Project Number: Design Qualification Test Report	Tracking Code: CR-1067801_Report_Rev_1
Requested by: Emmanuel Davis	Date: 8/13/2024
Part #: ADM6-100-03.5-S-4-2-A/ADF6-100-03.5-S-4-2-A	
Part description: ADM6 / ADF6	Tech: Richard Ison
Test Start: 3/15/2024	Test Completed: 5/6/2024

DESIGN QUALIFICATION TEST REPORT

ADM6 / ADF6
ADM6-100-03.5-S-4-2-A/ADF6-100-03.5-S-4-2-A

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
7/4/2024	**1**	**Initial test**	**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) 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-113827-TST

FLOWCHARTS

Mating/Unmating/Durability

Group 1
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating/Unmating Force (2)
3.	Cycles Quantity = 25 Cycles
4.	Mating/Unmating Force (2)
5.	Contact Gaps
6.	Thermal Shock (3)
7.	Humidity (1)
8.	Mating/Unmating Force (2)

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

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

FLOWCHARTS Continued

Current Carrying Capacity

Group 1
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
4 Pins Powered
Signal

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

Group 2
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
8 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 4 Number of Positions = 2

Group 3
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
12 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 4 Number of Positions = 3

Group 4
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
16 Pins Powered
Signal

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

Group 5
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
400 Pins Powered
Signal

Step	Description
1.	CCC (1) Rows = 4 Number of Positions = 100

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

FLOWCHARTS Continued

Mechanical Shock/Random Vibration/LLCR

Group 1
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
8 Assemblies

Step	Description
1.	LLCR (1)
2.	Mechanical Shock (2)
3.	Random Vibration (3)
4.	LLCR (1) Max Delta = 15 mOhm

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

(2) Mechanical Shock = EIA-364-27
Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(3) Random Vibration = EIA-364-28
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

Mechanical Shock/Random Vibration/Event Detection

Group 1
ADM6-100-03.5-S-4-2-A
ADF6-100-03.5-S-4-2-A
60 Points

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (1)
2.	Nanosecond Event Detection (Random Vibration) (2)

(1) Nanosecond Event Detection (Mechanical Shock)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-27 for Mechanical Shock:
Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(2) Nanosecond Event Detection (Random Vibration)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-28 for Random Vibration:
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

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

HUMIDITY:

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

MECHANICAL SHOCK (Specified Pulse):

1) Reference document: EIA-364-27, *Mechanical Shock Test Procedure for Electrical Connectors*
2) Test Condition G
3) Peak Value: 100 G
4) Duration: 6 Milliseconds
5) Wave Form: Sawtooth
6) Velocity: 12.3 ft/s
7) Number of Shocks: 3 Shocks / Direction, 3 Axis (18 Total)

VIBRATION:

1) Reference document: EIA-364-28, *Vibration Test Procedure for Electrical Connectors*
2) Test Condition V, Letter B
3) Power Spectral Density: 0.10 G^2 / Hz
4) G 'RMS': 7.56
5) Frequency: 50 to 2000 Hz
6) Duration: 2.0 Hours per axis (3 axis total)

NANOSECOND-EVENT DETECTION:

1) Reference document: EIA-364-87, *Nanosecond-Event Detection for Electrical Connectors*
2) Prior to test, the samples were characterized to assure the low nanosecond event being monitored will trigger the detector.
3) After characterization it was determined the test samples could be monitored for 50 nanosecond events

MATING/UNMATING:

1) Reference document: EIA-364-13, *Mating and Unmating Forces Test Procedure for Electrical Connectors*.
2) The full insertion position was to within 0.003" to 0.004" of the plug bottoming out in the receptacle to prevent damage to the system under test.
3) One of the mating parts is secured to a floating X-Y table to prevent damage during cycling.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

TEMPERATURE RISE (Current Carrying Capacity, CCC):

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

RESULTS

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise----------1.16A per contact with 4 contact (4 x 1) powered**
- **CCC for a 30°C Temperature Rise----------0.87 A per contact with 8 contacts (4 x 2) powered**
- **CCC for a 30°C Temperature Rise----------0.73 A per contact with 12 contacts (4 x 3) powered**
- **CCC for a 30°C Temperature Rise----------0.65 A per contact with 16 contacts (4 x 4) powered**
- **CCC for a 30°C Temperature Rise----------0.25 A per contact with All contacts (4x100) powered**

