Cmos Photonics based optical PMD for SAS 2.1

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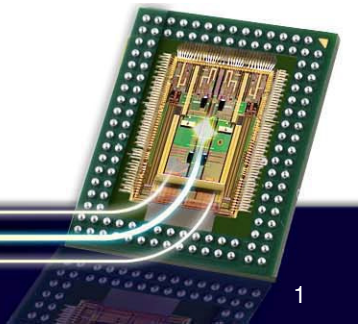
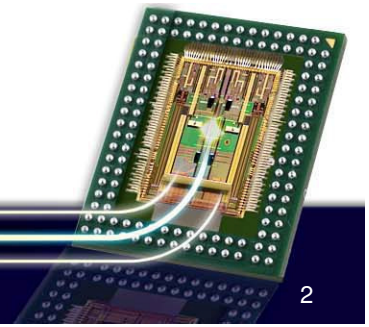
Luxtera
Nov 2008



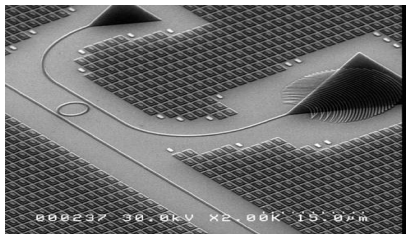
What is cmos photonics?

- Cmos photonics is the use of standard cmos processes to perform optical functions
  - Modulators
  - Attenuators
  - Waveguides
  - Splitters
  - E/O conversion (Luxtera does not do this)
  - O/E conversion
  - Couplers

