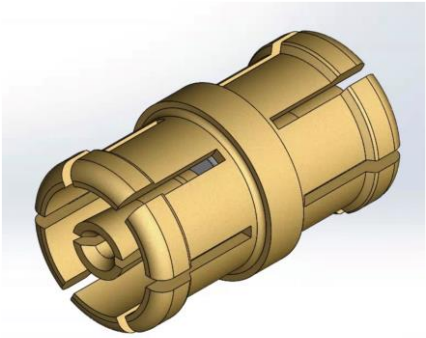
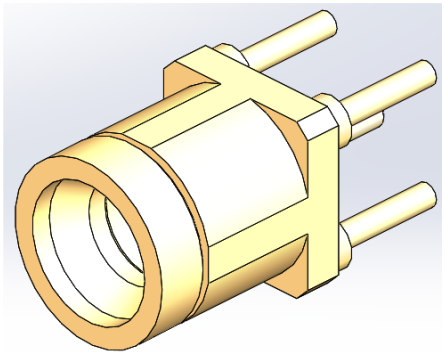
Project Number: Design Qualification Test Report	Tracking Code: 2854234_Report_Rev_1
Requested by: Ethan Chen	Date: 10/6/2021
Part #: PRFIA-SMPM-J-J-S-4/SMPM-PF-P-HG-ST-TH-1	
Part description: PRFIA/SMPM	Tech: Kason He
Test Start: 7/26/2021	Test Completed: 8/23/2021





DESIGN QUALIFICATION TEST REPORT

PRFIA/SMPM
PRFIA-SMPM-J-J-S-4/SMPM-PF-P-HG-ST-TH-1

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
10/6/2021	**1**	**Initial Issue**	**KH**

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: Design Qualification test. Please see test plan.

APPLICABLE DOCUMENTS

Standards: EIA Publication 364, DSCC-10019 and MIL-STD-202-107.

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 and DWV/IR 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 and DWV/IR 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-109619-TST/ PCB-109618-TST

FLOWCHARTS

Mating/Unmating/Durability

Note: Check signal and ground LLCR.

Group 1
PRFIA-SMPM-J-J-S-4
SMPM-PF-P-HG-ST-TH-1
8 Assemblies
FULL DETENT TO BULLET
Note: CYCLE ONLY ONE SIDE OF CONNECTOR.

Step	Description
1.	Contact Gaps
2.	LLCR (1)
3.	Mating/Unmating Force (2) - Non Standard
4.	Cycles Quantity = 25 Cycles
5.	Mating/Unmating Force (2) - Non Standard
6.	Contact Gaps
7.	LLCR (1) Max Delta = 15 mOhm
8.	Thermal Shock (3) - Non Standard
9.	LLCR (1) Max Delta = 15 mOhm
10.	Mating/Unmating Force (2) - Non Standard

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

(2) Mating/Unmating Force = Other
DSCC 10019, PER MIL-STD-348A, FULL DETENT
ENGAGE MAX = 8lbs ; DISENGAGE MIN = 3lbs

(3) Thermal Shock = Other
PER DSCC-10019 AND MIL-STD-202-107
TEST CONDITION B PER DSCC 10019. EXCEPTION: HIGH TEMP. TO BE +165°C

FLOWCHARTS Continued

IR/DWV

Note: 5000 megaohms min IR

Pin-to-Ground

Group 1
PRFIA-SMPM-J-J-S-4
SMPM-PF-P-HG-ST-TH-1
2 Assemblies

Note: 2 Thru Hole connectors and 1 Bullet required to test a full transmission path.

Step	Description
1.	Mated Height *Note: MEASURE MATED HEIGHT OF ALL 3 PARTS FULLY MATED. MEASURE FROM THE PCB SEATING SURFACE OF ONE MATING PART TO THE OTHER.*
2.	DWV Breakdown(2) - Non Standard

Group 2
PRFIA-SMPM-J-J-S-4

2 Assemblies

Step	Description
1.	DWV Breakdown(2) - Non Standard

Group 3
PRFIA-SMPM-J-J-S-4
SMPM-PF-P-HG-ST-TH-1
2 Assemblies

Note: 2 Thru Hole connectors and 1 Bullet required to test a full transmission path.

Step	Description
1.	Mated Height *Note: MEASURE MATED HEIGHT OF ALL 3 PARTS FULLY MATED. MEASURE FROM THE PCB SEATING SURFACE OF ONE MATING PART TO THE OTHER.*
2.	IR(4)
3.	DWV at Test Voltage(1) - Non Standard Test Voltage = 325 V
4.	Thermal Shock(5) - Non Standard
5.	IR(4)
6.	DWV at Test Voltage(1) - Non Standard Test Voltage = 325 V
7.	Humidity(3)
8.	IR(4)
9.	DWV at Test Voltage(1) - Non Standard Test Voltage = 325 V

(1) DWV at Test Voltage = Other
DSCC-10019 AND MIL-PRF-39012 (PARA 4.6.14)
Test Condition = 1 (Sea Level) ; DWV test voltage is equal to 75% of the lowest breakdown voltage ; Test voltage applied for 60 seconds.

