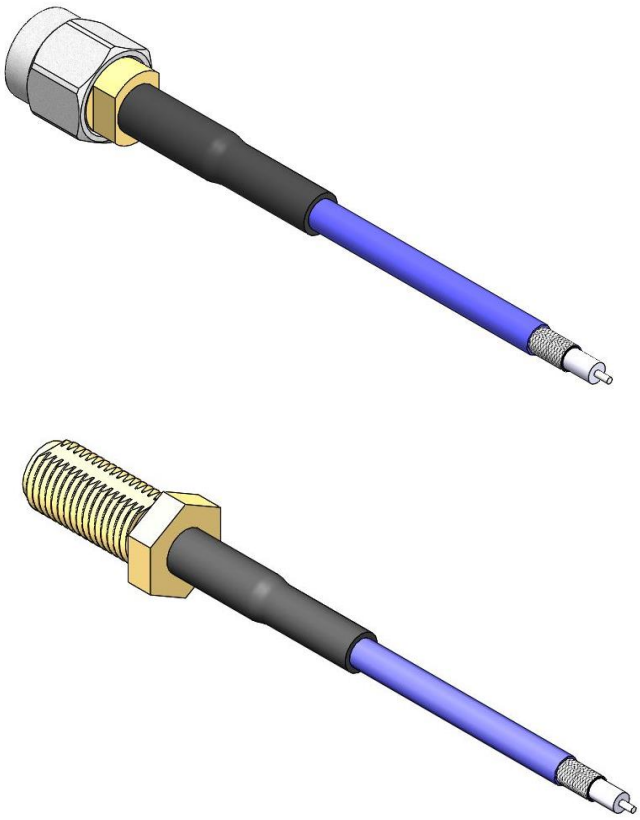
Project Number: Design Qualification Test Report	Tracking Code: 3408008_Report_Rev_1
Requested by: Jenny Chou	Date: 11/11/2022
Part #: RF23C-01SP-505050-0152/RF23C-01BJ-505050-0152	Tech: Peter Chen
Part description: RF23C-01SP/ RF23C-01BJ	Qty to test: 20
Test Start: 08/2/2022	Test Completed: 08/17/2022



DESIGN QUALIFICATION TEST REPORT

RF23C-01SP/ RF23C-01BJ
RF23C-01SP-505050-0152/RF23C-01BJ-505050-0152

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
8/18/2022	**1**	**Initial Issue**	**PC**

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: MIL-PRF-39012

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

FLOWCHARTS

IR/DWV

Pin-to-Ground

Group 1

RF23C-01SP-505050-0152

RF23C-01BJ-505050-0152

4 Assemblies

Step	Description
1.	Interface Gaging MAX. CONTACT DEPTH = 0.008 "
2.	IR (2) - Non Standard
3.	DWV at Test Voltage(1) - Non Standard Test Voltage = 500 V
4.	LLCR (3) - Non Standard *Note: Signal and ground.*
5.	Thermal Shock (4) - Non Standard
6.	IR (2) - Non Standard
7.	DWV at Test Voltage(1) - Non Standard Test Voltage = 500 V
8.	LLCR (3) - Non Standard *Note: Signal and ground.*
9.	Interface Gaging MAX. CONTACT DEPTH = 0.008 "

(1) DWV at Test Voltage = Other
Test Condition = 1 (Sea Level) Test voltage applied for 60 seconds
MIL-PRF-39012, Paragraph 4.6.14 per MIL-STD-202-301

(2) IR = Other
Test Condition = 500 Vdc, 2 Minutes Max
MIL-PRF-39012, Paragraph 4.6.8 per MIL-STD-202-302

(3) LLCR = Other
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
MIL-PRF-39012, Paragraph 4.6.13 except current to be 100mA nominal and voltage to be 20 mV maximum.

