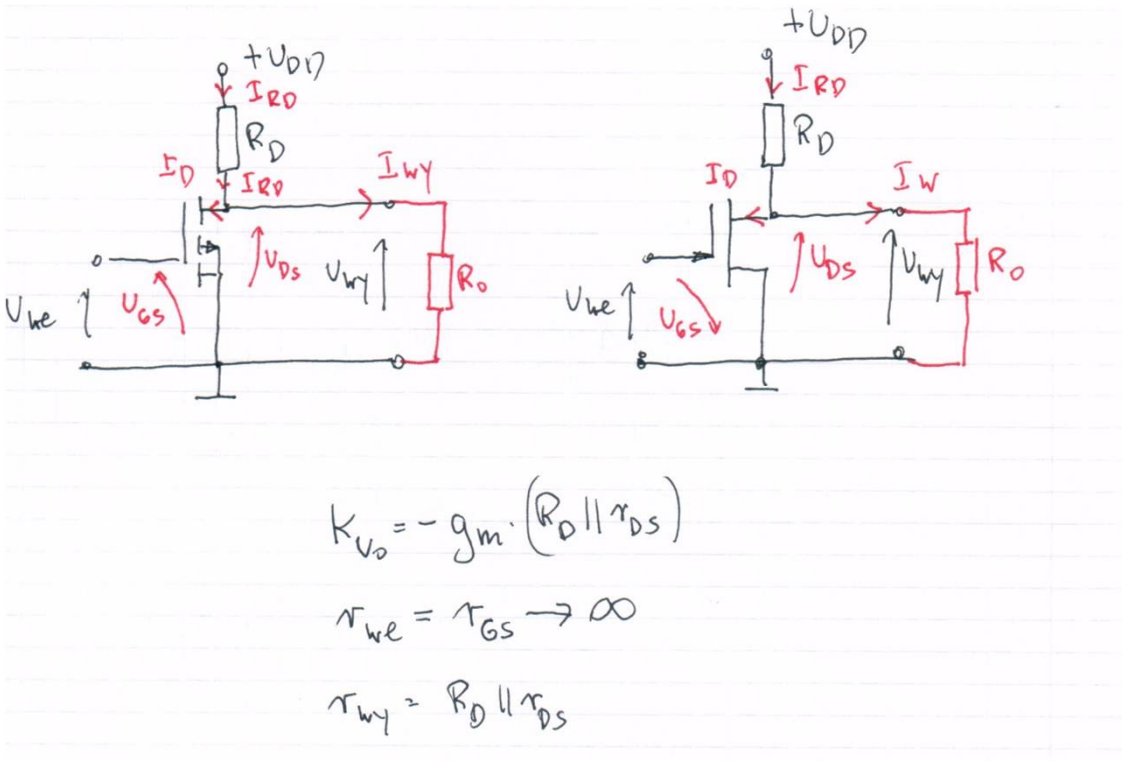
Tranzystory polowe
część 2

Podstawowe układy pracy wzmacniaczy z tranzystorami polowymi

WE - WŹ
