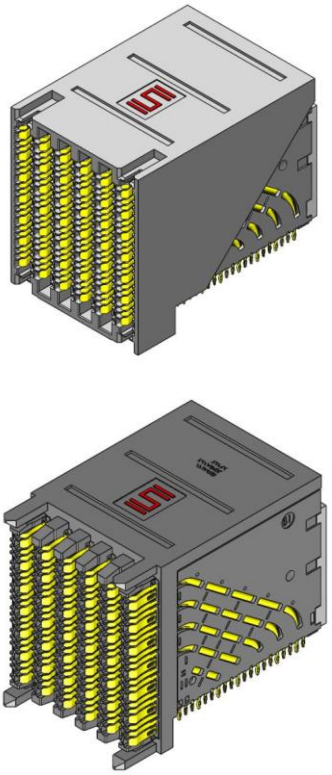
Project Number: Design Qualification Test Report	Tracking Code: 2203149_Report_Rev_2
Requested by: Corey Rose	Date: 2/27/2020
Part #: EBTM-6-12-2.0-S-RA-1/EBTF-6-12-2.0-S-RA-1	
Part description: EBTM/EBTF	Tech: Aaron McKim
Test Start: 12/17/2019	Test Completed: 1/27/2020



DESIGN QUALIFICATION TEST REPORT

EBTM/EBTF
EBTM-6-12-2.0-S-RA-1/EBTF-6-12-2.0-S-RA-1

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
2/27/2020	**1**	**Initial Issue**	**KH**
5/30/2025	**2**	**Notes added for CCC clarification**	**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) Parts not intended for testing LLCR are visually inspected and cleaned if necessary.
4) Any additional preparation will be noted in the individual test sequences.
5) Samtec Test PCBs used: PCB-109033-TST/PCB-109034-TST

FLOWCHARTS

Gas Tight

Group 1
EBTM-6-12-2.0-S-RA-1
EBTF-6-12-2.0-S-RA-1
8 Assemblies
Tin (IMMERSION) .016" SIG PTH, .022" GND PTH

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

(1) Gas Tight = EIA-364-36

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

Thermal Aging

Group 1
EBTM-6-12-2.0-S-RA-1
EBTF-6-12-2.0-S-RA-1
8 Assemblies
Tin (IMMERSION) .016" SIG PTH, .022" GND PTH

Step	Description
1.	Contact Gaps
2.	Mating/Unmating Force (2)
3.	LLCR (1)
4.	Thermal Age (3)
5.	LLCR (1) Max Delta = 15 mOhm
6.	Mating/Unmating Force (2)
7.	Contact Gaps

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

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

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

FLOWCHARTS Continued

Mating/Unmating/Durability

Group 1
EBTM-6-12-2.0-S-RA-1
EBTF-6-12-2.0-S-RA-1
8 Assemblies
Tin (IMMERSION) .016" SIG PTH, .022" GND PTH

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

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

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

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

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

FLOWCHARTS Continued

IR/DWV

Pin-to-Pin

Group 1	Group 2	Group 3	Group 4
EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTM-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH
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	Group 6	Group 7	Group 8
EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTM-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH
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)

Pin-to-Ground

Group 9	Group 10	Group 11	Group 12
EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTM-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH	EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 2 Assemblies Tin (IMMERSION) .016" SIG PTH, .022" GND PTH
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

Note: Tin (IMMERSION) .016" SIG PTH, .022" GND PTH

Group 1		Group 2		Group 3	
EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 1 Pins Powered Signal		EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 20 Pins Powered Signal		EBTM-6-12-2.0-S-RA-1 EBTF-6-12-2.0-S-RA-1 40 Pins Powered Signal	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	CCC (1) Rows = 1 Number of Positions = 1 *Note: Center of connector location.*	1.	CCC (1) Rows = 1 Number of Positions = 20 *Note: All signal pins combined carry supply while all grounds on that wafer carry return.*	1.	CCC (1) Rows = 2 Number of Positions = 20 *Note: Center wafer carries supply while adjacent wafer carries return.*

(1) CCC = EIA-364-70
Method 2, Temperature Rise Versus Current Curve
(TIN PLATING) - Tabulate calculated current at RT, 65°C, 75°C and 95°C after derating 20% and based on 105°C
(GOLD PLATING) - Tabulate calculated current at RT, 85°C, 95°C and 115°C after derating 20% and based on 125°C

FLOWCHARTS Continued

Mechanical Shock/Random Vibration/LLCR

Group 1
EBTM-6-12-2.0-S-RA-1
EBTF-6-12-2.0-S-RA-1
8 Assemblies
Tin (IMMERSION) .016" SIG PTH, .022" GND PTH

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
EBTM-6-12-2.0-S-RA-1
EBTF-6-12-2.0-S-RA-1
60 Points
Tin (IMMERSION) .016" SIG PTH, .022" GND PTH

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:

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

THERMAL SHOCK:

1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition: -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)

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

TEMPERATURE RISE (Current Carrying Capacity, CCC):

