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Top-gate Ge-Si$_x$Ge$_{1-x}$ core-shell nanowire field effect transistors with highly doped source and drain.[1] JUNGHYO NAH, E.-S. LIU, D. SHAHRJERDI, K. M. VARAHRAMYAN, S. K. BANERJEE, E. TUTUC, University of Texas at Austin — Semiconductor nanowires (NWs) field effect transistors (FETs) have been considered as candidates for aggressively scaled complementary metal-oxide-semiconductor (CMOS) devices. In particular, germanium (Ge) NW have been of interest thanks to their higher carrier mobility, compared to silicon (Si). Most of the reported semiconductor NW FETs up to date are measured on devices with metal (Schottky) contacts, where the carrier injection efficiency into the channel is significantly limited by the Schottky barrier at the metal/NW interface. Using low (3keV) energy boron ion implantation, we demonstrate here top-gate Ge-Si$_x$Ge$_{1-x}$ core-shell NW p-type FETs, with highly doped source (S) and drain (D). The highly doped, up to $\sim 10^{20}$ cm^3 levels, S/D areas of the NW FETs allow an efficient carrier injection into the NW and a low contact resistance. Compared to similar top gated NW FETs, but with undoped S/D and with metal-semiconductor contacts, the electrical characteristics of the top-gated NW FETs with doped S/D exhibit up to two orders of magnitude higher current, and an improved ON/OFF current ratio.

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