

The 2D Materials ELECTRONICS Playbook



HIGH FREQUENCY FIELD-EFFECT TRANSISTORS

Advantages of using graphene nanoribbons

- . definite bandgap at room temperature
- . excellent switching speeds attainable
- . high carrier mobility



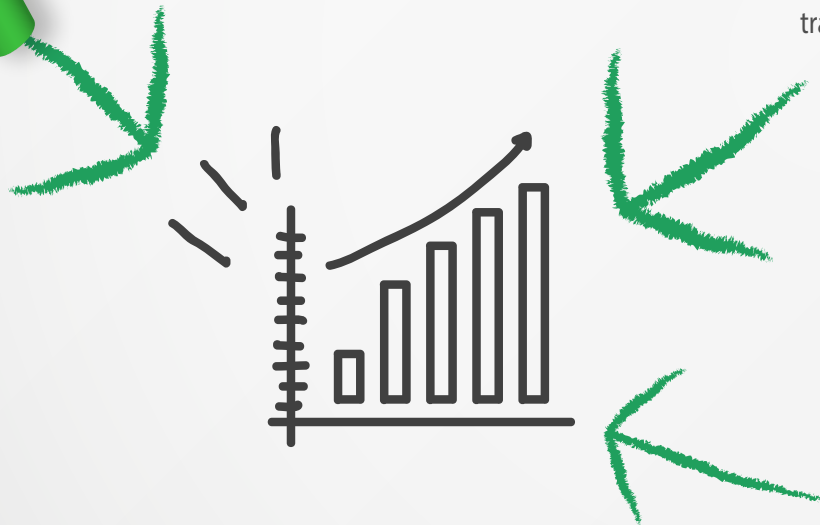
TRANSPARENT CONDUCTING ELECTRODES

Displays: LED, LCD backlights, flexible, touch screens

Others: Organic field-effect transistors, solar cells, smart windows, integrated circuit (IC) cards, electronic paper

Advantages of using monolayer graphene:

flexibility, durability, strain limit, sheet resistance, electrical conductivity, transparency, contact resistance, thermal/chemical/mechanical stability even with multiple bending cycles



RADIO FREQUENCY APPLICATIONS

Advantages of using bilayer graphene:

- . high power gain cutoff frequency
- . high output differential resistance
- . high intrinsic voltage gain



(A) AMBIPOLAR TRANSISTORS

(GRAPHENE FILM AND WS₂ FLAKES)

(B) TRANSISTORS FOR LOW POWER APPLICATIONS

(MOS₂ ON SiO₂ GATE OXIDE)

(a): full-wave rectifiers, frequency doublers, mixers, switches

. Advantages of using graphene- full-wave rectification, zero-volt threshold voltage, nearly 100% converting efficiency, reliability,

. Advantages of using WS₂: high on-off current ratio, current saturation over wide voltage range

(b) Advantages - relatively low mobility, large on-off current ratio, high degree of immunity to short channel effects, abrupt switching, photoswitching