

Tápegységek (stabilizátorok)



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PowerQuattro Zrt.

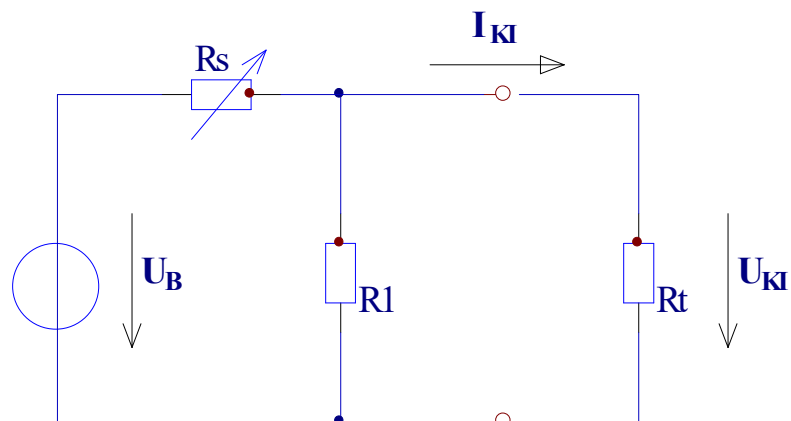
Fejlesztési igazgató

Címzetes Egyetemi Docens



Analóg üzemű tápegységek

1.



$$U_{KI} = U_B \frac{R_L \otimes R_T}{R_S + R_L \otimes R_T}$$

$$P_{DR_S} = \frac{U_B - U_{KI}}{R_S} (U_B - U_{KI}) = \frac{(U_B - U_{KI})^2}{R_S} = (U_B - U_{KI}) I_{KI}$$

$$pl.: U_{BE} = 10V$$

$$U_{KI} = 5V$$

$$I_{KI} = 10A$$

$$P_D = 5V \cdot 10A = 50W$$

$$P_{KI} = 5V \cdot 10A = 50W$$

$$\eta = \frac{P_{KI}}{P_{BE}} = \frac{50W}{100W} = 0,5 \rightarrow 50\%$$

$R_S \rightarrow$ Bipoláris tranzisztor

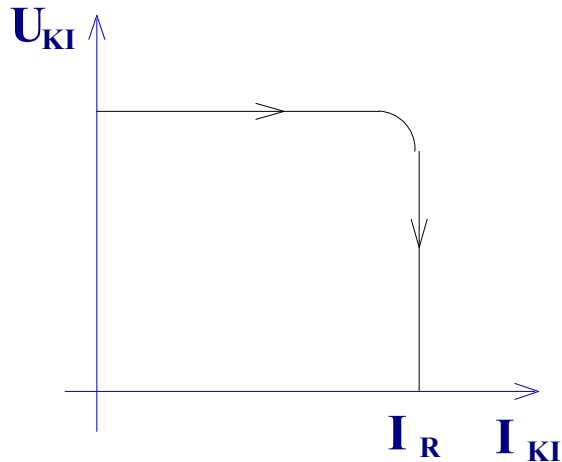
IGBT

FET

SIT

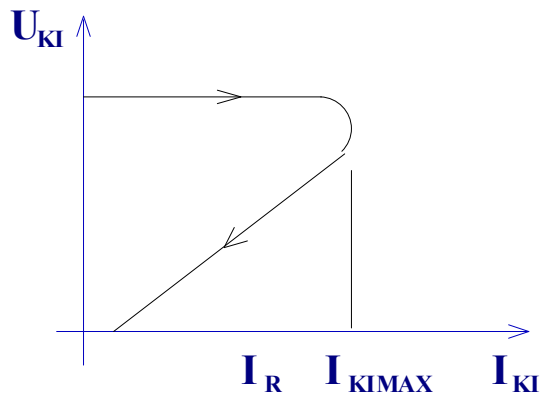
Túláram elleni védelem

2. a áramgenerátoros



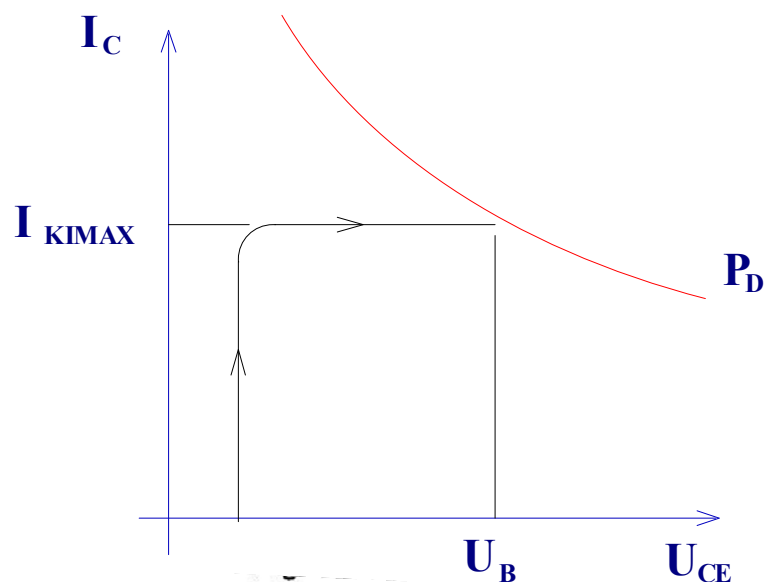
$$P_{DR} = U_{BI} \cdot I_{KI}$$
$$(P_{DR} = 10V \cdot 10A = 100W)$$

2. b visszahajló karakterisztikájú

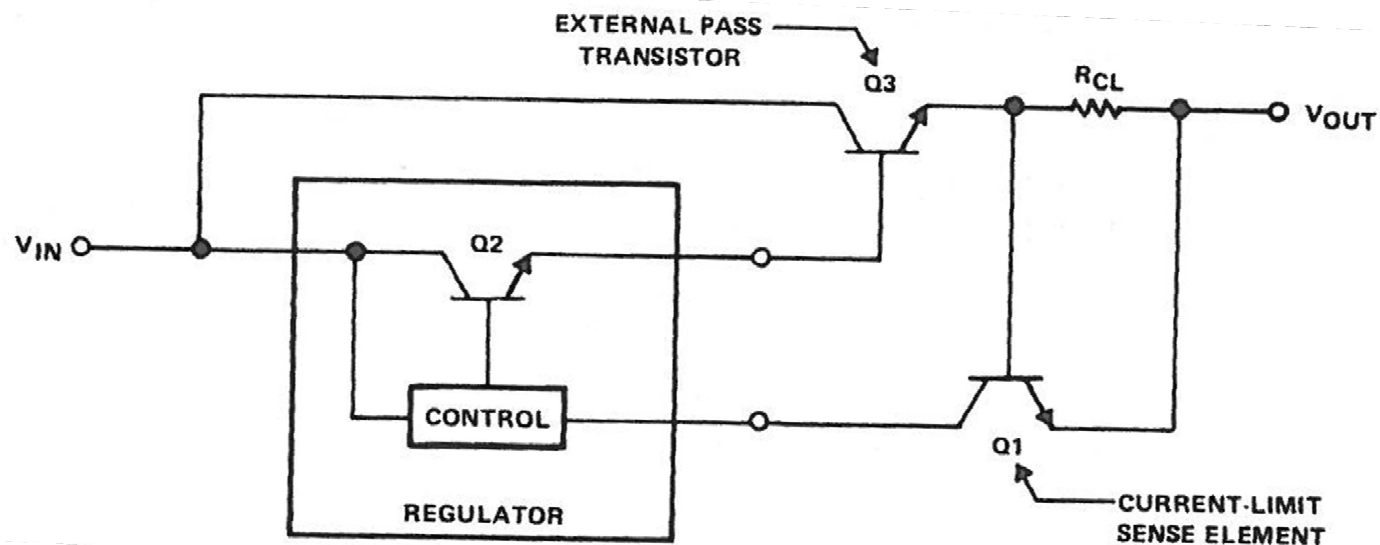


$$P_{DR} = U_{BI} \cdot I_R$$
$$(pl.: P_{DR} = 10V \cdot 2A = 20W)$$
$$(I_R = 2A)$$

