

# EE16B: DESIGNING INFORMATION DEVICES AND SYSTEMS II

## LECTURE NOTES

### INTRO TO RC CIRCUITS

*You will learn:*

- The transistor as a switch
- Why there are R's and C's
- Where there are R's and C's in the transistor
- Basic computing with transistors (PUN/PDN/inverting logic functions)
- Some “analog” stuff (the RC + opamp integration)

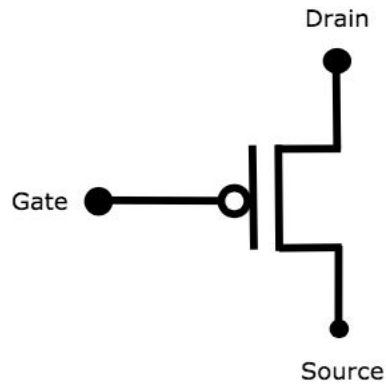
*Later:*

- Frequency Response
- “Phasors”
- Bode Plots

*Terminology:*

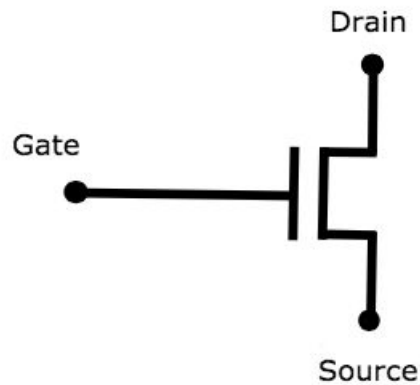
- $V_{GS}$ : Voltage between gate and source
- $V_{Th}$ : Threshold voltage
- $V_{DD}$ : Drain voltage
- MOS: Metal-Oxide-Semiconductor

Transistors can reduce computation (arithmetic, data manipulation, etc.) to logical operators on binary data.



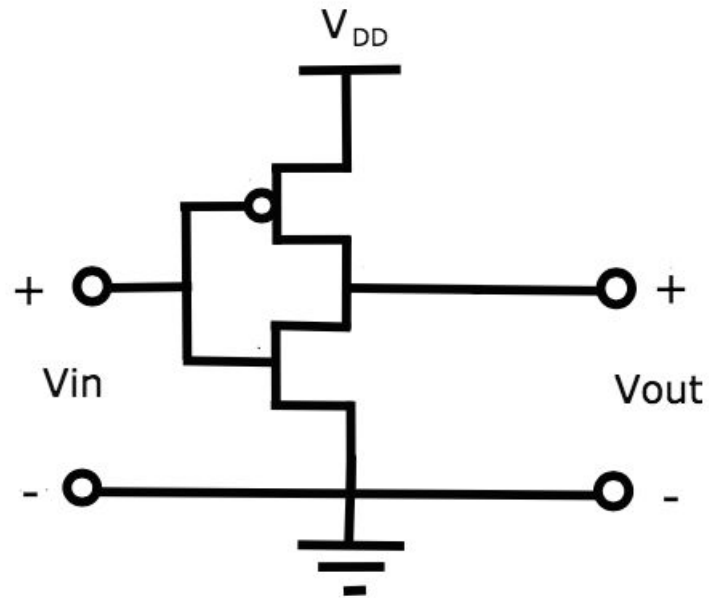
### P-Type MOS (PMOS)

- No current flows between gate and source or gate and drain
- 'On' if  $V_{GS} < -V_{Th}$
- 'Off' if  $V_{GS} > -V_{Th}$



### N-Type MOS (NMOS)

- No current flows between gate and source or gate and drain
- 'On' if  $V_{GS} > V_{Th}$
- 'Off' if  $V_{GS} < V_{Th}$



### Complementary MOS (CMOS)

- Contains both PMOS and NMOS
- When  $V_{in} = V_{DD}$ ,  $V_{out} = 0$
- When  $V_{in} = 0$ ,  $V_{out} = V_{DD}$