1) EIA-364-70, *Temperature Rise versus Current Test Procedure for Electrical Connectors and Sockets*.
2) When current passes through a contact, the temperature of the contact increases as a result of I^2R (resistive) heating.
3) The number of contacts being investigated plays a significant part in power dissipation and therefore temperature rise.
4) The size of the temperature probe can affect the measured temperature.
5) Copper traces on PC boards will contribute to temperature rise:
    a. Self heating (resistive)
    b. Reduction in heat sink capacity affecting the heated contacts
6) A de-rating curve, usually 20%, is calculated.
7) Calculated de-rated currents at four temperature points are reported:
    a. Ambient
    b. 85^{o} C
    c. 95^{o} C
    d. 115^{o} C
8) Typically, neighboring contacts (in close proximity to maximize heat 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 +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

GAS TIGHT:

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

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms:----------Stable
    b. +5.1 to +10.0 mOhms:----------Minor
    c. +10.1 to +15.0 mOhms: ----------Acceptable
    d. +15.1 to +50.0 mOhms: ----------Marginal
    e. +50.1 to +1000 mOhms:----------Unstable
    f. >+1000 mOhms:----------Open Failure
4) Procedure:
    a. Reference document: EIA-364-36, *Test Procedure for Determination of Gas-Tight Characteristics for Electrical Connectors, Sockets and/or Contact Systems*.
    b. Test Conditions:
        i. Class II--- Mated pairs of contacts assembled to their plastic housings.
        ii. Reagent grade Nitric Acid shall be used of sufficient volume to saturate the test chamber
        iii. The ratio of the volume of the test chamber to the surface area of the acid shall be 10:1.
        iv. The chamber shall be saturated with the vapor for at least 15 minutes before samples are added.
        v. Exposure time, 55 to 65 minutes.
        vi. The samples shall be no closer to the chamber walls than 1 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 5000 megohms.

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

To determine if the sockets can operate at its rated voltage and withstand momentary over potentials due to switching, surges, and other similar phenomenon. Separate samples are used to evaluate the effect of environmental stresses so not to influence the readings from arcing that occurs during the measurement process.

1) PROCEDURE:
    a. Reference document: EIA-364-20, *Withstanding Voltage Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Barometric Test Condition 1
        iii. Rate of Application 500 V/Sec
        iv. Test Voltage (VAC) until breakdown occurs
2) MEASUREMENTS/CALCULATIONS
    a. The breakdown voltage shall be measured and recorded.
    b. The dielectric withstanding voltage shall be recorded as 75% of the minimum breakdown voltage.
    c. The working voltage shall be recorded as one-third (1/3) of the dielectric withstanding voltage (one-fourth of the breakdown voltage).

RESULTS

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise--------4.3 A with 1 contact (1x1) powered.**
  (Note: Center of connector location)
- **CCC for a 30°C Temperature Rise--------16.0 A with 20 contacts (1x20) powered.**
  (Note: All signal pins combined carry supply while all grounds on that wafer carry return)
- **CCC for a 30°C Temperature Rise--------16.9 A with 40 contacts (2x20) powered**
  (Note: Center wafer carries supply while adjacent wafer carries return)

Mating – Unmating Forces

Thermal Aging Group

- **Initial**
  - **Mating**
    - **Min ----------16.79 lbs**
    - **Max----------17.52 lbs**
  - **Unmating**
    - **Min ---------- 9.92 lbs**
    - **Max----------11.36 lbs**
- **After Thermal**
  - **Mating**
    - **Min ----------10.02 lbs**
    - **Max----------11.05 lbs**
  - **Unmating**
    - **Min ---------- 8.62 lbs**
    - **Max---------- 9.47 lbs**

RESULTS Continued

Mating/Unmating Durability Group

- **Initial**
  - **Mating**
    - **Min ----------15.01 lbs**
    - **Max----------15.81 lbs**
  - **Unmating**
    - **Min ---------- 9.50 lbs**
    - **Max----------10.45 lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------16.02 lbs**
    - **Max----------17.68 lbs**
  - **Unmating**
    - **Min ----------10.83 lbs**
    - **Max----------12.34 lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------16.19 lbs**
    - **Max----------18.55 lbs**
  - **Unmating**
    - **Min ----------11.35 lbs**
    - **Max----------13.11 lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------16.77 lbs**
    - **Max----------18.94 lbs**
  - **Unmating**
    - **Min ----------11.69 lbs**
    - **Max----------13.60 lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------16.81 lbs**
    - **Max----------19.03 lbs**
  - **Unmating**
    - **Min ----------12.01 lbs**
    - **Max----------13.75 lbs**
- **After Humidity**
  - **Mating**
    - **Min ----------11.69 lbs**
    - **Max----------12.33 lbs**
  - **Unmating**
    - **Min ---------- 8.51 lbs**
    - **Max---------- 9.39 lbs**

RESULTS Continued

Insulation Resistance minimums, IR

Pin to Pin

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 5200 Meg Ω ---------- Passed**
  - **Unmated ---------- 6500 Meg Ω ---------- Passed**

Row to Row

- **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 ---------- 6300 Meg Ω ---------- Passed**
  - **Unmated ---------- 7200 Meg Ω ---------- Passed**

Pin to Ground

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 12500 Meg Ω ---------- Passed**
  - **Unmated ---------- 17500 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 770 VAC**
  - **Test Voltage ---------- 580 VAC**
  - **Working Voltage ---------- 190 VAC**

Pin to Pin

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

Row to Row

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

Pin to Ground

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

RESULTS Continued

LLCR Gas Tight (192 LLCR test points)

