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Author

Aslan B. Eastman LF.

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A THz-range planar NDR device utilizing ballistic electron acceleration in GaN

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Abstract

A planar and ultra-short gallium nitride (GaN) diode structure is investigated as a potential Terahertz (THz) range negative differential resistance (NDR) diode. An empirical velocity-field relation, exhibiting a peak electron velocity as high as 7 x 10(7) cm/s, is employed to characterize the high-field transport in the simulations, accounting for ballistic electron acceleration and velocity reduction due to phonon build up. The resulting device operation is in accumulation-layer transit-time mode and large-signal circuit simulation results are reported along with discussions. Conversion efficiencies up to similar to 3.4% at similar to 1.5 THz are shown to be possible.