SW - 1a

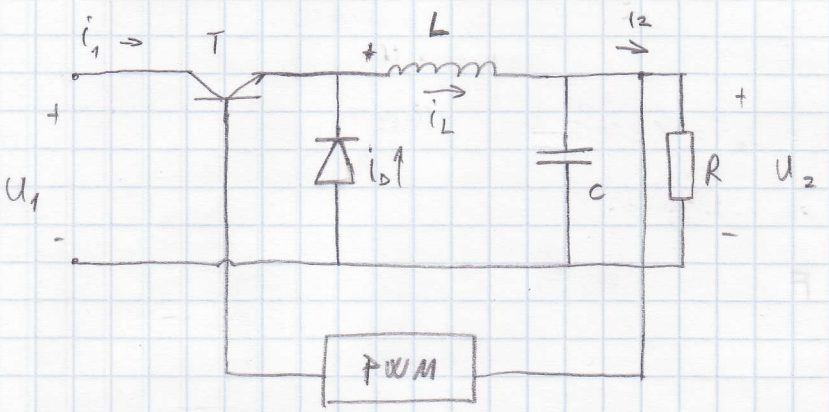
$U_1 = 20V \; +10\%/-15\% \rightarrow 17 - 22V$

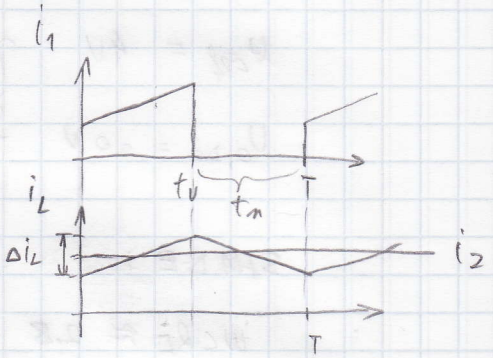
$U_2 = 12V \quad 0.5\%\,PP \rightarrow \Delta U_2 = 60mV$

$I_2 = 100mA \; +10\%/-90\% \rightarrow 10 - 110mA$

$\tau = CR_c = 100\mu s \quad , \; 20\mu F \leq C \leq 1000\mu F$

$f = 20kHz$





T - VODI

$$U_1 - U_{CES} - U_2 = L\frac{\Delta i_L}{\Delta t_v}$$

T - NE VODI

$$U_2 + U_D = L\frac{\Delta i_L}{\Delta t_n}$$

KONST.

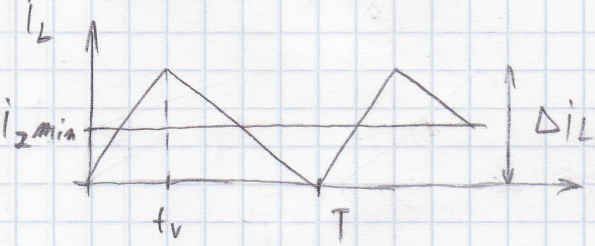
$$\Delta i_L = \frac{U_2 + U_D}{L}(T - t_v)$$

ŠTO JE S VEĆI TO JE VALOVITOST MANJA

$$\Delta i_L = \frac{U_2 + U_D}{fL}(1 - S), \quad S = \frac{t_v}{T}$$

- KONTINUIRANI REŽIM RADA - kroz L konstantno neka struja teče

↓ GRANIČNI SLUČAJ



$\Delta i_{L\,max} \rightarrow \Delta i_{L\,max} = 2\,i_{2\,min} = 20\,mA$

$$L_{min} = \frac{U_2 + U_D}{f\,\Delta i_{L\,max}}\left(1 - \frac{t_{v\,min}}{T}\right) \rightarrow \Delta i_L \text{ maximalan kada je } t_v \text{ minimalan}$$

$$\frac{t_v}{t_m} = \frac{U_2 + U_D}{U_1 - U_{CES} - U_2} \quad \Big\} \quad \frac{T}{t_v} - 1 = \frac{U_1 - U_{CES} - U_2}{U_2 + U_D}$$

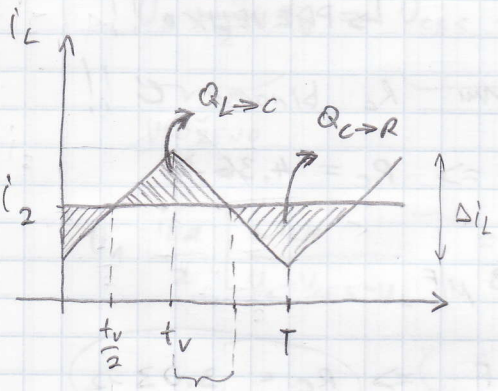
$$\frac{T}{t_v} = \frac{U_1 - U_{CES} + U_D}{U_2 + U_D}$$

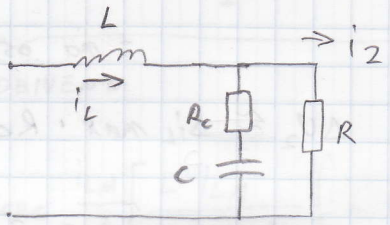
$$t_{v\,min} = \frac{U_2 + U_D}{U_{1max} - U_{CES} + U_D} T = 28.348\,\mu s$$

$$L_{min} = \frac{U_2 + U_D}{\Delta i_{L\,max}}\, t_{m\,max} = \frac{U_2 + U_D}{\Delta i_{L\,max}}\,(T - t_{v\,min}) = \underline{13.749\ mH}$$

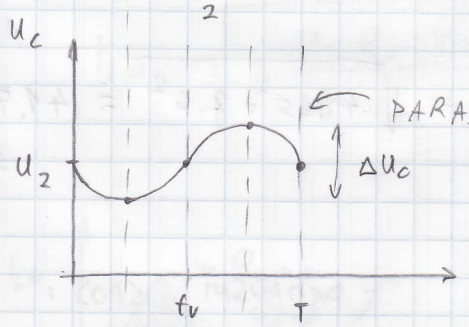
E-3 : 1 2 5 $\Rightarrow$ $L = 20\ mH$

$$\Delta i_{L\,max} = 13.749\ mA$$





- uvjet da struja maloritasti Δi_L teče samo kroz kondenzator:



$$\frac{1}{2\pi f C} \ll R = \frac{U_{2\,min}}{i_{2\,max}}$$

$$u_c = \frac{1}{C}\int i_c\,dt = \frac{Q}{C}$$

$$\Delta u_{C\,max} = \frac{Q_{max}}{C_{min}} \rightarrow \text{KRITIČNI SLUČAJ}$$

- pohranjeni naboj je maximalan kad $\Delta i_{L\,max}$

STACIONARNO STANJE: $Q_{L\to C} = Q_{C\to R}$

- koliko pohrani toliko daje

$$C_{min} = \frac{Q_{max}}{\Delta U_{max}} = \frac{Q_{L\to C}}{\Delta U_{max}}$$

$$Q_{L\to C} = \frac{1}{2}\cdot\frac{\Delta i_{L\,max}}{2}\left(\frac{+v_{min}}{2} + \frac{t_{n\,max}}{2}\right)$$

$$Q_{L\to C} = \frac{\Delta i_{L\,max}}{8} T$$

$$C_{min} = \frac{\Delta i_{L\,max}}{8\,\Delta U_{max}} T = 1{,}432\ \mu F$$

E-6: ±20%: 1 | 1.5 | 2,2 | 3.3 | 4.7 | 6.8

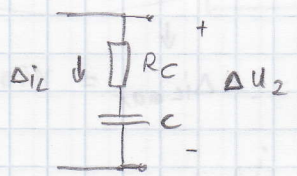
↑ PREMALI ZBOG TOLERANCIJE

$C = 2.2\ \mu F$

↓

$\Delta U_{C\,max} = 39.05\ mV$

ERS



$R_C = \frac{\tau}{C}$

$R_C = 5\,\Omega$

$\Delta U_{R_C} = R_C \cdot \Delta i_{L\,max} = 68{,}74\ mV$

↳ PREVELIKO !!

- na osnovu R_C biramo C !!