(4) Thermal Shock = Other
Exposure Time at Temperature Extremes =1/2 Hour
Method A, Test Condition = I (-55°C to +125°C)
Test Duration = test condition B except 10 cycles instead of 5.
MIL-PRF-39012, Paragraph. 4.6.17 per MIL-STD-202-107

FLOWCHARTS Continued

Cable Pull

Group 1
RF23C-01SP-505050-0152
2 Assemblies
0 Degrees

Step	Description
1.	Cable Retention (2) - Non Standard *Note: Pull-to-destruct.*

Group 2
RF23C-01BJ-505050-0152
2 Assemblies
0 Degrees

Step	Description
1.	Cable Retention (2) - Non Standard *Note: Pull-to-destruct.*

Group 3
RF23C-01SP-505050-0152
RF23C-01BJ-505050-0152
4 Assemblies
0 Degrees

Step	Description
1.	Interface Gaging MAX CONTACT DEPTH = 0.008 "
2.	LLCR (3) - Non Standard *Note: Signal and ground.*
3.	Cable Retention (1) - Non Standard APPLIED FORCE = 15 lbs
4.	LLCR (3) - Non Standard *Note: Signal and ground.*
5.	Interface Gaging MAX CONTACT DEPTH = 0.008 "

(1) Cable Retention = Other
Apply 15 pounds (6.80kg) for Cable Retention test.
MIL-PRF-39012, Paragraph 4.6.21

(2) Cable Retention = Other
Pull-to-destruct.
MIL-PRF-39012, Paragraph 4.6.21

(3) LLCR = Other
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
MIL-PRF-39012, Paragraph 4.6.13 except current to be 100mA nominal and voltage to be 20 mV maximum.

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) MIL-PRF-39012, *Paragraph. 4.6.17 per MIL-STD-202-107*
2) Test Condition: I (-65℃ to +125℃)
3) Test Time: ½ hour dwell at each temperature extreme
4) Test Duration: Test condition B except 10 cycles instead of 5.
5) All test samples are pre-conditioned at ambient.
6) All test samples are exposed to environmental stressing in the mated condition.

LLCR:

1) MIL-PRF-39012, *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

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: MIL-PRF-39012, *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.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

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: 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).

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

CABLE PULL:

1) Secure cable near center and pull on connector
    a. At 0°, in-line with cable

Fig. 1
0° Connector pull, notice the electrical continuity hook-up wires.

RESULTS

Cable Pull force

- **0° Pull**
  - **SP**
    - **Min ----------29.10 lbs**
    - **Max ----------35.70 lbs**
  - **BJ**
    - **Min ----------28.08 lbs**
    - **Max ----------30.08 lbs**

Insulation Resistance minimums, IR

Pin to Ground

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

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Test Voltage ----------500 VAC**

Pin to Ground

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

RESULTS Continued

Interface Gaging

IR/DWV Group

SP

Initial

- **Min ---------- 0.08 mm (0.0031 Inch)**
- **Max ---------- 0.10 mm (0.0039 Inch)**

After Thermal Shock

- **Min ---------- 0.06 mm (0.0023 Inch)**
- **Max ---------- 0.09 mm (0.0035 Inch)**

BJ

Initial

- **Min ---------- 0.02 mm (0.0008 Inch)-**
- **Max ---------- 0.04 mm (0.0016 Inch)**

After Thermal Shock

- **Min ---------- 0.03 mm (0.0012 Inch)-**
- **Max ---------- 0.06 mm (0.0024 Inch)**

Cable Pull Group

SP

Initial

- **Min ---------- 0.02 mm (0.0008 Inch)-**
- **Max ---------- 0.04 mm (0.0016 Inch)**

After Retention Force

- **Min ---------- 0.03 mm (0.0012 Inch)**
- **Max ---------- 0.06 mm (0.0024 Inch)**

BJ

Initial

- **Min ---------- 0.03 mm (0.0012 Inch)-**
- **Max ---------- 0.06 mm (0.0024 Inch)**

After Retention Force

- **Min ---------- 0.03 mm (0.0012 Inch)-**
- **Max ---------- 0.06 mm (0.0024 Inch)**

RESULTS Continued

LLCR IR/DWV (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 21.47 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 4 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 ---------- 7.11 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 4 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**

LLCR Cable Pull (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 22.15 mOhms Max**
- **15 Ib Retention**
  - **<= +5.0 mOhms ---------- 4 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 ---------- 8.46mOhms Max**
- **15 Ib Retention**
  - **<= +5.0 mOhms ---------- 4 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

Cable Pull Force:

0° Pull

01SP	Force (lbs)
Minimum	29.10
Maximum	35.70
Average	32.40

01BJ	Force (lbs)
Minimum	28.08
Maximum	30.08
Average	29.08

INSULATION RESISTANCE (IR):

	Pin to Ground
	Mated
Minimum	01SP/01BJ
Initial	45000
Thermal Shock	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	01SP/01BJ
Test Voltage	500

Pin to Ground (500 VAC)	
Initial Test Voltage	Pass
After Thermal Shock Test Voltage	Pass