Signal 1

- **Initial ---------- 16.60 mOhms Max**

Signal 2

- **Initial ---------- 27.48 mOhms Max**

Signal 3

- **Initial ---------- 47.28 mOhms Max**

Signal 4

- **Initial ---------- 50.07 mOhms Max**

Ground

- **Initial ----------2.85 mOhms Max**
- **Gas-Tight**
  - **<= +5.0 mOhms----------182 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 10 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**

LLCR Thermal Aging (192 LLCR test points)

Signal 1

- **Initial ---------- 14.93 mOhms Max**

Signal 2

- **Initial ---------- 29.54 mOhms Max**

Signal 3

- **Initial ---------- 40.02 mOhms Max**

Signal 4

- **Initial ---------- 43.60 mOhms Max**

Ground

- **Initial ----------2.52 mOhms Max**
- **Thermal Aging**
  - **<= +5.0 mOhms----------188 Points ---------- Stable**
  - **+5.1 to +8.0 mOhms ----------4 Points ---------- Minor**
  - **+8.1 to +10.0 mOhms ----------0 Points ---------- Acceptable**
  - **+10.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

LLCR Durability (192 LLCR test points)

Signal 1

- **Initial ---------- 15.48 mOhms Max**

Signal 2

- **Initial ---------- 28.35 mOhms Max**

Signal 3

- **Initial ---------- 38.49 mOhms Max**

Signal 4

- **Initial ---------- 47.06 mOhms Max**

Ground

- **Initial ----------1.81 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms----------191 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 +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms----------188 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------4 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms----------191 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ----------1 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

LLCR Shock & Vibration (192 LLCR test points)

Signal 1

- **Initial ---------- 14.80 mOhms Max**

Signal 2

- **Initial ---------- 28.89 mOhms Max**

Signal 3

- **Initial ---------- 40.74 mOhms Max**

Signal 4

- **Initial ---------- 45.93 mOhms Max**

Ground

- **Initial ----------2.68 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms----------183 Points ---------- Stable**
  - **+5.1 to +8.0 mOhms ----------9 Points ---------- Minor**
  - **+8.1 to +10.0 mOhms ----------0 Points ---------- Acceptable**
  - **+10.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**

Mechanical Shock & Random Vibration:

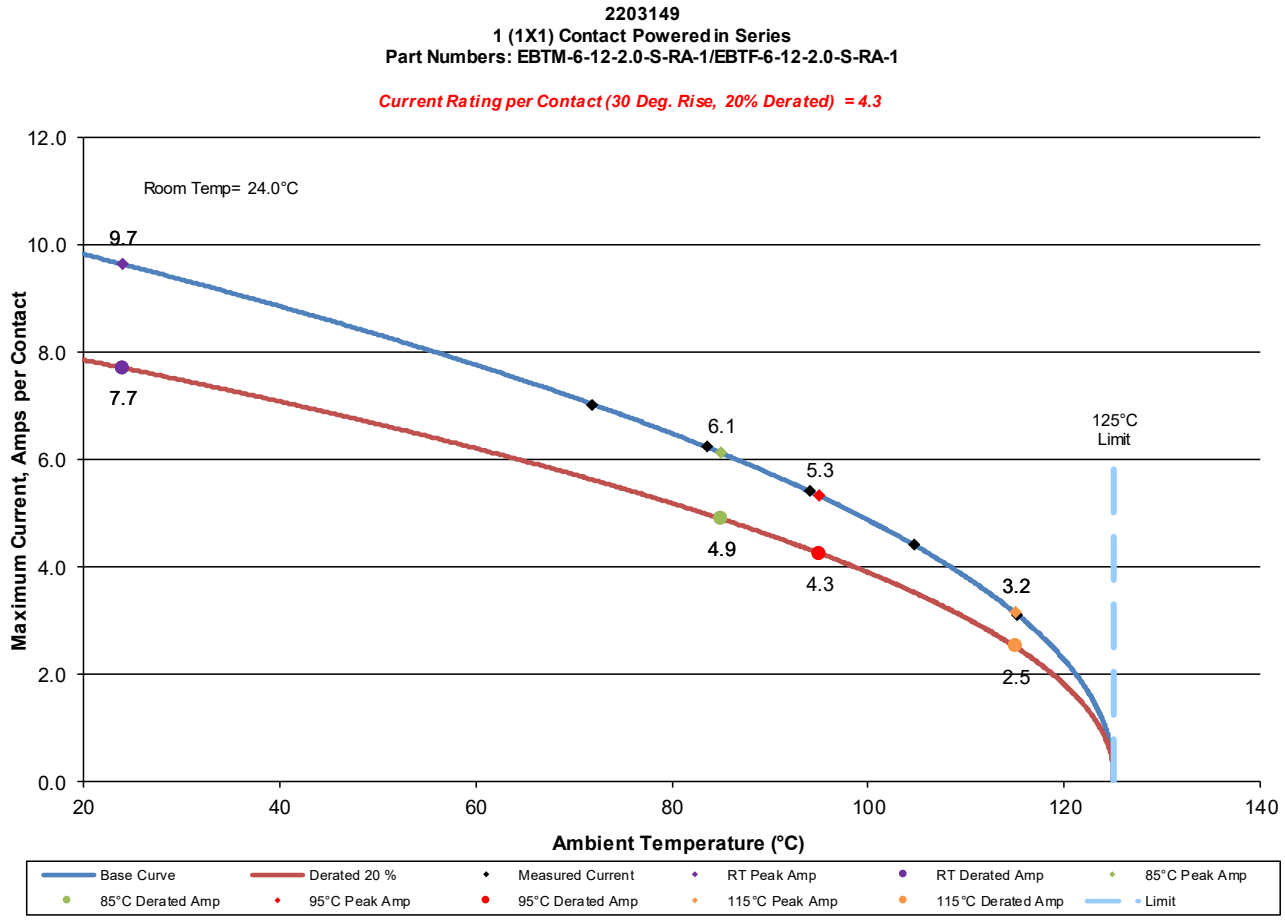
- **Shock**
  - **No Damage---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**
- **Vibration**
  - **No Damage---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**

