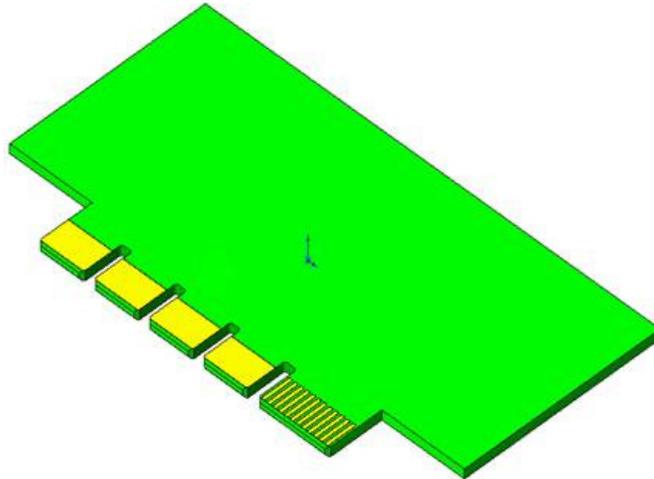
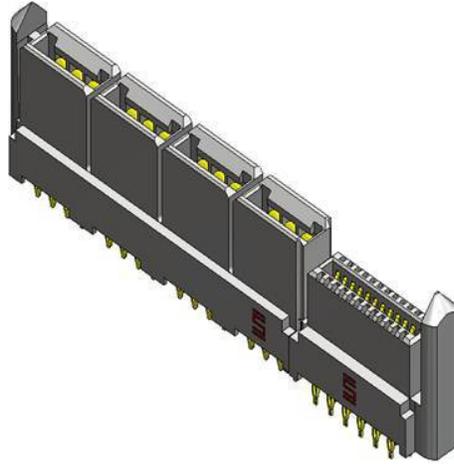




Project Number: 246893	Tracking Code: 246893_Power Test Report_Rev_2 .doc
Requested by: Leo Lee	Date: 06/26/2013
Part #: LPHS-08-32-L-VP1-GP/Edge card	
Part description: LPHS/Edge card	Technician: Tony Wagoner
Test Start: 04/03/2013	Test Completed: 05/01/2013



# **SAMTEC POWER CHARACTERIZATION**

## **PART DESCRIPTION**

**LPHS-08-32-L-VP1-GP/Edge card**

## 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

1. Temperature Rise/Current Carrying Capacity
  - 1.1. To determine the amount of current the device under test (DUT) can safely carry over the operating temperature range of the DUT.
  - 1.2. Contact loading will also be addressed in this document which will determine how much current can be carried as the number of energized contacts is varied.
2. Current Cycling
  - 2.1. To determine the performance of the device under test (DUT) when subjected to the power-on/power-off cycling that heats and cools the DUT in normal everyday use.
  - 2.2. Contact loading will set to 100% throughout the test.

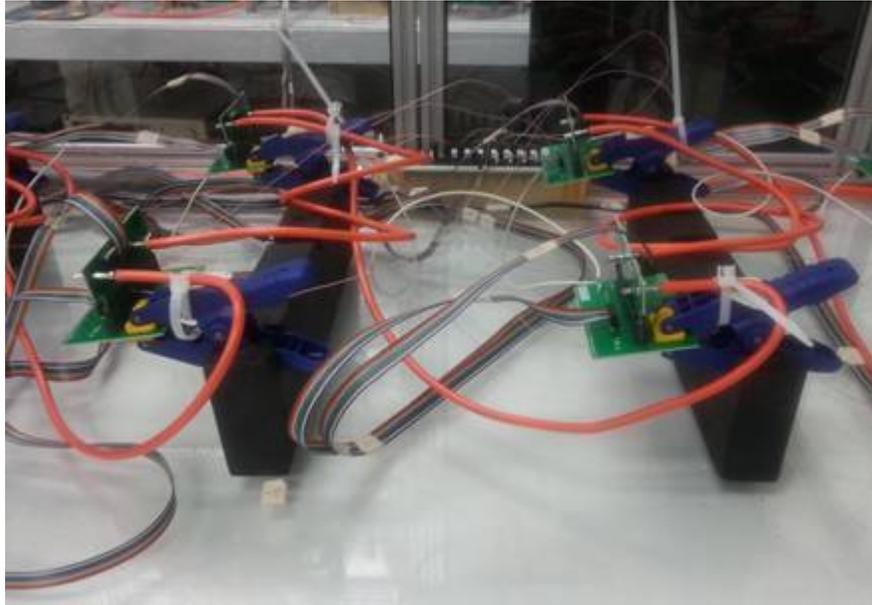
### APPLICABLE DOCUMENTS

Standards: EIA Publication 364-70 Temperature Rise  
EIA Publication 364-06 Contact Resistance  
EIA Publication 364-55 Current Cycling  
TLPM-032 Current Carrying Capacity  
TLPM-084 Current Cycling  
IEC 512-3 Electromechanical Components for Electronic Equipment: Basic Testing Procedures and Measuring Methods, Part 3: Current Carrying Capacity Tests

### TEST SAMPLES AND PREPARATION

- 1) All materials shall be manufactured in accordance with the applicable product specification.
- 2) All test samples shall be identified and encoded to maintain traceability throughout the test sequences.
- 3) After soldering, the parts to be used shall be cleaned according to TLWI-0001.
- 4) All samples shall be visually inspected and cleaned as necessary.
- 5) Any additional preparation shall be noted in the individual test sequences.
- 6) Solder Information: Lead Free
- 7) Re-Flow Time/Temp: See accompanying profile.
- 8) All products designed to operate mounted on a printed circuits board shall be tested mounted to test boards in accordance with EIA-364-70.

PREPARED TEST SAMPLE



- 9) The following loading configurations shall be tested for Temperature Rise/Current Carrying Capacity testing of two row connector systems:
- Two by One contact energized
  - Two by Two contacts energized adjacent to each other
  - Two by Three contacts energized adjacent to each other
  - Two by Four contacts energized adjacent to each other
  - All contacts energized

Test Condition as in 10.1 above

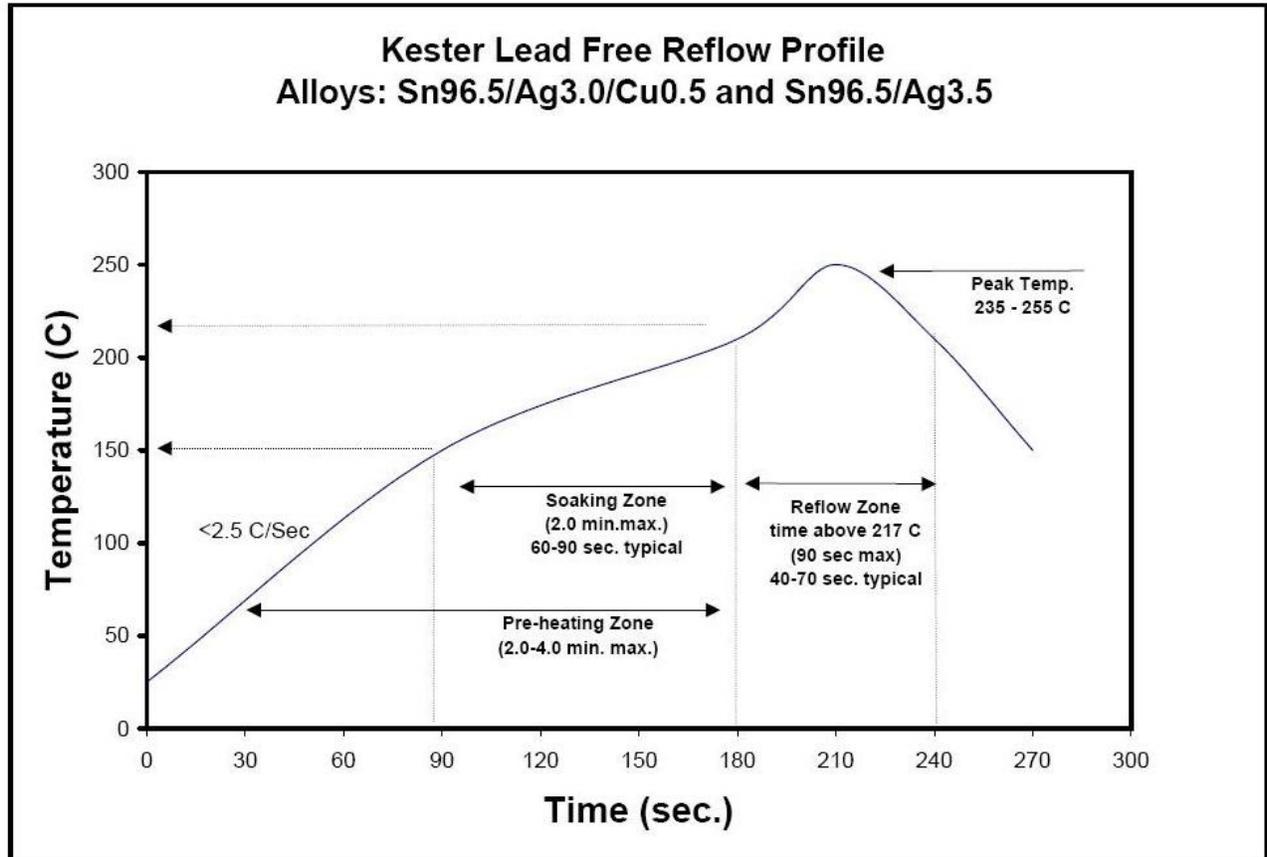
✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts  
✦ Indicates thermocouple monitored, energized contacts

10) For Current Cycling, only 100 % loading will be tested.

✦			
✦			

**OVEN PROFILE (Soldering Parts to Test Boards)**





# POWER INTEGRITY TEST REPORT

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## FLOWCHARTS

### POWER PINS

#### Current Carrying Capacity - Power Pins

TEST STEP	GROUP A1 3 Mated Assemblies 2 Contact Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP A2 3 Mated Assemblies 4 Contacts Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP A3 3 Mated Assemblies 6 Contacts Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP A4 3 Mated Assemblies All Contacts Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH
01	CCC	CCC	CCC	CCC

### SIGNAL PINS

#### Current Carrying Capacity - Singal Pins

TEST STEP	GROUP D1 3 Mated Assemblies 2 Pins Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP D2 3 Mated Assemblies 4 Pins Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP D3 3 Mated Assemblies 6 Pins Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP D4 3 Mated Assemblies 8 Pins Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH	GROUP D5 3 Mated Assemblies All Contacts Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH
01	CCC	CCC	CCC	CCC	CCC

### POWER & SIGNAL PINS

#### Current Carrying Capacity - Power and Signal Pins

TEST STEP	GROUP E1 3 Mated Assemblies Signal Pins @ 1/2 rated current from Group D5 Power Pins - All Contacts Powered 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH
01	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

#### Current Cycling

TEST STEP	GROUP A1 8 Mated Assemblies (Power Pins Only) 0.056" thick edge card(Min), .0335"/.0422" ENIG PTH
01	Current Cycle, 500 cycles

Current Cycle = EIA 364-55, Condition "B", Method #4

Test at Current Listed

Each cycle is 60 minutes

ON time is 45 minutes

OFF time is 15 minutes

Measure at 40 minutes into 45 minute ON time

ON current is 125% of the rated current



# POWER INTEGRITY TEST REPORT

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## TEST PROCEDURES

<b>Part No.</b>	<b>LPHS-08-32-L-VP1-GP</b>	<b>Mating Part No.</b>	<b>Edge Card</b>
<b>Sample Size</b>	<b>15</b>	<b>Technician</b>	Tony Wagoner
<b>Start Date</b>	04/03/2013	<b>Complete Date</b>	04/05/2013
<b>Room Ambient</b>	<b>23°C</b>	<b>Relative Humidity</b>	<b>49%</b>
<b>Equipment ID#: MO-04, PS-07, MO-09, PS-11, 246893-(001 - 030)</b>			

### TEMPERATURE RISE (Current Carrying Capacity, CCC):

- 1) Thermocouples shall be calibrated in accordance with Samtec documents; TLWI 0003, Thermocouple Welding Procedure and TLWI 0005, Thermocouple Calibration
- 2) The thermocouples shall be placed at a location to sense the maximum temperature generated during testing.
- 3) Temperature stability shall be defined as the temperature at which three successive readings, 5 minutes apart, differ not more than 1° C (computer controlled data acquisition). This is the Temperature Rise that the Current Carrying Capacity and De-rating curves are based on.
- 4) The following loading configurations shall be tested (double for two row systems):
  - a. One contact energized only
  - b. Two contacts energized adjacent to each other
  - c. Three contacts energized adjacent to each other
  - d. Four contacts energized adjacent to each other
  - e. All contacts energized
- 5) The following loading configurations shall be tested for Temperature Rise/Current Carrying Capacity testing of two row connector systems:
  - a. Two by One contact energized
  - b. Two by Two contacts energized adjacent to each other
  - c. Two by Three contacts energized adjacent to each other
  - d. Two by Four contacts energized adjacent to each other
  - e. All contacts energized
- 6) Three samples shall be tested for each of the above configurations for a total of eighteen assemblies.
- 7) Temperature Rise measurements shall be made at 5 different current levels yielding temperature rises in the 10 to 70°C range.
- 8) The base curve for the Current Rating chart will be derived from the average (maximum) value of three test specimens in accordance with IEC 512-3, Test 5b.



