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1.0 OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of Amphenol connector **U10-XXXX-XXXXXX Right Angle** type.

2.0 SCOPE

This Specification includes of the Materials/Finishing, Mechanical Performance, Electrical Performance, And Environmental Performance etc.

3.0 APPLICABLE DOCUMENTS

3.1 Application

3.1.1 Engineering drawings

3.2 Other Standards and Specifications

3.2.1 UL94V-0 : Flammability

3.2.2 EIA 364 : Electrical Connector/Socket Test Procedures Including Environmental Classifications

3.3 EIA Standards

3.3.1 (EIA-364-70) Current Rating

3.3.2 (EIA-364-23) Low Level Contact Resistance

3.3.3 (EIA-364-21) Insulation Resistance

3.3.4 (EIA-364-20) Dielectric Withstanding Voltage

3.3.5 (EIA-364-09) Durability

3.3.6 (EIA-364-13) Mating / Un-mating Force

3.3.7 (EIA-364-28) Vibration

3.3.8 (EIA-364-27) Mechanical Shock

3.3.9 (EIA-364-32) Thermal Shock

3.3.10 (EIA-364-31) Temperature/Humidity Cycling

3.3.11 (EIA-364-17) High Temperature Life

3.3.12 (EIA-364-65) Mixed Flowing Gas

3.3.13 (EIA -364-06) Contact Resistance

3.3.14 (EIA-364-110)Thermal Cycling

3.3.15 (EIA-364-91)Dust

4.0 REQUIREMENTS

4.1 Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein. Unless otherwise specified, all measurements shall be performed within the following lab conditions:
Temperature : 15 to 35°C
Relative Humidity : 20% to 80%
Atmospheric Pressure : 650mm to 800mm of Hg (86 ~106Kpa)

4.2 Material

Material for each part shall be specified herein, or equivalent. Substitute material shall meet the performance requirements of this specification.

4.2.1 Contacts
Copper Alloy.

4.2.2 Housing
High Temperature Thermoplastic, UL94V-0,Black.

4.3 Finish

Contacts plating: Gold plated on mating area,Matte tin plated on solder area.
Nickel plated overall.

4.4 Workmanship

Connectors shall be uniform in quality and shall be free from burrs, scratches, cracks, voids, chips, blisters, sharp edges, and other defects that will adversely affect product's life or serviceability

5.0 ELECTRICAL CHARACTERISTIC

5.1 Current Rating

The temperature rise above ambient shall not exceed 30°C at any point in the system when contact positions specified are powered at the power levels specified herein:
a) Ambient Conditions: still air at 25°C
b) Current Rating : 0.5A per pin.
c) Reference: EIA-364-70.

5.2 Low Level Contact Resistance

The mating pair should be meet:
LLCR: 20 m ohms Max(or Baseline), △R<20 mohms
The following details shall apply:
a)Test Voltage: 20mV DC maximum at open circuit.
b)Test Current: not to exceed 100mA
c) Reference: EIA-364-23C.

5.3 Voltage Rating

DC 30 V

5.4 Insulation Resistance

Mated connectors, the insulation resistance shall not be less than 1000M ohm when measured in accordance with EIA 364-21. The following details shall apply:
a) Test Voltage : 100V DC ±10%
b) Electrification Time : 1 minute
c) Point of Measurement: Between adjacent contacts.

5.5 Dielectric Withstanding Voltage

Mated connectors, there shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (0.5mA max) when tested in accordance with EIA 364-20. The following details shall apply:

a) Test Voltage: 300V AC.
b) Test Duration : 60seconds ±5 seconds.
c) Points of measurement : Between adjacent contacts

6.0 MECHANICAL CHARACTERISTIC

6.1 Durability. (reference EIA-364-09)

Mating and Un-mating at the speed rate of less than 10 cycles per minute

a) Number of Cycles : 250 cycles Min.
b) Cross Head Speed: 25.4mm per minute Max.
c) No physical damage shall be observed

6.2 Mating / Un-mating Force

When do these test ,The following details shall apply:

a) Cross Head Speed: 25.4mm per minute Max.
b) Reference: EIA -364-13

6.2.1 Mating force: 40N Max. For X4/X6/X8/X12
Mating force: 67N Max. For X16

6.2.2 Un-mating force: 3N Min. For X8/X12 (without latch)
Un-mating force: 1.5N Min. For X4/X6 (without latch).
Un-mating force: 5N Min. For X16 (without latch)

6.3 Latch Retention Force

When do these test ,The following details shall apply:

a) Cross Head Speed: 25.4mm per minute Max.
b) Reference: EIA -364-13
c) Retention force: 50N Min.

