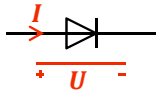
TSTE05 Elektronik & mätteknik

Föreläsning 12
Dioder
Bipolartransistorer - Inledning

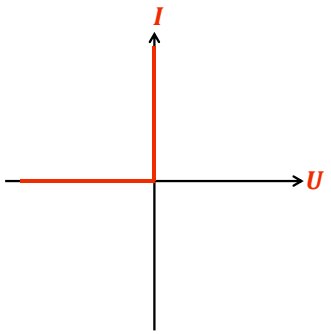
Mikael Olofsson
Institutionen för Systemteknik (ISY)
Ämnesområdet Elektroniska kretsar och system

LINKÖPINGS UNIVERSITET

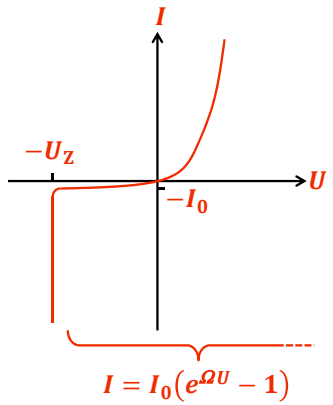
Dioder



Ideal diod

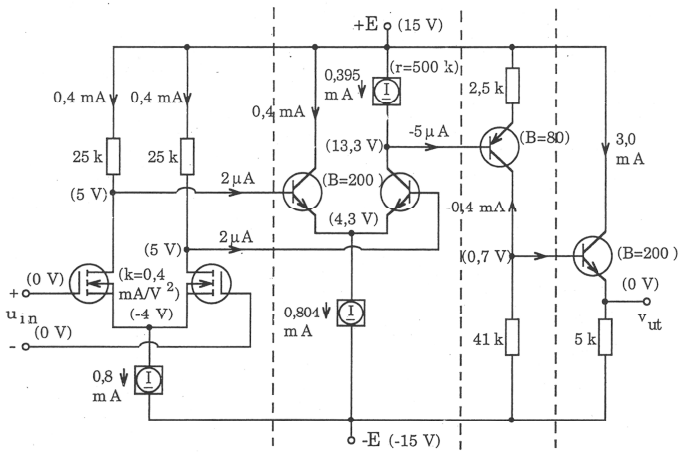


Verklig diod



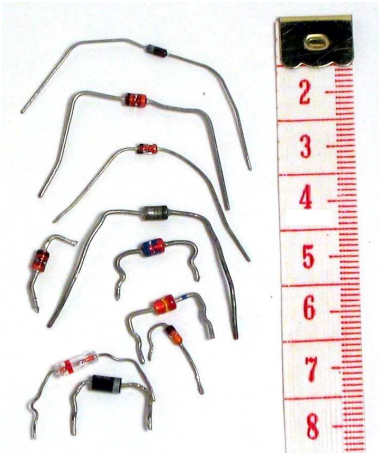
$$I = I_0\left(e^{\Omega U} - 1\right)$$

