Project Number: Design Qualification Test Report	Tracking Code: 2108584_Report_Rev_1
Requested by: Eric Olsen	Date: 11/7/2019
Part #: SMPM-PF-P-HG-ST-TH-1/RF23C-M0SJ-303030-0153	
Part description: SMPM/RF23C	Tech: Tony Wagoner
Test Start: 8/29/2019	Test Completed: 9/25/2019

DESIGN QUALIFICATION TEST REPORT

SMPM/RF23C
SMPM-PF-P-HG-ST-TH-1/RF23C-M0SJ-303030-0153

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
11/7/2019	**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

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-109618-TST

FLOWCHARTS

IR/DWV

Note: 5000 megaohms min IR

Pin-to-Ground

Group 1	Group 2	Group 3	Group 4
SMPM-PF-P-HG-ST-TH-1	SMPM-PF-P-HG-ST-TH-1		SMPM-PF-P-HG-ST-TH-1
RF23C-M0SJ-303030-0153		RF23C-M0SJ-303030-0153	RF23C-M0SJ-303030-0153
2 Assemblies	2 Assemblies	2 Assemblies	2 Assemblies

Step	Description
1.	DWV Breakdown (2)

Step	Description
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Step	Description
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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)

Retention

Group 1
SMPM-PF-P-HG-ST-TH-1
8 Assemblies

Step	Description
1.	Center Pin Retention

FLOWCHARTS Continued

Mechanical Shock/Random Vibration/LLCR

Note: Check signal and ground LLCR.

Group 1
SMPM-PF-P-HG-ST-TH-1
RF23C-M0SJ-303030-0153
8 Assemblies

Step	Description
1.	LLCR (1)
2.	Mechanical Shock (2) - Non Standard
3.	Random Vibration (3)
4.	LLCR (1) Max Delta = 15 mOhm

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

(2) Mechanical Shock = Other
Test Condition = G (100 G Peak, 6 milliseconds, Sawtooth, 3 shocks per axis)
EIA-364-27

(3) Random Vibration = EIA-364-28
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

Mechanical Shock/Random Vibration/Event Detection

Group 1
SMPM-PF-P-HG-ST-TH-1
RF23C-M0SJ-303030-0153
60 Points

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (1) - Non Standard
2.	Nanosecond Event Detection (Random Vibration) (2)

(1) Nanosecond Event Detection (Mechanical Shock) = Other
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-27 for Mechanical Shock:
Test Condition = G (100 G Peak, 6 milliseconds, Sawtooth, 3 shocks per axis)

(2) Nanosecond Event Detection (Random Vibration)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-28 for Random Vibration:
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

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 +125°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.

MECHANICAL SHOCK (Specified Pulse):

1) Reference document: EIA-364-27, *Mechanical Shock Test Procedure for Electrical Connectors*
2) Test Condition: G
3) Peak Value: 100 G
4) Duration: 6 Milliseconds
5) Wave Form: Sawtooth
6) Velocity: 12.3 ft/s
7) Number of Shocks: 3 Shocks / Direction, 3 Axis (18 Total)

VIBRATION:

1) Reference document: EIA-364-28, *Vibration Test Procedure for Electrical Connectors*
2) Test Condition V, Letter B
3) Power Spectral Density: 0.04 G^2 / Hz
4) G 'RMS': 7.56
5) Frequency: 50 to 2000 Hz
6) Duration: 2.0 Hours per axis (3 axis total)

NANOSECOND-EVENT DETECTION:

1) Reference document: EIA-364-87, *Nanosecond-Event Detection for Electrical Connectors*
2) Prior to test, the samples were characterized to assure the low nanosecond event being monitored will trigger the detector.
3) After characterization it was determined the test samples could be monitored for 50 nanosecond events

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

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

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 ---------- 45000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 1050 VAC**
  - **Test Voltage ---------- 790 VAC**
  - **Working Voltage ---------- 260 VAC**

Pin to Ground

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

Center pin retention force

Min ---------- 25.257 lbs
Max ---------- 28.409 lbs

RESULTS Continued

LLCR Shock & Vibration (8 signal and 8 ground LLCR test points)

Signal

- **Initial ---------- 23.15 mOhms Max**

Ground

- **Initial ----------9.12 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms---------- 16 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**

Mechanical Shock & Random Vibration:

- **Shock**
  - **No Damage---------- ---------- Pass**
  - **50 Nanoseconds---------- ---------- Pass**
- **Vibration**
  - **No Damage---------- ---------- Pass**
  - **50 Nanoseconds---------- ---------- Pass**

DATA SUMMARIES

INSULATION RESISTANCE (IR):

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**SMPM/RF23C**	**SMPM**	**RF23C**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**SMPM/RF23C**
Break Down Voltage	1050
Test Voltage	790
Working Voltage	260

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

Center pin retention force

	Force (lbs)
Minimum	25.257
Maximum	28.409
Average	**26.450**

DATA SUMMARIES Continued

LLCR Shock &Vibration 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). 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	9/23/2019	9/25/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	51	46		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Shock-Vib**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	22.68	0.20		
St. Dev.	0.22	0.17		
Min	22.46	0.01		
Max	23.15	0.62		
Summary Count	8	8		
Total Count	8	8		
	Pin Type 2: Ground			
Average	8.94	0.18		
St. Dev.	0.10	0.11		
Min	8.81	0.01		
Max	9.12	0.33		
Summary Count	8	8		
Total Count	8	8		

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

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	16
Test Condition	G, 100g's, 6ms, Sawtooth
Shock Events	0
Test Condition	V-B, 7.56 rms g
Vibration Events	0
Total Events	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: 11/14/2018, Next Cal: 11/14/2019

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

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 04/22/2019, Next Cal: 04/22/2020

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/18/2019, Next Cal: 07/18/2020

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 10/31/2018, Next Cal: 10/31/2019