WK - WD
WB - X

WŹ



$$K_{U_0} = -g_m \cdot (R_D \| r_{DS})$$

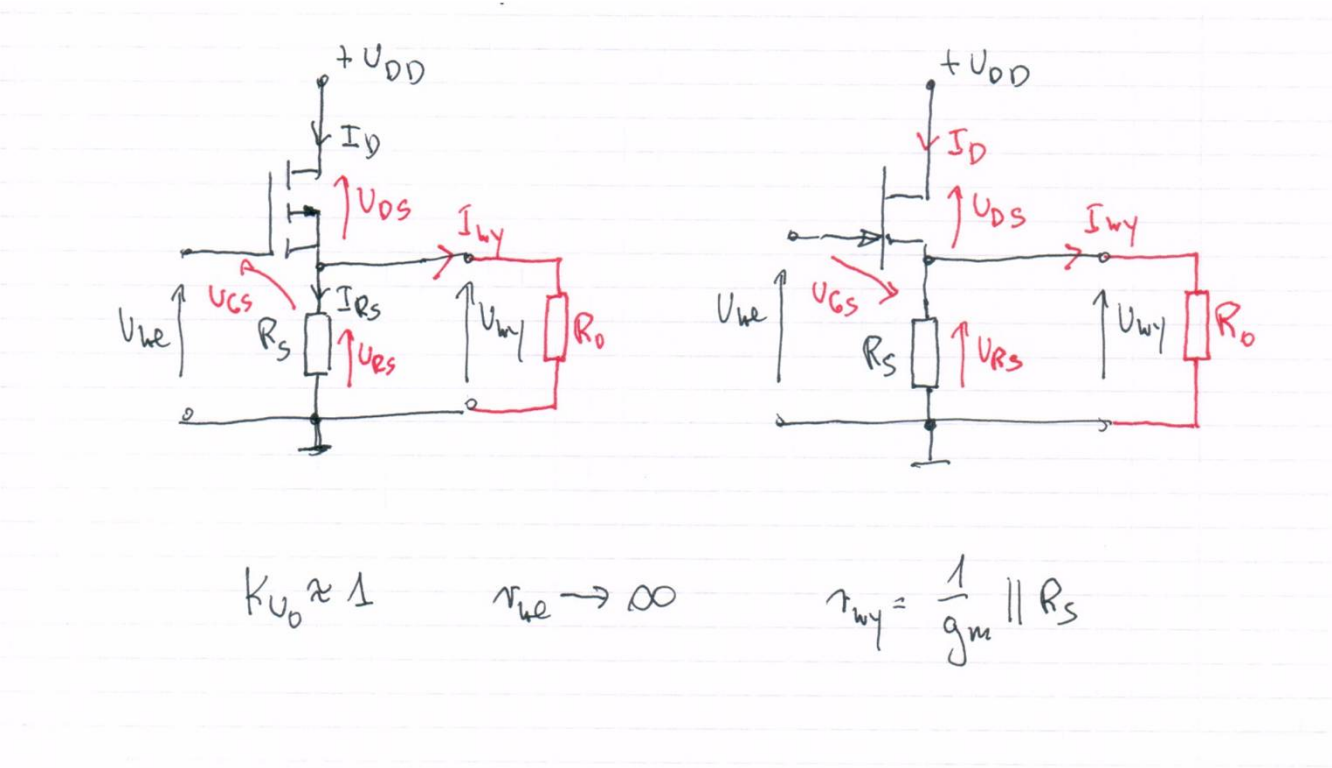
$$r_{we} = r_{GS} \rightarrow \infty$$

