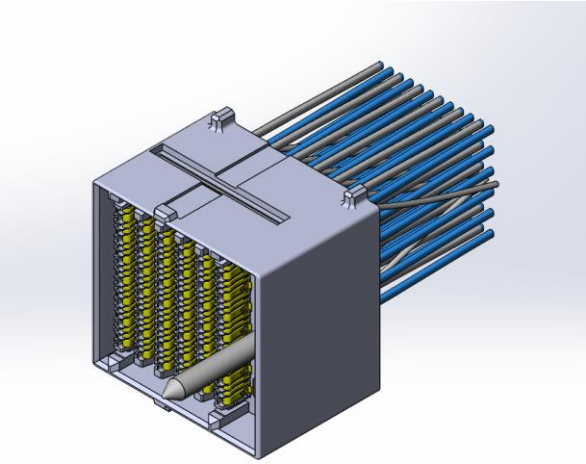
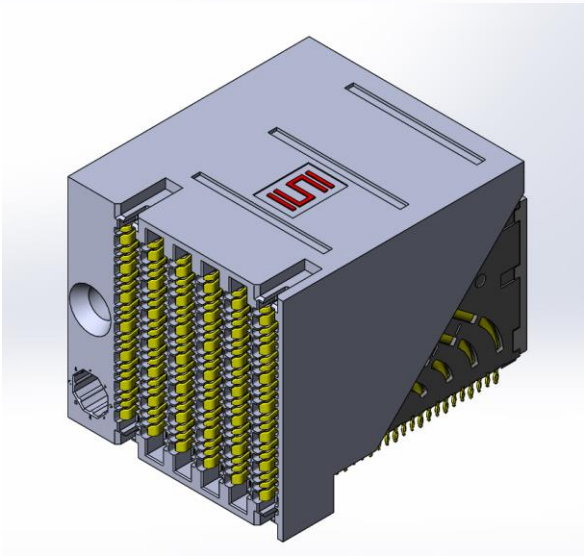
Project Number: Design Qualification Test Report	Tracking Code: 2566714_Report_Rev_1
Requested by: Chad Humphres	Date: 7/1/2022
Part #: EBCM-1-6-12-1-L-N-XX-X-X-X /EBTF-6-12-2.0-S-RA-1-L	Tech: Aaron McKim
Part description: EBCM / EBTF	Qty to test: 100
Test Start: 11/1/2020	Test Completed: 12/15/2020





Design Qualification Test Report

EBCM / EBTF
EBCM-1-6-12-1-L-N-XX-X-X-X /EBTF-6-12-2.0-S-RA-1-L

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
1/13/2021	**1**	**Initial Issue**	**PC**

CERTIFICATION

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

SCOPE

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

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts to be used for LLCR and DWV/IR testing were cleaned according to TLWI-0001.
4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
5) The automated procedure is used with aqueous compatible soldering materials.
6) Parts not intended for testing LLCR and DWV/IR are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Samtec Test PCBs used: PCB-111198-TST-XX.

FLOWCHARTS

Gas Tight

Group 1

EBCM-1-6-12-1-L-N-XX-X-X-X

EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1

3 Assemblies

Step	Description
1.	LLCR (2) *Note: Please separate twinax and coax LLCR readings when reporting.*
2.	Gas Tight (1)
3.	LLCR (2) Max Delta ▪ 15 mOhm *Note: Please separate twinax and coax LLCR readings when reporting.*

(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

EBCM-1-6-12-1-L-N-XX-X-X-X

EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1

3 Assemblies

Step	Description
1.	Contact Gaps *Note: Check gaps on each end and in the middle of each row*
2.	Mating/Unmating Force (2)
3.	LLCR (1) *Note: Please separate twinax and coax LLCR readings when reporting.*
4.	Thermal Age (3)
5.	LLCR (1) Max Delta ▪ 15 mOhm *Note: Please separate twinax and coax LLCR readings when reporting.*
6.	Mating/Unmating Force (2)
7.	Contact Gaps *Note: Check gaps on each end and in the middle of each row*

(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

EBCM-1-6-12-1-L-N-XX-X-X-X

EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1

3 Assemblies

Step	Description
1.	Contact Gaps *Note: Check gaps on each end and in the middle of each row*
2.	LLCR (2) *Note: Please separate twinax and coax LLCR readings when reporting.*
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 *Note: Check gaps on each end and in the middle of each row*
13.	LLCR (2) Max Delta ▪ 15 mOhm *Note: Please separate twinax and coax LLCR readings when reporting.*
14.	Thermal Shock (4) - Non Standard
15.	LLCR (2) Max Delta ▪ 15 mOhm *Note: Please separate twinax and coax LLCR readings when reporting.*
16.	Humidity (1)
17.	LLCR (2) Max Delta ▪ 15 mOhm *Note: Please separate twinax and coax LLCR readings when reporting.*
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 = Other
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-40°C to +85°C)
Test Duration = A-3 (100 Cycles)
Twinax Cable (TX-34100CU-T01-S) is only rated down to -40°C

FLOWCHARTS Continued

IR/DWV

Note: Single ended cable to be used for testing.

