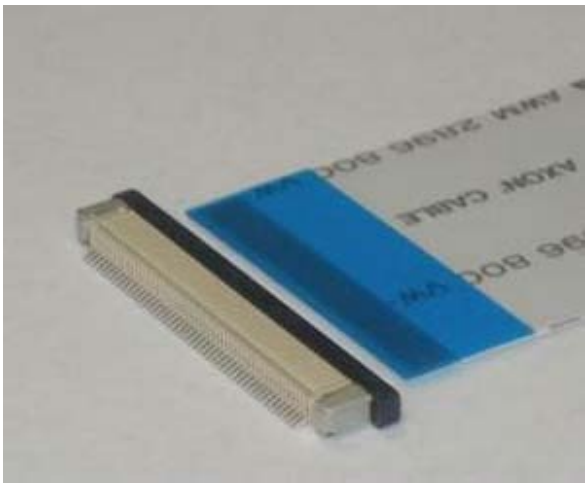
Project Number: Design Qualification Test Report	Tracking Code: 425311_Report_Rev_2
Requested by: Kevin Meredith	Date: 4/30/2015
Part #: ZF5S-50-01-T-WT-K-TR/ FJH-50-D-04.00-4	
Part description: ZF5S/FJH	Tech: Tony Wagoner
Test Start: 11/26/2014	Test Completed: 1/13/2015



(Actual part not depicted)

DESIGN QUALIFICATION TEST REPORT

ZF5S/FJH
ZF5S-50-01-T-WT-K-TR/ FJH-50-D-04.00-4

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
1/23/2015	**1**	**Initial Issue**	**KH**
1/26/2015	**2**	**Add the IR/DWV and CCC data**	**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-106598-TST/PCB-106599-TST

FLOWCHARTS

Gas Tight

Group 1
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
8 Assemblies

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

(1) Gas Tight = EIA-364-36

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

Normal Force

Group 1
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
8 Contacts Minimum
Signal Without Thermals

Step	Description
1.	Contact Gaps
2.	Normal Force (1) Deflection = 0.0057 " Expected Force at Max Deflection = 150 g

Group 2
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
8 Contacts Minimum
Signal With Thermals

Step	Description
1.	Contact Gaps
2.	Thermal Age (2)
3.	Contact Gaps
4.	Normal Force (1) Deflection = 0.0057 " 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
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating Force *Note: Mating force of the cam latch*
3.	LLCR (1)
4.	Thermal Age (2)
5.	LLCR (1) Max Delta = 15 mOhm
6.	Mating Force *Note: Mating Force of the cam latch*
7.	Contact Gaps

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

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

FLOWCHARTS Continued

Mating/Unmating/Durability

Group 1
ZF5S-06-01-T-WT-K-TR
FJH-06-D-04.00-4
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating Force *Note: Mating Force of the cam latch*
3.	Cycles Quantity = 25 Cycles *Note: Hand cycle, fully engage and disengage the cam latch*
4.	Mating Force *Note: Mating Force of the cam latch*
5.	Contact Gaps

Group 2
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating Force *Note: Mating force of the cam latch*
3.	LLCR (2)
4.	Cycles Quantity = 25 Cycles *Note: Hand cycle, fully engage and disengage the cam latch*
5.	Mating Force *Note: Mating force of the cam latch*
6.	Contact Gaps
7.	LLCR (2) Max Delta = 15 mOhm
8.	Thermal Shock (3) - Non Standard
9.	LLCR (2) Max Delta = 15 mOhm
10.	Humidity (1)
11.	LLCR (2) Max Delta = 15 mOhm
12.	Mating Force *Note: Mating force of the cam latch*

(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) Thermal Shock = Other
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = -30°C to +80°C)
Test Duration = A-3 (100 Cycles)
EIA-364-32

FLOWCHARTS Continued

IR & DWV

TEST STEP	GROUP A1 2 Mated Sets Break Down Pin-to-Pin	GROUP A2 2 Unmated of Part # Being Tested Break Down Pin-to-Pin	GROUP B1 2 Mated Sets Pin-to-Pin
01	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

-30°C to +85°C 1/2 hour dwell, 5 cycles

Humidity = EIA-364-31, Test Condition A (96 Hours)

and Method II (40°C @ 90% RH to 95% RH)

ambient pre-condition

IR = EIA-364-21

DWV = EIA-364-20, Test Condition 1

FLOWCHARTS Continued

Current Carrying Capacity - Single Row

TEST STEP	GROUP A1 3 Mated Assemblies 1 Contact Powered	GROUP A2 3 Mated Assemblies 2 Contacts Powered	GROUP A3 3 Mated Assemblies 3 Contacts Powered	GROUP A4 3 Mated Assemblies 4 Contacts Powered	GROUP A5 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/Random Vibration/LLCR

Group 1
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
8 Assemblies

Step	Description
1.	LLCR (1)
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
ZF5S-50-01-T-WT-K-TR
FJH-50-D-04.00-4
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: -30°C to +80°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

MATING/UNMATING:

1) Reference document: EIA-364-13, *Mating and Unmating Forces Test Procedure for Electrical Connectors*.
2) The full insertion position was to within 0.003" to 0.004" of the plug bottoming out in the receptacle to prevent damage to the system under test.
3) One of the mating parts is secured to a floating X-Y table to prevent damage during cycling.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING):

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

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. 40^{o} C
    c. 50^{o} C
    d. 70^{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

GAS TIGHT:

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

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms:---------- Stable
    b. +5.1 to +10.0 mOhms: ---------- Minor
    c. +10.1 to +15.0 mOhms: ---------- Acceptable
    d. +15.1 to +50.0 mOhms: ---------- Marginal
    e. +50.1 to +2000 mOhms:---------- Unstable
    f. >+2000 mOhms:---------- Open Failure
4) Procedure:
    a. Reference document: EIA-364-36, *Test Procedure for Determination of Gas-Tight Characteristics for Electrical Connectors, Sockets and/or Contact Systems.*
    b. Test Conditions:
        i. Class II--- Mated pairs of contacts assembled to their plastic housings.
        ii. Reagent grade Nitric Acid shall be used of sufficient volume to saturate the test chamber
        iii. The ratio of the volume of the test chamber to the surface area of the acid shall be 10:1.
        iv. The chamber shall be saturated with the vapor for at least 15 minutes before samples are added.
        v. Exposure time, 55 to 65 minutes.
        vi. The samples shall be no closer to the chamber walls than 1 inches and no closer to the surface of the acid than 3 inches.
        vii. The samples shall be dried after exposure for a minimum of 1 hour.
        viii. Drying temperature 50^{o} C
        ix. The final LLCR shall be conducted within 1 hour after drying.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

INSULATION RESISTANCE (IR):

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

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

RESULTS

Temperature Rise, CCC at a 20% de-rating (ZF5S-30-01-T-WT/FJH-30-D-12.00-4)

Signal interface

- **CCC for a 30°C Temperature Rise----------2.4A per contact with 1 contacts (1x1) powered**
- **CCC for a 30°C Temperature Rise----------2.0A per contact with 2 contacts (1x2) powered**
- **CCC for a 30°C Temperature Rise----- ---1.5A per contact with 3 contacts (1x3) powered**
- **CCC for a 30°C Temperature Rise----------1.4A per contact with 4 contacts (1x4) powered**
- **CCC for a 30°C Temperature Rise----------0.7A per contact with 30 contacts (1x30) powered**

Signal wire

- **CCC for a 30°C Temperature Rise----------1.8A per contact with 1 contacts (1x1) powered**
- **CCC for a 30°C Temperature Rise----------1.4A per contact with 2 contacts (1x2) powered**
- **CCC for a 30°C Temperature Rise----- ----1.1A per contact with 3 contacts (1x3) powered**
- **CCC for a 30°C Temperature Rise----------1.0A per contact with 4 contacts (1x4) powered**
- **CCC for a 30°C Temperature Rise----------0.6A per contact with 30 contacts (1x30) powered**

Mating/Unmating Forces:

Thermal Aging Group (ZF5S-50-01-T-WT-K-TR/FJH-50-D-04.00-4)

- **Initial**
  - **Mating**
    - **Min ----------10.47 Lbs**
    - **Max----------14.42 Lbs**
- **After Thermal**
  - **Mating**
    - **Min ----------11.11 Lbs**
    - **Max----------14.47 Lbs**

Mating/Unmating Durability Group (ZF5S-50-01-T-WT-K-TR/FJH-50-D-04.00-4)

- **Initial**
  - **Mating**
    - **Min ----------13.51 Lbs**
    - **Max----------15.74 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 8.96 Lbs**
    - **Max----------11.84 Lbs**
- **After Humidity**
  - **Mating**
    - **Min ---------- 8.36 Lbs**
    - **Max----------11.61 Lbs**

Mating/Unmating Basic Group (ZF5S-06-01-T-WT-K-TR/FJH-06-D-04.00-4)

- **Initial**
  - **Mating**
    - **Min ---------- 2.48 Lbs**
    - **Max---------- 3.03 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 2.17 Lbs**
    - **Max---------- 2.54 Lbs**

RESULTS Continued

Normal Force at 0.0057 inch deflection

- **Initial**
  - **Min ---------- 188.20 gf Set ----- 0.0019 in**
  - **Max ---------- 196.80 gf Set ----- 0.0022 in**
- **Thermal**
  - **Min ---------- 162.40 gf Set ----- 0.0020 in**
  - **Max ---------- 195.00 gf Set ----- 0.0024 in**

Insulation Resistance minimums, IR (ZF5S-30-01-T-WT/FJH-30-S-D)

- **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 (ZF5S-30-01-T-WT/FJH-30-S-D)

- **Minimums**
  - **Breakdown Voltage ---------- 780 VAC**
  - **Test Voltage ---------- 585 VAC**
  - **Working Voltage ---------- 195 VAC**
- **Initial DWV ---------- Passed**
- **Thermal DWV ---------- Passed**
- **Humidity DWV ---------- Passed**

LLCR Gas Tight (192 LLCR test points)

- **Initial ---------- 73.19 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**

LLCR Thermal Aging (192 LLCR test points)

- **Initial ---------- 73.40 mOhms Max**
- **Thermal Aging**
  - **<= +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 Durability (192 LLCR test points)

