

Open NPO Standards: Building the Optical Interconnect Ecosystem for SuperPOD

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Contents

- Emerging Trends in Optical Interconnect
- What is OPEN NPO?
- OPEN NPO Project – Overview of Electrical Connectors
- Call to Action

Linear Optical Interconnects: Building the Physical Foundation for Scale-Up Superpods Under System τ Scaling Law

- Refactor the system interconnection architecture to compress signal propagation delay
- Linear optical interconnects are essential for boosting bandwidth, managing power and heat, while delivering ultra-low latency in superpods.

Tao (τ) Scaling Law Released

Past: Geometric Scaling → **Tao (τ) Scaling Law** → **Future: Time Scaling**



Superpod Built on Linear High-Density Optical Interconnects

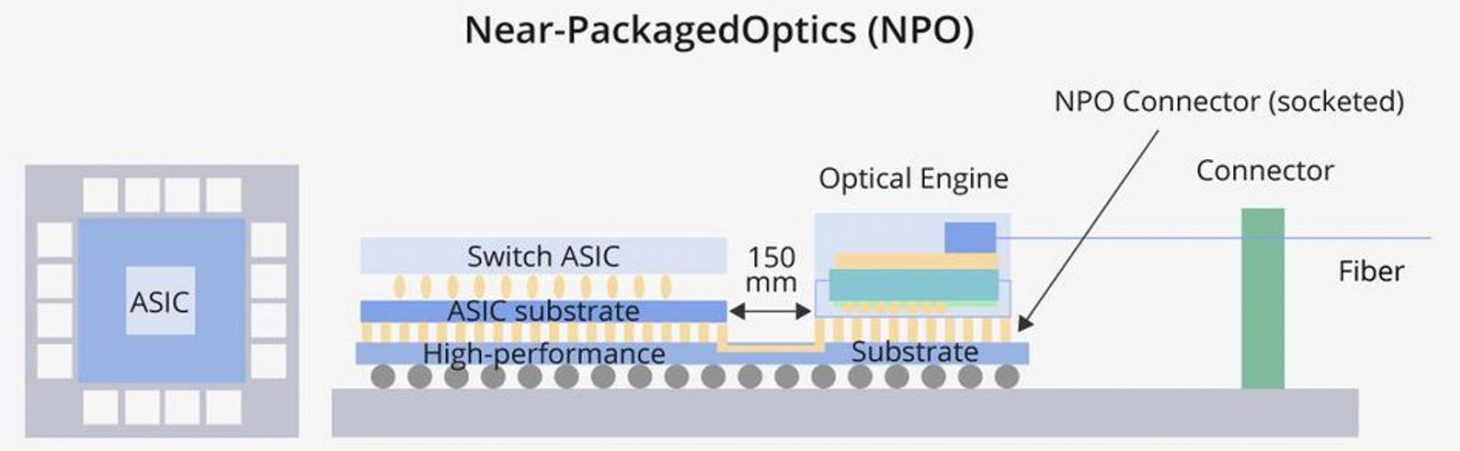
Time scaling:
Superpod
performance leap

system-level architecture reconstruction:
xPU bus interconnect for superpod,
And system time-scale miniaturization

Physical connectivity as the cornerstone:
Linear high-density optical interconnect solution

NPO has become the preferred short-term option for scaling up optical interconnects

NPO has been widely chosen by Chinese Internet enterprises, telecom operators, and system vendors as the primary optical interconnect technology for superpod deployment.

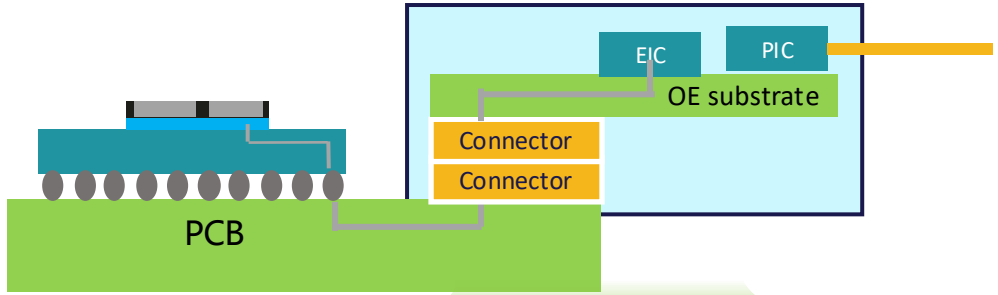


Advantages of NPO Industry Applications

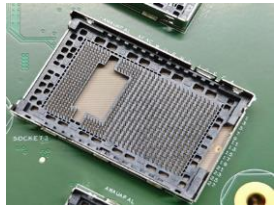
- **Maintainability:** Easy to replace, good for customer maintenance
- **Open decoupling:** Decoupling chips from OE enables diversified supply
- **Availability:** Low process requirements, relatively mature manufacturing
- **Industry Implementation:** The industry supply chain technology is well-developed and ready, allowing products to be launched quickly.

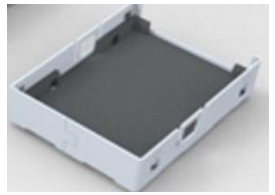
Electrical connectors are the core bottleneck in NPO industry promotion

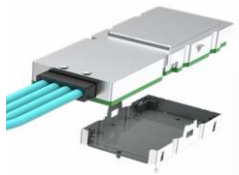
The NPO aims to promote and apply it in the industry. Electrical connectors urgently require standardization and a unified technical roadmap.