$$r_{wy} = R_D \| r_{DS}$$

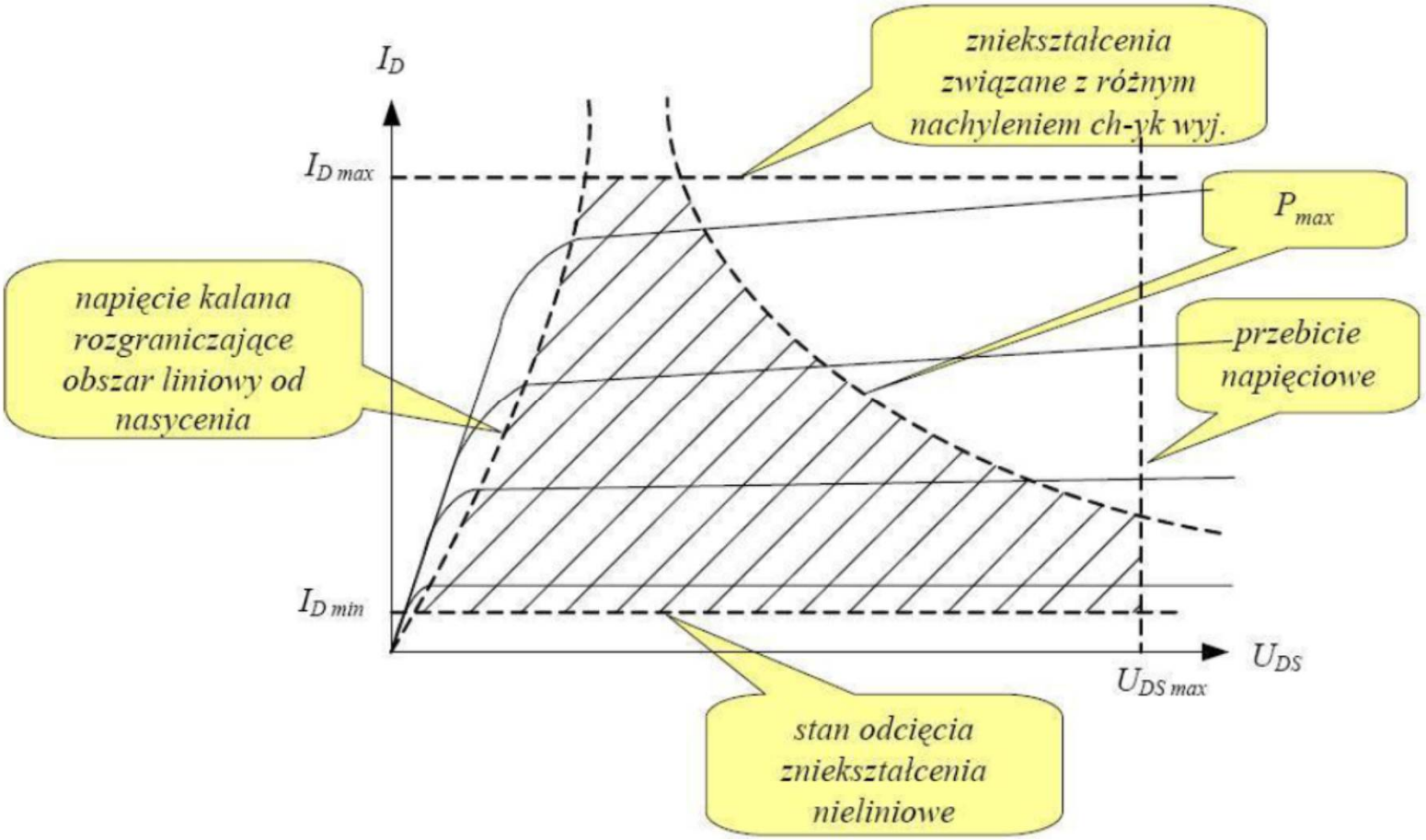
Podstawowe układy pracy wzmacniaczy z tranzystorami polowymi

