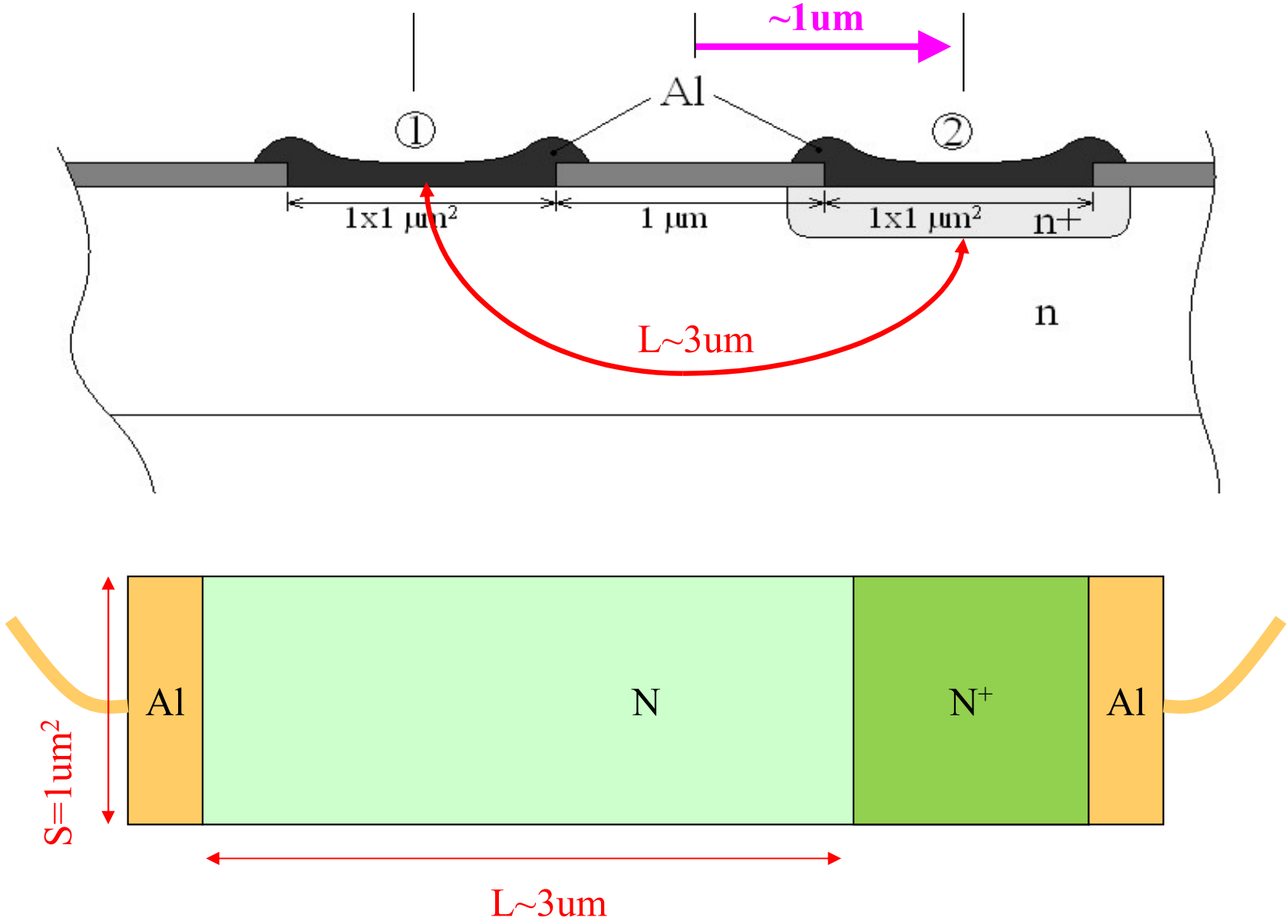
COMPOSANTS SEMI-CONDUCTEURS

V) Solutions S5

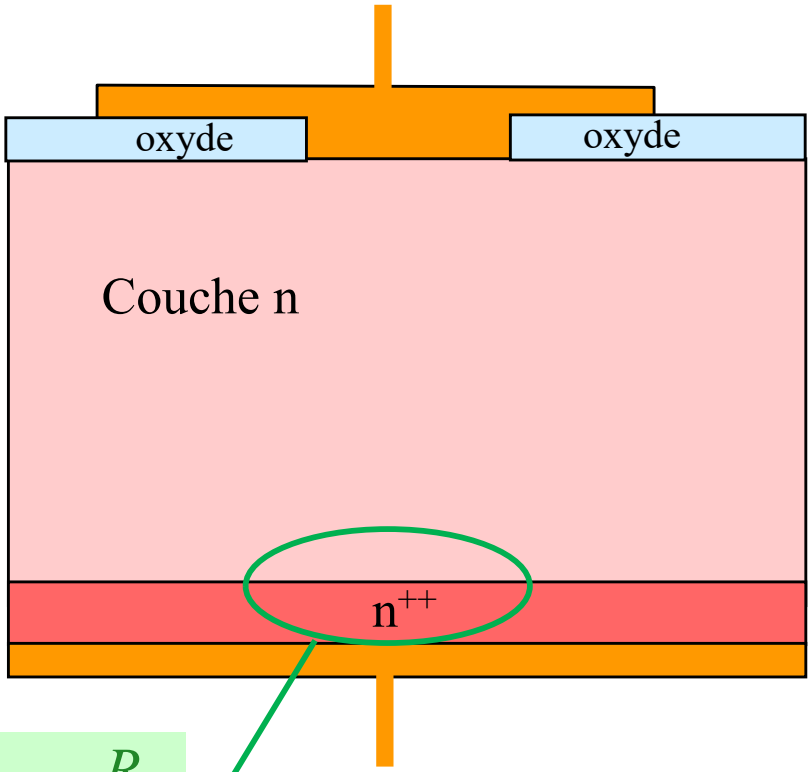
