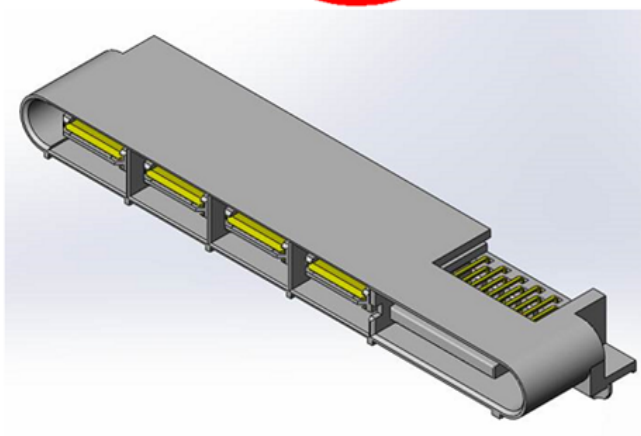
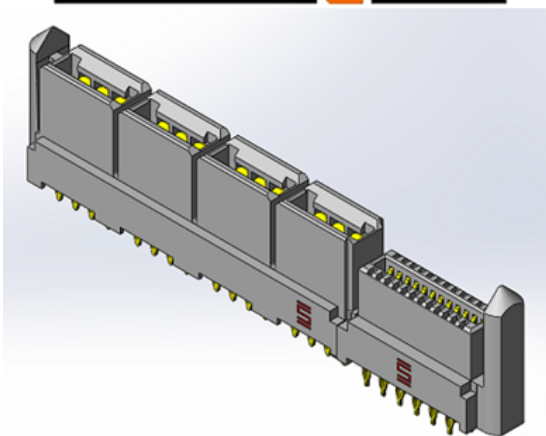




Project Number: Design Qualification Test Report	Tracking Code: 264947_Report_Rev_1
Requested by: Leo Lee	Date: 9/4/2015
Part #: LPHS-08-32-S-VP1-GP/Molex header: 45985-8261	Tech: Peter Chen
Part description: LPHS/Molex header	Qty to test: 20
Test Start: 06/28/2013	Test Completed: 07/23/2013



DESIGN QUALIFICATION TEST REPORT

LPHS/Molex header

LPHS-08-32-S-VP1-GP/Molex header: 45985-8261

Tracking Code: 264947 Report Rev 1	Part #: LPHS-08-32-S-VP1-GP/Molex header: 45985-8261
Part description: LPHS/Molex header	

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
09/25/2014	1	Initial Issue	PC

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to ISO 10012-1 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) After soldering, the parts to be used for LLCR testing were cleaned according to TLWI-0001.
- 4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
- 5) The automated procedure is used with aqueous compatible soldering materials.
- 6) Parts not intended for testing LLCR are visually inspected and cleaned if necessary.
- 7) Any additional preparation will be noted in the individual test sequences.
- 8) Solder Information: Lead free
- 9) Samtec Test PCBs used: PCB-104381-TST

FLOWCHARTS**Durability/Mating/Unmating/Gaps**

TEST STEP	GROUP B1 8 Boards (largest position submitted) .0335"/.0422" ENIG PTH
01	Contact Gaps
02	LLCR-1
03	Forces - Mating / Unmating
04	25 Cycles
05	Forces - Mating / Unmating
06	25 Cycles (50 Total)
07	Forces - Mating / Unmating
08	25 Cycles (75 Total)
09	Forces - Mating / Unmating
10	25 Cycles (100 Total)
11	Forces - Mating / Unmating
12	Clean w/Compressed Air
13	Contact Gaps
14	LLCR-2
15	Thermal Shock (Mated and Undisturbed)
16	LLCR-3
17	Cyclic Humidity (Mated and Undisturbed)
18	LLCR-4
19	Forces - Mating / Unmating

Thermal Shock = EIA-364-32, Table II, Test Condition I:

-55°C to +85°C 1/2 hour dwell, 100 cycles

Humidity = EIA-364-31, Test Condition B (240 Hours)

and Method III (+25°C to +65°C @ 90% RH to 98% RH)

ambient pre-condition and delete steps 7a and 7b

Mating / Unmating Forces = EIA-364-13

Contact Gaps / Height - No standard method. Usually measured optically.

