

COMPOSANTS SEMI-CONDUCTEURS

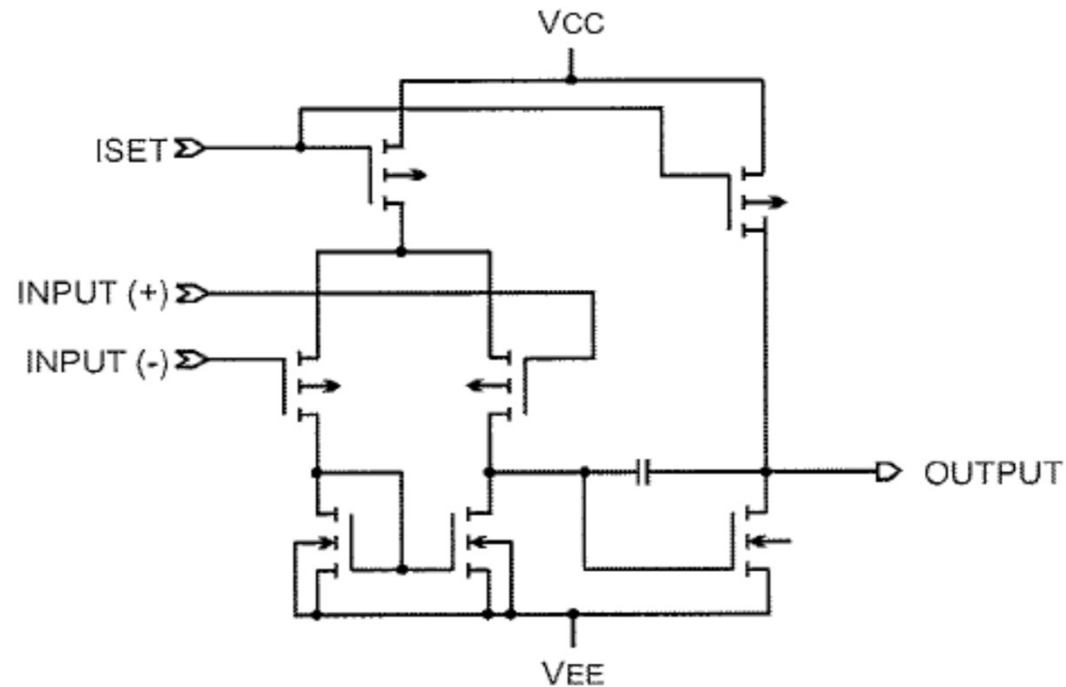
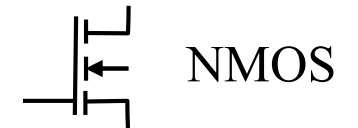
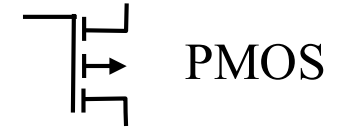
XIII) Solutions S13

P.A. Besse

EPFL



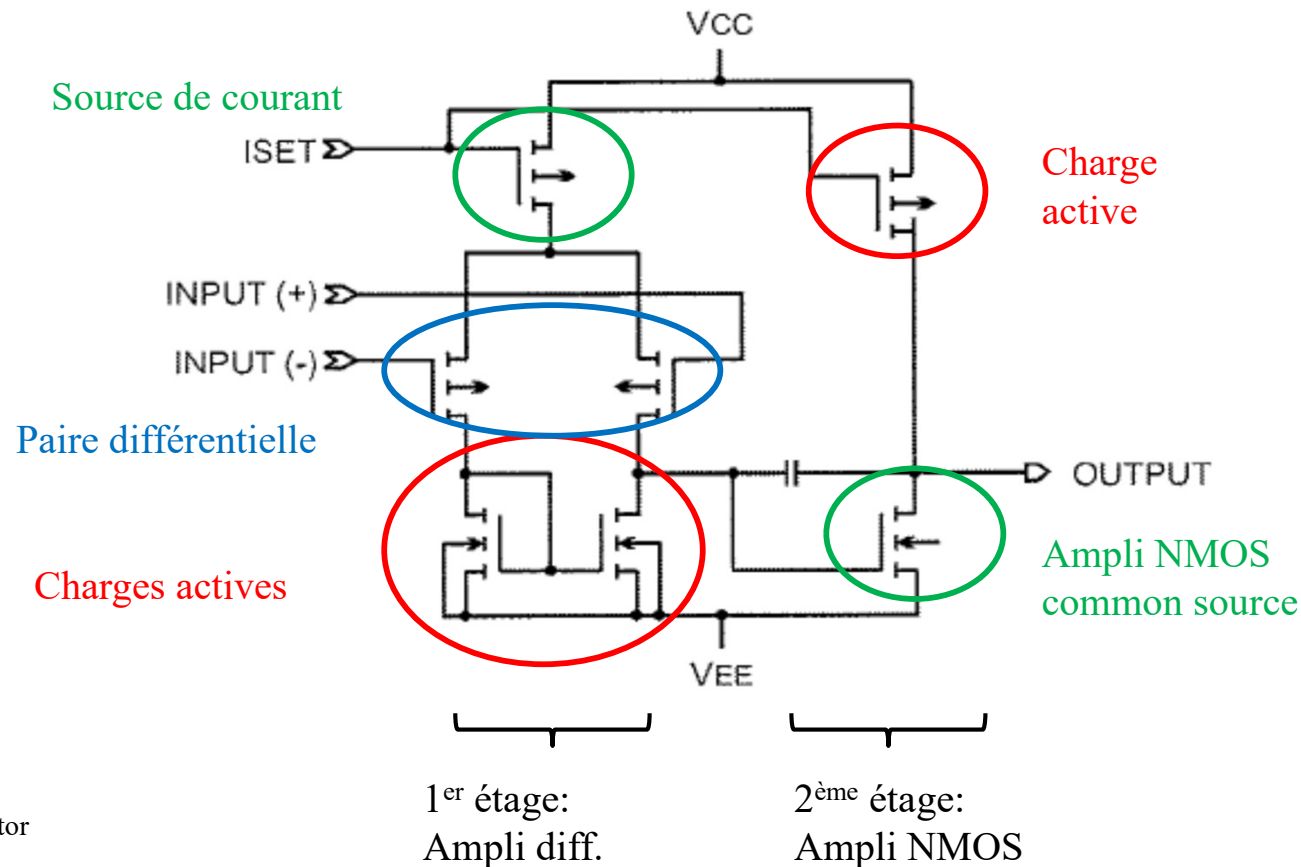
Interprétez ce schéma:



MC14573 from Motorola Semiconductor



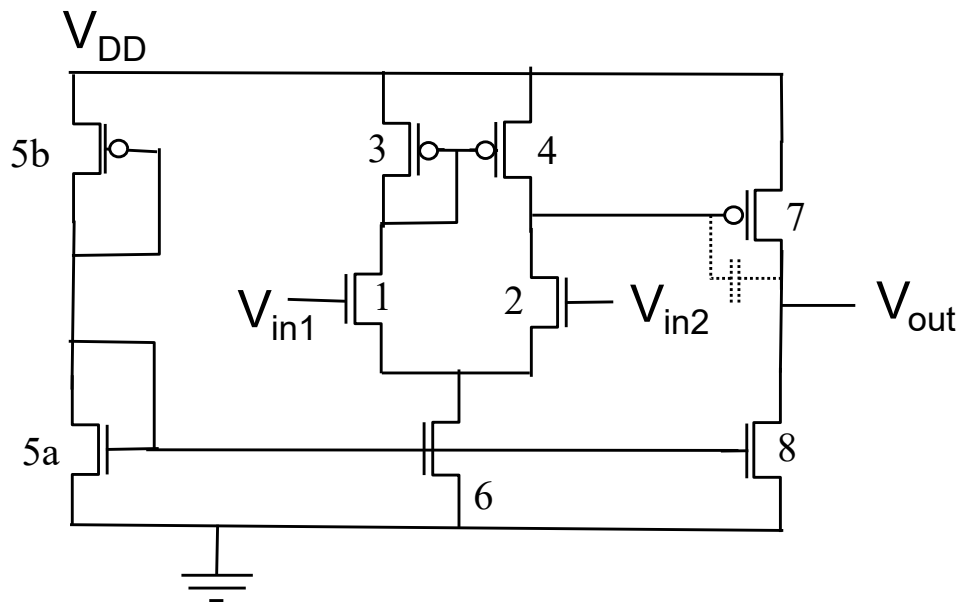
OpAmp deux étages mais basé sur une entrée PMOS



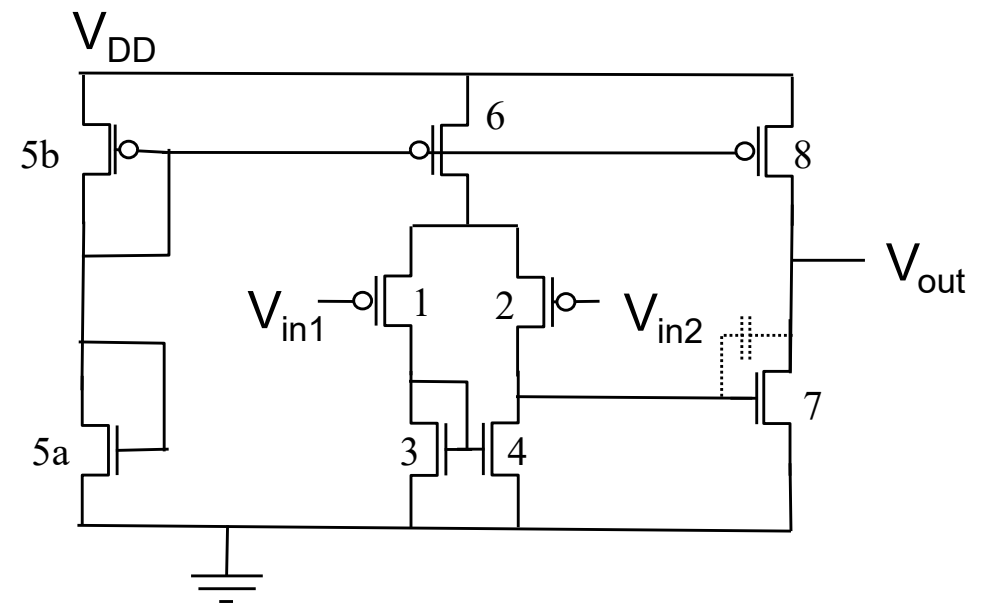
MC14573 from
Motorola Semiconductor

Differential amplifier

NMOS inputs

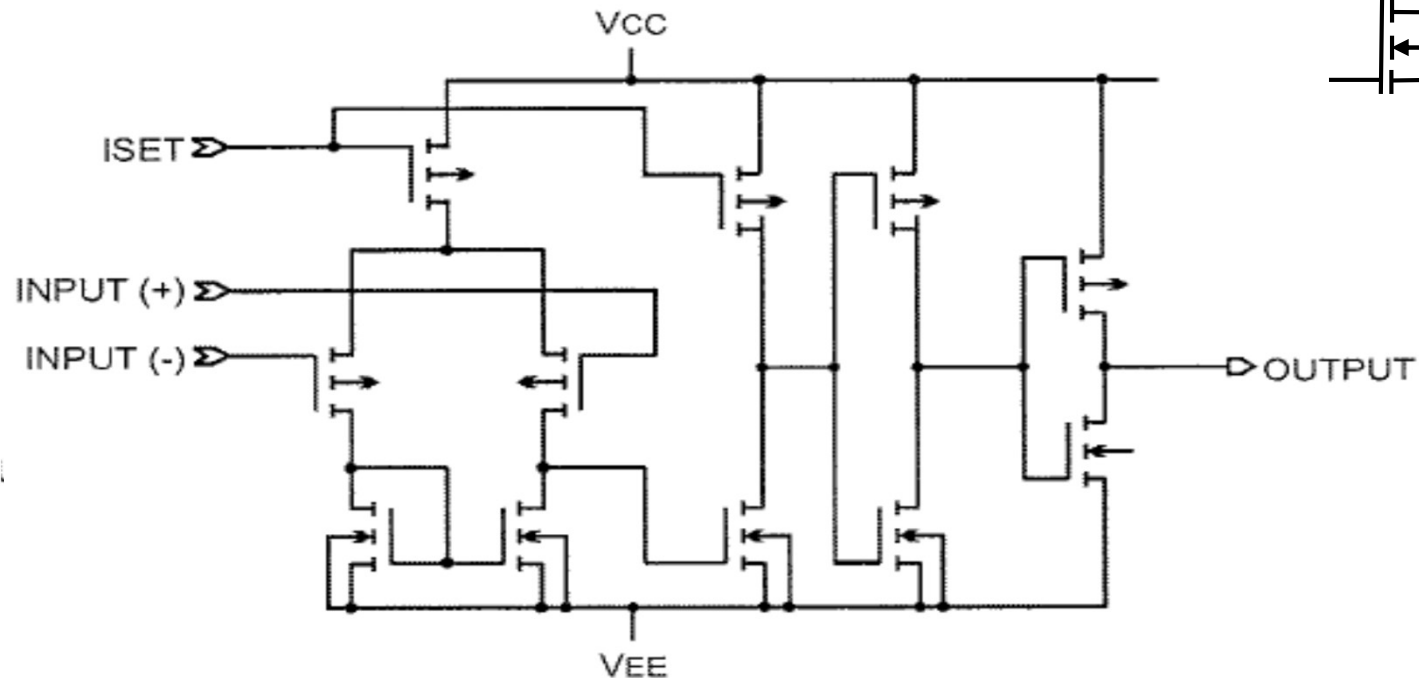
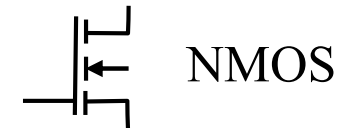
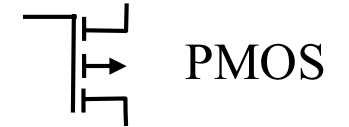


