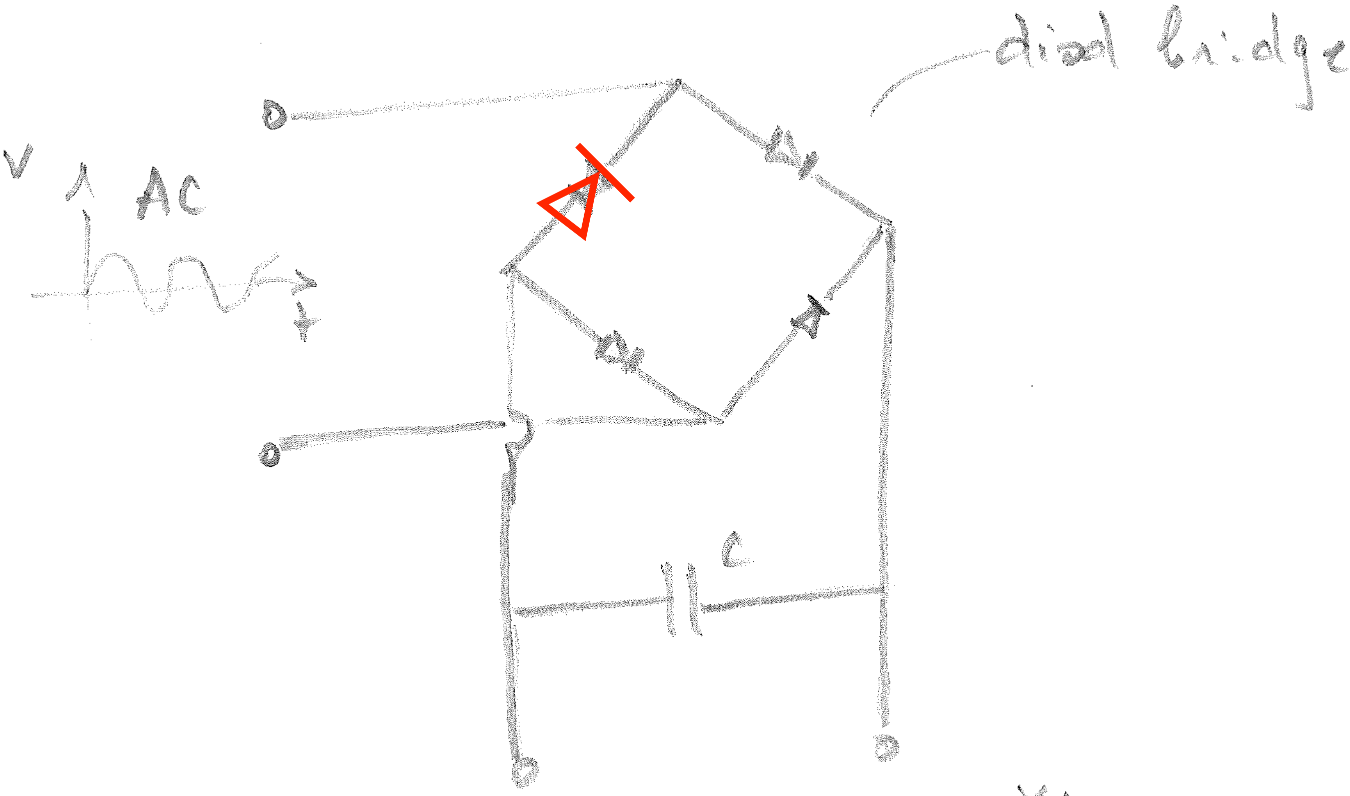
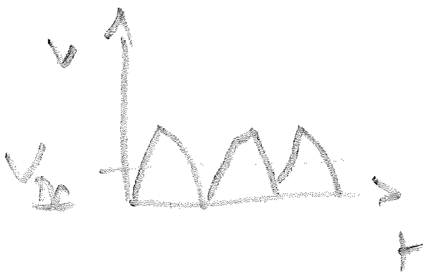
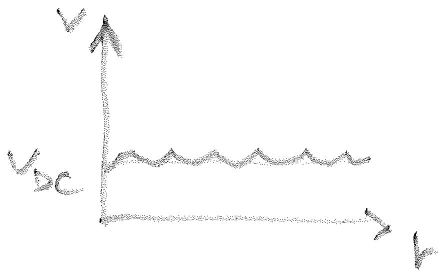
Power Electronics

AC - DC : Rectifier





without capacitor



with capacitor

DC - AC : Inverter Slide 19
PWM = Pulse Width Modulation

DC - DC :

