

Proposed 100G PSM4 relative costs

Tom Palkert
Luxtera



What drives end user cost*?

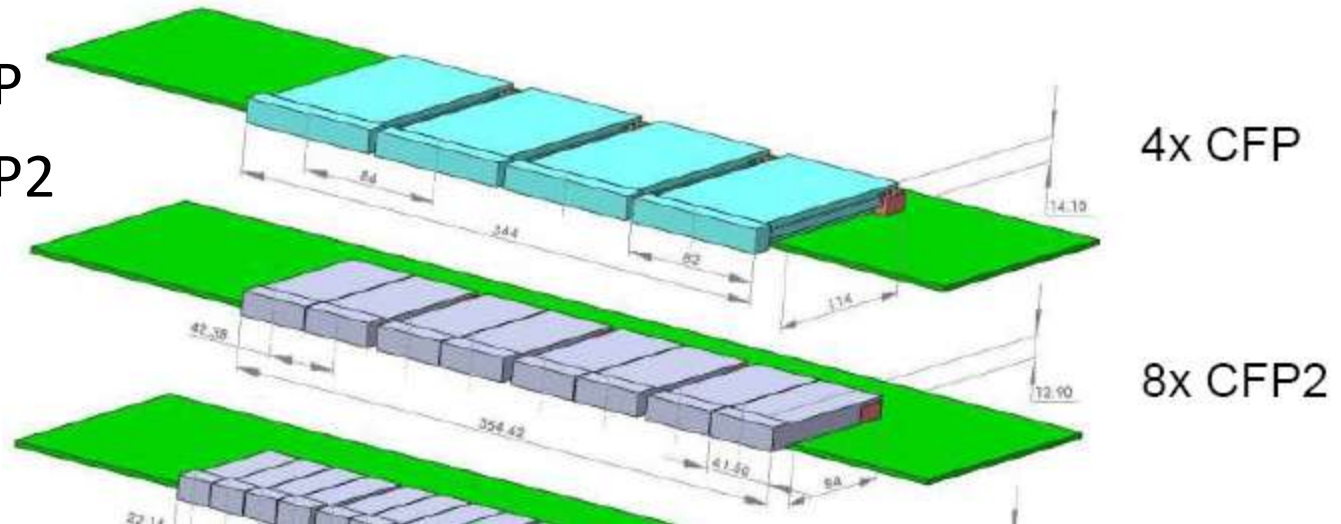
- Faceplate density
- Power dissipation
- BOM
- Ease of mfg