Mating/Unmating Durability Force

- **Initial**
  - **Mating**
    - **Min ----------19.25 lbs**
    - **Max----------21.12 lbs**
  - **Unmating**
    - **Min ----------10.06 lbs**
    - **Max----------11.00 lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------22.29 lbs**
    - **Max----------25.64 lbs**
  - **Unmating**
    - **Min ----------10.64 lbs**
    - **Max----------11.17 lbs**
- **After Humidity**
  - **Mating**
    - **Min ----------12.93 lbs**
    - **Max----------15.31 lbs**
  - **Unmating**
    - **Min ---------- 8.75 lbs**
    - **Max---------- 9.83 lbs**

RESULTS Continued

LLCR Shock & Vibration (192 LLCR test points)

- **Initial ---------- 34.75 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms----------192 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**

Mechanical Shock & Random Vibration:

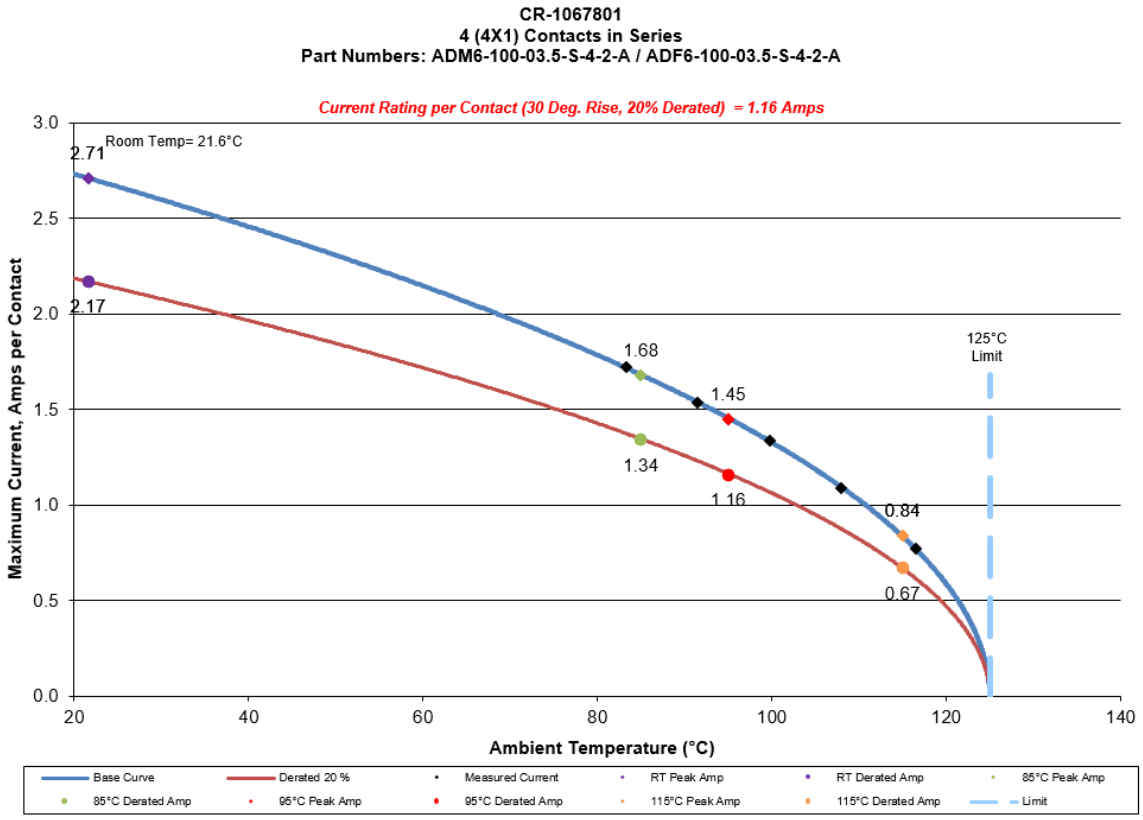
- **Shock**
  - **No Damage---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**
- **Vibration**
  - **No Damage---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**

