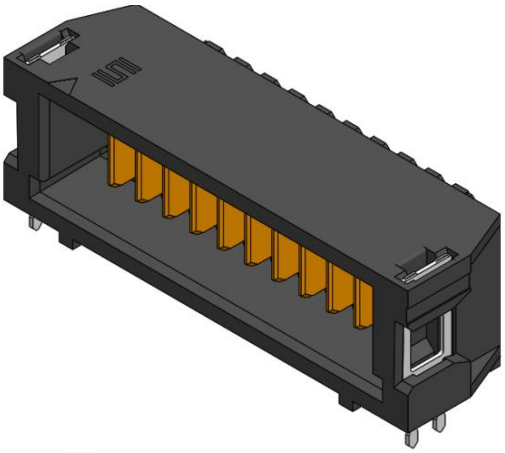
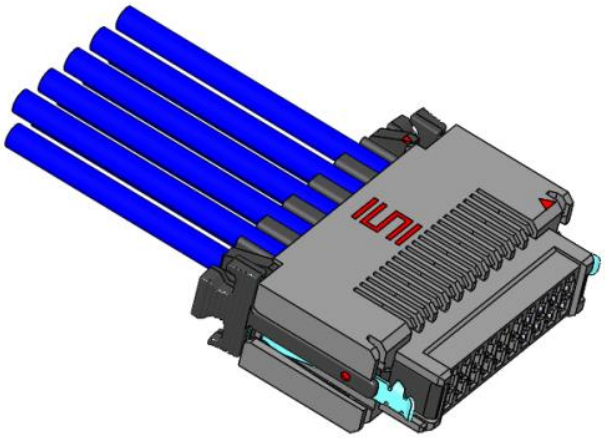
Project Number: Design Qualification Test Report	Tracking Code: 3296748_Report_Rev_2
Requested by: Andy Chen	Date: 2/3/2023
Part #: UMPCT-10-T-16-P-12.0-1/UMPT-10-02.5-T-V-S-W-P-TR	
Part description: UMPCT/UMPT	Tech: Kason He
Test Start: 4/21/2022	Test Completed: 5/23/2022





DESIGN QUALIFICATION TEST REPORT

UMPCT/UMPT
UMPCT-10-T-16-P-12.0-1/UMPT-10-02.5-T-V-S-W-P-TR
UMPCT-10-L-16-M-16.0-1/UMPT-10-01-L-RA-WT-M-TR

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
11/1/2022	**1**	**Initial Issue**	**KH**
2/3/2023	**2**	**Add Cable flex test 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.

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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) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
4) The automated procedure is used with aqueous compatible soldering materials.
5) Any additional preparation will be noted in the individual test sequences.
6) Solder Information: Lead free.
7) Samtec Test PCBs used: PCB-112057/PCB-112051-TST.

FLOWCHARTS

Current Carrying Capacity

Group 1
UMPCT-10-T-16-P-12.0-1
UMPT-10-02.5-T-V-S-W-P-TR
1 Pins Powered
FEP 16 AWG 600V

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

Group 2
UMPCT-10-T-16-P-12.0-1
UMPT-10-02.5-T-V-S-W-P-TR
2 Pins Powered
FEP 16 AWG 600V

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

Group 3
UMPCT-10-T-16-P-12.0-1
UMPT-10-02.5-T-V-S-W-P-TR
3 Pins Powered
FEP 16 AWG 600V

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

Group 4
UMPCT-10-T-16-P-12.0-1
UMPT-10-02.5-T-V-S-W-P-TR
4 Pins Powered
FEP 16 AWG 600V

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

Group 5
UMPCT-10-T-16-P-12.0-1
UMPT-10-02.5-T-V-S-W-P-TR
10 Pins Powered
FEP 16 AWG 600V

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 10

Group 11
UMPCT-10-L-16-M-16.0-1
UMPT-10-01-L-RA-WT-M-TR
1 Pins Powered
FEP 16 AWG 600V

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

Group 12
UMPCT-10-L-16-M-16.0-1
UMPT-10-01-L-RA-WT-M-TR
2 Pins Powered
FEP 16 AWG 600V

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

Group 13
UMPCT-10-L-16-M-16.0-1
UMPT-10-01-L-RA-WT-M-TR
3 Pins Powered
FEP 16 AWG 600V

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

Group 14
UMPCT-10-L-16-M-16.0-1
UMPT-10-01-L-RA-WT-M-TR
4 Pins Powered
FEP 16 AWG 600V

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

Group 15
UMPCT-10-L-16-M-16.0-1
UMPT-10-01-L-RA-WT-M-TR
10 Pins Powered
FEP 16 AWG 600V

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 10

(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

Cable Pull

Group 1	Group 2
UMPCT-10-T-16-P-12.0-1	UMPCT-10-T-16-P-12.0-1
UMPT-10-02.5-T-V-S-W-P-TR	UMPT-10-02.5-T-V-S-W-P-TR
5 Assemblies	5 Assemblies
0 Degrees - FEP 16 AWG 600V	90 Degrees - FEP 16 AWG 600V

Step	Description	Step	Description
1.	Cable Pull (1)	1.	Cable Pull (1)

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

Cable Flex

Group 1	Group 2	Group 3	Group 4
UMPCT-10-L-16-M-16.0-1	UMPCT-10-L-16-M-16.0-1	UMPT-10-01-L-RA-WT-M-TR	UMPCT-10-L-16-M-16.0-1
UMPT-10-01-L-RA-WT-M-TR			UMPT-10-01-L-RA-WT-M-TR
2 Assemblies	2 Assemblies	2 Assemblies	8 Assemblies
Flat Cable	Flat Cable	Flat Cable	Flat Cable
Note: Mated Set Breakdown	*Note: Cable Breakdown*	*Note: Connector Breakdown*	*Note: Cable flex Test*

Step	Description	Step	Description	Step	Description	Step	Description
1.	DWV Breakdown (3)	1.	DWV Breakdown (3)	1.	DWV Breakdown (3)	1.	IR (4)
						2.	DWV at Test Voltage (2)
						3.	Cable Flex (1)
						4.	Visual Inspection
						5.	IR (4)
						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) 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

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

ATTRIBUTE DEFINITIONS

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. 65^{o} C
    c. 75^{o} C
    d. 95^{o} C
8) Typically, neighboring contacts (in close proximity to maximize heat buildup) 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.

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).

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 0°, in-line with cable
    b. At 90°, in-line with cable

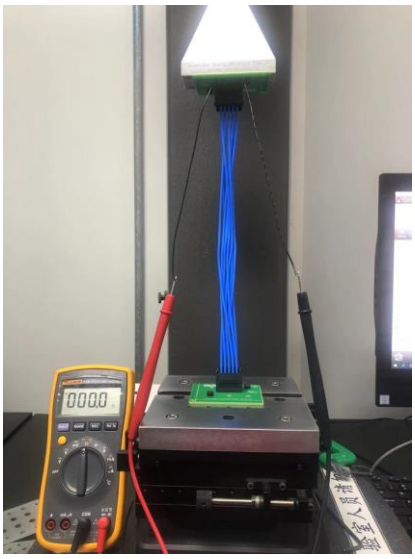


Fig. 1
0° Connector pull

CABLE DURABILITY:

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

Fig. 2
(Setup picture)

RESULTS

Temperature Rise, CCC at a 20% de-rating

UMPCT-10-T-16-P-12.0-1/UMPT-10-02.5-T-V-S-W-P-TR

- **CCC for a 30°C Temperature Rise----------19.1 A per contact with 1 contact (1x1) powered.**
- **CCC for a 30°C Temperature Rise----------15.0 A per contact with 2 contacts (1x2) powered.**
- **CCC for a 30°C Temperature Rise----------12.7 A per contact with 3 contacts (1x3) powered.**
- **CCC for a 30°C Temperature Rise----------12.3 A per contact with 4 contacts (1x4) powered.**
- **CCC for a 30°C Temperature Rise----------9.1 A per contact with 10 contacts (1x10) powered.**

UMPCT-10-L-16-M-16.0-1/UMPT-10-01-L-RA-WT-M-TR

- **CCC for a 30°C Temperature Rise----------17.2 A per contact with 1 contact (1x1) powered.**
- **CCC for a 30°C Temperature Rise----------14.9 A per contact with 2 contacts (1x2) powered.**
- **CCC for a 30°C Temperature Rise----------12.1 A per contact with 3 contacts (1x3) powered.**
- **CCC for a 30°C Temperature Rise----------10.7 A per contact with 4 contacts (1x4) powered.**
- **CCC for a 30°C Temperature Rise----------8.0 A per contact with 10 contacts (1x10) powered.**

