

Highly Sensitive PMOSFET Photodetector and Its Application to CMOS Active Pixel Sensor

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In this paper, a highly sensitive p-channel metal oxide field effect transistor (PMOSFET) photodetector fabricated using a standard complementary metal oxide semiconductor (CMOS) process is described. The photodetector is configured by the floating gate/n-well tied PMOSFET. The device has similar $I_{DS}-V_{DS}$ characteristics to a general PMOSFET when the incident light power instead of the gate voltage is supplied and has a transient response fast enough that there is no image lag in its application to an imager with television resolution. A 1×16 CMOS active pixel sensor using the PMOSFET photodetector was also designed and fabricated using 1-poly and 2-metal $1.5 \mu\text{m}$ CMOS technology. The unit pixel of this sensor consists of a PMOSFET photodetector and four n-channel metal oxide field effect transistors (NMOSFET). Its area is $86 \mu\text{m} \times 90.5 \mu\text{m}$ and fill factor is 12%. Even though the pixel has a relatively small its fill factor, a sufficient photocurrent can be obtained. A highly sensitive pixel is feasible with the use of the photodetector with current amplification and the pixel circuit with voltage gain.

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