Pin-to-Pin

Group 1 EBCM-1-6-12-1-L-N-XX-X-X-X EBTF-6-12-2.0-S-RA-1-L / EBCL-6-12-1 2 Assemblies		Group 2 EBCM-1-6-12-1-L-N-XX-X-X-X 2 Assemblies		Group 3 EBCM-1-6-12-1-L-N-XX-X-X-X EBTF-6-12-2.0-S-RA-1-L / EBCL-6-12-1 2 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	IR (4)
				2.	DWV at Test Voltage (1)
				3.	Thermal Shock (5) • Non Standard
				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 4 EBCM-1-6-12-1-L-N-XX-X-X-X EBTF-6-12-2.0-S-RA-1-L / EBCL-6-12-1 2 Assemblies		Group 5 EBCM-1-6-12-1-L-N-XX-X-X-X 2 Assemblies		Group 6 EBCM-1-6-12-1-L-N-XX-X-X-X EBTF-6-12-2.0-S-RA-1-L / EBCL-6-12-1 2 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	IR (4)
				2.	DWV at Test Voltage (1)
				3.	Thermal Shock (5) • Non Standard
				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 7 EBCM-1-6-12-1-L-N-XX-X-X-X EBTF-6-12-2.0-S-RA-1-L / EBCL-6-12-1 2 Assemblies		Group 8 EBCM-1-6-12-1-L-N-XX-X-X-X 2 Assemblies		Group 9 EBCM-1-6-12-1-L-N-XX-X-X-X EBTF-6-12-2.0-S-RA-1-L / EBCL-6-12-1 2 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	DWV Breakdown (2)	1.	DWV Breakdown (2)	1.	IR (4)
				2.	DWV at Test Voltage (1)
				3.	Thermal Shock (5) • Non Standard
				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 = Other
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-40°C to +85°C)
Test Duration = A-3 (100 Cycles)
Twinax Cable (TX-34100CU-T01-S) is only rated down to -40°C.

FLOWCHARTS Continued

Current Carrying Capacity

Note: In addition to monitoring temperature in the contact area, also monitor temperature in the middle of the cable, underneath the cable sleeve.

Group 1
EBCM-1-6-12-1-L-N-XX-X-X-X
EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1
1 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 1 *Note: Center of connector location*

Group 2
EBCM-1-6-12-1-L-N-XX-X-X-X
EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1
20 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 20 *Note: All signal pins combined carry supply while all grounds on that wafer carry return*

Group 3
EBCM-1-6-12-1-L-N-XX-X-X-X
EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1
40 Pins Powered
Signal

Step	Description
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

Cable Pull

Note: 2 AT-1544-008's will used to fixture the panel and non-panel mount boards toghether to simulate real world applications.

Group 1
EBCM-1-6-12-1-L-N-XX-X-X-X
EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1
4 Assemblies
90 Degrees - Lateral

Step	Description
1.	Cable Pull (1)

Group 2
EBCM-1-6-12-1-L-N-XX-X-X-X
EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1
4 Assemblies
90 Degrees - Vertical

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

Cable Flex

Note: 2 AT-1544-008's will used to fixture the panel and non-panel mount boards toghether to simulate real world applications.

Group 1 EBCM-1-6-12-1-L-N-12-1-L-N EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1 4 Assemblies Flat Cable - Vertical		Group 2 EBCM-1-6-12-1-L-N-12-1-L-N EBTF-6-12-2.0-S-RA-1-L / EBCB-6-12-1 4 Assemblies Flat Cable - Lateral	
Step	**Description**	**Step**	**Description**
1.	IR (3)	1.	IR (3)
2.	DWV at Test Voltage (2)	2.	DWV at Test Voltage (2)
3.	Cable Flex (1)	3.	Cable Flex (1)
4.	Visual Inspection	4.	Visual Inspection
5.	IR (3)	5.	IR (3)
6.	DWV at Test Voltage (2)	6.	DWV at Test Voltage (2)

(1) Cable Flex = EIA-364-41
- Circular Jacket Cable - to be tested 90° each direction (180° total)
- Flat Cable - to be tested 70° each direction (140° total)
- Monitor continuity during flex testing
- Failure = Discontinuity >1 microsecond at 10 ohms

(2) 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

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

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: -40℃ to +85℃
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 :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.

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.

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. Rate of Application 500 V/Sec
        iii. Test Voltage (VAC) until breakdown occurs
2) MEASUREMENTS/CALCULATIONS
    a. The breakdown voltage shall be measured and recorded.
    b. The dielectric withstanding voltage shall be recorded as 75% of the minimum breakdown voltage.
    c. The working voltage shall be recorded as one-third (1/3) of the dielectric withstanding voltage (one-fourth of the breakdown voltage).

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:
    c. Ambient
    d. 65^{o} C
    e. 75^{o} C
    f. 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.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes.

LLCR:

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms: ----------Stable
    b. +5.1 to +10.0 mOhms:----------Minor
    c. +10.1 to +15.0 mOhms: ----------Acceptable
    d. +15.1 to +50.0 mOhms: ----------Marginal
    e. +50.1 to +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure

GAS TIGHT:

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

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms: ----------Stable
    b. +5.1 to +10.0 mOhms:----------Minor
    c. +10.1 to +15.0 mOhms: ----------Acceptable
    d. +15.1 to +50.0 mOhms: ----------Marginal
    e. +50.1 to +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure
4) Procedure:
    g. Reference document: EIA-364-36, *Test Procedure for Determination of Gas-Tight Characteristics for Electrical Connectors, Sockets and/or Contact Systems*.
    h. 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.

CABLE PULL:

1) Secure cable near center and pull on connector
    a. At 90 Degrees - Lateral
    b. At 90 Degrees - Vertical

Fig. 1
0° Connector pull, notice the electrical continuity hook-up wires.

CABLE FLEX:

1) Oscillate and monitor electrical continuity for open circuit indication.
    a. ± 70° Flex Mode, bend up to 500 cycles. 16 oz load on cable end.