Cable Pull force

- **0° Pull**
  - **Min----------21.51 lbs**
  - **Max ----------22.98 lbs**
- **90° Pull**
  - **Min---------- 4.76 lbs**
  - **Max ---------- 5.56 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**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage---------- 1583 VAC**
  - **Test Voltage ---------- 1187 VAC**
  - **Working Voltage ----------396 VAC**

Pin to Pin

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

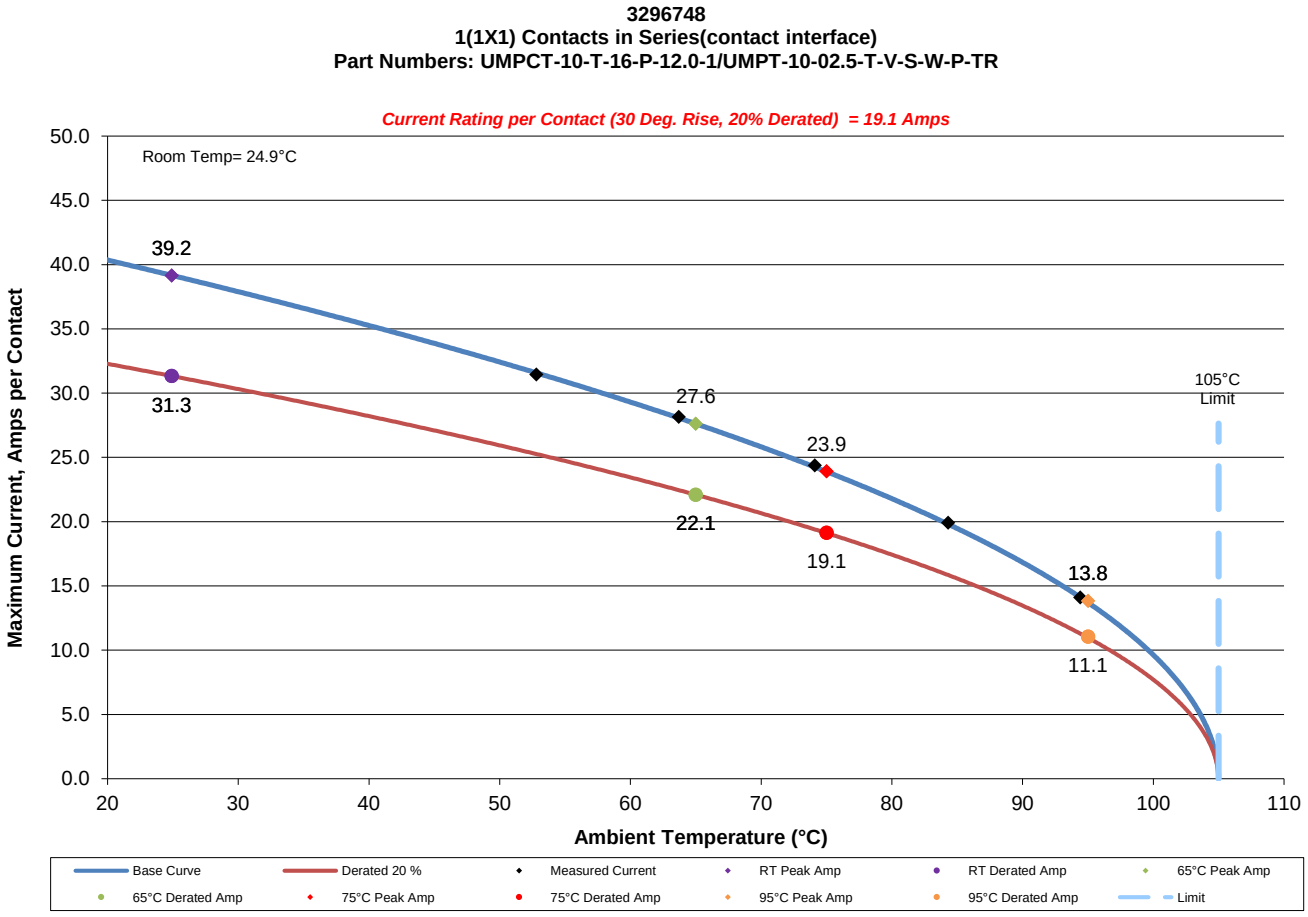
DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):

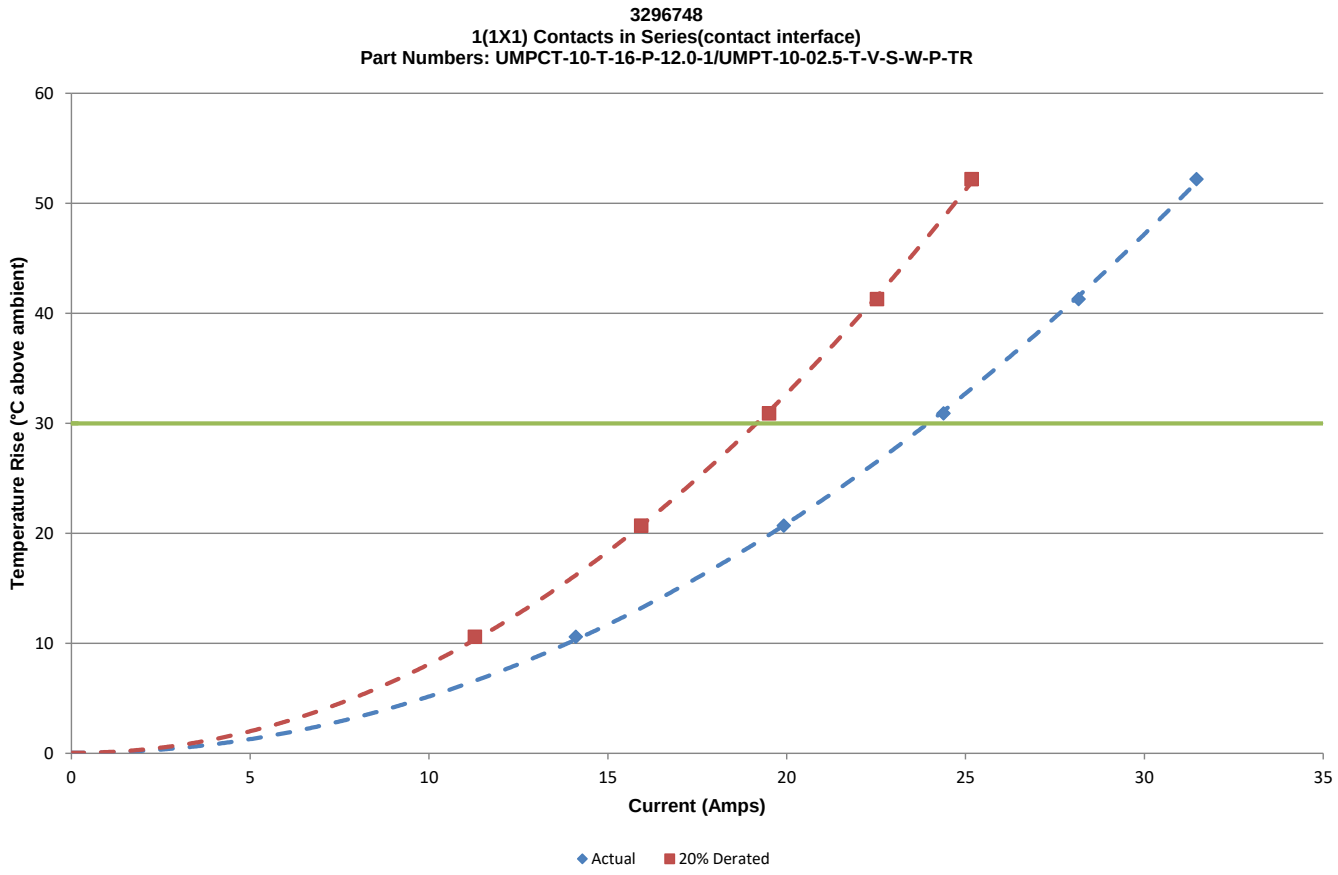
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes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

UMPCT-10-T-16-P-12.0-1/UMPT-10-02.5-T-V-S-W-P-TR

a. Linear configuration with 1 adjacent conductors/contacts powered.

