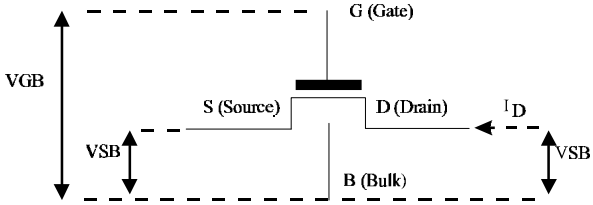

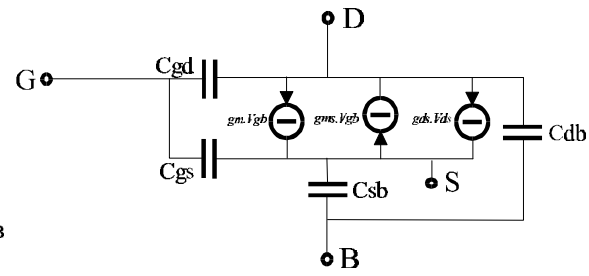

DC parameters:

Strong inversion:

$$Vdss = \frac{Vgs - Vt}{n}$$

$Vt = Vt(Vsb = 0) + (n0 - 1)Vsb$

n ~ n0 ~ 1 + 33/ $m_0 C_{ox}$, with $m_0 C_{ox}$ in uA/V^2

$b = m_0 C_{ox} W / L$

(C_{ox} = gate oxide capacitance, W = transistor width, L = transistor length, m_0 = electron mobility)

$$I_D = \frac{b}{2n} \cdot (Vgs - Vt)^2$$

for *Vds* >*Vdss* (MOST in saturation)

$$I_D = b \cdot ((Vgs - Vt) \cdot Vds)$$

for *Vds*<*Vds.*

Weak inversion:

$Vgs \sim Vt\text{-}5U_T$

$Vdss = 5U_T$

$Vt = Vt(Vsb = 0) + (n0 - 1)Vsb$

n ~ n0 ~ 1 + 33/ $m_0 C_{ox}$, with $m_0 C_{ox}$ in uA/V^2

Matching:

$$s(\Delta Vt) \approx K / \sqrt{LW}$$

$$s(\Delta b / b) \approx N \sqrt{(1/L^2) + (1/W^2)}$$

$$s\left(\frac{\Delta I_D}{I_D}\right) \approx \sqrt{s(\Delta b / b)^2 + \frac{gm}{I_D} \cdot s(\Delta Vt)^2}$$

$$s(\Delta Vt) \approx \sqrt{\frac{I_D}{gm} \cdot s(\Delta b / b)^2 + s(\Delta Vt)^2}$$

Kn ~ 16 mV.µm, Nn ~ 1.6E-2 µm (index n = NMOS)

Kp ~ 31 mV.µm, Np ~ 2.4E-3 µm (index p = PMOS)

AC parameters:

strong, week and moderate inversion , *Vds > Vdss*

$$I_{D\lim} = \frac{b}{2n}(2nU_T)^2$$

LIM = I_D/I_{dlim}

$$gm = \frac{I_D}{nU_T\sqrt{1 + LIM}}$$

gms = gm . n

Vearly = $L\, m_0 C_{ox}$ /X, where X = 10~8 V^3/uA.

gds = I_D/Vearly

Cgd = $C_{ox}.W.L_d$, L_d =length of the drain-gate overlap

Cgs = $C_{ox}.W.L_s + 2.C_{ox}.W.L/(3.n)$ (L_s = length of the source-gate overlap), weak inversion.
Cgs = $C_{ox}.W.L_s + 2.C_{ox}.W.L/3$ (L_s = length of the source-gate overlap), strong inversion.

Use for moderate inversion the average Cgs value

$$Cdb = Cj.Ad\frac{1}{(1 + Vdb / P_B)^{Mj}} + Cjsw.Pd\frac{1}{(1 + Vdb / P_B)^{Mjsw}}$$

$$Csb = Cj.As\frac{1}{(1 + Vsb / P_B)^{Mj}} + Cjsw.Ps\frac{1}{(1 + Vsb / P_B)^{Mjsw}}$$

$\overline{v_n(f)}^2$ = *4.n.k.T/(2.gm) + K/(W.L.f), weak inversion*

$\overline{v_n(f)}^2$ = *8.k.T/(3.gm) + K/(W.L.f), strong inversion*

Use for moderate inversion the average $\overline{v_n(f)}^2$ value.