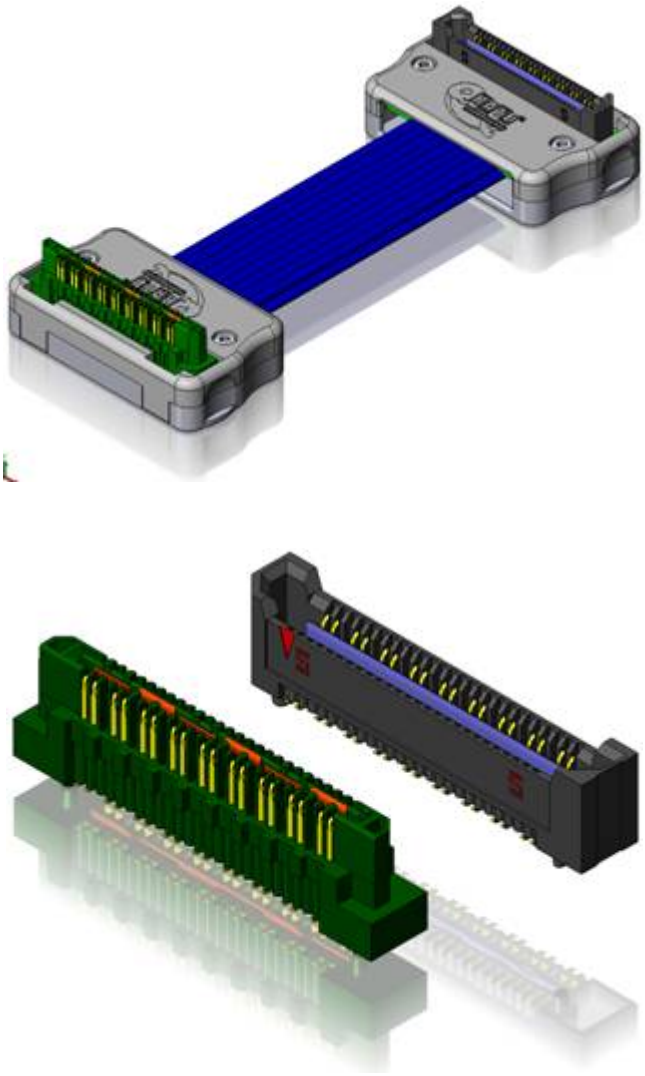
Project Number: Design Verification Test Report	Tracking Code: TC0948--2932_Report_Rev_1		
Requested by: John Riley	Date: 7/1/2010	Product Rev: 0	
Part #: EQRP-018-06.00-TTR-STL-1/ QRF8-018-05.0-L-D-DP-A-K/ QRM8-018-05.0-L-D-DP-A-K	Lot #: 3023772-0	Tech: Tony Wagoner	Eng: Eric Mings
Part description: Q-Rate			Qty to test: 40
Test Start: 11/25/09	Test Completed: 2/5/2010		



HDR Design Verification Test Report

EQRP-018-06.00-TTR-STL-1 &
QRF8-018-05.0-L-D-DP-A-K & QRM8-018-05.0-L-D-DP-A-K

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: Standard. HDR Design Verification Test .

