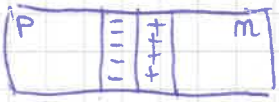
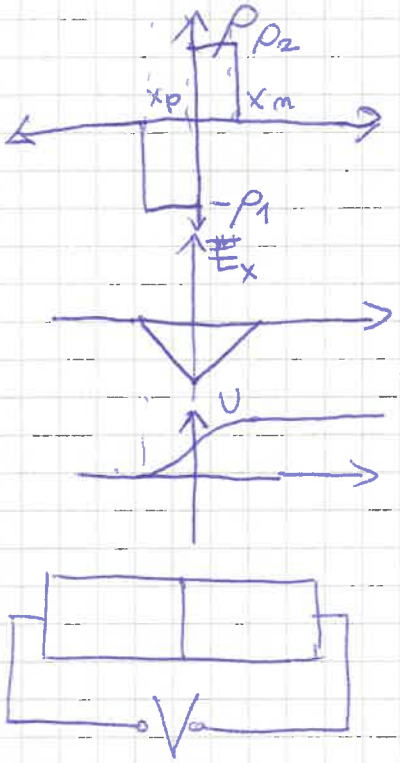
# POLPREVODNIŠKI DETEKTORJI

OSNOVA: p-n STIK [PONOVI MODFIZ 2!]




NA STIKU OBEH DELOV KRISTALA REKOMBINACIJA PROSTIH NOSILCEV NABOJA, VRZELI S p STRANI Z $e^-$ S n STRANI.




OHRANITEV NABOJA: $\rho_1 x_p = \rho_2 x_n$

ČE $\rho_1 \gg \rho_2$: $x_p \ll x_n$

ČE POVEČAMO NAPETOST V ZAPORNI SMERI, SE POVEČA OSIROMAŠENA PLAST.

$U = -\int E\,dx$

PRI SOBNI TEMP $\rho_1 \sim N_A$, $\rho_2 \sim N_D$

ČE $N_A \ll N_D$ $x_p \gg x_n$, $x_p \sim d$ DEBELINA OSIR. PLASTI

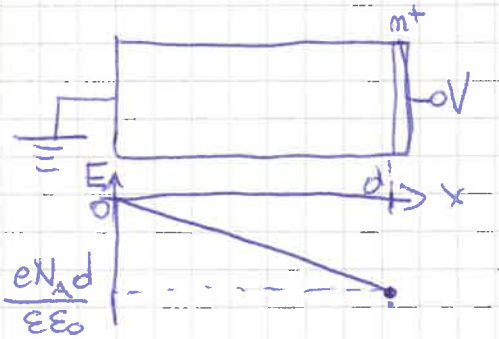
$d = (2\varepsilon\varepsilon_0 \rho_p \mu_e V)^{1/2}$

$\left(\frac{2\varepsilon\varepsilon_0 V}{e_0 N_A}\right)^{1/2}$

KER $j = e_0 n_e v_e = e_0 N_A \mu_e E = \frac{1}{\rho_p} E \Rightarrow \rho_p = \frac{1}{e N_A \mu_e}$

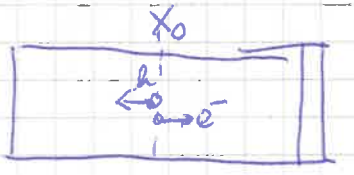
## RAZVOJ SIGNALA

VZAMIMO ZGORNJI PRIMER $N_A \ll N_d$ $x_p \sim d$




v tem primeru $n \to n^+$ OZNAKA

$E = -\frac{eN_A}{\varepsilon\varepsilon_0} x$




VOLUMEN DETEKTORJA: $V = Sd$

GOSTOTA NOSILCEV $n (= N_A)$

$I = jS = e v n S$

ZA EN SAM $e^-$: $nV = 1 = nSd \Rightarrow nS = \frac{1}{d}$

$\Rightarrow I = e_0 v / d \to d \cdot I = e_0 \cdot v \cdot 1 \cdot dt$ $\pm e_0$

$d \cdot I\,dt = e_0 v\,dt$

$d \cdot dQ = e_0\,dx \Rightarrow dQ \cdot d = \varrho\,dx$

$Q \cdot d = \varrho(x - x_0)$

$E = -\frac{1}{\varepsilon\varepsilon_0} e N_A x = -\frac{1}{\rho \varepsilon\varepsilon_0 \mu_e} x$

KER $\frac{1}{\rho} = e_0 N_A \mu_e$ VPELJEMO $\tau = \rho\varepsilon\varepsilon_0$

$\Rightarrow E = -\frac{x}{\mu_e \tau}$

$$E = -\frac{X}{X_\mu \tau}$$

ELEKTRONI: $\frac{dx}{dt} = v = -\mu_e E = \frac{\mu_e}{\mu_a} \cdot \frac{X}{\tau} \quad | \cdot dt$

$$\ln X \Big|_{x_0}^{x} = \frac{\mu_e}{\mu_a} \frac{t}{\tau} \Rightarrow x = x_0 \, e^{\frac{\mu_e}{\mu_a}\frac{t}{\tau}} \qquad x = x_0 \text{ ob } t = 0$$

za $x \leq d$

$$Q_e(t) = -\frac{e}{d}(x(t) - x_0) = -\frac{e}{d} x_0 \left(e^{\frac{\mu_e}{\mu_a}\frac{t}{\tau}} - 1\right)$$

VRZEL: $\frac{dx}{dt} = v_a = -\mu_a E = -\frac{x}{\tau}$

$$x(t) = x_0 \, e^{-\frac{t}{\tau}}$$

$$Q_h(t) = \frac{e}{d}(x(t) - x_0) = -\frac{e}{d} x_0 \left(1 - e^{-t/\tau}\right)$$