



Project Number: Design Qualification Test Report	Tracking Code: 684208_Report_Rev_1
Requested by: Liam Parkes	Date: 8/25/2016
Part #: ECUE-12-030-C1-FF-01-1/UEC5-019-1-H-D-RA-1-A	
Part description: ECUE/UEC5	Tech: Aaron McKim
Test Start: 12/10/2015	Test Completed: 12/25/2015



DESIGN QUALIFICATION TEST REPORT

ECUE/UEC5

ECUE-12-030-C1-FF-01-1/UEC5-019-1-H-D-RA-1-A

Tracking Code: 684208_Report_Rev_1	Part #: ECUE-12-030-C1-FF-01-1/UEC5-019-1-H-D-RA-1-A
Part description: ECUE/UEC5	

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
8/25/2016	1	Initial Issue	PC

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: 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-107087-TST/PCB-107088-TST.

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

ECUE-12-030-C1-FF-01-1

UEC5-019-1-H-D-RA-1-A

8 Assemblies

Step Description

1. LLCR ⁽¹⁾
2. Mechanical Shock ⁽²⁾
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 = EIA-364-27

Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)

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

(3) Random Vibration = EIA-364-28

Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

Mechanical Shock/Random Vibration/Event DetectionGroup 1

ECUE-12-030-C1-FF-01-1

UEC5-019-1-H-D-RA-1-A

60 Points

Step Description

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

(1) 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

(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)

FLOWCHARTS Continued**Cable Pull**Group 1

ECUE-12-030-C1-FF-01-1

UEC5-019-1-H-D-RA-1-A

5 Assemblies

0 Degrees

Step Description

1. Cable Pull ⁽¹⁾

Group 2

ECUE-12-030-C1-FF-01-1

UEC5-019-1-H-D-RA-1-A

5 Assemblies

90 Degrees

Step Description

1. Cable Pull ⁽¹⁾

(1) Cable Pull = EIA-364-38

Measure and Record Force Required to Failure

Failure = Discontinuity >1 microsecond at 10 ohms

Cable FlexGroup 1

ECUE-12-030-C1-FF-01-1

UEC5-019-1-H-D-RA-1-A

8 Assemblies

Flat Cable

Step Description

1. IR ⁽³⁾
2. DWV at Test Voltage ⁽²⁾
Test Voltage = 520 V
3. Cable Flex ⁽¹⁾
4. Visual Inspection
5. IR ⁽³⁾
6. DWV at Test Voltage ⁽²⁾
Test Voltage = 520 V

(1) Cable Flex = EIA-364-41

Circular Jacket Cable - to be tested 90° each direction (180° total)

Flat Cable - to be tested 70° each direction (140° total)

Monitor continuity during flex testing

Failure = Discontinuity >1 microsecond at 10 ohms

(2) 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

(3) IR = EIA-364-21

Test Condition = 500 Vdc, 2 Minutes Max

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

MECHANICAL SHOCK (Specified Pulse):

- 1) Reference document: EIA-364-27, *Mechanical Shock Test Procedure for Electrical Connectors*
- 2) Test Condition C
- 3) Peak Value: 100 G
- 4) Duration: 6 Milliseconds
- 5) Wave Form: Half Sine
- 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 G² / 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. $\leq +5.0$ 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

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 1000 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).

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

CONNECTOR PULL:

- 1) Secure cable near center and pull on connector
 - a. At 90°, right angle to cable
 - b. At 0°, in-line with cable



Fig. 1
(Typical set-up)

90° Connector pull, notice the electrical continuity hook-up wires.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

CABLE DURABILITY:

- a. 140° Flex Mode, bend up to 500 cycles with 8 oz. load on cable end.



Fig. 2
(Typical set-up)

RESULTS

LLCR Shock & Vibration (64 signal pin and 32 ground LLCR test points)

Signal pin:

- Initial -----686.05 mOhms Max

Ground Pin:

- Initial ----- 33.18 mOhms Max

Shock & Vibration

- <= +5.0 mOhms -----90 Points ----- Stable
- +5.1 to +10.0 mOhms -----6 Points ----- Minor
- +10.1 to +15.0 mOhms -----0 Points ----- Acceptable
- +15.1 to +50.0 mOhms -----0 Points ----- Marginal
- +50.1 to +2000 mOhms -----0 Points ----- Unstable
- >+2000 mOhms -----0 Points ----- Open Failure

Mechanical Shock & Random Vibration:

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

Cable Pull

- 0 ° Pull force
 - Min-----6.02 Lbs
 - Max -----9.25 Lbs
- 90 ° Pull force
 - Min-----8.02 Lbs
 - Max -----9.27 Lbs

RESULTS Continued**Cable Flex****IR****Pin to Pin**

- **Initial**
 - **Mated**-----**29000 Meg Ω** ----- **Passed**
- **After 500 Flex cycles**
 - **Mated**-----**45000 Meg Ω** ----- **Passed**

Row to Row

- **Initial**
 - **Mated**-----**45000 Meg Ω** ----- **Passed**
- **After 500 Flex cycles**
 - **Mated**-----**45000 Meg Ω** ----- **Passed**

DWV

- **Minimums**
 - **Breakdown Voltage**-----**693 VAC**
 - **Test Voltage** -----**520 VAC**
 - **Working Voltage** -----**170 VAC**

Pin to Pin

- **Initial DWV**----- **Passed**
- **500 Flex cycles DWV** -----**Passed**

Row to Row

- **Initial DWV**----- **Passed**
- **500 Flex cycles DWV** -----**Passed**

DATA SUMMARIES**Cable Pull****0 ° Pull force**

	Force (lbs)
Minimum	6.02
Maximum	9.25
Average	8.24

90 ° Pull force

	Force (lbs)
Minimum	8.02
Maximum	9.27
Average	8.84

Cable Flex**IR**

Pin to Pin	
Mated	
Minimum	
Initial	29000
After 500 Flex Cycles	45000
Row to Row	
Mated	
Minimum	
Initial	45000
After 500 Flex Cycles	45000

DWV

Voltage Rating Summary : Test Voltage Determined By Online Rating	
Minimum	
Break Down Voltage	693
Test Voltage	520
Working Voltage	170

Pin to Pin	
Initial Test Voltage	Passed
After 500 Flex Cycles Test Voltage	Passed

Row to Row	
Initial Test Voltage	Passed
After 500 Flex Cycles Test Voltage	Passed

DATA SUMMARIES Continued**LLCR Shock &Vibration:**

- 1). A total of 64 signal pin and 32 ground pin 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. $\leq +5.0$ 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

LLCR Measurement Summaries by Pin Type				
Date	12/17/2015	12/23/2015		
Room Temp (Deg C)	23	21		
Rel Humidity (%)	41	44		
Technician	Aaron McKim	Aaron McKim		
mOhm values	Actual	Delta	Delta	Delta
	Initial	Shock-Vib		
Pin Type 1: Signal				
Average	676.94	2.85		
St. Dev.	3.02	1.21		
Min	671.97	0.48		
Max	686.05	7.73		
Summary Count	80	64		
Total Count	80	64		
Pin Type 2: Ground				
Average	23.11	0.76		
St. Dev.	3.63	1.26		
Min	18.19	0.03		
Max	33.18	5.54		
Summary Count	40	32		
Total Count	40	32		

LLCR Delta Count by Category						
	Stable	Minor	Acceptable	Marginal	Unstable	Open
mOhms	≤ 5	$>5 \text{ \& } \leq 10$	$>10 \text{ \& } \leq 15$	$>15 \text{ \& } \leq 50$	$>50 \text{ \& } \leq 1000$	>1000
Shock-Vib	90	6	0	0	0	0

DATA SUMMARIES Continued

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	32
Test Condition	C, 100g's, 6ms, Half-Sine
Shock Events	0
Test Condition	V-B, 7.56 rms g
Vibration Events	0
Total Events	0

EQUIPMENT AND CALIBRATION SCHEDULES**Equipment #:** MO-11**Description:** Switch/Multimeter**Manufacturer:** Keithley**Model:** 3706**Serial #:** 120169**Accuracy:** See Manual

... Last Cal: 09/11/2015, Next Cal: 09/11/2016

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

... Last Cal: 05/15/2016, Next Cal: 05/15/2017

Equipment #: SVC-01**Description:** Shock & Vibration Table**Manufacturer:** Data Physics**Model:** LE-DSA-10-20K**Serial #:** 10037**Accuracy:** See Manual

... Last Cal: 04/22/2016, Next Cal: 04/22/2017

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

... Last Cal: 07/18/2016, Next Cal: 07/18/2017

Equipment #: ED-03**Description:** Event Detector**Manufacturer:** Analysis Tech**Model:** 32EHD**Serial #:** 1100604**Accuracy:** See Manual

... Last Cal: 10/31/2015, Next Cal: 10/31/2016