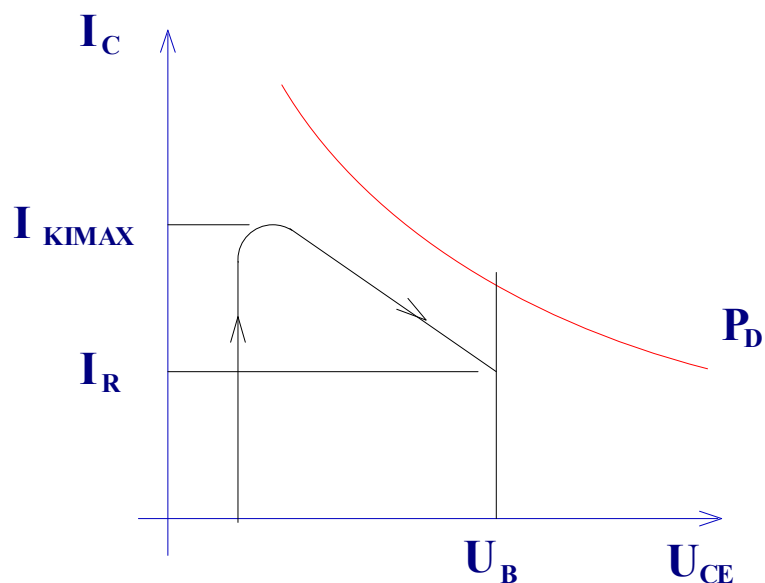
Munkapont pályák



áramgenerátoros

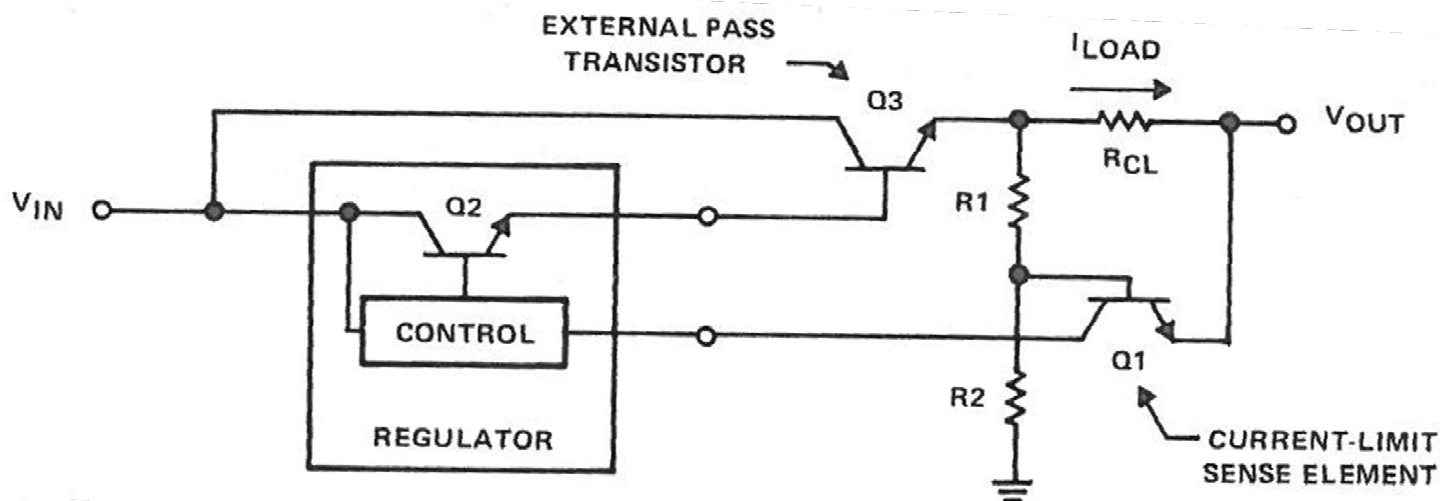


Munkapont pályák

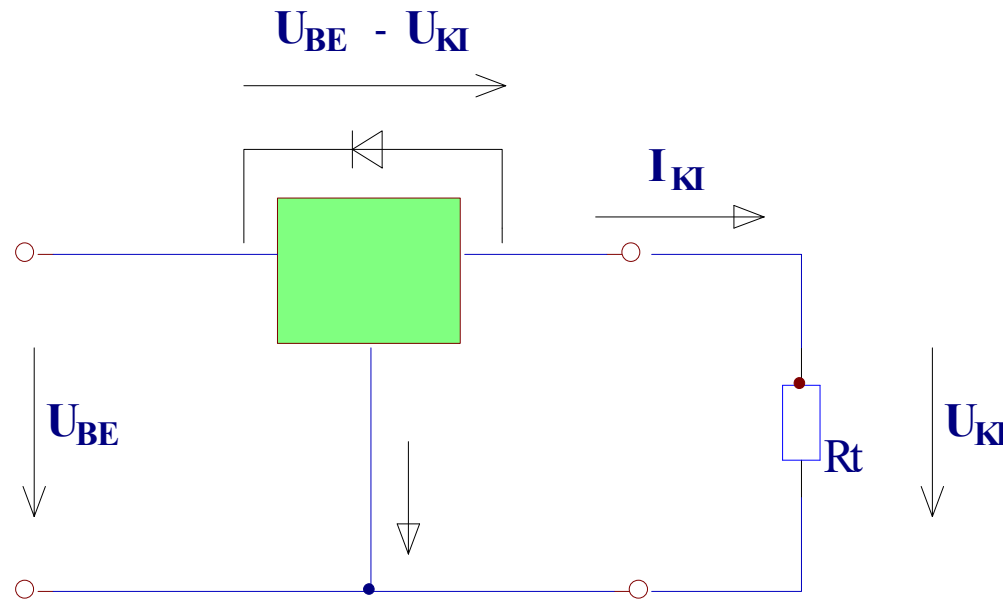


visszahajló
karakterisztikájú

$$I_{SC} = I_K @ (V_{OUT} = 0V) = \frac{V_{BE(Q1)}}{R_{CL}} \left(1 + \frac{R1}{R2}\right)$$

