DIC L1: Introduction (1)

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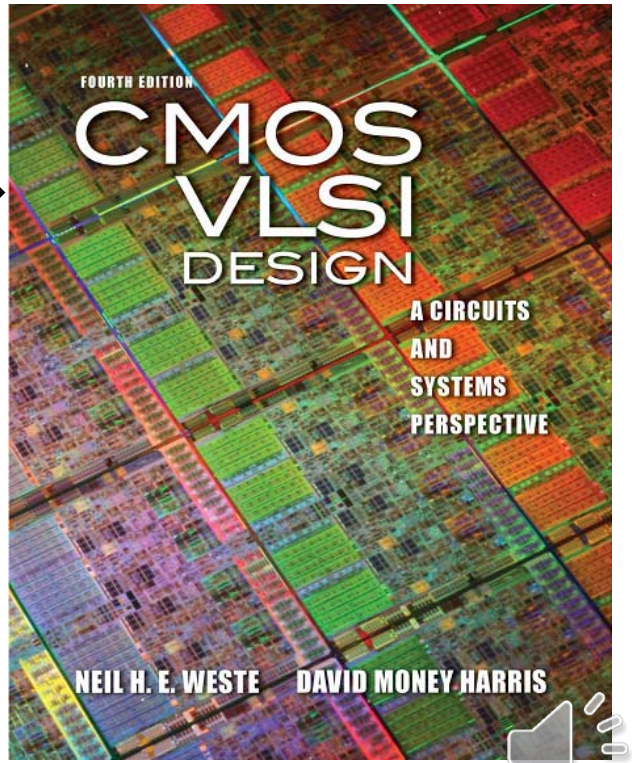
Course

- Digital Integrated Circuits, Fall 2019
  - Instructor: Sung-Min Hong
  - Textbook ➔➔➔➔➔➔➔➔➔➔➔➔➔➔➔



Resources

- Lecture PPT files (Converted to PDF format)
  - GitHub repository is found as

    https://github.com/hi2ska2/dic2019f
- YouTube channel
  - Sorry, limited availability in this semester

    https://www.youtube.com/channel/UCSmzU9aDVgIa4bo_R47mI2Q?view_as=subscriber
- Textbook
  - Supplementary materials are available at:

    http://pages.hmc.edu/harris/cmosvlsi/4e/index.html

1.3. MOS transistors (1)

- Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET)
  - Four terminals: Gate, source, drain, and body(/substrate)
  - NMOSFET & PMOSFET

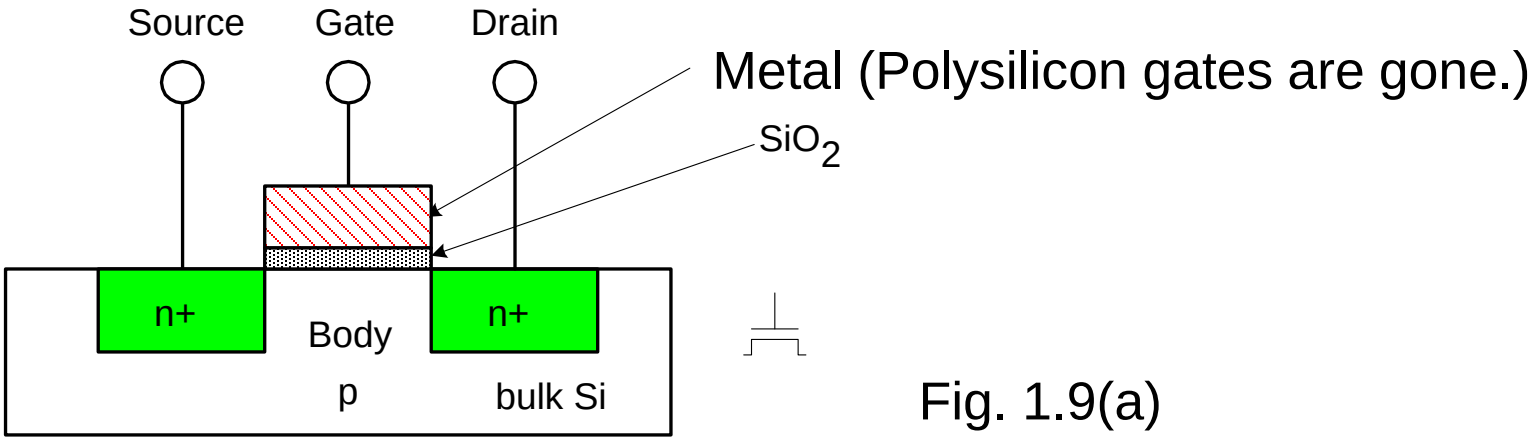
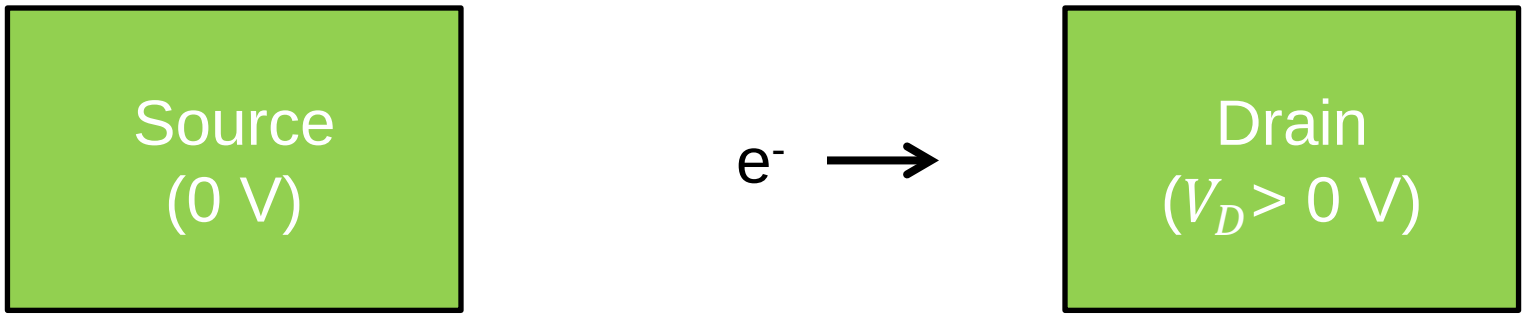


