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Optical PMD Overview

Tutorial T1A:

40/100 GbE: What's Happening?

Chris Cole

chris.cole@finisar.com

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Summary Overview

	PRESENT			FUTURE		
Rate Fiber	Optical Interface	Electrical Interface	Form Factor	Optical Interface	Electrical Interface	Form Factor
40GE SMF	-LR4 4x10G*	XLAUI 4x10G	CFP	-LR4 4x10G	XLPPI 4x10G	QSFP
40GE MMF	-SR4 4x10G	XLPPI 4x10G	QSFP (& CFP)	-SR4 4x10G	XLPPI 4x10G	QSFP
100GE SMF	-LR4, -ER4 4x25G	CAUI 10x10G	CFP	-LR4, -ER4 4x25G	*CAUI2* 4x25G	*CFP2*
100GE MMF	-SR10 10x10G	CPPI 10x10G	CXP (& CFP)	*-SR4* 4x25G	*CPPI2* 4x25G	*QSFP2 (& CFP2)*

* 40GE-LR, 1x40G, is now also being standardized to interoperate with legacy telecom interfaces (CFP form factor, XLAUI 4x10G I/O)

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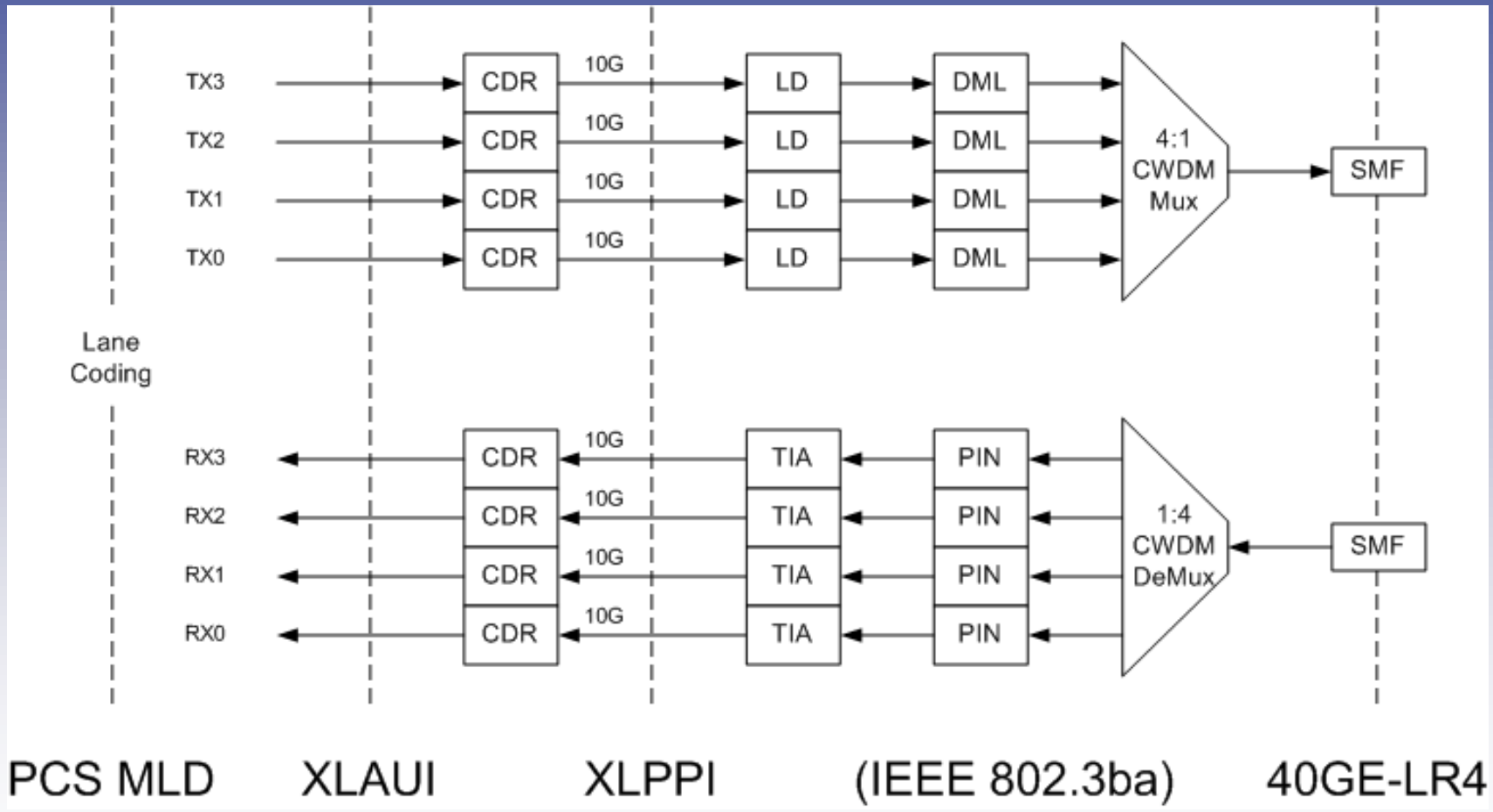
40GBase-LR4