P.A. Besse

EPFL

Exercice E5.1: diode Schottky

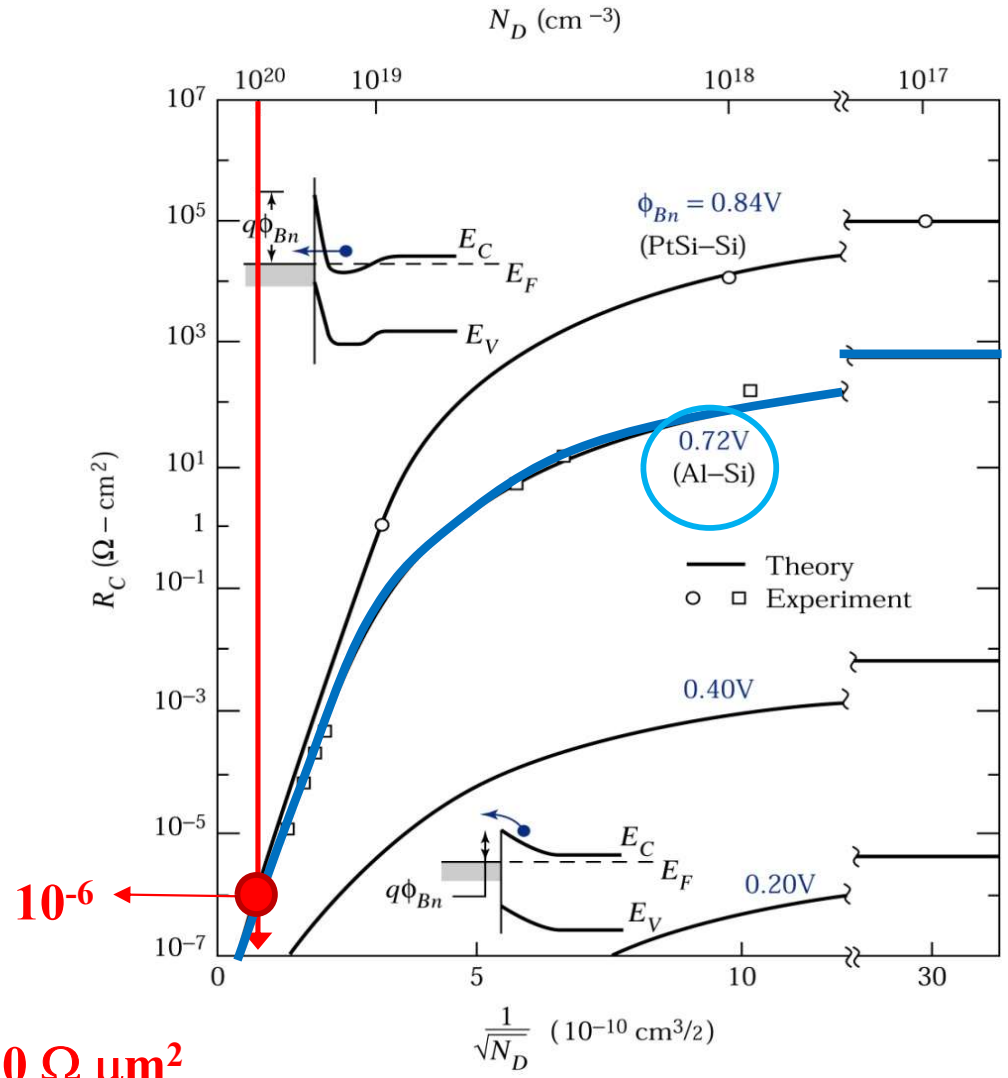


Résistance de contact



