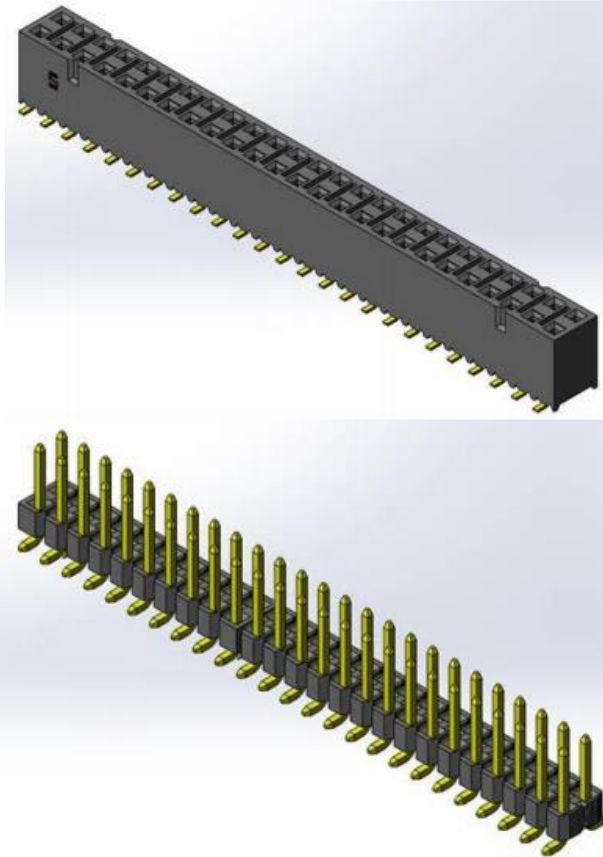


Project Number: Severe Environment Test Report	Tracking Code: 2039923_Report_Rev_1
Requested by: Stephen Brutscher	Date: 11/21/2019
Part #: TSM-140-01-S-DV/SSM-140-S-DV	
Part description: TSM/SSM	Tech: Scott Rollefstad
Test Start: 9/4/2019	Test Completed: 10/5/2019



SEVERE ENVIRONMENT TEST REPORT
TSM/SSM
TSM-140-01-S-DV/SSM-140-S-DV

Tracking Code: 2039923_Report_Rev_1	Part #: TSM-140-01-S-DV/SSM-140-S-DV
Part description: TSM/SSM	

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
11/21/2019	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-110069-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%.

<u>Group 1</u>		<u>Group 2</u>		<u>Group 3</u>	
TSM-140-01-S-DV		TSM-125-01-S-DV		TSM-105-01-S-DV	
SSM-140-S-DV		SSM-125-S-DV		SSM-105-S-DV	
8 Assemblies		8 Assemblies		8 Assemblies	
40 Positions		25 Positions		5 Positions	
Step	Description	Step	Description	Step	Description
1.	LLCR (2)	1.	Mating/Unmating Force (3)	1.	Mating/Unmating Force (3)
2.	Mating/Unmating Force (3)	2.	Cycles	2.	Cycles
3.	Cycles		Quantity = 250 Cycles		Quantity = 250 Cycles
4.	LLCR (2)	3.	Mating/Unmating Force (3)	3.	Mating/Unmating Force (3)
	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)				

(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

TSM-140-01-S-DV
SSM-140-S-DV
8 Assemblies
VITA 47.1 (V To V)

Group 2

TSM-140-01-S-DH
SSM-140-S-DV
8 Assemblies
VITA 47.1 (DH To V)

Step	Description	Step	Description
1.	LLCR (1)	1.	LLCR (1)
2.	Mechanical Shock (2) - Non Standard	2.	Mechanical Shock (2) - Non Standard
3.	Random Vibration (3) - 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 ² /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave	3.	Random Vibration (3) - 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 ² /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave
4.	LLCR (1) Max Delta = 15 mOhm	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

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 DetectionGroup 1

TSM-140-01-S-DV
SSM-140-S-DV
8 Assemblies
VITA 47.1 (V To V)

Group 2

TSM-140-01-S-DH
SSM-140-S-DV
8 Assemblies
VITA 47.1 (DH To V)

Step	Description	Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (1) - Non Standard	1.	Nanosecond Event Detection (Mechanical Shock) (1) - Non Standard
2.	Nanosecond Event Detection (Random Vibration) (2) - 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 ² /Hz 3) 1000 Hz to 2000 Hz PSD decreasing at 3dB/octave	2.	Nanosecond Event Detection (Random Vibration) (2) - 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 ² /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

TSM-140-01-S-DV

SSM-140-S-DV

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

TSM-140-01-S-DV

SSM-140-S-DV

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

TSM-140-01-S-DV
SSM-140-S-DV
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

TSM-140-01-S-DV
SSM-140-S-DV
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

