Improvment of Multi well Quantum Vertical Cavity Surface Emitting Surface Laser (vcsel) Specification Considering the Quantity & Thickness Effect

Sadegh Khojasteh Mah Sayeh*,Abbas Ghadimi,

Vertical Cavity Surface Emitting Lasers (VCSELs) are highly desirable in cost-effective applications as the Gigabit Ethernet optical communication systems and recently in long haul and DWDM optical communication systems. Some of the VCSEL advantages are very low threshold current, single longitudinal mode operation, circular output beam, low cost manufacturing, and compatibility with on-wafer probe testing. However, despite of these benefits, they still exhibit a number of less desirable characteristic. For example, some intricate effects such as spatial hole burning, current spreading, and thermal gradient in cavity, which cause higher order modes supported by the cavity, relaxation oscillations and secondary pulsations in the turn-off transient [4], and thermal behavior are the most important limitations of VCSEL performance causing errors in the receiver.. Eye diagram is a common and powerful tool to investigate the performance of a digital communication system. Eye diagram can determine signaldisturbance, jitter, ISI, and noise. Actually, the more open eye means the better and higher quality signal. Unfortunately, some problems such as drastic dependency to temperature, low optical power, multi transverse mode operation and etc are in related with using VCSELs. Because of high power single mode laser requirement in long-haul optical communication applications, in this research a novel structure using two oxide layers with different aperture sizes and locations is proposed. Moreover, for improving modulation speed, an ion iplant area is used in proposed structure. Design and analysis methods of a lot of kinds of VCSELs are investigated and their advantages and drawbacks are discussed as well. Another problem of VCSELs is lack of a comprehensive and circuit level model for it.

So a more complete model is suggested here involving important effects such as self-heating, satial hole burning, thermal lensing, self focusinf and etc. Moreover, some solutions are proposed to minimize the effect of these unwanted phenomena. our knowledge, no one model thermal lensing and self focusing. The static and dynamic behaviour of VCSEL is investigated and modulation responses of vertical modes are inspected. Then the model is changed to an HSPICE model which is very useful for driver design. Another feature of this model is a superior electrical model for VCSEL. Influence of current shaping is investigated using HSPICE VCSEL model. Finally, the impact of every kind of low pass filters on output eye diagram is investigated and the performance of VCSEL is improved by optimizing band width of every filter.

Keywords : Keywords: VCSEL, Single mode power, Spatial hole burning, Thermal lensing, Self focusing