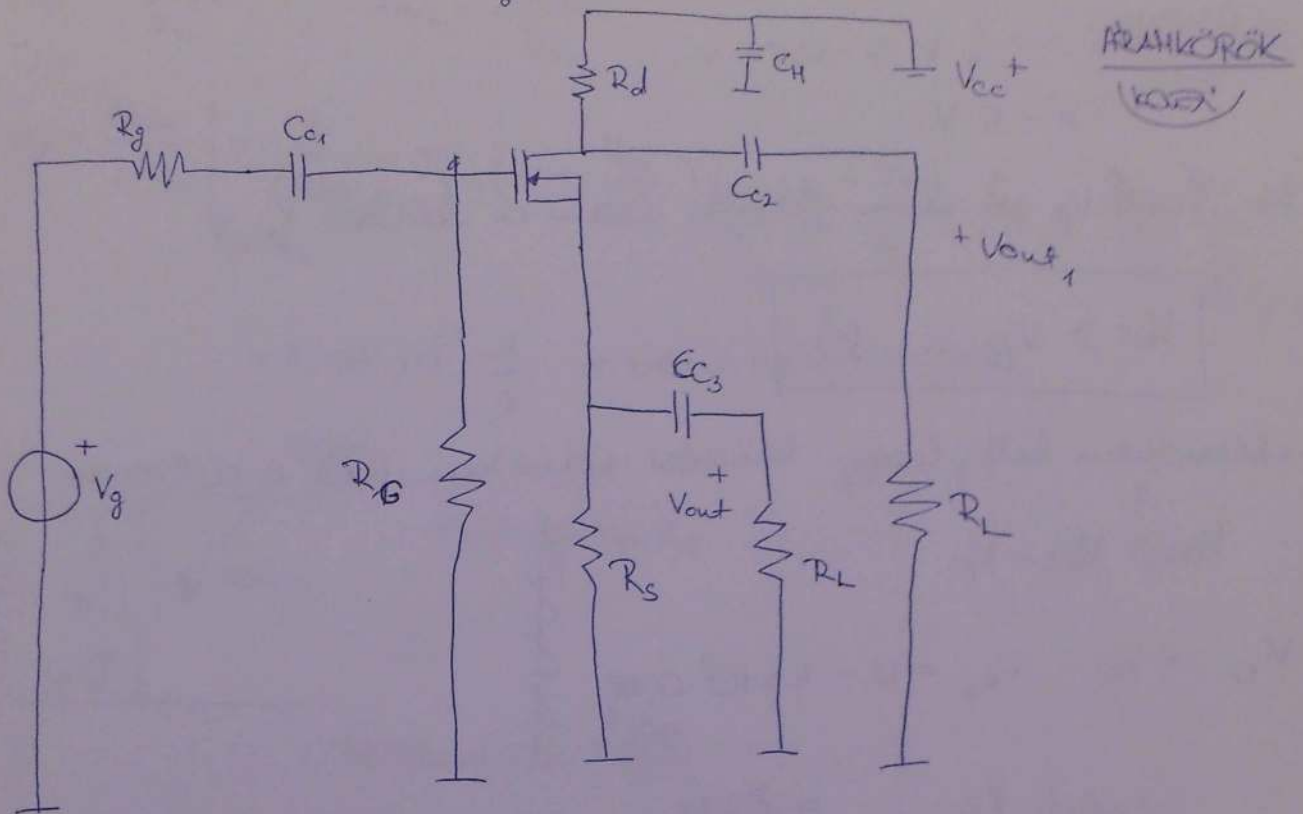


• MOSTET tranzisztor LESZ!

2013.12.18.

