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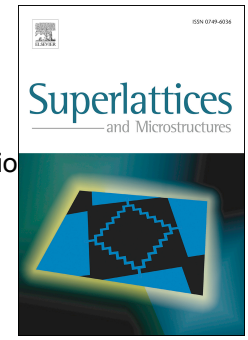

Dual delta tunnel FET: An energy efficient switch with improved current switching ratio and steeper subthreshold slope

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Dual delta tunnel FET: An energy efficient switch with improved current switching ratio and steeper subthreshold slope

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Abstract

In this paper, a single gate tunnel FET has been designed with two delta layers in both the source and channel regions. The width, position and doping concentration of both the delta regions are optimized to maximize the current switching ratio. The simulation work of the present DD-TFET device has been carried out by 2-D TCAD device simulator from Synopsys and the results are compared with the results of source delta doped TFET (SD-TFET), channel delta doped TFET (CD-TFET) and conventional TFET. The proposed device exhibits its superiority over other designs in terms of ON-state current, current switching ratio and subthreshold swing. Thus DD-TFET can be used as an energy efficient switch and has the potential to replace MOSFETs in high-speed and low-power applications.

Keywords

Delta doping, current switching ratio, subthreshold swing, TCAD.

1. Introduction

With continuous downscaling of the channel length, the bulk MOSFET devices experience various short channel effects (SCEs) such as drain induced barrier lowering (DIBL), surface scattering, velocity saturation, impact ionization and hot electron effect [1]. The OFF-state leakage current increases abruptly in the presence of SCEs due to the close proximity between source and drain [2]. Thus the device requires higher switching energy and large power consumption in the low-power applications [3]. It is a challenging job to restrict OFF-state current and limit the rise of subthreshold swing. In case of MOSFET, the electron injection over energy barrier is a thermionic process which unable to provide subthreshold swing (SS) below 60 mV/decade [4]. This makes it incompetent to be used as an energy efficient switch. In recent times, a number of researchers developed tunnel field effect