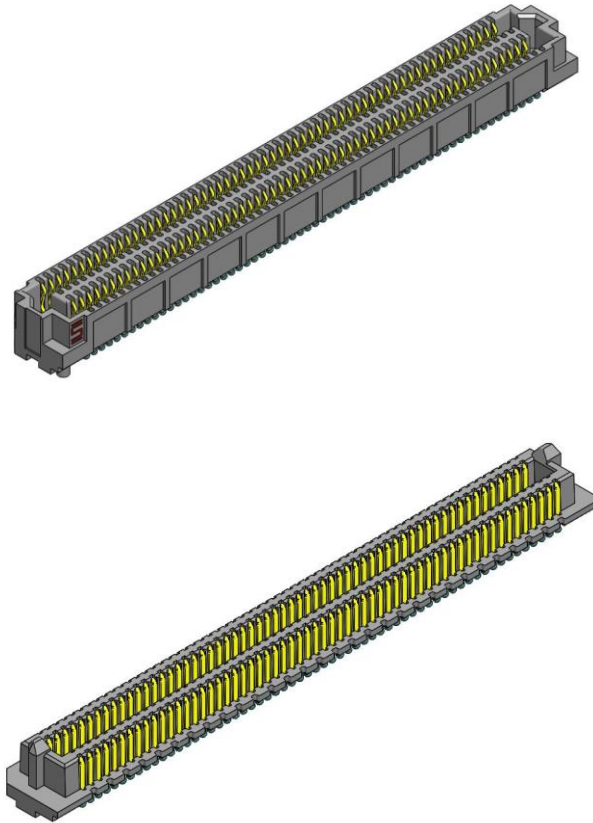




Project Number: Design Qualification Test Report	Tracking Code: CR-820802_Report_Rev_1
Requested by: Jacob Harris	Date: 12/12/2022
Part #: ADF6-60-03.5-S-4-2-A/ADM6-60-01.5-S-4-2-A	
Part description: ADF6/ADM6	Tech: Daniel Haydon
Test Start: 4/5/2022	Test Completed: 7/5/2022



EXTENDED LIFE TEST REPORT
ADF6/ADM6
ADF6-60-03.5-S-4-2/ADM6-60-01.5-S-4-2-A

Tracking Code: CR-820802_Report_Rev_1	Part #: ADF6-60-03.5-S-4-2-A/ADM6-60-01.5-S-4-2-A
Part description: ADF6/ADM6	

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
12/12/2022	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: Extended Life 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 CO-SC-WI-3029.
- 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-110007-TST

FLOWCHARTS

Extended Life

Group 1 ADF6-60-03.5-S-4-2-A ADM6-60-01.5-S-4-2-A 8 Assemblies 100 Cycles		Group 2 ADF6-60-03.5-S-4-2-A ADM6-60-01.5-S-4-2-A 8 Assemblies 250 Cycles		Group 3 ADF6-60-03.5-S-4-2-A ADM6-60-01.5-S-4-2-A 8 Assemblies 500 Cycles		Group 4 ADF6-60-03.5-S-4-2-A ADM6-60-01.5-S-4-2-A 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⁾

Group 5 ADF6-60-03.5-S-4-2-A ADM6-60-01.5-S-4-2-A 8 Assemblies 2500 Cycles	
Step	Description
1.	Plating Thickness Verification ⁽⁴⁾
2.	LLCR ⁽²⁾
3.	Cycles Quantity = 2500 Cycles
4.	LLCR ⁽²⁾ Max Delta = 15 mOhm
5.	Thermal Shock ⁽⁵⁾
6.	LLCR ⁽²⁾ Max Delta = 15 mOhm
7.	Humidity ⁽¹⁾
8.	LLCR ⁽²⁾ Max Delta = 15 mOhm
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: -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.

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.

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 Extended Life****100 cycles**

- **Initial** ----- 21.72 mOhms Max
- **Durability, 100 Cycles**
 - <= +5.0 mOhms ----- 480 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**
 - <= +5.0 mOhms ----- 479 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
- **Humidity**
 - <= +5.0 mOhms ----- 480 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

250 cycles

- **Initial** ----- 28.05 mOhms Max
- **Durability, 250 Cycles**
 - <= +5.0 mOhms ----- 479 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
- **Thermal**
 - <= +5.0 mOhms ----- 479 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
- **Humidity**
 - <= +5.0 mOhms ----- 478 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

RESULTS Continued**500 cycles**

- **Initial** ----- 24.64 mOhms Max
- **Durability, 500 Cycles**
 - <= +5.0 mOhms ----- 480 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**
 - <= +5.0 mOhms ----- 480 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
- **Humidity**
 - <= +5.0 mOhms ----- 479 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

1000 cycles

- **Initial** ----- 24.85 mOhms Max
- **Durability, 1000 Cycles**
 - <= +5.0 mOhms ----- 479 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
- **Thermal**
 - <= +5.0 mOhms ----- 480 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
- **Humidity**
 - <= +5.0 mOhms ----- 479 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

RESULTS Continued**2500 cycles**

- **Initial** ----- 22.85 mOhms Max
- **Durability, 2500 Cycles**
 - **<= +5.0 mOhms**-----480 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**
 - **<= +5.0 mOhms**-----480 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
- **Humidity**
 - **<= +5.0 mOhms**-----479 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

