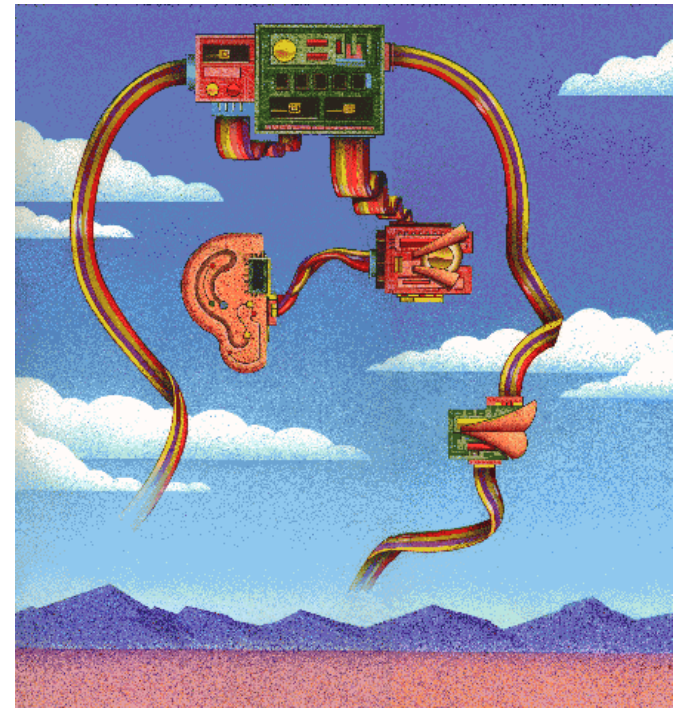


Make a Chip that Sees System Architecture Interactive

Andreas G. Andreou
Pedro Julian

Electrical and Computer Engineering
Johns Hopkins University

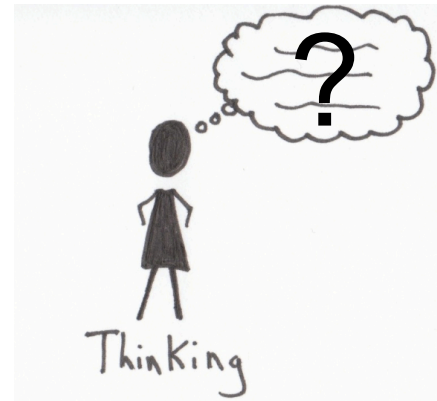
<http://andreoulab.net>



Make

Chip

YOU



See

back in the 70s

JANESICK (2001) "SCIENTIFIC CHARGE-COUPLED DEVICES" SPIE PRESS MONOGRAPH VOL. PM#3, P.4.

DATE 19 Oct. 1969
CASE No 39161-17

Charge "Bubble" Devices:

In collaboration with W.S. Boyle, scheme for moving packets of charge (or the absence of charge) along the surface of a semiconductor was devised. This resulted from discussions between W.S. Boyle and G.E. Smith held on Sept. 8, 1969 and the basic scheme was disclosed to F.H. Smith later that day. The principle is demonstrated by the following specific structure.

A negative voltage applied to the electrodes of the above structure causes a depletion region to form under the electrode. The band bending across section A-A when the voltage is first applied is shown below. As a result of generation-recombination centers in the depletion region and at

W.S. Boyle 10/12/69
G.E. Smith 10/14/69

The Nobel Prize in Physics 2009



Photo: U. Montan
Charles Kuen Kao
Prize share: 1/2

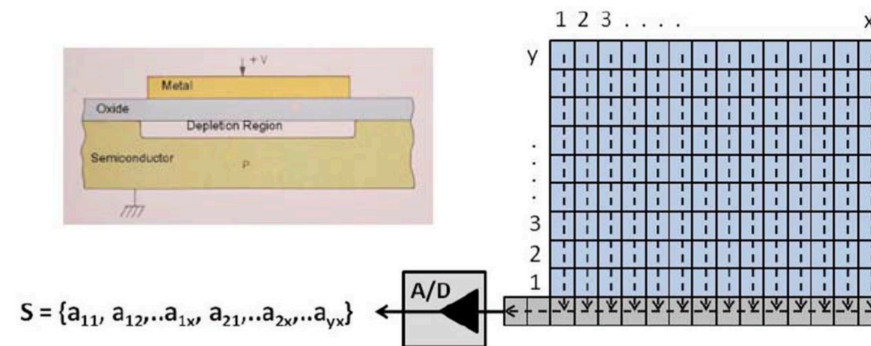


Photo: U. Montan
Willard S. Boyle
Prize share: 1/4



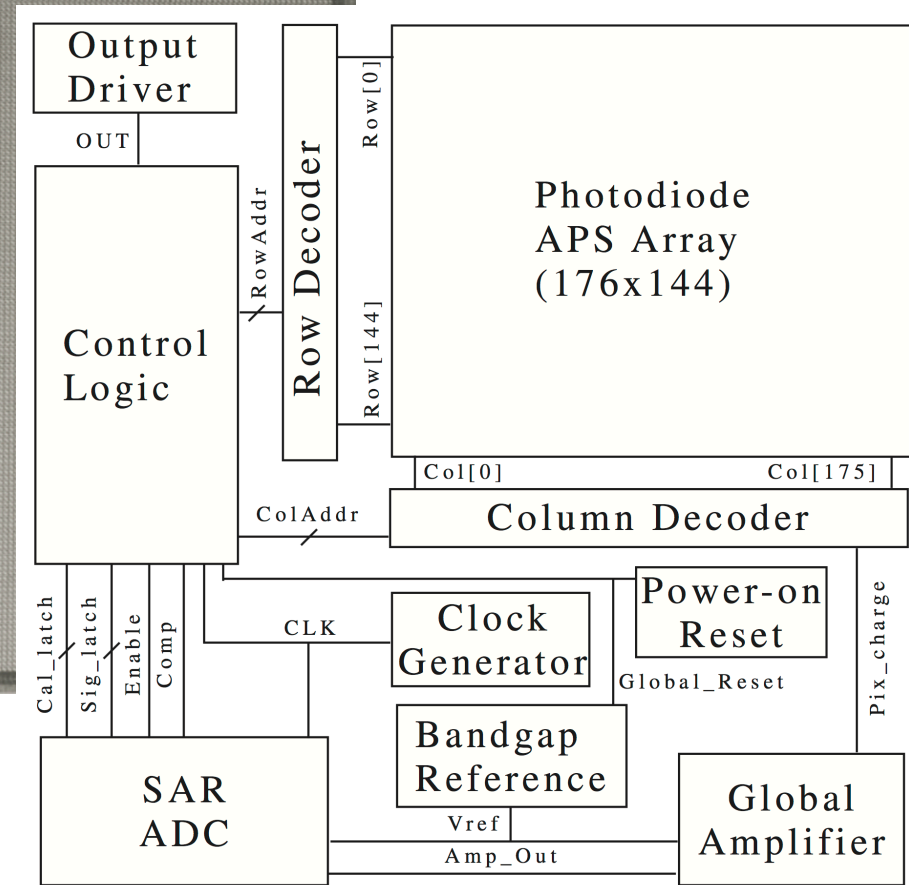
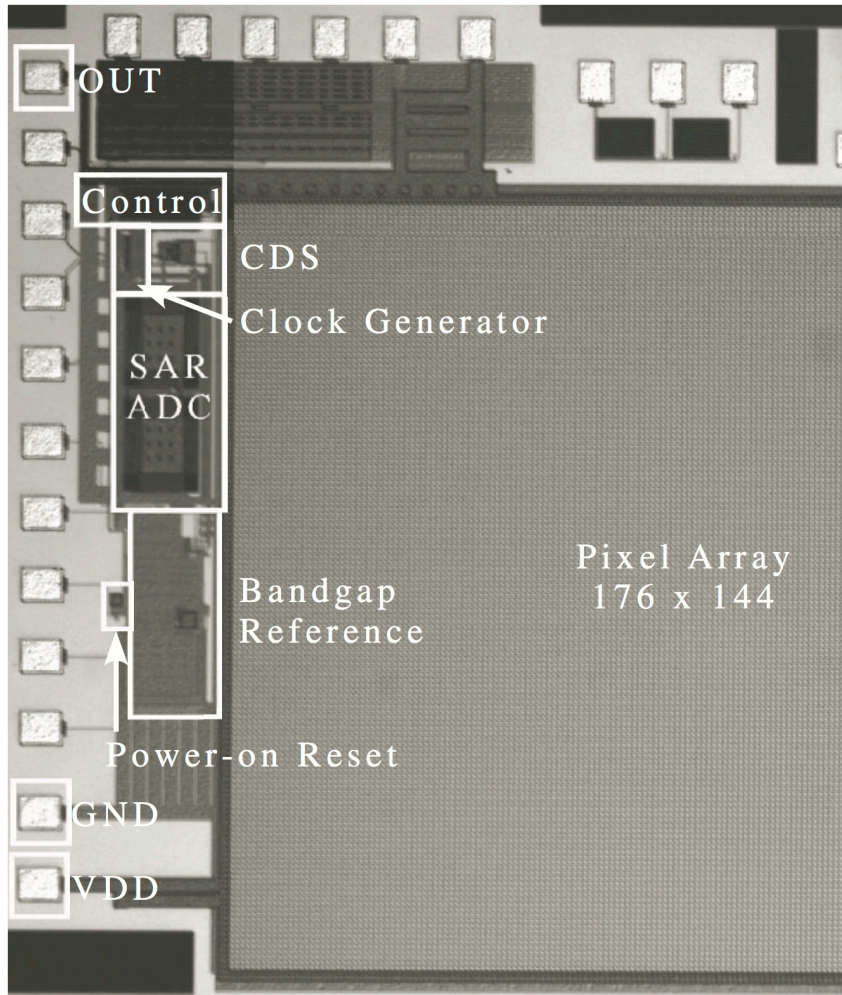
Photo: U. Montan
George E. Smith
Prize share: 1/4

