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Title:A computational study of high-frequency behavior of graphene field-effect transistors

Authors:Chauhan, Jyotsna (1); Liu, Leitao (1); Lu, Yang (1); Guo, Jing (1)
Author affiliation:(1) Department of Electrical and Computer Engineering, University of Florida, Gainesville, FL 32611-6130, United States
Corresponding author:Chauhan, J.

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Abstract:High Frequency potential of graphene field-effect transistors (FETs) is explored by quasi-static self-consistent ballistic and dissipative quantum transport simulations. The unity power gain frequency f<inf>MAX</inf> and the cut-off frequency f<inf>T</inf> are modeled at the ballistic limit and in the presence of inelastic phonon scattering for a gate length down to 5 nm. Our major results are (1) with a thin high-κ gate insulator, the intrinsic ballistic f<inf>T</inf> is above 5 THz at a gate length of 10 nm. (2) Inelastic phonon scattering in graphene FETs lowers both f<inf>T</inf> and f <inf>MAX</inf>, mostly due to decrease of the transconductance. (3) f <inf>MAX</inf> and f<inf>T</inf> are severely degraded in presence of source and drain contact resistance. (4) To achieve optimum extrinsic f<inf>MAX</inf> performance, careful choice of DC bias point and gate width is needed. © 2012 American Institute of Physics.

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