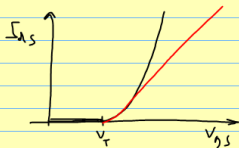
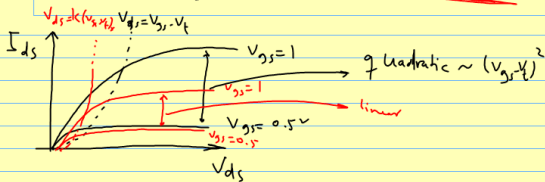
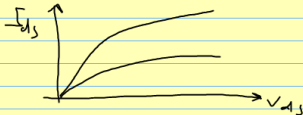


Long ch vs Short-ch



Velocity Saturation

1. The current prematurely saturates in short ch device.
(extended sate region)
2. I_{dsat} linear relationship V_{gs}
3. I_{dsat} has a weaker L dependence

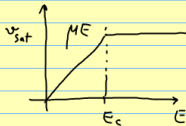


Simplified Velocity Sat Model

(i) assumption I

$$v = \begin{cases} v_{sat} & E > E_c \\ \mu E & E < E_c \end{cases}$$

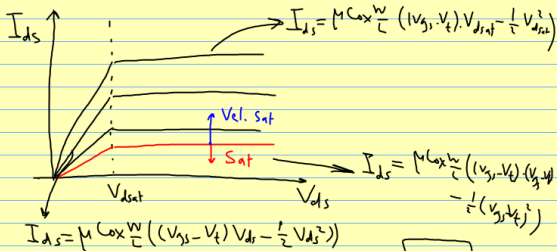
$$v_{sat} = \mu E_c$$



(ii) Assumption II for large $(V_{gs} - V_t)$

$$\underline{V_{dsat}} = \text{const} \approx E_c \cdot L = L \frac{v_{sat}}{\underline{\mu}}$$

Unified Mos Model



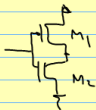
Unified Model

$$I_{ds} \begin{cases} 0 & V_{gs} < V_t \\ \mu C_{ox} \frac{W}{L} \left((V_{gs} - V_t) \underline{V_{min}} - \frac{1}{2} V_{min}^2 \right) (1 + \lambda V_{ds}) & \end{cases}$$

$$V_{min} = \min (V_{gs} - V_t, V_{ds}, V_{dsat})$$

$\swarrow$ Sat $\downarrow$ linear $\searrow$ Vol. Sat.

CAD Tools



extract
netlist

M1 W= L=

M2 W= L=

wire - - -

Run HSpice