EE303H
10/18/11

$$\frac{\beta}{c}\cdot t = \int_{x(0)}^{x(t)} \frac{-1/a}{x}\,dx + \int_{x(0)-a}^{x(t)-a} \frac{1/a}{x-a}\,d(x-a) \qquad x=a$$

$x = V_{DD} - v_O$

$a = 2(V_{DD} - |V_{T0}|)$

$\beta = \frac{KP}{2}\cdot\frac{W}{L}$ (PMOS)

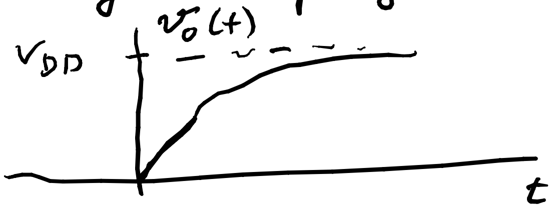
$$= -\frac{1}{a}\ln x\Big|_{x(0)}^{x(t)} + \frac{1}{a}\ln(x-a)\Big|_{x(0)}^{x(t)}$$

$$= \frac{1}{a}\left\{-\ln\left(\frac{x(t)}{x(0)}\right) + \ln\left(\frac{x(t)-a}{x(0)-a}\right)\right\} = \frac{1}{a}\ln\left(\frac{x(t)-a}{x(0)-a}\times\frac{x(0)}{x(t)}\right)$$

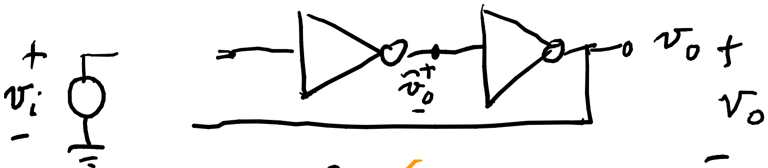
$$e^{\frac{a\beta}{c}t} = \left(\frac{x(t)-a}{x(0)-a}\times\frac{x(0)}{x(t)}\right)$$

look @ home

here 0 is shifted from switching time of inverter input to time of change of PMOS from saturation to ohmic



Look at the latch p. 1205



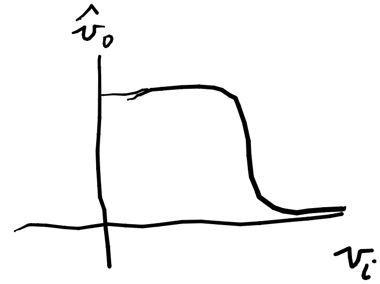
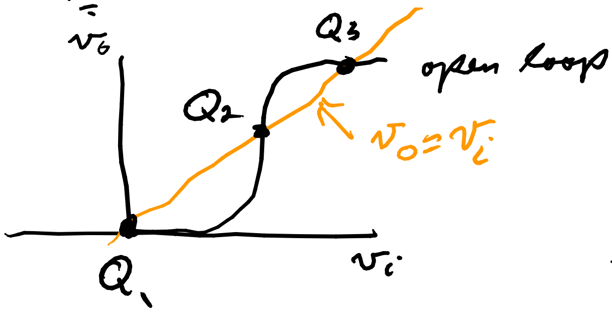


