Initiation

$$\psi_{sa} = \left[\sqrt{\frac{\gamma^2}{4} + V_G - V_{FB}} - \frac{\gamma}{2} \right]^2$$

Pinch-Off Surface Potential

$$a = \frac{\gamma}{2\sqrt{\psi_{sa}}}$$

Depletion-Region Charge Expansion Parameter

$$V_d = V_{FBsub} - V_{FB}$$

Implant Voltage

$$V_{Ba} = \gamma\sqrt{\psi_{sa}} - V_d$$

$$B = 2V_{Ba} \qquad b = aV_{th}$$

$$C = \gamma^2 V_{th} e^{\frac{(\psi_{sa} - V_{ch} - PHI)}{V_{th}}}$$

$$\Psi_{init} = a\left(\psi_{sa} - V_{th} - PHI - V_{ch}\right)$$

Iteration

$$\Psi = \Psi - \frac{b \cdot \ln\left(\dfrac{\Psi}{G}\right) + \Psi}{\dfrac{b}{\Psi} + 1}$$

Ψ = Channel Charge Gate Capacitance Voltage

Saturation

$$V_{Dsat} = \frac{\Psi}{a} + V_{th} \ln(150)$$

$$V_{DS} = V_{DS} > V_{Dsat} ? V_{Dsat} : V_{DS}$$

$$V_D = V_{DS} + V_{ch}$$

Drain Current

$$i_{Ds} = \frac{\Psi_S^{\ 2}}{2 \cdot a} + V_{th} \Psi_S$$

$$i_{Dd} = \frac{\Psi_D^{\ 2}}{2 \cdot a} + V_{th} \Psi_D$$

$$i_D = i_{Ds} - i_{Dd}$$

$$i_f = \frac{i_{Ds}}{2 \cdot a \cdot V_{th}^{\ 2}}$$

Dimensionless Currents

$$i_r = \frac{i_{Dd}}{2 \cdot a \cdot V_{th}^{\ 2}}$$