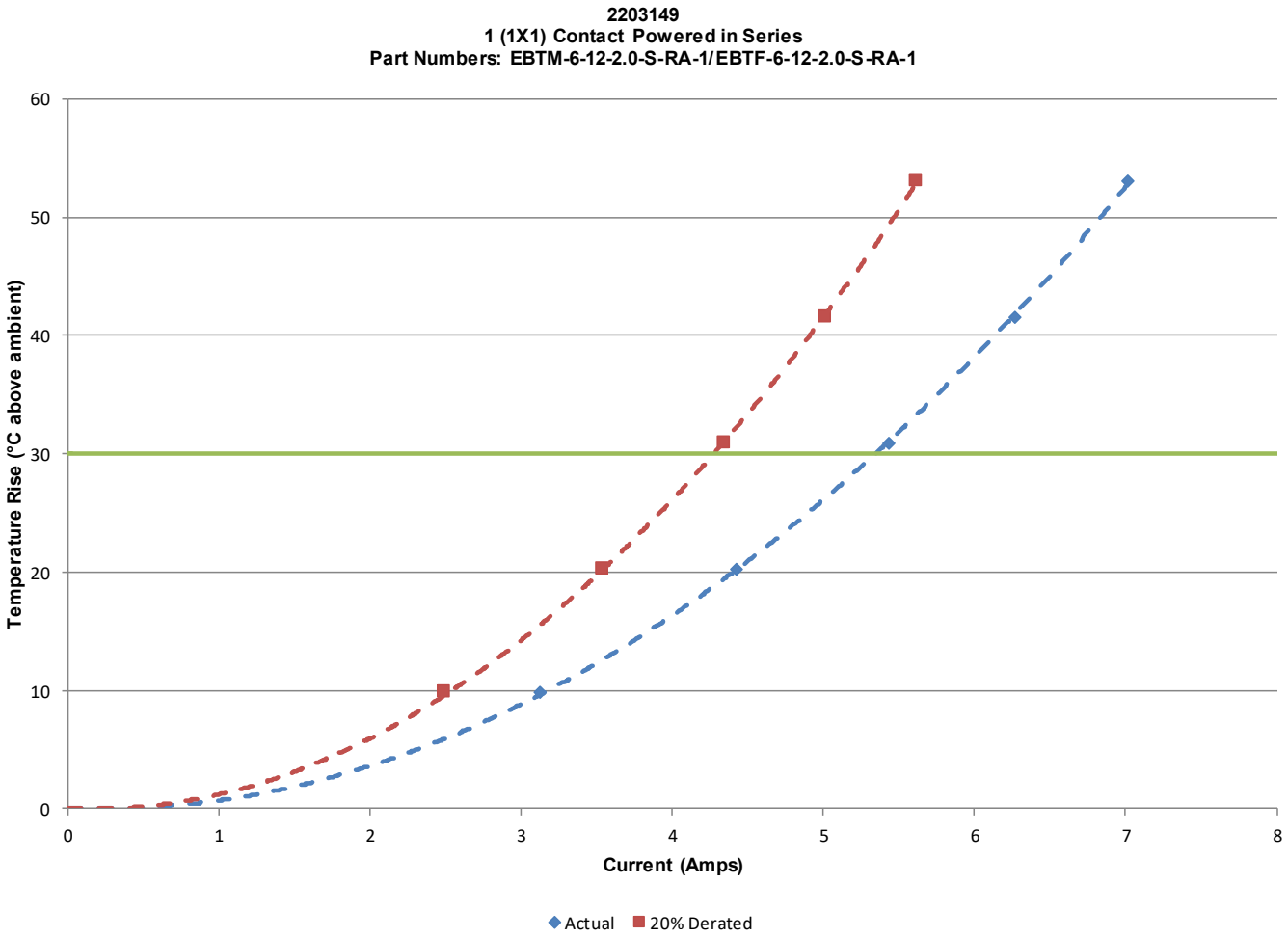
DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):

