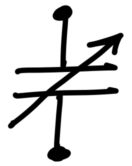
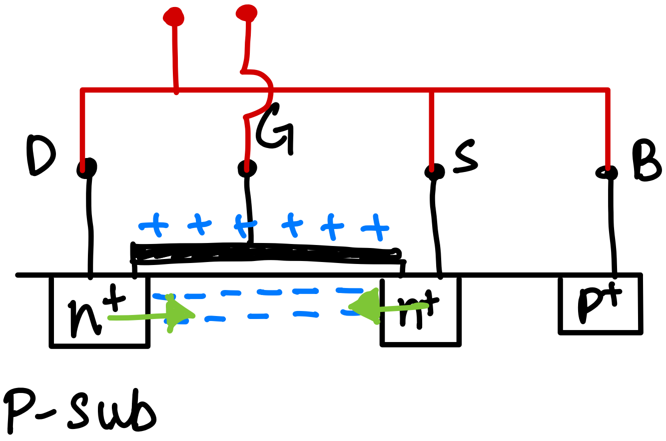
MOS Varactors {Variable capacitors}



1) Inversion-mode.

2) Accumulation-mode.

NMOS Layout

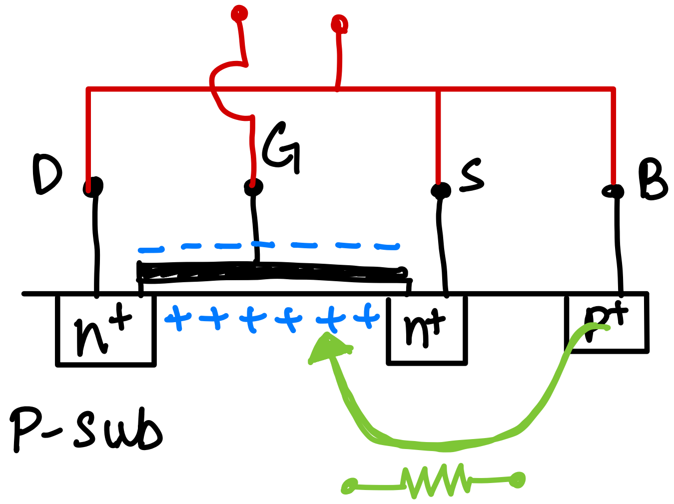


1) Strong inversion

> $V_{GS} \gg V_{th}$.

> Cap $\simeq C_{ox}$

> $n^+ \leftrightarrow$ channel $\leftrightarrow n^+$ form a low resistance bottom plate.

