# QSFP Stacked Double Density Connector and Cage Assembly

## 1. SCOPE

1.1. Content

This specification defines performance, test and quality requirements for the QSFP Stacked Double Density Connector with Cage Assembly.

1.2. Qualification

When tests are performed on subject product, procedures specified in this specification shall be used. All inspections shall be performed using applicable inspection plan and product drawing.

## 2. APPLICABLE DOCUMENTS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies. In the event of conflict between the requirements of the specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the reference documents, this specification shall take precedence.

2.1. TE Connectivity (TE) Documents

- 114-60028 Application Specification QSFP DD stacked connector with cage
- 501-160145 Qualification Test Report QSFP DD stacked connector with cage

2.2. Industry Documents

- EIA-364 Electrical Connector/Socket Test Procedures Including Environmental Classifications

2.3. Reference Documents

- 109-197: Test Specification (TE Test Specifications vs. EIA and IEC Test Methods)

## 3. REQUIREMENTS

3.1. Design and Construction

Products shall be of design, construction and physical dimensions as specified on the applicable product drawing.

3.2. Materials and Finish

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Working Voltage: 30 VDC Maximum
- Current Carrying capacity: Signal application only
- Operating Temperature: -40°C to 85°C
- Non-operating Temperature: -55°C to 105°C

3.4. Performance and Test Description

The product is designed to meet electrical, mechanical and environmental performance specified in this paragraph as tested per test sequence specified in Paragraph 3.5. Unless otherwise specified, all tests are performed at ambient environmental conditions and are performed with connectors in fully mated condition.

3.5. Test Requirements and Procedures Summary

**Table 1**

| Test Description | Requirement | Procedure |
|---|---|---|
| Initial examination of product | Meets requirements of product drawing. | EIA-364-18B.<br>Visual examination and dimensional (C of C) inspection per product drawing. |
| Final examination of product | Meets visual requirements. | EIA-364-18B.<br>Visual examination. |
| **ELECTRICAL** | | |
| Low Level Contact Resistance (LLCR) | For shield and signal contacts:<br>Baseline (Initial)<br>$\triangle$R 10 mΩ maximum change from initial (Baseline) | EIA-364-23C.<br>Max. Open voltage 20mV. Max current 100 mA DC. All contacts to be measured. |
| Insulation resistance | 1000 MΩ minimum | EIA-364-21.<br>Test voltage 100V DC. Duration: 1 minute. Measure between adjacent contacts. signal to signal and signal to ground. |
| Withstanding voltage | No breakdown or flashover. | EIA-364-20F, Condition I.<br>Test voltage: 300 volts AC at sea level. Duration 1 minute. Test between adjacent contacts, signal to signal and signal to ground |
| **MECHANICAL** | | |
| Random vibration | No contact discontinuity ≥ 1 microsecond<br>See Note. | EIA-364-28F, Test Condition V, Test Condition Letter C.<br>Subject mated specimens to random vibration spectrum with excitation frequency bounds of 50 and 2000 Hz. 120 minutes in each of 3 mutually perpendicular planes. |
| Mechanical shock | No contact discontinuity ≥ 1 microsecond<br>See Note. | EIA-364-27C, Test Condition A.<br>Subject mated specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. |
| Durability | 100 cycles for QSFPDD Module<br>See note | EIA-364-09D. Mate and un-mate specimens. Include latching/release function as intended. Rate: 300 cycles/hour. (max). |

**Table 1**

| Test Description | Requirement | Procedure |
|---|---|---|
| Mating force | QSFP module: 40N Maximum<br>QSFP-DD Module: 90 N maximum | EIA-364-13, Method A.<br>Measure force to mate cable plug into QSFP DD connector including cage. Maximum rate of 25.4mm per minute. |
| Un-mating force | QSFP module: 30N Maximum<br>QSFP-DD Module: 50 N maximum | EIA-364-13, Method A.<br>Measure force to un-mate cable plug from QSFP DD connector including cage by pulling at latching release feature. |
| Rotational cable pull | 33.4 N minimum without displacement of cage assembly or connector from PCB. | Load cable module into connector with cage assembly applied to PCB with attached bezel. Rotate cable 40 degrees toward PCB, and then rotate 360 degrees with the load still applied. |
| Compliant pin insertion force | Cage individual pin 44.5N maximum<br>Conn individual pin 20N maximum | TE Spec 109-41.<br>Measure force necessary to press connector with cage assembly into the PCB at a maximum rate of 12.7 mm [.50 inch] per minute. |
| Compliant pin retention force | Cage individual front pin 9.5N minimum<br>Cage individual rear pin and Conn individual pin 1.0N minimum (average) | TE Spec 109-30.<br>Measure force necessary to remove connector with cage assembly from the PCB at a maximum rate of 12.7 mm [.50 inch] per minute. |
| Module Retention | No damage to module below ≦90 N | Load cable module into connector with cage assembly applied to PCB with attached bezel. Apply specified axial load to engaged module at a maximum rate of 6.35 mm [.25 inch] per minute and hold 1 minute to very module retention and cag latch strength. |
| Cage latch Strength | 125 N minimum. | EIA 364-98.<br>Measure fore necessary to remove QSFP DD module from cage assembly with latches enabled. |
| Reseating | See note. | Manually un-mate and mate the specimen 1 time. |
| | | |

