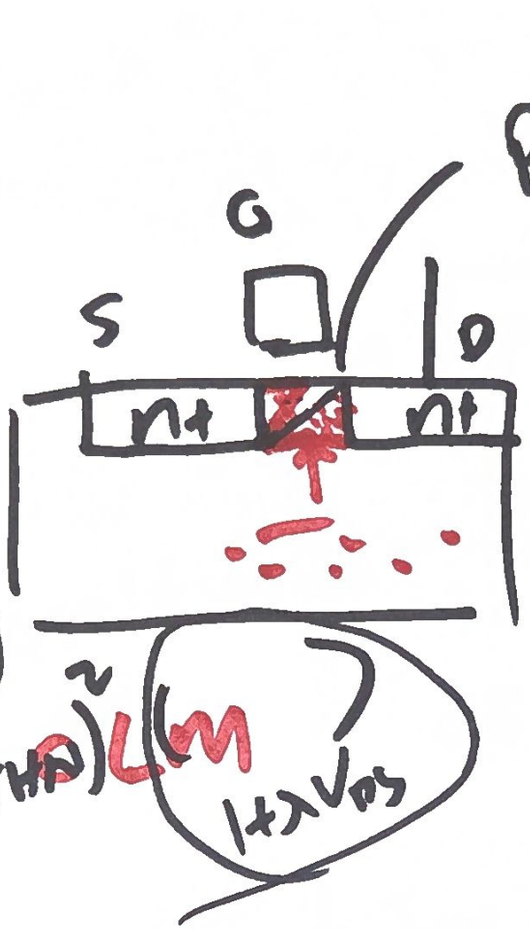
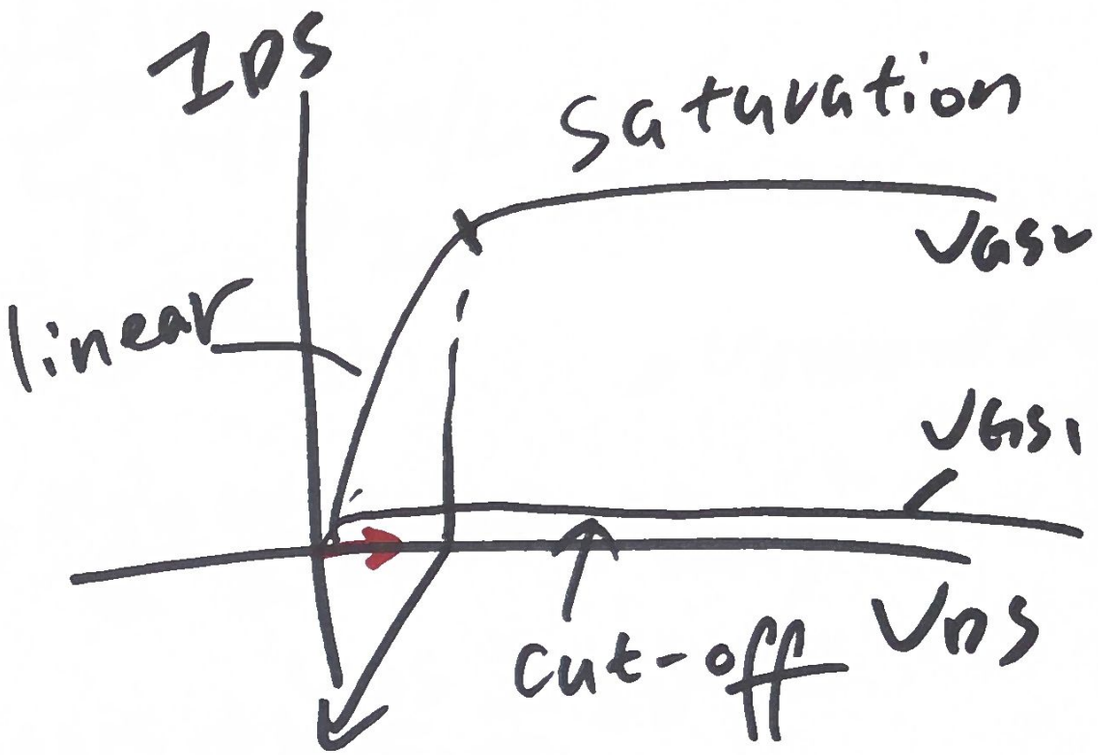