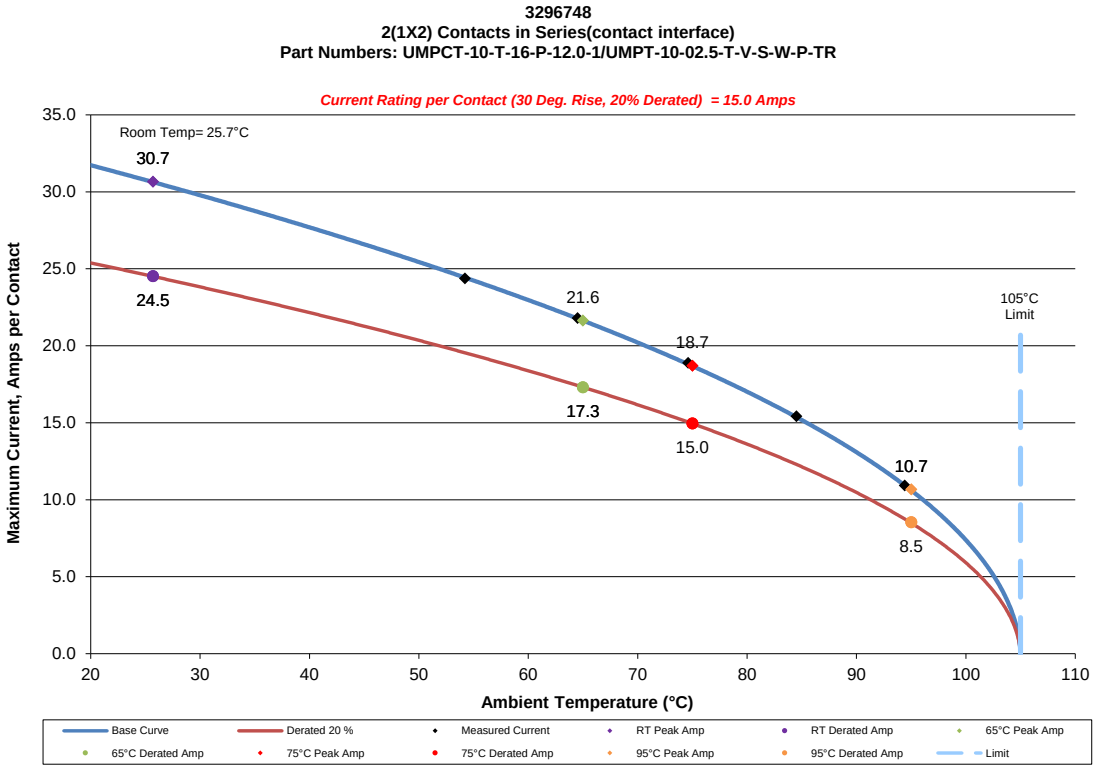


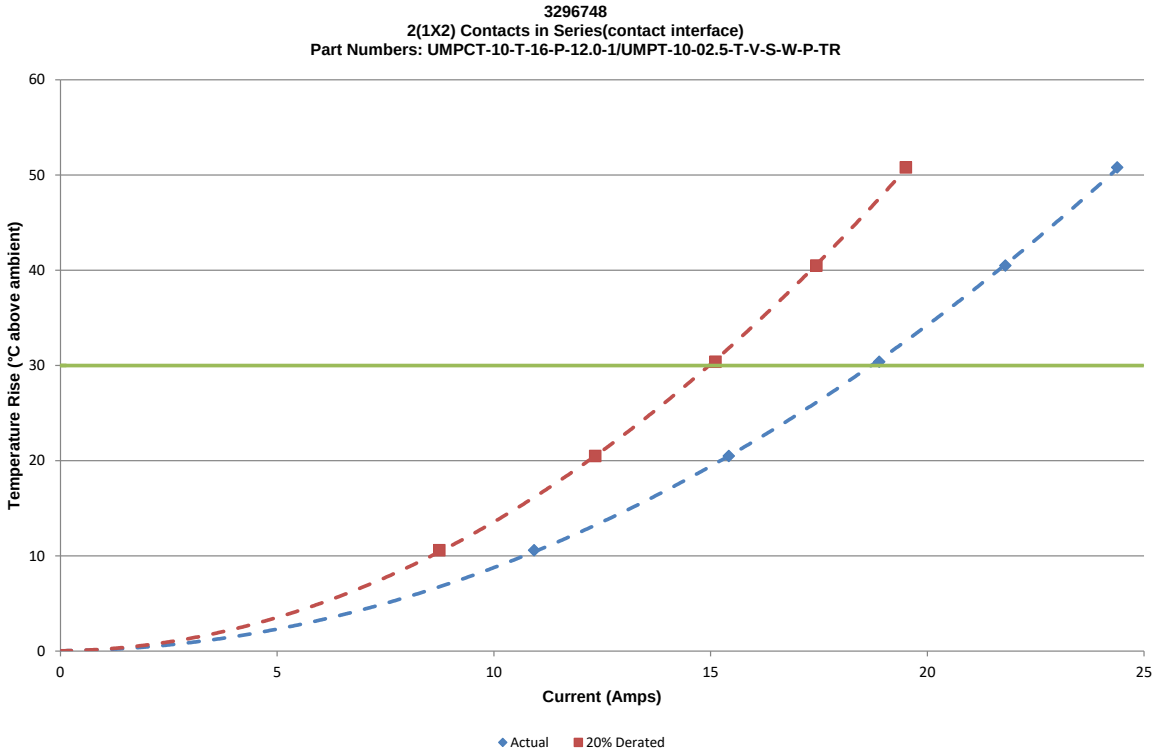
DATA SUMMARIES Continued



DATA SUMMARIES Continued

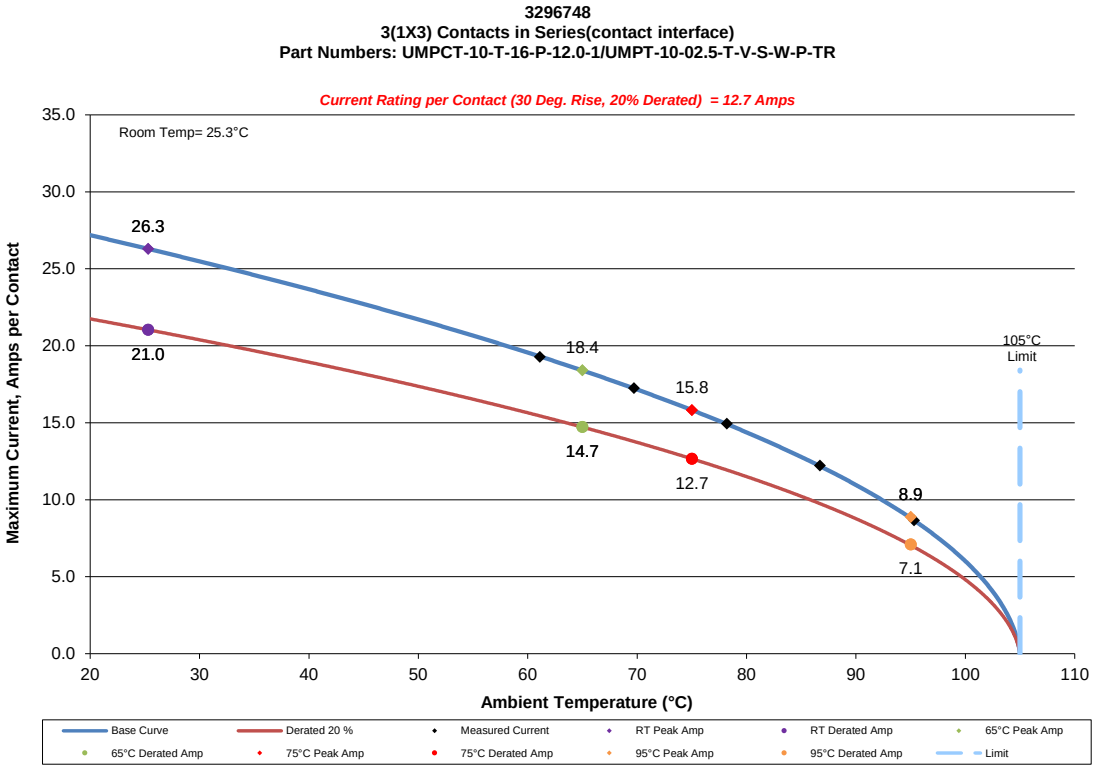
b. Linear configuration with 2 adjacent conductors/contacts powered.

