World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:15, No:12, 2021

Next Generation of Tunnel Field Effect Transistor: NCTFET

Authors : Naima Guenifi, Shiromani Balmukund Rahi, Amina Bechka

Abstract : Tunnel FET is one of the most suitable alternatives FET devices for conventional CMOS technology for low-power electronics and applications. Due to its lower subthreshold swing (SS) value, it is a strong follower of low power applications. It is a quantum FET device that follows the band to band (B2B) tunneling transport phenomena of charge carriers. Due to band to band tunneling, tunnel FET is suffering from a lower switching current than conventional metal-oxide-semiconductor field-effect transistor (MOSFET). For improvement of device features and limitations, the newly invented negative capacitance concept of ferroelectric material is implemented in conventional Tunnel FET structure popularly known as NC TFET. The present research work has implemented the idea of high-k gate dielectric added with ferroelectric material on double gate Tunnel FET for implementation of negative capacitance. It has been observed that the idea of negative capacitance further improves device features like SS value. It helps to reduce power dissipation and switching energy. An extensive investigation for circularity uses for digital, analog/RF and linearity features of double gate NCTFET have been adopted here for research work. Several essential designs paraments for analog/RF and linearity parameters like transconductance(gm), transconductance generation factor (gm/IDS), its high-order derivatives (gm2, gm3), cut-off frequency (fT), gain-bandwidth product (GBW), transconductance generation factor (gm/IDS) has been investigated for low power RF applications. The VIP_2, VIP_3, IMD_3, IIP_3, distortion characteristics (HD2, HD3), 1-dB, the compression point, delay and power delay product performance have also been thoroughly studied.

Keywords : analog/digital, ferroelectric, linearity, negative capacitance, Tunnel FET, transconductance
Conference Title : ICLPEA 2021 : International Conference on Low Power Electronics and Applications
Conference Location : Paris, France
Conference Dates : December 30-31, 2021