ABSTRACT

An image sensor pixel array that includes a photoelectric conversion unit supported by a substrate of a first conductivity type. The photoelectric conversion unit may be a photodiode that comprises a second region of a second conductivity type disposed in the substrate and vertically below a gate electrode of a transistor. A first region of the first conductivity and under a top surface of the substrate is disposed above the second region. The first region supports a channel of the transistor. A color filter transmits a light that penetrates through the gate electrode and the first region to generate carriers to be collected by the second region. The color filter may be a red color filter or a green color filter or a yellow color filter. The light may be transmitted to the gate electrode via a light guide. The light guide may be on top of the gate electrode. The gate electrode may be part of a transfer gate, a reset switch, a select switch or a output transistor. The gate electrode may be thinner than a gate of a transistor in a periphery circuit outside the pixel array. The gate electrode may be made thinner by means of a wet etch. An etchant for thinning the gate electrode may be introduced through an opening in an insulating film on the substrate. The light guide may be formed in the opening after the thinning. An anti-reflection stack may be formed at a bottom of the opening prior to forming the light guide.