The Nobel Prize in Physics 2009 was divided, one half awarded to Charles Kuen Kao "for groundbreaking achievements concerning the transmission of light in fibers for optical communication", the other half jointly to Willard S. Boyle and George E. Smith "for the invention of an imaging semiconductor circuit - the CCD sensor".



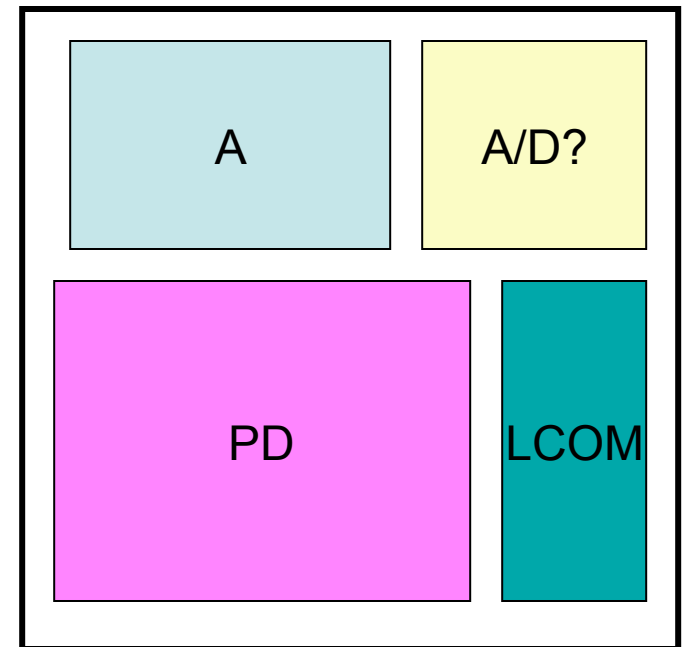
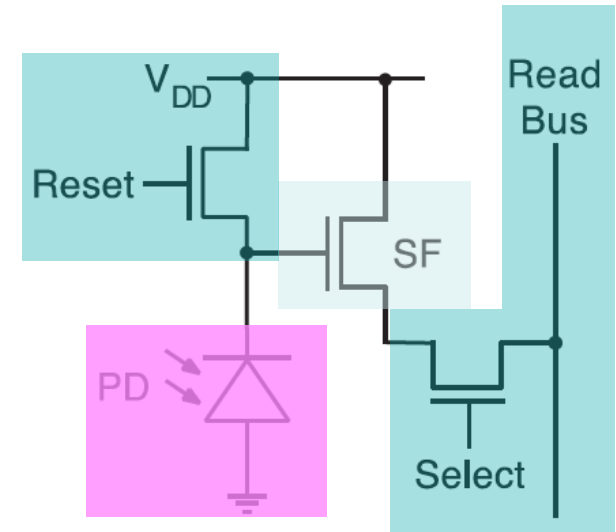
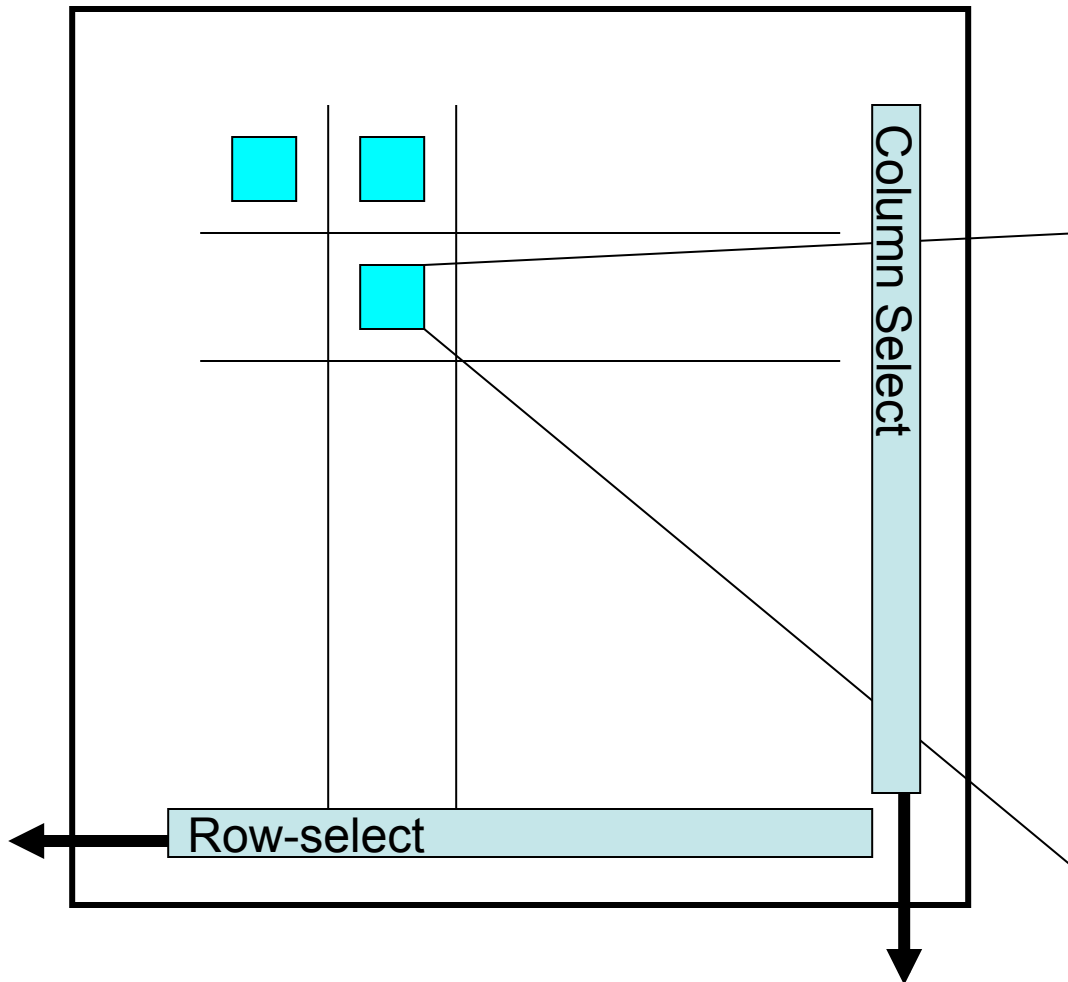
Scientific background on the Nobel prize in Physics 2009

