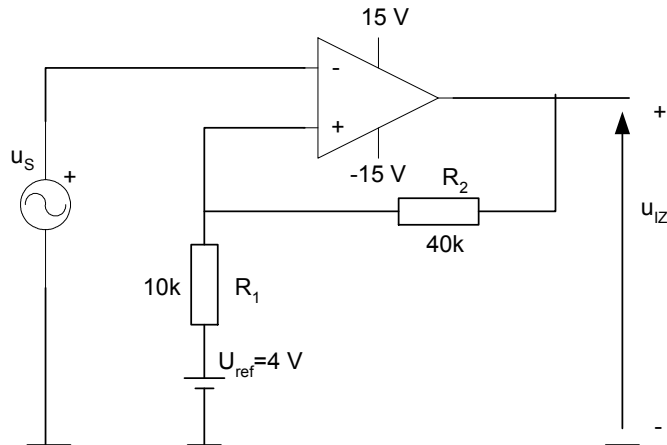


Zadatak 1.

Za komparator na slici nacrtati prijenosnu karakteristiku.



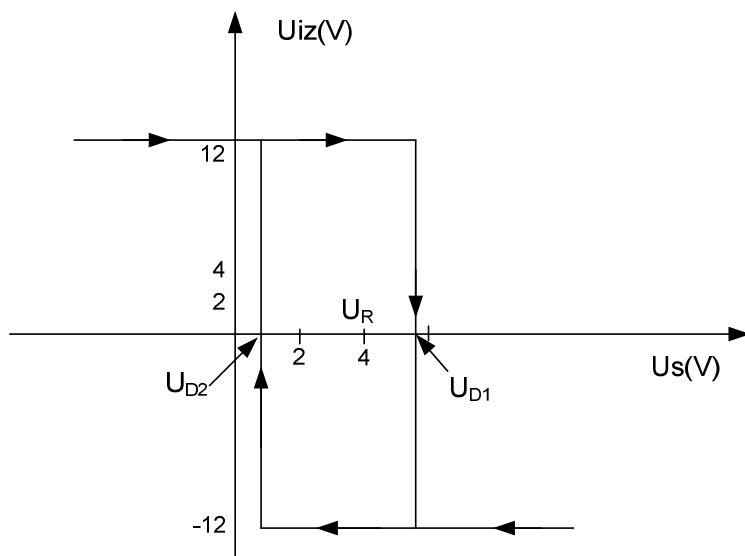
Za visokom i niskom razini uzima se vrijednost 80% napona napajanja.

$U_V = 12V$ i $U_N = -12V$. Dok je ulazni napon niži od napona na neinvertirajućem ulazu izlazni napon ima najveću vrijednost (U_V).

$$u_{D1} = U_{ref} * \frac{R_2}{R_1 + R_2} + U_V * \frac{R_1}{R_1 + R_2} = 5,6V$$

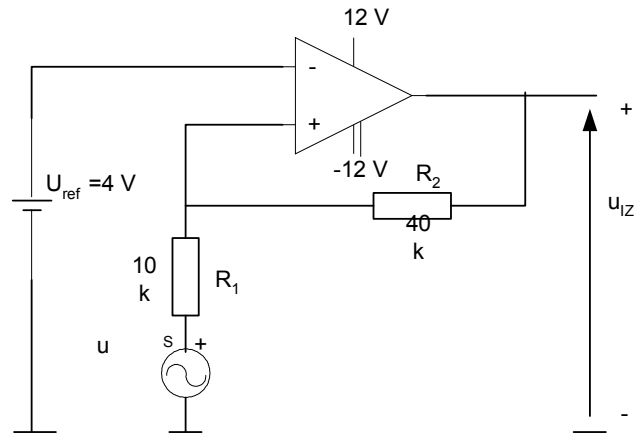
Kad ulazni napon neznatno nadvisi napon na neinvertirajućem ulazu (postane neznatno veći od u_{D1}) izlazni napon komparatora se mijenja na najnižu razinu (U_N).

$$u_{D2} = U_{ref} * \frac{R_2}{R_1 + R_2} + U_N * \frac{R_1}{R_1 + R_2} = 0,8V$$



Zadatak 2

Za komparator na slici nacrtati prijenosnu karakteristiku.



