
Lecture16: CMOS amplifier, common-source (3)

Sung-Min Hong (smhong@gist.ac.kr)

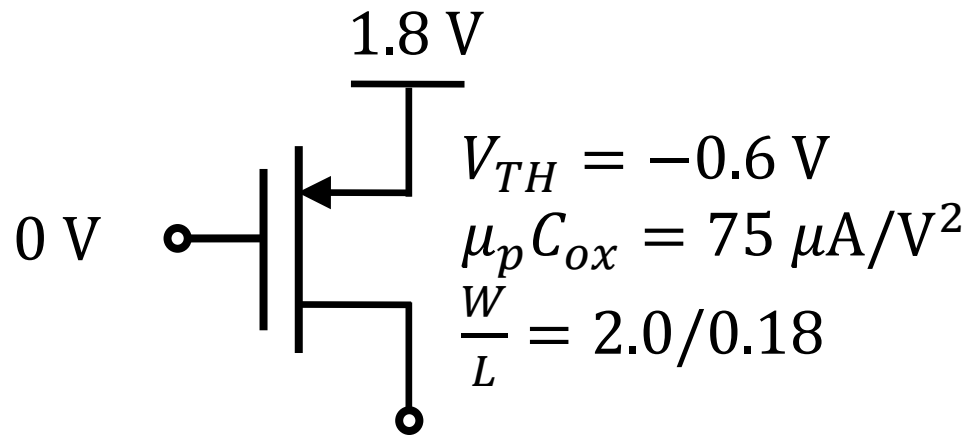
Semiconductor Device Simulation Lab.
School of Electrical Engineering and Computer Science
Gwangju Institute of Science and Technology

Review

- Voltage gain of a common-source amplifier
 - It is given by $A_v = -g_m(R_D || r_O)$.
 - By using a current source, we can maximize the voltage gain.
- Rule to calculate the input/output impedances

Biasing of PMOS devices

- Use a PMOS as a current source
 - The amount of “gate overdrive” is 1.2 V.
 - It is not 0.6 V.

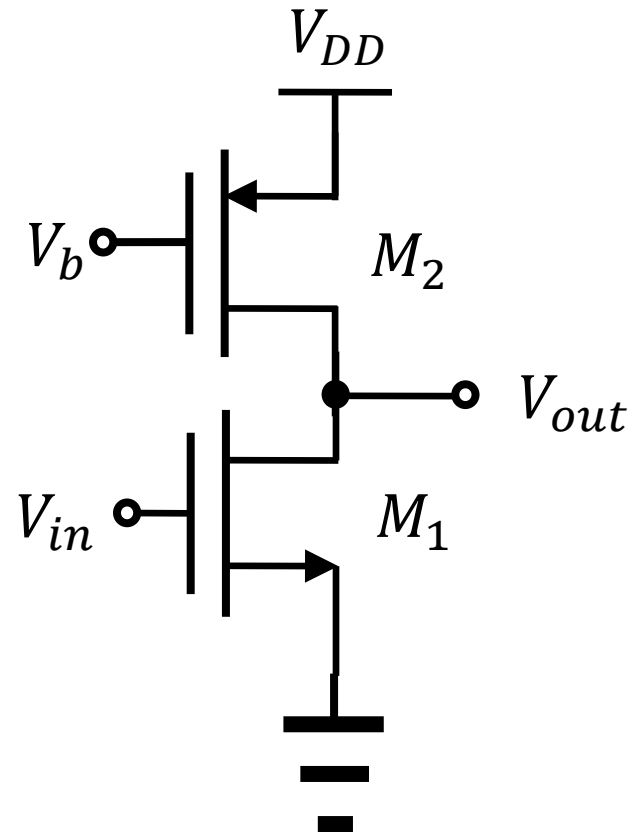


Real current-source load

- Use a PMOS as a current source.
 - It is not an ideal current source.

