Equivalent circuit modeling of dual channel vertical strained SiGe impact ionization MOSFET (DC-VESIMOS)

Abstract

The dual channel of VESIMOS (DC-VESIMOS) have been analyzed using the Silvaco TCAD tools whereas the equivalent circuit modeling of DC-VESIMOS have been analyzed using the ORCAD PSPICE software. Strained SiGe technology is introduced because it is believed that it is able to lower down the high supply voltage that are needed by vertical and planar IMOS. A single channel of VESIMOS is proposed to solve the problem. Next, the dual channel of VESIMOS is invented to increase the performance of the device in carrier mobility besides lowering the supply voltage. In contrast, the device has better performance in carrier mobility rather than by using a single channel of the SiGe layer in the VESIMOS structure [21]. The structure is referred from the vertical IMOS [13] that has been proposed to solve problems from planar IMOS. In addition, the equivalent circuit model of the vertical IMOS structure is studied to describe the behavioral characteristic of the device with respect to its terminals which is MOSFET and Bipolar Junction Transistor (BJT). The device modeling of vertical IMOS is done and it is shown that the vertical IMOS works in three different modes which is a Conventional MOSFET (CMOS), Impact Ionization (II) and Bipolar Junction Transistor (BJT) modes. The dual channel device modeling is then simulated; the PSPICE simulation gives the same ION/IOFF ratio with the TCAD simulation which is 1013μA/μm. Besides that, the analysis of subthreshold slope shows that the performance analysis is 86.79% with the TCAD simulation.