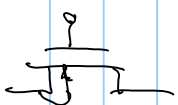
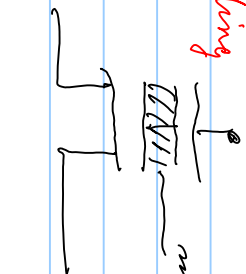
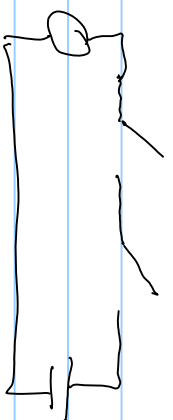


flooding gate MOS
metal $\approx$ adding a capacitor in series with the gate



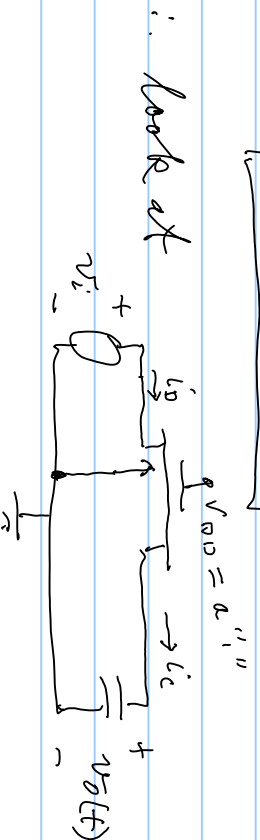
$a''1''$ as turned on all the way
 $V_{GS} \approx V_{DD}$
 $V_{GS} = 0$

$a''0''$ as turned off

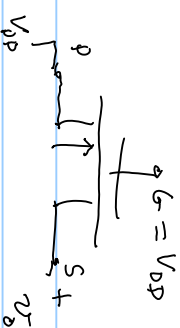


an analog in pass transistor form of $\sim$ is an MOS transistor

pass transistor

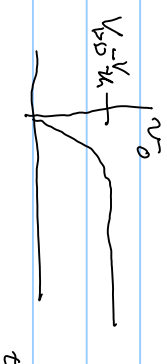


case 1: $v_o(0) = 0$, $v_i(t) = V_{DD}$, $v_g = V_{DD}$



$$v_{DS} = V_{DD} - v_o(t), \quad v_{GS} = V_{DD} - v_o(t)$$

$$V_{GS} - V_{th} < v_{DS} \Rightarrow \text{saturation}$$



$$i_d = C \frac{dv_o}{dt} = i_b = k (v_{GS} - V_{th})^2 = k (V_{DD} - V_{th} - v_o(t))^2$$

$$\frac{dv_o}{(V_{DD} - V_{th} - v_o)^2} = \frac{k}{C} dt \Rightarrow \int_{v_o(0)}^{v_o(t)} \frac{dv_o}{(V_{DD} - V_{th} - v_o)^2} = \frac{k}{C} \int_0^t d\tau$$

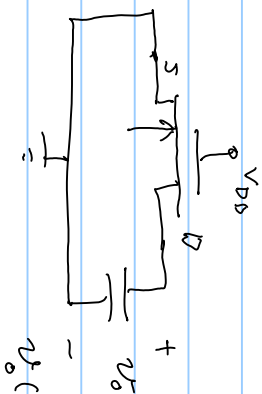
$$\text{def } x = V_{DD} - V_{th} - v_o, \quad dx = -dv_o, \quad a = V_{DD} - V_{th}, \quad \frac{dx}{x^2} = -\frac{1}{x^2} dx$$

$$\int_{x(0)}^{x(t)} \frac{-dx}{x^2} = \frac{k}{C} t = \frac{1}{x} \Big|_{a-v_o(0)}^{a-v_o(t)} = \frac{1}{a-v_o(t)} - \frac{1}{a-v_o(0)} = \frac{k}{C} t$$

$$\begin{aligned}
 a - v_o(t) &= \frac{1}{\frac{R}{C} + \frac{1}{a - v_o(0)}} \Rightarrow v_o(t) = a - \frac{a - v_o(0)}{1 + \frac{R}{C}(a - v_o(0))t} = a - a + \frac{a^2 \frac{R}{C} t}{1 + \frac{R}{C}(a - v_o(0))t} \\
 &= \frac{a^2 \frac{R}{C} t}{1 + \frac{R}{C} a t} \Rightarrow a a t \Rightarrow \infty \Rightarrow a = V_{DD} - V_{th}
 \end{aligned}$$

Case 2: $v_i(t) = 0$, $v_{GS}(t) = V_{DD}$, $v_o(0) = V_{DD}$

$$v_{GS} = V_{DD}, \quad v_{DS} = v_o(t), \quad v_{DS}(0) = V_{DD}$$



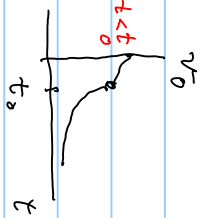
$$v_o(0) = V_{DD}$$

$$v_{GS}(t) = V_{DD}, \quad v_{GS}(t) = V_{DD} - V_{th}, \quad v_{DS} = v_o(t)$$

Becomes ohmic, when v_o drops below $V_{DD} - V_{th}$

from $t=0$ until this time $C \frac{dv_o}{dt} = -k(V_{DD} - V_{th})^2 \Rightarrow v_o(t) = -k t + V_{DD}, 0 \leq t < t_0$

after in ohmic state $-C \frac{dv_o}{dt} = k(2(V_{GS} - V_{th})v_o - v_o^2), t_0 \leq t$ Krieger's



$$\frac{dv_0}{(b-v_0)(v_0)} = \frac{1}{(b-v_0)(v_0)} = \frac{1}{v_0} \left[\frac{1}{b-v_0} + \frac{1}{v_0} \right] dv_0 = \frac{1}{b} \left[\frac{1}{v_0} + \frac{1}{b-v_0} \right] dv_0 = \frac{1}{b} \left[\ln v_0 - \ln(b-v_0) \right] + \frac{1}{b} \ln v_0$$

integrate over $t_0 < t$

$$= \frac{1}{b} \left[\ln v_0 + \frac{1}{b-v_0} \right]_{v_0(t_0)}^{v_0(t)} = \frac{1}{b} \left[\ln v_0 + \frac{1}{b-v_0} \right]_{v_0(t_0)}^{v_0(t)}$$

$$\int_{v_0(t_0)}^{v_0(t)} \left[\left(\frac{-1/b}{v_0-b} \right) dv_0 + \frac{1/b}{v_0} dv_0 \right] = -\frac{1}{b} \left[\ln(t-t_0) \right]_{v_0(t_0)}^{v_0(t)} = -\frac{1}{b} \ln \left(\frac{v_0(t)}{v_0(t_0)} \right)$$

$$= -\frac{1}{b} \ln \left[\frac{v_0(t)}{v_0(t_0)} \right] = -\frac{1}{b} \ln \left(\frac{v_0(t)}{v_0(t_0)} \right) = -\frac{1}{b} \ln \left(\frac{v_0(t)}{v_0(t_0)} \right) = -\frac{1}{b} \ln \left(\frac{v_0(t)}{v_0(t_0)} \right)$$

As for $v_0(t) \Rightarrow v_0(t) = \left[b e^{-\alpha(t-t_0)} \right] / \left[e^{-\alpha(t-t_0)} - 1 \right], t_0 < t, \alpha = \frac{b}{v_0(t_0)}, \alpha = \frac{v_0(t_0)}{v_0(t_0)-b}$

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