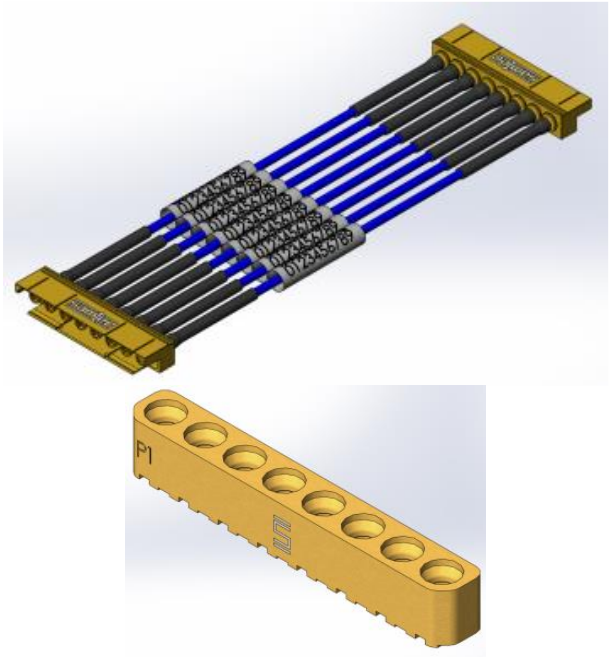
Project Number: Design Qualification Test Report	Tracking Code: CR-852602_Report_Rev_1
Requested by: Brian Luallen	Date: 1/11/2023
Part #: GPPC-PF-1-08-HG-ST-SL\GC47-1-08-505050-0305	
Part description: GPPC\GC47	Tech: Daniel Haydon
Test Start: 11/29/2022	Test Completed: 1/3/2023



DESIGN QUALIFICATION TEST REPORT

GPPC/GC47
GPPC-PF-1-08-HG-ST-SL\GC47-1-08-505050-0305

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
1/11/2023	**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, 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 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-111987-TST/PCB-111989-TST

FLOWCHARTS

IR/DWV

Pin-to-Ground

Group 1

GPPC-PF-1-08-HG-ST-SL

GC47-1-08-505050-0305

5 Assemblies

Note: CONNECTORS TESTED AFTER SOLDERED TO BOARD

Note: Use 2 parts for initial breakdown and remaining 3 parts for IR/DWV.

Step	Description
1.	DWV at Test Voltage (1) - Non Standard Test Voltage = 325 V *Note: Pin to Ground Mated*
2.	DWV Breakdown (2) - Non Standard
3.	IR (3) - Non Standard

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(1) DWV at Test Voltage = Other
Test Voltage = 325 Vrms min. at sea level per DSCC 10019.
Test voltage applied for 60 seconds. PER DSCC-10019 AND MIL-PRF-39012 (PARA 4.6.14)

(2) DWV Breakdown = Other
Record breakdown voltage. (Data only)
MIL-PRF-39012, Para 4.6.14

(3) IR = Other
5000 megohms min per DSCC 10019 and MIL-STD-202-302.
MIL-PRF-39012, Para 4.6.8, Test Condition A

FLOWCHARTS Continued

Mechanical Shock/Random Vibration/Event Detection

Group 1
GPPC-PF-1-08-HG-ST-SL
GC47-1-08-505050-0305
3 Assemblies

Note: CONNECTORS TESTED AFTER SOLDERED TO BOARD

Step	Description
1.	LLCR (1) - Non Standard MAX DELTA = 15 mOhm
2.	Mechanical Shock *Note: MIL-STD-202, Method 213, Test Condition H. EXCEPTION - 50 ns max. electrical interruption.*
3.	High Frequency Vibration *Note: MIL-STD-202-204, Test Condition D per DSCC 10019. EXCPETION - 50 ns max. electrical interruption.*
4.	LLCR (1) - Non Standard MAX DELTA = 15 mOhm

Group 2
GPPC-PF-1-08-HG-ST-SL
GC47-1-08-505050-0305
3 Assemblies

Note: CONNECTORS TESTED AFTER SOLDERED TO BOARD

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (2)
2.	Nanosecond Event Detection (Random Vibration) (3)

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

(2) Nanosecond Event Detection (Mechanical Shock)
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 = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(3) 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)