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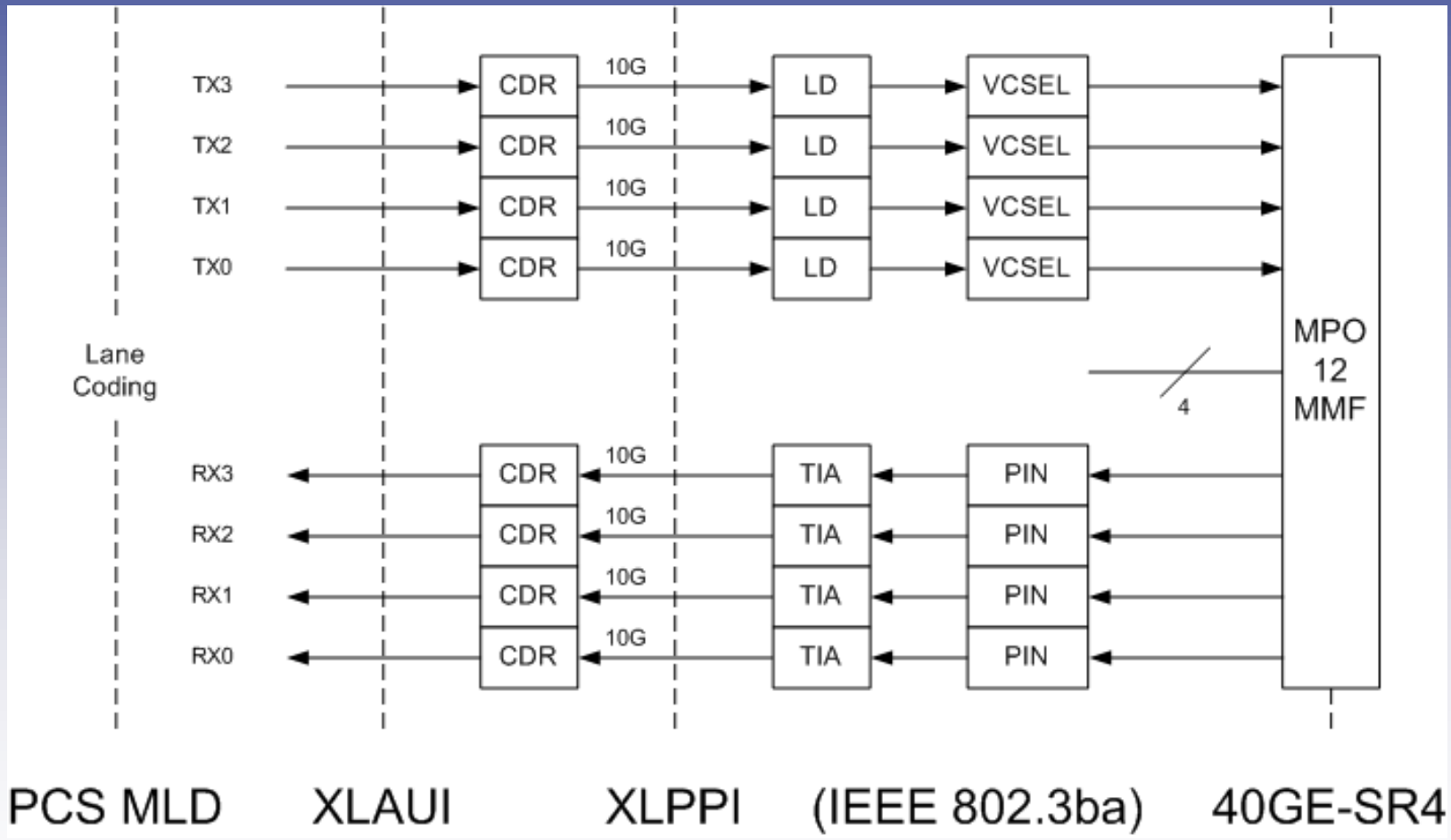
40GBase-SR4



