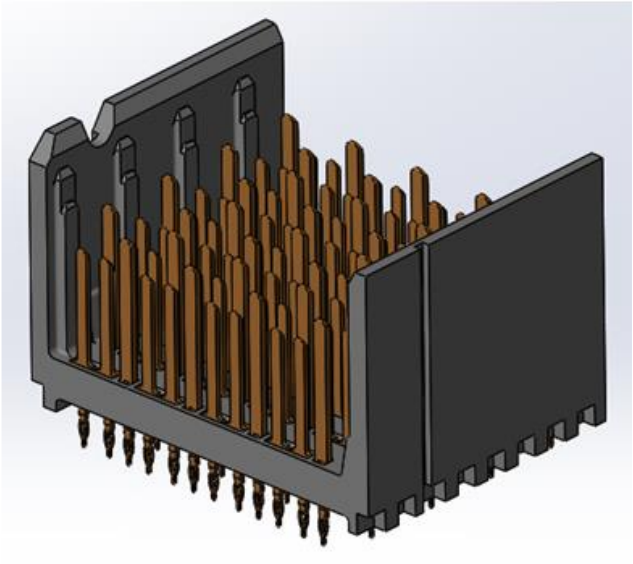
Project Number: Compliant Pin Qualification Test Report	Tracking Code: 1351917_Report_Rev_0
Requested by: Corey Rose	Date: 10/26/2023
Part #: HDTM-4-08-1-S-VT-0-1	
Part description: HDTM	Tech: Aaron McKim and Daniel Haydon
Test Start: 2/1/2023	Test Completed: 3/20/2023



(Actual part not depicted)

COMPLIANT PIN QUALIFICATION TEST REPORT

HDTM
HDTM-4-08-1-S-VT-0-1

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: Compliant pin 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) Any additional preparation will be noted in the individual test sequences.
4) Samtec Test PCBs used: PCB446BMAX (OSP Finish), PCB446BMAX (Tin Finish), PCB520H (OSP Finish), PCB520I (Tin Finish), PCB-112414-TST-XX (ENIG FINISH).
5) Connector Press Tool: HDTM Part # 694-4721-000

FLOWCHARTS

Compliant Pin Cross-Section Analysis

Group 1	Group 2	Group 3	Group 4
HDTM-4-08-1-S-VT-X-1	HDTM-4-08-1-S-VT-X-1	HDTM-4-08-1-S-VT-X-1	HDTM-4-08-1-S-VT-X-1
10 Points 0.0177" Drill / MIN Hole OSP	10 Points 0.0177" Drill / MAX Hole OSP	10 Points 0.0177" Drill / MIN Hole Immersion Tin	10 Points 0.0177" Drill / MAX Hole Immersion Tin

Step	Description	Step	Description	Step	Description	Step	Description
1.	Visual Inspection	1.	Visual Inspection	1.	Visual Inspection	1.	Visual Inspection
2.	Cross-Section Compliant In PTH	2.	Cross-Section Compliant In PTH	2.	Cross-Section Compliant In PTH	2.	Cross-Section Compliant In PTH
3.	Inspect PTH Integrity And Compliant Integrity	3.	Inspect PTH Integrity And Compliant Integrity	3.	Inspect PTH Integrity And Compliant Integrity	3.	Inspect PTH Integrity And Compliant Integrity
4.	Measure Radial Deformation	4.	Measure Radial Deformation	4.	Measure Radial Deformation	4.	Measure Radial Deformation

Compliant Pin Cross-Section Analysis

Group 1	Group 2
HDTM-4-08-1-S-VT-0	HDTM-4-08-1-S-VT-0
10 Points 0.0177" Drill / MIN Hole ENIG	10 Points 0.0177" Drill / MAX Hole ENIG

Step	Description	Step	Description
1.	Visual Inspection	1.	Visual Inspection
2.	Cross-Section Compliant In PTH	2.	Cross-Section Compliant In PTH
3.	Inspect PTH Integrity And Compliant Integrity	3.	Inspect PTH Integrity And Compliant Integrity
4.	Measure Radial Deformation	4.	Measure Radial Deformation

