

100G Next Gen Multi-Mode Optics

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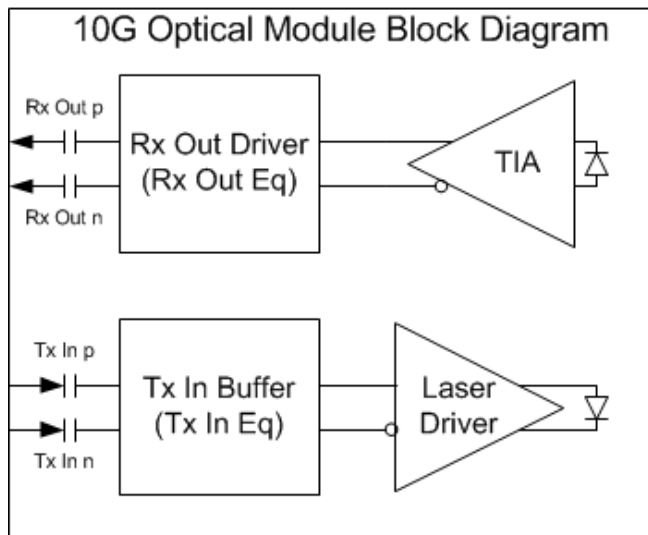
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Presentation Overview

- 10G/Lane Transceivers
- 14G/Lane Transceivers
- 25G/Lane Transceivers
- 32GFC (FC PI 6) Comments
- Next Steps

Block Diagram: 10G/Lane Transceivers



Released Specifications:

8GFC (8.5 GBd, NRZ, 8b10b)

IB 4X QDR (10 GBd/lane, NRZ, 8b10b)

IB 12X QDR (10 GBd/lane, NRZ, 8b10b)

10GBASE-SR (10.3125 GBd, NRZ, 64b66b)

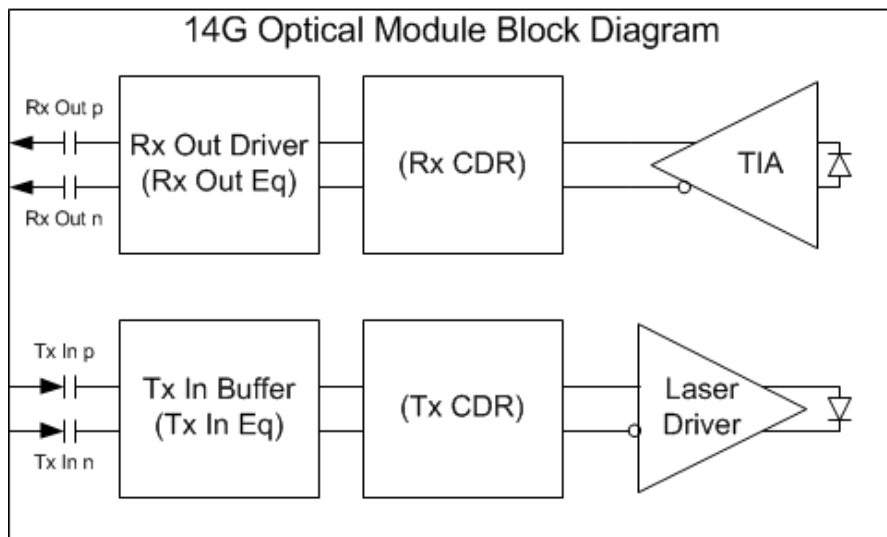
40GBASE-SR4 (10.3125 GBd/lane, NRZ, 64b66b)

100GBASE-SR10 (10.3125 GBd/lane, NRZ, 64b66b)

Discussion:

10G transceivers can be very simple. Input and output equalization are not assumed by relevant standards and if these functions exist they are vendor specific.

Block Diagram: 14G/Lane Transceivers



Released Specifications:

16GFC (14.025 GBd, NRZ, 64b66b)

Pre-initial-draft Specifications:

IB 4X FDR (14.0625 GBd/lane, NRZ, 64b66b)

IB 12X FDR (14.0625 GBd/lane, NRZ, 64b66b)

Discussion:

16G FC addresses the electrical and the optical interfaces of the transceiver.

CDRs are assumed in the Tx and Rx chains for shortwave MMF applications.