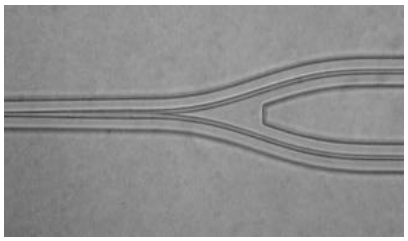


Luxtera's CMOS Photonics Technology

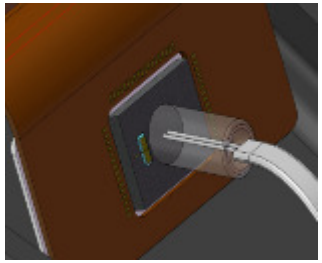
Grating Coupler

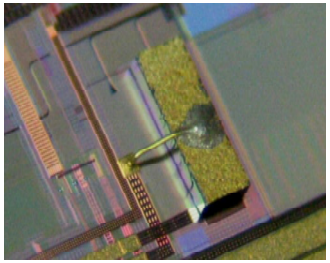


Waveguides

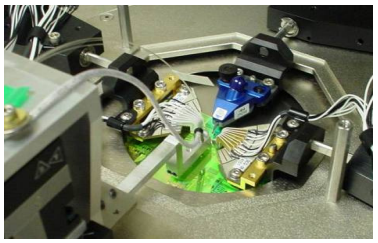


Laser Sources

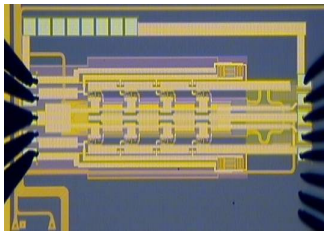


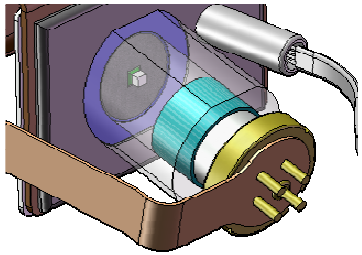


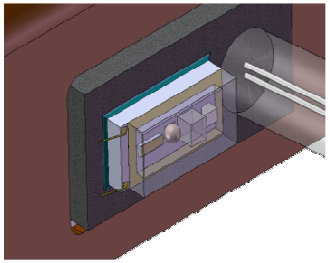
Optical/Electrical Wafer Testing



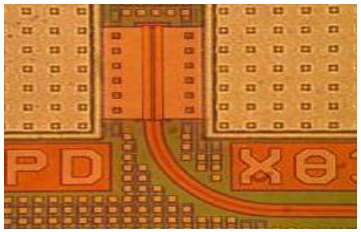
MZ Modulator

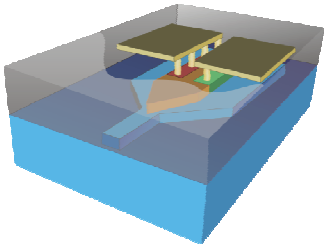




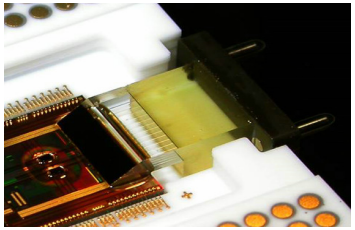


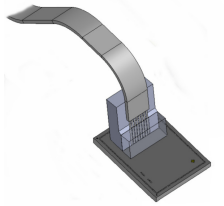
Integrated Photo-Detector

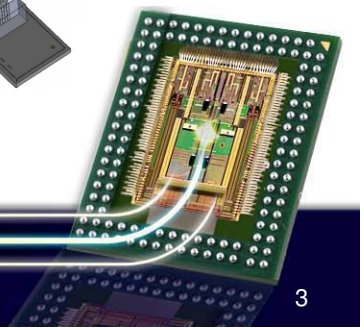




Fiber Attach



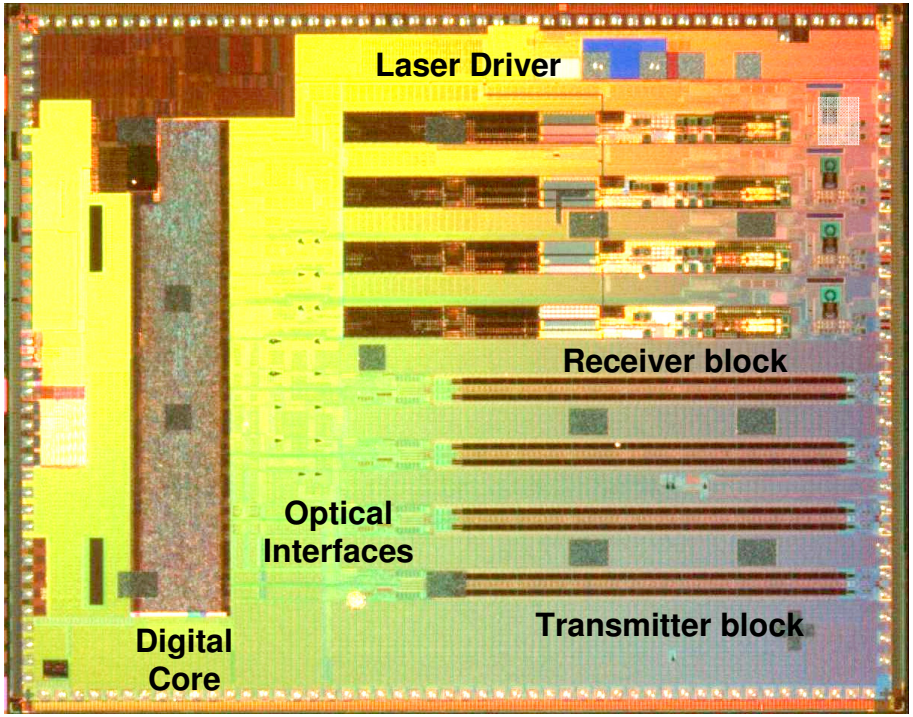




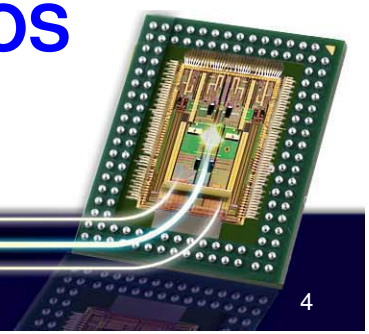
EPIC – Electro-Photonic Integrated Circuit

Unprecedented Opto/Electronic CMOS Integration

- Optics
  - Fiber coupled directly to the die
  - Integrated wave guides
  - Integrated modulators
  - Integrated photo-detectors
- Analog and Digital Electronics
  - Integrated modulator driver
  - Integrated amplifiers and CDRs
  - Integrated digital functions