1)

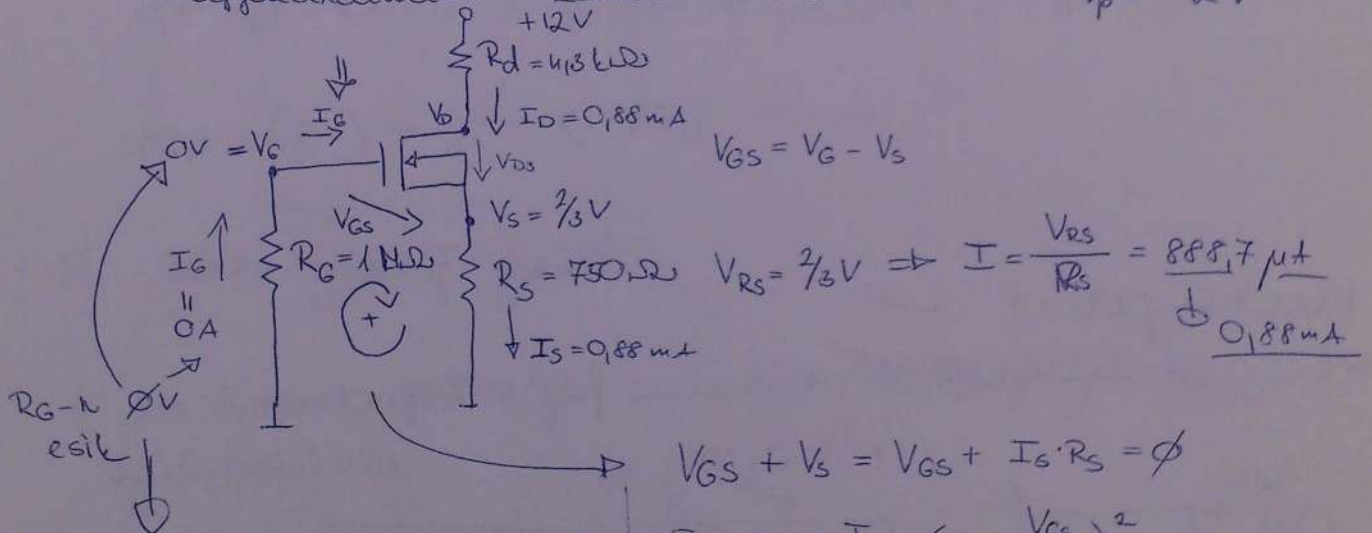


→ először tranzisztor működés

→ egyenáramú áram → kimeneti → működés

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

$$V_p = -2 \text{ V}$$



$$V_S = V_G - V_{GS} = 0 - (-\frac{2}{3}) = \frac{2}{3} \text{ V}$$

$$V_{GS} + V_S = V_{GS} + I_S \cdot R_S = 0$$

$$I_S = I_D = I_{DSS} \left(1 - \frac{V_{GS}}{V_p}\right)^2$$

$$V_{GS} + R_S \cdot I_{DSS} \left(1 - \frac{V_{GS}}{V_p}\right)^2 = 0$$

$$\frac{V_{GS}}{R_S \cdot I_{DSS}} + 1 - \frac{2}{V_p} V_{GS} + \frac{1}{V_p^2} V_{GS}^2 = 0$$

$$\frac{1}{V_p^2} V_{GS}^2 + V_{GS} \left(\frac{1}{R_S I_{DSS}} - \frac{2}{V_p} \right) + 1 = 0 \quad \text{2 megoldás van}$$

↳ helyettesítve: $V_p, I_{DSS} \rightarrow$

2)))

$$V_{GS} = -\frac{2}{3} V \approx -0,66 V$$

$$= -0,6 V$$

ha $V_{GS} < V_p \rightarrow$ nem fogja át a kimenő?

$$\boxed{V_{GS} > V_p \text{ a jó}}$$

↳ ellenőrizni kell, hogy telítési áram van-e a tranz.