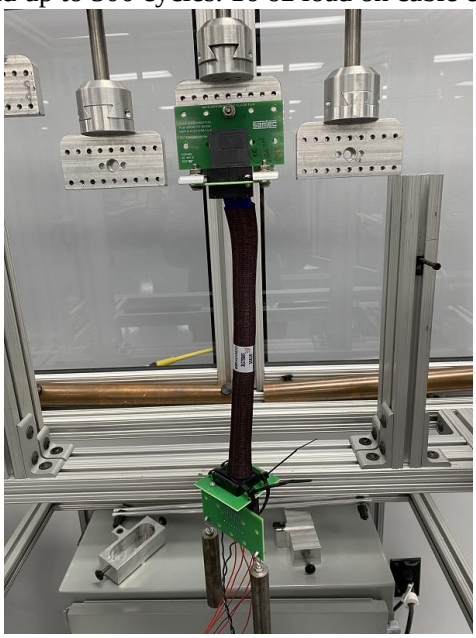


Fig. 2
(Setup picture)

RESULTS

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise----------2.9 A per contact with 1 contact (1x1) powered (Note: Center of the connector location)**
- **CCC for a 30°C Temperature Rise----------11.0 A per wafer with 20 contacts (1x20) powered (Note: All signal pins combined carry supply while all grounds on that water carry return)**
- **CCC for a 30°C Temperature Rise----------9.7 A per wafer with 40 contacts (2x20) powered (Note: Center wafer carries supply while adjacent water carries return)**

Mating – Unmating Forces

Thermal aging Group

- **Initial**
  - **Mating**
    - **Min ----------10.83 lbs**
    - **Max----------11.33 lbs**
  - **Unmating**
    - **Min ---------- 6.99 lbs**
    - **Max---------- 7.45 lbs**
- **After Thermal**
  - **Mating**
    - **Min ---------- 6.98 lbs**
    - **Max---------- 7.42 lbs**
  - **Unmating**
    - **Min ---------- 5.08 lbs**
    - **Max---------- 5.51 lbs**

RESULTS Continued

Mating – Unmating Forces

Mating/Unmating Durability Group

- **Initial**
  - **Mating**
    - **Min ----------10.22 lbs**
    - **Max----------10.87 lbs**
  - **Unmating**
    - **Min ---------- 6.94 lbs**
    - **Max---------- 7.35 lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------10.75 lbs**
    - **Max----------11.28 lbs**
  - **Unmating**
    - **Min ---------- 7.48 lbs**
    - **Max---------- 8.03 lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------11.12 lbs**
    - **Max----------11.62 lbs**
  - **Unmating**
    - **Min ---------- 7.42 lbs**
    - **Max---------- 8.41 lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------11.25 lbs**
    - **Max----------11.98 lbs**
  - **Unmating**
    - **Min ---------- 7.98 lbs**
    - **Max---------- 8.55 lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------11.50 lbs**
    - **Max----------12.22 lbs**
  - **Unmating**
    - **Min ---------- 8.16 lbs**
    - **Max---------- 8.69 lbs**
- **After Humidity**
  - **Mating**
    - **Min ---------- 8.67 lbs**
    - **Max---------- 9.13 lbs**
  - **Unmating**
    - **Min ---------- 5.61 lbs**
    - **Max---------- 6.33 lbs**

RESULTS Continued

Cable Pull force

- **90° Pull Lateral**
  - **Min ---------- 11.65 lbs**
  - **Max ---------- 16.11 lbs**
- **90° Pull Vertical**
  - **Min ---------- 13.70 lbs**
  - **Max ---------- 17.74 lbs**

Cable Flex:

Insulation Resistance minimums, IR

Pin to Pin

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
- **After 500 flex cycles**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**

Row to Row

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
- **After 500 flex cycles**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**

Pin to Ground

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
- **After 500 flex cycles**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Test Voltage ---------- 380 VAC**

Pin to Pin

- **Initial DWV ---------- Passed**
- **After 500 Flex cycles DWV ---------- Passed**

Row to Row

- **Initial DWV ---------- Passed**
- **After 500 Flex cycles DWV ---------- Passed**

Pin to Ground

- **Initial DWV ---------- Passed**
- **After 500 Flex cycles DWV ---------- Passed**

LLCR Gas Tight (432 Twinax and 36 Coax and 3 ground LLCR test points)

Twinax pin:

- **Initial ---------- 380.97 mOhms Max**

Coax pin:

- **Initial ---------- 320.79 mOhms Max**

Ground pin:

- **Initial ---------- 13.82 mOhms Max**
- **Gas-Tight**
  - **<= +5.0 mOhms ---------- 457 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 14 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**

RESULTS Continued

LLCR Durability (432 Twinax and 36 Coax and 3 ground LLCR test points)

Twinax pin:

- **Initial ---------- 386.18 mOhms Max**

Coax pin:

- **Initial ---------- 322.57 mOhms Max**

Ground pin:

- **Initial ---------- 8.47 mOhms Max**
- **After 25 cycles**
  - **<= +5.0 mOhms ---------- 471 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 +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After thermal shock**
  - **<= +5.0 mOhms ---------- 463 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 8 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**
- **After humidity**
  - **<= +5.0 mOhms ---------- 465 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 6 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 (432 Twinax and 36 Coax and 3 ground LLCR test points)

Twinax pin:

- **Initial ---------- 388.48 mOhms Max**

Coax pin:

- **Initial ---------- 320.68 mOhms Max**

Ground pin:

- **Initial ---------- 20.83 mOhms Max**
- **Thermal Aging**
  - **<= +5.0 mOhms ---------- 457 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 14 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**

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 ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 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 ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 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 ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 502 VAC**
  - **Test Voltage ---------- 380 VAC**
  - **Working Voltage ---------- 125 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

