EQ Reference List

$$V_T = V_{T0} + \gamma(\sqrt{|-2\phi_F| + V_{SB}} - \sqrt{|-2\phi_F|})$$

$$I_D = \frac{k'_n}{2}\frac{W}{L}(V_{GS} - V_T)^2(1 + \lambda V_{DS}) \quad \text{(sat)}$$

$$I_D = k'_n \frac{W}{L}(V_{GS} - V_T)V_{DS} - \frac{{V_{DS}}^2}{2} \quad \text{(triode)}$$

$$k' = \mu_n \cdot C_{ox}$$

$$k = k' \cdot \frac{W}{L}$$

$$\phi_0 = \frac{kT}{q}\ln\frac{N_A \cdot N_D}{n_i^2}$$

$$\phi_{osw} = \frac{kT}{q}\ln\frac{N_A' \cdot N_D}{n_i^2}$$

$$C_{j0} = \sqrt{\frac{\varepsilon_{si} \cdot q}{2}\left(\frac{N_A \cdot N_D}{N_A + N_D}\right)} \cdot \frac{1}{\sqrt{\phi_0}}$$

$$C_{josw} = \sqrt{\frac{\varepsilon_{si} \cdot q}{2}\left(\frac{N_A' \cdot N_D}{N_A' + N_D}\right)} \cdot \frac{1}{\sqrt{\phi_{osw}}}$$

$$C_{jsw} = X_j C_{josw}$$

$$C_{drain} = Keq \cdot Cj0 \cdot A + Keq' \cdot Cjsw \cdot P$$

$$C_{eq} = \frac{\Delta Q_j}{\Delta V_D} = \frac{Q_j(V_{high}) - Q_j(V_{low})}{V_{high} - V_{low}} = K_{eq} C_{j0}$$

$$K_{eq} = \frac{-\phi_0^m}{(V_{high} - V_{low})(1 - m)}[(\phi_0 - V_{high})^{1-m} - (\phi_0 - V_{low})^{1-m}]$$

$$NM_L = V_{IL} - V_{OL}$$

$$NM_H = V_{OH} - V_{IH}$$

In VTC, the point which indicates V_{IH} or V_{IL} must satisfy:

$$\frac{dV_{out}}{dV_{in}} = -1$$

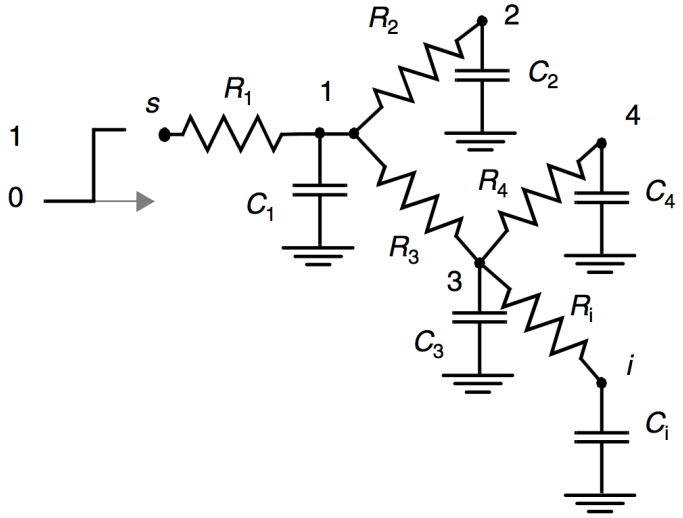
$$\tau_P = \frac{\tau_{PHL} + \tau_{PLH}}{2}$$

$$t_{PHL} = \ln 2 \, C_L R_{eqn}$$

$$t_{PLH} = \ln 2 \, C_L R_{eqp}$$

$$R_{eq} = \frac{1}{2 \ln 2} \frac{1}{1 + \lambda V_{DD}} \frac{V_{DD}}{I_{DSAT}}$$

Elmore delay model and formula:



Shared path resistance:

$$R_{ik} = \sum R_j \Rightarrow (R_j \in [path(s \rightarrow i) \cap path(s \rightarrow k)])$$

The Elmore delay at node i:

$$\tau_{Di} = \sum_{k=1}^{N} C_k R_{ik}$$