100G Next Gen 2 km SM PMD

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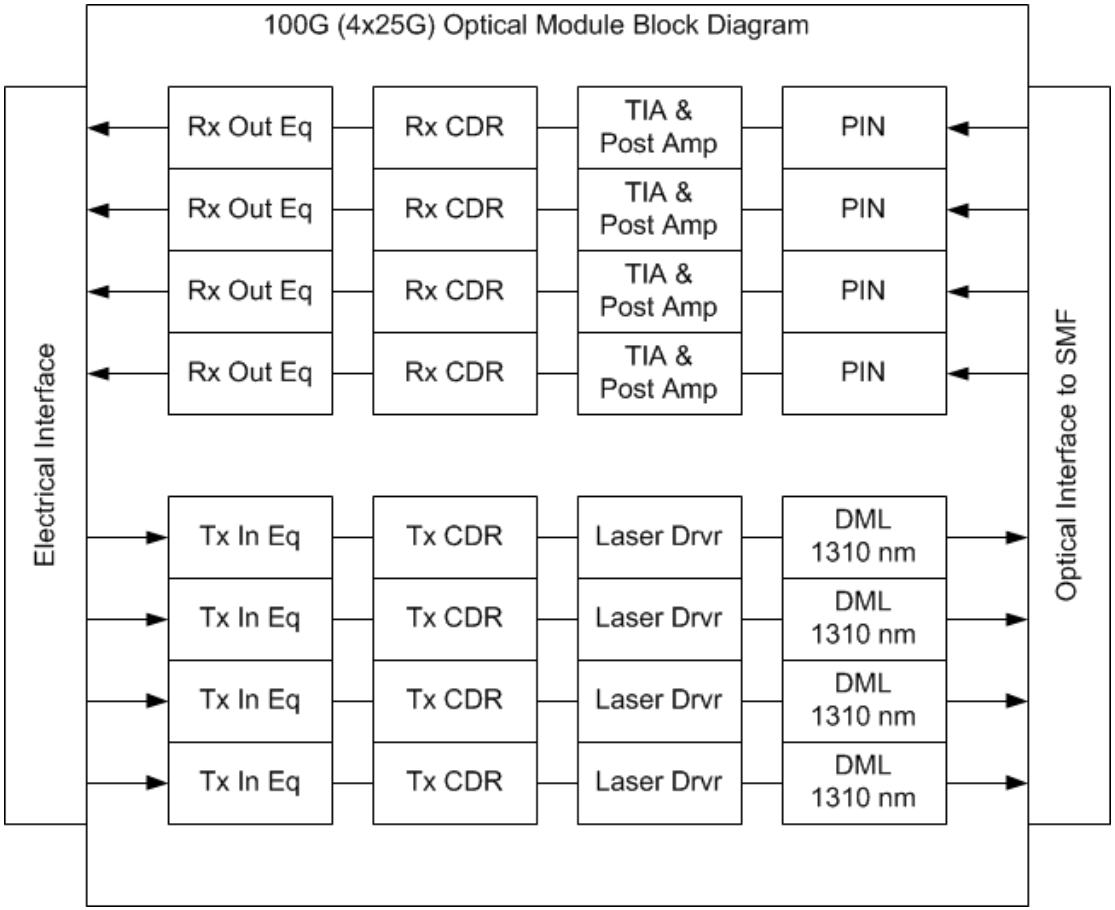
November 2011

Presentation Summary

- From CFI-consensus-presentation, potential areas for SM study includes, “Study alternate PMD technologies to determine if there is significant opportunity for additional size, power and cost reduction”
- From, “ Objectives for Next Generation 100GbE Optical Interfaces”, “a possible objective could be: Define a 100 Gb/s PHY for operation over at least Zkm of SMF”
- This presentation recommends for consideration a 100 Gb/s (4 lane) PMD that will operate over, at least, 2 km of multi-lane SM fiber (G.652) with BER < 10^{-12} based on 1310 nm lasers, NRZ modulation and 64b/66b encoding.

