

6. Homojunctions**Problems**

6.1. A p/n homojunction solar cell has the following properties:

$$n_i = 7.0 \times 10^8 \text{ cm}^{-3} \text{ //intrinsic carrier density}$$

$$N_A = 5.0 \times 10^{16} \text{ cm}^{-3} \text{ //acceptor density in the p-type region}$$

$$N_D = 3.0 \times 10^{17} \text{ cm}^{-3} \text{ //donor density in the n-type region}$$

$$\mu_n = \mu_p = 1600 \text{ cm}^2/(\text{V} \cdot \text{s}) \text{ //electron, hole mobilities}$$

$$\tau_n = \tau_p = 50 \text{ } \mu\text{s} \text{ //electron, hole minority-carrier lifetimes}$$

$$G = 3.0 \times 10^{18} \text{ cm}^{-3}\text{s}^{-1} \text{ //uniform photogeneration rate}$$

$$\epsilon_s = 12.0 \text{ //relative permittivity}$$

a) Find:

i) the built-in potential V_{bi}

ii) the dark current J_0 ;

b) The device is operated at an output voltage of $V = 0.71 \text{ V}$. Find the following:

i) The photocurrent density J_{photo}

ii) The output power density P .

Notice that photogeneration in the space-charge region is negligible.

c) Find the open-circuit voltage V_{OC} .