CFP Module

- 40GE/100GE SMF and MMF transceivers
- CFP MSA specified: 82mm x 145mm x 13.6mm (w x l x h)
- SC optical connector shown (LC, MPO alternatives)
- 148-pin electrical plug connector with 12x10G I/O

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QSFP Module and Active Cable

- 40GE MMF and SMF transceivers
- 40GE MMF and SMF active cables (no optical connector)
- QSFP MSA specified: 18.5mm x 72.5mm x 8.5mm (w x l x h)
- MPO optical connector shown (LC alternative)
- 38-pad electrical PCB connection with 4x10G I/O

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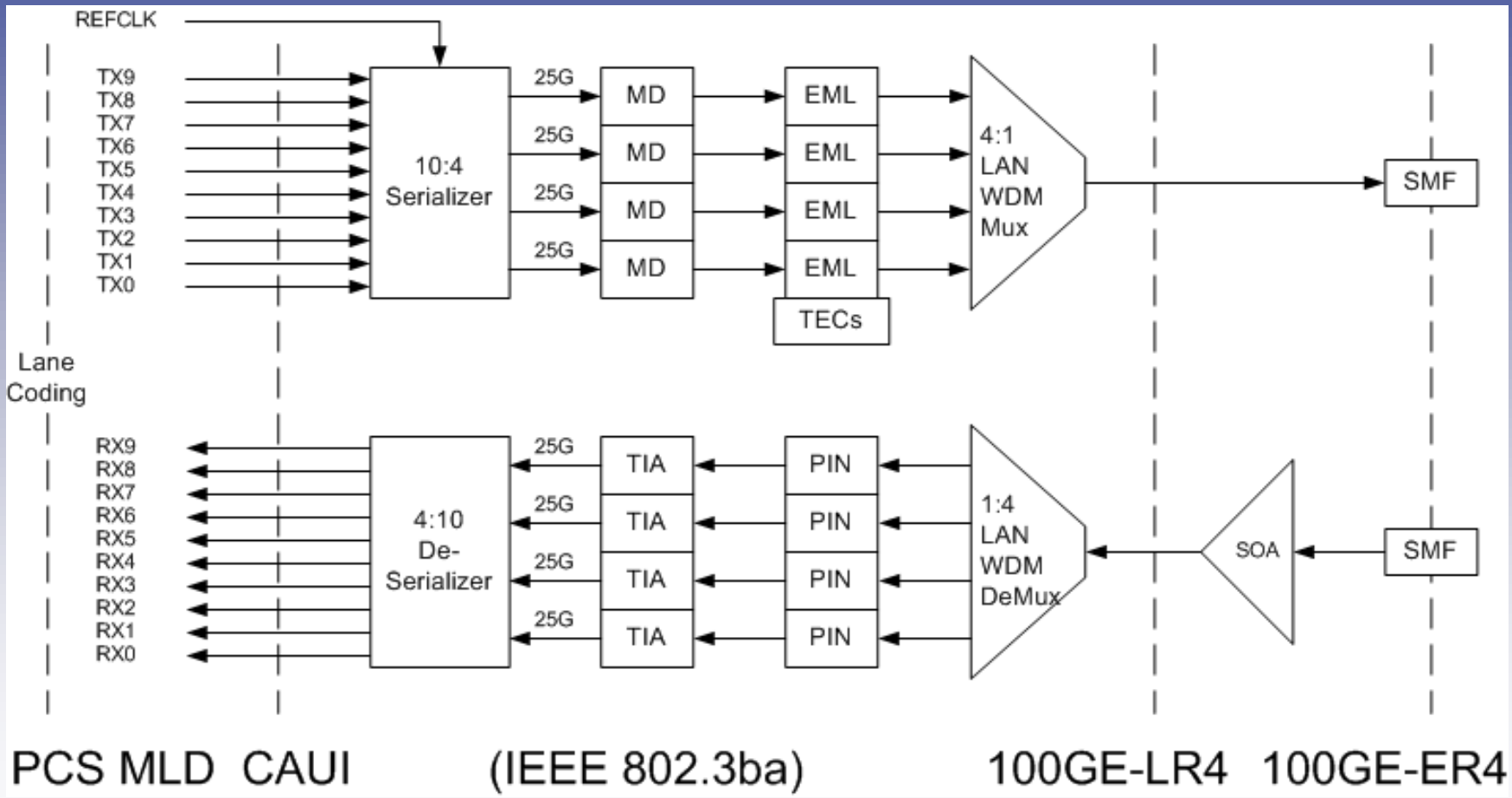
100GBase-LR4, -ER4