$$V_{DS} > V_{GS} - V_p$$

$$V_D = V_{CC} - V_{RD} = 12 - 4 \cdot 3 \cdot 10^3 \cdot 0,88 \cdot 10^{-3}$$

$$= 8,22$$

$$V_S = \frac{2}{3}$$

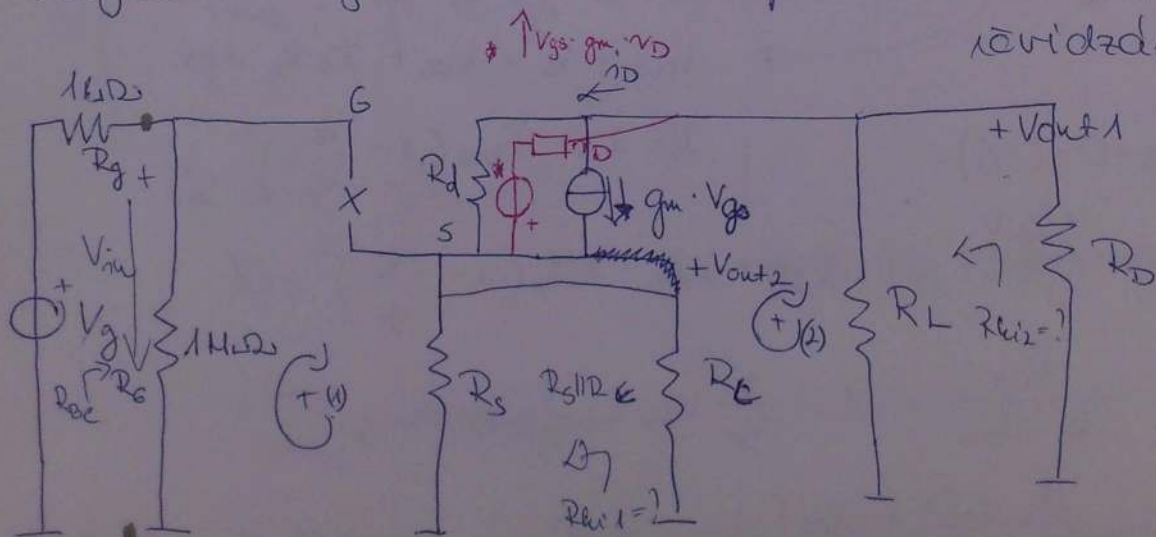
$$V_{DS} = V_D - V_S = 7,55 V \rightarrow$$

$$7,55 > -\frac{2}{3} - (-2) = 1,333$$

meg felel. jó volt.

mutapont ✓

↳ kisjeleű helyettesítés + némi fel + kondenzátorok rövidzárként



2013.12.18.

3.)

$$A_{u1} = \frac{V_{out1}}{V_{in}}$$

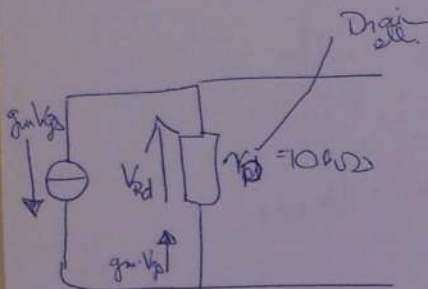
$$A_{u2} = \frac{V_{out2}}{V_{in}} \quad \text{feszültségátviteli}$$

ÁRAMKÖR
KÉP

5.)

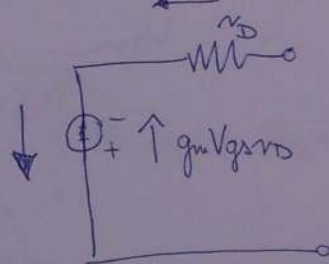
$$g_m = \left. \frac{di_D}{dV_{gs}} \right|_{V_{gs}=V_{gs}} = \frac{d}{dV_{gs}} I_{DSS} \left(1 - \frac{V_{gs}}{V_p} \right)^2 = \left. - \frac{2 I_{DSS}}{V_p} \left(1 - \frac{V_{gs}}{V_p} \right) \right|_{V_{gs}=V_{gs}}$$

