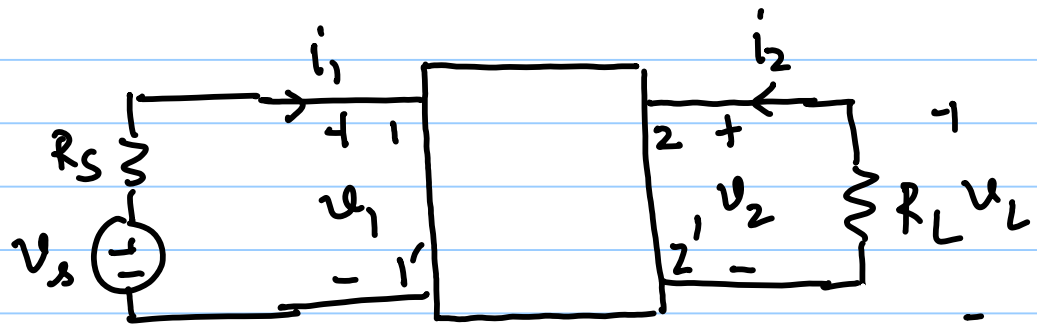
Note Title

Lecture # 06

12-08-2021



$$\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}$$

$$\frac{v_L}{v_s} = \frac{-y_{21}/R_s}{\left(y_{11}+\frac{1}{R_s}\right)\left(y_{22}+\frac{1}{R_L}\right) - y_{12}y_{21}} \rightarrow 0 \rightarrow \infty$$

