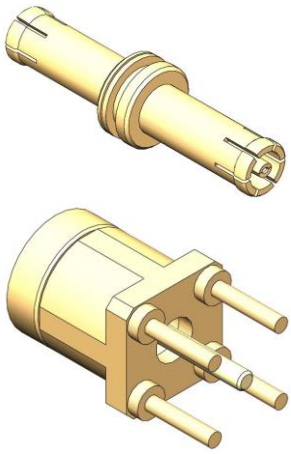
Project Number: Design Qualification Test Report	Tracking Code: 2179139_Report_Rev_2
Requested by: Tim Clare	Date: 5/7/2020
Part #: PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1 / SMPM-PF-P-HG-ST-TH-1	
Part description: PRFIA/SMPM	Tech: Tony Wagoner
Test Start: 12/16/2019	Test Completed: 4/24/2020



DESIGN QUALIFICATION TEST REPORT

PRFIA/SMPM
PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1 / SMPM-PF-P-HG-ST-TH-1

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
2/25/2020	**1**	**Initial Issue**	**KH**
5/7/2020	**2**	**Change part number SMPM-J-B-HG-ST-12.7 to PRFIA-SMPM-J-J-S-3**	**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

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 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 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-109237-TST

FLOWCHARTS

Mating/Unmating/Durability

Note: Check signal and ground LLCR.

Group 1

PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1

SMPM-PF-P-HG-ST-TH-1

8 Assemblies

FD TO BULLET

Note: 1 Thru Hole and 1 bullet connector required, During the mate/unmate, only one side is cycled.

Step	Description
1.	Contact Gaps
2.	LLCR (1)
3.	Mating/Unmating Force (2)
4.	Cycles Quantity = 25 Cycles
5.	Mating/Unmating Force (2)
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)

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

(2) Mating/Unmating Force = EIA-364-13

(3) Thermal Shock = Other
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +125°C)
Test Duration = A-3 (25 Cycles)

FLOWCHARTS Continued

IR/DWV

Note: 5000 megaohms min IR

Pin-to-Ground

Group 1
PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1
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.	DWV Breakdown (2)

Group 2
PRFIA-SMPM-J-J-S-3
2 Assemblies

Step	Description
1.	DWV Breakdown (2)

Group 3
PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1
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.	IR (4)
2.	DWV at Test Voltage(1)
3.	Thermal Shock (5) - Non Standard
4.	IR (4)
5.	DWV at Test Voltage(1)
6.	Humidity (3)
7.	IR (4)
8.	DWV at Test Voltage(1)

Group 4
PRFIA-SMPM-J-J-S-1
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.	DWV Breakdown (2)

Group 5
PRFIA-SMPM-J-J-S-1
2 Assemblies

Step	Description
1.	DWV Breakdown (2)

Group 6
PRFIA-SMPM-J-J-S-1
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.	IR (4)
2.	DWV at Test Voltage(1)
3.	Thermal Shock (5) - Non Standard
4.	IR (4)
5.	DWV at Test Voltage(1)
6.	Humidity (3)
7.	IR (4)
8.	DWV at Test Voltage(1)

(1) DWV at Test Voltage = EIA-364-20
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 = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(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
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +125°C)
Test Duration = A-3 (100 Cycles)

FLOWCHARTS Continued

Retention

Group 1 PRFIA-SMPM-J-J-S-3 8 Assemblies BULLET		Group 2 PRFIA-SMPM-J-J-S-3 8 Assemblies BULLET	
Step	**Description**	**Step**	**Description**
1.	Center Pin Retention	1.	Housing Retention *Note: Retention between -03 shell and -04 shell until failure.*

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 I: -55°C to +125°C
3) Test Time: ½ hour dwell at each temperature extreme
4) Test Duration A-3: 100 Cycles
5) All test samples are pre-conditioned at ambient.
6) All test samples are exposed to environmental stressing in the mated condition.

THERMAL SHOCK:

1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition I: -55°C to +125°C
3) Test Time: ½ hour dwell at each temperature extreme
4) Test Duration A-3: 25 Cycles
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.
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 +8.0 mOhms: ----------Minor
    c. +8.1 to +10.0 mOhms:----------Acceptable
    d. +10.1 to +50.0 mOhms: ----------Marginal
    e. +50.1 to +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure

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: EIA-364-20, *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 ---------- 4.21 lbs**
    - **Max---------- 6.99 lbs**
  - **Unmating**
    - **Min ---------- 6.14 lbs**
    - **Max---------- 7.85 lbs**
- **After 25 cycles**
  - **Mating**
    - **Min ---------- 5.64 lbs**
    - **Max---------- 7.07 lbs**
  - **Unmating**
    - **Min ---------- 3.89 lbs**
    - **Max---------- 7.37 lbs**
- **After Thermal Shock**
  - **Mating**
    - **Min ---------- 2.11 lbs**
    - **Max---------- 3.44 lbs**
  - **Unmating**
    - **Min ---------- 3.88 lbs**
    - **Max---------- 6.11 lbs**