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

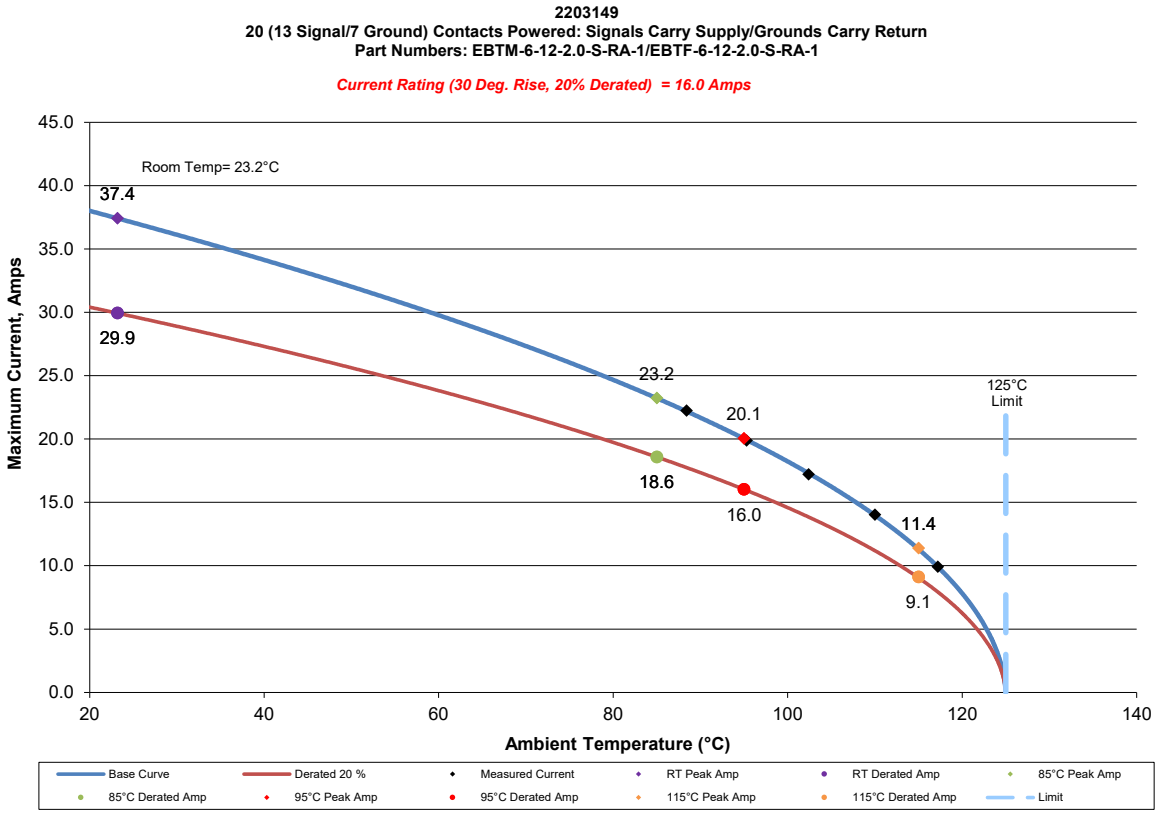
    a. Linear configuration with 1 adjacent conductors/contacts powered

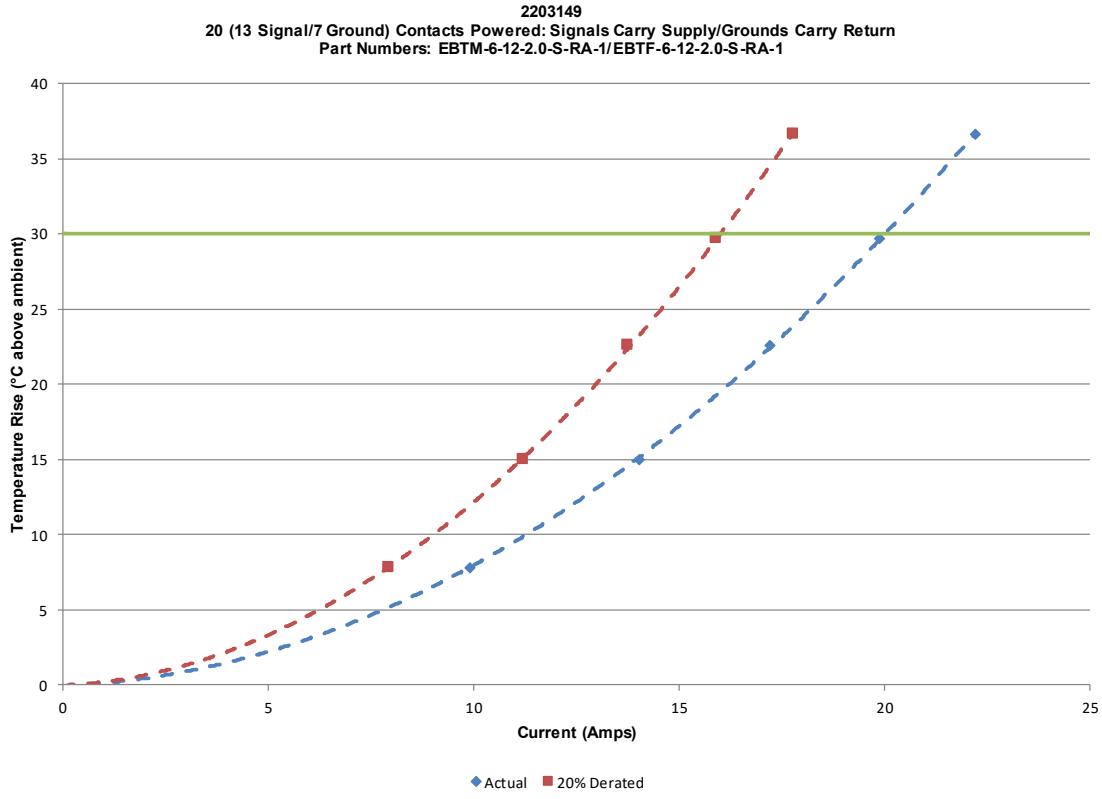



2203149
1 (1X1) Contact Powered in Series
Part Numbers: EBTM-6-12-2.0-S-RA-1/EBTF-6-12-2.0-S-RA-1
Temperature Rise (°C above ambient)
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
Current (Amps)
Actual
20% Derated