*Based on information from OIDA Data Center Metrics conference at OFC2012

Port density comparison

- Port density

- 4 ports for CFP
- 8 ports for CFP2



- 36 ports for QSFP28



\$ value of faceplate density

- CFP2 is 41x106xmm
- QSFP is 25x51mm
- Port density is 4x better with QSFP

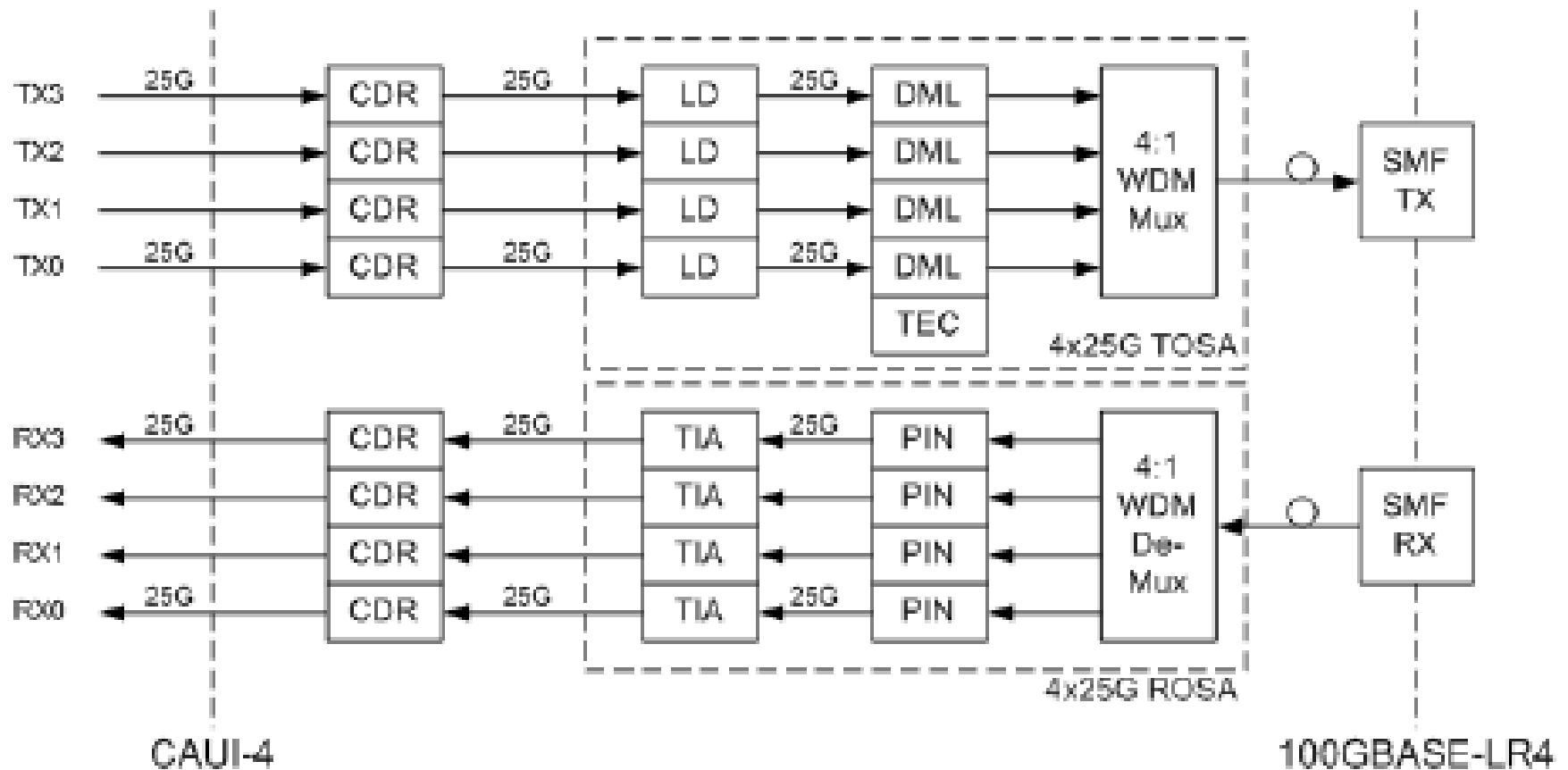


- What is the \$ value of higher port density?
 - Very high if you assume a 4:1 switch count ratio.

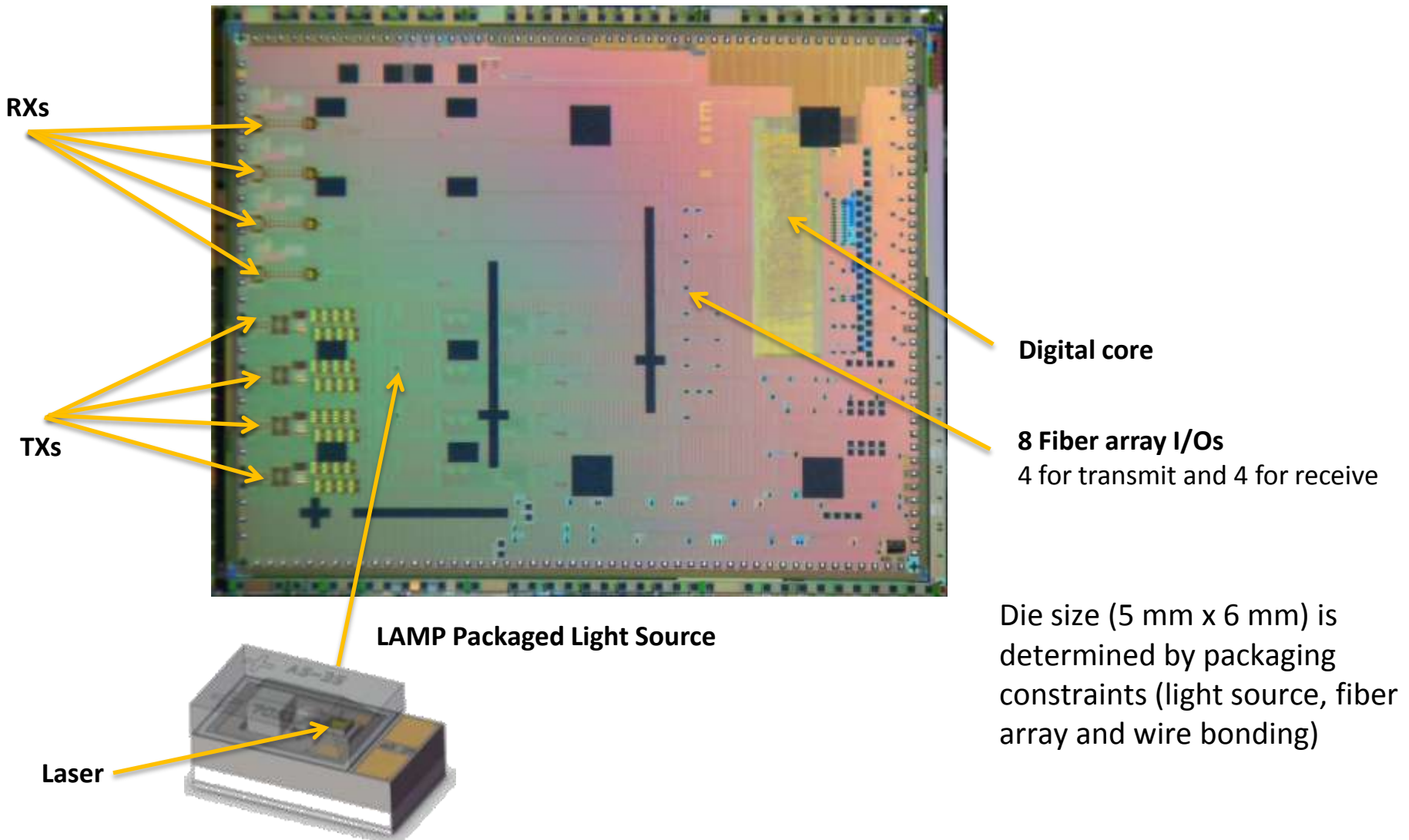
Total Operating Cost comparison (TOC)