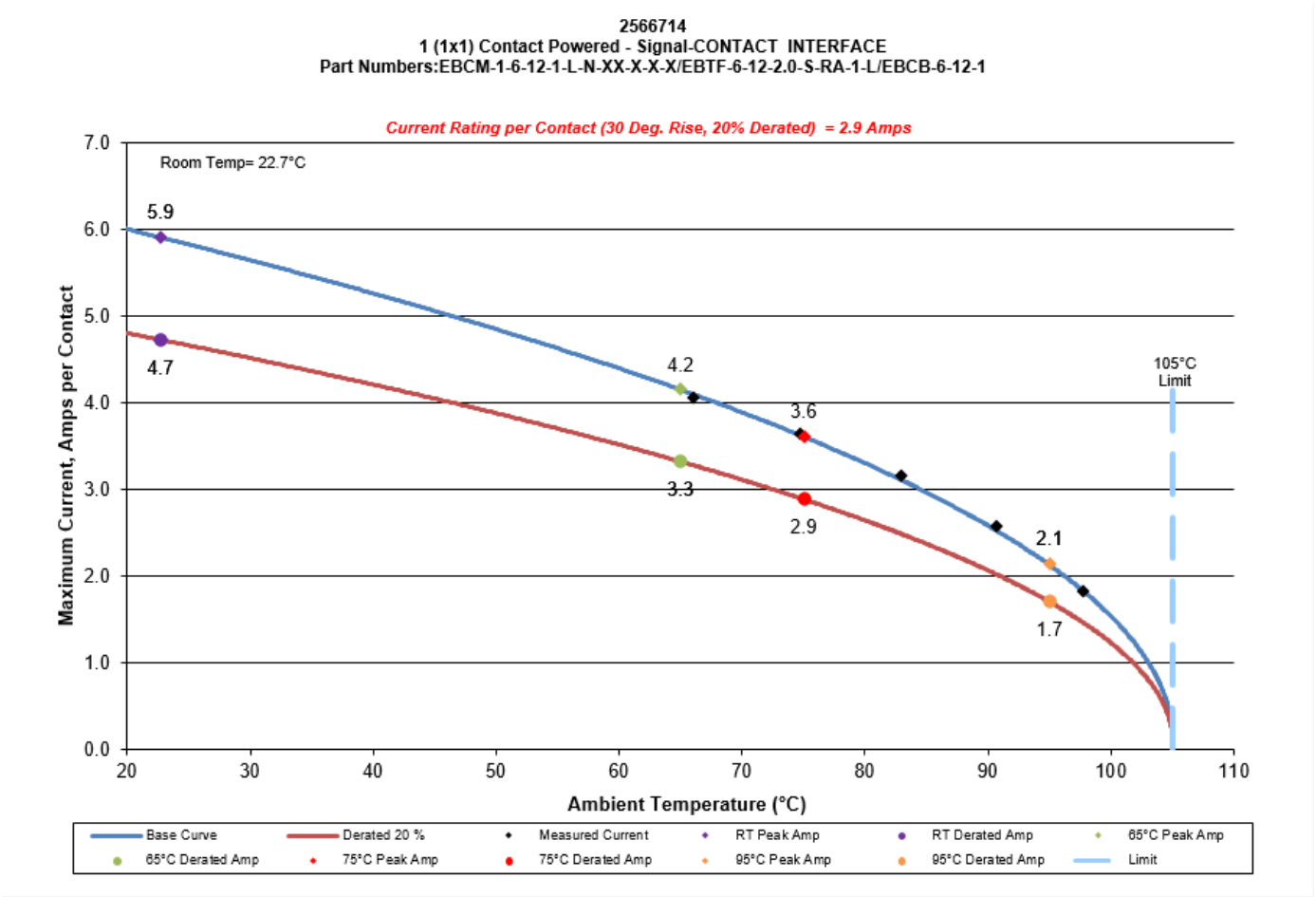
- **Initial DWV ---------- Passed**
- **Thermal DWV ---------- Passed**
- **Humidity DWV ---------- Passed**

DATA SUMMARIES

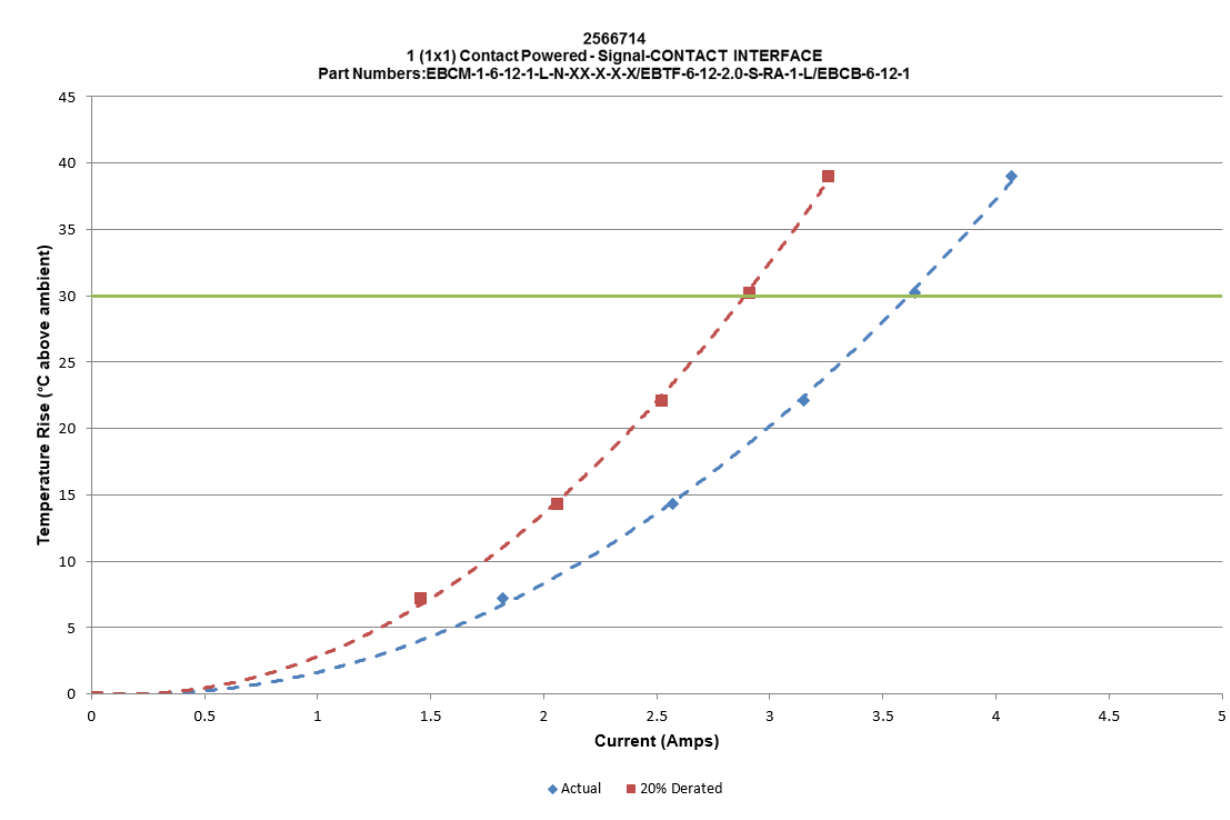
TEMPERATURE RISE (Current Carrying Capacity, CCC):

