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Ultrathin dual-gated graphene p-n junction photodetectors NITYAN NAIR, NATHANIEL GABOR, QIONG MA, Massachusetts Institute of Technology, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Japan, WENJING FANG, JING KONG, PABLO JARILLO-HERRERO, Massachusetts Institute of Technology — Optoelectronic devices composed of atomically thin graphene and boron nitride membranes yield great promise for next-generation photonics and optoelectronic research, yet numerous fabrication challenges remain. We use chemical vapor deposited (CVD) graphene to produce atomically thin, local bottom-gates for high-quality exfoliated graphene optoelectronic devices. By incorporating CVD graphene instead of the more conventional silicon bottom-gate electrodes, we create very low-profile dual-gated field effect p-n junction devices with hexagonal boron nitride as the insulating gate dielectric layer. Combining electron-beam and photolithography techniques, we can shape the bottom-gates to locally modulate the carrier density in the active graphene layer. In addition to avoiding optical transmission through thick top-gate electrodes, our approach allows us to perform temperature dependent photoresponse measurements over various device length scales and with direct control of local electronic carrier densities.

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