| ENVIRONMENTAL | | |
|---|---|---|
| **Test Description** | **Requirement** | **Procedure** |
| Thermal shock | See Note. | EIA-364-32G, Method A, Test Condition II. Subject un-mated specimens to 5 cycles between -65° and 105°C with 60 minutes dwells at temperature extremes and 1minute transition between temperatures. |
| Humidity/temperature cycling | See Note. | EIA-364-31F, method III, condition B. Mated specimens were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours between 25°C and 65°C twice while maintaining high humidity. |
| Temperature life (preconditioning). | See Note. | EIA-364-17C, Method A, Test condition 4. Test subject specimens mated to blank transceivers to 105°C for 120 hours. |
| Temperature life | See Note. | EIA-364-17C, Method A, Test Subject mated specimens to 105°C for 1000 hours. |
| Thermal Cycling | See Note. | EIA-364-110, Condition A. Subject mated and board mounted specimens to 10 temperature cycles between 15±3˚ and 85±3˚ as measured on the specimen. Ramp times >2°C per minute with dwell times long enough to ensure contacts reach the temperature extremes (5 minutes minimum). Humidity not controlled. |
| Mixed flowing gas. | See Note. | EIA-364-65B, Class IIA (4 gas). Subject board mounted specimens to environmental Class IIA for 14 days. One-half of the specimens (receptacle only) unmated for 168 hours followed by 168 hours mated. The remaining one-half of the specimens mated for 14 days. |
| Dust. | See Note. | EIA-364-91B. Subject unmated specimens to benign dust contamination for 1 hour. |

**NOTE**

*Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Table 2.*

3.6. Resistance Measurement

Resistance within the mated terminated connectors shall be measured with four-circuit measuring method. It consists of bulk resistance of the contacts, resistance of the connector contacts to cable printed circuit board (PCB) transition, and the resistances of the fixed contact connections to cable and PCB. Bulk resistance of circuits outside the connector, such as PCB paths and cable wire outside the terminated section, are not included in the requirement and therefore, shall be measured and documented separately for reference (in case of significant influence).

3.7. Test Frames

During vibration and mechanical shock tests, an electrical circuit is checking that no electrical contact interruptions occur that exceed the requirement.

Test-frames shall provide mechanical stability of the connector in relation to its mating parts and shall cover the requirements specified in the TE application specification.

3.8. Product Qualification and Requalification Test Sequence

**Table 2**

| Test or Examination | Test Group (a) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | Test Sequence (b) | | | | | | | | |
| Initial examination of product | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Low Level Contact Resistance(e) | 2,4,6,8 | 2,4,6 | 2,4,6,8 | 2,5,7 | 2,4,6 | 3,5 | | | |
| Withstanding voltage | | | | | | 2,6 | | | |
| Random vibration | 5 | | | | | | | | |
| Mechanical shock | 7 | | | | | | | | |
| Durability | | | | | | 4 | 4 | | |
| Mating force | | | | | | | 2,5(g) | | |
| Un-mating force | | | | | | | 3,6(g) | | |
| Rotational cable pull | | | | | | | 7 | | |
| Compliant pin insertion force | | | | | | | | 2 | |
| Compliant pin retention force | | | | | | | | 3 | |
| Cage latch Strength | | | | | | | | | 3 |
| Thermal shock | | | 3(c) | | | | | | |
| Humidity/temperature cycling | | | 5 | | | | | | |
| Temperature life (preconditioning) | 3(c) | | | 3(c) | | | | | 2(c)(d) |
| Temperature life | | 3(c) | | | | | | | |
| Thermal Cycling(disturbance) | | | | | 5 | | | | |
| Mixed flowing gas | | | | 4(f) | | | | | |
| Dust | | | | | 3(c) | | | | |
| Reseating | | 5 | 7 | 6 | 7 | | | | |
| Final examination of product | 9 | 7 | 9 | 8 | 9 | 7 | 8 | 4 | 4 |

**NOTE**

*(a) See Paragraph 4.1.A.*

*(b) Numbers indicate sequence in which tests are performed.*

*(c) Precondition specimens with 20 durability cycles with latches engaged.*

*(d) Mated to blank transceivers (no components added to cable connector PCB)*

*(e) An extra LLCR measurement was taken after preconditioning durability because of the use of "dummy" transceivers.*

*(f) Five Samples, 2 mated 14 days, 3 un-mated 7 days, mated 7days.*

*(g) Modified transceiver that removes the kick-out spring and latch from the test*

## 4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification testing

A. Sample selection

Samples shall be prepared in accordance with applicable instructions and shall be selected at random from current production. Unless otherwise specified, all test groups shall consist of a minimum of 5 connectors of which all contacts shall be tested.

B. Test sequence

Qualification inspection shall be verified by testing samples as specified in Paragraph 3.5.

4.2. Requalification testing

If changes significantly affecting form, fit, or function are made to product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based upon verification that product meets requirements of Paragraph 3.4. Failures attributed to equipment, test set-up, applied customer components, or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for requalification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality conformance inspection

Applicable TE quality inspection plan will specify sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with applicable product drawing and this specification.