- **Initial ---------- 72.88 mOhms Max**
- **Durability, 25 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**
- **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**
- **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 Shock & Vibration (192 LLCR test points)

- **Initial ---------- 200.26 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms ---------- 172 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 18 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 2 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**

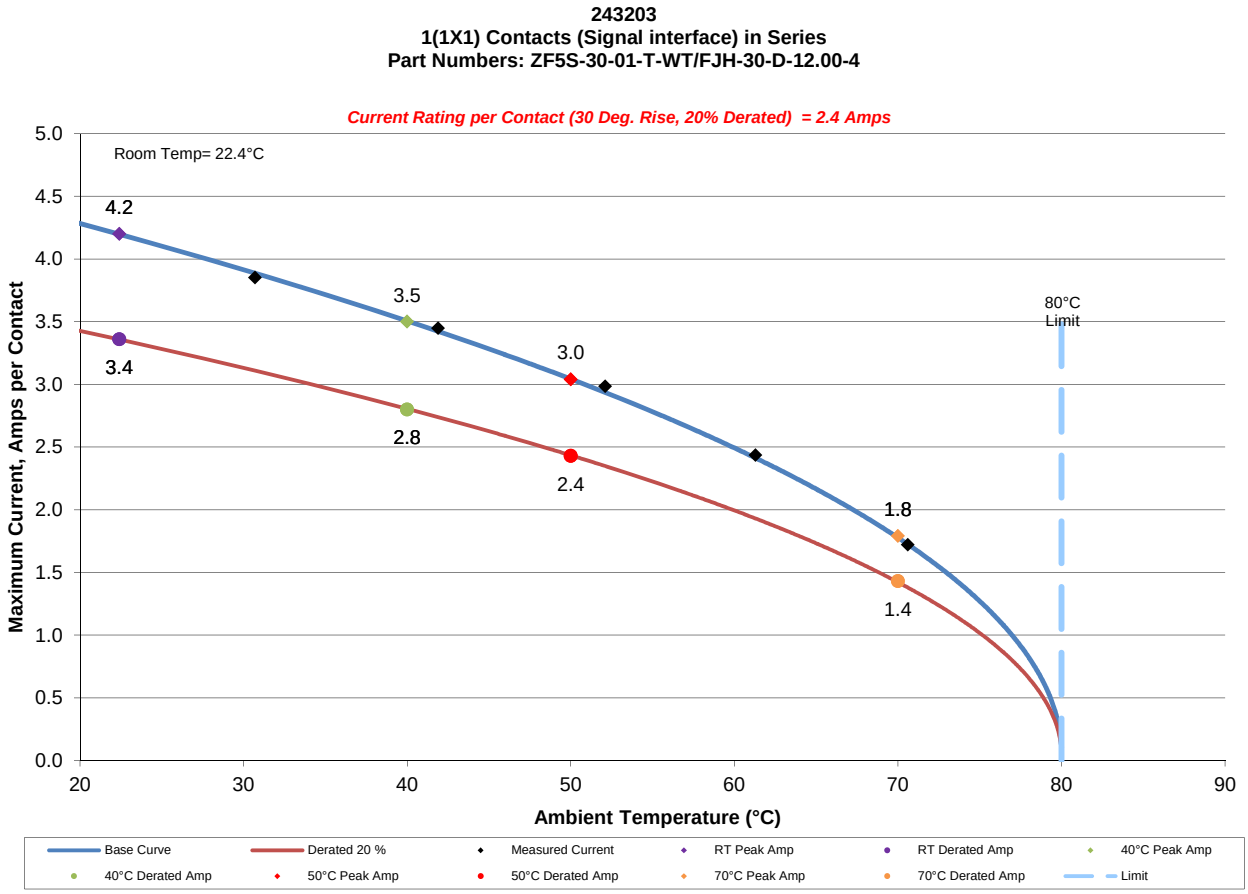
Mechanical Shock & Random Vibration:

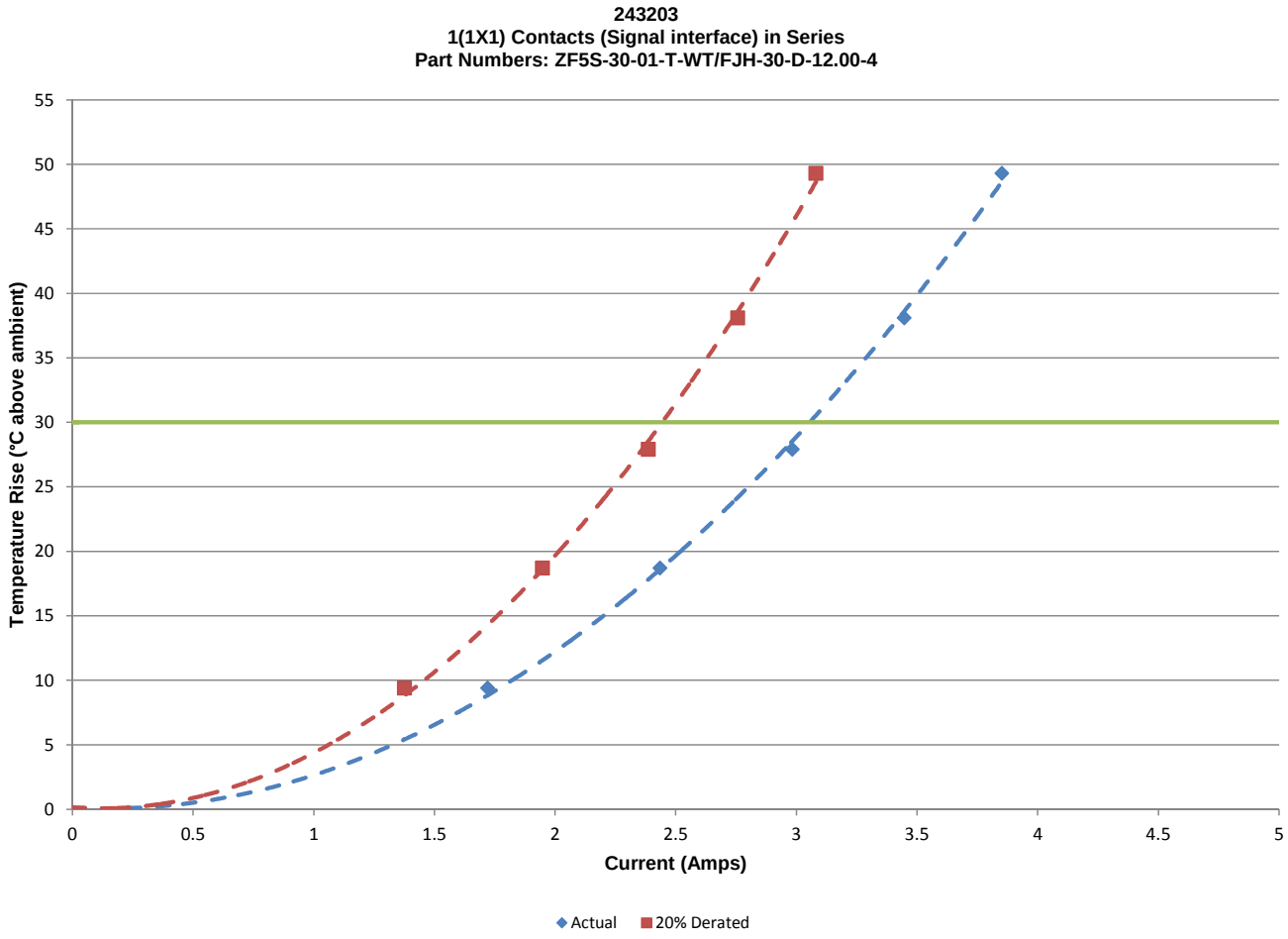
- **Shock**
  - **No Damage ---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**
- **Vibration**
  - **No Damage ---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**

DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):

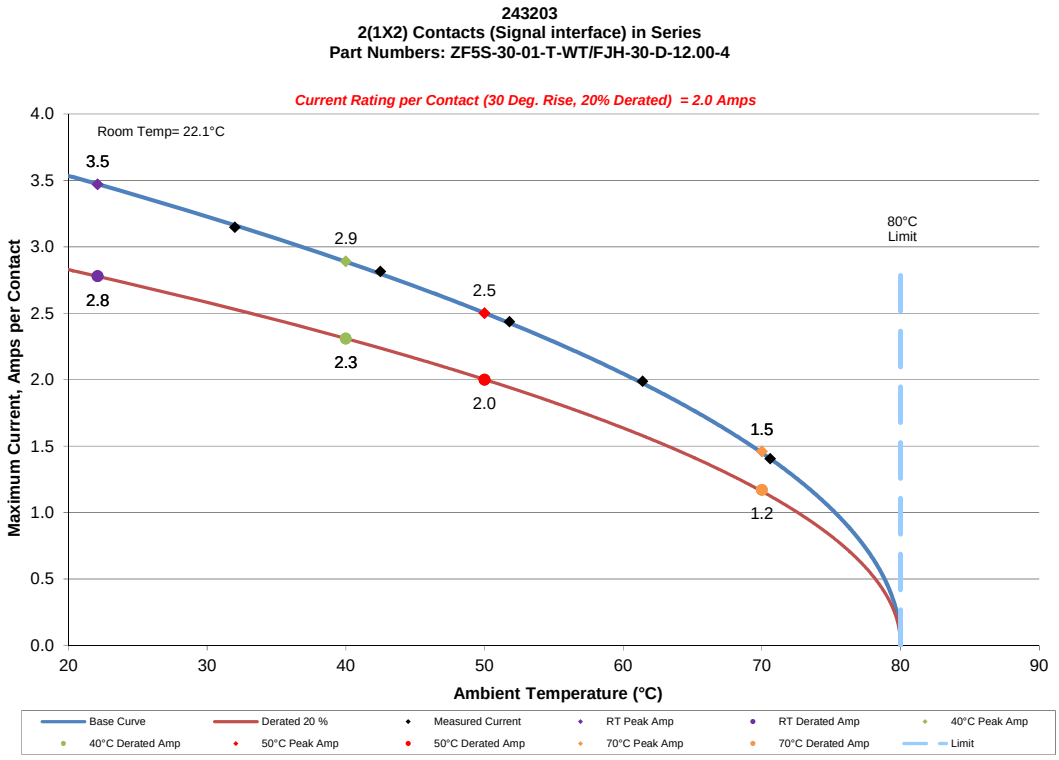
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes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