$$= 1,333 \cdot 10^{-3} \frac{A}{V} \rightarrow \text{transzistor vezetése}$$



$$V_{rd} = g_m \cdot V_{gs} \cdot R_D$$

Thévenin kép

at lehet
rajzolni

$$(1) -V_{in} + V_{gs} + i_s R_s = 0$$

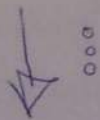
$$(2) -V_{out2} + g_m r_D V_{gs} - i_D r_D - i_D (R_D \parallel R_L) = 0$$

$$V_{gs} = V_{in} - i_s R_s$$

$$0 = -V_{out2} + g_m r_D (V_{in} - i_s R_s) - i_D r_D - i_D (R_D \parallel R_L)$$

$$i_D = i_s = \frac{V_{out2}}{R_s \parallel R_L}$$

$$-V_{out2} + g_m r_D \left(V_{in} - \frac{V_{out2}}{R_s \parallel R_L} R_s \right) - \frac{V_{out2}}{R_s \parallel R_L} r_D - \frac{V_{out2}}{R_s \parallel R_L} (R_D \parallel R_L) = 0$$



$$A_{u2} = \frac{V_{out2}}{V_{in}} = 0,4 \quad \text{dB-ben} \Rightarrow 20 \cdot \lg 0,4 = \underline{-8 \text{ dB}}$$

$$\left. \begin{aligned} -i_D (R_D \parallel R_L) &= V_{out1} \\ i_D &= \frac{-V_{out1}}{R_D \parallel R_L} \end{aligned} \right\} \quad \frac{-V_{out1}}{R_D \parallel R_L} = \frac{V_{out2}}{R_S \parallel R_L}$$

$$\downarrow$$

$$V_{out2} = \frac{R_S \parallel R_L}{R_D \parallel R_L} \cdot V_{out1}$$

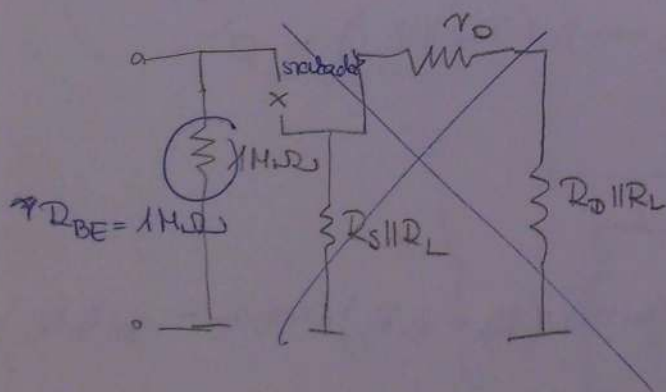
$$A_{u1} = ? = \frac{V_{out1}}{V_{in}}$$

$$= \frac{-V_{out2} \cdot \frac{R_D \parallel R_L}{R_S \parallel R_L}}{V_{in}} = \ominus$$

↓
kín/ben.
fesz ell. irása!