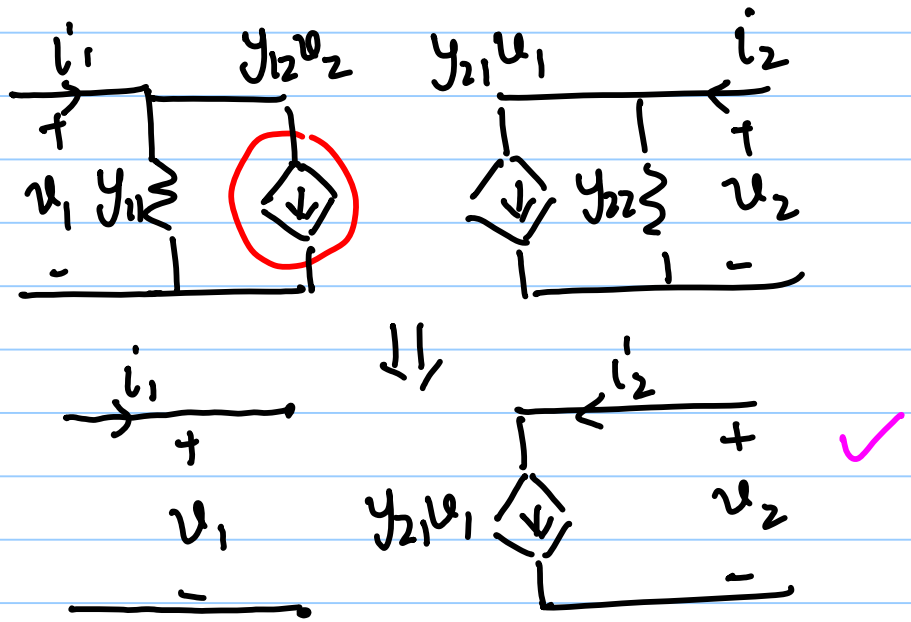
y_{11} : 0

y_{12} : 0

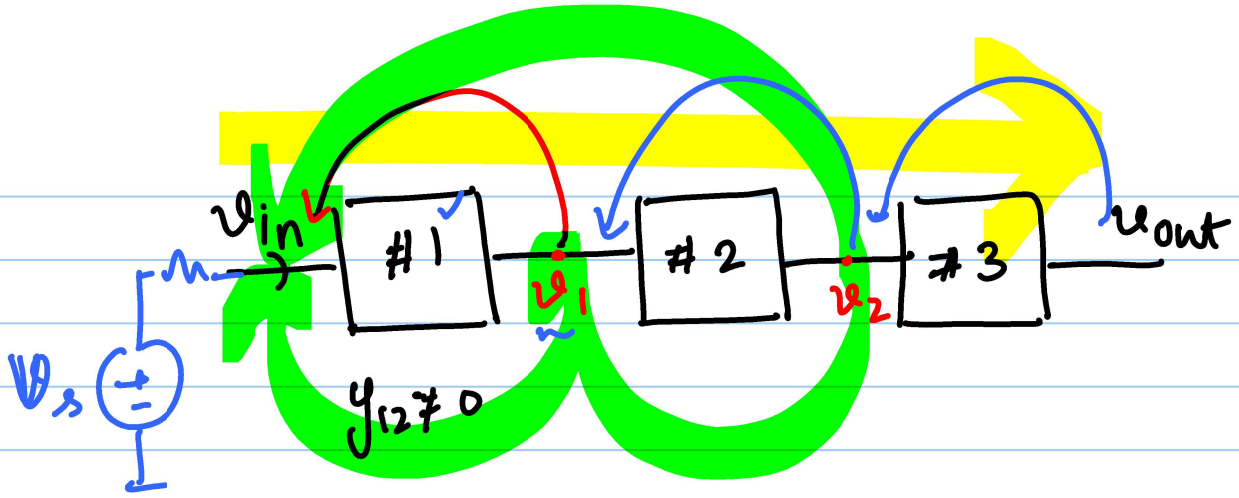
y_{22} : 0

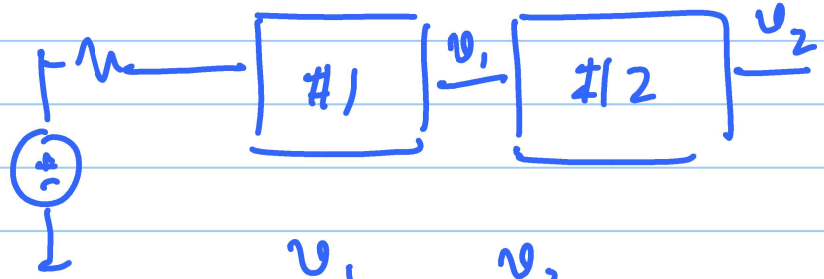
y_{21} !

$y_{21} \not\rightarrow y_{12}$

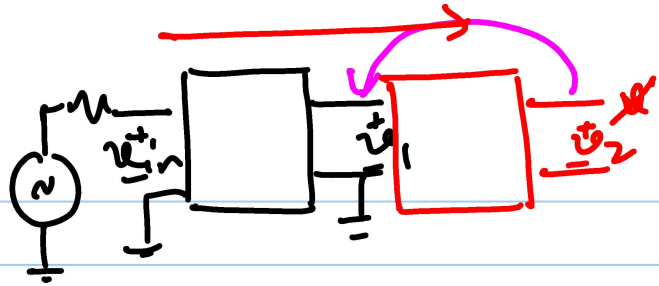


✓





$$\frac{v_1}{v_{in}} \times \frac{v_2}{v_1}$$



$$\frac{v_1}{v_{in}} = H(s) = A$$

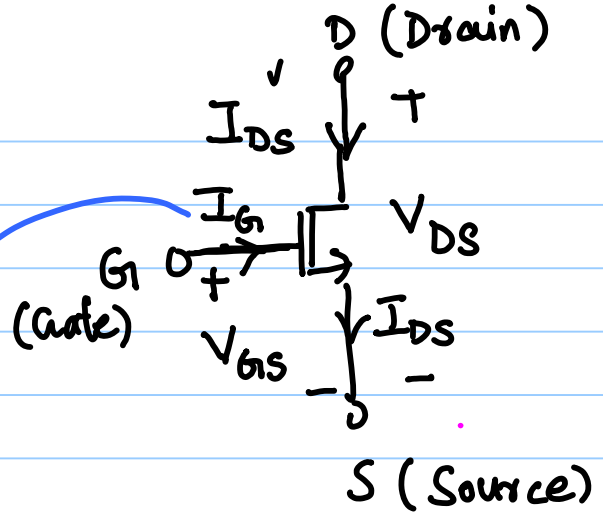
$$\frac{v_2}{v_{in}} = A^2$$

$y_{21} \rightarrow$ (y_{12}) Controlled independently.

