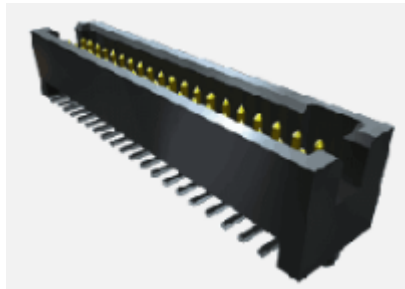




Project Number: Severe Environment Test Report	Tracking Code: 1726516_Report_Rev_1
Requested by: Mark Shireman	Date: 8/14/2019
Part #: SFM-150-02-S-D/TFM-150-02-S-D	
Part description: SFM/TFM	Tech: Tony Wagoner
Test Start: 2/12/2019	Test Completed: 4/18/2019



## **SEVERE ENVIRONMENT TEST REPORT**

**SFM/TFM**

**SFM-150-02-S-D/TFM-150-02-S-D**

Tracking Code: 1726516_Report_Rev_1	Part #: SFM-150-02-S-D/TFM-150-02-S-D
Part description: SFM/TFM	

### REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
8/14/2019	1	Initial Issue	KH

## CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to ISO 10012-1 and ANSI/NCSL 2540-1, as applicable.

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## SCOPE

To perform the following tests: Severe Environment test. Please see test plan.

## APPLICABLE DOCUMENTS

Standards: EIA Publication 364; VITA 47.1

## 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-109461-TST/ PCB-109718-TST

## FLOWCHARTS

### Mating/Unmating/Durability

*Note: With Humidity (Up to 100% RH, 240 hours, 25°C to 65°C)*

*Note: From MIL-STD-810G: For chamber control purposes, 100% RH implies as close to 100% RH as possible, but not less than 95%.*

Group 1  
SFM-150-02-S-D  
TFM-150-02-S-D  
8 Assemblies  
50 Positions

Group 2  
SFM-125-02-S-D  
TFM-125-02-S-D  
8 Assemblies  
25 Positions

Group 3  
SFM-105-02-S-D  
TFM-105-02-S-D  
8 Assemblies  
5 Positions

Step	Description
1.	LLCR (2)
2.	Mating/Unmating Force (3)
3.	Cycles Quantity = 250 Cycles
4.	LLCR (2) Max Delta = 15 mOhm
5.	Thermal Shock (4)
6.	LLCR (2) Max Delta = 15 mOhm
7.	Humidity (1) - Non Standard
8.	LLCR (2) Max Delta = 15 mOhm
9.	Mating/Unmating Force (3)



Step	Description
1.	Mating/Unmating Force (3)
2.	Cycles Quantity = 250 Cycles
3.	Mating/Unmating Force (3)



Step	Description
1.	Mating/Unmating Force (3)
2.	Cycles Quantity = 250 Cycles
3.	Mating/Unmating Force (3)



(1) Humidity = Other  
240 Hours  
+25°C to +65°C @ 95% RH up to 100% RH

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

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

(4) 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)

**FLOWCHARTS Continued****Mechanical Shock/Random Vibration/LLCR**Group 1

SFM-150-02-S-D

TFM-150-02-S-D

8 Assemblies

VITA 47.1 (V To V)

Step	Description
1.	LLCR <sup>(1)</sup>
2.	Mechanical Shock <sup>(2)</sup> - Non Standard
3.	Random Vibration <sup>(3)</sup> - Non Standard <i>Note: Conditions:</i> 1) 5 Hz to 100 Hz, PSD increasing at 3dB/octave 2) 100 Hz to 1000 Hz 0.10 g <sup>2</sup> /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave
4.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm

Group 2

SFM-150-02-S-D

TFM-150-02-S-DH

8 Assemblies

VITA 47.1 (DH To V)

Step	Description
1.	LLCR <sup>(1)</sup>
2.	Mechanical Shock <sup>(2)</sup> - Non Standard
3.	Random Vibration <sup>(3)</sup> - Non Standard <i>Note: Conditions:</i> 1) 5 Hz to 100 Hz, PSD increasing at 3dB/octave 2) 100 Hz to 1000 Hz 0.10 g <sup>2</sup> /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave
4.	LLCR <sup>(1)</sup> Max Delta = 15 mOhm