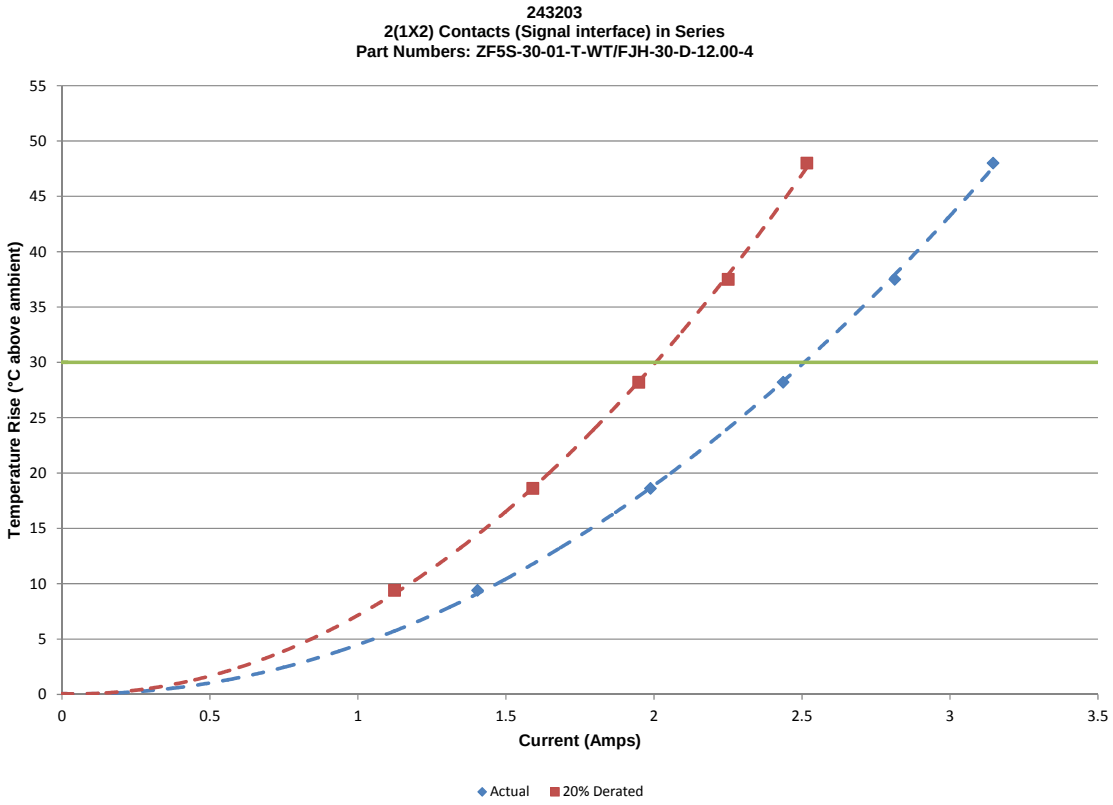



243203
1(1X1) Contacts (Signal interface) in Series
Part Numbers: ZF5S-30-01-T-WT/FJH-30-D-12.00-4
Temperature Rise (°C above ambient)
55
50
45
40
35
30
25
20
15
10
5
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Current (Amps)
Actual
20% Derated

DATA SUMMARIES Continued

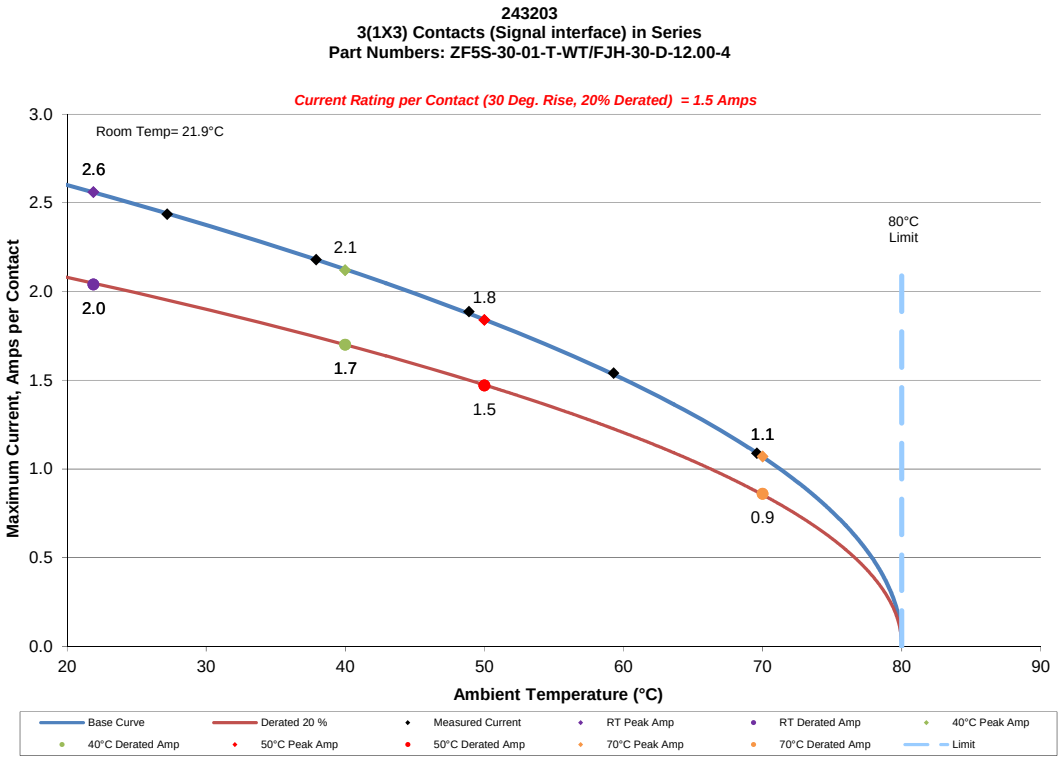
b. Linear configuration with 2 adjacent conductors/contacts (signal interface) powered

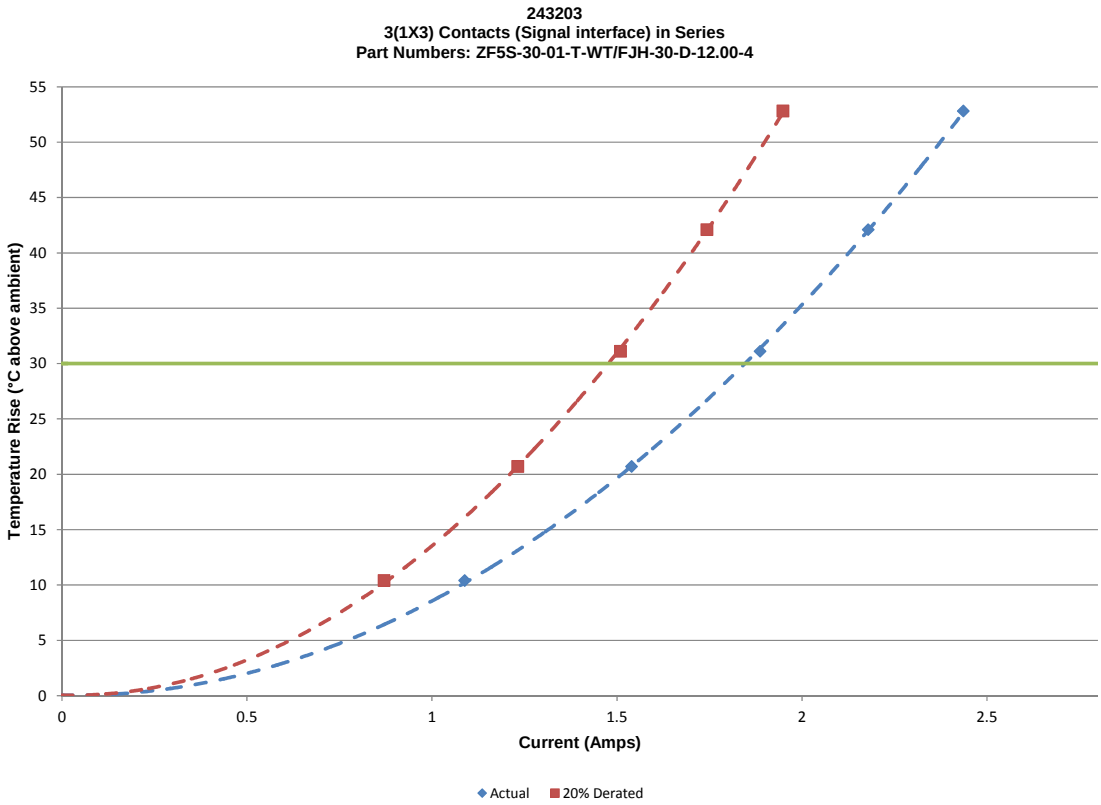




DATA SUMMARIES Continued

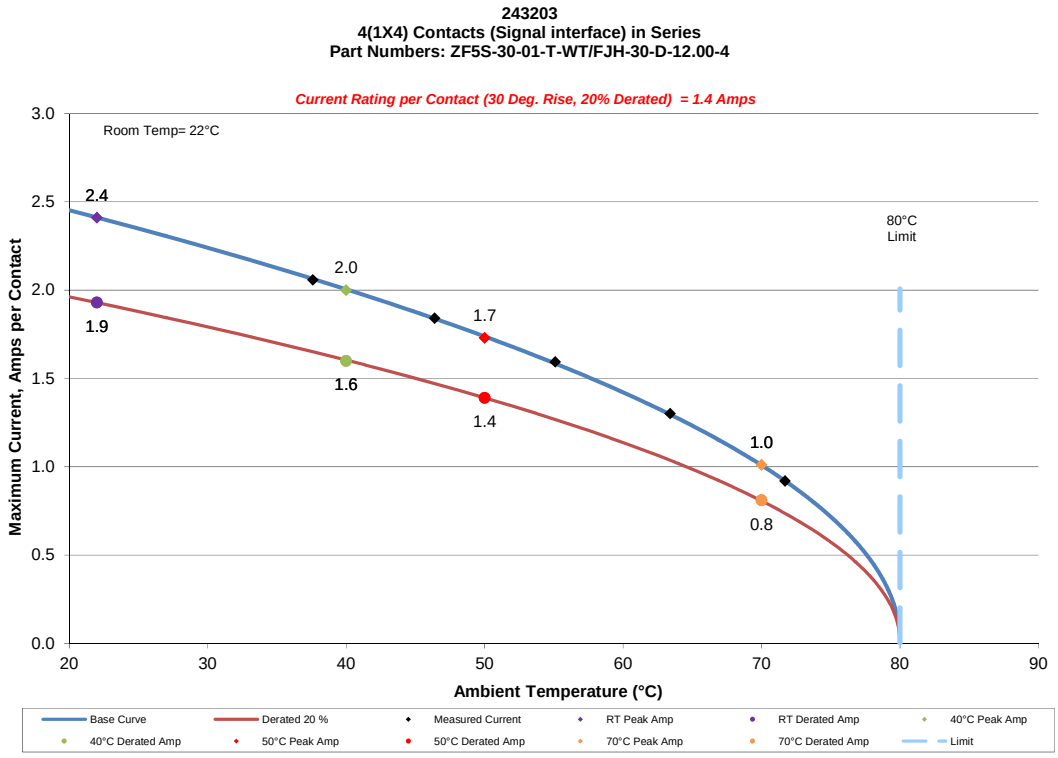
c. Linear configuration with 3 adjacent conductors/contacts (signal interface) powered

