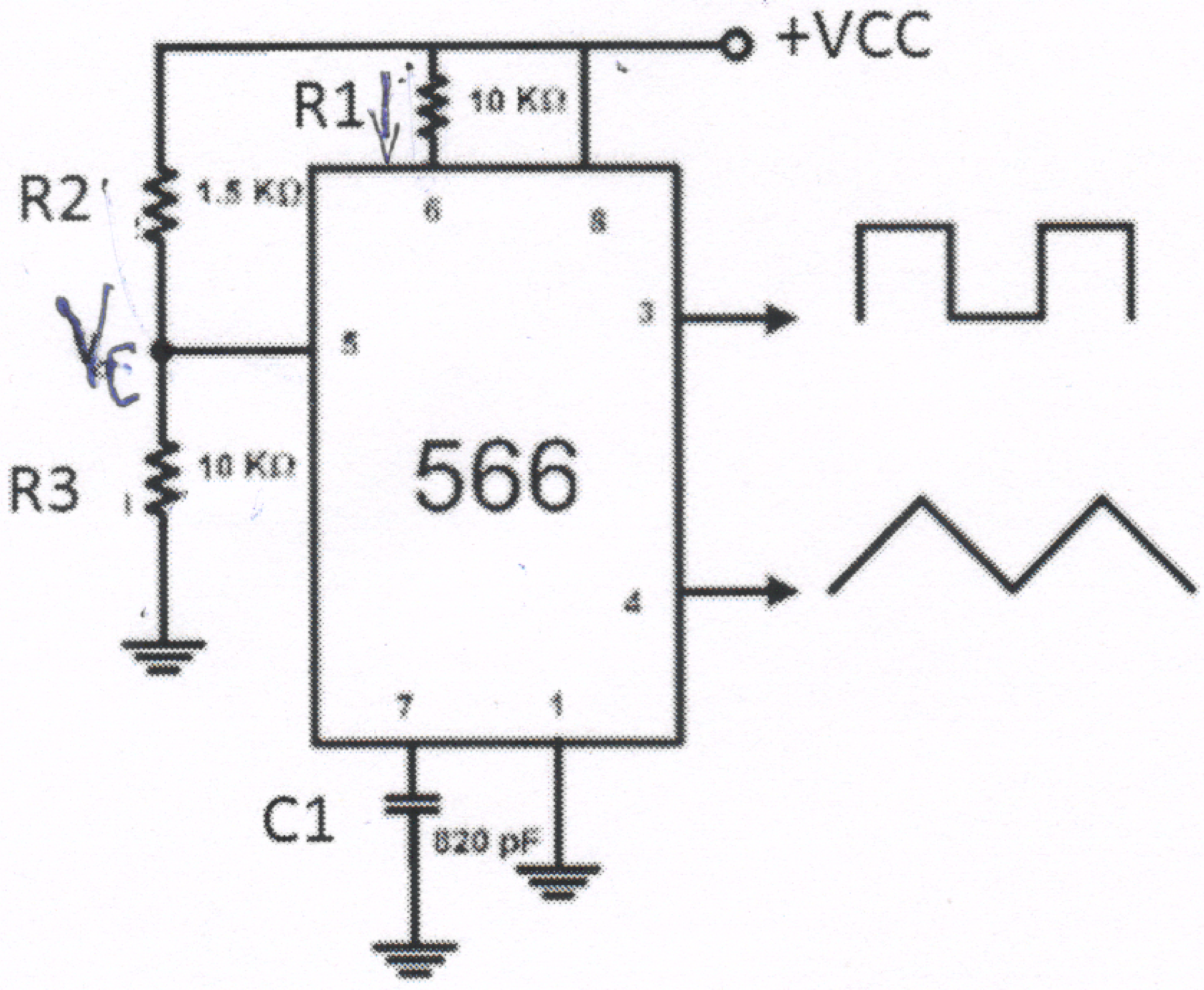
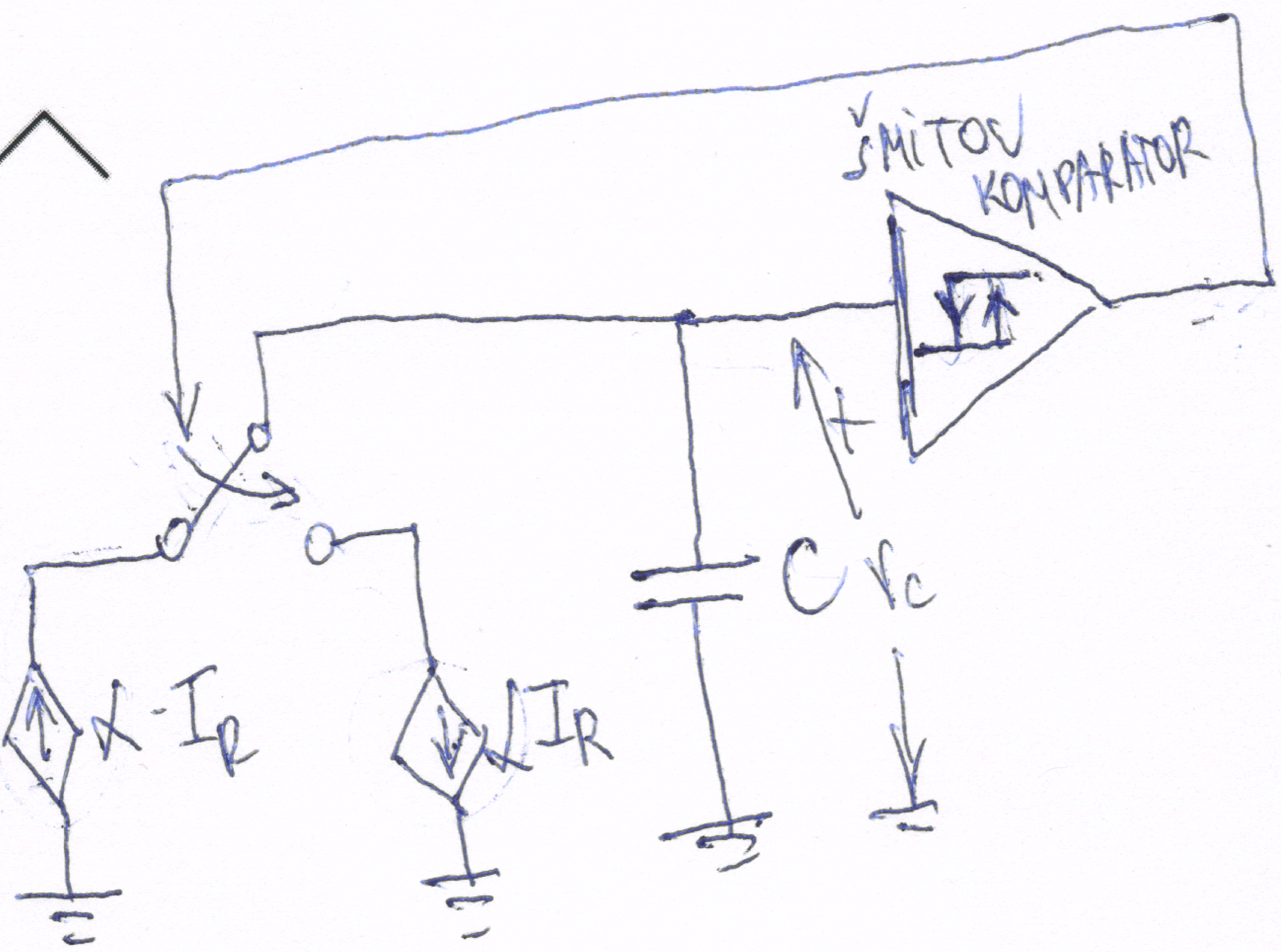
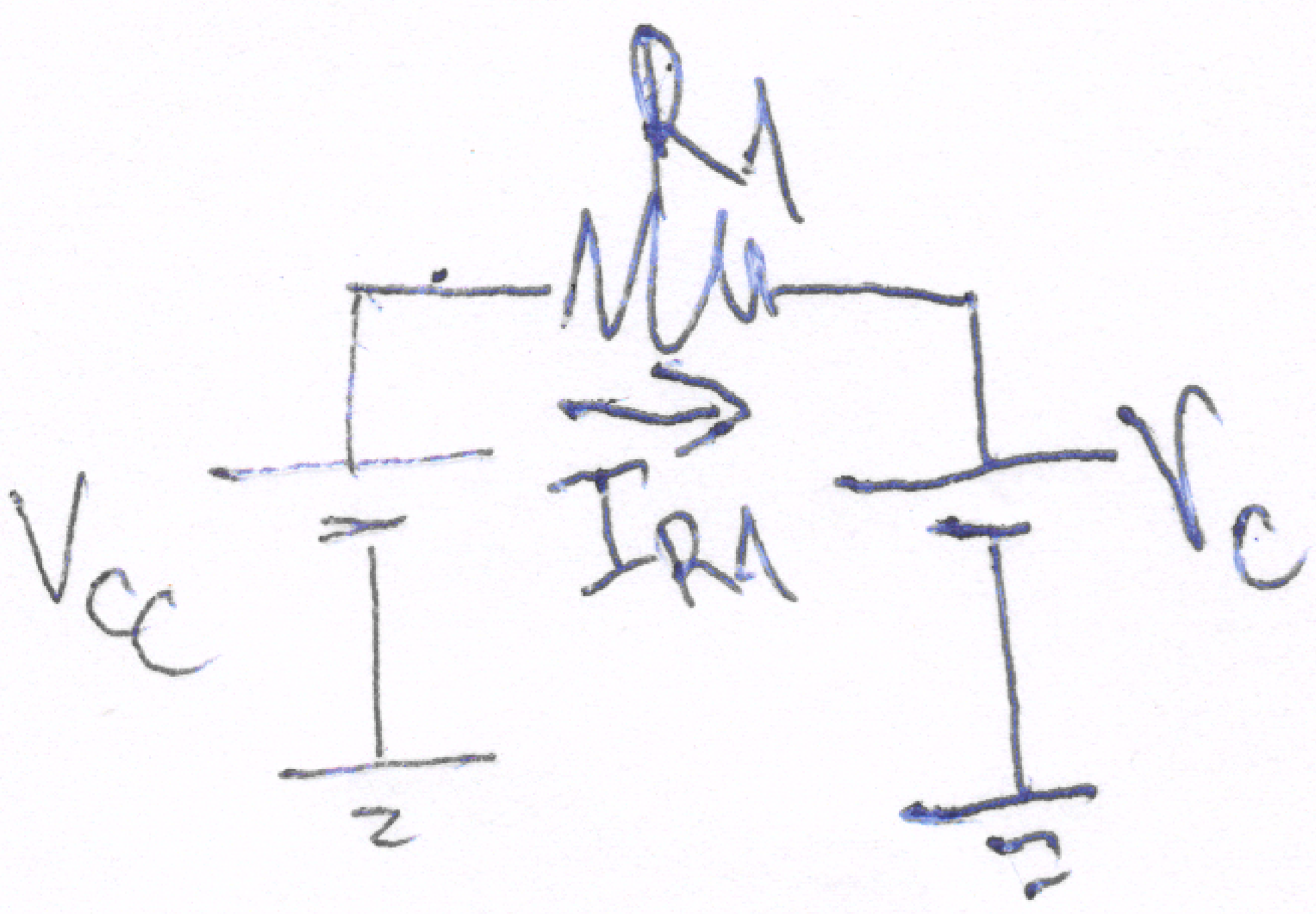
1. Za kolo naponom kontrolisanog oscilatora, prikazano na slici odrediti kontrolni napon i frekvenciju slobodnog oscilovanja, fo. Histerezis Šmitovog komparatora iznosi 3 V. Poznato je: R1=10kΩ; R2=1.5 kΩ; R3=10kΩ; C=820 pF; VCC=12 V.