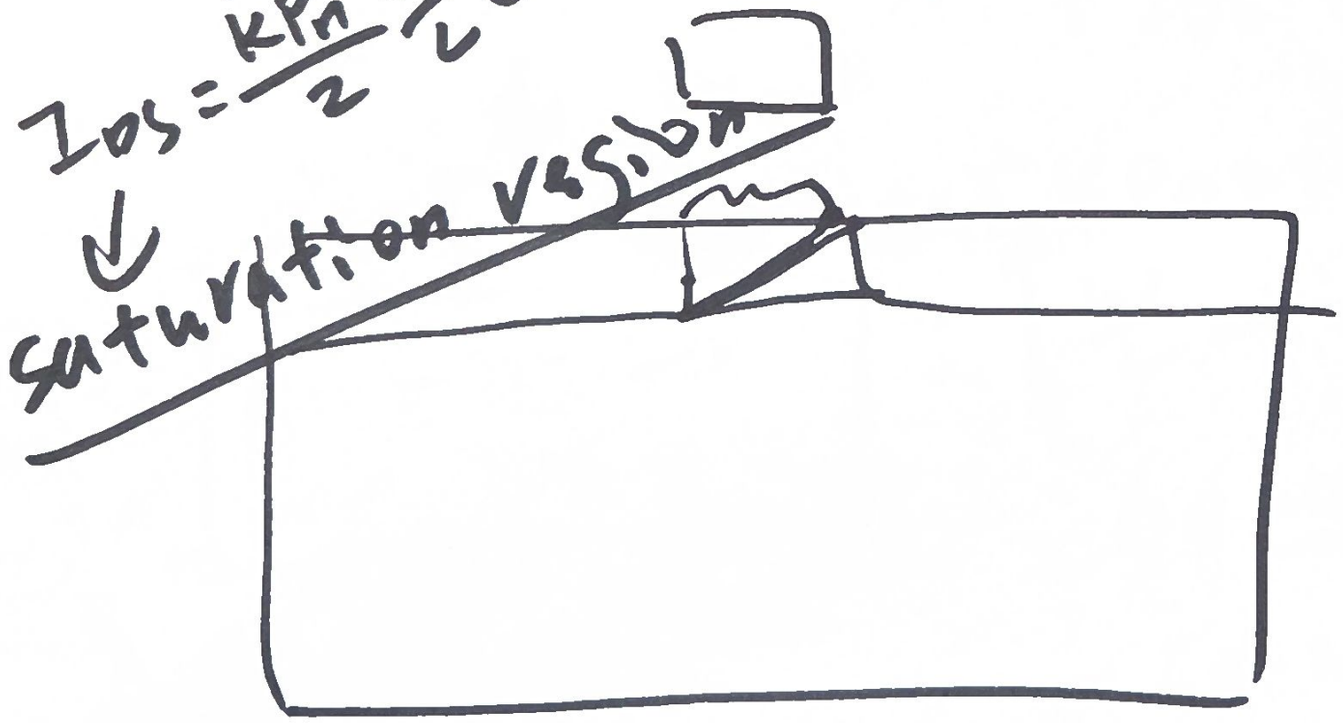
Square Law Equation

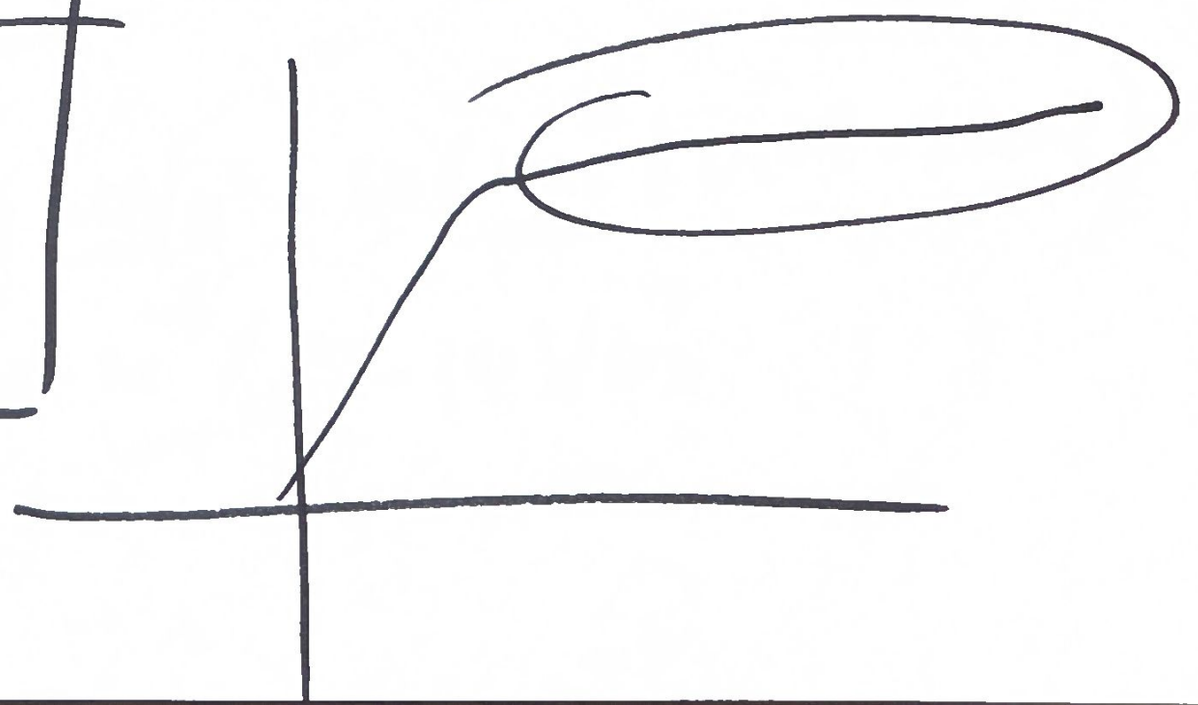
$I_{DS} = \frac{k_{Pn}}{2} \frac{W}{L} (V_{GS} - V_{THN})^2 (1 + \lambda V_{DS})$