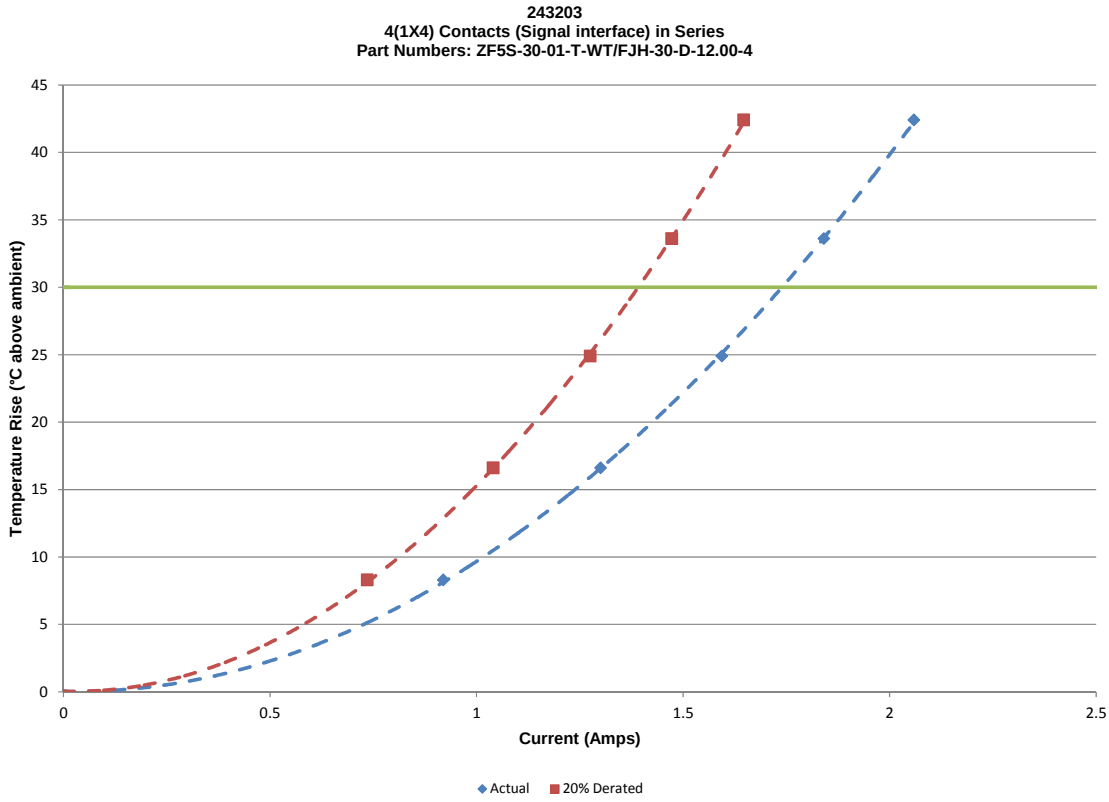




DATA SUMMARIES Continued

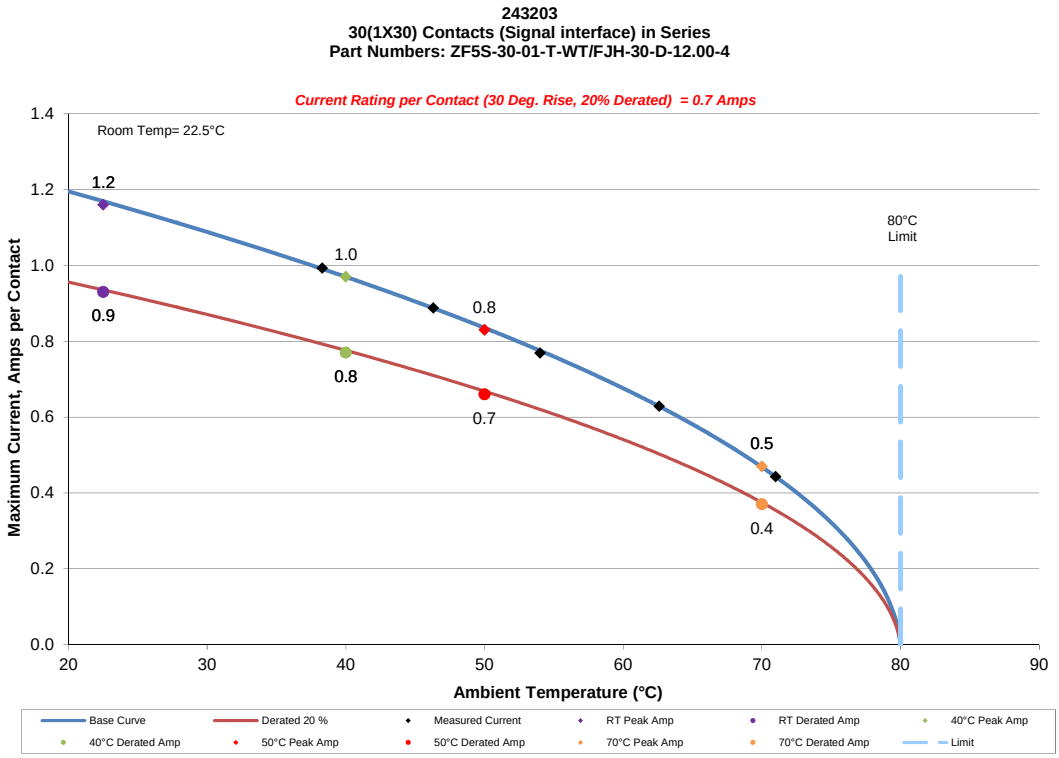
d. Linear configuration with 4 adjacent conductors/contacts (signal interface) powered

