

## **Performance analysis of single and dual channel vertical strained SiGe impact ionization MOSFET (VESIMOS)**

### **Abstract**

Single Channel (SC) and Dual Channel (DC) Vertical Strained-SiGe Impact Ionization MOSFET (VESIMOS) has been successfully simulated and analyzed in this paper. Found out that SC VESIMOS operate in conventional MOSFET mode at  $V_{DS} = 1.75V$ , with 10% to 30% Ge mole fraction. However for Ge=50%, it's operated in Impact Ionization (II) mode with fast switching speed of subthreshold value,  $S=9.8$  mV/dec. A better performance in threshold voltage,  $V_{TH}$ ,  $S$  value and ION/IOFF ratio were found in DC VESIMOS as compared to SC VESIMOS. The  $V_{TH}=0.6V$ ,  $S=10.98$  mV/dec and  $I_{ON}/I_{OFF} = 1 \times 10^{13}$  were measured in DC VESIMOS with Ge=30% that clarify the advantage of DC utilization on VESIMOS device. These improvements were mainly due to the enhancement of electron mobility from 600  $m^2/V-s$  (first channel) to 1400  $m^2/V-s$  (second channel). The electron mobility was increased due to the splitting of conduction band valley into six fold where the electron mass are reduced in out of plane direction and thus enhanced the mobility of electron.