**POWER INTEGRITY TEST  
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<b>Part No.</b>	<b>LPHS-08-32-L-VP1-GP</b>	<b>Mating Part No.</b>	<b>Edge Card</b>
<b>Sample Size</b>	<b>15</b>	<b>Technician</b>	Tony Wagoner
<b>Start Date</b>	04/17/2013	<b>Complete Date</b>	05/01/2013
<b>Room Ambient</b>	<b>23°C</b>	<b>Relative Humidity</b>	<b>49%</b>
<b>Equipment ID#: MO-09, PS-09, 246893(047 - 054)</b>			

**CURRENT CYCLING**

1. Samples shall be prepared and tested as above (paragraph 14.5).
2. Current Cycling shall be performed in accordance with EIA-364-55, Test Condition
3. Testing shall be as follows:
  - 3.1. Test Current: **TEST CURRENT**(125% of 30°C Rating)
  - 3.2. "ON" Time: 45 Minutes
  - 3.3. "OFF" Time: 15 Minutes
  - 3.4. Number of Cycles: 500
  - 3.5. Measurements: 40 minutes into ON cycle
    - 3.5.1. Temperature
    - 3.5.2. Voltage Drop/Contact Resistance
4. Temperature vs. Number of Cycles and Voltage Drop vs. Number of Cycles shall be measured and recorded.



# POWER INTEGRITY TEST REPORT

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## TEST RESULTS

### CURRENT CARRYING CAPACITY (CCC) RESULTS

- There was no evidence of physical damage to the test samples as tested.
- The following is a summary of the observed data:

#### Temperature Rise, CCC at a 20% de-rating

##### Power pin

- CCC for a 30°C Temperature Rise -----28.9 A per contact with 2 contacts (2 x 1) powered
- CCC for a 30°C Temperature Rise -----25.9 A per contact with 4 contacts (2 x 2) powered
- CCC for a 30°C Temperature Rise -----22.4 A per contact with 6 contacts (2 x 3) powered
- CCC for a 30°C Temperature Rise -----21.5 A per contact with 8 contacts (All) powered

##### Signal pin

- CCC for a 30°C Temperature Rise -----2.8 A per contact with 2 contacts (2 x 1) powered
- CCC for a 30°C Temperature Rise -----2.2 A per contact with 4 contacts (2 x 2) powered
- CCC for a 30°C Temperature Rise -----2.0 A per contact with 6 contacts (2 x 3) powered
- CCC for a 30°C Temperature Rise -----1.8 A per contact with 8 contacts (2 x 4) powered
- CCC for a 30°C Temperature Rise -----1.2 A per contact with 32 contacts (All) powered

#### Power pin and signal pin (signal contacts powered @ 1/2 rated current @ 0.75 AMPS.)

- CCC for a 30°C Temperature Rise-----20.9 A per contact with all adjacent power contacts powered

### CURRENT CYCLING RESULTS

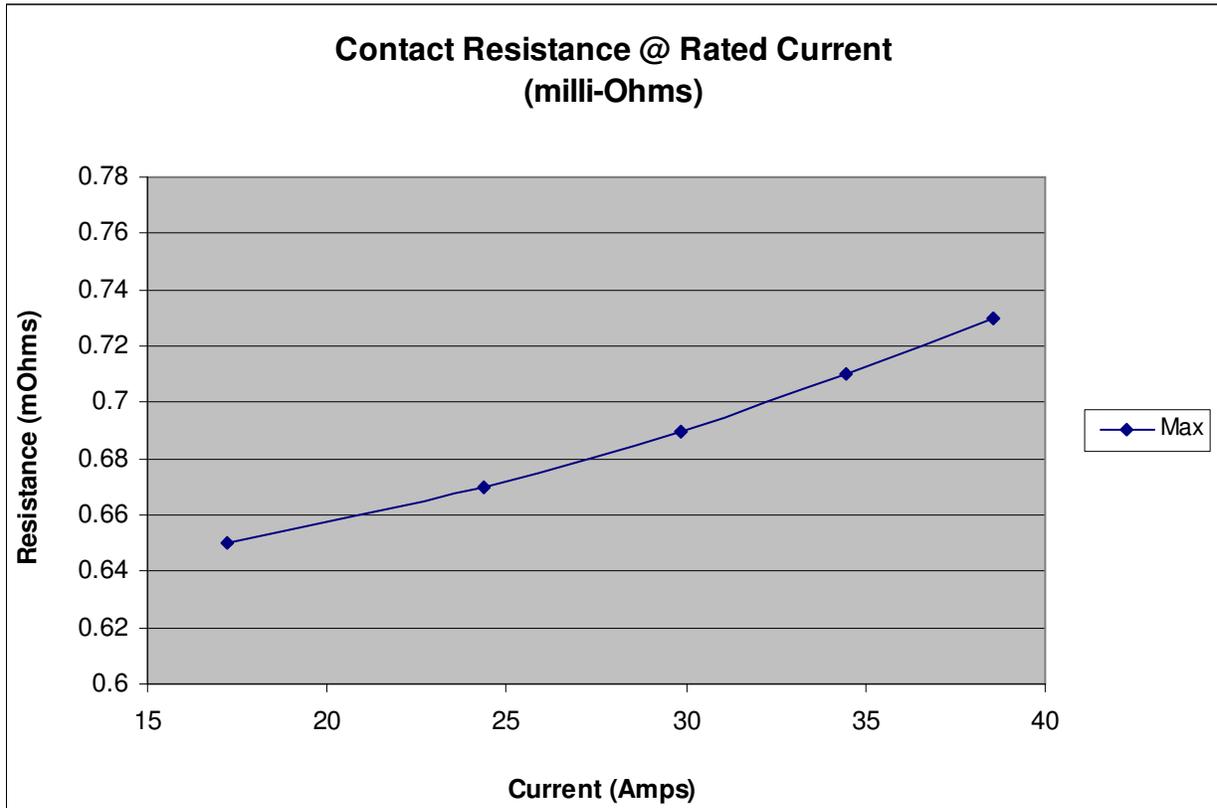
#### Test Condition: 500 Cycles, 45 minutes ON and 15 minutes OFF

- Test Current -----26.8 Amps
- Contact Resistances, Measured 40 minutes into the FIRST and LAST ON cycle
  - Initial
    - Min ----- 0.39mOhms
    - Max----- 0.68mOhms
  - Final
    - Min ----- 0.36mOhms
    - Max----- 0.58mOhms
- Temperature Change, Measured 40 minutes into the FIRST and LAST ON cycle
  - Initial Temperature Change -----29.8°C
  - Final Temperature Change -----27.3°C

**TEST DATA**

**CONTACT RESISTANCE @ RATED CURRENT - DC Resistance (DCR)**

The following data represents the Voltage drop and Contact Resistance at Rated Current for the 100% energized samples:



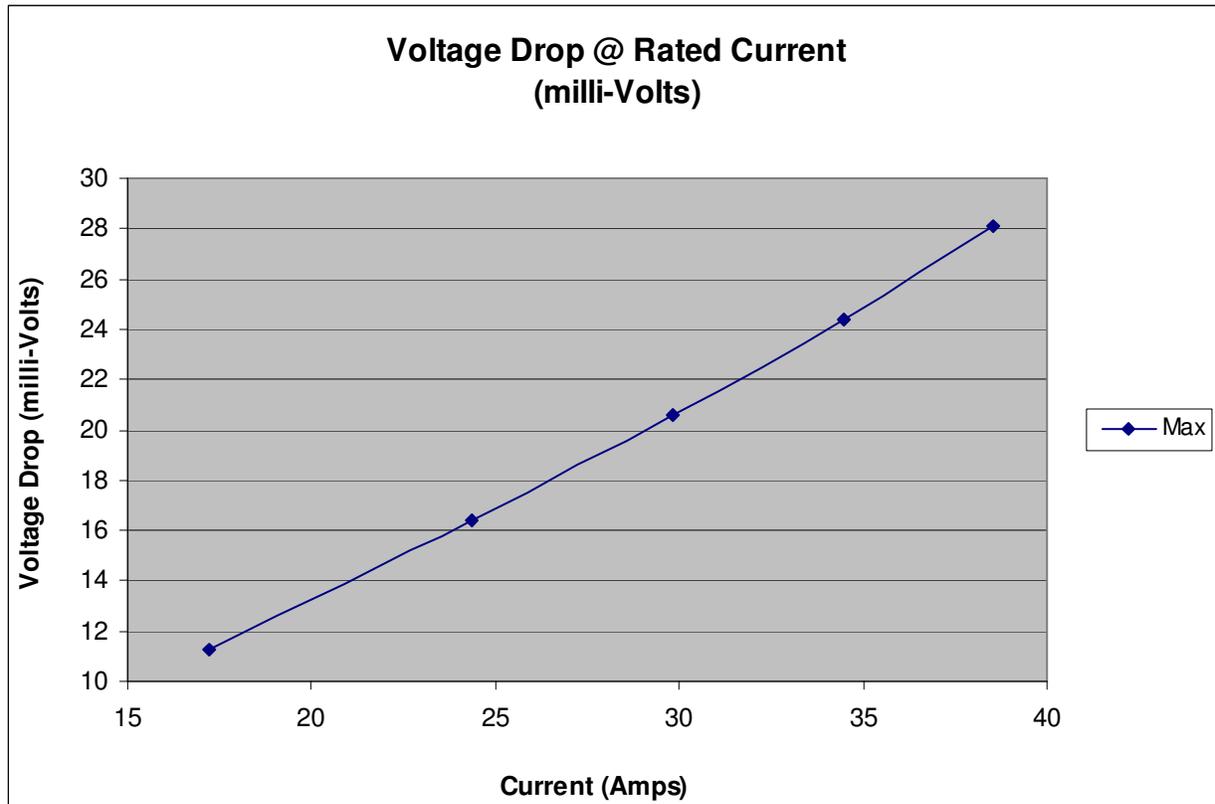
**CONTACT RESISTANCE DATA  
ALL CONTACTS ENERGIZED  
(mΩ)**

TEST CURRENT AMPS	17.23	24.35	29.84	34.46	38.55
Min	0.42	0.43	0.44	0.46	0.47
Max	0.65	0.67	0.69	0.71	0.73
Avg	0.47	0.49	0.5	0.51	0.53