$$A_{u1}(\text{dB}) = 20 \cdot \lg | \dots | = \underline{\quad}$$

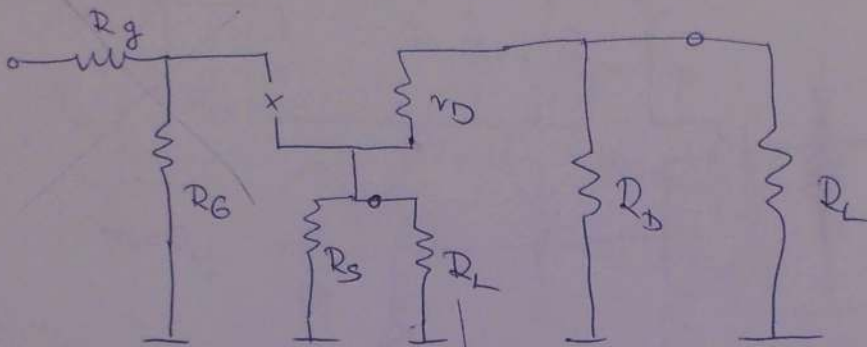
↳ benneő, kimenő ellenőrzés



↳ bemenő ellenállás

ÁRAMKÖRÖK
KÖNYV

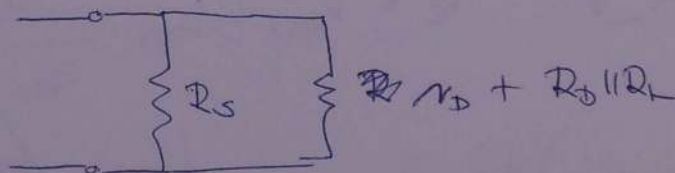
R_{ei1} , R_{ei2}



hordókapcsoló . ill. uelő ellenállása
↳ áramforrás belső ellenállásának

keve vesszük az aktuális R_L -t

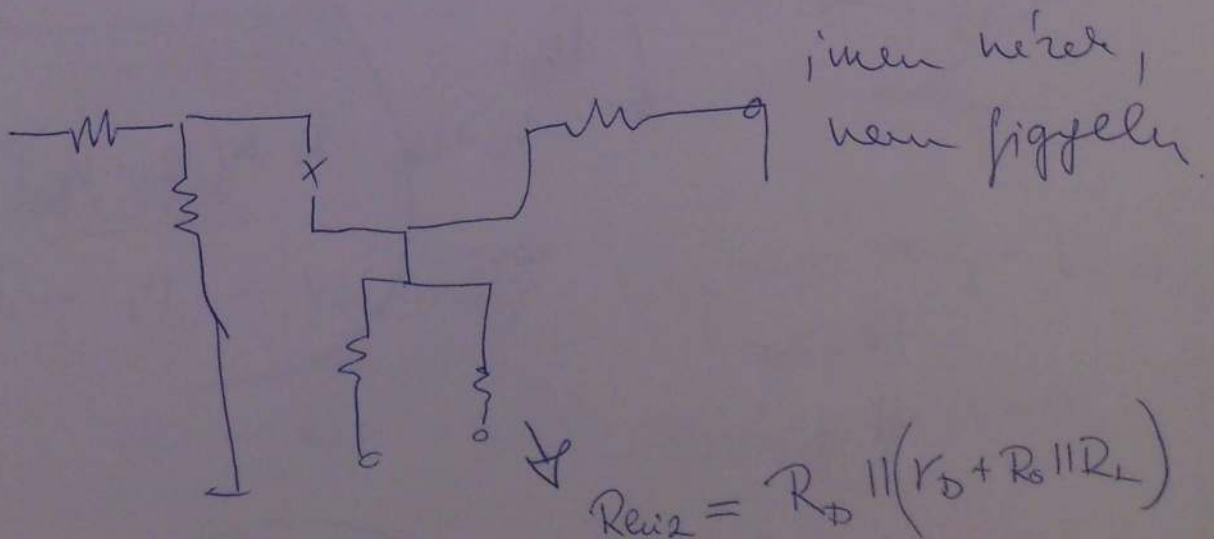
