

Cost, power, size differences
of proposed MMF PMDs:
20 m un-retimed module
VS
100 m retimed module (baseline)

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Introduction

- 100 m reach MMF PMD baseline ¹
 - 4 lanes, FEC supported, ‘fully retimed’.
 - E.g. input data jitter characteristics to the PMD are consistent with retiming inside a pluggable module.
 - 850 nm VCSEL compatible specs.
- Proposed 20 m reach MMF PMD ^{2,3}
 - 4 lanes, FEC supported, ‘un-retimed’
 - E.g. input data jitter characteristics to the PMD are consistent with an un-retimed pluggable module.
 - 850 nm VCSEL compatible specs.
- The difference between 100 m OM4 and 20 m OM3 is ~ 1.4 dB of link budget ^{4,5}; the same optics assumed for both PMDs ^{4,5}.
- For pluggable module implementations, the main difference will be power consumed by the retiming function on 8 (Tx + Rx) lanes
 - Same optics BOM, PCBA, shell, connectors, much IC functionality in common

Cost

- Same BOM cost for 20 m un-retimed and 100 m retimed modules
 - Test cost for retimed module probably slightly lower than un-retimed module*
 - BERT vs high speed oscilloscope measurements
 - Cost of CDRs is negligible
 - CDRs are a small percentage of total IC area

cost difference is small

* Also applies to optics-on-board implementations

Power comparison between retimed and un-retimed*

Function	Retimed	Un-retimed
Amplification (TIA/LA)	Yes	Yes
Equalization (CTLE)	Yes	Yes
VCSEL Laser Driver	Yes	Yes
Host Driver	Yes	Yes
uC and other	Yes	Yes
Clock and data recovery	Yes	No

In Q1'13, how much power did the CDR function consume? < 55 mW/channel
Will this go down over time? Yes

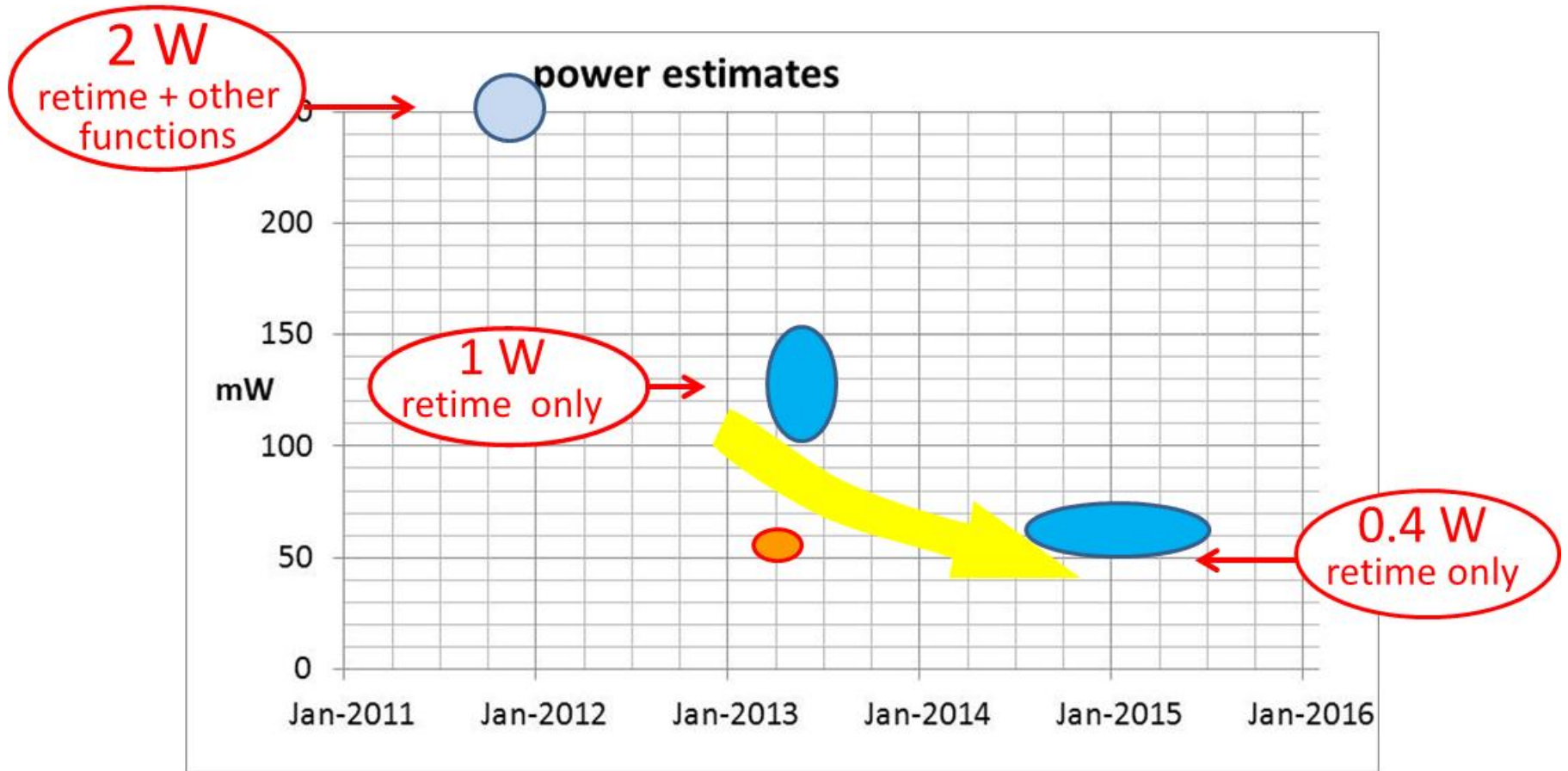
* Also applies to optics-on-board implementations