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 power conductors/contacts powered

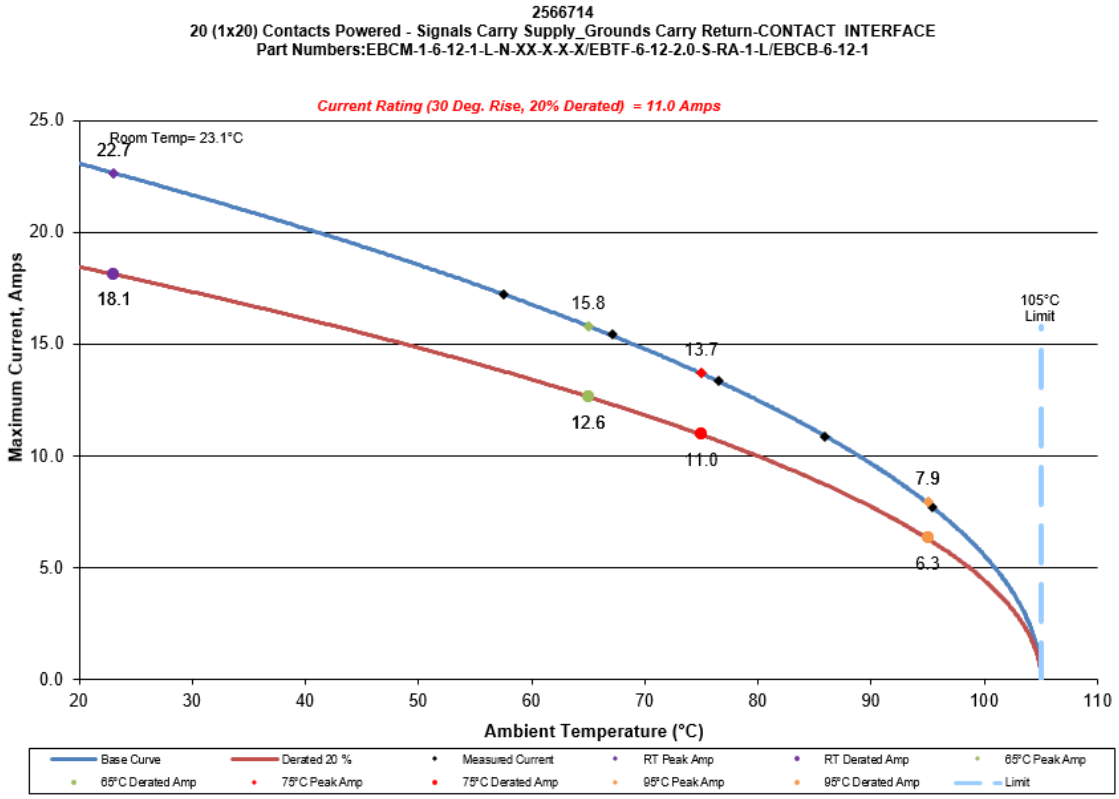


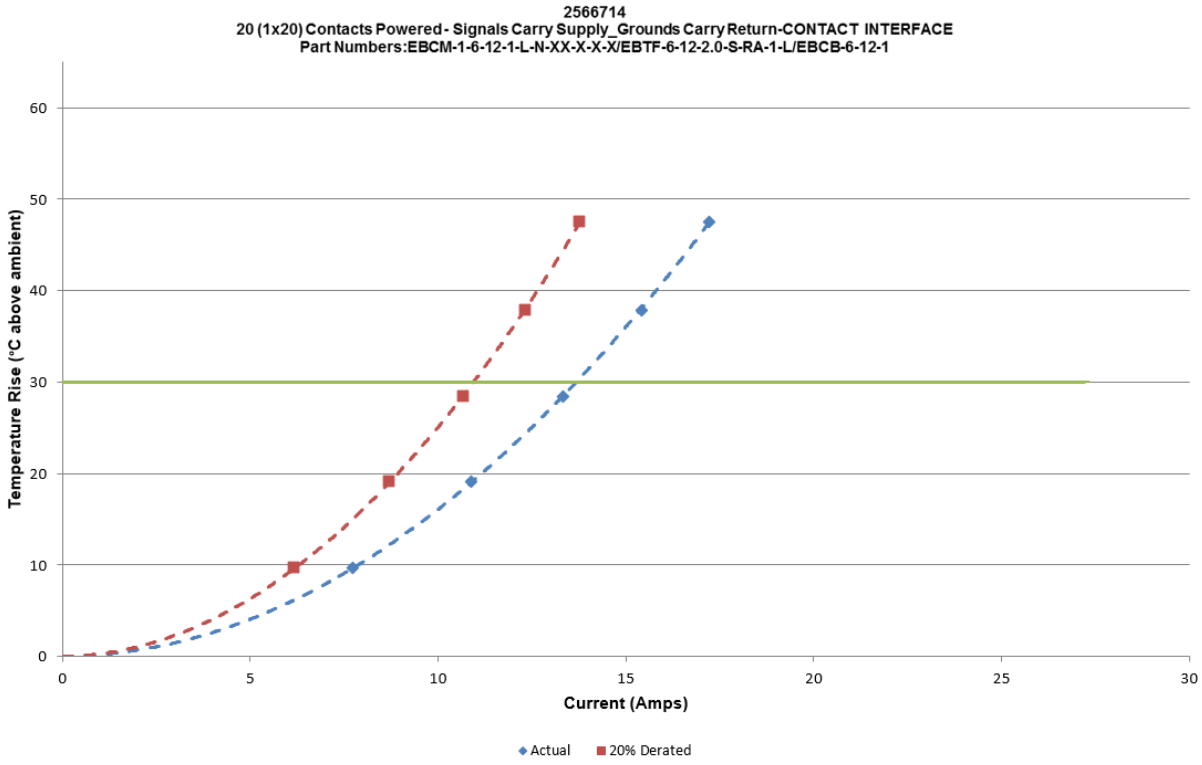