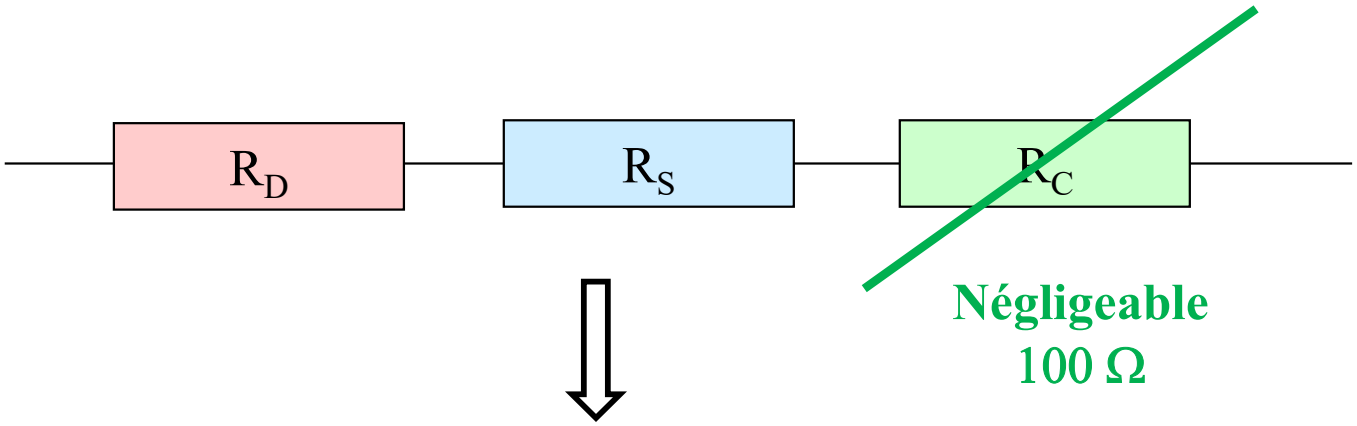
$$R = \frac{R_C}{S}$$

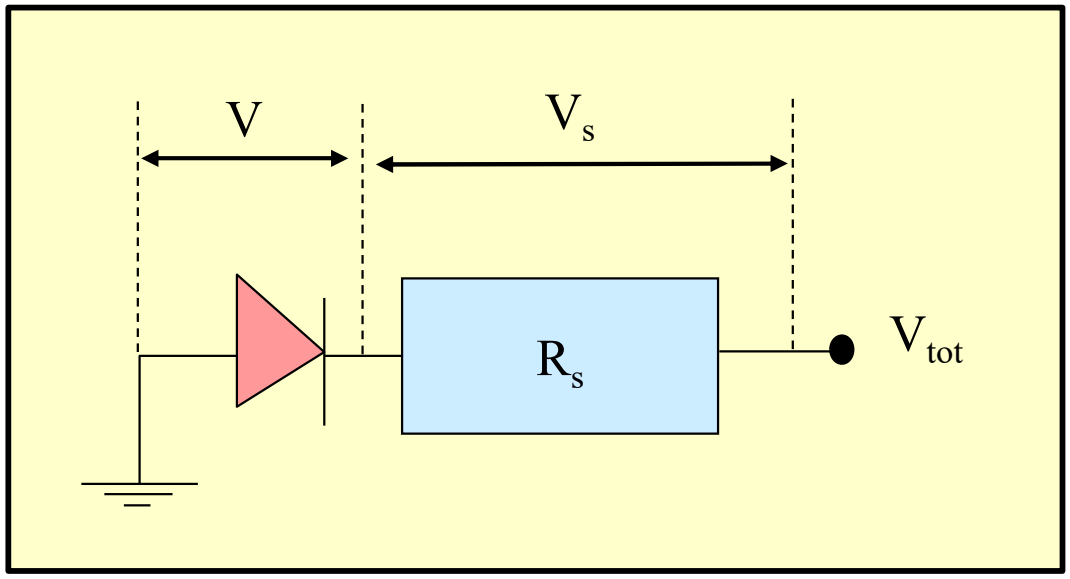
S. Sze
« *Semiconductor devices* »



