Abstract:
A diplexer chip is formed through the monolithic integration of a 1310 nm surface-emitting Fabry-Perot laser, a monitoring photodetector, and a 1490 nm high-speed PIN detector.

The horizontal cavity surface-emitting laser (HCSEL) with perpendicular emission to the plane of the substrate was recently demonstrated [1]. This surface-emitting laser has been monolithically integrated with a monitoring photodetector as well as a 1490 nm receiving PIN detector to form a diplexer chip for use in Fiber To The Premises (FTTP) applications. The device is shown schematically in Figures 1 and 2.

An InGaAlAs based MQW laser structure is grown on top of an InGaAs p-i-n structure by MOCVD on semi-insulating InP substrates. A ridge-type HCSEL Fabry-Perot laser is fabricated using chemically assisted ion beam etching (CAIBE). The 45 degree etched mirror on the front facet reflects light out of the plane of the chip. Wet chemical etching is used in conjunction with etch stop layers to define the PIN detector.

Compared to other types of surface-emitting lasers, such as 1310 nm VCSELs, the HCSEL has an output power in excess of 10 mW over the -40 to 85°C temperature range. This power output is adequate for most premise side units of FTTP.

The diplexer chip is used in conjunction with two lenses and a dichroic beam splitter as shown in Figure 2. The dichroic beam splitter directs the 1490 nm signal from the fiber to the detector while allowing the 1310 nm laser light to pass through.

Optical isolation between output and input signals is a key factor in the performance of the diplexer chip. Depending on physical spacing between the output aperture of the laser and receiving photodetector on the chip, the upstream laser light can be isolated from the receive detector to better than 60 dB, as shown in Figure 3.

Summary:
We have demonstrated a novel and simple solution for FTTP applications using a monolithically integrated surface-emitting Fabry-Perot laser, MPD, and PIN detector fabricated using etched facet technology. The device offers a new cost-effective and compact option for performing the diplexer function. Optical isolation of over 60 dB between the laser and the receiving photodetector was obtained.

Alfred Schremer, Malcolm Green, Alan Morrow and the rest of the BinOptics technical team contributed to this work.

References:
Monolithically Integrated Diplexer Chip for FTTP

CNF Project # 924-01

Principal Investigator(s): Alex Behfar

User(s):
Cristian Stagarescu
Vinu Vainateya

Principal Investigator(s):
Alex Behfar

Affiliation(s):
BinOptics Corporation

Primary Funding:
BinOptics Corporation

Contact Information:
behfar@binoptics.com
stagarescu@binoptics.com
vainateya@binoptics.com

http://www.binoptics.com

- Fiber to the premises (FTTP).
- Diplexer chip for the premises side of FTTP.
- Monolithically integrated 1310 nm laser, monitoring photodetector, and high-speed 1490 nm detector.

Figure 1: Diplexer chip top view.

Figure 2: Diplexer chip and external optics cross-sectional view.

Figure 3: Laser to photodetector optical isolation.