DATA SUMMARIES



DATA SUMMARIES

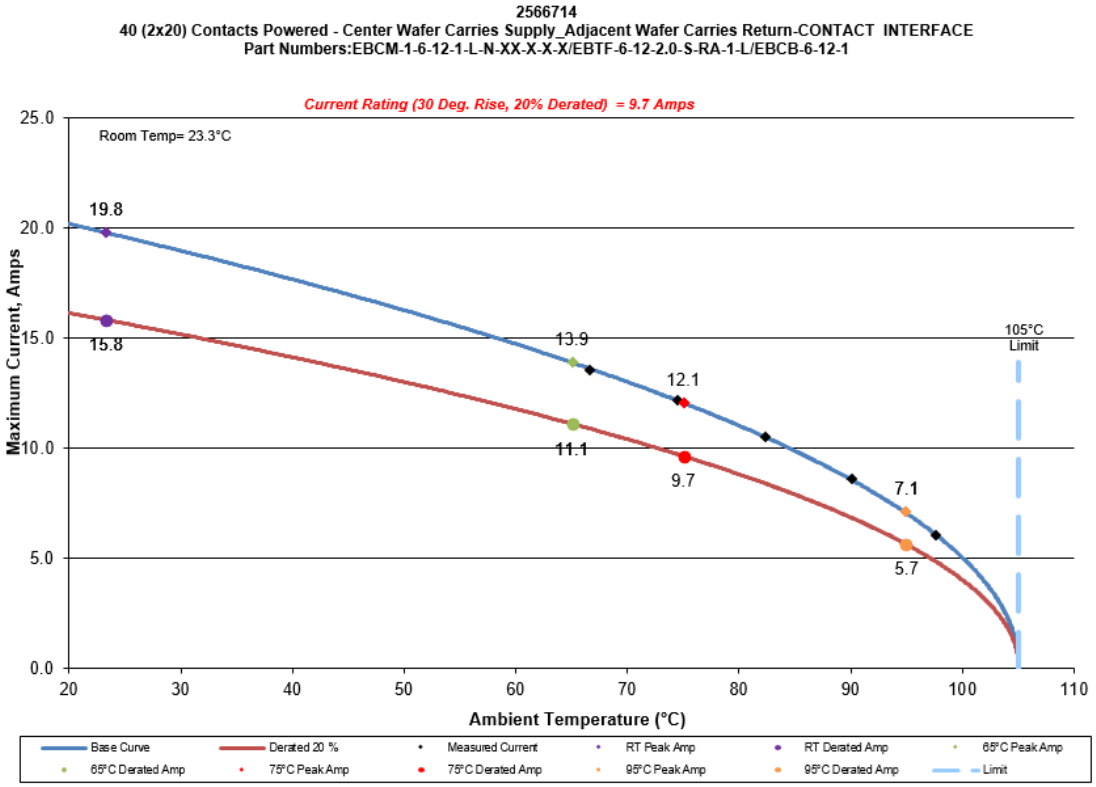
b. Linear configuration with 20 adjacent power conductors/contacts powered

