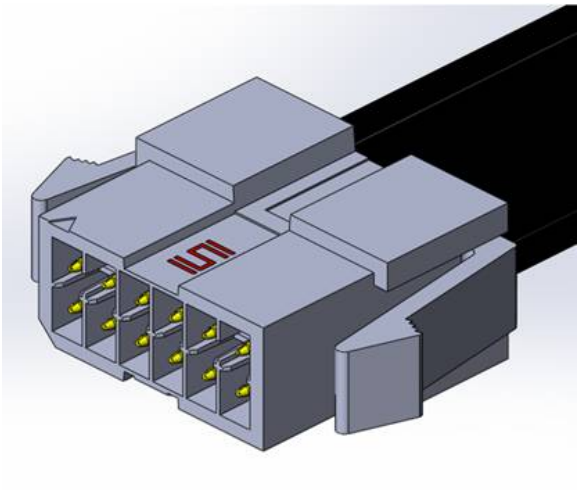
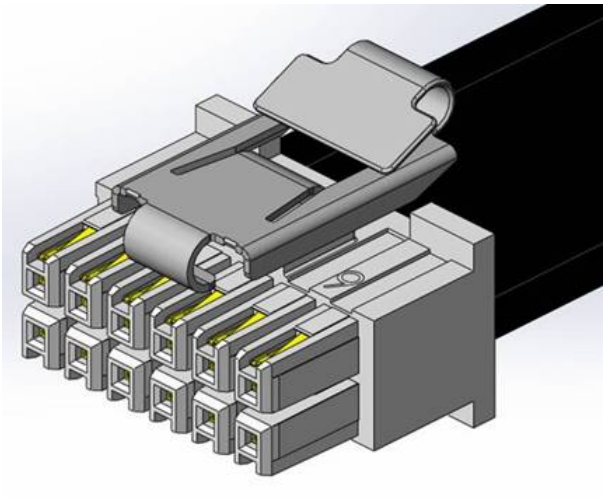
Project Number: Design Qualification Test Report	Tracking Code: 299779_Report_Rev_3
Requested by: Hardy Tain	Date: 12/12/2014
Part #: MRTD-08-20-L-03.00/MMSD-08-20-L-03.00-S-M	
Part description: MRTD/MMSD	Tech: Kason He
Test Start: 1/10/2014	Test Completed: 2/21/2014





(Actual part not depicted)

DESIGN QUALIFICATION TEST REPORT

MRTD/MMSD
MRTD-08-20-L-03.00/MMSD-08-20-L-03.00-S-M

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
08/12/2014	**1**	**Initial Issue**	**KH**
12/12/2014	**3**	**Update the part number**	**KH**

CERTIFICATION

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

SCOPE

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

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts to be used for LLCR 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 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-103826-TST/PCB-103827-TST

FLOWCHARTS

Mating/Unmating/Durability

Group 1
MRTD-08-20-L-06.00
MMSD-08-20-L-06.00-S-M
8 Assemblies

Note: Remove the latch to test mating&unmating force.

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

Group 2
MRTD-02-20-L-03.00
MMSD-02-20-L-03.00-S-M
8 Assemblies

Note: removing the latch.

Step	Description
1.	Mating/Unmating Force (3)
2.	Cycles Quantity = 25 Cycles
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)

Group 3
MRTD-15-20-L-03.00
MMSD-15-20-L-03.00-S-M
8 Assemblies

Note: removing the latch.

Step	Description
1.	Mating/Unmating Force (3)
2.	Cycles Quantity = 25 Cycles
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)

(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 MRTD-08-20-L-03.00 MMSD-08-20-L-03.00-S-M 2 Assemblies		Group 2 MRTD-08-20-L-03.00 2 Assemblies		Group 3 MMSD-08-20-L-03.00-S-M 2 Assemblies		Group 4 MRTD-08-20-L-03.00 MMSD-08-20-L-03.00-S-M 2 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**	**Step**	**Description**
1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	IR (4)
						2.	DWV at Test Voltage (1)
						3.	Thermal Shock (5)
						4.	IR (4)
						5.	DWV at Test Voltage (1)
						6.	Humidity (3)
						7.	IR (4)
						8.	DWV at Test Voltage (1)

Row-to-Row

Group 5 MRTD-08-20-L-03.00 MMSD-08-20-L-03.00-S-M 2 Assemblies		Group 6 MRTD-08-20-L-03.00 2 Assemblies		Group 7 MMSD-08-20-L-03.00-S-M 2 Assemblies		Group 8 MRTD-08-20-L-03.00 MMSD-08-20-L-03.00-S-M 2 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**	**Step**	**Description**
1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	IR (4)
						2.	DWV at Test Voltage (1)
						3.	Thermal Shock (5)
						4.	IR (4)
						5.	DWV at Test Voltage (1)
						6.	Humidity (3)
						7.	IR (4)
						8.	DWV at Test Voltage (1)

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

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

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

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

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

FLOWCHARTS Continued

Current Carrying Capacity

Group 1
MRTD-15-20-L-03.00
MMSD-15-20-L-03.00-S-M
2 Pins Powered
Signal

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

Group 2
MRTD-15-20-L-03.00
MMSD-15-20-L-03.00-S-M
4 Pins Powered
Signal

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

Group 3
MRTD-15-20-L-03.00
MMSD-15-20-L-03.00-S-M
6 Pins Powered
Signal

Step	Description
1.	CCC(1) Rows = 2 Number of Positions = 3

Group 4
MRTD-15-20-L-03.00
MMSD-15-20-L-03.00-S-M
8 Pins Powered
Signal

Step	Description
1.	CCC(1) Rows = 2 Number of Positions = 4

Group 5
MRTD-15-20-L-03.00
MMSD-15-20-L-03.00-S-M
30 Pins Powered
Signal

Step	Description
1.	CCC(1) Rows = 2 Number of Positions = 15

(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

Cable Pull

Group 1
MRTD-08-20-L-03.00
MMSD-08-20-L-03.00-S-M
5 Assemblies
0 Degrees

Step	Description
1.	Cable Pull(1)

Group 2
MRTD-08-20-L-03.00
MMSD-08-20-L-03.00-S-M
5 Assemblies
90 Degrees

Step	Description
1.	Cable Pull(1)

(1) Cable Pull = EIA-364-38
Measure and Record Force Required to Failure
Failure = Discontinuity >1 microsecond at 10 ohms

FLOWCHARTS Continued

Mechanical Shock/Random Vibration/LLCR

Group 1
MRTD-08-20-L-12.00
MMSD-08-20-L-12.00-S-M
8 Assemblies

Step	Description
1.	LLCR (1) Max Delta = 15 mOhm
2.	Mechanical Shock (2)
3.	Random Vibration (3)
4.	LLCR (1) Max Delta = 15 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 Detection

Group 1
MRTD-08-20-L-12.00
MMSD-08-20-L-12.00-S-M
60 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.

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)

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.

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. 65^{o} C
    c. 75^{o} C
    d. 95^{o} C
8) Typically, neighboring contacts (in close proximity to maximize heat build up) are energized.
9) The thermocouple (or temperature measuring probe) will be positioned at a location to sense the maximum temperature in the vicinity of the heat generation area.
10) A computer program, *TR 803.exe*, ensures accurate stability for data acquisition.
11) Hook-up wire cross section is larger than the cross section of any connector leads/PC board traces, jumpers, etc.
12) Hook-up wire length is longer than the minimum specified in the referencing standard.

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

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 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).