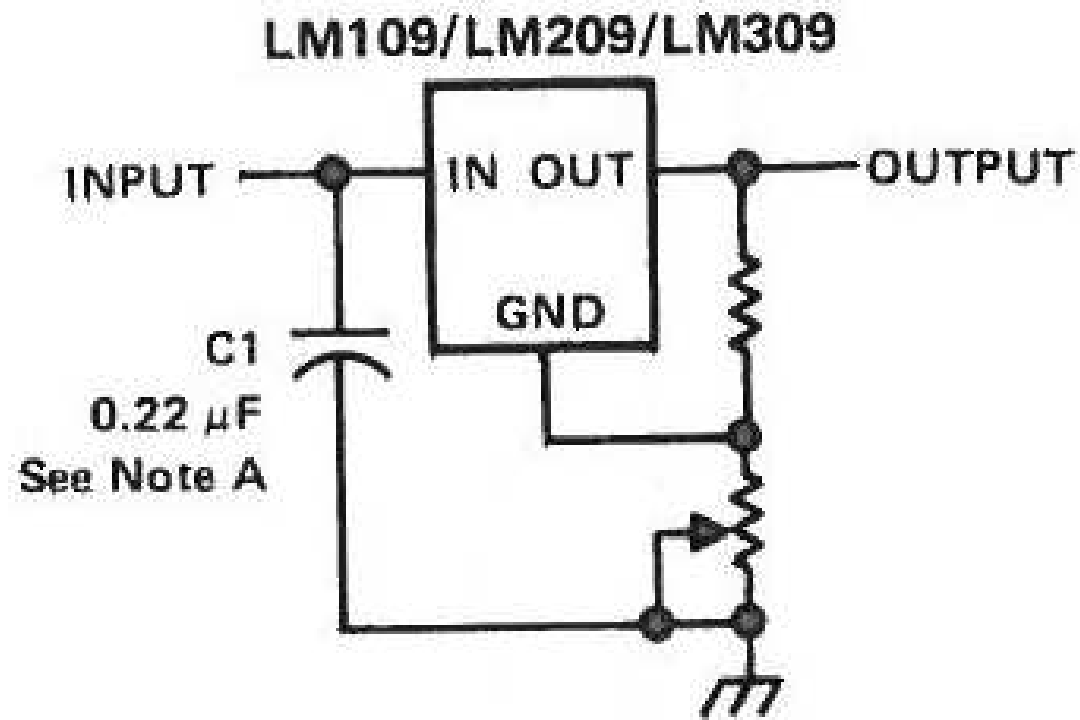


3 pont stabilizátorok

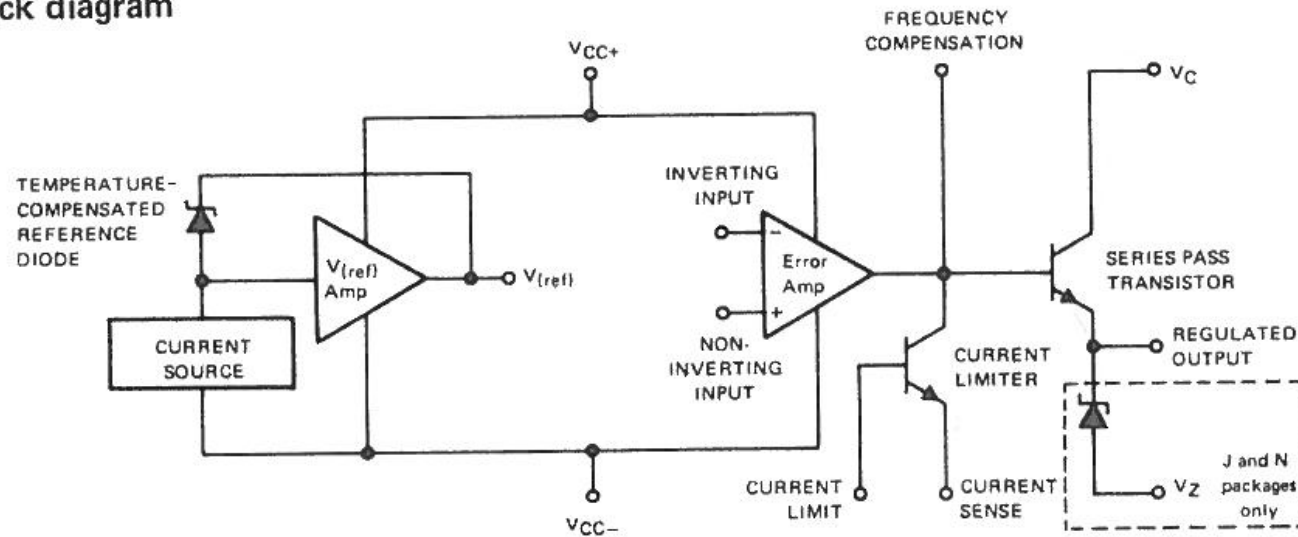


$$P_D \cong (U_{BE} - U_{KI}) \cdot I_{KI}$$

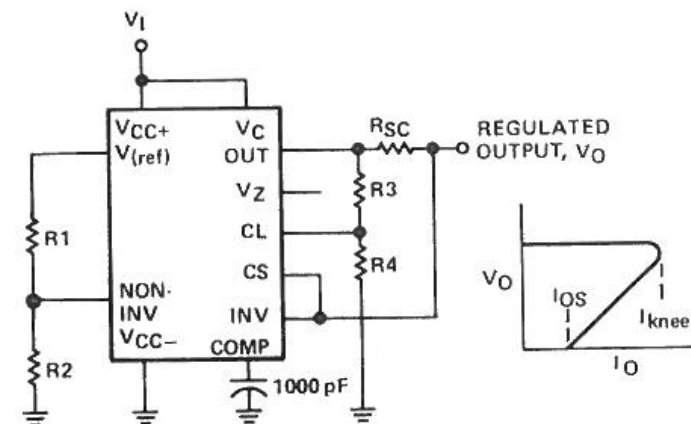
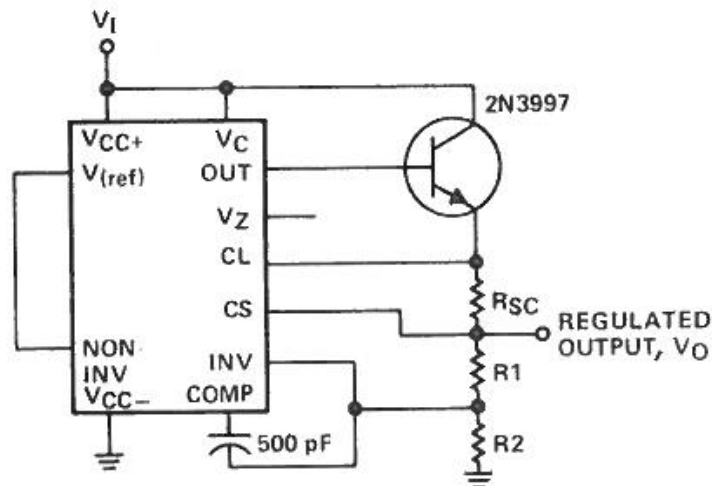
- Hővédelem (túlmelegedés elleni védelem)
- Rövidzárlat elleni védelem
- SOA védelem



functional block diagram



uA723



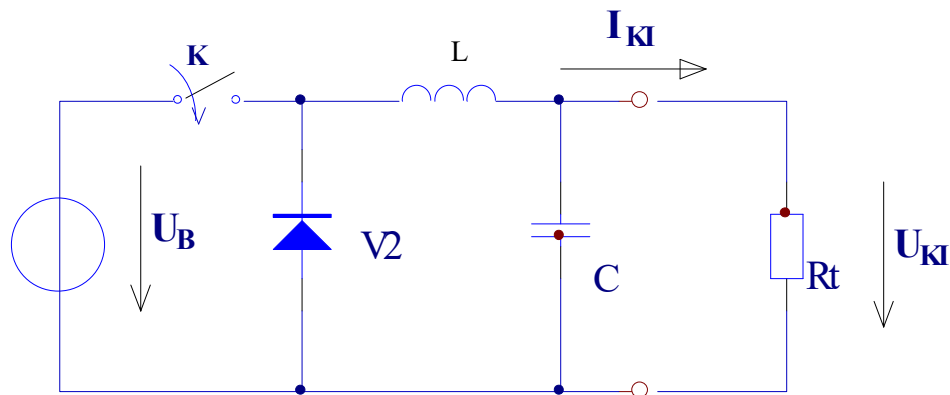
Előnyök:

- egyszerű felépítés
- RF zaj kicsi
- jó tranziens viselkedés
- alacsony kimeneti feszültség hullámosság

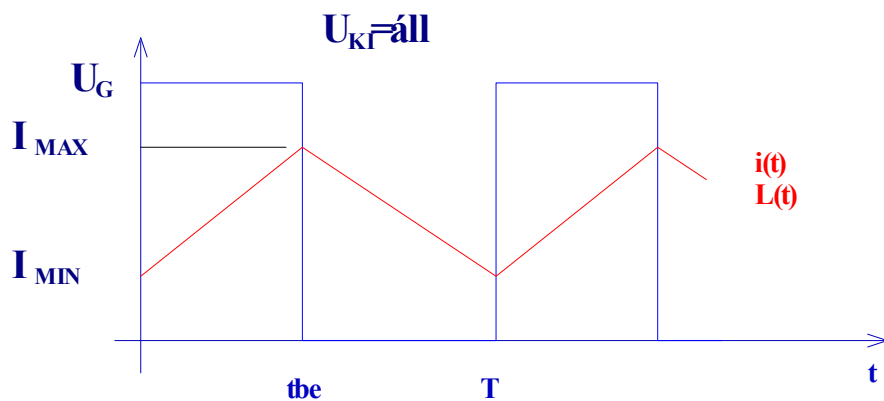
Hátrányok:

- rossz hatásfok
- nagy disszipációs teljesítmény
- nagy hűtőfelület
- nagy súly és méret

Kapcsoló üzemű tápegység



$$U_{KI} = U_B \frac{T_{be}}{T_{be} + t_{ki}} = U_B \frac{T_{be}}{T} = U_B \delta$$

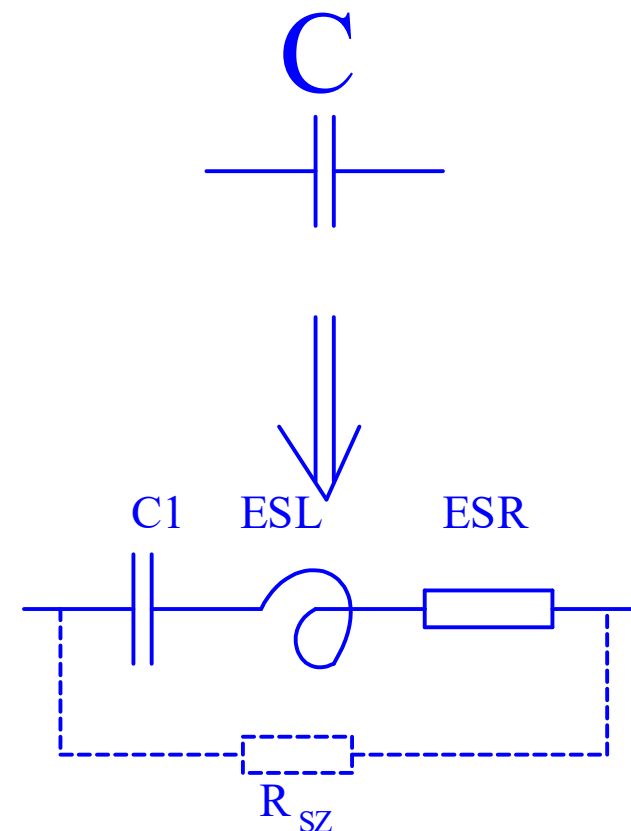
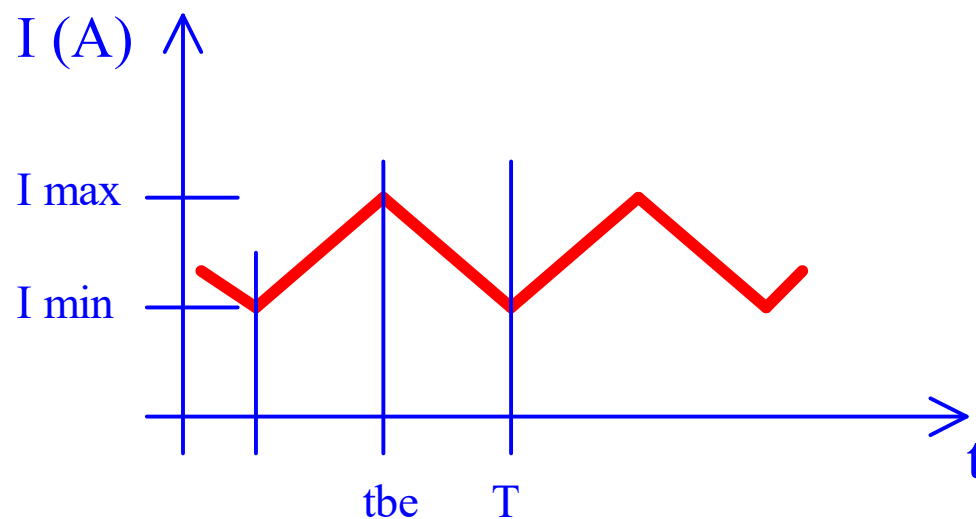
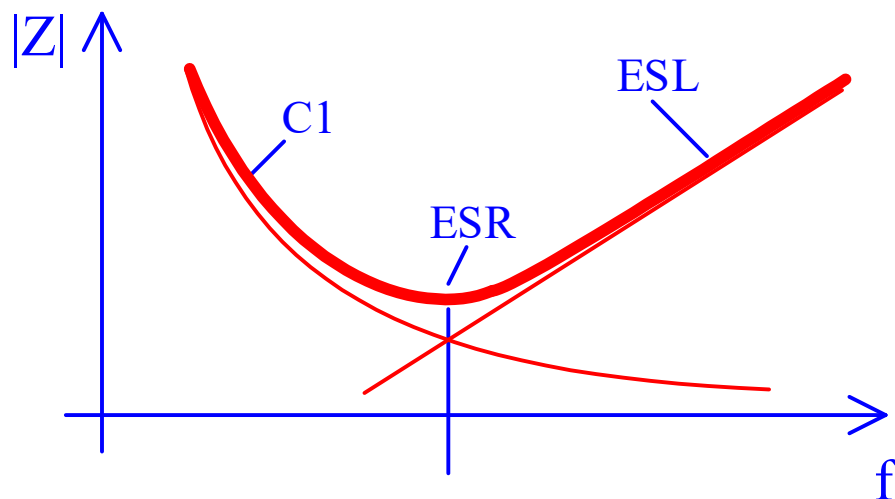


$$U_L = L \frac{di}{dt}$$

$$\frac{U_L}{L} dt = di \Rightarrow \int_0^{t_{be}} \frac{U_L}{L} dt = \int_{i_{min}}^{i_{max}} di$$

$$\Delta i = \frac{U_L}{L} t_{be} = \frac{U_B - U_{KI}}{L} t_{be} \Rightarrow L = \frac{U_B - U_{KI}}{\Delta i} t_{be}$$

Kondenzátor helyettesítő képe



$$\Delta I = I_{max} - I_{min}$$

C1

$$U_C = \frac{1}{C} \int i dt$$

$$\Delta U_C = \frac{1}{C} \int dQ$$

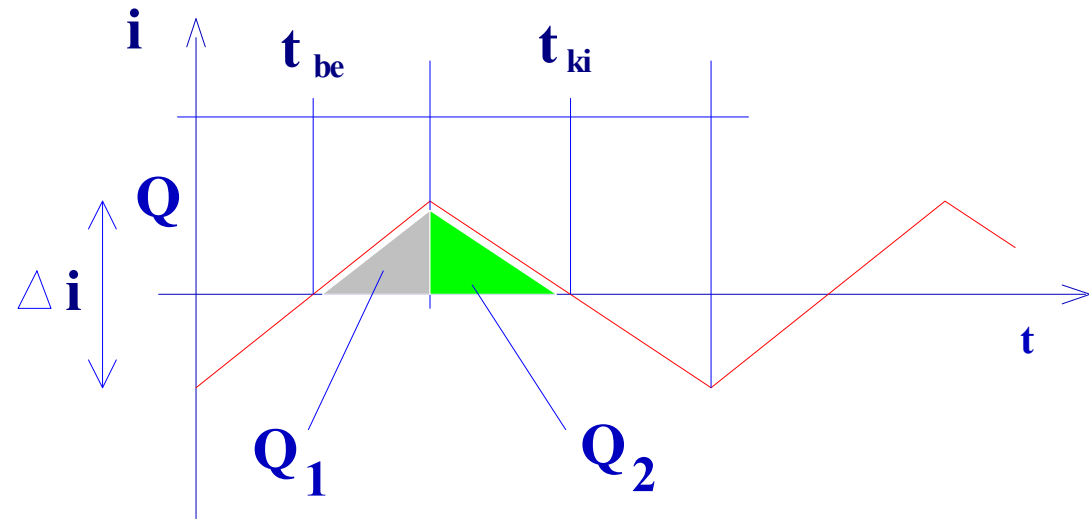
$$\Delta U_C = \frac{1}{C} \Sigma Q$$

$$Q_1 = \frac{\Delta i}{2} \frac{t_{be}}{2} \frac{1}{2}$$

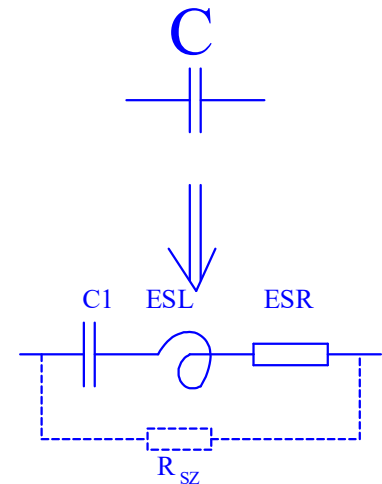
$$Q_2 = \frac{\Delta i}{2} \frac{t_{ki}}{2} \frac{1}{2}$$