WE - WŹ
WK - WD
WB - X

WD

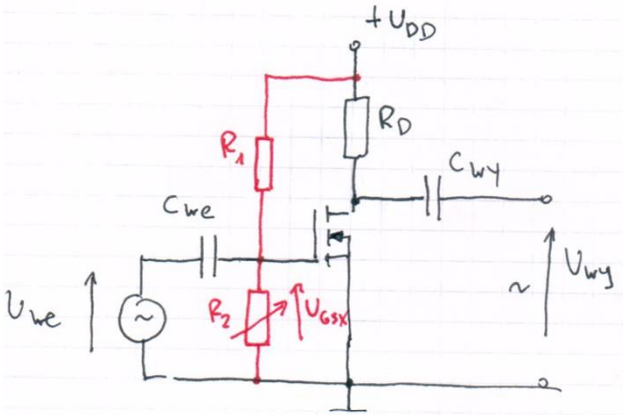


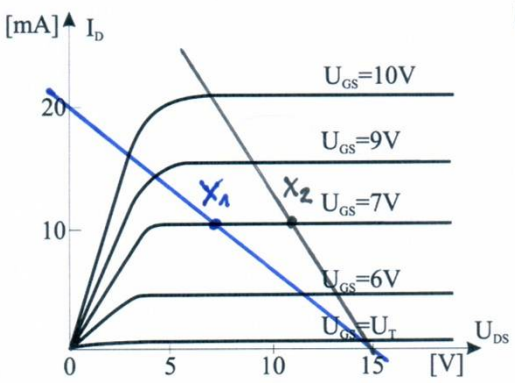
Parametry graniczne

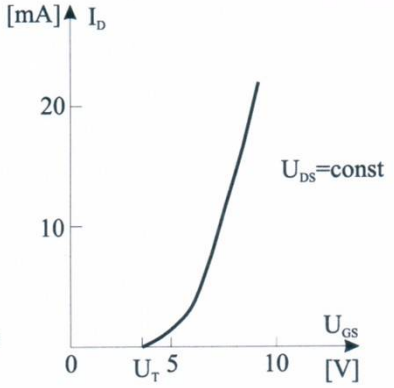


Wzmacniacze napięcia zmiennego z tranzystorami polowymi

Układ WZ - tranzystor MOSFET

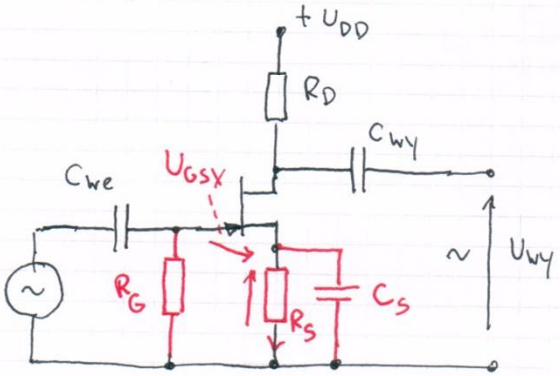




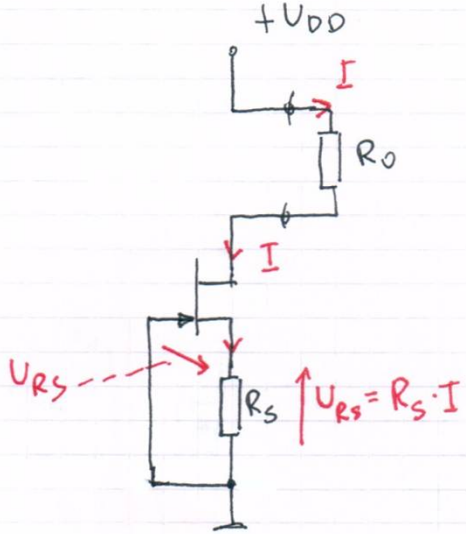


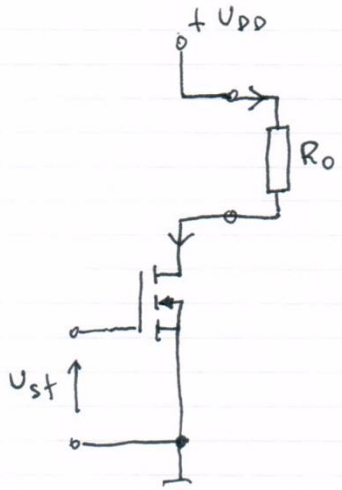
Ustalenie punktu pracy (polaryzacja) za pomocą dzielnika napięcia