100 Ω µm²

Modèle électrique



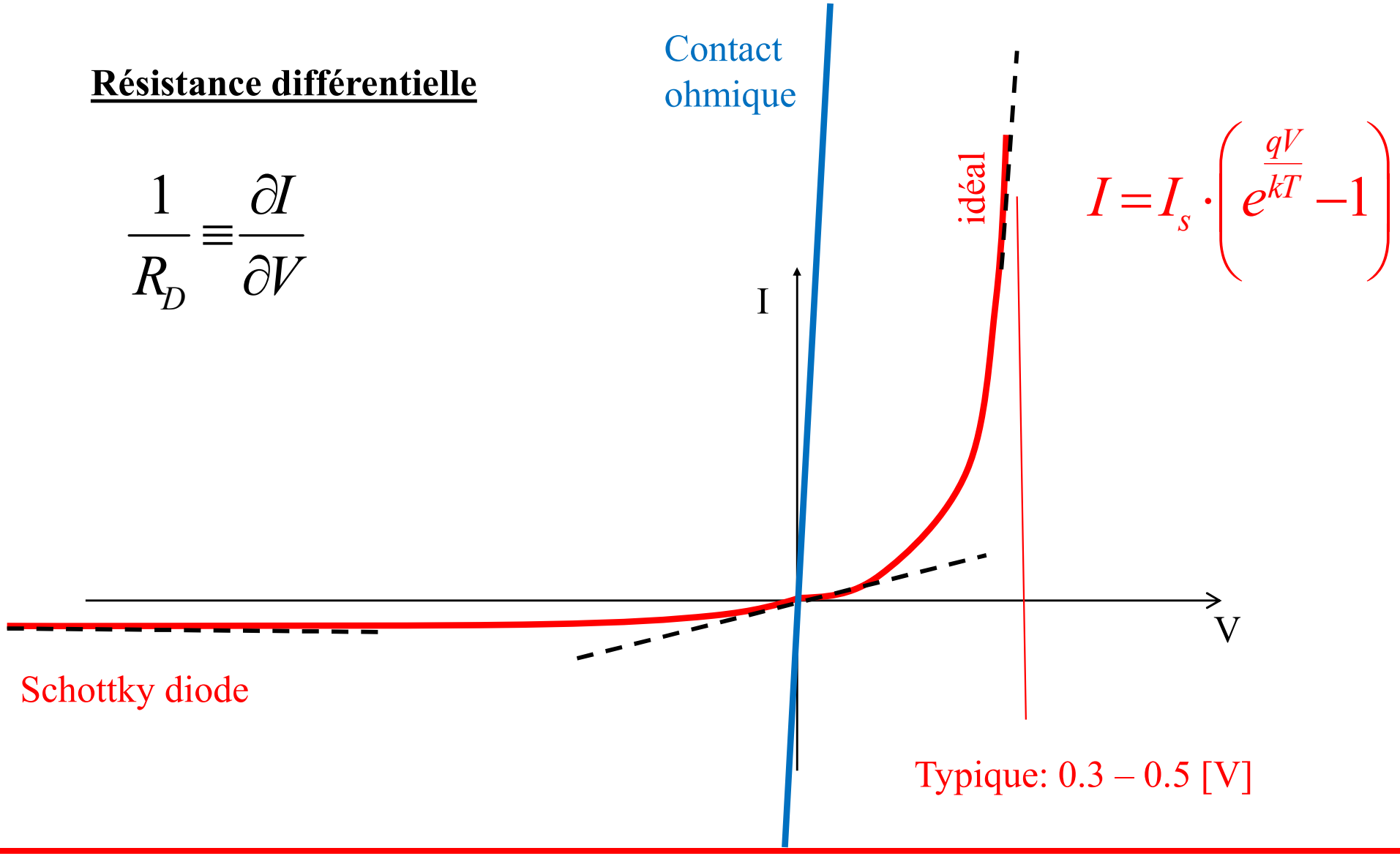


$$R_s = \frac{L}{S}\frac{1}{qn\mu_n} \cong 15\ k\Omega$$

Résistance différentielle et contact ohmique

Résistance différentielle

$$\frac{1}{R_D} \equiv \frac{\partial I}{\partial V}$$



Calcul des résistances

Résistance de la diode Schottky:

$$\frac{1}{R_D} = \frac{\partial I}{\partial V} = \frac{qI_S}{kT} e^{qV/kT}$$

$$I_S = S \cdot A_0 \cdot T^2 \cdot e^{-\frac{q\phi_B}{kT}} \cong S \cdot A_0 \cdot T^2 \cdot e^{-\frac{E_g/2}{kT}} \cong 30\ pA$$