DATA SUMMARIES Continued

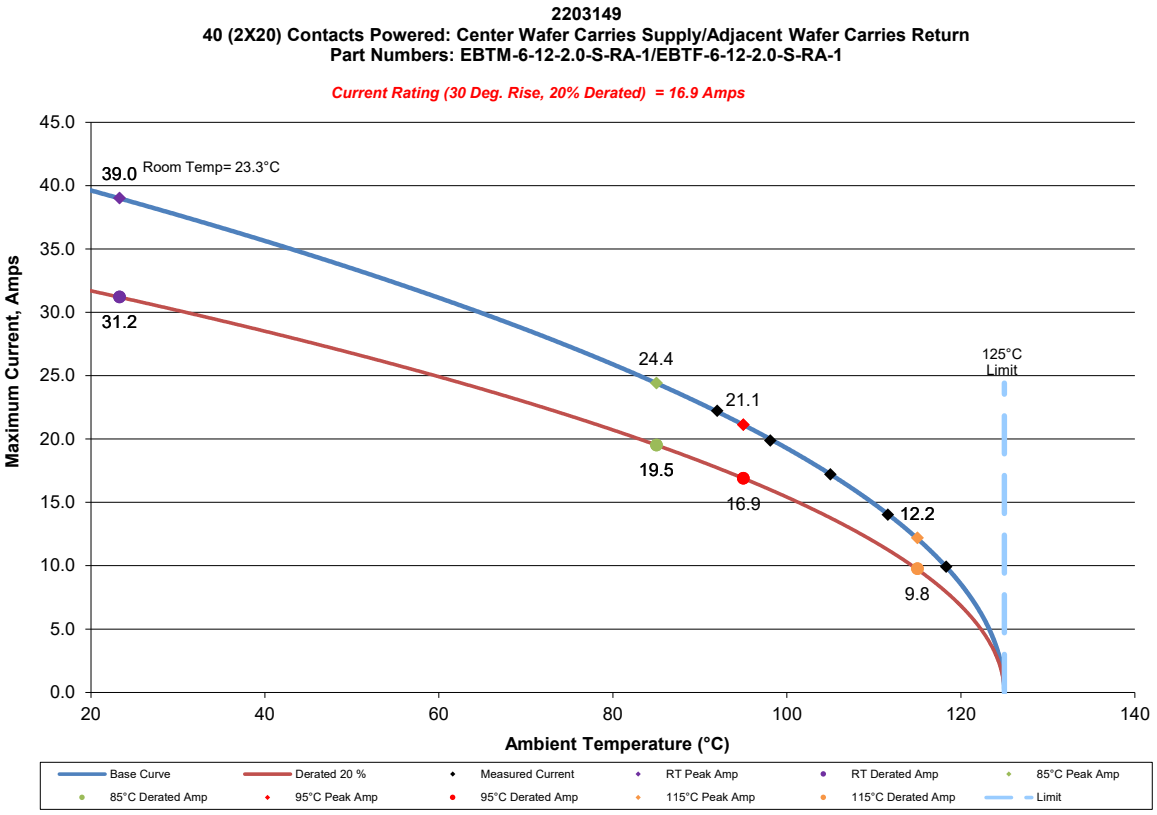
b. Linear configuration with 20 adjacent conductors/contacts powered