(1) LLCR = EIA-364-23

Open Circuit Voltage = 20 mV Max

Test Current = 100 mA Max

(2) Mechanical Shock = Other

40G, 11 milliseconds, Half Sine

Number of Shocks = 3 Per Direction, Per Axis, 18 Total

Operating Shock Class OS2

(3) Random Vibration = Other

12 G 'RMS', 5Hz to 2000Hz, 1 Hours/Axis

Vibration Class V3 VITA 47.1

**Mechanical Shock/Random Vibration/Event Detection**Group 1

SFM-150-02-S-D

TFM-150-02-S-D

8 Assemblies

VITA 47.1 (V To V)

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) <sup>(1)</sup> - Non Standard
2.	Nanosecond Event Detection (Random Vibration) <sup>(2)</sup> - Non Standard <i>Note: Conditions:</i> 1) 5 Hz to 100 Hz, PSD increasing at 3dB/octave 2) 100 Hz to 1000 Hz 0.10 g <sup>2</sup> /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave

Group 2

SFM-150-02-S-D

TFM-150-02-S-DH

8 Assemblies

VITA 47.1 (DH To V)

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) <sup>(1)</sup> - Non Standard
2.	Nanosecond Event Detection (Random Vibration) <sup>(2)</sup> - Non Standard <i>Note: Conditions:</i> 1) 5 Hz to 100 Hz, PSD increasing at 3dB/octave 2) 100 Hz to 1000 Hz 0.10 g <sup>2</sup> /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave

(1) Nanosecond Event Detection (Mechanical Shock) = Other

Use EIA-364-87 for Nanosecond Event Detection:

Test Condition = F (50 nanoseconds at 10 ohms)

40G, 11 milliseconds, Half Sine

(2) Nanosecond Event Detection (Random Vibration) = Other

Use EIA-364-87 for Nanosecond Event Detection:

Test Condition = F (50 nanoseconds at 10 ohms)

Random Vibration: 12 G 'RMS', 5Hz to 2000Hz, 1 Hours/Axis, Vibration Class V3 VITA 47.1

**FLOWCHARTS Continued****Temperature Cycling**Group 1

SFM-150-02-S-D

TFM-150-02-S-D

8 Assemblies

500 Thermal Cycles

*Note: Reference MIL-STD-202G, Method  
107, Thermal Shock*

**Step Description**

1. Continuity (Initial)
2. Temperature Cycles (1) - Non Standard  
Cycles = 500 Cycles  
Continuity = Monitor for 1 MicroSecond  
Interruptions Throughout
3. Continuity (Following Last  
Cycle)

(1) Temperature Cycles = Other

Max Temperature = 125° C

Min Temperature = -65° C

Dwell Time = 30 minutes at each extreme

Ramp Rate = 10° C/min

VITA 47.1

**Non-Operating Class Temperature****VITA 47.1**Group 1

SFM-150-02-S-D

TFM-150-02-S-D

8 Assemblies

Non-Operating Class Temperature

**Step Description**

1. LLCR (1)  
Max Delta = 15 mOhm
2. Temperature Cycle  
Cycles = 100  
Temperature Cycle = -55°C to 105°C
3. LLCR (1)  
Max Delta = 15 mOhm
4. Temperature Cycle  
Cycles = 100  
Temperature Cycles = -65°C to 125°C
5. LLCR (1)  
Max Delta = 15 mOhm

(1) LLCR = EIA-364-23

Open Circuit Voltage = 20 mV Max

Test Current = 100 mA Max

**FLOWCHARTS Continued****DWV @ Altitude****Pin to Pin**Group 1

SFM-150-02-S-D

TFM-150-02-S-D

3 Assemblies

Custom Group

**Step Description**

1. DWV at Test Voltage (1) - Non  
Standard  
*Note: Test Voltage to be 300 VAC*

**Row to Row**Group 2

SFM-150-02-S-D

TFM-150-02-S-D

3 Assemblies

Custom Group

**Step Description**

1. DWV at Test Voltage (2) - Non  
Standard  
*Note: Test Voltage to be 300 VAC*

- 
- (1) DWV at Test Voltage = Other  
Test Condition IV= 70,000 ft  
DWV test voltage is equal to 75% of the lowest breakdown voltage  
Test voltage applied for 60 seconds
- (2) DWV at Test Voltage = Other  
Test Condition IV= 70,000 ft  
DWV test voltage is equal to 75% of the lowest breakdown voltage  
Test voltage applied for 60 seconds

**Electrostatic Discharge (ESD)**Group 1

SFM-150-02-S-D

TFM-150-02-S-D

8 Assemblies

EN61000-4-2

**Step Description**

1. Exposure To 5kV, 10kV, 15kV,  
Repeat 10 Times  
*Note: The connector shall not be  
susceptable to damage by ESD  
events from 0 to 15kV as  
discharged from a 150 pf capacitor  
through a 330 ohm resistor.*

**ATTRIBUTE DEFINITIONS**

The following is a brief, simplified description of attributes.