- LR4:
 - CFP2 = 9-12W
- PSM4
 - QSFP = 2.5-3.5W
- End user cost of power (TOC) = 2x-7x module power
 - Cost of power supplies cooling etc.
 - Cost of power = .11/kwhr*
 - 4yr lifetime = \$46-\$162 cost savings/module
 - Assuming a 36 port switch: TOC savings for PSM4 modules = \$1,656-\$5,832
 - *Electricchoice.com: average cost of electricity in the US .1153/kw hr in 2010

LR4 block diagram



Single Chip 4x28Gbps Optical Transceiver



Die size (5 mm x 6 mm) is determined by packaging constraints (light source, fiber array and wire bonding)

BOM comparison

LR4

PSM4

SR4

- 4 WDM lasers (TEC)
 - 1 WDM Mux
 - 1 WDM Demux
 - 4 PIN/TIA (ROSA)
 - 2x4 channel Retimers
 - 1x4 channel MZI drivers
 - 4 Limiting Amp
 - 1 microcontroller
 - 1 PCB (106x41.5mm)
 - 1 CFP2 connector
 - 1 CFP2 card cage
 - 1 CFP2 module
 - 1 Dual LC connector
 - 1 x2 fiber
 - Heat sink
- 1 CW Laser
 - 1 die
 - 1 microcontroller
 - 1 PCB (25x50mm)
 - 1 QSFP28 connector
 - 1 QSFP28 card cage
 - 1 QSFP28 module
 - 1 MPO connector
 - 1 x8 fiber ribbon
 - Heat sink
- 4 VCSEL lasers ?
 - 4 PIN/TIA (ROSA) ?
 - 2x4 channel Retimers
 - 1x4 channel Laser drivers
 - 4 Limiting Amp
 - 1 microcontroller
 - 1 PCB (25x50mm)
 - 1 QSFP28 connector
 - 1 QSFP28 card cage
 - 1 QSFP28 module
 - 1 MPO connector
 - 1 x8 fiber ribbon
 - Heat sink

- PSM4 module contains minimal # of parts
 - Laser, Die, Microcontroller, Power supply, decoupling caps (<25 components)
- LR4 module contains a large # of parts.
 - 4 lasers, 2 quad retimers, WDM mux, demux, 4x ROSA, MZI, MZI drivers, microcontroller etc. (>75 components)

SFP 10G LR cost comparison

- Ethernet has consistently demonstrated that broad market adoption occurs when we achieve 10x speed for 3x cost.

How can this be achieved for 10GBASE-LR vs PSM4?

10GBASE-LR BOM

- 1 direct mod Laser
- 1 PIN/TIA (ROSA)
- No Retimers
- 1 Laser driver
- 1 Limiting Amp
- 1 microcontroller
- 1 PCB (1/2 size of QSFP)
- 1 SFP connector 19 pins
- 1 SFP card cage
- 1 SFP module (size)
- 1 Dual LC connector
- 1 x2 fiber
- Heat sink

PSM4 BOM

- 1 CW Laser
- 1 die
- 1 microcontroller
- 1 PCB (25x50mm)
- 1 QSFP28 connector
- 1 QSFP28 card cage
- 1 QSFP28 module
- 1 MPO connector
- 1 x8 fiber ribbon
- Heat sink