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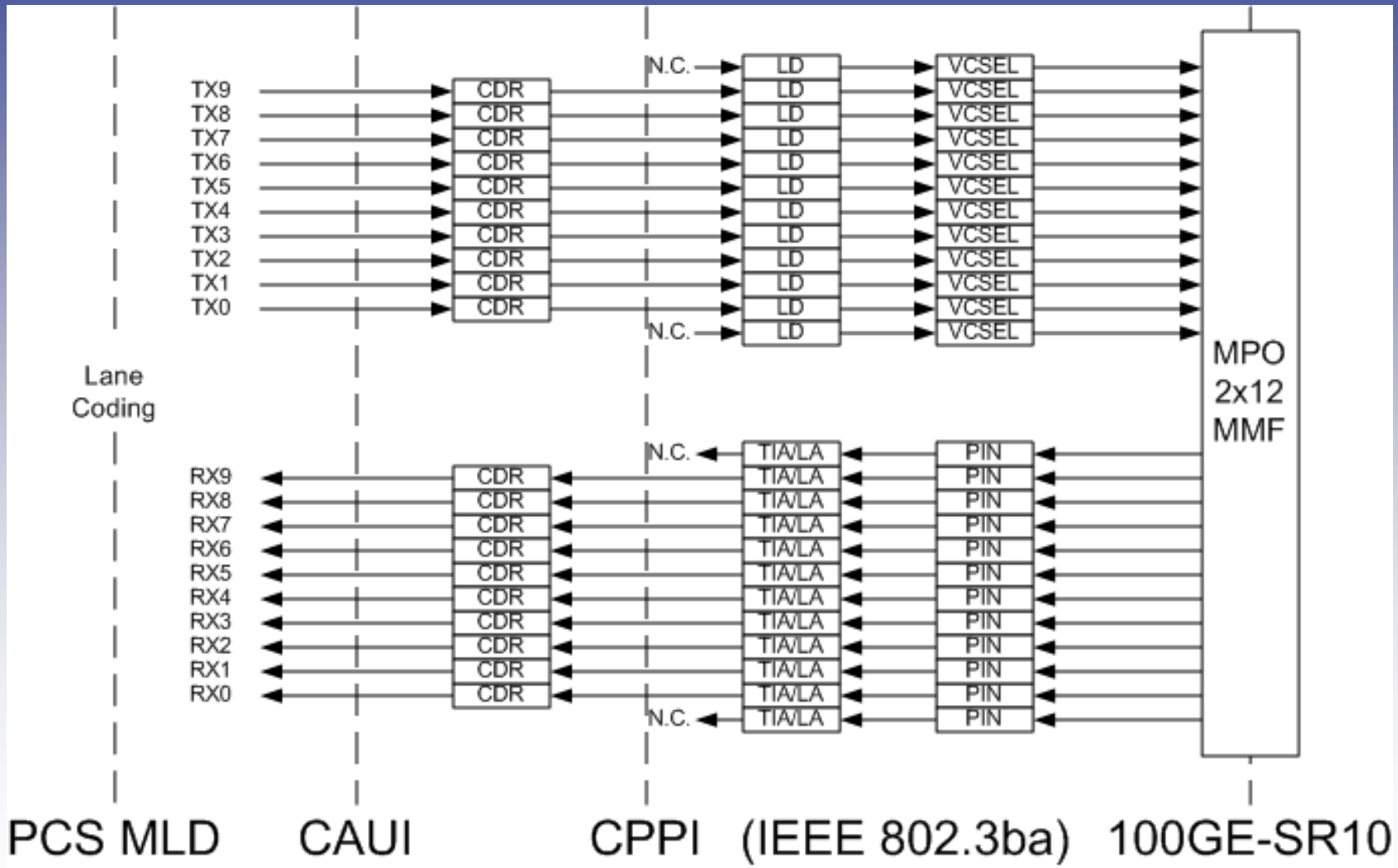
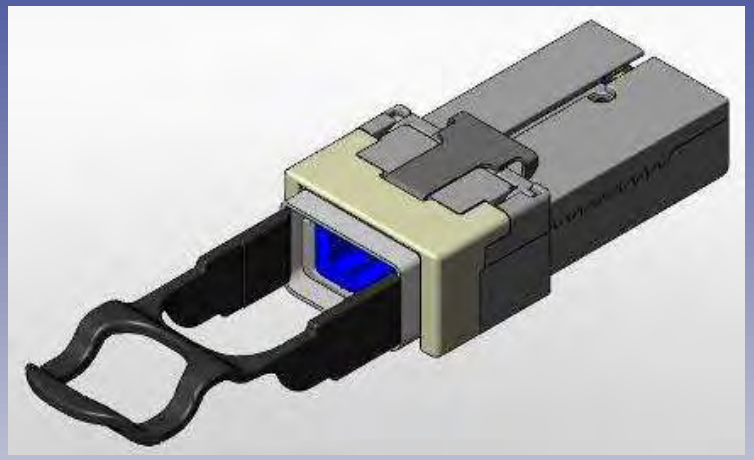
100GBase-SR10



