

$$\Delta V_{GB} \rightarrow \Delta V_{ch}$$

$$\Delta V_{ch} \approx \Delta V_{GB}$$

Tensión en el canal: V_{ch}

$$\Delta V_{GB} \rightarrow \Delta V_{ch} = \frac{V_{GB}}{\frac{1}{C_B} + \frac{1}{C_{ox}}}, \Delta V_{GB} =$$

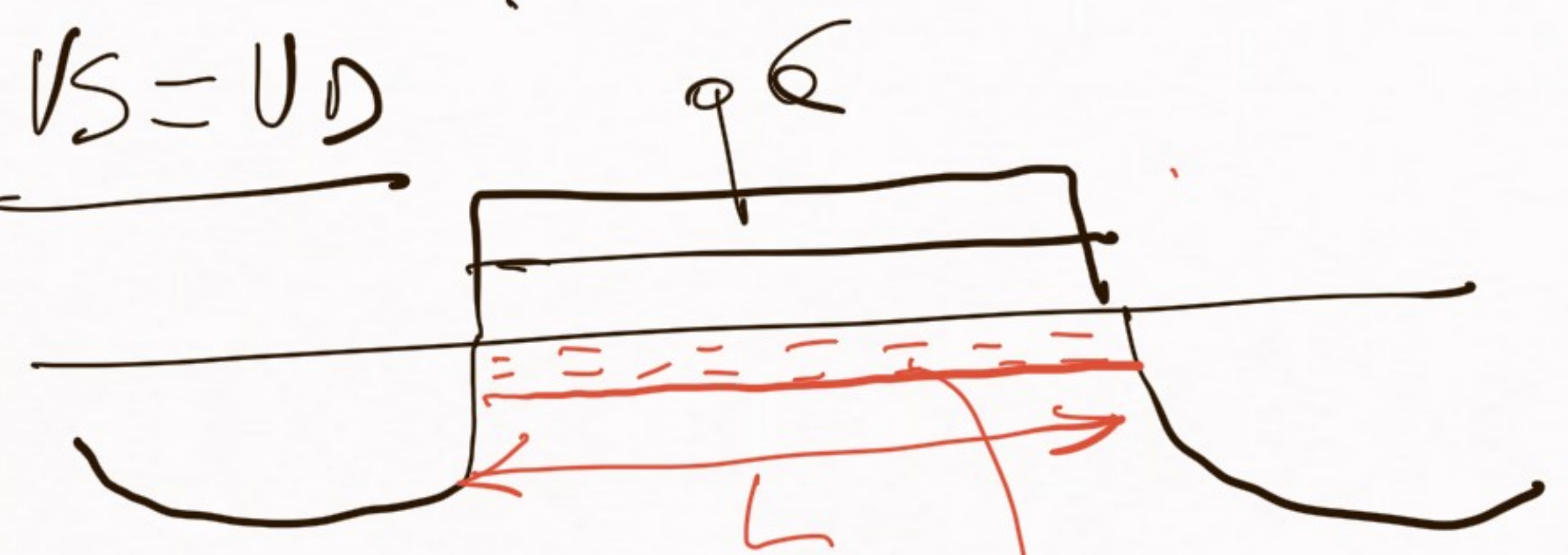
$$= \frac{C_{ox}}{C_B + C_{ox}} \ll 1$$

$$\frac{1}{1+\beta}, \quad \beta = \frac{C_B}{C_{ox}}$$