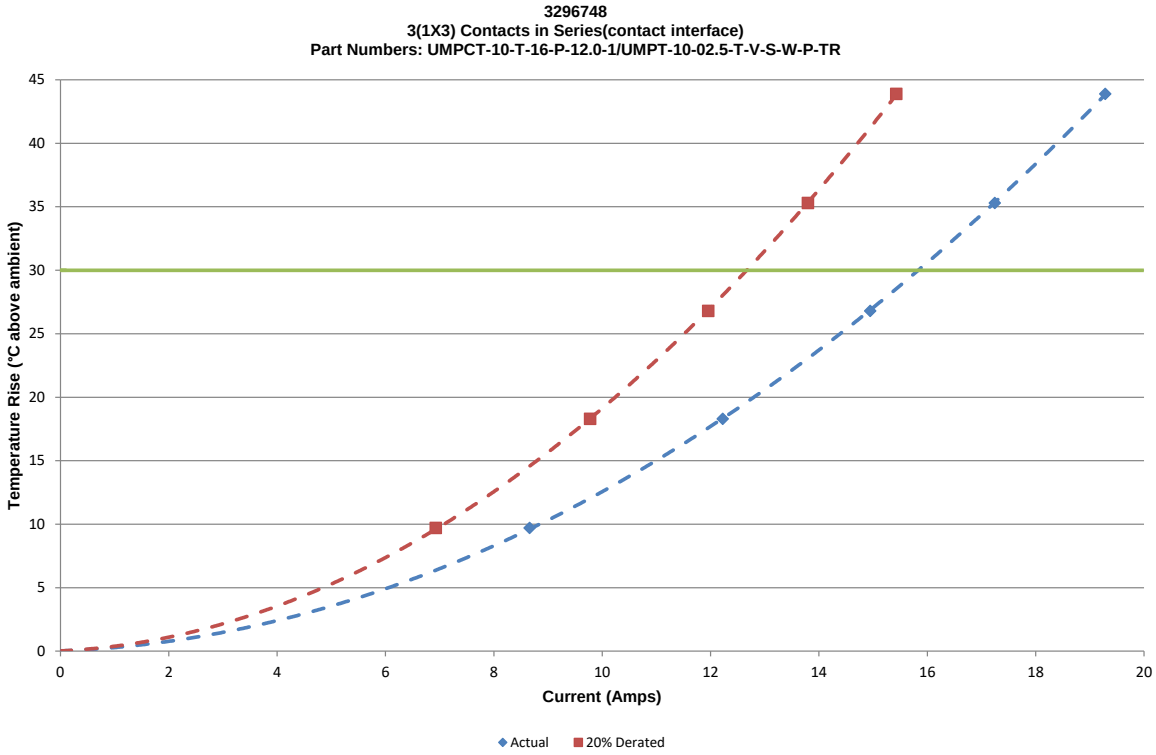




DATA SUMMARIES Continued

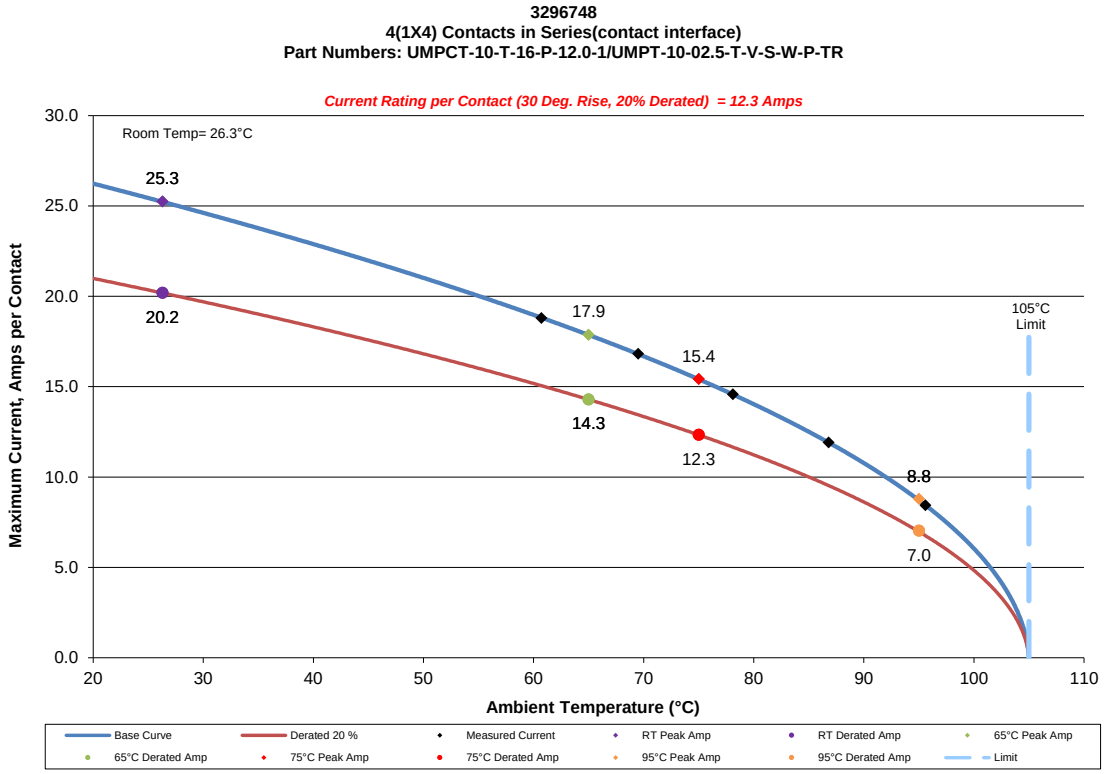
c. Linear configuration with 3 adjacent conductors/contacts powered.