* decrease the DC voltage
  → buck converter Slide 16

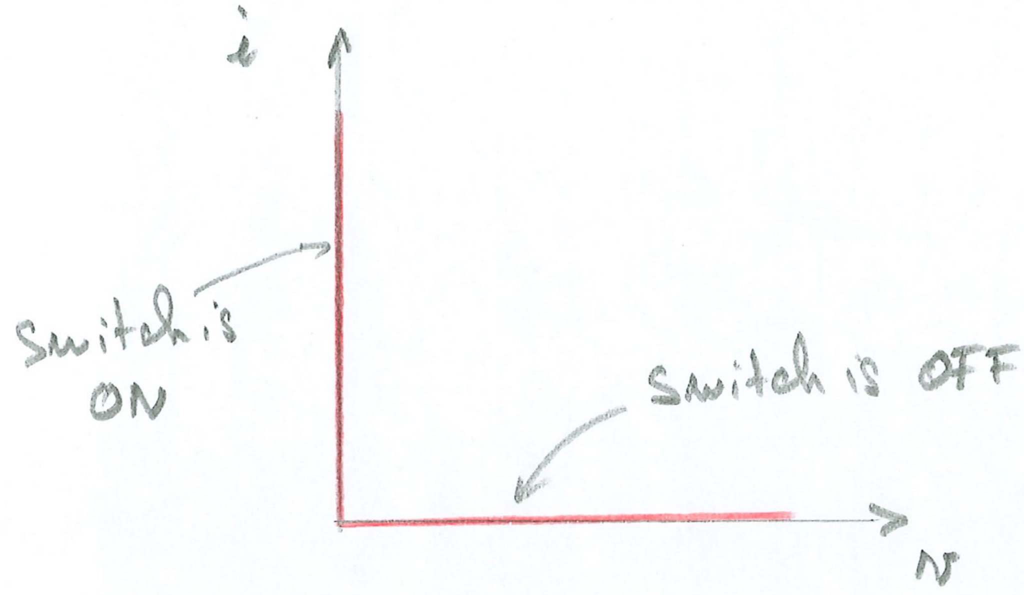
* increase the DC voltage
  → boost converter Slide 18

Note that the positions of the interruptor and of the inductance are just permuted to change the buck converter into a boost converter.

AC - AC : Cyclo-converter

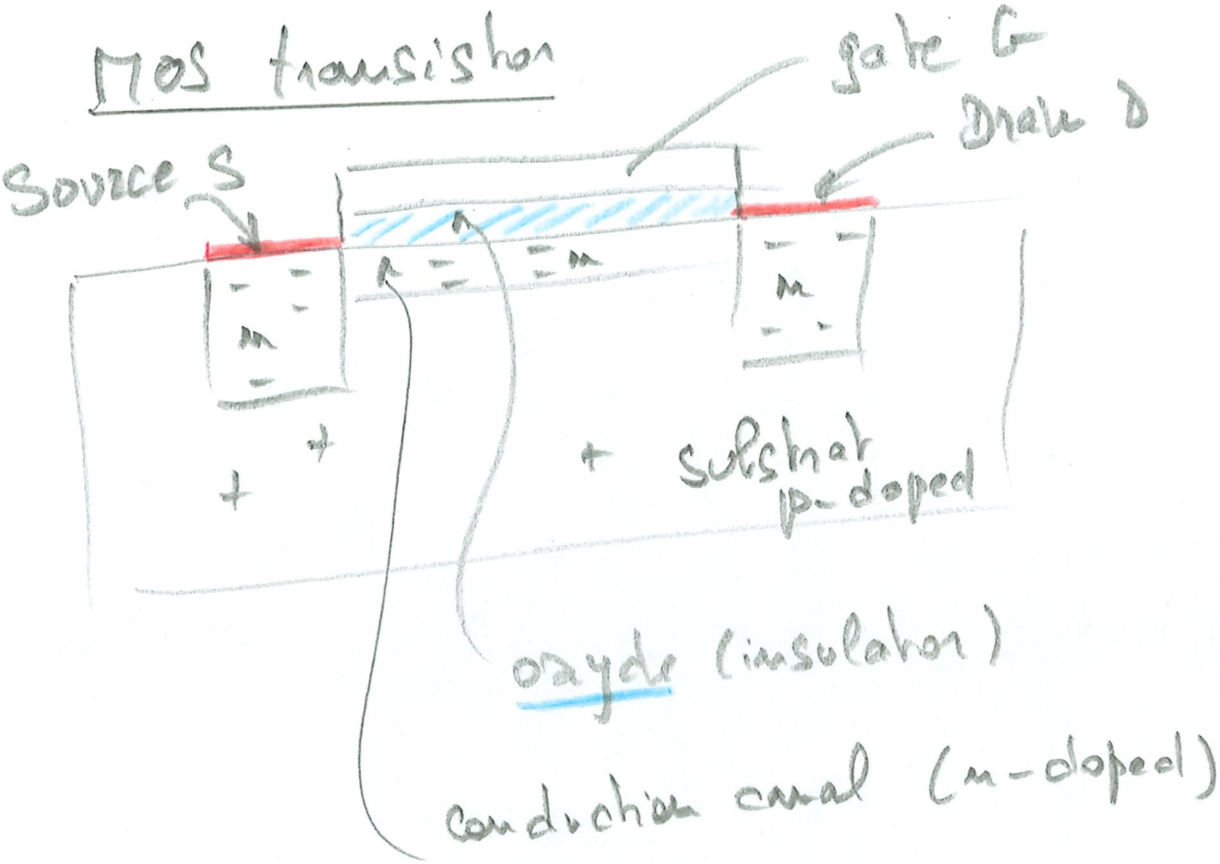
$$\text{AC-AC} = \underbrace{\text{AC} - \text{DC}}_{\text{rectify}} \quad \underset{\text{(capacitor)}}{\text{DC link}} \quad \underbrace{\text{DC} - \text{AC}}_{\text{invert with another amplitude and another frequency}}$$