FLOWCHARTS Continued

Pull/Shear

PIN TO GROUND

Group 1

GPPC-PF-1-08-HG-ST-SL

RF047-A-M0SJ-505050-0305

6 Assemblies

Note: NOTE: CONECTORS TESTED AFTER SOLDERED TO BOARD

Step	Description
1.	LLCR (1)
2.	Cycles Quantity = 100 Cycles *Note: NOTE: PER DSCC 10019*
3.	LLCR (1) Max Delta = 15 mOhm
4.	Connector Pull *Note: NOTE: Record failure force (data only). 3 Samples*
5.	Connector Shear *Note: NOTE: Record failure force (data only). 3 Samples*

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

THERMAL SHOCK/CONTACT RESISTANCE

Group 1

GPPC-PF-1-08-HG-ST-SL

GC47-1-08-505050-0305

5 Assemblies

Note: CONNECTORS TESTED AFTER SOLDERED TO BOARD

Step	Description
1.	LLCR (1) - Non Standard MAX DELTA = 15 mOhm
2.	Thermal Shock (2) - Non Standard
3.	LLCR (1) - Non Standard MAX DELTA = 15 mOhm

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

(2) Thermal Shock = Other
MIL-STD-202-107
Test condition B per DSCC 10019. Exception - high temperature to be +165°C. Visual inspection for damage.

FLOWCHARTS Continued

Interface Gauging

Group 1
GPPC-PF-1-08-HG-ST-SL
GC47-1-08-505050-0305
5 Assemblies

Note: NOTE: CONNECTORS TESTED WITHOUT BOARD

Step	Description
1.	Interface Gauging *Note: NOTE: Prior to Center Contact Retention take a baseline interface reading, record measurement*
2.	Center Contact Retention Retention Force = 1.5 lbs *Note: NOTE: 1.5 pounds (24 oz.) (.002 max contact movement). Contact movement change can be measured from any body reference surface (Delta = Before - After)*
3.	Interface Gauging *Note: NOTE: After Contact Retention remeasure interface and record measurement*

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) MIL-STD-202-107, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition B per DSCC 10019. Exception – high temperature to be +165° C. Visual inspection for damage.
3) All test samples are pre-conditioned at ambient.
4) All test samples are exposed to environmental stressing in the mated condition.

MECHANICAL SHOCK (Specified Pulse):

1) Reference document: MIL-STD-202, *Mechanical Shock Test Procedure for Electrical Connectors*
2) Test Condition: MIL-STD-202, Method 213 Cond. I.

VIBRATION:

1) Reference document: MIL-STD-202, *Vibration Test Procedure for Electrical Connectors*
2) Test Condition: MIL-STD-202-204, Condition D per DSCC 10019.

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

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.
5000 megohms min per DSCC 10019 and MIL-STD-202-302. MIL-PRF-39012, Para 4.6.8.

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) Breakdown:
    Record breakdown voltage. (Data only). MIL-PRF-39012, para 4.6.14
2) Test Voltage
    a. 325 V rms min. at sea level per DSCC 10019.
    b. Test voltage applied for 60 seconds. Per DSCC-10019 and MIL-PRF-39012, PARA 4.6.14.

RESULTS

Connector Pull & Shear Force:

Connector Pull force

- **Min ----------42.10 lbs**
- **Max ----------47.19 lbs**

Connector Shear force

- **Min ----------56.11 lbs**
- **Max ----------69.08 lbs**

Interface Gaging

Initial

- **Min ---------- 0.0043 inch**
- **Max ---------- 0.0049 inch**

After 1.5 Pound Retention Force

- **Min ---------- 0.0037 inch**
- **Max ---------- 0.0040 inch**

Insulation Resistance minimums, IR

Pin to Ground

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

Dielectric Withstanding Voltage minimums, DWV

- **Test Voltage ----------325 VAC**

Pin to Ground

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

Pin to Ground

- **Breakdown Voltage ----------875 VAC**

RESULTS Continued

LLCR Pull&Shear (6 signal and 6 ground LLCR test points)

Signal pin

- **Initial ---------- 92.43 mOhms Max**
- **Durability 100 cycles**
  - **<= +5.0 mOhms ---------- 6 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 ---------- 31.75 mOhms Max**
- **Durability 100 cycles**
  - **<= +5.0 mOhms ---------- 6 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 Thermal Shock (5 signal and 5 ground LLCR test points)