How Do Cameras See (CMOS Imager Architecture)

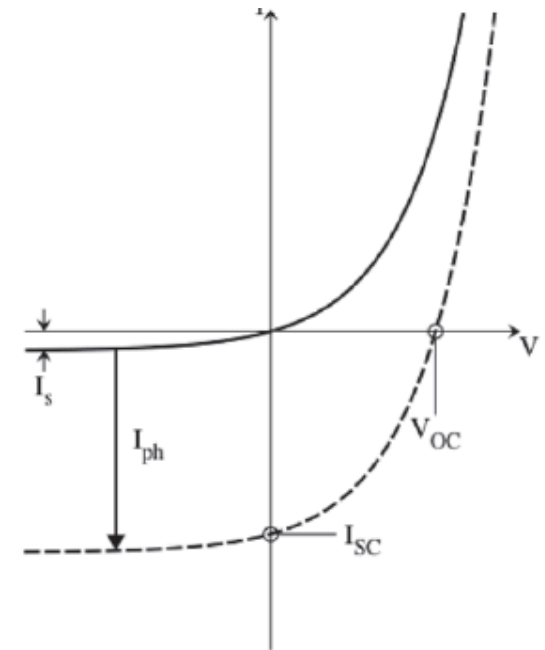
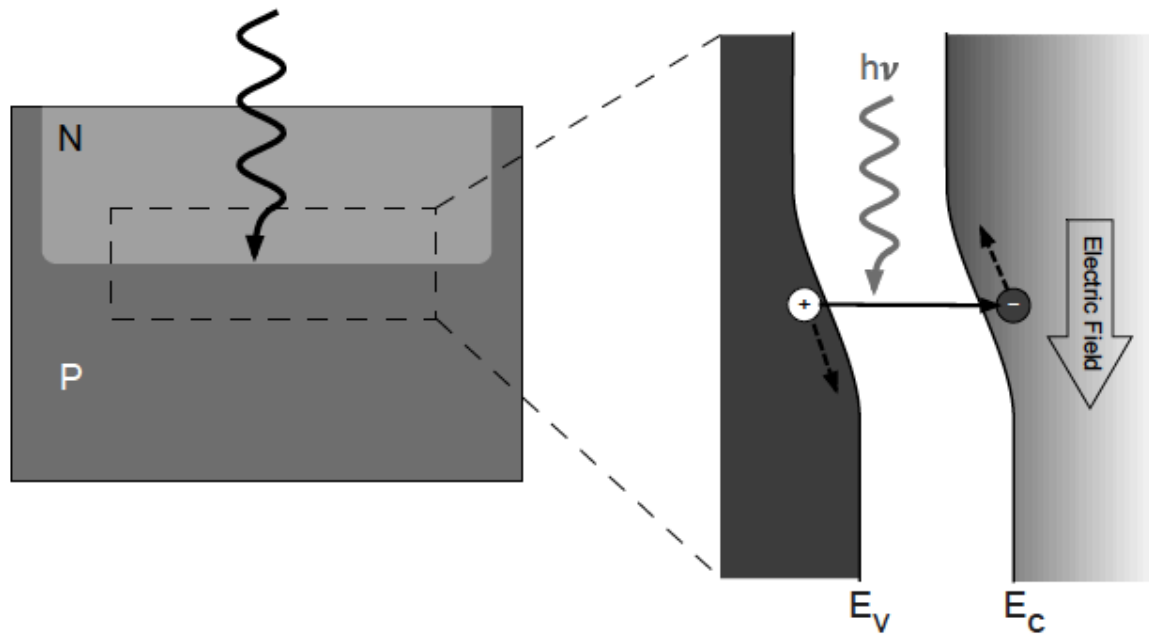
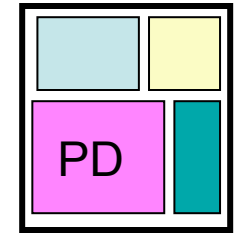


J. H. Lin, R. Özgün, P. O. Pouliquen, A. G. Andreou, C. M. Andreou, and J. Georgiou, "A 3-pin {1V} 115{u}W 176{x}144 autonomous active pixel image sensor in {0.18}{u}m {CMOS}," presented at the Proceedings of the 2011 IEEE International Symposium on Circuits and Systems (ISCAS), 2011, pp. 1568–1571.

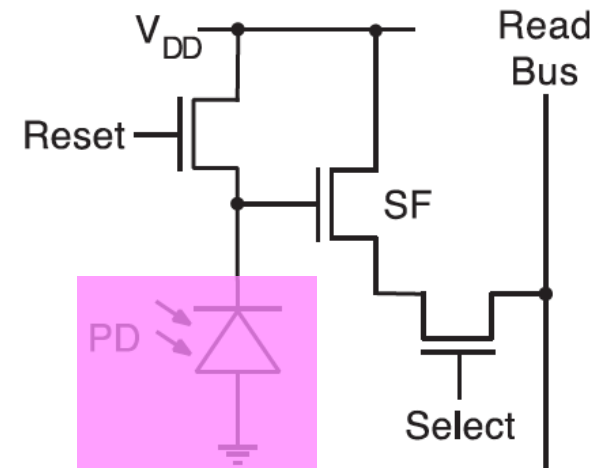
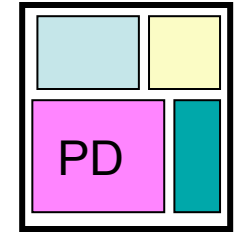
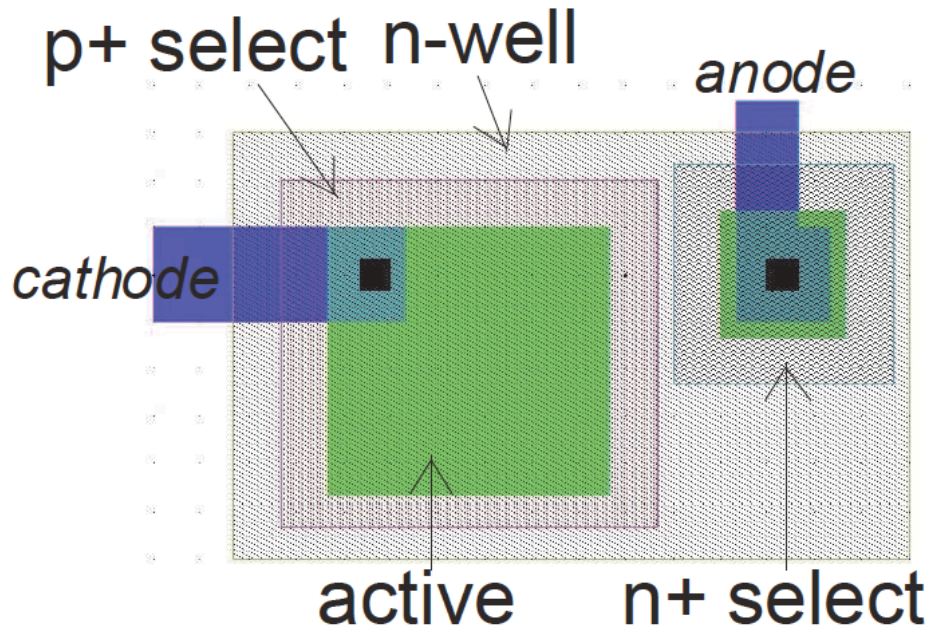
System Architecture 3T APS