CXP Module and Active Cable



- 100GE MMF transceivers
- 100GE MMF active cables (no optical connector)
- InfiniBand Association specified: 24mm x 51mm x 14mm (w x l x h)
- 2x12 MPO optical connector
- 84-pad electrical dual-PCB connection with 12x10G I/O

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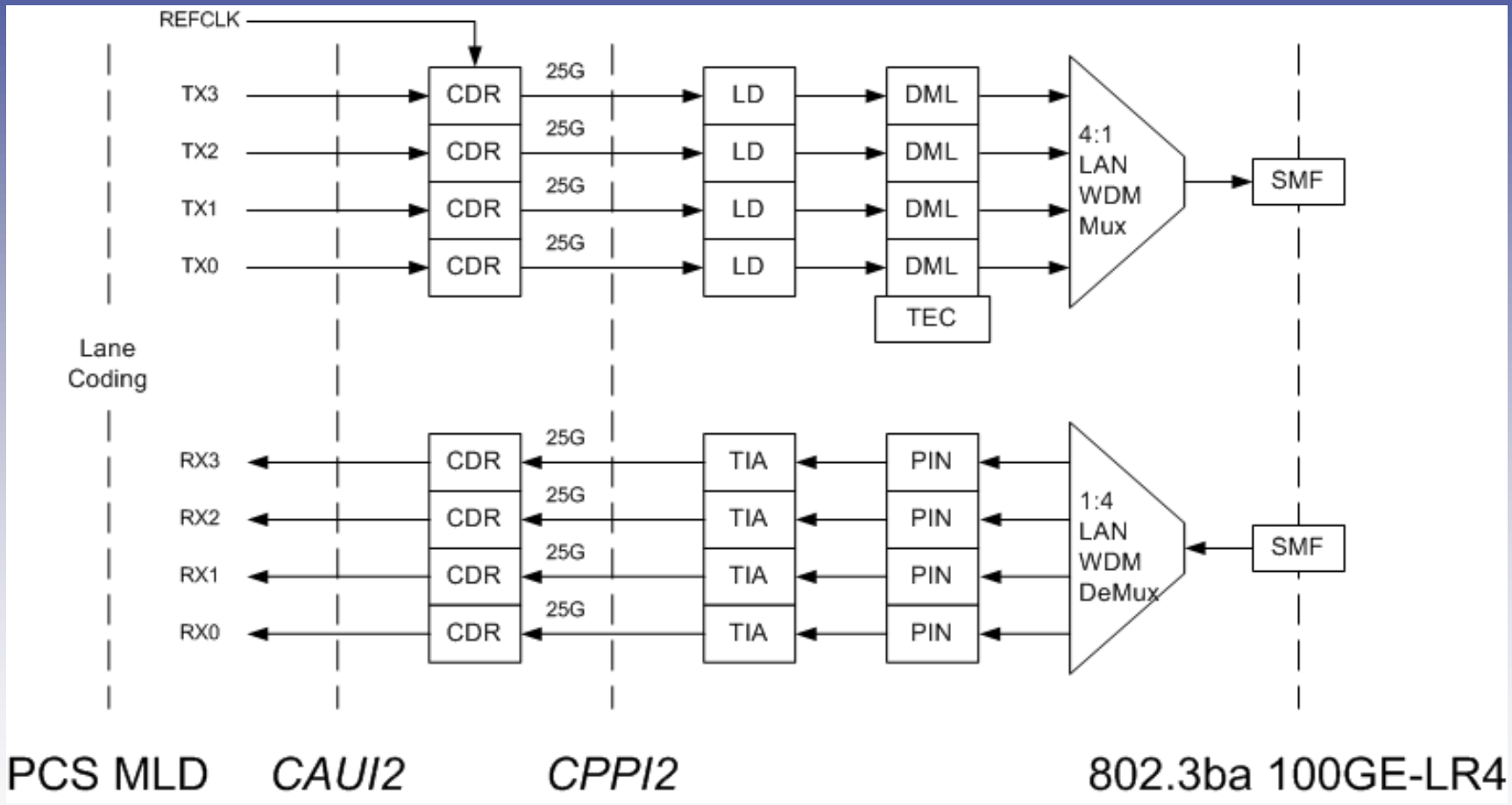
Future 100GBase-LR4