**TEMPERATURE CYCLES:**

- 1) OTHER, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors*.
- 2) Test Condition: -65°C to +125°C.
- 3) Test Time: ½ hour dwell at each temperature extreme.
- 4) Test Duration: 500 Cycles
- 5) All test samples are pre-conditioned at ambient.
- 6) All test samples are exposed to environmental stressing in the mated condition.

**TEMPERATURE CYCLES:**

- 7) OTHER, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors*.
- 8) Test Condition: -55°C to +105°C and -65°C to +125°C.
- 9) Test Time: ½ hour dwell at each temperature extreme.
- 10) Test Duration: 100 Cycles
- 11) All test samples are pre-conditioned at ambient.
- 12) 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 +85°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.

**HUMIDITY:**

- 1) Reference document: Other, *Humidity Test Procedure for Electrical Connectors*.
- 2) Test Condition, 240 Hours.
- 3) Method, +25° C to + 65° C, 95% to 100% 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.

**MECHANICAL SHOCK (Specified Pulse):**

- 1) Reference document: other, *Mechanical Shock Test Procedure for Electrical Connectors*
- 2) Test Condition: OS2
- 3) Peak Value: 40 G
- 4) Duration: 11 Milliseconds
- 5) Wave Form: Half Sine
- 6) Number of Shocks: 3 Shocks / Direction, 3 Axis (18 Total)

**VIBRATION:**

- 1) Reference document: other, *Vibration Test Procedure for Electrical Connectors*
- 2) Test Condition: V3 vita 47.1.
- 3) Power Spectral Density: 0.04 G<sup>2</sup> / Hz
- 4) G ‘RMS’: 12
- 5) Frequency: 5 to 2000 Hz
- 6) Duration: 1 Hours per axis (3 axis total)



**ATTRIBUTE DEFINITIONS Continued**

The following is a brief, simplified description of attributes.

**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.  $\leq +5.0$  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  $+2000$  mOhms: -----Unstable
  - f.  $>+2000$  mOhms: -----Open Failure

**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 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: other, *Withstanding Voltage Test Procedure for Electrical Connectors*.
  - b. Test Conditions IV=70000 ft
  - c. Test voltage applied for 60 seconds.

**ELECTROSTATIC DISCHARGE:**

- 1) Reference Document: EN61000-4-2, VITA 47
- 2) Connector shall not be susceptible to damage by electrostatic discharge (ESD) events from 0 to 15kV as discharged from a 150-pf capacitor through a 330-ohm resistor.
- 3) Any damage shall be noted.

## RESULTS

### Mating – Unmating Forces

#### Mating Unmating Durability Group (SFM-150-02-S-D/TFM-150-02-S-D)

- **Initial**
  - **Mating**
    - **Min** -----18.13 lbs
    - **Max** -----22.22 lbs
  - **Unmating**
    - **Min** -----13.27 lbs
    - **Max** -----18.17 lbs
- **After 250 Cycles**
  - **Mating**
    - **Min** -----20.64 lbs
    - **Max** -----25.95 lbs
  - **Unmating**
    - **Min** -----14.83 lbs
    - **Max** -----21.69 lbs
- **After Humidity**
  - **Mating**
    - **Min** -----12.14 lbs
    - **Max** -----16.59 lbs
  - **Unmating**
    - **Min** ----- 9.54 lbs
    - **Max** -----14.84 lbs

#### Mating Unmating Basic Group (SFM-125-02-S-D/TFM-125-02-S-D)

- **Initial**
  - **Mating**
    - **Min** -----10.36 lbs
    - **Max** -----13.18 lbs
  - **Unmating**
    - **Min** -----10.11 lbs
    - **Max** -----11.43 lbs
- **After 250 Cycles**
  - **Mating**
    - **Min** -----12.37 lbs
    - **Max** -----15.57 lbs
  - **Unmating**
    - **Min** -----10.82 lbs
    - **Max** -----13.26 lbs