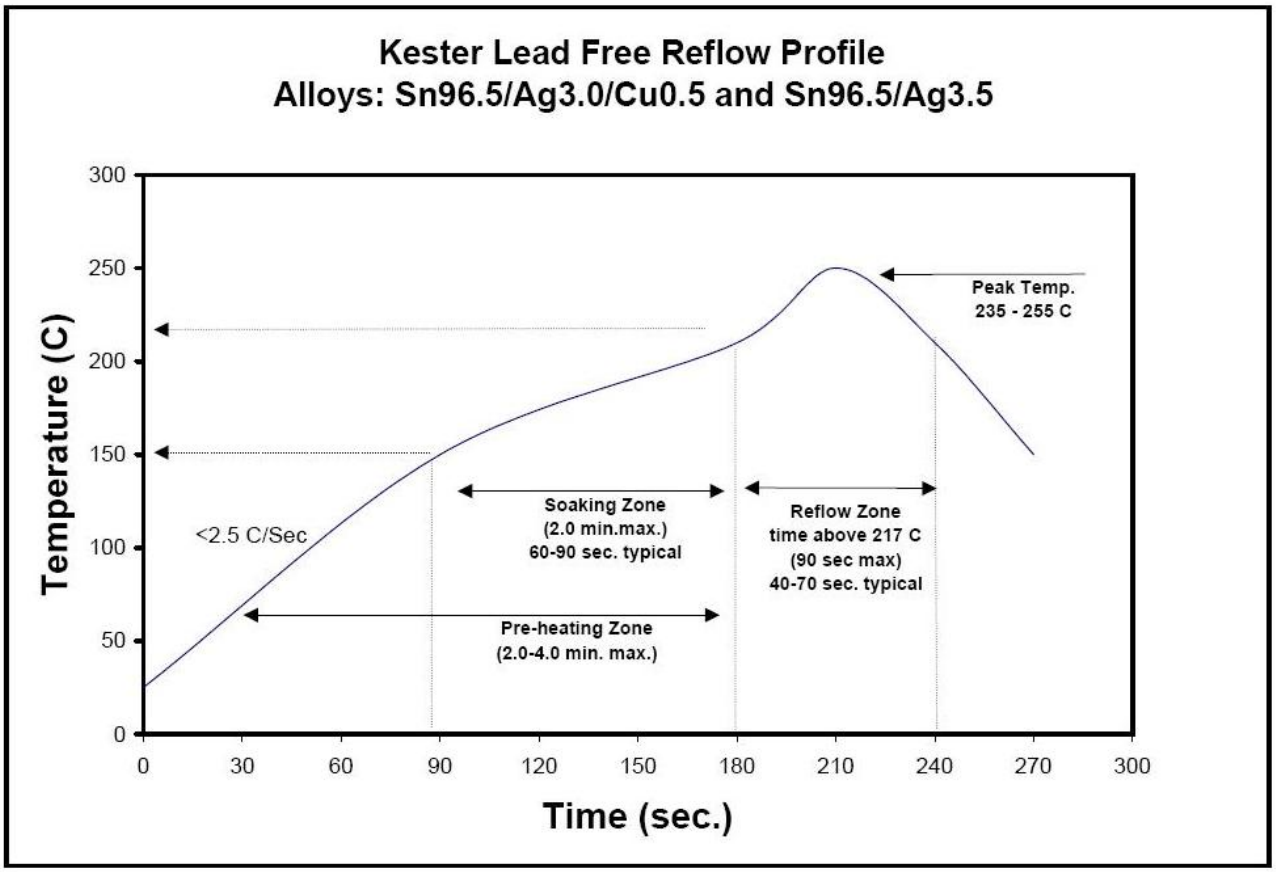
APPLICABLE DOCUMENTS

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) Solder Information: Lead free
9) Re-Flow Time/Temp: See accompanying profile.
10) Samtec Test PCBs used: PCB-102274-TST-XX / PCB-102265-TST-XX

TYPICAL OVEN PROFILE (Soldering Parts to Test Boards)



FLOWCHARTS

IR & DWV

TEST STEP	GROUP A1 2 Mated Sets Break Down - Pin to Pin	GROUP A2 2 Unmated of Part # Being Tested Break Down - Pin to Pin	GROUP A3 2 Unmated of Mating Part # Break Down - Pin to Pin	GROUP B 2 Mated Sets Pin to Pin
01	DWV/Break Down Voltage	DWV/Break Down Voltage	DWV/Break Down Voltage	IR & DWV at test voltage (on both mated sets and on each connector unmated)
02				Thermal Aging (both sets unmated)
03				IR & DWV at test voltage (on both mated sets and on each connector unmated)
04				Cyclic Humidity (both sets unmated)
05				IR & DWV at test voltage (on both mated sets and on each connector unmated)

*** - DWV on group B to be performed at Test Voltage**
DWV test voltage is equal to 75% of the lowest break down voltage from group A1, A2 or A3
Thermal Aging = EIA-364-17, Test Condition 4 (105 °C)
Time Condition 'B' (250 hours)
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
IR = EIA-364-21
DWV = EIA-364-20, Test Condition 1

DOUBLE ROW

Current Carrying Capacity **3 Mated Assemblies Each**

TEST STEP	GROUP A 3 Mated Assemblies 2 CONTACT POWERED	GROUP B 3 Mated Assemblies 4 CONTACTS POWERED	GROUP C 3 Mated Assemblies 6 CONTACTS POWERED	GROUP D 3 Mated Assemblies 8 CONTACTS POWERED	GROUP E 3 Mated Assemblies ALL CONTACTS POWERED
01	CCC	CCC	CCC	CCC	CCC

GROUND PLANES

Current Carrying Capacity **3 Mated Assemblies Each**

TEST STEP	GROUP A 3 Mated Assemblies 1 GROUND PLANE POWERD
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

Connector Pull

	5 Pieces	5 Pieces
TEST STEP	GROUP 1 DV SIG 0°	GROUP 2 DV SIG 90°
01	Pull test, Continuity	Pull test, Continuity

Secure both cables in the center
Monitor continuity and pull
record forces when continuity fails.