PMOS inputs





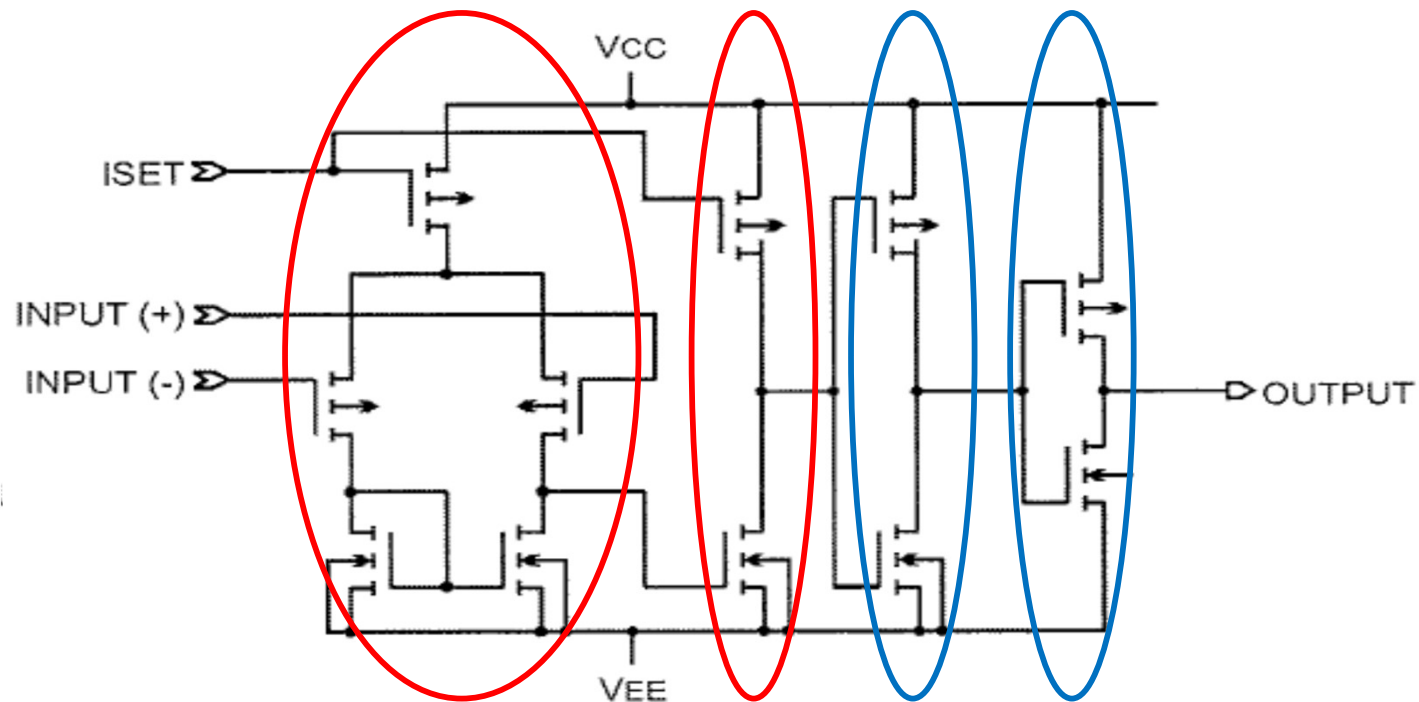
Interprétez ce schéma:



MC14574 from Motorola Semiconductor



Comparateur = OpAmp 2 étages et 2 inverseurs en amplificateurs



MC14574 from
Motorola Semiconductor

Ampli diff.
PMOS

Ampli
NMOS

Inverter
CMOS

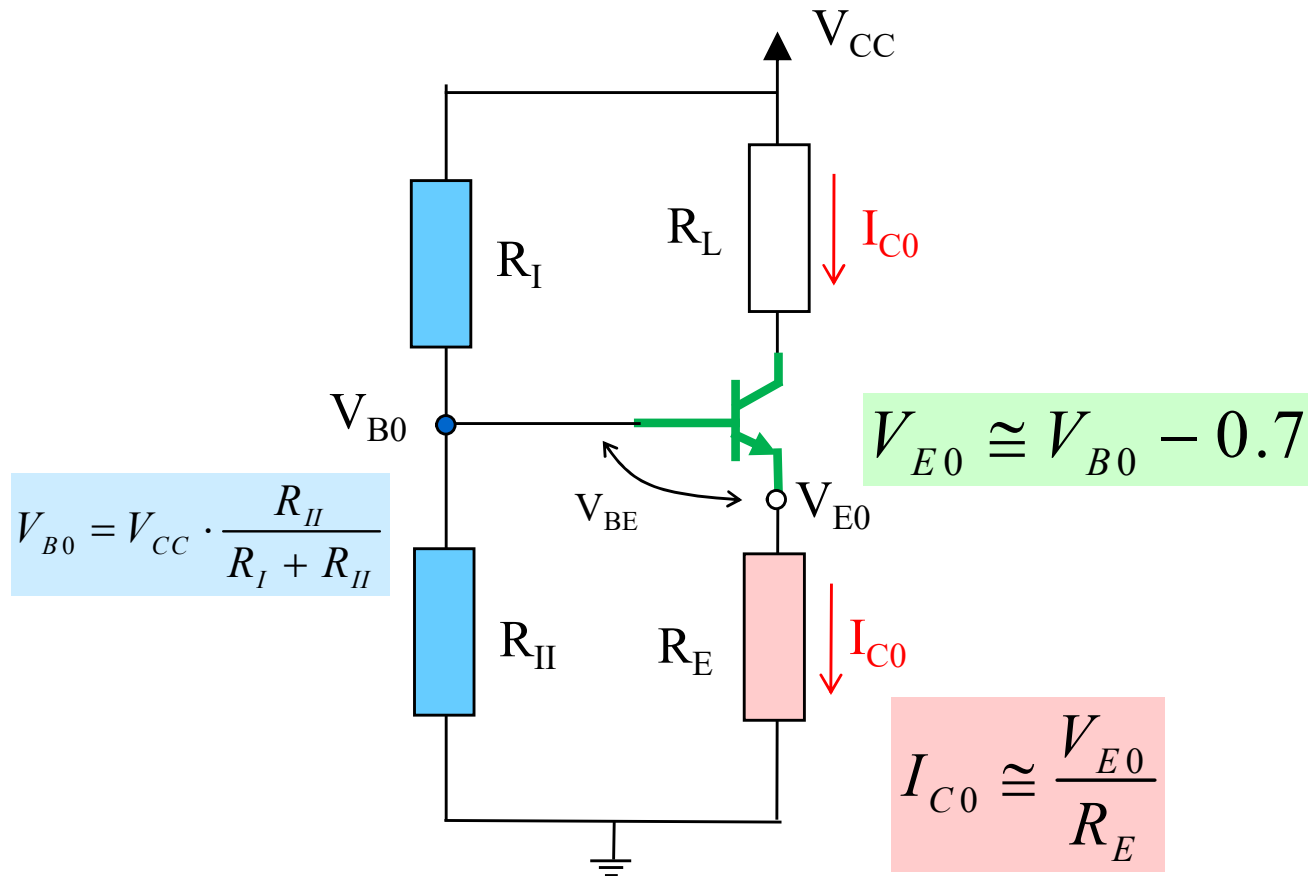
Inverter
CMOS

Exercice E13.2: Ampli de tension avec NMOS

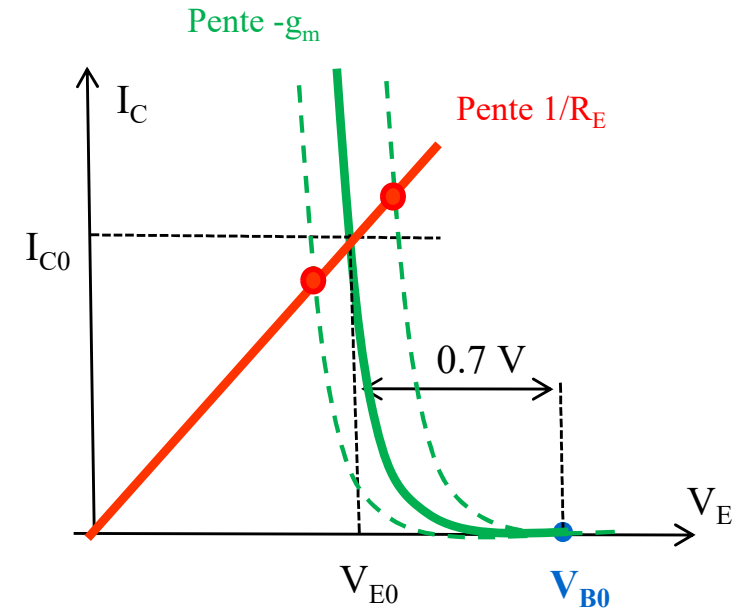


Utilisez un NMOS comme ampli de tension.
Inspirez-vous du chapitre 7 sur les BJT.
Remplacez le transistor bipolaire par un NMOS !

BIPOLAIRE npn: point de travail

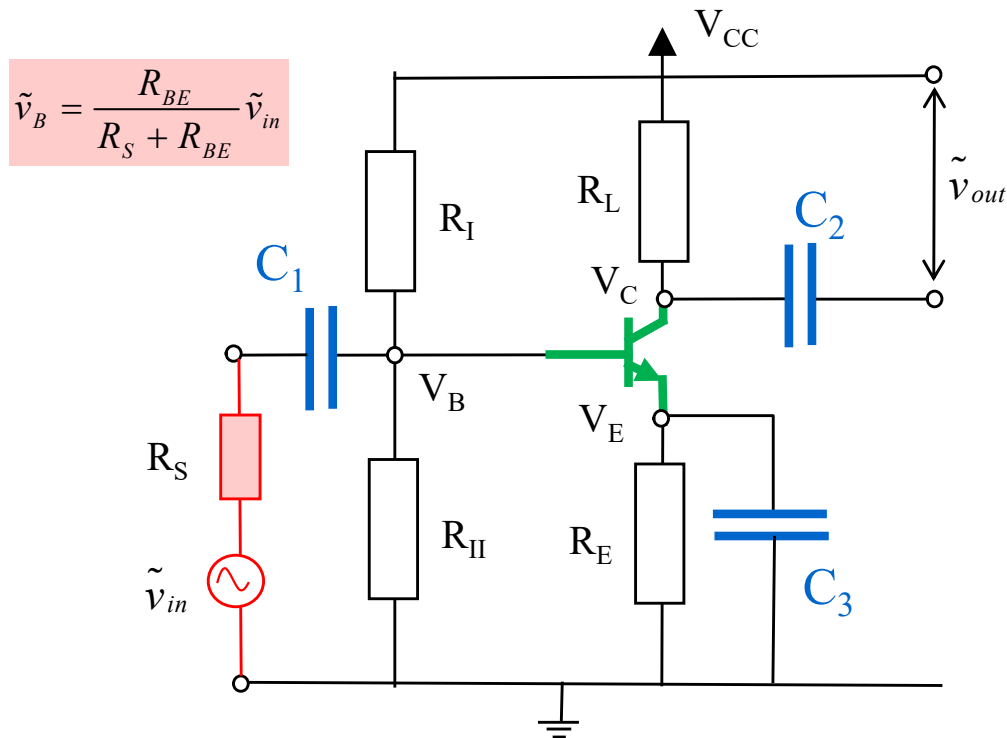


Courbe: $I_C(V_{BE}) = \beta_F \cdot I_B(V_{BE})$

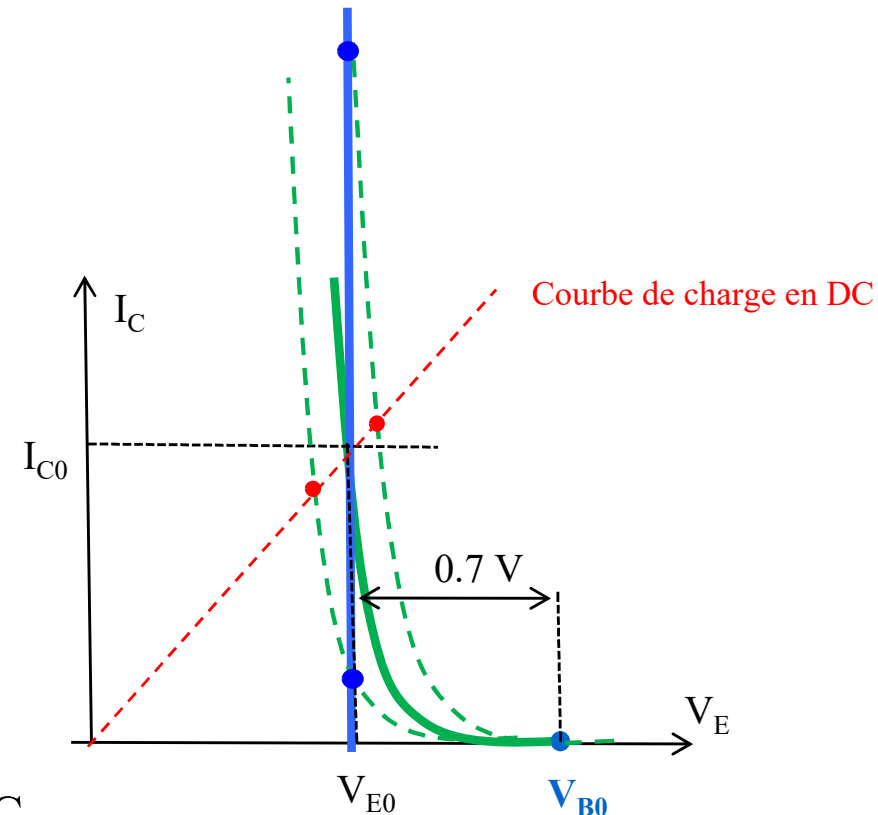


R_E assure la stabilité du courant de bias I_{C0} .