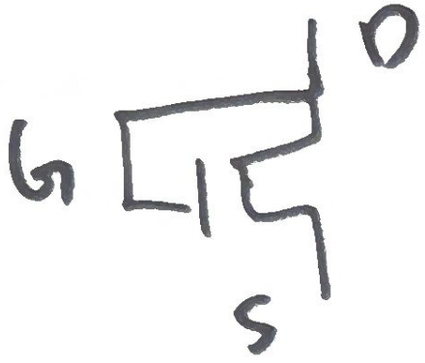
$V_{DS} = V_{DS,sat}$

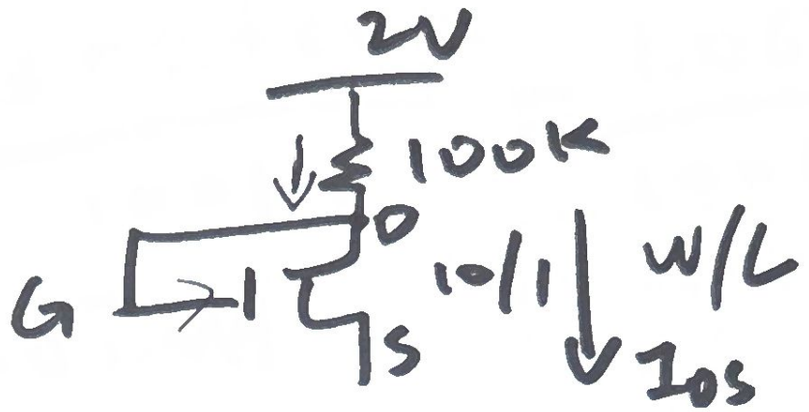
$V_{GS1} \leq V_{THN}$





D





in saturation

$V_{DS} > V_{DS,sat} = V_{GS} - V_{THN}$

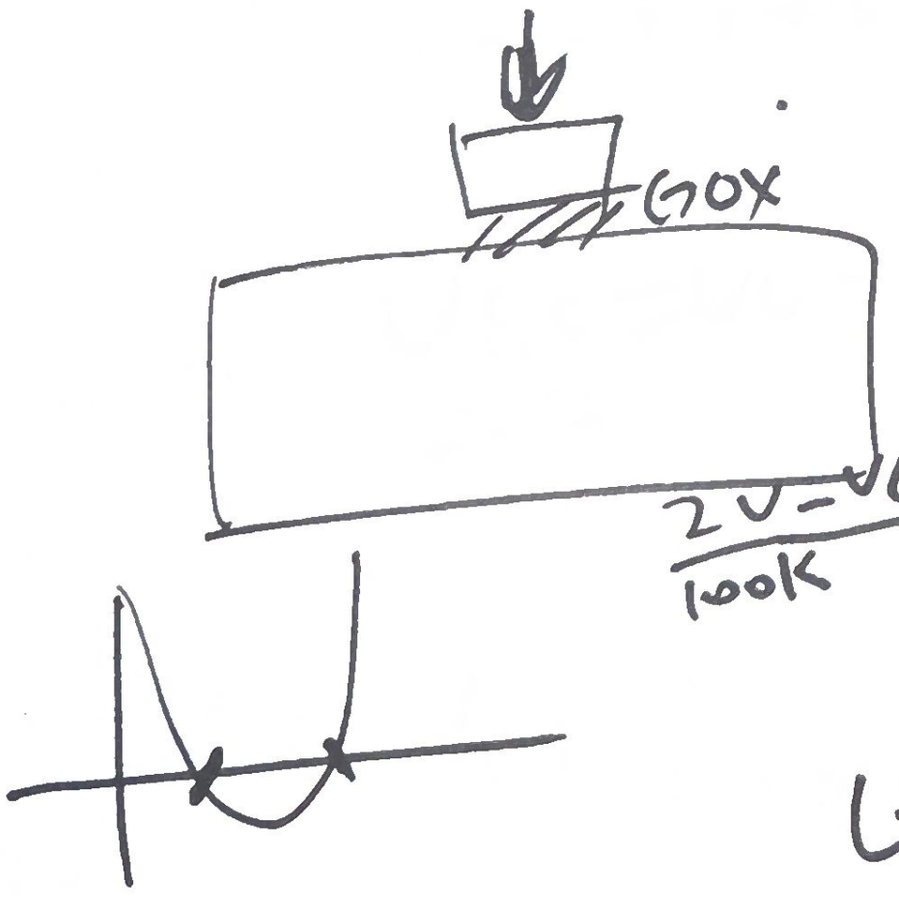
$\Rightarrow V_{THN} = 0,8V$

$\Vert$

V_{GS}

