MOSFETS

(n-channel enhancement, or NMOS)

These parts are static sensitive, handle with care

triode region
(a.k.a., ohmic or linear)

\[
\begin{align*}
V_D &< V_G - V_t \\
V_G &> V_D \\
V_D &< V_G - V_t
\end{align*}
\]

saturation region
(a.k.a., constant current or active)

\[
\begin{align*}
V_D &> V_G - V_t \\
V_G &> V_D \\
V_G &< V_D
\end{align*}
\]

The constants see p. 364 in text

\[
\begin{align*}
\mu_n &= \text{electron mobility} = \frac{580 \text{ cm}^2}{\text{V-s}} \\
\mu_p &= \text{hole mobility} = \frac{230 \text{ cm}^2}{\text{V-s}} \\
C_{ox} &= \text{oxide capacitance} = \frac{\varepsilon_0 \varepsilon_r}{d} \\
k' &= \mu_n C_{ox} \\
W &= \text{channel width} \\
L &= \text{channel length} \\
K &= \frac{k'nW}{L} = \text{gain factor} \\
g_m &= \frac{\mu_n W}{L} (V_G - V_t) = \text{transconductance (small signal)}
\end{align*}
\]

Body effects
If the body (substrate) is NOT connected to the source, \( V_t \) will be different. See p. 374 in text.

Thermal effects
\[
\Delta V_t \approx -\frac{2.5 mV}{\text{degC}}
\]

so MOSFETs can be hooked in parallel