Concluding a noisy debate

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The 1/*f* noise in semiconductor components is well documented, enthusiastically explored, and definitely feared. There are two distinct camps in the 1/*f* world. For McWhorter's partisans, there is no doubt that the noise originates from fluctuations in the carrier number. In MOS devices for example, carrier trapping is related to the presence of slow traps in the gate oxide. MOSFET results accumulated for years are rather convincing in this respect, except for Hooge and disciples. For them, there is even less doubt that the 1/*f* noise in semiconductor devices proceeds from carrier mobility fluctuations. The universality of 1/*f* noise is actually packed in an empirical model.

The aim of our paper is to show that the G^4-FET SOI transistor is a competent referee for this rivalry. The G^4-FET has four independent gates, offering tremendous versatility of operation. In depletion-all-around mode (Fig. 1, left), the channel is merely a wire composed of majority carriers. The key point is that the carriers flow in the volume, being safely separated from the Si/SiO_2 interface by depletion *and* inversion regions. There is no possible carrier trapping in the oxide, and indeed the 1/*f* noise does feature the pattern predicted by Hooge. However, by changing the top gate bias, an accumulation channel can be formed at the front interface (Fig. 1, right). This triggers a sudden increase in noise. Even more spectacular is the chameleon-like metamorphosis of the noise, which now reflects the McWhorter model.

Besides this first fundamental demonstration of the noise transformation, we discuss potential applications for low-noise G^4-FET circuits. What about the conclusion of the noisy competition between the two camps? One set each.

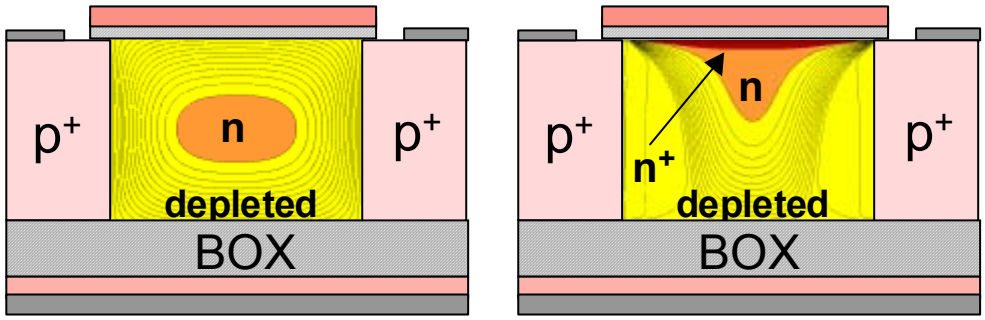

FIG. 1. Cross-section of the G^4-FET channel. The noise transforms from mobility fluctuations (Hooge) to number fluctuations (McWhorter) when the channel is moved from the volume towards the surface.