Intel® 3.125Gbps Physical Medium Dependent Chipset

Intel® LXT37002 Vertical Cavity Surface Emitting Laser Driver, LXT37003 Laser Driver, LXT34001 Transimpedance Amplifier, LXT33002 Limiting Amplifier

developer.intel.com

Product Description

The accelerating growth of data traffic continues to push network managers toward higher bandwidth solutions. As a result, Gigabit Ethernet is being used to eliminate bottlenecks in the enterprise LAN environment. Similarly, SONET OC-48 is becoming the workhorse of the MAN access network. In delivering these technologies, OEMs are challenged by the need to reduce the cost per port while increasing port density.

To meet this challenge, Intel has developed the 3.125Gbps Physical Medium Dependent chipset for optical networking, providing high-performance transmit and receive amplifiers in a low-cost/low-power CMOS process. The Intel® 3.125Gbps Physical Medium Dependent chipset provides a high-bandwidth/low-power solution for optical-electronic interfaces. Innovative design techniques and a standard CMOS process combine to create a high-performance, low-cost chipset.

With performance up to 3.125Gbps, the Physical Medium Dependent components may be used in optical modules for Gbps Ethernet, SONET OC-48, 2G Fibre Channel, InfiniBand* 4X and a variety of other Very Short Reach (VSR) optical interconnect applications. The devices can also be used in the 10GBASE-LX4 and SW4 systems currently being defined by the IEEE 802.3ae committee.

The CMOS Advantage

CMOS technology provides a considerable power savings over bipolar alternatives and enables the realization of small form factor optical modules. Use of standard CMOS processes enables the devices to be manufactured at a lower cost compared to devices that depend on GaAs, SiGe or other bipolar process technologies.

Key Features

The Intel® Physical Medium Dependent chipset features four primary components:

- Intel® LXT37002 Vertical Cavity Surface Emitting Laser Driver
  - Maximum 40mA modulation current
  - Maximum 20mA bias current
  - Automatic power control
  - Available in 16-pin SSOP-EPP or die
- Intel® LXT37003 Laser Driver
  - Maximum 80mA modulation current
  - Maximum 80mA bias current
  - Automatic power control
  - Single 3.3V power supply
  - Available in 32-pin TQFP-EPP or die
- Intel® LXT34001 Transimpedance Amplifier
  - Single 3.3V power supply
  - Small signal transimpedance of 1.8kΩ
  - Input referred noise current of 420nA
  - Wide dynamic range of 6µA to 2mA
- Intel® LXT33002 Limiting Amplifier
  - Up to 3.125Gbps operation
  - Single 3.3V power supply
  - Input sensitivity of better than 8mV
  - Programmable loss of signal indicator
  - Available in 16-pin TSOP-EPP or die

Jitter performance is one of the key features of the chipset. Novel circuit architecture and careful control of noise and signal levels in the devices allow the chipset to meet the demanding jitter requirements of the ITU G.709 specification for SONET OC-48. The chipset also supports the jitter requirements defined in the emerging IEEE 802.3ae specification for 10Gbps Ethernet WWDM applications.

Combined, the Physical Medium Dependent chipset consumes less than 600mW of power, excluding laser bias and modulation current. Each device is offered in die form or plastic package to meet diverse customer needs. The device performance is guaranteed over a –40°C to +85°C operating range, making the 3.125Gbps Physical Medium Dependent chipset an ideal solution for carrier class telecommunication systems.

The LXT37002 has been optimized for driving high performance Vertical Cavity Surface Emitting Lasers. A power control function allows the laser driver to adjust both bias and modulation current to the laser and correct for temperature variations and aging. Fault detection circuitry monitors several internal references. The driver can be configured to automatically shut down until the power is cycled, if the laser power regulation cannot be maintained within +/- 20 percent.

The LXT37003 offers the same features and performance as the LXT37002, yet with modulation and drive currents that are sufficient for driving Fabry Perot (FP) and Distributed Feedback (DFB) laser diodes.

