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(57) Abstract :
 QUANTUM DOT INTEGRATION IN MOSFETS: ULTRA-SCALED NANO-ELECTRONICS FOR ENERGY-EFFICIENT CIRCUITRY DESIGN ABSTRACT The invention relates to a metal-oxide-semiconductor field-effect transistor device (100), consisting of a semiconductor substrate (102), a gate dielectric layer (104) formed on the semiconductor substrate, a gate electrode (106) formed on the gate dielectric layer, and a source-drain region. Quantum dots are integrated into the gate dielectric layer, identified by reference numeral (104), thereby significantly enhancing device performance through improved charge carrier confinement and tunability. The fabrication method for these quantum dot-integrated MOSFETs involves distinct steps with corresponding reference numerals: (a) forming a semiconductor substrate (102); (b) depositing a gate dielectric layer (104) on the semiconductor substrate; (c) introducing quantum dots into the gate dielectric layer; (d) forming a gate electrode (106) on the gate dielectric layer; and (e) creating source-drain regions. This method ensures the production of MOSFET devices with integrated quantum dots (104), marked by reference numerals, resulting in superior performance and energy efficiency for ultra-scaled nano-electronics.

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