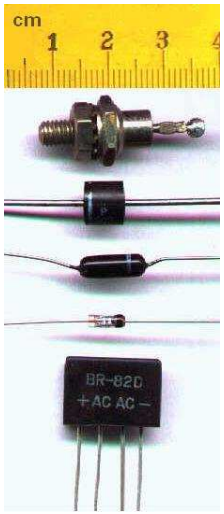
Operationsförstärkare



Ingångs-steg | Högförstärk-ningssteg | Nivå-skiftare | Utgångs-steg

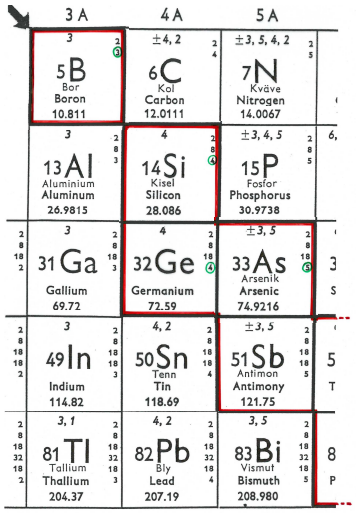
Dioder – Exempel

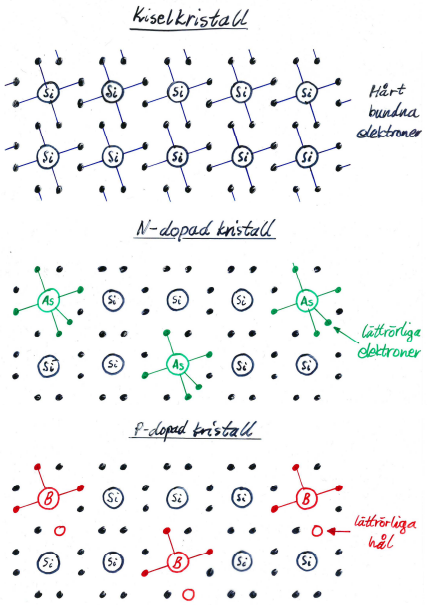




Källa: Wikipedia

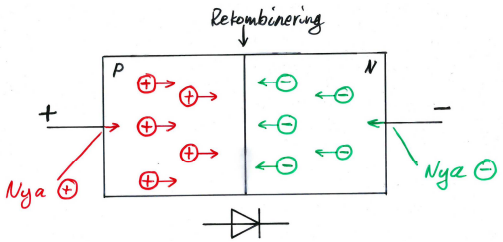
Halvledare



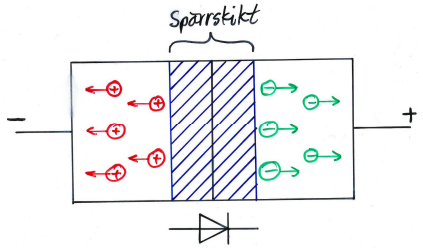


Diodens funktion

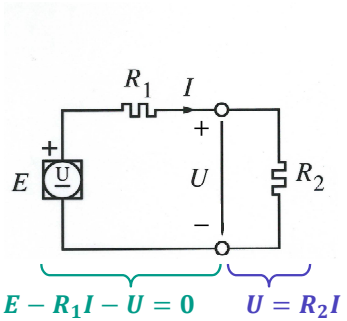
Framspänd diod:

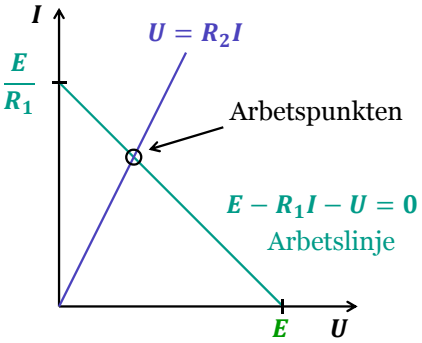


Backspänd diod:



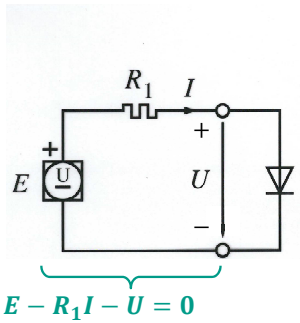
Arbetspunktsbestämning – Introduktion

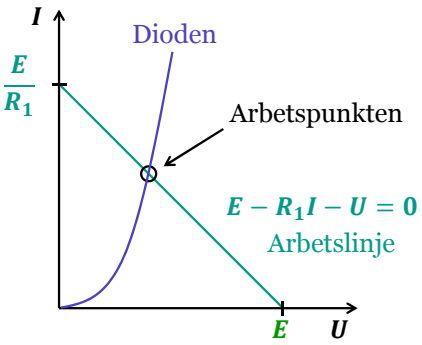




$$I = \frac{E}{R_1 + R_2} \qquad U = \frac{R_2}{R_1 + R_2} E$$

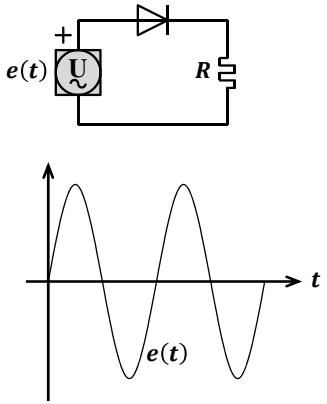
Arbetspunktsbestämning för diod



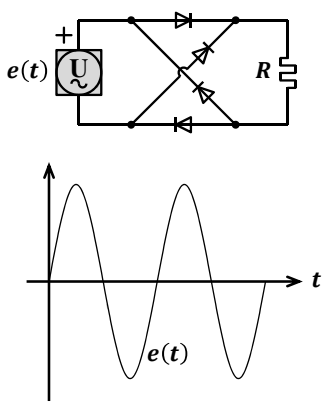


Likriktning med diod 1(3)