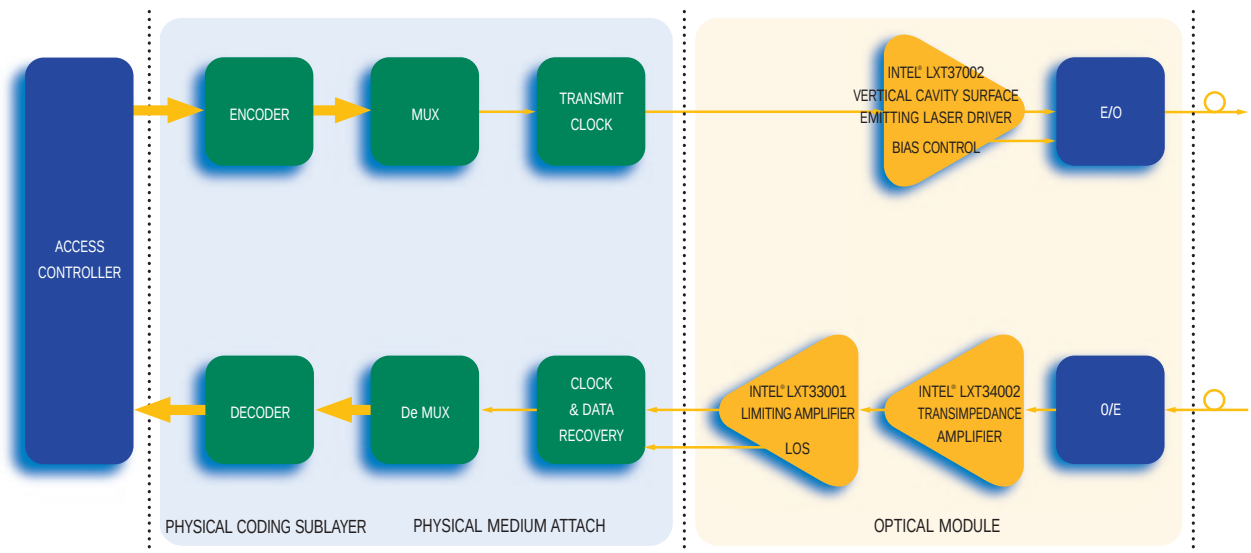
In the receive path, either a PIN or Avalanche photodiode is used to convert the optical input signal into an electrical current. The LXT34001 TIA converts the current into an electrical voltage. The chip features high dynamic range and is sensitive to currents as low as 6µA. An on-chip AGC function allows the TIA to handle signals as high as 2mA, while the output from the TIA may vary from a few mW to over 50mVpp. The LXT33002 Limiting Amplifier (LIA) boosts the signal to a sufficient level (600mVpp) to drive the subsequent Clock and Data Recovery (CDR) stage.

In the 10Gbps Ethernet WWDM applications, the Physical Medium Dependent function is essentially replicated four times to provide individual signal paths. Optical muxing is used to combine the four individual signal paths onto a single transmit fiber. Similarly, optical demuxing is used to separate the four signal paths from the corresponding fiber. Or, in the case of InfiniBand* 4X, parallel fiber may be used to transport each channel.

