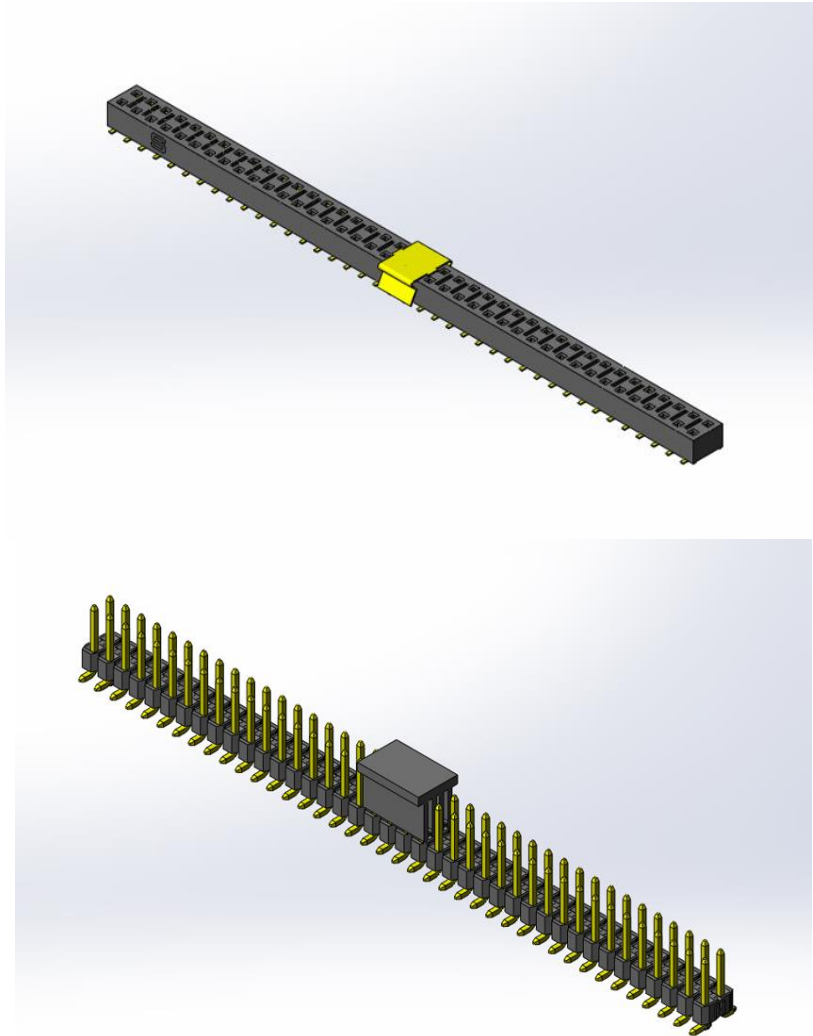




Project Number: Mixed Flowing Gas test report	Tracking Code: 3204238_Report_Rev_1
Requested by: Mark Shireman	Date: 10/13/2022
Part #: HLE-140-02-S-DV-A-P/ TSM-140-01-S-DV-A-P	
Part description: HLE-TSM	Tech: Keney Chen
Test Start: 9/6/2022	Test Completed: 9/22/2022



**MIXED FLOWING GAS TEST REPORT**

**HLE/TSM**

**HLE-140-02-S-DV-A-P/ TSM-140-01-S-DV-A-P**

**REVISION HISTORY**

<b>DATE</b>	<b>REV.NUM.</b>	<b>DESCRIPTION</b>	<b>ENG</b>
10/9/2022	1	Initial Issue	KC

## 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: Mixed Flowing Gas per EIA-364-65 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 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 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-112139-TST

**FLOWCHARTS****Mixed Flowing Gas****Group 1**

HLE-140-02-S-DV-A-P

TSM-140-01-S-DV-A-P

8 Assemblies

<b>Step</b>	<b>Description</b>
1.	Plating Thickness Verification <sup>(4)</sup>
2.	LLCR <sup>(1)</sup>
3.	Cycles Quantity = 20 Cycles
4.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm
5.	Mixed Flowing Gas Unmated <sup>(3)</sup> Duration = 7 Days
6.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm
7.	Cycles Quantity = 1 Cycles
8.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm
9.	Mixed Flowing Gas Mated <sup>(2)</sup> Duration = 7 Days
10.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm
11.	Cycles Quantity = 1 Cycles
12.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm

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(1) LLCR = EIA-364-23

Open Circuit Voltage = 20 mV Max

Test Current = 100 mA Max

(2) Mixed Flowing Gas Mated = EIA-364-65

Environmental Conditions = Class IIA

(3) Mixed Flowing Gas Unmated = EIA-364-65

Environmental Conditions = Class IIA

(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

## ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

### 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.

### Mixed Flowing Gas:

- 1) EIA-364-65B, *Mixed Flowing Test Procedure For Electrical Connectors Contacts And Sockets*.
- 2) To adequately evaluate the risk of corrosion, the Mixed Flowing Gas test shall be done with the gas mixtures in below table.

