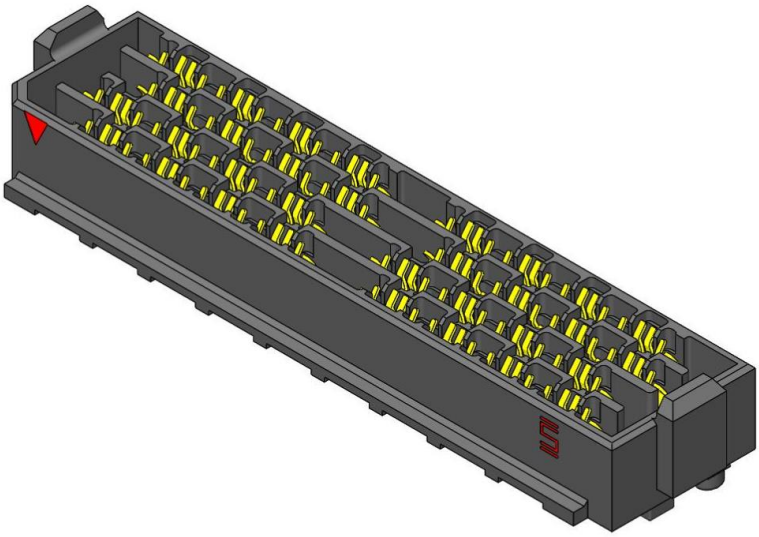
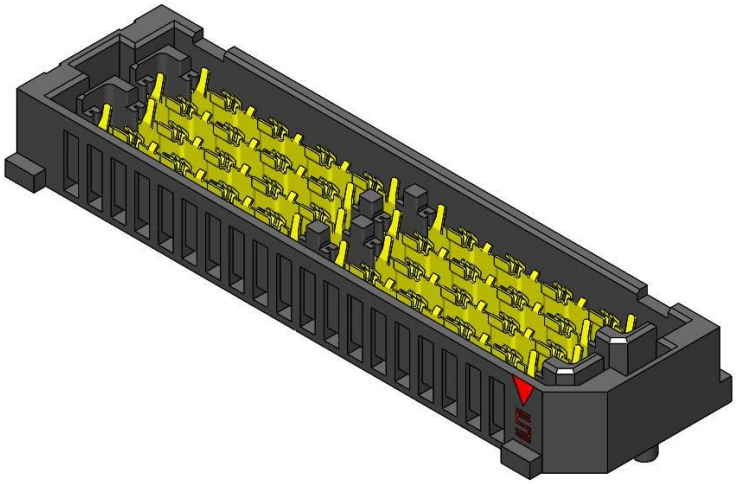
Project Number: Mixed Flowing Gas test report	Tracking Code: 2161230_Report_Rev_1
Requested by: Jonathan Ochsner	Date: 3/12/2020
Part #: NVAF-DP-04-2-05.0-S-2/NVAM-DP-04-2-02.0-S-2	
Part description: NVAF-NVAM	Tech: Keney Chen
Test Start: 12/9/2019	Test Completed: 12/30/2019





(Actual part not depicted)

MIXED FLOWING GAS TEST REPORT

NVAF/NVAM
NVAF-DP-04-2-05.0-S-2/NVAM-DP-04-2-02.0-S-2

REVISION HISTORY

DATE	REV.NUM.	DESCRIPTION	ENG
3/12/2020	**1**	**Initial Issue**	**KC**

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: 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-110010-TST-01/02

FLOWCHARTS

Mixed Flowing Gas

Note: LLCR - Minimum of 25% of the contact positions to be tested.

Group 1
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
6 Assemblies

Step	Description
1.	LLCR(1)
2.	Cycles Cycles = 20 Cycles
3.	Thermal Age (4) - Non Standard *Note: EIA-364-1000, Table 9, 60°C for 10 years.*
4.	LLCR(1) Max Delta = 10 mOhm
5.	Mixed Flowing Gas Unmated (3) Duration = 168 hrs *Note: 1/2 of samples mated 1/2 of samples unmated*
6.	LLCR(1) Max Delta = 10 mOhm
7.	Mixed Flowing Gas Mated (2) Duration = 168 hrs *Note: All samples mated*
8.	LLCR(1) Max Delta = 10 mOhm
9.	Cycles Cycles = 1 Cycles *Note: Manually unmate/mate the interconnect system once.*
10.	LLCR(1) Max Delta = 10 mOhm

(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) Thermal Age = Other
Test Condition = 105°C
Time Condition = 66 Hours
EIA-364-17

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_2	NO_2	H_2S	SO_2
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 (256 LLCR test points)

- **Initial ---------- 22.76 mOhms Max**
- **Durability, 20 Cycles**
  - **<= +5.0 mOhms ---------- 256 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**
- **Thermal Age, 105 ℃ 72Hours**
  - **<= +5.0 mOhms ---------- 256 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 ---------- 255 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 +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 ---------- 253 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------3 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 ---------- 254 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**

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. <= +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	12/3/2019	12/6/2019	12/9/2019	12/16/2019	12/26/2019	12/26/2019
Room Temp (Deg C)	23	23	23	23	23	23
Rel Humidity (%)	54	51	44	44	44	44
Technician	Keney Chen	Keney Chen	Keney Chen	Keney Chen	Keney Chen	Keney Chen
mOhm values	**Actual Initial**	**Actual 20 Cycles**	**Actual Therm Age**	**Actual 7 days MFG**	**Actual 14 days MFG**	**Actual 1 Cycles**
	Pin Type 1: Signal					
Average	21.34	-0.27	0.37	1.19	1.62	1.53
St. Dev.	0.62	0.65	0.60	1.15	1.17	1.29
Min	19.95	-1.57	-1.30	-0.78	-0.81	-0.80
Max	22.76	1.65	2.61	5.30	5.90	5.52
Summary Count	192	192	192	192	192	192
Total Count	192	192	192	192	192	192
	Pin Type 1: Ground					
Average	1.72	0.00	-0.05	-0.08	-0.19	-0.17
St. Dev.	0.05	0.05	0.06	0.08	0.11	0.08
Min	1.62	-0.15	-0.21	-0.24	-0.62	-0.52
Max	1.86	0.10	0.07	0.11	-0.01	0.01
Summary Count	64	64	64	64	64	64
Total Count	64	64	64	64	64	64

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
20 Cycles	**256**	**0**	**0**	**0**	**0**	**0**
Therm Age	**256**	**0**	**0**	**0**	**0**	**0**
7 days MFG	**255**	**1**	**0**	**0**	**0**	**0**
14 days MFG	**253**	**3**	**0**	**0**	**0**	**0**
1 Cycles	**254**	**2**	**0**	**0**	**0**	**0**

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: 3/7/2019, Next Cal: 3/6/2020

Equipment #: HZ-MO-05
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 3706
Serial #: 1285188
Accuracy: Last Cal: 9/25/2020, Next Cal: 9/24/2021

Equipment #: DG-MFG-01
Description: Mixed Flow Gas Chamber
Manufacturer: Yamasaki
Model: GH-180
Serial #: 715
Accuracy: Last Cal: 12/5/2019, Next Cal: 12/4/2020