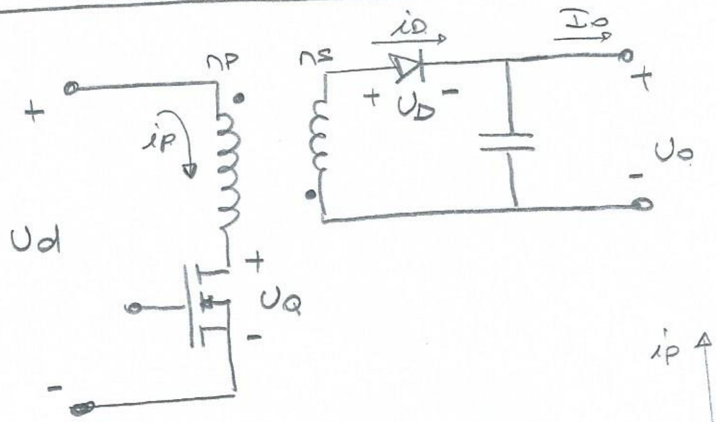
# Examen Electrónica de Potencia - Julio 2021

## Solución Problema 2




$U_o = 12V \quad I_{omáx} = 8A.$

$U_{dmín} = 80V \quad U_{dmáx} = 140V.$

$f = 50kHz \quad \delta_{máx} = 0,42.$

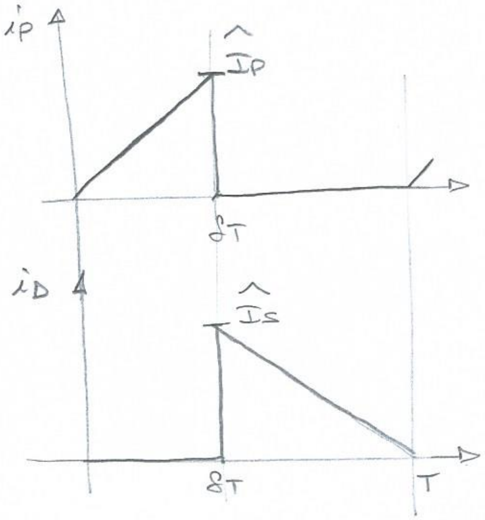
$U_D = 1V.$

a) $\hat{I}_P, \hat{I}_S$

$I_o = \langle i_D \rangle = \frac{1}{\cancel{T}} \frac{1}{2} (1-\delta)\cancel{T} . \hat{I}_S$

$\Rightarrow \hat{I}_S = \frac{2 I_o}{1-\delta} = \frac{2.8}{1-0,42.}$

$\boxed{\hat{I}_S = 27,59 A}$




Condición LCC para carga máxima y $U_d = U_{dmín}$
$\Downarrow$
siempre trabaja en MCD

$P_{in} = P_o + P_D = 12.8 + 1.8 = 104W.$

$\left. \begin{array}{l} P_{in} = \frac{1}{2} L_P \hat{I}_P^2 . f \\ \hat{I}_P = \frac{U_d}{L_P} . \delta T \end{array} \right\} \Rightarrow P_{in} = \frac{1}{2} \cancel{L_P} . \frac{U_d^2 \delta^2 T^{\cancel{2}}}{L_P^{\cancel{2}}} . \cancel{f}$

$\Rightarrow L_P = \frac{U_d^2 . \delta^2}{2.P_{in}. f} = \frac{(80.0,42)^2}{2.104.50 \times 10^3} = 108,55 \mu H$

$\hat{I}_P = \frac{80.0,42}{108,55 \times 10^{-6} . 50 \times 10^3} \Rightarrow \boxed{\hat{I}_P = 6,19 A.}$

b) $n_S \hat{I}_S = n_P \hat{I}_P \Rightarrow \frac{n_S}{n_P} = \frac{\hat{I}_P}{\hat{I}_S} = \frac{6,19}{27,59} \Rightarrow \boxed{\frac{n_S}{n_P} = 0,224} \quad \boxed{\frac{n_P}{n_S} = 4,457}$

c) $U_{Qmáx}, U_{Dmáx}$

$\left. \begin{array}{l} \text{Llave OFF} \Rightarrow U_Q = -U_P + U_d \\ U_S = U_D + U_o \Rightarrow U_P = (-U_D - U_o) . \frac{n_P}{n_S} \end{array} \right\} \Rightarrow U_{Qmáx} = U_{dmáx} + (U_D + U_o) . \frac{n_P}{n_S}$

$U_{Qmáx} = 140 + 13 . 4,457$

$\boxed{U_{Qmáx} = 197,9 V}$

$\left. \begin{array}{l} \text{Llave ON} \Rightarrow U_D = U_S - U_o \\ U_S = -\frac{n_S}{n_P} . U_d \end{array} \right\} \Rightarrow U_{Dmáx} = -\frac{n_S}{n_P} U_{dmáx} - U_o = -0,224 . 140 - 12$

$\boxed{U_{Dmáx} = -43,36 V}$

Examen Electrónica de Potencia – Julio 2021

Solución Problema 2 (cont.)

d) cortocircuito a la salida $\Rightarrow$ ahora $U_O = U_D = 1V$.

