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Exercise:
Source Follower and Differential Amplifier

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1. NMOS Source Follower

- Implement an NMOS Source follower
  - Use an NMOS with W/L = 1µ / 0.2µ
  - Connect Bulk to Source
  - Use an NMOS mirror with W/L = 1µ / 0.5µ as current source
  - Bias the circuit with 10µA

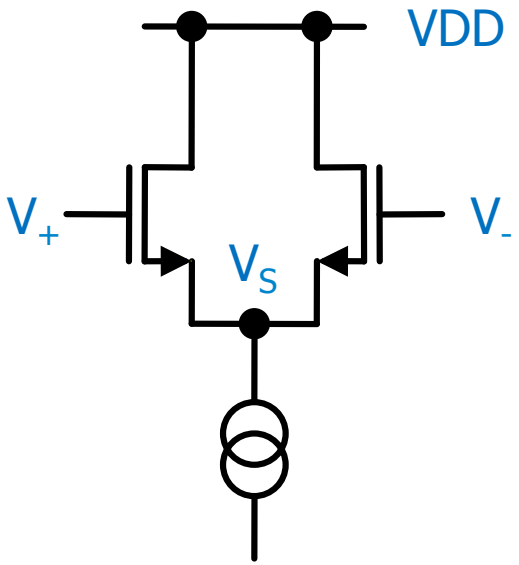
- Perform a DC and a transient analysis
  - What is the gain?
  - What happens for low input voltages? Why?
  - How does the gain change when you connect the bulk of the SF - NMOS to ground?

2. *PMOS* Source Follower

- Now draw a PMOS source follower with the same transistor dimensions & current...

3. Differential pair

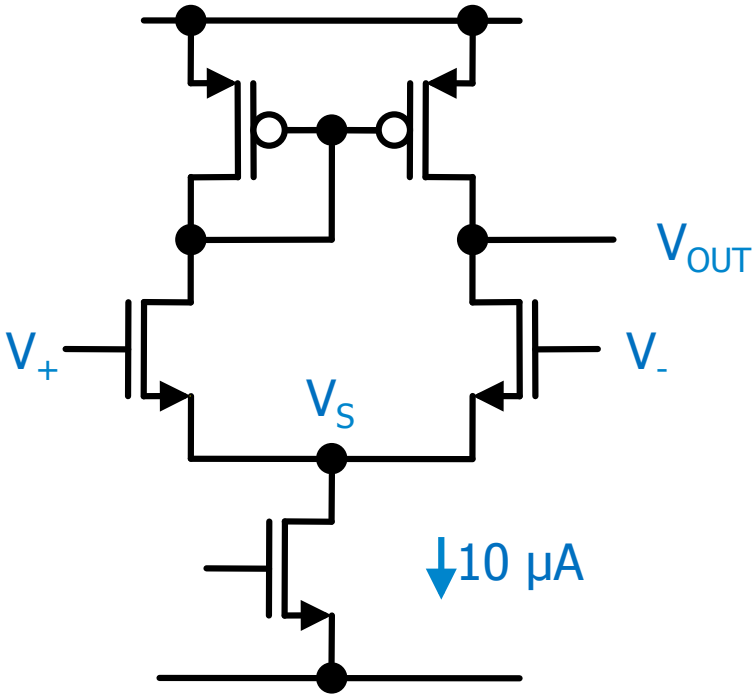
- Draw a differential NMOS pair



- Set V_- = 1V and vary V_+ from 0 to VDD = 1.8V
  - Observe I_+, I_- and V_S.
  - Explain what you see!

4. Differential Amplifier

- Draw a full differential amplifier



- Start with V_- = 0.5V
- What is the gain?
  - Can you guess an analytical approximation for the gain?
- Check the large signal behavior for different V_-.

5. *PMOS* Differential Amplifier

- Draw a full differential amplifier with a PMOS input stage
  - You must also change the other MOSs…