

$$I_D = \frac{\mu_n C_{ox} W}{L} \left(V_{GS} - V_{FB} - 2\phi_F - \frac{V_{DS}}{2} \right) V_{DS} \\ - \frac{2}{3} \mu_n \frac{W}{L} \sqrt{2\varepsilon_s q N_a} \left((2\phi_F + V_{DB})^{3/2} - (2\phi_F + V_{SB})^{3/2} \right)$$