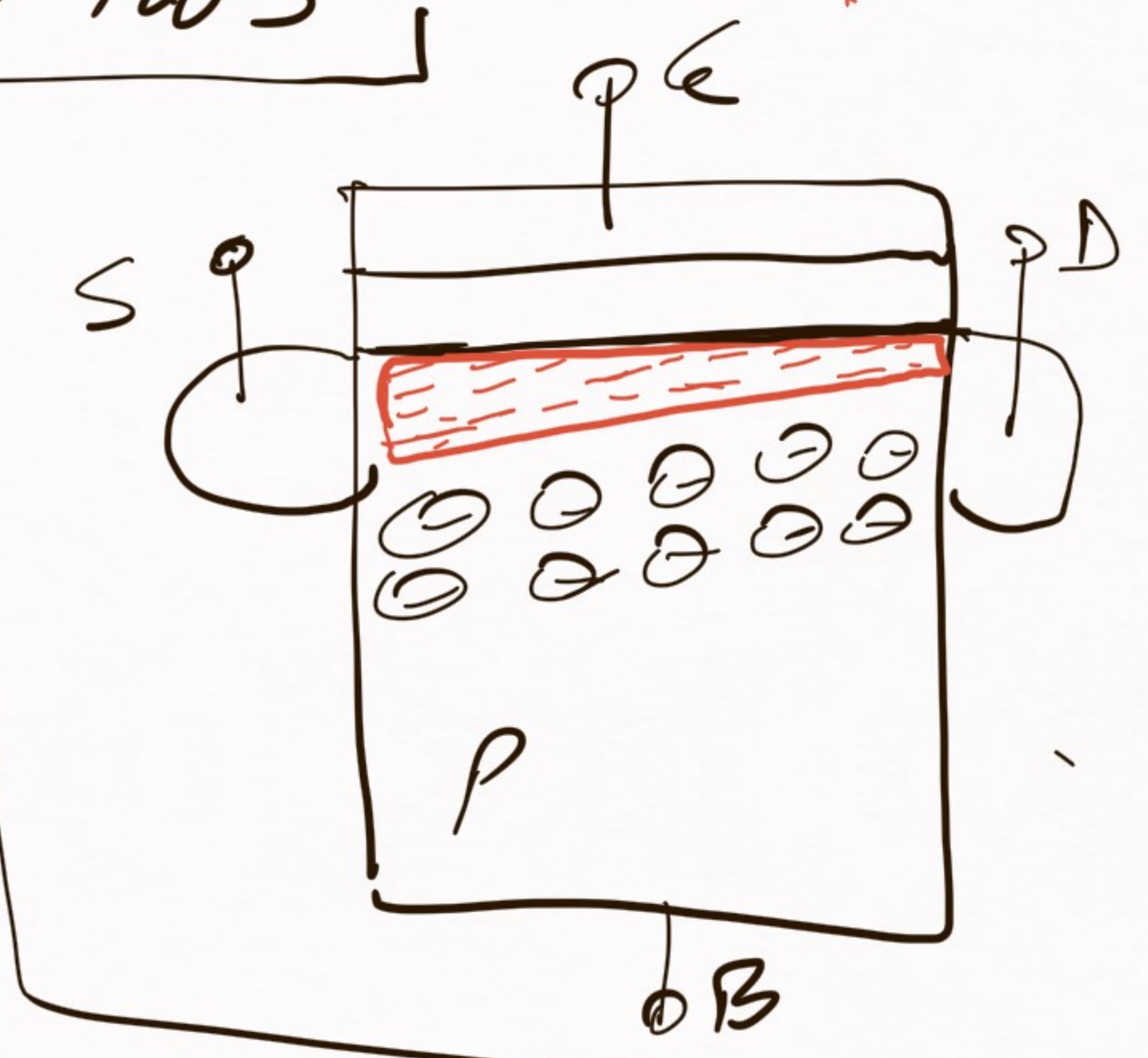
ECS transistor MOS

(en zone lineal)

① $V_S = V_D$



$V_{ch} = V_{ce} = V_S = V_D$



$$Q_{it} = -w \cdot L \cdot C_{ox} \left(V_G - (1+\delta) \underbrace{V_{ch}}_{V_S = V_D} - V_{to} \right)$$

$\frac{\epsilon_{ox} \kappa}{t_{ox}}$

Carga de inversión total en el canal.

