Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Fabrication and Characterization of Self-Aligned T-gate High-Purity Semiconducting Carbon Nanotube RF Transistors YUCHI CHE, ALEXANDER BADMAEV, PYOJAE KIM, University of Southern California, ALBORZ JOOYAIE, University of California, Los Angeles, CHONGWU ZHOU, University of Southern California, CHONGWU ZHOU'S NANOLAB TEAM — We applied the scalable self-aligned T-shaped gate design to semiconducting nanotube RF transistors. In this way, the channel length can be scaled down to 140 nm which enables quasi ballistic transport, and the gate dielectric is reduced to 2-3 nm aluminum oxide, leading to quasi quantum capacitance operation. As a result, our nanotube transistors exhibit excellent on-chip device performance and high linearity with channel length scaling down to 140 nm. With T-shaped gate structure, a cut-off frequency up to 22 GHz and power gain frequency of 10 GHz for separated nanotube transistor are achieved. The T-shaped gate design enables high-yield wafer-scale fabrication with controllable gate length scaling. Furthermore, we also characterized the linearity properties of nanotube transistors, with the 1-dB compression point measurement, in source/load pull setup, with positive power gain to our knowledge, for the first time. Above all, our work reveals that the semiconducting nanotube RF transistor is an interesting and promising direction in high frequency device and circuit exploration.

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Date submitted: 09 Nov 2012 Electronic form version 1.4