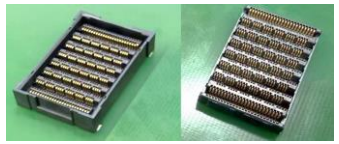
Socket Formation

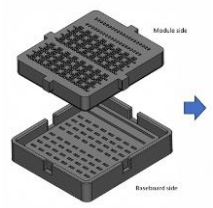






Clamp Plate Formation





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- **Computing / switching module:** Requires differentiated design.
- **OE:** Requires customization; not for multiple users.
- Computing / switching and OE modules from different vendors are incompatible.

Impact

NPO electrical connectors feature multiple product designs and **lack unified technical approaches.**

What is OPEN NPO？

Global Computing Consortium

An industry organization established by computing technology providers, manufacturers, system integrators, enterprise users, and research institutes.

300+ members

Open AI Infra
A Chapter of GCC

200+ members

User Organizational Unit

Optical interconnection industry chain units

...

40+ members

Objective: Unify the NPO electrical connector and promote its industry implementation.

OPEN NPO

- Open NPO optical interconnection project
- All Open AI Infra community members may participate.

Project Address: https://openaiinfra.gccorg.com/projects/ai-cabinet

26.6 Preparation and Planning



26.7 Start-up



OPEN NPO: Project Plan

The OPEN NPO project focuses on electrical connectors, planning a phased release of two types. Type 1 connector and NPO module samples are currently being tested.

Electrical connector sample testing in progress.





The NPO module is being tested.

Current Industry Commercial Status

Compatible with LPO-800G specs.



Low latency, easy maintenance.

- 800G@112G/L
- Pluggable panel, mature standards

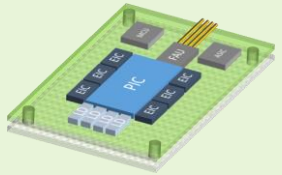
Optical Interconnect

apply

~2025

Phase I

Define type1 electrical interface



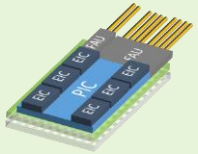
Low latency, high bandwidth

- xxT capacity @ 224G/L
- Integrated light source architecture
- Standardized NPO electrical connector

2026~2027

Phase II

Define type 2 high-density electrical interface.



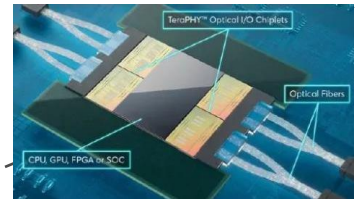
3D miniaturization, 1000+ Radix

standardized high-density electrical connectors.

2027~2028

Phase III

Define OIO optical interface.

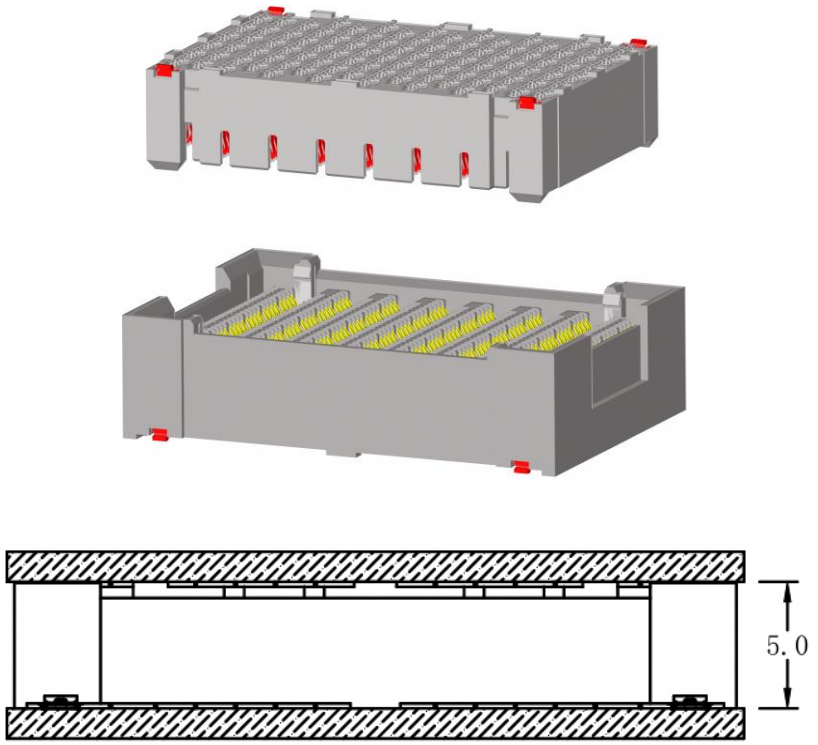


Concept image: Internet source.

