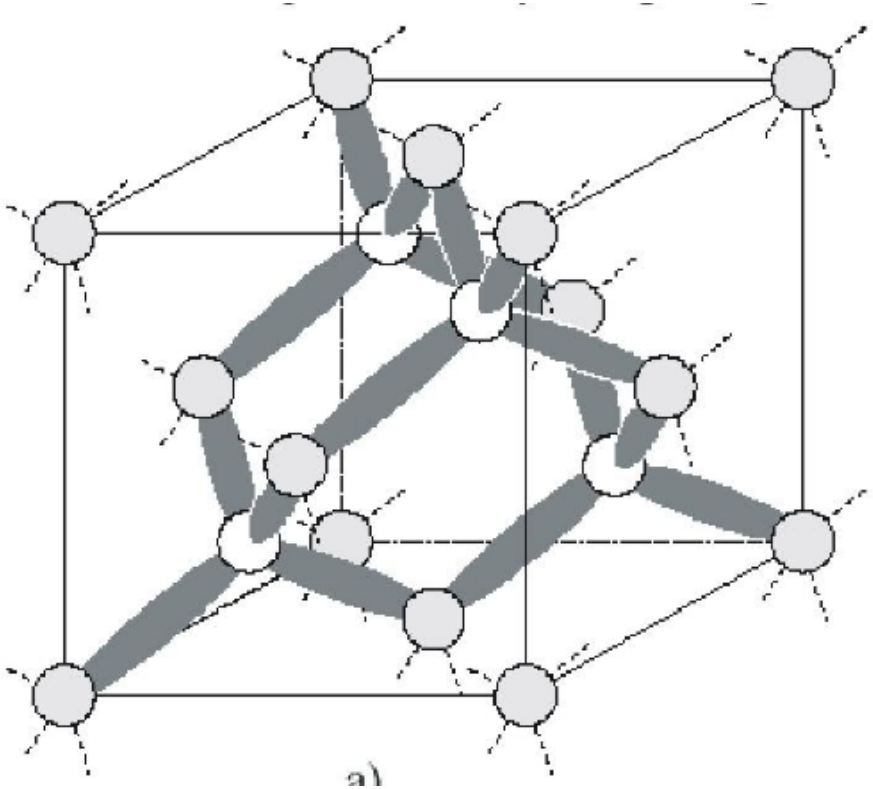
Anyagtudomány
Félvezetők

Groma István

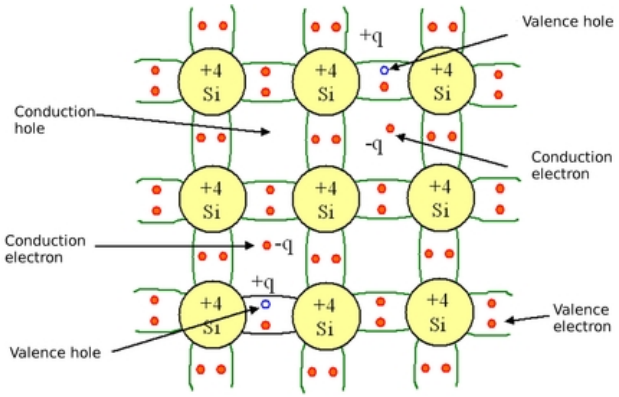
ELTE

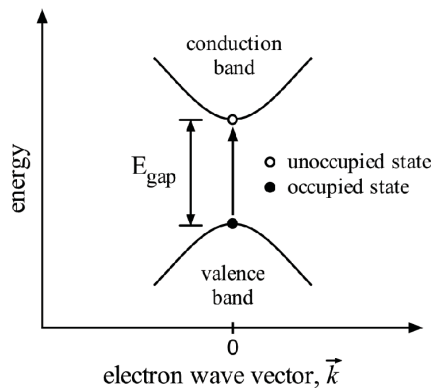
April 25, 2021

Félvezető



Félvezető

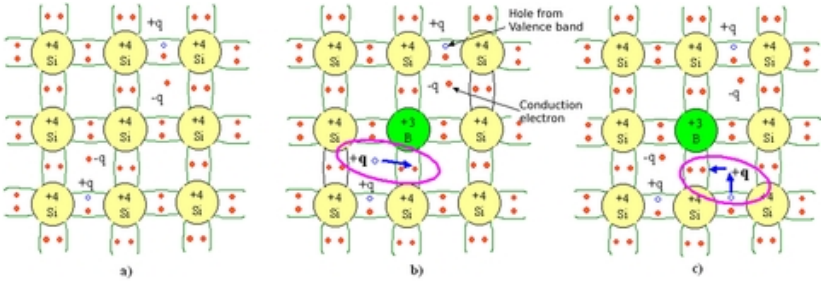