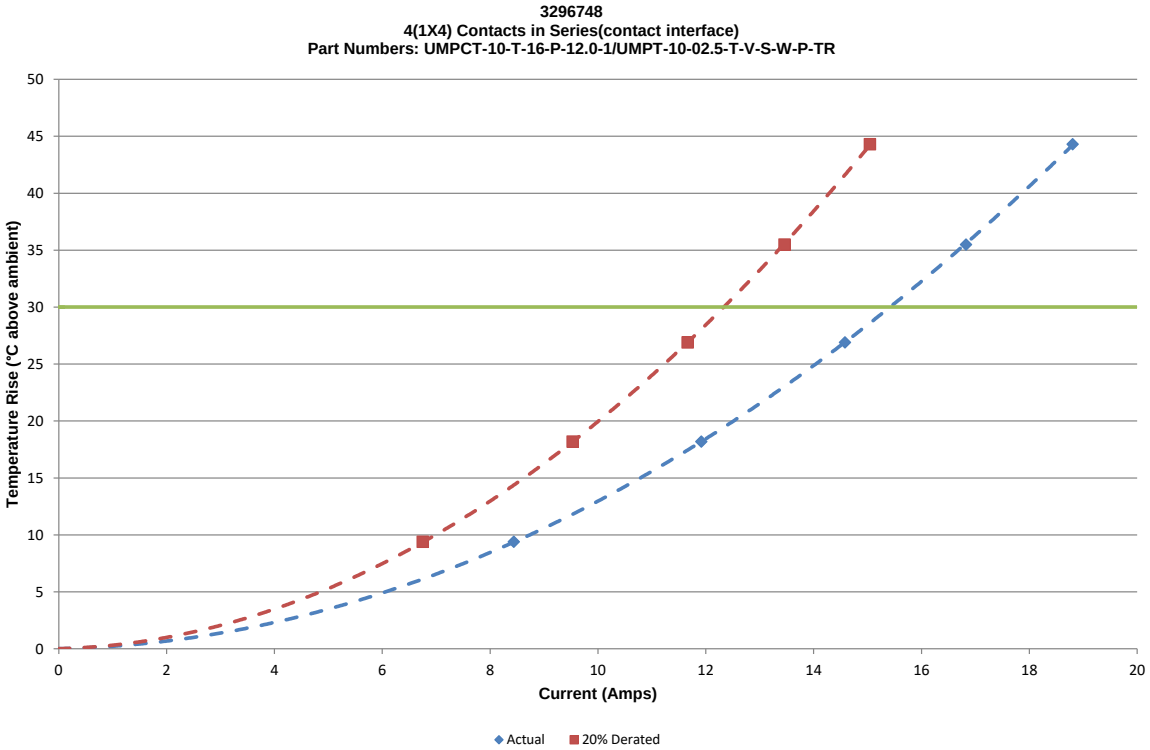




DATA SUMMARIES Continued

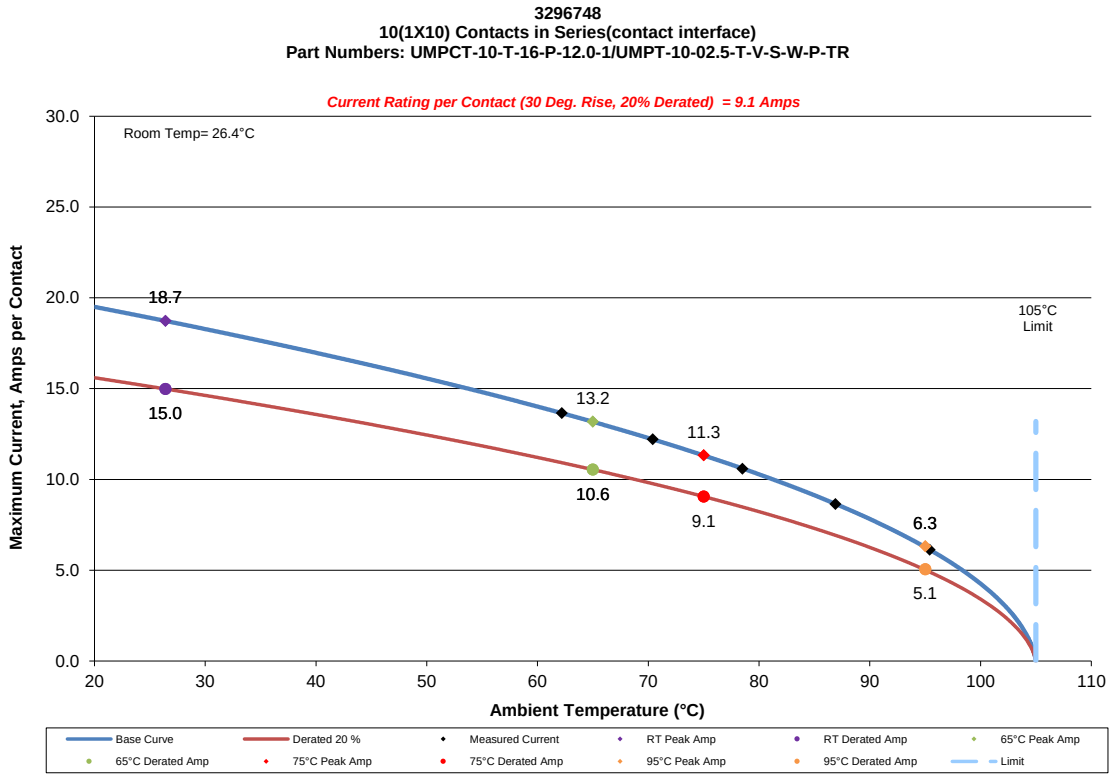
d. Linear configuration with 4 adjacent conductors/contacts powered.