$$\Sigma Q = Q_1 + Q_2 = \frac{1}{8} \Delta i T$$

$$\Delta U_C = \frac{1}{C} \frac{1}{8} \Delta i T = \frac{1}{8} \frac{1}{C_f} \Delta i = \frac{\Delta i}{8 C f}$$

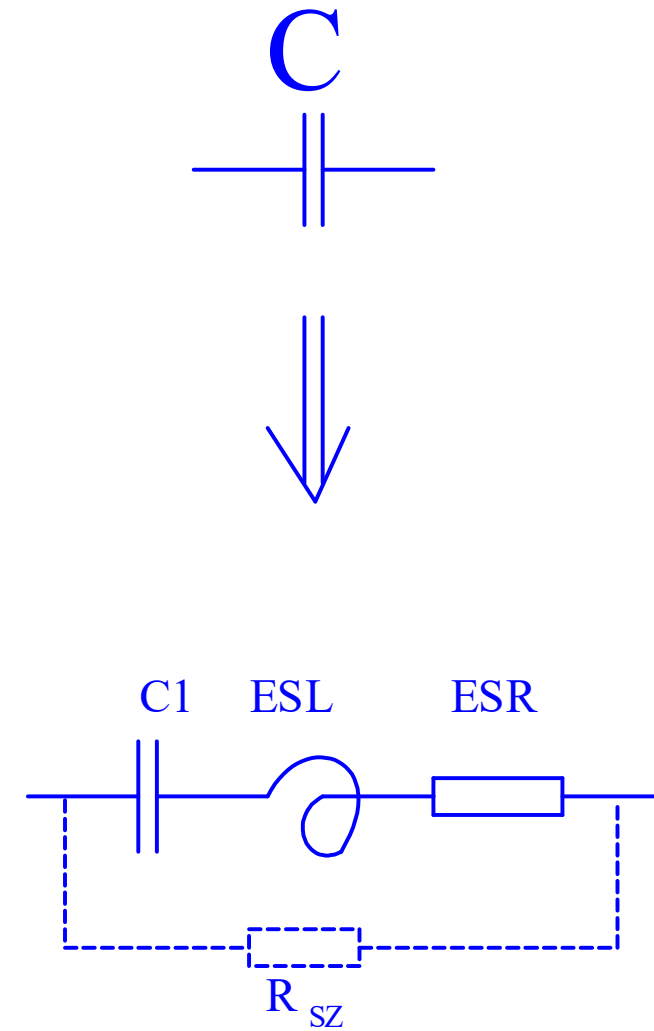
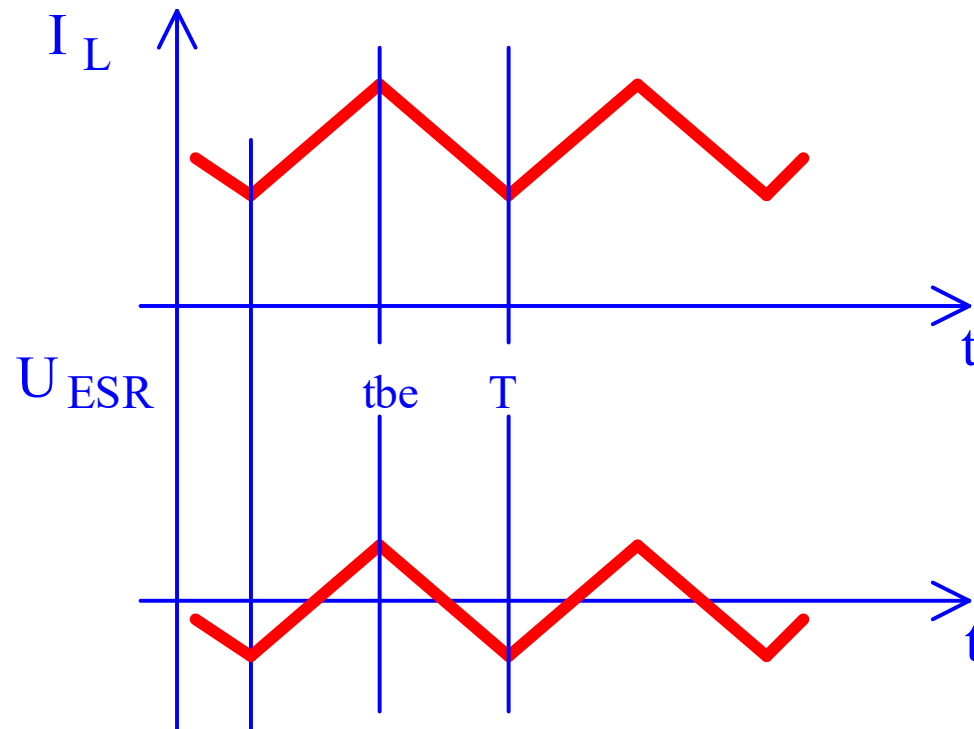


$$\Delta Q_C = Q_1 + Q_2$$



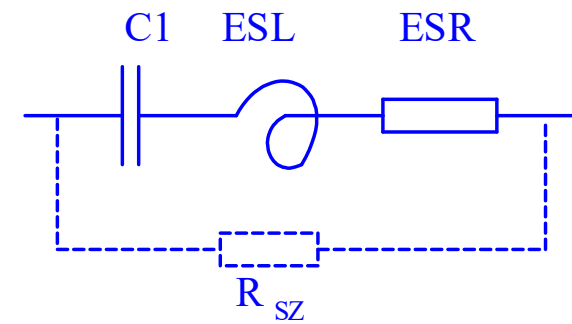
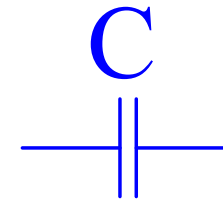
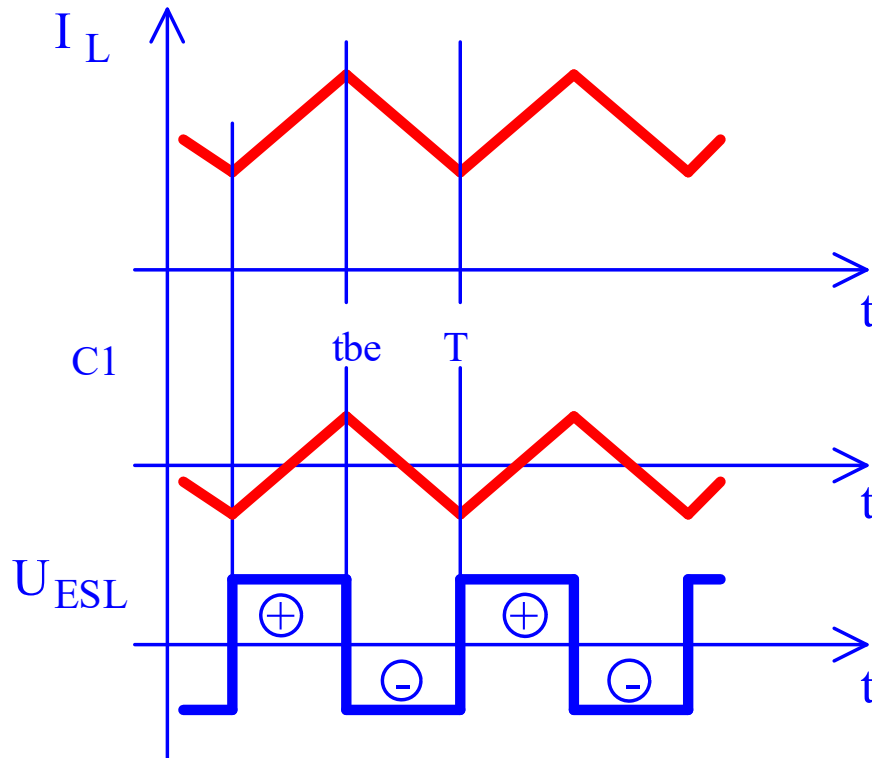
ESR