Monolithically integrated in mainstream SOI CMOS



How we build a 40G Transceiver in CMOS

Single Laser Powers 4 Lanes

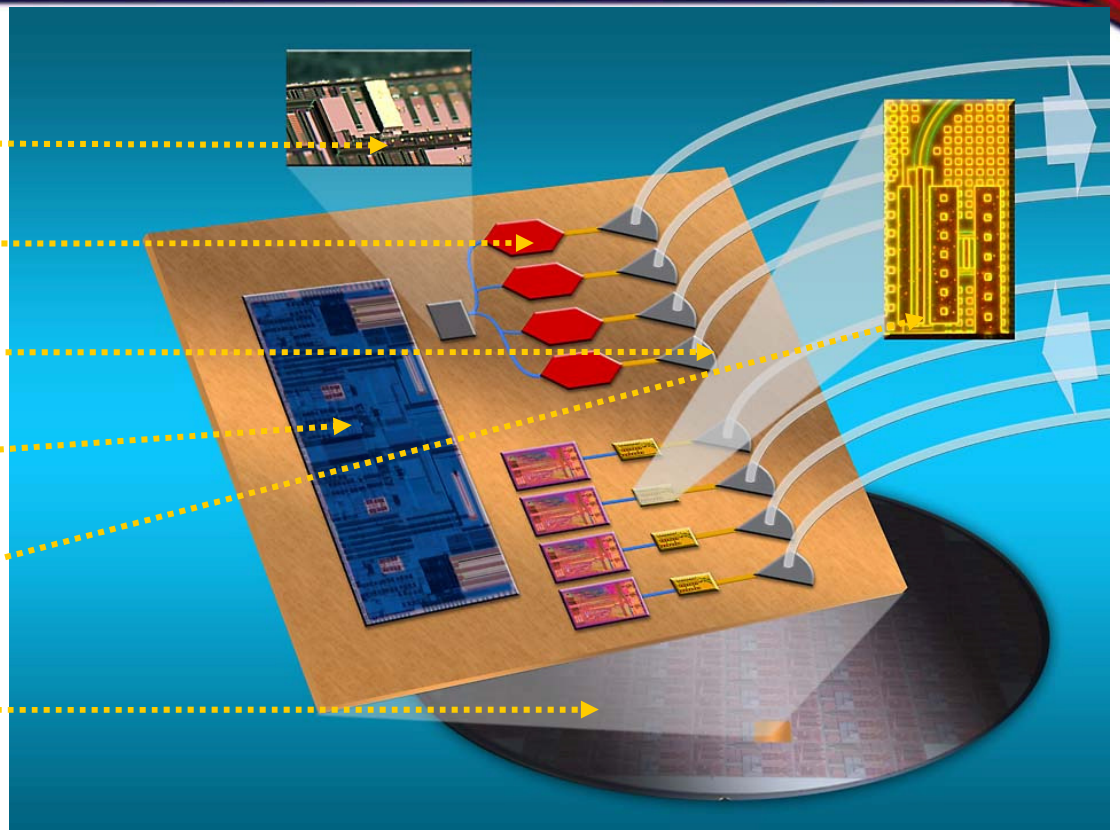
On-Die Modulators

Fiber-to-the-Chip Coupling

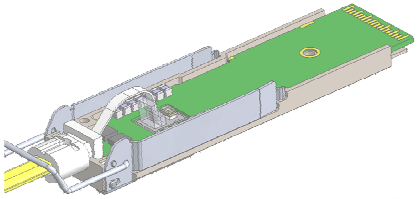
Integrated Electronics

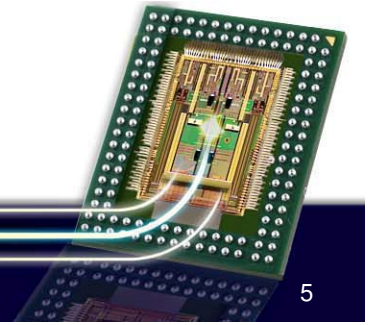
Integrated Photo-Detectors

Wafer Scale Testability



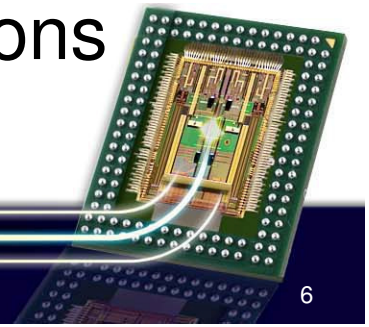
Packaged in MSA Compatible Connectors



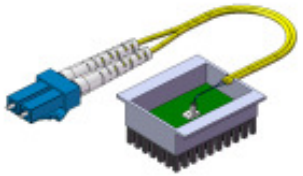


How would cmos photonics be implemented for SAS?