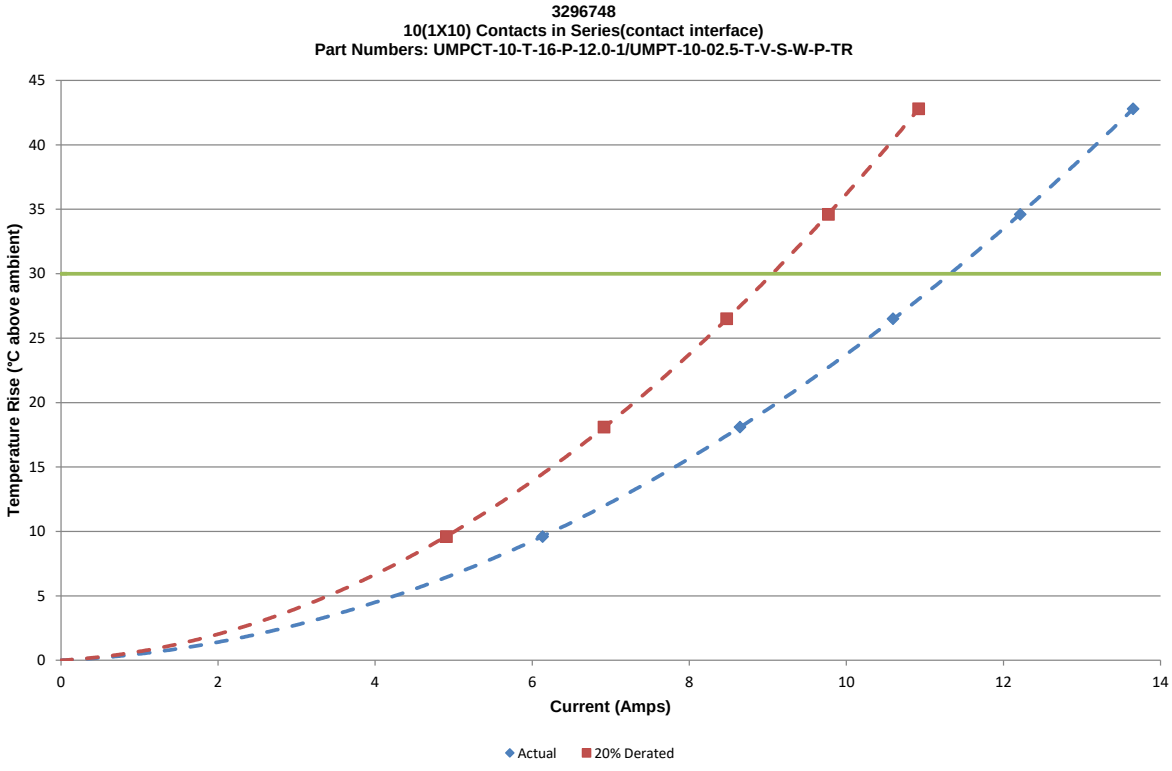




DATA SUMMARIES Continued

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

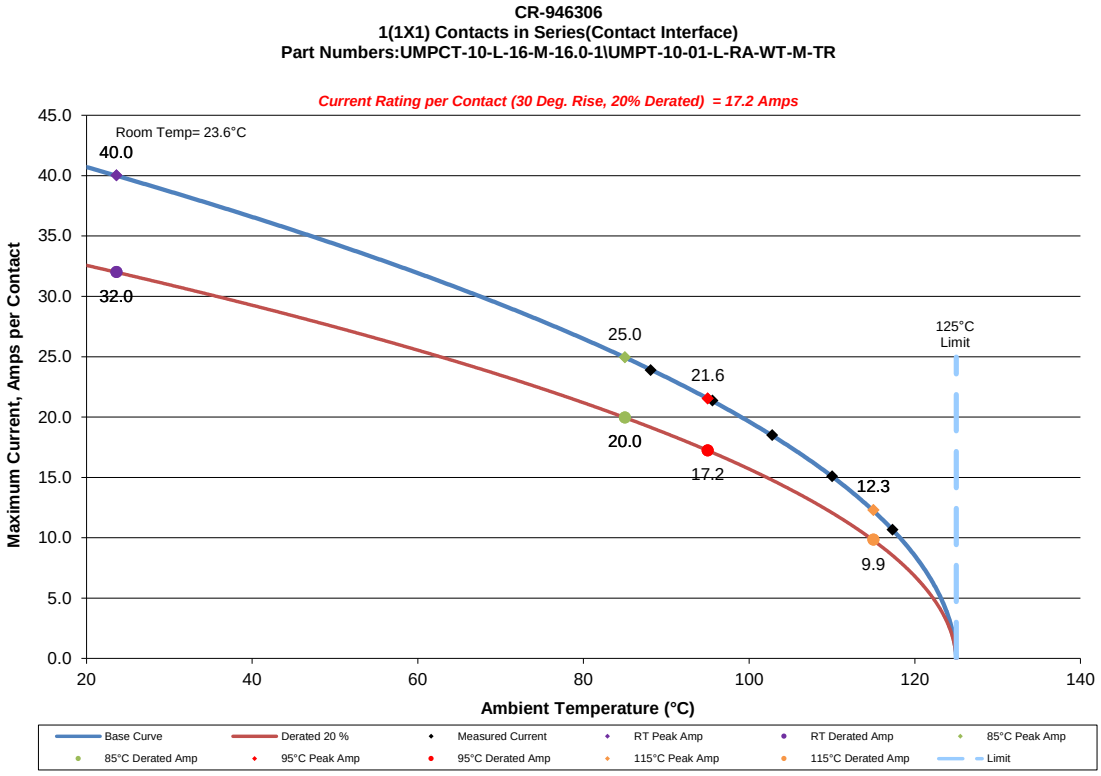


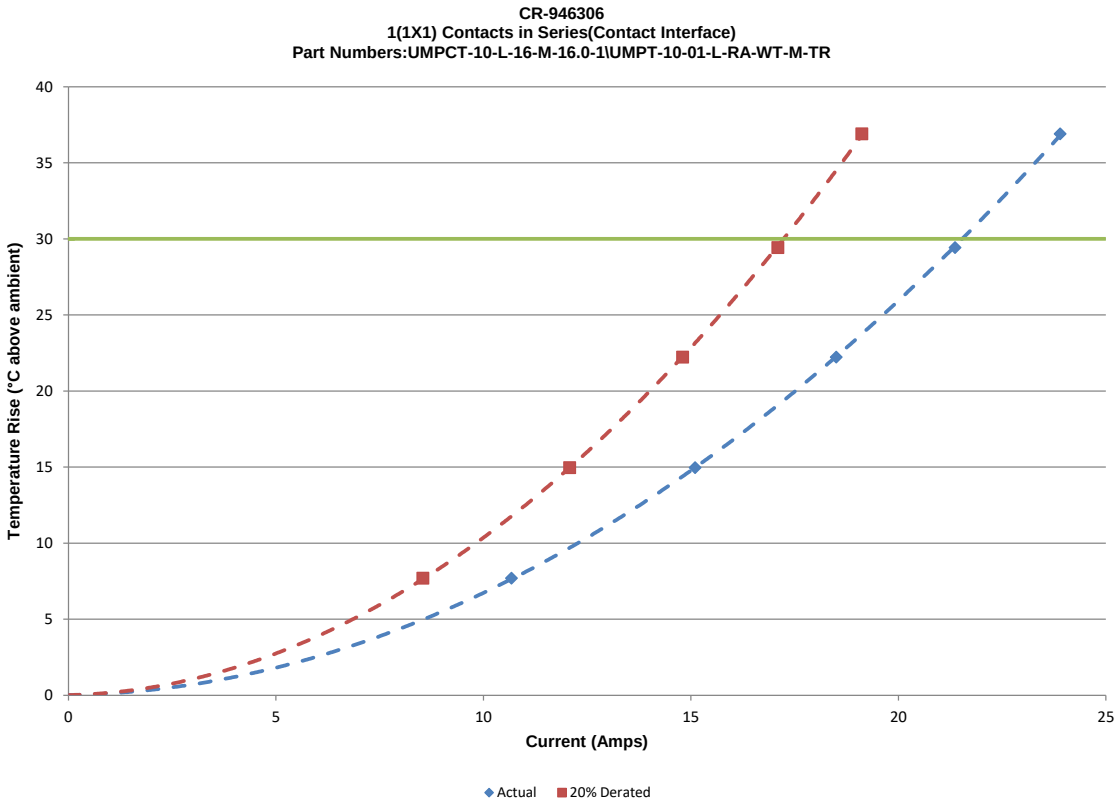


DATA SUMMARIES Continued

UMPCT-10-L-16-M-16.0-1/UMPT-10-01-L-RA-WT-M-TR

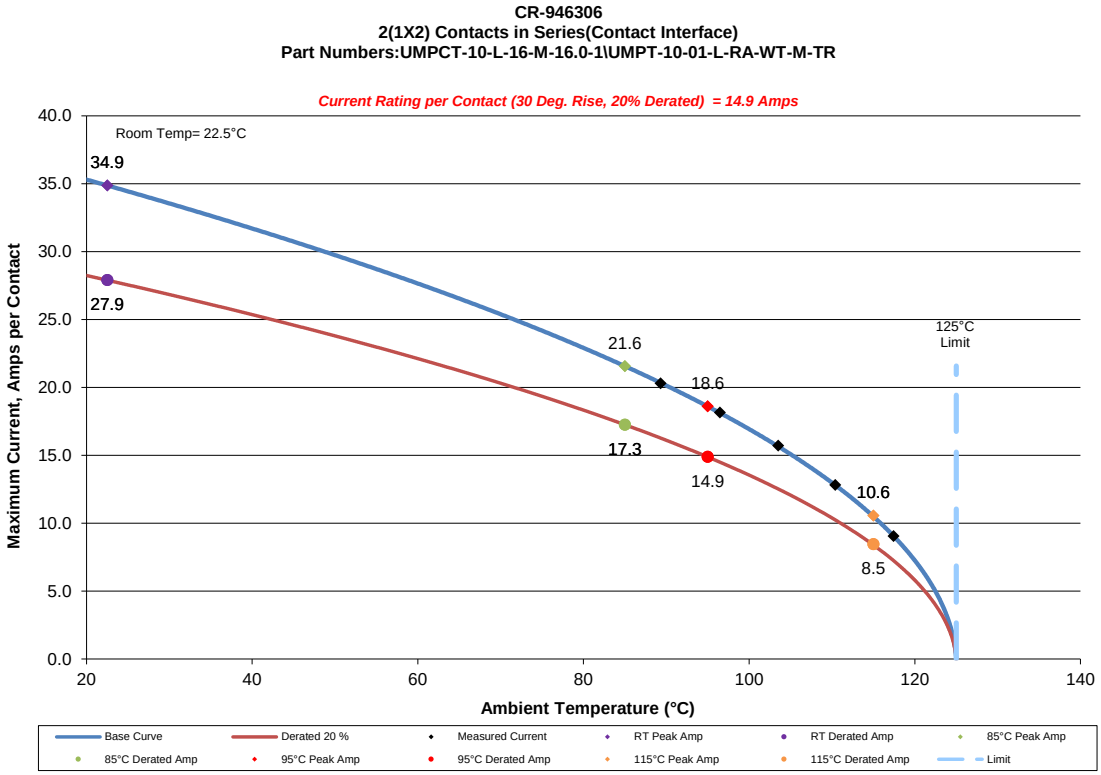
a) Linear configuration with 1 adjacent conductors/contacts powered.

