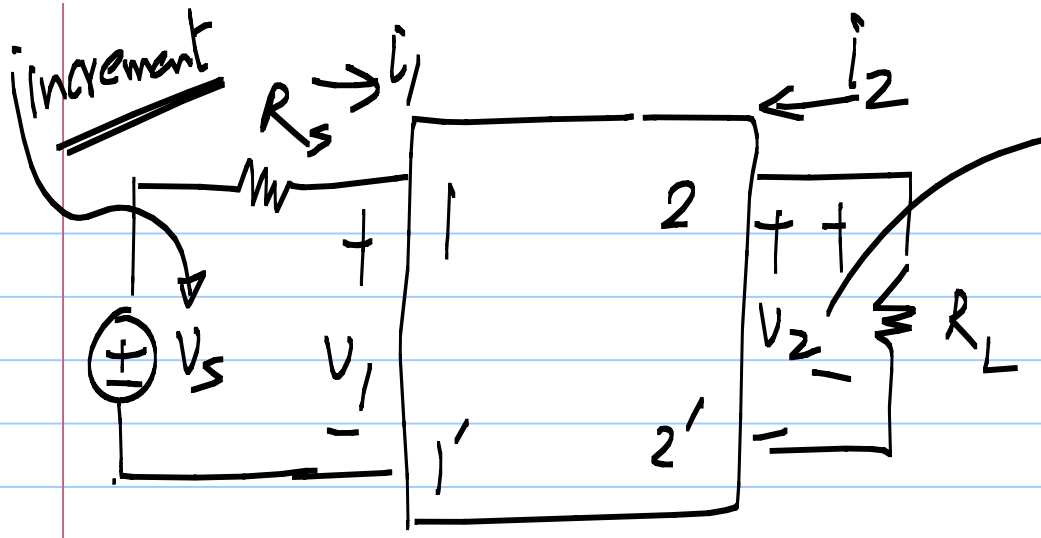


$$i_1 = y_{11} v_1 + y_{12} v_2$$

$$i_2 = y_{21} v_1 + y_{22} v_2$$

incr. y parameters

$$\begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix}$$

$$v_s = i_1 R_s + v_1$$

$$v_2 = -i_2 R_L$$

$$\frac{v_2}{v_s} = \frac{-y_{21} R_L}{(1 + y_{22} R_L)(1 + y_{11} R_s) - y_{12} y_{21} R_L R_s}$$

$$\frac{V_2}{V_s} = \frac{-y_{21} R_L}{(1+y_{11}R_s)(1+y_{22}R_L) - y_{12}y_{21} R_L R_s}$$

$$\frac{V_2}{V_s} = \frac{-y_{21} G_s}{(y_{11}+G_s)(y_{22}+G_L) - y_{12}y_{21}}$$

For high gain:

