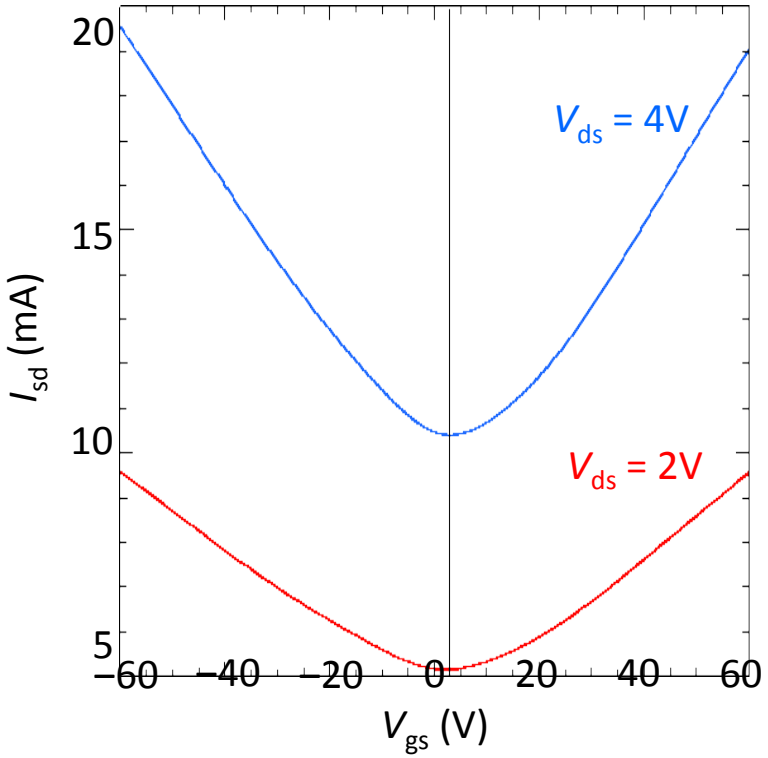
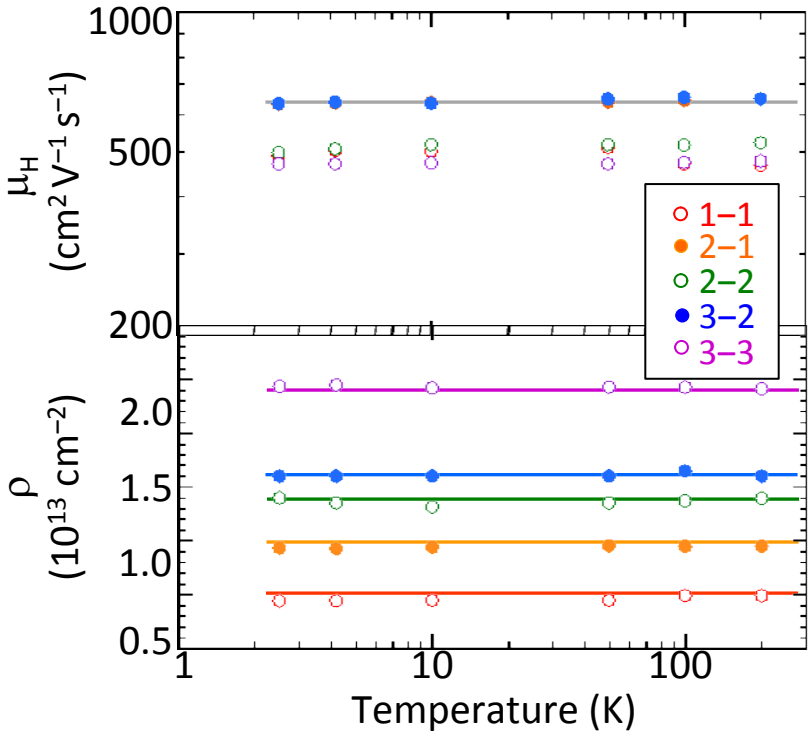
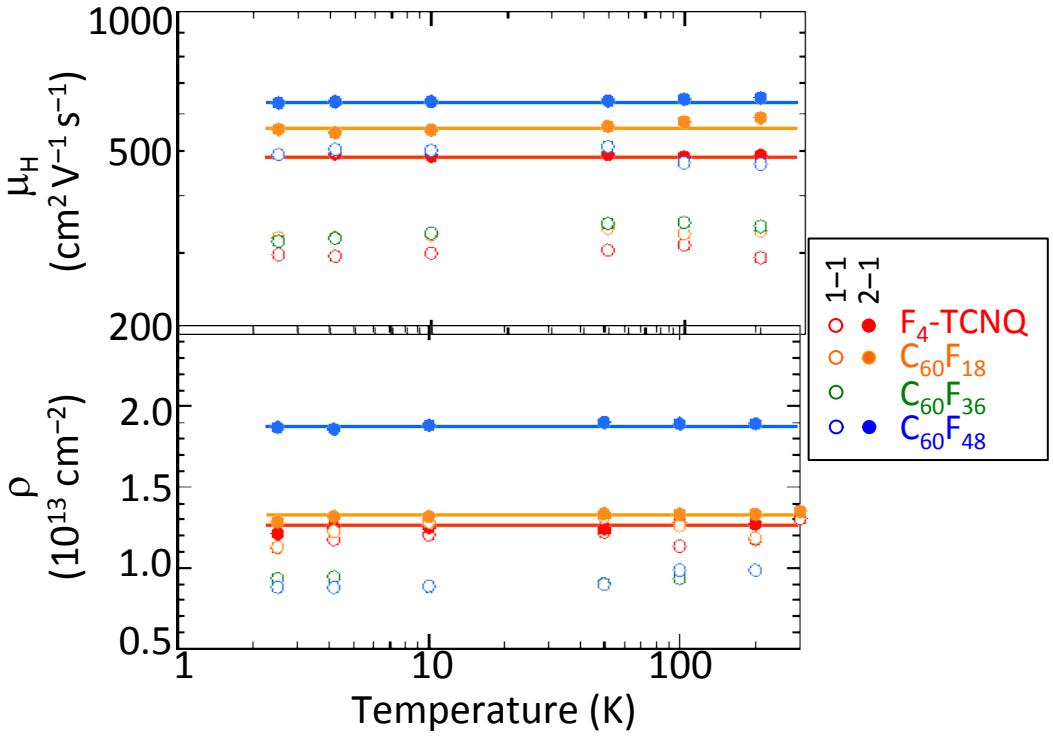
Electronic Supplementary Material (ESI) for Materials Horizons.