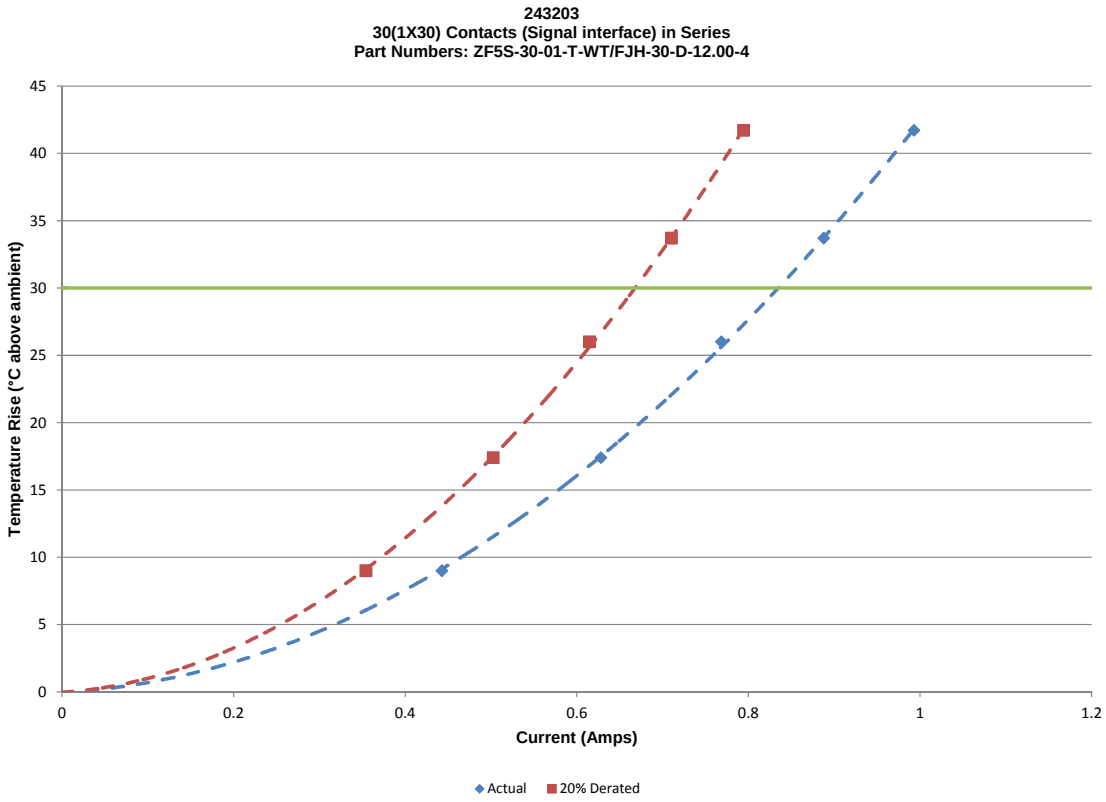




DATA SUMMARIES Continued

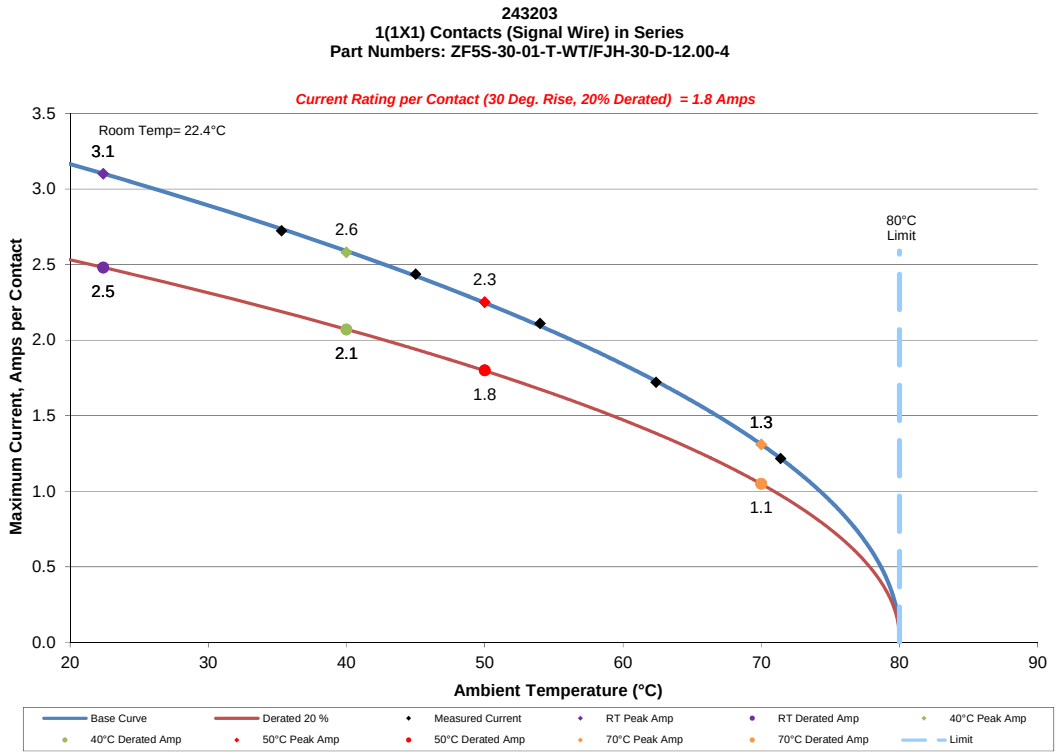
e. Linear configuration with all adjacent conductors/contacts (signal interface) powered

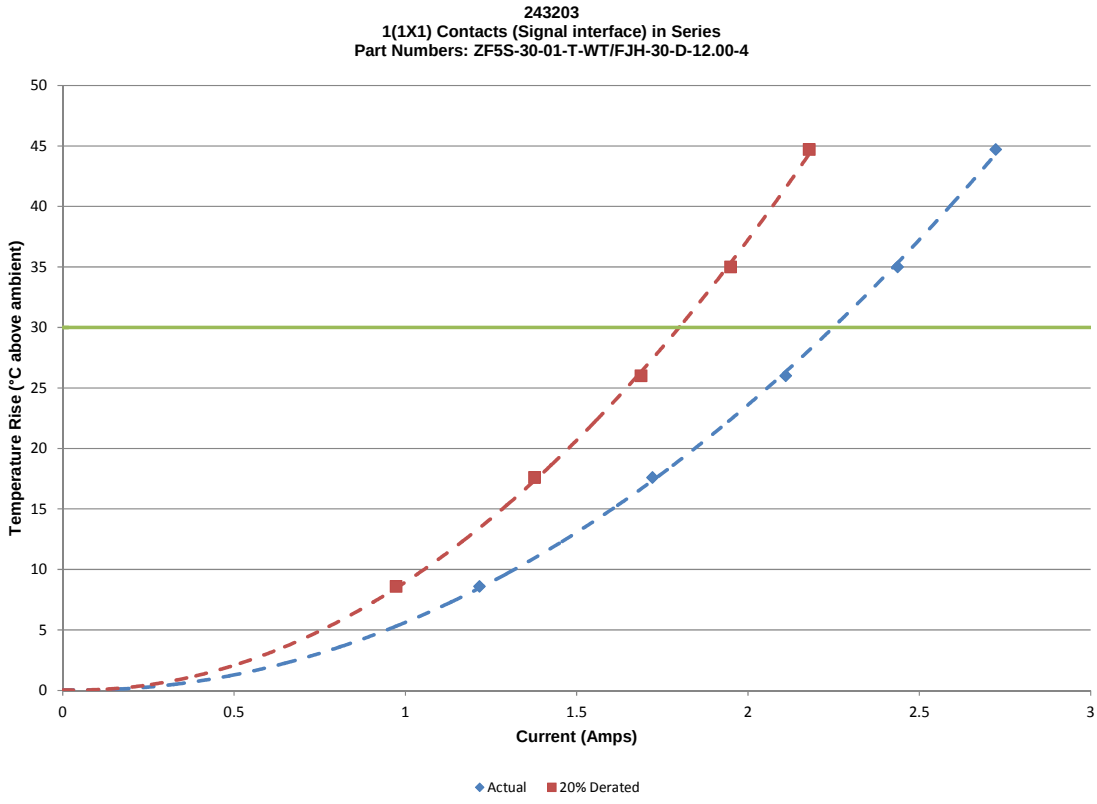




DATA SUMMARIES Continued

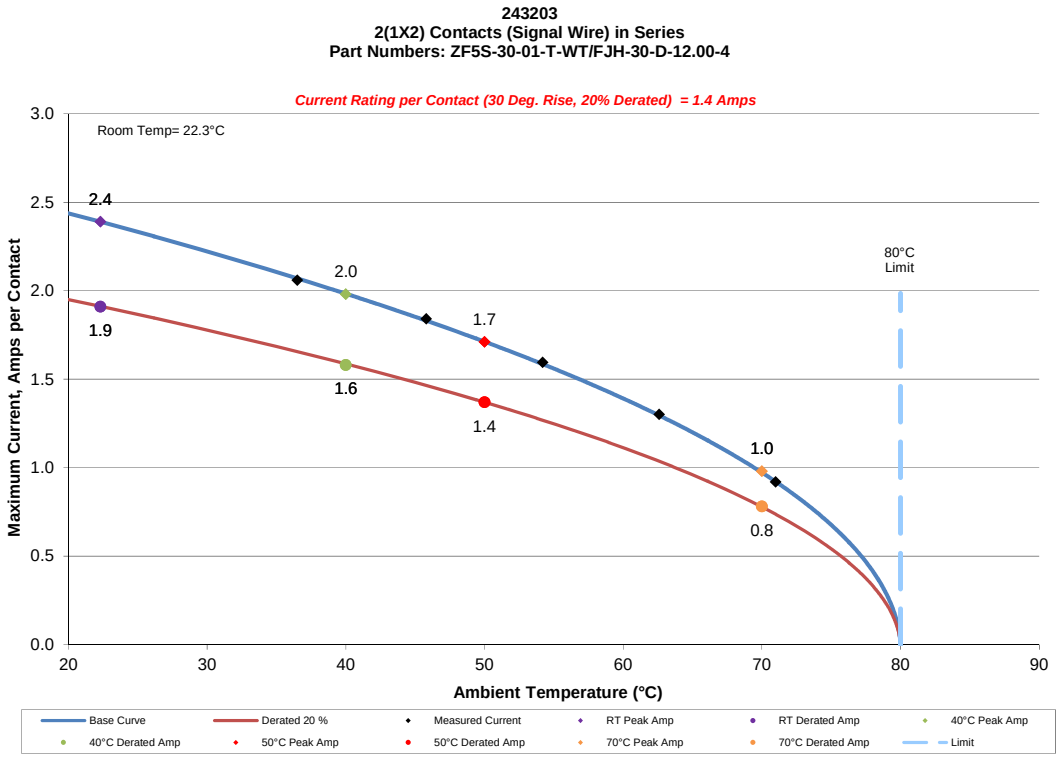
f. Linear configuration with 1 adjacent conductors/contacts (signal wire) powered