6.4 Vibration

a) Reference: EIA -364-28
b) The test sample connectors shall be mounted on a PC board and tested in according with Condition Ⅱ for the duration of 2 hours in each of three mutually perpendicular axes. The test sample shall be mounted rigidly to a test fixture and shall simulate as closely as possible to the normal mounting of the connectors. All contacts shall be wired in series with at least 100 milliamperes of current allowed to flow.
c) The tested samples connectors shall be performed according to vibration amplitude: 1.52 mm (0.06inch) DA or 10G acceleration, frequency range: 10 to 55 to 10 Hz and sweep time: 15 minutes per cycle. An accelerometer shall monitor the vibration forces at a point on a near the test samples. A suitable instrument shall be employed to monitor any discontinuity or interruption of current flow in excess 1 μ second.
d) Need no discontinuities excess 1 μ second were detected during vibration testing. After vibration testing, no cracks, breaks, or loose parts on the test samples were visible.

6.5 Mechanical Shock.

a) Reference: EIA -364-27

b) Three (3) Half-Sine shock pulses shall be applied, in each direction along the three mutually perpendicular axes of the test sample for a total of eighteen (18) shock pulses. An accelerometer shall monitor the shock forces at a point or near the test samples.

c) The peak acceleration values for the half-sine pulse shall be 490 m/s2 (50 g's) and the normal duration shall be 11 milliseconds. Velocity change shall be 2.07 m/s (6.8 ft/s). The test sample shall be mounted rigidly to a test fixture and shall simulate as closely as possible to the normal mounting of the connectors.

d) All contacts shall be wired in series with a minimum of 100 mA of current allowed to flow. A suitable instrument shall be employed to monitor any discontinuity or interruption of current flow in excess 1 μ second.

e) Need no discontinuities excess 1 μ second were detected during mechanical shock testing. After mechanical shock testing. the test samples shall meet the LLCR, LLCR change and no cracks, breaks, or loose parts on the test samples were visible.

7.0 ENVIRONMENTAL CHARACTERISTIC

7.1 Thermal Shock.

a) Reference: EIA-364-32,

b) In mated connector,-65°C / 30min.,+105 °C / 30min.,Making this a cycle, repeat 10 cycles.

c) After thermal shock testing, the test samples shall meet the LLCR, LLCR change , Insulation Resistance and Dielectric Withstanding Voltage spec.

7.2 Temperature/Humidity Cycling.

a) Reference: EIA-364-31,

b) The mated test samples shall be tested with temperature and humidity, 24Hours Cycling(10 times) is following sequence:

25°C~65°C,90%-98%RH,3Hours,

50°C at 90% RH,9Hours,

50°C~25°C,90%-80%RH, 3Hours,

25°C,95% RH,9Hours

At the end of the first & final cycle, -10°C for 3Hours

Dwell times start when the temperature and humidity have stabilized within the specified levels.

c) After temperature & humidity cycling testing, the test samples shall meet the LLCR, LLCR change , Insulation Resistance and Dielectric Withstanding Voltage spec.

7.3 High Temperature Life.

a) Reference: EIA-364-17

b) Test Duration: 72H/250H/750H

c) Temperature: 105±3°C

d) After high temperature testing, the test samples shall meet the LLCR, LLCR change spec.

7.4 Mixed Flowing Gas

a) Reference: EIA-364-65
b) Temperature: 30±1°C,70±2%RH.
c) Gas Concentration: Cl2 10±3ppb, NO2 200±50ppb, H2S 10±5ppb, SO2 100±20ppb
d) Two mixed flowing gas tests are required: 10 days Mated
e) LLCR:△R<20 mohms

7.5 Thermal Cycling

a) Reference: EIA-364-110
b) Test Temperature: 15±3°C ~ 85±3°C.
c) Test Duration: 500 cycles.
d) LLCR:△R<20 mohms

7.6 Dust

a) Reference: EIA-364-91
b) Temperature: 25±7°C,Relative Humidity:<70%.
c) Test Air Flow Rate: 300 meters/minute for 1Hour.
d) After test, the test samples shall meet the LLCR, LLCR change and mating/unmating force spec.

