

Photodiode as current source

Student Group

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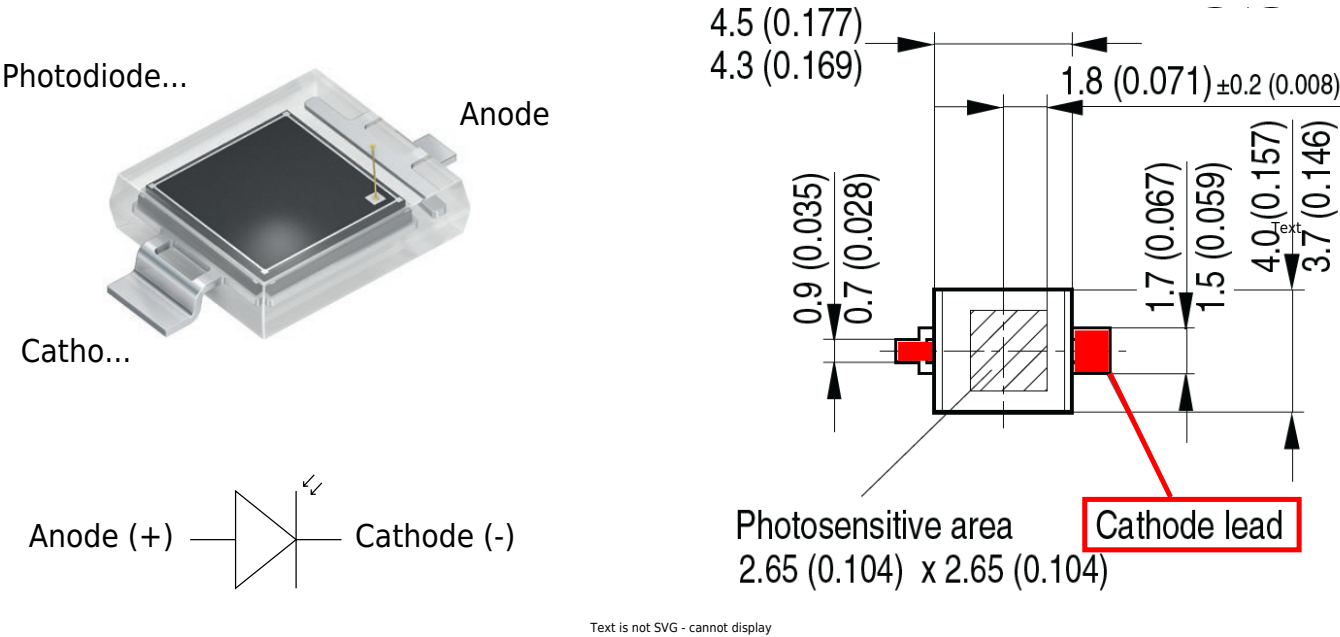


Fig. 2: Inverting Op-Amp: Photo Diode BPW 34 S

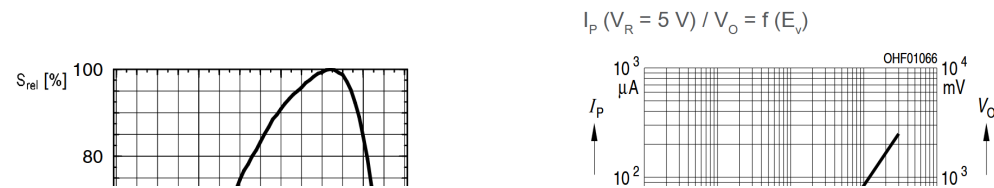


Fig. 3: Inverting Op-Amp: Diagramms of BPW 34 S

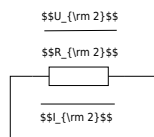


Fig. 4: Inverting Op-Amp: Photo Diode as current source

$$U_{DD} \approx 10\text{ V}, U_{SS} \approx -10\text{ V}$$

We assume a good illuminated room of 300 lx, illuminated by a white LED. White light is a mixture of many wavelengths across the visible spectrum, roughly 380 to 780 nm.

For a typical white LED, the spectrum usually comes from a blue LED chip with a peak around 450 nm, plus a broader phosphor emission that spreads across green, yellow, and red wavelengths.

For an easier calculation, we take a mean value of 500 nm which is close to the peak value of the blue LED (in reality a greenish light) and 300 lx for the illumination.

The graph in [figure 3](#) shows that the photodiode sensitivity at 500 nm is only 30%. The maximum current (100%) at 300 lx is 30 μA .

We can now estimate the current we would expect from the diode at 300 lx:

$$I_1 = 30\text{ }\mu\text{A} * 0.3 = 9\text{ }\mu\text{A}$$

$$I_1 \approx 10\text{ }\mu\text{A}$$

30% of 30 μA is roughly 10 μA .

Complete the arrows in the schematic of the circuit.

Calculate R_2 so that $U_{OUT} = 5\text{ V}$ at 300 lx. Take a resistor from the E6 series that is as close as possible to the calculated value.

Also fill in the values for I_1 , I_2 , U_{OUT} and U_2

$$I_1 \approx$$

$$I_2 \approx$$

$U_{\text{OUT}} \approx$

$U_2 \approx$

$R_2 \approx$

What value would you expect for U_D and why?

$U_D \approx$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

What value would you expect for U_D at 300 lx when it is not connected to the Op-Amp or any other electronic component (open-circuit voltage) and why?

$U_{\rm D} \approx$

$\dots$

$\dots$

$\dots$

$\dots$

$\dots$

$\dots$

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