

pass transistors, p. 1153

best treatment:

webpages.eng.wayne.edu/codence/ECE6570/doc/

lect 3-1.pdf

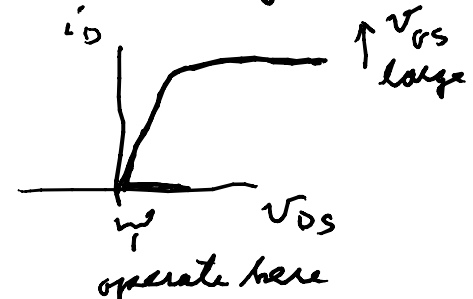
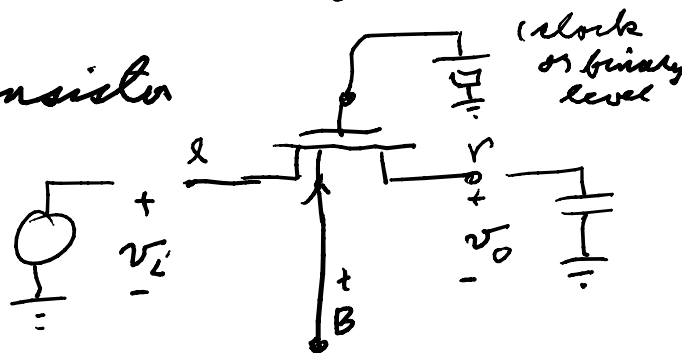
p. 11 has a NAND gate

digital computers \Rightarrow binary logic \Rightarrow fixed voltages

digital signal processing \Rightarrow clocked delays, analog samples

hardware all uses, MOS, BJT, C, R, L, transformers
all are analog

Pass transistor



v_{GS} = lowest voltage available

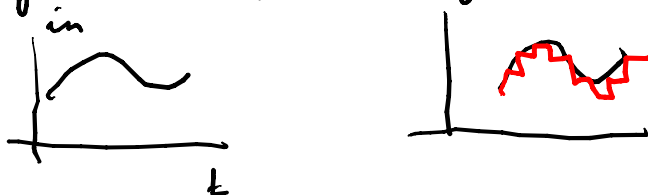
Case 1: if $v_i > v_o$ then $v_{rD} > 0$ & $r = \text{drain}$, $l = \text{source}$

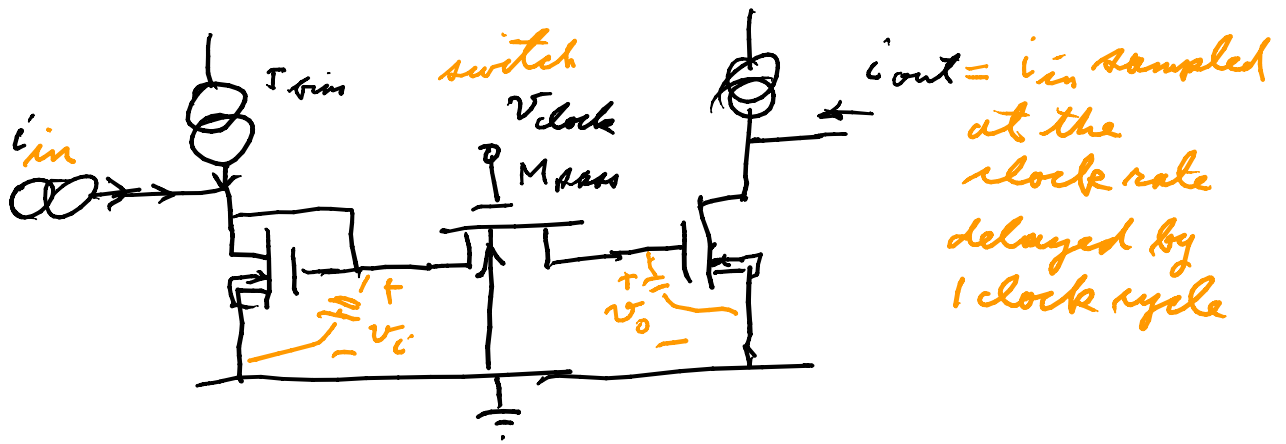
charges C until v_o forces $v_{GS} = v_{rl} = \text{threshold}$
 $= V_{T0} + \gamma(\sqrt{V} - \sqrt{V})$

Case 2: $v_i < v_o$ then $v_{rD} > 0$ & $r = \text{drain}$, $l = \text{source}$

discharges the capacitor

Digital signal processing \Rightarrow have a "fast" clock



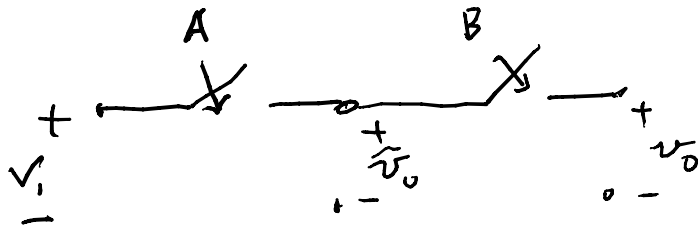
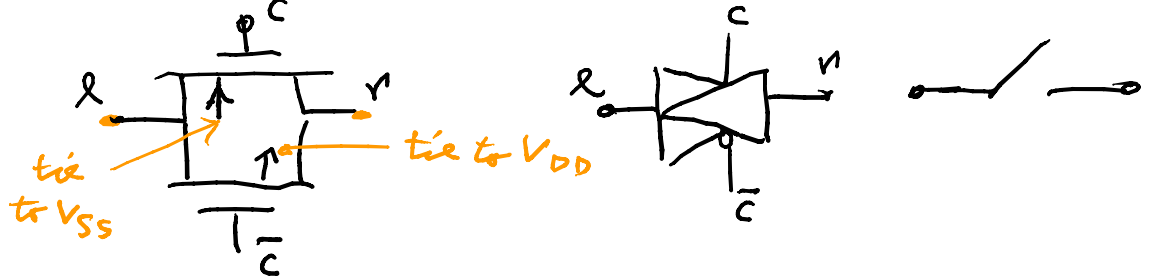