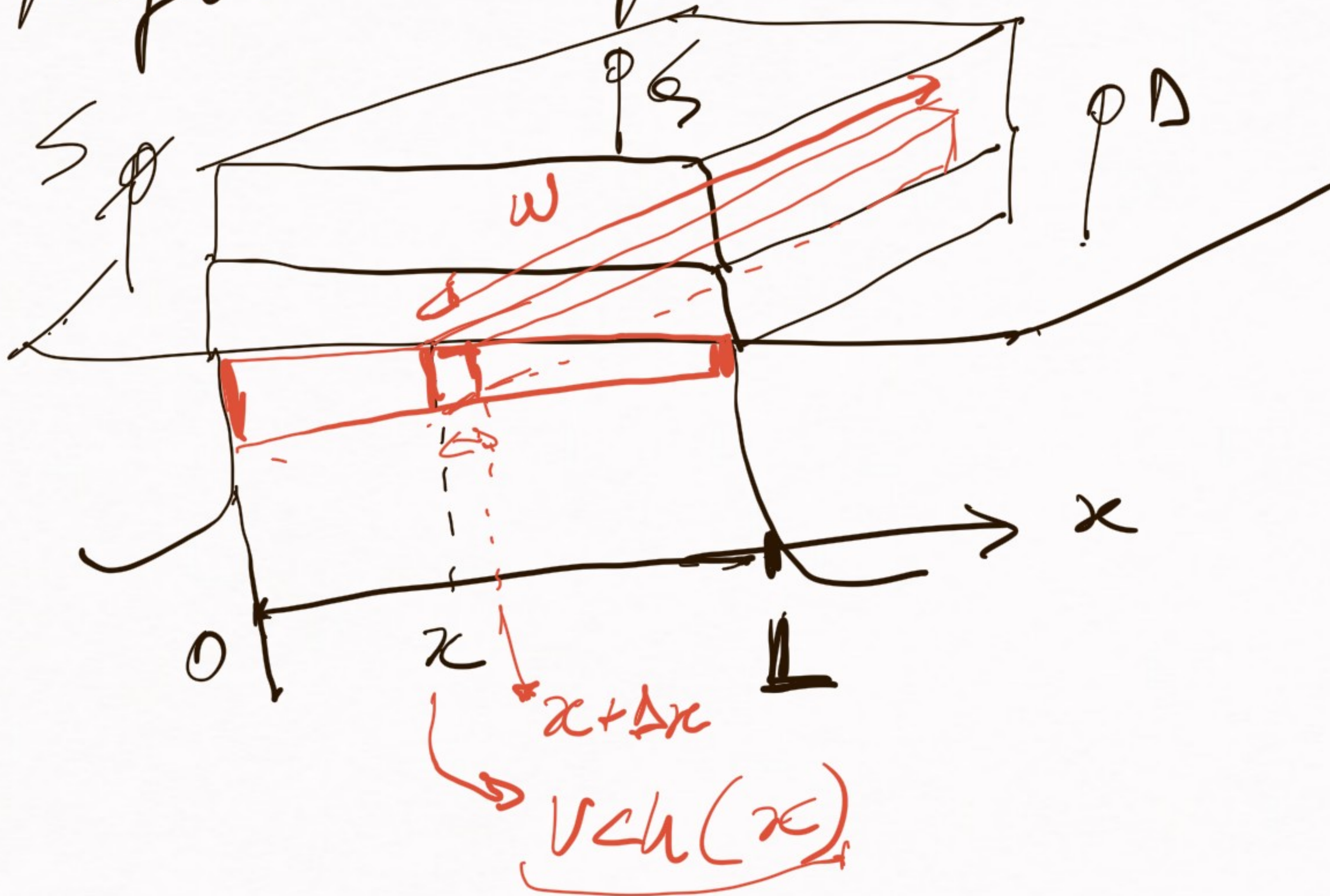
$V_S \neq V_D \Rightarrow V_{ch} = V_{ch}(x):$