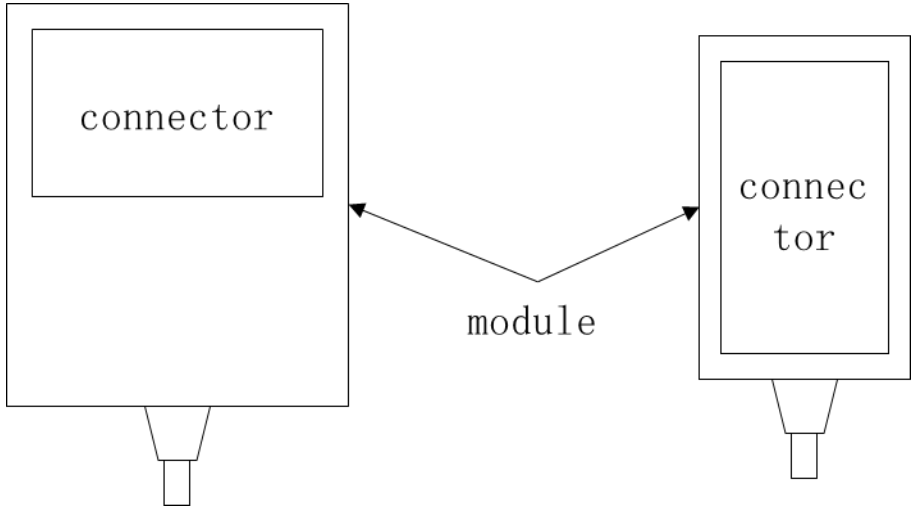
2029~2030

OPEN NPO: Standard Content 1 – Electrical Connectors

Electrical Connector Shape and Appearance



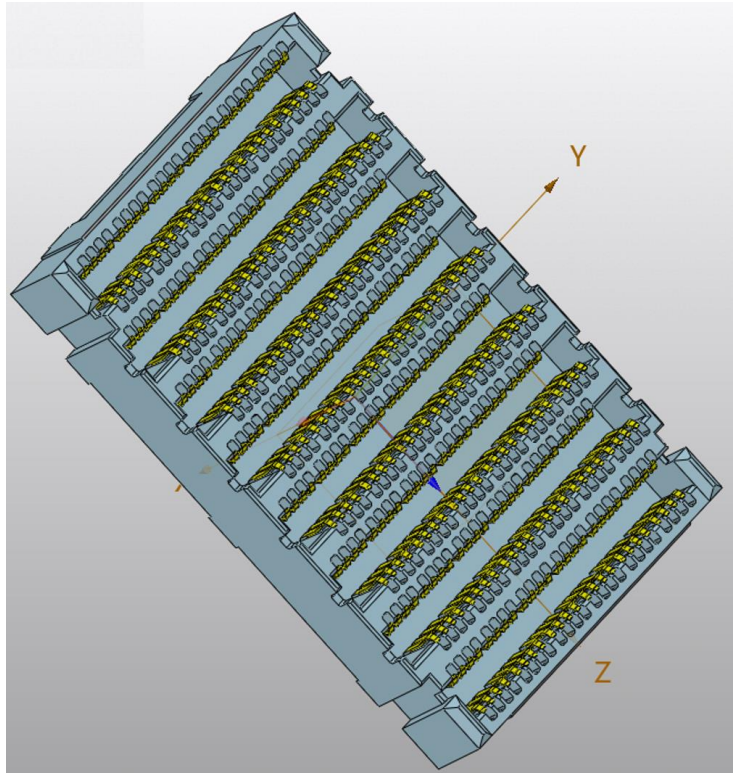
Electrical Connector Application Scenarios