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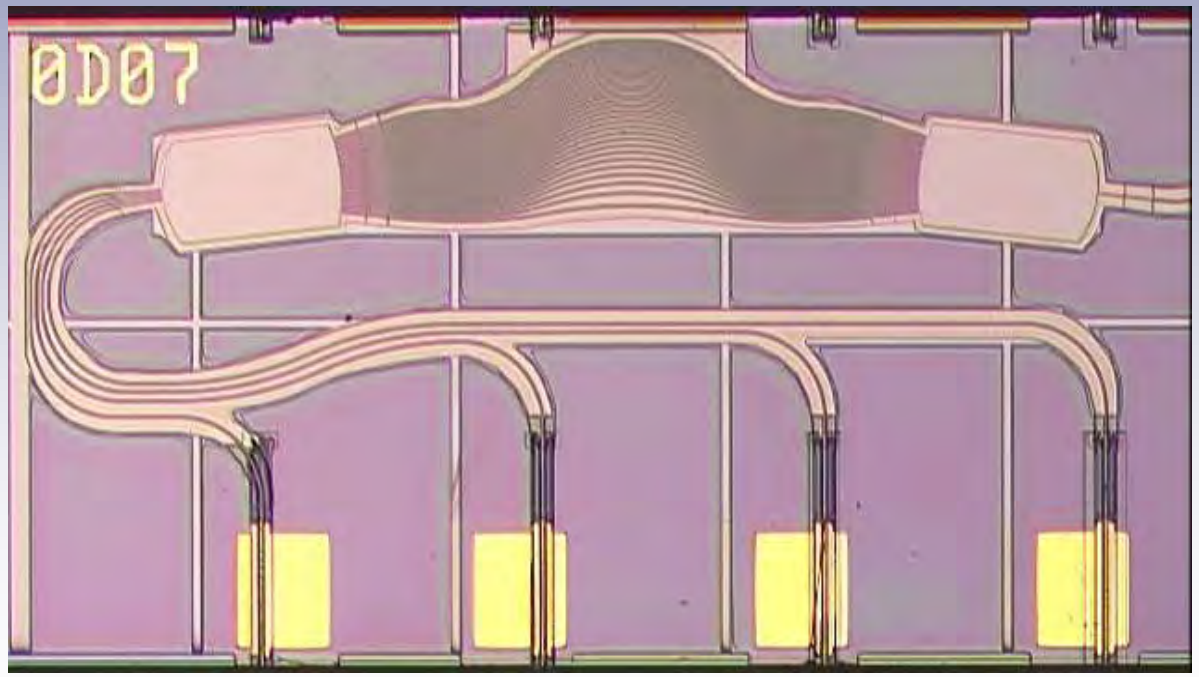
Future Key SMF Technology

- High yield Photonic Integrated Circuit (PIC) technology is required for low power and low cost 40GE & 100GE transceivers