**Table 1 - Environmental classes**

Class	Relative humidity, %	Temperature, °C	Concentration, ppb			
			Cl <sub>2</sub>	NO <sub>2</sub>	H <sub>2</sub> S	SO <sub>2</sub>
I	Discontinued as a test procedure.					
II	Superseded by class IIA					
IIA	70 ± 2	30 ± 1	10 ± 3	200 ± 50	10 ± 5	100 ± 20
III	Superseded by class IIIA					
IIIA	70 ± 2	30 ± 1	20 ± 5	200 ± 50	100 ± 20	200 ± 50
IV	75 ± 2	40 ± 2	30 ± 5	200 ± 50	200 ± 20	N/A

- 3) The mated and unmated exposure is done in parallel for qualification at Class IIA conditions.
- 4) Exposure time for mated and unmated is 14 days

### 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 +1000 mOhms: -----Unstable
  - f. >+1000 mOhms: -----Open Failure

**RESULTS****LLCR Mixed Flowing Gas Group (192 LLCR test points)**

- **Initial** -----7.44 mOhms Max
- **Durability, 20 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 +1000 mOhms -----0 Points ----- Unstable
  - >+1000 mOhms -----0 Points ----- Open Failure
- **7 Days Mixed Flowing Gas (with 4 Samples Unmated & 4 Samples Mated During Exposure)**
  - <= +5.0 mOhms ----- 190 Points ----- Stable
  - +5.1 to +10.0 mOhms -----2 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
- **1 Cycle**
  - <= +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
- **14 Days Total Mixed Flowing Gas (with All 8 Samples Mated During Exposure)**
  - <= +5.0 mOhms ----- 190 Points ----- Stable
  - +5.1 to +10.0 mOhms -----2 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
- **1 Cycle**
  - <= +5.0 mOhms ----- 185 Points ----- Stable
  - +5.1 to +10.0 mOhms -----7 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

**DATA SUMMARIES****LLCR Mixed Flowing Gas 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  $+1000$  mOhms-----Unstable
  - f.  $> +1000$  mOhms:-----Open Failure

<b>LLCR Measurement Summaries by Pin Type</b>						
Date	9/6/2022	9/7/2022	9/14/2022	9/14/2022	9/21/2022	9/21/2022
Room Temp (Deg C)	23	23	23	23	23	23
Rel Humidity (%)	51	51	51	51	51	51
Technician	Keney Chen	Keney Chen	Keney Chen	Keney Chen	Keney Chen	Keney Chen
<b>mOhm values</b>	<b>Actual Initial</b>	<b>Delta 20 Cycles</b>	<b>Delta 7 Days MFG</b>	<b>Delta 1 Cycles</b>	<b>Delta 14 Days MFG</b>	<b>Delta 1 Cycles</b>
<b>Pin Type 1: Signal</b>						
Average	6.22	0.32	0.61	0.74	0.90	1.33
St. Dev.	0.40	0.26	0.92	0.79	1.01	1.48
Min	5.42	0.00	0.01	0.01	0.01	0.01
Max	7.44	1.46	6.35	4.49	7.61	7.89
Summary Count	192	192	192	192	192	192
Total Count	192	192	192	192	192	192

<b>LLCR Delta Count by Category</b>						
	<b>Stable</b>	<b>Minor</b>	<b>Acceptable</b>	<b>Marginal</b>	<b>Unstable</b>	<b>Open</b>
<b>mOhms</b>	<b><math>\leq 5</math></b>	<b><math>&gt;5</math> &amp; <math>\leq 10</math></b>	<b><math>&gt;10</math> &amp; <math>\leq 15</math></b>	<b><math>&gt;15</math> &amp; <math>\leq 50</math></b>	<b><math>&gt;50</math> &amp; <math>\leq 1000</math></b>	<b><math>&gt;1000</math></b>
<b>20 Cycles</b>	<b>192</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>7 Days MFG</b>	<b>190</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>1 Cycles</b>	<b>192</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>14 Days MFG</b>	<b>190</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>1 Cycles</b>	<b>185</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**EQUIPMENT AND CALIBRATION SCHEDULES****Equipment #:** HZ-TCT-01**Description:** Normal force analyzer**Manufacturer:** Mecmesin Multitester**Model:** Mecmesin Multitester 2.5-i**Serial #:** 08-1049-04**Accuracy:** Last Cal: 3/7/2022, Next Cal: 3/6/2023**Equipment #:** HZ-MO-05**Description:** Micro-ohmmeter**Manufacturer:** Keithley**Model:** 3706**Serial #:** 1285188**Accuracy:** Last Cal: 9/26/2022, Next Cal: 9/25/2023**Equipment #:** DG-MFG-01**Description:** Mixed Flow Gas Chamber**Manufacturer:** Yamasaki**Model:** GH-180**Serial #:** 715**Accuracy:** Last Cal: 12/5/2021, Next Cal: 12/4/2022