**TEST DATA**

**VOLTAGE DROP @ RATED CURRENT**

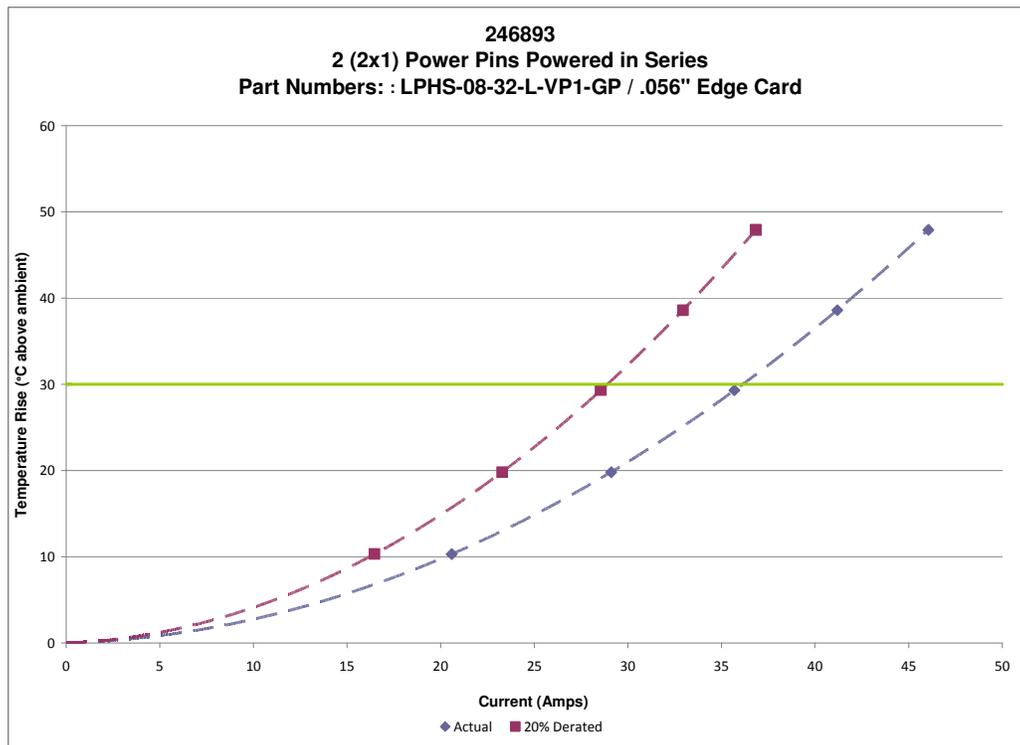
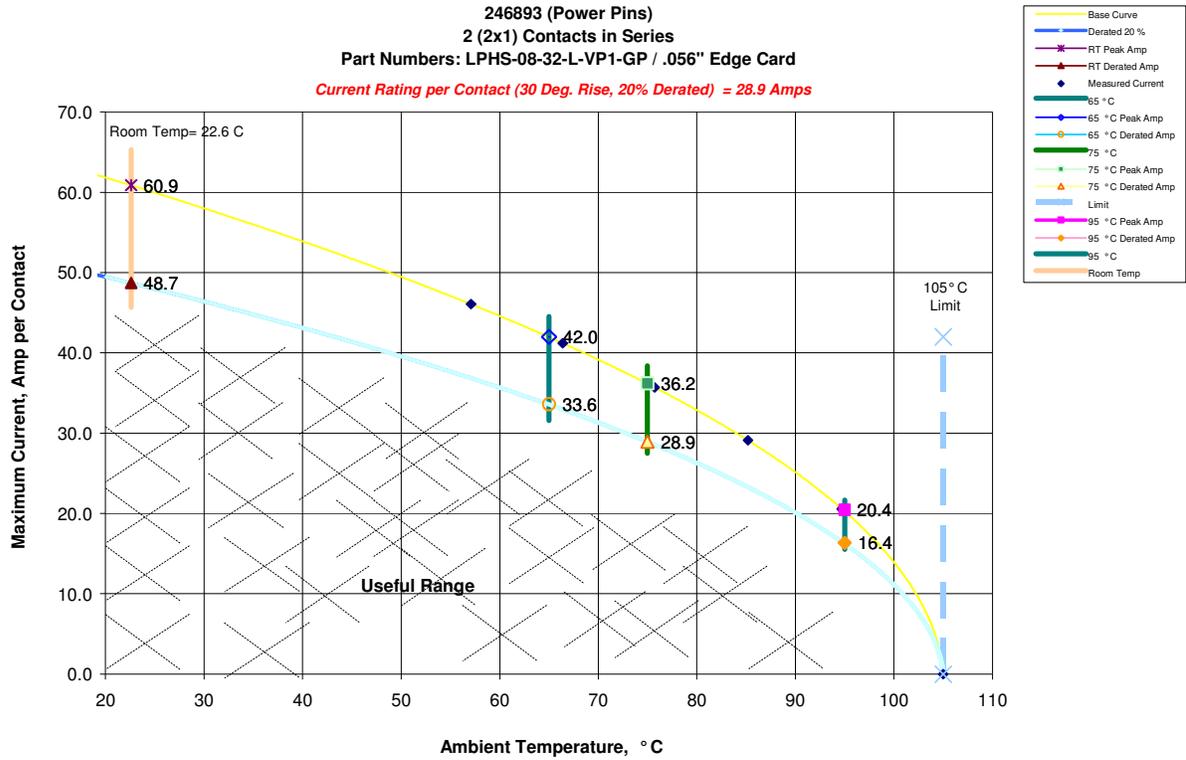
The following data represents the Voltage drop at Rated Current for the 100% energized samples:



**VOLTAGE DROP DATA  
ALL CONTACTS ENERGIZED  
(mV)**

TEST CURRENT AMPS	17.23	24.35	29.84	34.46	38.55
Min	7.23	10.46	13.23	15.74	18.08
Max	11.24	16.43	20.6	24.41	28.08
Avg	8.5	12.31	15.49	18.35	21.09

### CURRENT CARRYING CAPACITY DATA





# POWER INTEGRITY TEST REPORT

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## TEMPERATURE RISE DATA TWO CONTACT ENERGIZED (Degrees Celsius above ambient)

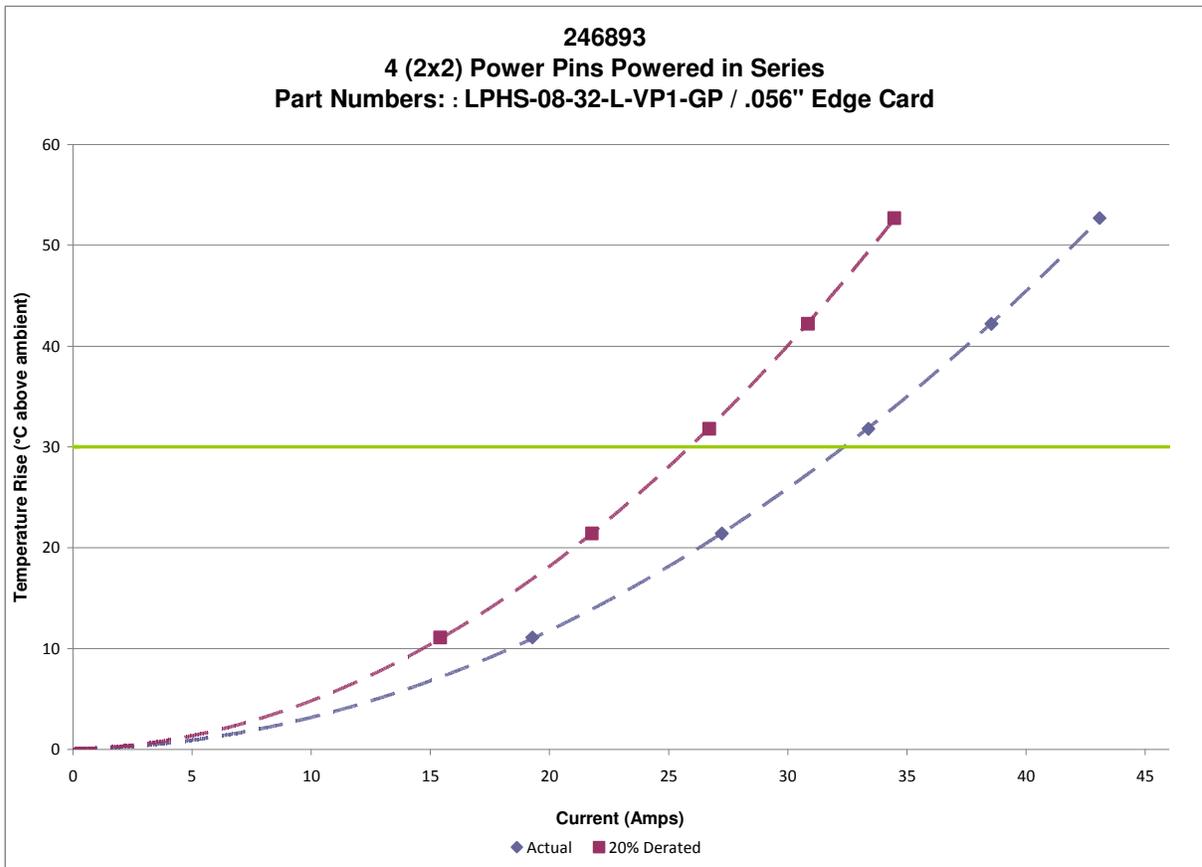
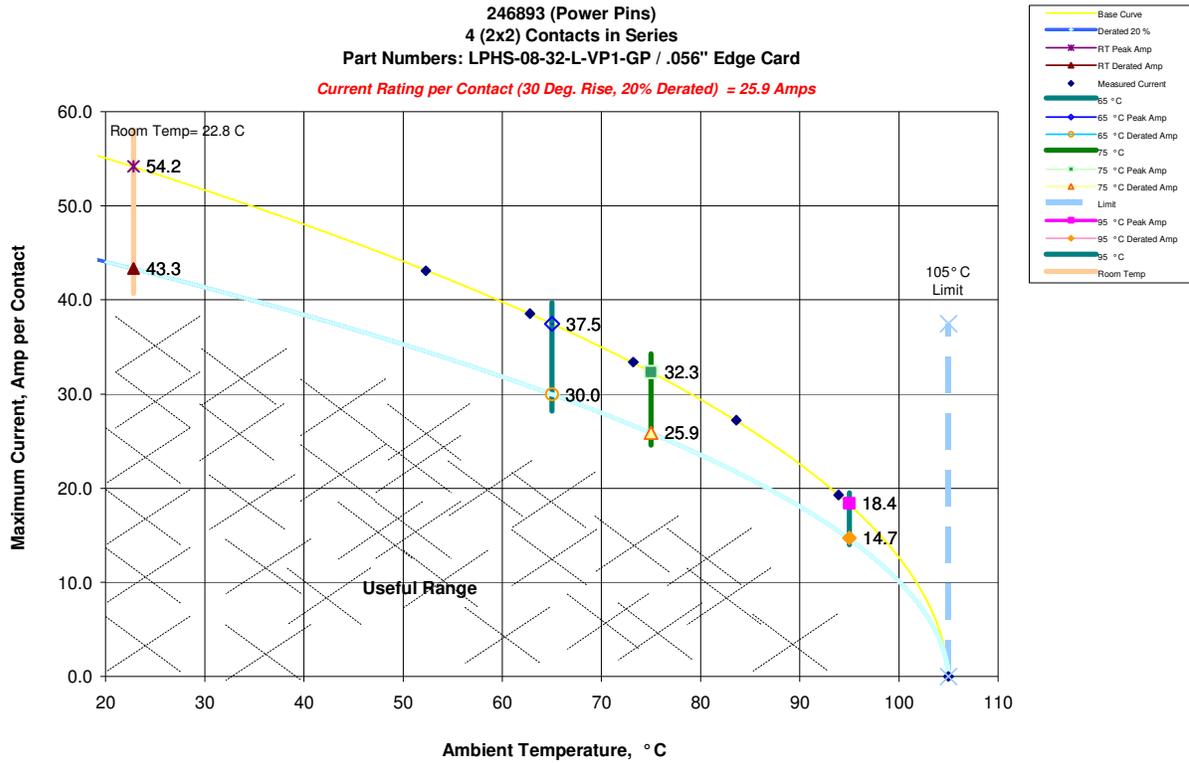
TEST CURRENT AMPS	20.59	29.12	35.69	41.19	46.05
Sample 1	10.4	20	29.8	39.2	49
Sample 2	10	19.2	28.4	37.4	46.4
Sample 3	10.5	20.1	29.7	39.1	48.4
Min	10	19.2	28.4	37.4	46.4
Max	10.5	20.1	29.8	39.2	49
Avg	10.3	19.77	29.3	38.57	47.93