$$U_{\text{ESR}} = i(t) \text{ ESR}$$

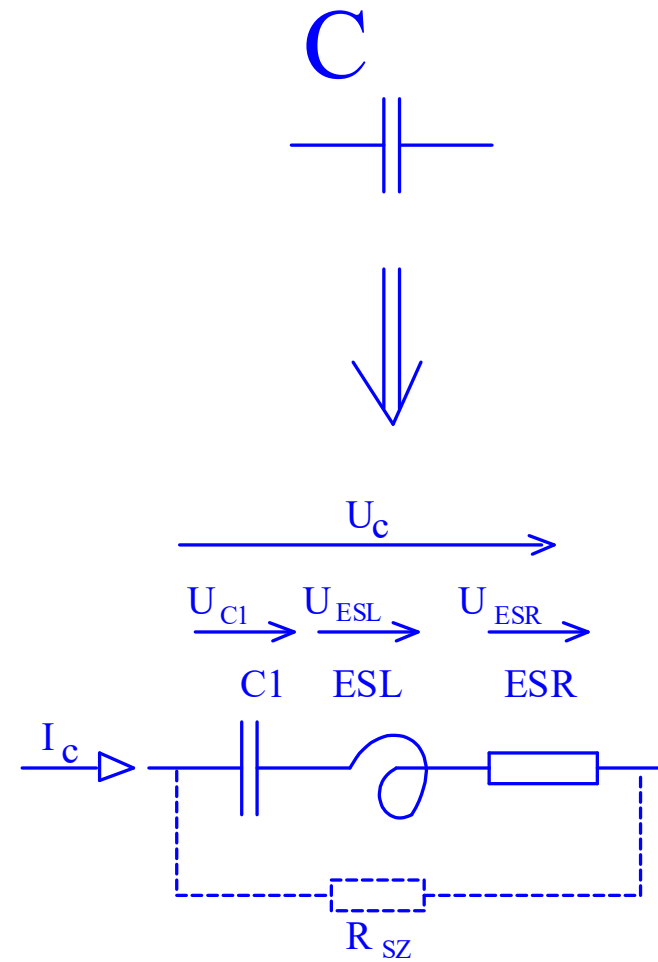
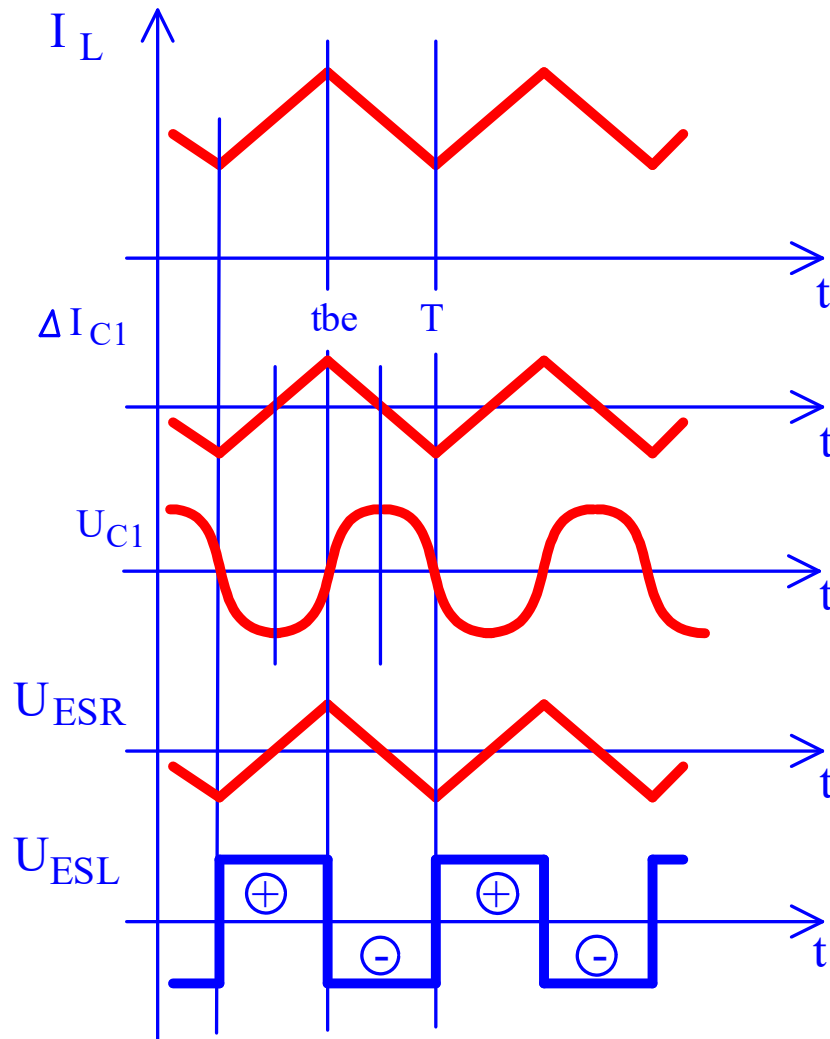


ESL

$$U_{ESR} = ESL \frac{di}{dt}$$

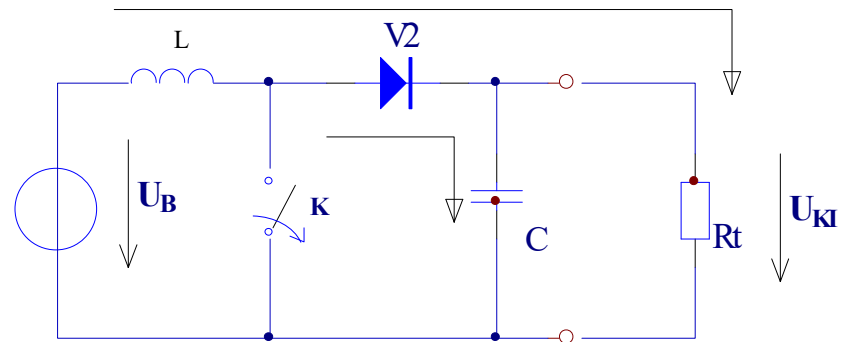
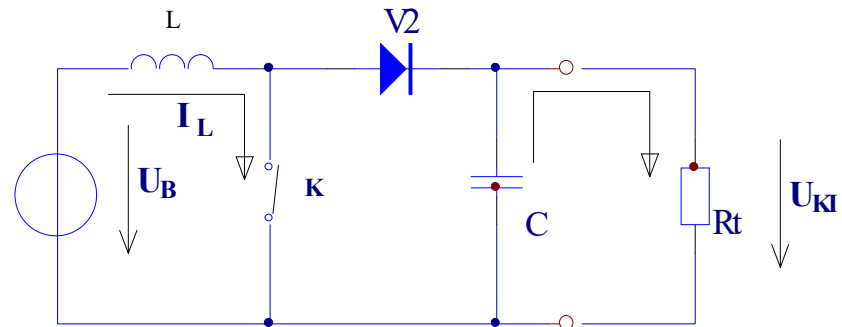
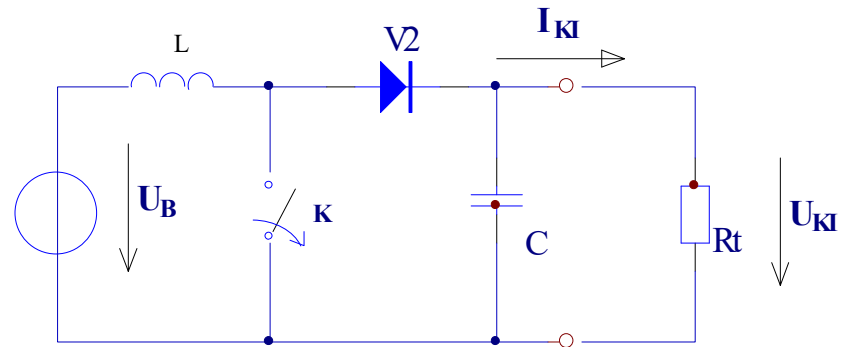


C1, ESL, ESR

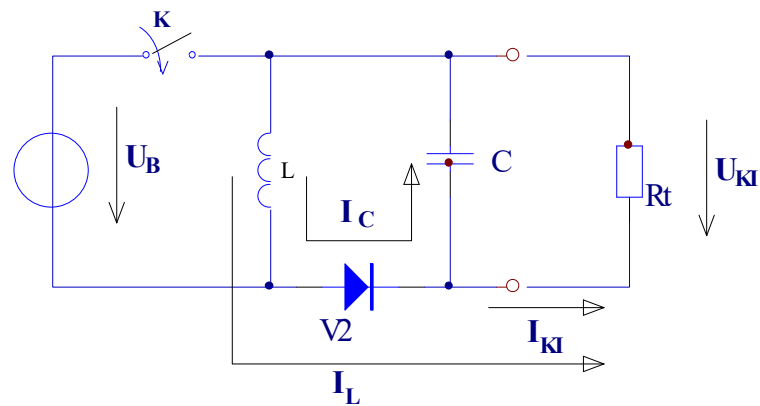
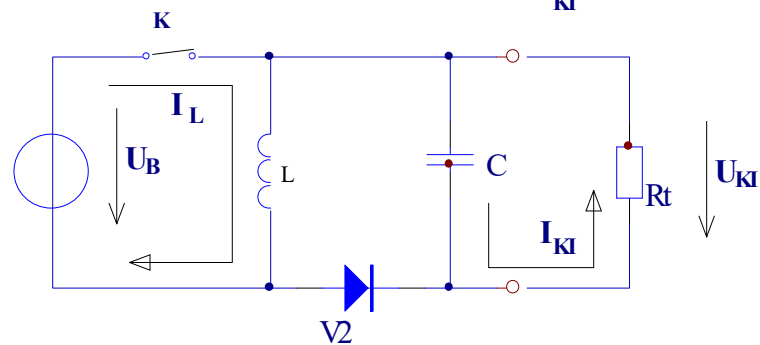
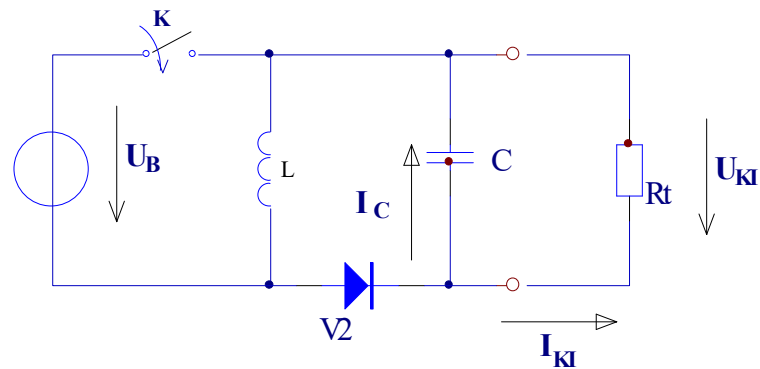


$$U_C(t) = U_{C1}(t) + U_{ESL}(t) + U_{ESR}(t)$$

Záróüzemű konverter

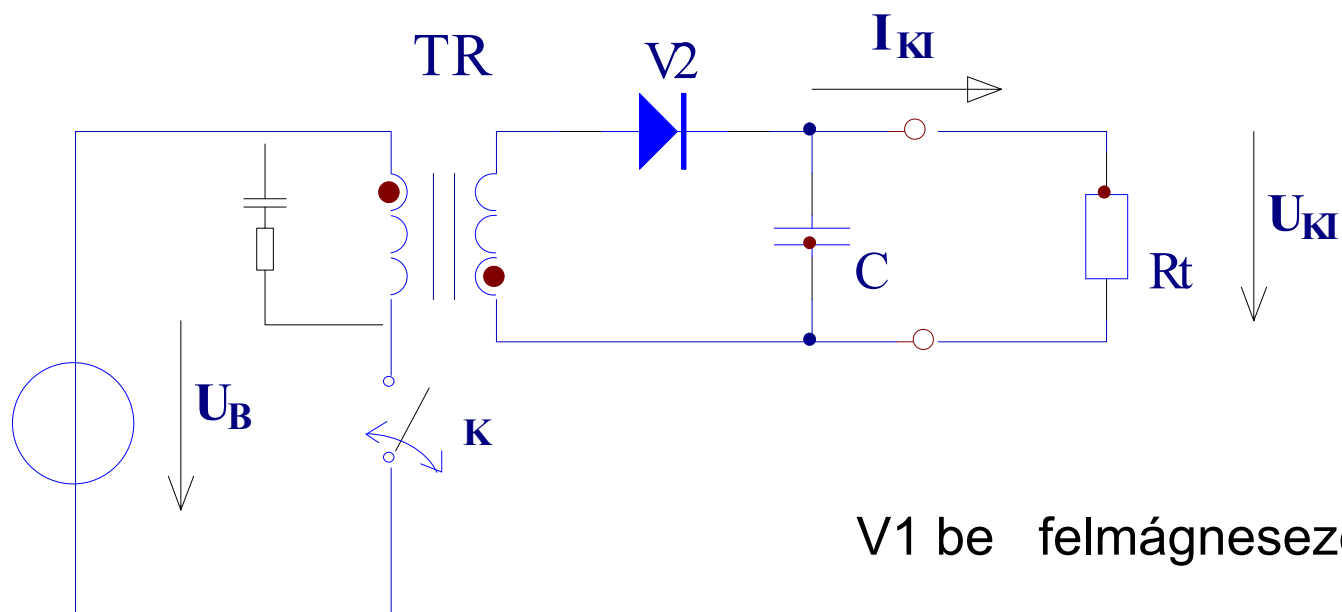


Polaritás váltó konverter



Szigetelt tápegységek (DC-DC konverter)