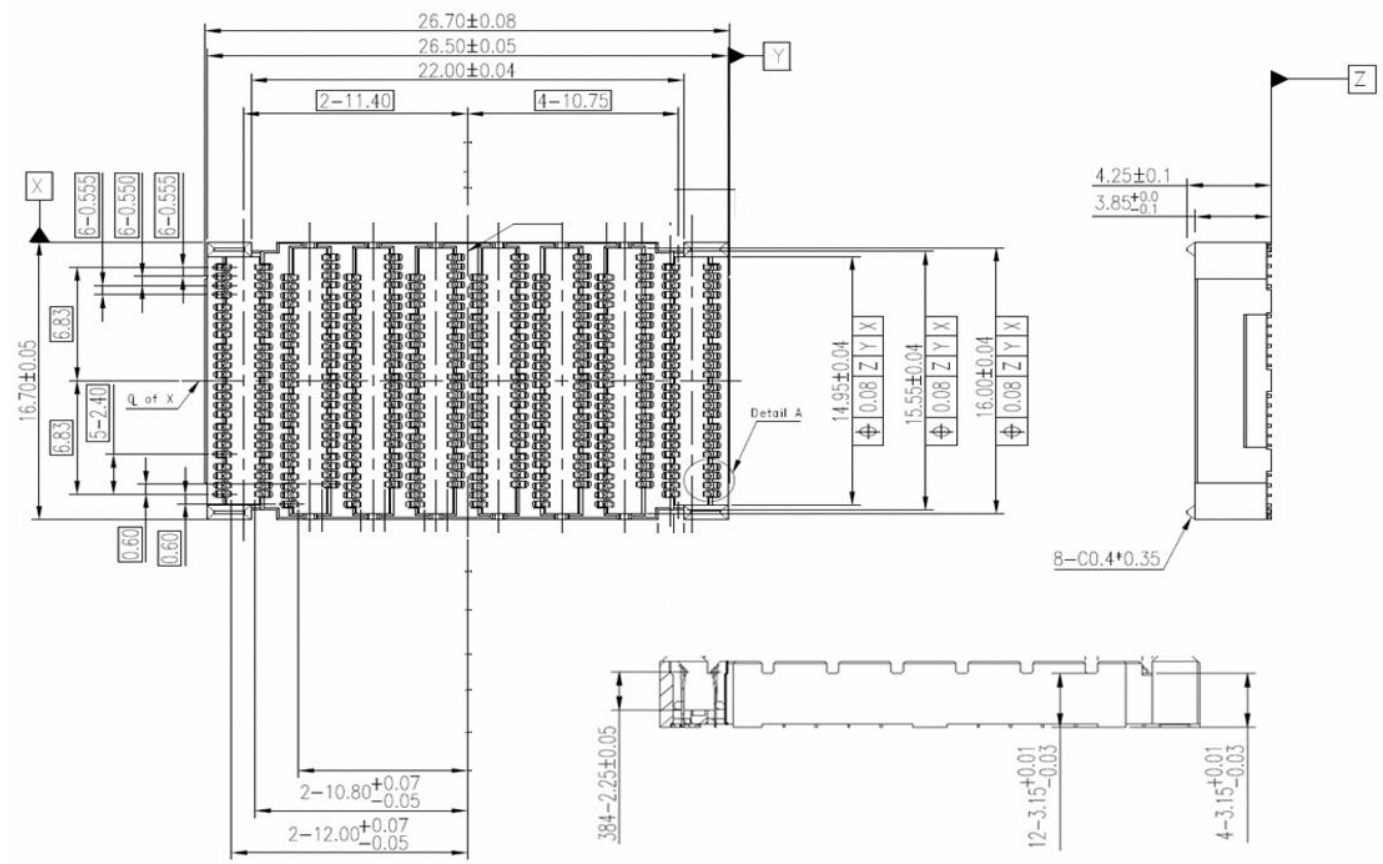


It offers strong versatility and compatibility, adapting to NPO modules of various specifications and sizes.

OPEN NPO: Standard Content 2 – Male Electrical Connector Drawing

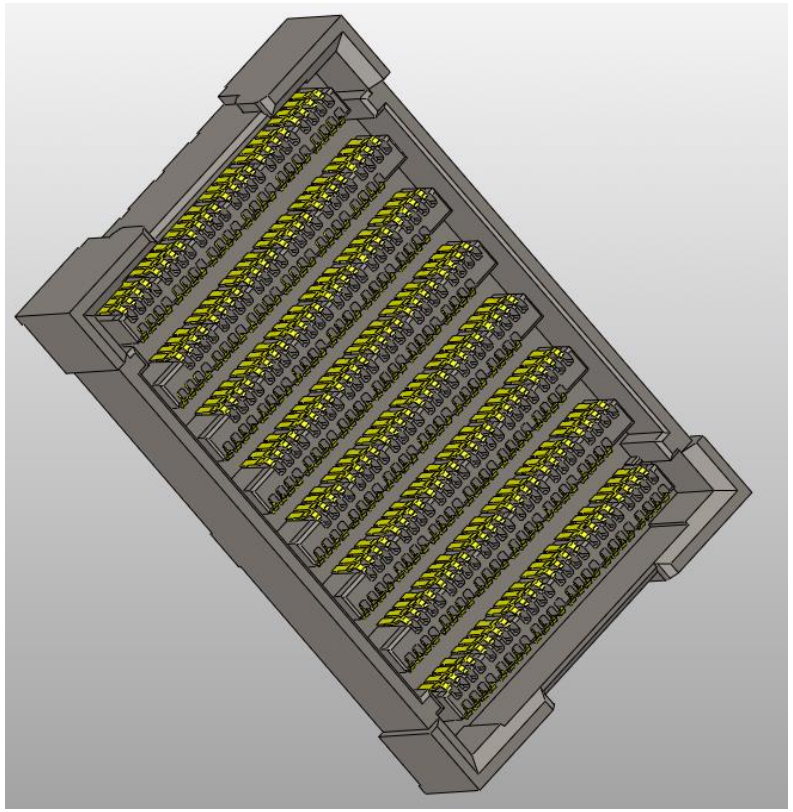
3D drawings are contributed to the Open AI Infra community.

