Abstracts

Theoretical Comparison of 0.35µm Gate Length GaAs and GaInAs HEMTs

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We present a theoretical study of the performance of nearly identical 0.35 µm gate length HEMTs made from three different materials systems, GaAs/Al/sub 0.32/Ga/sub 0.68/As, In/sub 0.15/Ga/sub 0.85/As/Al/sub 0.15/Ga/sub 0.85/As, and Ga/sub 0.47/In/sub 0.53/As/Al/sub 0.48/In /sub 0.52/As. The calculations are made using an ensemble Monte Carlo simulation which includes the full details of real space transfer, the transport properties of the two-dimensional electron gas, nonstationary transport, and the two-dimensional electric field profile through the self-consistent solution of the Poisson equation. The performance of each device type, measured in terms of the current-voltage characteristic, transconductance, and cutoff frequency is compared. In this way, the effects of the material parameters on the device performance can be completely isolated and as such independently ascertained. It is found that the InGaAs-based devices well outperform the "conventional" GaAs/AlGaAs device, consistent with recent experimental measurements. Of the three devices, the GaInAs/AlInAs structure provides the highest frequency performance and delivers the greatest current.

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