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Complementary-like semiconducting graphene logic inverters SONG-LIN LI, HISAO MIYAZAKI, KAZUHITO TSUKAGOSHI, National Institute for Materials Science, Japan, AKINOBU KANDA, University of Tsukuba, Japan — The application of graphene as a post-silicon channel material is an interesting but challenging topic due to its metallic nature and low switching ratio. It is expected that the condition would change if a sizeable band gap is introduced. Here we report the electrical characteristics of the first semiconducting graphene-based logic inverters. Free of doping, the p- and n- branches in the bipolar graphene transistors are delicately used as the complementary components required in logic devices. Within perpendicular electric fields, large transport band gap ($> 100\,\mathrm{meV}$) and high switching ratio (~ 200 at $77\,\mathrm{K}$) are obtained in bilayer graphene channels. Besides, a simple and high capacitive-efficiency top gate with natural alumina dielectric ($\sim 0.9\,\mu\mathrm{F/cm^2}$) is adopted and the operating bias is lowered within $2\,\mathrm{V}$. For the first time, > 1 voltage gain are extracted from graphene inverters. Voltage gain up to 8 and 2 are achieved at liquid-nitrogen and room temperatures, respectively. Importantly, a match between input and output voltage levels is realized, indicating the potential for direct cascading between multiple devices for future large-scale integration.

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