(2) DWV Breakdown = Other
MIL-PRF-39012 (PARA 4.6.14)
RECORD BREAKDOWN VOLTAGE. (DATA ONLY)

(3) 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

(4) IR = EIA-364-21
Test Condition = 500 Vdc, 2 Minutes Max

(5) Thermal Shock = Other
PER DSCC-10019 AND MIL-STD-202-107
TEST CONDITION B PER DSCC 10019. EXCEPTION: HIGH TEMP. TO BE +165°C

Retention

Group 1
PRFIA-SMPM-J-J-S-4

10 Assemblies
BULLET

Step	Description
1.	Center Contact Retention MIN AXIAL RETENTION = 1.5 lbs *Note: PER DSCC 10019*

Group 2
PRFIA-SMPM-J-J-S-4

10 Assemblies
BULLET

Step	Description
1.	Center Contact Retention *Note: PUSH TO DESTRUCT. RECORD FORCE.*

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) DSCC-10019 and MIL-STD-202-107, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition: -65°C to +165°C
3) Test Time: ½ hour dwell at each temperature extreme
4) Number of Cycles: 10
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: DSCC-10019 and MIL-STD-202-107, *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

CENTER CONTACT RETENTION:

1) Apply force to the center socket contact until captivation failure, record force.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes.

INSULATION RESISTANCE (IR):

To determine the resistance of insulation materials to leakage of current through or on the surface of these materials when a DC potential is applied.

1) PROCEDURE:
    a. Reference document: EIA-364-21, *Insulation Resistance Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Electrification Time 2.0 minutes
        iii. Test Voltage (500 VDC) corresponds to calibration settings for measuring resistances.
2) MEASUREMENTS:
3) When the specified test voltage is applied (VDC), the insulation resistance shall not be less than 5000 megohms.

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

To determine if the sockets can operate at its rated voltage and withstand momentary over potentials due to switching, surges, and other similar phenomenon. Separate samples are used to evaluate the effect of environmental stresses so not to influence the readings from arcing that occurs during the measurement process.

1) PROCEDURE:
    a. Reference document: DSCC-10019 and MIL-PRF-39012, *Withstanding Voltage Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Barometric Test Condition 1
        iii. Rate of Application 500 V/Sec
        iv. Test Voltage (VAC) until breakdown occurs
2) MEASUREMENTS/CALCULATIONS
    a. The breakdown voltage shall be measured and recorded.
    b. The dielectric withstanding voltage shall be recorded as 75% of the minimum breakdown voltage.
    c. The working voltage shall be recorded as one-third (1/3) of the dielectric withstanding voltage (one-fourth of the breakdown voltage).

RESULTS

Mating/Unmating Forces

Mating/Unmating Durability Group

- **Initial**
  - **Mating**
    - **Min ---------- 6.08 Lbs**
    - **Max---------- 7.75 Lbs**
  - **Unmating**
    - **Min ---------- 9.34 Lbs**
    - **Max----------12.76 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 5.35 Lbs**
    - **Max---------- 7.97 Lbs**
  - **Unmating**
    - **Min ---------- 5.56 Lbs**
    - **Max---------- 9.81 Lbs**
- **After Thermal Shock**
  - **Mating**
    - **Min ---------- 3.38 Lbs**
    - **Max---------- 5.09 Lbs**
  - **Unmating**
    - **Min ---------- 3.98 Lbs**
    - **Max---------- 5.13 Lbs**

Center Contact Retention:

Group 1 Measure the position of the center contact reference to the body.

- **Initial**
  - **Min ---------- 0.00157 inch**
  - **Max---------- 0.00197 inch**
- **After Retention 1.5 Ibs**
  - **Min ---------- 0.00154 inch**
  - **Max---------- 0.00209 inch**

Group 2 Apply force to the center contact until failure.