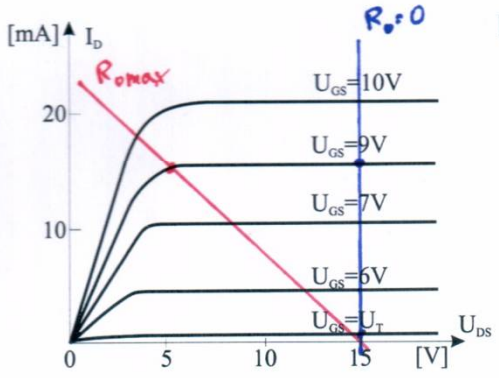
tranzystor JFET

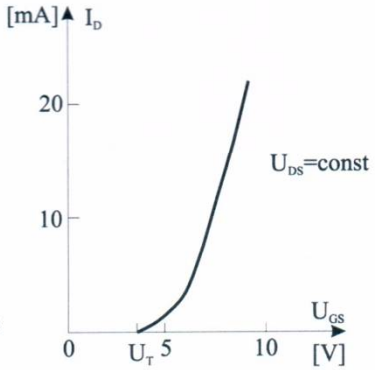


Tranzystor polowy jako źródło prądowe

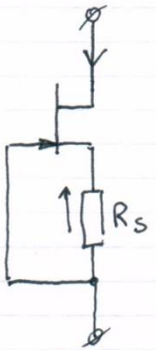








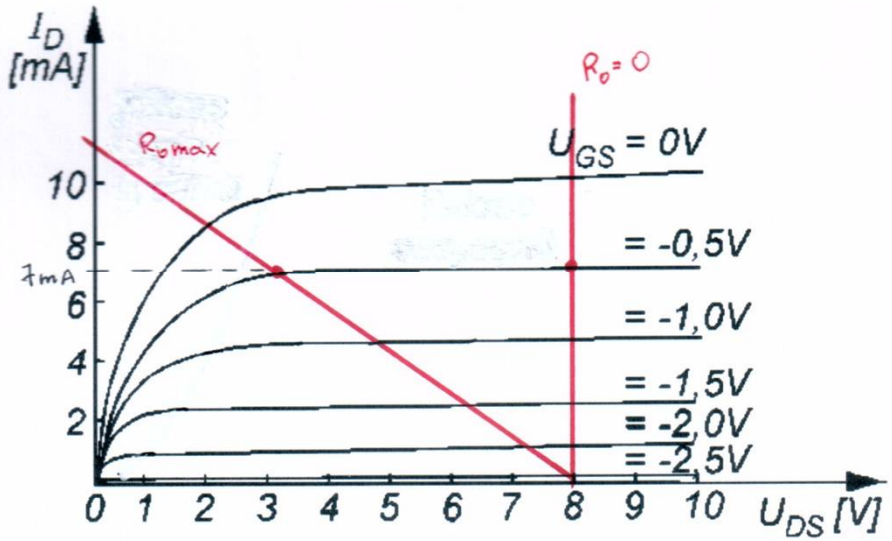
Dioda polowa



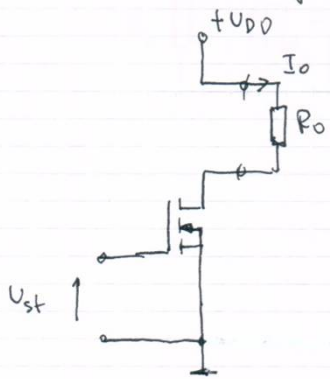
$$U_{GS} = R_S \cdot I$$

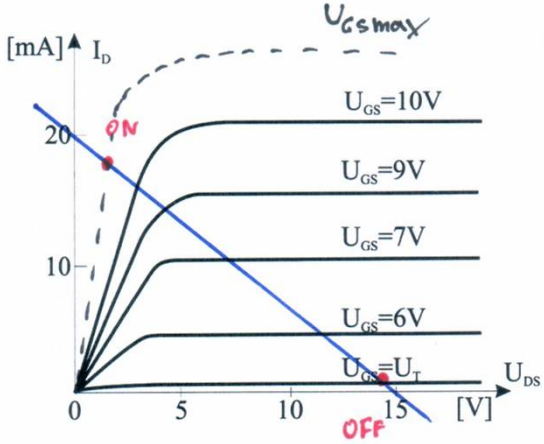
$$R_S = \frac{U_{GS}}{I}$$

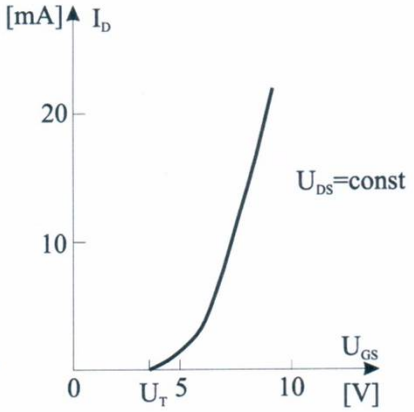
$$R_S = \frac{0,5}{0,007} = 74,1\ \Omega$$



