02 | | | | Thermal Shock (Mated and Undisturbed) |
| 03 | | | | IR & DWV at test voltage (on both mated sets and on each connector unmated) |
| 04 | | | | Cyclic Humidity (Mated and Undisturbed) |
| 05 | | | | IR & DWV at test voltage (on both mated sets and on each connector unmated) |

| TEST STEP | GROUP C1<br>2 Mated Sets<br>Break Down Row-to-Row | GROUP C2<br>2 Unmated of Part # Being Tested<br>Break Down Row-to-Row | GROUP C3<br>2 Unmated of Mating Part #<br>Break Down Row-to-Row | GROUP D1<br>2 Mated Sets<br>Row-to-Row |
|---|---|---|---|---|
| 01 | DWV/Break Down Voltage | DWV/Break Down Voltage | DWV/Break Down Voltage | IR & DWV at test voltage (on both mated sets and on each connector unmated) |
| 02 | | | | Thermal Shock (Mated and Undisturbed) |
| 03 | | | | IR & DWV at test voltage (on both mated sets and on each connector unmated) |
| 04 | | | | Cyclic Humidity (Mated and Undisturbed) |
| 05 | | | | IR & DWV at test voltage (on both mated sets and on each connector unmated) |

**DWV on Group B1 to be performed at Test Voltage**

**DWV test voltage is equal to 75% of the lowest break down voltage from Groups A1, A2 or A3**

**Thermal Shock = EIA-364-32, Table II, Test Condition I:**

**-55°C to +85°C 1/2 hour dwell, 100 cycles**

**Humidity = EIA-364-31, Test Condition B (240 Hours)**

**and Method III (+25°C to +65°C @ 90% RH to 98% RH)**

**ambient pre-condition and delete steps 7a and 7b**

**IR = EIA-364-21**

**DWV = EIA-364-20, Test Condition 1**

# FLOWCHARTS Continued

**Normal Force**

| TEST STEP | GROUP A1 Individual Contacts (8-10 min) | GROUP A2 Individual Contacts (8-10 min) |
|---|---|---|
| 01 | Contact Gaps | Contact Gaps |
| 02 | Setup Approved | Thermal Aging (Mated and Undisturbed) |
| 03 | Normal Force (in the body and soldered on PCB unless otherwise specified) | Contact Gaps |
| 04 | | Setup Approved |
| 05 | | Normal Force (in the body and soldered on PCB unless otherwise specified) |

**Thermal Aging = EIA-364-17, Test Condition 4 (105°C)**
**Time Condition 'B' (250 Hours)**
**Normal Force = EIA-364-04**
**(Perpendicular) Displacement Force = 12.7 mm/min ± 6 mm/min**
**Spec is 50 N @ 1 mm displacement**
**Contact Gaps / Height - No standard method. Usually measured optically**
**Gaps to be taken on a minimum of 20% of each part tested**

**Current Carrying Capacity - Double Row**

| TEST STEP | GROUP B1 3 Mated Assemblies 2 Contacts Powered | GROUP B2 3 Mated Assemblies 4 Contacts Powered | GROUP B3 3 Mated Assemblies 6 Contacts Powered | GROUP B4 3 Mated Assemblies 8 Contacts Powered | GROUP B5 3 Mated Assemblies All Contacts Powered |
|---|---|---|---|---|---|
| 01 | CCC | CCC | CCC | CCC | CCC |

**(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**
**CCC, Temp rise = EIA-364-70**

# FLOWCHARTS Continued

**Mechanical Shock / Vibration / LLCR**

| TEST STEP | GROUP A1 192 Points |
| --- | --- |
| 01 | LLCR-1 |
| 02 | Shock |
| 03 | Vibration |
| 04 | LLCR-2 |

**Mechanical Shock = EIA 364-27 Half Sine,**

**100 g's, 6 milliSeconds (Condition "C") each axis**

**Vibration = EIA 364-28, Random Vibration**

**7.56 g RMS, Condition VB -- 2 hours/axis**

**LLCR = EIA-364-23, LLCR**

**20 mV Max, 100 mA Max**

**Use Keithley 580 or 3706 in 4 wire dry circuit mode**

**Shock / Vibration / nanoSecond Event Detection**

| TEST STEP | GROUP A1 60 Points |
| --- | --- |
| 01 | Event Detection, Shock |
| 02 | Event Detection, Vibration |

**Mechanical Shock = EIA 364-27 Half Sine,**

**100 g's, 6 milliSeconds (Condition "C") each axis**

**Vibration = EIA 364-28, Random Vibration**

**7.56 g RMS, Condition VB -- 2 hours/axis**

**Event detection requirement during Shock / Vibration is 50 nanoseconds minimum**

## 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

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.

### 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.

### 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.

## ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

### 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. Rate of Application 500 V/Sec
        iii. 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)

### 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 three temperature points are reported:
    a. Ambient
    b. $80^{o}$ C
    c. $95^{o}$ C
    d. $115^{o}$ 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

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.

# RESULTS

**Temperature Rise, CCC at a 20% de-rating**

- **CCC for a 30°C Temperature Rise ----------5.5 A per contact with 2 adjacent signal contacts powered**
- **CCC for a 30°C Temperature Rise ----------4.2 A per contact with 4 adjacent signal contacts powered**
- **CCC for a 30°C Temperature Rise ----------3.6 A per contact with 6 adjacent signal contacts powered**
- **CCC for a 30°C Temperature Rise ----------3.3 A per contact with 8 adjacent signal contacts powered**
- **CCC for a 30°C Temperature Rise ----------2.1 A per contact with all adjacent signal contacts powered**

## Mating /unmating force

**Mating&Unmating durability (CES-125-01-L-D/TSW-125-07-L-D):**

- **Initial**
  - **Mating**
    - **Min ----------19.87 Lbs**
    - **Max----------25.42 Lbs**
  - **Unmating**
    - **Min ----------13.43 Lbs**
    - **Max----------14.90 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------18.33 Lbs**
    - **Max----------22.12 Lbs**
  - **Unmating**
    - **Min ----------14.12 Lbs**
    - **Max----------15.23 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------19.26 Lbs**
    - **Max----------23.54 Lbs**
  - **Unmating**
    - **Min ----------13.73 Lbs**
    - **Max----------15.76 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------20.12 Lbs**
    - **Max----------24.02 Lbs**
  - **Unmating**
    - **Min ----------15.64 Lbs**
    - **Max----------16.41 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------20.70 Lbs**
    - **Max----------24.50 Lbs**
  - **Unmating**
    - **Min ----------16.21 Lbs**
    - **Max----------17.77 Lbs**
- **After Humidity**
  - **Mating**
    - **Min ----------12.10 Lbs**
    - **Max----------13.27 Lbs**
  - **Unmating**
    - **Min ----------10.07 Lbs**
    - **Max----------10.84 Lbs**

## RESULTS Continued

**Mating/Unmating basic (CES-150-01-L-D/TSW-150-07-L-D):**

- **Initial**
  - **Mating**
    - **Min ----------41.81 Lbs**
    - **Max----------50.16 Lbs**
  - **Unmating**
    - **Min ----------24.98 Lbs**
    - **Max----------29.77 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------38.86 Lbs**
    - **Max----------47.16 Lbs**
  - **Unmating**
    - **Min ----------26.79 Lbs**
    - **Max----------32.58 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------38.97 Lbs**
    - **Max----------50.32 Lbs**
  - **Unmating**
    - **Min ----------27.12 Lbs**
    - **Max----------34.76 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------45.12 Lbs**
    - **Max----------52.47 Lbs**
  - **Unmating**
    - **Min ----------30.17 Lbs**
    - **Max----------36.62 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------42.12 Lbs**
    - **Max----------55.17 Lbs**
  - **Unmating**
    - **Min ----------31.23 Lbs**
    - **Max----------38.78 Lbs**

