Abstract Submitted
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Negative Differential Transconductance in Silicon Quantum Well MOSFET/Bipolar Hybrid Transistors[1] CLINT NAQUIN, MARK LEE, Univ of Texas, Dallas, HAL EDWARDS, TATHAGATA CHATTERJEE, GURU MATHUR, KEN MAGGIO, Texas Instruments, UNIV OF TEXAS, DALLAS/TEXAS INSTRUMENTS COLLABORATION — Introducing explicit quantum transport into Si transistors in a manner amenable to industrial fabrication has proven challenging. Hybrid field-effect / bipolar Si transistors fabricated on an industrial 45 nm process line are shown to demonstrate explicit quantum transport signatures. These transistors incorporate a lateral ion implantation-defined quantum well (QW) whose potential depth is controlled by a gate voltage (VG). Quantum transport in the form of negative differential transconductance (NDTC) is observed to temperatures >200 K. The NDTC is tied to a non-monotonic dependence of bipolar current gain on VG that reduces drain-source current through the QW. These devices establish the feasibility of exploiting quantum transport to transform the performance horizons of Si devices fabricated in an industrially scalable manner.

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