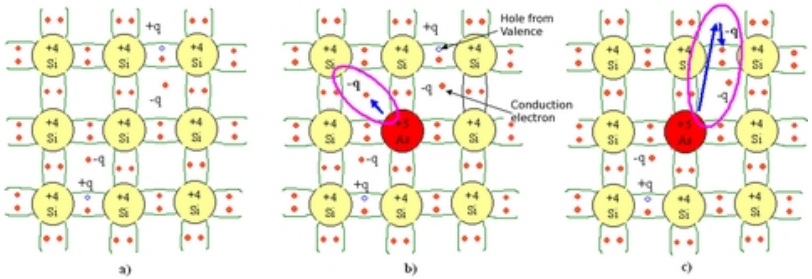
$$n(T) = 2\left(\frac{m_e k_B}{2\pi\hbar^2}\right)^{3/2} T^{3/2} e^{-\frac{E_f - E_v}{k_B T}}$$

Dópolt félvezető

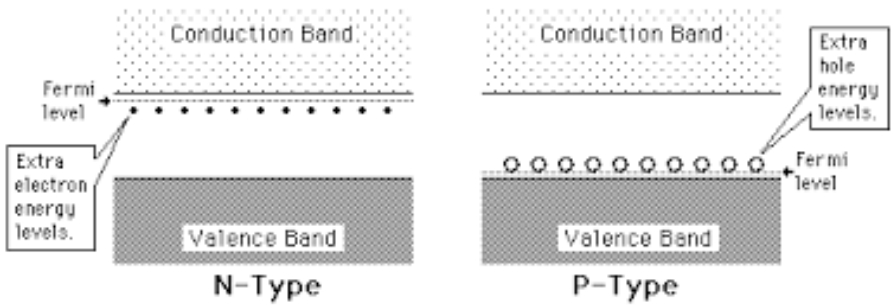
n típus 5 vegyérték (B)



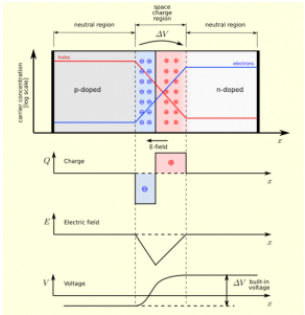
p típus 3 vegyérték (As)