- Ex. monolithic InP TX PIC with four O-band DMLs (lasers) and an AWG with 24.5nm Δλ, 1.1 x 2.4 mm, CyOptics Inc.



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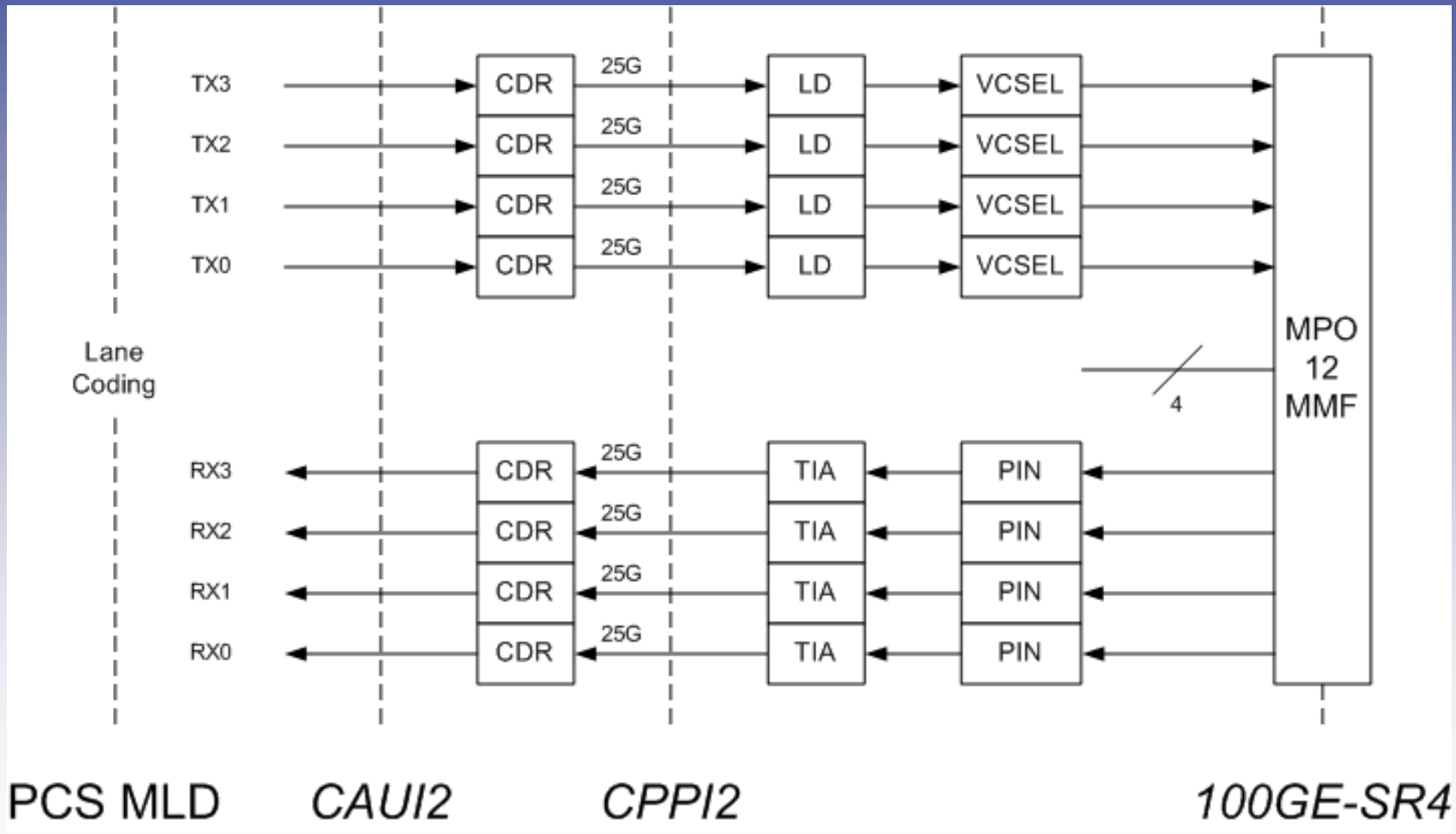
Future *100GBase-SR4*