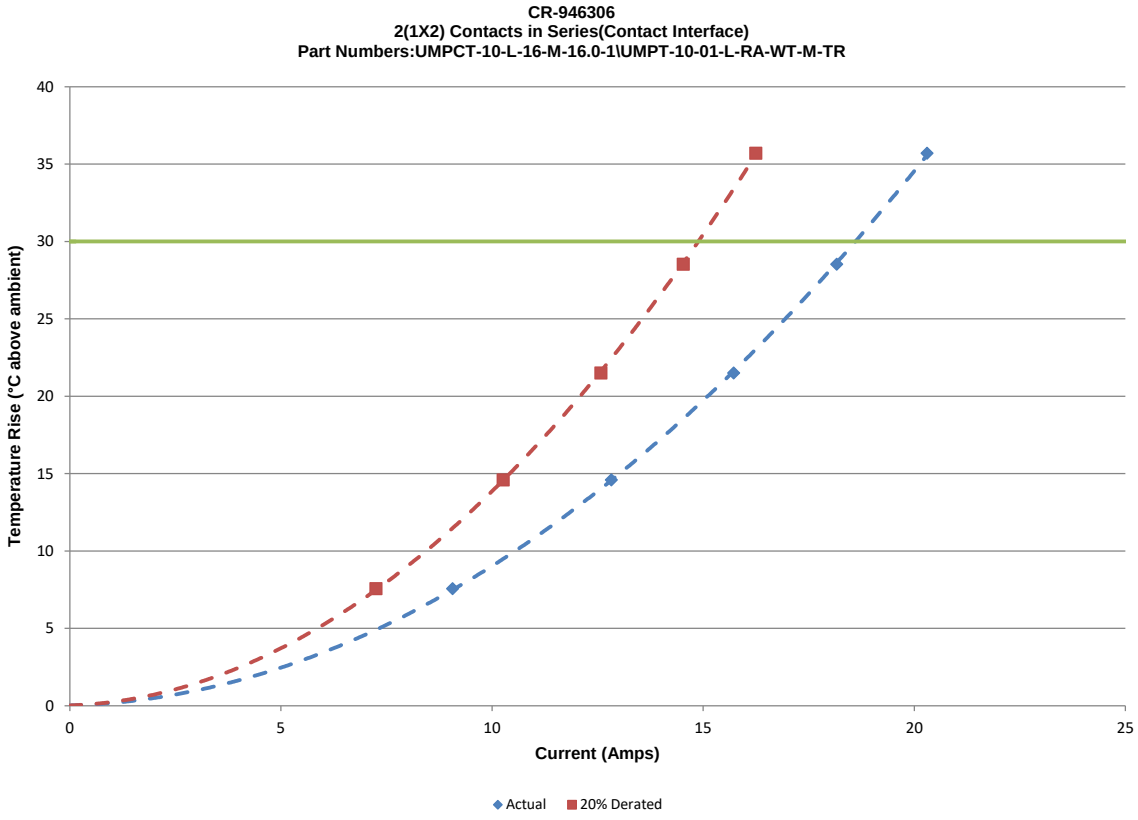




DATA SUMMARIES Continued

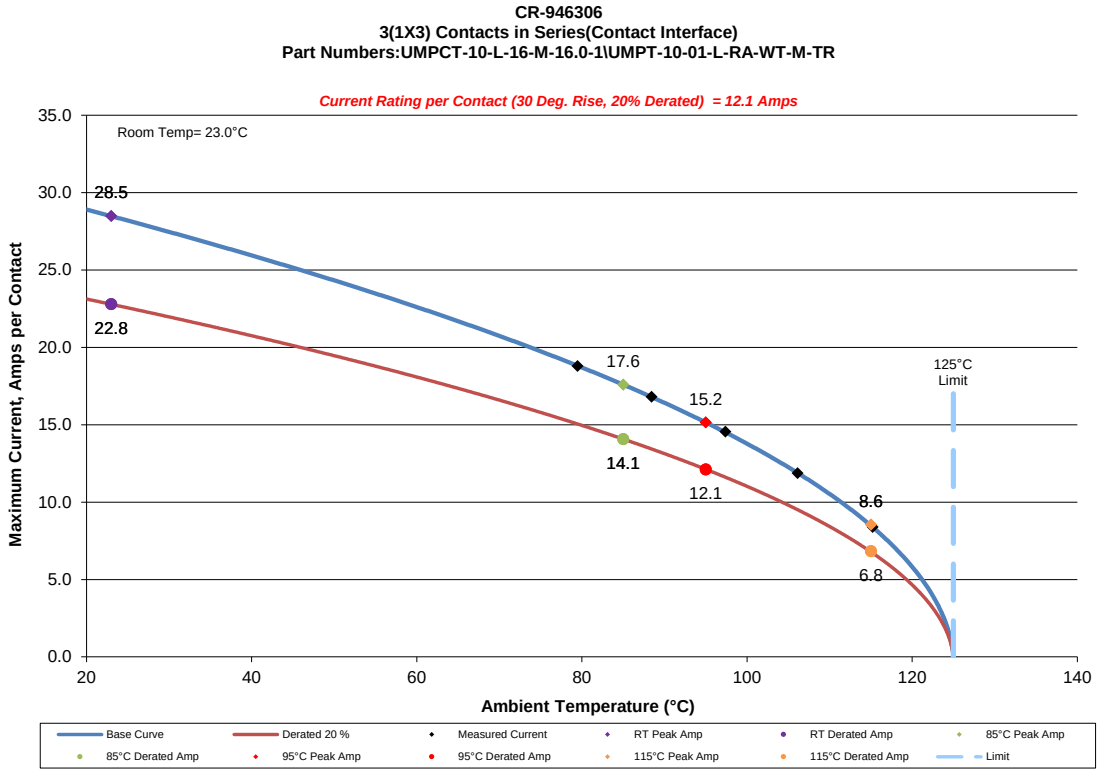
b) Linear configuration with 2 adjacent conductors/contacts powered.

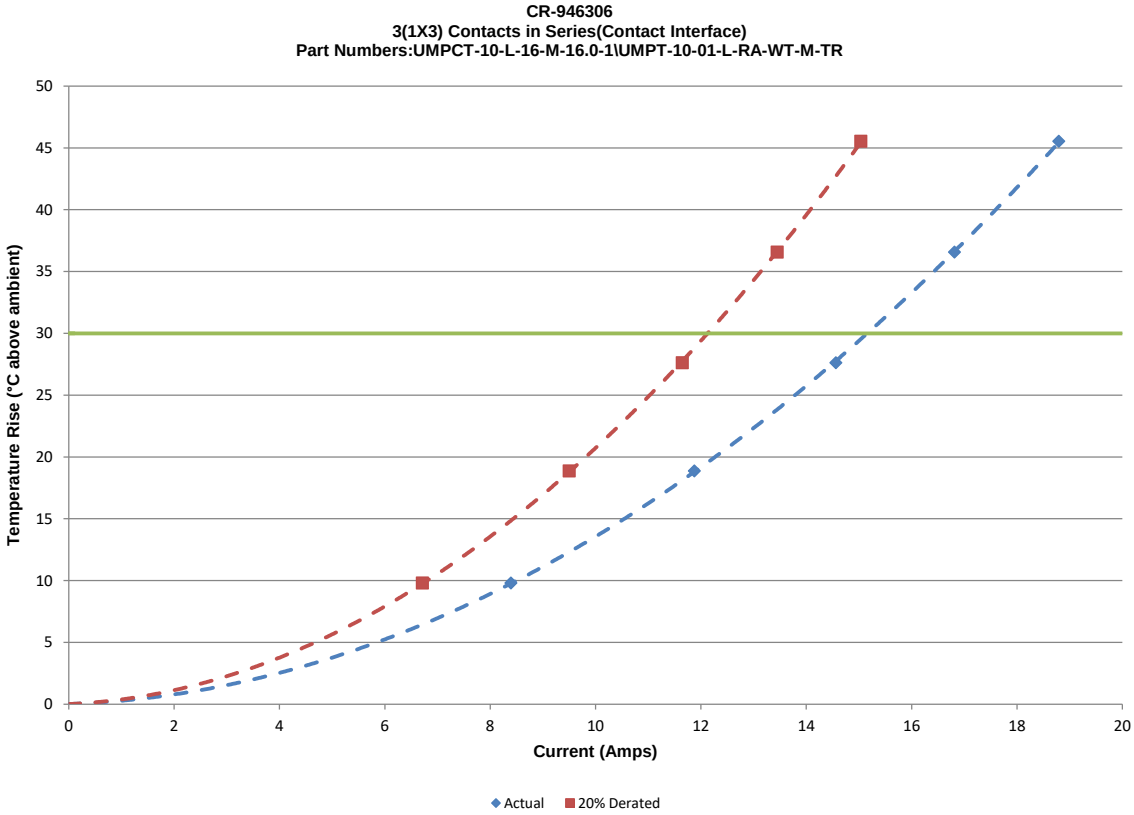




DATA SUMMARIES Continued

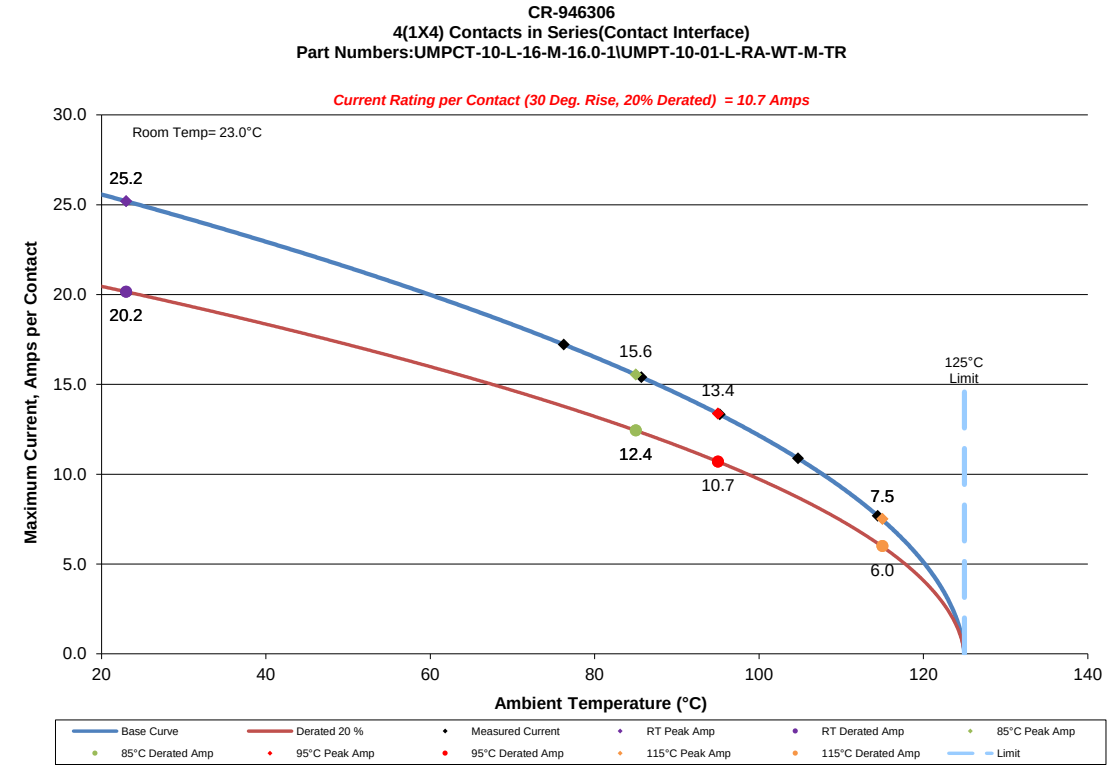
c) Linear configuration with 3 adjacent conductors/contacts powered.

