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标题: Performance of Gate-All-Around Tunneling Field-Effect Transistors Based on Si1-x Ge-x Layer
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摘要: Electrical performances of gate-all-around (GAA) tunneling field-effect transistors (TFETs) based on a silicon germanium (Si1-xGex) layer have been investigated in terms of subthreshold swing (SS), on/off current ratio, on-state current (I-on). Cut-off frequency (f(T)) and maximum oscillation frequency (f(max)) were demonstrated from small-signal parameters such as effective gate resistance (R-g), gate-drain capacitance (C-gd), and transconductance (g(m)). According to the technology computer-aided design (TCAD) simulation results, the current drivability, f(T), and f(max) of GAA TFETs based on Si1-xGex layer were higher than those of GAA TFETs based on silicon. The simulated devices had 60 nm channel length and 10 nm channel radius. A GAA TFET with x = 0.4 had maximum I-on of 51.4 mu A/mu m, maximum f(T) of 72 GHz, and maximum f(max) of 610 GHz. Additionally, improvements of performance at the presented device with PNPN junctions were demonstrated in terms of I-on, SS, f(T) and f(max). When the device was designed with x = 0.4 and n(+) layer width (W-n) = 6 nm, it shows I-on of 271 mu A/mu m, f(T) of 245 GHz, and f(max) of 1.49 THz at an operating bias (V-GS = V-DS = 1.0 V).
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