$\Delta U_2 \approx \Delta i_{L\,max} \cdot R_C \Rightarrow R_C = 4.36\,\Omega$

$C_{min} = \frac{\tau}{R_C} = 22{,}9\ \mu F$

E-6 → $C = 33\ \mu F$ ⇒ $R_C = 3.03\,\Omega$

- provjera:

$\Delta U_2 = \sqrt{U_{R_C}^2 + \Delta U_C^2} = \sqrt{41.65^2 + 2.6^2} = 41{,}74\ mV$

$\angle 60°$

- PROPUSNI (PO):

$I_L = I_2$

$$\eta = \frac{I_2 \cdot U_2}{I_L \cdot \delta U_{CES} + (1-\delta) I_L U_D + I_2 U_2}$$

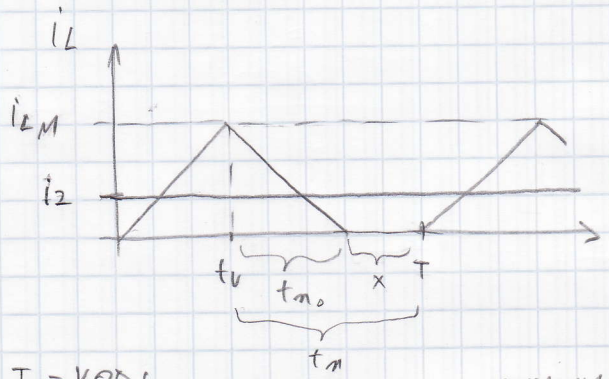
- najgori slučaj: $\delta_{min} \Rightarrow \eta_{min}$ $(U_{CES} < U_D)$

↳ VIŠE UTJEČE

$\eta_{min} = 96.2\%$

DISKONTINUIRAN NAČIN RADA (NIJE ZADANO, ALI AKO BI BILO)

$R > R_{max} \Rightarrow i_2 < i_{2\,min}$



- struja kroz zavojnicu ne teče cijelu periodu

T - VODI

$$u_1 - u_{CES} - u_2 = L\frac{i_{LM}}{t_U}$$ → MAKSIMALNA PROMJENA

$$t_U = \frac{L\,i_{LM}}{u_1 - u_{CES} - u_2}$$

T - NE VODI

$$u_2 + u_D = L\frac{i_{LM}}{t_{m0}}$$

u_2 → KONST

$$i_{LM} = \frac{u_2 + u_D}{L}\,t_{m0}$$

$T - t_U$ (X) → FALI X !!

- energetska ravnoteža:

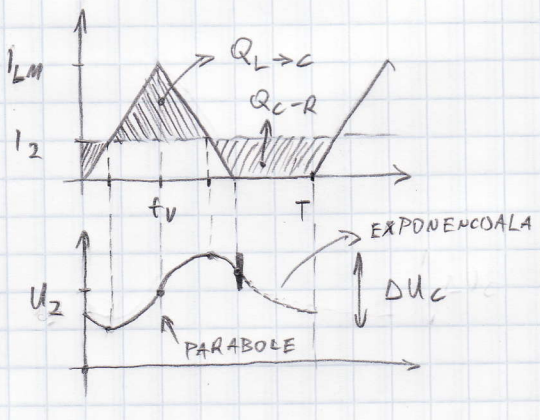
$$u_1\frac{i_{LM}}{2}t_U = u_{CES}\frac{i_{LM}}{2}t_U + u_D\frac{i_{LM}}{2}t_{m0} + u_2 i_2 T$$

$u_1\frac{i_{LM}}{2}t_U$ — ULOŽENO

$u_{CES}\frac{i_{LM}}{2}t_U + u_D\frac{i_{LM}}{2}t_{m0} + u_2 i_2 T$ — DOBIVENO

$$u_1\frac{i_{LM}}{2}\left[\frac{L\,i_{LM}}{u_1 - u_{CES} - u_2}\right] = u_{CES}\frac{i_{LM}}{2}\left[\frac{L\,i_{LM}}{u_1 - u_{CES} - u_2}\right] + u_D\frac{i_{LM}}{2}\left[\frac{L\,i_{LM}}{u_2 + u_D}\right] + u_2 i_2 T$$

$$i_{LM} = \sqrt{2\,\frac{u_1 - u_2 - u_{CES}}{u_1 - u_{CES} + u_D}\cdot\frac{(u_D + u_2)\,i_2}{f\cdot L}}$$ → STRUJA OVISI O i_2 !!



STACIONARNO STANJE: $Q_{LC} = Q_{RC}$

$$\Delta u_{Cmax} = \frac{Q_{LCmax}}{C_{min}}$$

- Q_{LC} se može računati, ali ne treba jer je $i_{LM} < \Delta i_{Lmax}$, pa je Δu_C u ovom slučaju manji