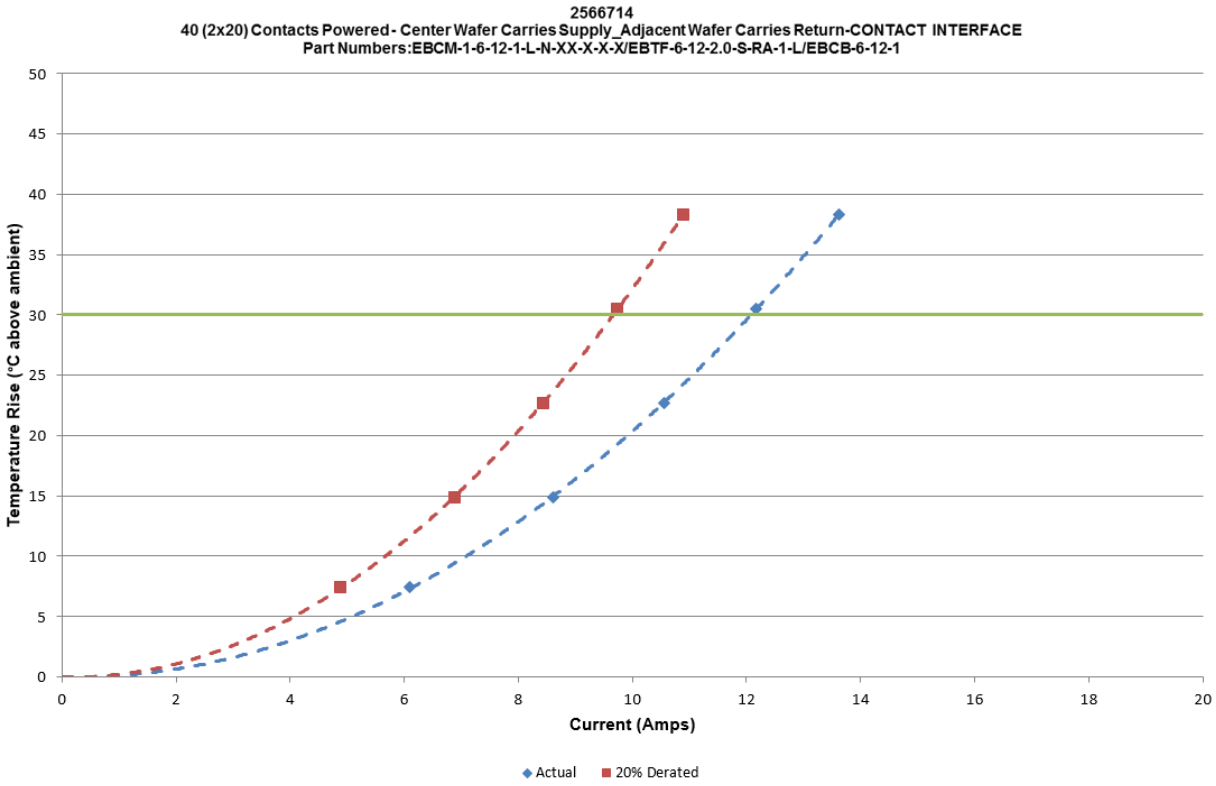




DATA SUMMARIES

c. Linear configuration with 40 adjacent power conductors/contacts powered





DATA SUMMARIES

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	48.18	10.83	31.08	6.99	31.03	6.98	22.61	5.08
Maximum	50.40	11.33	33.14	7.45	33.01	7.42	24.50	5.51
Average	49.37	**11.10**	32.24	**7.25**	32.28	**7.26**	23.45	**5.27**
St Dev	1.12	0.25	1.06	0.24	1.08	0.24	0.96	0.22
Count	3	3	3	3	3	3	3	3

Mating/Unmating Durability Group

	Initial				25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)
Minimum	45.47	10.22	30.85	6.94	47.81	10.75	33.27	7.48
Maximum	48.37	10.87	32.71	7.35	50.19	11.28	35.72	8.03
Average	46.90	**10.55**	31.98	**7.19**	48.80	**10.97**	34.86	**7.84**
St Dev	1.45	0.33	0.99	0.22	1.24	0.28	1.38	0.31
Count	3	3	3	3	3	3	3	3
	50 Cycles				75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)	New tons	Force (Lbs)
Minimum	49.47	11.12	33.02	7.42	50.03	11.25	35.50	7.98
Maximum	51.69	11.62	37.39	8.41	52.90	11.89	38.03	8.55
Average	50.22	**11.29**	35.67	**8.02**	51.60	**11.60**	36.92	**8.30**
St Dev	1.27	0.29	2.33	0.52	1.45	0.33	1.30	0.29
Count	3	3	3	3	3	3	3	3
	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	51.15	11.50	36.29	8.16	38.56	8.67	24.95	5.61
Maximum	54.34	12.22	38.64	8.69	40.61	9.13	28.16	6.33
Average	52.89	**11.89**	37.80	**8.50**	39.71	**8.93**	26.57	**5.97**
St Dev	1.61	0.36	1.31	0.29	1.04	0.23	1.60	0.36
Count	3	3	3	3	3	3	3	3

DATA SUMMARIES Continued

Cable Pull:

90° Pull - Lateral

	Force (lbs)
Minimum	11.65
Maximum	16.11
Average	13.83

90° Pull - Vertical

	Force (lbs)
Minimum	13.70
Maximum	17.74
Average	16.65

Cable Flex:

Insulation Resistance minimums, IR

Pin to Pin	
Mated	
Minimum	
Initial	45000
After 500 Flex Cycles	45000

Pin to Ground	
Mated	
Minimum	
Initial	45000
After 500 Flex Cycles	45000

Row to Row	
Mated	
Minimum	
Initial	45000
After 500 Flex Cycles	45000

DATA SUMMARIES Continued

Dielectric Withstanding Voltage minimums, DWV

Voltage Rating Summary	
Minimum	
Break Down Voltage	502
Test Voltage	380
Working Voltage	125

Pin to Pin	
Initial Test Voltage	Passed
After 500 Flex Cycles Test Voltage	Passed

Row to Row	
Initial Test Voltage	Passed
After 500 Flex Cycles Test Voltage	Passed

Pin to Ground	
Initial Test Voltage	Passed
After 500 Flex Cycles Test Voltage	Passed

DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**EBCM/EBTF**	**EBCM**	**EBTF**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**EBCM/EBTF**	**EBCM**	**EBTF**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