Gaps to be taken on a minimum of 20% of each part tested

LLCR = EIA-364-23, LLCR

20 mV Max, 100 mA Max

Use Keithley 580 or 3706 in 4 wire dry circuit mode

Tracking Code: 264947 Report Rev 1	Part #: LPHS-08-32-S-VP1-GP/Molex header: 45985-8261
Part description: LPHS/Molex header	

FLOWCHARTS Continued

Current Carrying Capacity - Power Pins

TEST STEP	GROUP A1 3 Mated Assemblies 2 Contact Powered, .0335"/.0422" ENIG PTH	GROUP A2 3 Mated Assemblies 4 Contacts Powered, .0335"/.0422" ENIG PTH	GROUP A3 3 Mated Assemblies 6 Contacts Powered, .0335"/.0422" ENIG PTH	GROUP A4 3 Mated Assemblies All Contacts Powered, .0335"/.0422" ENIG PTH
01	CCC	CCC	CCC	CCC

(TIN PLATING) - Tabulate calculated current at RT, 65°C, 75°C and 95°C
after derating 20% and based on 105°C

(GOLD PLATING) - Tabulate calculated current at RT, 85°C, 95°C and 115°C
after derating 20% and based on 125°C

CCC, Temp rise = EIA-364-70

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

- 1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors*.
- 2) Test Condition 1: -55°C to +85°C
- 3) Test Time: ½ hour dwell at each temperature extreme
- 4) Number of Cycles: 100
- 5) All test samples are pre-conditioned at ambient.
- 6) All test samples are exposed to environmental stressing in the mated condition.

HUMIDITY:

- 1) Reference document: EIA-364-31, *Humidity Test Procedure for Electrical Connectors*.
- 2) Test Condition B, 240 Hours.
- 3) Method III, +25° C to + 65° C, 90% to 98% Relative Humidity excluding sub-cycles 7a and 7b.
- 4) All samples are pre-conditioned at ambient.
- 5) All test samples are exposed to environmental stressing in the mated condition.

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.

LLCR:

- 1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
- 2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
- 3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
 - a. <= +5.0 mOhms: ----- Stable
 - b. +5.1 to +10.0 mOhms: ----- Minor
 - c. +10.1 to +15.0 mOhms: ----- Acceptable
 - d. +15.1 to +50.0 mOhms: ----- Marginal
 - e. +50.1 to +2000 mOhms: ----- Unstable
 - f. >+2000 mOhms: ----- Open Failure

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes.

TEMPERATURE RISE (Current Carrying Capacity, CCC):

- 1) EIA-364-70, *Temperature Rise versus Current Test Procedure for Electrical Connectors and Sockets*.
- 2) When current passes through a contact, the temperature of the contact increases as a result of I^2R (resistive) heating.
- 3) The number of contacts being investigated plays a significant part in power dissipation and therefore temperature rise.
- 4) The size of the temperature probe can affect the measured temperature.
- 5) Copper traces on PC boards will contribute to temperature rise:
 - a. Self heating (resistive)
 - b. Reduction in heat sink capacity affecting the heated contacts
- 6) A de-rating curve, usually 20%, is calculated.
- 7) Calculated de-rated currents at three temperature points are reported:
 - a. Ambient
 - b. 65° C
 - c. 75° C
 - d. 95° 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.

RESULTS

Temperature Rise, CCC at a 20% de-rating

- CCC for a 30°C Temperature Rise-----31.4 A per contact with 2 contacts (2x1) powered
- CCC for a 30°C Temperature Rise-----27.5 A per contact with 4 contacts (2x2) powered
- CCC for a 30°C Temperature Rise-----24.5 A per contact with 6 contacts (2x3) powered
- CCC for a 30°C Temperature Rise-----23.0 A per contact with 8 contacts (2x4) powered

Mating – Unmating Forces

100 cycles

- Initial
 - Mating
 - Min -----11.28 Lbs
 - Max-----13.12 Lbs
 - Unmating
 - Min -----10.48 Lbs
 - Max-----11.37 Lbs
- After 25 Cycles
 - Mating
 - Min -----11.81 Lbs
 - Max-----14.13 Lbs
 - Unmating
 - Min -----10.83 Lbs
 - Max-----11.98 Lbs
- After 50 Cycles
 - Mating
 - Min -----11.81 Lbs
 - Max-----14.35 Lbs
 - Unmating
 - Min -----10.68 Lbs
 - Max-----11.87 Lbs
- After 75 Cycles
 - Mating
 - Min -----12.17 Lbs
 - Max-----14.43 Lbs
 - Unmating
 - Min -----10.96 Lbs
 - Max-----12.05 Lbs
- After 100 Cycles
 - Mating
 - Min -----12.29 Lbs
 - Max-----14.39 Lbs
 - Unmating
 - Min -----10.72 Lbs
 - Max-----12.20 Lbs
- Humidity
 - Mating
 - Min ----- 7.68 Lbs
 - Max----- 9.68 Lbs
 - Unmating
 - Min ----- 6.28 Lbs
 - Max----- 7.94 Lbs

RESULTS Continued**LLCR Mating/Unmating Durability Group (Total 192 LLCR test points, include 160 signals and 32 ground pin)****Signal pin**

- Initial ----- 29.41 mOhms Max
- Durability, 100 Cycles
 - ≤ +5.0 mOhms ----- 160 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 0 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure
- Thermal Shock
 - ≤ +5.0 mOhms ----- 160 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 0 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure
- Humidity
 - ≤ +5.0 mOhms ----- 160 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 0 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure

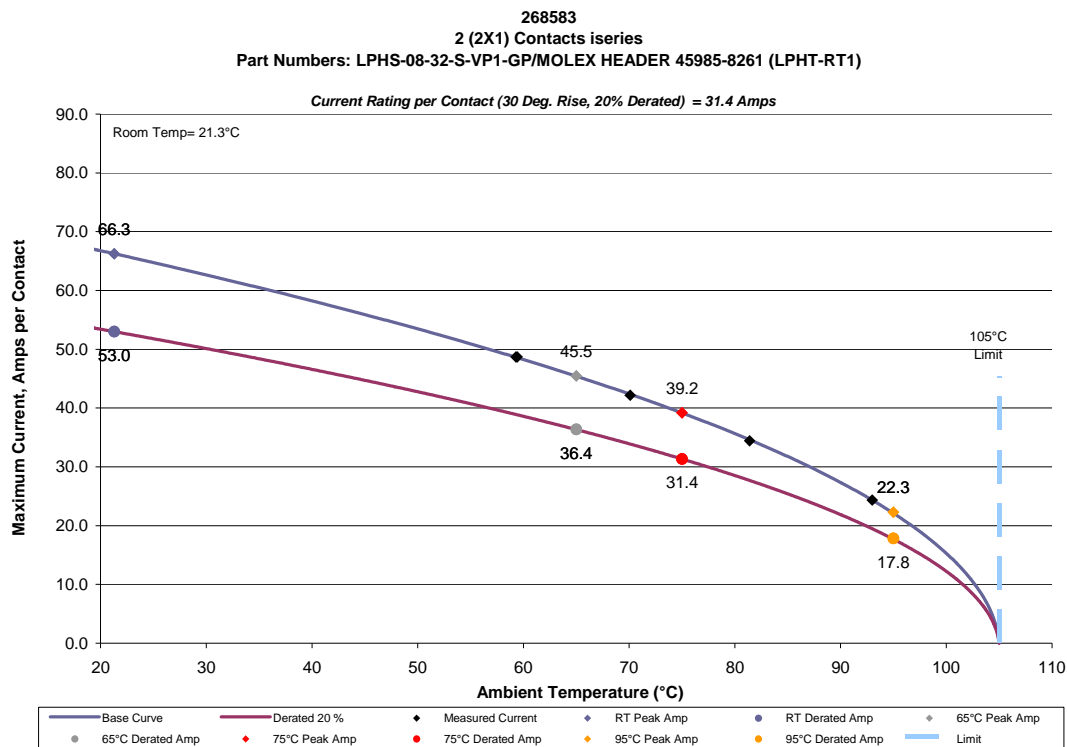
Ground pin

- Initial ----- 1.92 mOhms Max
- Durability, 100 Cycles
 - ≤ +5.0 mOhms ----- 32 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 0 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure
- Thermal Shock
 - ≤ +5.0 mOhms ----- 32 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 0 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure
- Humidity
 - ≤ +5.0 mOhms ----- 32 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 0 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms ----- 0 Points ----- Marginal
 - +50.1 to +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure

DATA SUMMARIES**TEMPERATURE RISE (Current Carrying Capacity, CCC):**

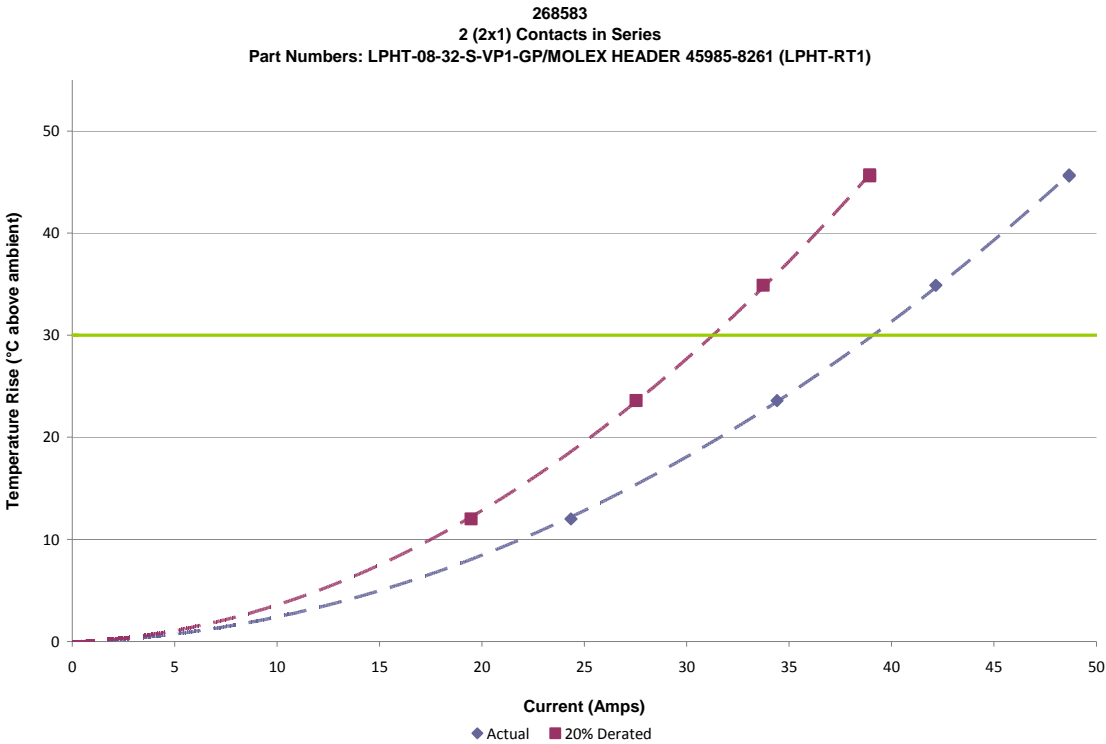
- 1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
- 2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
- 3) Temperature readings recorded are those for which three successive readings,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