- **Min ---------- 2.75 Lbs**
- **Max---------- 3.46 Lbs**

RESULTS Continued

Insulation Resistance minimums, IR

Pin to Ground

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

Group 1 DWV Breakdown

- **Minimums**
  - **Breakdown Voltage ---------- 1061 VAC**
  - **Test Voltage ---------- 796 VAC**
  - **Working Voltage ---------- 265 VAC**

Group 3 DWV Test

- **Test Voltage ---------- 325 VAC**

Pin to Ground

- **Initial DWV ---------- Passed**
- **Thermal DWV ---------- Passed**
- **Humidity DWV ---------- Passed**

Mated Height

Group 1

- **Min ---------- 0.39102 inch**
- **Max ---------- 0.39122 inch**

Group 3

- **Min ---------- 0.39055 inch**
- **Max ---------- 0.39094 inch**

RESULTS Continued

LLCR Mating/Unmating Durability Group (8 signal and 8 ground LLCR test points)

Signal pin

- **Initial ---------- 4.83 mOhms Max**
- **Durability, 25 Cycles**
  - **<= +5.0 mOhms ---------- 8 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 Shock**
  - **<= +5.0 mOhms ---------- 8 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**

Ground pin

- **Initial ---------- 0.69 mOhms Max**
- **Durability, 25 Cycles**
  - **<= +5.0 mOhms ---------- 8 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 Shock**
  - **<= +5.0 mOhms ---------- 8 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**

DATA SUMMARIES

MATING-UNMATING FORCE:

Mating-Unmating Durability Group

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	27.04	6.08	41.54	9.34	23.80	5.35	24.73	5.56
Maximum	34.47	7.75	56.76	12.76	35.45	7.97	43.63	9.81
Average	30.22	**6.79**	46.86	**10.54**	31.54	**7.09**	38.64	**8.69**
St Dev	3.03	0.68	4.41	0.99	3.63	0.82	6.05	1.36
Count	8	8	8	8	8	8	8	8

	After Thermals Shock			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	15.03	3.38	17.70	3.98
Maximum	22.64	5.09	22.82	5.13
Average	18.26	**4.11**	19.75	**4.44**
St Dev	2.67	0.60	1.68	0.38
Count	8	8	8	8

CENTER CONTACT RETENTION:

Group 1 Measure the position of the center contact reference to the body.

	Initial(inch)	After Retention 1.5 Ibs(inch)
Minimum	**0.00157**	**0.00154**
Maximum	0.00197	0.00209
Average	0.00177	0.00182

Group 2 Apply force to the center contact until failure.

Retention	Force (lbs)
Minimum	**2.75**
Maximum	3.46
Average	3.04

DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**PRFIA/SMPM**	**PRFIA**	**SMPM**
Initial	45000	45000	Not Tested
Thermal	45000	45000	Not Tested
Humidity	45000	45000	Not Tested

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Group 1 DWV Breakdown

Voltage Rating Summary	
Minimum	**PRFIA/SMPM**
Break Down Voltage	1061
Test Voltage	796
Working Voltage	265

Group 3 DWV Test

Pin to Ground	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

Unit: inch

	Sample #	Mated Height
Group 1	009	0.39102
	010	0.39122
Group 3	013	0.39055
	014	0.39094

DATA SUMMARIES Continued

LLCR Mating/Unmating Durability Group

1). A total of 8 signal and 8 ground 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	7/26/2021	8/3/2021	8/10/2021
Room Temp (Deg C)	22	20	22
Rel Humidity (%)	50	50	52
Technician	Kason He	Kason He	Kason He
mOhm values	Actual **Initial**	**Delta 25 Cycles**	**Delta Ther Shock**
	Pin Type: Signal 1		
Average	4.34875	0.2225	0.215
St. Dev.	0.2082	0.1737	0.1303
Min	4.16	0.09	0.03
Max	4.83	0.56	0.35
Summary Count	8	8	8
Total Count	8	8	8
	Pin Type: GND 1		
Average	0.6375	0.1025	0.155
St. Dev.	0.0301	0.0578	0.0840
Min	0.59	0.01	0
Max	0.69	0.15	0.28
Summary Count	8	8	8
Total Count	8	8	8

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
25 Cycles	**16**	**0**	**0**	**0**	**0**	**0**
Ther Shock	**16**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HZ-TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnatti Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14994
Accuracy: See Manual
… Last Cal: 04/15/2021, Next Cal: 04/14/2022

Equipment #: DG-HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 025866
Accuracy:
… Last Cal: 04/15/2021, Next Cal: 04/14/2022

Equipment #: HZ-MO-05
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 3706
Serial #: 1285188
Accuracy: Last Cal: 1/2/2021, Next Cal: 1/1/2022

Equipment #: HZ-THC-01
Description: Humidity transmitter
Manufacturer: Thermtron
Model: SM-8-8200
Serial #: 38846
Accuracy: Last Cal: 2/26/2021, Next Cal: 2/25/2022

Equipment #: HZ-TCT-01
Description: Normal force analyzer
Manufacturer: Mecmesin Multitester
Model: Mecmesin Multitester 2.5-i
Serial #: 08-1049-04
Accuracy: Last Cal: 4/24/2021, Next Cal: 4/23/2022