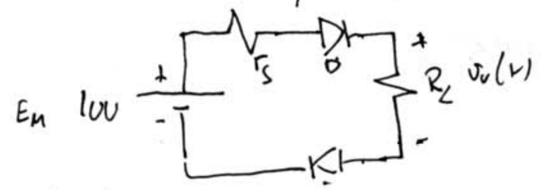
1) $v_0(t)$:

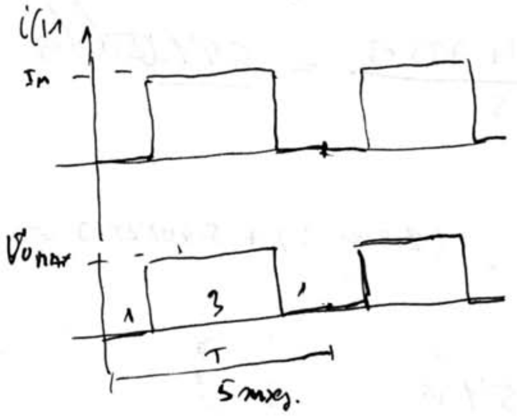
1

Circuit equivalente: cuando $v_i(t)$ vale $+E_M$ (100 v).



$$i(t) = \frac{E_M - 2E_d}{r_s + R_L} = \frac{100 - 2 \cdot 1'5}{20} = \frac{97}{20} = 4'85 \text{ Amp} = I_{MAX}$$

$I_{max} = 4'85$ Amp



$$V_{oMAX} = R_L \cdot I_{MAX} = 10 \cdot 4'85 = \underline{48'5 \text{ v}}$$

$$\overline{V_0(t)} = \frac{3}{5} \cdot 48'5 = \underline{29'1 \text{ V}}$$

$$V_0\Big|_{ef}^2 = \frac{1}{T}\int_0^T (V_0(t))^2 dt = \frac{1}{5} \cdot 48'5^2 \cdot 3 \Rightarrow$$

$$\underline{V_{0ef} = 37'57 \text{ v}}$$

$P_{Diod.} = \overline{i_D(t)} \cdot E_d =$

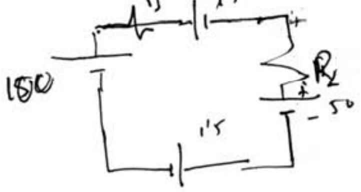
$$\overline{i_D(t)} = \frac{1}{2}\left[4'85 \cdot \frac{3}{5}\right] = 1'455 \text{ Amp}$$

$$P_{Diodo}\Big|_{promedio} = 1'455 \cdot 1'5 = 2'18 \text{ W}$$

$$P_{CARGA}: \frac{V_{ef}^2}{R} = \frac{37'57^2}{10} = \underline{\underline{141'2 \text{ W}}}$$

$$P_{FUENTE} = P_{R_s} + P_{R_L} + P_{Diodos} = 141'2 + 141'2 + 2'18 \cdot 4 = 291'1 \text{ W}$$

b) circuito equivalente cuando conduce el circuito.



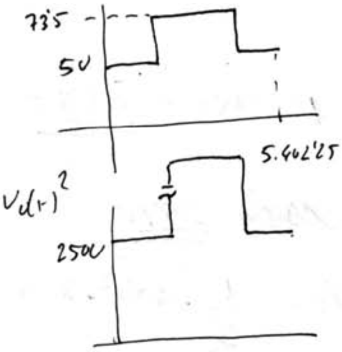
$$I(t) = \frac{100-50-3}{r_1+R_L} = 2'35 \text{ Amp}$$

$V_0(t)$

$0 \le t \le 1$ mseg. $\quad$ 50

$1 \le t \le 4$ mseg $\quad (50+2'35 \times 10) = 23'5+50 = 73'5$ v

$4 \le t \le 5$ mseg $\quad$ 50



$$\overline{V_o(t)} = \frac{2\times(50\times1)+73'5\times3}{5} = \underline{64'1 \text{ Volts}}$$

$$\frac{1}{T}\int_0^T V_o^2(t) = \frac{1}{5} \times (2.500\times2) + 5.402'25\times3 \Rightarrow$$

$$\underline{V_o|_{ef} = 65'1 \text{ v.}}$$

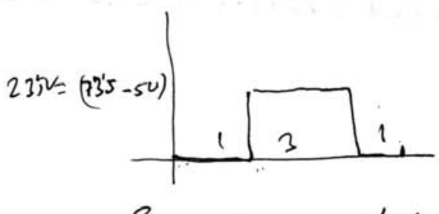
$$\frac{\overline{V_o(t)}}{R_L} = I_o = \frac{64'1-50}{10} = 1'41 \text{ Amp.}$$

$$P_{DIODOS} = \left(\frac{1'41}{2}\right)\times 1'5 = 1'0575 W$$

$$P_{R_L} = \frac{V_{ef}^2{}_{RESIS.}}{R_L}$$

FORMA DE ONDA DE TENSIÓN EN LA RESISTENCIA

$$V_{ef}^2 = (23'5)^2 \times \frac{3}{5} \Rightarrow P_{R_L} = \frac{23'5^2\times3}{5\times10} = 33'135 W$$



$$P_{BATERÍA} = 1'41 \times E_B = 1'41 \times 50$$

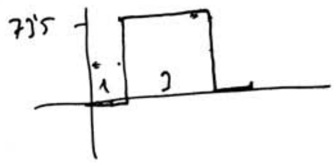
$$P_{FUENTE} = P_{R_L} + P_{R_S} + P_{BATERÍA} + P_{DIODOS} = 33'135 + 33'135 + 70'5 + 4'23$$
$$= 141 W.$$

3:)

$0 \le t \le 1\,mseg.$ 0

$1mseg \le t \le 4mseg$ 73'5V.

$4mseg \le t \le 5m$ 0



$73'5 \cdot \frac{3}{5} = \underline{\underline{44'1V}}$

$V_{ef}^2 = 73'5^2 \cdot \frac{3}{5} \Rightarrow V_{ef} = 56'93V.$

$i_o(t)$: $0 \le t \le 1\,mseg.$ 0

$1mseg \le t \le 4mseg$ $\frac{73'5-50}{10} = 2'35\,Amp.$

$4mseg \le t \le 5mseg$ 0

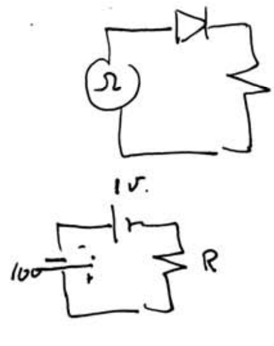
$I_o = 2'35 \cdot \frac{3}{5} = \underline{1'41\,Amp}$

$P_D = \frac{1'41}{2} \cdot 1'5 = 1'0575$

$P_{RL} = I_{ef}^2 \cdot R_L$ Como la función corriente es la misma que en el apartado anterior la potencia disipada en R_L será la misma

---

En conducción $I_o = \frac{100-1}{10} = \frac{99}{10} = \underline{9'9\,Amp}$



$Q_d = \tau_p \cdot I_o$ $\quad 0'5 \cdot 10^{-6} \cdot 9'9\,Amp =$

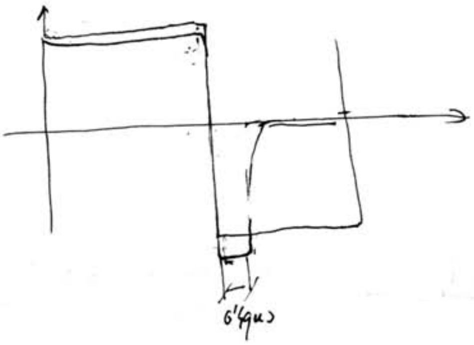
$Q_d = 4'95 \cdot 10^{-6}\,C.$

$I_{descarga} = \frac{101}{10} = 10'1\,Amp$

$10'1 \cdot t_a = 4'95 \cdot 10^{-6}\,C$

$t_a = \frac{4'95 \cdot 10^{-6}}{10'1} =$

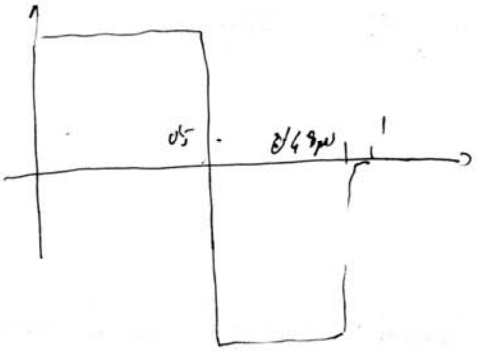
$100\,KHz \rightarrow T = 10\,\mu s \Rightarrow T/2 = 5\,\mu s$



$$\overline{V_o(t)} = \frac{(100-1)\cdot 5\mu s - (100+1)\cdot 0'49\mu s}{10\mu s} = 44'55V$$

$$\overline{V_o(t)} = 44'55V$$

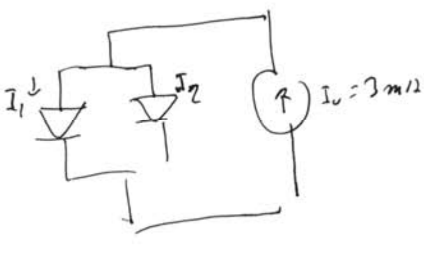
Para $f = 1\,MHz$, todos los valores son los mismos, salvo el periodo:



$$\overline{V_o(t)} = \frac{(100-1)\,0'5 - 101\cdot 0'49}{1\mu s} = \underline{\underline{0'01V}}$$

$$\overline{V_o(t)} = \underline{0'01V} \simeq \underline{\underline{0}}$$

$$i_D(t) = I_S\, e^{\frac{V_D}{\eta V_T}}$$



$$\left.\begin{array}{l} I_1 + I_2 = 3mA \\ \frac{I_1}{I_2} = 0'2 \end{array}\right\} \Rightarrow I_1 = 0'2 I_2$$

$$I_2 = 5 I_1$$

$$6 I_1 = 3mA \qquad I_1 = \frac{3}{6}\,mA = 0'5\,mA$$

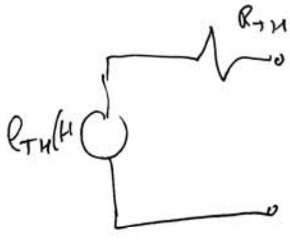
$$0'5\cdot 10^{-3} = 10^{-15}\cdot e^{\frac{V_D}{25mV}}$$

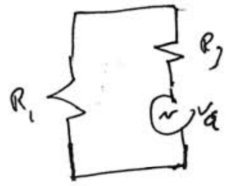
$$5\cdot 10^{11} = e^{\frac{V_D}{25mV}}$$

$$26'93 = \frac{V_D}{25mV} \Rightarrow V_D = 0'67325V.$$

FIGURA 3.

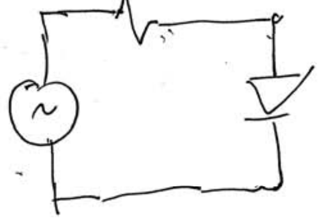
CIRCUITO EQUIVALENTE THEVENIN:



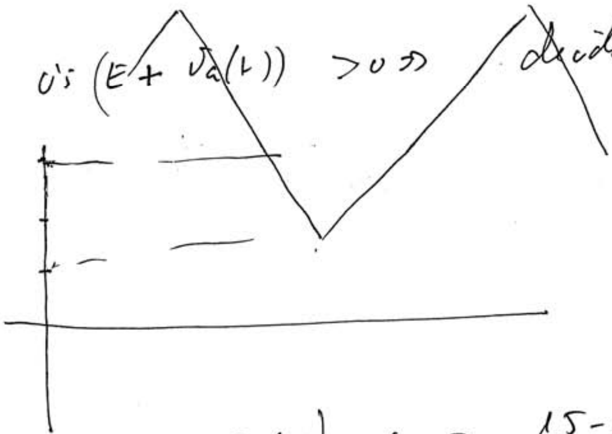


$$e_{TH} = E \times \frac{R_3}{R_1+R_3} + \frac{R_1}{R_1+R_3} v_a = 0'5\,E + 0'5\,v_a$$

$R_{TH} = 0'5K + 2K = 2'5\,K$



$0'5\,(E + v_a(t)) > 0 \Rightarrow$ diodo conduce



Como $E + v_a(t)\big|_{min} = 15 - 10 = 5$ v., el diodo está siempre conduciendo. $\Rightarrow$ $\underline{v_d(t) \simeq 0\,v}$

$$\overline{i_D(t)} = I_D = \frac{0'5\,E}{R_{TH}} = \frac{0'5 \times 15}{2'5\,K} = 3\,mA$$