Resistance, SIG Contiinuity

	10 Pieces	10 Pieces
TEST STEP	GROUP 1 DV End 90°	GROUP 1A DV End 35°
	SIG	SIG
01	Resistance	Resistance
02	1000 Cycles	1000 Cycles
03	Resistance	Resistance
04	Data Review	Data Review
05	2000 Cycles	2000 Cycles
06	Resistance	Resistance
07	Data Review	Data Review
08	3000 Cycles	3000 Cycles
09	Resistance	Resistance
10	Data Review	Data Review
11	4000 Cycles	4000 Cycles
12	Resistance	Resistance
13	Data Review	Data Review
14	5000 Cycles	5000 Cycles
15	Resistance	Resistance

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL:

1) EIA-364-17, *Temperature Life with or without Electrical Load Test Procedure for Electrical Connectors.*
2) Test Condition 4 at 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.

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. 80^{o} C
    c. 95^{o} C
    d. 115^{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.

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 Meg ohms.

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).

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.

CONNECTOR PULL:

1) Secure cable near center and pull on connector
    a. At 90°, right angle to cable
    b. At 0°, in-line with cable

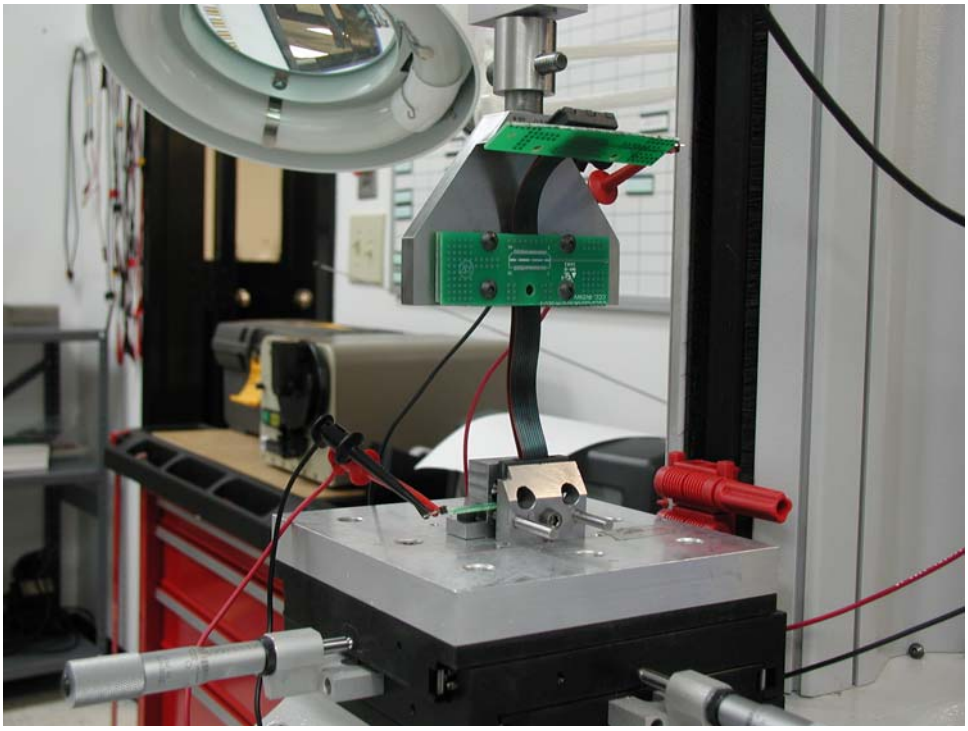


Fig. 1
(Typical set-up, actual part not depicted.)
0° Connector pull, notice the electrical continuity hook-up wires.

CABLE DURABILITY:

To determine the effectiveness of circular jacketed cable to plug seal, or flat cable to plug seal or interface to withstand strain under repeated alternating cable-flexing stresses as experienced in use with cable strain-relief design electrical connectors.
Reference document: EIA-364-41D *Cable flexing test procedure for electrical connectors*

1) Oscillate and monitor electrical continuity for open circuit indication.
    a. ± 35° Pendulum Mode, bend up to 5,000 cycles with 8 oz. load on cable end.