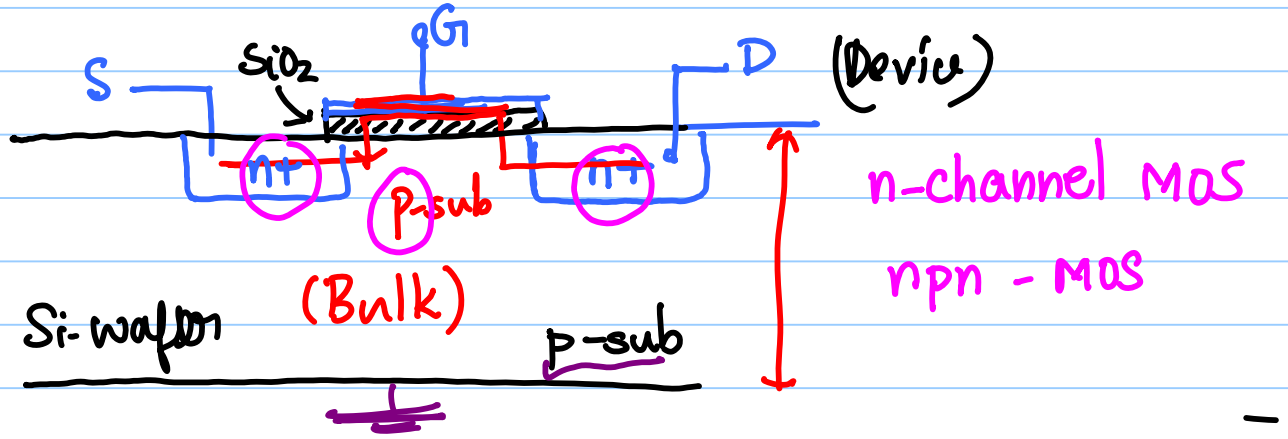
$\frac{1}{10} \rightarrow \frac{1}{5}$

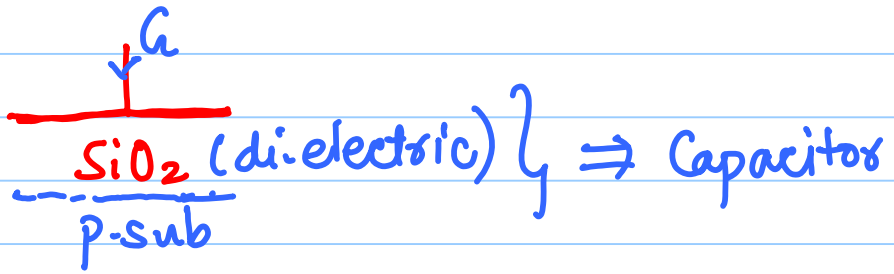
$\frac{2}{10} \rightarrow \frac{2}{5}$

MOSFET: Metal-Oxide-Semiconductor FET

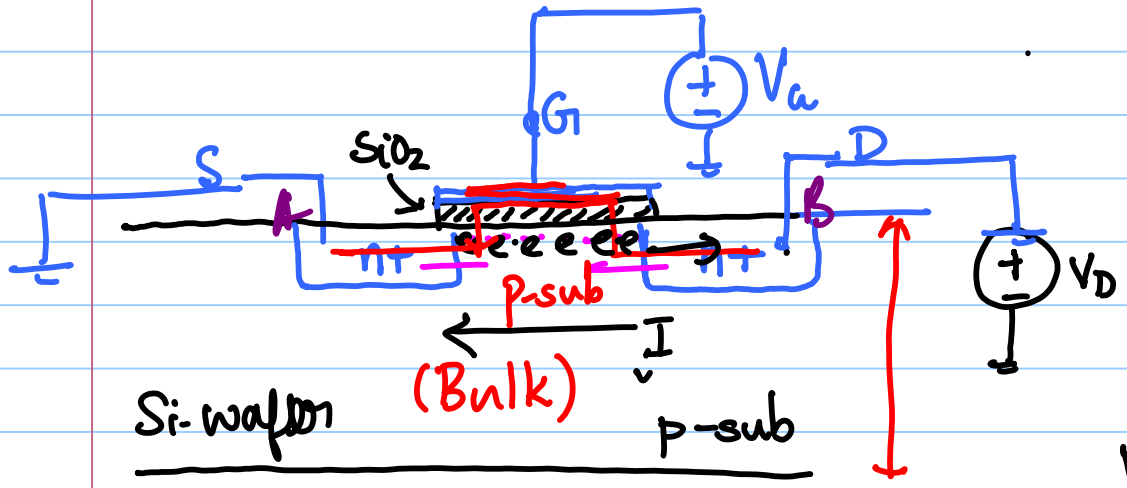


$I_G = 0$





$\Rightarrow$ Capacitor

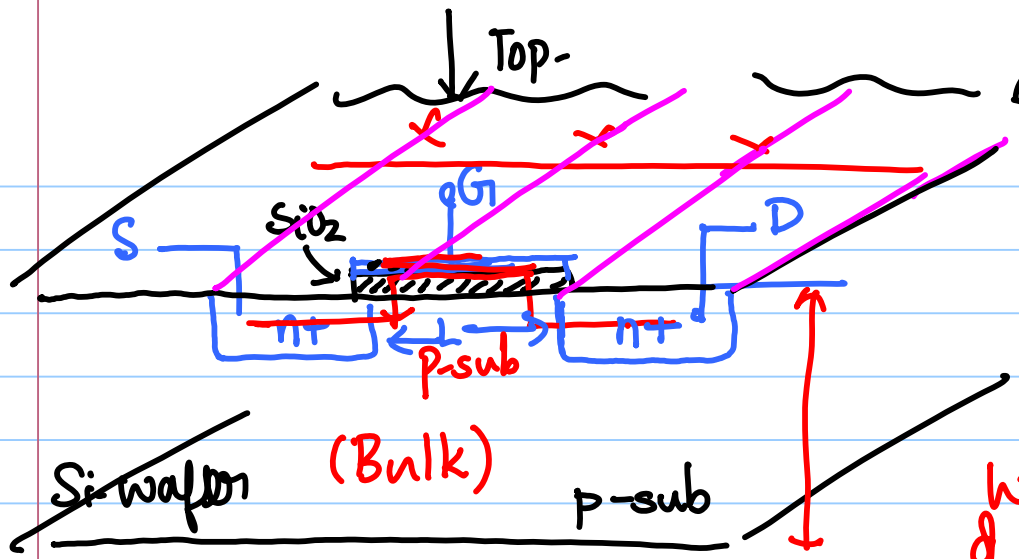


$V_D = V_S = 0$

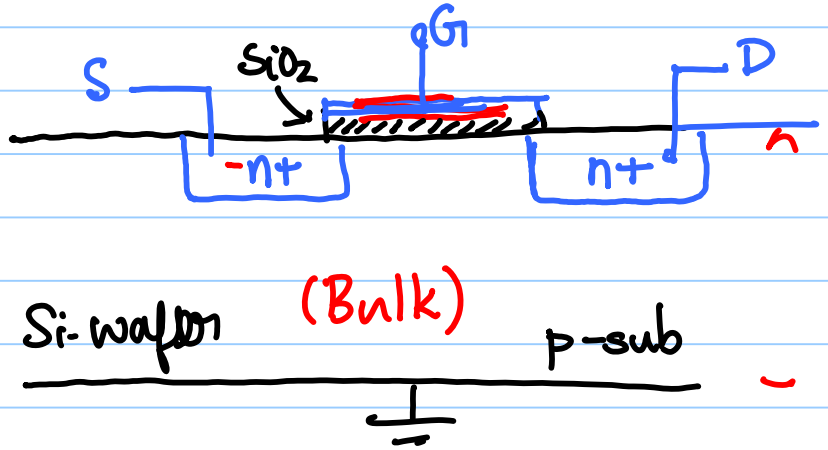
Change $V_a > 0$

