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Dual-Gated Carbon Nanotube Field-Effect Transistors with Tunable Polarities YU-MING LIN, JOERG APPENZELLER, PHAEDON AVOURIS, IBM T. J. Watson Research Center — In this paper, we present a novel design for carbon nanotube field-effect transistors (CNFETs). This design allows us to obtain a p-i-p (or n-i-n) doping profile along the tube. Our CNFET structure is based on a back-gated geometry. An additional middle gate electrode is patterned between the source and drain contacts, so that the segments of the nanotube near the source/drain contacts can be electrically and/or chemically doped in a self-aligned fashion. The potential of outer and middle nanotube segments is independently controlled by the back gate and middle gate, respectively. By controlling the potential of the nanotube in the outer regions, p- or n-type CNFETs can be obtained on the same device. The dual-gated CNFETs exhibit bulk switching behavior, rather than switching dominated by the Schottky barriers at the contacts, and show excellent performance close to theoretical limits.

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