7.7 Reseating

Manually unplug/plug the connector or socket. Perform 3 such cycles.

7.8 Thermal Disturbance

Cycle the connector or socket between 15°C and 85°C. Ramps should be a minimum of 2°C per minute, and dwell times should insure that the contacts reach the temperature extremes (a minimum of 5 minutes). Humidity is not controlled. Perform 10 such cycle.

7.9 Operating Temperature

-40 °C ~+85 °C

8.0 SI Characteristic(SI性能)

PCIe 3.0 FOR 85Ω

Parameter	Procedure	Requirements
Differential Insertion Loss (DDIL)	EIA 364-101 The EIA standard shall be used with the following considerations: 1. The measured differential S parameter shall be referenced to an 85 Ω differential impedance. 2. The test fixture shall meet the test fixture requirement defined in Section 6.3.4.1. 3. The test fixture effect shall be removed from the measured S parameters. Refer to Note 1.	≥ -0.5 dB up to 2.5 GHz; ≥ -[0.8*(f-2.5)+0.5] dB for 2.5 GHz < f ≤ 5 GHz (for example, ≥ -2.5 dB at f = 5 GHz); ≥ -[3.0*(f-5)+2.5] dB for 5 GHz < f ≤ 12 GHz (for example, ≥ -10 dB at f = 7.5 GHz)
Differential Return Loss (DDRL)	EIA 364-108 The EIA standard shall be used with the following considerations: 1. The measured differential S parameter shall be referenced to an 85 Ω differential impedance. 2. The test fixture shall meet the test fixture requirement in Section 6.3.4.1. 3. The test fixture effect shall be removed. Refer to Note 1.	≤ -15 dB up to 3.0 GHz; ≤ 5*f - 30 dB for 3.0 GHz < f ≤ 5 GHz; ≤ -1 dB for 5.0 GHz < f ≤ 12 GHz
Intra-pair Skew	Intra-pair skew must be achieved by design; measurement not required.	5 ps max
Differential Near End Crosstalk (DDNEXT)	EIA 364-90 The EIA standard must be used with the following considerations: 1. The crosstalk requirement is with respect to all the adjacent differential pairs including the crosstalk from opposite sides of the connector, as illustrated in Figure 6-4. 2. This is a differential crosstalk requirement between a victim differential signal pair and all of its adjacent differential signal pairs. The measured differential S parameter shall be referenced to an 85 Ω differential impedance.	≤ -32 dB up to 2.5 GHz; ≤ -26 dB for 2.5 GHz < f ≤ 5.0 GHz; ≤ -20 dB for 5.0 GHz < f ≤ 10 GHz < -10 dB for 10 GHz < f ≤ 12 GHz

Notes:
1. The specified S-parameters requirements are for connector only, not including the test fixture effect. While the TRL calibration method is recommended, other calibration methods are allowed.

SAS 3.0 FOR 85Ω

Characteristic [a] [b]	Units	Value
Maximum near-end crosstalk (NEXT) for each signal pair [c] [d]	dB	-35
Maximum far-end crosstalk (FEXT) for each signal pair [c] [d]	dB	-35
Maximum S_{DD22} 100 MHz to 6 000 MHz	dB	-12
Maximum S_{CC22} from 100 MHz to 6 000 MHz	dB	-3.0
Minimum S_{DD21} from 100 MHz to 6 000 MHz	dB	-1.0

8.0 SI Characteristic (SI性能)

PCIe 4.0 FOR 85Ω

Table 41: Signal Integrity Requirements and Test Procedures for 16.0 GT/s Support