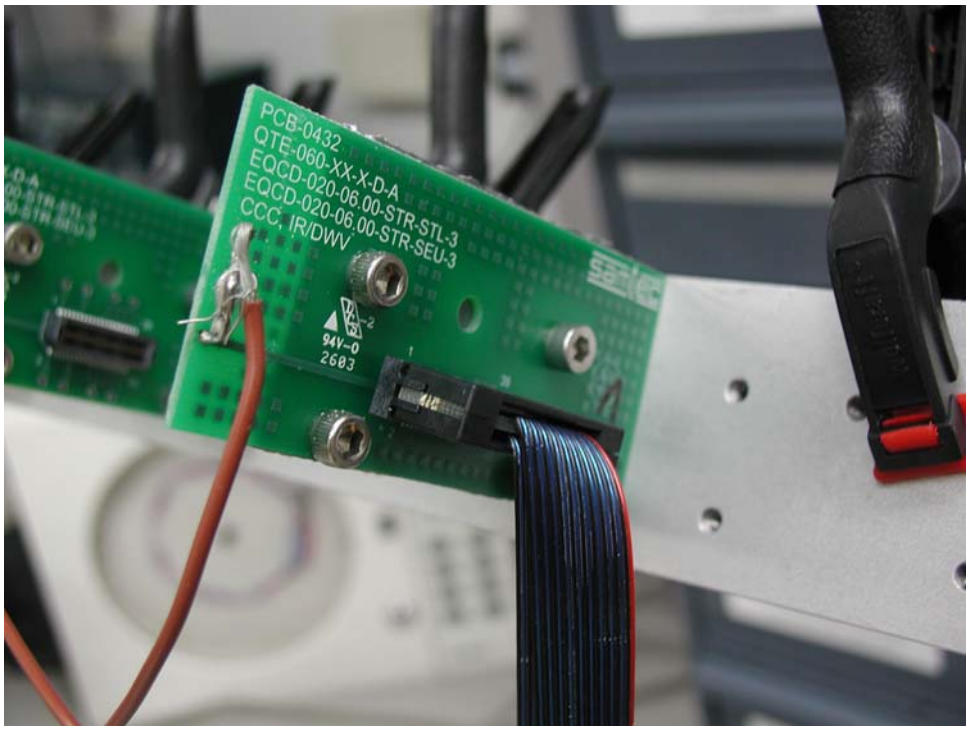


Fig. 2
(Typical set-up, actual part not depicted.)

b. ± 90° Flex Mode, bend up to 5,000 cycles with 4 oz. load on cable end.

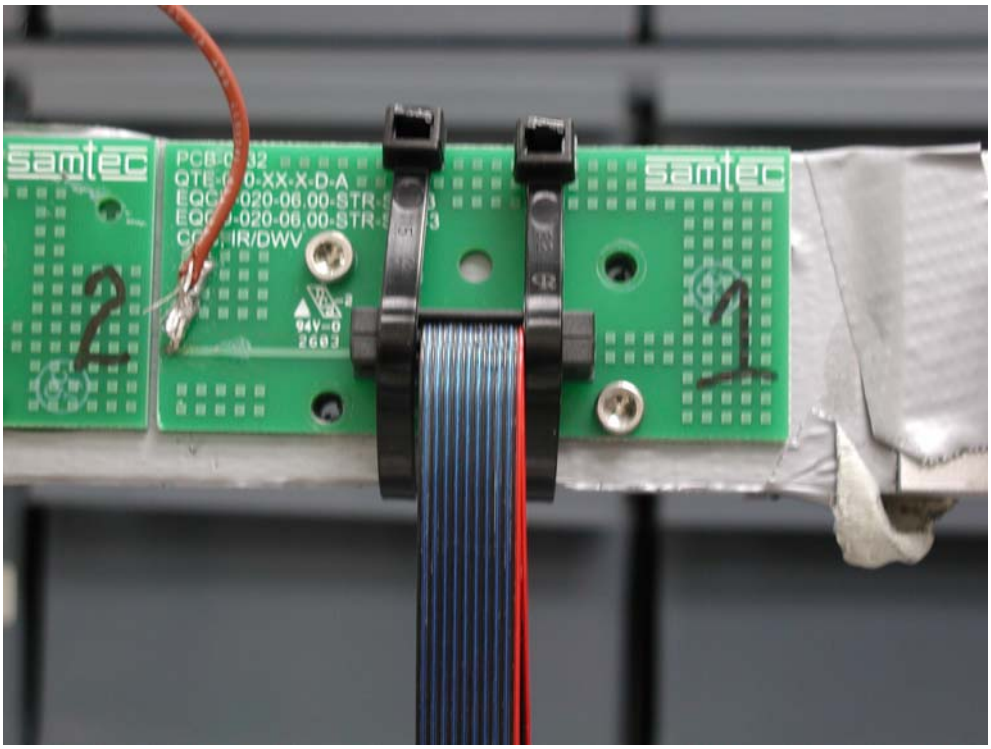


Fig. 3
(Typical set-up, actual part not depicted.)