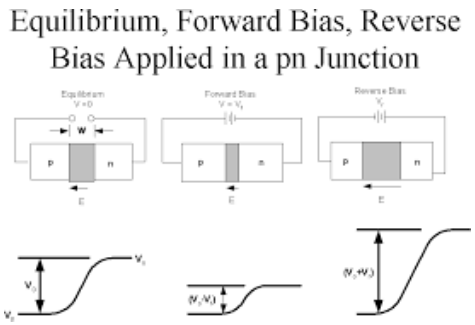
Sávszerkezet



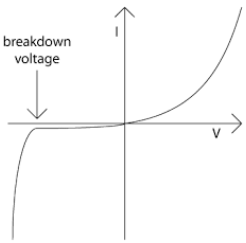
p-n átmenet

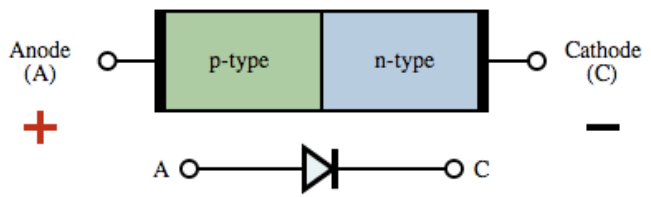


Előfeszítés



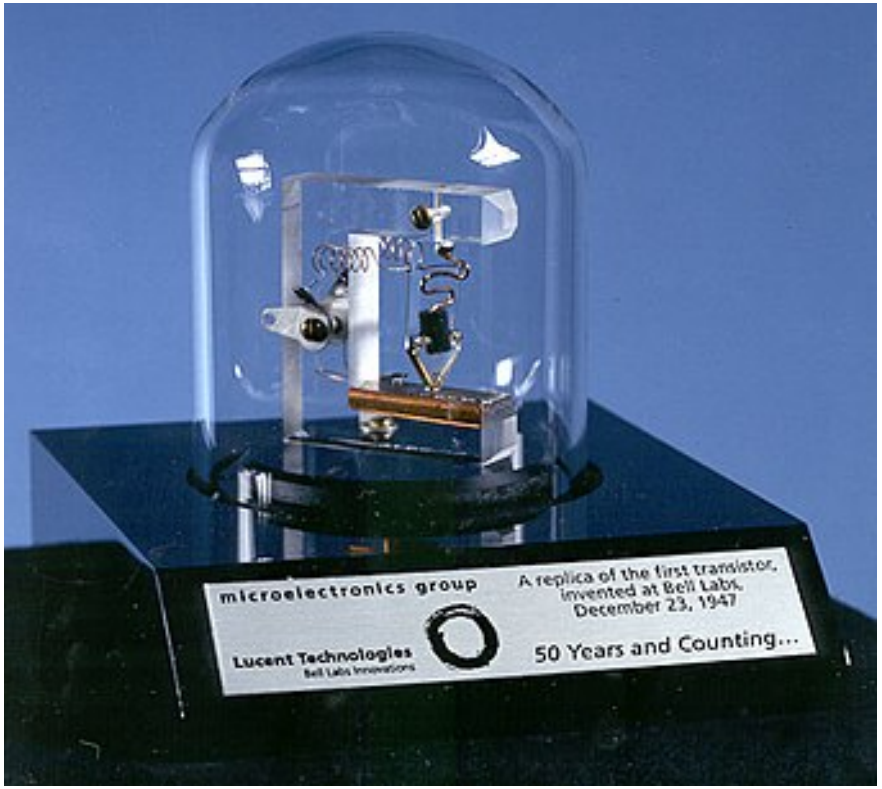
Feszültség-áram karakterisztika



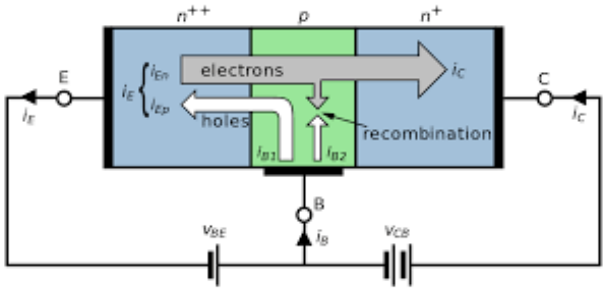


Transisztor

Bardeen, Brattain,Shockley 1947, 1956



Transisztor



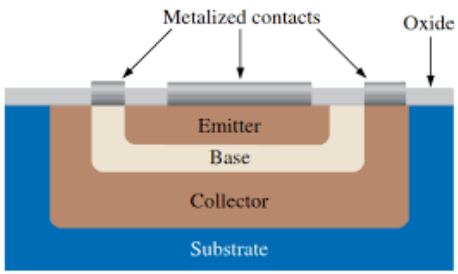
$$I_c = \alpha I_e \qquad \alpha \approx 0.95$$