$$\begin{cases} I_{DS} = \frac{KP_n}{2}\frac{W}{L}(V_{GS} - V_{THN})^2 \\ I_{DS} \cdot 100K + V_{GS} = 2V \end{cases}$$

$$\begin{cases} KP_n = 120\,\mu A/V^2 \\ \frac{W}{L} = 10 \end{cases}$$



$= 60\,\mu A/V^2 \cdot 10(V_{GS}^2 + 0.64 - 1.6V_{GS})$

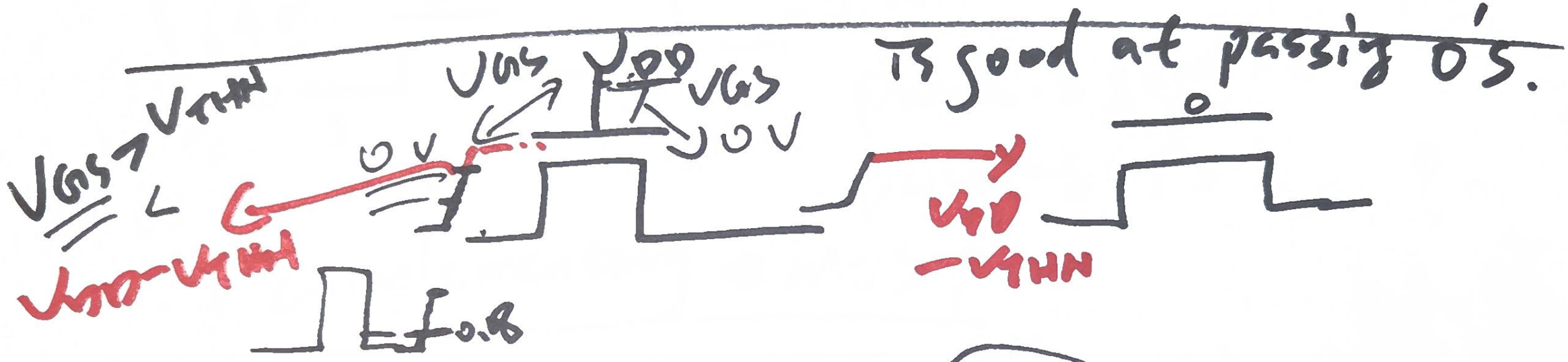
$= 60 \cdot 10^{-6}/V^2 \cdot 10 V_{GS}^2$

