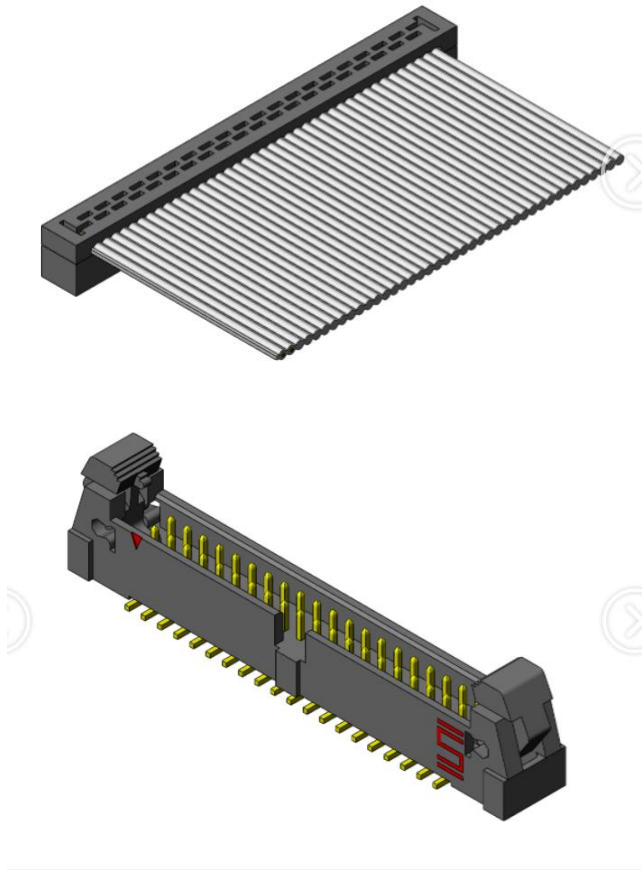




Project Number: Design Qualification Test Report	Tracking Code: 988117_Report_Rev_1
Requested by: Donnie Baldwin	Date: 6/2/2017
Part #: TCSD-20-S-06.00-01/EHT-120-01-S-D	Tech: Peter Chen
Part description: TCSD/EHT	Qty to test: 32
Test Start: 12/09/2016	Test Completed: 02/21/2017



DESIGN QUALIFICATION TEST REPORT

TCSD/EHT
TCSD-20-S-06.00-01/EHT-120-01-S-D

Tracking Code: 988117_Report_Rev_1	Part #: TCSD-20-S-06.00-01/EHT-120-01-S-D
Part description: TCSD/EHT	

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
6/1/2017	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 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) Samtec Test PCBs used: PCB-107815-TST-01.

FLOWCHARTS Continued**Extended Life**

Group 1 TCSD-20-S-06.00-01 EHT-120-01-S-D 8 Assemblies 100 Cycles		Group 2 TCSD-20-S-06.00-01 EHT-120-01-S-D 8 Assemblies 250 Cycles		Group 3 TCSD-20-S-06.00-01 EHT-120-01-S-D 8 Assemblies 500 Cycles		Group 4 TCSD-20-S-06.00-01 EHT-120-01-S-D 8 Assemblies 1000 Cycles	
Step	Description	Step	Description	Step	Description	Step	Description
1.	Plating Thickness Verification ⁽⁴⁾	1.	Plating Thickness Verification ⁽⁴⁾	1.	Plating Thickness Verification ⁽⁴⁾	1.	Plating Thickness Verification ⁽⁴⁾
2.	LLCR ⁽²⁾	2.	LLCR ⁽²⁾	2.	LLCR ⁽²⁾	2.	LLCR ⁽²⁾
3.	Cycles Quantity = 100 Cycles	3.	Cycles Quantity = 250 Cycles	3.	Cycles Quantity = 500 Cycles	3.	Cycles Quantity = 1000 Cycles
4.	LLCR ⁽²⁾ Max Delta = 15 mOhm	4.	LLCR ⁽²⁾ Max Delta = 15 mOhm	4.	LLCR ⁽²⁾ Max Delta = 15 mOhm	4.	LLCR ⁽²⁾ Max Delta = 15 mOhm
5.	Thermal Shock ⁽⁵⁾	5.	Thermal Shock ⁽⁵⁾	5.	Thermal Shock ⁽⁵⁾	5.	Thermal Shock ⁽⁵⁾
6.	LLCR ⁽²⁾ Max Delta = 15 mOhm	6.	LLCR ⁽²⁾ Max Delta = 15 mOhm	6.	LLCR ⁽²⁾ Max Delta = 15 mOhm	6.	LLCR ⁽²⁾ Max Delta = 15 mOhm
7.	Humidity ⁽¹⁾	7.	Humidity ⁽¹⁾	7.	Humidity ⁽¹⁾	7.	Humidity ⁽¹⁾
8.	LLCR ⁽²⁾ Max Delta = 15 mOhm	8.	LLCR ⁽²⁾ Max Delta = 15 mOhm	8.	LLCR ⁽²⁾ Max Delta = 15 mOhm	8.	LLCR ⁽²⁾ Max Delta = 15 mOhm
9.	Photos ⁽³⁾	9.	Photos ⁽³⁾	9.	Photos ⁽³⁾	9.	Photos ⁽³⁾

(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) LLCR = EIA-364-23

Open Circuit Voltage = 20 mV Max

Test Current = 100 mA Max

(3) Photos

Attach 2-3 photos of contact area

(4) Plating Thickness Verification

Measure, verify, and document plating thickness on both male and female (one group only)

Plating thickness to be measured on loose pins used during assembly

(5) 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)

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.

