

Real MOS Structure

5/11/2014

1. Work fn. of Metal Gate \neq Work fn. of Semiconductor.

↳ Bent band situation in eq^m

↳ Flat band $V_{GB} = V_{FB}^{\Phi} = \frac{W_m - W_s}{e} = \Phi_M - \Phi_S = \Phi_{MS} < 0$

poly-gate

↳ polycrystalline Semiconductor

2. Oxide Charge (Q_{ox}) \rightarrow band is bent in eq^m

↳ Flat band $V_{GB} = V_{FB}^{Q_{ox}} = -\frac{Q_{ox}}{C_{ox}}$

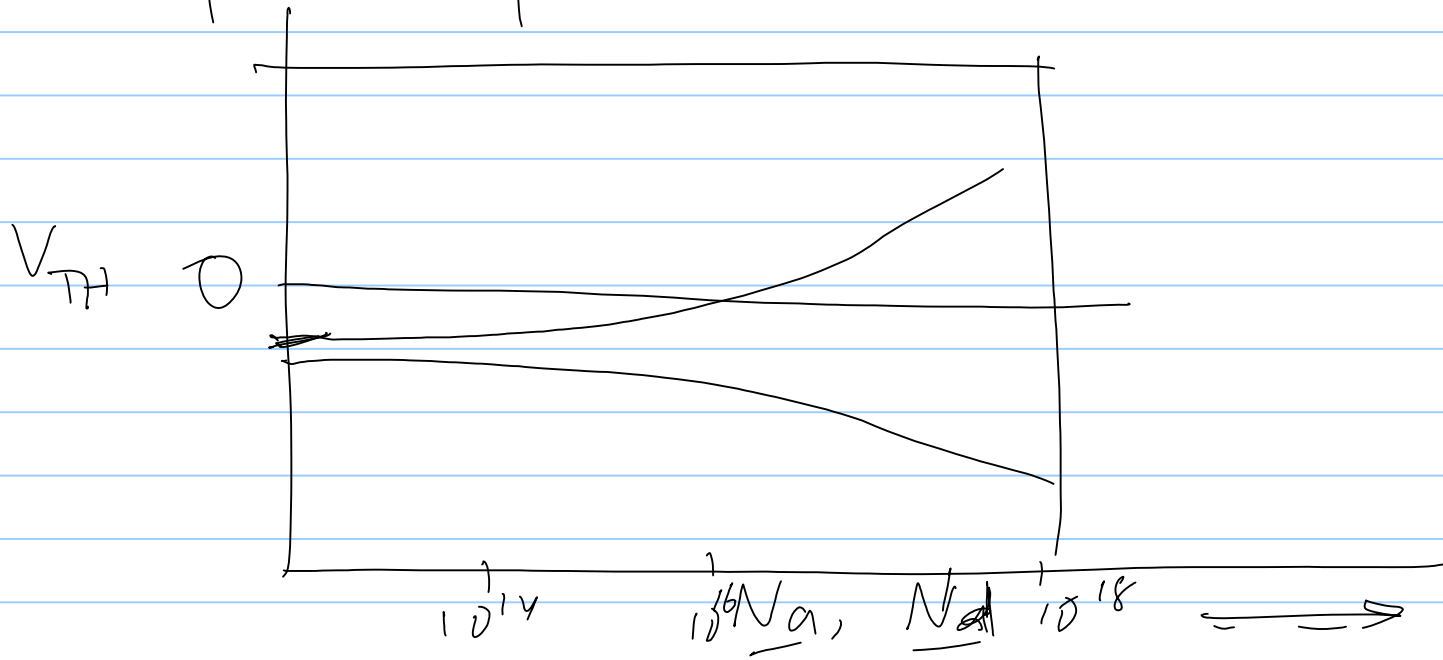
$$V_{FB} = \Phi_{MS} \left\{ \left(\frac{Q_{ox}}{C_{ox}} \right) \right\}$$