BIPOLAIRE npn Couplage capacitif



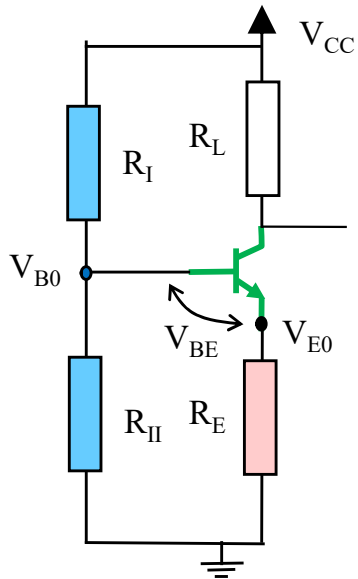
Courbe de charge en AC



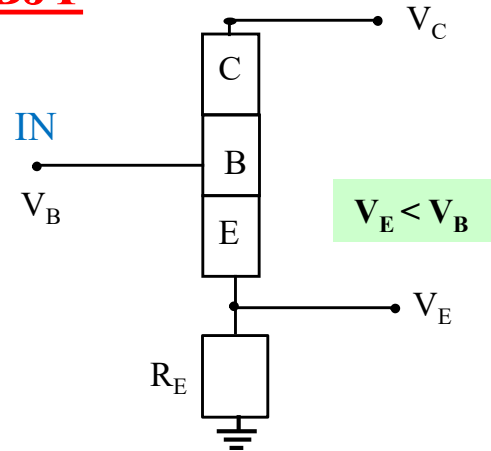
- Les capacités C_1 et C_2 assurent le couplage du signal AC à l'entrée et à la sortie
- La capacité C_3 maintient la tension de bias V_{E0} fixe et assure un transfert complet du signal v_{in} sur le courant I_C .
- R_S doit être beaucoup plus petit que $R_{BE}=1/g_{BE}$

$$\frac{\tilde{v}_{out}}{\tilde{v}_B} \cong -g_m \cdot R_L$$

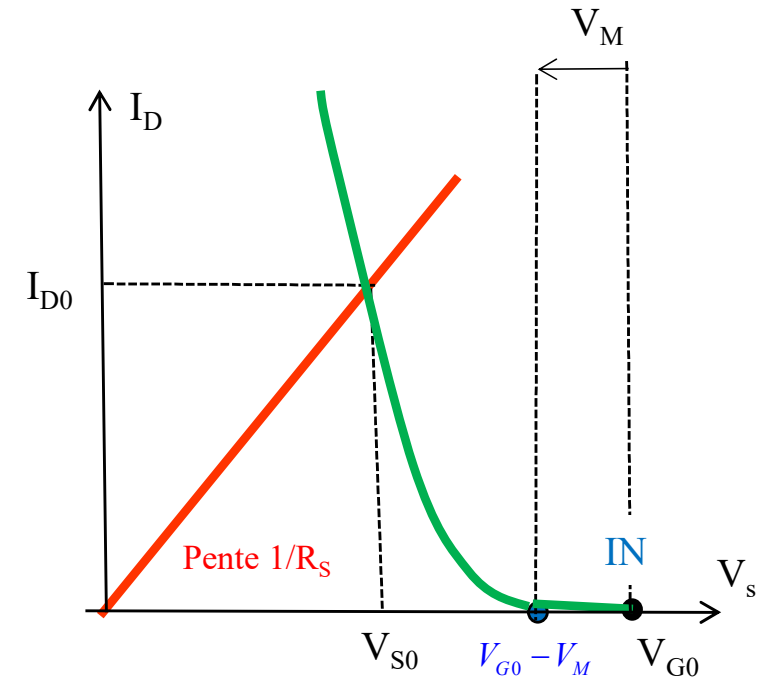
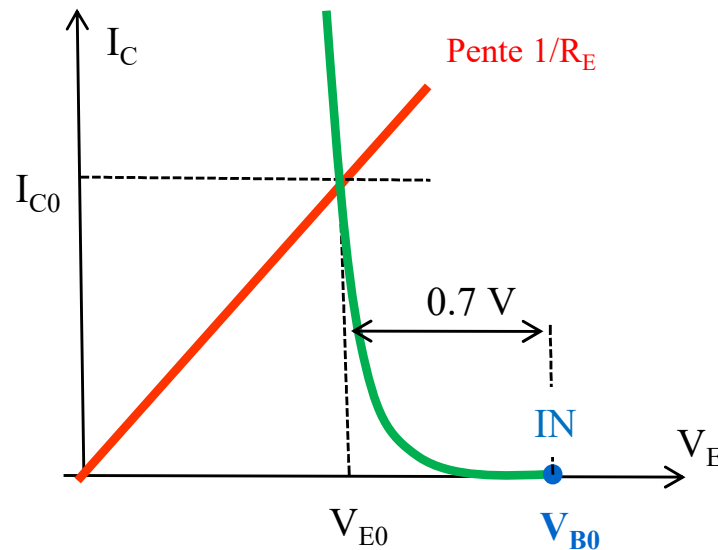
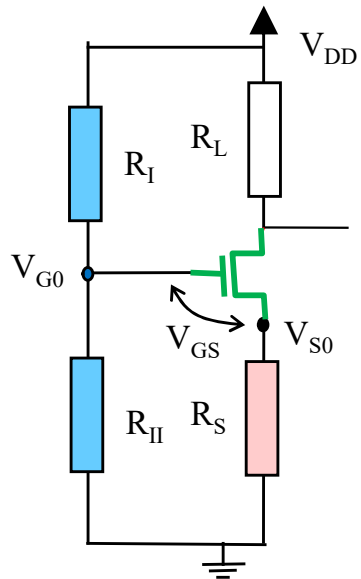
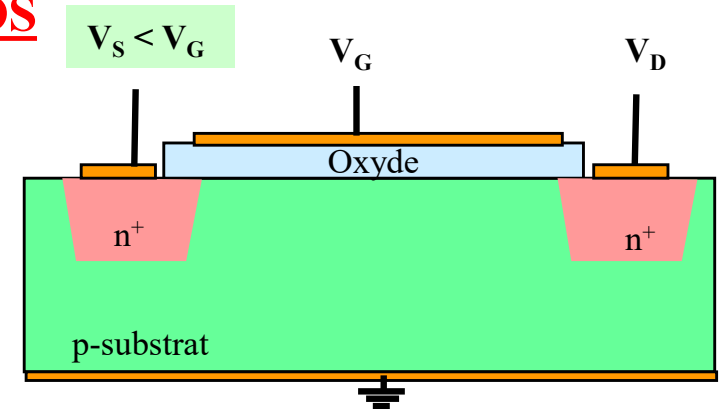
Comparaison BJT-NMOS