#### Mating Unmating Basic Group (SFM-105-02-S-D/TFM-105-02-S-D)

- **Initial**
  - **Mating**
    - **Min** ----- 1.90 lbs
    - **Max** ----- 2.64 lbs
  - **Unmating**
    - **Min** ----- 1.72 lbs
    - **Max** ----- 2.33 lbs
- **After 250 Cycles**
  - **Mating**
    - **Min** ----- 2.25 lbs
    - **Max** ----- 2.38 lbs
  - **Unmating**
    - **Min** ----- 1.92 lbs
    - **Max** ----- 2.35 lbs

**RESULTS Continued**

**Temperature Cycling**

**Continuity Initial**

- No Interruptions -----Passed

**Continuity Following 500 Cycles**

- No Interruptions -----Passed

**DWV @ Altitude**

- Minimums
  - Test Voltage -----300 VAC
  - Altitude Tested -----70000 ft.

**Pin to Pin**

- DWV-----Passed

**Row to Row**

- DWV-----Passed

**Electrostatic Discharge**

**5kV**

- No Damage -----Passed

**10kV**

- No Damage -----Passed

**15kV**

- No Damage -----Passed

**RESULTS Continued****LLCR Mating Unmating Durability Group (192 LLCR test points)**

- **Initial** -----8.49 mOhms Max
- **Durability, 250 Cycles**
  - **<= +5.0 mOhms** ----- 192 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** ----- 192 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** ----- 192 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

**RESULTS Continued****LLCR Vibration and Mechanical Shock Group (192 LLCR test points)****Group 1 SFM-150-02-S-D/TFM-150-02-S-D (V to V)**

- Initial -----8.66 mOhms Max
- Shock and Vibe
  - <= +5.0 mOhms ----- 192 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

**Group 2 SFM-150-02-S-D/TFM-150-02-S-DH (DH to V)****Row 1**

- Initial ----- 12.23 mOhms Max
- Shock and Vibe
  - <= +5.0 mOhms -----92 Points ----- Stable
  - +5.1 to +10.0 mOhms -----4 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

**Row 2**

- Initial ----- 12.81 mOhms Max
- Shock and Vibe
  - <= +5.0 mOhms -----95 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

**Mechanical Shock & Random Vibration:**

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

**RESULTS Continued****LLCR Non-Operating Class Temperature Group (192 LLCR test points)**

- **Initial -----9.97 mOhms Max**
- **Temperature Cycle1 (-55°C to +105°C)**
  - **<= +5.0 mOhms ----- 192 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**
- **Temperature Cycle2 (-65°C to +125°C)**
  - **<= +5.0 mOhms ----- 192 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:****Mating Unmating Durability Group****SFM-150-02-S-D/TFM-150-02-S-D**

	Initial				250 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	80.66	18.13	59.02	13.27	91.82	20.64	65.94	14.83
Maximum	98.83	22.22	80.80	18.17	115.40	25.95	96.48	21.69
<b>Average</b>	86.70	<b>19.49</b>	73.14	<b>16.44</b>	103.76	<b>23.33</b>	86.89	<b>19.53</b>
St Dev	7.12	1.60	7.51	1.69	7.88	1.77	10.17	2.29
Count	8	8	8	8	8	8	8	8

	After Humidity			
	Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	53.99	12.14	42.43	9.54
Maximum	73.79	16.59	65.99	14.84
<b>Average</b>	62.05	<b>13.95</b>	53.10	<b>11.94</b>
St Dev	6.33	1.42	7.17	1.61
Count	8	8	8	8

**Mating Unmating Basic Group****SFM-125-02-S-D/TFM-125-02-S-D**

	Initial				250 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	46.08	10.36	44.96	10.11	55.03	12.37	48.13	10.82
Maximum	58.62	13.18	50.83	11.43	69.26	15.57	58.99	13.26
<b>Average</b>	53.34	<b>11.99</b>	47.19	<b>10.61</b>	65.43	<b>14.71</b>	54.18	<b>12.18</b>
St Dev	3.95	0.89	2.25	0.51	4.65	1.05	3.49	0.79
Count	8	8	8	8	8	8	8	8

**SFM-105-02-S-D/TFM-105-02-S-D**

	Initial				250 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	8.46	1.90	7.65	1.72	10.00	2.25	8.53	1.92
Maximum	11.73	2.64	10.37	2.33	10.58	2.38	10.47	2.35
<b>Average</b>	9.96	<b>2.24</b>	9.05	<b>2.03</b>	10.25	<b>2.30</b>	9.39	<b>2.11</b>
St Dev	1.06	0.24	0.94	0.21	0.17	0.04	0.69	0.15
Count	8	8	8	8	8	8	8	8