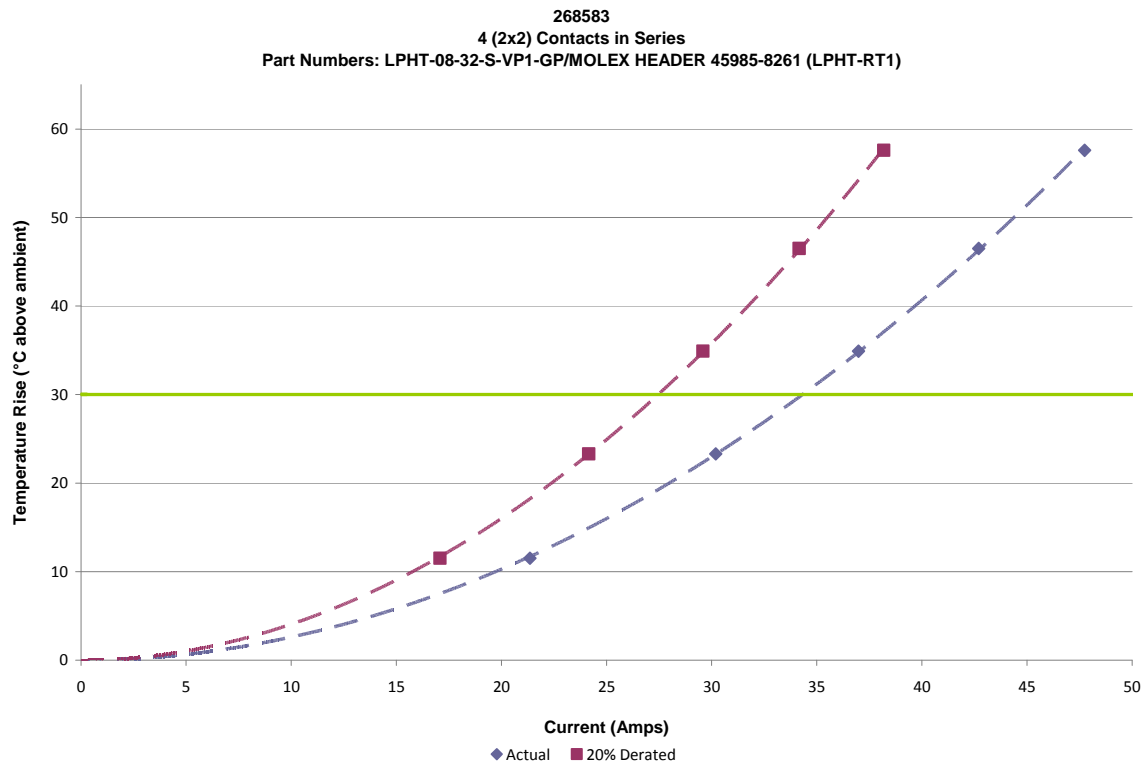
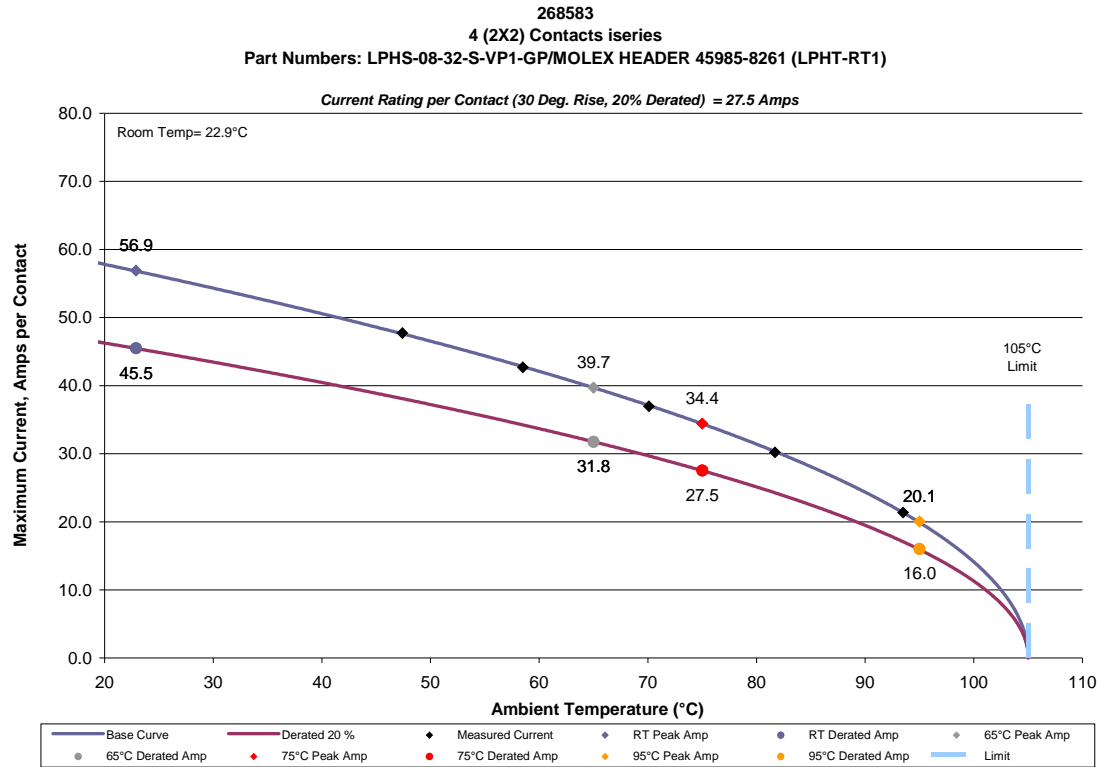
- a. Linear configuration with 2 adjacent conductors/contacts powered