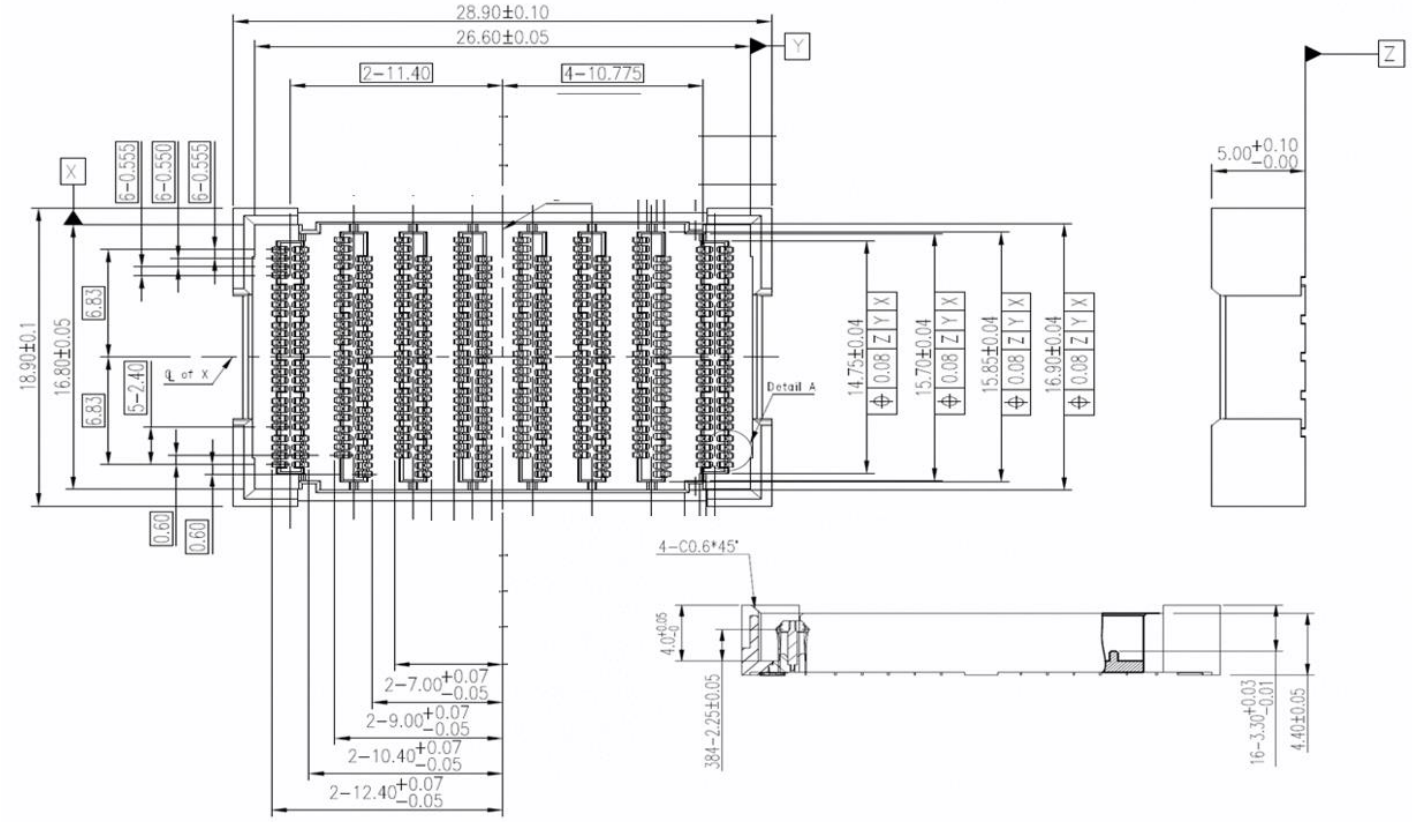




OPEN NPO: Standard Content 3 – Female Electrical Connector Drawing

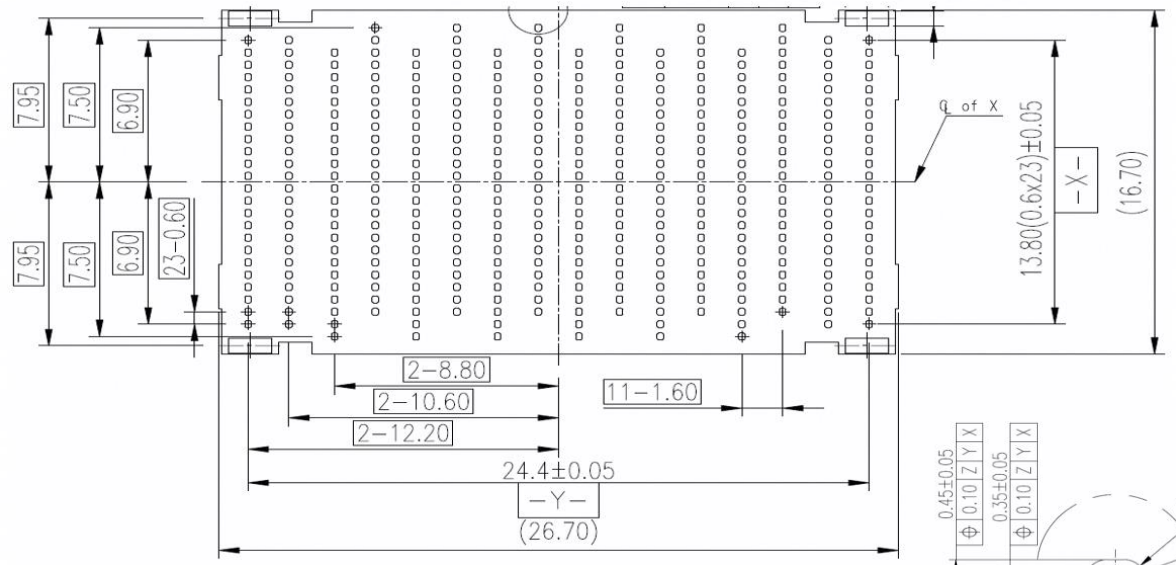
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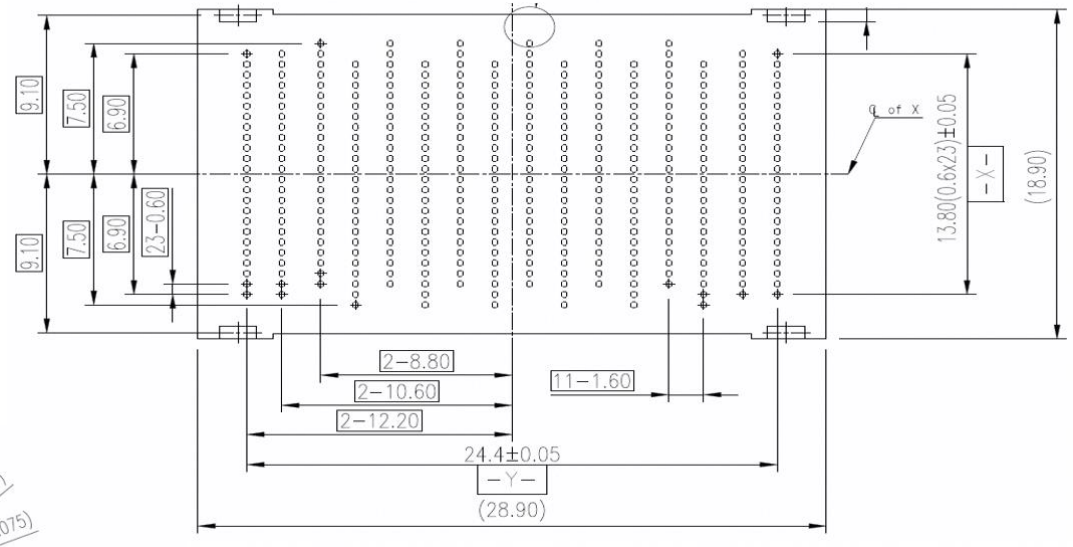