Signal Pin

- **Initial ---------- 93.77 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 5 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 ---------- 32.33 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 0 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 5 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 Shock & Vibration (3 signal and 3 ground LLCR test points)

Signal Pin

- **Initial ---------- 93.11 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms----------3 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 ---------- 30.36 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms----------3 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

Connector Pull & Shear Force:

Connector Pull

	Force (lbs)
Minimum	**42.10**
Maximum	47.19
Average	44.41

Connector Shear

	Force (lbs)
Minimum	**56.11**
Maximum	69.08
Average	63.41

Interface Gaging

	Initial Interface Gauging	After 1.5 Pound Retention Force
Sample #	Distance in inches	Distance in inches
1	0.0048	0.00395
2	0.0049	0.0039
3	0.0043	0.00365
4	0.0042	0.00335
5	0.0048	0.00375
Minimum	0.0043	0.0037
Maximum	0.0049	0.0040
Average	0.0047	0.0038

DATA SUMMARIES Continued

IR\DWV:

Initial

	Pin to Ground	
	Mated	
	GPPB / RF047A	
	IR	DWV
Minimum	45000	325
Maximum	45000	325
Average	45000	325

BREAKDOWN:

Pin to Ground	
Mated	
GPPB / RF047A	
Sample#	Breakdown
1	875
2	875

DATA SUMMARIES Continued

LLCR Pull&Shear:

1) A total of 6 signal and 6 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 +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	2022/11/29	2022/11/29		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	39	39		
Technician	Daniel Haydon	Daniel Haydon		
mOhm values	Actual **Initial LLCR**	**Delta** **After 100 Cycles**		
Pin Type: Signal 1				
Average	92.02	0.15		
St. Dev.	0.29	0.13		
Min	91.69	0.01		
Max	92.43	0.32		
Summary Count	6	6		
Total Count	6	6		
Pin Type: GND 1				
Average	30.82	0.38		
St. Dev.	0.61	0.14		
Min	29.95	0.21		
Max	31.75	0.63		
Summary Count	6	6		
Total Count	6	6		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After 100 Cycles	**12**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Thermal Shock:

1) A total of 5 signal and 5 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 +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	2022/11/30	2023/1/3		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	39	53		
Technician	Daniel Haydon	Daniel Haydon		
mOhm values	Actual **Initial LLCR**	**Delta LLCR After Thermal Shock**		
	Pin Type: Signal 1			
Average	93.36	0.68		
St. Dev.	0.34	0.28		
Min	93	0.41		
Max	93.77	1.15		
Summary Count	5	5		
Total Count	5	5		
	Pin Type: GND 1			
Average	30.81	6.31		
St. Dev.	1.13	0.8		
Min	29.7	5.48		
Max	32.33	7.22		
Summary Count	5	5		
Total Count	5	5		

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

DATA SUMMARIES Continued

LLCR Shock &Vibration:

1). A total of 3 signal and 3 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	2022/11/29	2022/12/1		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	39	38		
Technician	Daniel Haydon	Daniel Haydon		
mOhm values	Actual	**Delta**		
	Initial	**Shock-Vib**		
Pin Type: Signal 1				
Average	92.73	0.29		
St. Dev.	0.34	0.18		
Min	92.44	0.09		
Max	93.11	0.45		
Summary Count	3	3		
Total Count	3	3		
Pin Type: GND 1				
Average	29.85	0.78		
St. Dev.	0.53	0.5		
Min	29.3	0.48		
Max	30.36	1.35		
Summary Count	3	3		
Total Count	3	3		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock-Vib	**6**	**0**	**0**	**0**	**0**	**0**

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	4
Test Condition	MIL-STD-202 Method 213 Test Condition H
Shock Events	0
Test Condition	MIL-STD-202-204 Test Condition D
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: 05/29/2022, Next Cal: 05/29/2023

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2022, Next Cal: 09/11/2023

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

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 04/22/2022, Next Cal: 04/22/2023

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/18/2022, Next Cal: 07/18/2023

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 10/31/2022, Next Cal: 10/31/2023