	Row to Row		
	Mated	Unmated	Unmated
Minimum	**EBCM/EBTF**	**EBCM**	**EBTF**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

DATA SUMMARIES Continued

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**EBCM/EBTF**
Break Down Voltage	502
Test Voltage	380
Working Voltage	125

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 Durabiltiy:

1) A total of 471 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	11/3/2020	11/16/2020	11/23/2020	12/14/2020		
		Room Temp (Deg C)	22	22	23	23		
		Rel Humidity (%)	37	36	39	39		
		Technician	Aaron McKim	Aaron McKim	Aaron McKim	Aaron McKim		
		mOhm values	**Actual Initial**	**Delta After 100 Cycles**	**Delta Thermal Shock**	**Delta Humidity**	**Delta**	**Delta**
Bussed Cable			**Pin Type 1: Twinax**					
		Average	355.40	1.00	1.22	0.85		
		St. Dev.	9.85	0.84	1.03	0.82		
		Min	332.58	0.00	0.02	0.00		
		Max	386.18	4.88	6.34	5.69		
		Summary Count	432	432	432	432		
		Total Count	432	432	432	432		
			Pin Type 2: Coax					
		Average	305.47	0.80	1.57	1.65		
		St. Dev.	10.61	0.77	1.42	1.67		
		Min	287.04	0.04	0.06	0.16		
		Max	322.57	4.11	6.12	7.64		
		Summary Count	36	36	36	36		
		Total Count	36	36	36	36		
			Pin Type 3: Ground					
		Average	8.07	0.72	2.54	2.56		
		St. Dev.	0.36	0.71	0.38	0.38		
		Min	7.76	0.09	2.13	2.18		
		Max	8.47	1.49	2.88	2.93		
		Summary Count	3	3	3	3		
		Total Count	3	3	3	3		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After 100 Cycles	**471**	**0**	**0**	**0**	**0**	**0**
After Thermal Shock	**463**	**8**	**0**	**0**	**0**	**0**
After Humidity	**465**	**6**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Thermal aging

1) A total of 471 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	11/5/2020	12/2/2020				
		Room Temp (Deg C)	22	23				
		Rel Humidity (%)	38	35				
		Technician	Aaron McKim	Aaron McKim				
		mOhm values	**Actual**	**Delta**	**Delta**	**Delta**	**Delta**	**Delta**
			Initial	**Thermal Age**				
Bussed Cable			**Pin Type 1: Twinax**					
		Average	355.12	1.44				
		St. Dev.	9.81	1.37				
		Min	334.85	0.00				
		Max	388.42	7.56				
		Summary Count	432	432				
		Total Count	432	432				
			Pin Type 2: Coax					
		Average	304.53	1.28				
		St. Dev.	10.27	1.15				
		Min	283.52	0.04				
		Max	320.68	4.85				
		Summary Count	36	36				
		Total Count	36	36				
			Pin Type 3: Ground					
		Average	15.87	2.35				
		St. Dev.	5.95	1.91				
		Min	9.27	0.30				
		Max	20.83	4.09				
		Summary Count	3	3				
		Total Count	3	3				

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Thermal Age	**457**	**14**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR GAS TIGHT:

1) A total of 471 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	11/5/2020	12/2/2020				
		Room Temp (Deg C)	22	23				
		Rel Humidity (%)	38	35				
		Technician	Aaron McKim	Aaron McKim				
		mOhm values	**Actual**	**Delta**	**Delta**	**Delta**	**Delta**	**Delta**
			Initial	**Acid Vapor**				
Bussed Cable			**Pin Type 1: Twinax**					
		Average	349.52	1.61				
		St. Dev.	12.12	1.18				
		Min	322.50	0.02				
		Max	380.97	8.13				
		Summary Count	432	432				
		Total Count	432	432				
			Pin Type 2: Coax					
		Average	297.40	1.10				
		St. Dev.	15.55	0.73				
		Min	267.37	0.02				
		Max	320.79	2.66				
		Summary Count	36	36				
		Total Count	36	36				
			Pin Type 3: Ground					
		Average	10.95	1.26				
		St. Dev.	2.69	1.71				
		Min	8.50	0.04				
		Max	13.82	3.22				
		Summary Count	3	3				
		Total Count	3	3				

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Acid Vapor	**457**	**14**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HPM-01
Description: Hipot Megommeter
Manufacturer: Hipotronics
Model: H306B-A
Serial #: M9905004
Accuracy: 2 % Full Scale Accuracy
… Last Cal: 05/24/2020, Next Cal: 08/24/2021

Equipment #: TCT-06
Description: Test Resources test stand
Manufacturer: Test Resources
Model: 100R250-12
Serial #: 0710016-01
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Displacement: +/- 5 micrometers.
… Last Cal: 05/03/2020, Next Cal: 05/03/2021

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 04/30/2020, Next Cal: 04/30/2021

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: 02/18/2020, Next Cal: 02/18/2021

Equipment #: THC-01
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-7800
Serial #: 30676
Accuracy: See Manual
… Last Cal: 10/24/2020, Next Cal: 10/24/2021

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: 06/30/2020, Next Cal: 06/30/2021

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: MO-02
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0780546
Accuracy: Last Cal: 6/16/2020, Next Cal: 6/16/2021

Equipment #: PS-01
Description: Power Supply
Manufacturer: Hewlett Packard
Model: 6033A
Serial #: 3329A-07330
Accuracy: Last Cal: 6/12/2020, Next Cal: 6/12/2021

Equipment #: PS-02
Description: Power Supply
Manufacturer: Hewlett Packard
Model: 6033A
Serial #: 2847A-04167
Accuracy: Last Cal: 6/12/2020, Next Cal: 6/12/2021