$\hookrightarrow V_{GS} = \begin{cases} 0.933V \\ 0.65V \end{cases}$

(2)

$$I_{DS} = \frac{2 - 0.933}{100K} = \frac{1.067V}{100K}$$

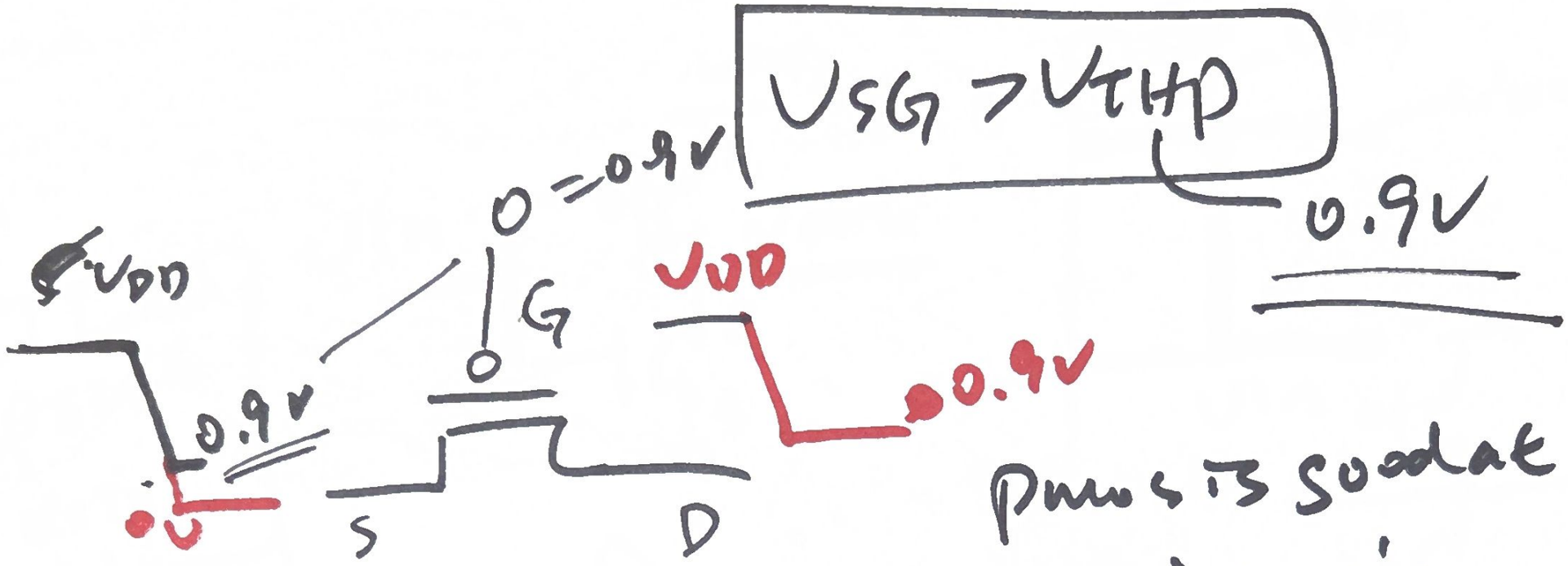
$$= 10.67\mu A$$



$$V_{GS} = V_G - V_S = V_{DD} - V_S \equiv V_{T1tN}$$

