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Study of Drain Characteristics of N-Channel MOSFET with Varying Impurity Concentration - A Comparative Study

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Abstract: *In this work, n-channel MOSFETs of varying Boron doping profiles, using Silvaco TCAD tools namely Athena and Atlas, have been analysed. The fabrication of nMOS has been done through a series of fabrication steps, which include wafer selection with appropriate orientation and phosphorus doping, oxide diffusion, boron-implantation for p-well formation, polysilicon deposition, phosphorus-implantation for heavily doped n+- regions, aluminium-deposition for source/drain contact and extraction of unused materials. All of these steps have been performed through the Athena tool. Afterward, Atlas performs several simulations to deduce the transfer characteristics curves (the I_D-V_{GS} curves). Performance parameters of MOSFETs of varying doping profiles, such as Threshold Voltage (V_{TH}), Trance-conductance, and channel length modulation have been compared. These simulation-based analyses provide a better understanding of an nMOS device's fabrication process and a clearer physical insight into its characteristic curves and performance parameters.*

Keywords: Doping, Threshold Voltage, trance-conductance, channel length modulation

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