CONSTANTES FÍSICAS

$e = 1{,}6\ 10^{-19}\mathrm{C}$
$m_0 = 9{,}1\ 10^{-31}\ \mathrm{Kg}$
$c = 2{,}998\ 10^{8}\mathrm{m/s}$
$\varepsilon_0 = 8{,}854\ 10^{-12}\mathrm{F/m}$
$\mu_0 = 4\pi\ 10^{-7}\ \mathrm{H/m}$
$k_B = 1{,}38\ 10^{-23}\mathrm{J/^oK}$
$h = 6{,}6\ 10^{-34}\mathrm{Js}$

SEMICONDUCTORES

Silicio (T= 300 ºK)	Germanio (T= 300 ºK)	Arseniuro de Galio GaAs (T= 300 ºK)
$U_C = 2{,}8\ 10^{19}\ \mathrm{cm}^{-3}$	$U_C = 2{,}8\ 10^{19}\ \mathrm{cm}^{-3}$	$U_C = 4{,}7\ 10^{17}\ \mathrm{cm}^{-3}$
$U_V = 1{,}04\ 10^{19}\ \mathrm{cm}^{-3}$	$U_V = 6\ 10^{18}\ \mathrm{cm}^{-3}$	$U_V = 7\ 10^{18}\ \mathrm{cm}^{-3}$
$n_i = 1{,}45\ 10^{10}\ \mathrm{cm}^{-3}$	$n_i = 2{,}4\ 10^{13}\ \mathrm{cm}^{-3}$	$n_i = 1{,}39\ 10^{6}\ \mathrm{cm}^{-3}$
$E_g = 1{,}12\ \mathrm{eV}$	$E_g = 0{,}66\ \mathrm{eV}$	$E_g = 1{,}42\ \mathrm{eV}$
$\varepsilon = 11{,}9\ \varepsilon_0$	$\varepsilon = 16\ \varepsilon_0$	$\varepsilon = 13{,}1\ \varepsilon_0$
$e\chi = 4{,}05\ \mathrm{eV}$	$e\chi = 4{,}0\ \mathrm{eV}$	$e\chi = 4{,}07\ \mathrm{eV}$
$\mu_n = 1350\ \mathrm{cm}^2/(\mathrm{Vs})$	$\mu_n = 3600\ \mathrm{cm}^2/(\mathrm{Vs})$	$\mu_n = 8500\ \mathrm{cm}^2/(\mathrm{Vs})$
$\mu_p = 480\ \mathrm{cm}^2/(\mathrm{Vs})$	$\mu_p = 1800\ \mathrm{cm}^2/(\mathrm{Vs})$	$\mu_p = 400\ \mathrm{cm}^2/(\mathrm{Vs})$

ESTADÍSTICA DE SEMICONDUCTORES

$$n_0 = U_c e^{-\frac{\varepsilon_C - \varepsilon_F}{kT}} \qquad p_0 = U_v e^{-\frac{\varepsilon_F - \varepsilon_V}{kT}}$$

$$U_c = 2(2\pi m_n^* kT/h^2)^{3/2} \qquad U_v = 2(2\pi m_p^* kT/h^2)^{3/2}$$

$$n_0 p_0 = n_i^2 \qquad p_0 + N_D = n_0 + N_A$$

$$\varepsilon_{Fi} = \frac{1}{2}(\varepsilon_v + \varepsilon_c) + kT\ln\sqrt{U_v/U_c} \qquad \varepsilon_F = \varepsilon_{Fi} \pm kT\ln\frac{|N_D - N_A|}{n_i}$$

EXCESOS EN SEMICONDUCTORES

$$D_n = \frac{\mu_n kT}{e}; \quad D_p = \frac{\mu_p kT}{e}; \quad \vec{J}_p = -D_p\vec{\nabla}p + p\mu_p\vec{E}; \quad \vec{J}_n = -D_n\vec{\nabla}n - n\mu_n\vec{E}; \quad \vec{I} = e(\vec{J}_p - \vec{J}_n)$$

$$-\vec{\nabla}\cdot\vec{J}_p + g_p - \frac{p}{\tau_p} = \frac{\partial p}{\partial t}; \qquad -\vec{\nabla}\cdot\vec{J}_n + g_n - \frac{n}{\tau_n} = \frac{\partial n}{\partial t}$$

$$D^*\nabla^2(\delta p) - \mu^*\vec{E}\cdot\vec{\nabla}(\delta p) + g' - \frac{\delta p}{\tau} = \frac{\partial(\delta p)}{\partial t}$$

JUNTURA PN

$$\phi_0 = \frac{kT}{e}\ln\frac{N_D N_A}{n_i^2}; \quad N_A x_p = N_D x_n; \quad E_{máx} = -\frac{eN_D x_n}{\varepsilon}$$

$$\Delta\phi = \frac{e}{2\varepsilon}(N_D x_n^2 + N_A x_p^2) = \phi_0 - V_0; \; W = x_n + x_p = \sqrt{\frac{2\varepsilon}{e}(\phi_0 - V_0)\frac{(N_A + N_D)}{N_A N_D}}$$

$$i_D = Ae\left(\frac{D_p}{L_p}p_{n0} + \frac{D_n}{L_n}n_{p0}\right)\left(e^{\frac{eV_0}{kT}} - 1\right); \; L_p = \sqrt{D_p\tau_p}; \; L_n = \sqrt{D_n\tau_n}$$

JUNTURA METAL SEMICONDUCTOR

$$\phi_0 = \phi_M - \phi_S; \quad E_{máx} = -\frac{1}{\varepsilon}eN_D x_n; \quad \phi_0 = \frac{eN_D x_n^2}{2\varepsilon}; \; x_n = \sqrt{\frac{2\varepsilon\phi_0}{eN_D}} = \sqrt{\frac{2\varepsilon(\phi_M - \phi_S)}{eN_D}}$$

$$I = \frac{e4\pi m}{h^3}(kT)^2 e^{-e\phi_B/kT}\left(e^{eV_0/kT} - 1\right); \quad I = I_S\left(e^{eV_0/kT} - 1\right)$$

"ecuación del diodo ideal"

- Para portadores minoritarios (electrones o huecos) en Si el tiempo de vida se puede calcular como:

$$\tau = \frac{45x10^{-6}\,\text{seg}}{\left(1 + 7{,}7x10^{-18}\,xN_{D,A} + 4{,}5x10^{-36}\,xN_{D,A}^{2}\right)}$$

- Para huecos en Si

$$\mu_p = \left\{ \frac{418{,}3}{\left[1 + \left(N_{A,D} \big/ 1{,}6x10^{17}\right)^{0{,}7}\right]} \right\} + 49{,}7;\ \text{en}\left(\text{cm}^2 / \text{V} - \text{seg}\right)$$

- Para electrones en Si

$$\mu_n = \left\{ \frac{1268}{\left[1 + \left(N_{A,D} \big/ 1{,}3x10^{17}\right)^{0{,}91}\right]} \right\} + 92;\ \text{en}\left(\text{cm}^2 / \text{V} - \text{seg}\right)$$