R_{ei1}



||

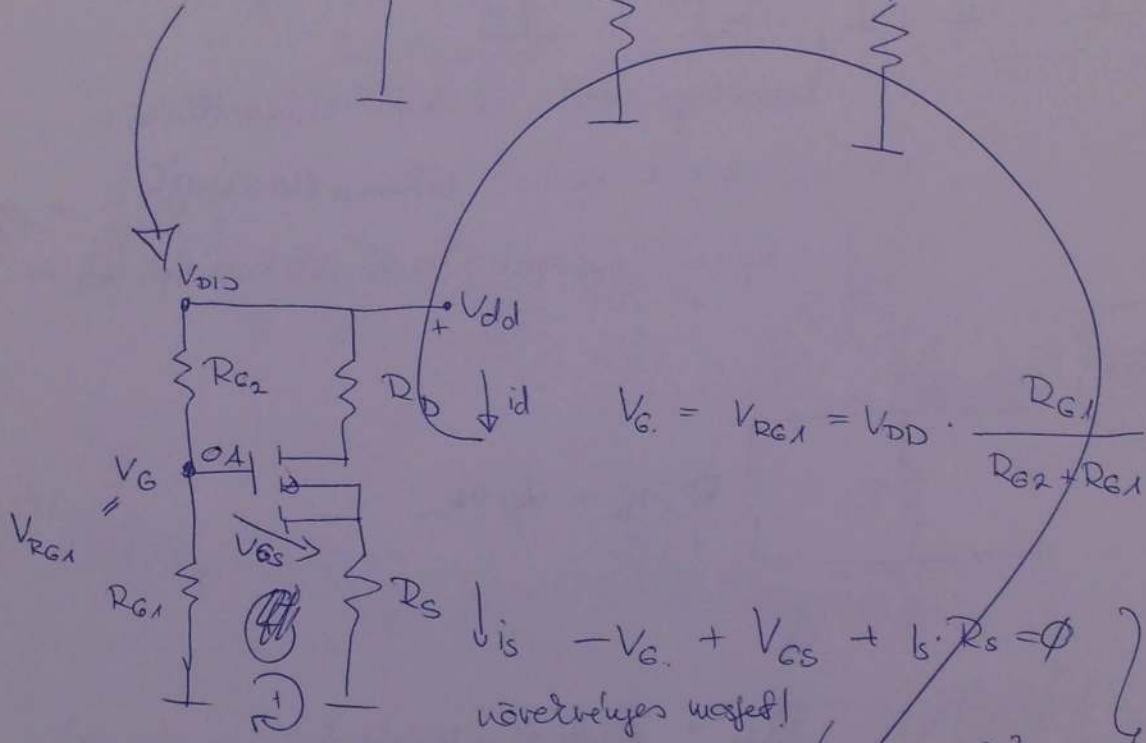
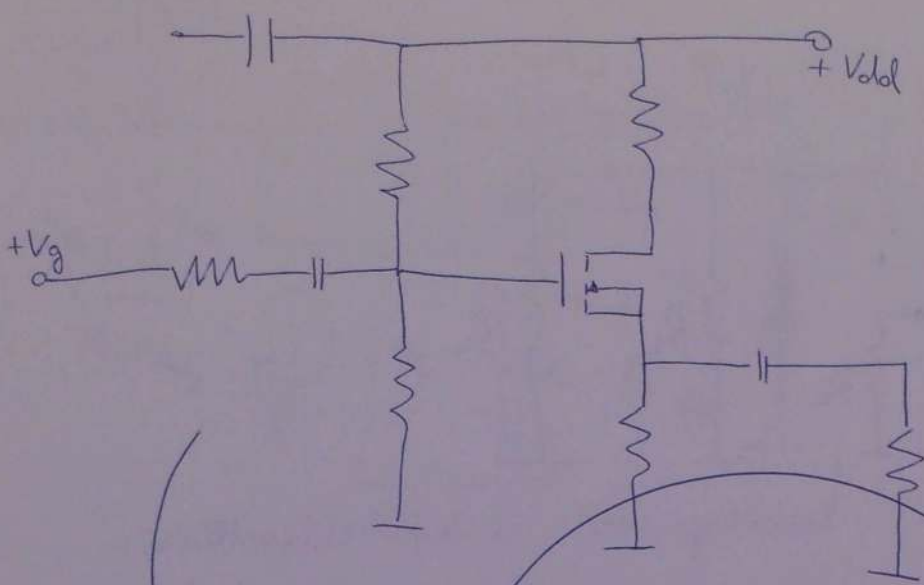
$$R_{ei1} = R_S \parallel (R_D + R_D \parallel R_L)$$

R_{ei2}



innen nézve,
nem figyelve.

$$R_{ei2} = R_D \parallel (R_D + R_S \parallel R_L)$$



$$V_G = V_{RG1} = V_{DD} \cdot \frac{R_{G1}}{R_{G2} + R_{G1}}$$

$$-V_G + V_{GS} + I_S \cdot R_S = 0$$

növelvegyes megf.!

