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Current Status and Trends in RF SOI Material and Device

Current Status and Trends in RF SOI Material and Device

Performance of RF integrated circuit (IC) is directly linked to the analog and high frequency characteristics of the transistors, the quality of the back-end of line process as well as the electromagnetic properties of the substrate. This last decade Silicon-on-Insulator (SOI) MOSFET technology has demonstrated its potentialities for high frequency commercial applications pushing the limits of CMOS technology. Thanks to the introduction of the trap-rich high-resistivity SOI substrate on the market, the ICs requirements in term of linearity for RF switches, for instance, are fulfilled. Today partially depleted SOI MOSFET is the mainstream technology for RF SOI systems. Future generations of mobile communication systems will require transistors with better high frequency performance at lower power consumption. The advanced MOS transistors in competition are FinFET and Ultra Thin Body and Buried oxide (UTBB) SOI MOSFETs. Both devices have been intensively studied these last years. Most of the reported data concern their digital performance. In this lecture, their analog/RF behavior is described and compared. Both show pretty similar characteristics in terms of transconductance, Early voltage, voltage gain, self-heating issue but UTBB outperforms FinFET in terms of cutoff frequencies thanks to their relatively lower fringing parasitic capacitances. The use of specific RF test structures at the early stage of a technological node development is of first importance to analyze the transistor parasitic resistances and capacitances, the transistor cutoff frequencies, the self-heating, and the

substrate coupling and non-linear behavior. The relative impact of the transistor and the passive elements and interconnections on the small- and large-signal RF performance of SOI RF switches and other RF ICs will be presented.

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