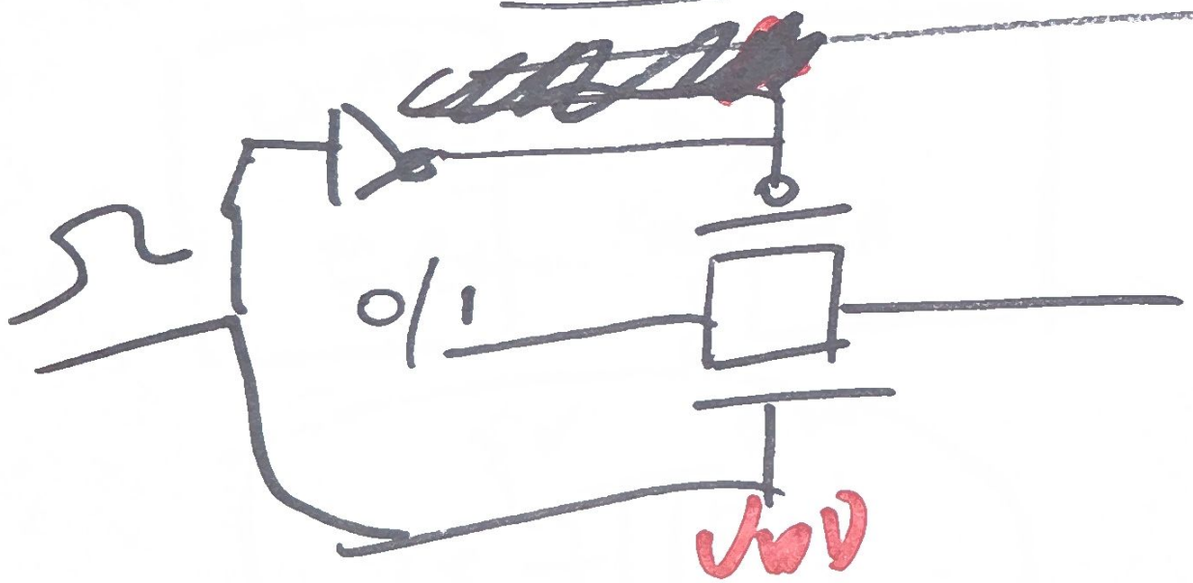
$$\Rightarrow V_{DD} - V_{T1tN} = V_S$$

$$V_{GS} = V_{DD} - (V_{DD} - V_{tHN}) \equiv V_{T1tN} \quad (3)$$

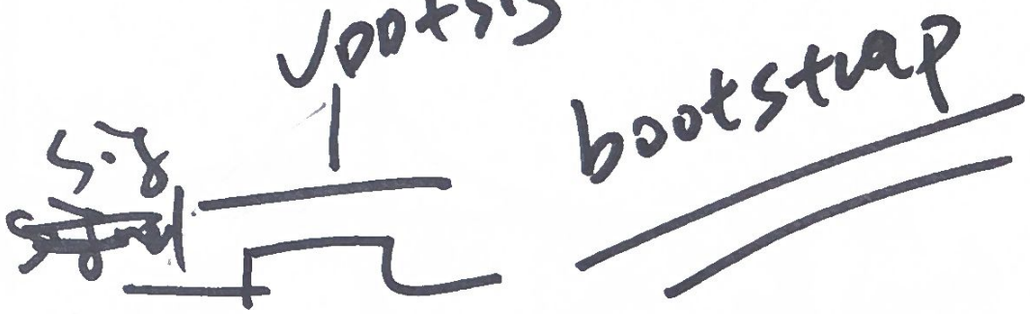


Pmos is good at passing 1's

