

Design and Simulation of 3-Transistor Active Pixel Sensor Using MATLAB Simulink

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Abstract : There has been a growing interest in CMOS-based sensors technology in cameras as they afford low-power, small-size, and cost-effective imaging systems. This article describes the CMOS image sensor pixel categories and presents the design and the simulation of the 3-Transistor (3T) Active Pixel Sensor (APS) in MATLAB/Simulink tool. The analysis investigates the conversion of the light into an electrical signal for a single pixel sensing circuit, which consists of a photodiode and three NMOS transistors. The paper also proposes three modes for the pixel operation; reset, integration, and readout modes. The simulations of the electrical signals for each of the studied modes of operation show how the output electrical signals are correlated to the input light intensities. The charging/discharging speed for the photodiodes is also investigated. The output voltage for different light intensities, including in dark case, is calculated and showed its inverse proportionality with the light intensity.

Keywords : APS, CMOS image sensor, light intensities photodiode, simulation

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