**DATA SUMMARIES Continued****Temperature Cycling**

<b>Temperature Cycling Event Detection Summary</b>	
Contacts tested	800
Test Conditions	Continuity (Monitor for 1 Microsecond Interruptions Throughout)
Temperature	Min Temp = -65°C / Max Temp = 125°C
Dwell Time	30 Minutes at each Extreme
Ramp Rate	10°C/min
Total Events	0

**DWV @ Altitude**

<b>Altitude Tested = 70,000 feet</b>	
<b>Test Voltage= 300</b>	
<b>Pin to Pin</b>	<b>Row to Row</b>
<b>Mated</b>	<b>Mated</b>
<b>Passed</b>	<b>Passed</b>
<b>Passed</b>	<b>Passed</b>
<b>Passed</b>	<b>Passed</b>

**Electrostatic Discharge**

<b>Electrostatic Discharge (ESD) Summary</b>	
Assemblies tested	8
Test Conditions	Exposure to 5kV, 10kV, and 15kV (Repeated 10 Times)
5kV	No Damage
10kV	No Damage
15kV	No Damage
Pass/Fail	Pass



**DATA SUMMARIES Continued****LLCR Mating Unmating Durability 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

<b>LLCR Measurement Summaries by Pin Type</b>				
Date	2/12/2019	2/12/2019	2/20/2019	3/11/2019
Room Temp (Deg C)	23	23	22	22
Rel Humidity (%)	45	43	32	35
Technician	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner
mOhm values	<b>Actual Initial</b>	<b>Delta 250 Cycles</b>	<b>Delta Therm Shck</b>	<b>Delta Humidity</b>
<b>Pin Type 1: Signal</b>				
Average	7.35	0.41	0.85	0.91
St. Dev.	0.37	0.44	0.77	0.88
Min	6.46	0.00	0.00	0.01
Max	8.49	2.29	2.92	3.51
Summary Count	192	192	192	192
Total Count	192	192	192	192

<b>LLCR Delta Count by Category</b>						
	<b>Stable</b>	<b>Minor</b>	<b>Acceptable</b>	<b>Marginal</b>	<b>Unstable</b>	<b>Open</b>
mOhms	$\leq 5$	$>5 \text{ \& } \leq 10.0$	$>10.1 \text{ \& } \leq 15$	$>15.1 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	$>1000$
<b>250 Cycles</b>	192	0	0	0	0	0
<b>Therm Shck</b>	192	0	0	0	0	0
<b>Humidity</b>	192	0	0	0	0	0

**DATA SUMMARIES Continued****LLCR Vibration and Mechanical Shock 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

**Group 1 SFM-150-02-S-D/TFM-150-02-S-D (V to V)**

<b>LLCR Measurement Summaries by Pin Type</b>				
Date	3/26/2019	3/28/2019		
Room Temp (Deg C)	23	22		
Rel Humidity (%)	34	35		
Technician	Joe Schoettmer	Joe Schoettmer		
mOhm values	<b>Actual Initial</b>	<b>Delta Shock-Vib</b>	<b>Delta</b>	<b>Delta</b>
<b>Pin Type 1: Signal</b>				
Average	7.51	0.11		
St. Dev.	0.41	0.13		
Min	6.76	0.00		
Max	8.66	0.70		
Summary Count	192	192		
Total Count	192	192		

<b>LLCR Delta Count by Category</b>						
	<b>Stable</b>	<b>Minor</b>	<b>Acceptable</b>	<b>Marginal</b>	<b>Unstable</b>	<b>Open</b>
mOhms	$\leq 5$	$>5 \text{ \& } \leq 10.0$	$>10.1 \text{ \& } \leq 15$	$>15.1 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	$>1000$
<b>Shock-Vib</b>	<b>192</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Nanosecond Event Detection:**

<b>Shock and Vibration Event Detection Summary</b>	
Contacts tested	60
Test Condition	F, 40g's, 11ms, Half-Sine
Shock Events	0
Test Condition	V3 VITA 47.1, 12 G 'RMS', 5Hz to 2000Hz
Vibration Events	0
<b>Total Events</b>	<b>0</b>