Fig 15.1



When close the feedback loop

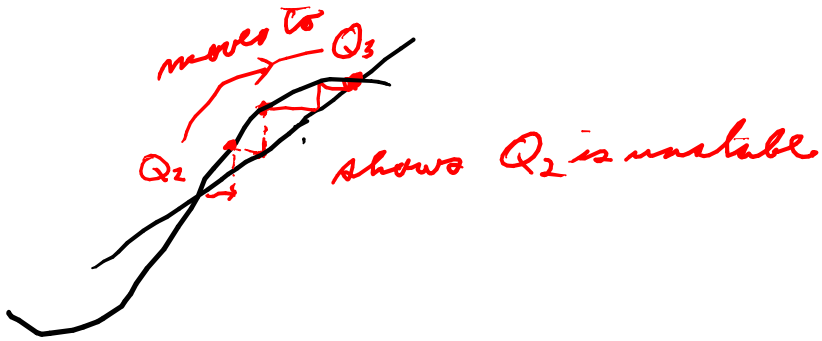
$v_o = v_i$

has 3 rest points

Q_1, Q_2, Q_3

unstable

stable



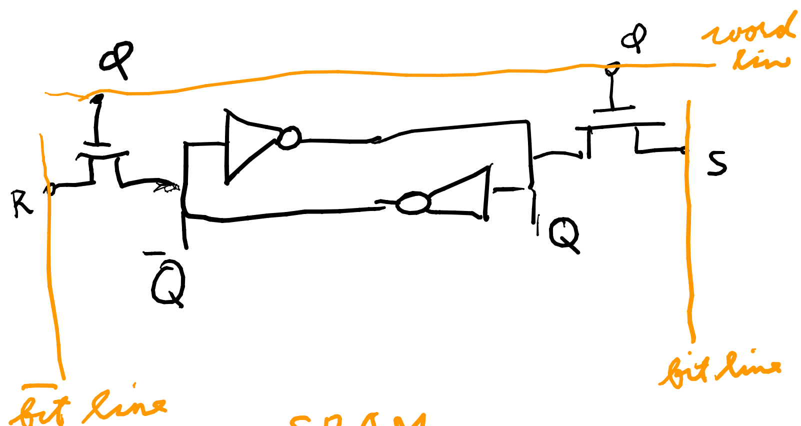
This latches the output for any little input

To make flip-flops go to Fig. 15.3

But first look at memory using the latch

use a stable equilibrium point to remember

Fig. 15.7 a clocked flip flop



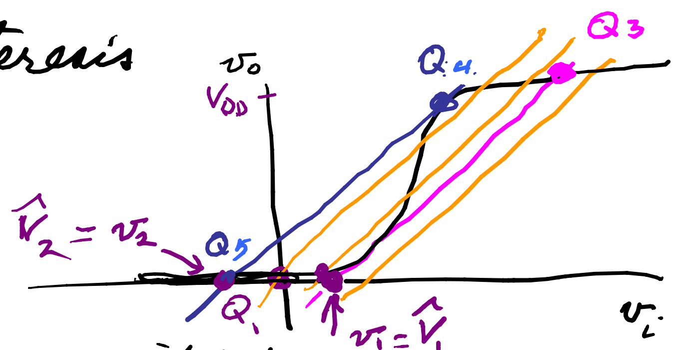
see Fig 15.12

φ = clock on word line ⇒ access for a change

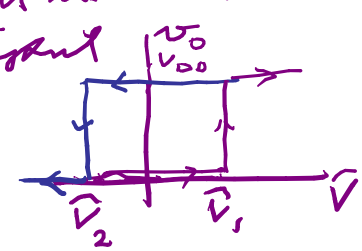
SRAM

static random access memory

Hysteresis



let $\hat{V}$ be a parameter if it is the actual input

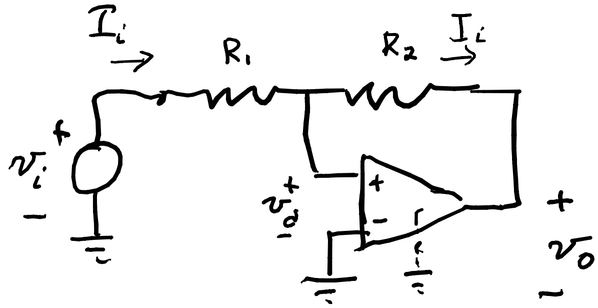


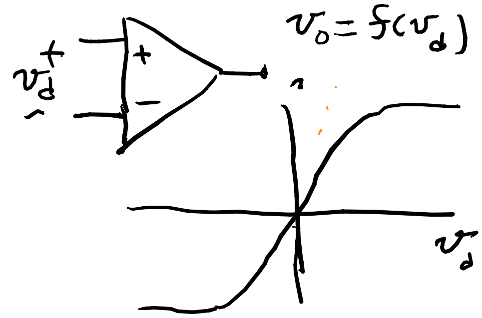
if start at Q_1 we have to jump to Q_3 when move to violet line.