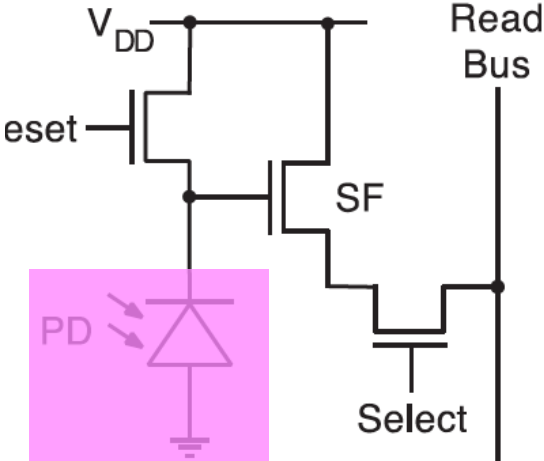
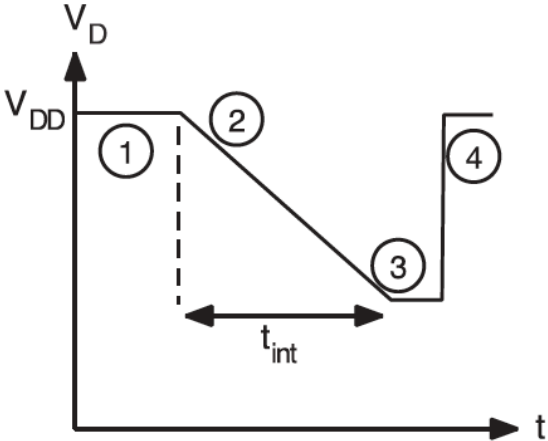
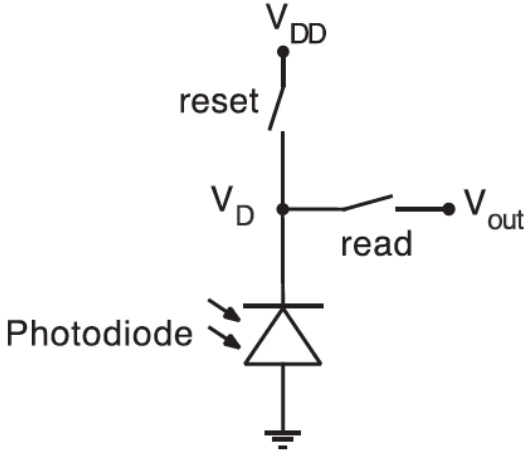
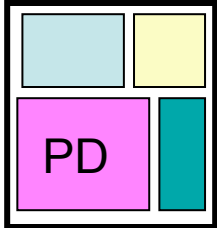
Phototransduction (I)



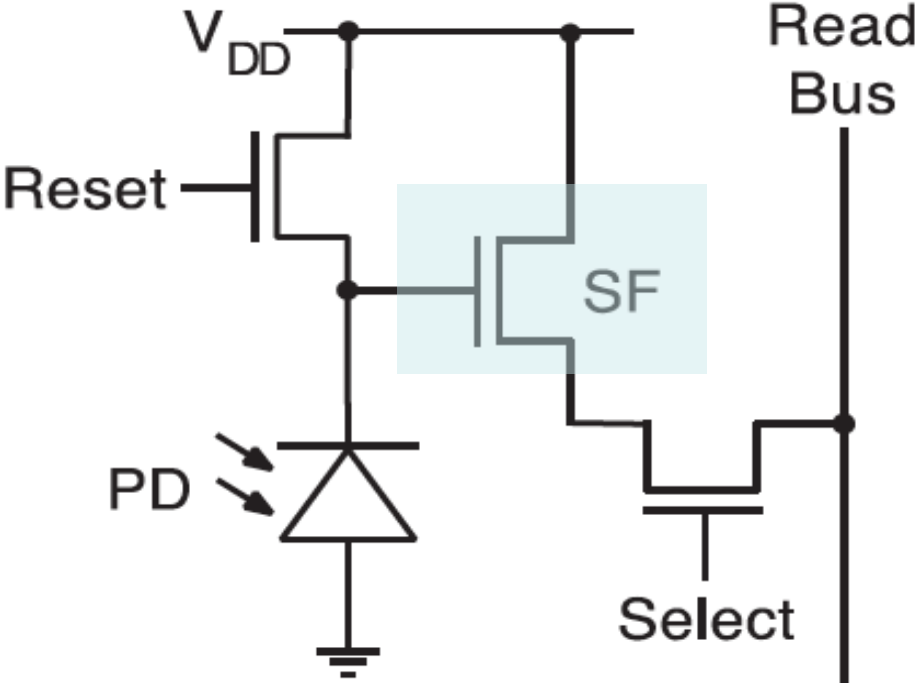
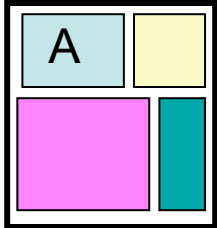
Phototransduction (II)



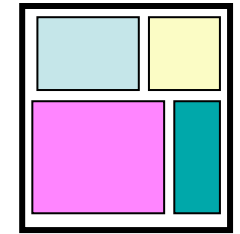
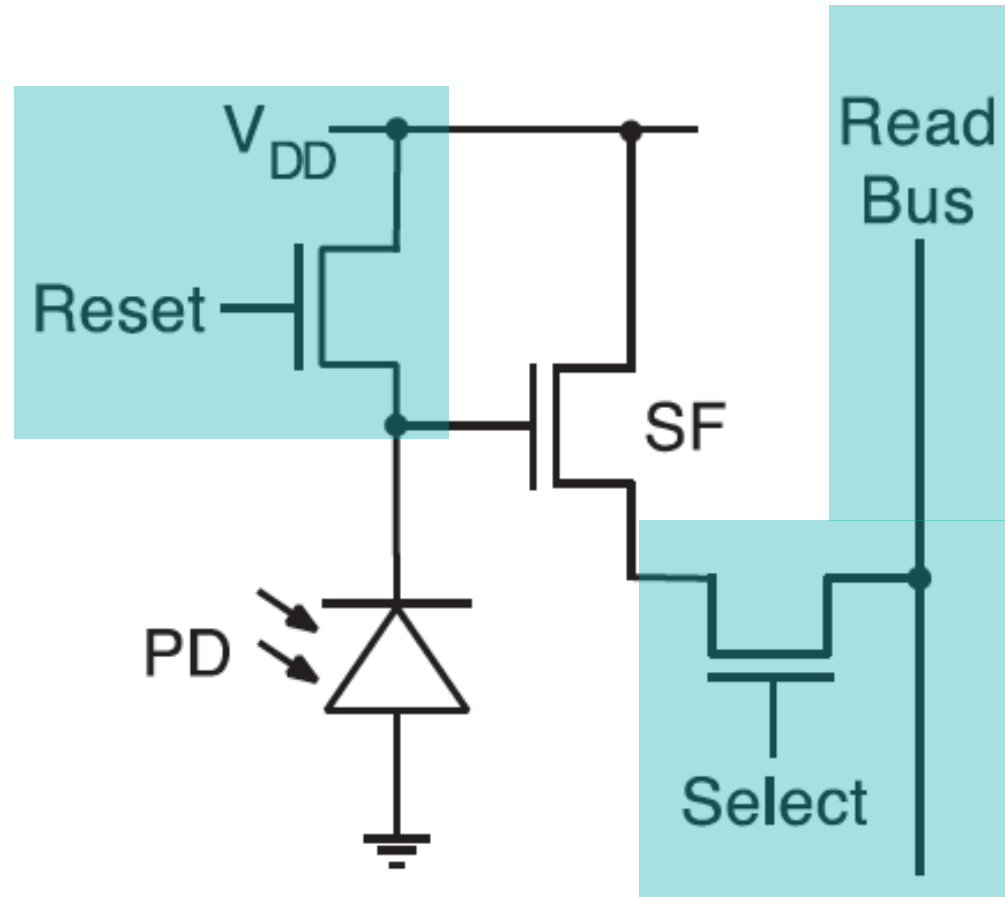
Current to Voltage conversion