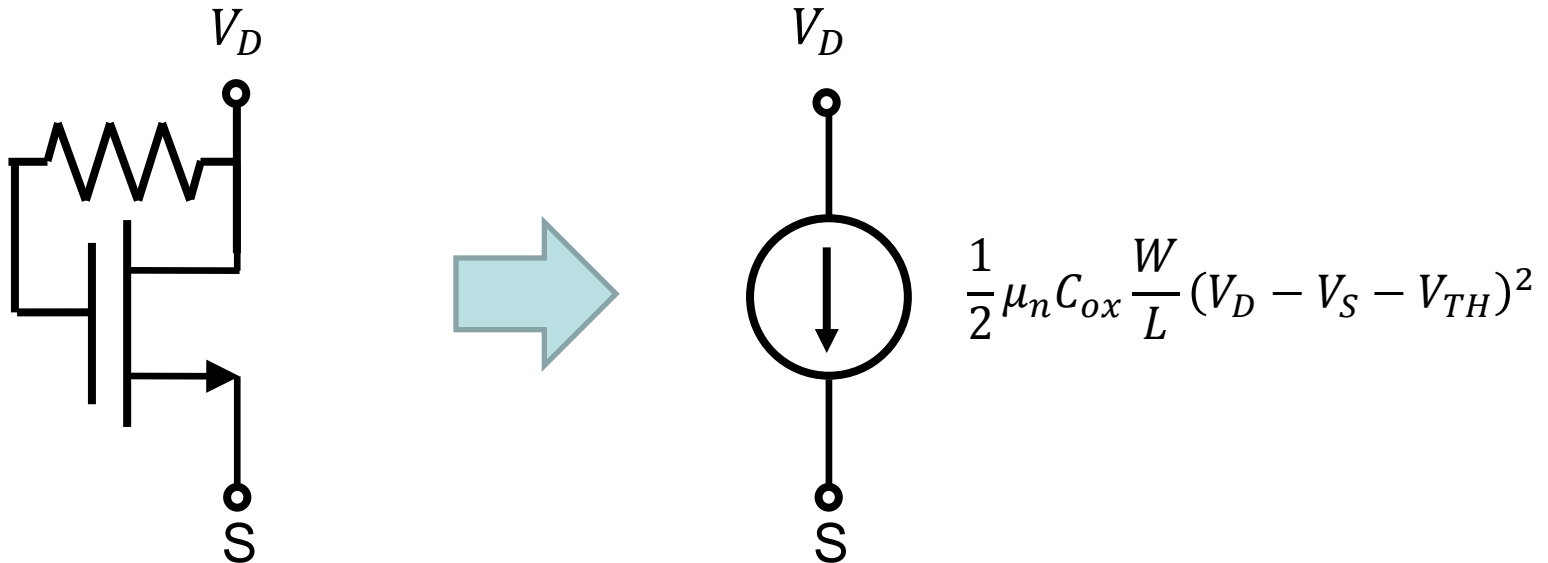
$$v_{out} = -g_{m1}(r_{O1}||r_{O2})v_{in}$$

$$A_v = -g_{m1}(r_{O1}||r_{O2})$$



Self-biasing

- Already covered in Example 6.13.
 - Always in the saturation region.



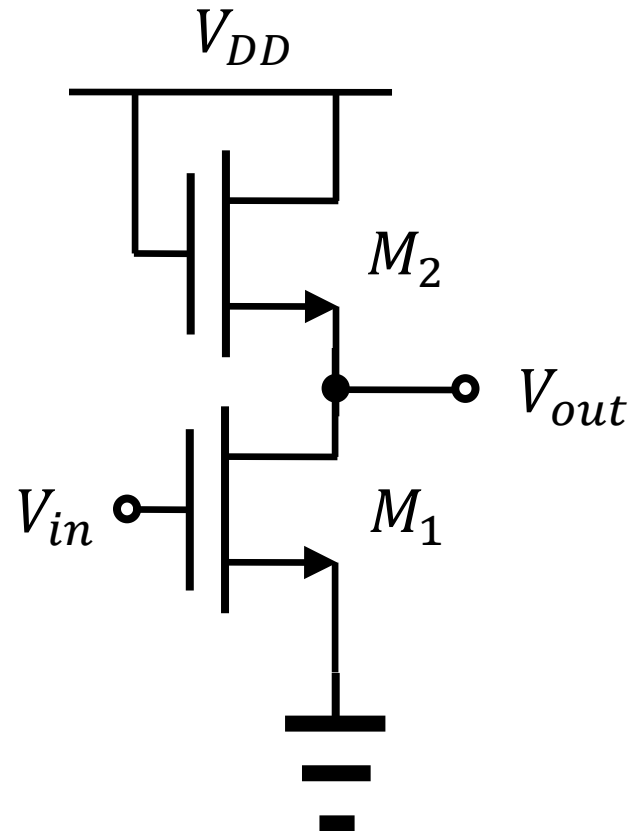
Gate and drain are tied.