Halvvågslikriktning

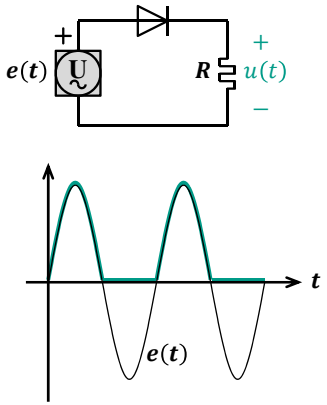


Helvågslikriktning

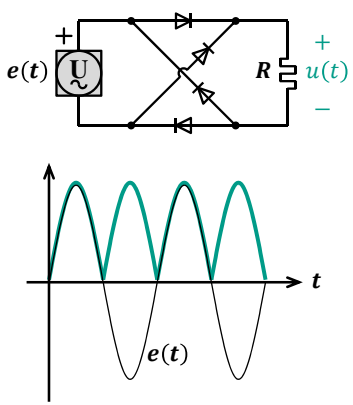


Likriktning med diod 2(3)

Halvvågslikriktning

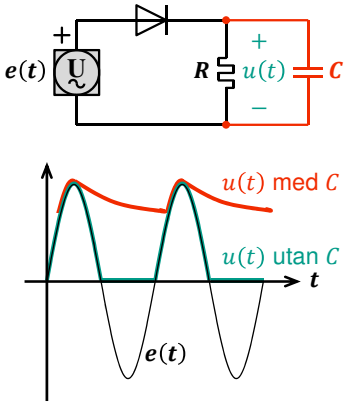


Helvågslikriktning

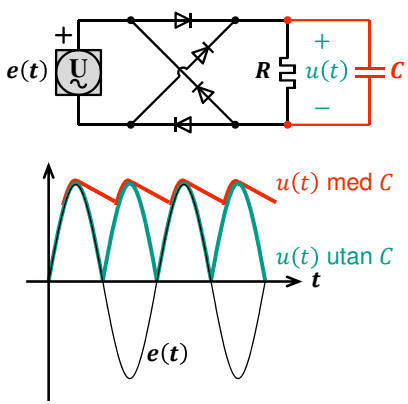


Likriktning med diod 2(3)