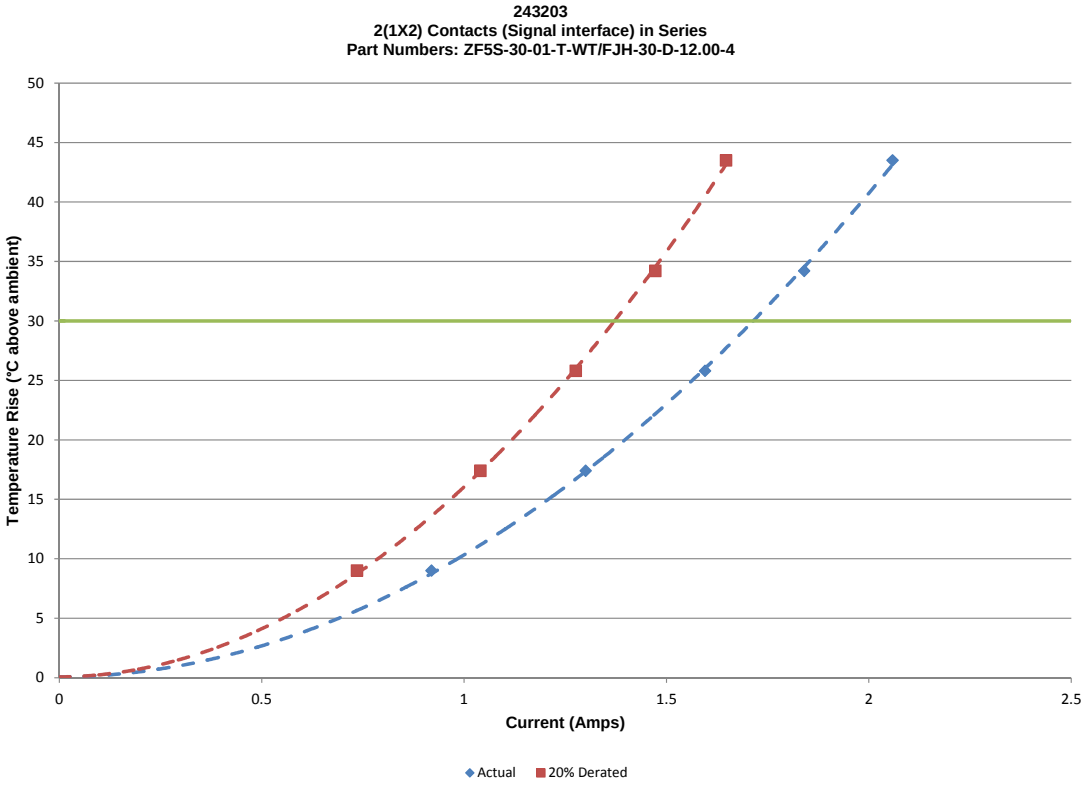




DATA SUMMARIES Continued

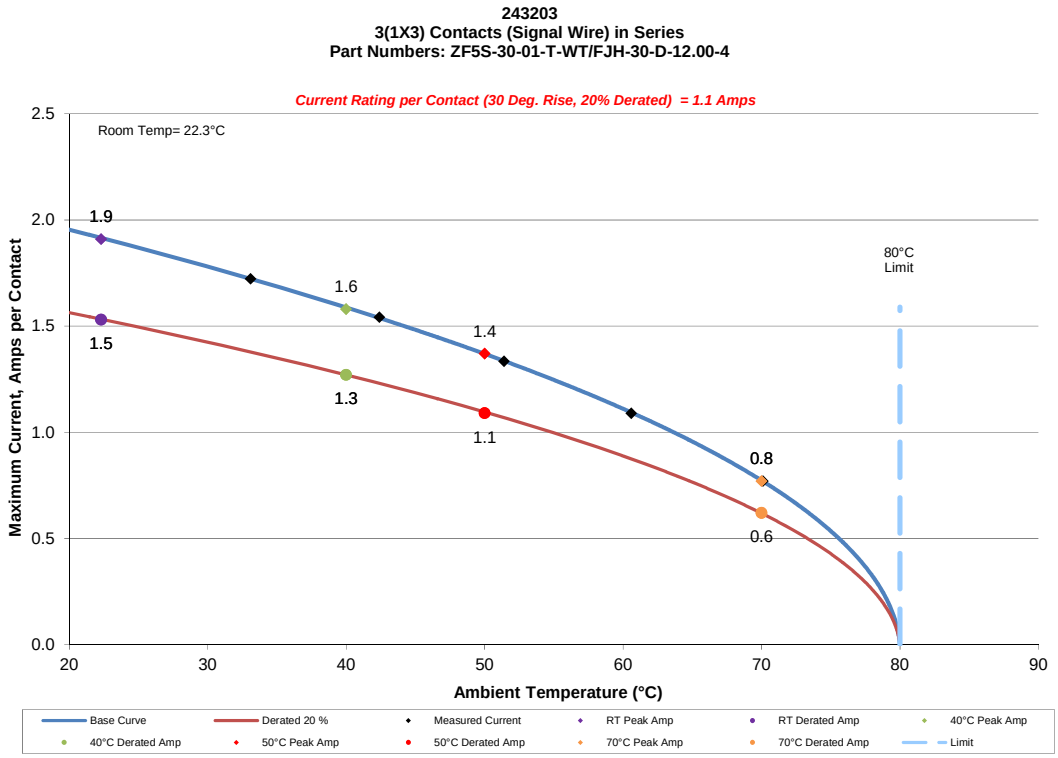
g. Linear configuration with 2 adjacent conductors/contacts (signal wire) powered

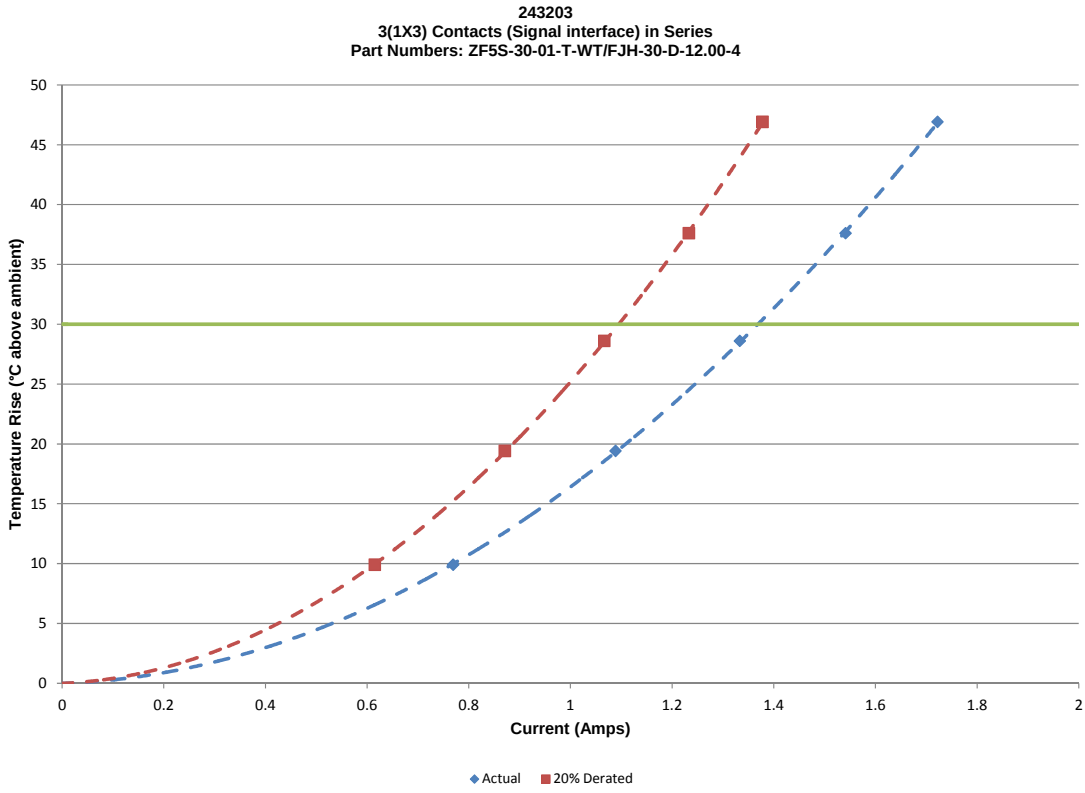




DATA SUMMARIES Continued

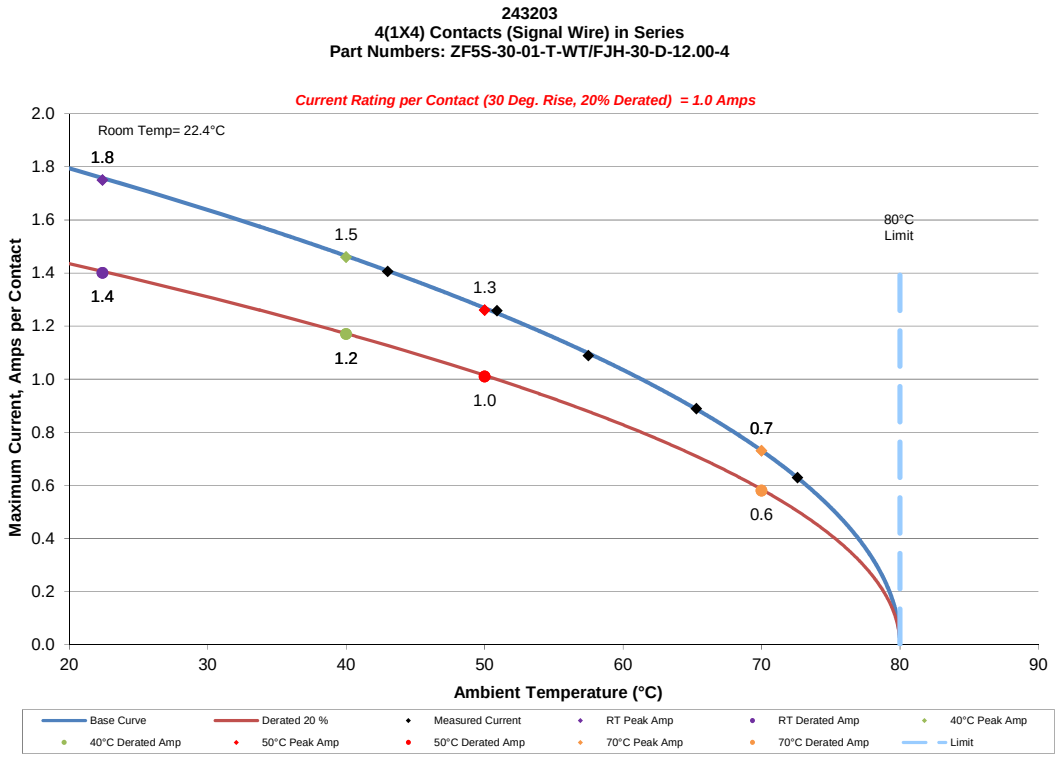
h. Linear configuration with 3 adjacent conductors/contacts (signal wire) powered

