Abstracts

Air-bridged gate MESFET: a new structure to reduce wave propagation effects in high-frequency transistors

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In conventional microwave transistors, the gain and output power are significantly reduced by gate ohmic resistance and phase cancellation. The air-bridged gate (ABG) transistors overcomes both problems by providing larger gate cross section along the propagation direction of the signal, and keeping both the input and output signals in phase along the device width. The performance of the air-bridged and conventional transistor is evaluated from both dc and radio-frequency (RF) points-of-view. A full hydrodynamic transport model, which accurately describes the electron dynamics in short channel devices, is used in the dc analysis. For RF analysis, a full-wave model, capable of capturing all important high-frequency effects, such as wave-particle interactions and traveling-wave effects, is implemented. This model is based on the coupling of the hydrodynamic transport equations with Maxwell's equations. Results related to the traveling-wave effects in conventional and ABG devices, such as phase mismatch and gain reduction at high frequencies, are illustrated, From these results, we show that the ABG metal-semiconductor field-effect transistor (MESFET) has superior performance at very high frequency as compared to conventional planar MESFETs.

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