HW-4 Solutions

Gain = \frac{\tau_p}{\tau_t}, \quad \tau_p := \text{lifetime} \quad ----(1)

\tau_t := \text{transit time}

For the base doping of 10^{15}\text{cm}^{-3}, \text{read } \tau_p \text{ from the plot } \Leftrightarrow 2 \times 10^{-4} \text{ sec}

\tau_t = \frac{w_B^2}{2D_B} \quad --- (2)

w_B \text{ varying from } 10\text{um} \text{ to } 60 \text{ um}. \text{ Read } D_B (\text{Diffusion constant}) \text{ from the plot of diffusion length.}

For base doping of 10^{15}\text{cm}^{-3}, L_p=4 \times 10^{-2} \text{ cm}

L_p = \sqrt{D_p \tau_p}

So \quad D_p = \frac{L_p^2}{\tau_p} = \frac{(4 \times 10^{-2})^2}{10^{-4}} = 16 \text{cm}^2 / \text{sec}

For w_B \rightarrow 10 \text{ um to } 60 \text{ um} \text{ i.e. calculate corresponding } \tau_t \text{ from (2)}

Calculate gains from (1) using \tau_t \text{ values}

Plot w_B \text{ VS gain.}