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

CONNECTOR PULL:

1) Secure cable near center and pull on connector
    a. At 90°, right angle to cable
    b. At 0°, in-line with cable

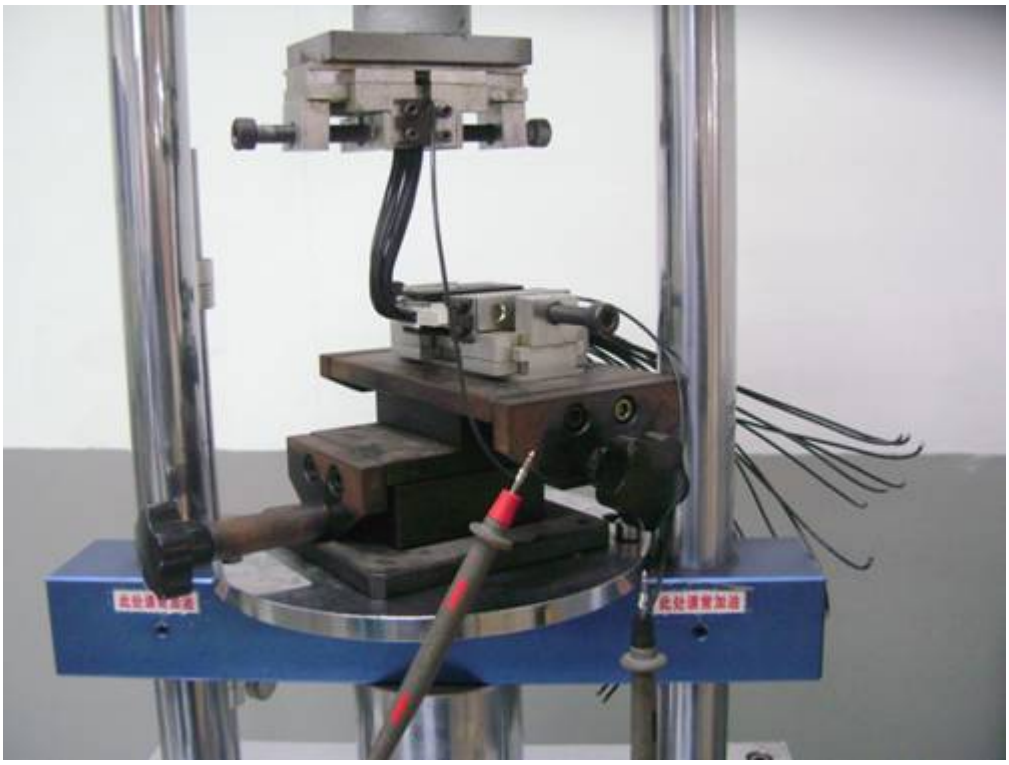


Fig. 1
(Typical set-up, actual part not depicted.)
90° Connector pull, notice the electrical continuity hook-up wires.

RESULTS

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise ----------3.9 A per contact with 2 contacts (2 x 1) powered**
- **CCC for a 30°C Temperature Rise ----------3.3 A per contact with 4 contacts (2 x 2) powered**
- **CCC for a 30°C Temperature Rise ----------3.1 A per contact with 6 contacts (2 x 3) powered**
- **CCC for a 30°C Temperature Rise ----------3.0 A per contact with 8 contacts (2 x 4) powered**
- **CCC for a 30°C Temperature Rise ----------2.2 A per contact with 30 contacts (2 x 15) powered**

Mating/Unmating Forces

Mating-Unmating Durability Group (MRTD-08-20-L-06.00/MMSD-08-20-L-06.00-S-M)

- **Initial**
  - **Mating**
    - **Min ---------- 1.27 Lbs**
    - **Max---------- 1.43 Lbs**
  - **Unmating**
    - **Min ---------- 0.75 Lbs**
    - **Max---------- 0.90 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 1.35 Lbs**
    - **Max---------- 1.51 Lbs**
  - **Unmating**
    - **Min ---------- 0.80 Lbs**
    - **Max---------- 0.92 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 1.42 Lbs**
    - **Max---------- 1.59 Lbs**
  - **Unmating**
    - **Min ---------- 0.82 Lbs**
    - **Max---------- 0.98 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 1.47 Lbs**
    - **Max---------- 1.70 Lbs**
  - **Unmating**
    - **Min ---------- 0.91 Lbs**
    - **Max---------- 1.02 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 1.52 Lbs**
    - **Max---------- 1.74 Lbs**
  - **Unmating**
    - **Min ---------- 0.95 Lbs**
    - **Max---------- 1.11 Lbs**
- **Humidity**
  - **Mating**
    - **Min ---------- 1.49 Lbs**
    - **Max---------- 2.25 Lbs**
  - **Unmating**
    - **Min ---------- 0.57 Lbs**
    - **Max---------- 0.85 Lbs**

RESULTS Continued

Mating/Unmating Forces

Mating-Unmating Basic (MRTD-02-20-L-03.00/MMSD-02-20-L-03.00-S-M)

- **Initial**
  - **Mating**
    - **Min ---------- 0.25 Lbs**
    - **Max---------- 0.47 Lbs**
  - **Unmating**
    - **Min ---------- 0.13 Lbs**
    - **Max---------- 0.22 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 0.28 Lbs**
    - **Max---------- 0.47 Lbs**
  - **Unmating**
    - **Min ---------- 0.15 Lbs**
    - **Max---------- 0.21 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 0.31 Lbs**
    - **Max---------- 0.47 Lbs**
  - **Unmating**
    - **Min ---------- 0.15 Lbs**
    - **Max---------- 0.24 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 0.31 Lbs**
    - **Max---------- 0.49 Lbs**
  - **Unmating**
    - **Min ---------- 0.17 Lbs**
    - **Max---------- 0.23 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 0.32 Lbs**
    - **Max---------- 0.50 Lbs**
  - **Unmating**
    - **Min ---------- 0.16 Lbs**
    - **Max---------- 0.24 Lbs**

RESULTS Continued

Mating/Unmating Forces

Mating-Unmating Basic (MRTD-15-20-L-03.00/MMSD-15-20-L-03.00-S-M)

- **Initial**
  - **Mating**
    - **Min ---------- 1.53 Lbs**
    - **Max---------- 2.20 Lbs**
  - **Unmating**
    - **Min ---------- 0.76 Lbs**
    - **Max---------- 1.23 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 1.78 Lbs**
    - **Max---------- 2.53 Lbs**
  - **Unmating**
    - **Min ---------- 0.86 Lbs**
    - **Max---------- 1.39 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 1.96 Lbs**
    - **Max---------- 2.74 Lbs**
  - **Unmating**
    - **Min ---------- 1.02 Lbs**
    - **Max---------- 1.59 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 2.13 Lbs**
    - **Max---------- 2.91 Lbs**
  - **Unmating**
    - **Min ---------- 1.44 Lbs**
    - **Max---------- 1.81 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 2.23 Lbs**
    - **Max---------- 3.12 Lbs**
  - **Unmating**
    - **Min ---------- 1.25 Lbs**
    - **Max---------- 1.89 Lbs**

RESULTS Continued

Insulation Resistance minimums, IR

- **Initial**
  - **Mated ---------- 10000 Meg Ω ---------- Passed**
  - **Unmated ---------- 10000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 10000 Meg Ω ---------- Passed**
  - **Unmated ---------- 10000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 10000 Meg Ω ---------- Passed**
  - **Unmated ---------- 10000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 1750 VAC**
  - **Test Voltage ---------- 1313 VAC**
  - **Working Voltage ---------- 435 VAC**
- **Initial DWV ----------Passed**
- **Thermal DWV----------Passed**
- **Humidity DWV----------Passed**