## RESULTS Continued

**Mating/Unmating basic (CES-105-01-L-D/TSW-105-07-L-D):**

- **Initial**
  - **Mating**
    - **Min ---------- 4.35 Lbs**
    - **Max---------- 4.92 Lbs**
  - **Unmating**
    - **Min ---------- 2.85 Lbs**
    - **Max---------- 3.57 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 4.20 Lbs**
    - **Max---------- 4.92 Lbs**
  - **Unmating**
    - **Min ---------- 3.03 Lbs**
    - **Max---------- 3.62 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 3.82 Lbs**
    - **Max---------- 4.67 Lbs**
  - **Unmating**
    - **Min ---------- 2.77 Lbs**
    - **Max---------- 3.82 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 3.75 Lbs**
    - **Max---------- 4.79 Lbs**
  - **Unmating**
    - **Min ---------- 3.17 Lbs**
    - **Max---------- 4.01 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 3.72 Lbs**
    - **Max---------- 4.82 Lbs**
  - **Unmating**
    - **Min ---------- 3.31 Lbs**
    - **Max---------- 4.10 Lbs**

**Thermal aging (CES-125-01-L-D/TSW-125-07-L-D)**

- **Initial**
  - **Mating**
    - **Min ----------19.68 Lbs**
    - **Max----------23.56 Lbs**
  - **Unmating**
    - **Min ----------13.35 Lbs**
    - **Max----------14.87 Lbs**
- **After thermal aging**
  - **Mating**
    - **Min ----------10.33 Lbs**
    - **Max----------12.05 Lbs**
  - **Unmating**
    - **Min ---------- 9.19 Lbs**
    - **Max---------- 9.84 Lbs**

## RESULTS Continued

### Normal Force at 0.0045 inch deflections

- **Initial**
  - **Min ---------- 243.80 gf Set ----- 0.0000 Inch**
  - **Max ---------- 291.40 gf Set ----- 0.0013 Inch**
- **Thermal**
  - **Min ---------- 151.60 gf Set ----- 0.0019 Inch**
  - **Max ---------- 193.80 gf Set ----- 0.0028 Inch**

### Insulation Resistance minimums, IR

**Pin-Pin**

- **Initial**
  - **Mated ---------- 10000Meg Ω ---------- Pass**
  - **Unmated ---------- 10000Meg Ω ---------- Pass**
- **Thermal**
  - **Mated ---------- 10000Meg Ω ---------- Pass**
  - **Unmated ---------- 10000Meg Ω ---------- Pass**
- **Humidity**
  - **Mated ---------- 10000Meg Ω ---------- Pass**
  - **Unmated ---------- 10000Meg Ω ---------- Pass**

**Row-Row**

- **Initial**
  - **Mated ---------- 10000Meg Ω ---------- Pass**
  - **Unmated ---------- 10000Meg Ω ---------- Pass**
- **Thermal**
  - **Mated ---------- 10000Meg Ω ---------- Pass**
  - **Unmated ---------- 10000Meg Ω ---------- Pass**
- **Humidity**
  - **Mated ---------- 10000Meg Ω ---------- Pass**
  - **Unmated ---------- 10000Meg Ω ---------- Pass**

### Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 1600 VAC**
  - **Test Voltage ---------- 1200 VAC**
  - **Working Voltage ---------- 400 VAC**

**Pin - pin**

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

**Row-Row**

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

## RESULTS Continued

### LLCR Durability (192 pin LLCR test points)

- **Initial ----------4.23 mOhms Max**
- **After 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **After 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **After humidity**
  - **<= +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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

### LLCR Thermal aging (192 pin LLCR test points)

- **Initial ----------4.16 mOhms Max**
- **Thermal**
  - **<= +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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

### LLCR Gas Tight (192 pin LLCR test points)

- **Initial ----------4.64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

## RESULTS Continued

### LLCR Shock &Vibration (192 pin LLCR test points)

- **Initial ----------4.33mOhms 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

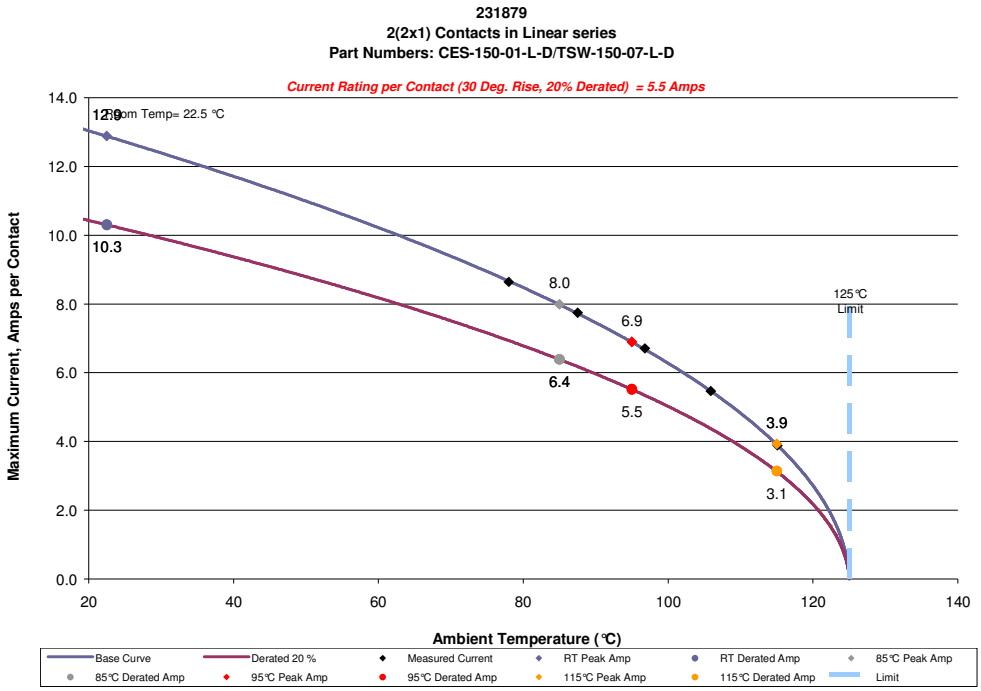
### Mechanical Shock & Random Vibration:

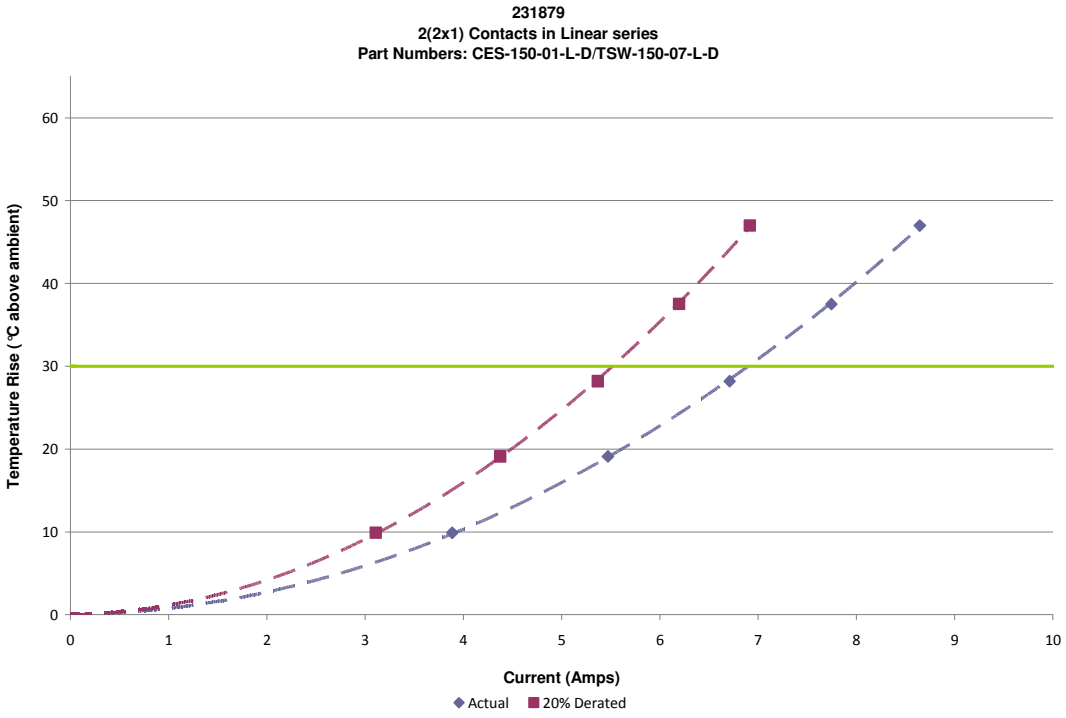
- **Shock**
  - **No Damage---------- ---------- Passed**
  - **50 Nanoseconds---------- ---------- Passed**
- **Vibration**
  - **No Damage---------- ---------- Passed**
  - **50 Nanoseconds---------- ---------- Passed**