$V_S = V_{SB}, V_D = V_{DB}$

$V_G = V_{GB}$

$V_S \leq V_{ch}(x) \leq V_D$ para $0 \leq x \leq L$

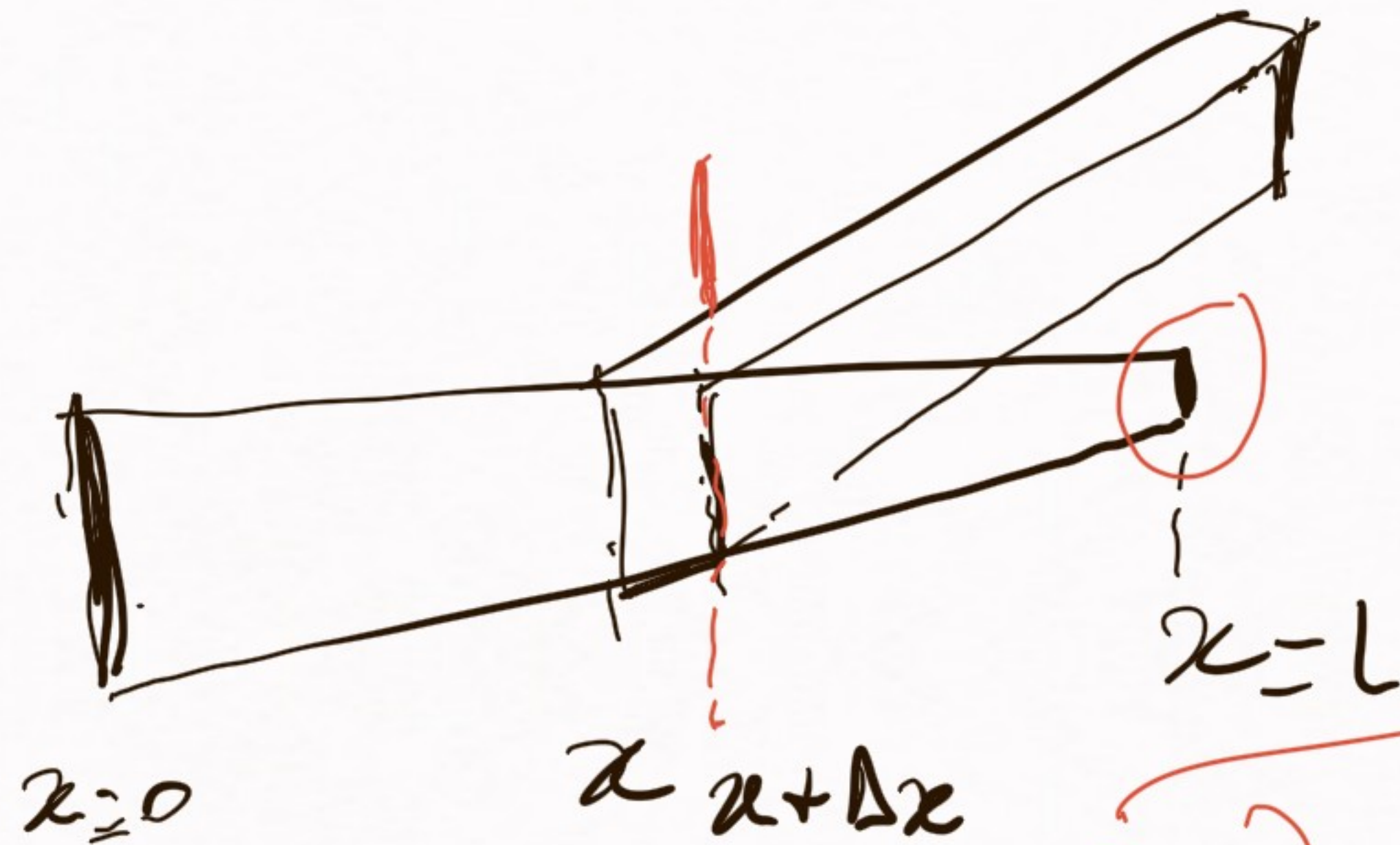
la curva de inversión tiene un perfil "trapezoidal" a lo largo del canal.



Q: barra entre x y $x + \Delta x =$
 $= -w \cdot \Delta x \cdot C_{ox} \cdot (V_G - V_{T0} - (1+\delta)V_{ch}(x))$

Qi barra entre
 x y $x + \Delta x$
 Γ_D ?

$$= -\omega \cdot \Delta x \cdot \cos(V_G - V_{to} - (1+\delta)V_{ch}(x))$$



velocidad
 de los
 portadores

$$\Gamma_D = \frac{\Delta Q}{\Delta t} = \frac{\Delta Q}{\Delta x} \cdot \frac{\Delta x}{\Delta t} = v_d$$

$\underbrace{\frac{\Delta Q}{\Delta x}}_{Q \text{ barra}}$

$$Q'_i(x) = \frac{Q_{barra}}{\omega \cdot \Delta x}$$

$$\Rightarrow \Gamma_D = -\omega \cdot \cos(V_G - V_{to} - (1+\delta)V_{ch}(x)) \cdot v_d(x)$$

$$I_D = Q'_i(x) \cdot \omega \cdot \underbrace{N_D(x)} = Q'_i(x) \cdot \omega \cdot \underbrace{\mu \cdot E}_{= S_D}$$

$$= Q'_i(x) \cdot \omega \cdot \mu \cdot \left(\frac{-dV_{ch}}{dx} \right) \quad \text{movilidad}$$

$$I_D = \frac{1}{2} \text{Corr} \left(V_G - V_{to} - (1+\delta) V_{ch}(x) \right) \cdot \omega \cdot \mu \cdot \left(\frac{-dV_{ch}}{dx} \right)$$