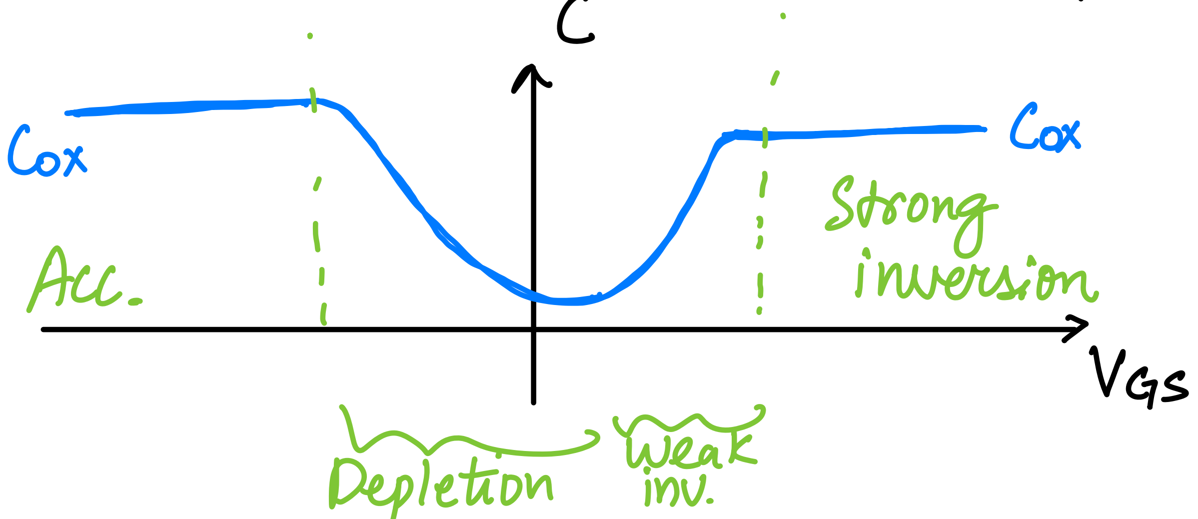


2) Accumulation

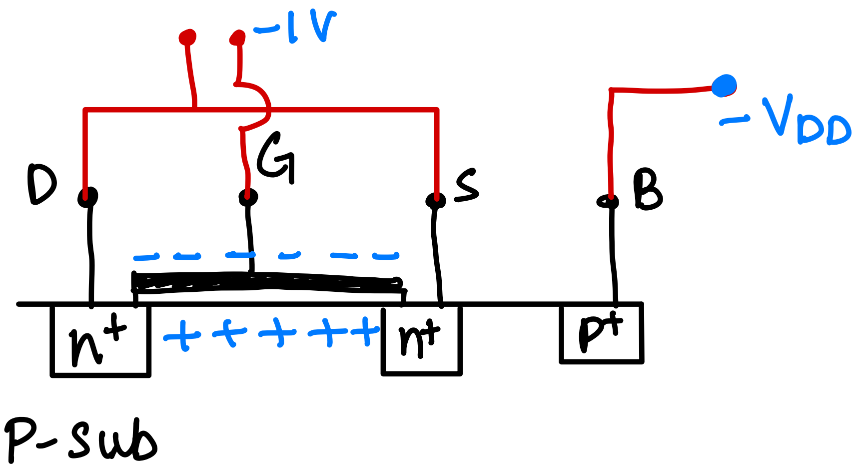
> $V_{GS} < 0$

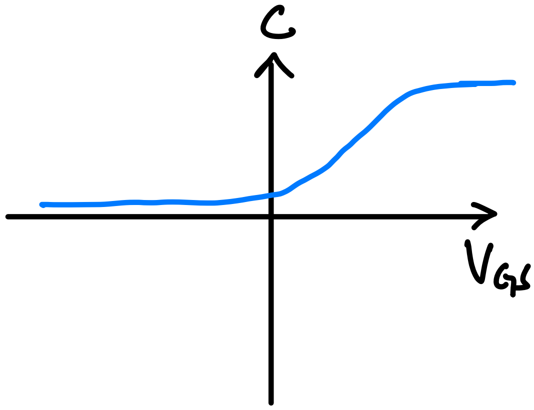
> Cap $\simeq C_{ox}$

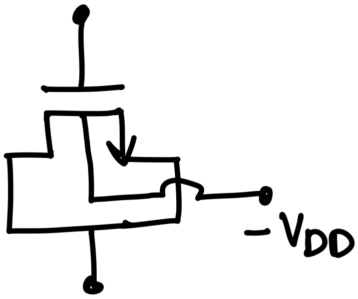
> Large series parasitic res.



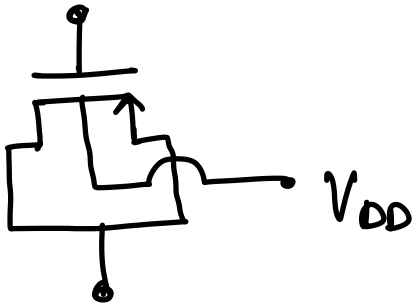
Ⓘ Inversion-mode MOSCAP (Eliminate accumulation)





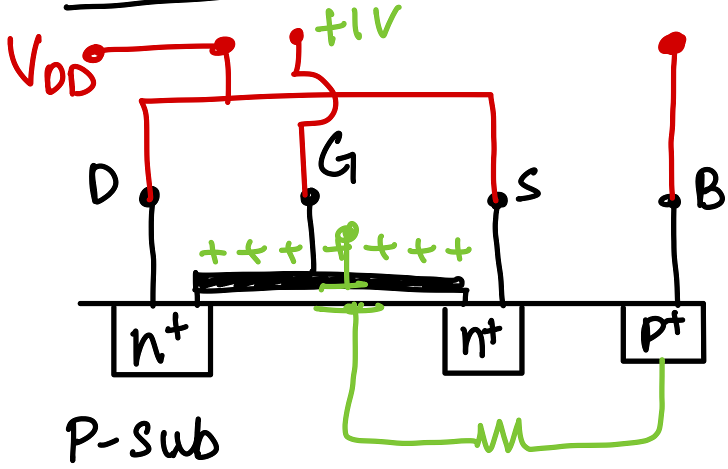


IM- NMOS

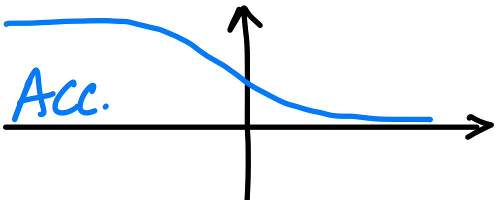


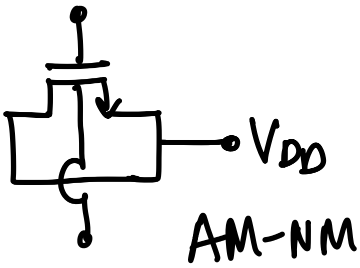
IM-PMOS

Ⓘⓘ Accumulation mode MOSCAP (Eliminate inversion)

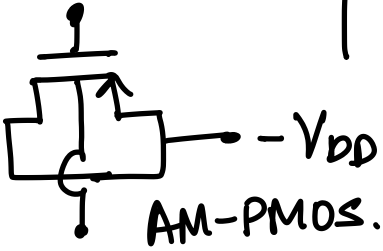


> Be careful about swing & junction breakdown!



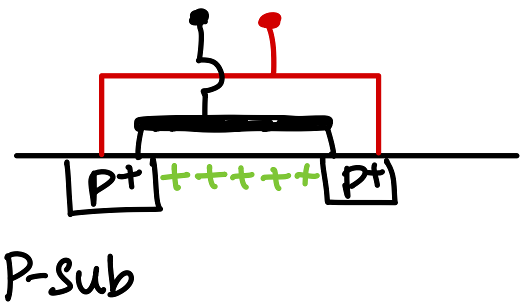


AM-NMOS



AM-PMOS.

Improve accumulation mode MOS caps



- > No par. resistance.
- > No weak inversion.
- > Large supply of maj. carriers nearby.
- > No unnecessary parasitics!
- > Custom Layout & characterization if not available in PDK.