$\hat{I}_P$ limitada a 6,19 A.

$\rightarrow$ Asumo MCC. $\frac{U_o}{U_d} = \frac{n_s}{n_p} \cdot \frac{\delta}{1-\delta} \Rightarrow \delta = \frac{\frac{n_p}{n_s} \cdot U_o/U_d}{1 + n_p/n_s \, U_o/U_d}$

$\Rightarrow \delta = \frac{4,457 \cdot 1/80}{1 + 4,457 \cdot 1/80} \Rightarrow \delta = 0,053$

Llave OFF:

$U_Q = U_{d\,min} + \frac{n_p}{n_s} \cdot U_D$

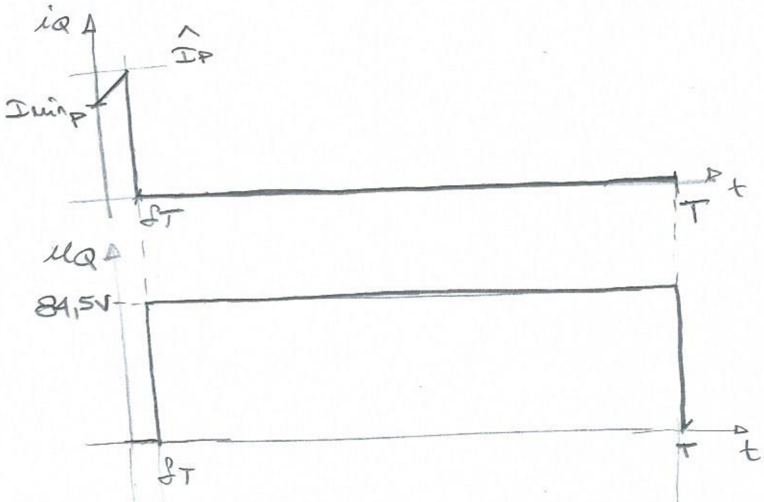
$U_Q = 80 + 4,457 \cdot 1 = 84,5V$

$\hat{I}_P = I_{min_p} + \frac{U_d}{L_p} \cdot \delta T$

$\Rightarrow I_{min_p} = \hat{I}_P - \frac{U_d}{L_p} \cdot \delta T$

$I_{min_p} = 6,19 - \frac{80 \cdot 0,053}{108,55\times10^{-6} \cdot 50\times10^{3}}$

$I_{min_p} = 5,41 A$ $\leftarrow$ MCC (ok)

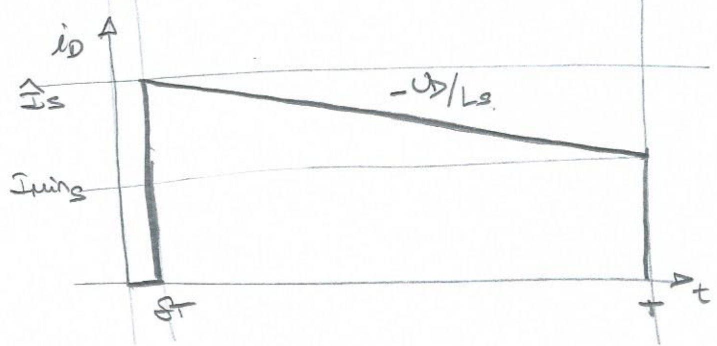



e) $\hat{I}_S = 27,59 A$

$I_{min_S} = \hat{I}_S - \frac{U_D}{L_S}(1-\delta)T$

$L_S = \left(\frac{n_s}{n_p}\right)^2 \cdot L_P = 0,224^2 \cdot 108,55\times10^{-6}$

$L_S = 5,45\,\mu H$




$I_{min_S} = 27,59 - \frac{1 \cdot (1-0,053)}{5,45\times10^{-6} \cdot 50\times10^{3}} \Rightarrow I_{min_S} = 24,11 A$ (*)

$\langle i_D \rangle = \frac{1}{\cancel{T}} \cdot \frac{1}{2}(\hat{I}_S + I_{min_S}) \cdot (1-\delta)\cancel{T} = \frac{27,59 + 24,11}{2} \cdot (1-0,053)$

$\Rightarrow \boxed{\langle i_D \rangle = 24,48 A}$

(*) Otra: $I_{min_S} = \frac{n_p}{n_s} I_{min_p} = 4,457 \cdot 5,41$

$I_{min_S} = 24,11 A$ ✓