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Electronic ICs supporting high-speed optical transceivers for short-reach applications

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We present progress on high-speed driver and receiver integrated circuits intended for high-capacity short-reach links inside data centres. Optical transceivers for these applications need to provide high baud rates, while being highly energy efficient (<<10pJ/bit) and occupy small physical footprints. Realization of such electronics in a CMOS process offers the advantage of monolithic integration with large-scale digital chips. The low (<1V) breakdown voltage of the transistors in deep sub-micron CMOS limits the achievable drive voltage, which may limit the optical modulation amplitude. At the receiver side, it can be difficult to achieve low-noise, high gain and wideband amplification. Integration into a large-scale digital chip will require consideration of crosstalk due to logic switching activity. In case analog performance is important then SiGe BiCMOS processes can be considered. Driver circuits need to generate sufficient current or voltage swing into or across the electrical load presented by the optical modulator, possibly overcoming breakdown limitations of the used CMOS or SiGe BiCMOS processes. Examples developed for VCSELs (vertical cavity surface emitting lasers), Silicon Photonic microring resonators, electro-absorption modulators, lumped Silicon Photonic and Indium Phosphide travelling wave Mach-Zehnder modulators using deep sub-micron CMOS and SiGe BiCMOS technologies are given.

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