\uparrow \uparrow \uparrow
 $(-ve)$ $(-ve)$ $(-ve)$

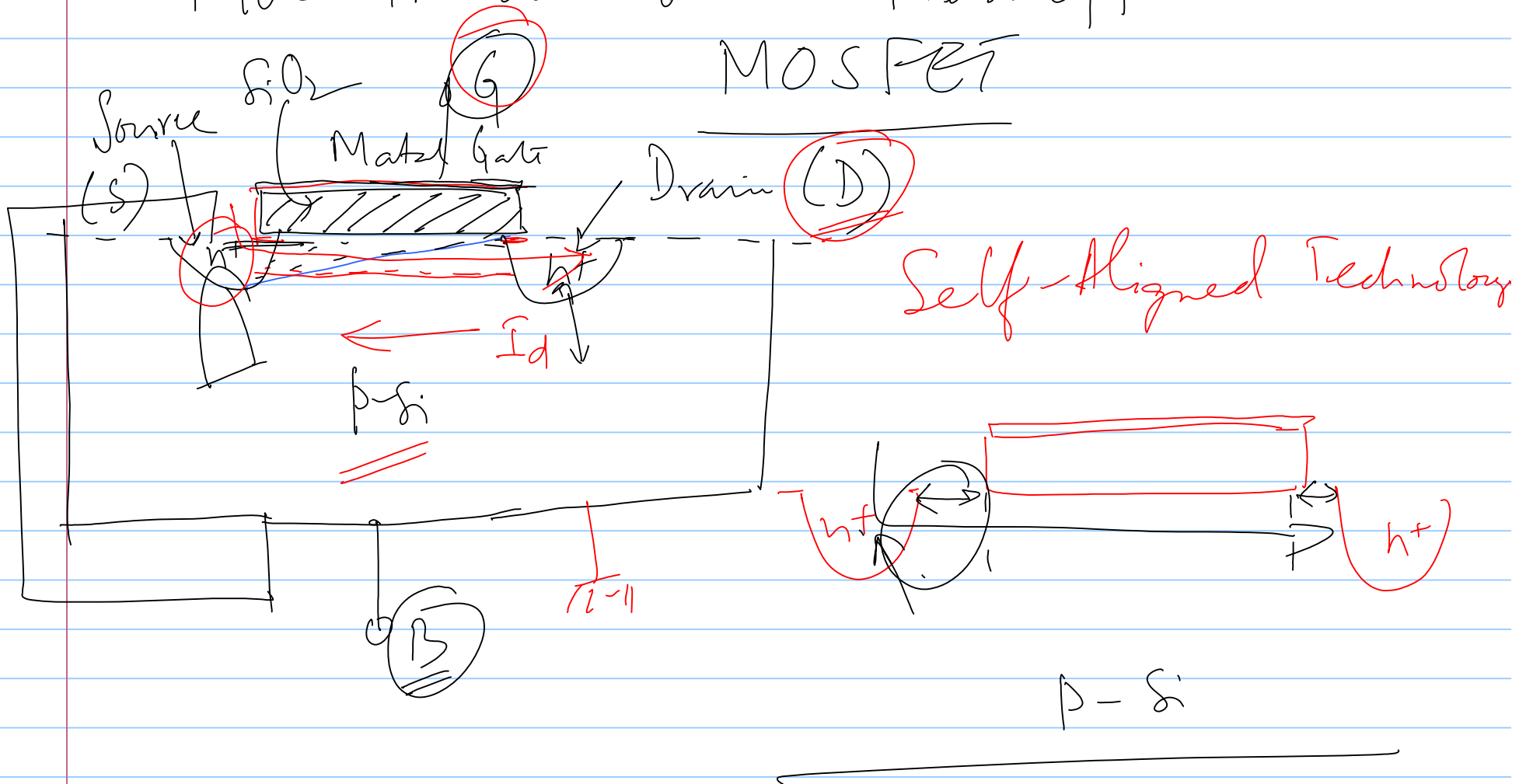
Delect MOS: $V_{TH} = 2\Phi_F - \frac{Q_{dep,max}}{C_{ox}}$ > 0 (p-si)