DATA SUMMARIES

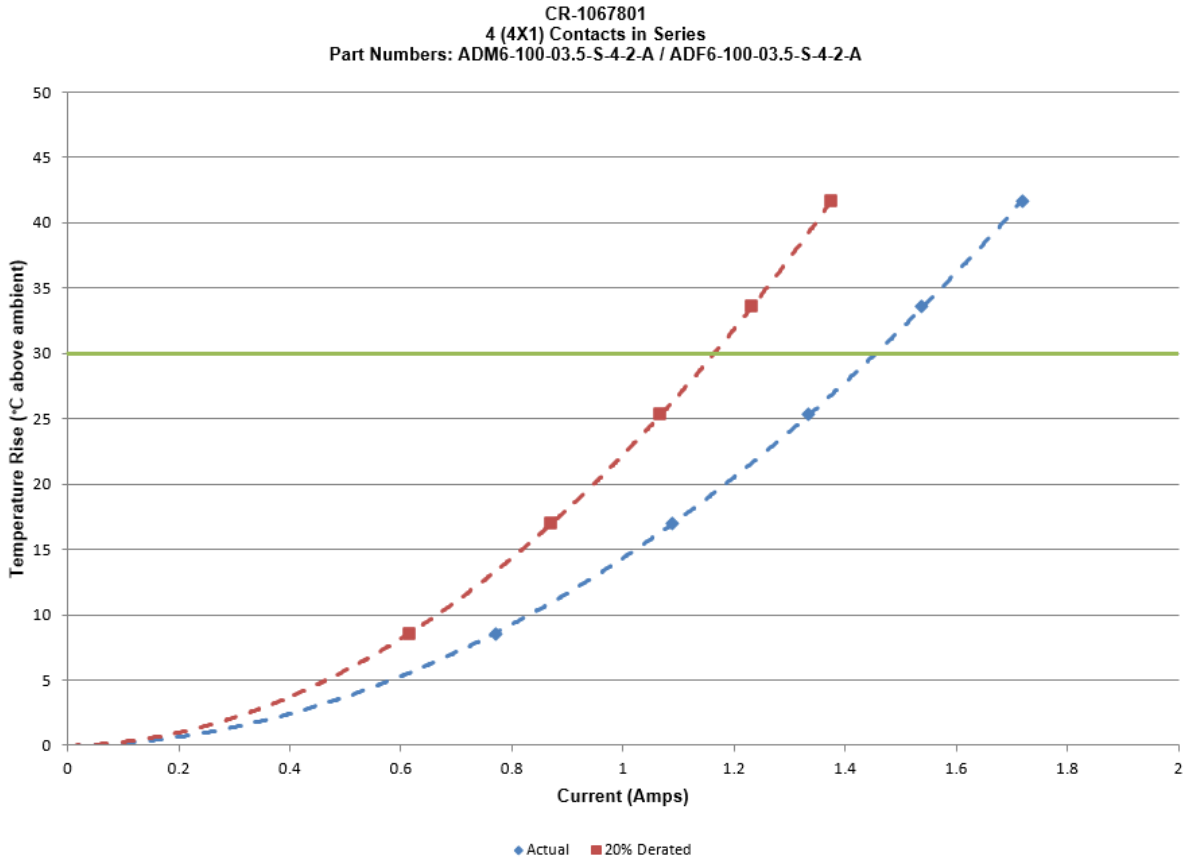
TEMPERATURE RISE (Current Carrying Capacity, CCC):

