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Full Band Monte Carlo Simulation of $In_{0.7}Ga_{0.3}As$ Junctionless Nanowire Field Effect Transistors.[1] RAGHURAJ HATHWAR, MARCO SARANITI, STEPHEN GOODNICK, Arizona State University — Junctionless nanowire FETs (JNFETs) have gained popularity since its demonstration by the Tyndall Institute. The device is relatively simple to fabricate, with good scaling behavior, making it a promising next-generation technology for the end of the semiconductor roadmap. Simulations of such devices have either involved a simplified assumption on the band structure of the nanowire or by using a fully quantum mechanical approach such as the non-equilibrium Green's function (NEGF) method which is computationally expensive. In the present work we implement a full band Monte Carlo simulation coupled with a Schrödinger solver to simulate quantum confinement effects and phonon limited dissipative transport in such devices. The Schrödinger equation is solved by using the semi-empirical $sp^3d^5s^*$ Tight Binding (TB) model including spin. The charge carriers are treated as particles moving freely along the axis of the nanowire and confined along the transverse directions. Polar optical phonon scattering rates and deformation potential scattering rates are calculated within the TB framework. A new way to calculate the polar optical phonon scattering rates from the TB coefficients is also presented.

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