RESULTS

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise----------0.6 A per contact with all adjacent contacts powered**
- **CCC for a 30°C Temperature Rise----------0.6 A per cable with all adjacent contacts powered**
- **CCC for a 30°C Temperature Rise----------7.9 A per contact with all ground plane powered**

Insulation Resistance minimums, IR

- **Initial**
  - **Mated----------25000 Meg Ω ----------Pass**
  - **Unmated ----------25000 Meg Ω ----------Pass**
- **Thermal**
  - **Mated---------- 100000 Meg Ω ----------Pass**
  - **Unmated ---------- 100000 Meg Ω ----------Pass**
- **Humidity**
  - **Mated---------- 2300 Meg Ω ----------Pass**
  - **Unmated ---------- 2000 Meg Ω ----------Pass**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage----------760VAC**
  - **Test Voltage ----------570VAC**
  - **Working Voltage ----------190VAC**
- **Initial DWV ----------Passed**
- **Thermal DWV----------Passed**
- **Humidity DWV----------Passed**

RESULTS Continued

Supplemental – Connector/Cable Pull

- **0° ---------- 101.5 lbs min**
- **90° ---------- 58.5 lbs min**

Supplemental – Cable Bend 5,000 Cycles

- **±35° Pendulum Mode ---------- No Electrical Failures**
- **±90° Flex Mode ---------- No Electrical Failures**

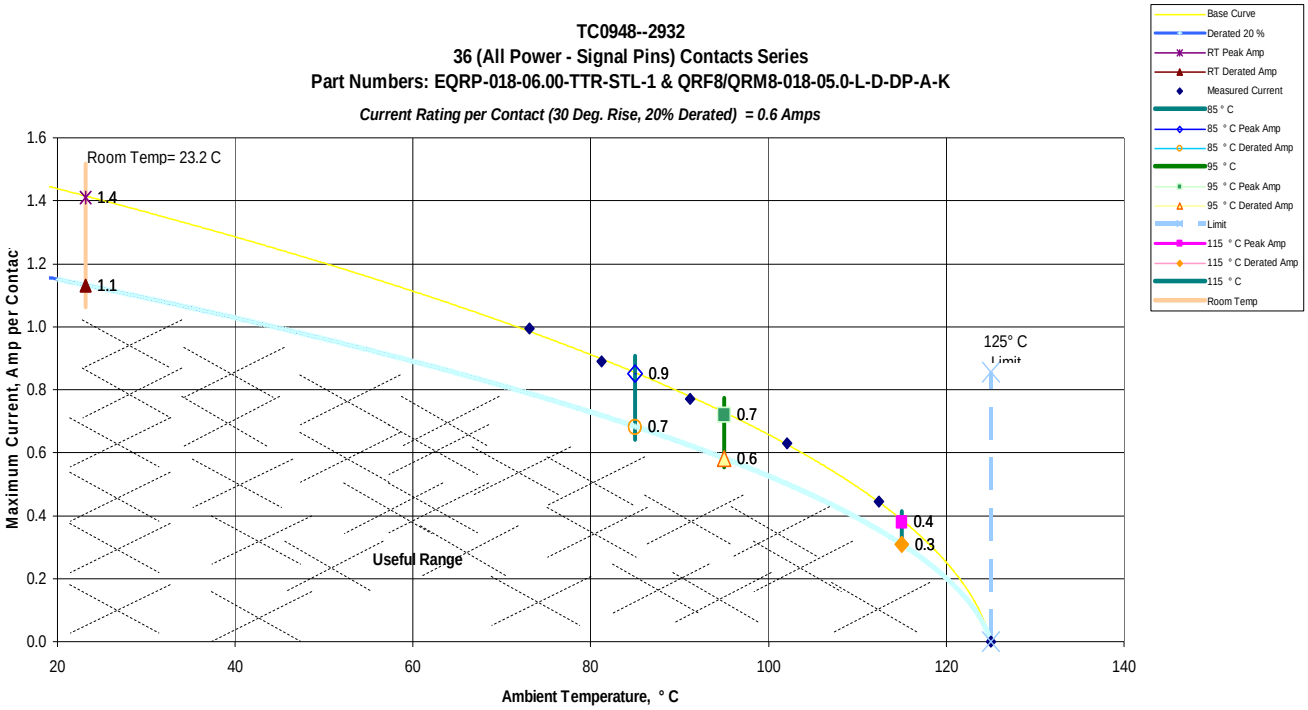
Note: in ±35° test process, In reference to sample#1, the bracket came loose during cycling. This allowed the sample to be cycled in a more severe manner. The bracket was replaced for samples 6-10. In conclusion sample #1 Failure could be thrown out due to bad fixturing.