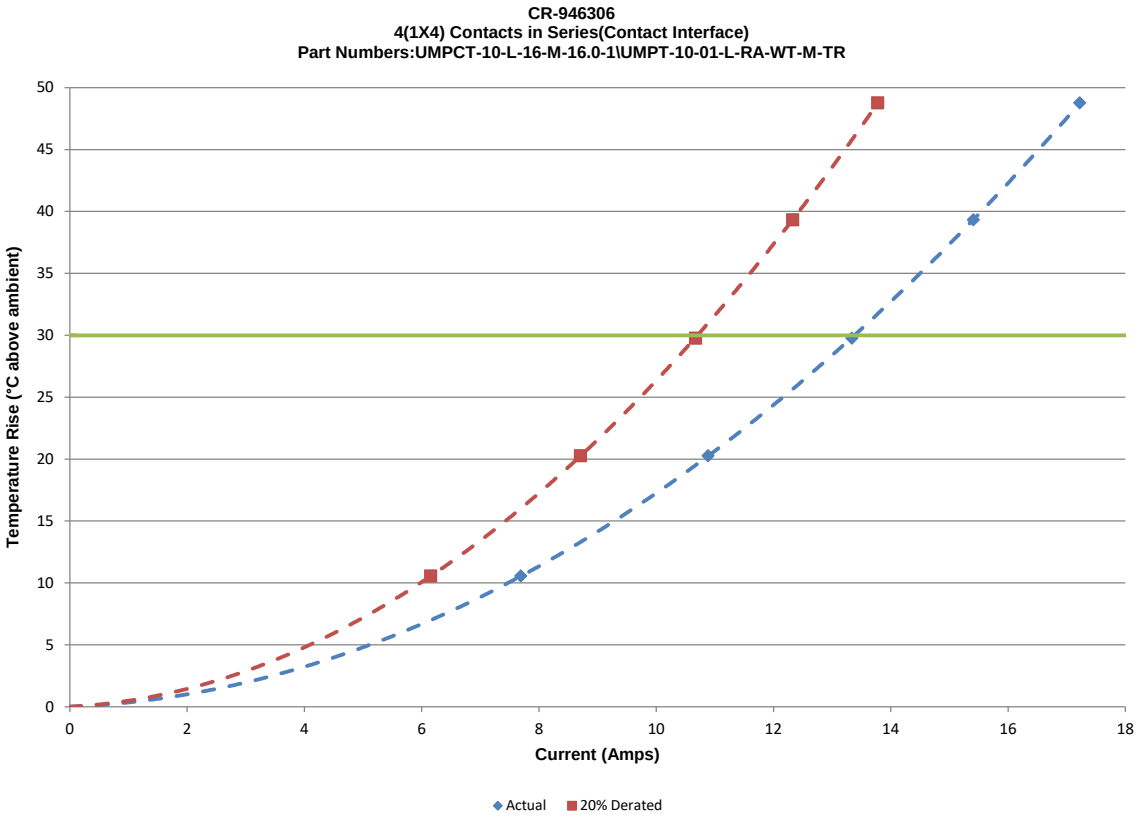




DATA SUMMARIES Continued

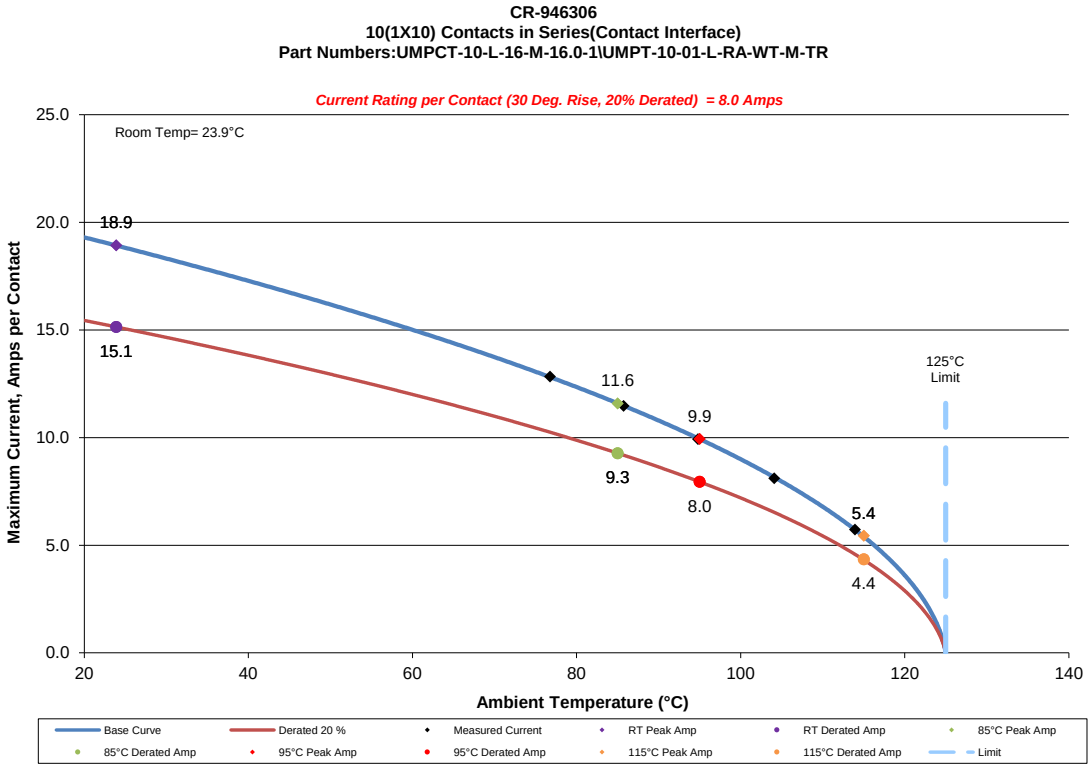
d) Linear configuration with 4 adjacent conductors/contacts powered.

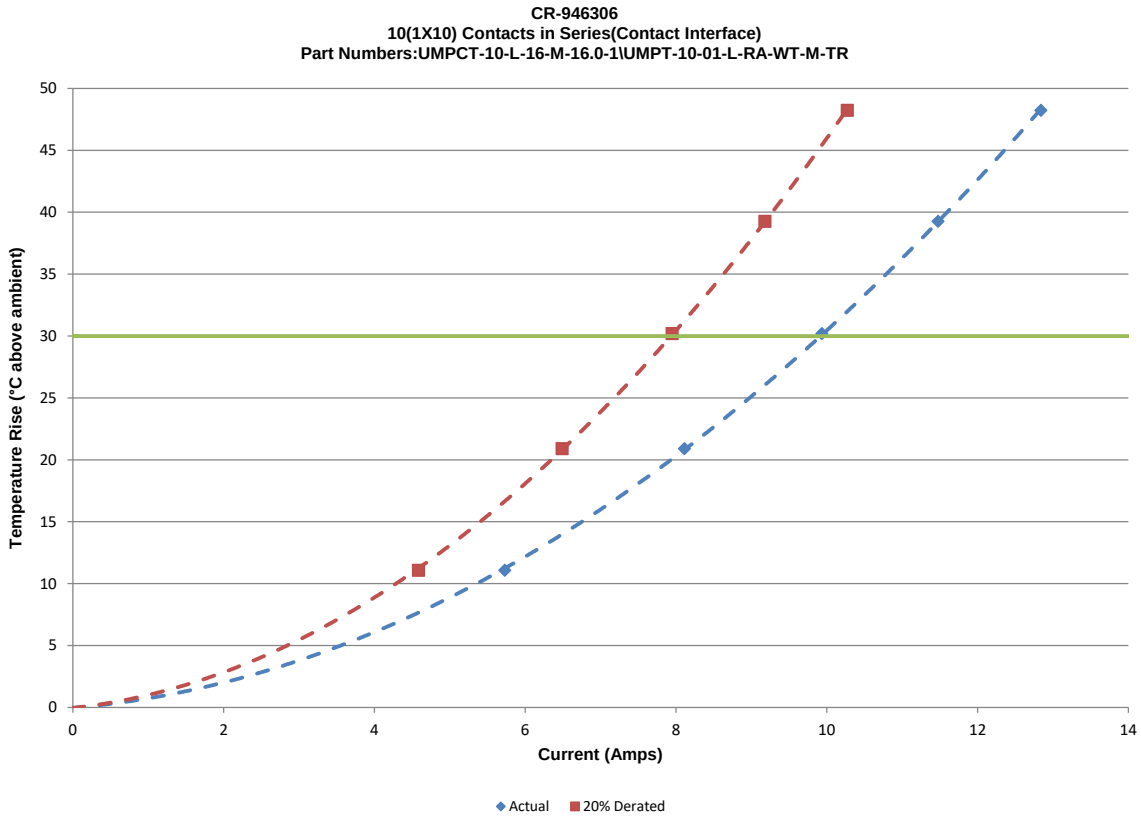




DATA SUMMARIES Continued

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





DATA SUMMARIES Continued

Cable Pull Force:

0° Pull

	Force (lbs)
Minimum	**21.51**
Maximum	22.98
Average	22.23

90° Pull

	Force (lbs)
Minimum	**4.76**
Maximum	5.56
Average	5.08

Cable Flex:

Insulation Resistance minimums, IR

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

Dielectric Withstanding Voltage minimums, DWV

Voltage Rating Summary	
Minimum	**UMPCT\UMPT**
Break Down Voltage	1583
Test Voltage	1187
Working Voltage	396

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

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HZ-TCT-01
Description: Normal force analyzer
Manufacturer: Mecmesin Multitester
Model: Mecmesin Multitester 2.5-i
Serial #: 08-1049-04
Accuracy: Last Cal: 3/5/2022, Next Cal: 3/4/2023

Equipment #: HZ-MO-01
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 2700
Serial #: 1199807
Accuracy: Last Cal: 05/19/2022, Next Cal: 05/18/2023

Equipment #: HZ-PS-01
Description: Power Supply
Manufacturer: Agilent
Model: 6031A
Serial #: MY41000982
Accuracy: Last Cal: 04/16/2022, Next Cal: 04/15/2023

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2022, Next Cal: 05/15/2023