

# AIC HW1

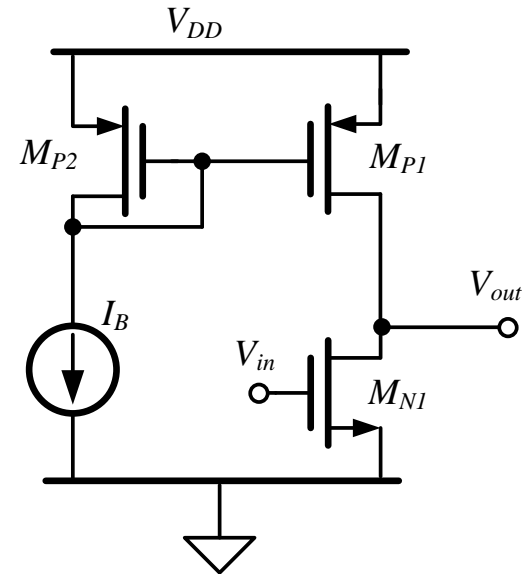
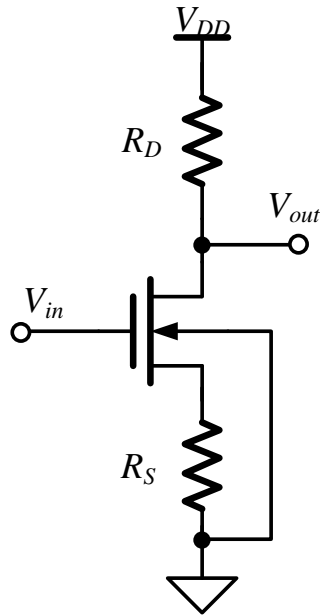
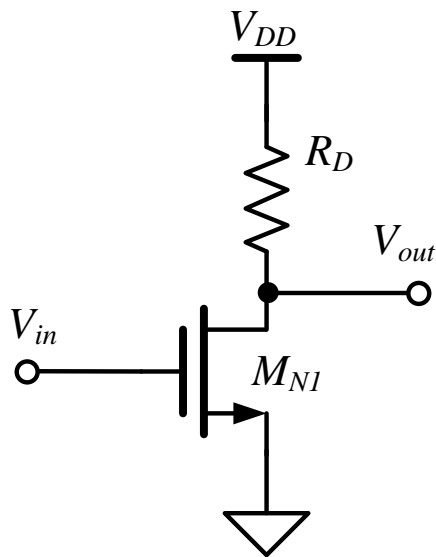