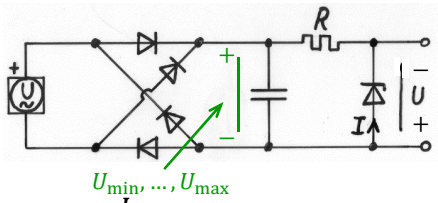
Halvvågslikriktning



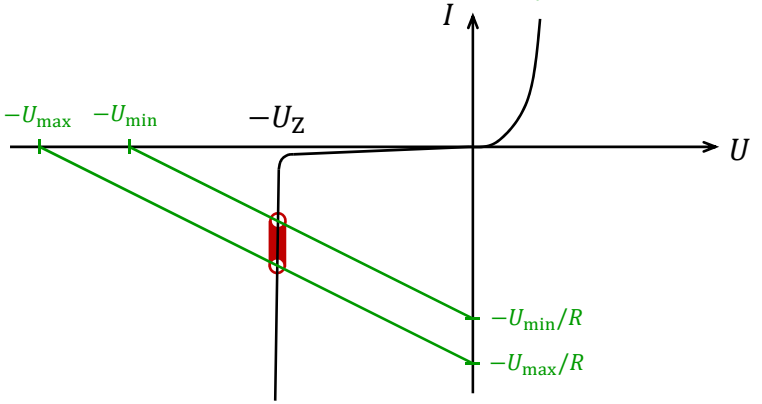
Helvågslikriktning



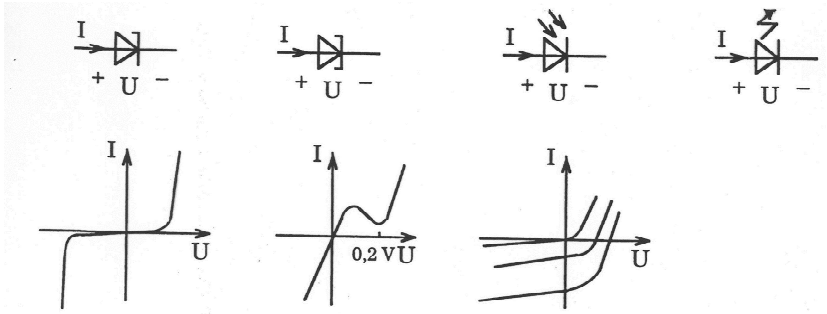
Stabilisering med zenerdiod



$U_{\min}, \ldots, U_{\max}$



Andra slags dioder

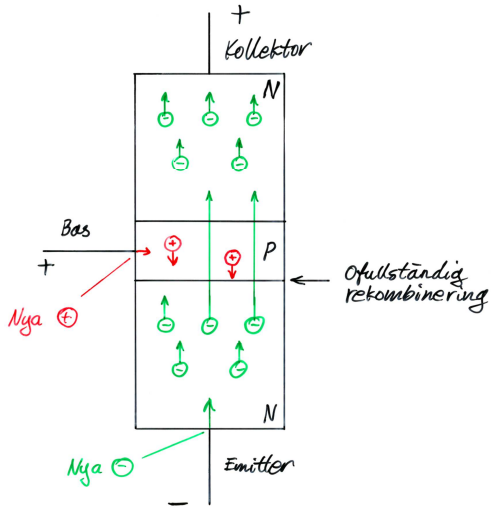


a) Zenerdiod *b) Tunneldiod* *c) Fotodiod* *d) Lysdiod*

Figur 3.72 Symbol och karaktäristik för några olika diodtyper.

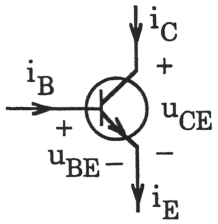
Figur 3.72 ur Söderkvist

Bipolartransistorn - NPN



Bipolartransistorer – Variabler och referensriktningar

NPN-transistor



Krav

Positiva strömmar och spänningar

Grundekvationer

Strömförstärkning

$$i_C = Bi_B$$

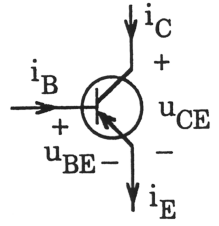
Strömförstärkningsfaktor

$$5 < B < 1000$$

Kirchhoffs strömlag

$$i_E = i_C + i_B$$

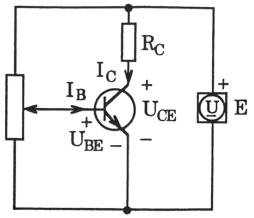
PNP-transistor



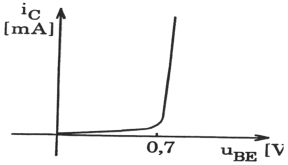
Krav

Negativa strömmar och spänningar

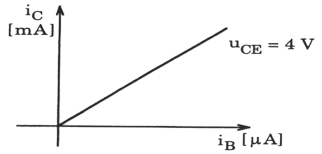
Bipolartransistorer – Några samband



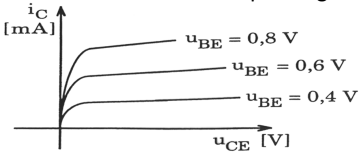
Kollektorström som funktion av bas-emitter-spänning