Parameter	Procedure	Requirements
Differential Insertion Loss (DDIL)	EIA 364-101 The EIA standard shall be used with the following considerations: 1. The measured differential S parameter shall be referenced to an 85 Ω differential impedance. 2. The test fixture shall meet the test fixture requirement defined in Section 6.3.4.1. 3. The test fixture effect shall be removed from the measured S parameters. See Note 1.	≥ -0.5 dB up to 4 GHz; ≥ [-0.25*f +0.5] dB for 4 GHz < f < 8 GHz (for example -1.5 dB at 8 GHz); ≥ [-0.75*f+4.5] dB for 8 GHz< f < 10 GHz (for example: -3.0 dB at 10 GHz)
Parameter	**Procedure**	**Requirements**
Differential Return Loss (DDRL)	EIA 364-108 The EIA standard shall be used with the following considerations: 1. The measured differential S parameter shall be referenced to an 85 Ω differential impedance. 2. The test fixture shall meet the test fixture requirement in Section 6.3.4.1. 3. The test fixture effect shall be removed. See Note 1.	≤ -15 dB up to 3 GHz; ≤ [5*f – 30] dB for 3 < f < 4.4 GHz; (for example: -10 dB at 4 GHz); ≤ -8 dB from 4.4 to 10 GHz
Intra-pair Skew	Intra-pair skew must be achieved by design; measurement not required.	5 ps max
Differential Near End Crosstalk (DDNEXT)	EIA 364-90 The EIA standard must be used with the following considerations: 1. The crosstalk requirement is with respect to all the adjacent differential pairs including the crosstalk from opposite sides of the connector, as illustrated in Figure 38. 2. This is a differential crosstalk requirement between a victim differential signal pair and all of its adjacent differential signal pairs. The measured differential S parameter shall be referenced to an 85 Ω differential impedance.	≤ -32 dB up to 8 GHz and -20 dB from 8 GHz to 10 GHz

Notes:
1. The specified S-parameters requirements are for connector only, not including the test fixture effect. While the TRL calibration method is recommended, other calibration methods are allowed.

SAS 4.0 FOR 85Ω

Characteristic [a]	Equation	Units	Range
Minimum $\lvert S_{DD21}(f)\rvert$ [b]	$-0.08\sqrt{f/1\times10^{9}} - 0.336(f/1\times10^{9})$	dB	$0.05\ \text{GHz} \le f \le \left(\frac{3}{4}\right)f_{baud}$
Maximum $\lvert S_{DD21}(f)\rvert$ [b]	$-0.12 - 0.475\sqrt{f/1\times10^{9}} - 0.364(f/1\times10^{9})$	dB	$0.05\ \text{GHz} \le f \le \left(\frac{3}{4}\right)f_{baud}$
Maximum $\lvert S_{DD22}(f)\rvert$ [c d]	$-20\log_{10}[W(f)^{0.353}] - 12$	dB	$0.05\ \text{GHz} \le f \le \left(\frac{3}{4}\right)f_{baud}$
Maximum $\lvert S_{CD21}(f)\rvert$ [e]	$\begin{cases} -25 + 20\left(\frac{f}{f_{baud}}\right) \\ -18 + 6\left(\frac{f}{f_{baud}}\right) \end{cases}$	dB	$\begin{cases} 0.05\ \text{GHz} \le f \le \frac{f_{baud}}{2} \\ \frac{f_{baud}}{2} < f \le \left(\frac{3}{4}\right)f_{baud} \end{cases}$
Maximum $\lvert S_{CD22}(f)\rvert$ [f]	$\begin{cases} -25 + 20\left(\frac{f}{f_{baud}}\right) \\ -18 + 6\left(\frac{f}{f_{baud}}\right) \end{cases}$	dB	$\begin{cases} 0.05\ \text{GHz} \le f \le \frac{f_{baud}}{2} \\ \frac{f_{baud}}{2} < f \le \left(\frac{3}{4}\right)f_{baud} \end{cases}$

9.0 TEST SEQUENCE

Test Item	Test Group	1	2	3	4	5	6	7
	Sample Q'ty	5	5	5	5	5	5	5
Visual Examination of Product		1,13	1,19	1,16	1,13	1,15	1,16	1,13
Low Level Contact Resistance		4,6,8, 10	4,6,8, 12,16	4,6,8, 11,13	2,4,6,8 ,10,12	4,6,8, 12,14	4,9,11 ,15	6,8
Insulation Resistance			9,13					5,12
Dielectric Withstanding Voltage			10,14					4,11
Durability		5	5	5	3	5	5	7
Mating		2,11	2,17	2,14		2,9	2,7,12	2,9
Unmating		3,12	3,18	3,15		3,10	3,8,13	3,10
Vibration				9				
Mechanical Shock				10				
Thermal Shock			7					
High Temperature Life		7		7	5	7		
Temperature/Humidity Cycling			11					
Mixed Flowing Gas					7			
Reseating		9	15	12	9	13	14	
Thermal Disturbance					11		10	
Thermal Cycling						11		
Dust							6	