Constants Needed

GaAs material parameters:

Band gap energy at 300 K: E_G = 1.42 eV

Electron affinity: χ = 4.07 eV

Relative permittivity: $\varepsilon_s/\varepsilon_o$ = 12.9

Effective mass: Electron: $m_e^* = 0.067 m_o$ Hole: $m_h^* = 0.47 m_o$

Mobility: Electron: μ_n = 8500 $cm^2/V \cdot s$ Hole: μ_p = 400 $cm^2/V \cdot s$

Diffusion coefficient: Electron: D_n = 200 cm^2/s Hole: D_p = 10 cm^2/s

GaP material parameters

Band gap energy at 300 K: E_G = 2.3 eV

Effective mass: Electron: $m_e^* = 0.12 m_o$ Hole: $m_h^* = 0.5 m_o$

Si material parameters

Band gap energy at 300 K: E_G = 1.12 eV

Effective mass: Electron: $m_e^* = m_o$ Hole: $m_h^* = 0.7 m_o$

Physical Constants:

Permittivity of vacuum: $\varepsilon_o = 8.85 \times 10^{-14}$ F/cm

Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$ Henry/meter

Planck's constant: $h = 6.63 \times 10^{-34}$ J·s Speed of light: $c = 3.0 \times 10^{10}$ cm/s

Electronic charge: $q = 1.60 \times 10^{-19}$ C Electron rest mass: $m_o = 9.11 \times 10^{-31}$ kg

Boltzmann constant: $k_B = 1.38 \times 10^{-23}$ J/K Thermal energy at 300 K: k_BT = 0.0259 eV

Energy conversion: 1 eV = 1.60×10^{-19} J

Thermal voltage (at T = 300 K) $V_t = \frac{kT}{q}$ 25.86 milliVolt

1 eV = 1.6×10^{-19} J

Integral tables:

$$\int_0^\infty \sqrt{x} e^{-nx} dx = \frac{1}{2n}\sqrt{\frac{\pi}{n}} \qquad \int_0^\infty \frac{e^{-nx}}{\sqrt{x}} dx = \sqrt{\frac{\pi}{n}}$$