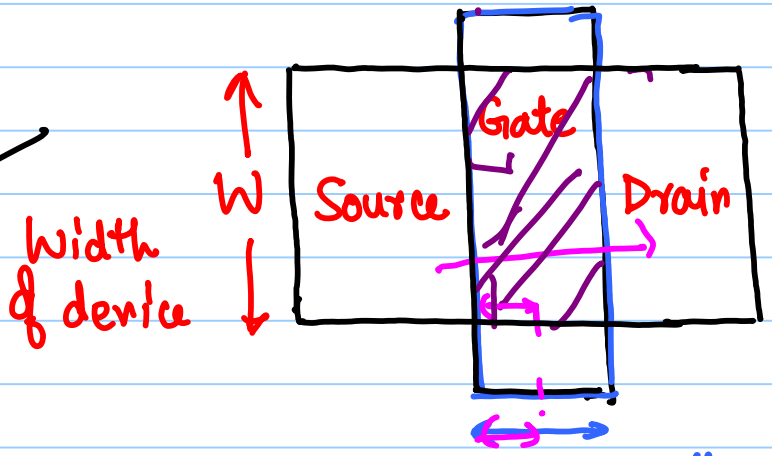
$V_{GS} > V_{th}$

$i = \frac{dq}{dt}$

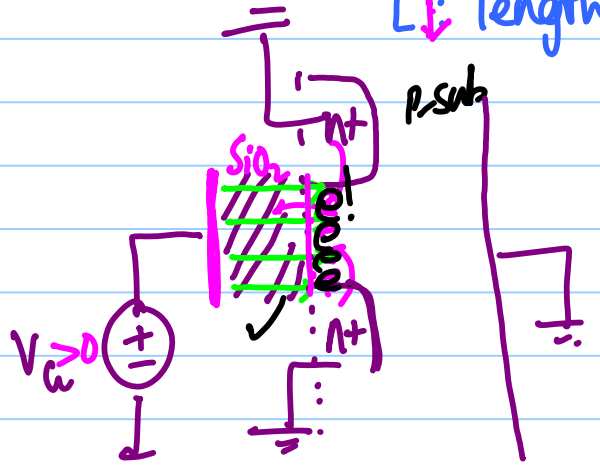


Front-view



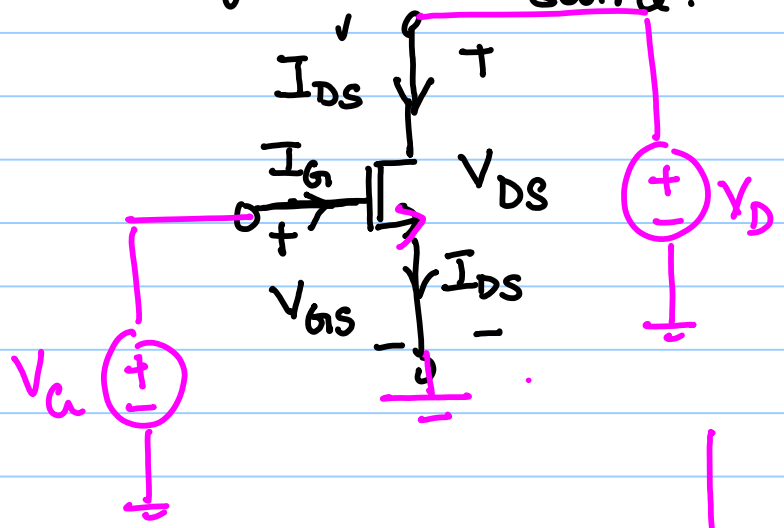


L : length of channel.



$V_G > V_{th}$

MOS: voltage controlled current source.



a) When $V_{GS} \leq V_{th}$, $V_{DS} \geq 0$

V_{GS}: gate-to-source potential

V_{th}: threshold voltage of device.

$I_{DS} = 0$, $I_G = 0$

b) $V_{GS} > V_{th}$, $V_{DS} < V_{GS} - V_{th}$

V_{DS}: drain-to-source potential difference

$I_G = 0$

$$I_{DS} = \mu_n C_{ox} \frac{W}{L} \left[(V_{GS} - V_{th}) V_{DS} - \frac{V_{DS}^2}{2} \right]$$

μ_n: mobility of e⁻

C_{ox}: capacitance per unit area.

W: width of the device

L: length of channel.

c) $V_{GS} > V_{th}$, $V_{DS} \geq V_{GS} - V_{th}$

$I_G = 0$

$$I_{DS} = \frac{\mu_n C_{ox}}{2} \frac{W}{L} (V_{GS} - V_{th})^2$$