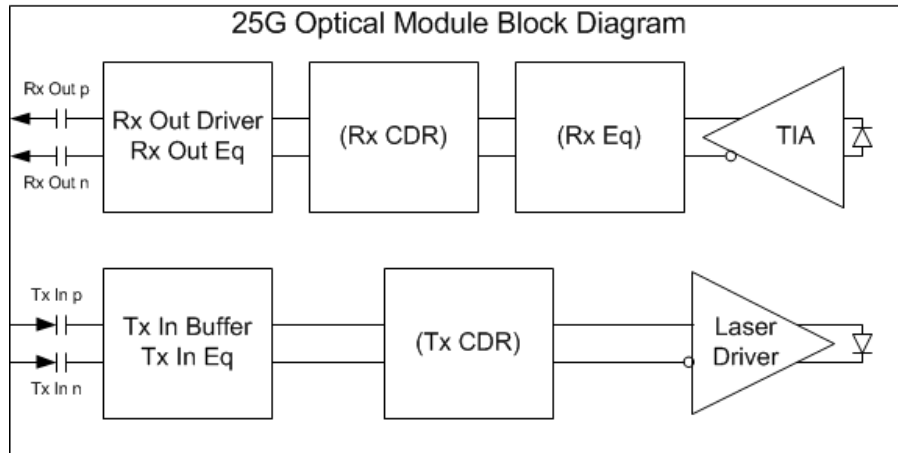
Equalizers are defined for the module electrical data inputs and outputs.

The electrical output has a tunable, unit interval spaced, 3-tap FIR filter.

The electrical input equalizer recovers data sent through an electrical channel with 20.5 dB insertion loss at 7.0125 GHz.

IB FDR only addresses the electrical interfaces and will try to avoid the need for any CDR in the module.

Expected Block Diagram: 25G/Lane Transceivers



Draft Specification:

CEI-28G-VSR (19.6 - 28.05 GBd/lane, NRZ, various)

Pre-initial-draft Specifications:

32GFC (28.05 GBd, NRZ, 64b66b)

IB 4X EDR (25.78425 GBd/lane, NRZ, 64b66b)

IB 12X EDR (25.78425 GBd/lane, NRZ, 64b66b)

100GBASE-SR4 (25.78425 GBd/lane, NRZ, 64b66b)

Discussion:

CEI-28-VSR addresses the electrical interfaces of the transceiver.

CDRs are assumed in the Tx and Rx chains, and equalizers are assumed at the module electrical data inputs and outputs – a CTLE in the Tx, and output equalization in the Rx.

32GFC will address the optical and electrical interfaces of the transceiver.

Currently, CDRs are expected in the Tx and Rx, and equalization in the electrical data inputs and outputs.

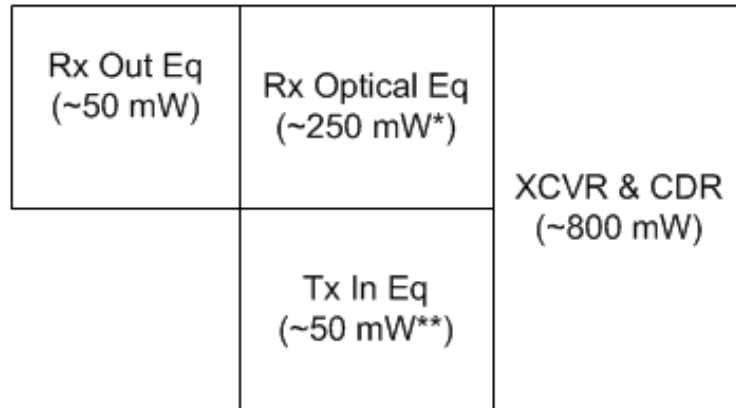
In addition, Rx optical equalization is likely to be required to meet the 100m OM4 reach targeted by the FCIA.

From FC PI 6 11-250v0, “Considerations for 32G Fiber Channel links” Jim Tatum, Jonathan King, Richard Johnson, David Cunningham

Link Distance Specification

- “It is possible to achieve ~50m on OM3 fiber without optical equalization
 - Assumes reasonable VCSEL and detector parameters
- With optical equalization, the FCIA goal of 70m is feasible
- In either case, electrical equalization is likely required”

MM XCVR Power Consumption Block Diagram



*Without adaption; add 250 mW for adaption when active.

**Eq power is a function of electrical channel loss.

Equalization or Not?

- With equalization we can achieve the FCIA requested 70m link distance on OM3, so what is the problem?
 - Increase in electrical power of 250mW in continuous operation, more at start up training
 - Achieving total transceiver power dissipation of <1W may not be possible given electrical equalization also may be required
 - Increase in complexity of speed negotiation and potentially other protocol
 - If the equalization is complex, it could add manufacturing test cost”

‘Question at FCIA

- Is the added power dissipation of optical equalization and protocol complexity (possibly requiring speed negotiation timing changes) worth increasing link distance from 50m to 70m on OM3 MM and/or link distance 70m to 100m on OM4 MM?
 - Transceiver power dissipation will likely exceed 1W/lane for MM.’

100G Next Gen Multi-Mode Optics: Next Steps

- Examine the 32GFC cases/conclusions to see if the gain from the expected lower signal rate for Next Gen 100GBE is available to spend on longer reach or lower power consumption or used up in the shift from a single lane module to multilane module.
- Explore elimination of the CDRs from the optics module.