RESULTS Continued

LLCR Mating/Unmating Durability Group (128 LLCR test points)

- **Initial ---------- 20.12 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 128 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+2000 mOhms ---------- 0 Points ---------- Open Failure**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 128 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+2000 mOhms ---------- 0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ---------- 128 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 Shock & Vibration Group (128 LLCR test points)

- **Initial ---------- 32.90 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms ---------- 127 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 1 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+2000 mOhms ---------- 0 Points ---------- Open Failure**

Cable Pull

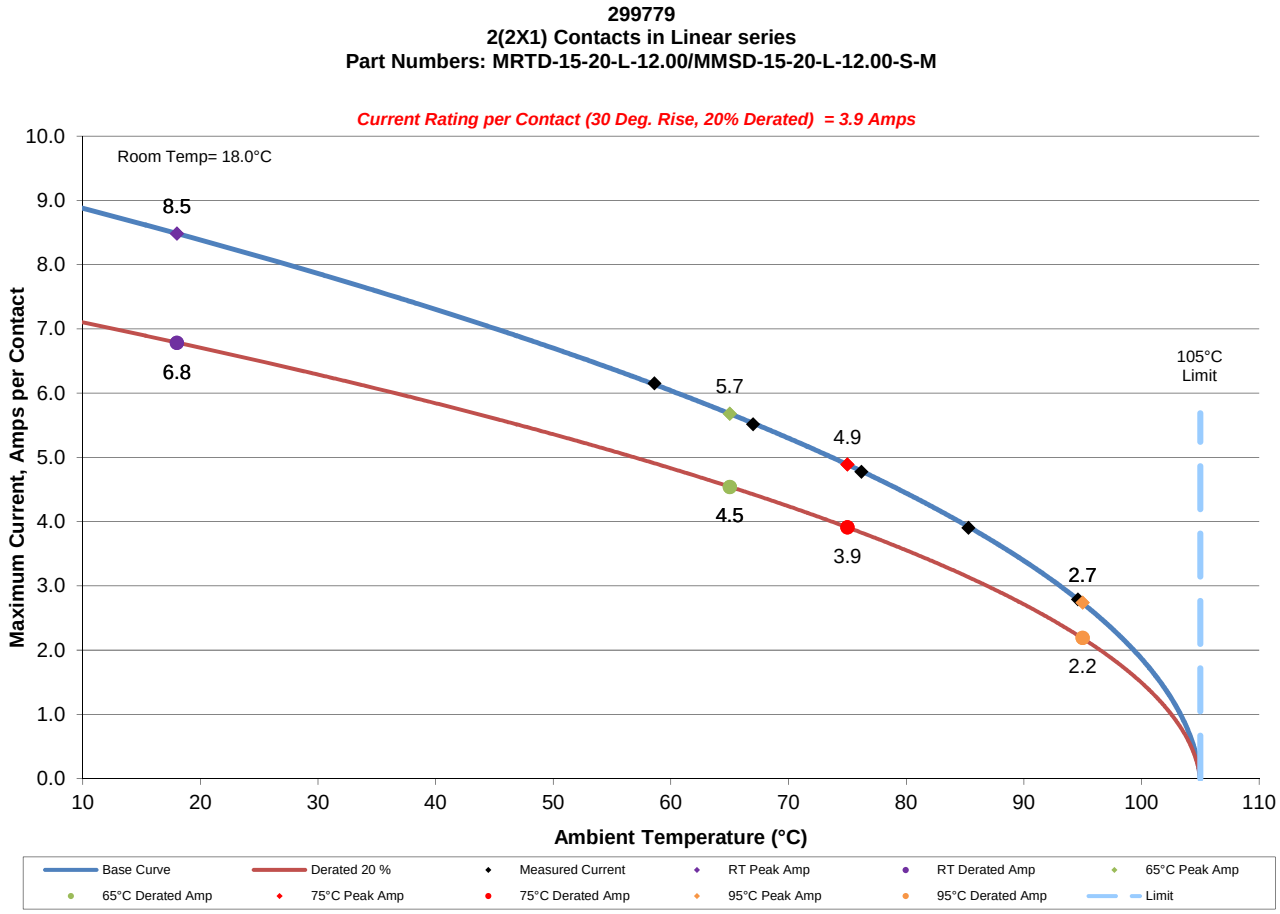
- **0 ° Pull force**
  - **Min ---------- 13.19 Lbs**
  - **Max ---------- 15.88 Lbs**
- **90 ° Pull force**
  - **Min ---------- 12.80 Lbs**
  - **Max ---------- 15.42 Lbs**

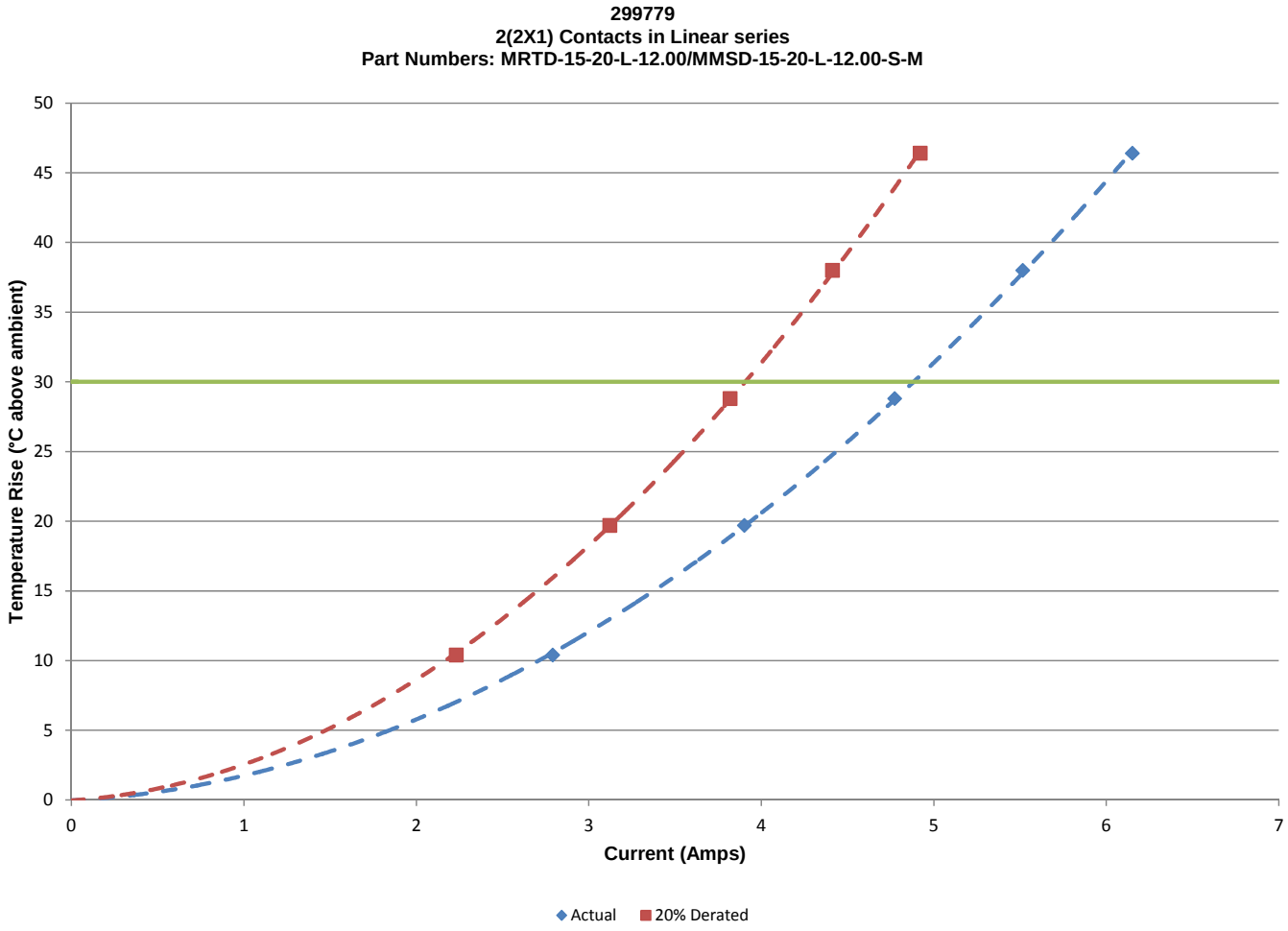
DATA SUMMARIES

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:

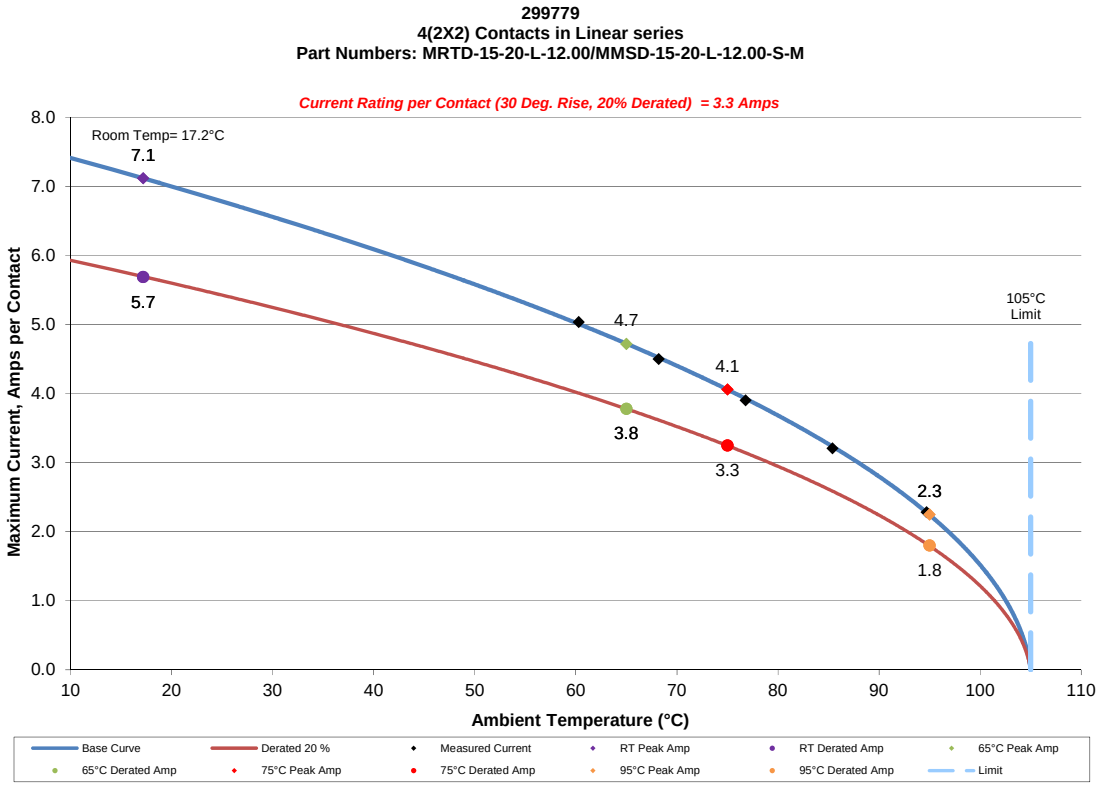
    a. Linear configuration with 2 adjacent conductors/contacts powered

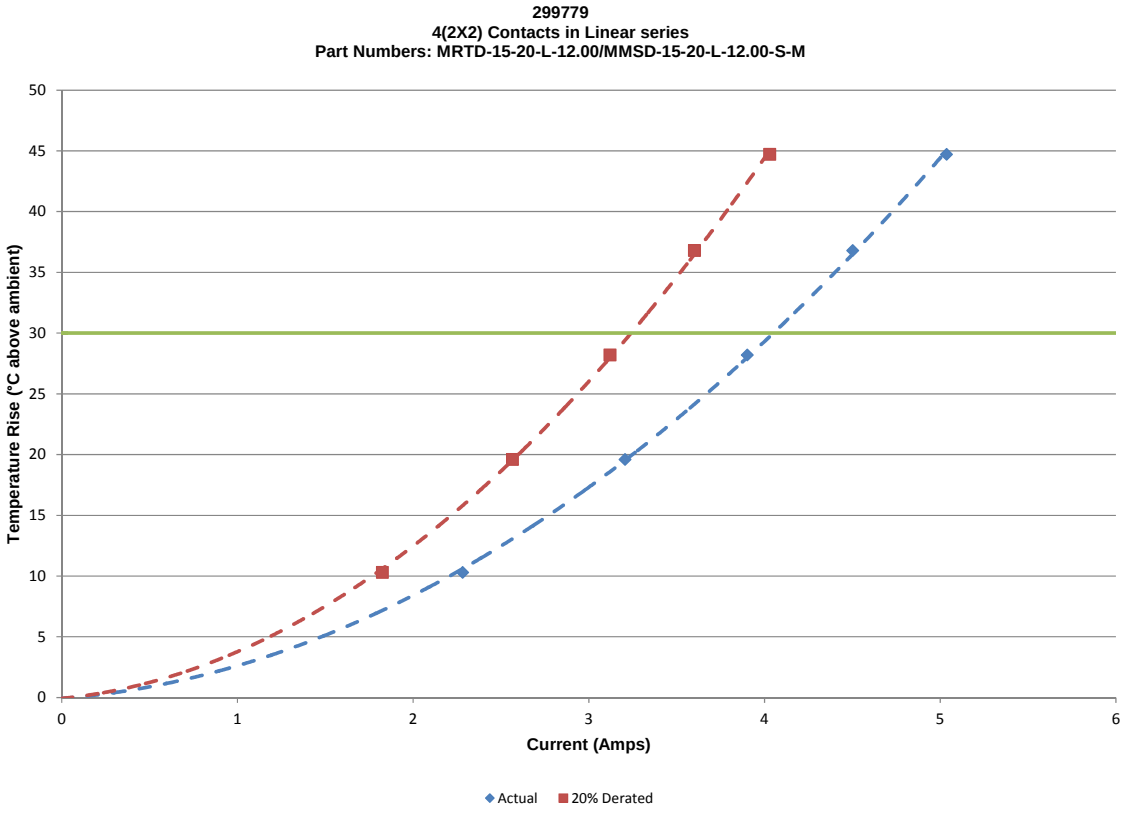



299779
2(2X1) Contacts in Linear series
Part Numbers: MRTD-15-20-L-12.00/MMSD-15-20-L-12.00-S-M
Temperature Rise (°C above ambient)
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
Current (Amps)
Actual
20% Derated

