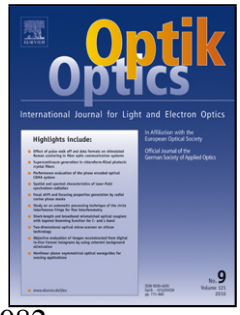

Title: An OE-VLSI for Parallel Optical Interconnection

Authors: Miao Peng, Tian Ling, Wang ZhiGong

PII: S0030-4026(17)30486-2
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2017.04.082
Reference: IJLEO 59124

To appear in:

Received date: 8-6-2014
Revised date: 23-4-2017
Accepted date: 23-4-2017

Please cite this article as: Miao Peng, Tian Ling, Wang ZhiGong, An OE-VLSI for Parallel Optical Interconnection, Optik - International Journal for Light and Electron Opticshttp://dx.doi.org/10.1016/j.ijleo.2017.04.082

An OE-VLSI for Parallel Optical Interconnection

Miao Peng*, Tian Ling, Wang ZhiGong

Institute of RF-&OE-ICs of Southeast University, Nanjing, 210096, China

*Corresponding author. Tel.:+86-25-83793303-8006; fax:+86-25-83792882.

Email address: miaopeng123@seu.edu.cn

Abstract - This paper presents a prototype OE-VLSI (Optoelectronic-VLSI) with 12-channel input and output ports for optical parallel link applications. The OE-VLSI comprises of a 12-channel parallel VCSEL (Vertical Cavity Semi-conductor Laser) array and a 12-channel parallel Photo Diode array, a CPU, a 12-channel VCSEL driver array and a 12-channel optical front-end amplifier. The 12×10Gbps VCSEL driver array and the optical front-end amplifier array are fabricated in 0.18μm CMOS technology. The chip was partitioned into 12 parallel channels to demonstrate chip-to-chip interconnection functions appropriate for applications of OE-VLSI technology. The OE-VLSI chip has been validated on an optical parallel transmission system with bit-error-rate BER less than 10^{-12} and an aggregate 120Gpbs bandwidth.

Key Words: OE-VLSI; Optical-interconnect; VCSEL; Parallel transmission

1. Introduction

With the rapid development of VLSI manufacture technology, the semiconductor industry is continuously trying to increase the size of the MOS circuit. On the other hand, the minimum feature size continues to shrink in. It is anticipated that the speeds of MOS circuits will soon be limited by interconnection delays,
rather than gate delays[1]. Since the OPTOELECTRONIC-VLSI (OE-VLSI) technology had been put forward by J. W. Goodman in 1984, significant progress has been made. It begins to take the place of electrical interconnection in computer and telecommunication system. Interconnection between VLSI chips is easily influenced by distributed parameters caused by metal wires, which are regard as unterminated RC transmission lines[2-3]. Influenced by capacitance of electric wiring per unit length, the transmission speed, distance and the load support capability are limited. What's more, the electric connection has made crosstalk a serious concern.

On the country, optical communication has many advantages over electrical interconnection such as higher bandwidth, lower power consumption, shorter delay, stronger anti-interference ability, and higher load capacity characteristics and so on. The interconnection between ICs could be realized by OE-VLSI technology. Many issues in long distance optical transmission could be neglected, such as dispersion, fiber attenuation and non-linearity etc. Moreover, laser source requirements could be reduced.

OE-VLSI technology associates with utilizing 850nm cavity surface emitting laser (VCSEL)-based transmitter arrays for parallel high speed data links output. The first VCSEL was fabricated by Prof. Kenichi Iga in 1979[4]. As a new type of semiconductor laser, its beam is