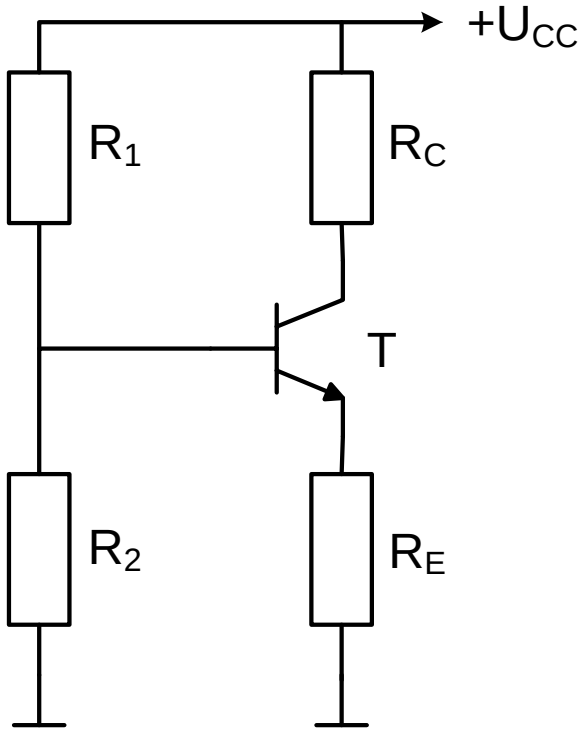
Elektronika

Auditorne vježbe 9

Zadatak 35.

- Odrediti statičku radnu točku tranzistora u sklopu prema slici. Zadano je: U_{CC}=20 V, R_E=0,5 k, R_C= 2,2 k, R_1= 56 k, R_2= 10 k, β=150.



☑ Rješenje:

U_{BB}=3,03 V, R_B=8,48 k
I_B=27,7 µA, I_C=4,16 mA
U_{CE}=8,75 V

Utjecaj temperature na stabilnost radne točke

$$I_C = \beta \cdot I_B + I_{CE0} \qquad I_{CB0} = \frac{I_{CE0}}{(\beta + 1)}$$

$$\frac{\Delta I_{CQ}}{\Delta T} = -\frac{1}{R_E}\frac{\Delta U_{BE}}{\Delta T} + \left(1 + \frac{R_B}{R_E}\right)\frac{\Delta I_{CB0}}{\Delta T} \qquad \Delta I_{CB0} = I_{CB0}\left[\exp(a\Delta T) - 1\right]$$

$$\frac{\Delta I_{CQ}}{\Delta T} = -\frac{1}{R_E}\frac{\Delta U_{BE}}{\Delta T} + \left(1 + \frac{R_B}{R_E}\right) I_{CB0}\,\frac{\exp(a\Delta T) - 1}{\Delta T}$$

Zadatak 36.

- Odrediti temperaturni koeficijent struje I_{CQ}, prirast struje ΔI_{CQ} te postotnu promjenu $\Delta I_{CQ}/I_{CQ}$ za promjenu temperature ΔT=30°C. Poznato je: R_E=200 Ω, R_B=5 kΩ, I_{CBO}=0,1 μA, I_{CQ}=5 mA, $\Delta U_{BEQ}/\Delta T$=-2 mV/°C, a=0,07/°C.

☑ Rješenje:

$\Delta I_{CQ}/\Delta T = 1{,}062 \cdot 10^{-2}$ mA/°C

ΔI_{CQ}= 0,32 mA

$\Delta I_{CQ}/I_{CQ}$=6,4%

Osjetljivost sklopa s emiterskom degeneracijom

$$I_{CQ} = I_{CQ}\left(U_{BEQ}, I_{CB0}, \beta, U_{CC}, R_1, R_2, R_E\right)$$

$$dI_{CQ} = \frac{\partial I_{CQ}}{\partial U_{BEQ}} dU_{BEQ} + \frac{\partial I_{CQ}}{\partial I_{CB0}} dI_{CB0} + \frac{\partial I_{CQ}}{\partial \beta} d\beta + ...$$

$$S_U = \frac{\partial I_{CQ}}{\partial U_{BEQ}}$$ - faktor stabilnosti s obzirom na napon U_{BEQ}

$$S_I = \frac{\partial I_{CQ}}{\partial I_{CBO}}$$ - faktor stabilnosti s obzirom na struju I_{CB0}

$$S_\beta = \frac{\partial I_{CQ}}{\partial \beta}$$ - faktor stabilnosti s obzirom na β

