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| Project Number: Mixed Flowing Gas test report | Tracking Code: 2657654_Report_Rev_1 |
| Requested by: Kason He | Date: 3/4/2021 |
| Part #: ACP-16-01-S-00.35-T-BC-P-1/ACR-16-01-S-00.35-S-BC-P-1 | |
| Part description: ACP-ACR | Tech: Keney Chen |
| Test Start: 1/12/2021 | Test Completed: 2/1/2021 |



(Actual part not depicted)

MIXED FLOWING GAS TEST REPORT

ACP/ACR

ACP-16-01-S-00.35-T-BC-P-1/ACR-16-01-S-00.35-S-BC-P-1

REVISION HISTORY

| DATE | REV.NUM. | DESCRIPTION | ENG |
|-----------------|-----------------|----------------------|------------|
| 3/5/2021 | 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-103219-TST

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

ACP-16-01-S-00.35-T-BC-P-1

ACR-16-01-S-00.35-S-BC-P-1

8 Assemblies

| Step | Description |
|-------------|---|
| 1. | Plating Thickness Verification ⁽⁴⁾ |
| 2. | LLCR ₍₁₎ |
| 3. | Cycles Quantity = 20 Cycles |
| 4. | LLCR ₍₁₎ Max Delta = 15 mOhm |
| 5. | Mixed Flowing Gas Unmated ⁽³⁾ Duration = 7 Days |
| 6. | LLCR ₍₁₎ Max Delta = 15 mOhm |
| 7. | Cycles Quantity = 1 Cycles |
| 8. | LLCR ₍₁₎ Max Delta = 15 mOhm |
| 9. | Mixed Flowing Gas Mated ⁽²⁾ Duration = 7 Days |
| 10. | LLCR ₍₁₎ Max Delta = 15 mOhm |
| 11. | Cycles Quantity = 1 Cycles |
| 12. | LLCR ₍₁₎ Max Delta = 15 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) 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 ₂ | NO ₂ | H ₂ S | 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 (112 LLCR test points)**

- **Initial** ----- 143.15 mOhms Max
- **Durability, 20 Cycles**
 - <= +5.0 mOhms ----- 110 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
- **7 Days Mixed Flowing Gas (with 4 Samples Unmated & 4 Samples Mated During Exposure)**
 - <= +5.0 mOhms ----- 106 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 6 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 ----- 110 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
- **14 Days Total Mixed Flowing Gas (with All 8 Samples Mated During Exposure)**
 - <= +5.0 mOhms ----- 103 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 +1000 mOhms ----- 0 Points ----- Unstable
 - >+1000 mOhms ----- 0 Points ----- Open Failure
- **1 Cycle**
 - <= +5.0 mOhms ----- 107 Points ----- Stable
 - +5.1 to +10.0 mOhms ----- 5 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

| LLCR Measurement Summaries by Pin Type | | | | | | |
|---|----------------|------------------|-------------------|----------------|--------------------|----------------|
| Date | 1/12/2021 | 1/12/2021 | 1/22/2021 | 1/22/2021 | 2/1/2021 | 2/1/2021 |
| Room Temp (Deg C) | 23 | 23 | 23 | 23 | 23 | 23 |
| Rel Humidity (%) | 51 | 51 | 51 | 51 | 51 | 51 |
| Technician | Kason He | Keney Chen | Keney Chen | Keney Chen | Keney Chen | Keney Chen |
| mOhm values | Actual | Delta | Delta | Delta | Delta | Delta |
| | Initial | 20 Cycles | 7 Days MFG | 1 Cycle | 14 Days MFG | 1 Cycle |
| Pin Type 1: Signal | | | | | | |
| Average | 131.99 | 1.05 | 2.64 | 2.69 | 3.00 | 3.16 |
| St. Dev. | 6.93 | 1.15 | 1.15 | 0.99 | 1.33 | 1.38 |
| Min | 112.80 | 0.01 | 0.20 | 0.03 | 0.01 | 0.00 |
| Max | 143.15 | 8.24 | 6.72 | 6.60 | 8.62 | 9.44 |
| Summary Count | 112 | 112 | 112 | 112 | 112 | 112 |
| Total Count | 112 | 112 | 112 | 112 | 112 | 112 |

| LLCR Delta Count by Category | | | | | | |
|-------------------------------------|----------|---------------------|-------------------|-------------------|---------------------|---------|
| mOhms | Stable | Minor | Acceptable | Marginal | Unstable | Open |
| | ≤ 5 | >5 & ≤ 10 | >10 & ≤ 15 | >15 & ≤ 50 | >50 & ≤ 1000 | >1000 |
| 20 Cycles | 110 | 2 | 0 | 0 | 0 | 0 |
| 7 Days MFG | 106 | 6 | 0 | 0 | 0 | 0 |
| 1 Cycle | 110 | 2 | 0 | 0 | 0 | 0 |
| 14 Days MFG | 103 | 9 | 0 | 0 | 0 | 0 |
| 1 Cycle | 107 | 5 | 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: 3/7/2020, Next Cal: 3/6/2021**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: 12/5/2020, Next Cal: 12/4/2021