# DATA SUMMARIES

## TEMPERATURE RISE (Current Carrying Capacity, CCC):

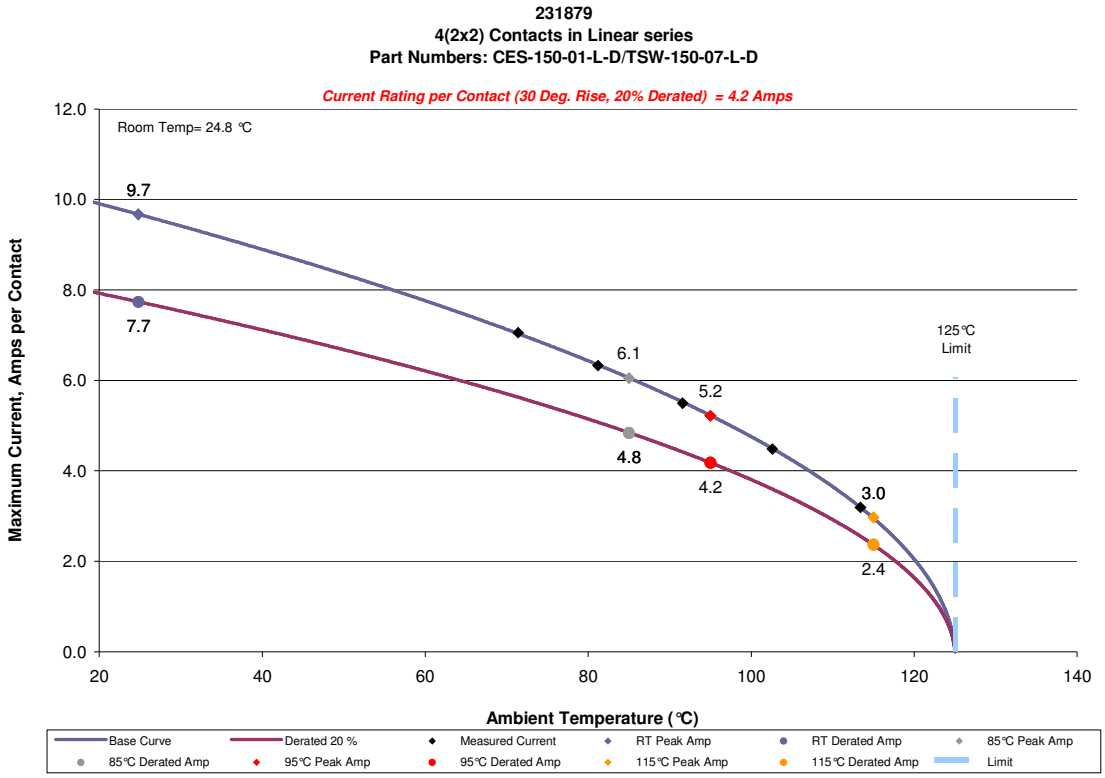
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes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