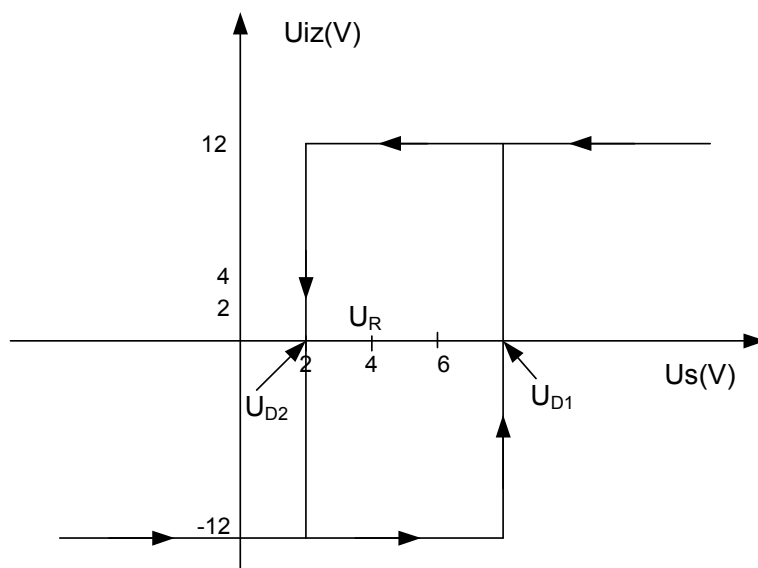
$$U_V = 12\text{V} \text{ i } U_N = -12\text{V}$$

Izlazni napon ima vrijednost U_N sve dok je ulazni napon niži od:

$$u_{D1} = U_{ref} * \frac{R_1 + R_2}{R_2} + |U_N| * \frac{R_1}{R_2} = 8\text{V}$$

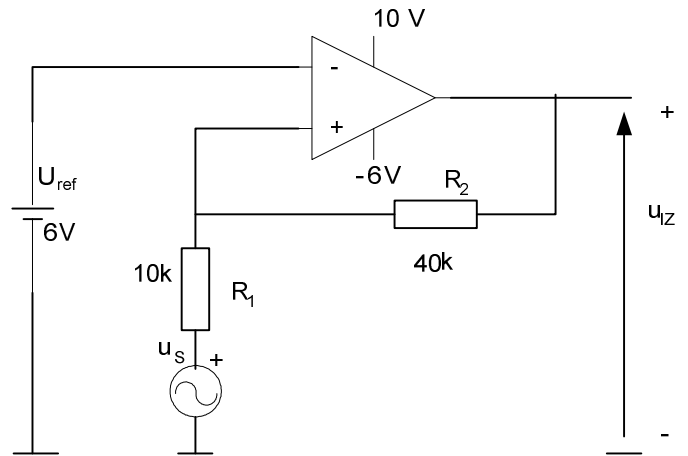
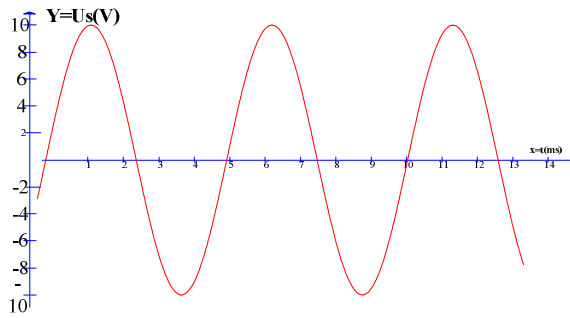
Tada izlazni napon poprimi vrijednost U_V i na toja vrijednosti je sve dok ulazni napon ne dosegne vrijednost:

$$u_{D2} = U_{ref} * \frac{R_1 + R_2}{R_2} - U_V * \frac{R_1}{R_2} = 2\text{V}$$



Zadata 3.

- a) Za komparator na slici nacrtati prijenosnu karakteristiku.
 b) Nacrtati vremesku ovisnost izlaznog signala

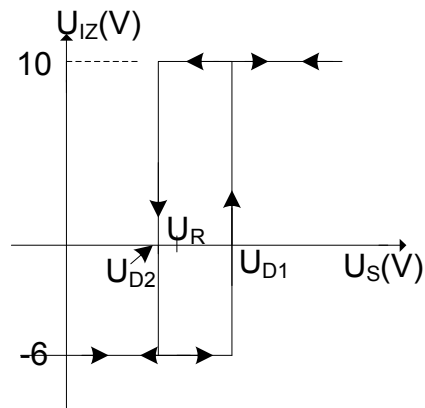


Rješenje:

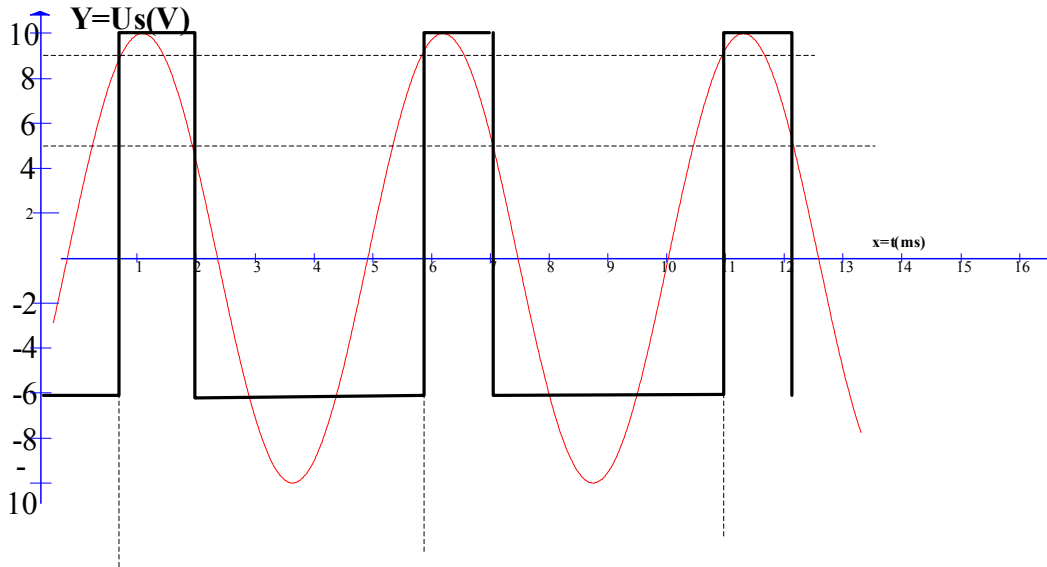
a)

$$u_{D1} = U_{ref} * \frac{R_1 + R_2}{R_2} + |U_N| * \frac{R_1}{R_2} = 9V$$

$$u_{D2} = U_{ref} * \frac{R_1 + R_2}{R_2} - U_V * \frac{R_1}{R_2} = 5V$$

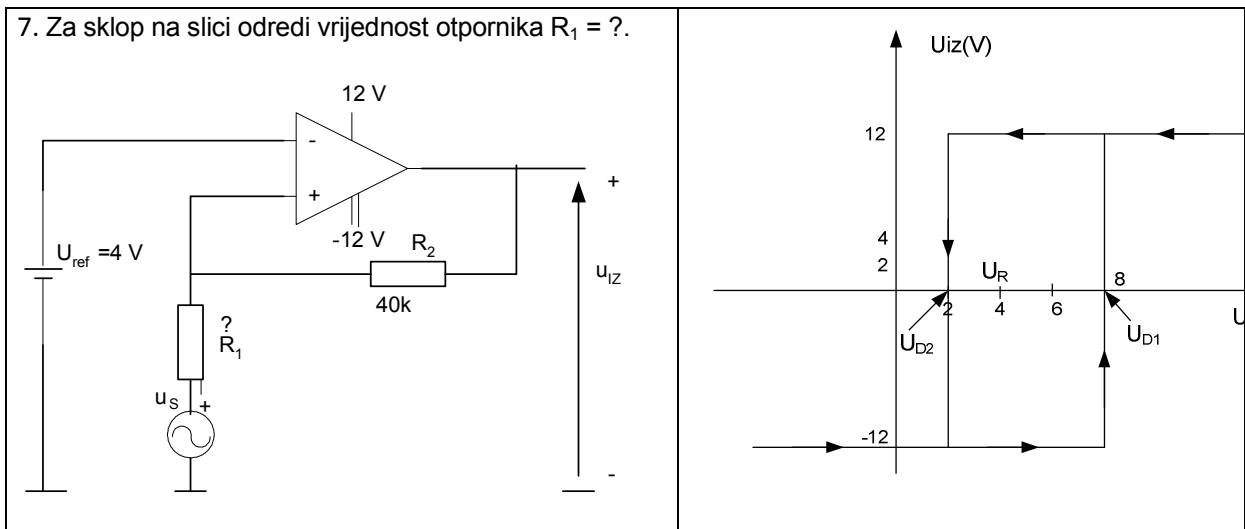


b)



Zadatak 4.