DATA SUMMARIES Continued

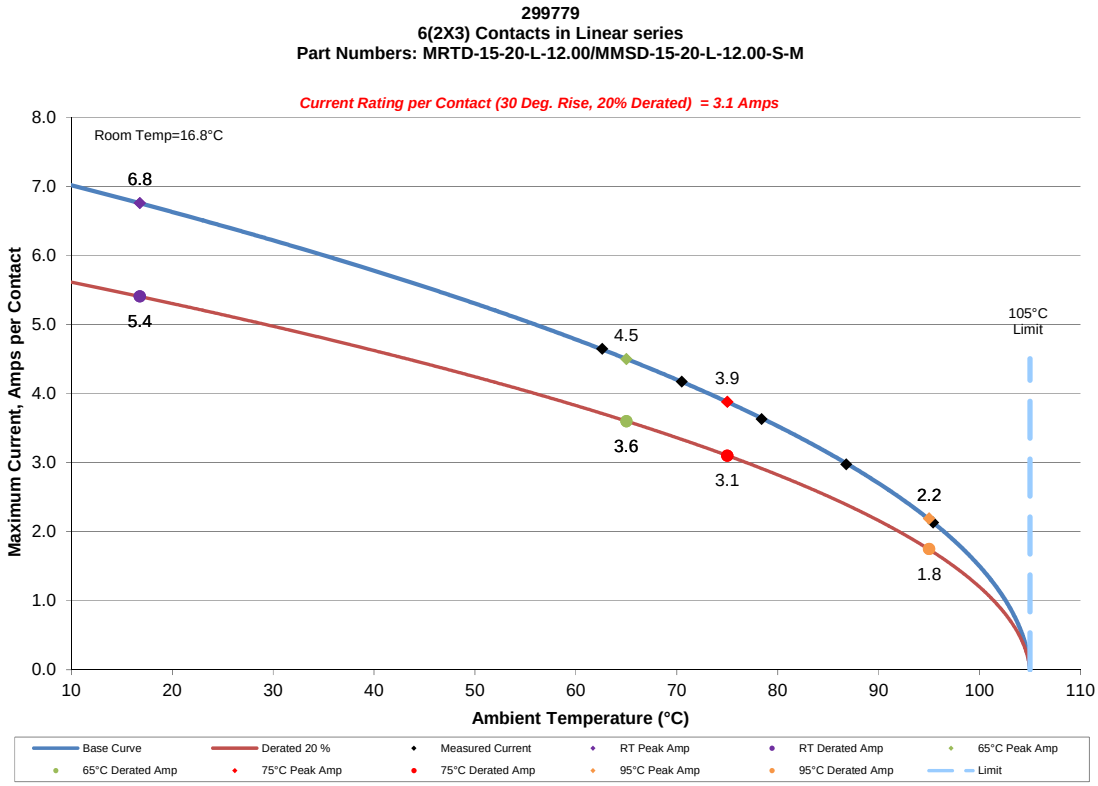
b. Linear configuration with 4 adjacent conductors/contacts powered