Ampification

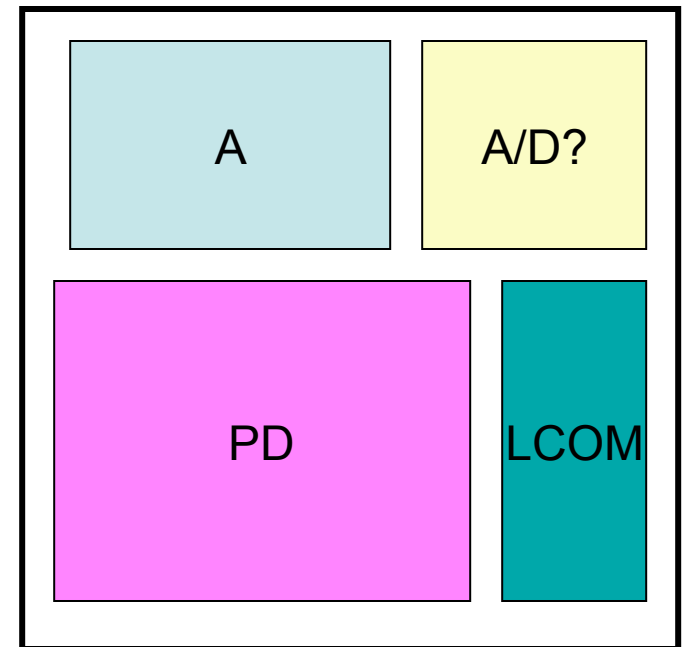
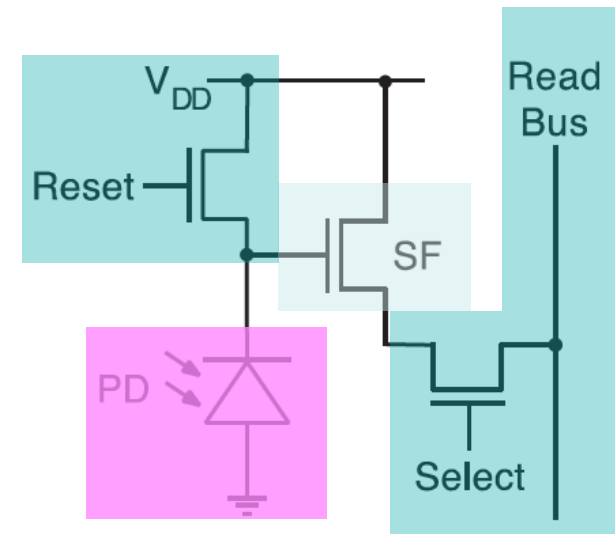
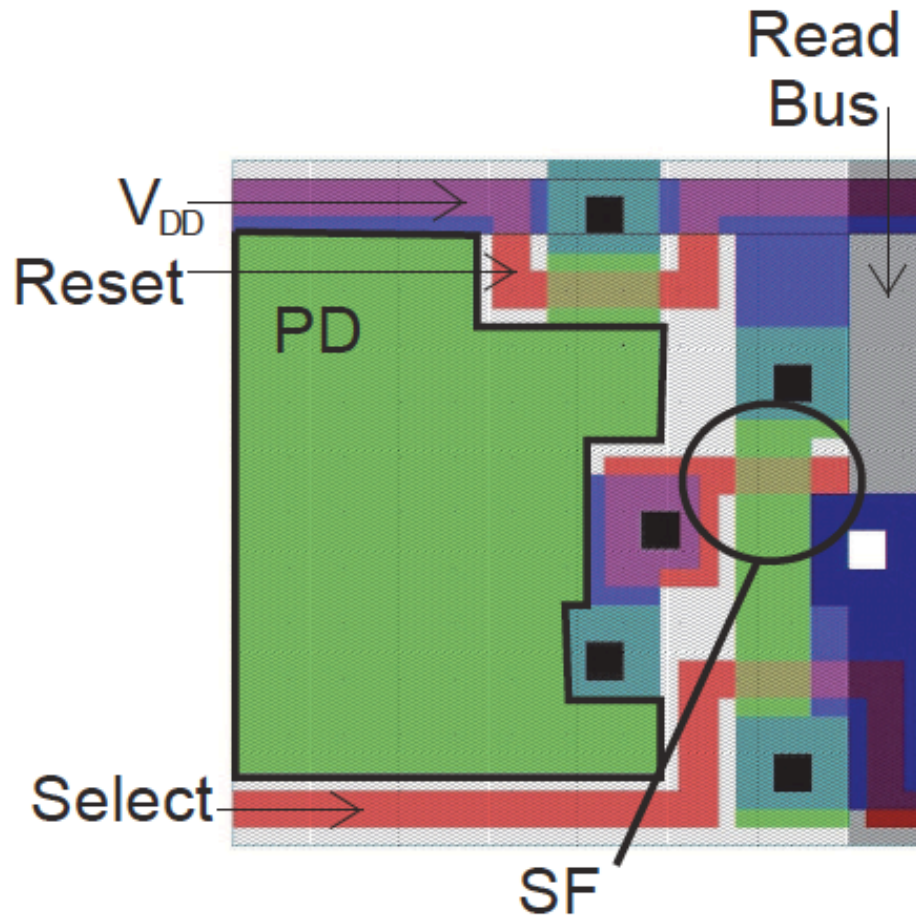


Communication

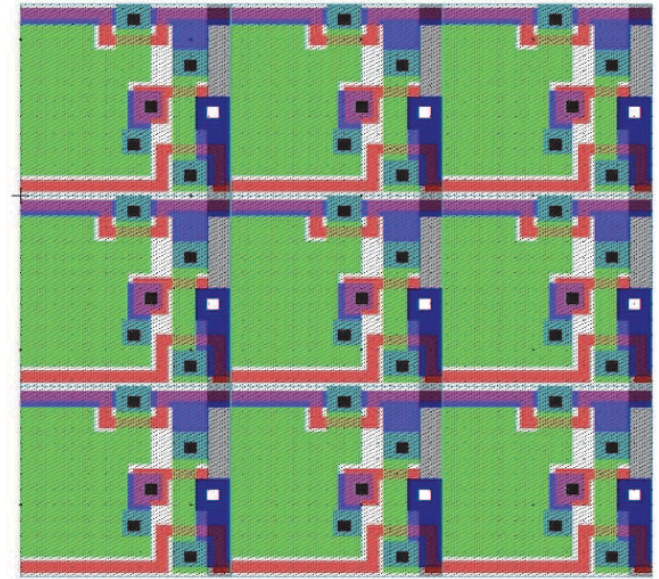
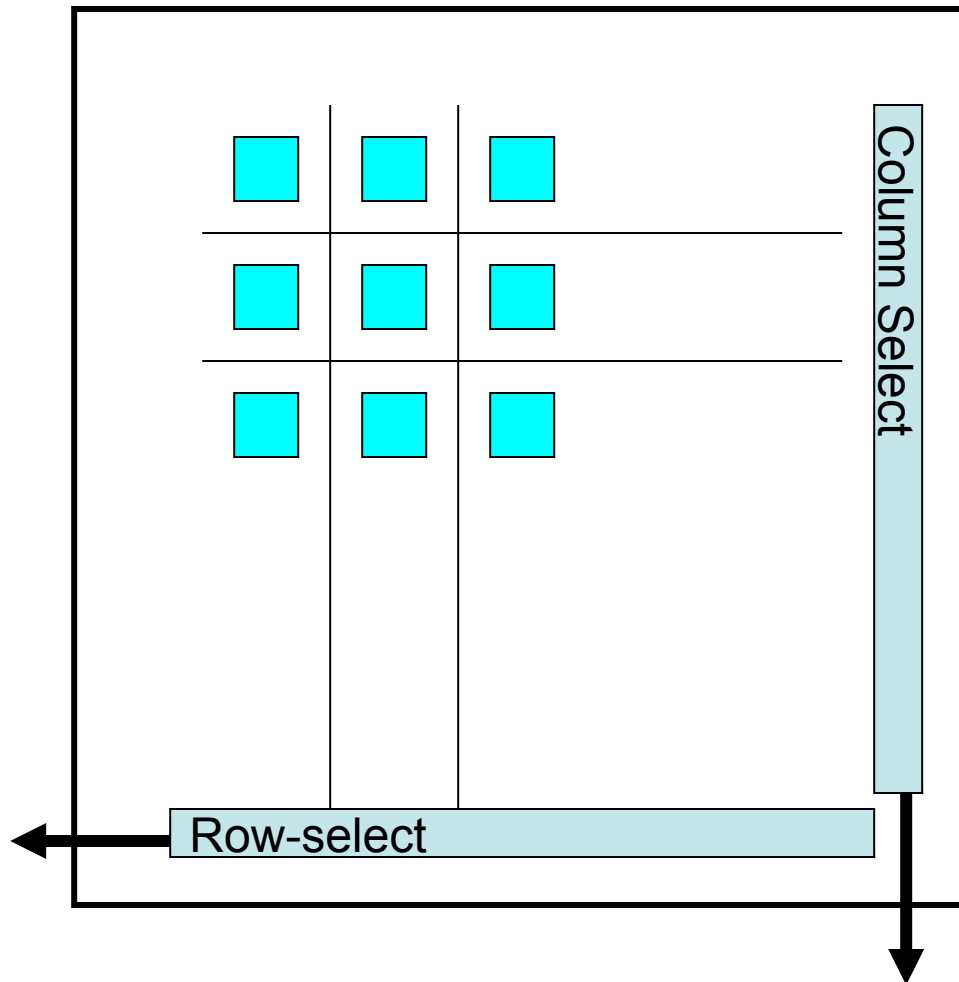