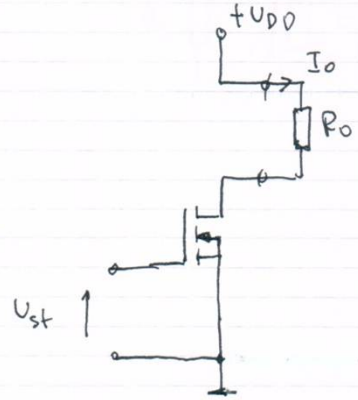
Tranzystor polowy MOSFET jako klucz

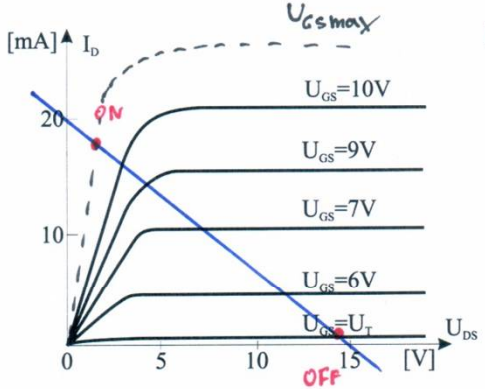


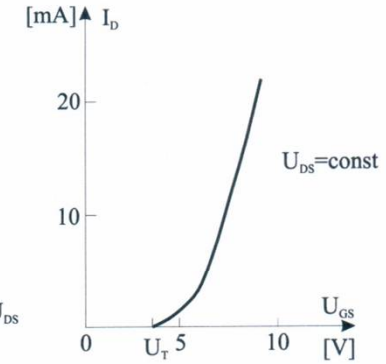




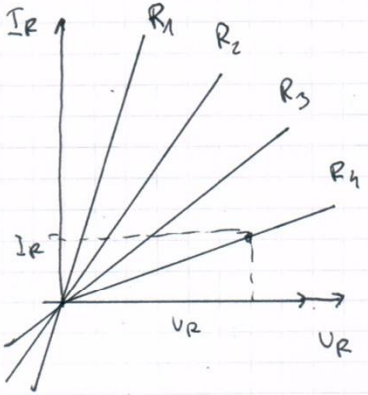
Tranzystor polowy MOSFET jako klucz

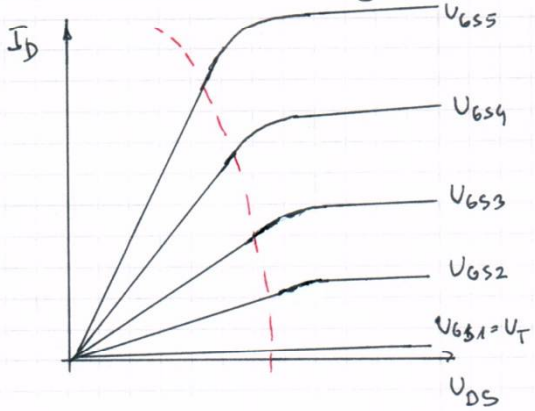


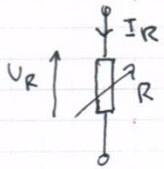


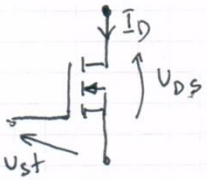


Tranzystor polowy jako sterowana rezystancja

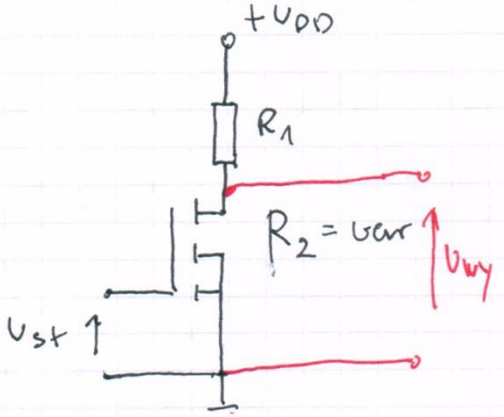


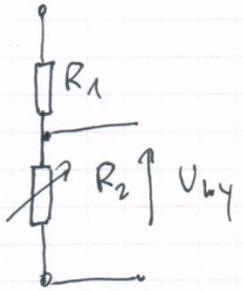






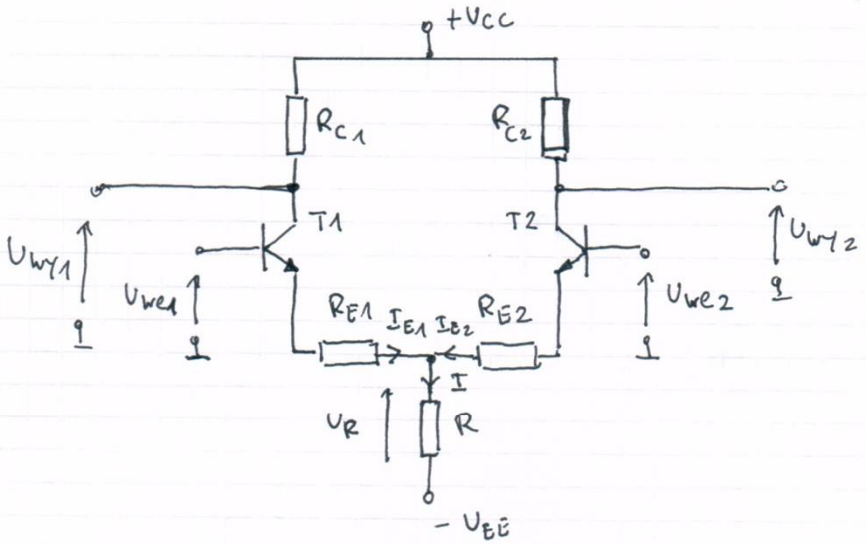
Sterowany dzielnik napięcia





Wzmacniacz różnicowy

Wzmacniacz różnicowy



$R_{C1} = R_{C2} = R_C$

$R_{E1} = R_{E2} = R_E$

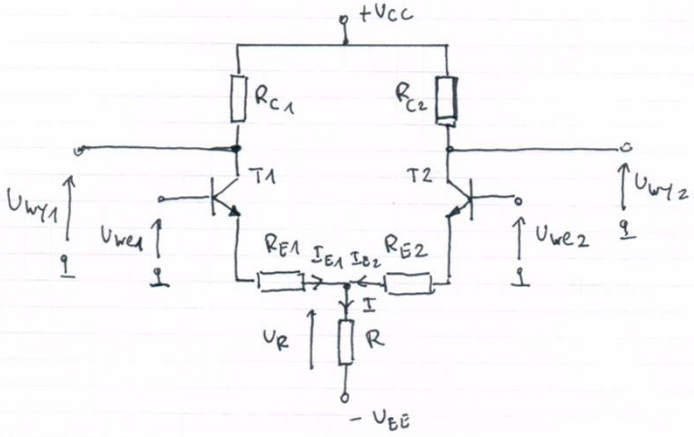
Wzmacniacz WE + sprzężenie zwrotne $K_{U_0} = -\frac{R_C}{R_E}$

Każdy wzmacniacz osobno