Ideal Switch (exterior characteristic)

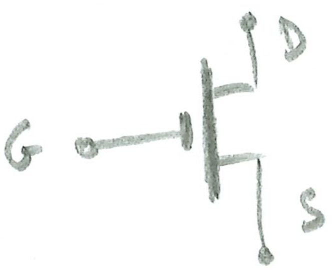


* ON $v(t) = 0$ whatever $i(t)$
* OFF $i(t) = 0$ whatever $v(t)$
* power $p(t) = v(t)\, i(t) = 0$

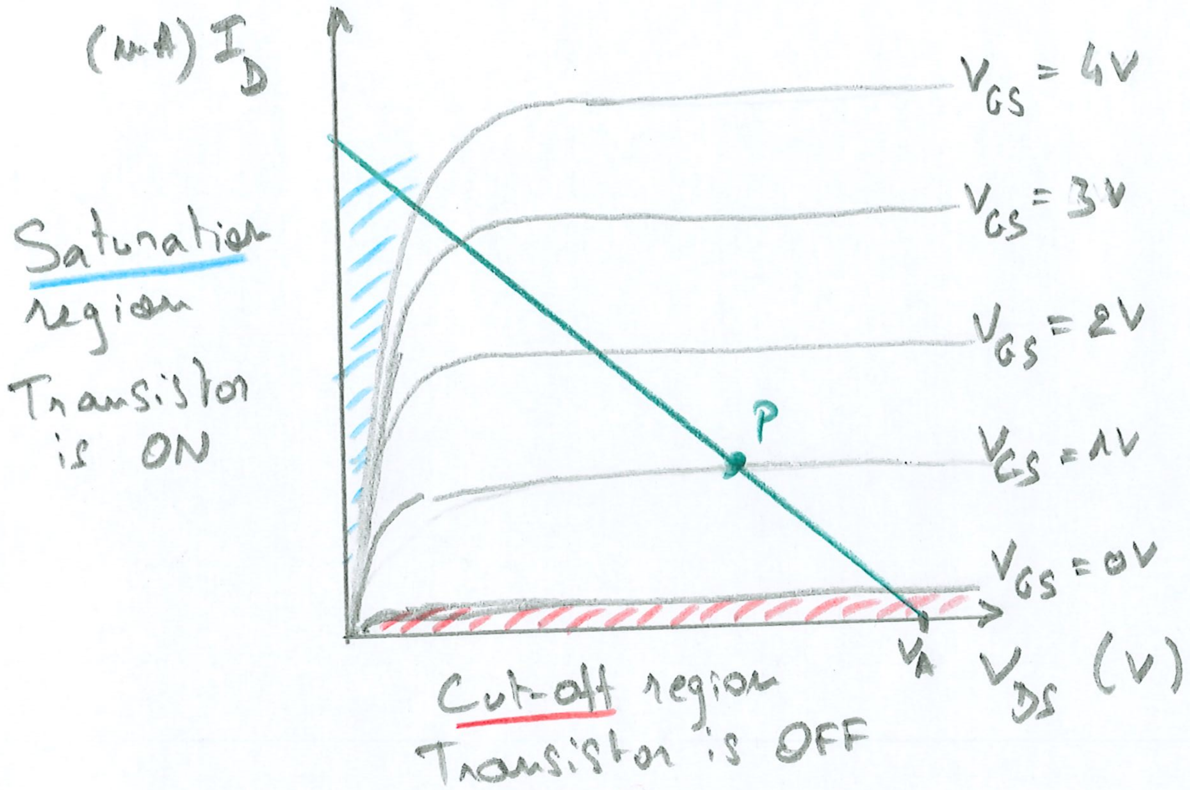
MOS transistor



- Silicium technology
- > 1980
- geometry and dimensions are essential
- the reality of electronic components is much more complex than their conventional idealized view
- Symbolic representation



MOS transistor (exterior characteristic)



V_{DS} : Drain - Source voltage

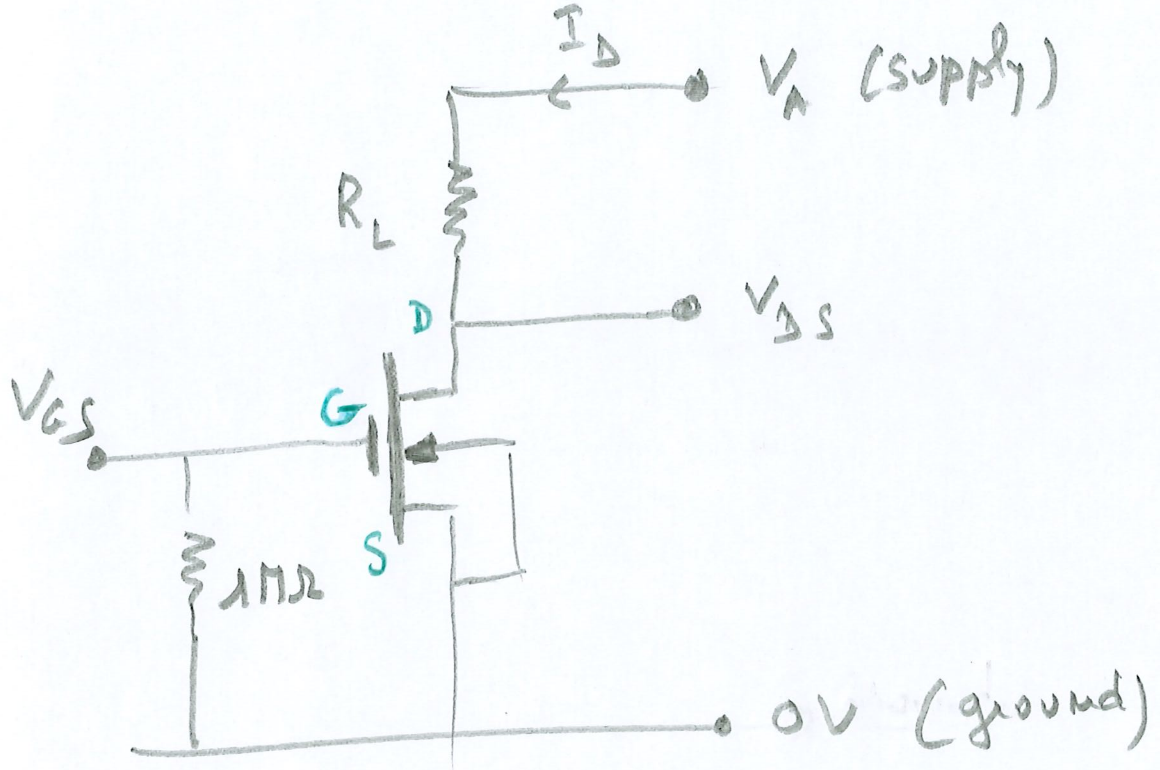
V_{GS} : Gate - Source voltage

I_D : Drain current

Saturation region and cut-off region correspond to the MOS operated as a switch (ON-OFF interruptor). They not too badly match the exterior characteristic of the ideal switch (page 3). Losses are not zero, but they are small.

MOS operated as amplifier (e.g. microphone)

Single-stage amplifier



The green line on the previous page has equation $V_{DS} = V_A - R_L I_D$. Its intersection with the exterior characteristic of the MOS for e.g. $V_{GS} = 1V$ gives the working point P. Ohmic losses are important in this case!