if start at Q_3 and decrease until slopes are equal we jumps at Q_4 to Q_5

gives hysteresis of width $\hat{V}_1 - \hat{V}_2$, see p. 1357

To make → need positive feedback





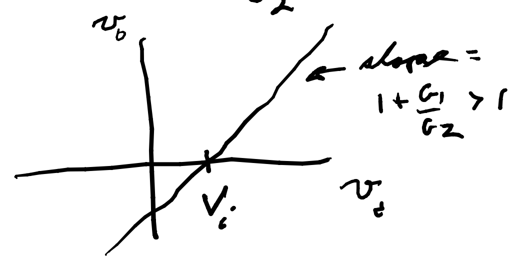
$$I_i = (v_i - v_d)\cdot G_1 = (v_d - v_o)G_2$$

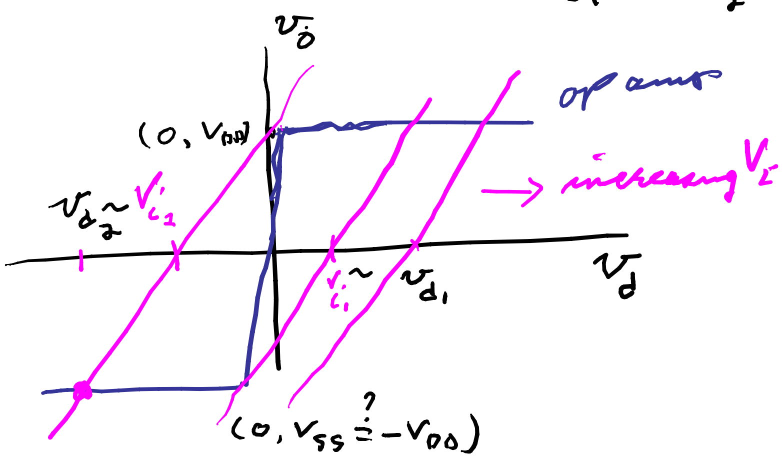
$$\frac{G_1}{G_2}(v_i - v_d) = v_d - v_o \Rightarrow v_o = v_d + \frac{G_1}{G_2}v_d - \frac{G_1}{G_2}v_i$$

$$= \left(1+\frac{G_1}{G_2}\right)v_d - \frac{G_1}{G_2}v_i$$

have load line with slope $\left(1+\frac{G_1}{G_2}\right)$ &

intersect of $V_i = \frac{G_2}{G_1}\left(1+\frac{G_1}{G_2}\right)v_d$





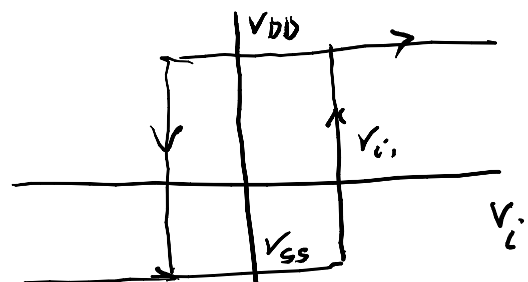


Fig 17.20

V_{i_1} is at $v_{d_1} = \left[\frac{G_1}{G_2}\Big/\left(1+\frac{G_1}{G_2}\right)\right]V_{i_1}$, $\quad v_{d_2} = \frac{G_1}{G_2}\cdot\frac{1}{1+\frac{G_1}{G_2}}V_{i_2}$

here $\left(\frac{V_{DD}}{-v_{d_2}}\right)$ = slope of right triangle