Double Row Configuration

✦ Indicates energized contacts

✦ Indicates thermocouple monitoring

✦			
✦			





# POWER INTEGRITY TEST REPORT

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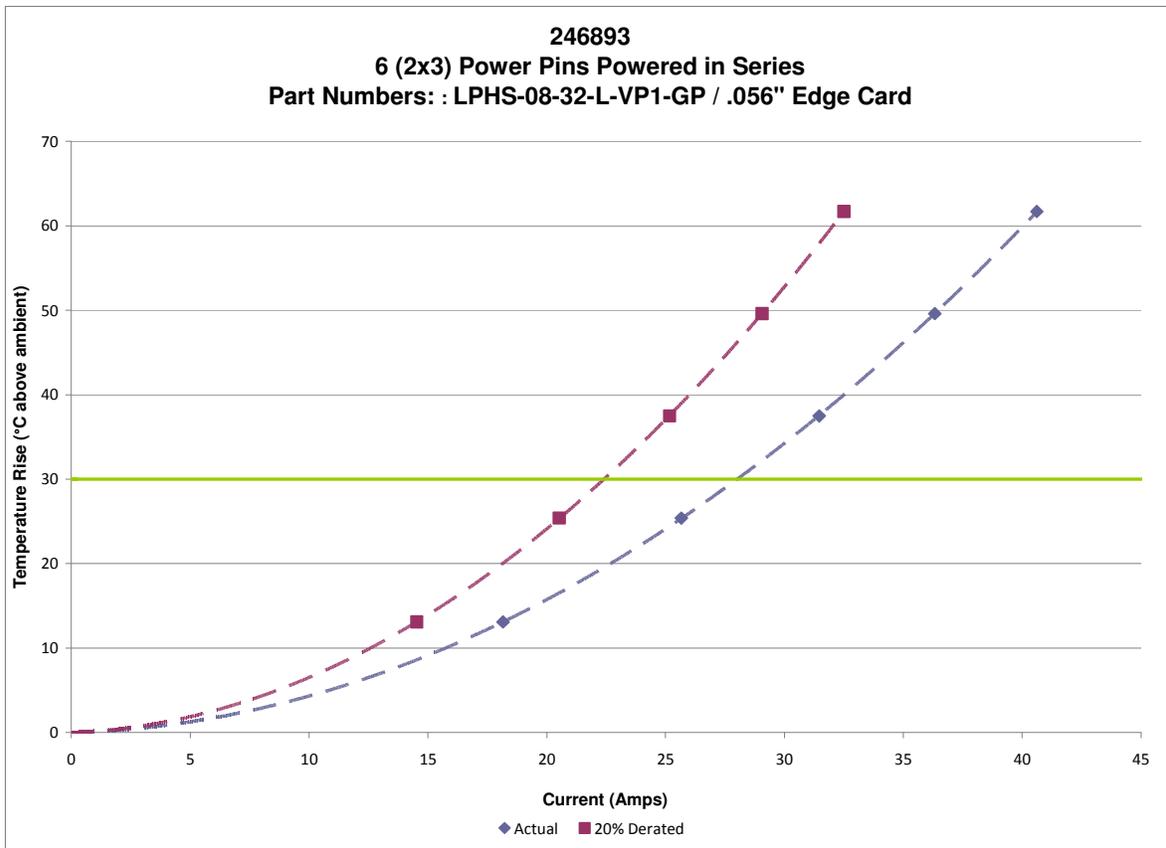
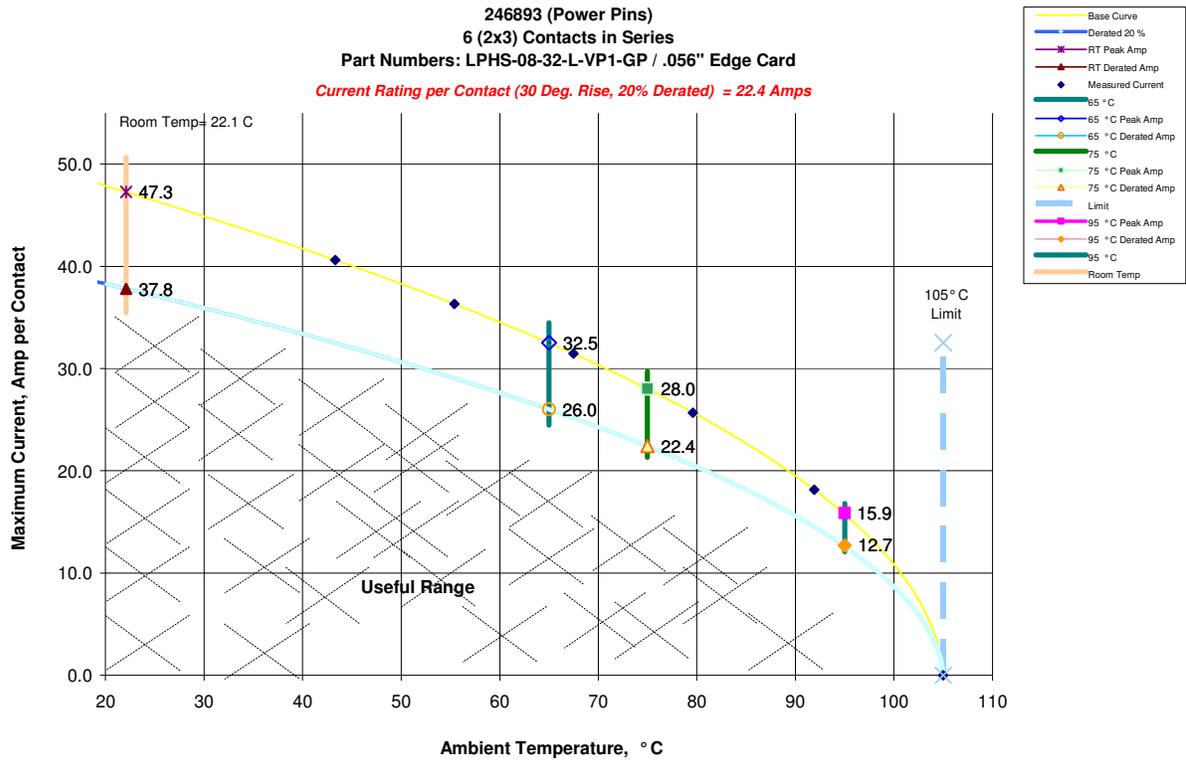
## TEMPERATURE RISE DATA FOUR CONTACTS ENERGIZED (Degrees Celsius above ambient)

TEST CURRENT AMPS	19.27	27.23	33.38	38.55	43.08
Sample 4	11.4	22	32.9	43.7	54.5
Sample 5	11.4	21.9	32.4	43	53.8
Sample 6	10.6	20.4	30.2	39.8	49.7
Min	10.6	20.4	30.2	39.8	49.7
Max	11.4	22	32.9	43.7	54.5
Avg	11.13	21.43	31.83	42.17	52.67

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

✦	✦		
✦	✦		





**POWER INTEGRITY TEST  
REPORT**

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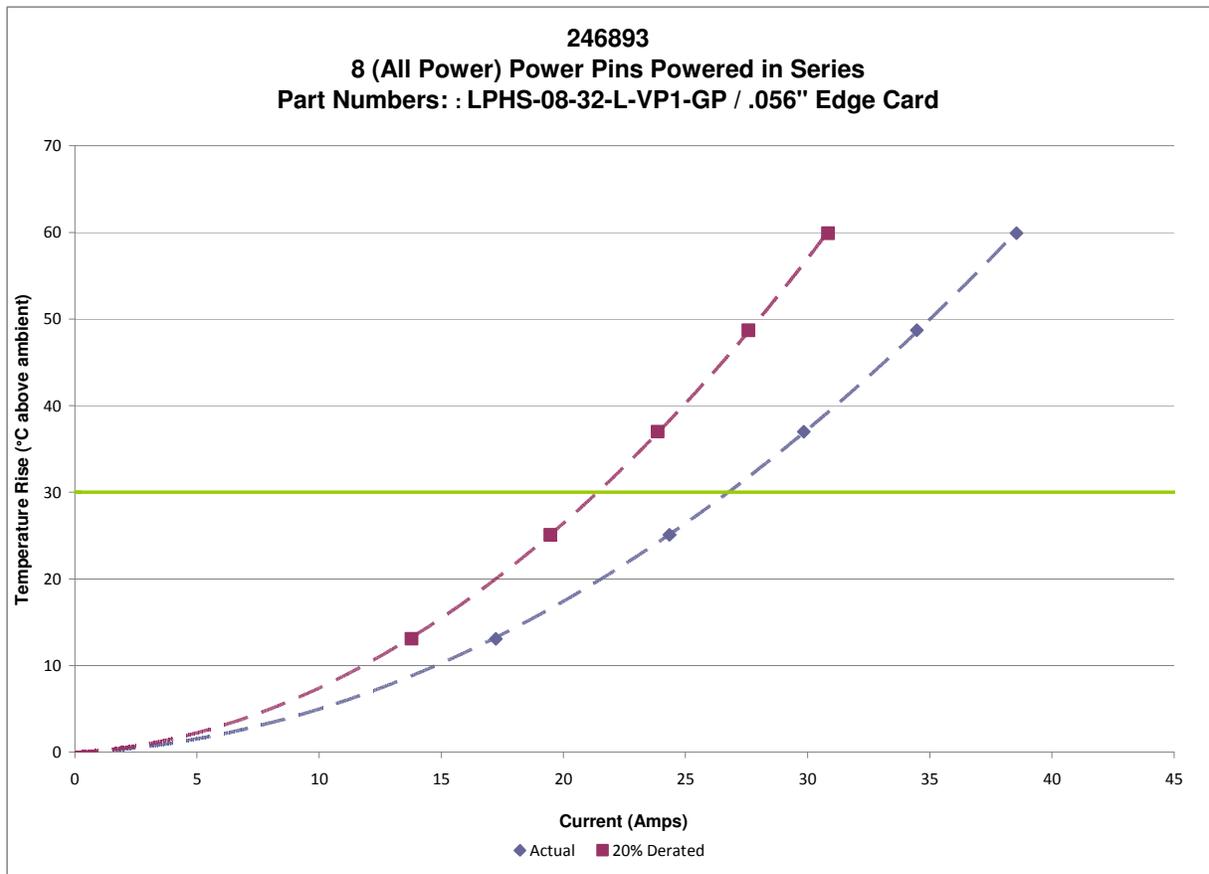
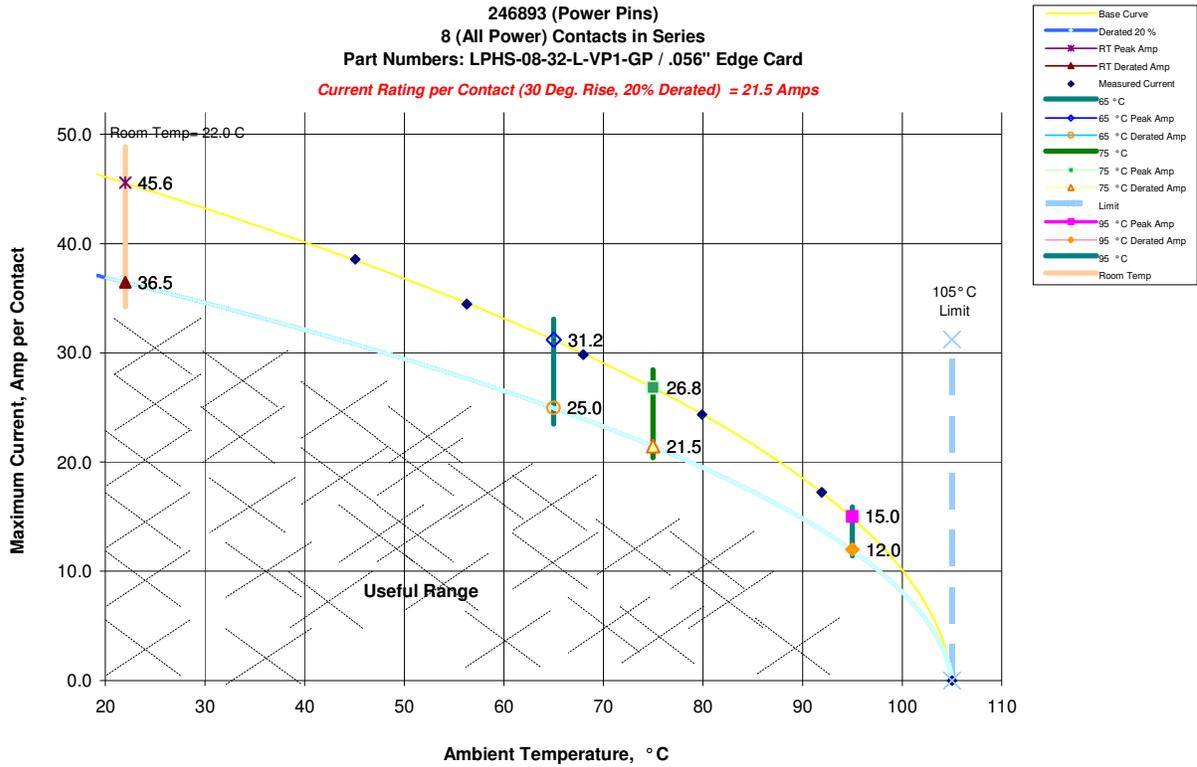
**TEMPERATURE RISE DATA  
SIX CONTACTS ENERGIZED  
(Degrees Celsius above ambient)**

TEST CURRENT AMPS	18.17	25.67	31.47	36.33	40.62
Sample 7	13.1	25.5	37.6	49.9	61.8
Sample 8	13.3	25.9	38.2	50.5	63.1
Sample 9	12.8	24.7	36.6	48.4	60.2
Min	12.8	24.7	36.6	48.4	60.2
Max	13.3	25.9	38.2	50.5	63.1
Avg	13.07	25.37	37.47	49.6	61.7

