Silicon Photoreceptors
Energy: \( h\nu = \frac{hc}{\lambda} = 1.24 / \lambda(\mu) \) in eV

\( h\nu = E_g = 1.1\text{eV} \) for Si

Green  \( 0.55\ \mu \sim 2.5\text{ eV} \)
Red  \( 0.7-0.8\ \mu \sim 1.7\text{ eV} \)
GaAs LEDs  \( 0.86\ \mu \sim 1.3 \)
PN junction under illumination

Carriers “Go home”

Junction is forward biased by the light

Photodiode

Solar cell

$I$ with light

$V$
Photosensitive structures (I)

n-well / p-sub diode

n-well / p-diff diode

n-diff / p-sub diode
Photosensitive structures (II)

p-diff / n-well / p-sub bipolar

photogate
Photosensitive structures (III)

n-diff / p-base diode

n-well / p-base diode

n-diff / p-base / n-well bipolar

p-base
CMOS Logarithmic Photoreceptor (I): Source Follower

$p-substrate$

$I_{ph}$
CMOS Logarithmic Photoreceptor (II): Zero-threshold MOS Load

$p - substrate$

$I_{ph}$
CMOS Logarithmic Photoreceptor (III): Diode Connected Load

\[ V_S \]

\[ V_O \]

\[ I_{ph} \]

\[ p-\text{substrate} \]
Adaptive Logarithmic Photoreceptor: Tobi Photoreceptor