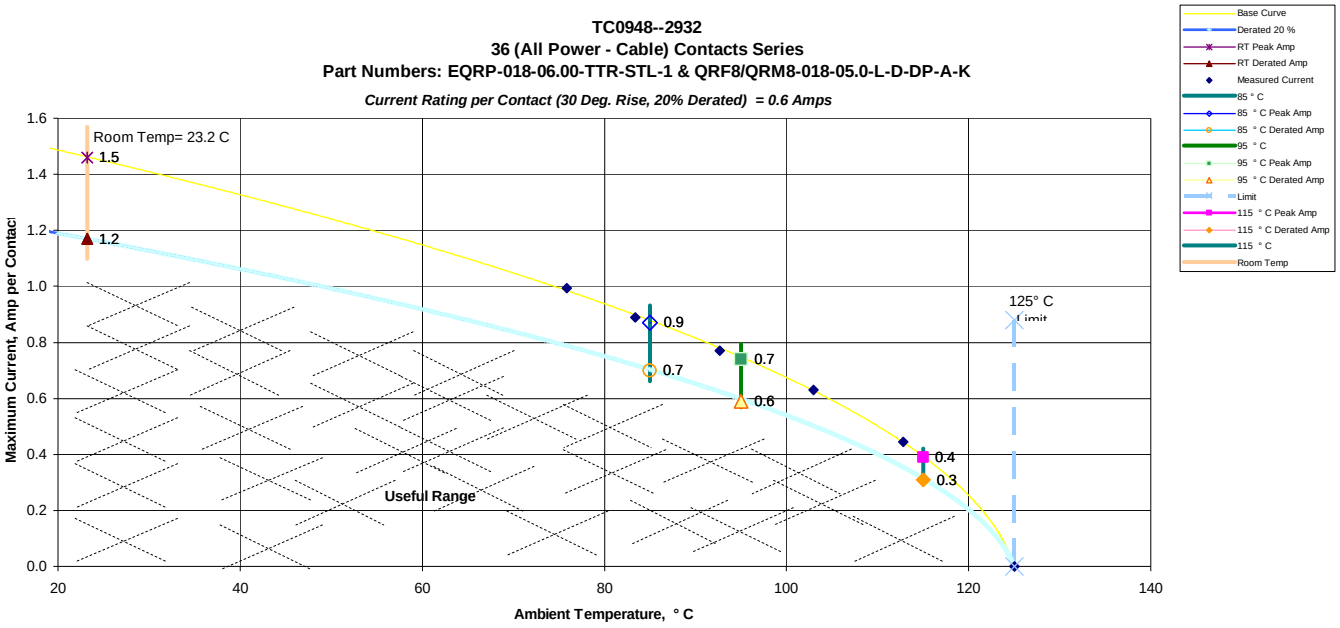
DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):

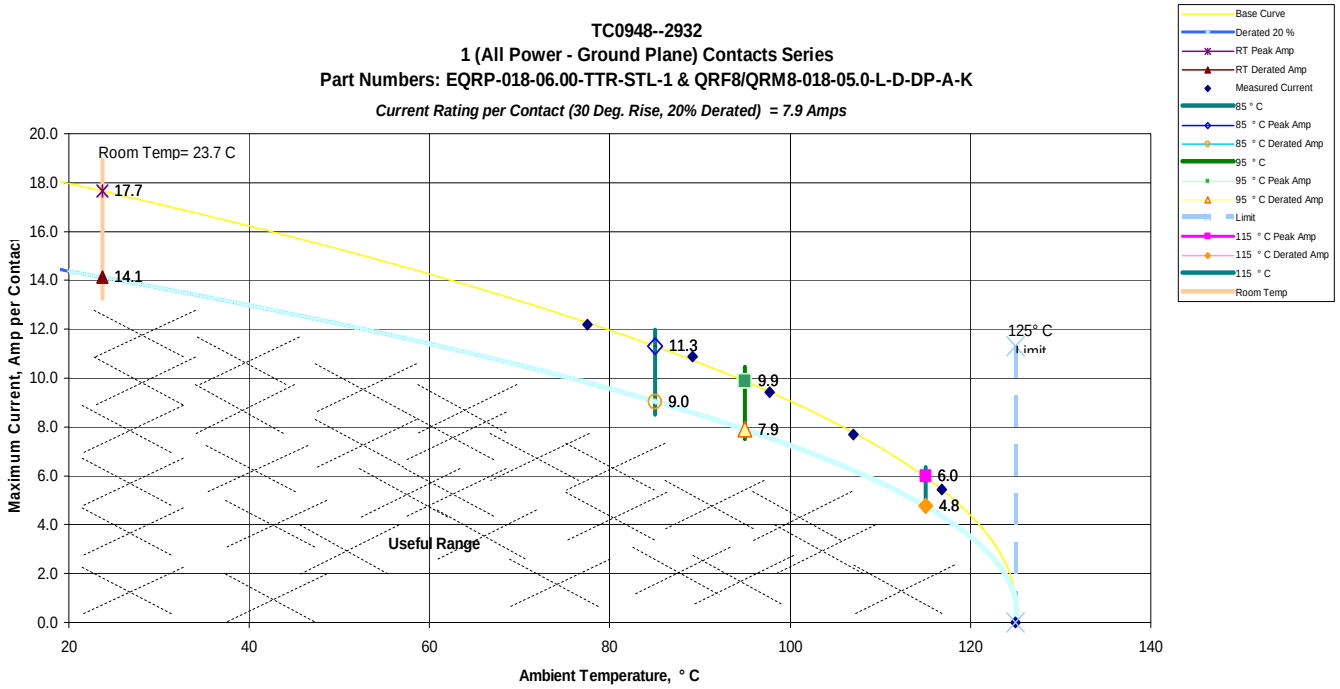
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes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

