Cage Assembly with Interleaved Plate Thermal Bridge

1. SCOPE

1.1. Content

This specification defines performance, test and quality requirements for an interleaved plate thermal bridge (IPTB) application used in a cage assembly (QSFP28, QSFP-DD, SFP28 & SFP-DD Form factors).

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line has not been completed. The Qualification Test Report number will be issued upon successful qualification testing.

2. APPLICABLE DOCUMENTS AND FORMS

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.

2.1. TE Documents

- 114-130017: Application Specification
- 501-134102: Qualification Test Report

2.2. Industry Documents

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

2.3. Reference Document

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

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions 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

Voltage	Current	Temperature
Not applicable	Not applicable	-40°C to 85°C operating -55°C to 105°C non-operating

3.4. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Initial examination of product	Meets requirements of product drawing.	**EIA-364-18** Visual examination and dimensional (C of C) inspection per product drawing.
Final examination of product	Meets visual requirements.	**EIA-364-18** Visual examination.
MECHANICAL		
Random vibration	See note.	**EIA-364-28, Test Condition VII, Test Condition Letter D** Subject mated specimens to 3.10 G's RMS between 20 to 500 Hz. 15 minutes in each of 3 mutually perpendicular planes.
Durability Preconditioning	See note	**EIA-364-9** Manually mate/un-mate 125 cycles, Rate: 300 cycles/hour maximum rate.
Mechanical shock	See note.	**EIA-364-27, Test Condition H** Subject mated specimens to 30 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	See note.	**EIA-364-9** Mate and un-mate specimens 250 cycles with cage latch operable, Rate: 300 cycles/hour maximum rate.
Transceiver mating force	90 N maximum (QSFP-DD) 46 N maximum (SFP28)	**EIA-364-13, Method A** Measure force to mate cable plug into Cage & connector assembly with Thermal Bridge. Maximum rate of 25.4mm/min
Transceiver un-mating force	50 N maximum (QSFP-DD) 14.5 N maximum (SFP28)	**EIA-364-13, Method A** Measure force to un-mate cable plug from cage connector assembly by pulling at latching release feature. Maximum rate of 25.4mm/min

Transceiver mating force without connector	45N maximum (QSFP-DD) 18N maximum (SFP28)	**EIA-364-13, Method A** Measure force to mate cable plug into Cage. Maximum rate of 25.4mm / min (does not include kickout springs for SFP+ Cages)
Transceiver un-mating force without connector	35 N maximum (QSFP-DD) 14.5 N maximum (SFP28)	**EIA-364-13 Method A** Measure force to un-mate cable plug from Cage by pulling at latch release feature. Maximum rate of 25.4mm / min (does not include kickout springs for SFP+ Cages)
	THERMAL	
Bridge thermal resistance	QSFP28, QSFP-DD 1.4 °C/W maximum **1.05 °C/W** typical SFP, SFP-DD 2.3 °C/W maximum **1.67 °C/ W** typical	At nominal working height, dry.
	ENVIRONMENTAL	
Thermal shock	See note.	**EIA-364-32, Test Condition I** Subject mated specimens to 10 cycles between -55° and 85°C with 30 minute (specimen weight up to 0.3 lb) dwells at temperature extremes and 1 minute transition between temperatures. **Note: Dwell Time dependent on specimen weight, if weight between 0.3 – 3lb (1 hour dwell time at temperature extremes)**
Temperature / humidity cycling	See note.	**EIA-364-31, Method IV** Subject mated specimens between 25℃±3°C and 65°C ± 3° C at 80 to 100% RH, 10 cycles (10 days)
Temperature life	See note.	**EIA-364-17, Method A, Test condition 4**. Test Subject mated specimens to 115°C for 411 hours.
Mixed flowing gas	See note.	**EIA-364-65, Class IIA** (4 gas) Subject board mounted specimens to environmental Class IIA for 20 days. One-half of the specimens unmated for 10 days followed by 10 days mated. The remaining one-half of the specimens mated for 20 days.

Dust	See note.	**EIA-364-91** Expose subject to dust contamination. Dust composition: #1. Flow rate: 300 meters/minute. Exposure time: 1 hour. Half the number of samples subjected to dust exposure must have transceivers unmated (only test specimen will be subjected to dust exposure) while the remainder of the samples must be subjected to dust exposure while transceivers are mated in the cage

NOTE
Shall meet visual requirements, show no physical damage

3.5. Thermal Resistance Measurement

Performance of the thermal bridge is verified by measuring the thermal resistance across the thermal bridge, including contact resistance at the interfaces (thermal bridge with module & thermal bridge with cold plate). Thermal Resistance is measured by passing a known amount of heat across the thermal bridge and measuring the temperature difference across it.