FLOWCHARTS Continued

LLCR

Group 5 HDTM-4-08-1-S-VT-X-1 30 Points 0.0177" Drill / MAX Hole OSP		Group 6 HDTM-4-08-1-S-VT-X-1 30 Points 0.0177" Drill / MAX Hole Immersion Tin		Group 3 HDTM-4-08-1-S-VT-0 40 Points 0.0177" Drill / MAX Hole ENIG	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	Visual Inspection	1.	Visual Inspection	1.	Visual Inspection
2.	Press 1st Connector	2.	Press 1st Connector	2.	Press 1st Connector
3.	LLCR (1) Max LLCR = 1 mOhm	3.	LLCR (1) Max LLCR = 1 mOhm	3.	LLCR (1) Max Delta = 1 mOhm
4.	Remove Connector	4.	Remove Connector	4.	Remove Connector
5.	Press 2nd Connector	5.	Press 2nd Connector	5.	Press 2nd Connector
6.	LLCR (1) Max Delta = 1 mOhm	6.	LLCR (1) Max Delta = 1 mOhm	6.	LLCR (1) Max Delta = 1 mOhm
7.	Remove Connector	7.	Remove Connector	7.	Remove Connector
8.	Press 3rd Connector	8.	Press 3rd Connector	8.	Press 3rd Connector
9.	LLCR (1) Max Delta = 1 mOhm	9.	LLCR (1) Max Delta = 1 mOhm	9.	LLCR (1) Max Delta = 1 mOhm
10.	Thermal Age (2) - Non Standard	10.	Thermal Age (2) - Non Standard	10.	Thermal Age (2) - Non Standard
11.	LLCR (1) Max Delta = 1 mOhm	11.	LLCR (1) Max Delta = 1 mOhm	11.	LLCR (1) Max Delta = 1 mOhm

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

(2) Thermal Age = Other
Test Condition = 4 (105°C)
Time Condition = C (500 Hours)
EIA-364-17

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 at 105° C.
3) Test Time Condition C for 500 hours.
4) All test 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 for compliant pin only.
    a. <= +1 mOhms: ---------- Stable
    b. > +1 to +7.5 mOhms: ---------- Minor
    c. +7.5 to +10 mOhms: ---------- Acceptable
    d. +10 to +50.0 mOhms:---------- Marginal
    e. +50.1 to +2000 mOhms:---------- Unstable
    f. >+2000 mOhms: ---------- Open Failure

RESULTS

Compliant Pin Cross Section Analysis Group

Visual Inspection: Requirements ---------- No Damage

Group 1--0.0177" Drill/Min Hole OSP
- **Visual Inspection----------Passed**

Group 2--0.0177" Drill/Max Hole OSP
- **Visual Inspection----------Passed**

Group 3--0.0177" Drill/Min Hole Immersion Tin
- **Visual Inspection----------Passed**

Group 4--0.0177" Drill/Max Hole Immersion Tin
- **Visual Inspection----------Passed**

Group 5--0.0177" Drill/Min Hole ENIG
- **Visual Inspection----------Passed**

Group 6--0.0177" Drill/Max Hole ENIG
- **Visual Inspection----------Passed**

PTH and Compliant Integrity Inspection

Group 1--0.0177" Drill/Min Hole OSP
- **Visual Inspection----------Passed**

Group 2--0.0177" Drill/Max Hole OSP
- **Visual Inspection----------Passed**

Group 3--0.0177" Drill/Min Hole Immersion Tin
- **Visual Inspection----------Passed**

Group 4--0.0177" Drill/Max Hole Immersion Tin
- **Visual Inspection----------Passed**

Group 5--0.0177" Drill/Min Hole ENIG
- **Visual Inspection----------Passed**

Group 6--0.0177" Drill/Max Hole ENIG
- **Visual Inspection----------Passed**

RESULTS Continued

Measure Radial Deformation

Group 1--0.0177" Drill/Min Hole OSP

- **Min----------0.0012 inch**
- **Max ----------0.0018 inch**

Group 2--0.0177" Drill/Max Hole OSP

- **Min----------0.0003 inch**
- **Max ----------0.0007 inch**

Group 3--0.0177" Drill/Min Hole Immersion Tin

- **Min----------0.0013 inch**
- **Max ----------0.0019 inch**

Group 4--0.0177" Drill/Max Hole Immersion Tin

- **Min----------0.0001 inch**
- **Max ----------0.0006 inch**

Group 5--0.0177" Drill/Min Hole ENIG

- **Min----------0.0006 inch**
- **Max ----------0.0011 inch**

Group 6--0.0177" Drill/Max Hole ENIG

- **Min----------0.0001 inch**
- **Max ----------0.0004 inch**

RESULTS Continued

Insertion/Retention Force w/ Temperature life

Visual Inspection: Requirements ---------- No Damage

Group 1--0.0177" Drill/Min Hole OSP
- **Visual Inspection----------Passed**

Group 2--0.0177" Drill/Max Hole OSP
- **Visual Inspection----------Passed**

Group 3--0.0177" Drill/Min Hole Immersion Tin
- **Visual Inspection----------Passed**