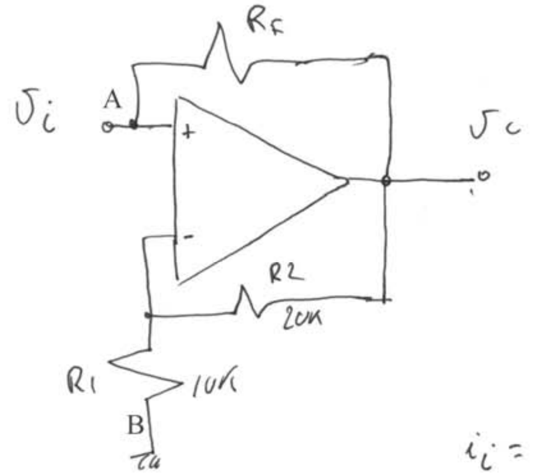
$\overline{v_2(t)} - \overline{v_3(t)} = R_2 \times \overline{i_{D1}(t)} \Rightarrow$

$\overline{v_2(t)} = R_2\,\overline{i_{D1}(t)} + \overline{v_3(t)} = 2K \times 3mA + 0 \Rightarrow$

$$\boxed{\overline{v_2(t)} = 6 \text{ voltios}}$$

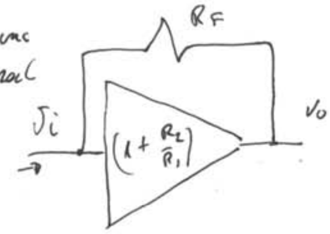
$\overline{i_{R1}(t)} = (E - \overline{v_2(t)})/R_1 = \frac{15-6}{1K} = 9\,mA$

$\overline{i_{R3}(t)} = \frac{\overline{v_2(t)} - 0}{R_3} = \frac{6}{1K} = 6\,mA$



Si funciona linealmente

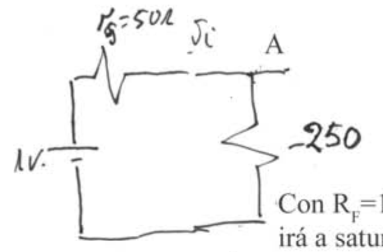
≡



$V_o = A V_i$

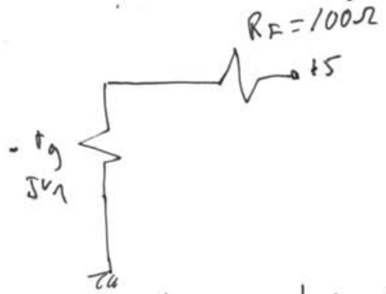
$$i_i = \frac{V_i - V_o}{R_F} = \frac{V_i - A V_i}{R_F} = \frac{V_i(1-A)}{R_F}$$

$$\boxed{\frac{V_i}{i_i} = \frac{R_F}{1-A}} = \frac{R_F}{1-3} = -\frac{R_F}{2} = \text{-500 ohmios @ } R_F\text{=1k}$$



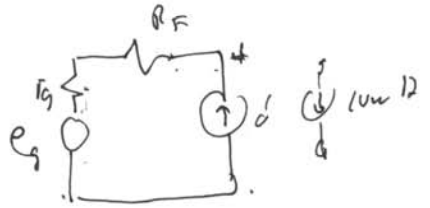
@ R_F=500 ohmios,
R_i= -250 ohmios => $V_A = \frac{-250}{-250+50} 1 = \frac{-250}{-200} = 1'25\ V.$

Con R_F=100 ohmios y r_g=50 ohm, el A.O tiene relimentacion neta positiva,yla salida se irá a saturación positiva o negativa. Pero entra en acción la protección contra sobrecorriente



$\frac{15}{150} \div 100mA$ => entra en juego la protección contra sobrecorriente.
$100mA \times 15\Omega$

En el último apartado también entra en juego la protección contra sobrecorriente



$V_o = (R_F + r_g) I_o + e_g$

$V_o(t) = 15\Omega \times 100mA + e_g = 1'5V + V_{in}$