Fig. 1.9(a)

1.3. MOS transistors (2)

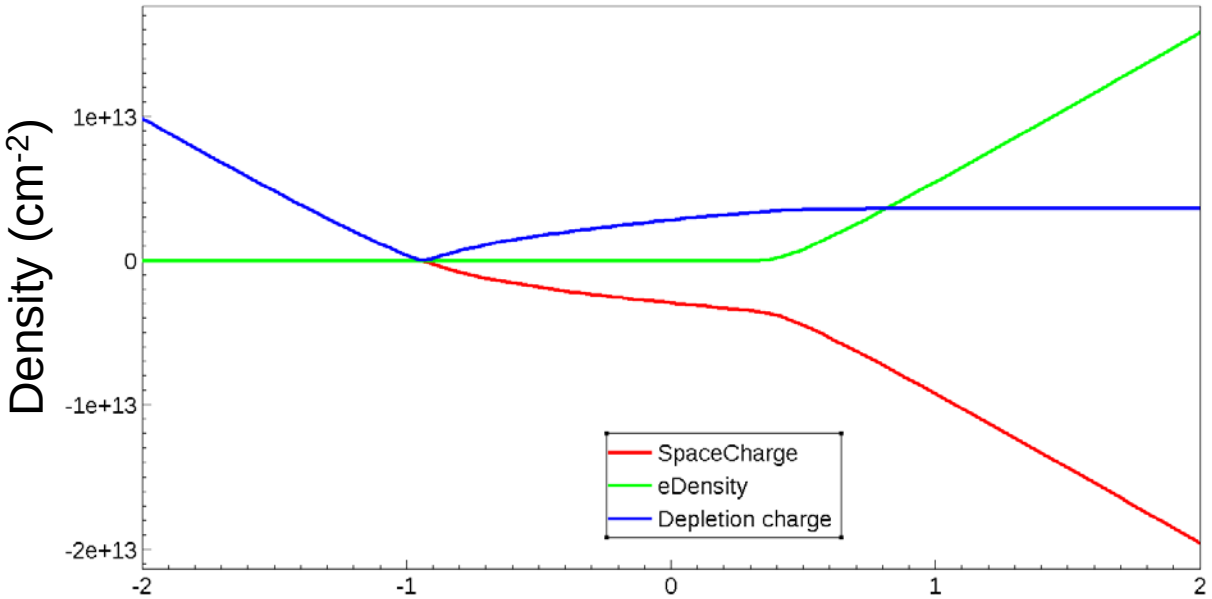
- Usually, $V_D > V_S$.
  - When we have an electron between the source/drain regions, it is drifted toward the drain. (Current conduction)



  - The key is to control the number of electrons.
  - (# of electrons) ≠ (# of negatively charged particles)

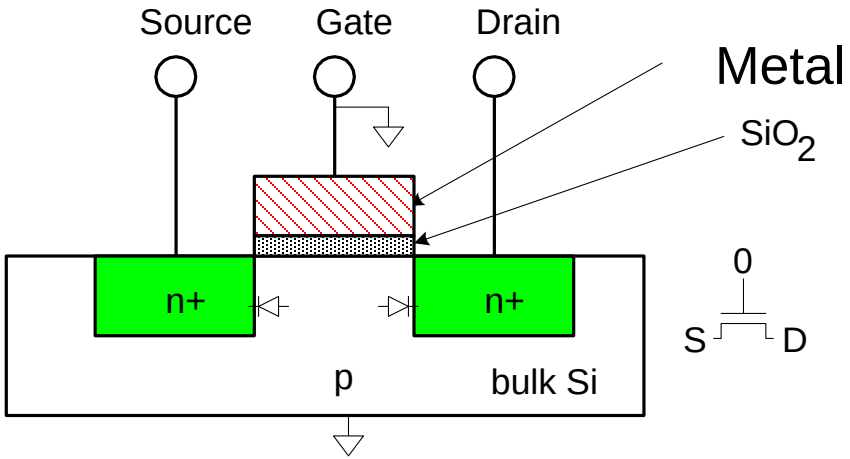
1.3. MOS transistors (3)

- MOS capacitor
  - It is a “nonlinear” capacitor.



1.3. MOS transistors (4)

- Body is tied to ground (GND).
- When $V_{GS} \equiv V_G - V_S$ is low, (BTW, “low” means what?)
  - No current flows.
  - The transistor is said to be OFF.



1.3. MOS transistors (5)

- When $V_{GS} \equiv V_G - V_S$ is high, (Again, “high” means what?)
  - Current can flow from the source thorugh the channel to the drain.
  - The transistor is said to be ON.