$K_{U_1} = \frac{\Delta U_{wy1}}{\Delta U_{we1}}$ $K_{U_1} = -\frac{R_C}{R_E + R}$ $K_{U_2} = \frac{\Delta U_{wy2}}{\Delta U_{we2}} = -\frac{R_C}{R_E + R}$ $\Delta I = \Delta I_{E_2}$

$\Delta I = \Delta I_{E1}$

Wzmacniacz różnicowy



Wzmacniacz WE + sprzężenie zwrotne $K_{U_0} = -\frac{R_C}{R_E}$

Każdy wzmacnia osobno

$K_{U_1} = \frac{\Delta U_{wy1}}{\Delta U_{we1}}$ $K_{U_1} = -\frac{R_C}{R_E+R}$ $K_{U_2} = \frac{\Delta U_{wy2}}{\Delta U_{we2}} = -\frac{R_C}{R_E+R}$ $\Delta I = \Delta I_{E_2}$

$\Delta I = \Delta I_{E1}$

1) $\Delta U_{we_1} = \Delta U_{we2}$ $\Delta I_{E1} = \Delta I_{E2}$

$\Delta I = \Delta I_{E1} + \Delta I_{E2} = 2\Delta I_E$

$\Delta U_R = 2 \cdot R \cdot \Delta I_E$

$K_{U_1} = -\frac{R_C}{R_E+2R}$

wzmocnie wspólne K_{US}

sygnał wejściowy wspólny $\Delta U_{wes} = \frac{1}{2}(\Delta U_{we_1} + \Delta U_{we2})$