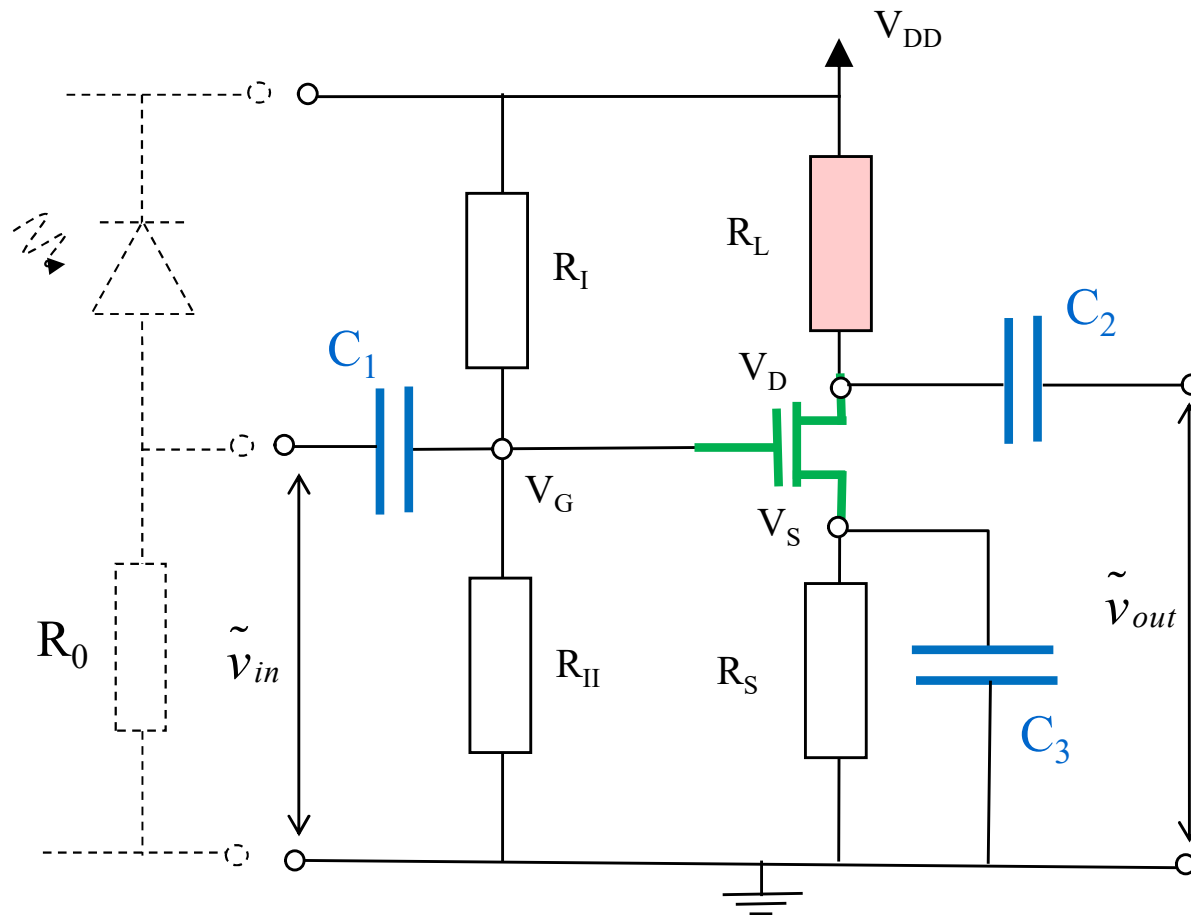


BJT



NMOS

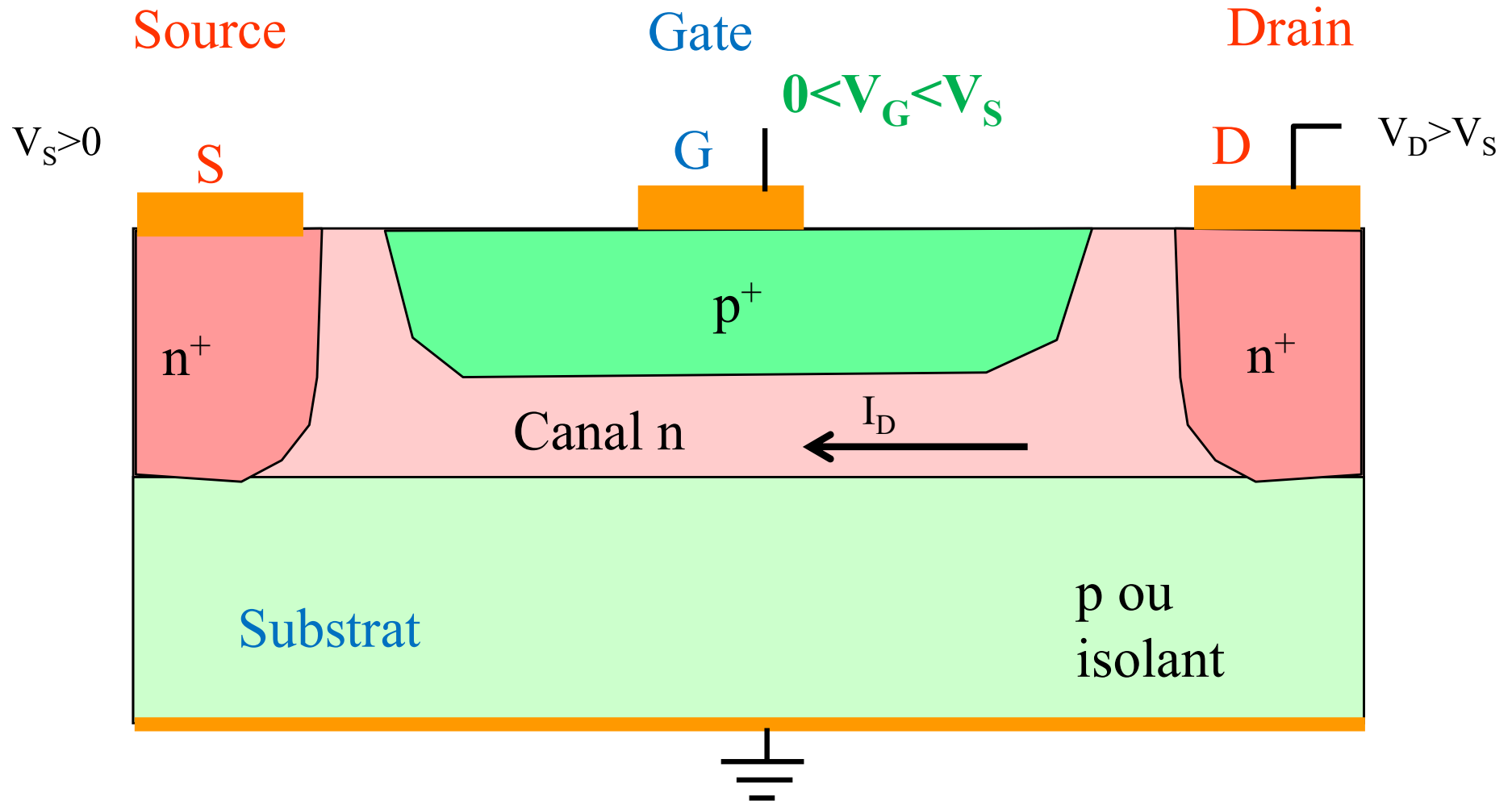




Gain en tension

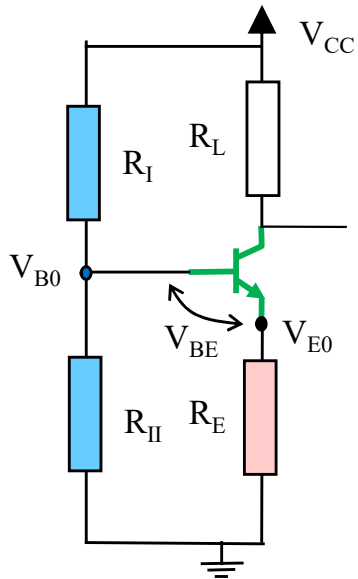
$$\frac{\tilde{v}_{out}}{\tilde{v}_{in}} \cong -g_m \cdot R_L$$