Group 4--0.0177" Drill/Max Hole Immersion Tin
- **Visual Inspection----------Passed**

Group 5--0.0177" Drill/Min Hole ENIG
- **Visual Inspection----------Passed**

Group 6--0.0177" Drill/Max Hole ENIG
- **Visual Inspection----------Passed**

Group 7--0.0177" Drill/Max Hole OSP (LLCR)
- **Visual Inspection----------Passed**

Group 8--0.0177" Drill/Max Hole Immersion Tin (LLCR)
- **Visual Inspection----------Passed**

Group 9--0.0177" Drill/Max Hole ENIG (LLCR)
- **Visual Inspection----------Passed**

RESULTS Continued

LLCR (40 LLCR test points)

0.0177" Drill/ MAX Hole OSP

- **1st Connector ---------- 0.74 mOhms Max**
- **2nd Connector**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**
- **3rd Connector**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**
- **After Thermals**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**

0.0177" Drill/ MAX Hole Immersion Tin

- **1st Connector ---------- 0.84 mOhms Max**
- **2nd Connector**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**
- **3rd Connector**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**
- **After Thermals**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**

RESULTS Continued

LLCR (40 LLCR test points)

0.0177" Drill/ MAX Hole ENIG

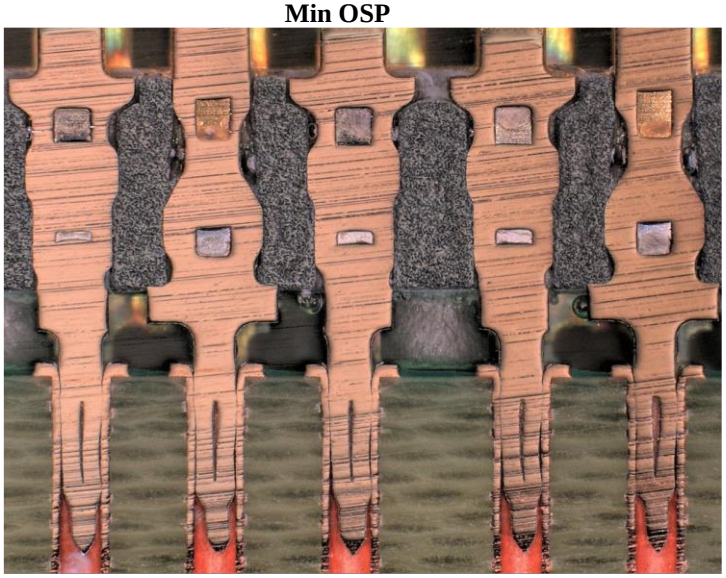
- **1st Connector ---------- 0.21 mOhms Max**
- **2nd Connector**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**
- **3rd Connector**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**
- **After Thermals**
  - **<= +1 mOhms ----------40 Points----------Stable**
  - **+1 to +7.5 mOhms ---------- 0 Points----------Minor**
  - **+7.5 to +10 mOhms---------- 0 Points----------Acceptable**
  - **+10 to +50.0 mOhms ---------- 0 Points----------Marginal**
  - **+50.1 to +2000 mOhms ---------- 0 Points----------Unstable**
  - **>+2000 mOhms ---------- 0 Points----------Open Failure**

DATA SUMMARIES

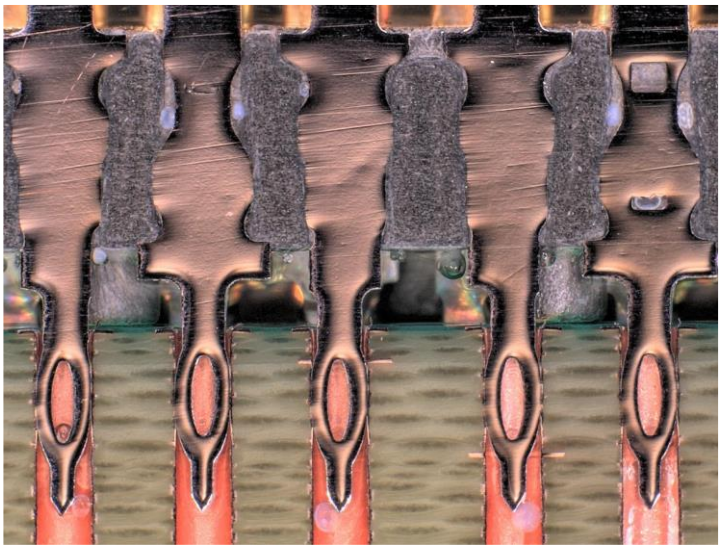
Compliant Pin Cross Section Analysis Group