dla $\Delta U_{we_1} = \Delta U_{we2}$

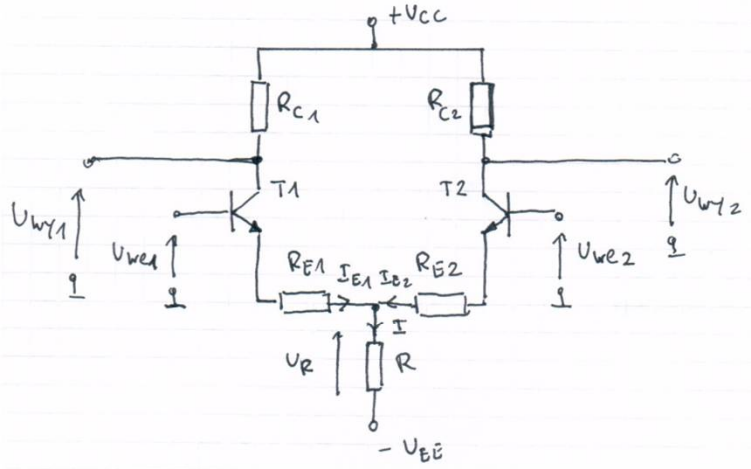
$\Delta U_{wes} = \Delta U_{we_1} (\Delta U_{we2})$

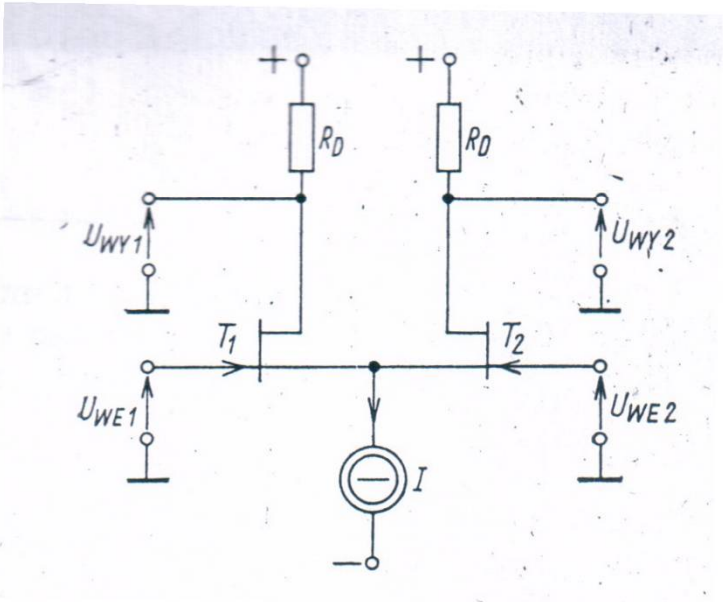
1) Wzmocnienie wspólne K_{US}

— ↓ — pomiarowe

$$K_{US} = \frac{\Delta U_{wy1}}{\Delta U_{wes}} = \frac{\Delta U_{wy1}}{\Delta U_{we_1}} = -\frac{R_C}{R_E+2R}$$

Wzmacniacz różnicowy





2) Wzmocnienie różnicowe

$\Delta U_{we\,r} = \Delta U_{we1} - \Delta U_{we2}$

dla $\Delta U_{we2} = -\Delta U_{we1} \longrightarrow \Delta I_{E1} = -\Delta I_{E2}$

$\Delta U_{we\,r} = 2\,\Delta U_{we1}$

dla $\Delta I_{E1} = -\Delta I_{E2}$

$\Delta I = \Delta I_{E1} + \Delta I_{E2} = 0$

$\Delta U_R = \Delta I \cdot R = 0$

$K_{U\,r} = \dfrac{\Delta U_{wy1}}{\Delta U_{we\,r}}$

$$K_{U\,r} = \frac{\Delta U_{wy1}}{2\,\Delta U_{we1}} = -\frac{R_C}{2R_E}$$ (duże!)

$$K_{U\,s} = -\frac{R_C}{R_E + 2R} \approx -\frac{R_C}{2R}$$ (b. małe)

dla $R \gg R_E$

$R \gg R_C$

Współczynnik tłumienia sygnału wspólnego (Commone Mode Reduction Ratio) – **CMRR**

$$CMRR = \frac{K_{U\,r}}{K_{U\,s}}$$ – im większa wartość tym lepszy wzmacniacz różnicowy