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

    a. Linear configuration with 4 adjacent conductors/contacts powered

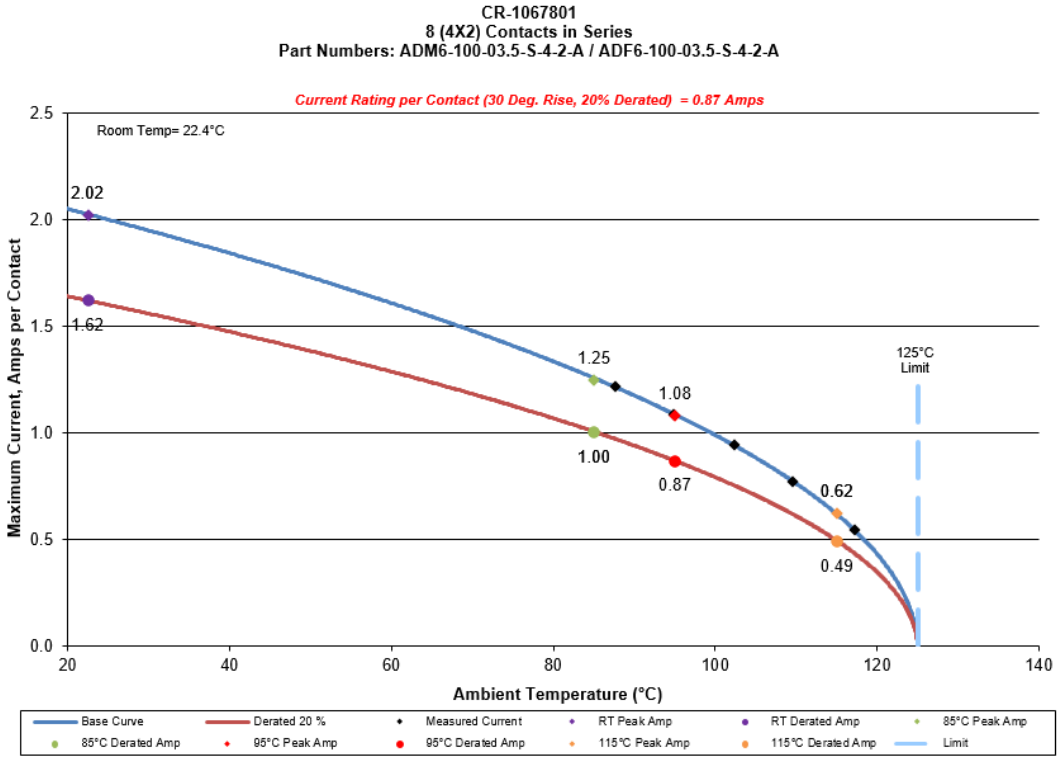