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Future 100GE Electrical Interface

- 25GBaud adopted by all mainstream datacom standards as the future electrical signaling rate
  - Ethernet: 26GBaud (4x26Gb/s → 103Gb/s)
  - Telecom: 28GBaud (4x28Gb/s → 112Gb/s)
  - Infiniband: 25Gbaud (4 x 25Gb/s, 12 x 25Gb/s)
  - FiberChannel: 28Gbaud (28Gb/s)
- Standardization discussions started in IEEE, OIF, IBTA and FC
- Critical to establish liaison between organizations to maximize development efficiency
- Critical to share technology
  - Connectors
  - IC I/O

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Future 100GE Modules

- *CFP2*
  - 100GE SMF and MMF transceivers
  - Future MSA specified: 25% to 50% CFP size
  - SC and LC optical connectors
  - New connector with 4x25G electrical I/O
- *QSFP2*
  - 100GE MMF transceivers and active cables
  - Future MSA specified: ~ QSFP size
  - 1x12 MPO optical connector
  - New connector (preferably not PCB connection) with 4x25G electrical I/O
- 100GE SMF PIC based optics may eventually fit into *QSFP2*

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Biography

Chris Cole is a director at Finisar Corp., Sunnyvale, Calif. He received a B.S. in Aeronautics and Astronautics, and B.S. and M.S. in Electrical Engineering from the Massachusetts Institute of Technology. At Hughes Aircraft Co. (now Boeing SDC,) and then M.I.T. Lincoln Laboratory, Chris contributed to multiple imaging and communication satellite programs. Later, he consulted on telecom ICs for Texas Instruments' DSP Group and Silicon Systems Inc. (now Teridian.) At Acuson Corp. (now Siemens Ultrasound,) Chris was one of the architects of the Sequoia coherent imaging ultrasound platform, where he was also director of hardware and software development groups. As a principal consultant with the Parallax Group, he carried out signal processing analysis and product definition for several imaging and communication systems. Chris is now managing the development of 40-Gb/s and 100-Gb/s LAN and WAN optical transceivers at Finisar (which acquired his previous company, Big Bear Networks.) He is a Senior Member of the IEEE.

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Finisar Corp.

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