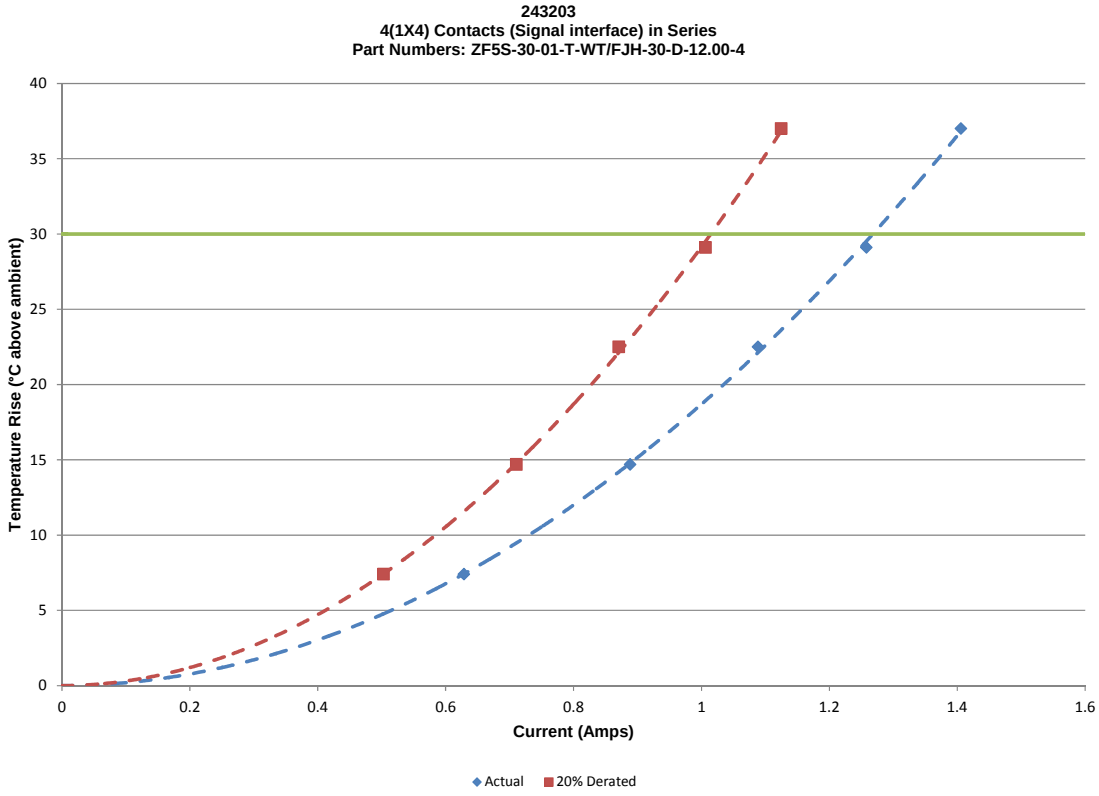




DATA SUMMARIES Continued

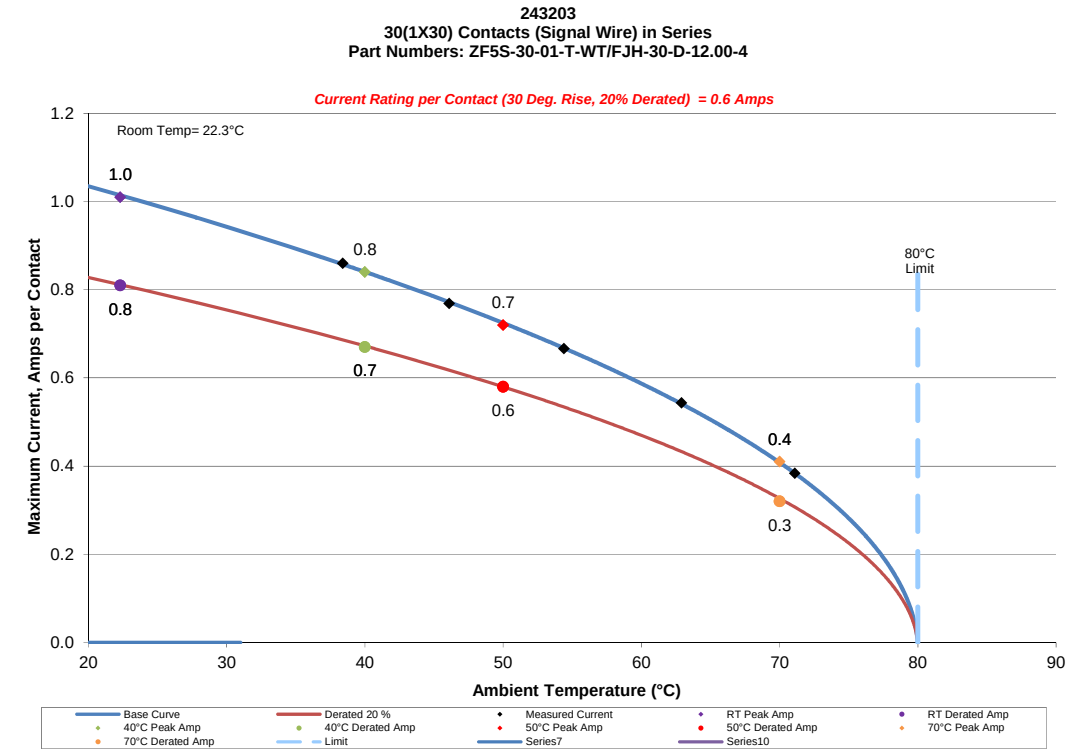
i. Linear configuration with 4 adjacent conductors/contacts (signal wire) powered

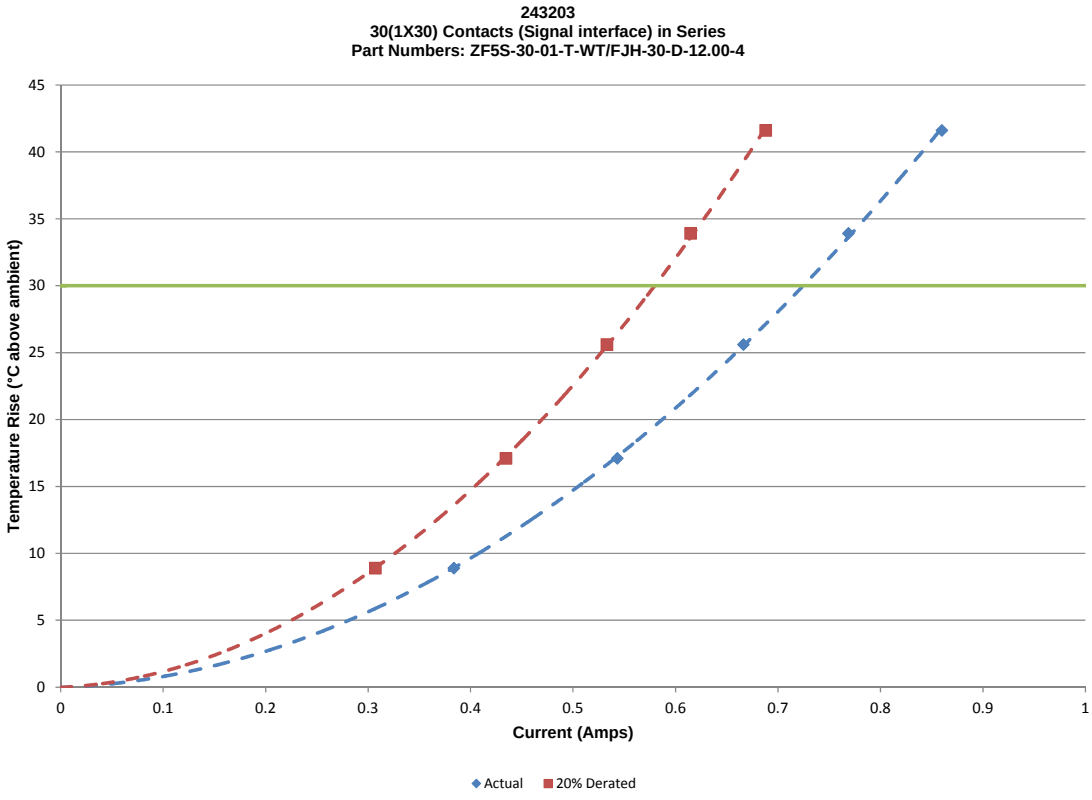




DATA SUMMARIES Continued

j. Linear configuration with all adjacent conductors/contacts (signal wire) powered





DATA SUMMARIES Continued

Mating\Unmating Force:

Thermal Aging Group (ZF5S-50-01-T-WT-K-TR/ FJH-50-D-04.00-4)

	Initial		After Thermal	
	Mating		Mating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	46.55	10.47	49.41	11.11
Maximum	64.15	14.42	64.36	14.47
Average	54.70	**12.30**	57.06	**12.83**
St Dev	6.97	1.57	6.04	1.36
Count	8	8	8	8

Mating\Unmating Durability Group (ZF5S-50-01-T-WT-K-TR/ FJH-50-D-04.00-4)

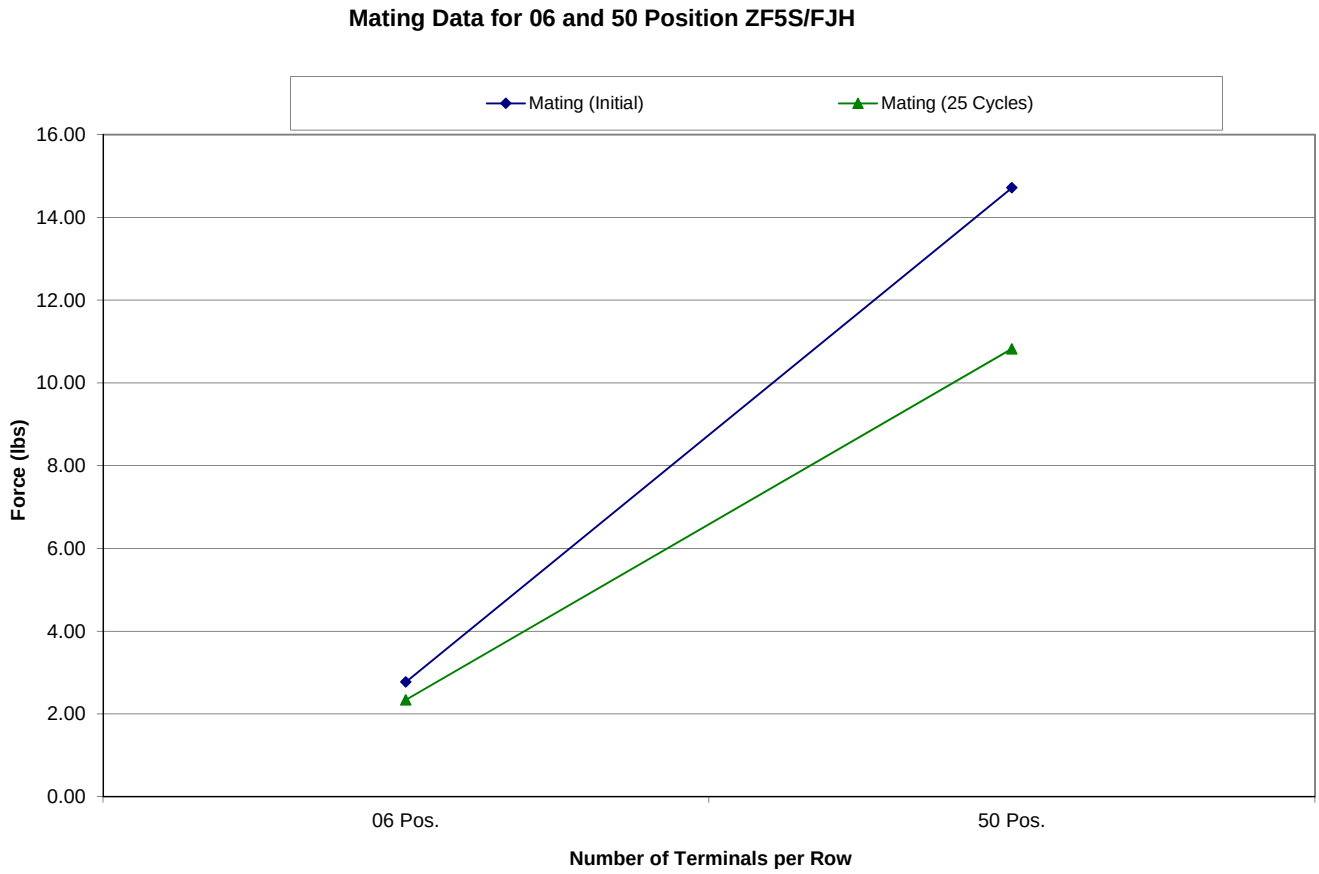
	Initial		After 25 cycles		After Humidity	
	Mating		Mating		Mating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	60.07	13.51	39.85	8.96	37.20	8.36
Maximum	69.99	15.74	52.67	11.84	51.64	11.61
Average	65.42	**14.71**	48.12	**10.82**	44.50	**10.00**
St Dev	3.15	0.71	4.79	1.08	5.63	1.26
Count	8	8	8	8	8	8

