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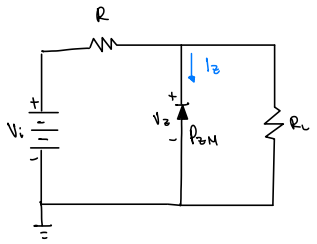
ELECTRÓNICA BÁSICA
GRUPO:4
TAREA 6: DIODO ZENER



Determinar V_{RL}, V_R, I_Z y P_Z

$$V = V_L = \frac{R_L V_i}{R + R_L}$$

① $V_i = 15\,|V|$, $R = 1000\,|\Omega|$, $R_L = 2700\,|\Omega|$, $V_Z = 10\,|V|$, $P_{ZM} = 40\,|mW|$

$$V = V_L = \frac{R_L V_i}{R + R_L} = \frac{(2700\,|\Omega|)(15\,V)}{(1000 + 2700)\,|\Omega|} = 10.946\,|V| \Rightarrow V_Z < V \therefore \text{Zener encendido}$$

$$V_R = V_i - V_{RL} = (15 - 10)\,|V| = 5\,|V| \qquad V_{RL} = 10\,|V|$$

$$I_Z = I_R - I_L = (5 - 3.704)\,|mA| = 1.296\,|mA|$$

$$I_R = \frac{5\,|V|}{1000\,|\Omega|} = 5\,|mA| \qquad I_L = \frac{10\,|V|}{2700\,|\Omega|} = 3.704\,|mA|$$

$$P_Z = V_Z I_Z = (10\,|V|)(1.296\,mA) = 12.96\,|mW|$$

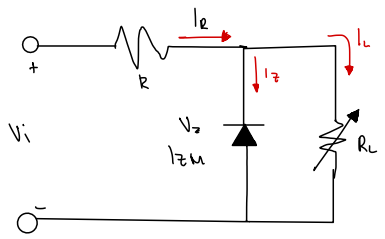
② $V_i = 18\,|V|$, $R = 910\,|\Omega|$, $R_L = 2200\,|\Omega|$, $V_Z = 12\,|V|$, $P_{ZM} = 30\,|mW|$

$$V = V_L = \frac{R_L V_i}{R + R_L} = \frac{(2200\,\Omega)(18\,|V|)}{(910 + 2200)\,|\Omega|} = 12.7331\,|V| \qquad V_Z < V \qquad \text{Zener encendido}$$

$$V_R = V_i - V_{RL} = (18 - 12)\,|V| = 6\,|V| \qquad V_{RL} = V_Z = 12\,|V|$$

$$I_Z = I_R - I_L = \frac{V_R}{R_R} - \frac{V_{RL}}{R_L} = (6.5934 - 5.4545)\,|mA| = 1.1389\,|mA|$$

$$P_Z = V_Z I_Z = (12\,|V|)(1.1389\,|mA|) = 13.667\,|mW|$$



Determine los intervalos de R_L e I_L que hagan que V_L se mantenga en el valor nominal del diodo Zener

Determine el valor nominal de potencias del diodo Zener en Watts.

1 $V_i = 35\,|V|$, $R = 680\,|\Omega|$, $V_z = 11\,|V|$, $I_{ZM} = 30\,mA$

$$V_{RL} = \frac{R_L}{R_L + R}(V_i) \Rightarrow \frac{V_{RL}}{V_i} = \frac{R_L}{R_L + R} \Rightarrow \frac{V_i}{V_{RL}} = \frac{R_L + R}{R_L} \Rightarrow \frac{V_i}{V_{RL}} = 1 + \frac{R}{R_L}$$

$$\Rightarrow \frac{V_i}{V_{RL}} - 1 = \frac{R}{R_L} \Rightarrow R_L = \frac{R}{\left(\frac{V_i}{V_{RL}} - 1\right)} \Rightarrow R_L = \frac{680\,|\Omega|}{\left(\frac{35}{11}\,|V| - 1\right)} = 311.6671\,|\Omega|$$

Mínima para que Zener funcione

$$I_{LMAX} = \frac{11\,|V|}{311.6671\,|\Omega|} = 35.2941\,|mA|$$

$$I_R = \frac{(35-11)\,|V|}{680} = 35.2941\,|mA|$$

$$\Rightarrow I_{LMIN} = I_{LMAX} - I_{ZM} = (35.2941 - 30)\,|mA| = 5.2941\,|mA|$$

$$R_{LMAX} = \frac{11\,|V|}{5.2941\,|mA|} = 2077.7847\,|\Omega|$$

$\therefore\ 5.2941 \leq I_L \leq 35.29\ |mA|$

$311.667 \leq R_L \leq 2077.7847\ |\Omega|$

$0 \leq P_z \leq 0.33\ |W|$

Si $R_L = 311.6671\,|\Omega|$

$I_Z = 0$

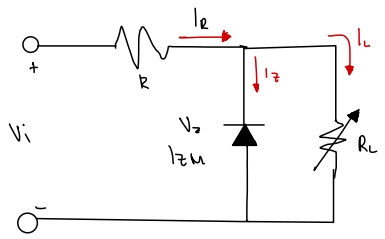
$P_z = (11\,|V|)(0) = 0\,|W|$

Si $R_L = 2077.7847\,|\Omega|$

$I_{RL} = 5.2941\,|mA|$

$I_z = 30\,|mA|$

$P_z = (11\,|V|)(30\,mA) = 0.33\,|W|$



Determine los intervalos de R_L e I_L que hagan que V_L se mantenga en el valor nominal del diodo Zener

Determine el valor nominal de potencias del diodo Zener en Watts.