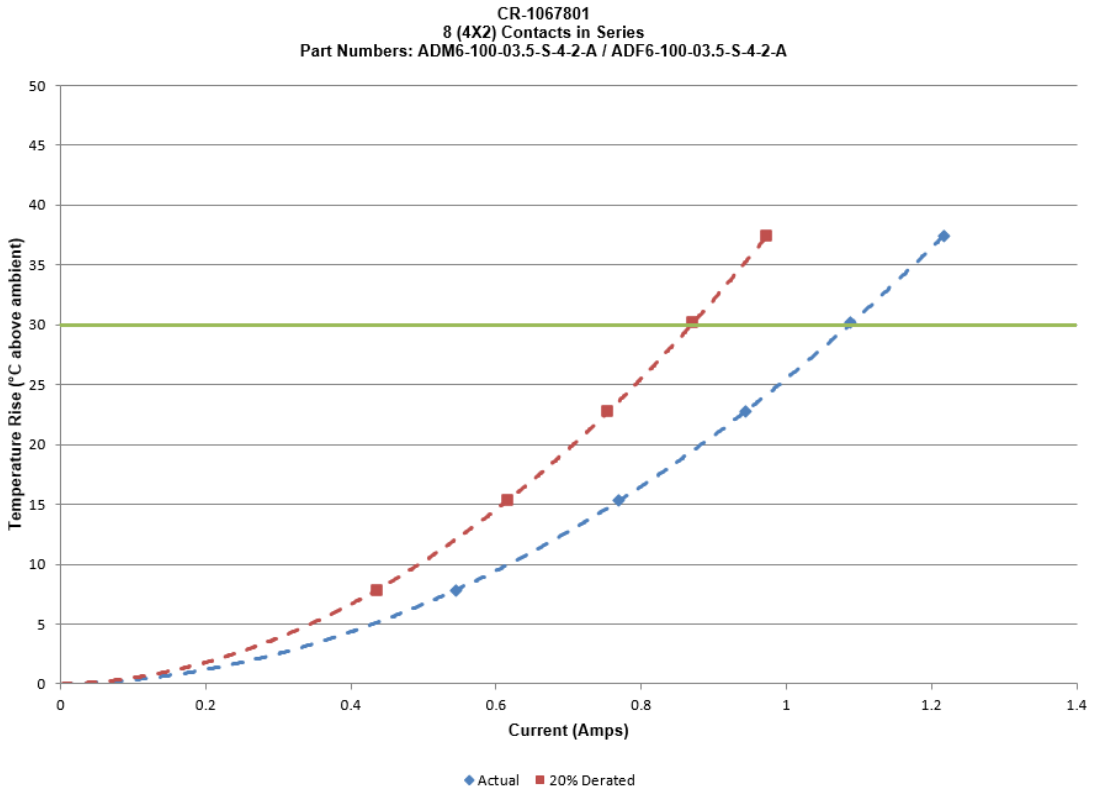
DATA SUMMARIES Continued



DATA SUMMARIES Continued

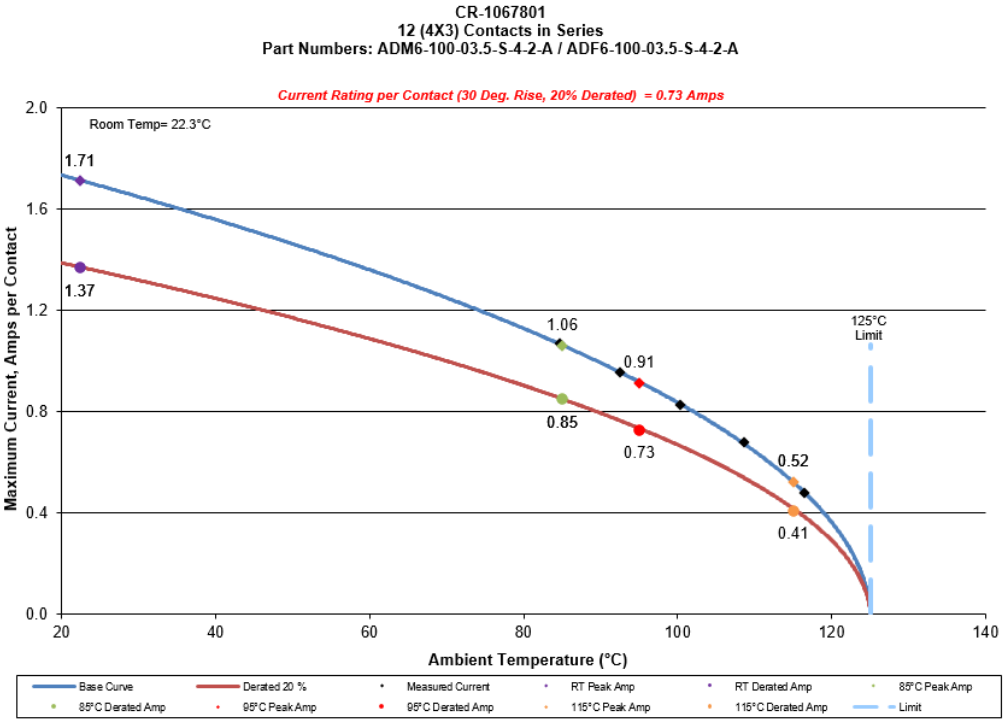
b. Linear configuration with 8 adjacent conductors/contacts powered

