



COBO applications for short reach interconnects based on Silicon Photonics

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Introduction



COBO applications for short-reach interconnects based on Si photonics

PETRA's approach Silicon photonics chip scale package "Optical I/O Core" as a building block for OBOs and pluggable modules MMF optics for low-cost assembly

400Gbps COBO class-A form factor 300m transmission at 25Gbps demonstrated Application: FPGA adapter card for HPC and AI, deep learning

High density packaging technology Polymer waveguide integrated PCB Half-pitch fiber array and connector discussion in IEC



SMF and MMF market trend

SMF dominates in Cloud datacenter MMF used in Enterprise servers

Enterprise + Hyper/Large Cloud

Courtesy of Doug Coleman, Corning



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Business Name

HPC and Cluster computing



On board optics and co-packaging challenge for high performance

Short reach interconnect within 30m 300m is covered with 1310 nm optimized MMF



Mesh switch-less clustering



Structure of Optical I/O Core



LD and Drv./Rec. IC are mounted on the photonics integration chip
Optical and electrical I/Os are fabricated on the photonics integration chip



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Optical I/O Core specifications

AIO Core

Optical I/O core chip based on silicon photonics

booth 4246

Item	Specification
Throughput	300G(25Gbps × 12ch)
Size	5mm×5mm
Power consumption	5mW/Gbps
Chanel pitch	125µm
Wavelength	1.3µm(O-band)
Transmission Mode	Multimode



Error-free transmission up to 300m over 1310-optimized MMF (OFC 2015) Wide temperature range operation using Quantum-dot lasers (OFC2016) CDR-less optical I/O for LSI-LSI interconnection (OFC2016 demo)

- Low cost solution through the combination of Si-Photonics and multimode optics with wide alignment margin
- SMF and WDM of chip scale package are in progress

OBO package demonstrators in PETRA





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16-lane class A COBO module



Module size: 33x36mm (case size) Capacity: 400Gbps (25Gbps x 16ch) Power consumption: approx.3W (w/o CDR)



Micro controller/ LD driver and Monitor



Optical fiber wiring and casing



OFC Live demo at COBO booth 1817

EV-L001

G/ED/CDR

4Ch 25Gb/



Error-free transmission 28Gbps 300m MMF

compatible for Soldier and Dem approximation



Horizontal [Relative UI]

MMF transm

COBO module to consolidate 100G OBOs to 400G

FPGA

FPGA for Process off-loading (HPC and image processing) Deep-learning and AI





400G COBO x 2p



COBO module to consolidate 100G OBOs to 400G



100Gbps Optical engine



400Gbps COBO



12 x 12 mm Proprietary design OE-EO function 33 x 36 mm Common footprint and pin assignment All in one functionality

Interoperable between other technologies SMF/Coherent Upgradable up to 1.6Tbps with 100G/ch signaling

Polymer waveguide integrated PCB for COBO

Low cost assembly for optical chips



Polymer optical waveguide

Core : 30 μ m \Box

Propagation loss 0.29 dB/cm at 1.3 μm

125µm-pitch optical card edge connector High density interface discussion in IEC TC86 JWG9

125 µm



LD

WG

DRV

Interposer

Summary



COBO applications for short-reach interconnects based on Si photonics

Silicon photonics chip scale package "Optical I/O Core" MMF optics for low-cost assembly

400Gbps COBO class-A form factor 300m transmission at 25Gbps demonstrated Application: FPGA adapter card for HPC and AI, deep learning

High density packaging technology employing polymer waveguide integration to PCB

Transition to co-packaging technology and SI discussion in COBO