    a. Linear configuration with all adjacent conductors/contacts powered





b. Linear configuration with all adjacent ground plane powered



DATA SUMMARIES

INSULATION RESISTANCE (IR):

	Pin to Pin				
	Mated	Unmated	Unmated	Unmated	Unmated
Minimum	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
Initial	25000	25000	25000	50000	100000
Thermal	100000	100000	100000	100000	100000
Humidity	2300	2700	4000	3500	2000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	EQRP/QRF8/QRM8
Break Down Voltage	760
Test Voltage	570
Working Voltage	190

Pin to Pin	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

DATA SUMMARIES Continued

Connector Pull

Signal	*0 Deg.*	*90 Deg.*
Pull DV	Force (Lbs)	Force (Lbs)
Minimum	101.50	58.50
Maximum	*122.00*	*71.00*
Average	***110.8***	***64.8***

CABLE DURABILITY:

35 Deg. Flex Continuity Testing

	Resistance, Ohms					
	Initial	**After 1000**	**After 2000**	**After 3000**	**After 4000**	**After 5000**
Avg	5.6000	5.5400	5.5200	5.5222	5.5222	5.6000
Min	5.5000	5.5000	5.5000	5.5000	5.5000	5.5000
Max	5.7000	5.6000	5.6000	5.6000	5.6000	5.7000
St. Dev.	0.0471	0.0516	0.0422	0.0441	0.0441	0.0500
Count	10	10	10	9	9	9

90 Deg. Flex Continuity Testing - Grounds

	Resistance, Ohms					
	Initial	**After 1000**	**After 2000**	**After 3000**	**After 4000**	**After 5000**
Avg	0.1700	0.1900	0.1900	0.2000	0.2100	0.2200
Min	0.1000	0.1000	0.1000	0.2000	0.2000	0.2000
Max	0.2000	0.2000	0.2000	0.2000	0.3000	0.3000
St. Dev.	0.0483	0.0316	0.0316	0.0000	0.0316	0.0422
Count	10	10	10	10	10	10

DATA

INSULATION RESISTANCE (IR):

Initial Insulation Resistance
Measured In Meg Ohms

	Pin to Pin				
	Mated	Unmated			
	X	X	X	X	X
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	50000	25000	100000	50000	100000
2	25000	25000	25000	50000	100000

Thermal Insulation Resistance
Measured In Meg Ohms

	Pin to Pin				
	Mated	Unmated			
	X	X	X	X	X
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	100000	100000	100000	100000	100000
2	100000	100000	100000	100000	100000

Humidity Insulation Resistance
Measured In Meg Ohms

	Pin to Pin				
	Mated	Unmated			
	X	X	X	X	X
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	5000	7000	100000	10000	100000
2	2300	2700	4000	3500	2000

DATA Continued

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Initial Breakdown Voltage
Test Voltage *Until Breakdown Occurs*

	Pin to Pin				
	Mated	Unmated			
	X				
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	760	940	880	1000	940
2	840	960	940	960	960

Initial DWV
Test Voltage = 570

	Pin to Pin				
	Mated	Unmated			
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	570	570	570	570	570
2	570	570	570	570	570

Thermal Test Voltage
Test Voltage = 570

	Pin to Pin				
	Mated	Unmated			
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	570	570	570	570	570
2	570	570	570	570	570