Osjetljivost sklopa s emiterskom degeneracijom

Općeniti izraz

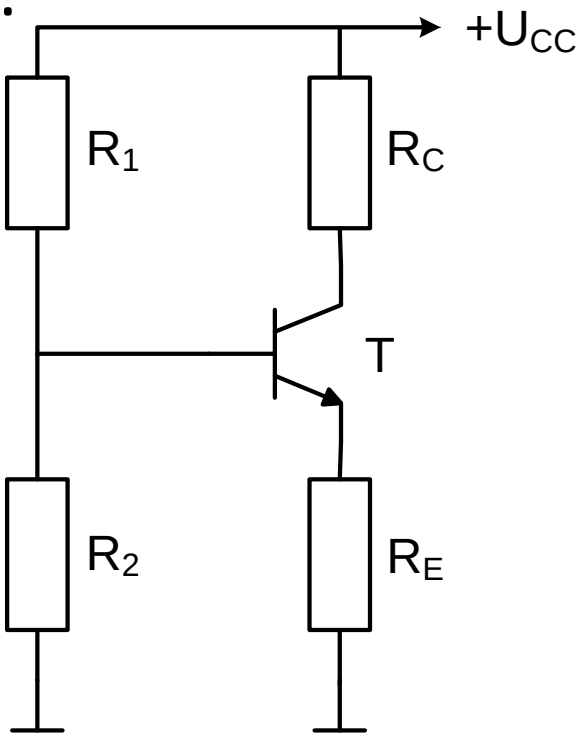
$$I_C = \beta \cdot I_B + (\beta + 1) \cdot I_{CB0}$$

$$S_I = \frac{\partial I_{CQ}}{\partial I_{CB0}} = \frac{1+\beta}{1-\beta(dI_B / dI_C)}$$

$$I_B = f(I_C) = ???$$

Zadatak 37.

- Odrediti faktor stabilnosti s obzirom na promjenu struje I_{CBO} te maksimalne vrijednosti s obzirom na otpor R_E. Zadano je: U_{CC}=15 V, U_{BE}=0,6 V, R_E= 1 k, R_C= 2 k, R_1= 15 k, R_2= 3 k, β=50.

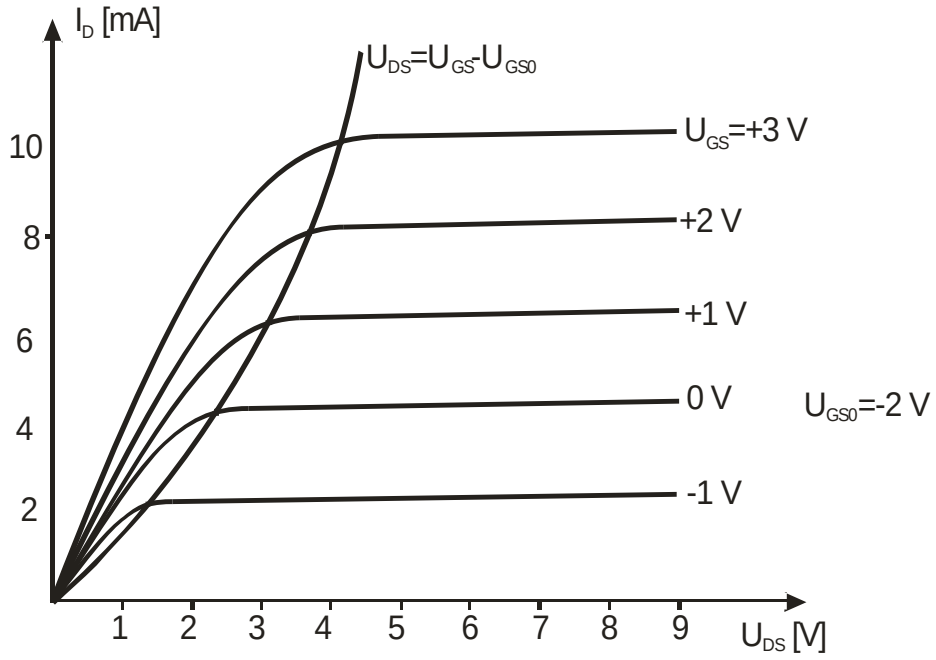


☑ Rješenje:

S_I=3,3

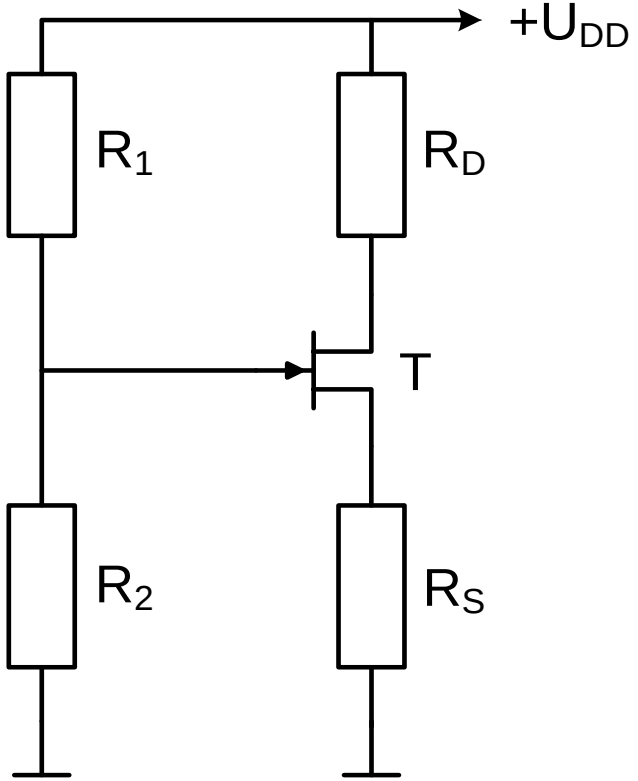
Sklopovi s unipolarnim tranzistorom

- Zajednička karakteristika FET-ova: **velik ulazni otpor**.
- 2 područja rada: triodno i područje zasićenja.
- Sklopovi pojačala: **radna točka u području zasićenja**!
- Strujni izvor upravljan naponom U_{GS}.



Zadatak 38.

- Odrediti statičku radnu točku tranzistora u sklopu na slici. Zadano je: U_{DD}=20 V, R_S= 0,5 kΩ, R_D= 2 kΩ, R_1= 1,9 MΩ, R_2= 0,1 MΩ, I_{DSS} =4 mA, U_{GS0}=-2 V.

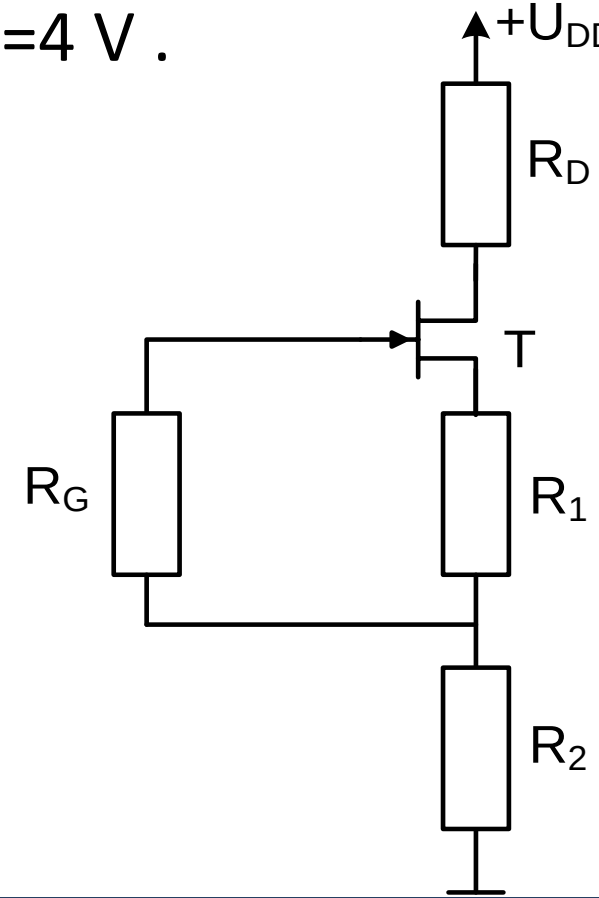


☑ Rješenje:

- U_{GS}=-0,35 V
- I_D=2,7 mA
- U_{DS}=13,25 V

Zadatak 39.

- Odrediti vrijednosti otpornika R_1 i R_2 u sklopu na slici ako je zadano: U_{DD}=12 V, R_D= 4,7 kΩ, R_G= 1 MΩ, I_{DSS} =2 mA, U_{GS0}=-4 V, U_D=6 V, U_S=4 V .



☑ Rješenje:

- U_{GS1}=-0,8 V
- R_1=625 Ω
- R_2=2,5 kΩ