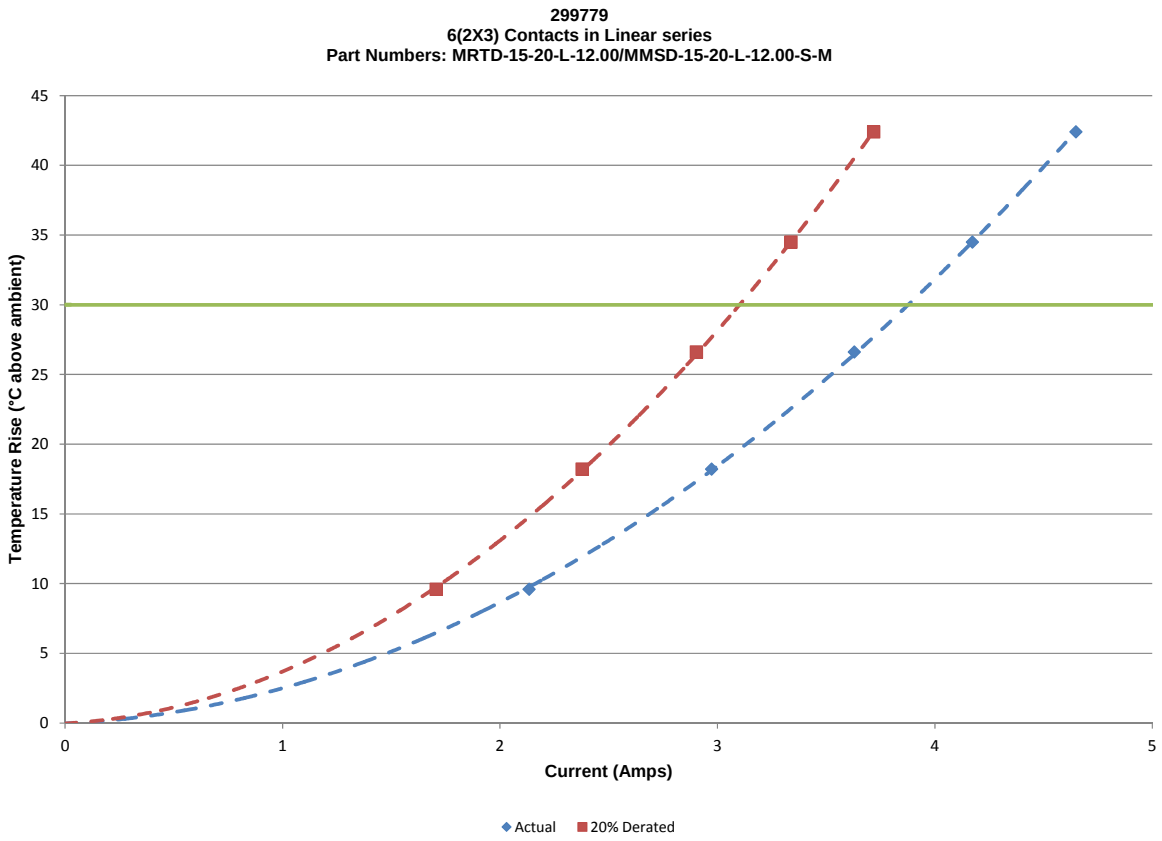




DATA SUMMARIES Continued

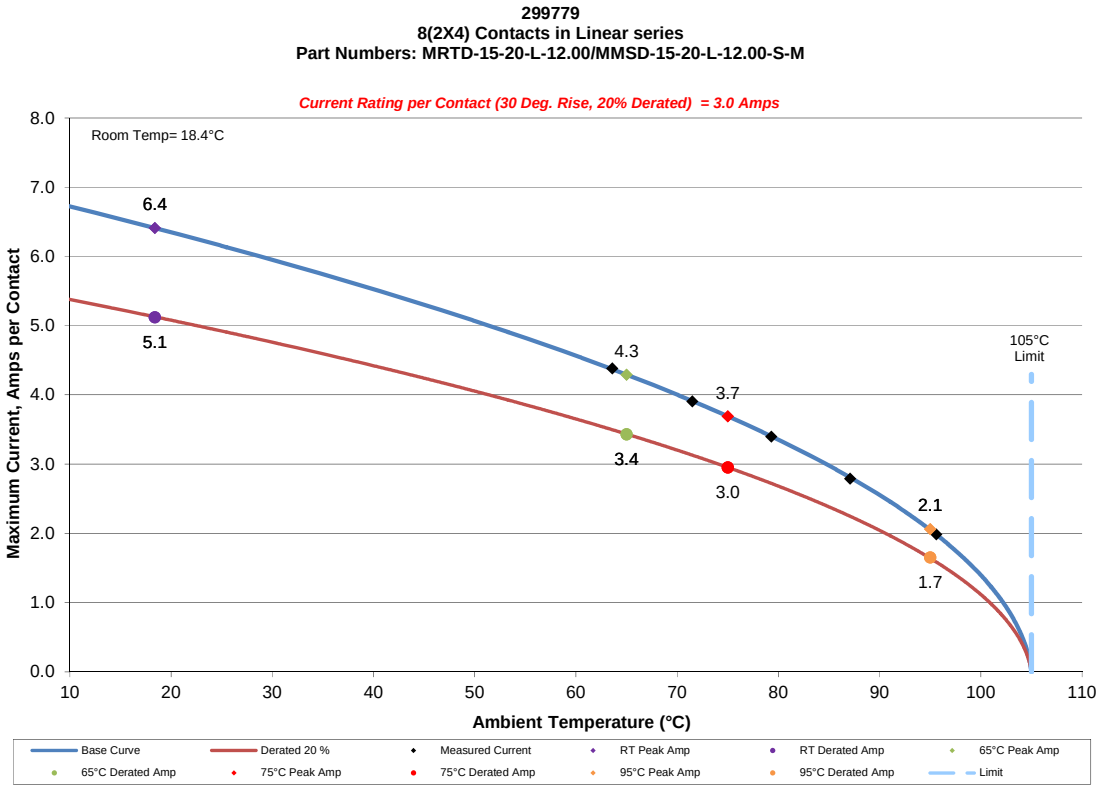
c. Linear configuration with 6 adjacent conductors/contacts powered

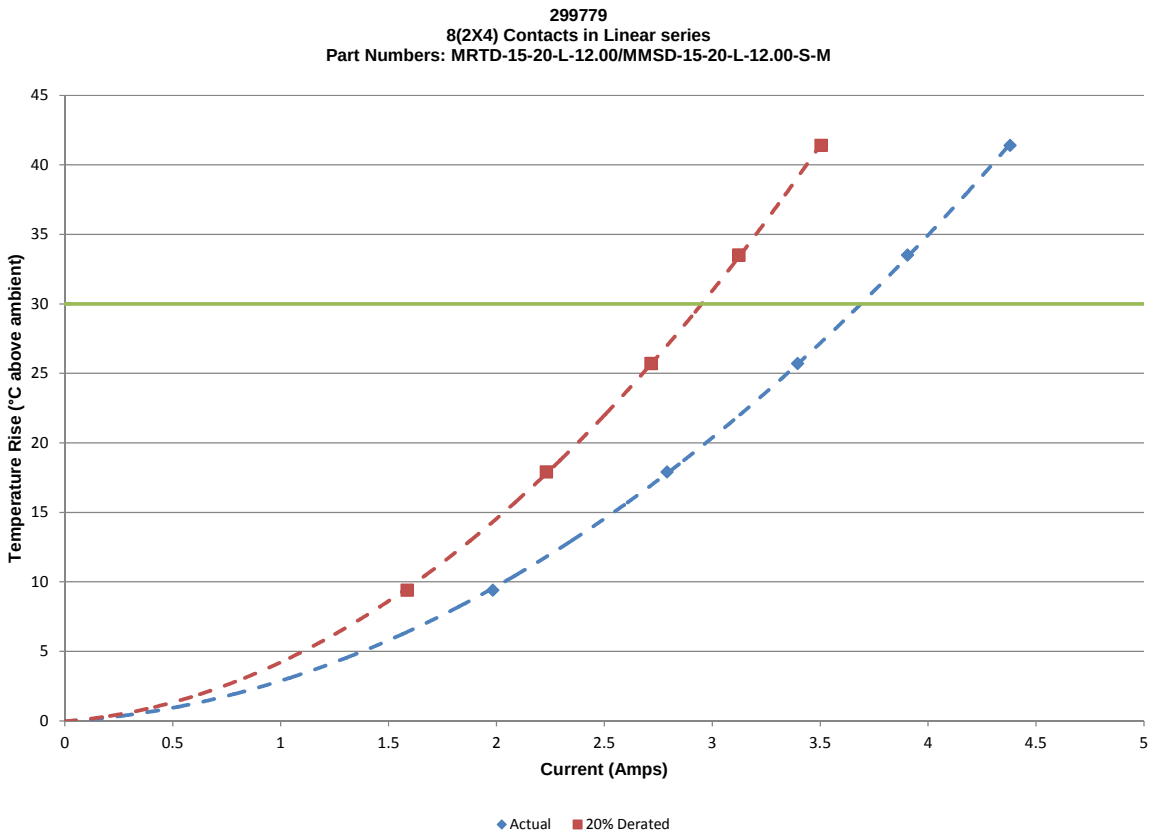



299779
6(2X3) Contacts in Linear series
Part Numbers: MRTD-15-20-L-12.00/MMSD-15-20-L-12.00-S-M
Temperature Rise (°C above ambient)
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
Current (Amps)
Actual
20% Derated

DATA SUMMARIES Continued

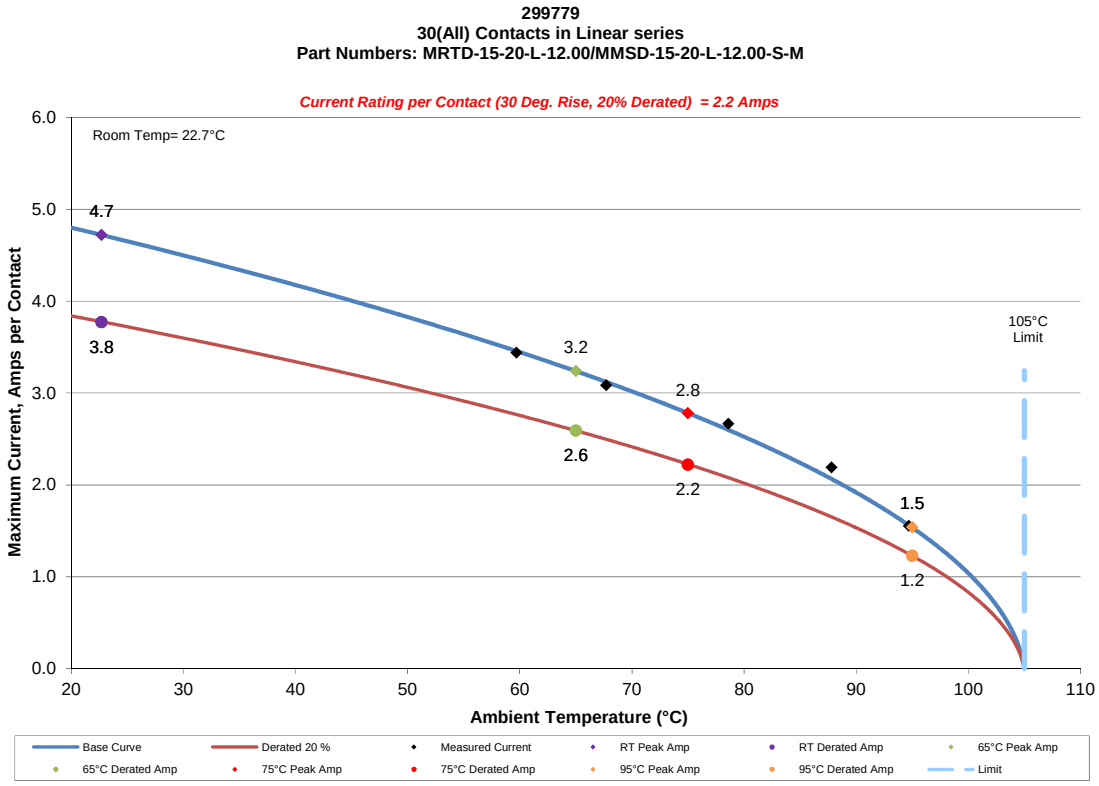
d. Linear configuration with 8 adjacent conductors/contacts powered