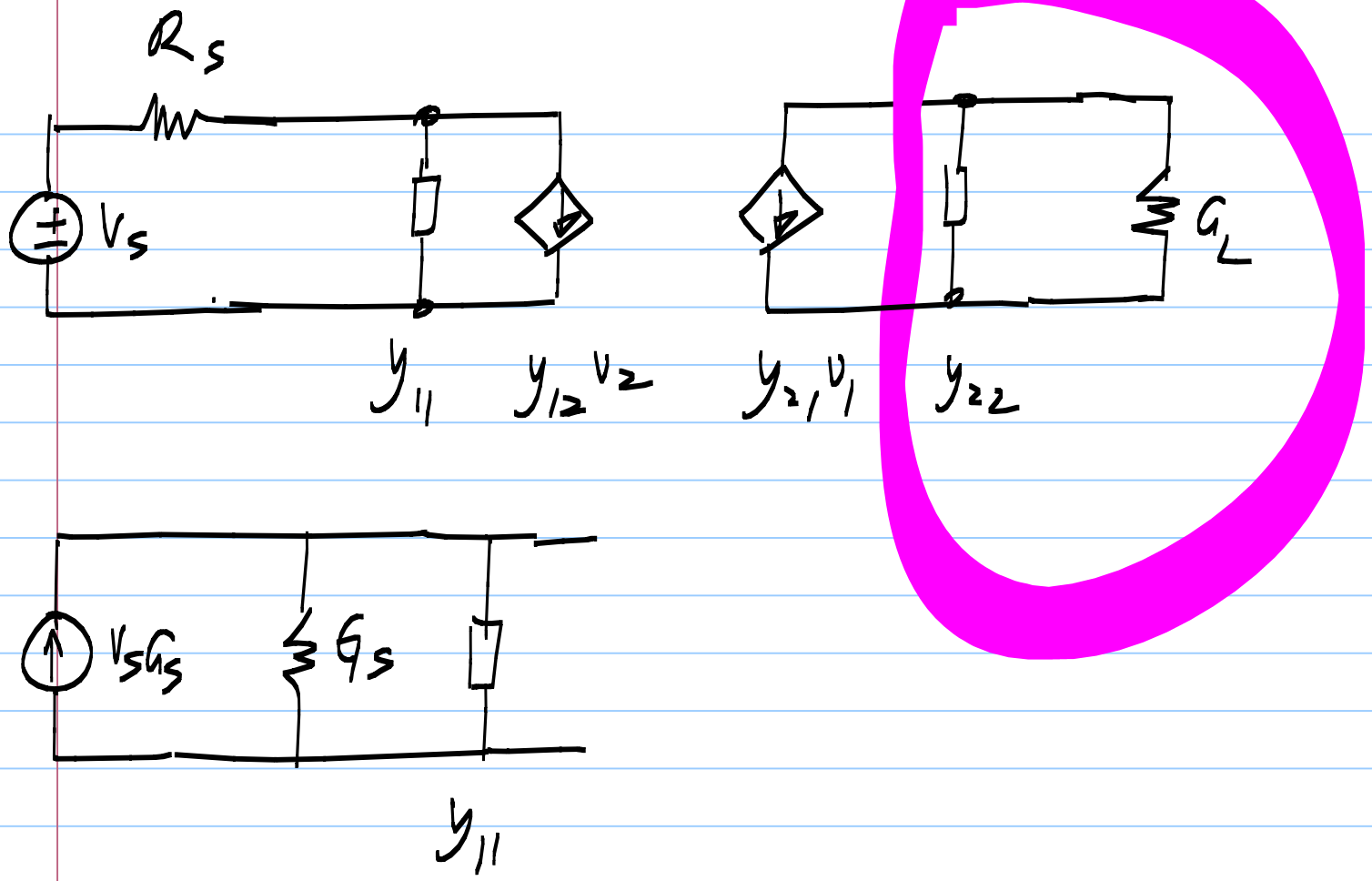
$y_{11} = 0$

$y_{22} = 0$

y_{21} : large

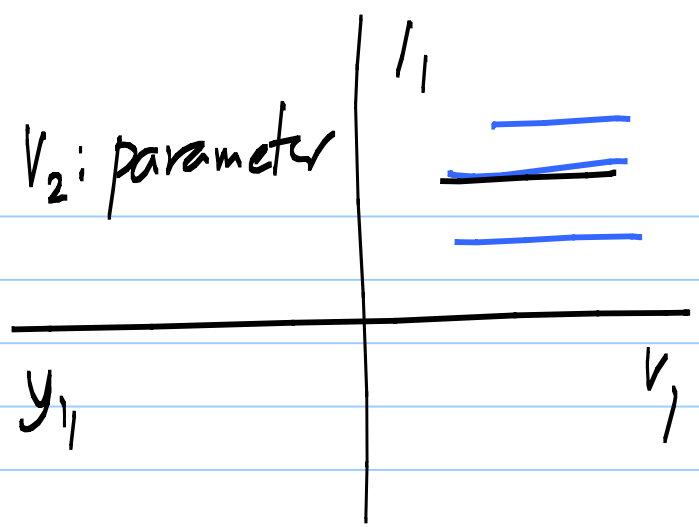
$y_{12} = 0$

To avoid instability

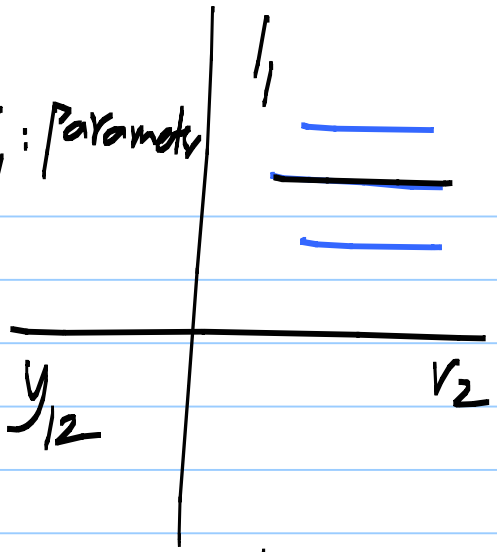

R_s
V_s
y_{11}
$y_{12}V_2$
$y_{21}V_1$
y_{22}
G_L
V_sG_s
G_s
y_{11}

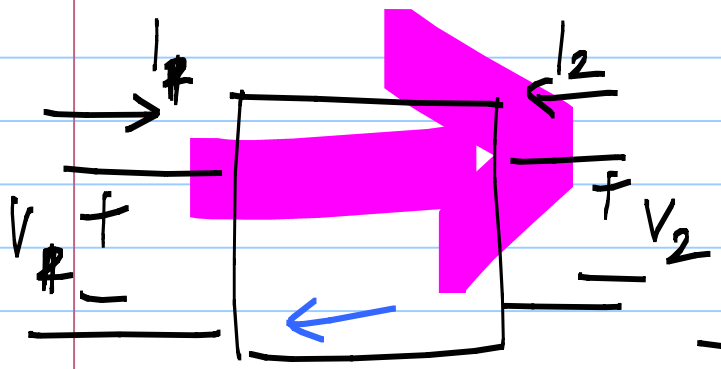
I_1: constant

V_2: parameter

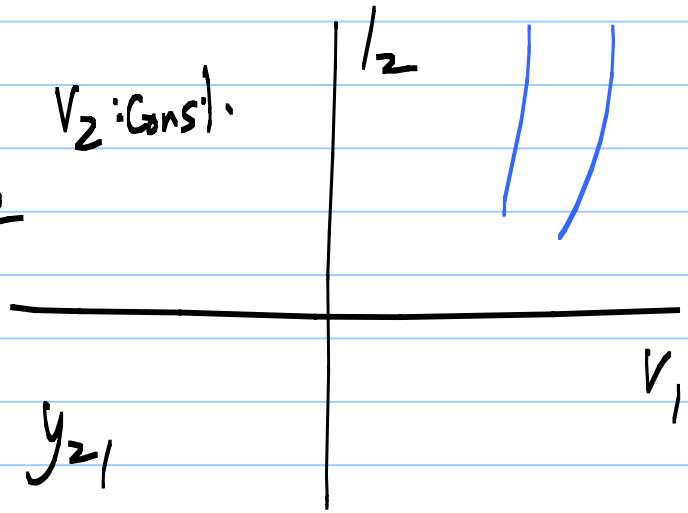


V_1: parameter

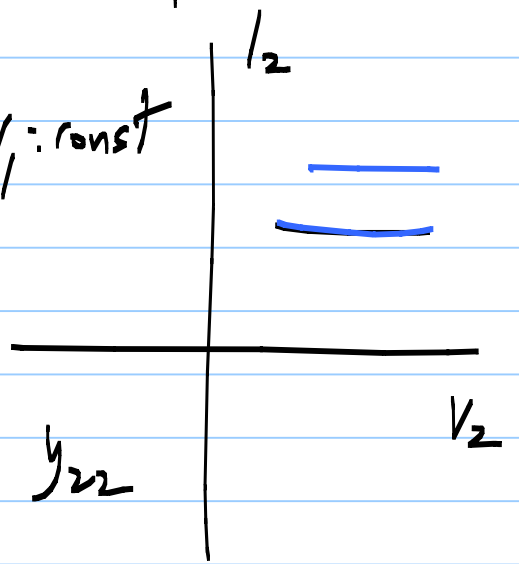




V_2: Const.

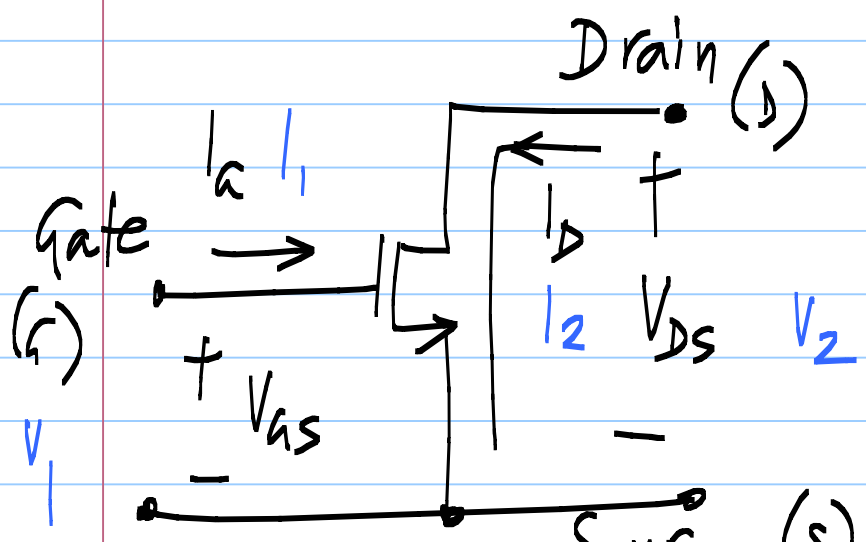


V_1: const



$$\left.\begin{aligned} I_1 &= f_1(V_1, V_2) \\ I_2 &= f_2(V_1, V_2) \end{aligned}\right\} \; y_{21}$$

MOS (Metal-Oxide-Semiconductor) transistor



nMOS transistor

* 3 terminal device
* Ports: G-S, D-S
* $I_G = 0$ (dc)
* I_D

$I_D = 0$ $\quad V_{GS} < V_T$ [threshold voltage]

$= \mu C_{ox} \frac{W}{L}\left[(V_{GS} - V_T)\cdot V_{DS} - \frac{V_{DS}^2}{2}\right]$ $\quad V_{GS} > V_T$, $V_{DS} < V_{GS} - V_T$

$= \frac{\mu C_{ox}}{2} \frac{W}{L}\left[(V_{GS} - V_T)^2\right]$ $\quad V_{GS} > V_T$, $V_{DS} > V_{GS} - V_T$

$[V_{DS} \geq 0]$

$I_1 = I_G = 0$