

Photodiode as current source

Student Group

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Table of Contents

Photo Diode as current source 2

Photo Diode as current source



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.

In the diagram in [figure 3](#) we see that the sensitivity of the photo diode at 500 nm is only 30%. The maximum current (100%) at 300 lx is $30\ \mu\text{A}$.

Now we can calculate the current we expect from the diode at 300 lx:

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

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

30% of $30\ \mu\text{A}$ is roughly $10\ \mu\text{A}$.

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.

$$I_D = ?$$

$$I_2 = ?$$

U_{OUT}

U_2

R_2

What value would you expect for U_D and why?

U_D

\dots

\dots

\dots

\dots

\dots

\dots

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

U_D

$\{\rm \dots\}$

$\{\rm \dots\}$

$\{\rm \dots\}$

$\{\rm \dots\}$

$\{\rm \dots\}$

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