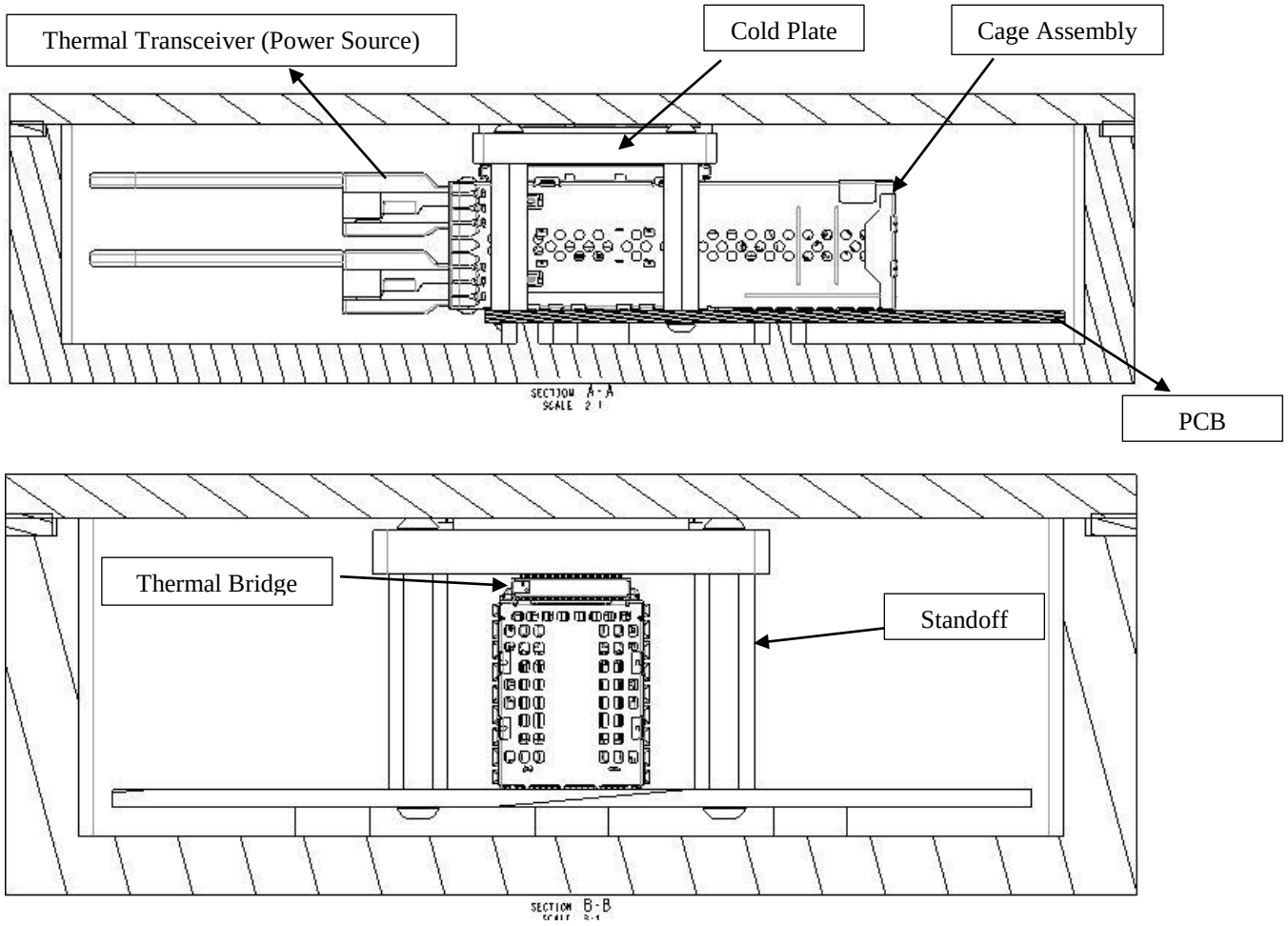

Figure 2: Section views of Thermal Bridge Thermal Measurement Test Setup

Figure 2 shows a sectioned view of the test setup which comprises the thermal bridge on a cage assembly mounted onto the PCB. The Cold Plate is mounted on a standoff and compresses the thermal bridge. Thermal Transceiver is plugged into the cage and provides the overall compression needed for the thermal bridge to be operational and transfer heat from the transceiver to the cold plate. For a stacked cage assembly, the top port of the cage requires the thermal transceiver and the bottom port can utilize a standard transceiver. For the purposes of accurately measuring thermal resistance, the test setup is placed in a thermally insulated box to isolate it from the environment.

3.6. Test Frames

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.

3.7. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	Test Group (a)						
	1	2	3	4	5	6	7 (e)
	Test Sequence (b)						
Initial examination of product	1	1	1	1	1	1	1
Random vibration	3						
Mechanical shock	4						
Durability Preconditioning			3,9				
Durability					4		3
Transceiver mating force							2
Transceiver un-mating force							4
Transceiver mating force without connector					2		
Transceiver un-mating force without connector					6		
Bridge thermal resistance	2,5	2,4,6	2,4,6,8,10	2,4	3,5	2,4	
Thermal shock		3					
Humidity / temperature cycling		5					
Temperature life				3			
Mixed flowing gas			5 (d), 7 (d)				
Dust						3	
Final examination of product	6	7	11	5	7	5	5

NOTE

(a) *See Paragraph 4.1.A for sample selection*

(b) *Total of 7 Test Groups – numbers under each test group indicate the sequence in which tests will be performed.*

(c) *Testing to be performed for 4 different cage configurations assembled with Thermal Bridge – (QSFP-DD 1X1, QSFP-DD Stacked 2X1, QSFP28 1X6, ZSFP+ 1X1) – For TG1, 4 cage combinations listed above must be tested. Cage combinations (QSFP-DD Stacked 2X1 and ZSFP+ 1X1) will be tested for TG2 through TG6. For TG7, 2 Combinations will be used (QSFP-DD 1X1 and ZSFP+ 1X1)*

(d) *MFG exposure interval of 10 days.*

(e) *2 samples to be used for TG7*

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. Except for TG7, all test groups shall consist of a minimum of 5 thermal bridge assemblies.

B. Test sequence

Qualification inspection shall be verified by testing samples as specified in Paragraph 3.7.

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.