Complementary eMOS

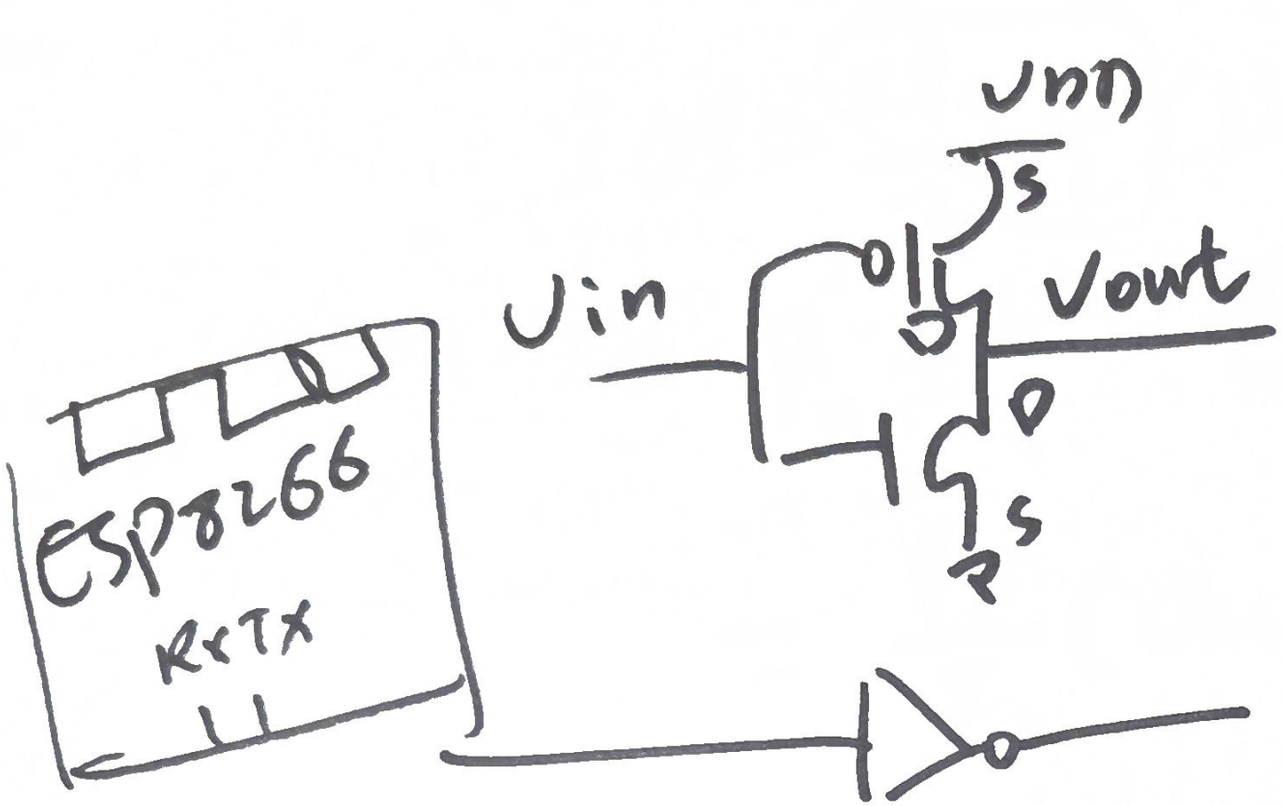


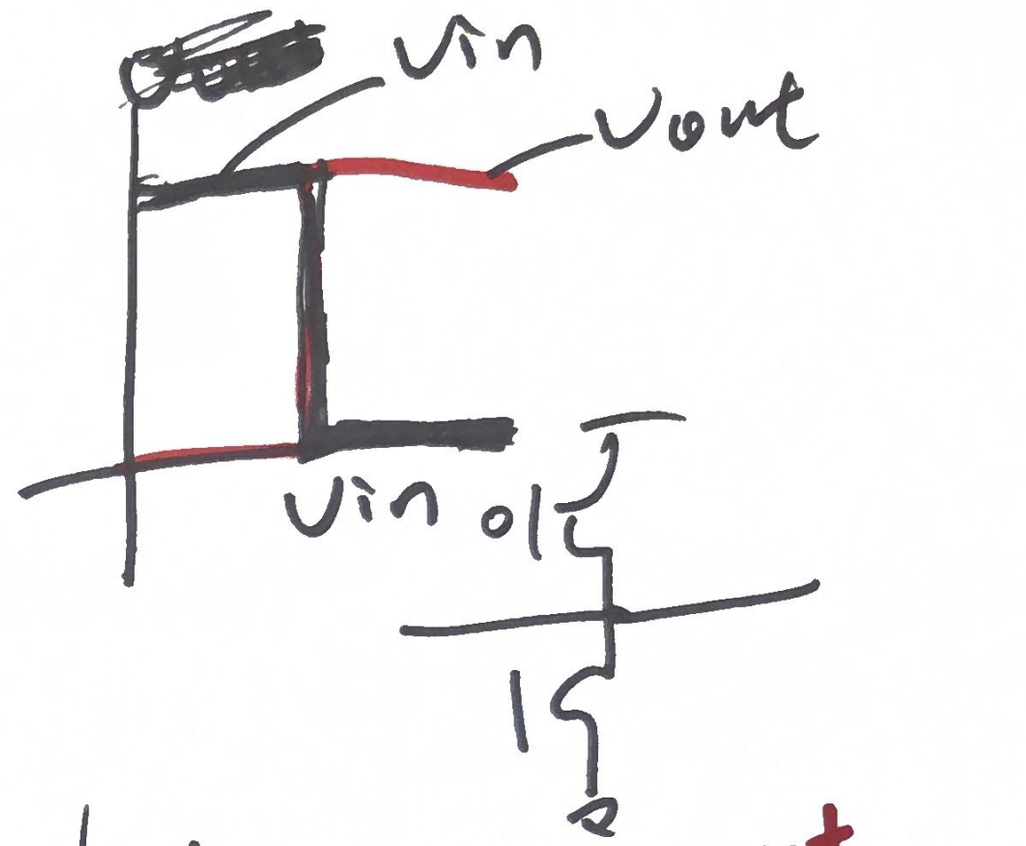
TG : Transmission Gate



pG

pass Gate


ESP8266
RxTx
Vin
Vout
Vdd
S
D
S
3.3V
5V
UART
TX
Rx
3.3V
TX
RX
5V
3.3V
TX
RX
level shifter