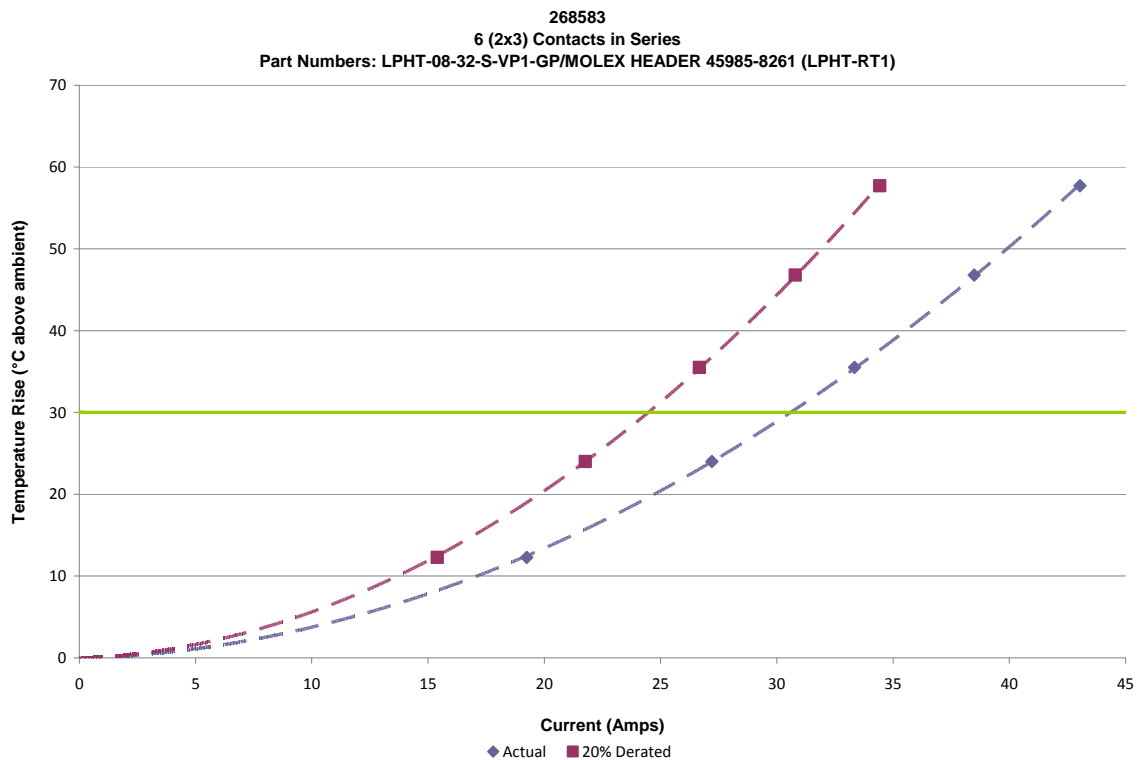
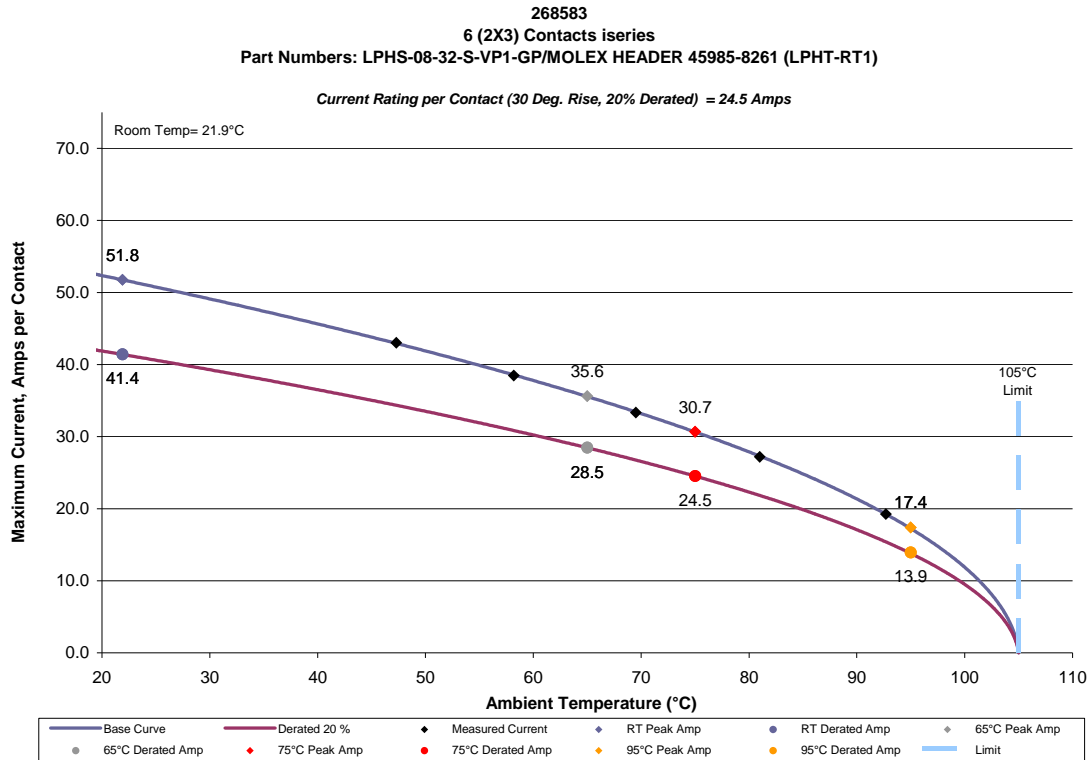