- Packaged in industry standard pluggable modules (Both connectorized modules and active cables can be supported)
  - QSFP+
  - SFP+
  - SFF-8644
  - Future smaller form factors
  - Chip on motherboard
- Note: cmos photonics reduces required module size as compared to VCSEL based solutions

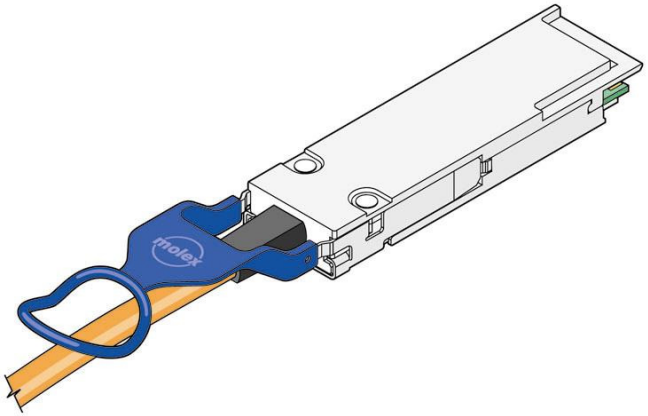


SFP+Pluggable Optical Module

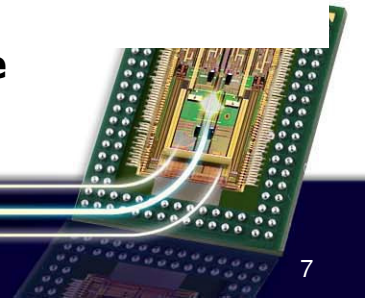


Chip on board Optical Module

QSFP+ Pluggable Optical Module

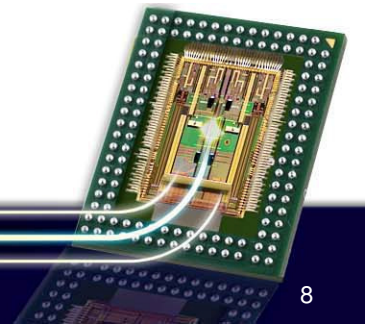


QSFP+ Active Optical Cable



What needs to be done?

- Add support for QSFP+, SFP+ and SFF-8092 to the SAS specification
  - No changes to SAS electrical/jitter specs.
- Add optical specs
- Modify Protocol timeouts if needed to accommodate longer distances

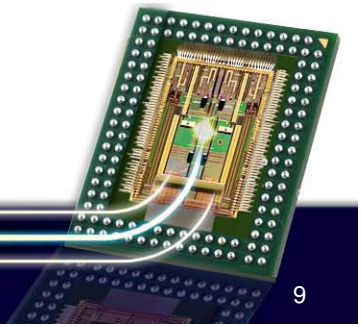


Will support for cmos photonics affect other PMD types?

NO:

All modules would be specified to support:

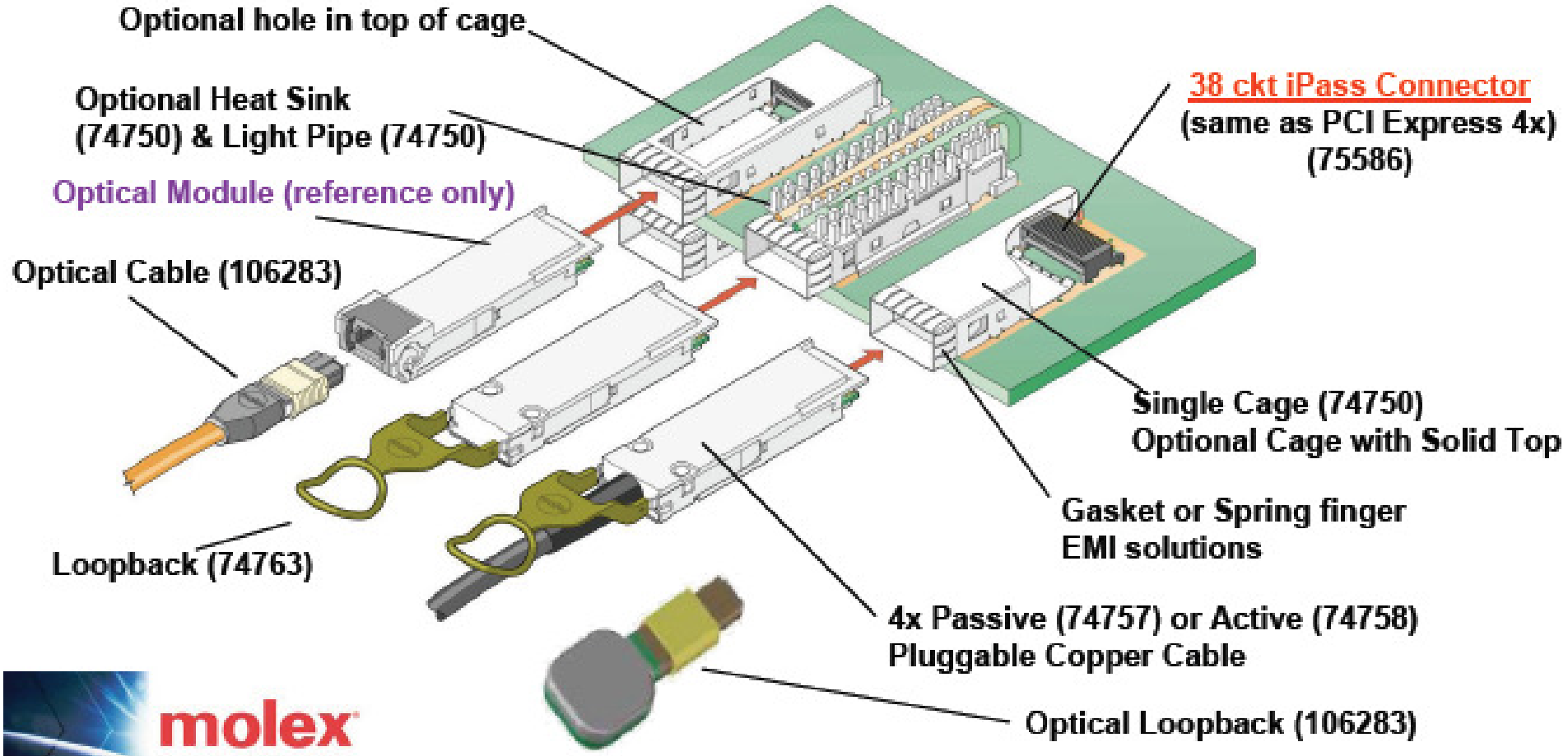
- Passive copper
- Active copper
- Active optical
- VCSEL based optical
- Cmos photonics based optical



QSFP – Quad Small Form-factor Pluggable

The QSFP MSA was released 12/4/2006

- **The MSA defines an (8) Differential Pair / 4x Pluggable Copper & Optical Module**
- **4 lanes @ up to 10 Gbps each per connector**
- **Uses only 30% more PCB space over SFP to get 10x data density**



molex

Estimated distances supported

	Direct attach copper	Active copper	Active optical	MM optical	SM Optical LC-I	SM optical LC-L
FC-PI-4 delta	7m	20m	.1-2km	50-100m	1.4km.	10km
FC-PI-4 Beta	5m	20m	.1-2km	NA	NA	NA
8431	7m	20m	.1-2km			10km
XFI	1m	20m	.1-2km			
IB QDR	3m	20m	.1-2km			
IB DDR	10m	20m	.1-2km			
IB SDR	17m	20m	.1-2km			
6G SAS	10m	20m	.1-2km	>50	2km	10km?
12G SAS	10m	20m	.1-2km	50m	2km	10km?

THANK YOU

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