Retention

Center Pin Retention

- **Min ---------- 2.11 lbs**
- **Max---------- 3.65 lbs**

Housing Retention

- **Min ----------26.65 lbs**
- **Max----------32.49 lbs**

RESULTS Continued

Insulation Resistance minimums, IR

PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1 / SMPM-PF-P-HG-ST-TH-1

Pin to Ground

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

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

Pin to Ground

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

Dielectric Withstanding Voltage minimums, DWV

PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1 / SMPM-PF-P-HG-ST-TH-1

- **Minimums**
  - **Break Down Voltage---------- 1038 VAC**
  - **Test Voltage ----------780 VAC**
  - **Working Voltage ----------260 VAC**

Pin to Ground

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

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

- **Minimums**
  - **Break Down Voltage---------- 1346 VAC**
  - **Test Voltage ---------- 1010 VAC**
  - **Working Voltage ----------335 VAC**

Pin to Ground

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

RESULTS Continued

LLCR Durability Group (8 signal and 8 ground LLCR test points)

Signal Pin

- **Initial ----------5.19 mOhms Max**
- **Durability, 25 Cycles**
  - **<= +5.0 mOhms----------8 Points ---------- Stable**
  - **+5.1 to +8.0 mOhms ----------0 Points ---------- Minor**
  - **+8.1 to +10.0 mOhms----------0 Points ---------- Acceptable**
  - **+10.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**
- **Thermal Shck**
  - **<= +5.0 mOhms----------8 Points ---------- Stable**
  - **+5.1 to +8.0 mOhms ----------0 Points ---------- Minor**
  - **+8.1 to +10.0 mOhms----------0 Points ---------- Acceptable**
  - **+10.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**

Ground Pin

- **Initial ----------0.51 mOhms Max**
- **Durability, 25 Cycles**
  - **<= +5.0 mOhms----------8 Points ---------- Stable**
  - **+5.1 to +8.0 mOhms ----------0 Points ---------- Minor**
  - **+8.1 to +10.0 mOhms----------0 Points ---------- Acceptable**
  - **+10.1 to +50.0 mOhms ----------0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**
- **Thermal Shck**
  - **<= +5.0 mOhms----------8 Points ---------- Stable**
  - **+5.1 to +8.0 mOhms ----------0 Points ---------- Minor**
  - **+8.1 to +10.0 mOhms----------0 Points ---------- Acceptable**
  - **+10.1 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:

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	18.73	4.21	27.31	6.14	25.09	5.64	17.30	3.89
Maximum	31.09	6.99	34.92	7.85	31.45	7.07	32.78	7.37
Average	26.45	**5.95**	31.62	**7.11**	28.33	**6.37**	27.31	**6.14**
St Dev	3.93	0.88	2.44	0.55	2.83	0.64	4.66	1.05
Count	8	8	8	8	8	8	8	8

	After Thermals			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	9.39	2.11	17.26	3.88
Maximum	15.30	3.44	27.18	6.11
Average	12.17	**2.74**	23.00	**5.17**
St Dev	1.83	0.41	2.91	0.65
Count	8	8	8	8

Retention

Center Pin Retention

	Force (lbs)
Minimum	**2.11**
Maximum	3.65
Average	2.82

Hosing Retention

	Force (lbs)
Minimum	**26.65**
Maximum	32.49
Average	30.64

DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1 / SMPM-PF-P-HG-ST-TH-1

	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

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

	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):

PRFIA-SMPM-J-J-S-3 / PRFIA-SMPM-J-J-S-1 / SMPM-PF-P-HG-ST-TH-1

Voltage Rating Summary	
Minimum	**PRFIA/SMPM**
Break Down Voltage	1038
Test Voltage	780
Working Voltage	260

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

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

Voltage Rating Summary	
Minimum	**PRFIA/SMPM**
Break Down Voltage	1346
Test Voltage	1010
Working Voltage	335

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

DATA SUMMARIES Continued

LLCR 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 +8.0 mOhms:----------Minor
   c. +8.1 to +10.0 mOhms: ----------Acceptable
   d. +10.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms----------Unstable
   f. >+1000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	1/7/2020	1/10/2020	1/16/2020	
Room Temp (Deg C)	22	23	22	
Rel Humidity (%)	36	42	39	
Technician	Tony Wagoner	Tony Wagoner	Tony Wagoner	
mOhm values	**Actual Initial**	**Delta 25 Cycles**	**Delta Therm Shck**	**Delta**
	Pin Type 1: Ground			
Average	0.47	0.04	0.07	
St. Dev.	0.02	0.02	0.04	
Min	0.45	0.01	0.01	
Max	0.51	0.08	0.11	
Summary Count	8	8	8	
Total Count	8	8	8	
	Pin Type 2: Signal			
Average	4.73	0.19	0.15	
St. Dev.	0.28	0.11	0.09	
Min	4.29	0.00	0.03	
Max	5.19	0.34	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**
Therm Shck	**16**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2019, Next Cal: 05/29/2020

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2019, Next Cal: 09/11/2020

Equipment #: THC-05
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 05 23 00 02
Accuracy: See Manual
… Last Cal: 5/31/2019, Next Cal: 05/31/2020

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnati Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 06/30/2019, Next Cal: 06/30/2020

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2019, Next Cal: 05/15/2020