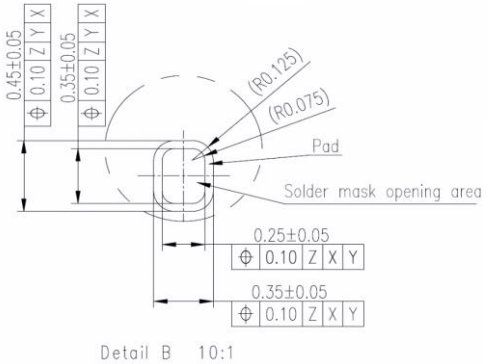
OPEN NPO: Standard Content 4 – Footprint

Connector footprint on the OE side for soldering the board to the connector.



Host-side connector footprint for soldering the board to the connector.





Pad Definition

OPEN NPO: Standard Content 5 – Pinmap

72 differential pairs (36 channels) and 96 power and low-speed pins. Differential pairs occupy the middle 12 columns; power and low-speed pins occupy the first and last columns.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1				GND		GND		GND		GND		GND		GND			1
2	PWR	PWR		TX		TX		TX		TX		TX		TX	PWR	PWR	2
3	PWR	PWR	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	PWR	PWR	3
4	PWR	PWR	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	PWR	PWR	4
5	PWR	PWR	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	PWR	PWR	5
6	PWR	PWR	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	PWR	PWR	6
7	PWR	PWR	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	PWR	PWR	7
8	PWR	PWR	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	PWR	PWR	8
9	PWR	PWR	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	PWR	PWR	9
10	PWR	PWR	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	PWR	PWR	10
11	PWR	PWR	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	PWR	PWR	11
12	PWR	PWR	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	PWR	PWR	12
13	PWR	PWR	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	TX	GND	PWR	PWR	13
14	PWR	PWR	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	PWR	PWR	14
15	PWR	PWR	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	PWR	PWR	15
16	PWR	PWR	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	PWR	PWR	16
17	PWR	PWR	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	PWR	PWR	17
18	PWR	PWR	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	PWR	PWR	18
19	PWR	PWR	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	PWR	PWR	19
20	PWR	PWR	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	PWR	PWR	20
21	PWR	PWR	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	PWR	PWR	21
22	PWR	PWR	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	PWR	PWR	22
23	PWR	PWR	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	PWR	PWR	23
24	PWR	PWR	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	RX	GND	PWR	PWR	24
25	PWR	PWR	RX		RX		RX		RX		RX		RX		PWR	PWR	25
26			GND		GND		GND		GND		GND		GND				26
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

Power Supply & Low Speed GND TX RX

OPEN NPO: Standard Content 6 – Mechanical and Reliability Specifications

Mechanical and reliability specifications for electrical connectors.

item	Specifications
Number of pins	High-speed differential: 72pair Low speed & power supply: 96pin
Terminal Configuration and Spatial Layout	Low-speed areas are at both ends, with high-speed areas in the middle.
Total Insertion Force	Maximum 150N
Total extraction force	Initial removal force: 20 N min @ full mating Maximum removal force during the entire removal process: 80 N
Wafer Retention Force	Minimum 2N
Terminal forward force	Initial: 30gf min @0.25mm compression; 15gf min @0.15mm compression; After high temperature: 12gf min @0.12mm compression;
durability	50 times
Resilience to Stress	The connector's pressure-bearing surface is at the four corners of the female connector; the center bears no pressure. Instantaneous pressure-bearing capacity: 380N min. Long-term pressure-bearing capacity: 183N min.

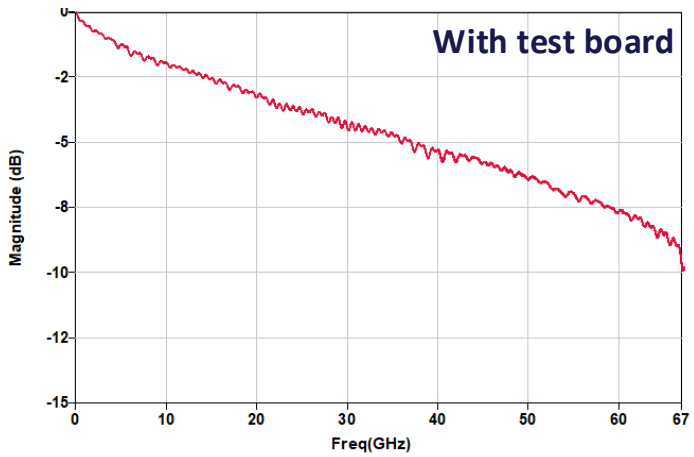
OPEN NPO: Standard Content 7 - Electrical Specifications