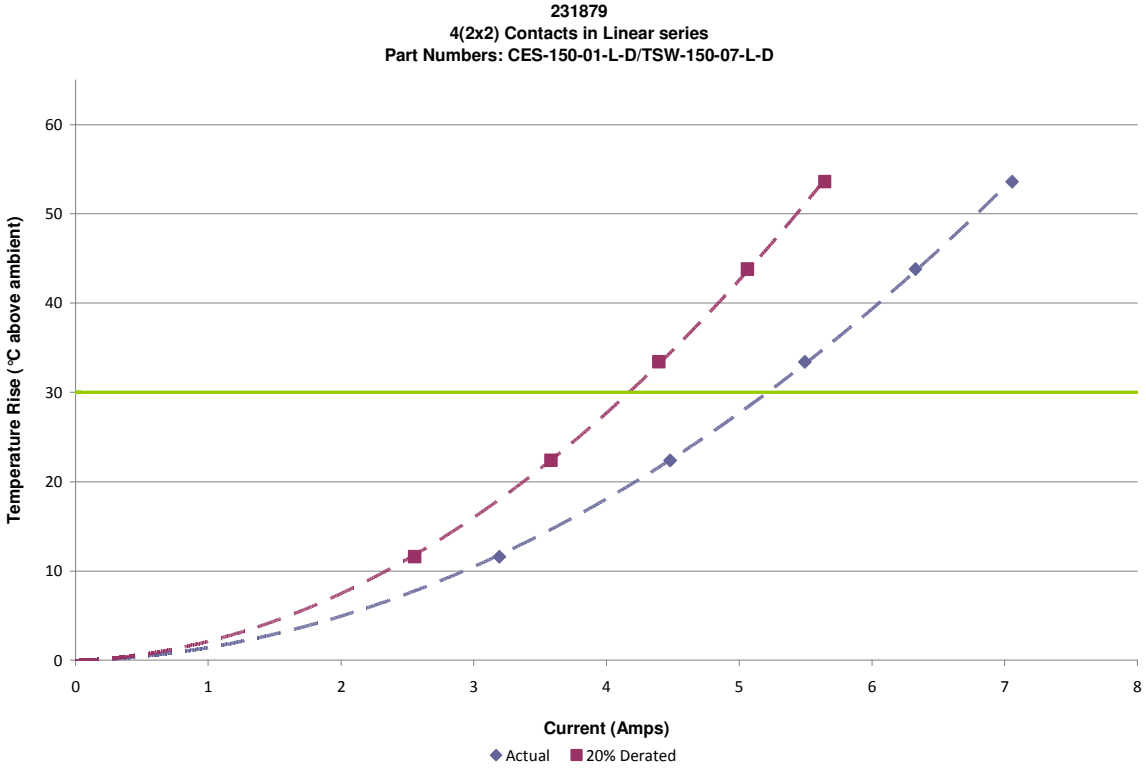


# DATA SUMMARIES Continued

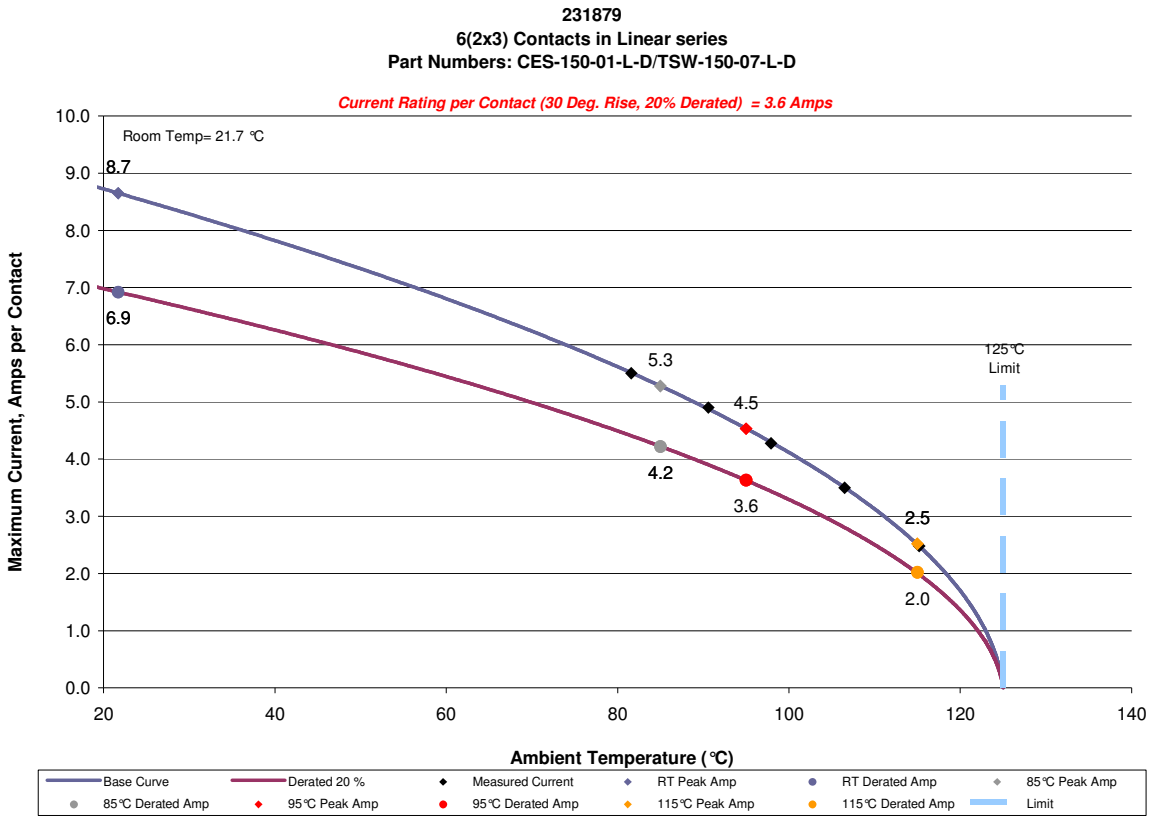
b. Linear configuration with 4 adjacent signal conductors/contacts powered

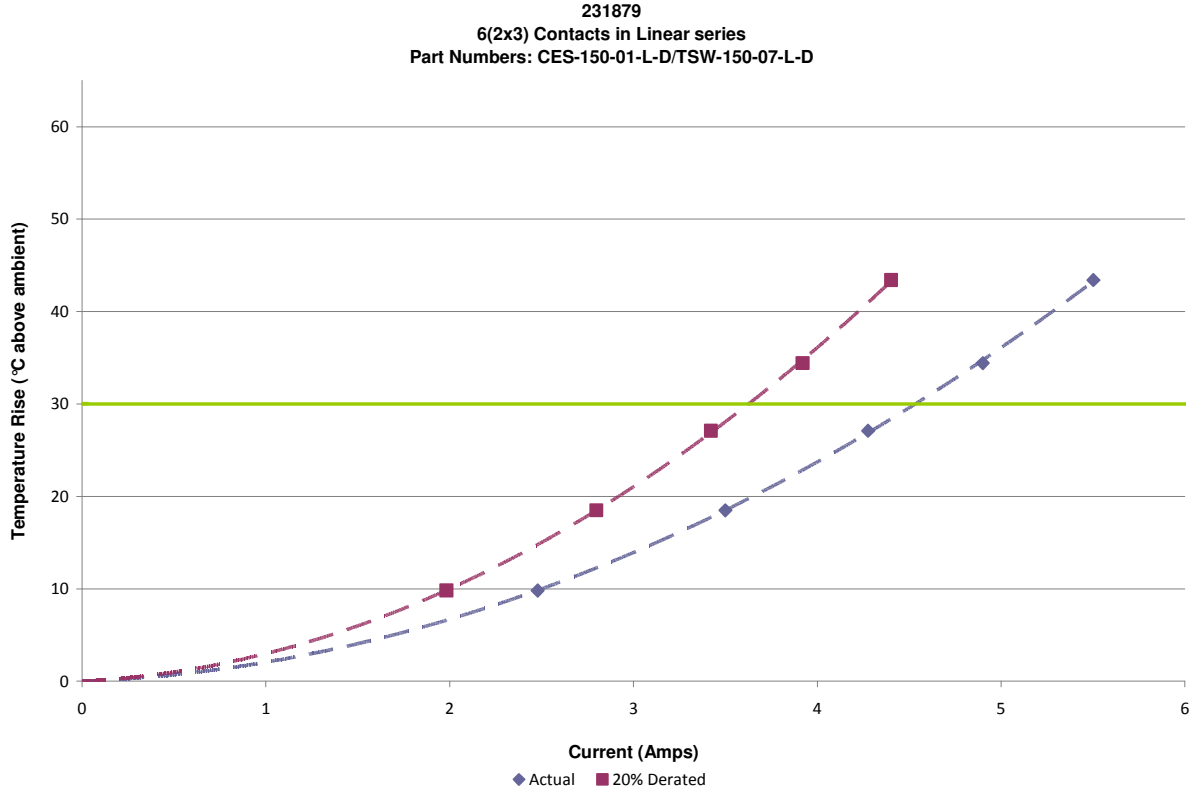


# DATA SUMMARIES Continued

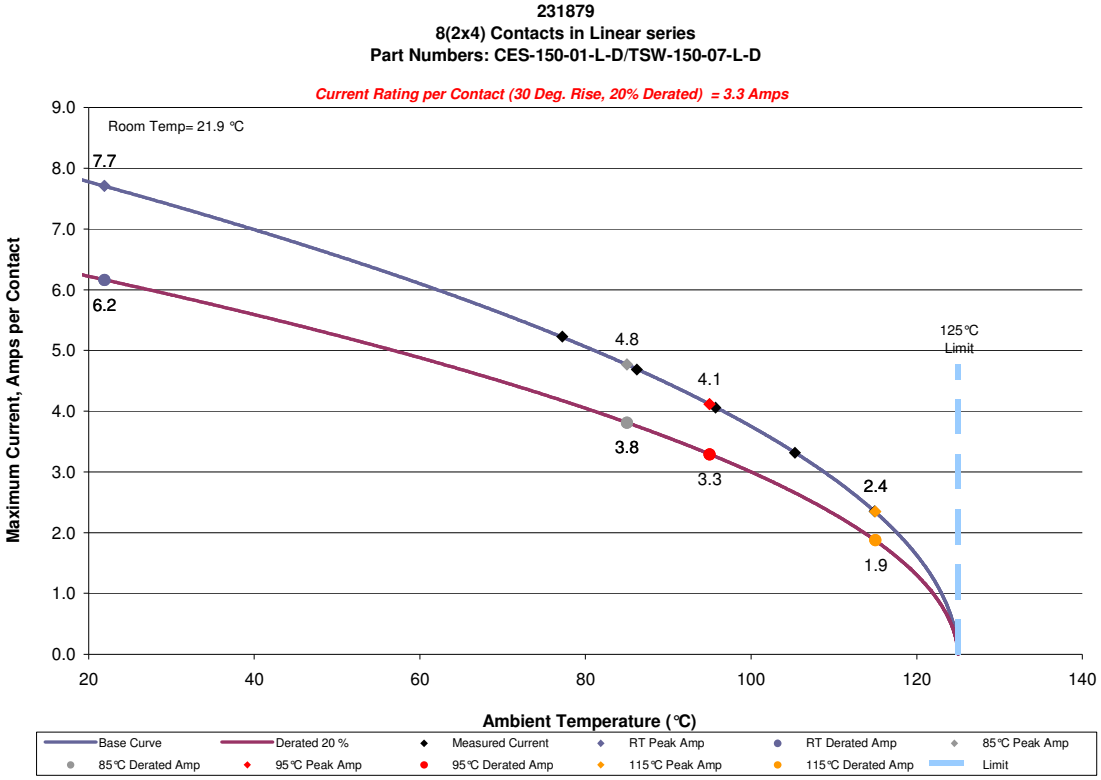
c. Linear configuration with 6 adjacent signal conductors/contacts powered