7. Za sklop na slici odredi vrijednost otpornika $R_1 = ?$.



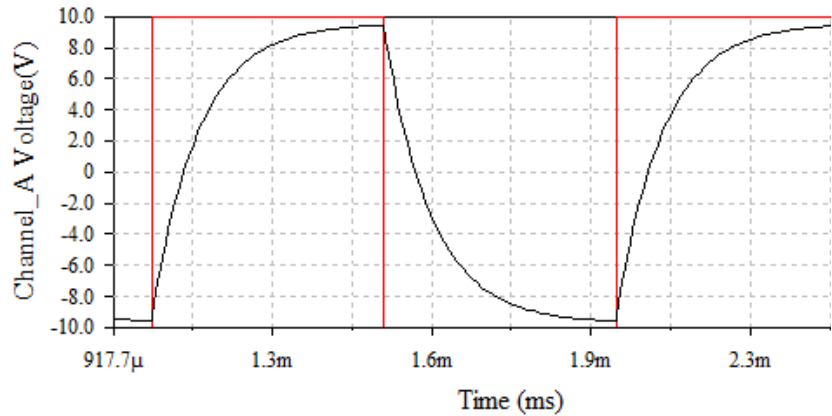
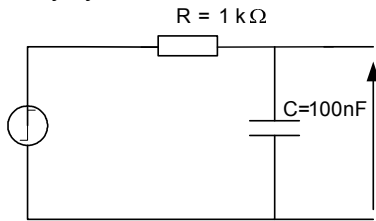
$$I) u_{D1} = U_{ref} * \frac{R_1 + R_2}{R_2} + |U_N| * \frac{R_1}{R_2} = 8V \Rightarrow 4 * \frac{R_1 + R_2}{R_2} + 12 * \frac{R_1}{R_2} = 8$$

$$II) u_{D2} = U_{ref} * \frac{R_1 + R_2}{R_2} - U_V * \frac{R_1}{R_2} = 2V \Rightarrow 4 * \frac{R_1 + R_2}{R_2} - 12 * \frac{R_1}{R_2} = 2$$

Sada od I) jednađbe oduzemo II) jednađbu!

$$II) u_{D1} - u_{D2} = 6 = 0 + 24 * \frac{R_1}{R_2} \Rightarrow \frac{R_1}{R_2} = \frac{6}{24} \Rightarrow R_1 = R_2 * \frac{6}{24} = 40 * \frac{6}{24} = 10 \text{ k}\Omega$$

5. a) Koji sklop je prikaza na slici 2%
 b) Izračunaj vremensku konstantu sklopa τ i označi je na dijagramu 2%
 c) Izračunaj U_{iz} za $t = \tau$ ($U_0=20V$) i označi ga na dijagramu 4%
 d) Izračunaj i na dijagramu označi vrijeme porasta 5%
 e) Izračunaj i na dijagramu označi kašnjenje 4%



Rješenje:

a) RC integrator.

$$b) \tau = R * C = 1 * 10^3 * 100 * 10^{-9} = 100 \mu s$$

$$c) U_{iz} = U_0 * (1 - e^{-t/\tau}) = U_0 * (1 - e^{-1}) = 20 * (1 - 0,37) = 20 * 0,63 = 12,6 V$$

d) Računamo za 10% i 90% konačnog signala

$$U_{iz} = U_0 * (1 - e^{-t/\tau}) \Rightarrow 2 = 20 * (1 - e^{-t/\tau}) \Rightarrow e^{-t/\tau} = 1 - \frac{2}{20} \Rightarrow -\frac{t}{\tau} = \ln(0,9) \Rightarrow t_1 = (-100) * (-0,1) = 10 \mu s$$

$$U_{iz} = U_0 * (1 - e^{-t/\tau}) \Rightarrow 18 = 20 * (1 - e^{-t/\tau}) \Rightarrow e^{-t/\tau} = 1 - \frac{18}{20} \Rightarrow -\frac{t}{\tau} = \ln(0,1) \Rightarrow t_2 = (-100) * (-2,3) = 230 \mu s$$

$$t_r = t_2 - t_1 = 220 \mu s$$

e) Računamo na 50% konačnog signala

$$U_{iz} = U_0 * (1 - e^{-t/\tau}) \Rightarrow 10 = 20 * (1 - e^{-t/\tau}) \Rightarrow e^{-t/\tau} = 1 - \frac{10}{20} \Rightarrow -\frac{t}{\tau} = \ln(0,5) \Rightarrow t_d = (-100) * (-0,7) = 70 \mu s$$