$$I_S = I_D = K \cdot (V_{GS} - V_T)^2$$

$$-V_G + V_{GS} + R_S \cdot K (V_{GS} - V_T)^2 = 0$$

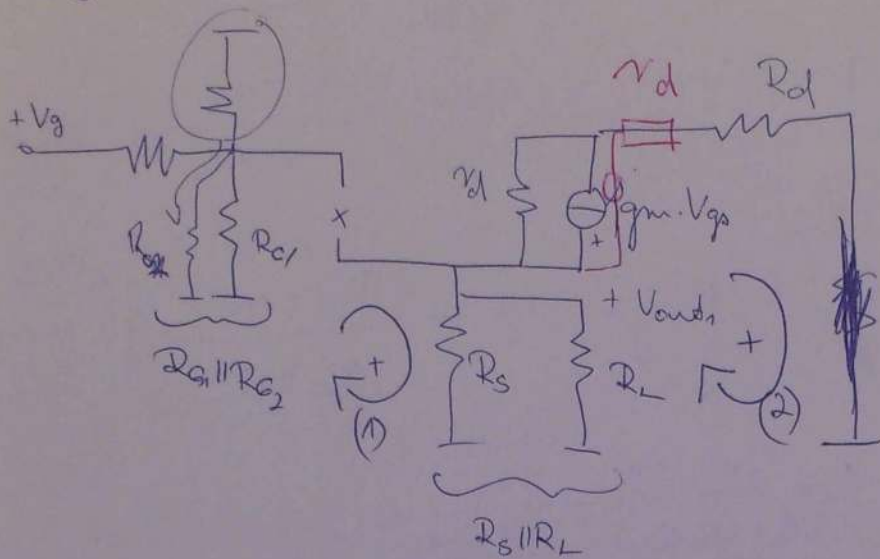
$$V_{GS} =$$

$$V_{GS} > V_T$$

$$V_{GS} \gg V_{GS} - V_T$$

→ kisjelölés hely.

ÁRAMERŐK
REK



$$g_m = \left. \frac{d i_D}{d V_{gs}} \right|_{V_{gs}=V_{gs}} = \left. \frac{d}{d V_{gs}} K (V_{gs} - V_T)^2 \right|_{V_{gs}=V_{gs}} =$$

$$= 2K(V_{gs} - V_T) \big|_{V_{gs}=V_{gs}} = 2K(V_{gs} - V_T)$$

$$K = 0,5 \frac{\text{mA}}{\text{V}^2} = 0,5 \cdot 10^{-3} \frac{\text{A}}{\text{V}^2}$$

AT KELL
VÁLT

fest. értékek:

$$\left. \begin{aligned} (1) \quad -V_{in} + V_{gs} + V_{out} &= 0 \Rightarrow V_{gs} = V_{in} - V_{out} \\ (2) \quad -V_{out} + g_m \cdot V_{gs} \cdot r_D - (r_D + R_D) i_D &= 0 \end{aligned} \right\}$$

$$V_{out} = i_D (R_S \parallel R_L) \quad \Rightarrow \quad i_D = \frac{V_{out}}{R_S \parallel R_L}$$

$$-V_{out} + g_m \cdot r_D (V_{in} - V_{out}) - (r_D + R_D) \frac{V_{out}}{R_S \parallel R_L} = 0$$

$$-V_{out} + g_m \cdot r_D V_{in} - g_m r_D \cdot V_{out} - V_{out} \cdot \frac{R_D + r_D}{R_S \parallel R_L} = 0$$

$$g_m \cdot r_D V_{in} = V_{out} \left(1 + g_m \cdot r_D - \frac{R_D + r_D}{R_S \parallel R_L} \right)$$

$$A_m = \frac{V_{out}}{V_{in}} = \frac{g_m \cdot r_D}{1 + g_m r_D - \frac{R_D + r_D}{R_S \parallel R_L}}$$

↳ be es ei ell.?

$$R_{DE} = R_{G1} \parallel R_{G2}$$

$$R_{ki} = R_S \parallel (R_D + r_D)$$