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

✦	✦	✦	
✦	✦	✦	





**POWER INTEGRITY TEST  
REPORT**

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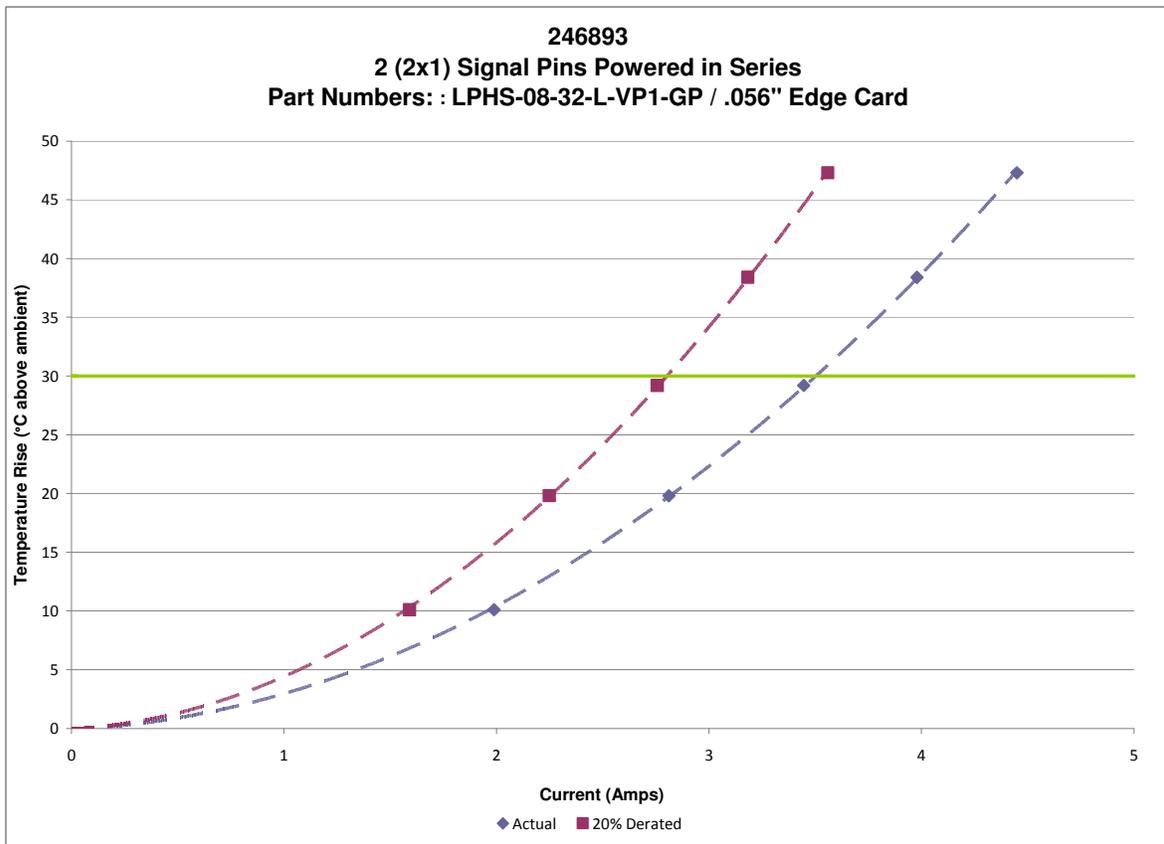
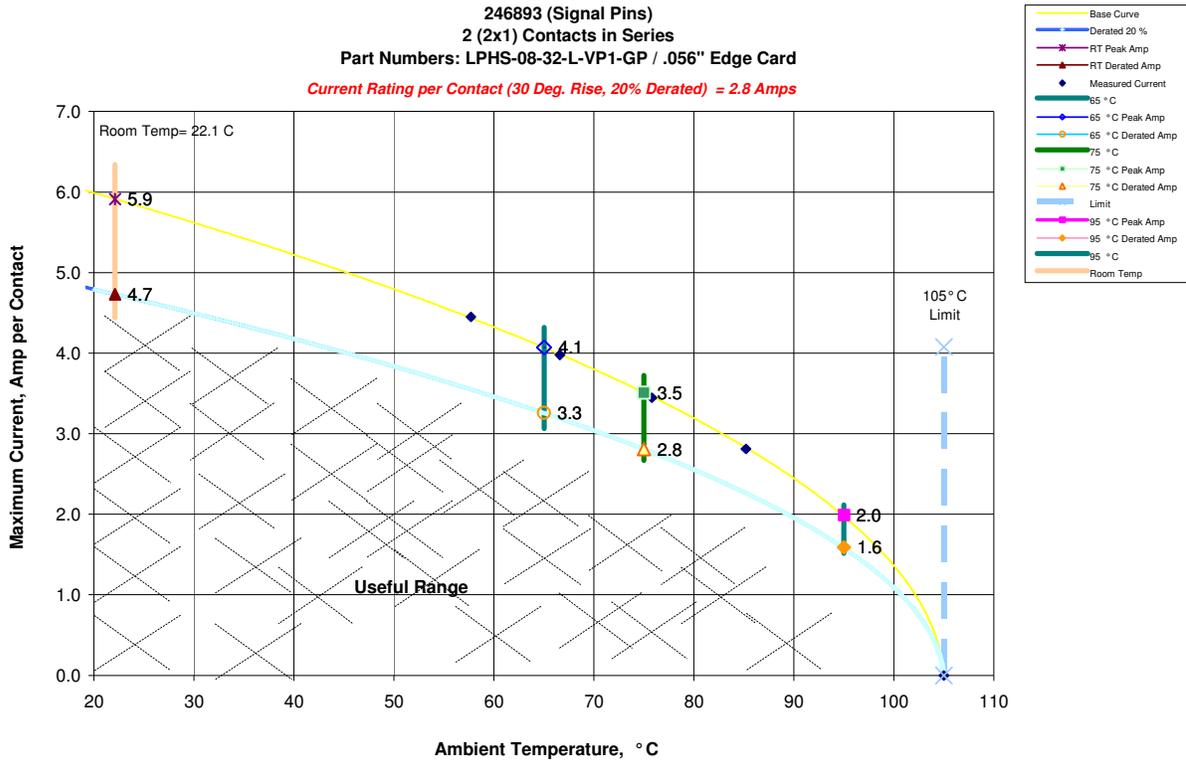
**TEMPERATURE RISE DATA  
EIGHT CONTACTS ENERGIZED  
(Degrees Celsius above ambient)**

TEST CURRENT AMPS	17.23	24.35	29.84	34.46	38.55
Sample 10	13.3	25.9	38.4	50.9	63.3
Sample 11	12.6	24.4	36.2	47.7	58.8
Sample 12	13.3	24.9	36.3	47.6	57.6
Min	12.6	24.4	36.2	47.6	57.6
Max	13.3	25.9	38.4	50.9	63.3
Avg	13.07	25.07	36.97	48.73	59.9

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

✦	✦	✦	✦
✦	✦	✦	✦





# POWER INTEGRITY TEST REPORT

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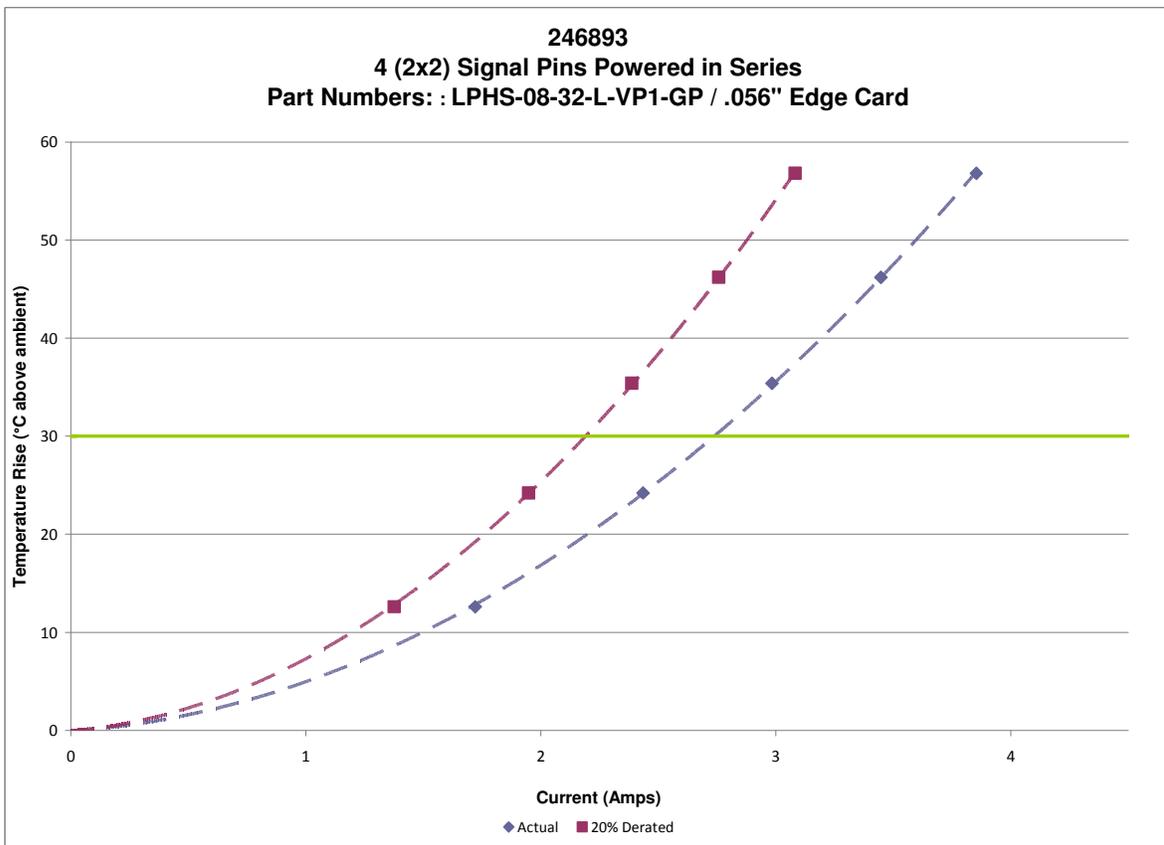
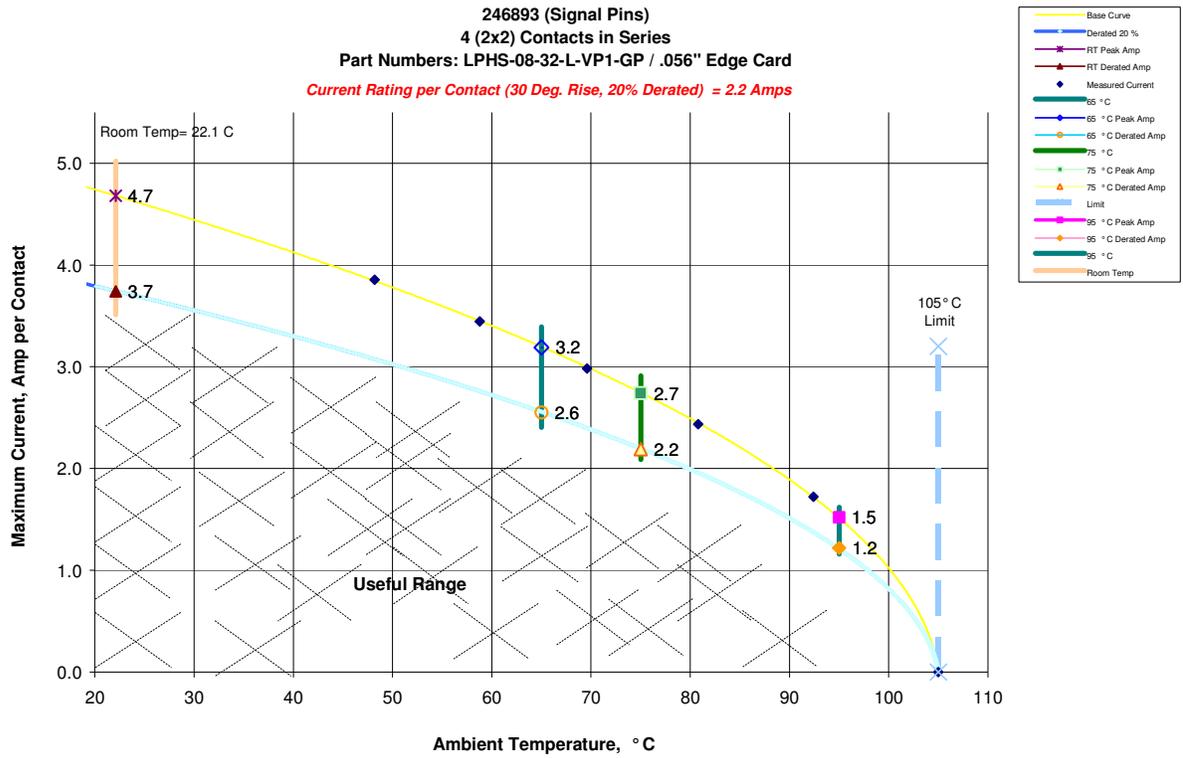
## TEMPERATURE RISE DATA ALL CONTACTS ENERGIZED (Degrees Celsius above ambient)

TEST CURRENT AMPS	1.99	2.81	3.45	3.98	4.45
Sample 13	10.4	20.3	30	39.5	48.8
Sample 14	10.1	19.8	29.2	38.2	46.8
Sample 15	9.9	19.4	28.5	37.4	46.2
Min	9.9	19.4	28.5	37.4	46.2
Max	10.4	20.3	30	39.5	48.8
Avg	10.13	19.83	29.23	38.37	47.27