$$R_D\big|_{V=-1} \cong \infty$$

$$R_D\big|_{V=0} \cong 0.8\ G\Omega$$

$$R_D\big|_{V=0.1} \cong 15\ M\Omega$$

$$R_D\big|_{V=0.4} \cong 94\ \Omega$$

Résistance du substrat

$$R_s = \frac{L}{S}\frac{1}{qn\mu_n} \qquad \mu_n \cong 1200\,[cm^2/Vs]$$

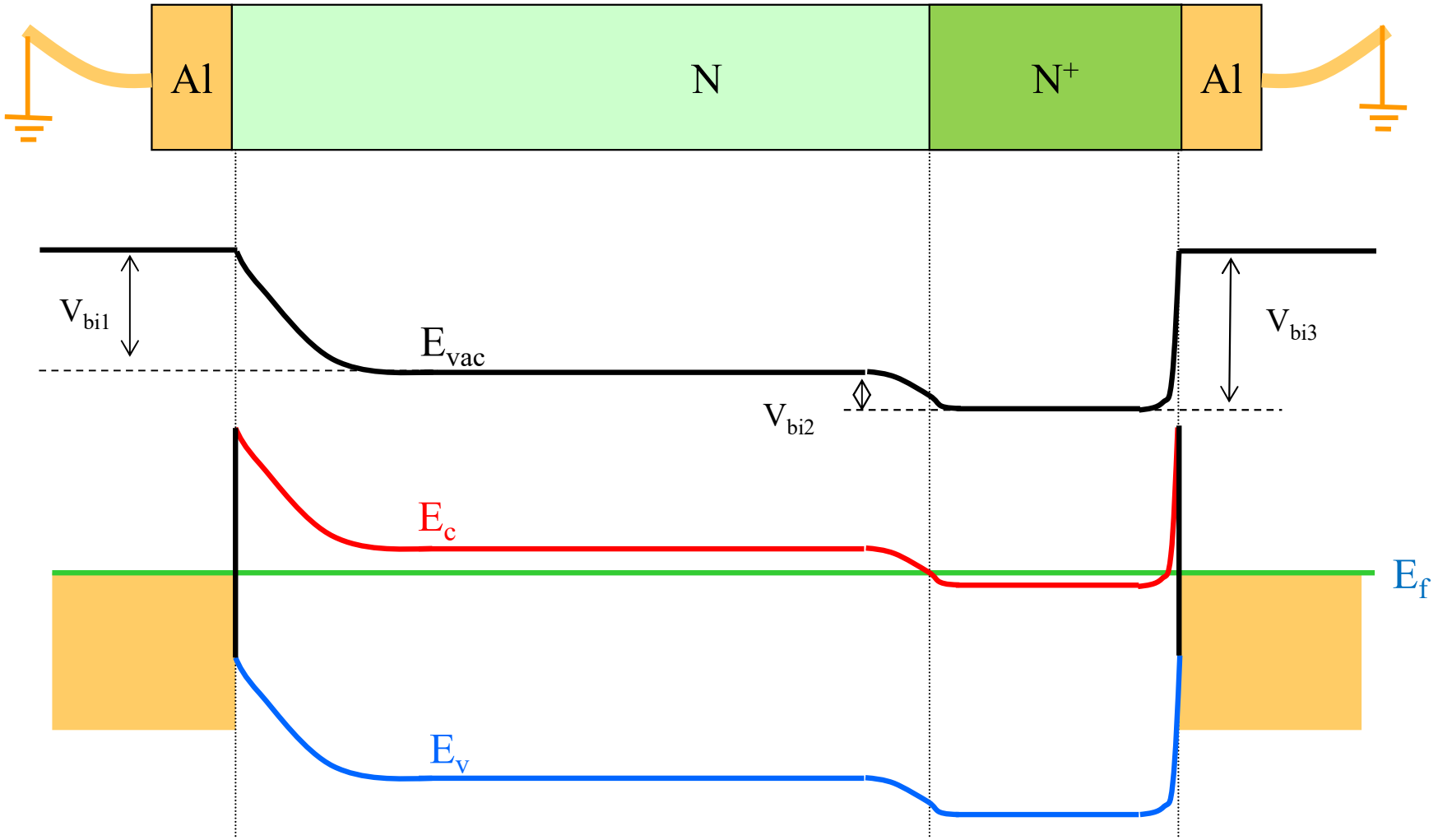
$$R_S \cong 15\ k\Omega$$

Résistance du contact ohmique:

$$R_C \cong 10^{-6} \Big/ S_{[cm^2]}$$

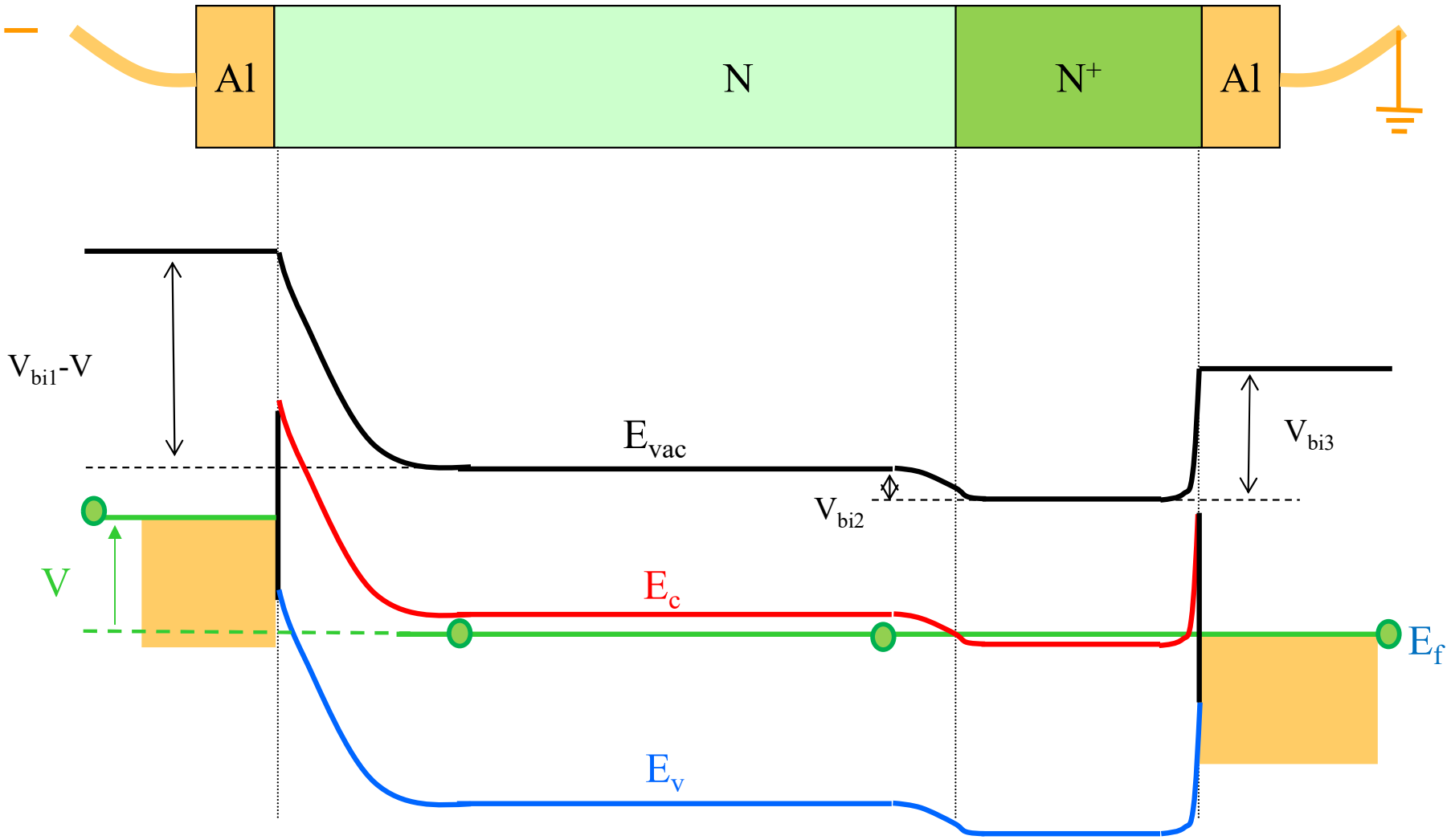
$$R_C \cong 100\ \Omega$$

Pas de polarisation