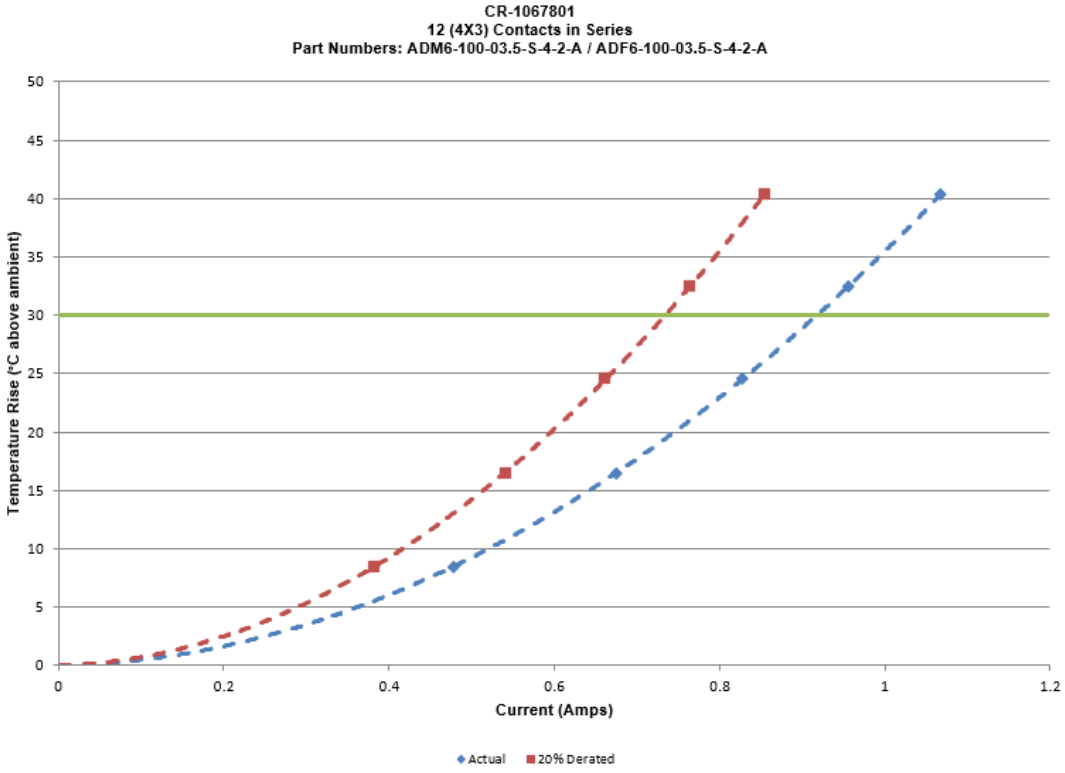




DATA SUMMARIES Continued

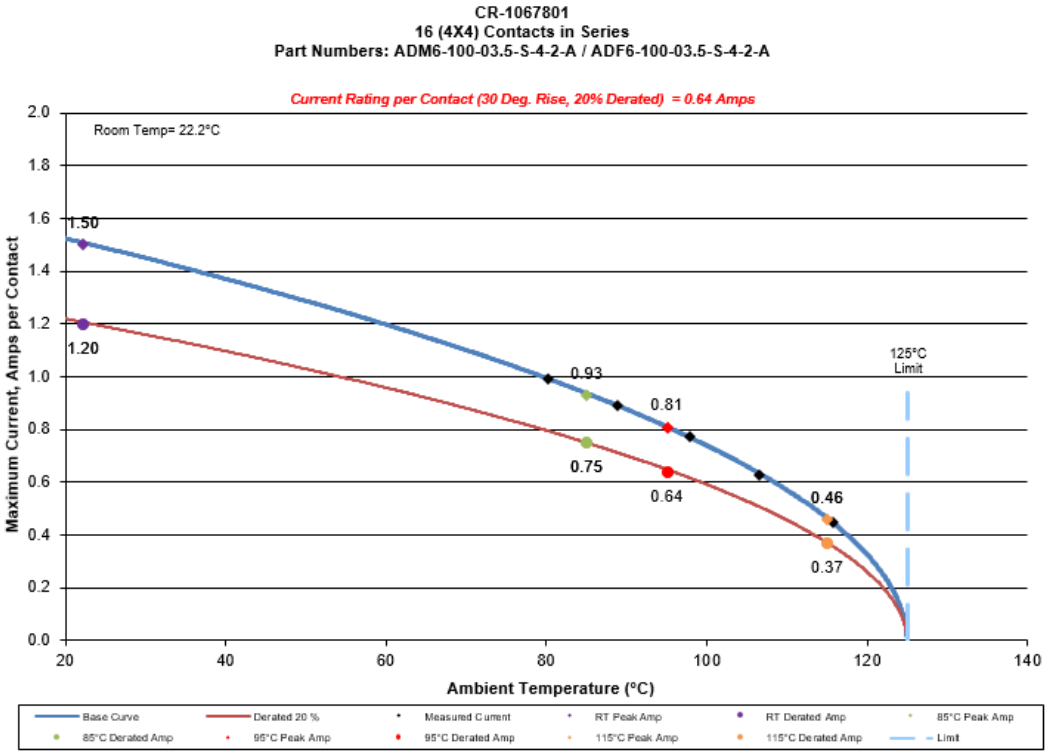
c. Linear configuration with 12 adjacent conductors/contacts powered