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

✦			
✦			





# POWER INTEGRITY TEST REPORT

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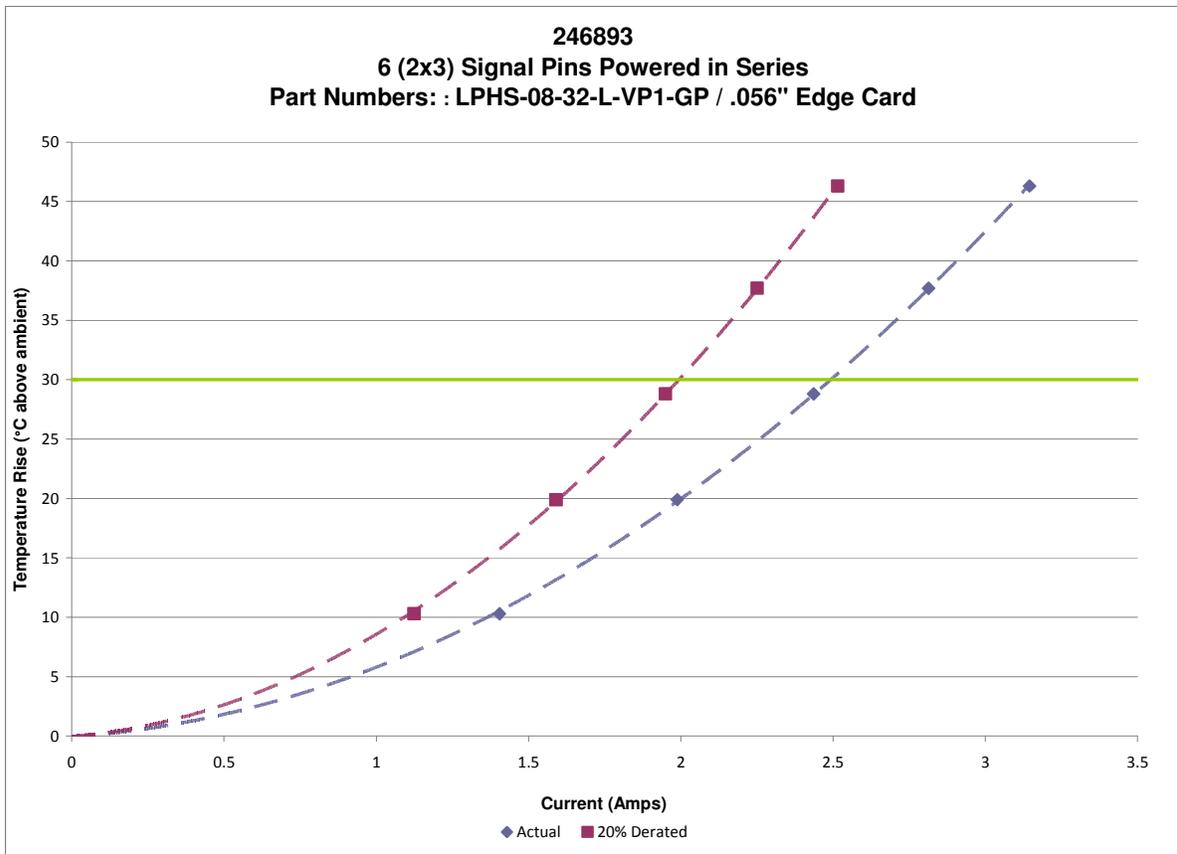
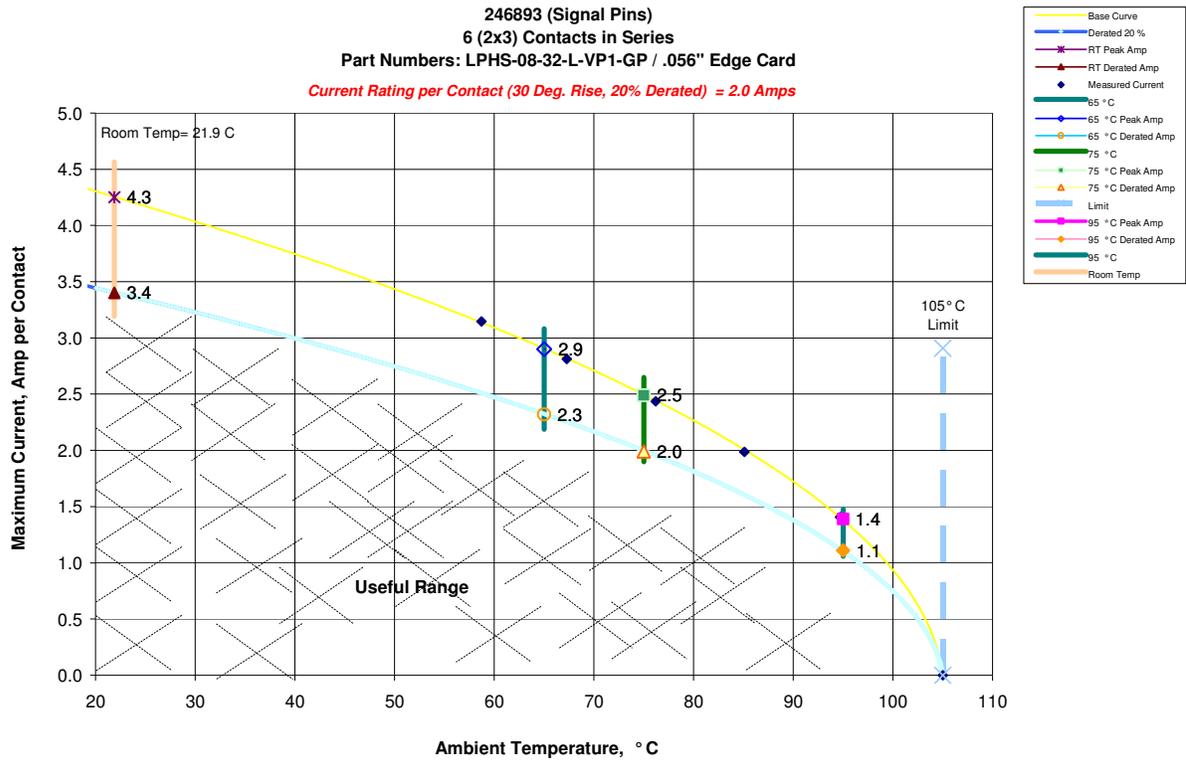
## TEMPERATURE RISE DATA ALL CONTACTS ENERGIZED (Degrees Celsius above ambient)

TEST CURRENT AMPS	1.72	2.43	2.98	3.45	3.85
Sample 16	12.9	24.8	36.3	47.2	57.8
Sample 17	12.1	23.4	34.2	44.7	55.1
Sample 18	12.8	24.5	35.8	46.7	57.5
Min	12.1	23.4	34.2	44.7	55.1
Max	12.9	24.8	36.3	47.2	57.8
Avg	12.6	24.23	35.43	46.2	56.8

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

✦	✦		
✦	✦		





# POWER INTEGRITY TEST REPORT

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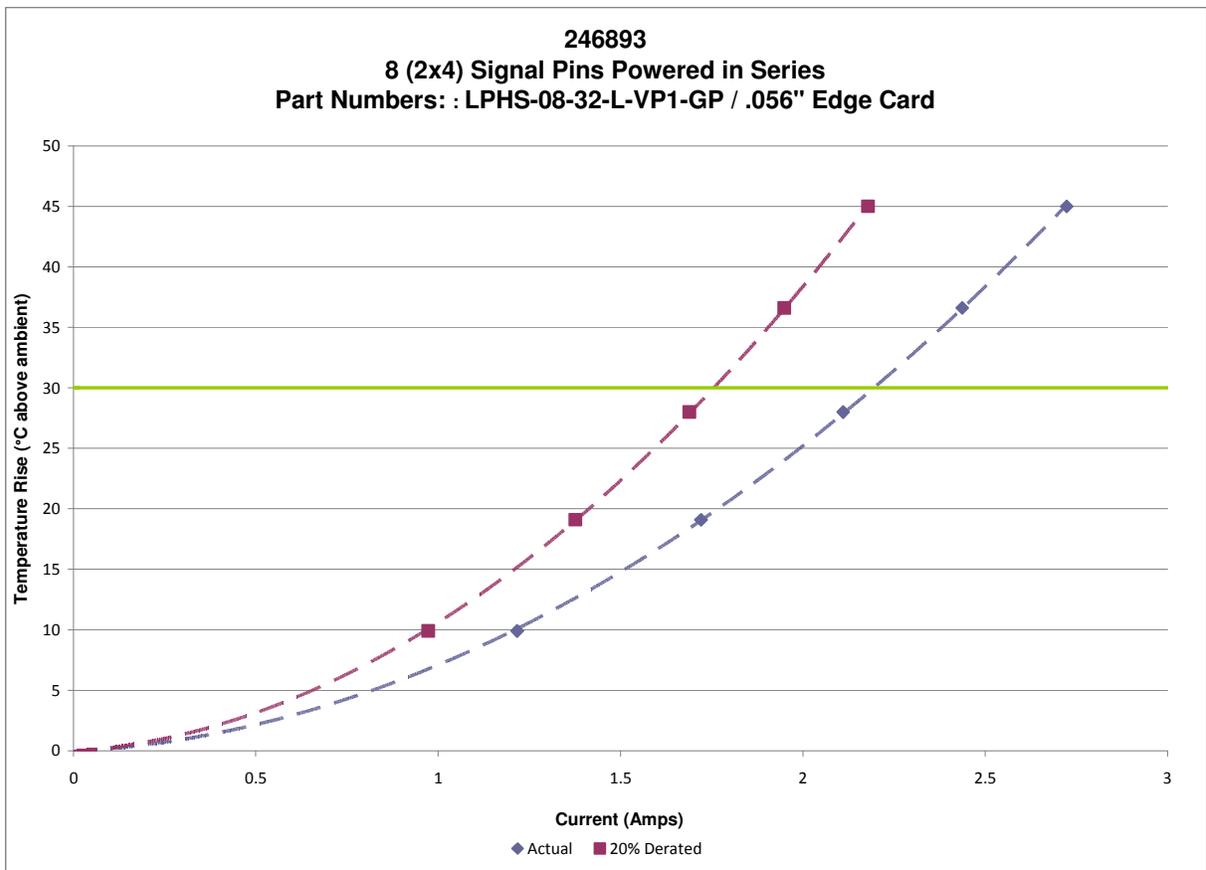
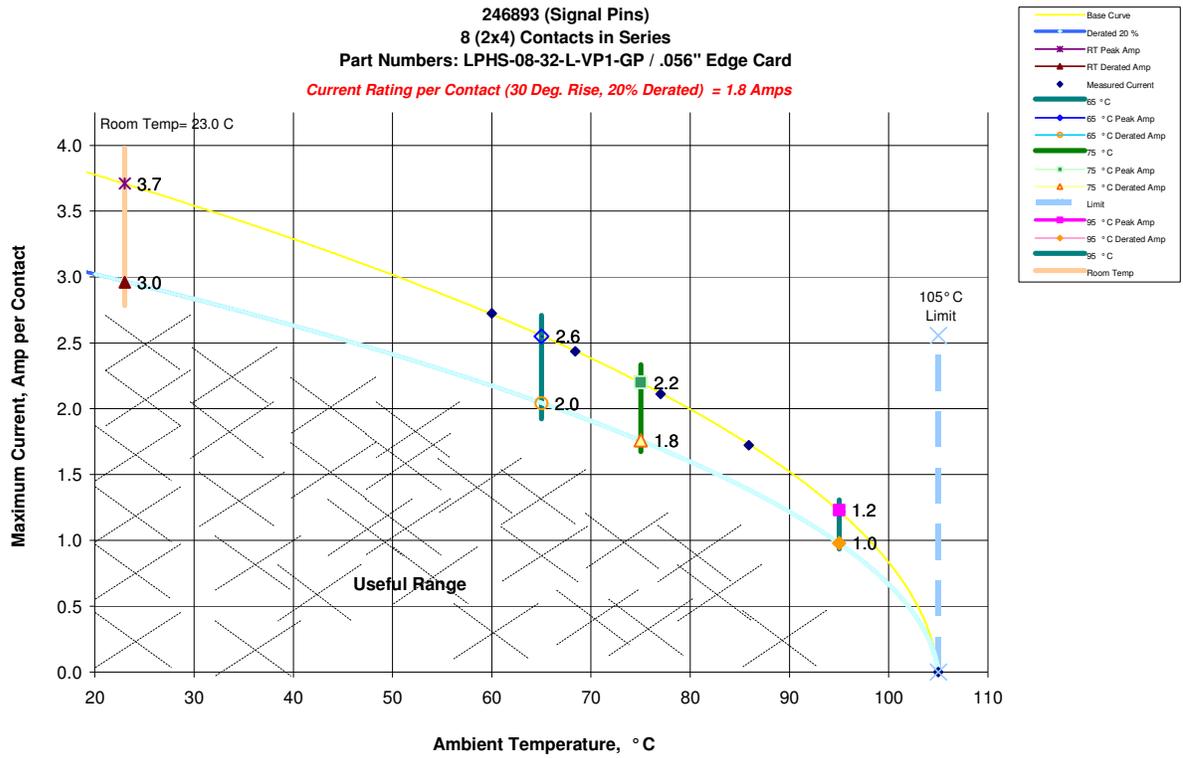
## TEMPERATURE RISE DATA ALL CONTACTS ENERGIZED (Degrees Celsius above ambient)

TEST CURRENT AMPS	1.41	1.99	2.44	2.81	3.15
Sample 19	10.5	20.1	29.3	38.4	47.1
Sample 20	10.6	20.5	30	39.3	48.5
Sample 21	9.8	19	27.2	35.5	43.4
Min	9.8	19	27.2	35.5	43.4
Max	10.6	20.5	30	39.3	48.5
Avg	10.3	19.87	28.83	37.73	46.33