Power

- Finisar:
 - End of 2011 estimate was ~ 250 mW per CDR IC (including IO and other functionality) (king_01_1111)
 - Current 26 Gb/s CDR designs: 100 to 150 mW per CDR for retiming function alone (SiGe)
 - 800 to 1200 mW per module
 - Expect 50 to 75 mW per CDR for retiming function alone in 1 to 2 year time frame
 - 400 to 600 mW per module (SiGe)
- Mindspeed
 - Current 26 Gb/s CDR design measured less than 55 mW per CDR for the retiming function alone
 - < 440 mW per module

Power difference < 0.5 W

CDR power with time



	Q4, 2011	Q2, 2013	~Q4, 2014
A	~250 mW *	100 to 150 mW	50 to 75 mW
B		55 mW	< 50 mW

* king_01_1111

Size

- Same component count for 100 m reach retimed and 20 m reach un-retimed modules
 - Removing CDRs doesn't reduce size of components
 - 4x: VCSELs, drivers, receivers, input/output CTLEs; management functions and I2C; 8 lane wide electrical connector, optical connector.
 - Both are QSFP+/CFP4 compatible
- Similar power dissipation
 - Retimed 100 m reach module ~ 3 W
 - Un-retimed 20 m reach module ~ 2.5 W ?
 - Both are QSFP+/CFP4 compatible

equivalent BOM + similar power = same size

Conclusions

- By about the same time 802.3bm is technically stable (H2 2014) there will be no significant power, cost, or size advantage to be gained for pluggable modules from an un-retimed short reach PMD.
 - Insufficient data has been provided to justify a need for an un-retimed short reach PMD via optics-on-board
 - A 20 m reach un-retimed PMD would not meet the criteria for distinct identity.
- The 20 m reach objective is met by the 100 m reach PMD, a separate 20 m PMD is not required.

Supporting the conclusions:

Pete Anslow, Ciena

Stephen Bates, PMC Sierra

Vipul Bhatt, Cisco

Sudeep Bhoja, Inphi

Brad Booth, Dell

David Brown, Semtech

Matt Brown, Applied Micro

Derek Cassidy, BT

Chris Cole, Finisar

Mike Dudek, Qlogic

Mark Gustlin, Xilinx

David Lewis, JDSU

Mike Peng Li, Altera

Brian Misek, Avago Technologies

Andy Moorwood, Infinera

Karl Muth, Texas Instruments

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Rick Rabinovich, Alcatel-Lucent

Sam Sambasivan, AT&T

Jeff Slavick, Avago Technologies

Andre Szczepanek, Inphi

Francois Tremblay, Semtech

Katsuhisa Tawa, Sumitomo Electric

Nathan Tracy, TE Connectivity

Not supporting the conclusions:

References

- 1) king_02_0113_optx.pdf
- 2) “Jitter Budget for unretimed MMF PMD (revised)”, Piers Dawe, MMF ad hoc 28th Feb 2013;
- 3) “20m MMF Tracking Tables (pre-meeting)”, Jonathan king, 14th March 2013
- 4) petrilla_01_0313_optx.pdf
- 5) MMF ad hoc minutes, 14th March 2013