ABSTRACT

Multi-gate structures are one of the potential solutions to mitigate the Short Channel Effects (SCEs) faced by the planar MOSFET devices. Among multi-gate structures, Silicon Nanotube Field Effect Transistor (SiNT-FET) is the latest version which has two gates namely inner gate and outer gate. Since the inner and outer gates are controlling the tubular channel of SiNT-FET, the device has enhanced performance in terms of excellent immunity to SCEs. Many aspects of the tube structures like junctionless operation, independent gate operation, impact of process variations are yet to be studied.

The following variations of the Silicon nanotubes are explored in this work.

- Junctionless SiNT-FET
- SiNT FET with independent gate operation
- Tunneling operation on junctionless SiNT FET

Apart from these, the impact of various structural parameters of the SiNT-FET is also investigated. Junctionless SiNT-FETs offer excellent immunity to SCEs among multi-gate structures. Tube wall thickness of SiNT-FETs offers one more degree of freedom to get lower OFF current. Asymmetric inner and outer gate structure of SiNT-FET provides the asymmetric characteristics in the independent gate operation.
Tube structures can be used as tunnelling devices with lower sub-threshold swing, and lower OFF current (both PIN and junctionless structures). Process variation study of the tube structure suggests that the outer diameter of the tube is the most sensitive parameter.