Enhancing equivalent circuit model of Dual Channel Vertical Strained Impact Ionization MOSFET (DC-VESIMOS) for biosensor applications

Abstract

Dual Channel Vertical Strained Impact Ionization MOSFET (DC-VESIMOS) device shows superb performance with lower subthreshold slope (S) value of 11.48mV/dec and high range of ON and OFF current of 10^{13} obtained which indicates fast switching behavior and low leakage current respectively by using Silvaco's TCAD. Besides that, high breakdown voltage, V_B of 2.45V is obtained which results in high reliability where the device become a promising candidates as a biosensor applications device. DC-VESIMOS demonstrated S value of 10.53mV/dec with supply voltage of V_{DS}=1.75V in circuitry level. A considerable high breakdown voltage (V_B=2.6V) and high ratio of I_{ON}/I_{OFF} indicates low leakage currents and good reliability. The input of K parameter determines device behavior and the best value selected is when K=5 when compared with the published experimental works. Increase in body doping concentration will decrease the ON voltage of the device. In many aspects, DC-VESIMOS performance revealed that it was a best candidate to become one of the low power and high performance based biosensor applications device in the future.