LCOM

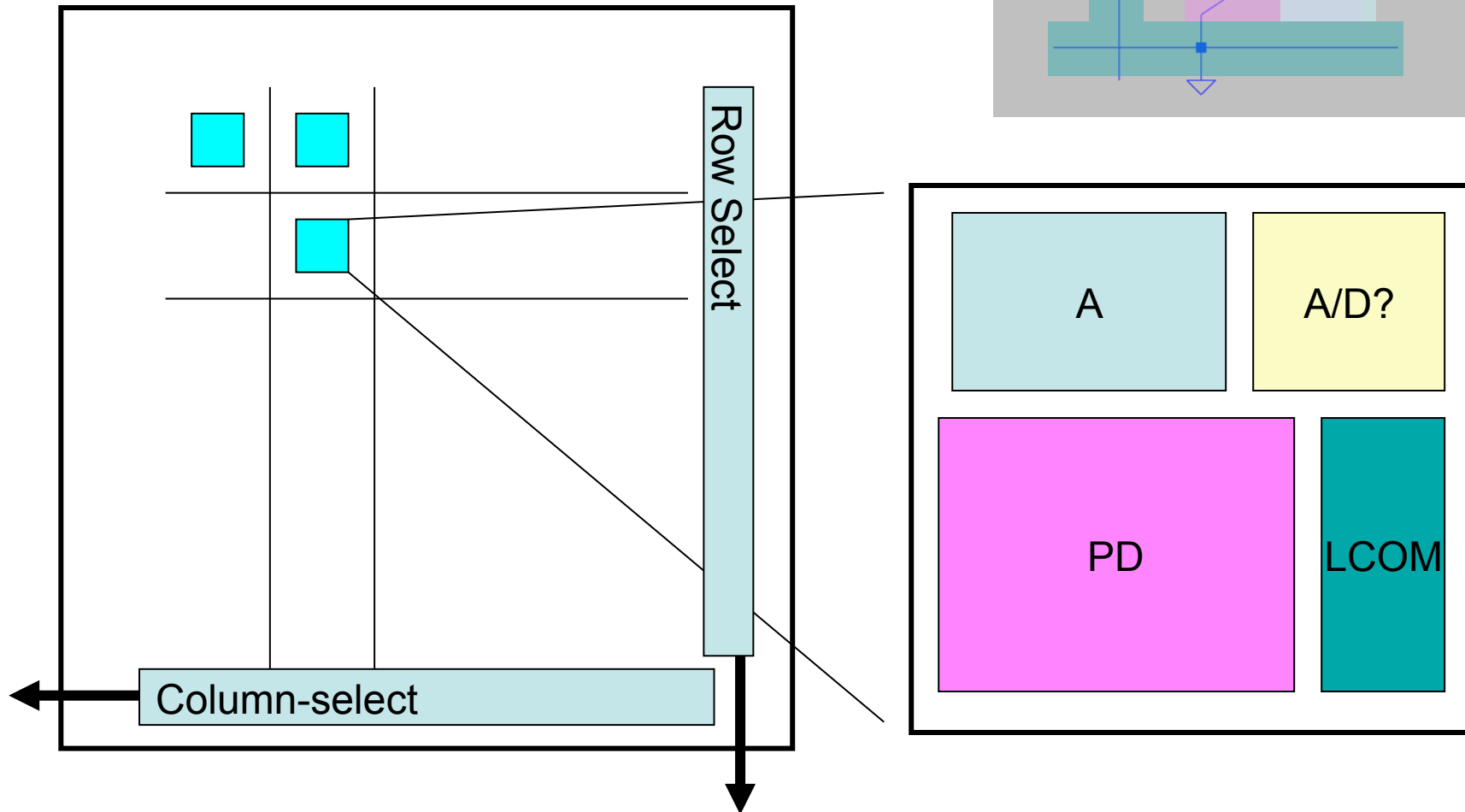
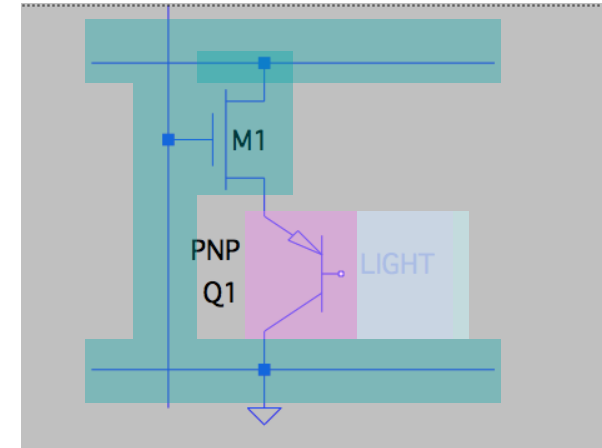
System Architecture (II)



