Universidade Federal de Pernambuco

CTG – Centro de tecnologia e geociências
DES – Departamento de Eletrônica e Sistemas
Introdução aos Dispositivos Semicondutores
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FORMULÁRIO – 2ª. Unidade

Transistor Bipolar de junção (TBJ)

$$I_E = I_C + I_B \qquad I_C = \alpha . I_E$$

$$I_C = B . I_{E_P} \qquad I_C = \beta . I_B$$

$$I_{E_P} = \gamma . I_E$$

$$\gamma = \left[1 + \left(\frac{D_{n_E} . N_d . L_p}{D_p . N_a . L_{n_E}} . \tanh\left(\frac{l}{L_p} \right) \right) \right]^{-1} \qquad B = \sec h\left(\frac{l}{L_p} \right)$$

$$\alpha = \left\{ \cosh\left(\frac{l}{L_p} \right) + \left[\frac{D_{n_E} . N_d . L_p}{D_p . N_a . L_{n_E}} . \operatorname{senh}\left(\frac{l}{L_p} \right) \right] \right\}^{-1}$$

$$\beta = \left\{ \cosh\left(\frac{l}{L_p} \right) + \left[\frac{D_{n_E} . N_d . L_p}{D_p . N_a . L_{n_E}} . \operatorname{senh}\left(\frac{l}{L_p} \right) \right] - 1 \right\}^{-1}$$

$$I_E = I_{E_S} \left(e^{\frac{e.V_{EB}}{K_B T}} - 1 \right) - \alpha_I . I_{C_S} \left(e^{\frac{e.V_{CB}}{K_B T}} - 1 \right)$$

$$I_C = \alpha_{N.} I_{E_S} \left(e^{\frac{e.V_{EB}}{K_B T}} - 1 \right) - I_{C_S} \left(e^{\frac{e.V_{CB}}{K_B T}} - 1 \right)$$

$$I_{E_S} = \frac{e.A.D_p . p_B}{L_p} . \coth\left(\frac{l}{L_p} \right) + \frac{e.A.D_{n_E} . n_E}{L_{n_E}}$$

$$I_{C_S} = \frac{e.A.D_p . p_B}{L_p} . \coth\left(\frac{l}{L_p} \right) + \frac{e.A.D_{n_C} . n_C}{L_{n_C}}$$

$$\alpha_N = \frac{e.A.D_p . p_B}{I_{E_S} . L_p} . \operatorname{csc} h\left(\frac{l}{L_p} \right) \qquad \alpha_I = \frac{e.A.D_p . p_B}{I_{C_S} . L_p} . \operatorname{csc} h\left(\frac{l}{L_p} \right)$$

$$\alpha_N . I_{E_S} = \alpha_I . I_{C_S}$$

Transistor Efeito de campo - Junção (JFET)

$$V_C = \frac{e.N_d.a^2}{2 \in}$$

$$|I_D| = G_0.V_C.\left[\frac{V_D}{V_C} + \frac{2}{3}\left(\frac{-V_p}{V_C}\right)^{\frac{3}{2}} - \frac{2}{3}\left(\frac{V_D - V_p}{V_C}\right)^{\frac{3}{2}}\right]$$

$$G_0 = \frac{2e.N_d.\mu_n.D.a}{L}$$

$$V_{D_{sat}} = V_c + V_p$$

Transistor Efeito de campo – MOS (MOSFET)

$$V_C = \frac{Q_d - Q_{ox}}{C_i} + 2\phi_F + \phi_{ms}$$

$$2\phi_F = \frac{2K_BT}{e}\ln\left(\frac{N_a}{n_i}\right)$$

$$Q_d = 2\left(\in_S .e.N_a.\phi_F\right)^{\frac{1}{2}}.A$$

$$C_i = \frac{\in_i .A}{d}$$

$$I_{D_{sat}} = \frac{\mu_n.C_i.V_{DS}^2}{2L^2}$$

$$I_D = \frac{\mu_n.C_i}{L^2}.\left[\left(V_p - V_C\right)V_D - \frac{V_D^2}{2}\right]$$

Dispositivos opto-eletrônicos

$$I = I_0.e^{-\alpha x}$$

$$\alpha = \frac{2\omega\kappa}{c}$$

$$N = n + iK$$

$$R = \left|\frac{(N-1)}{N+1}\right|^2$$

$$g = \frac{\eta.I_0}{\hbar.\omega.d}$$

$$\Delta I = \frac{b.d.g.\tau_r.e.\left(\mu_n + \mu_p\right)V}{l}$$

$$G = \frac{\Delta I}{e.g.b.d.l}$$

$$I = I_S.\left(e^{\frac{eV}{K_BT}} - 1\right) - I_L$$

$$I_L = \frac{\eta.e.I_0.A}{\hbar.\omega} = \frac{\eta.e.P_L.\lambda}{hc}$$

$$P_L = I.A$$

$$FF = \frac{I_m.V_m}{I_{cc}.V_{ca}}$$

$$r = \frac{I_L}{P_L} = \frac{\eta.e.\lambda}{hc}$$

$$\eta_{conv} = \frac{P_{ele}}{P_L} = \frac{I_m.V_m}{P_L}$$