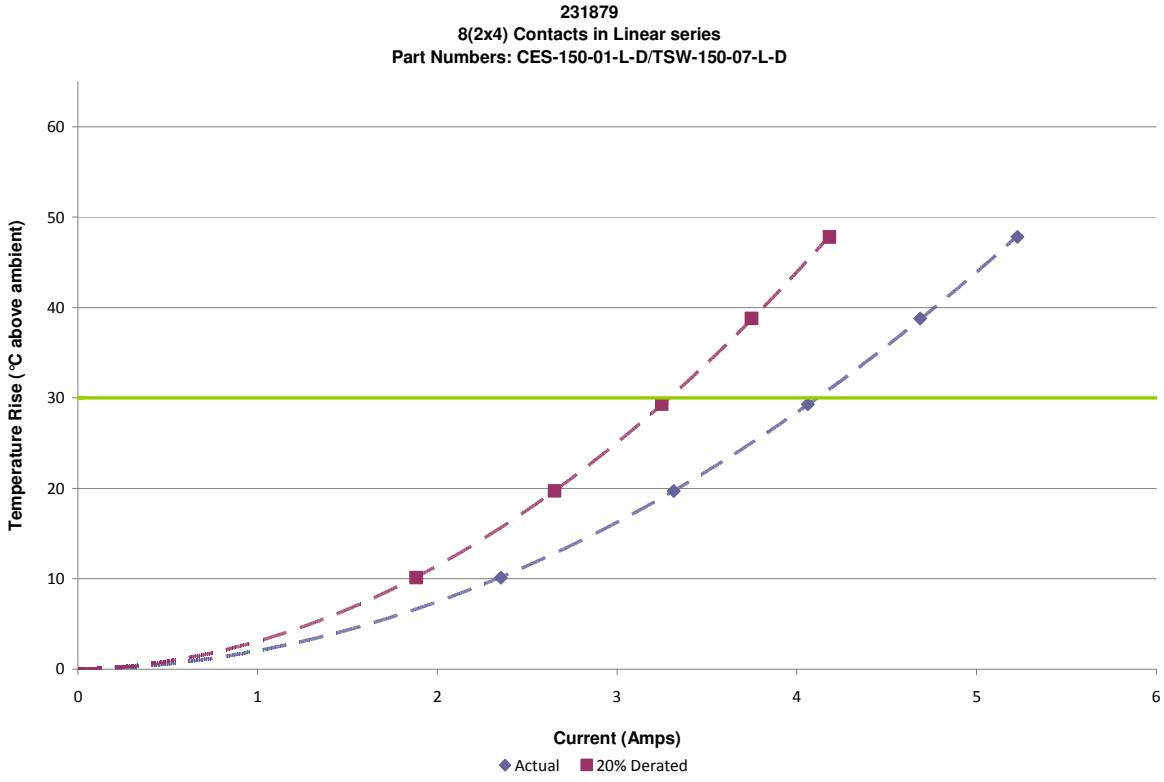


## DATA SUMMARIES Continued

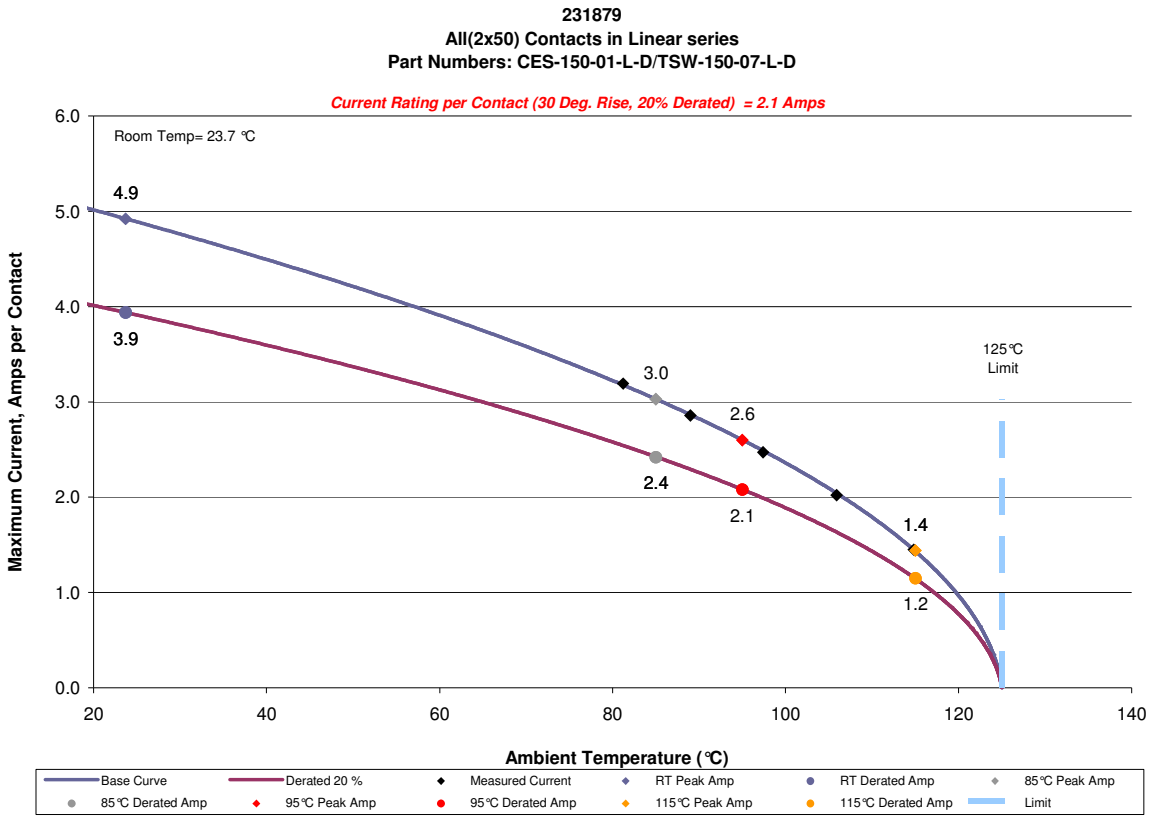
d. Linear configuration with 8 adjacent signal conductors/contacts powered