Integramos a lo largo del canal en ambos lados.

$$\int_0^L I_D \cdot dx = \mu \cdot \text{Corr} \cdot \omega \int_0^L (V_G - V_{to} - (1+\delta) V_{ch}(x)) \left(\frac{dV_{ch}}{dx} \right) \cdot dx$$

$$\boxed{I_D \cdot L = \mu \cdot \text{Corr} \cdot \omega \int_{V_S}^{V_D} (V_G - V_{to} - (1+\delta) V_{ch}) \cdot dV_{ch}}$$

$$I_D = \underbrace{\mu \cdot Cox \cdot \frac{W}{L}}_{\beta} \int_{V_S}^{V_D} (V_G - V_{to} - (1+\delta)V_{ch}) dV_{ch}$$

$$I_D = \beta \cdot \left[(V_G - V_{to})(V_D - V_S) - \frac{(1+\delta)}{2} [V_D^2 - V_S^2] \right]$$

Es de la T.A. nos en zone

$$I_D = \beta \left[(V_G - V_{to}) - \frac{(1+\delta)}{2} (V_D + V_S) \right] (V_D - V_S)$$

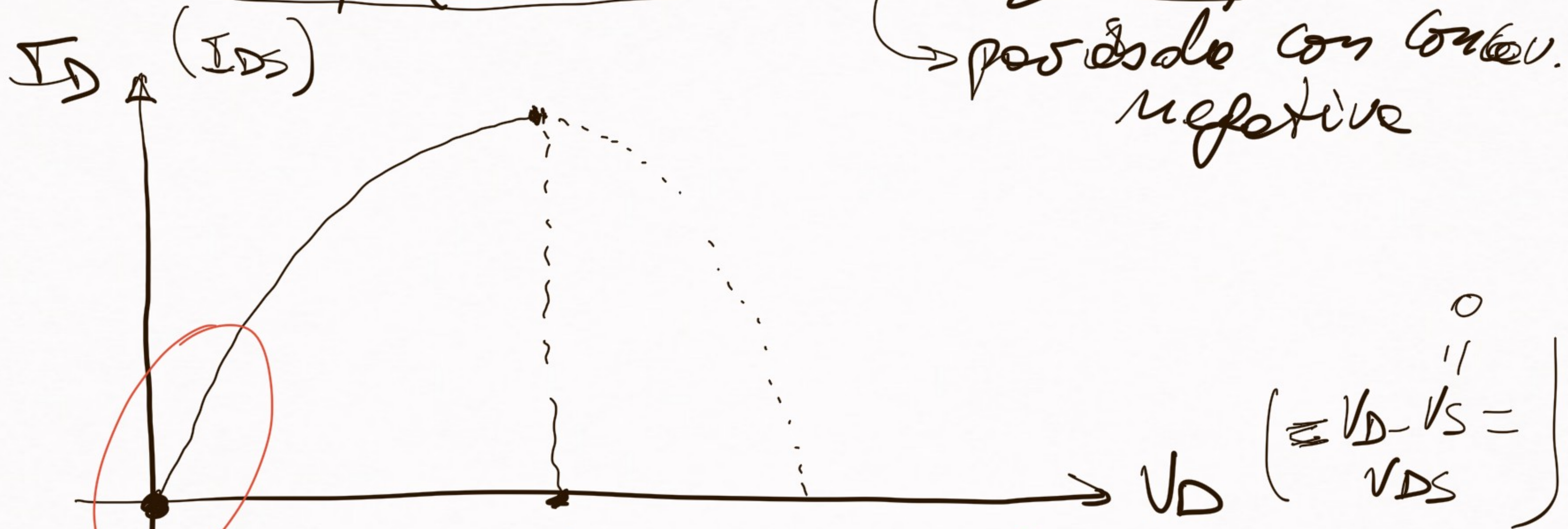
⊛ $V_S < V_P$, $V_D < V_P$ } $V_S < V_P$
 $V_P = \frac{V_G - V_{to}}{(1+\delta)}$
 $V_G > V_{to} + (1+\delta)V_S$
 lineal ref. al sustrato (B)