TSM-140-01-S-DV
SSM-140-S-DV
8 Assemblies
EN61000-4-2

Step Description

1. Exposure To 5kV, 10kV, 15kV,
Repeat 10 Times
*Note: The connector shall not be
susceptible 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 G² / 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 $+10$ 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

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 (TSM-140-01-S-DV/SSM-140-S-DV)**

- **Initial**
 - **Mating**
 - **Min** -----14.61 lbs
 - **Max** -----18.65 lbs
 - **Unmating**
 - **Min** -----12.52 lbs
 - **Max** -----14.05 lbs
- **After 250 Cycles**
 - **Mating**
 - **Min** -----19.73 lbs
 - **Max** -----25.18 lbs
 - **Unmating**
 - **Min** -----17.87 lbs
 - **Max** -----22.56 lbs
- **After Humidity**
 - **Mating**
 - **Min** -----14.00 lbs
 - **Max** -----18.21 lbs
 - **Unmating**
 - **Min** -----12.77 lbs
 - **Max** -----15.41 lbs

Mating Unmating Basic Group (TSM-125-01-S-DV/SSM-125-S-DV)

- **Initial**
 - **Mating**
 - **Min** ----- 8.74 lbs
 - **Max** -----10.39 lbs
 - **Unmating**
 - **Min** ----- 6.78 lbs
 - **Max** ----- 8.28 lbs
- **After 250 Cycles**
 - **Mating**
 - **Min** -----13.79 lbs
 - **Max** -----17.75 lbs
 - **Unmating**
 - **Min** -----12.26 lbs
 - **Max** -----15.86 lbs

Mating Unmating Basic Group (TSM-105-01-S-DV/SSM-105-S-DV)

- **Initial**
 - **Mating**
 - **Min** ----- 1.81 lbs
 - **Max** ----- 4.10 lbs
 - **Unmating**
 - **Min** ----- 1.34 lbs
 - **Max** ----- 1.53 lbs
- **After 250 Cycles**
 - **Mating**
 - **Min** ----- 2.60 lbs
 - **Max** ----- 3.18 lbs
 - **Unmating**
 - **Min** ----- 2.30 lbs
 - **Max** ----- 2.83 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

Mated**Pin to Pin**

- DWV-----Passed

Row to Row

- DWV-----Passed

Un Mated**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** -----5.52 mOhms Max
- **Durability, 250 Cycles**
 - **<= +5.0 mOhms**-----192 Points ----- Stable
 - **+5.1 to +10 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 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 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 TSM-140-01-S-DV/SSM-140-S-DV (V to V)**

- **Initial** -----5.70 mOhms Max
- **Shock and Vibe**
 - **<= +5.0 mOhms**-----192 Points ----- Stable
 - **+5.1 to +10 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 TSM-140-01-S-DH/SSM-140-S-DV (DH to V)

- **Initial** -----7.06 mOhms Max
- **Shock and Vibe**
 - **<= +5.0 mOhms**-----192 Points ----- Stable
 - **+5.1 to +10 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

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

- **Initial -----6.24 mOhms Max**
- **Temperature Cycle1 (-55°C to +105°C)**
 - **<= +5.0 mOhms-----192 Points ----- Stable**
 - **+5.1 to +10 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 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****TSM-140-01-S-DV/SSM-140-S-DV**

	Initial				250 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newton's	Force (Lbs)	Newton's	Force (Lbs)	Newton's	Force (Lbs)	Newton's	Force (Lbs)
Minimum	64.97	14.61	55.68	12.52	87.78	19.73	79.48	17.87
Maximum	82.97	18.65	62.48	14.05	111.99	25.18	100.34	22.56
Average	74.08	16.65	58.28	13.10	101.78	22.88	91.43	20.56
St Dev	6.48	1.46	2.60	0.58	10.82	2.43	8.91	2.00
Count	7	7	7	7	7	7	7	7
	After Humidity							
	Mating		Unmating					
	Newton's	Force (Lbs)	Newton's	Force (Lbs)				
Minimum	62.28	14.00	56.80	12.77				
Maximum	81.02	18.21	68.53	15.41				
Average	73.41	16.51	64.17	14.43				
St Dev	6.93	1.56	3.71	0.83				
Count	7	7	7	7				

Mating Unmating Basic Group**TSM-125-01-S-DV/SSM-125-S-DV**

	Initial				250 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newton's	Force (Lbs)	Newton's	Force (Lbs)	Newton's	Force (Lbs)	Newton's	Force (Lbs)
Minimum	38.87	8.74	30.17	6.78	61.35	13.79	54.53	12.26
Maximum	46.22	10.39	36.82	8.28	78.96	17.75	70.55	15.86
Average	42.86	9.64	33.26	7.48	71.04	15.97	63.30	14.23
St Dev	2.57	0.58	2.49	0.56	6.93	1.56	6.17	1.39
Count	8	8	8	8	8	8	8	8