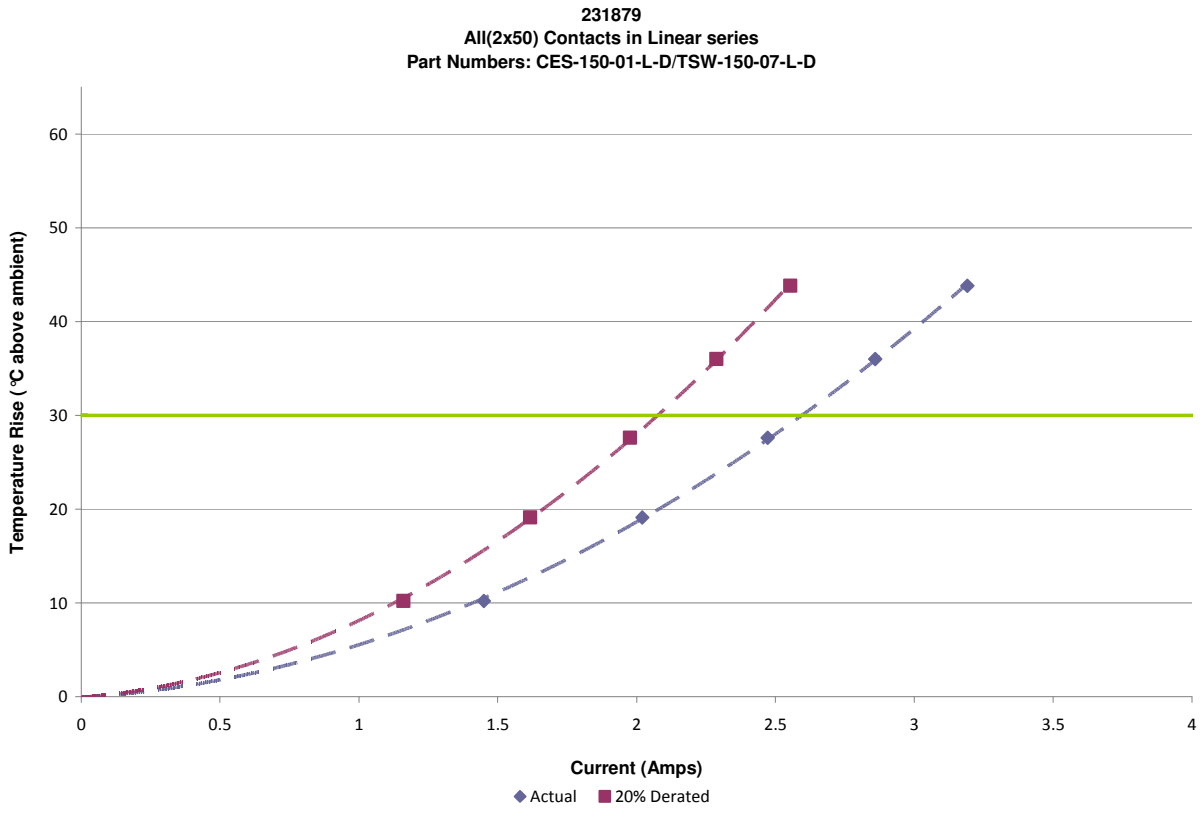


# DATA SUMMARIES Continued

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



## DATA SUMMARIES Continued

**MATING/UNMATING FORCE:**
**Mating/Unmating durability (CES-125-01-L-D/TSW-125-07-L-D):**

| | Initial | | | | After 25 Cycles | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mating** | | **Unmating** | | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 88.38 | 19.87 | 59.74 | 13.43 | 81.53 | 18.33 | 62.81 | 14.12 |
| Maximum | 113.07 | 25.42 | 66.28 | 14.90 | 98.39 | 22.12 | 67.74 | 15.23 |
| **Average** | 99.87 | **22.45** | 61.70 | **13.87** | 91.22 | **20.51** | 64.76 | **14.56** |
| St Dev | 7.67 | 1.72 | 2.24 | 0.50 | 6.47 | 1.46 | 1.68 | 0.38 |
| 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 | 85.67 | 19.26 | 61.07 | 13.73 | 89.49 | 20.12 | 69.57 | 15.64 |
| Maximum | 104.71 | 23.54 | 70.10 | 15.76 | 106.84 | 24.02 | 72.99 | 16.41 |
| **Average** | 94.51 | **21.25** | 66.98 | **15.06** | 97.83 | **22.00** | 71.00 | **15.96** |
| St Dev | 7.32 | 1.65 | 2.73 | 0.61 | 6.75 | 1.52 | 1.39 | 0.31 |
| 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 | 92.07 | 20.70 | 72.10 | 16.21 | 53.82 | 12.10 | 44.79 | 10.07 |
| Maximum | 108.98 | 24.50 | 79.04 | 17.77 | 59.02 | 13.27 | 48.22 | 10.84 |
| **Average** | 100.76 | **22.65** | 74.85 | **16.83** | 57.03 | **12.82** | 46.73 | **10.51** |
| St Dev | 6.25 | 1.41 | 2.26 | 0.51 | 1.64 | 0.37 | 1.05 | 0.24 |
| Count | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

## DATA SUMMARIES Continued

**Mating/Unmating basic (CES-150-01-L-D/TSW-150-07-L-D):**

| | Initial | | | | After 25 Cycles | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mating** | | **Unmating** | | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 185.97 | 41.81 | 111.11 | 24.98 | 172.85 | 38.86 | 119.16 | 26.79 |
| Maximum | 223.11 | 50.16 | 132.42 | 29.77 | 209.77 | 47.16 | 144.92 | 32.58 |
| **Average** | 204.76 | **46.03** | 125.63 | **28.24** | 193.97 | **43.61** | 133.26 | **29.96** |
| St Dev | 14.69 | 3.30 | 7.52 | 1.69 | 12.51 | 2.81 | 8.85 | 1.99 |
| 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 | 173.34 | 38.97 | 120.63 | 27.12 | 200.69 | 45.12 | 134.20 | 30.17 |
| Maximum | 223.82 | 50.32 | 154.61 | 34.76 | 233.39 | 52.47 | 162.89 | 36.62 |
| **Average** | 202.67 | **45.56** | 141.26 | **31.76** | 215.68 | **48.49** | 151.55 | **34.07** |
| St Dev | 15.79 | 3.55 | 10.65 | 2.39 | 11.85 | 2.66 | 9.18 | 2.06 |
| Count | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

| | After 100 Cycles | | | |
|---|---|---|---|---|
| | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 187.35 | 42.12 | 138.91 | 31.23 |
| Maximum | 245.40 | 55.17 | 172.49 | 38.78 |
| **Average** | 223.63 | **50.28** | 158.73 | **35.69** |
| St Dev | 18.36 | 4.13 | 10.51 | 2.36 |
| Count | 8 | 8 | 8 | 8 |

## DATA SUMMARIES Continued

**Mating/Unmating basic (CES-105-01-L-D/TSW-105-07-L-D):**

| | Initial | | | | After 25 Cycles | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mating** | | **Unmating** | | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 19.35 | 4.35 | 12.68 | 2.85 | 18.68 | 4.20 | 13.48 | 3.03 |
| Maximum | 21.88 | 4.92 | 15.88 | 3.57 | 21.88 | 4.92 | 16.10 | 3.62 |
| **Average** | 20.53 | **4.62** | 14.06 | **3.16** | 20.04 | **4.51** | 14.63 | **3.29** |
| St Dev | 0.95 | 0.21 | 1.02 | 0.23 | 1.13 | 0.25 | 0.85 | 0.19 |
| Count | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