Vin
Vout
Vin
Vout
Vsp = 2.5 (50% Vdd)
switching point

$$I_{DS} = \frac{K_{Pn}}{2}\frac{W}{L}(V_{GS} - V_{tHN})^2$$

$$\beta_n = K_{Pn} \cdot \frac{W}{L}$$

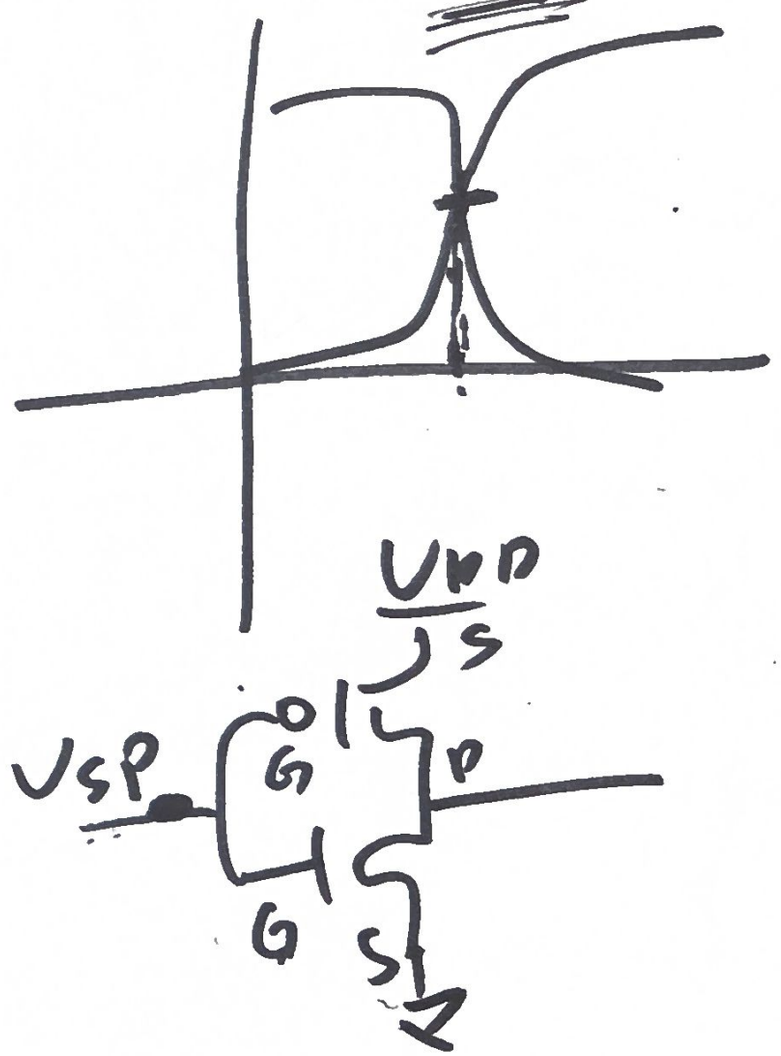
$$= \frac{\beta_n}{2}(V_{GS} - V_{tHN})^2$$

$$\frac{\beta_n}{2}(V_{GS} - V_{tHN})^2$$

$$= \frac{\beta_P}{2}(V_{SG} - V_{tHP})^2$$

~~V_{SG}~~ $= \frac{\beta_n}{2}(V_{SP} - V_{tHN})^2$

$$= \frac{\beta_P}{2}(V_{DD} - V_{SP} - V_{tHP})^2$$



$$V_{SP} = \frac{\sqrt{\frac{\beta_n}{\beta_p}}\, \xi \times V_{THN} + (V_{DD} - V_{THp})}{1 + \sqrt{\frac{\beta_n}{\beta_p}}}$$