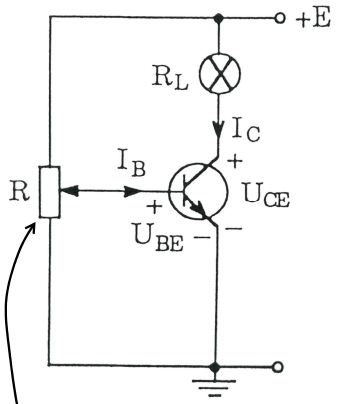
Kollektorström som funktion av basström

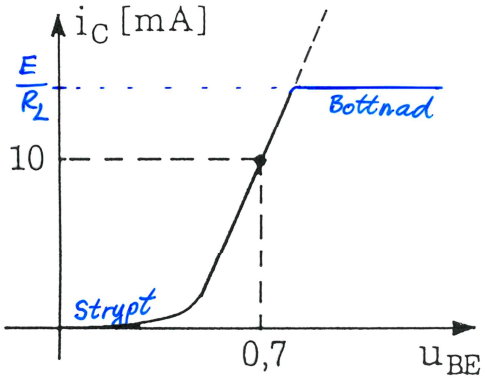


Kollektorström som funktion av kollektor-emitter-spänning



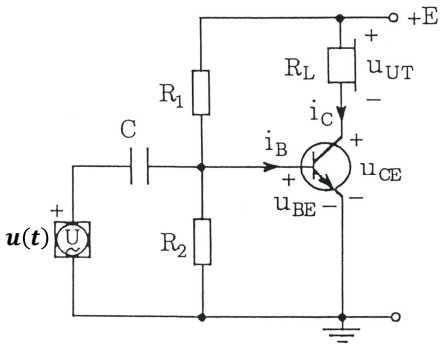
Strömstyrning med NPN-transistor

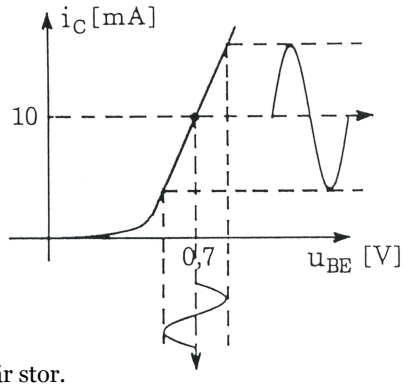




Potentiometer (vridmotstånd)

Förstärkning av signalspänning



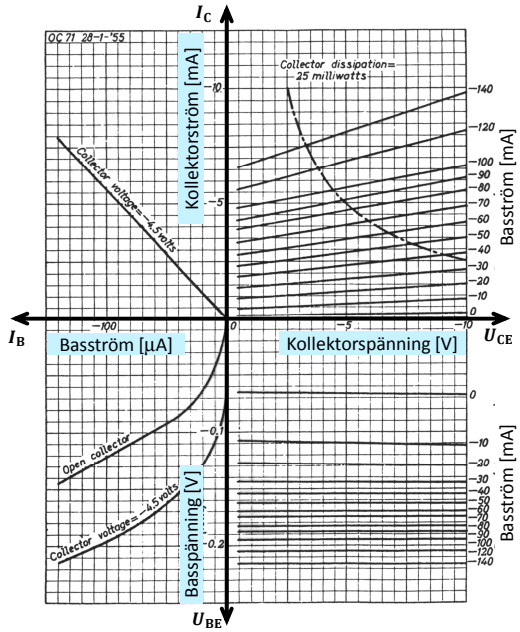


Obs! Signalspänningen $u_{be}(t) = u(t)$ om C är stor.

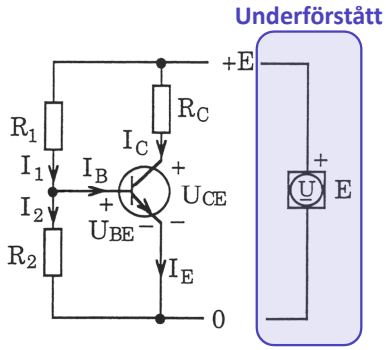
$u_{BE}(t) = U_{BEQ} + u_{be}(t)$ $\quad i_C(t) = I_{CQ} + i_c(t)$ $\quad u_{UT}(t) = R_L i_C(t)$

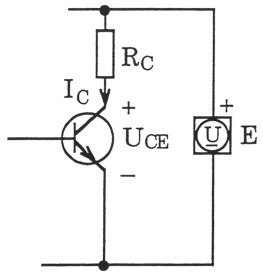
Fullständigt kurvblad för PNP-transistor

Observera: Fyra diagram i ett. Varje kvadrant är ett separat diagram



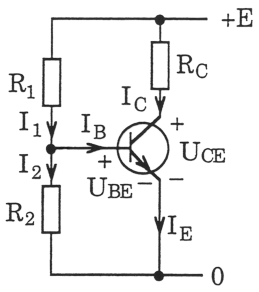
Enkel transistorkoppling – Arbetslinje



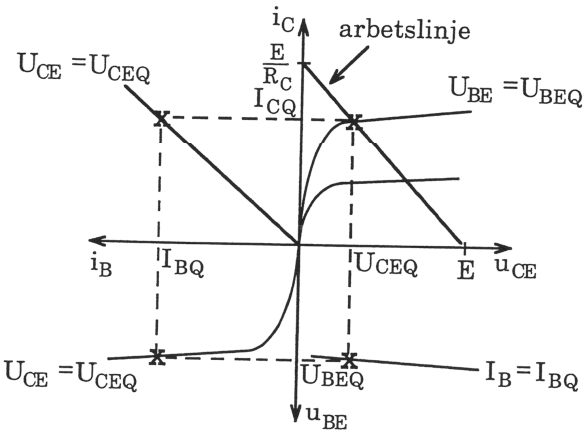


KVL: $E - R_C I_C - U_{CE} = 0$

Enkel transistorkoppling – Arbetspunkt



$$E - R_C I_C - U_{CE} = 0$$



Mikael Olofsson
ISY/EKS
www.liu.se

LINKÖPINGS UNIVERSITET

GE-steg – Gemensam emitter