JFET à canal n

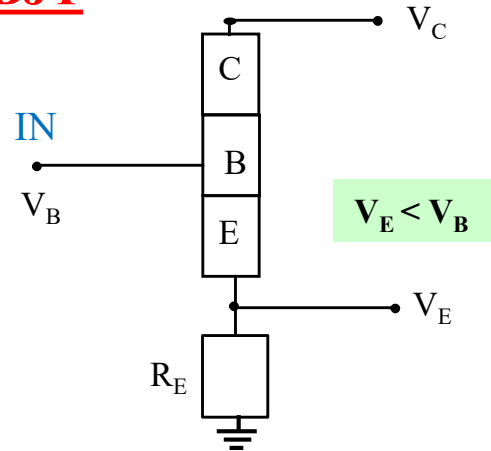


Plus V_S est supérieur à V_G plus le canal se ferme !

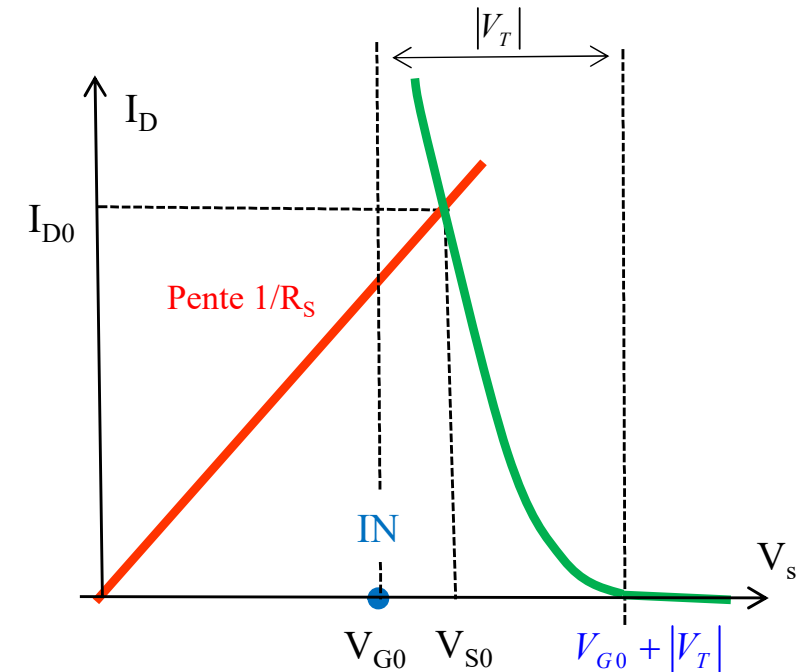
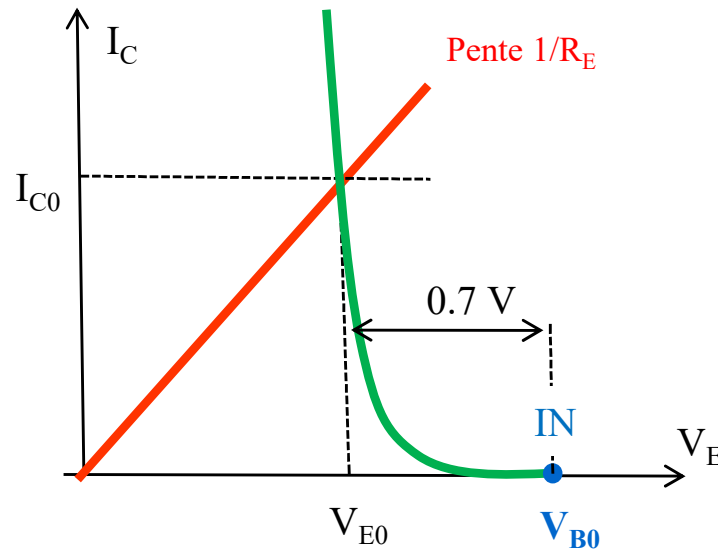
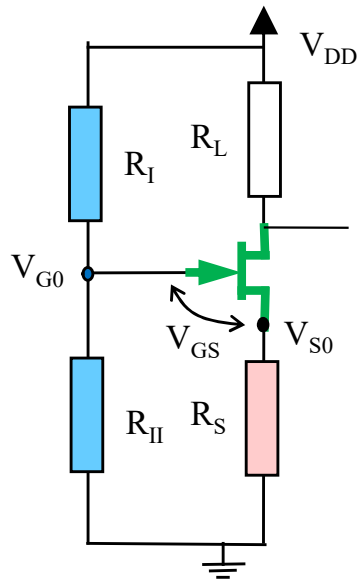
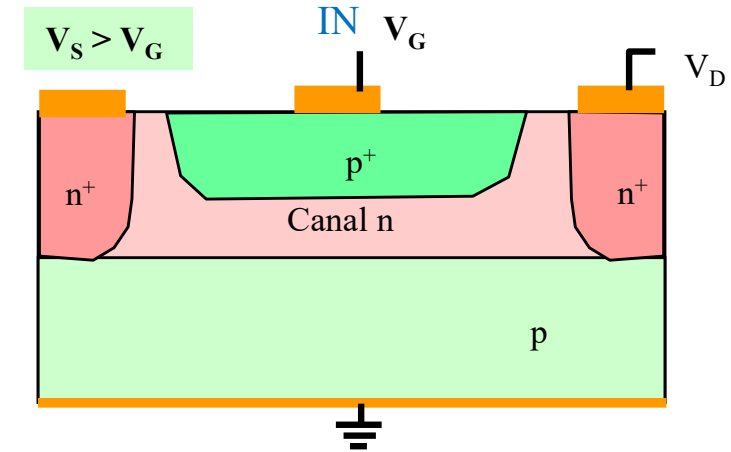
Comparaison BJT-JFET