Tracking Code: 264947 Report Rev 1	Part #: LPHS-08-32-S-VP1-GP/Molex header: 45985-8261
Part description: LPHS/Molex header	

DATA SUMMARIES Continued

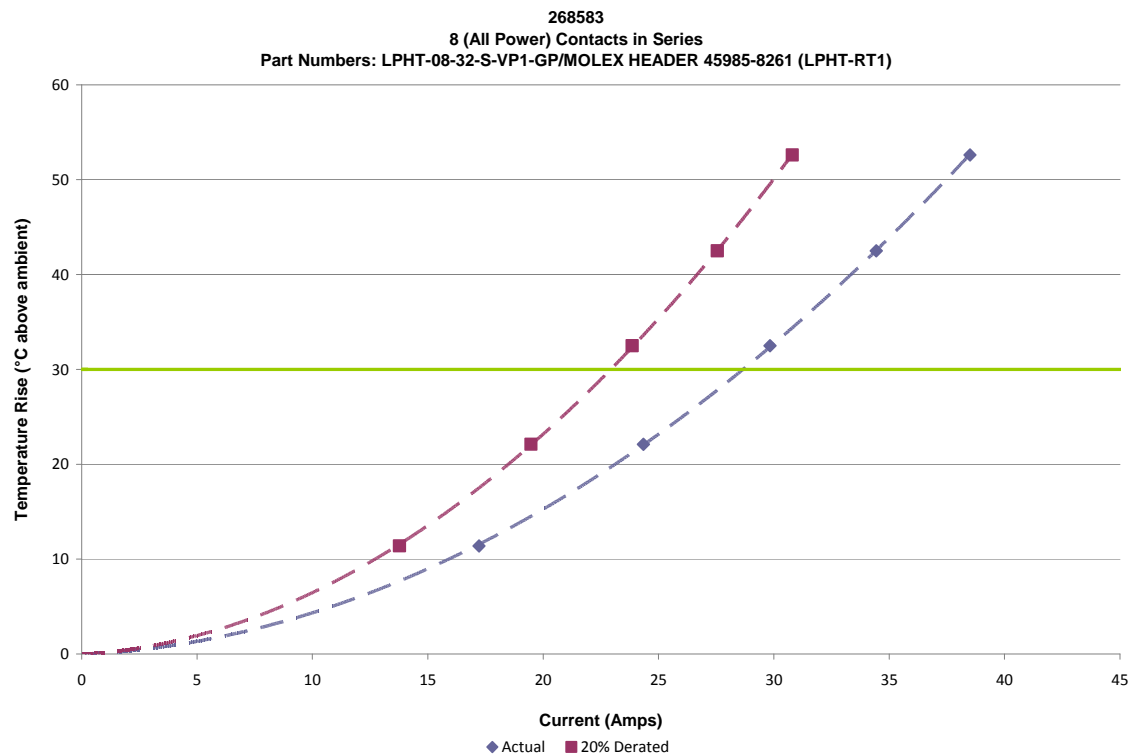
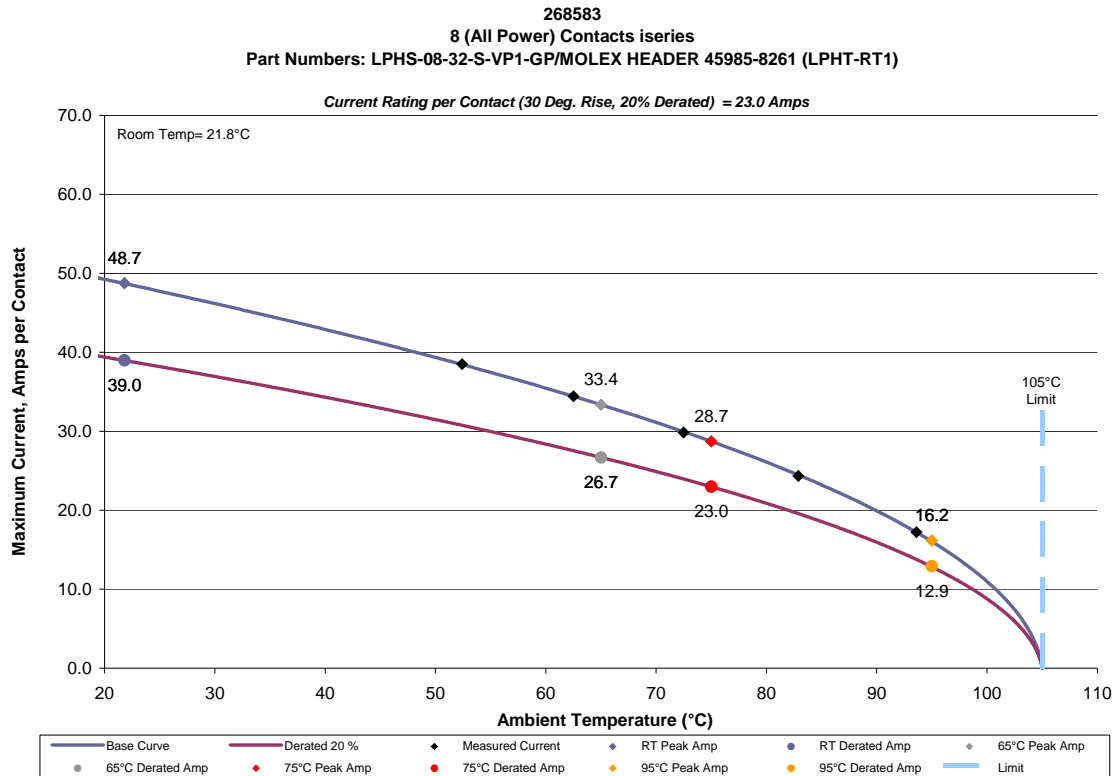


DATA SUMMARIES Continued**b. Linear configuration with 4 adjacent conductors/contacts powered**

DATA SUMMARIES Continued**c. Linear configuration with 6 adjacent conductors/contacts powered**

DATA SUMMARIES Continued

d. Linear configuration with all adjacent conductors/contacts powered



DATA SUMMARIES Continued**MATING-UNMATING FORCE:****Mating-Unmating Durability Group**