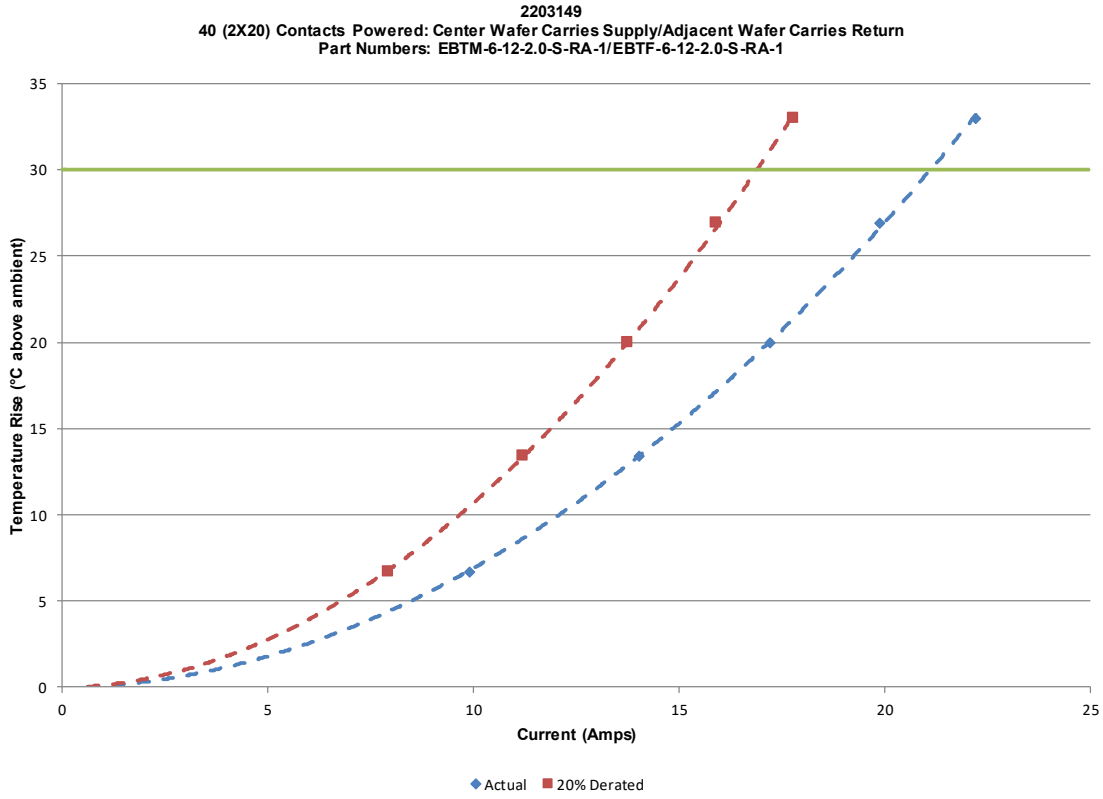




DATA SUMMARIES Continued

c. Linear configuration with 40 adjacent conductors/contacts powered





DATA SUMMARIES Continued

MATING/UNMATING:

Thermal Aging Group

	Initial				After Thermals			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	74.68	16.79	44.12	9.92	44.57	10.02	38.34	8.62
Maximum	77.93	17.52	50.53	11.36	49.15	11.05	42.12	9.47
Average	76.46	**17.19**	46.96	**10.56**	46.29	**10.41**	40.57	**9.12**
St Dev	1.26	0.28	1.79	0.40	1.48	0.33	1.11	0.25
Count	8	8	8	8	8	8	8	8

Mating/Unmating Durability Group

	Initial				25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	66.76	15.01	42.26	9.50	71.26	16.02	48.17	10.83
Maximum	70.32	15.81	46.48	10.45	78.64	17.68	54.89	12.34
Average	69.01	**15.52**	44.20	**9.94**	76.22	**17.14**	51.62	**11.61**
St Dev	1.10	0.25	1.35	0.30	2.74	0.62	2.07	0.47
Count	8	8	8	8	8	8	8	8

	50 Cycles				75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	72.01	16.19	50.48	11.35	74.59	16.77	52.00	11.69
Maximum	82.51	18.55	58.31	13.11	84.25	18.94	60.49	13.60
Average	78.51	**17.65**	54.18	**12.18**	80.82	**18.17**	55.59	**12.50**
St Dev	4.09	0.92	2.33	0.52	3.25	0.73	2.50	0.56
Count	8	8	8	8	8	8	8	8

	100 Cycles				After Humidity			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	74.77	16.81	53.42	12.01	52.00	11.69	37.85	8.51
Maximum	84.65	19.03	61.16	13.75	54.84	12.33	41.77	9.39
Average	81.28	**18.27**	56.67	**12.74**	53.53	**12.04**	40.37	**9.08**
St Dev	3.22	0.72	2.42	0.54	1.08	0.24	1.35	0.30
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**EBTM/EBTF**	**EBTM**	**EBTF**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	5200	6500	45000

	Row to Row		
	Mated	Unmated	Unmated
Minimum	**EBTM/EBTF**	**EBTM**	**EBTF**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	6300	7200	45000

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**EBTM/EBTF**	**EBTM**	**EBTF**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	12500	17500	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**EBTM/EBTF**
Break Down Voltage	770
Test Voltage	580
Working Voltage	190

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

Pin to Ground	
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 +1000 mOhms----------Unstable
    f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	12/20/2019	1/2/2020	1/13/2020	1/27/2020
Room Temp (Deg C)	23	22	23	22
Rel Humidity (%)	37	37	38	36
Technician	Aaron Mckim	Aaron McKim	Aaron McKim	Aaron McKim
mOhm values	Actual **Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type: Signal 1			
Average	13.41	0.47	0.28	0.56
St. Dev.	1.57	0.38	0.28	0.38
Min	10.98	0.06	0.01	0.04
Max	15.48	2.08	1.02	1.51
Summary Count	32	32	32	32
Total Count	32	32	32	32
	Pin Type: Signal 2			
Average	23.51	0.52	0.59	0.83
St. Dev.	3.27	0.51	0.92	0.72
Min	18.59	0.03	0	0.06
Max	28.35	2.35	5	3.52
Summary Count	40	40	40	40
Total Count	40	40	40	40
	Pin Type: Signal 3			
Average	34.74	0.34	0.41	0.68
St. Dev.	2.85	0.27	0.43	0.45
Min	29.85	0.01	0	0.1
Max	38.49	1.35	1.7	1.82
Summary Count	40	40	40	40
Total Count	40	40	40	40
	Pin Type: Signal 4			
Average	39.61	0.66	1.63	1.24
St. Dev.	5.37	1.21	2.35	2.17
Min	33.63	0.03	0.05	0.02
Max	47.06	6.77	8.78	11.21
Summary Count	32	32	32	32
Total Count	32	32	32	32
	Pin Type: GND 1			
Average	1.56	0.07	0.08	0.15
St. Dev.	0.12	0.05	0.05	0.05
Min	1.36	0	0	0.07
Max	1.81	0.21	0.25	0.32
Summary Count	48	48	48	48
Total Count	48	48	48	48

