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A specific floating-body effect in fully depleted SOI MOSFETs with ultra-thin gate oxide

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Abstract

Transconductance measurements are performed on advanced fully depleted SOI MOSFETs and reveal a new floating-body effect. Gate tunneling current is responsible for the body charging and may lead to the onset of a strong second peak in front-gate transconductance. This effect occurs at low drain voltage and can be modulated by the back gate bias. We have investigated the size and the temperature (down to 100 K) dependence of the peak magnitude. A qualitative analytical model describes the onset and experimental behavior of the second transconductance peak.
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Keywords: Silicon-on-insulator; Tunneling; Floating-body effect

1. Introduction

Fully depleted (FD) SOI MOSFETs, combining very thin silicon films with ultra-thin gate oxides, are promising advanced devices. Parasitic floating-body effects (FBEs) are generally associated with partially depleted (PD) transistors. On the contrary, two conditions may be achieved in FD transistors which normally guarantee the absence of FBEs: full depletion, no impact ionization. Our work demonstrates that none of these conditions is sufficient when the gate tunneling current becomes large enough to charge the body.

2. Experimental results and discussion

2.1. Transconductance measurements

Measurements were performed on advanced SOI transistors fabricated in CEA-LETI featuring 10–18 nm film thickness (t_{si}), 2 nm thick gate oxide (t_{ox1}), 400 nm thick buried oxide (t_{BOX}). Fig. 1 shows the front-channel transconductance curves, $g_m(V_{G1})$, measured at low drain voltage, as the back-gate bias V_{G2} is driven from depletion to accumulation, for various *p*- and *n*-MOSFETs. The lateral shift of these curves was expected and

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