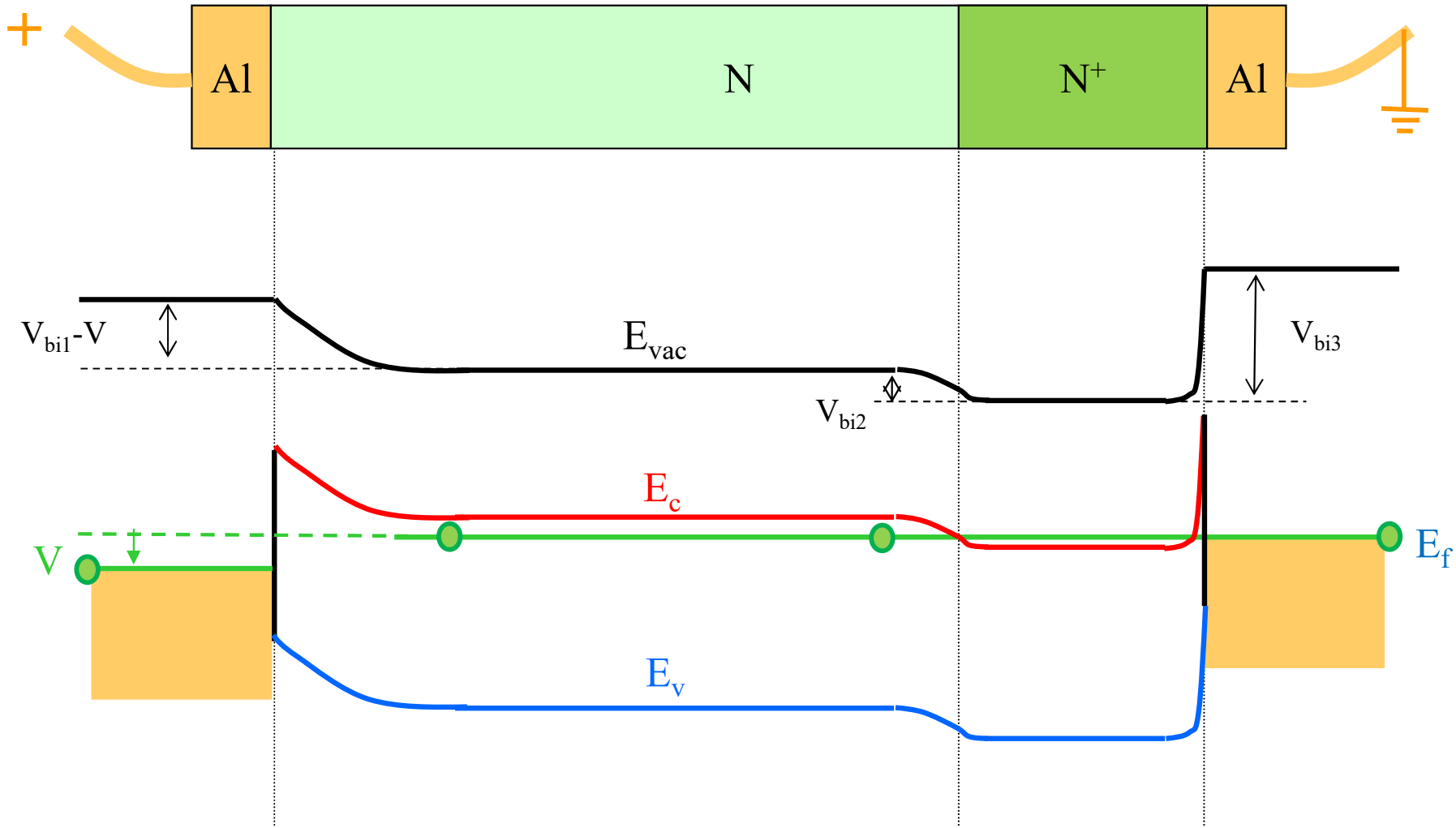
Polarisation inverse de 1V

V= -1 [V]: $I = -I_s \cong -30\ pA$ $\Longrightarrow V_s \cong R_S \cdot I \cong -0.45\,[\mu V]$