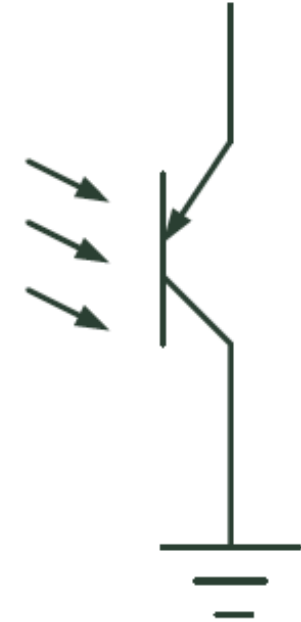
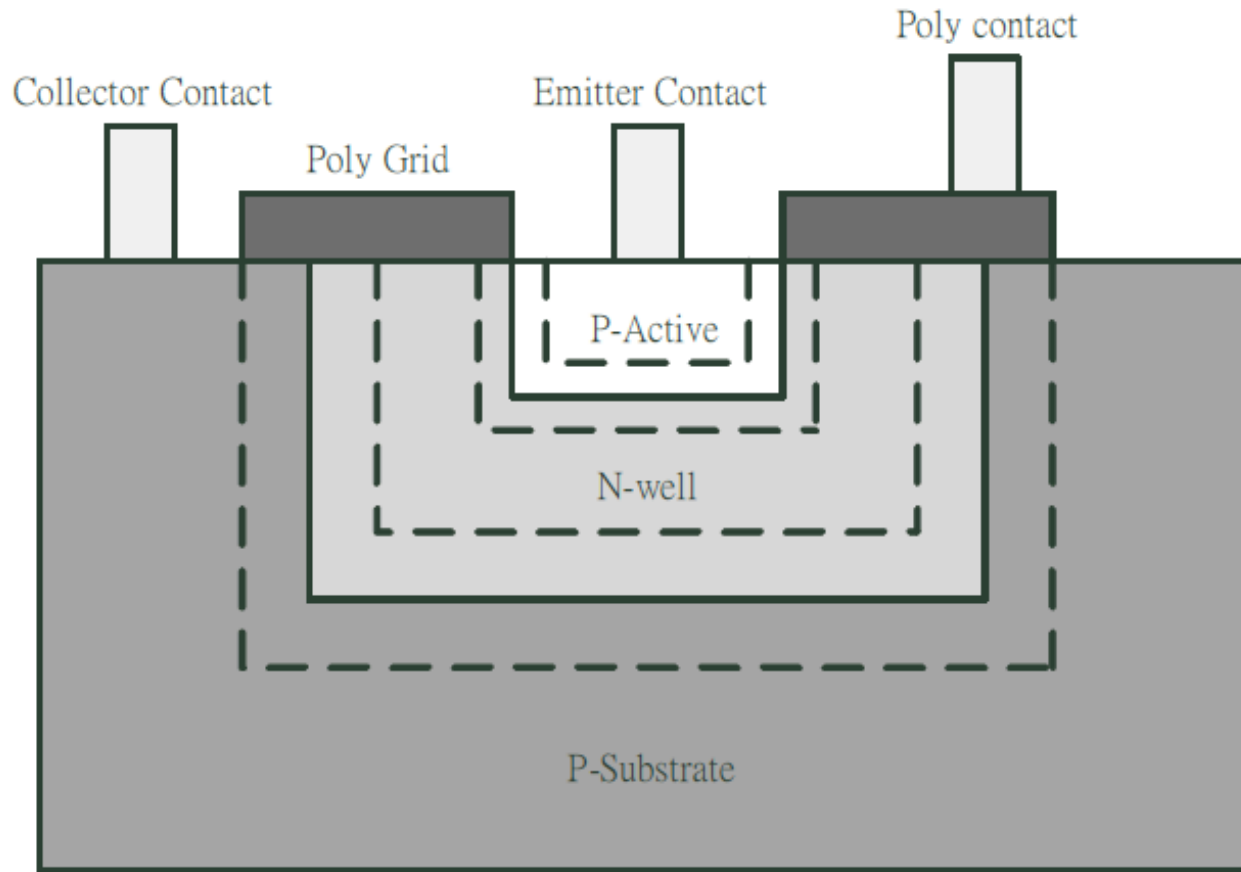
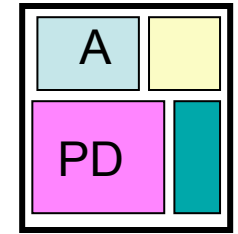
System Architecture (III)



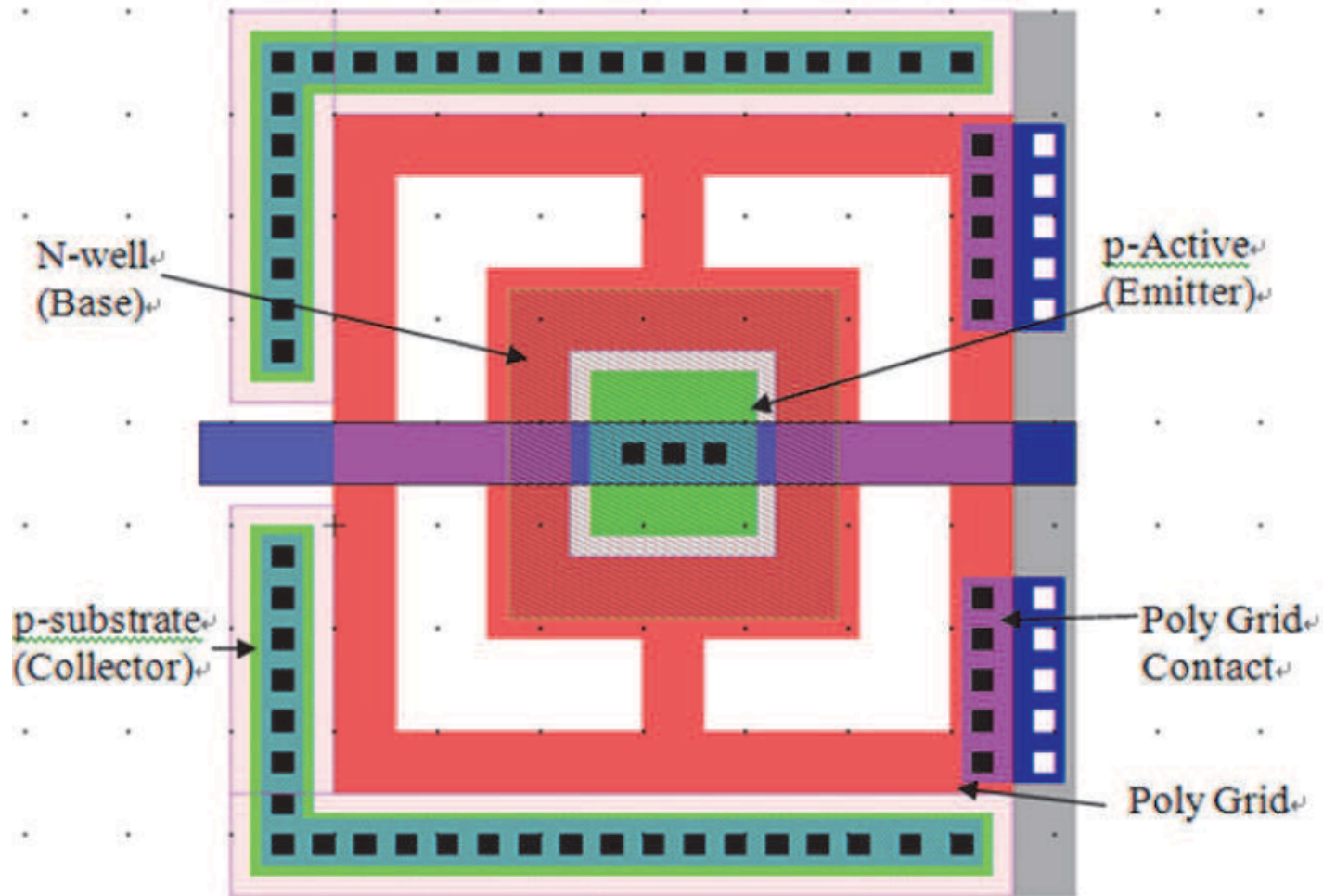
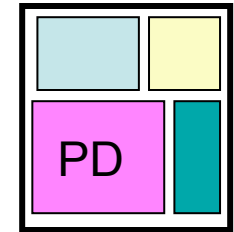
YOUR System Architecture