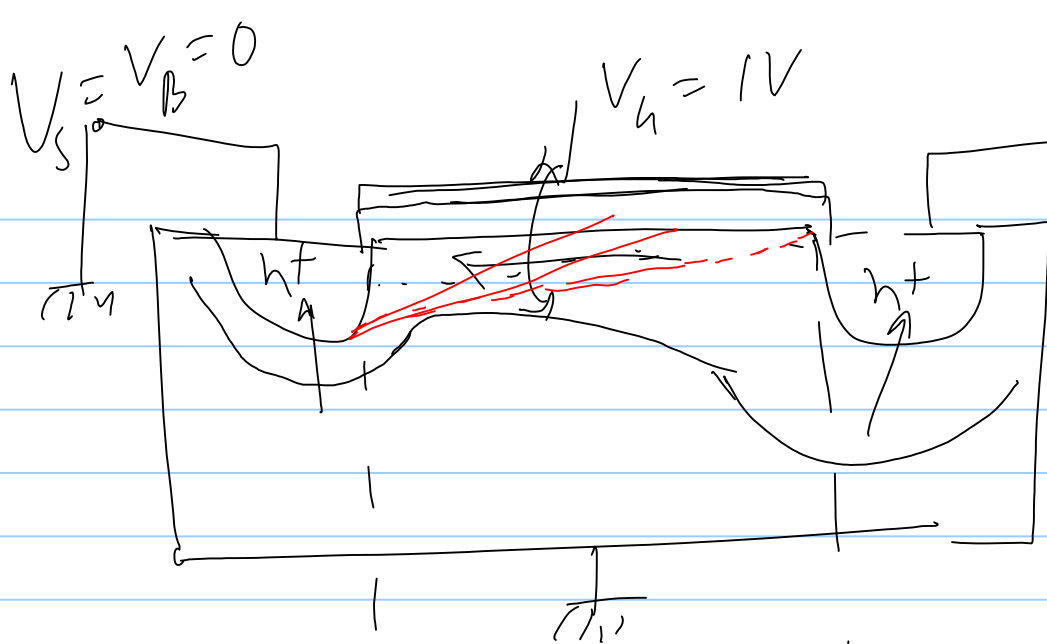
Real MOS: $V_{TH} = V_{FB} + 2\Phi_F - \frac{Q_{dep,max}}{C_{ox}}$ (n-channel)

	Φ_{MS}	$-\frac{Q_{ox}}{C_{ox}}$	$2\phi_f$	$-\frac{Q_{dep,max}}{C_{ox}}$	
V_{TH}	-ve	-ve	(+ve)	(+ve)	n-channel (p-Si)
	-ve	-ve	(-ve)	(-ve)	p-channel (n-Si)



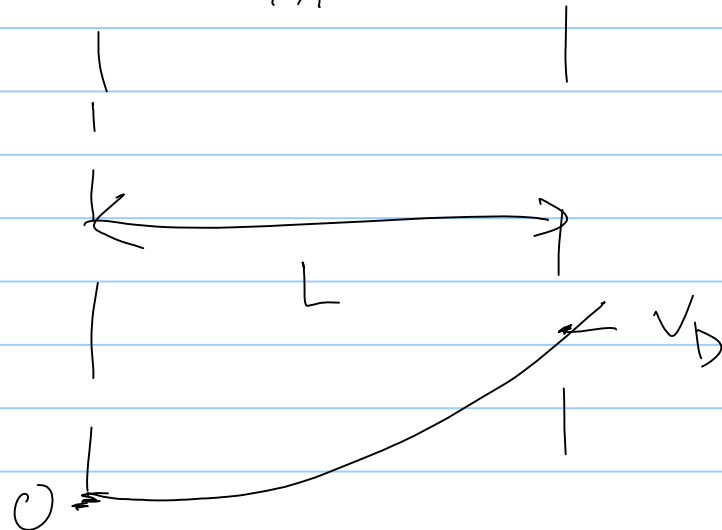
MOS Transistor = MOS Field Effect Transistor MOSFET





$$V_D = 1V$$

$$V_{TH} = 0.5V$$



$$V_{gc}(x)$$

$$\text{at } x=0, V_{gc} = 1V$$

$$\text{at } x=L, V_{gc} = 0V$$