$V_c(t_1) = V_{tL}$ – [illegible] нула; доњи праг окидања

$$V_c(t_1+\Delta t) = \frac{1}{C}\int_0^{\Delta t} i_R(t)\,dt + V_{tL}$$

$$i_R(t) = \frac{V_{cc}-V_c}{R_1}$$

$$V_c(t_1+\Delta t) = \frac{1}{C}\frac{(V_{cc}-V_c)}{R_1}\cdot\Delta t + V_{tL}$$

$$V_c\left(t_1+\frac{T}{2}\right) = \frac{1}{C}\cdot\frac{(V_{cc}-V_c)}{R_1}\cdot\frac{T}{2} + V_{tL} = V_{tH}$$

$$T = \frac{2(V_{TH}-V_{TL})}{(V_{cc}-V_c)}\cdot C\cdot R_1$$

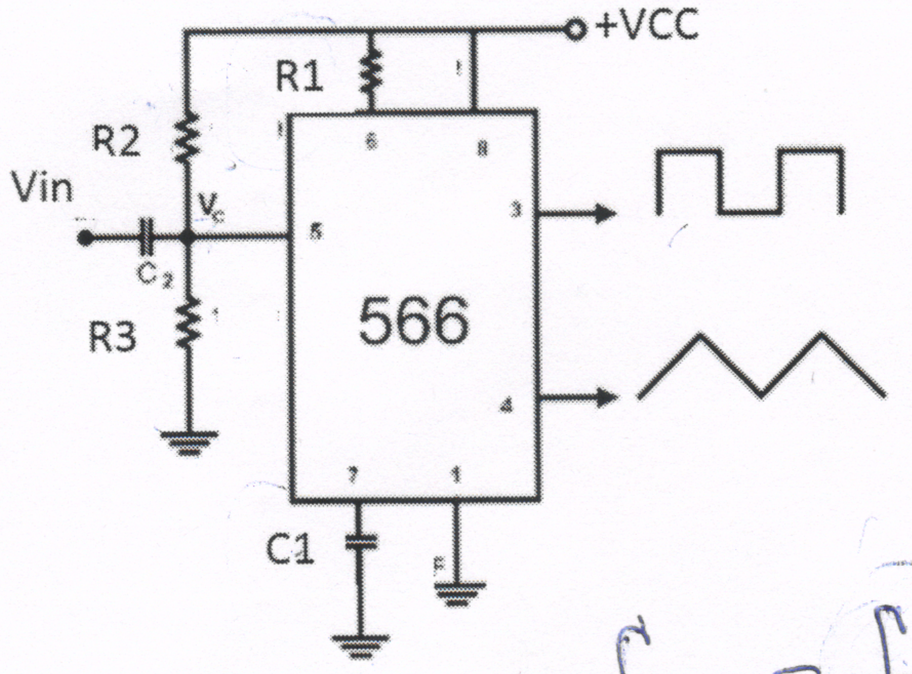
$$H = V_{tH} - V_{tL} = 3V$$

$$V_{cc} - V_c = V_{cc} - \frac{R_3}{R_2+R_3} \cdot V_{cc} = \left(1 - \frac{10}{11,5}\right) \cdot 12$$

$$f_0 = \frac{1}{T} = \frac{(V_{cc} - V_c)}{2(V_{TH} - V_{TL})} \frac{1}{CR_1} = 32,5 KHz$$

$$f_0 = \frac{2}{R_1 C} \quad \frac{V_{cc} - V_c}{V_{cc}}$$

2. Za kolo naponom kontrolisanog oscilatora, prikazano na slici odrediti elemente kola tako da frekvencija slobodnog oscilovanja iznosi f_0=30 kHz, a osetljivost naponom kontrolisanog oscilatora K_{VCO}=15000 $\frac{Hz}{V}$. Histerezis Šmitovog komparatora iznosi 3 V. Poznato je VCC=12 V.



$$f_{ot} = f_0 + K_{VCO} \cdot V_{ulaz}$$

$$v_2(t) = V_c + v_{cm} \sin \omega t$$

$$f_{ot} = \frac{[V_{cc} - V_c - v_{cm} \sin \omega t]}{2(V_{tH} - V_{tL})} \frac{1}{C_1 R_1}$$

$$f_0 = \frac{(V_{cc} - V_c)}{2(V_{tH} - V_{tL})} \frac{1}{C_1 R_1}$$

$$K_{VCO} = \frac{1}{2(V_{tH} - V_{tL}) \cdot C_1 R_1}$$

$$C_1 R_1 = \frac{1}{2(V_{tH} - V_{tL}) \cdot K_{VCO}}$$

$$\tau_1 = C_1 R_1 = \frac{1}{6V \cdot 15000 \frac{Hz}{V}} = 1{,}25 \cdot 10^{-5} s$$

$R_1 = 12{,}5 k\Omega$

$C_1 = 1 nF$

$C_1 R_1 = 1{,}25 \cdot 10^{-5} s$

$$f_0 = \frac{(V_{cc} - V_c)}{2(V_{tH} - V_{tL})} \frac{1}{CR} = (V_{cc} - V_c) \cdot K_{VCO}$$

$$V_{cc} - V_c = \frac{f_0}{K_{VCO}}$$

$$V_c = V_{cc} - \frac{f_0}{K_{VCO}} = 12V - \frac{3 \cdot 10^4 Hz}{1,5 \cdot 10^4 \frac{Hz}{V}}$$

$$V_c = 12V - 2V = 10V$$

$$V_c = \frac{R_3}{R_2 + R_3} \cdot V_{cc}$$

$$1 + \frac{R_2}{R_3} = \frac{V_{cc}}{V_c} = 1,2$$

$$\frac{R_2}{R_3} = 0,2$$

$R_2 = 2K\Omega$

$R_3 = 10K\Omega$