2024/10/13~10/29

Single stage amplifier

Differential amplifier

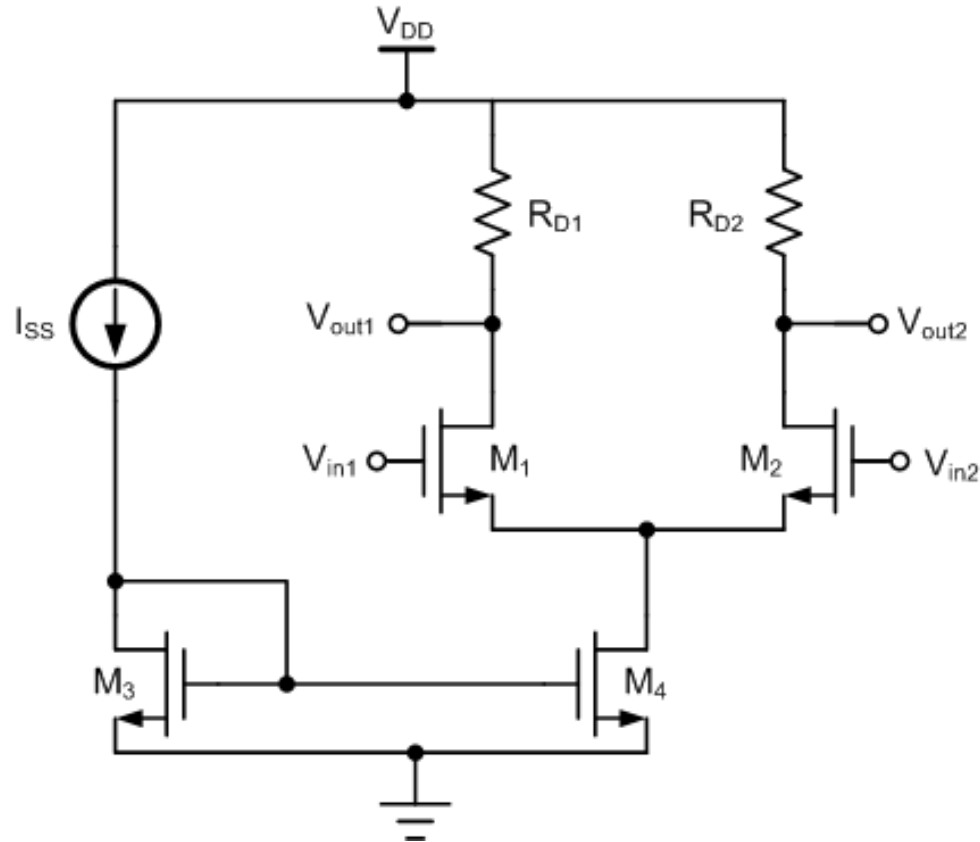
# Single stage amplifier-CS stage



## □ Design the above amplifiers

- (I) CS stage
- (II) CS stage with source resistor
- (III) CS stage with active load ( $I_B$  is the ideal current source)

# Differential amplifier



- Design the differential amplifier ( $I_{SS}$  is ideal current source)

# Specifications

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Parameters	CS(I)	CS(II)	CS(III)	Differential pair
Gain ( $A_v$ ), (V/V)	5	3	35	5
Output voltage swing ( $V_{sw}$ )	1V	1.9V	2.6V	2V
Power consumption ( $P_{DD}$ )	80 $\mu$ W			
Step response ( $S_t$ )	0.2V/ $\mu$ s with 5pF capacitor load (Give 10mV input up-step within 1ns)			

**\*Use 0.18 $\mu$ m technology 3.3V device with 3.3V  $V_{DD}$  supply**

# Grade

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$$\text{FOM} = \frac{A_V \times V_{SW} \times S_t}{P_{DD} \times \text{Area}} \left\{ \begin{array}{l} A_V: \text{DC gain (V}_{\text{out}}/\text{V}_{\text{in}}) \\ V_{SW}: \text{Output voltage swing (V)} \\ P_{DD}: \text{Power consumption (W)} \\ S_t: \text{Up-step response (V}/\mu\text{S)} \\ \text{Area}: \text{Layout area } (\mu\text{m}^2) \end{array} \right.$$

- Use the above FOM to evaluate your design.
  - Single stage amplifier (I)(II)(III)
  - Differential amplifier
- Please list the above factors in your report.
  - $A_V, V_{SW}, P_{DD}, S_t, \text{Area}$
- Please calculate your own FOM of your design.
- **The larger your FOM, the higher your grade.**

# Detail

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## □ Homework1

- Determine the optimized Length (L) first. Please show the I/V curve and explain it.
- Design the single stage amplifier and the differential amplifier.
- Use 0.18 $\mu$ m technology with 3.3V  $V_{DD}$  supply (Use 3.3V device)
- Your upload file must include
  - 1. Report (.pdf), including the following
    - (i) All the design parameters
    - (ii) Simulation results (Including each corner)
    - (iii) Discussion (Analysis and compares these results)
  - 2. Spice file (.sp)

# Detail (con't)

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- 作業請上傳到 E3 系統
  - Title: 學校\_學號\_hw1 (ex: NCTU\_9812633\_hw1)
  - 學分班同學請務必在報告中註明姓名
- Your upload file must include (一律上傳壓縮檔)
  - Report (.pdf) needs to include waveforms and explanation.
  - Spice file (.sp).
- 遲交分數會打折，不可抄襲
- Deadline: 2024/10/29