3) $I_{D7} = \frac{k_p}{2} \cdot \frac{W}{L} \cdot (V_{GS} - V_{Thp})^2 \cdot \left(1 + \frac{V_{DS}}{VA}\right)$

$0{,}2\,mA = \frac{20}{2} \cdot 10^{-6} \cdot \frac{20}{1{,}4} \cdot (V_{GS} + 0{,}8)^2 \cdot \left(1 + \frac{V_{DS}}{40}\right)$

$0{,}5 = (V_G - 3 + 0{,}8)^2 \cdot \left(1 + \frac{V_D - 3}{40}\right)$

$V_{D7} = V_{S1} = V_{S2}$

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$g_{m8} = g_{m9} = g_{m7} = \sqrt{2 \cdot 40\mu \cdot \frac{14}{0,7} \cdot 0,2m} = 5,65 \cdot 10^{-4}\,S$

$g_{m1} = \sqrt{2 \cdot 40\mu \cdot \frac{28}{0,7} \cdot 0,1m} = 5,65 \cdot 10^{-4}\,S$

$g_{m2} = g_{m1}$

$g_{m3} = g_{m4} = \sqrt{2 \cdot 80\mu \cdot \frac{7}{0,2} \cdot 0,1m} = 4 \cdot 10^{-4}\,S$

$g_{m5} = g_{m6} = \sqrt{2 \cdot 60\mu \cdot 20 \cdot 0,2m} = 8 \cdot 10^{-4}\,S$

1) $V_{in2} = 0$

$A_{d11} = \frac{V_{o1}}{V_{in1}} = \frac{V_{d5}}{V_{g5}} \cdot \frac{V_{d7}}{V_{s2}} \cdot \frac{V_{s1}}{V_{g1}}$

$A_{d21} = \frac{V_{o2}}{V_{in1}} = \frac{V_{d6}}{V_{g6}} \cdot \frac{V_{d1}}{V_{g1}}$

$r_{di7} = r_{ds7} = 200k\Omega$

$r_{di1} = r_{ds1} + g_{m1} \cdot r_{ds7} \cdot r_{ds1} + r_{ds7}$

$r_{ds1} = 400k\Omega$

$r_{di8} =$

$\frac{V_{s1}}{V_{gs1}} \cong \frac{g_{m1} \cdot r_{ds7}}{1 + g_{m1} \cdot r_{ds7}}$ $\qquad$ $\frac{V_{d5}}{V_{g5}} \cong -g_{m5} \cdot r_{di8}$

$\frac{V_{d2}}{V_{s2}} \cong g_{m2} \cdot \frac{1}{g_{m3}}$

$\frac{V_{o1}}{V_{in1}} \cong \frac{g_{m1} \cdot r_{ds7}}{1 + g_{m1} \cdot r_{ds7}} \cdot (-g_{m5} \cdot r_{di8}) \cdot \left(\frac{g_{m2}}{g_{m3}}\right)$ ($\frac{g_{m1} \cdot r_{ds7}}{1 + g_{m1} \cdot r_{ds7}} \cong 1$, $\frac{g_{m2}}{g_{m3}} = 1,4$)

$\frac{V_{d1}}{V_{g1}} \cong -\frac{g_{m1} \cdot \frac{1}{g_{m3}}}{1 + g_{m1} \cdot r_{di7}}$ $\qquad$ $\frac{V_{d6}}{V_{g6}} = -g_{m6} \cdot r_{di7}$

$A_{d21} = \frac{V_{o2}}{V_{in1}} = -\frac{g_{m1} \cdot \frac{1}{g_{m3}}}{1 + g_{m1} \cdot r_{di7}} \cdot (-g_{m6} \cdot r_{di7})$

$0,012$

$V_{in1} = 0$

$$\frac{V_{o1}}{V_{in2}} = \frac{V_{ds5}}{V_{gs5}} \cdot \frac{V_{d2}}{V_{g2}} = A_{d21}$$

$$\frac{V_{o2}}{V_{in2}} = \frac{V_{d6}}{V_{g6}} \cdot \frac{V_{s1}}{V_{d1}} \cdot \frac{V_{s2}}{V_{g2}} = A_{d11}$$

$$V_{o1} = A_{d21} \cdot V_{in2} + A_{d11} \cdot V_{in1}$$

$$V_{o2} = A_{d21} \cdot V_{in1} + A_{d11} \cdot V_{in2}$$

$$V_{o2} - V_{o1} = A_{d21} \cdot V_{in1} + A_{d11} \cdot V_{in2} - A_{d21} \cdot V_{in2} - A_{d11} \cdot V_{in1}$$

$$V_{o2} - V_{o1} = A_{d21}(V_{in1} - V_{in2}) - A_{d11}(V_{in1} - V_{in2})$$

$$\frac{V_{o2} - V_{o1}}{V_{in1} - V_{in2}} = A_{d21} - A_{d11} = g_{m5} \cdot r_{di7} \cdot \frac{g_{m2}}{g_{m3}} \left( \frac{1}{1 + g_{m1} \cdot r_{di7}} - 1 \right)$$

$$= g_{m5} \cdot r_{di7} \cdot (-1.4)$$

2)