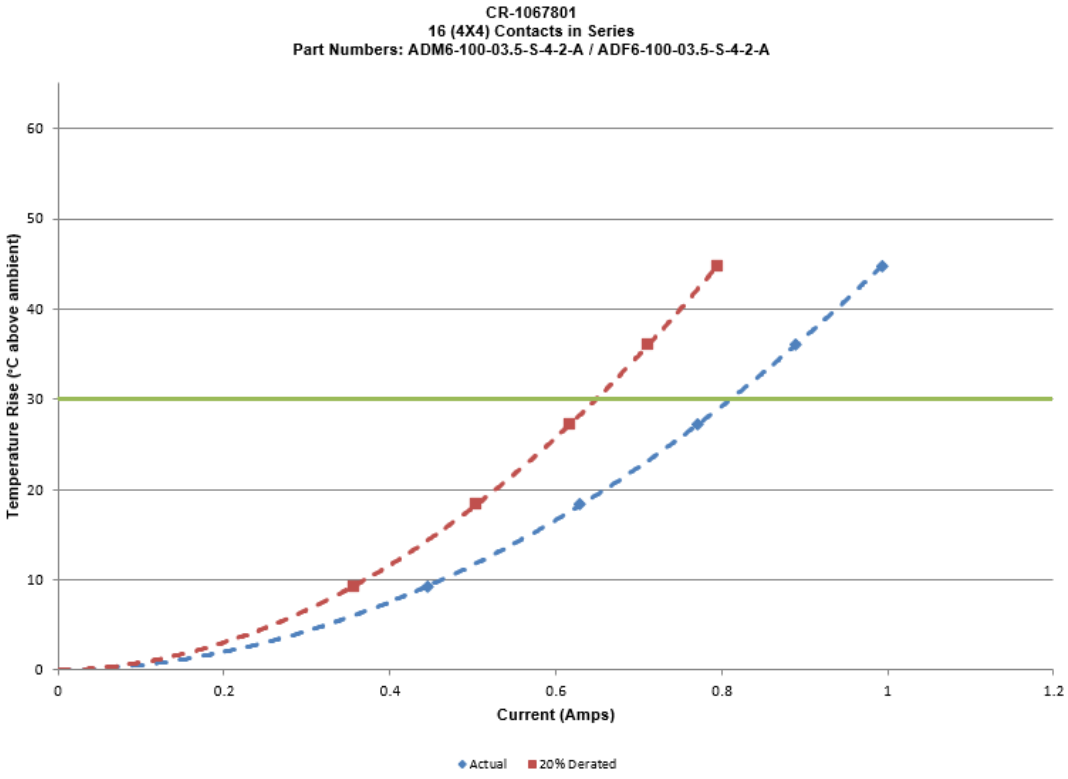




DATA SUMMARIES Continued

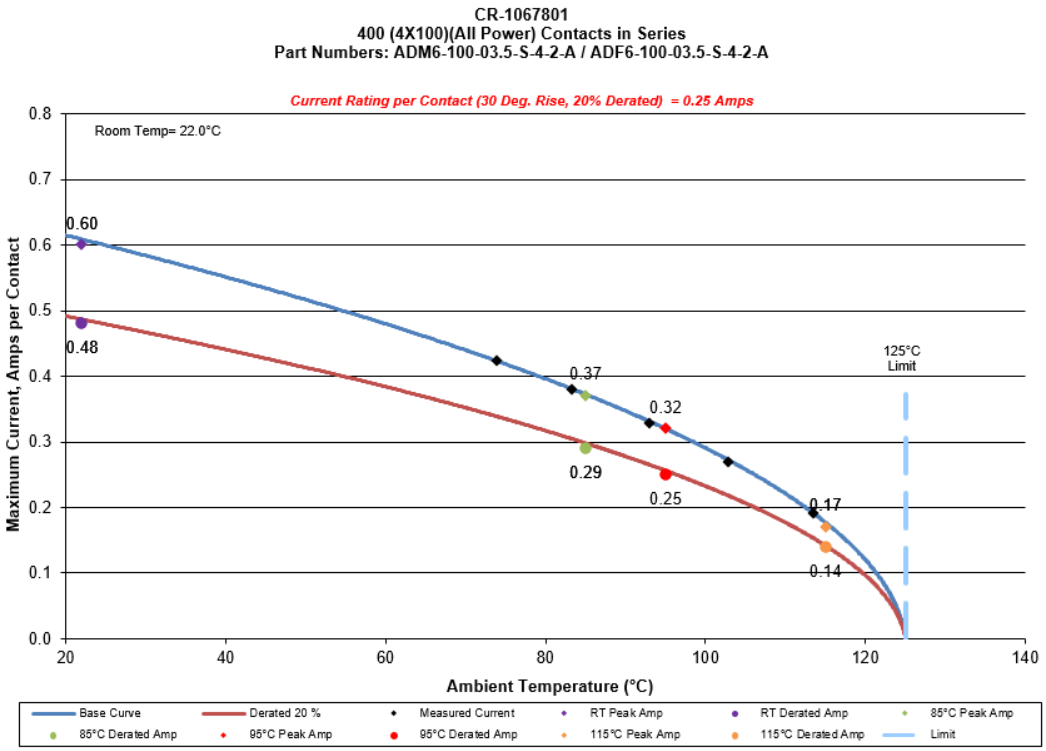
d. Linear configuration with 16 adjacent conductors/contacts powered