Kirchoff törvény

$$I_e = I_c + I_b$$

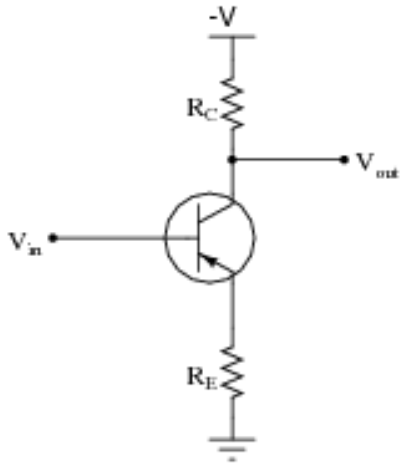
Innen

$$I_c = \frac{\alpha}{1-\alpha} I_b = \beta I_b \qquad \beta \approx 100$$



(a) Basic epitaxial planar structure

Erősítő



$$\begin{aligned} U_{BE} &= U_{be}(I_b) + R_e I_e \\ U_{KI} &= U_t - R_c I_c \end{aligned}$$

$$\begin{aligned} U_{BE} + \triangle U_{BE} &= U_{be}(I_b + \triangle I_b) + R_e(I_e + \triangle I_e) \\ U_{KI} + \triangle U_{KI} &= U_t - R_c(I_c + \triangle I_c) \end{aligned}$$

Erősítő

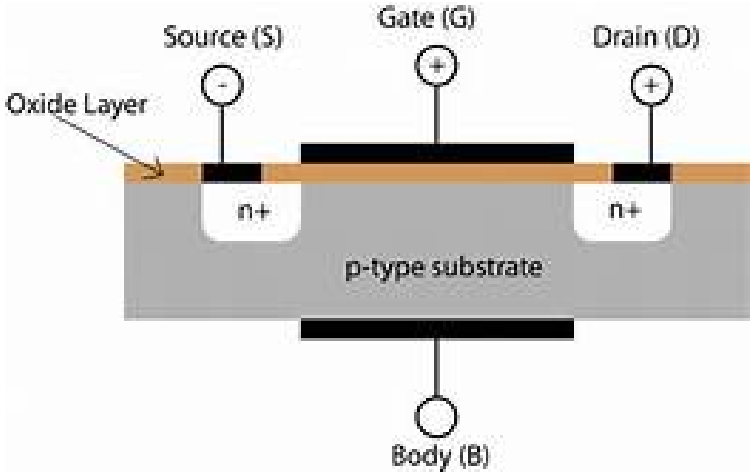
$$\begin{aligned} \triangle U_{BE} &= U_{be}(I_b + \triangle I_b) - U_{be}(I_b) + R_e \triangle I_e \\ \triangle U_{KI} &= -R_c \triangle I_c \end{aligned}$$

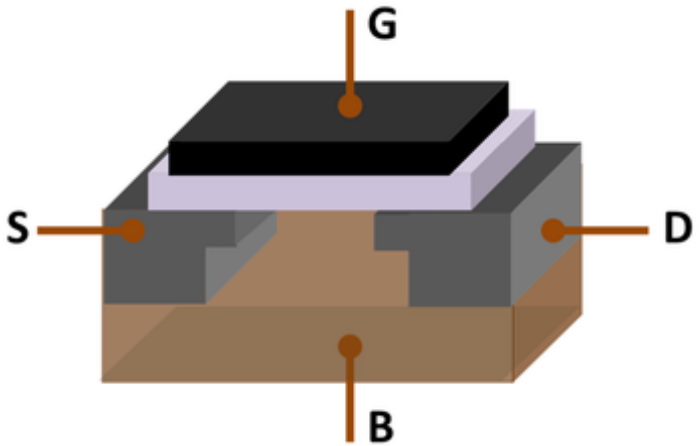
$$\begin{aligned} \triangle U_{BE} &= R_B \triangle I_b + R_e \triangle I_e \\ \triangle U_{KI} &= -R_c \triangle I_c \end{aligned}$$

$$\begin{aligned} \triangle U_{BE} &= R_B \triangle I_b + R_e(1+\beta) \triangle I_b \\ \triangle U_{KI} &= -R_c \beta \triangle I_b \end{aligned}$$

$$A = \frac{\triangle U_{KI}}{\triangle U_{BE}} = -\frac{\beta R_c}{R_B + R_e(1+\beta)} \approx -\frac{R_c}{R_e}$$

FET, MOSFET


Source (S)
Gate (G)
Drain (D)
Oxide Layer
n+
n+
p-type substrate
Body (B)


G
S
D
B