

Implant-free quantum-well SiGe pFETs for future high-performance CMOS architectures

July 12 2011

Imec announces that it has successfully fabricated implant-free quantum-well (IF-QW) pFETs with an embedded silicon-germanium (SiGe) source/drain. These devices show an excellent short channel control and a record logic performance. A benchmark against various competing technologies showed competitive results. Finally, the device performance was also demonstrated at low operating voltages. These results prove that this device architecture is a viable option for the 16nm technology node and beyond.

Next-generation multimedia applications will require ICs that are at the same time very powerful and low power. One attractive option is to use high-mobility channels, for example using SiGe ([silicon-germanium](#)) with a high Ge content. However, further scaling of the gate length will require a better electrostatic gate control, and a low variability of the key electrical parameters. [Imec](#) and its partners have recently shown that the IF-QW concept with a buried SiGe channel meets these requirements while significantly improving the device performance.

Imec now presents the 2nd generation of SiGe45% IF-QW pFETs, processed on standard 300mm STI wafers. Compared to earlier IF-QW devices, the raised SiGe and Si [substrate](#) are recessed and replaced with a thick SiGe25% epi-layer to form the source/drain [electrodes](#). Also, imec has developed process modules that minimize local variations and maximize the device performance.

This has resulted in an excellent short channel control, with a drain induced barrier lowering of $\sim 110\text{mV/V}$ at 35nm-LG and a record $1\text{mA}/\mu\text{m}$ -Ion at -1V. For lower operating voltages, an increased performance was demonstrated. The devices were benchmarked at various operating voltages against state-of-the-art technologies such as SOI nFETs or SiGe-FET, showing at least equivalent results. These results show that SiGe IF-QW devices with embedded source drain form a promising architecture for integration on bulk Si, from the 16nm node onwards.

These results were obtained in cooperation with imec's key partners in its core CMOS programs Globalfoundries, INTEL, Micron, Panasonic, Samsung, TSMC, Elpida, Hynix, Fujitsu and Sony.

Provided by IMEC

Citation: Implant-free quantum-well SiGe pFETs for future high-performance CMOS architectures (2011, July 12) retrieved 10 April 2024 from <https://phys.org/news/2011-07-implant-free-quantum-well-sige-pfets-future.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--