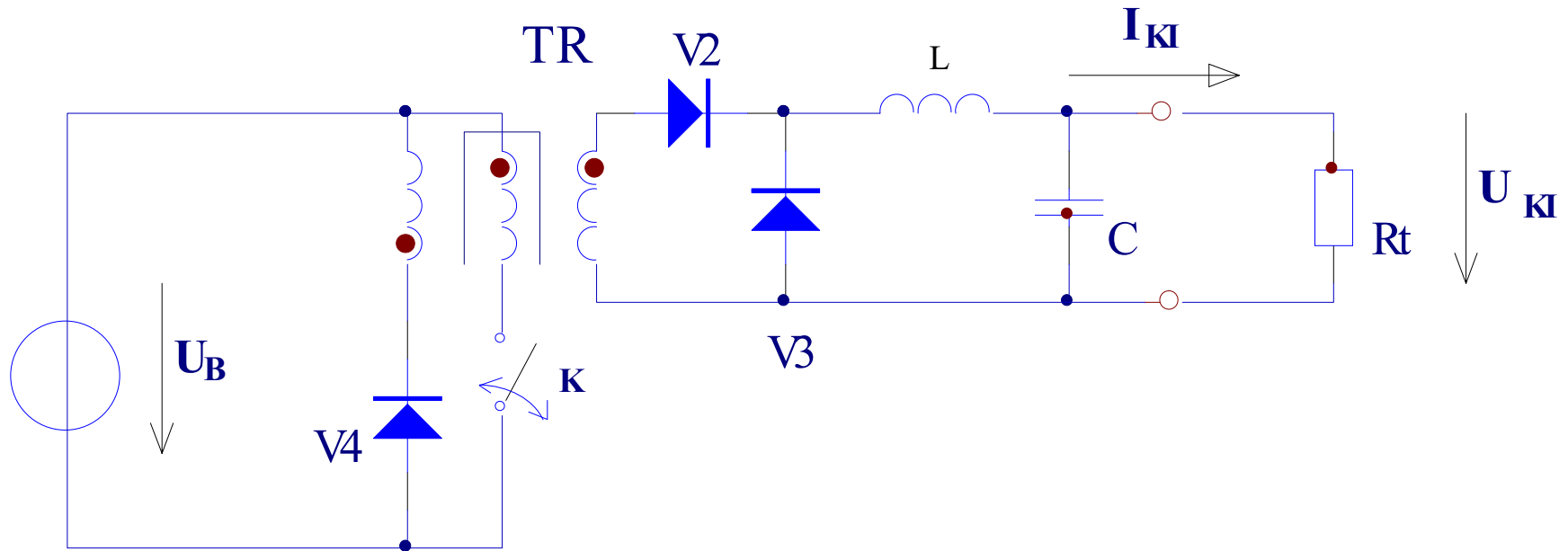
1. Záróüzemű tápegység



V1 be felmágnesezés

V1 ki energia leadás

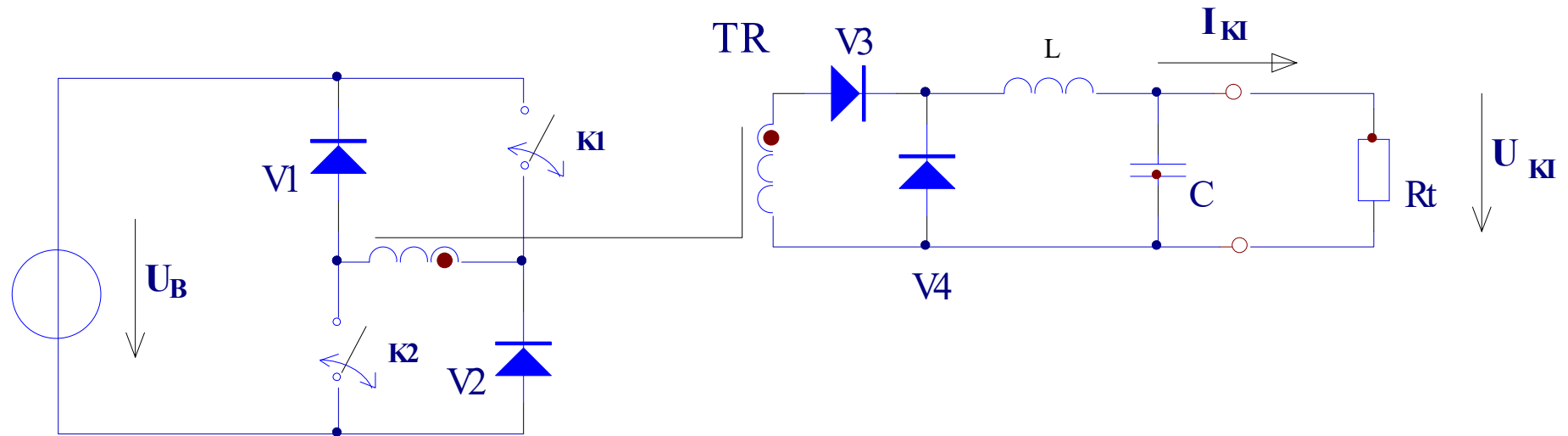
2.a Nyitó üzemű konverter (egy kapcsoló elemmel)



V1 be transzformáció

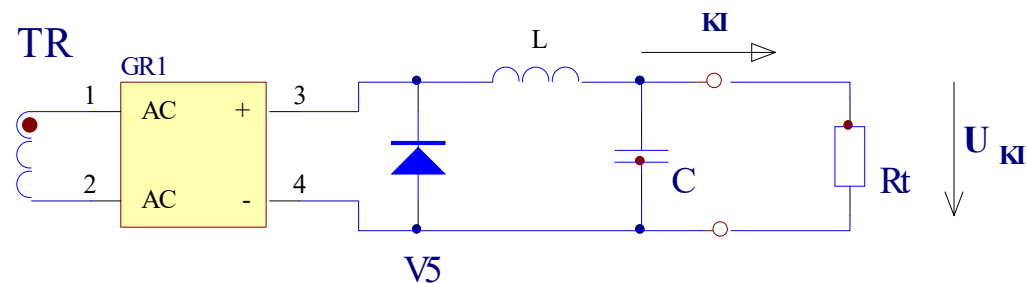
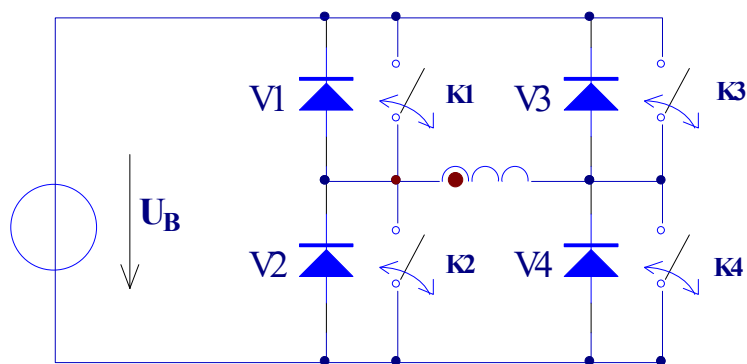
V1 ki lemágnesezés

2.b Nyitó üzemű konverter (kettő kapcsoló elemmel)



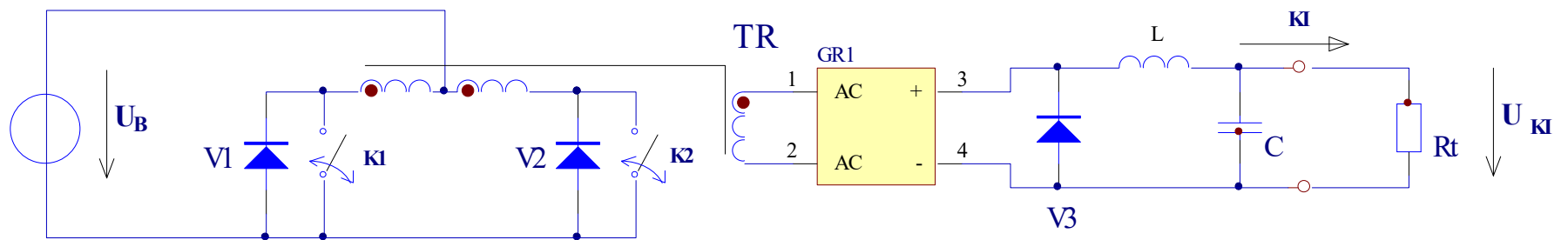
$$\delta \leq 0,5$$

Ellenütemű (híd) kapcsolás



1F2U2Ü

Középpont kapcsolás



Köszönöm a figyelmet!