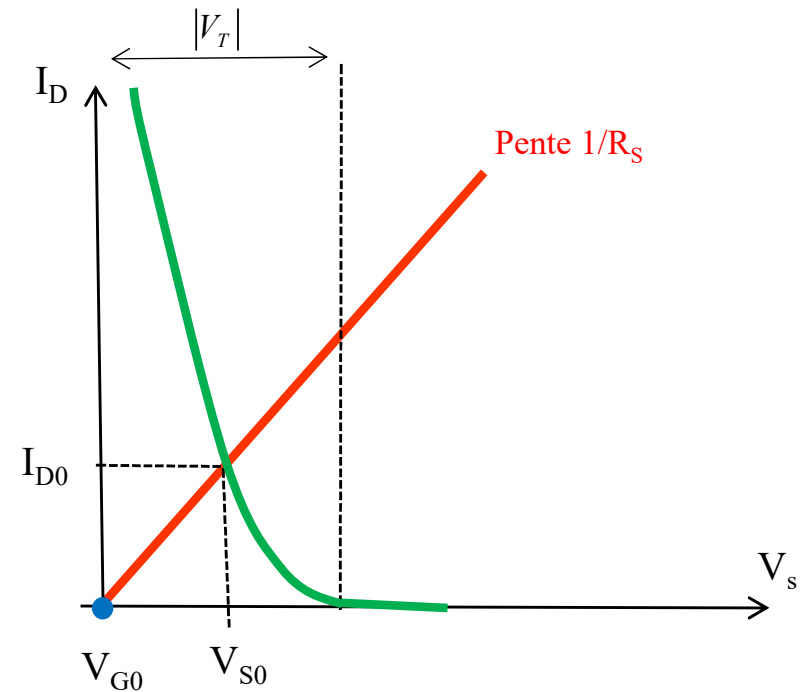
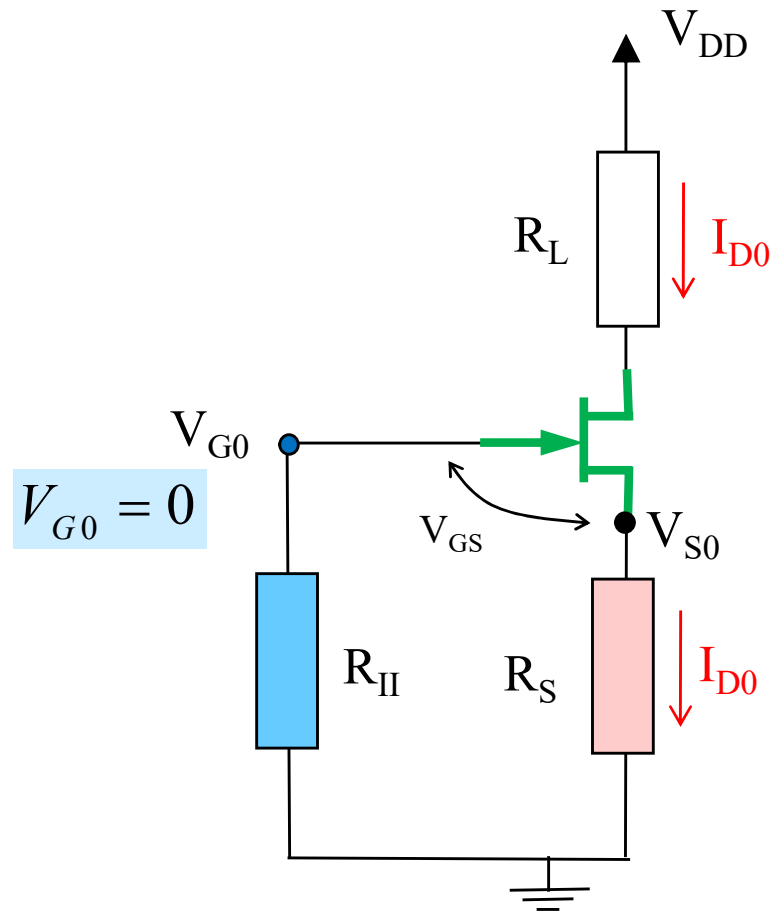


BJT



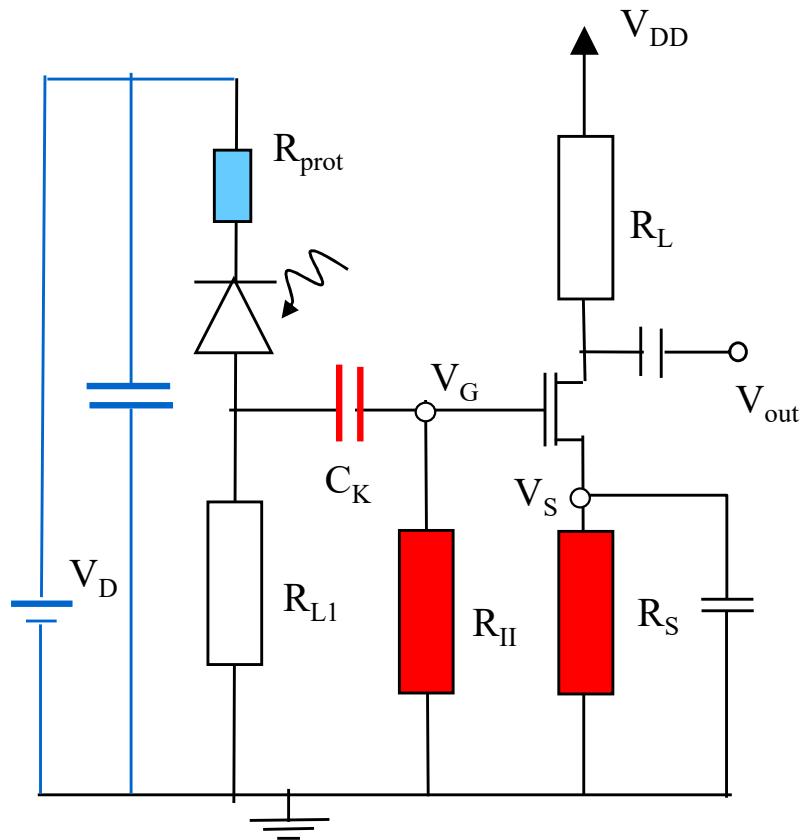
JFET



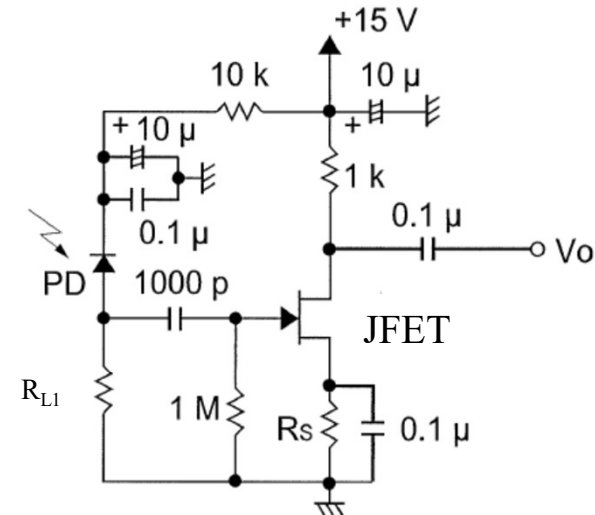


Il est possible de travailler avec $V_{G0}=0$

Couplage capacitif



Note d'application Hamamatsu



PD : High-speed PIN photodiodes (S5052, S2506-02, S8314, S5971, S5972, S5973, etc.)

R_{L1} : Determined by sensitivity and time constant of C_t of photodiode

R_S : Determined by operation point of FET

FET: 2SK152, 2SK192A, 2SK362, etc.

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