TSM-105-01-S-DV/SSM-105-S-DV

	Initial				250 Cycles			
	Mating		Unmating		Mating		Unmating	
	Newton's	Force (Lbs)	Newton's	Force (Lbs)	Newton's	Force (Lbs)	Newton's	Force (Lbs)
Minimum	8.05	1.81	5.95	1.34	11.55	2.60	10.21	2.30
Maximum	18.23	4.10	6.81	1.53	14.15	3.18	12.58	2.83
Average	10.60	2.38	6.41	1.44	12.62	2.84	11.46	2.58
St Dev	3.17	0.71	0.29	0.07	0.84	0.19	0.77	0.17
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued**Temperature Cycling**

Temperature Cycling Event Detection Summary	
Contacts tested	640
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

Altitude Tested = 70,000 feet	
Test Voltage= 300	
Pin to Pin	Row to Row
Mated	Mated
Passed	Passed
Passed	Passed
Passed	Passed

Altitude Tested at = 70,000 feet	
Test Voltage= 300	
Pin to Pin	Row to Row
Un Mated	Un Mated
Passed	Passed
Passed	Passed
Passed	Passed

Electrostatic Discharge

Electrostatic Discharge (ESD) Summary	
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 $+10$ 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	9/4/2019	9/5/2019	9/16/2019	10/2/2019
Room Temp (Deg C)	22	23	23	23
Rel Humidity (%)	53	47	51	52
Technician	Scott Rollefstad	Scott Rollefstad	Tony Wagoner	Scott Rollefstad
mOhm values	Actual Initial	Delta 250 Cycles	Delta Therm Shck	Delta Humidity
Pin Type 1: Signal				
Average	4.90	0.14	0.27	0.31
St. Dev.	0.24	0.10	0.16	0.21
Min	4.29	0.00	0.00	0.00
Max	5.52	0.59	0.85	1.44
Summary Count	192	192	192	192
Total Count	192	192	192	192

LLCR Delta Count by Category						
mOhms	Stable	Minor	Acceptable	Marginal	Unstable	Open
	≤ 5	>5 & ≤ 10	>10 & ≤ 15	>15 & ≤ 50	>50 & ≤ 1000	>1000
250 Cycles	192	0	0	0	0	0
Therm Shck	192	0	0	0	0	0
Humidity	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 $+10$ mOhms: -----Minor
 - c. $+7.6$ 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

Group 1 TSM-140-01-S-DV/SSM-140-S-DV (V to V)

LLCR Measurement Summaries by Pin Type				
Date	9/11/2019	9/26/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	51	47		
Technician	Scott Rollefstad	Scott Rollefstad		
mOhm values	Actual	Delta	Delta	Delta
	Initial	Shock-Vib		
Pin Type 1: Signal				
Average	4.84	0.3		
St. Dev.	0.32	0.27		
Min	3.86	0		
Max	5.7	1.79		
Summary Count	192	192		
Total Count	192	192		

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 5	$>5 \ \& \ \leq 10$	$>10 \ \& \ \leq 15$	$>15 \ \& \ \leq 50$	$>50 \ \& \ \leq 1000$	>1000
Shock-Vib	192	0	0	0	0	0

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
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**Group 2 TSM-140-01-S-DH/SSM-140-S-DV (DH to V)**

LLCR Measurement Summaries by Pin Type				
Date	10/1/2019	10/3/2019		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	54	50		
Technician	Scott Rollefstad	Scott Rollefstad		
mOhm values	Actual	Delta	Delta	Delta
	Initial	Shock-Vib		
Pin Type 1: Signal				
Average	5.58	0.23		
St. Dev.	0.68	0.32		
Min	4.48	0		
Max	7.06	3.29		
Summary Count	192	192		
Total Count	192	192		

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	<=5	>5 & <=10	>10 & <=15	>15 & <=50	>50 & <=1000	>1000
Shock-Vib	192	0	0	0	0	0

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
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

LLCR Measurement Summaries by Pin Type			
Date	9/10/2019	9/30/2019	10/5/2019
Room Temp (Deg C)	23	23	22
Rel Humidity (%)	51	50	40
Technician	Scott Rollefstad	Scott Rollefstad	Tony Wagoner
mOhm values	Actual Initial	Delta Temp Cycle1	Delta Temp Cycle 2
Pin Type 1: Signal			
Average	4.99	0.51	0.55
St. Dev.	0.32	0.29	0.28
Min	4.01	0.03	0.02
Max	6.24	2.13	1.93
Summary Count	192	192	192
Total Count	192	192	192

LLCR Delta Count by Category - Signal						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 5	>5 & ≤ 10	>10 & ≤ 15	>15 & ≤ 50	>50 & ≤ 1000	>1000
Temp Cycle 1	192	0	0	0	0	0
Temp Cycle 2	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: 05/29/2019, 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: 05/31/2019, Next Cal: 11/30/2019

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 #: 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: 04/22/2019, 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