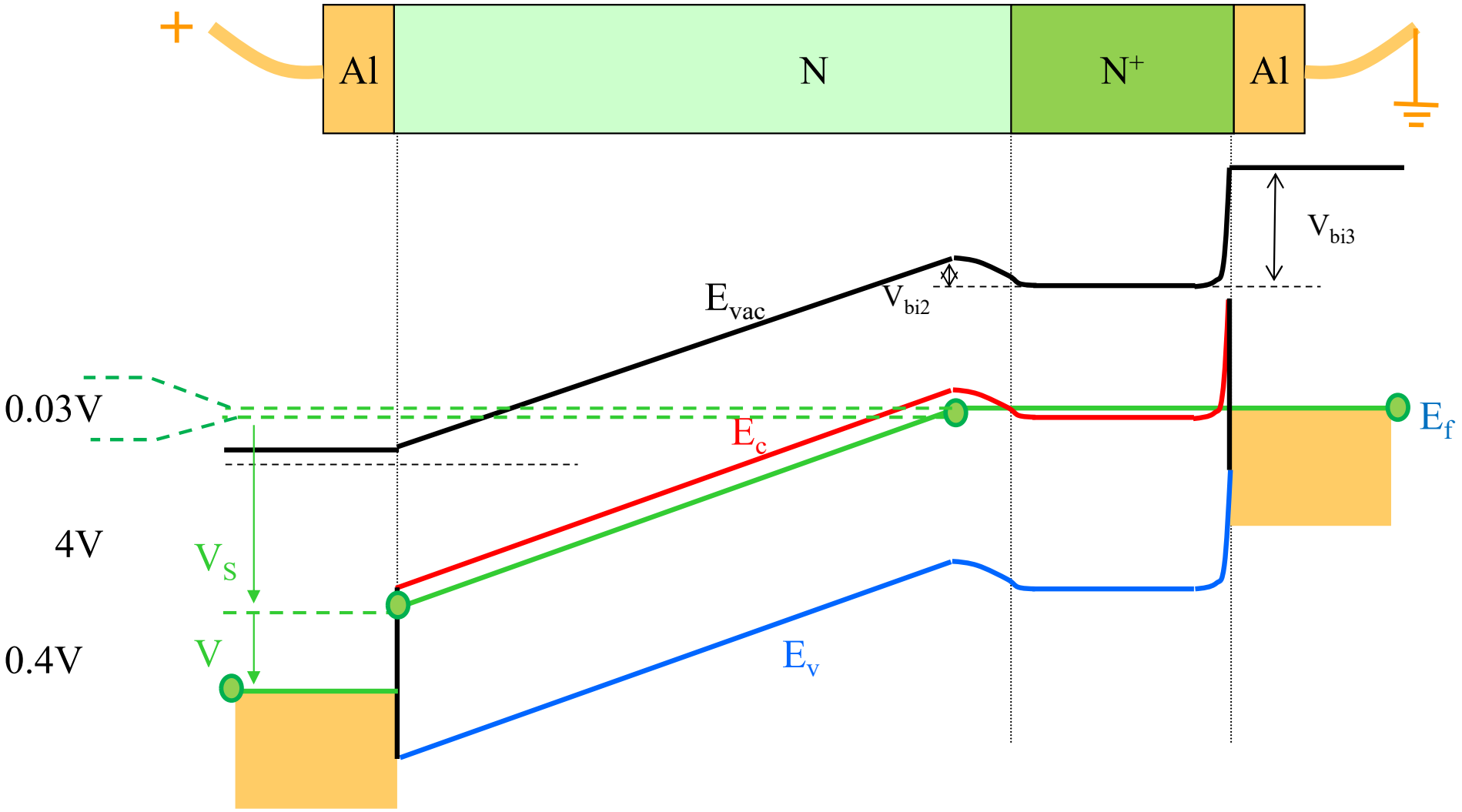
Polarisation directe de 0.1V

V= +0.1 [V]: $I = I_s(e^{\frac{qV}{kT}} - 1) \cong 1.6\ nA \Longrightarrow V_s \cong R_S \cdot I \cong 24\ [\mu V]$



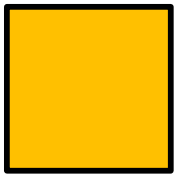
Polarisation directe de 0.4V

V= +0.4 [V]: $I \cong I_s e^{\frac{qV}{kT}} \cong 0.26\ mA \Longrightarrow V_s \cong R_S \cdot I \cong 4\,[V]$

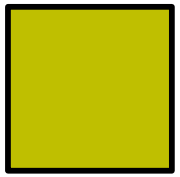


Diminuer la résistance en série

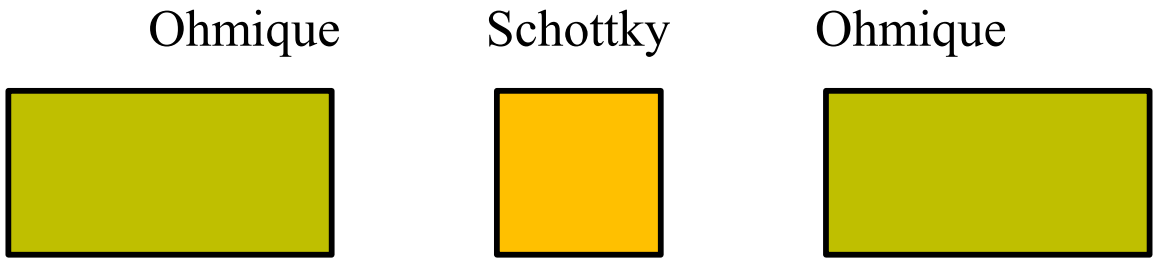
Schottky



Ohmique



Diminuer la résistance en série



Diminuer la résistance en série