Electrical specifications of the electrical connector

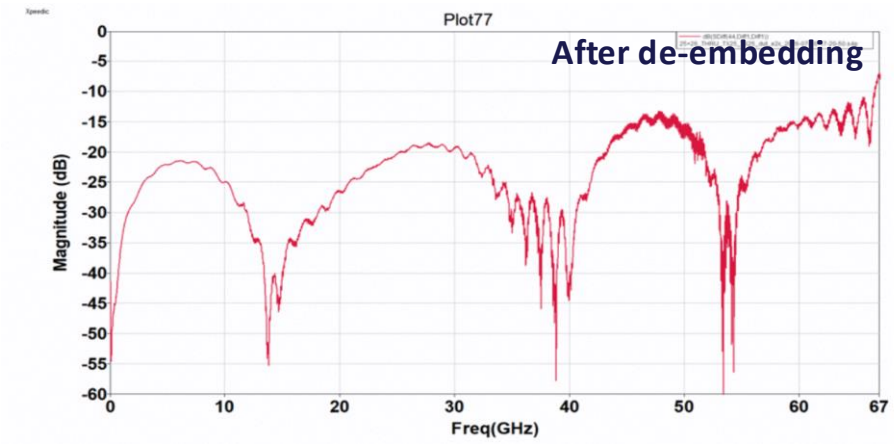
item	Specifications
rated current	1A/pin (Applicable to pins located in low-speed and power supply domains)
rated voltage	12V DC (Applicable to pins located in low-speed and power supply domains)
Impedance Magnitude	Impedance of the connector body: 80-90 ohm ;
SI	IL≤1.5dB@10MHz~56GHz
EL	ERL≥11dB， The calculation conditions are based on the OIF CEI-224G-Linear standard.
cross talk	The test board contains the MCB and HCB, 100 mil traces, vias, and connectors. Frequency-domain crosstalk specifications are for reference only. Single-channel near-end crosstalk: NEXT： <= -50dB@10MHz~56GHz;<= -45dB@56GHz~67GHz; Single-Path Far-End Crosstalk: FEXT： <= -45dB@10MHz-56GHz;<= -40dB@56GHz~67GHz;
Maximum temperature rise under rated current conditions	30℃

