

Mitigating breakdown voltage with dual channel Vertical Strained SiGe Impact Ionization MOSFET (VESIMOS)

Abstract

The Single and Dual Strained SiGe layer for Vertical Strained Silicon Germanium (SiGe) Impact Ionization MOSFET (VESIMOS) have been successfully analyzed in this paper. It is found that drain current for single (SC) and dual channel (DC) VESIMOS were increased sharply initially due to the presence of Germanium. Germanium has high impact ionization rates to ensure that the transition from OFF state to ON state is abrupt. However, breakdown voltage of the SC device was decreased from $BV = 2.9V$ to $2.5V$ by increasing the composition of Ge from 10% to 30%. The same characteristics were found for DC VESIMOS where $BV = 2V$ had decreased to $1.6V$ by varying the Ge composition. In short, the breakdown voltage which affected by the appearance of second SiGe channel and Ge composition was justified. Apart from that, with the presence of second SiGe channel, the switching speed and I_{ON}/I_{OFF} of the device were improved. It was found that the sub-threshold slope of SC and DC VESIMOS were inversely proportional to the breakdown voltage. Hence, DC VESIMOS can be promoted as extraordinary candidate for low power nanoelectronics device.