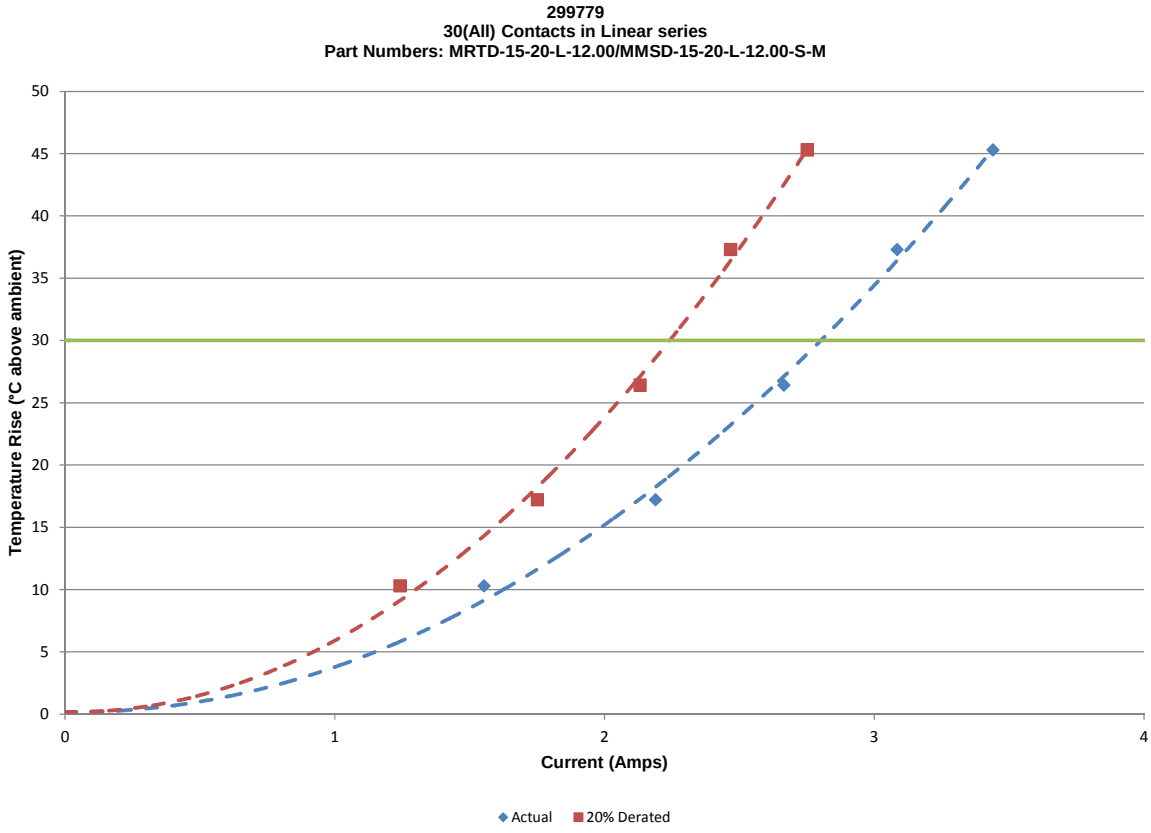



299779
8(2X4) Contacts in Linear series
Part Numbers: MRTD-15-20-L-12.00/MMSD-15-20-L-12.00-S-M
Temperature Rise (°C above ambient)
Current (Amps)
0
5
10
15
20
25
30
35
40
45
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Actual
20% Derated

DATA SUMMARIES Continued

e. Linear configuration with all adjacent conductors/contacts powered





DATA SUMMARIES Continued

MATING-UNMATING FORCE:

Mating-Unmating Durability Group (MRTD-08-20-L-06.00/MMSD-08-20-L-06.00-S-M)

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)
Minimum	5.65	1.27	3.34	0.75	6.00	1.35	3.56	0.80
Maximum	6.36	1.43	4.00	0.90	6.72	1.51	4.09	0.92
Average	6.11	**1.37**	3.70	**0.83**	6.41	**1.44**	3.75	**0.84**
St Dev	0.22	0.05	0.20	0.05	0.24	0.05	0.15	0.03
Count	8	8	8	8	8	8	8	8
	After 50 Cycles				After 75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)
Minimum	6.32	1.42	3.65	0.82	6.54	1.47	4.05	0.91
Maximum	7.07	1.59	4.36	0.98	7.56	1.70	4.54	1.02
Average	6.69	**1.50**	3.96	**0.89**	6.97	**1.57**	4.21	**0.95**
St Dev	0.26	0.06	0.20	0.04	0.34	0.08	0.15	0.03
Count	8	8	8	8	8	8	8	8
	After 100 Cycles				After Humidity			
	Mating		**Unmating**		**Mating**		**Unmating**	
	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)
Minimum	6.76	1.52	4.23	0.95	6.63	1.49	2.54	0.57
Maximum	7.74	1.74	4.94	1.11	10.01	2.25	5.83	1.31
Average	7.26	**1.63**	4.46	**1.00**	8.42	**1.89**	3.76	**0.85**
St Dev	0.33	0.07	0.23	0.05	1.34	0.30	0.95	0.21
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued

MATING-UNMATING FORCE:

Mating-Unmating Basic (MRTD-02-20-L-03.00/MMSD-02-20-L-03.00-S-M)

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	1.11	0.25	0.58	0.13	1.25	0.28	0.67	0.15
Maximum	2.09	0.47	0.98	0.22	2.09	0.47	0.93	0.21
Average	1.47	**0.33**	0.75	**0.17**	1.63	**0.37**	0.76	**0.17**
St Dev	0.33	0.07	0.13	0.03	0.27	0.06	0.10	0.02
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	1.38	0.31	0.67	0.15	1.38	0.31	0.76	0.17
Maximum	2.09	0.47	1.07	0.24	2.18	0.49	1.02	0.23
Average	1.67	**0.38**	0.84	**0.19**	1.74	**0.39**	0.87	**0.20**
St Dev	0.24	0.06	0.12	0.03	0.29	0.06	0.10	0.02
Count	8	8	8	8	8	8	8	8

	After 100 Cycles			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	1.42	0.32	0.71	0.16
Maximum	2.22	0.50	1.07	0.24
Average	1.82	**0.41**	0.87	**0.20**
St Dev	0.27	0.06	0.11	0.03
Count	8	8	8	8

DATA SUMMARIES Continued

MATING-UNMATING FORCE:

Mating-Unmating Basic (MRTD-15-20-L-03.00/MMSD-15-20-L-03.00-S-M)