	Initial				After 25 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newton	Force (Lbs)	Newton	Force (Lbs)	Newton	Force (Lbs)	Newton	Force (Lbs)
Minimum	50.17	11.28	46.62	10.48	52.53	11.81	48.17	10.83
Maximum	58.36	13.12	50.57	11.37	62.85	14.13	53.29	11.98
Average	53.44	12.01	48.93	11.00	57.70	12.97	50.65	11.39
St Dev	2.52	0.57	1.36	0.31	4.00	0.90	1.46	0.33
Count	8	8	8	8	8	8	8	8
	After 50 Cycles				After 75 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newton	Force (Lbs)	Newton	Force (Lbs)	Newton	Force (Lbs)	Newton	Force (Lbs)
Minimum	52.53	11.81	47.50	10.68	54.13	12.17	48.75	10.96
Maximum	63.83	14.35	52.80	11.87	64.18	14.43	53.60	12.05
Average	58.84	13.23	50.55	11.37	59.68	13.42	51.34	11.54
St Dev	4.14	0.93	1.75	0.39	3.74	0.84	1.78	0.40
Count	8	8	8	8	8	8	8	8
	After 100 Cycles				After Humidity			
	Mating		Unmating		Mating		Unmating	
	Newton	Force (Lbs)	Newton	Force (Lbs)	Newton	Force (Lbs)	Newton	Force (Lbs)
Minimum	54.67	12.29	47.68	10.72	34.16	7.68	27.93	6.28
Maximum	64.01	14.39	54.27	12.20	43.06	9.68	35.32	7.94
Average	59.98	13.49	51.71	11.63	37.94	8.53	30.54	6.87
St Dev	3.69	0.83	2.24	0.50	2.96	0.67	2.50	0.56
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued**LLCR Mating/Unmating Durability 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). 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. $\leq +5.0$ mOhms:-----Stable
 - b. $+5.1$ to $+10.0$ mOhms:-----Minor
 - c. $+10.1$ to $+15.0$ mOhms:-----Acceptable
 - d. $+15.1$ to $+50.0$ mOhms:-----Marginal
 - e. $+50.1$ to $+2000$ mOhms-----Unstable
 - f. $> +2000$ mOhms:-----Open Failure

LLCR Measurement Summaries by Pin Type				
Date	6/28/2013	7/2/2013	7/9/2013	7/23/2013
Room Temp (Deg C)	23	23	23	23
Rel Humidity (%)	56	56	58	56
Technician	Peter Chen	Peter Chen	Peter Chen	Peter Chen
mOhm values	Actual Initial	Delta 100 Cycles	Delta Therm Shck	Delta Humidity
Pin Type 1: Row 1				
Average	22.02	0.44	0.48	0.52
St. Dev.	2.00	0.47	0.52	0.48
Min	17.06	0.00	0.00	0.01
Max	25.03	2.97	3.27	2.88
Summary Count	72	72	72	72
Total Count	72	72	72	72
Pin Type 2: Row 2				
Average	24.95	0.88	0.85	0.98
St. Dev.	1.47	0.71	0.68	0.76
Min	22.90	0.01	0.01	0.01
Max	29.41	3.65	3.37	3.13
Summary Count	88	88	88	88
Total Count	88	88	88	88
Pin Type 3: Power				
Average	1.29	0.04	0.05	0.06
St. Dev.	0.33	0.05	0.05	0.05
Min	0.89	0.00	0.00	0.00
Max	1.92	0.23	0.24	0.21
Summary Count	32	32	32	32
Total Count	32	32	32	32

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 5	$>5 \text{ \& } \leq 10$	$>10 \text{ \& } \leq 15$	$>15 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	>1000
100 Cycles	192	0	0	0	0	0
Therm Shck	192	0	0	0	0	0
Humidity	192	0	0	0	0	0

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: 04/26/20143, Next Cal: 04/25/2015**Equipment #:** HZ-THC-01**Description:** Humidity transmitter**Manufacturer:** Thermtron**Model:** SM-8-8200**Serial #:** 38846**Accuracy:** Last Cal: 02/28/2014, Next Cal: 02/27/2015**Equipment #:** HZ-MO-05**Description:** Micro-ohmmeter**Manufacturer:** Keithley**Model:** 3706**Serial #:** 1285188**Accuracy:** Last Cal: 11/15/2013, Next Cal: 11/14/2014**Equipment #:** HZ-TSC-01**Description:** Vertical Thermal Shock Chamber**Manufacturer:** Cincinnatti Sub Zero**Model:** VTS-3-6-6-SC/AC**Serial #:** 10-VT14994**Accuracy:** See Manual

... Last Cal: 06/28/2014, Next Cal: 06/27/2015

Equipment #: MO-04**Description:** Multimeter /Data Acquisition System**Manufacturer:** Keithley**Model:** 3706**Serial #:** 0798688**Accuracy:** See Manual

... Last Cal: 04/30/2014, Next Cal: 04/30/2015

Equipment #: PS-01**Description:** System Power Supply**Manufacturer:** Hewlett Packard**Model:** HP 6033A**Serial #:** 3329A-07330**Accuracy:** See Manual

... Last Cal: 06/15/2014, Next Cal: 06/15/2015