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

RESULTS

LLCR Extended Life Group (192 LLCR test points)

Group 1 –100 cycles

- Initial ----- 35.50 mOhms Max
- Durability, 100 Cycles
 - ≤ +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 +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure
- Thermal Shock
 - ≤ +5.0 mOhms ----- 177 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 14 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 1 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 ----- 158 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 33 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 1 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

Group 2 –250 cycles

- Initial ----- 36.61 mOhms Max
- Durability, 250 Cycles
 - ≤ +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 +2000 mOhms ----- 0 Points ----- Unstable
 - >+2000 mOhms ----- 0 Points ----- Open Failure
- Thermal Shock
 - ≤ +5.0 mOhms ----- 173 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 19 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 ----- 159Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 33 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

RESULTS Continued**Group 3 -500 cycles**

- **Initial** ----- 35.44 mOhms Max
- **Durability, 500 Cycles**
 - <= +5.0 mOhms ----- 191 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 1 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 ----- 31 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 1 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 ----- 144 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 48 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

Group 4 -1000 cycles

- **Initial** ----- 36.56 mOhms Max
- **Durability, 1000 Cycles**
 - <= +5.0 mOhms ----- 183 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 9 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 ----- 153 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 39 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 ----- 97 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 88 Points ----- Minor
 - +10.1 to +15.0 mOhms ----- 7 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**LLCR Extended Life 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

Group 1-100 cycles

LLCR Measurement Summaries by Pin Type				
Date	12/9/2016	12/15/2016	12/26/2016	1/10/2017
Room Temp (Deg C)	24	23	23	23
Rel Humidity (%)	52	56	63	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: Signal				
Average	33.26	0.87	2.13	3.18
St. Dev.	0.68	0.63	1.73	1.96
Min	31.60	0.01	0.04	0.07
Max	35.50	3.56	10.54	11.33
Summary Count	192	192	192	192
Total Count	192	192	192	192

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	177	14	1	0	0	0
Humidity	158	33	1	0	0	0

DATA SUMMARIES Continued**Group 2-250 cycles**

LLCR Measurement Summaries by Pin Type				
Date	12/9/2016	12/15/2016	12/26/2016	1/10/2017
Room Temp (Deg C)	24	23	23	23
Rel Humidity (%)	52	56	63	56
Technician	Peter Chen	Peter Chen	Peter Chen	Peter Chen
mOhm values	Actual Initial	Delta 250 Cycles	Delta Therm Shck	Delta Humidity
Pin Type 1: Signal				
Average	33.54	0.44	2.47	3.24
St. Dev.	0.73	0.70	1.77	1.71
Min	32.05	0.00	0.03	0.33
Max	36.61	4.54	6.74	7.63
Summary Count	192	192	192	192
Total Count	192	192	192	192

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
250 Cycles	192	0	0	0	0	0
Therm Shck	173	19	0	0	0	0
Humidity	159	33	0	0	0	0

DATA SUMMARIES Continued**Group 3-500 cycles**

LLCR Measurement Summaries by Pin Type				
Date	12/9/2016	12/15/2016	12/26/2016	1/10/2017
Room Temp (Deg C)	24	23	23	23
Rel Humidity (%)	52	56	63	56
Technician	Peter Chen	Peter Chen	Peter Chen	Peter Chen
mOhm values	Actual Initial	Delta 500 Cycles	Delta Therm Shck	Delta Humidity
Pin Type 1: Signal				
Average	33.58	0.58	2.65	3.59
St. Dev.	0.73	0.77	2.37	1.91
Min	31.89	0.00	0.01	0.02
Max	35.44	6.69	10.42	8.71
Summary Count	192	192	192	192
Total Count	192	192	192	192

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
500 Cycles	191	1	0	0	0	0
Therm Shck	160	31	1	0	0	0
Humidity	144	48	0	0	0	0

DATA SUMMARIES Continued**Group 4-1000 cycles**

LLCR Measurement Summaries by Pin Type				
Date	12/9/2016	12/26/2016	1/4/2017	2/21/2017
Room Temp (Deg C)	24	23	24	23
Rel Humidity (%)	52	63	54	56
Technician	Peter Chen	Peter Chen	Peter Chen	Peter Chen
mOhm values	Actual Initial	Delta 1000 Cycles	Delta Therm Shck	Delta Humidity
Pin Type 1: Signal				
Average	33.56	1.29	3.11	5.58
St. Dev.	0.64	1.60	1.79	3.38
Min	31.91	0.00	0.01	0.90
Max	36.56	9.10	7.46	12.75
Summary Count	192	192	192	192
Total Count	192	192	192	192

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
1000 Cycles	183	9	0	0	0	0
Therm Shck	153	39	0	0	0	0
Humidity	97	88	7	0	0	0

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HZ-THC-01

Description: Humidity transmitter

Manufacturer: Thermtron

Model: SM-8-8200

Serial #: 38846

Accuracy: Last Cal: 2/28/2016, Next Cal: 2/27/2017

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: 06/28/2016, Next Cal: 06/27/2017

Equipment #: HZ-MO-05

Description: Micro-ohmmeter

Manufacturer: Keithley

Model: 3706

Serial #: 1285188

Accuracy: Last Cal: 11/15/2016, Next Cal: 11/14/2017