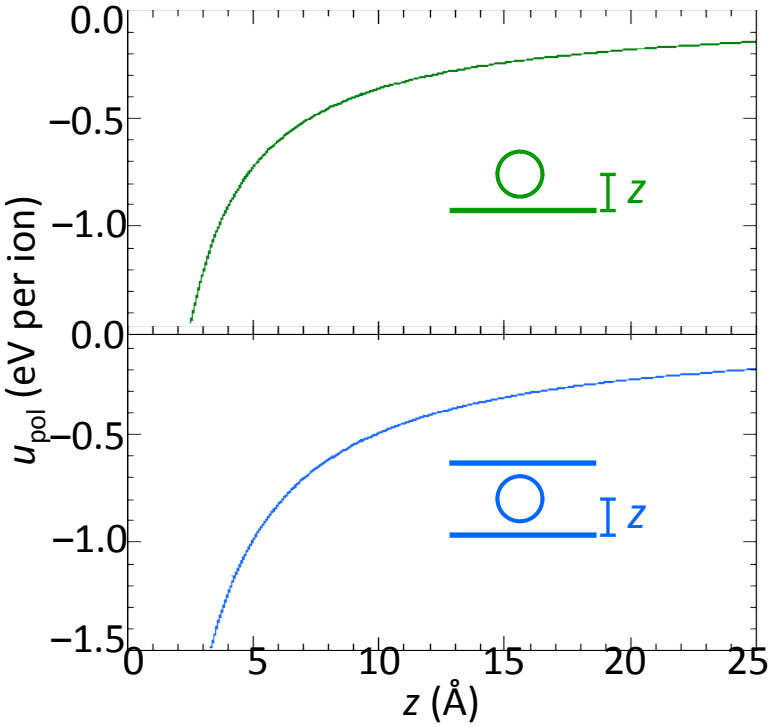
Supplementary Figure 1. Typical field-effect characteristics of a single CVD graphene sheet. Channel length, 40 mm; channel width, 1.2 mm; gate dielectric capacitance, 11.5 nF cm^{-2}. Gate dielectric, hexamethyldisilazane-treated 300-nm-thick SiO_2/ Si wafers. Back gate, p^+-doped Si; source–drain array, lithographically-patterned Au. Vertical line marks the neutrality point at +3 V.