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

✦	✦	✦	
✦	✦	✦	





# POWER INTEGRITY TEST REPORT

**246893**  
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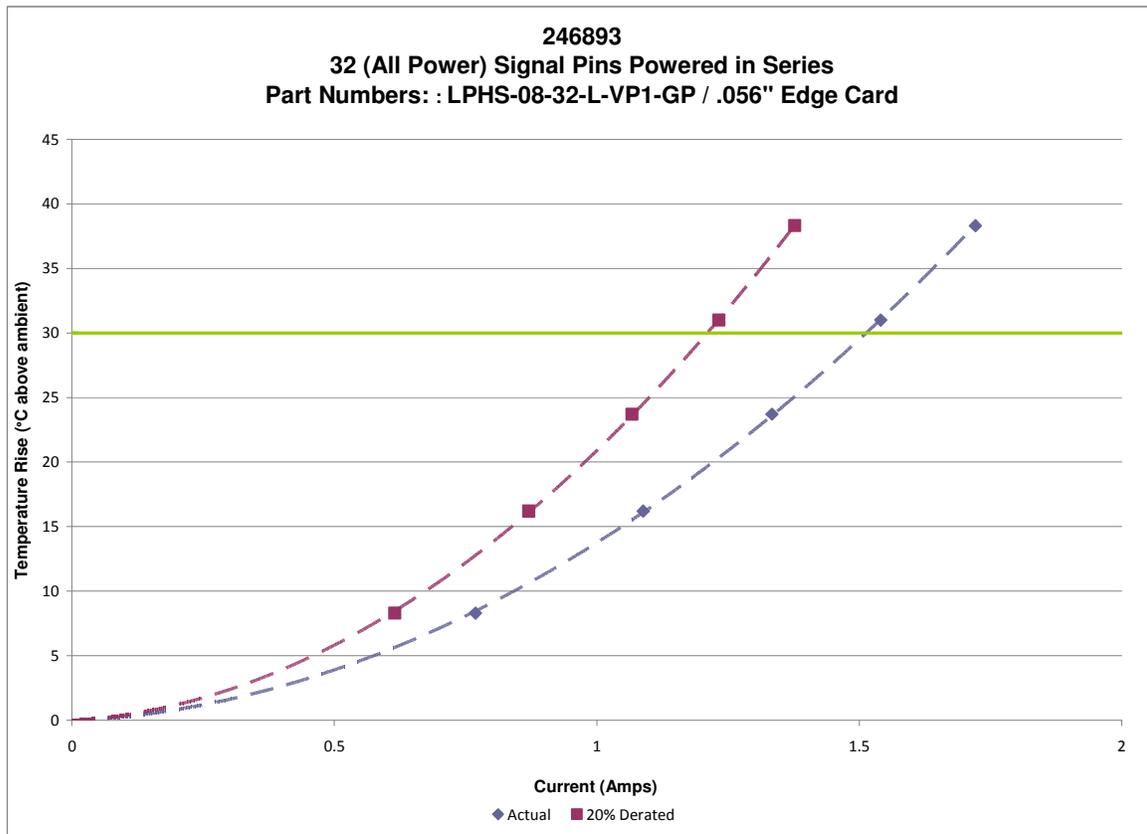
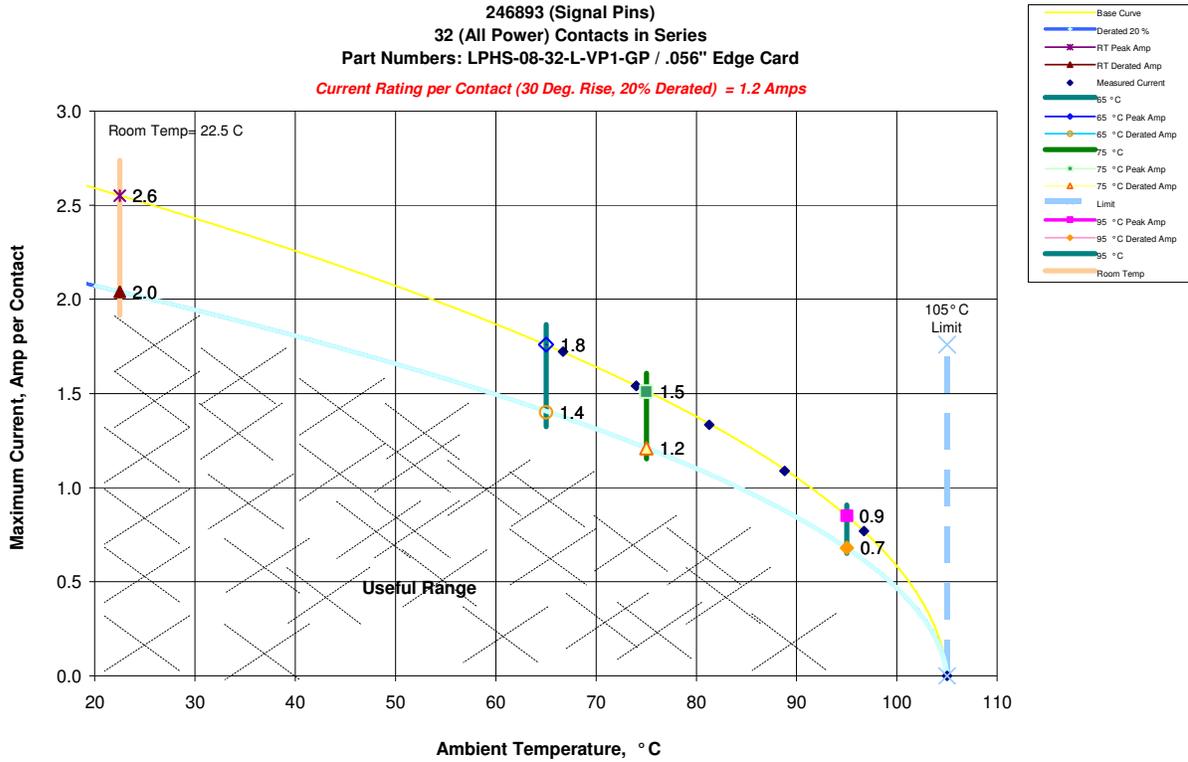
## TEMPERATURE RISE DATA ALL CONTACTS ENERGIZED (Degrees Celsius above ambient)

TEST CURRENT AMPS	1.22	1.72	2.11	2.44	2.72
Sample 22	9.8	18.9	27.8	36.4	44.7
Sample 23	10.3	19.6	28.7	37.4	45.7
Sample 24	9.7	18.7	27.7	36.4	44.7
Min	9.7	18.7	27.7	36.4	44.7
Max	10.3	19.6	28.7	37.4	45.7
Avg	9.93	19.07	28.07	36.73	45.03

✦ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

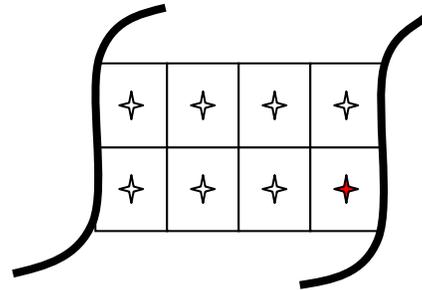
✦	✦	✦	✦
✦	✦	✦	✦

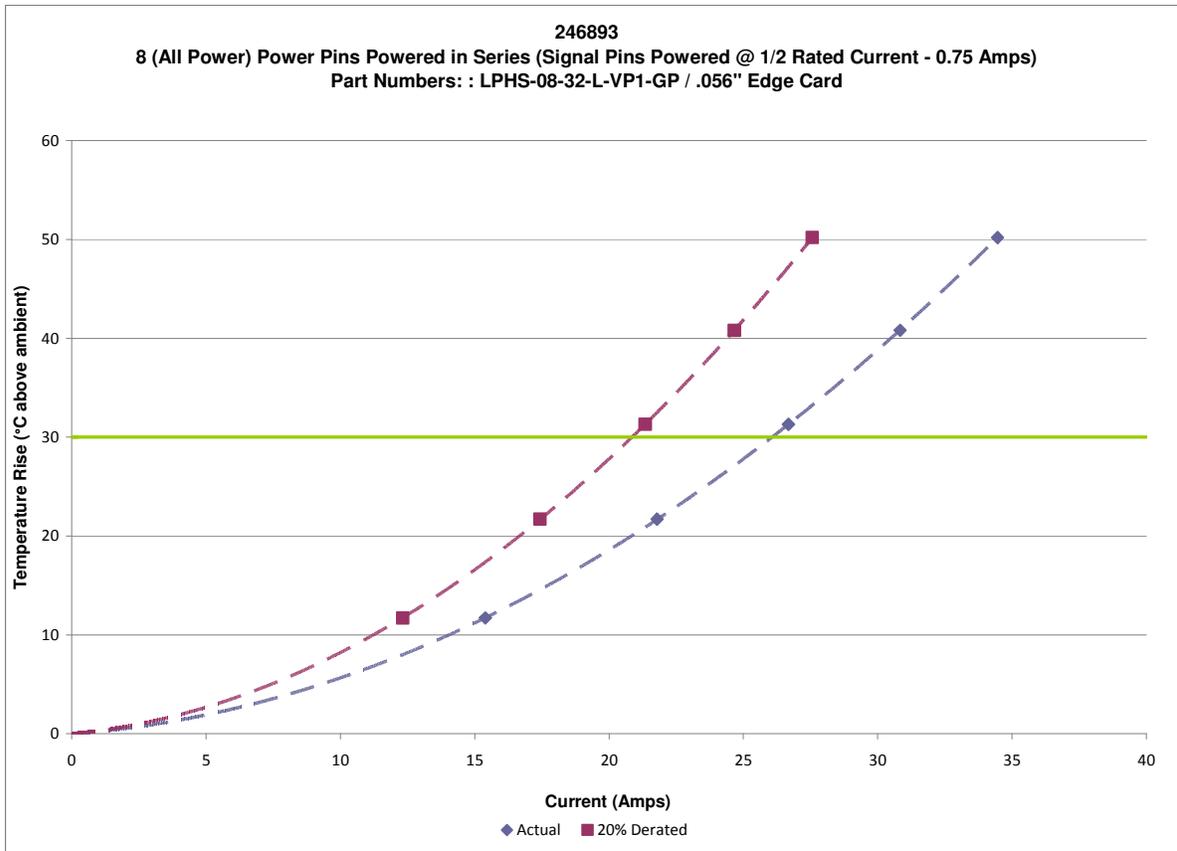
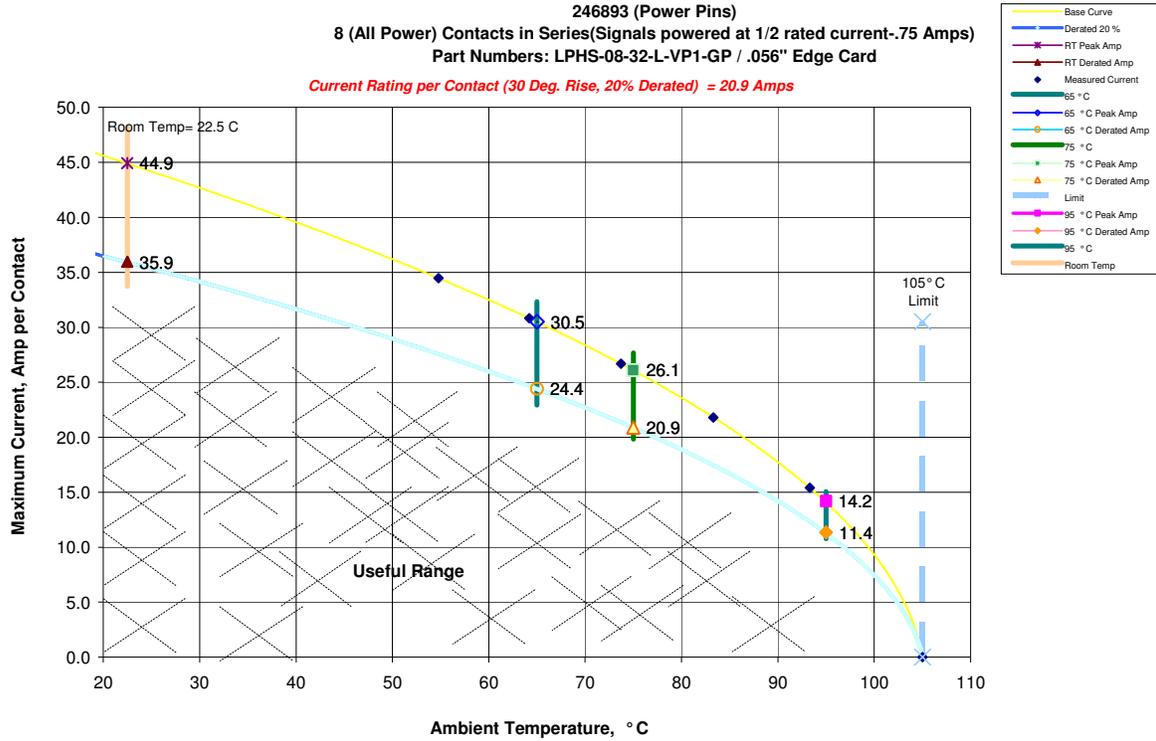


**TEMPERATURE RISE DATA  
ALL CONTACTS ENERGIZED  
(Degrees Celsius above ambient)**

TEST CURRENT AMPS	0.77	1.09	1.33	1.54	1.72
Sample 25	8	15.9	23.4	30.7	38
Sample 26	8.6	16.6	24.2	31.6	39
Sample 27	8.4	16.1	23.5	30.8	37.8
Min	8	15.9	23.4	30.7	37.8
Max	8.6	16.6	24.2	31.6	39
Avg	8.33	16.2	23.7	31.03	38.27

- ✦ Indicates energized contacts
- ✦ Indicates thermocouple monitored, energized contacts