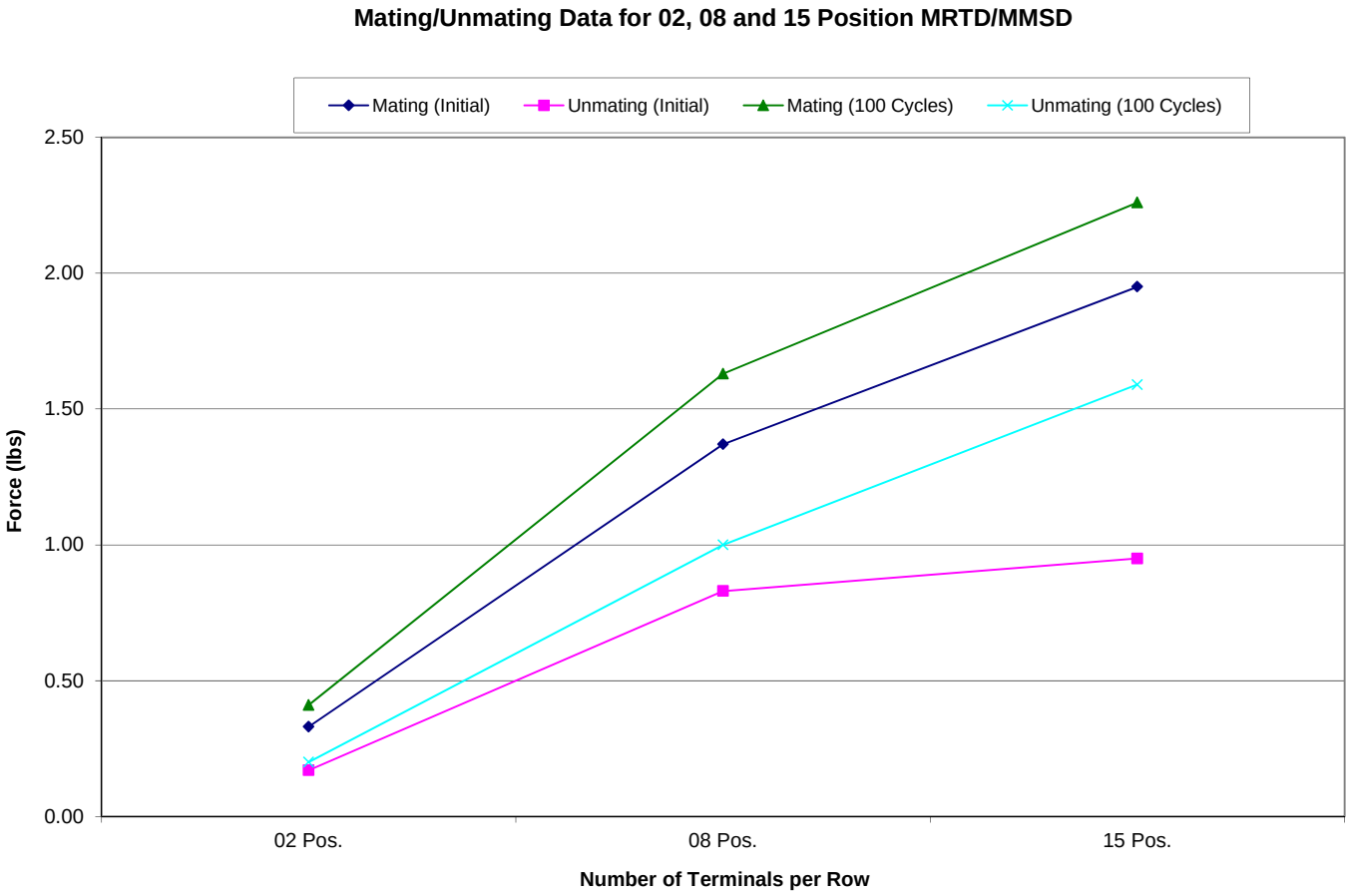
	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	6.81	1.53	3.38	0.76	7.92	1.78	3.83	0.86
Maximum	9.79	2.20	5.47	1.23	11.25	2.53	6.18	1.39
Average	8.68	**1.95**	4.23	**0.95**	9.88	**2.22**	5.10	**1.15**
St Dev	0.91	0.20	0.69	0.15	0.97	0.22	0.76	0.17
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	8.72	1.96	4.54	1.02	9.47	2.13	5.07	1.14
Maximum	12.19	2.74	7.07	1.59	12.94	2.91	8.05	1.81
Average	10.90	**2.45**	5.88	**1.32**	11.66	**2.62**	6.48	**1.46**
St Dev	1.08	0.24	0.80	0.18	1.06	0.24	0.90	0.20
Count	8	8	8	8	8	8	8	8

	After 100 Cycles			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	9.92	2.23	5.56	1.25
Maximum	13.88	3.12	8.41	1.89
Average	12.29	**2.76**	7.05	**1.59**
St Dev	1.15	0.26	0.91	0.20
Count	8	8	8	8

DATA SUMMARIES Continued

Mating\Unmating Force Comparison



DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	MRTD/MMSD	MRTD	MMSD
Initial	10000	10000	10000
Thermal	10000	10000	10000
Humidity	10000	10000	10000

	Row to Row		
	Mated	Unmated	Unmated
Minimum	MRTD/MMSD	MRTD	MMSD
Initial	10000	10000	10000
Thermal	10000	10000	10000
Humidity	10000	10000	10000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	MRTD/MMSD
Break Down Voltage	1750
Test Voltage	1313
Working Voltage	435

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 Mating/Unmating Durability Group

1). A total of 128 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	2014-1-10	2014-1-13	2014-1-21	2014-2-21
Room Temp (Deg C)	20	19	19	18
Rel Humidity (%)	42	42	25	42
Technician	Kason He	Kason He	Kason He	Kason He
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	18.19	0.59	0.54	0.62
St. Dev.	0.65	0.49	0.49	0.53
Min	16.44	0.00	0.00	0.01
Max	20.12	2.06	2.33	2.54
Summary Count	128	128	128	128
Total Count	128	128	128	128

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**128**	**0**	**0**	**0**	**0**	**0**
Therm Shck	**128**	**0**	**0**	**0**	**0**	**0**
Humidity	**128**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Shock & Vibration Group

1) A total of 128 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	2014-7-21	2014-7-24		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	42	40		
Technician	Aaron McKim	Aaron McKim		
mOhm values	**Actual Initial**	**Delta Shock-Vib**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	28.10	0.88		
St. Dev.	0.97	0.72		
Min	26.23	0.03		
Max	32.90	5.22		
Summary Count	128	128		
Total Count	128	128		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock-Vib	**127**	**1**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

Cable Pull

0 ° Pull force

	Force (lbs)
Minimum	**13.19**
Maximum	15.88
Average	14.51

90 ° Pull force

	Force (lbs)
Minimum	**12.80**
Maximum	15.42
Average	13.59

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: 4/26/2013, Next Cal: 4/25/2014

Equipment #: HZ-THC-01
Description: Humidity transmitter
Manufacturer: Thermtron
Model: SM-8-8200
Serial #: 38846
Accuracy: Last Cal: 2/28/2013, Next Cal: 2/27/2014

Equipment #: HZ-HPM-01
Description: NA9636H
Manufacturer: Ainuo
Model: 6031A
Serial #: 089601091
Accuracy: Last Cal: 3/7/2013, Next Cal: 3/6/2014

Equipment #: HZ-MO-05
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 3706
Serial #: 1285188
Accuracy: Last Cal: 11/14/2013, Next Cal: 11/13/2014

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: 06/27/2013, Next Cal: 06/26/2014

Equipment #: HZ-PS-01
Description: 120 Amp Power Supply
Manufacturer: Agilent
Model: 6031A PS
Serial #: MY41000982
Accuracy: See Manual
… Last Cal: 07/02/2013, Next Cal: 07/01/2014

Equipment #: HZ-MO-01
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 1199807
Accuracy: See Manual
… Last Cal: 07/02/2013, Next Cal: 07/01/2014

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 08/21/2013, Next Cal: 08/21/2014

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 11/31/2013, Next Cal: 11/31/2014