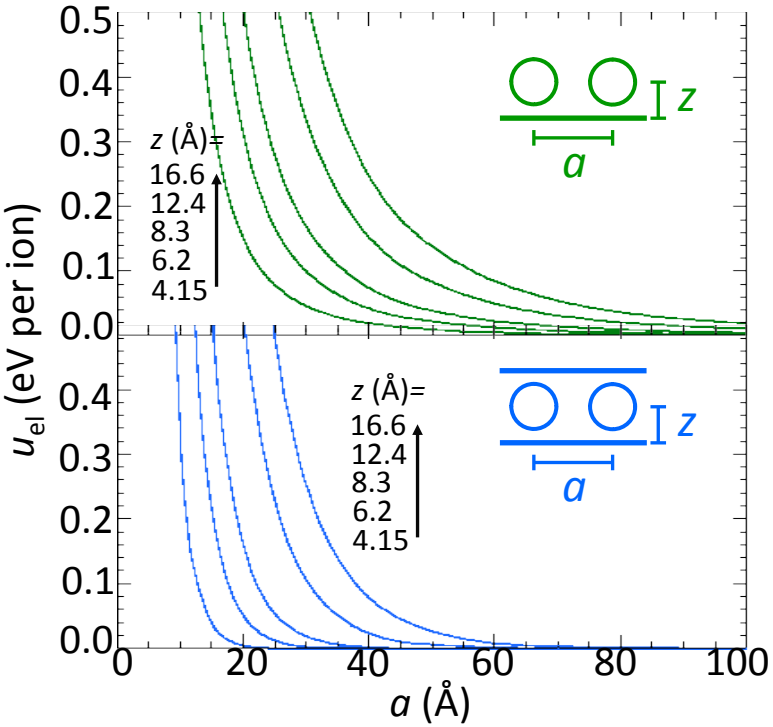
Supplementary Figure 2. Temperature dependence of Hall mobility (μ_H) and total hole density (ρ) for alternating graphene–$C_{60}F_{48}$ stacks. Stack index *n*-*m* gives number of G sheets *n* and A monolayers *m*.



Supplementary Figure 3. Temperature dependence of Hall mobility (μ_H) and total hole density (ρ) for graphene–acceptor stacks. Acceptors include $C_{60}F_{48}$, $C_{60}F_{36}$, $C_{60}F_{18}$ and F_4-TCNQ, for stack index 1–1 and 2–1.



Supplementary Figure 4. Electrostatic polarization energy in graphene/ dopant assemblies. Electrostatic polarization u_{pol}, computed for a singly-charged non-polarizable dopant ion located above a grounded perfectly-conducting sheet (top) or in a symmetrical sandwich between two grounded perfectly-conducting sheets (bottom). These two configurations represent the Coulomb interaction between the ionized acceptor and the hole in the graphene sheet. u_{pol} is obtained as the difference in electrostatic field energy for the free ion and when it is in the stated configuration, as a function of distance from ion center to conducting sheet mid-plane z. Vacuum permittivity is assumed in the space between the conducting sheets. For G/ $C_{60}F_{48}$, the relevant $z \approx 8.3$ Å. Negative energy corresponds to stabilization. Computation method is given in Supplementary Information S2.



Supplementary Figure 5. Ion–ion Coulomb interaction energy in graphene/ dopant assemblies. Mutual Coulomb interaction energy between singly-charged dopant ions located above a grounded perfectly-conducting sheet (top) or in a symmetrical sandwich between two grounded perfectly-conducting sheets (bottom). The array of ions are assumed to be distributed in a hexagonal lattice with primitive unit cell constant a for different ion center-to-conducting sheet mid-plane distance z. Nearly hard wall-like repulsion is observed with onset at $a \approx 6z$ and $3z$ in the surface and sandwich configurations, respectively. Positive energy corresponds to destabilization. Computation method is given in Supplementary Information S2.