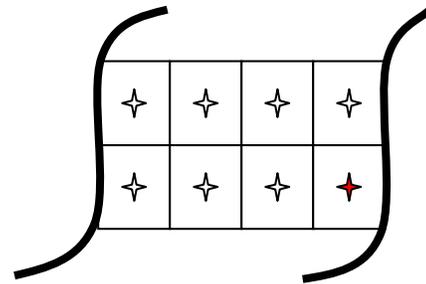


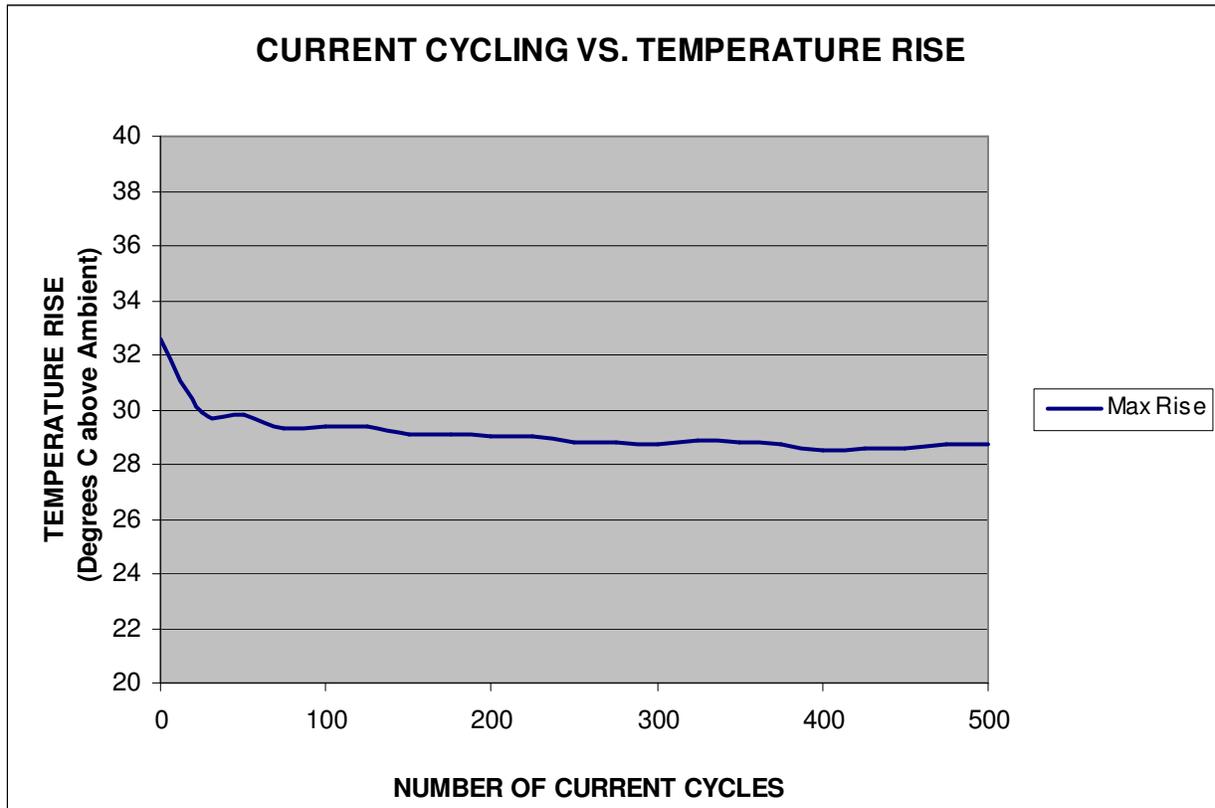


**TEMPERATURE RISE DATA  
ALL CONTACTS ENERGIZED  
(Degrees Celsius above ambient)**

TEST CURRENT AMPS	15.4	21.79	26.68	30.83	34.46
Sample 28	11.8	21.7	31.2	40.9	50.7
Sample 29	11.3	20.9	30.4	39.6	49
Sample 30	12.1	22.5	32.3	42	51
Min	11.3	20.9	30.4	39.6	49
Max	12.1	22.5	32.3	42	51
Avg	11.73	21.7	31.3	40.83	50.23

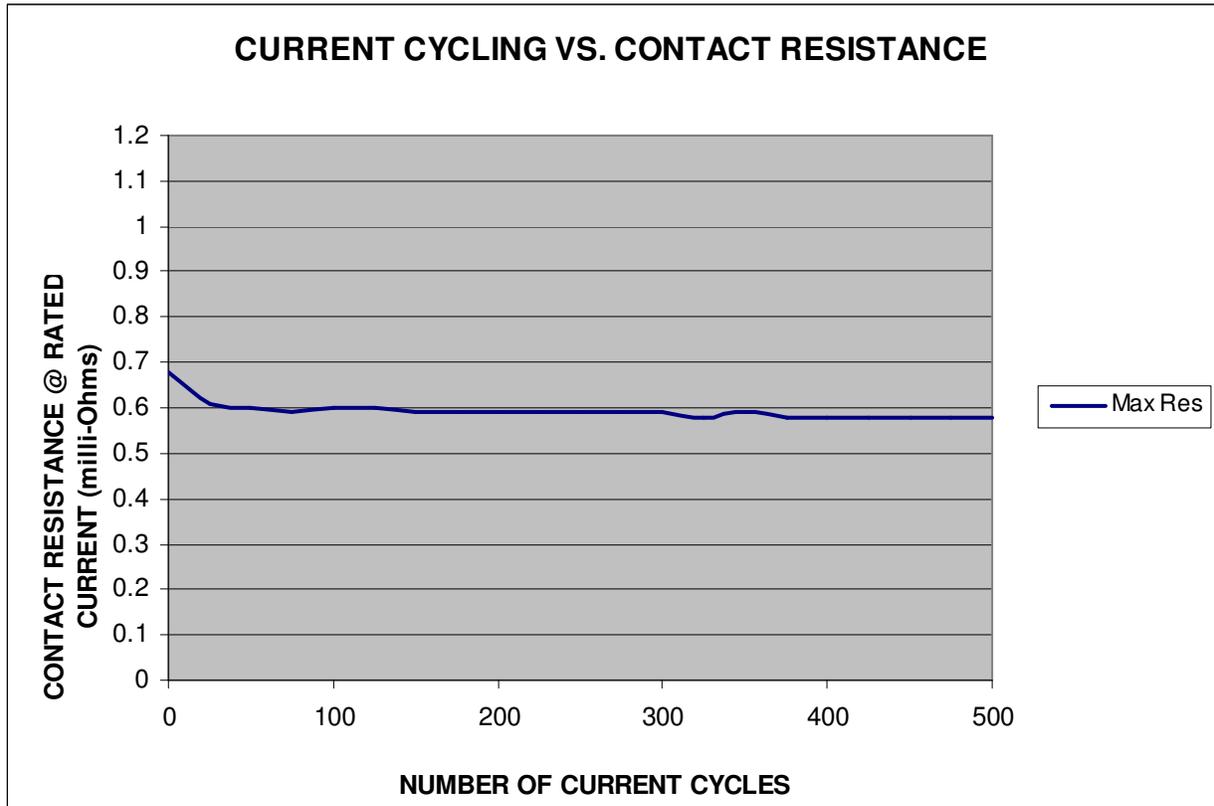
- ✦ Indicates energized contacts
- ✦ Indicates thermocouple monitored, energized contacts



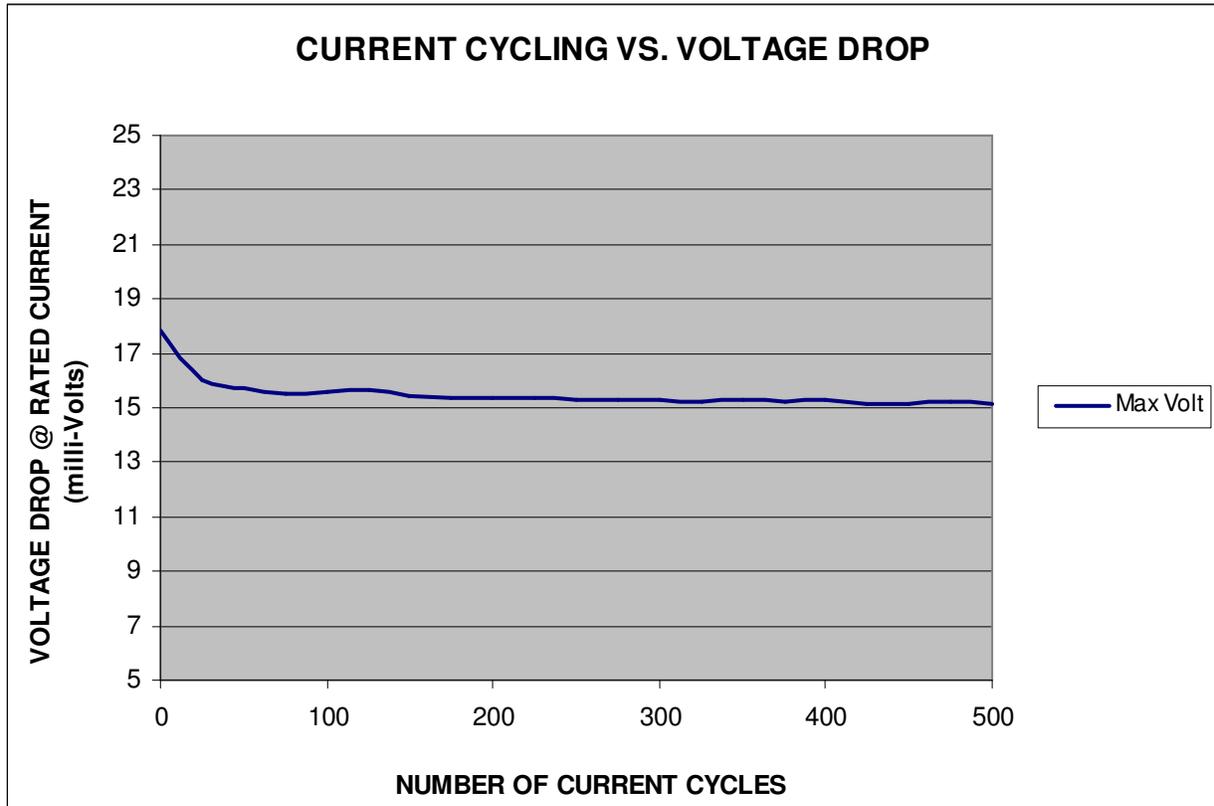


**TEMPERATURE RISE DATA  
ALL CONTACTS ENERGIZED  
(Degrees Celsius above ambient)**

	<b>INITIAL</b>	<b>50 CYCLES</b>	<b>100 CYCLES</b>	<b>200 CYCLES</b>	<b>500 CYCLES</b>
<b>Min</b>	28.5	27.1	26.7	26.8	26.6
<b>Max</b>	32.6	29.8	29.4	29	28.7
<b>Avg</b>	29.8	28.1	27.8	27.6	27.3



<b>CONTACT RESISTANCE DATA ALL CONTACTS ENERGIZED (mΩ)</b>					
	<b>INITIAL</b>	<b>50 CYCLES</b>	<b>100 CYCLES</b>	<b>200 CYCLES</b>	<b>500 CYCLES</b>
<b>Min</b>	0.39	0.37	0.37	0.37	0.36
<b>Max</b>	0.68	0.6	0.6	0.59	0.58
<b>Avg</b>	0.49	0.45	0.45	0.44	0.44



**VOLTAGE DROP DATA  
ALL CONTACTS ENERGIZED  
(MV)**

	INITIAL	50 CYCLES	100 CYCLES	200 CYCLES	500 CYCLES
<b>Min</b>	10.23	9.74	9.62	9.58	9.39
<b>Max</b>	17.87	15.74	15.6	15.34	15.18
<b>Avg</b>	12.7	11.85	11.7	11.57	11.41



**POWER INTEGRITY TEST  
REPORT**

**246893**

**INITIAL RELEASE**

**EQUIPMENT AND CALIBRATION SCHEDULES**

**Equipment #:** MO-04

**Description:** Multimeter /Data Acquisition System

**Manufacturer:** Keithley

**Model:** 2700

**Serial #:** 0798688

**Accuracy:** See Manual

... Last Cal: 04/30/2013, Next Cal: 04/30/2014

**Equipment #:** PS-07

**Description:** 20 V, 120 A DC Power Supply - AutoRanging SO/HPIB

**Manufacturer:** Hewlett Packard / Agilent

**Model:** AT-6031A

**Serial #:** 2721A00648

**Accuracy:** See Manual

... Last Cal: Reference Only, Next Cal: Reference Only

**Equipment #:** MO-09

**Description:** Model 2750 Multimeter/Switch System

**Manufacturer:** Keithley

**Model:** 2750

**Serial #:** WDC-874817

**Accuracy:** See Manual

... Last Cal: 10/20/2012, Next Cal: 10/20/2013

**Equipment #:** PS-09

**Description:** 60 V, 50 A DC Power Supply - AutoRanging SO

**Manufacturer:** Hewlett Packard / Agilent

**Model:** AT-6032A

**Serial #:** US38322853

**Accuracy:** See Manual

... Last Cal: Reference Only, Next Cal: Reference Only