The standard switched current circuit

(a sample and hold)

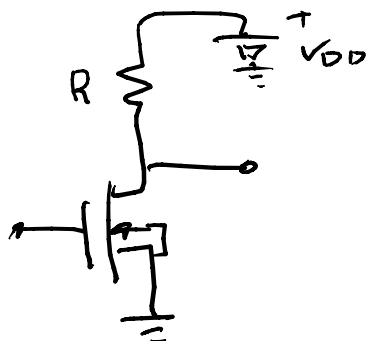
has a "small" problem with clock feed through due to M_{pass} C_{gs} or C_{gd} holding charge

transmission gate; uses N & P MOS

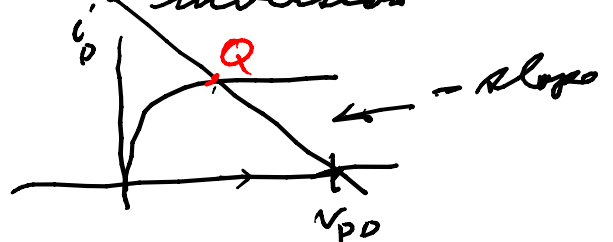


and gate

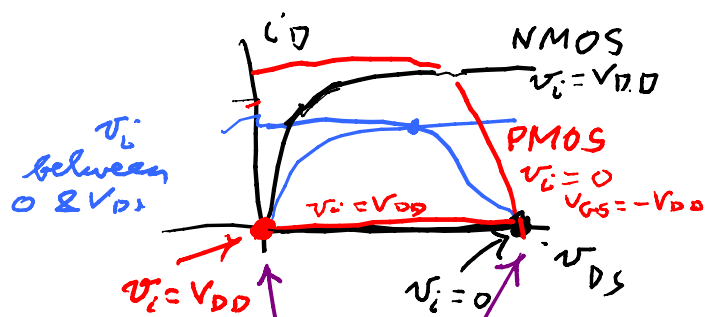
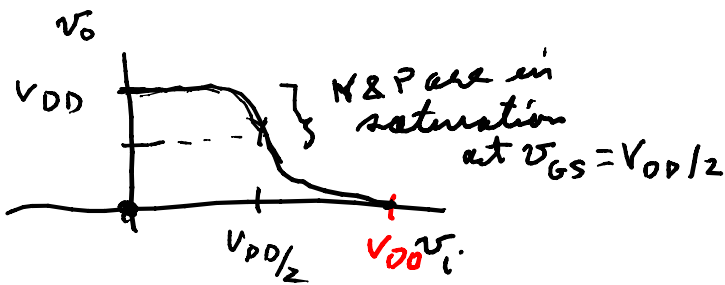
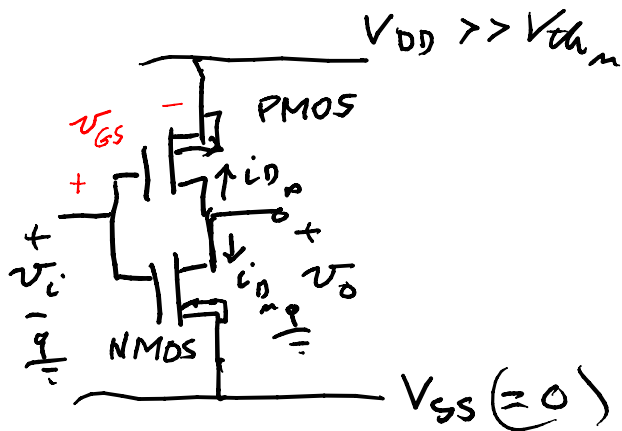
Inverter



$A_v = -g_m R$ small signal inversion



uses power all the time



desire large signal
as binary or clock
are at the rails
so changes are large

these are rest points
where $i_D \approx 0 \Rightarrow$ no power
into the transistors

at $V_{DD}/2 = v_i$:

both transistors are in saturation if $v_o = V_{DD}/2$

$$i_{Dn} = -i_{Dp} \Rightarrow \frac{K_P}{2} \left(\frac{W}{L}\right)_m (V_{DD} - V_{TOm})^2 = \frac{K_P}{2} \left(\frac{W}{L}\right)_p (V_{DD} - \frac{V_{DD}}{2} - |V_{TOp}|)^2$$

$$\frac{\left(\frac{W}{L}\right)_p}{\left(\frac{W}{L}\right)_m} = \frac{K_{Pm} \cdot \left(\frac{V_{DD} - V_{TOm}}{2}\right)^2}{K_{Pp} \cdot \left(\frac{V_{DD}}{2} - |V_{TOp}|\right)^2} \approx \frac{K_{Pm}}{K_{Pp}}$$

for $4007_m = K_{Pm} = 20.54 \times 10^{-6}$

$4007_p = K_{Pp} = 10.32 \times 10^{-6}$

$$\Rightarrow \frac{W_p}{W_m} \approx 2$$

they are

$W_m = 144\mu$

$W_p = 328\mu$