Cross Section Picture

Min OSP

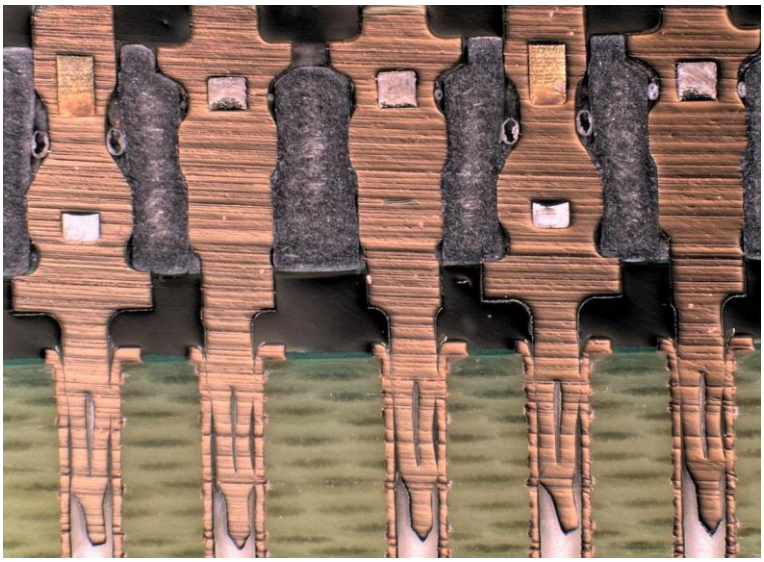


Max OSP

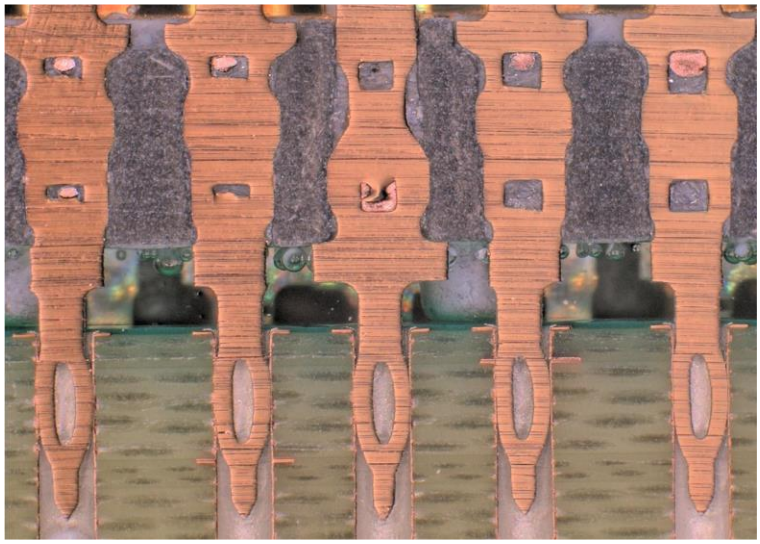


DATA SUMMARIES Continued

Min Tin

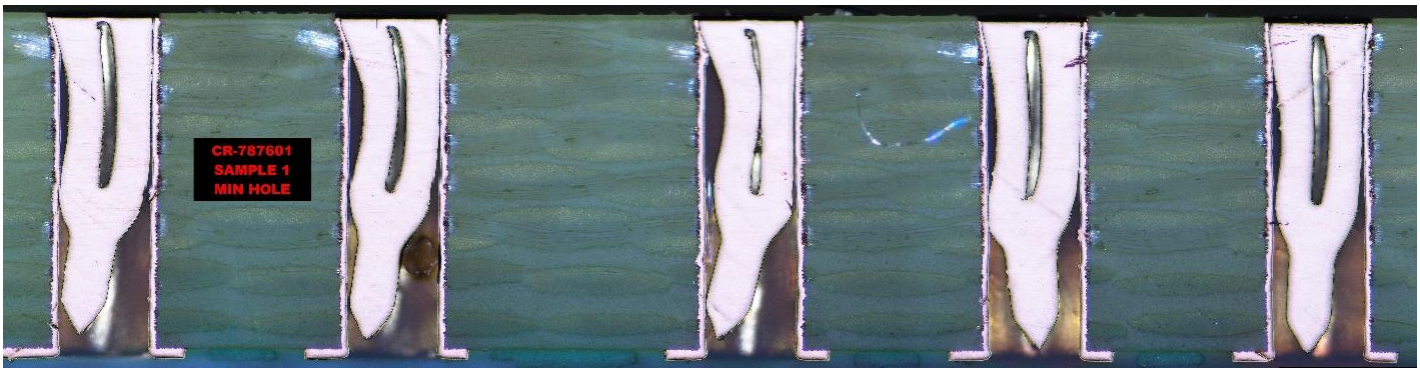


Max Tin

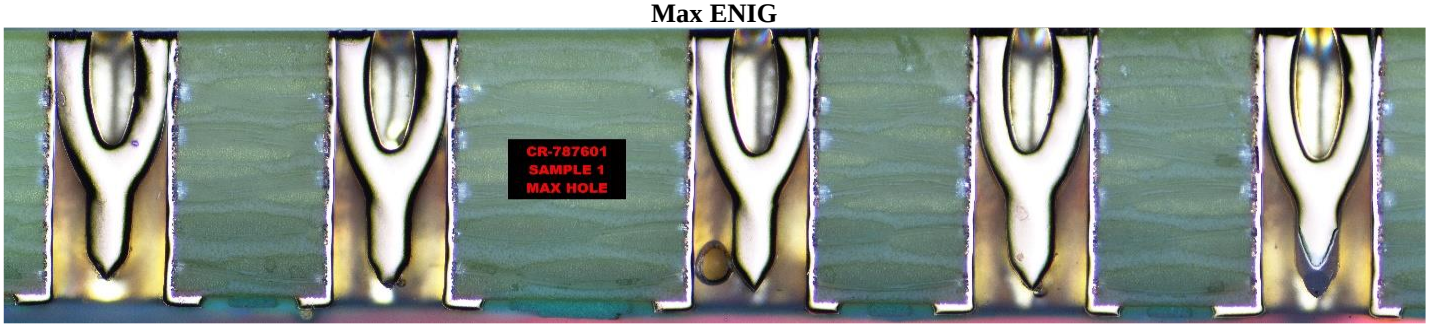


DATA SUMMARIES Continued

Min ENIG



Max ENIG



DATA SUMMARIES Continued

Measure radial deformation:

Hole Deformation Inspection Min/Max OSP

Sample:	.012 PTH	.016 PTH
1	0.0018	0.0003
2	0.0014	0.0006
3	0.0012	0.0007
4	0.0013	0.0006
5	0.0012	0.0006
6	0.0013	0.0004
7	0.0012	0.0005
8	0.0012	0.0006
9	0.0015	0.0004
10	0.0013	0.0005
minimum:	**0.0012**	**0.0003**
maximum:	0.0018	0.0007
average:	0.0013	0.0005

Hole Deformation Inspection Min/Max Tin

Sample:	.012 PTH	.016 PTH
1	0.0019	0.0006
2	0.0013	0.0004
3	0.0018	0.0003
4	0.0016	0.0004
5	0.0018	0.0003
6	0.0018	0.0003
7	0.0013	0.0002
8	0.0016	0.0001
9	0.0018	0.0002
10	0.0013	0.0002
minimum:	**0.0013**	**0.0001**
maximum:	0.0019	0.0006
average:	0.0016	0.0003

DATA SUMMARIES Continued

Measure radial deformation:

Hole Deformation Inspection Min/Max ENIG

Sample:	.012 PTH	.016 PTH
1	0.0009	0.0004
2	0.0007	0.0003
3	0.0011	0.0002
4	0.0011	0.0003
5	0.0008	0.0003
6	0.0007	0.0004
7	0.0006	0.0001
8	0.0008	0.0001
9	0.0010	0.0003
10	0.0010	0.0001
minimum:	**0.0006**	**0.0001**
maximum:	0.0011	0.0004
average:	0.0009	0.0002

