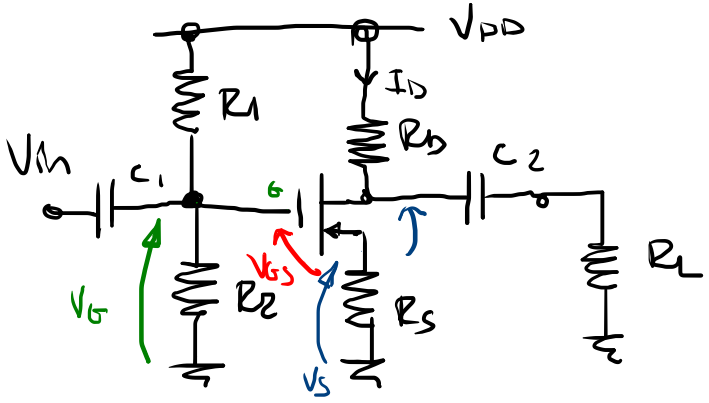


2N7000 CHN - en

$I_D \simeq I_S$

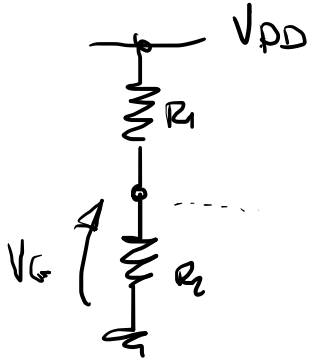
$$V_{DD} = I_D \cdot R_D + V_{DS} + I_D \cdot R_S$$

$$I_D (R_D + R_S) = V_{DD} - V_{DS}$$

$$R_S + R_D = \frac{V_{DD} - V_{DS}}{I_D} \qquad V_{DS} = V_D - V_S$$

$$R_S = \frac{V_S}{I_D} \qquad R_D = \frac{V_{DD} - V_D}{I_D}$$

$$V_{GS} = V_G - V_S = V_G - R_S \cdot I_D \rightsquigarrow V_G = V_{GS} + R_S \cdot I_D$$

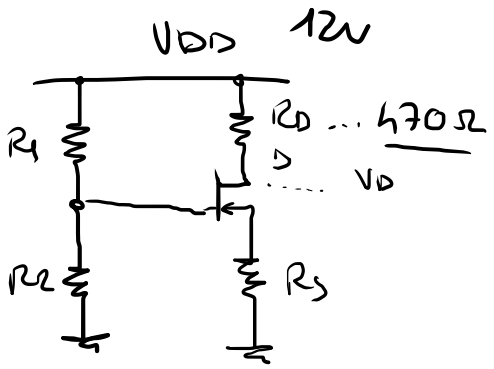


$$i = \frac{V_{DD}}{R_1 + R_2} \qquad V_G = i \cdot R_2 = \frac{V_{DD}}{R_1 + R_2} \cdot R_2$$

K

2N 7000

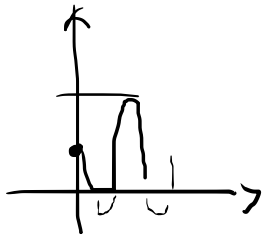
$V_{GS} = 3{,}5\,V$ $\quad K = ?$



$V_{TH} = \frac{0{,}8 + 3}{2} = 1{,}9\,V$

$I_D = \blacksquare \simeq 100\,mA$ (SAT)

$$K = \frac{I_D}{(V_{GS} - V_{TH})^2} = \frac{0{,}1}{(3{,}5 - 1{,}9)^2} \cong 0{,}039\ \frac{A}{V^2} = 39\ \frac{mA}{V}$$



$V_D = \frac{V_{DD}}{2} = \frac{12}{2} = 6\,V$

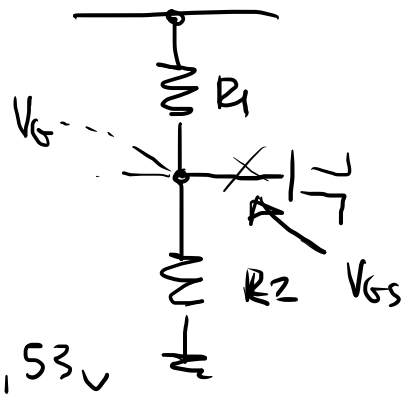
$R_D = 470\,\Omega \rightsquigarrow I_D = \frac{12 - 6}{470} = \frac{6}{470} = 0{,}0128\,A = 12{,}8\,mA$

$I_D = K(V_{GS} - V_T)^2 \rightsquigarrow V_{GS}$ $\qquad \frac{I_D}{K} = (V_{GS} - V_T)^2$

$\sqrt{\frac{I_D}{K}} = V_{GS} - V_T \rightsquigarrow V_{GS} = V_T + \sqrt{\frac{I_D}{K}} = 1{,}9 + \sqrt{\frac{0{,}0128}{0{,}039}} = 2{,}47\,V$

VG

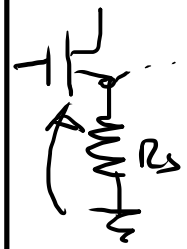
$V_{GS} = 2{,}47\,V$



$V_G = \frac{V_{DD}}{3} = \frac{12}{3} = 4\,V$

$V_{GS} = V_G - V_S \rightsquigarrow V_S = V_G - V_{GS} = 4 - 2{,}47 = 1{,}53\,V$

$R_S = \frac{V_S}{I_D} = \frac{1{,}53}{0{,}0128} \simeq 120\,\Omega$



R_1, R_2

$i = \frac{V_{DD}}{R_1 + R_2}$ $\qquad V_2 = V_G = \frac{V_{DD}}{3} = \frac{V_{DD}}{R_1 + R_2} \cdot R_2$

$R_2 = 100\,k\Omega$ $\qquad \frac{12}{R_1 + 100k} \cdot 100k = 4\,V$

$R_1 = \frac{100k \cdot 12}{4} - 100k = 200k\Omega \rightarrow 220k\Omega$

100kΩ

$R_{in} = R_1 // R_2 \simeq 67k\Omega$ $\qquad \frac{R_1 \cdot R_2}{R_1 + R_2}$

$A_V = -\frac{R_D}{R_S} = -\frac{470}{120} = -4$

2N7000