100G 25G/Lane Parallel SM Transceiver: Description

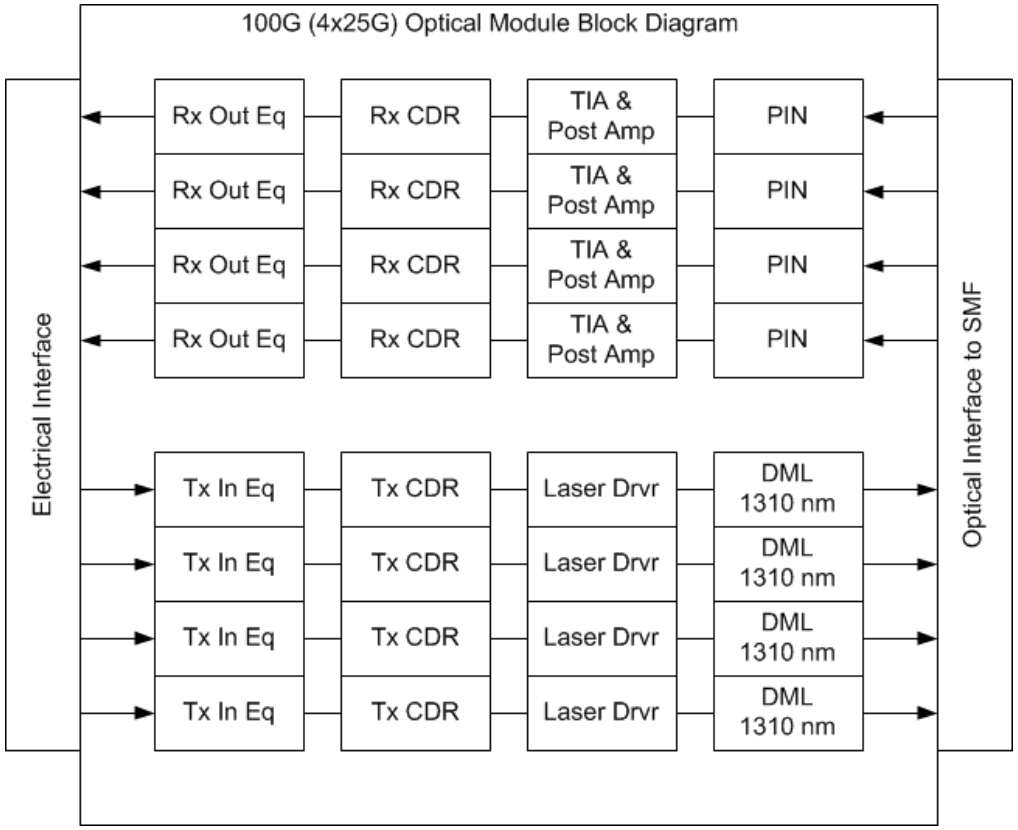


- No optical MUX
- No optical DMUX
- No tight wavelength requirements
- No TEC
- No optical channel equalization
- No FEC

Since this device can be viewed as a simplified and/or reduced cost 100GBASE-LR4 for a reduced reach, feasibility has been demonstrated .

NRZ modulation and 64b/66b encoding expected for both electrical and optical signals.
Electrical interfaces expected to require equalization and retiming, at least initially.
An MPO connector can be used at the optical interface.

100G 25G/Lane Parallel SM Transceiver: Comparisons 1/3



Possible shared items:

Rx chain: TIA, Post Amp, CDR & Output Driver and Equalization can be shared with 100GBASE-S/LR4 modules.

Tx chain: Tx Input buffer and equalization, CDR & laser driver can be shared with 100GBASE-S/LR4.

100GBASE-LR4 Comparison:

Parallel SMF (8 fibers) replaces duplex SMF

Four isolators vs. single isolator

No optical MUX or optical DMUX

No tight wavelength requirements

No TEC

100GBASE-SR4 Comparison:

- 1310 nm lasers (e.g. DFB) replace 850 nm SR4 lasers (e.g. VCSEL)
- Responsivity range of PIN photodiode shifted to 1310 nm range
- Bandwidth of 1310 nm optical devices and channel should not require equalization
- Removing a CDR from Tx or Rx chains may be possible

100G 25G/Lane Parallel SM Transceiver: Comparisons 2/3

	100G SR4	100G PSM	100G LR4	Comments
Cost				
Cable Plant ($/m)	Highest	4x Lowest	Lowest	
Lasers	Lowest		Highest	
Laser Isolators	Not Req'd	4x Highest [1]	Highest	[1] 100G PSM is highest if 4 isolators are needed; otherwise none are required.
WDM MUX/DMUX	Not Req'd	Not Req'd	Highest	
TEC	Not Req'd	Not Req'd	Highest	
Power Consumption				
TEC	Not Req'd	Not Req'd	Highest	
Tx (w/o TEC)	Lowest	← w/o CDR w CDR→	Highest	
Rx Equalization	Highest [2]	Not Req'd	Not Req'd	[2] If optical Rx equalization needed
Size				
@ Power Dissipation	Lowest	← w/o Tx CDR w Tx CDR→	Highest	
Signal Budget				
	Lowest(?)	Highest	Lowest(?)	

100G 25G/Lane Parallel SM Transceiver: Comparisons 3/3

•Costs and power consumption for a multi-lane parallel 1310 nm SM transceiver, like the supported fiber reach, is expected to be between those of 100GBASE-SR4 and 100GBASE-LR4.

Costs:

•Compared to SR4, the different lasers and different economies of scale are expected to yield a higher cost structure.

•Parallel SM fiber is expected at lower cost/m than parallel MM fiber but with a higher termination cost.

•Note that parallel fiber does not imply ribbon fiber. Preferred industry practice uses a loose tube assembly.

•Compared to LR4, the absence of optical MUX and DMUX blocks, multiple and tightly controlled wavelengths and TEC are expected to yield a lower cost structure perhaps compromised by additional isolators.

•Parallel SMF (8 fibers) will carry a higher cost than a single pair of SM fiber.

•From a system-cost point-of-view, there will be trade-off between module cost and cable cost that may favor the parallel SM transceiver, e.g. from 100 m to 1 km.

Power:

•Compared to SR4, the bias current for the different lasers will lead to higher power consumption which will be somewhat mitigated by the absence of optical channel equalization and potential removal of half the CDRs.

•Compared to LR4, the absence of TEC will permit lower power consumption.

•Depending on the power consumption relative to SR4, the parallel SM transceiver will either fit within the same form factor as the SR4 or require the somewhat larger form factor required for LR4.

Thank You