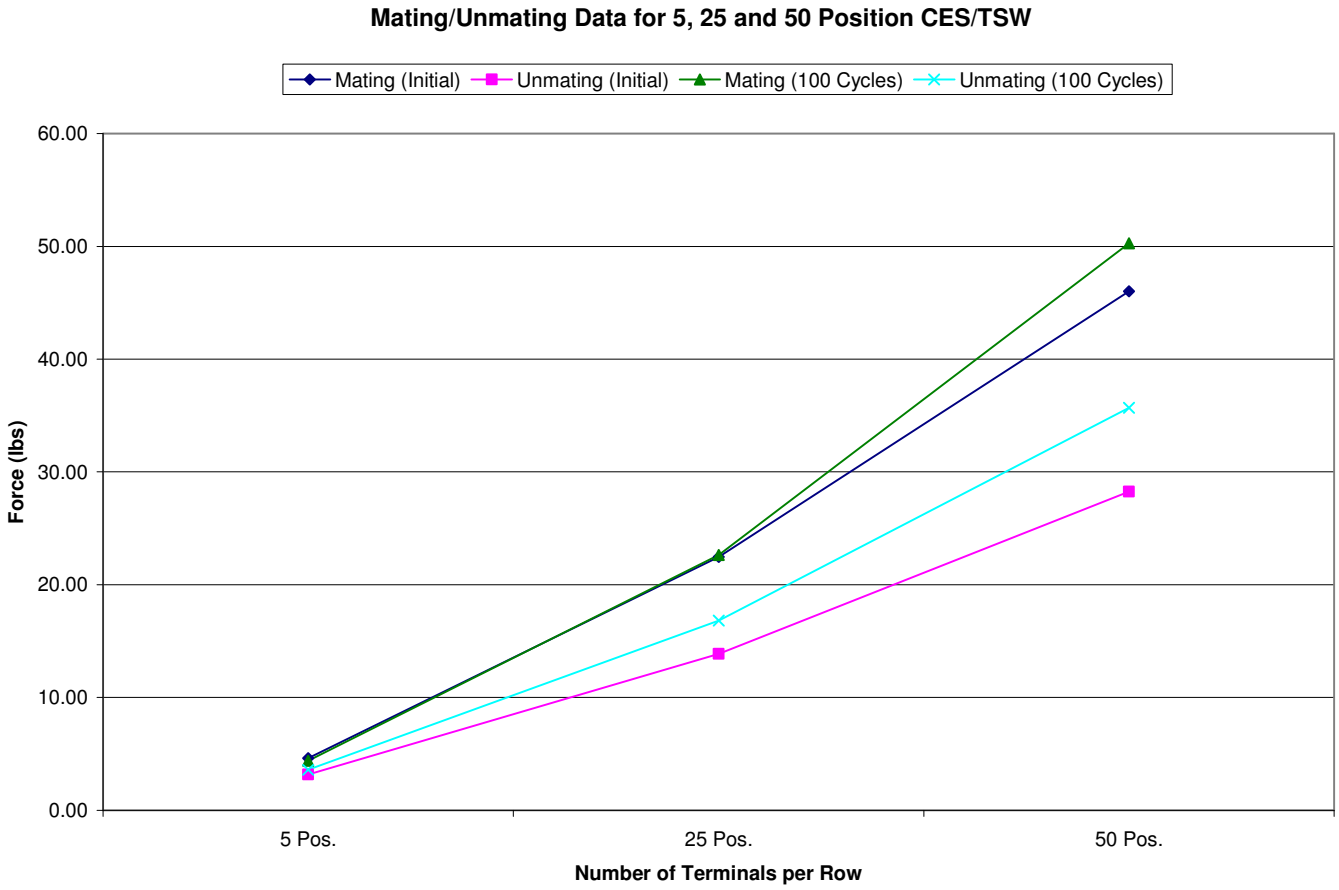
| | After 50 Cycles | | | | After 75 Cycles | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mating** | | **Unmating** | | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 16.99 | 3.82 | 12.32 | 2.77 | 16.68 | 3.75 | 14.10 | 3.17 |
| Maximum | 20.77 | 4.67 | 16.99 | 3.82 | 21.31 | 4.79 | 17.84 | 4.01 |
| **Average** | 18.94 | **4.26** | 14.93 | **3.36** | 19.47 | **4.38** | 15.55 | **3.50** |
| St Dev | 1.34 | 0.30 | 1.37 | 0.31 | 1.59 | 0.36 | 1.18 | 0.27 |
| Count | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

| | After 100 Cycles | | | |
|---|---|---|---|---|
| | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 16.55 | 3.72 | 14.72 | 3.31 |
| Maximum | 21.44 | 4.82 | 18.24 | 4.10 |
| **Average** | 19.45 | **4.37** | 15.92 | **3.58** |
| St Dev | 1.56 | 0.35 | 1.16 | 0.26 |
| Count | 8 | 8 | 8 | 8 |

**Thermal aging (CES-125-01-L-D/TSW-125-07-L-D)**

| | Initial | | | | After Thermals | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mating** | | **Unmating** | | **Mating** | | **Unmating** | |
| | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) | Newtons | Force (Lbs) |
| Minimum | 87.54 | 19.68 | 59.38 | 13.35 | 45.95 | 10.33 | 40.88 | 9.19 |
| Maximum | 104.79 | 23.56 | 66.14 | 14.87 | 53.60 | 12.05 | 43.77 | 9.84 |
| **Average** | 94.54 | **21.25** | 62.33 | **14.01** | 50.55 | **11.37** | 42.19 | **9.49** |
| St Dev | 5.24 | 1.18 | 2.51 | 0.56 | 2.47 | 0.56 | 0.89 | 0.20 |
| Count | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

## DATA SUMMARIES Continued




### Normal force:

| Initial | Deflections in inches Forces in Grams | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **0.0005** | **0.0009** | **0.0014** | **0.0018** | **0.0023** | **0.0027** | **0.0032** | **0.0036** | **0.0041** | **0.0045** | ***SET*** |
| **Averages** | 30.08 | 63.72 | 89.61 | 119.34 | 143.61 | 166.38 | 191.97 | 219.73 | 241.58 | 266.68 | 0.0008 |
| **Min** | 20.30 | 53.50 | 73.20 | 101.20 | 128.50 | 148.40 | 175.40 | 199.60 | 215.60 | 243.80 | 0.0000 |
| **Max** | 42.20 | 74.70 | 100.20 | 136.10 | 161.40 | 190.80 | 219.20 | 254.20 | 276.00 | 291.40 | 0.0013 |
| **St. Dev** | 7.224 | 6.853 | 8.305 | 8.514 | 10.240 | 12.012 | 13.194 | 15.521 | 16.966 | 15.685 | 0.0004 |
| **Count** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

| After Thermals | Deflections in inches Forces in Grams | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **0.0005** | **0.0009** | **0.0014** | **0.0018** | **0.0023** | **0.0027** | **0.0032** | **0.0036** | **0.0041** | **0.0045** | ***SET*** |
| **Averages** | -0.02 | -0.01 | -0.01 | 4.56 | 20.97 | 50.70 | 86.36 | 118.58 | 144.82 | 176.78 | 0.0023 |
| **Min** | -0.50 | -0.50 | -0.50 | -0.50 | 7.10 | 36.60 | 71.20 | 98.60 | 125.20 | 151.60 | 0.0019 |
| **Max** | 0.40 | 0.40 | 0.40 | 18.50 | 48.40 | 73.20 | 107.60 | 137.00 | 161.30 | 193.80 | 0.0028 |
| **St. Dev** | 0.298 | 0.284 | 0.297 | 8.272 | 14.831 | 12.244 | 11.591 | 11.277 | 10.878 | 13.673 | 0.0002 |
| **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 | **CES/TSW** | **CES** | **TSW** |
| **Initial** | 10000 | 10000 | 10000 |
| **Thermal** | 10000 | 10000 | 10000 |
| **Humidity** | 10000 | 10000 | 10000 |

| | Row to Row | | |
|---|---|---|---|
| | Mated | Unmated | Unmated |
| Minimum | **CES/TSW** | **CES** | **TSW** |
| **Initial** | 10000 | 10000 | 10000 |
| **Thermal** | 10000 | 10000 | 10000 |
| **Humidity** | 10000 | 10000 | 10000 |