OPEN NPO: Electrical Connector Test Data

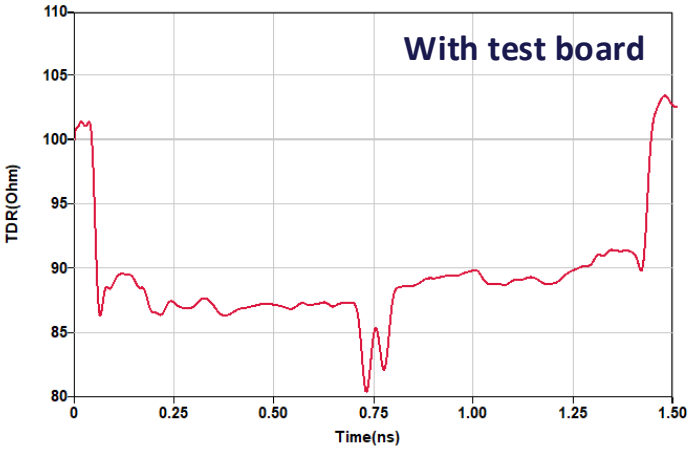
Insertion Loss



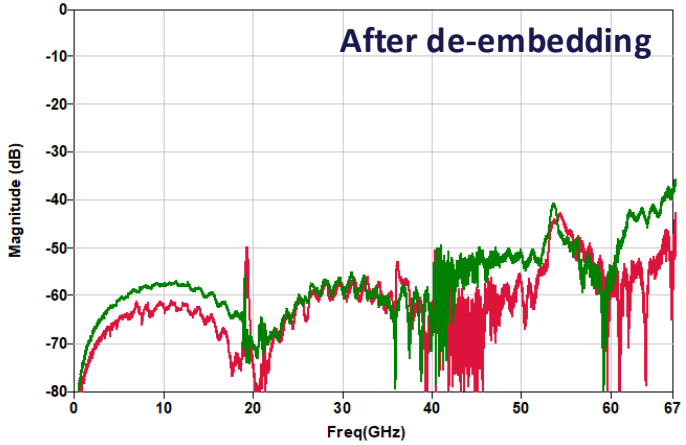
Return Loss



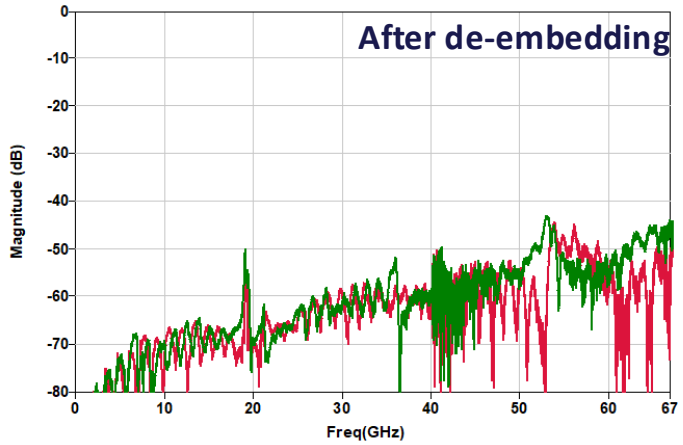
Impedance



Near-end Crosstalk



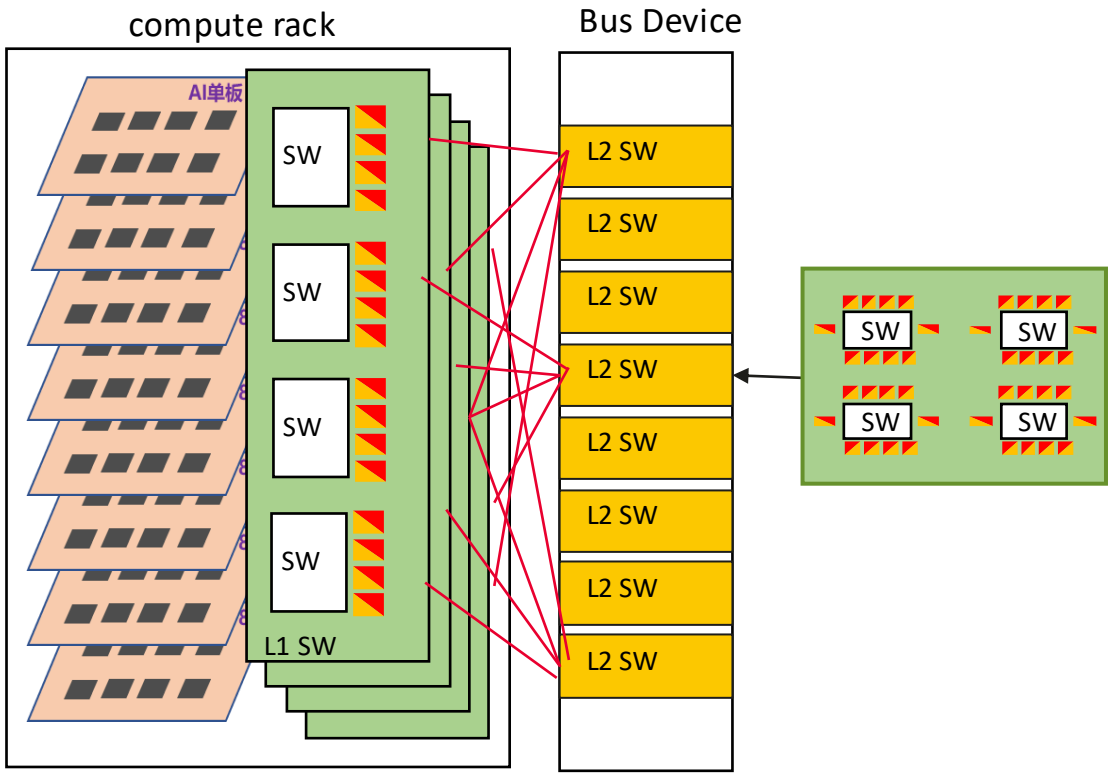
Far-end Crosstalk



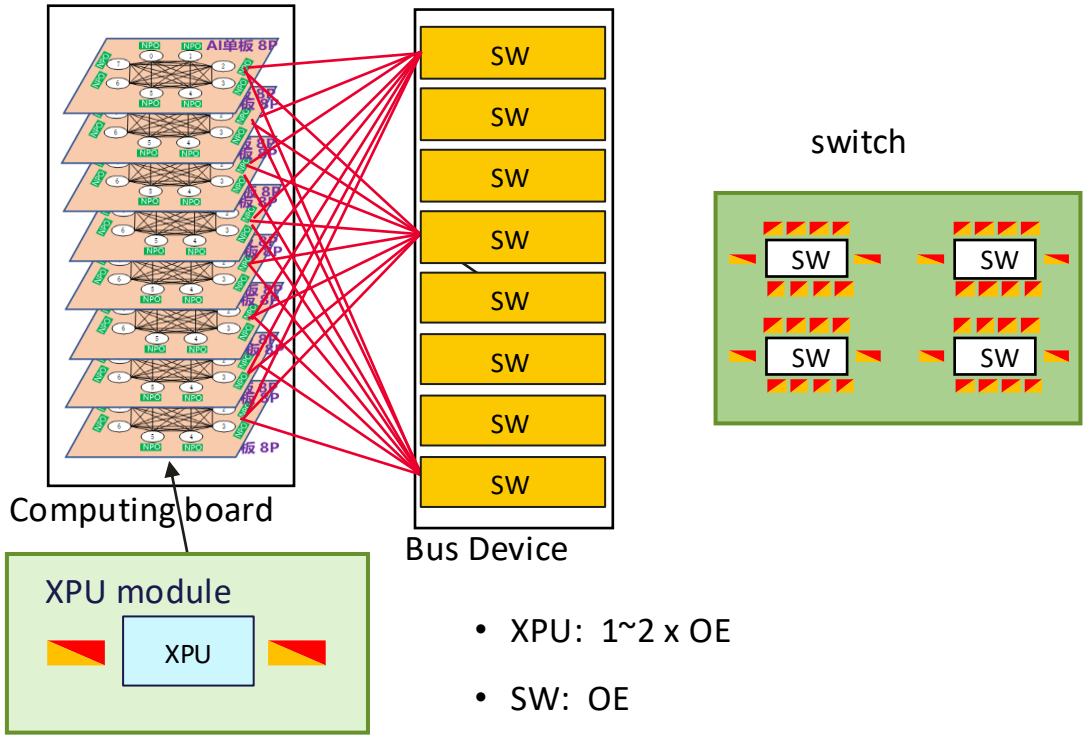
OPEN NPO: SuperPOD Implementation Solution and Plan

SW Interconnection and XPU Light Output establish diverse computing power clusters.

(2027–2028) Scenario 1: Super POD, SW (L1) ↔ SW (L2). NPO doubles networking switching capacity.



(2028–2029) Scenario 2: The XPU, deployed in a large flat-layer POD, provides ultra-low latency optical signals via the NPO.



- XPU: 1~2 x OE
- SW: OE

Call to Action

- We are willing to contribute content related to the OPEN NPO project to OCP and welcome more companies and organizations to participate in this project together.
- How to get involved in the project/sub-project community ： At the current stage, contact wangdongwei@gccorg.com first.
- Timeline for contribution availability: first step 2026.12.30
- Where to find additional information (URL links)
  - Project address ： https://openaiinfra.gccorg.com/projects/ai-cabinet

Thank You!