Key Applications

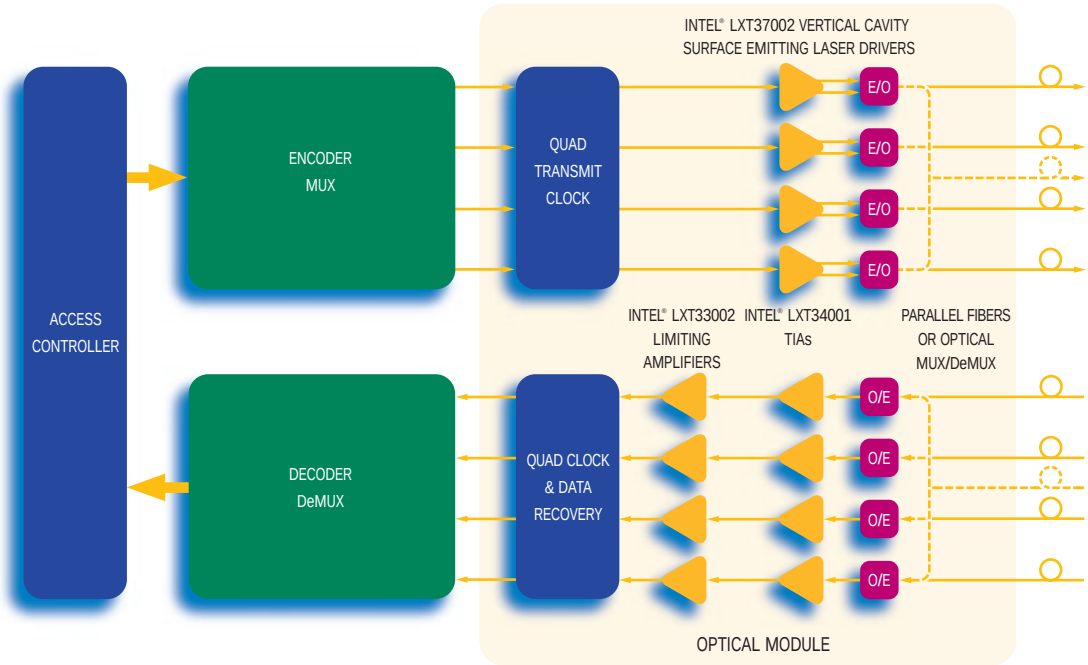
Optical Transceiver Modules

- 1GBASE-LX, SX
  - 10GBASE-LX4, SW4
- Fibre Channel FC-2
- SONET/SDH OC-48
- InfiniBand 4X
- Non-standard VSR modules



1.25/2.5/3.125Gbps Serial Transceiver

Features	Benefits
Chipset	
■ Low-power Physical Medium Dependent solution < 600mW for the chipset (excluding laser bias and modulation currents)	■ Reduced heat generation, enabling implementations within small form factor modules
■ -40C to +85C operating temperature	■ Suitable for “carrier class” telecommunication applications
■ CMOS implementation	■ Low-cost manufacturing
■ Devices available in either package or die form	■ Small implementation footprint for high density applications enables short chip interconnects for reduced parasitic inductance and capacitance and improved signal integrity
■ 3.125Gbps operation	■ Encompasses applications that require 1.25, 2.48 and 3.125Gbps line rates
■ 3.3V supply voltages	■ Compatible with the MSA SFP module specification for Fibre Channel, Gigabit Ethernet and SONET/SDH. Also, supports the preliminary 10GbE XGP and XENPAC module specifications



10Gbps WWDM Transceiver

LXT37002 Vertical Cavity Surface Emitting Laser Driver	
■ Drive current capability • Bias current > 20mA • Modulation current > 40mA	■ Sufficient for biasing and driving most commercial grade Vertical Cavity Surface Emitting Lasers
■ Low-power consumption < 150mW	■ Reduced heat generation, enabling implementations within small form factor modules
■ Broadband operation with fast rise and fall time (20% to 80%) < 90ps	■ Low jitter and open eye pattern at 3.125Gbps data rates
■ Low signal overshoot and undershoot < 15%	■ Low jitter and open eye pattern at 3.125Gbps data rates
■ Automatic power control	■ Stabilizes laser current (and power) against temperature variations and aging
■ High/Low bias alarm indicators	■ Indicates laser stability
■ Available in either die or 16-pin TSOP package	■ Minimal electrical parasitics

Features (continued)	Benefits (continued)
LXT37003 Laser Driver	
■ Drive current capability • Bias current > 80mA • Modulation current > 80mA	■ Sufficient for biasing and driving most commercial grade FP and DFB laser diodes
■ Low-power consumption < 270 mW	■ Reduced heat generation, enabling implementations within small form factor modules
■ Automatic power control	■ Stabilizes laser current (and power) against temperature variations and aging.
■ High/Low bias alarm indicators	■ Indicates laser stability
■ Available in either die or 32-pin TQFP package	■ Minimal electrical parasitics
LXT34001 Transimpedance Amplifier (TIA)	
■ High transimpedance gain Z_T >1.8KΩ	■ Increase the signal from the photodiode
■ Low-power consumption < 140mW	■ Reduced heat generation, enabling implementations within small form factor modules
■ Tolerant to photodiode capacitance of 0.8pF	■ Broadband operations with available photodiodes
■ Low input referred noise current	■ High signal to noise ratio
LXT33002 Limiting Amplifier	
■ High gain and wide bandwidth	■ Broadband operation
■ On-chip DC offset compensation	■ Increases sensitivity
■ Sensitivity to low input voltage < 8mV differential	■ High dynamic range at the receiver input
■ Low-power consumption < 300mW	■ Reduced heat generation, enabling implementations within small form factor modules
■ Broadband operation with fast rise and fall time (20% to 80%) < 120ps	■ Low jitter and open eye pattern at 3.125Gbps data rates
■ 0.6V output voltage swing	■ Interfaces with Current Mode Logic (CML)
■ Low differential input noise < 200uV	■ Good signal to noise ratio
■ Loss of signal function	■ Indicates when the receiver input is below a level required for a minimum Bit Error Rate (BER)
■ Available in either die form or 16-pin TSOP package	■ Allows optimal layout for small footprint and good signal integrity

Intel Access

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