Humidity Test Voltage
Test Voltage = 570

	Pin to Pin				
	Mated	Unmated			
Sample#	EQRP/QRF8/QRM8	EQRP/QRF8	EQRP/QRM8	QRF8	QRM8
1	570	570	570	570	570
2	570	570	570	570	570

DATA Continued

Connector Pull

Signal	*0 Deg.*	*90 Deg.*
Sample#	Maximum Force (Lbs)	Maximum Force (Lbs)
1	104.00	58.50
2	101.50	63.00
3	122.00	62.00
4	111.50	69.50
5	115.00	71.00

CABLE DURABILITY

35 Deg. Flex Continuity Testing

Resistance, mOhms

Cable	Initial	After 1000 Cycles	After 2000 Cycles	After 3000 Cycles	After 4000 Cycles	After 5000 Cycles
1	5.6	5.6	5.5	***Failed at 2668***	**N/A**	**N/A**
2	5.6	5.5	5.5	5.5	5.5	5.6
3	5.7	5.6	5.6	5.6	5.6	5.7
4	5.6	5.5	5.5	5.5	5.5	5.6
5	5.6	5.5	5.5	5.5	5.5	5.6
6	5.6	5.5	5.5	5.5	5.5	5.6
7	5.6	5.5	5.5	5.5	5.5	5.6
8	5.6	5.6	5.6	5.6	5.6	5.6
9	5.5	5.5	5.5	5.5	5.5	5.5
10	5.6	5.6	5.5	5.5	5.5	5.6

90 Deg. Flex Continuity Testing – Grounds

Resistance, mOhms

Cable	Initial	After 1000 Cycles	After 2000 Cycles	After 3000 Cycles	After 4000 Cycles	After 5000 Cycles
1	0.20	0.20	0.20	0.20	0.20	0.20
2	0.20	0.20	0.10	0.20	0.20	0.20
3	0.20	0.20	0.20	0.20	0.30	0.30
4	0.10	0.10	0.20	0.20	0.20	0.20
5	0.10	0.20	0.20	0.20	0.20	0.30
6	0.20	0.20	0.20	0.20	0.20	0.20
7	0.20	0.20	0.20	0.20	0.20	0.20
8	0.20	0.20	0.20	0.20	0.20	0.20
9	0.20	0.20	0.20	0.20	0.20	0.20
10	0.10	0.20	0.20	0.20	0.20	0.20

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: STG-01
Description: Hipot Megometer Safety Test Cage
Manufacturer: Hipotronics
Model: TC-25
Serial #: M9910141
Accuracy: N/A
… Last Cal: No Calibration Required, Next Cal:

Equipment #: HPM-01
Description: Hipot Megommeter
Manufacturer: Hipotronics
Model: H306B-A
Serial #: M9905004
Accuracy: 2 % Full Scale Accuracy
… Last Cal: 11/24/08, Next Cal: 11/24/09

Equipment #: OV-03
Description: Cascade Tek Forced Air Oven
Manufacturer: Cascade Tek
Model: TFO-5
Serial #: 0500100
Accuracy: Temp. Stability: +/-.1C/C change in ambient
… Last Cal: 06/17/2009, Next Cal: 06/17/2010

Equipment #: THL-01
Description: Temperature/Humidity Chart Recorder
Manufacturer: Dickson
Model: THDX
Serial #: 9316255
Accuracy: Temp: +/- 1C; Humidity: +/-2% RH (0 - 60%) +/- 3% RH (61 - 95%).
… Last Cal: 06/07/07, Next Cal: 06/07/08

Equipment #: PS-01
Description: System Power Supply
Manufacturer: Hewlett Packard
Model: HP 6033A
Serial #: (HP) 3329A-07330
Accuracy: See Manual
… Last Cal: 06/16/08, Next Cal: 06/16/09

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 04/06/09, Next Cal: 04/06/2010

Equipment #: MO-01
Description: Micro-Ohmeter
Manufacturer: Keithley
Model: 580
Serial #: 0772740
Accuracy: See Manual See Manual
… Last Cal: 06/16/09, Next Cal: 06/16/2010

Equipment #: MO-03
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0791975
Accuracy: See Manual
… Last Cal: 06/16/09, Next Cal: 06/16/2010

Equipment #: TCT-03
Description: Dillon Quantrol TC2 Test Stand
Manufacturer: Dillon Quantrol
Model: TC2
Serial #: 02-1033-03
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Displacement: +/- 5 micrometers.
… Last Cal: 5/12/2009, Next Cal: 5/6/2010

Equipment #: HDR-02
Description: HDR Cycle Tester
Manufacturer: Samtec Inc.
Model: AT-1544-011
Serial #: AT-1544-011
Accuracy: N/A
… Last Cal: No Calibration Required, Next Cal: