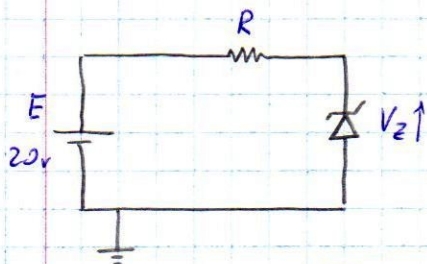


1.5.2.2.2



$$P_{Zmax} = 100mW; \quad I_{Zmin} = 0,1mA$$

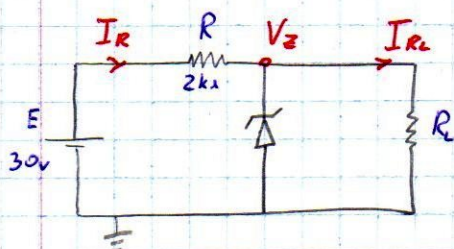
$$V_Z = 10V$$

$$P_{Zmax} = I_{Zmax} \cdot V_Z; \quad I_{Zmax} = \frac{P_{Zmax}}{V_Z} = \frac{100m}{10} = 10mA$$

$$I_{Zmax} = \frac{E - V_Z}{R_{min}}; \quad 10mA = \frac{20 - 10}{R_{min}}; \quad R_{min} = 1k\Omega$$

$$I_{Zmin} = \frac{E - V_Z}{R_{max}}; \quad 0,1mA = \frac{20 - 10}{R_{max}}; \quad R_{max} = 100k\Omega$$

$$1k\Omega \leq R \leq 100k\Omega$$



2.5.2.2.2

$$P_{Zmax} = 200mW$$

$$I_{Zmin} = 3mA$$

$$V_Z = 6V$$

① $R_L = 10k\Omega \quad I_Z = ?$

$$I_R = \frac{E - V_Z}{R} = \frac{30 - 6}{2k} = 12mA$$

$$I_{RL} = \frac{V_Z}{R_L} = \frac{6}{10k} = 0,6mA$$

$$I_Z = I_R - I_{RL} = 12 - 0,6 = 11,4mA //$$

② $I_R - I_{RL} = I_{Zmin}$

$$12mA - \frac{6}{R_{Lmin}} = 3mA; \quad \frac{12R_{Lmin} - 3}{R_{Lmin}} = 3$$

$$R_{Lmin} = \frac{6}{9} = 0,666k\Omega$$

③ $I_{Zecn} = \frac{I_{Zmax}}{2} \quad R_L = 10k\Omega \quad R = ?$

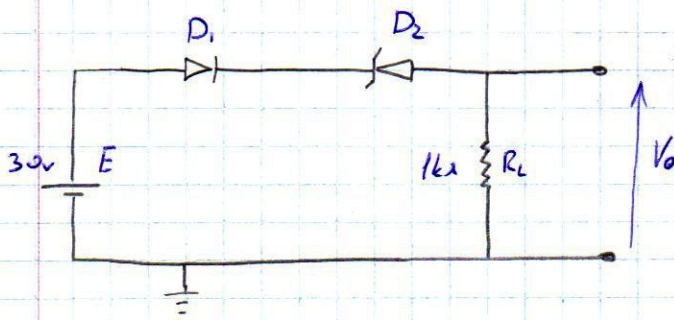
$$I_{Zmax} = \frac{P_{Zmax}}{V_Z} = \frac{200m}{6} = 33,33mA$$

$$I_{Zecn} = \frac{33,33}{2} = 16,66mA$$

$$I_{RL} = \frac{U_Z}{R_L} = \frac{6}{10k} = 0,6mA; \quad I_R = I_{RL} + I_{Zecn} = 17,26mA$$

$$\frac{E - V_Z}{R} = I_R; \quad \frac{30 - 6}{R} = 17,26; \quad R = 1,39k\Omega //$$

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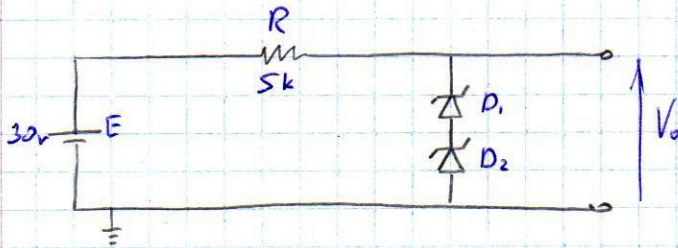
$$V_Z = 10V$$

$$I_{R_L} = \frac{E - V_Z}{R_L} = \frac{30 - 10}{1k} = 20mA //$$

$$V_o = I_{R_L} \cdot R_L = 20mA \cdot 1k\Omega = 20V //$$

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1



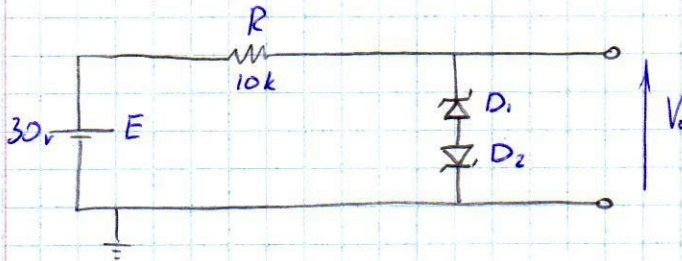
$$V_Z = 10V$$

$$V_{D_{ON}} = 0.7V$$

$$I_{R_s} = \frac{E - V_Z - V_Z}{R} = \frac{30 - 10 - 10}{5k} = 2mA$$

$$V_o = V_Z + V_Z = 20V$$

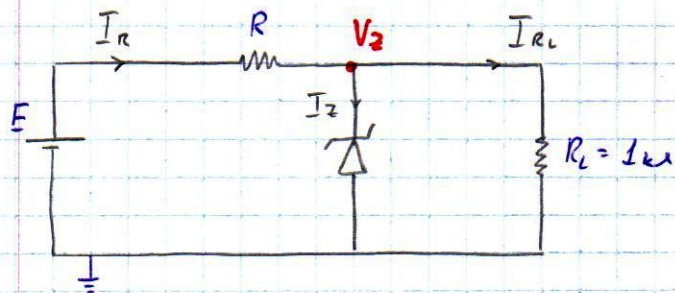
2



$$V_o = 10 + 0.7 = 10.7V \quad \left\{ \begin{array}{l} V_{D_1} = 10V \leftarrow \text{нагрузка} - D_1 \\ V_{D_2} = 0.7V \leftarrow \text{нагрузка} - D_2 \end{array} \right.$$

$$I_R = \frac{E - \Delta U_{D_0}}{R} = \frac{30 - 10.7}{10k} = 1.93mA //$$

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$$I_{Z_{max}} = 40 \text{ mA}$$

$$I_{Z_{min}} = 2 \text{ mA}$$

$$V_Z = 10 \text{ V}$$

$$E = 20 \pm 2 \text{ V}$$

$$U_{R_L} = 10 \text{ V}$$

$$I_{R_L} = \frac{U_{R_L}}{R_L} = \frac{10}{1k} = 10 \text{ mA}$$

$$I_R - I_{R_L} = I_Z$$

$$R_{min} = \frac{E_{max} - V_Z}{I_{R_{max}}}$$

$$I_{R_{max}} = I_{Z_{max}} + I_{R_L} = 40 + 10 = 50 \text{ mA}$$

$$E_{max} = 20 + 2 = 22 \text{ V}$$

$$R_{min} = \frac{22 - 10}{50 \text{ m}} =$$

$$= 0,24 \text{ k}\Omega$$

$$R_{max} = \frac{E_{min} - V_Z}{I_{R_{min}}}$$

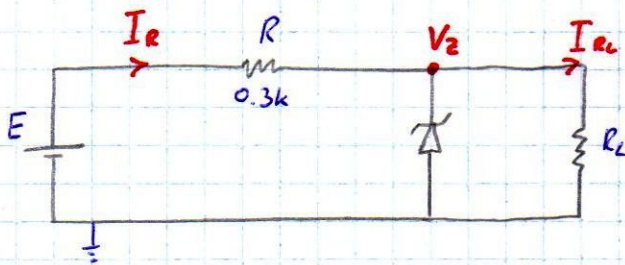
$$I_{R_{min}} = I_{Z_{min}} + I_{R_L} = 2 + 10 = 12 \text{ mA}$$

$$E_{min} = 20 - 2 = 18 \text{ V}$$

$$R_{max} = \frac{18 - 10}{12} =$$

$$= 0,666 \text{ k}\Omega$$

$$0,24 \text{ k}\Omega \leq R \leq 0,666 \text{ k}\Omega$$



6.5.277

$$I_{Zmax} = 40 \text{ mA}$$

$$I_{Zmin} = 2 \text{ mA}$$

$$V_Z = 10 \text{ V}$$

$$E = 21 \pm 3 \text{ V}$$

$$U_{RL} = 10 \text{ V}$$

~~Handwritten scribble~~

$$I_Z = I_R - I_{RL}$$

$$I_{Zmin} < I_R - I_{RL}$$

$$I_{Zmin} < \frac{E_{min} - V_Z}{R} - \frac{V_Z}{R_L}$$

$$2 \text{ mA} < \frac{21 - 3 - 10}{0.3} - \frac{10}{R_L}$$

$$2 \text{ mA} < 26,66 - \frac{10}{R_L}$$

$$-24,66 \text{ mA} < -\frac{10}{R_L}$$

$$R_L > 0,4 \text{ k}\Omega$$

$$I_R - I_{RL} < I_{Zmax}$$

$$\frac{E_{max} - V_Z}{R} - \frac{V_Z}{R_L} < I_{Zmax}$$

$$\frac{21 + 3 - 10}{0.3} - \frac{10}{R_L} < 40 \text{ mA}$$

$$46,66 - \frac{10}{R_L} < 40 \text{ mA}$$

$$-\frac{10}{R_L} < -6,66$$

$$R_L > 1,5 \text{ k}\Omega$$

$$1,5 \text{ k}\Omega \geq R_L \geq 0,4 \text{ k}\Omega$$