

Ballistic Saturation Velocity Modelling Beyond Ohm's Law

Abstract

The ballistic saturation velocity models were presented and its impact towards the failure of Ohm's law was evaluated on nano-circuits design. The ballistic transport is predicted in the presence of high electric field and its behavior is characterized by an onset of the critical voltage, V_c . 5- μ m resistor shows deviation from Ohm's law for relatively low voltages above $V_c = 1.9$ V. When applied to the voltage division and current division circuits, the lower-length resistors are found to have higher resistance as compared to higher-length resistor even if their ohmic values are the same. Consequently, the power consumption will not only be lower, but also will have a linear behavior that affects the figure of merit with tradeoff between frequency and power in nano-circuits. The results presented can have profound effect on characterization and performance evaluation of nano-circuits being considered for various applications.