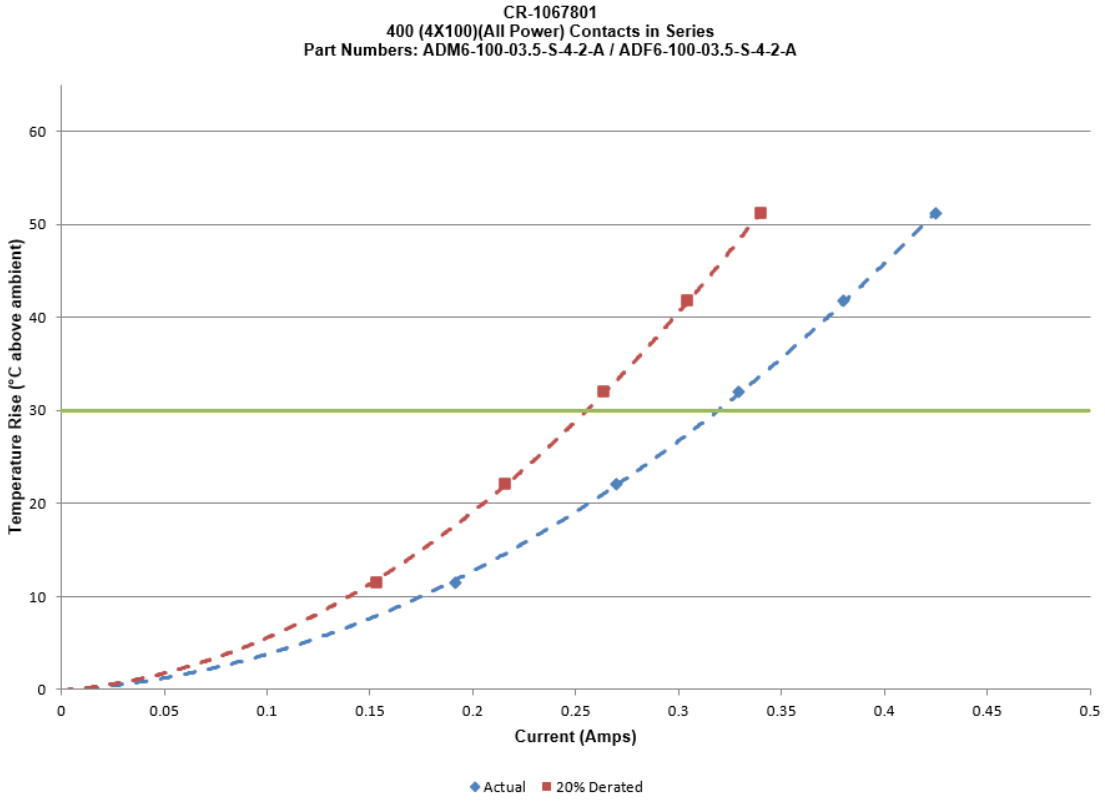




DATA SUMMARIES Continued

e. Linear configuration with All adjacent conductors/contacts powered





DATA SUMMARIES Continued

MATING/UNMATING:

Mating/Unmating Durability Group

	Initial				25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	85.64	19.25	44.75	10.06	99.15	22.29	47.33	10.64
Maximum	93.94	21.12	48.93	11.00	114.05	25.64	49.68	11.17
Average	89.23	**20.06**	46.65	**10.49**	107.98	**24.28**	48.47	**10.90**
St Dev	2.92	0.66	1.50	0.34	5.07	1.14	0.81	0.18
Count	8	8	8	8	8	8	8	8

	After Humidity			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	57.51	12.93	38.92	8.75
Maximum	68.10	15.31	43.72	9.83
Average	63.41	**14.26**	40.80	**9.17**
St Dev	3.54	0.79	1.58	0.35
Count	8	8	8	8

DATA SUMMARIES Continued

LLCR Shock &Vibration:

1). A total of 192 points were measured.
2). EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3). The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms: ----------Stable
   b. +5.1 to +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	3/18/2024	3/19/2024		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	22	21		
Technician	Daniel Haydon	Daniel Haydon		
mOhm values	Actual	**Delta**		
	Initial	**Shock-Vib**		
	Pin Type: Signal 1			
Average	26.19	0.88		
St. Dev.	1.4	0.86		
Min	24.39	0		
Max	34.75	4.46		
Summary Count	192	192		
Total Count	192	192		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock-Vib	**192**	**0**	**0**	**0**	**0**	**0**

Nanosecond Event Detection:

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

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2024, Next Cal: 05/29/2025

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2023, Next Cal: 09/11/2024

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: 06/30/2024, Next Cal: 06/30/2025

Equipment #: THC-05
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 05 23 00 02
Accuracy: See Manual
… Last Cal: 11/14/2023, Next Cal: 05/31/2024

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 11/31/2023, Next Cal: 11/31/2024
Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/09/2023, Next Cal: 07/09/2024

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 06/04/2023, Next Cal: 06/04/2024