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Scaling Laws for NanoFET Sensors QI-HUO WEI, FU-SHAN ZHOU, Liquid Crystal Institute, Kent State University — In this paper, we report our numerical studies of the scaling laws for nanoplate field-effect transistor (FET) sensors by simplifying the nanoplates as random resistor networks. Nanowire/tube FETs are included as the limiting cases where the device width goes small. Computer simulations show that the field effect strength exerted by the binding molecules has significant impact on the scaling behaviors. When the field effect strength is small, nanoFETs have little size and shape dependence. In contrast, when the field-effect strength becomes stronger, there exists a lower detection threshold for charge accumulation FETs and an upper detection threshold for charge depletion FET sensors. At these thresholds, the nanoFET devices undergo a transition between low and large sensitivities. These thresholds may set the detection limits of nanoFET sensors. We propose to eliminate these detection thresholds by employing devices with very short source-drain distance and large width.

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