Mating\Unmating Basic Group (ZF5S-06-01-T-WT-K-TR/ FJH-06-D-04.00-4)

	Initial		After 25 Cycles	
	Mating		Mating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	11.03	2.48	9.67	2.17
Maximum	13.46	3.03	11.31	2.54
Average	12.32	**2.77**	10.42	**2.34**
St Dev	1.03	0.23	0.58	0.13
Count	8	8	8	8

DATA SUMMARIES Continued

Mating\Unmating Force Comparison



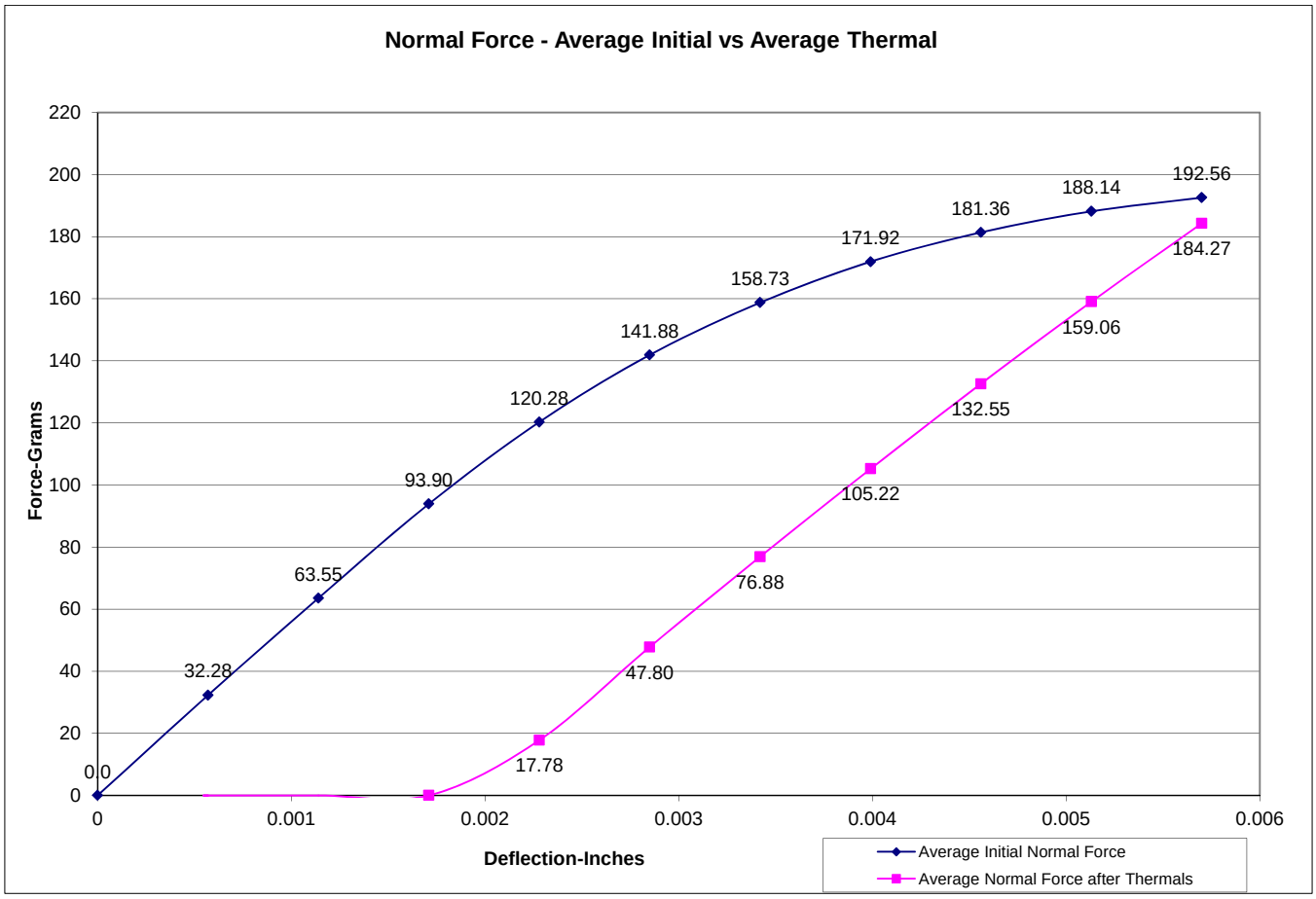
DATA SUMMARIES Continued

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.

	Deflections in inches Forces in Grams										
Initial	**0.0006**	**0.0011**	**0.0017**	**0.0023**	**0.0029**	**0.0034**	**0.0040**	**0.0046**	**0.0051**	**0.0057**	***SET***
Averages	**32.28**	**63.55**	**93.90**	**120.28**	**141.88**	**158.73**	**171.92**	**181.36**	**188.14**	**192.56**	**0.0020**
Min	24.20	51.50	79.80	104.40	127.50	145.20	161.30	172.80	182.30	188.20	0.0019
Max	35.10	67.90	101.30	129.90	150.10	166.40	178.20	186.10	192.00	196.80	0.0022
St. Dev	2.987	4.686	6.699	7.929	8.158	7.409	5.921	4.481	3.213	2.760	0.0001
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermals	Deflections in inches Forces in Grams										
	0.0006	**0.0011**	**0.0017**	**0.0023**	**0.0029**	**0.0034**	**0.0040**	**0.0046**	**0.0051**	**0.0057**	***SET***
Averages	**0.00**	**0.00**	**0.00**	**17.78**	**47.80**	**76.88**	**105.22**	**132.55**	**159.06**	**184.27**	**0.0022**
Min	0.00	0.00	0.00	14.00	43.70	70.70	96.10	119.30	141.30	162.40	0.0020
Max	0.00	0.00	0.00	23.10	53.60	84.50	111.30	138.80	167.60	195.00	0.0024
St. Dev	0.000	0.000	0.000	2.741	2.962	4.064	5.417	7.127	9.574	11.967	0.0001
Count	10	10	10	10	10	10	10	10	10	10	10



DATA SUMMARIES Continued

INSULATION RESISTANCE (IR): (ZF5S-30-01-T-WT/FJH-30-S-D)

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**ZF5S/FJH**	**ZF5S**	**FJH**
Initial	45000	45000	Not Tested
Thermal	45000	45000	Not Tested
Humidity	45000	45000	Not Tested

DIELECTRIC WITHSTANDING VOLTAGE (DWV): (ZF5S-30-01-T-WT/FJH-30-S-D)

Voltage Rating Summary	
Minimum	**ZF5S/FJH**
Break Down Voltage	780
Test Voltage	585
Working Voltage	195

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

DATA SUMMARIES Continued

LLCR Durability:

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	2014/11/26	2014/12/1	2014/12/8	2014/12/30
Room Temp (Deg C)	22	21	22	22
Rel Humidity (%)	35	39	35	37
Technician	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner
mOhm values	**Actual Initial**	**Delta 25 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	71.36	0.40	0.57	0.49
St. Dev.	0.66	0.29	0.48	0.48
Min	69.78	0.01	0.01	0.00
Max	72.88	2.11	3.61	3.75
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**
25 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	2014/11/26	2014/12/8		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	35	35		
Technician	Tony Wagoner	Ton y Wagoner		
mOhm values	**Actual Initial**	**Delta Thermal**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	71.77	0.13		
St. Dev.	0.75	0.17		
Min	70.05	0.00		
Max	73.40	1.32		
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	2014/11/26	2014/11/26		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	37	34		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Acid Vapor**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	71.45	2.50		
St. Dev.	0.70	0.46		
Min	70.15	1.41		
Max	73.19	3.41		
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 Shock &Vibration:

1). A total of 192 points were measured.
2). EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
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

LLCR Measurement Summaries by Pin Type				
Date	2015/1/9	2015/1/13		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	35	35		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Shock-Vib**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	193.98	1.76		
St. Dev.	1.15	2.20		
Min	192.07	0.00		
Max	200.26	11.95		
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	**172**	**18**	**2**	**0**	**0**	**0**

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	60
Test Condition	C, 100g's, 6ms, Half-Sine
Shock Events	0
Test Condition	V-B, 7.56 rms g
Vibration Events	0
Total Events	0

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2014, Next Cal: 05/29/2015

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2014, Next Cal: 09/11/2015

Equipment #: THC-05
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 05 23 00 02
Accuracy: See Manual
… Last Cal: 11/14/2014, Next Cal: 05/31/2015

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnati Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 06/30/2014, Next Cal: 06/30/2015

Equipment #: OV-05
Description: Forced Air Oven, 5 Cu. Ft., 120 V (Chamber Room)
Manufacturer: Sheldon Mfg.
Model: CE5F
Serial #: 02008008
Accuracy: +/- 5 deg. C
… Last Cal: 02/18/2014, Next Cal: 02/18/2015

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2014, Next Cal: 05/15/2015

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 04/22/2014, Next Cal: 04/22/2015

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/18/2014, Next Cal: 07/18/2015

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 10/31/2014, Next Cal: 10/31/2015

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 09/11/2014, Next Cal: 09/11/2015

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