DATA SUMMARIES**LLCR Extended Life:**

- 1) A total of 480 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

Group 1 100 cycles

LLCR Measurement Summaries by Pin Type				
Date	4/5/2022	4/6/2022	4/19/2022	5/4/2022
Room Temp (Deg C)	22	22	22	22
Rel Humidity (%)	45	45	39	47
Technician	TM/DH	Daniel Haydon	Daniel Haydon	Daniel Haydon
mOhm values	Actual	Delta	Delta	Delta
	Pin Type: Signal 1	Cycles	Therm Shck	Humidity
Pin Type: Signal 1				
Average	20.02	0.99	1.07	0.99
St. Dev.	0.61	0.69	0.80	0.70
Min	18.25	0	0.01	0
Max	21.72	3.05	6.42	3.99
Summary Count	480	480	480	480
Total Count	480	480	480	480

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 5	>5 & ≤ 10	>10 & ≤ 15	>15 & ≤ 50	>50 & ≤ 1000	>1000
Cycles	480	0	0	0	0	0
Therm Shck	479	1	0	0	0	0
Humidity	480	0	0	0	0	0

DATA SUMMARIES Continued**Group 2 250 cycles**

LLCR Measurement Summaries by Pin Type				
Date	5/4/2022	5/6/2022	5/16/2022	5/26/2022
Room Temp (Deg C)	22	22	22	22
Rel Humidity (%)	45	49	50	50
Technician	Daniel Haydon	Jakob Sutter	Daniel Haydon	Daniel Haydon
mOhm values	Actual Initial	Delta Cycles	Delta Therm Shck	Delta Humidity
Pin Type: Signal 1				
Average	20.11	0.54	0.51	0.66
St. Dev.	0.79	0.59	0.53	0.83
Min	18.29	0	0	0
Max	28.05	8.29	7.77	8.71
Summary Count	480	480	480	480
Total Count	480	480	480	480

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
Cycles	479	1	0	0	0	0
Therm Shck	479	1	0	0	0	0
Humidity	478	2	0	0	0	0

DATA SUMMARIES Continued**Group 3 500 cycles**

LLCR Measurement Summaries by Pin Type				
Date	6/13/2022	6/15/2022	6/21/2022	7/5/2022
Room Temp (Deg C)	22	22	22	22
Rel Humidity (%)	52	53	49	55
Technician	Daniel Haydon	Daniel Haydon	Daniel Haydon	Daniel Haydon
mOhm values	Actual	Delta	Delta	Delta
	Initial	Cycles	Therm Shck	Humidity
Pin Type: Signal 1				
Average	20.64	0.68	0.81	0.84
St. Dev.	1.03	0.62	0.66	0.71
Min	17.78	0	0	0
Max	24.64	4.72	4.31	6.02
Summary Count	480	480	480	480
Total Count	480	480	480	480

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
Cycles	480	0	0	0	0	0
Therm Shck	480	0	0	0	0	0
Humidity	479	1	0	0	0	0

DATA SUMMARIES Continued**Group 4 1000 cycles**

LLCR Measurement Summaries by Pin Type				
Date	6/13/2022	6/16/2022	6/21/2022	7/5/2022
Room Temp (Deg C)	23	23	22	22
Rel Humidity (%)	54	52	49	53
Technician	Daniel Haydon	Daniel Haydon	Daniel Haydon	Daniel Haydon
mOhm values	Actual	Delta	Delta	Delta
	Initial	Cycles	Therm Shck	Humidity
Pin Type: Signal 1				
Average	20.71	1.06	1.04	0.9
St. Dev.	1.07	0.93	0.81	0.86
Min	15.21	0	0.01	0
Max	24.85	6.25	4.66	5.12
Summary Count	480	480	480	480
Total Count	480	480	480	480

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
Cycles	479	1	0	0	0	0
Therm Shck	480	0	0	0	0	0
Humidity	479	1	0	0	0	0

DATA SUMMARIES Continued**Group 5 2500 cycles**

LLCR Measurement Summaries by Pin Type				
Date	10/15/2021	10/29/2021	11/2/2021	11/19/2021
Room Temp (Deg C)	22	23	23	23
Rel Humidity (%)	51	38	38	36
Technician	Scott Rollefstad	Scott Rollefstad	Scott Rollefstad	Scott Rollefstad
mOhm values	Actual	Delta	Delta	Delta
	Initial	Cycles	Therm Shck	Humidity
Pin Type: Signal 1				
Average	20.14	0.92	0.66	1
St. Dev.	0.85	0.71	0.63	0.81
Min	18.07	0	0	0
Max	22.85	3.78	3.04	5.24
Summary Count	480	480	480	480
Total Count	480	480	480	480

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
Cycles	480	0	0	0	0	0
Therm Shck	480	0	0	0	0	0
Humidity	479	1	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: 3/7/2022, Next Cal: 3/6/2023**Equipment #:** HZ-MO-05**Description:** Micro-ohmmeter**Manufacturer:** Keithley**Model:** 3706**Serial #:** 1285188**Accuracy:** Last Cal: 9/25/2022, Next Cal: 9/24/2023