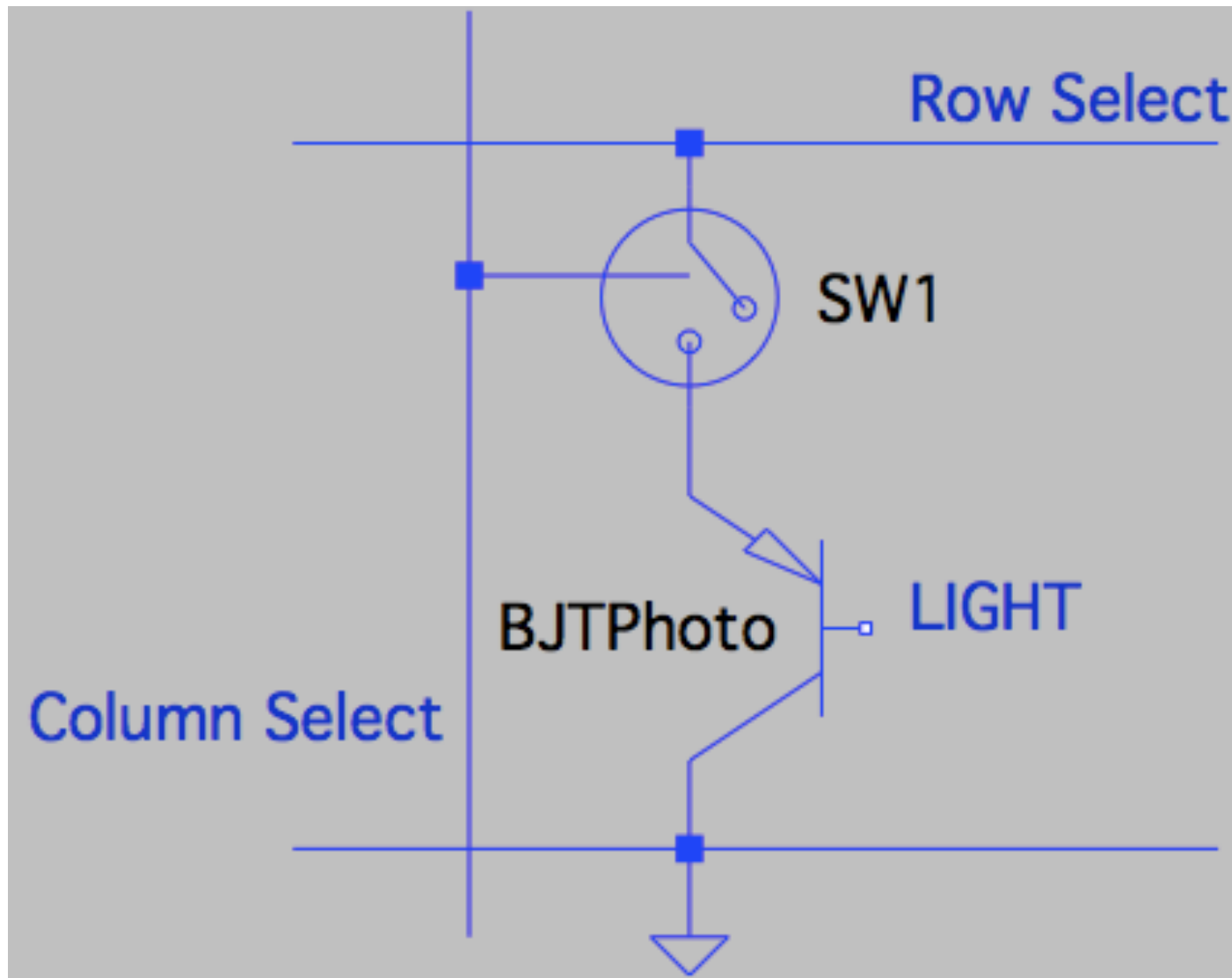
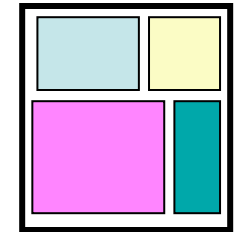
Bipolar Junction Transistor Phototransduction



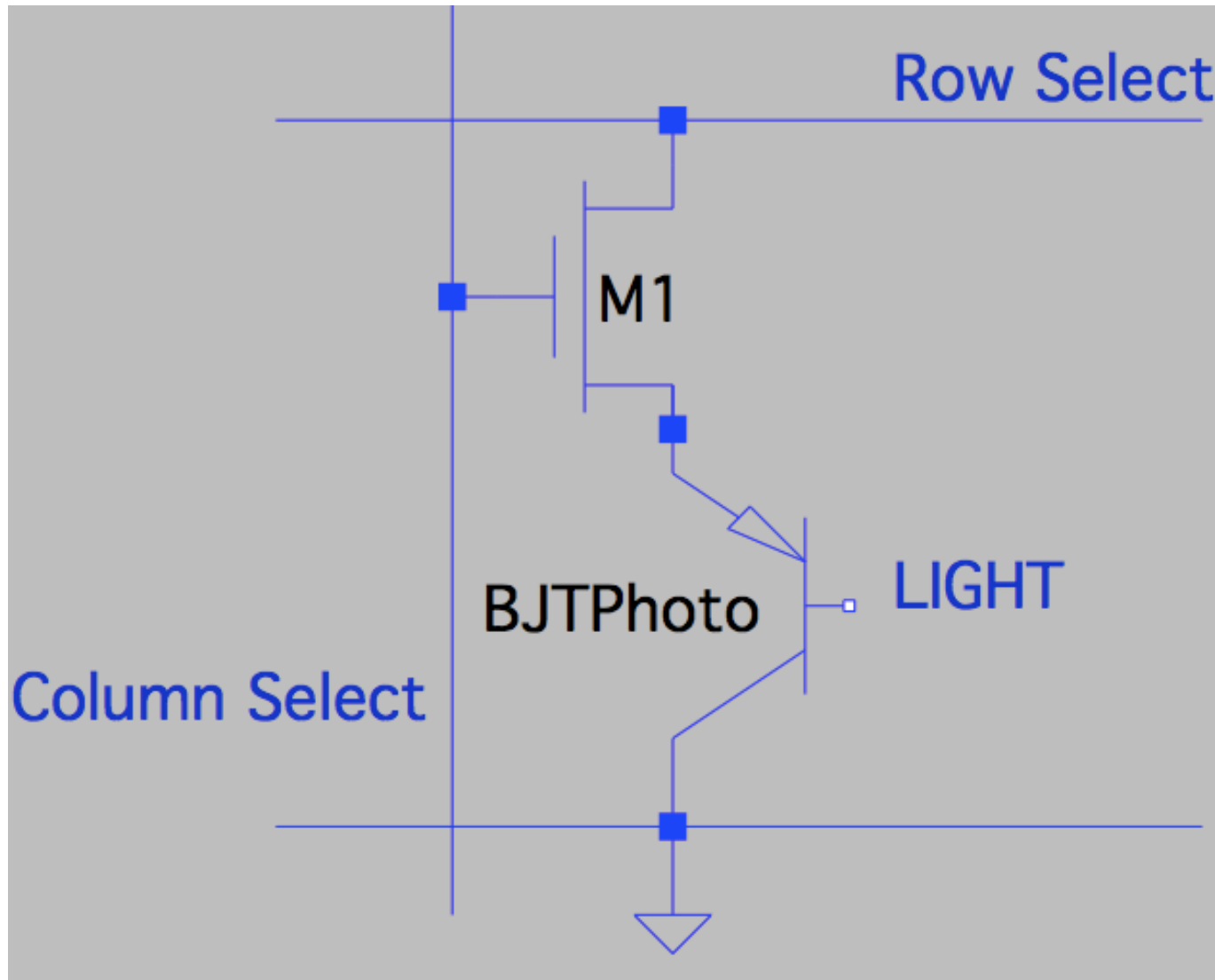
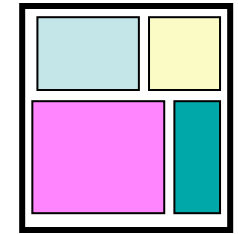
Phototransistor Layout



Bipolar transistor pixel



Bipolar transistor 1T pixel



Your Pixel Layout