DATA SUMMARIES Continued

INTERFACE GAGING

IR/DWV Group

Gaging (0.20 / 0.00) (mm)						
	Initial		Thermal shock		Deltas	
01SP	mm	Inch	mm	Inch	mm	Inch
1	0.09	0.0035	0.08	0.0031	0.01	0.0004
2	0.08	0.0031	0.09	0.0035	0.01	0.0004
3	0.09	0.0035	0.09	0.0035	0.00	0.0000
4	0.10	0.0039	0.06	0.0024	0.04	0.0016
Min	0.08	0.0031	0.06	0.0024	0.00	0.0000
Max	0.10	0.0039	0.09	0.0035	0.04	0.0016
Avg	0.09	0.0035	0.08	0.0031	0.015	0.0006

Gaging (0.20 / 0.00) (mm)						
	Initial		Thermal shock		Deltas	
01BJ	mm	Inch	mm	Inch	mm	Inch
1	0.04	0.0016	0.03	0.0012	0.01	0.0004
2	0.03	0.0012	0.05	0.0020	0.02	0.0008
3	0.03	0.0012	0.06	0.0024	0.03	0.0012
4	0.02	0.0008	0.04	0.0016	0.02	0.0008
Min	0.02	0.0008	0.03	0.0012	0.01	0.0004
Max	0.04	0.0016	0.06	0.0024	0.03	0.0012
Avg	0.03	0.0012	0.045	0.0018	0.02	0.0008

Cable Pull Group

Gaging (0.20 / 0.00) (mm)						
	Initial		After Pull		Deltas	
01SP	mm	Inch	mm	Inch	mm	Inch
1	0.04	0.0016	0.05	0.0020	0.01	0.0004
2	0.03	0.0012	0.06	0.0024	0.03	0.0012
3	0.02	0.0008	0.03	0.0012	0.01	0.0004
4	0.03	0.0012	0.04	0.0016	0.01	0.0004
Min	0.02	0.0008	0.03	0.0012	0.01	0.0004
Max	0.04	0.0016	0.06	0.0024	0.03	0.0012
Avg	0.03	0.0012	0.05	0.0020	0.02	0.0008

Gaging (0.20 / 0.00) (mm)						
	Initial		After Pull		Deltas	
01BJ	mm	Inch	mm	Inch	mm	Inch
1	0.06	0.0024	0.05	0.0020	0.01	0.0004
2	0.04	0.0016	0.06	0.0024	0.02	0.0008
3	0.03	0.0012	0.03	0.0012	0.00	0.0000
4	0.04	0.0016	0.05	0.0020	0.01	0.0004
Min	0.03	0.0012	0.03	0.0012	0.01	0.0004
Max	0.06	0.0024	0.06	0.0024	0.02	0.0008
Avg	0.04	0.0016	0.05	0.0020	0.01	0.0004

DATA SUMMARIES Continued

LLCR IR/DWV:

1) A total of 4 signal and 4 ground points were measured.
2) MIL-PRF-39012, *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	8/17/2022	8/17/2022		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	54	54		
Technician	Peter Chen	Peter Chen		
mOhm values	**Actual Initial**	**Delta After Thermal shock**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	21.27	0.77		
St. Dev.	0.14	0.41		
Min	21.09	0.17		
Max	21.47	1.26		
Summary Count	4	4		
Total Count	4	4		
	Pin Type 2: Ground			
Average	6.98	0.45		
St. Dev.	0.17	0.34		
Min	6.68	0.13		
Max	7.11	1.00		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After Thermal shcok	**8**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Cable Pull:

1) A total of 4 signal and 4 ground points were measured.
2) MIL-PRF-39012, *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	9/28/2022	9/29/2022		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	54	54		
Technician	Peter Chen	Peter Chen		
mOhm values	**Actual Initial**	**Delta After Pull**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	20.72	1.13		
St. Dev.	0.83	0.53		
Min	20.14	0.59		
Max	22.15	2.00		
Summary Count	4	4		
Total Count	4	4		
	Pin Type 2: Ground			
Average	8.24	0.08		
St. Dev.	0.13	0.06		
Min	8.11	0.03		
Max	8.46	0.19		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After Pull	**8**	**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: 05/29/2022, Next Cal: 05/29/2023

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2021, Next Cal: 09/11/2022

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: 06/30/2022, Next Cal: 06/30/2023

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2022, Next Cal: 05/15/2023