DATA SUMMARIES Continued

LLCR

1) A total of 40 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 for compliant pin only
   a. <= +1 mOhms: ---------- Stable
   b. > +1 to +7.5 mOhms: ---------- Minor
   c. +7.5 to +10 mOhms: ---------- Acceptable
   d. +10 to +50.0 mOhms: ---------- Marginal
   e. +50.1 to +1000 mOhms: ---------- Unstable
   f. >+1000 mOhms: ---------- Open Failure

0.0177" Drill/ MAX Hole OSP

	LLCR Measurement Summaries by Pin Type			
Date	12/20/2017	1/10/2018	1/31/2018	2/7/2018
Room Temp (Deg C)	23	23	23	22
Rel Humidity (%)	34	35	32	33
Technician	Aaron McKim	Aaron McKim	Aaron McKim	Aaron McKim
mOhm values	**Actual 1st Connector**	**Delta 2nd Connector**	**Delta 3rd Connector**	**Delta After Thermals**
Max (.0162") OSP	**Pin Type 1: Signal**			
Average	0.42	0.08	0.10	0.13
St. Dev.	0.14	0.06	0.08	0.08
Min	0.21	0.01	0.00	0.01
Max	0.74	0.23	0.36	0.42
Summary Count	40	40	40	40
Total Count	40	40	40	40

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=1**	**>1 & <=7.5**	**>7.5 & <=10**	**>10 & <=50**	**>50 & <=1000**	**>1000**
2nd Connector	**40**	**0**	**0**	**0**	**0**	**0**
3rd Connector	**40**	**0**	**0**	**0**	**0**	**0**
After Thermals	**40**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

0.0177" Drill/ MAX Hole Immersion Tin

	LLCR Measurement Summaries by Pin Type			
Date	12/20/2017	1/10/2018	1/31/2018	2/7/2018
Room Temp (Deg C)	23	23	23	22
Rel Humidity (%)	34	35	32	33
Technician	Aaron McKim	Aaron McKim	Aaron McKim	Aaron McKim
mOhm values	**Actual 1st Connector**	**Delta 2nd Connector**	**Delta 3rd Connector**	**Delta After Thermals**
Max (.0162") Immersion Tin	**Pin Type 1: Signal**			
Average	0.54	0.05	0.04	0.08
St. Dev.	0.16	0.05	0.05	0.09
Min	0.29	0.00	0.00	0.00
Max	0.84	0.22	0.23	0.41
Summary Count	40	40	40	40
Total Count	40	40	40	40

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=1**	**>1 & <=7.5**	**>7.5 & <=10**	**>10 & <=50**	**>50 & <=1000**	**>1000**
2nd Connector	**40**	**0**	**0**	**0**	**0**	**0**
3rd Connector	**40**	**0**	**0**	**0**	**0**	**0**
After Thermals	**40**	**0**	**0**	**0**	**0**	**0**

0.0177" Drill/ MAX Hole ENIG

	LLCR Measurement Summaries by Pin Type			
Date	2023/2/1	2023/2/24	2023/2/24	2023/3/20
Room Temp (Deg C)	23	23	22	22
Rel Humidity (%)	34	35	38	38
Technician	Daniel Haydon	Daniel Haydon	Daniel Haydon	Daniel Haydon
mOhm values	**Actual 1st Connector**	**Delta 2nd Connector**	**Delta 3rd Connector**	**Delta After Thermals**
Max (.0162") ENIG	**Pin Type 1: Signal**			
Average	0.15	0.03	0.05	0.04
St. Dev.	0.03	0.02	0.02	0.02
Min	0.11	0.00	0.01	0.00
Max	0.21	0.07	0.09	0.08
Summary Count	40	40	40	40
Total Count	40	40	40	40

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=1**	**>1 & <=7.5**	**>7.5 & <=10**	**>10 & <=50**	**>50 & <=1000**	**>1000**
2nd Connector	**40**	**0**	**0**	**0**	**0**	**0**
3rd Connector	**40**	**0**	**0**	**0**	**0**	**0**
After Thermals	**40**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Automated Test Stand
Manufacturer: Chatillon/Lloyd
Model: LF Plus
Serial #: LF1310
Accuracy: See Manual
… Last Cal: 11/14/2022, Next Cal: 11/14/2023

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 09/11/2022, Next Cal: 09/11/2023

Equipment #: OV-05
Description: Forced Air Oven, 5 Cu. Ft., 120 V (Chamber Room)
Manufacturer: Sheldon Mfg.
Model: CE5F
Serial #: 02008008
Accuracy: +/- 5 deg. C
… Last Cal: 03/18/2023, Next Cal: 03/18/2024