### DIELECTRIC WITHSTANDING VOLTAGE (DWV):

| Voltage Rating Summary | |
|---|---|
| **Minimum** | **CES/TSW** |
| **Break Down Voltage** | 1600 |
| **Test Voltage** | 1200 |
| **Working Voltage** | 400 |

| Pin to Pin | |
|---|---|
| **Initial Test Voltage** | Passed |
| **After Thermal Test Voltage** | Passed |
| **After Humidity Test Voltage** | Passed |

| Row to Row | |
|---|---|
| **Initial Test Voltage** | Passed |
| **After Thermal Test Voltage** | Passed |
| **After Humidity Test Voltage** | Passed |

## DATA SUMMARIES Continued

### LLCR Durabiltiy:

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 +2000 mOhms ---------- Unstable
   f) >+2000 mOhms:---------- Open Failure

| | ***LLCR Measurement Summaries by Pin Type*** | | | |
|---|---|---|---|---|
| Date | 4/1/2013 | 4/3/2013 | 4/10/2013 | 4/23/2013 |
| Room Temp (Deg C) | 21 | 21 | 23 | 23 |
| Rel Humidity (%) | 60 | 56 | 56 | 60 |
| Technician | Peter Chen | Peter Chen | Peter Chen | Peter Chen |
| **mOhm values** | **Actual Initial** | **Delta 100 Cycles** | **Delta Therm Shck** | **Delta Humidity** |
| | **Pin Type 1: Signal** | | | |
| Average | 3.57 | 0.10 | 0.08 | 0.09 |
| St. Dev. | 0.21 | 0.11 | 0.08 | 0.11 |
| Min | 2.89 | 0.00 | 0.00 | 0.00 |
| Max | 4.23 | 0.66 | 0.50 | 0.68 |
| Summary Count | 192 | 192 | 192 | 192 |
| Total Count | 192 | 192 | 192 | 192 |

| ***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 Thermal aging:

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 +2000 mOhms ---------- Unstable
   f) >+2000 mOhms:---------- Open Failure

| | ***LLCR Measurement Summaries by Pin Type*** | | | |
|---|---|---|---|---|
| Date | 4/2/2013 | 4/17/2013 | | |
| Room Temp (Deg C) | 21 | 23 | | |
| Rel Humidity (%) | 54 | 56 | | |
| Technician | Peter Chen | Peter Chen | | |
| **mOhm values** | **Actual Initial** | **Delta Thermal** | **Delta** | **Delta** |
| | **Pin Type 1: Signal** | | | |
| Average | 3.62 | 0.07 | | |
| St. Dev. | 0.19 | 0.07 | | |
| Min | 3.18 | 0.00 | | |
| Max | 4.16 | 0.47 | | |
| Summary Count | 192 | 192 | | |
| Total Count | 192 | 192 | | |

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

## DATA SUMMARIES Continued

### LLCR Gas Tight:

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 +2000 mOhms ---------- Unstable
   f) >+2000 mOhms:---------- Open Failure

| | ***LLCR Measurement Summaries by Pin Type*** | | | |
|---|---|---|---|---|
| Date | 4/24/2013 | 4/26/2013 | | |
| Room Temp (Deg C) | 23 | 23 | | |
| Rel Humidity (%) | 60 | 56 | | |
| Technician | Peter Chen | Peter Chen | | |
| **mOhm values** | **Actual Initial** | **Delta Acid Vapor** | **Delta** | **Delta** |
| | **Pin Type 1: Signal** | | | |
| Average | 3.74 | 0.08 | | |
| St. Dev. | 0.22 | 0.11 | | |
| Min | 3.12 | 0.00 | | |
| Max | 4.64 | 0.87 | | |
| Summary Count | 192 | 192 | | |
| Total Count | 192 | 192 | | |

| ***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 S&V:

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 +2000 mOhms ---------- Unstable
   f) >+2000 mOhms:---------- Open Failure

| | ***LLCR Measurement Summaries by Pin Type*** | | | |
|---|---|---|---|---|
| Date | 3/26/2013 | 4/24/2013 | | |
| Room Temp (Deg C) | 23 | 23 | | |
| Rel Humidity (%) | 34 | 37 | | |
| Technician | Troy Cook | Troy Cook | | |
| **mOhm values** | **Actual Initial** | **Delta Shock-Vib** | **Delta** | **Delta** |
| | **Pin Type 1: Signal** | | | |
| Average | 3.52 | 0.11 | | |
| St. Dev. | 0.24 | 0.12 | | |
| Min | 2.91 | 0.00 | | |
| Max | 4.33 | 0.70 | | |
| Summary Count | 192 | 192 | | |
| Total Count | 192 | 192 | | |

| ***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** |

### Shock and Vibration 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 #:** HZ-MO-05
**Description:** Digital Multimeter
**Manufacturer:** Keithley
**Model:** 3706
**Serial #:** 1285188
**Accuracy:** Last Cal: 2012-8-18, Next Cal: 2013-8-18

**Equipment #:** HZ-TCT-01
**Description:** Normal force analyzer
**Manufacturer:** Mecmesin Multitester
**Model:** Mecmesin Multitester 2.5-i
**Serial #:** 08-1049-04
**Accuracy:** Last Cal: 2013-4-28, Next Cal: 2014-4-27

**Equipment #:** HZ-THC-01
**Description:** Humidity transmitter
**Manufacturer:** Thermtron
**Model:** HMM30C
**Serial #:** D0240037
**Accuracy:** Last Cal: 2013-3-3, Next Cal: 2014-3-2

**Equipment #:** HZ-TSC-01
**Description:** Thermal Shock transmitter
**Manufacturer:** CSZ
**Model:** 10-VT14994
**Serial #:** VTS-3-6-6-SC/AC
**Accuracy:** Last Cal: 2012-11-1, Next Cal: 2013-11-1

**Equipment #:** HZ-OV-01
**Description:** Oven
**Manufacturer:** Huida
**Model:** CS101-1E
**Serial #:** CS101-1E-B
**Accuracy:** Last Cal: 2012-12-14, Next Cal: 2013-12-13

**Equipment #:** HZ-HPM-01
**Description:** IR/DWV Tester
**Manufacturer:** AN9636H
**Model:** AN9636H
**Serial #:** 089601091
**Accuracy:** Last Cal: 2012-7-6, Next Cal: 2013-7-5

## EQUIPMENT AND CALIBRATION SCHEDULES

**Equipment #:** HZ-MO-02
**Description:** Micro-ohmmeter
**Manufacturer:** Keithley
**Model:** 2700
**Serial #:** 1199807
**Accuracy:** Last Cal: 2013-4-28, Next Cal: 2014-4-27

**Equipment #:** HZ-PS-01
**Description:** Power Supply
**Manufacturer:** Agilent
**Model:** 6031A
**Serial #:** MY41000982
**Accuracy:** Last Cal: 2013-4-28, Next Cal: 2014-4-27

**Equipment #:** SVC-01
**Description:** Shock & Vibration Table
**Manufacturer:** Data Physics
**Model:** LE-DSA-10-20K
**Serial #:** 10037
**Accuracy:** See Manual
… Last Cal: 2012-11-31, Next Cal: 2013-11-31

**Equipment #:** ACLM-01
**Description:** Accelerometer
**Manufacturer:** PCB Piezotronics
**Model:** 352C03
**Serial #:** 115819
**Accuracy:** See Manual
… Last Cal: 2012-07-9, Next Cal: 2013-7-9

**Equipment #:** ED-03
**Description:** Event Detector
**Manufacturer:** Analysis Tech
**Model:** 32EHD
**Serial #:** 1100604
**Accuracy:** See Manual
… Last Cal: 2013-06-4, Next Cal: 2014-06-4