2 $V_i = 40\,|V|$, $R = 500\,|\Omega|$, $V_z = 12\,|V|$, $I_{ZM} = 40\,|mA|$

$$V_{RL} = \frac{R_L}{R_L + R}(V_i) \Rightarrow \frac{V_{RL}}{V_i} = \frac{R_L}{R_L + R} \Rightarrow \frac{V_i}{V_{RL}} = \frac{R_L + R}{R_L} \Rightarrow \frac{V_i}{V_{RL}} = 1 + \frac{R}{R_L}$$

$$\Rightarrow \frac{V_i}{V_{RL}} - 1 = \frac{R}{R_L} \Rightarrow R_L = \frac{R}{\left(\frac{V_i}{V_{RL}} - 1\right)} \Rightarrow \frac{500\,|\Omega|}{\left(\frac{40}{12}|V| - 1\right)} = 214.286\,|\Omega|$$

$$I_{LMAX} = \frac{12\,|V|}{214.286\,|\Omega|} = 55.99\,|mA| \qquad I_R = \frac{(40-12)\,|V|}{500\,|\Omega|} = 56\,|mA|$$

$$I_{LMIN} = I_R - I_{ZM} = 56 - 40\,|mA| = 16\,|mA|$$

$$R_{LMAX} = \frac{12\,|V|}{16\,|mA|} = 750\,|\Omega|$$

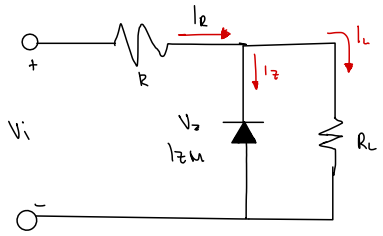
Si $R_L = 214.286\,|\Omega|$
$I_Z = 0\,|A|$
$P_Z = (12\,|V|)(0\,|A|) = 0\,|W|$

Si $R_L = 750\,|\Omega|$
$I_L = 16\,|mA|$
$I_Z = 40\,|mA|$
$P_Z = (12\,|V|)(40\,mA) = 0.48\,|W|$

$$16 \leq I_{RL} \leq 56\,|mA|$$

$$214.286 \leq R_{RL} \leq 750\,|\Omega|$$

$$0 \leq P_Z \leq 0.48\,|W|$$



Determine el intervalo de valores de V_i que mantendrá "encendido" el diodo Zener de la fig.

Utilice los siguientes datos

① $R = 120\,\Omega$, $R_L = 330\,\Omega$, $V_Z = 5.1\,V$, $I_{ZM} = 40\,mA$

$$V_{RL} = \frac{R_L}{R_L + V_L}(V_i) \Rightarrow \frac{V_{RL}}{V_i} = \frac{R_L}{R_L + R} \Rightarrow V_i = \frac{V_{RL}}{\frac{R_L}{R_L + R}} = \frac{V_{RL}(R_L + R)}{R_L}$$

$$V_{i_{MIN}} = \frac{(5.1\,V)(330 + 120\,\Omega)}{330\,\Omega} = 6.9545\,V$$

$$I_L = \frac{5.1\,V}{330\,\Omega} = 15.\overline{45}\,mA \Rightarrow I_{R_{MAX}} = I_L + I_{ZM} = 15.\overline{45} + 40\,mA = 55.\overline{45}\,mA$$

$$V_R = (120\,\Omega)(55.\overline{45}\,mA) = 6.654\,V$$

$$\Rightarrow V_{i_{MAX}} = V_{R_{MAX}} + V_Z = 6.654 + 5.1\,V = 11.754\,V$$

$$\therefore\ 6.9545 \le V_i \le 11.7541\,V$$

② $R = 150\,\Omega$, $R_L = 330\,\Omega$, $V_Z = 12\,V$, $I_{ZM} = 60\,mA$

$$V_{RL} = \frac{R_L}{R_L + V_L}(V_i) \Rightarrow \frac{V_{RL}}{V_i} = \frac{R_L}{R_L + R} \Rightarrow V_i = \frac{V_{RL}}{\frac{R_L}{R_L + R}} = \frac{V_{RL}(R_L + R)}{R_L}$$

$$V_{i_{MIN}} = \frac{(12\,V)(330 + 150)\,\Omega}{330\,\Omega} = 17.\overline{45}\,V$$

$$I_L = \frac{12\,V}{330\,\Omega} = 36.\overline{36}\,mA \Rightarrow I_{R_{MAX}} = I_L + I_{ZM} = 36.\overline{36} + 60 = 96.\overline{36}\,mA$$

$$V_R = (150\,\Omega)(96.\overline{36}\,mA) = 14.454\,V$$

$$V_{i_{MAX}} = V_{R_{MAX}} + V_Z = 14.454 + 12\,V = 26.454\,V$$

$$\therefore\ 17.\overline{45} \le V_i \le 26.454\,V$$