**DATA SUMMARIES Continued****Group 1 SFM-150-02-S-D/TFM-150-02-S-DH (DH to V)**

<b>LLCR Measurement Summaries by Pin Type</b>				
Date	4/16/2019	4/18/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	34	46		
Technician	Joe Schoettmer	Tony Wagoner		
mOhm values	<b>Actual</b>	<b>Delta</b>	<b>Delta</b>	<b>Delta</b>
	<b>Initial</b>	<b>Shock-Vib</b>		
<b>Pin Type 1: Row 1</b>				
Average	9.51	2.05		
St. Dev.	0.89	1.63		
Min	8.09	0.04		
Max	12.23	8.64		
Summary Count	96	96		
Total Count	96	96		
<b>Pin Type 2: Row 2</b>				
Average	10.23	1.49		
St. Dev.	0.73	0.91		
Min	8.43	0.02		
Max	12.81	5.82		
Summary Count	96	96		
Total Count	96	96		

<b>LLCR Delta Count by Category</b>						
	<b>Stable</b>	<b>Minor</b>	<b>Acceptable</b>	<b>Marginal</b>	<b>Unstable</b>	<b>Open</b>
mOhms	<b>&lt;=5</b>	<b>&gt;5.1 &amp; &lt;=10.0</b>	<b>&gt;10.1 &amp; &lt;=15</b>	<b>&gt;15.1 &amp; &lt;=50</b>	<b>&gt;50 &amp; &lt;=1000</b>	<b>&gt;1000</b>
<b>Shock-Vib</b>	<b>187</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Nanosecond Event Detection:**

<b>Shock and Vibration Event Detection Summary</b>	
Contacts tested	60
Test Condition	F, 40g's, 11ms, Half-Sine
Shock Events	0
Test Condition	V3 VITA 47.1, 12 G 'RMS', 5Hz to 2000Hz
Vibration Events	0
Total Events	0

**DATA SUMMARIES Continued****LLCR Non-Operating Class Temperature 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  $+10$  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

<b>LLCR Measurement Summaries by Pin Type</b>			
Date	2/14/2019	2/27/2019	3/5/2019
Room Temp (Deg C)	23	23	22
Rel Humidity (%)	25	27	22
Technician	Tony Wagoner	Tony Wagoner	Joe Schoettmer
mOhm values	<b>Actual Initial</b>	<b>Delta Temp Cycle1</b>	<b>Delta Temp Cycle 2</b>
<b>Pin Type 1: Signal</b>			
Average	7.40	0.90	1.45
St. Dev.	0.53	0.68	1.12
Min	6.65	0.00	0.01
Max	9.97	3.29	3.76
Summary Count	192	192	192
Total Count	192	192	192

<b>LLCR Delta Count by Category - Signal</b>						
	<b>Stable</b>	<b>Minor</b>	<b>Acceptable</b>	<b>Marginal</b>	<b>Unstable</b>	<b>Open</b>
mOhms	$\leq 5$	$>5.1 \text{ \& } \leq 10.0$	$>10.1 \text{ \& } \leq 15$	$>15.1 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	$>1000$
<b>Temp Cycle 1</b>	192	0	0	0	0	0
<b>Temp Cycle 2</b>	192	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: 05/29/2018, Next Cal: 05/29/2019**Equipment #:** MO-11**Description:** Switch/Multimeter**Manufacturer:** Keithley**Model:** 3706**Serial #:** 120169**Accuracy:** See Manual

... Last Cal: 09/11/2018, Next Cal: 09/11/2019

**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: 05/31/2019

**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: 06/30/2018, Next Cal: 06/30/2019

**Equipment #:** HPT-01**Description:** Hipot Safety Tester**Manufacturer:** Vitrek**Model:** V73**Serial #:** 019808**Accuracy:**

... Last Cal: 05/15/2018, Next Cal: 05/15/2019

**Equipment #:** OV-05**Description:** Forced Air Oven, 5 Cu. Ft., 120 V (Chamber Room)**Manufacturer:** Sheldon Mfg.**Model:** CE5F**Serial #:** 02008008**Accuracy:** +/- 5 deg. C

... Last Cal: 02/05/2019, Next Cal: 02/05/2020

**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: 04/22/2018, Next Cal: 04/22/2019

**Equipment #:** ACLM-01**Description:** Accelerometer**Manufacturer:** PCB Piezotronics**Model:** 352C03**Serial #:** 115819**Accuracy:** See Manual

... Last Cal: 07/18/2018, Next Cal: 07/18/2019

**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