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**191**	**1**	**0**	**0**	**0**	**0**
Therm Shck	**188**	**4**	**0**	**0**	**0**	**0**
Humidity	**191**	**0**	**1**	**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 +1000 mOhms ----------Unstable
    f. >+1000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	12/23/2019	1/3/2020		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	36	44		
Technician	Aaron McKim	Aaron McKim		
mOhm values	Actual **Initial**	**Delta Thermal**		
Pin Type: Signal 1				
Average	12.6	0.85		
St. Dev.	1.38	0.52		
Min	9.54	0.02		
Max	14.93	2.53		
Summary Count	32	32		
Total Count	32	32		
Pin Type: Signal 2				
Average	22.03	1.48		
St. Dev.	3.48	1.07		
Min	16.09	0.16		
Max	29.54	5.75		
Summary Count	40	40		
Total Count	40	40		
Pin Type: Signal 3				
Average	32.99	2.07		
St. Dev.	2.82	1.35		
Min	27.61	0.01		
Max	40.02	5.8		
Summary Count	40	40		
Total Count	40	40		
Pin Type: Signal 4				
Average	37.29	2.27		
St. Dev.	5.06	1.23		
Min	30.64	0.29		
Max	43.6	6.66		
Summary Count	32	32		
Total Count	32	32		
Pin Type: GND 1				
Average	1.45	0.21		
St. Dev.	0.3	0.23		
Min	1.02	0		
Max	2.52	1.16		
Summary Count	48	48		
Total Count	48	48		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Thermal	**188**	**4**	**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 +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	12/19/2019	1/2/2020		
Room Temp (Deg C)	22	23		
Rel Humidity (%)	36	35		
Technician	Aaron McKim	Aaron McKim		
mOhm values	Actual **Initial**	**Delta Acid Vapor**		
	Pin Type: Signal 1			
Average	13	2.01		
St. Dev.	1.6	1.63		
Min	10.15	0.1		
Max	16.6	8.39		
Summary Count	32	32		
Total Count	32	32		
	Pin Type: Signal 2			
Average	22.31	1.93		
St. Dev.	3.2	1.24		
Min	16.17	0.08		
Max	27.48	4.95		
Summary Count	40	40		
Total Count	40	40		
	Pin Type: Signal 3			
Average	33.64	2.65		
St. Dev.	3.9	1.59		
Min	27.56	0.06		
Max	47.28	6.66		
Summary Count	40	40		
Total Count	40	40		
	Pin Type: Signal 4			
Average	38.12	2.67		
St. Dev.	5.19	2.07		
Min	31.38	0.11		
Max	50.07	8.39		
Summary Count	32	32		
Total Count	32	32		
	Pin Type: GND 1			
Average	1.71	0.42		
St. Dev.	0.39	0.37		
Min	1.19	0.01		
Max	2.85	1.56		
Summary Count	48	48		
Total Count	48	48		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Acid Vapor	**182**	**10**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Shock &Vibration Group:

1). A total of 192 points were measured.
2). EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3). 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 +8.0 mOhms:----------Minor
   c. +8.1 to +10.0 mOhms:----------Acceptable
   d. +10.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms ----------Unstable
   f. >+1000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	12/17/2019	1/16/2020		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	35	38		
Technician	Aaron McKim	Aaron McKim		
mOhm values	Actual	**Delta**		
	Initial	**Shock-Vib**		
Pin Type: Signal 1				
Average	12.09	1.01		
St. Dev.	1.77	1		
Min	7.09	0.01		
Max	14.8	5.07		
Summary Count	32	32		
Total Count	32	32		
Pin Type: Signal 2				
Average	22.38	1.56		
St. Dev.	3.59	1.57		
Min	15.39	0.02		
Max	28.89	6.97		
Summary Count	40	40		
Total Count	40	40		
Pin Type: Signal 3				
Average	32.44	1.94		
St. Dev.	3.22	1.43		
Min	26.75	0.03		
Max	40.74	6.94		
Summary Count	40	40		
Total Count	40	40		
Pin Type: Signal 4				
Average	36.56	1.92		
St. Dev.	5.16	1.64		
Min	29.99	0.04		
Max	45.93	5.75		
Summary Count	32	32		
Total Count	32	32		
Pin Type: GND 1				
Average	1.49	0.33		
St. Dev.	0.37	0.33		
Min	1	0		
Max	2.68	1.44		
Summary Count	48	48		
Total Count	48	48		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock-Vib	**183**	**9**	**0**	**0**	**0**	**0**

Nanosecond Event Detection:

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

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2019, Next Cal: 05/29/2020

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

Equipment #: THC-05
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 05 23 00 02
Accuracy: See Manual
… Last Cal: 11/14/2019, Next Cal: 11/14/2020

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnati Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 06/30/2019, Next Cal: 06/30/2020

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

Equipment #: 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: 02/05/2019, Next Cal: 02/05/2020

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 09/11/2019, Next Cal: 09/11/2020

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

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

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

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