

Homework J1

If a simple p - n diode has very asymmetric doping, $N_A \gg N_D$ or $N_D \gg N_A$, it is known as a *one-sided diode*. For the case of a one-sided silicon diode where $N_D \gg N_A$, modify the p - n diode equations for built-in potential, maximum electric field, total depletion-layer width, and current-density pre-factor. Then calculate specific values for the case of $N_D = 5 \times 10^{17} \text{ cm}^{-3}$ and $N_A = 5 \times 10^{15} \text{ cm}^{-3}$. As always, sketches of the charge density profile, electric field profile and band diagram may be helpful.

expressions:

- Built-in potential: $\phi_{bi} =$ _____.
- Maximum electric field, (in terms of ϕ_{bi}): $\mathcal{E}_{max} =$ _____.
- Total depletion-layer width (in terms of ϕ_{bi}), $X_D =$ _____.
- Current density pre-factor, $J_S =$ _____.

values:

- Built-in potential: $\phi_{bi} =$ _____.
- Maximum electric field $E_{max} =$ _____.
- Total depletion-layer width $X_D =$ _____.
- Current density pre-factor, $J_S =$ _____.