$$I_D = \beta (V_G - V_{th}) (V_D - V_S) - \frac{1+\delta}{2} (V_D^2 - V_S^2)$$

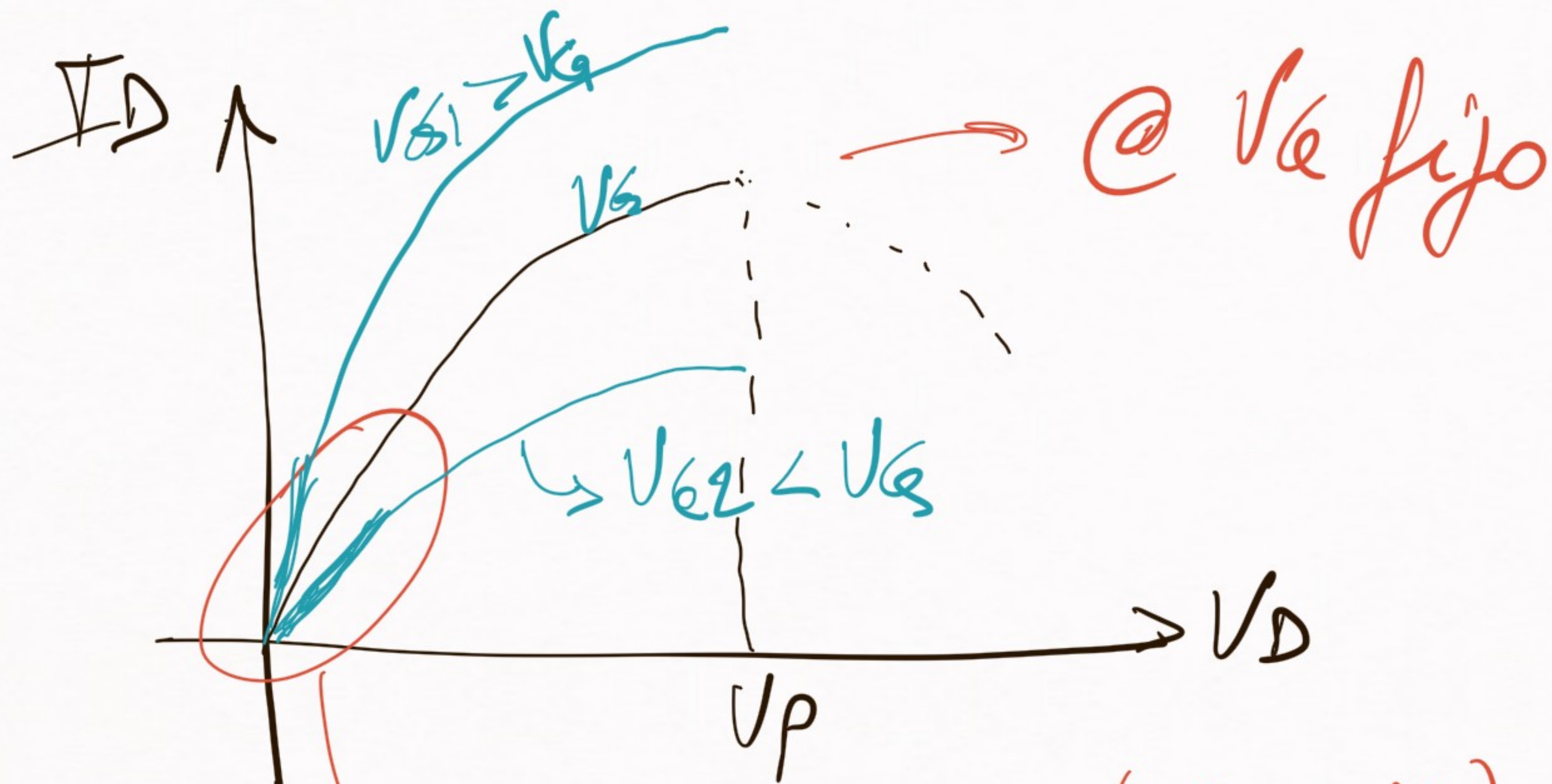
Caso $V_S = 0$ (S y B conectados)

$$\Rightarrow I_D = \beta (V_G - V_{th}) V_D - \frac{1+\delta}{2} V_D^2$$

→ parábola con concav. negativa



→ V_D "pequeño" $\Rightarrow I_D = \beta (V_G - V_{th}) V_D$



$$I_D = \beta (V_{GS} - V_{th}) \cdot V_D$$

$$I_D = \frac{1}{R_{ON}} \cdot V_D, \quad R_{ON} = \frac{1}{\beta (V_{GS} - V_{th})}$$