Diode-connected load

- Use a diode-connected load.
 - It is not an ideal current source.

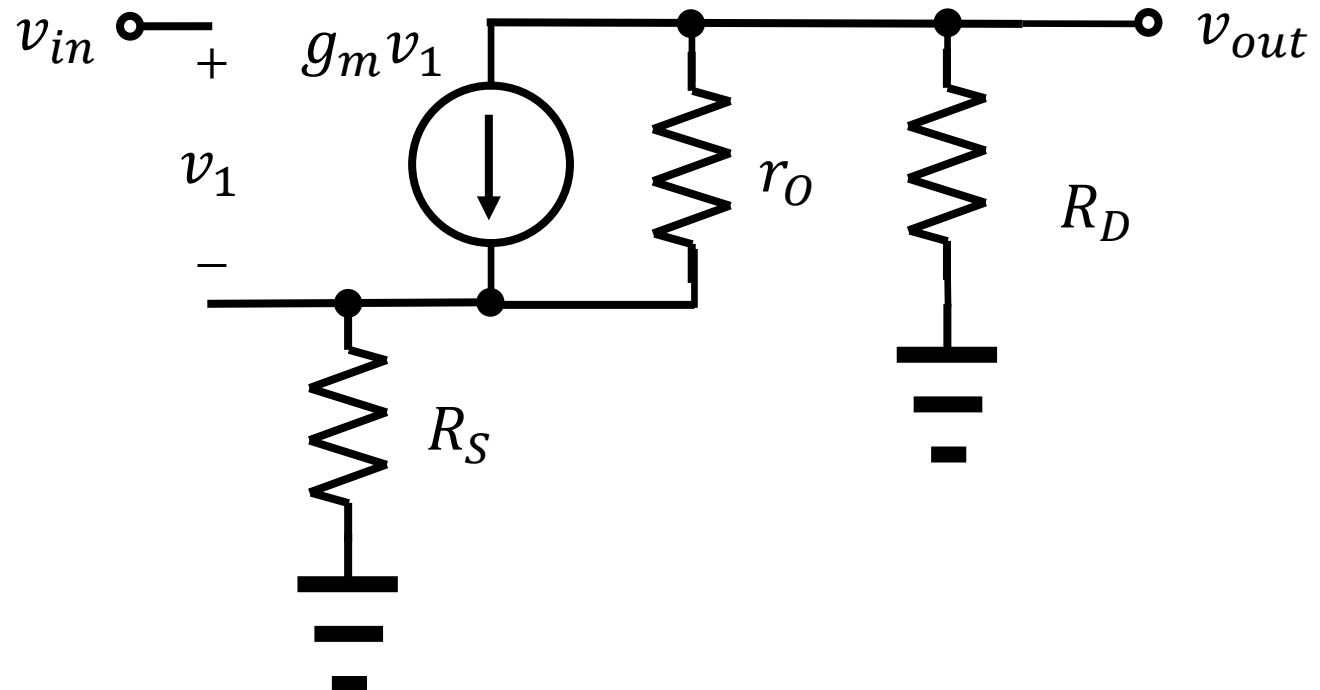
$$v_{out} = -g_{m1} \left(r_{O1} \parallel \frac{1}{g_{m2}} \parallel r_{O2} \right) v_{in}$$

$$A_v = -g_{m1} \left(r_{O1} \parallel \frac{1}{g_{m2}} \parallel r_{O2} \right)$$



Source degeneration

- Consider a case with a source resistor, R_S .
 - Calculate the gain.
 - Calculate the output impedance.



Configurations

- Three terminals of the MOSFET
 - One for the common terminal
 - One for the input terminal
 - One for the output terminal

Source	Gate	Drain	Remark
Common	Input	Output	Common-source amp.
Common	Output	Input	X
Input	Common	Output	It will be covered.
Output	Common	Input	X
Input	Output	Common	X
Output	Input	Common	It will be covered.