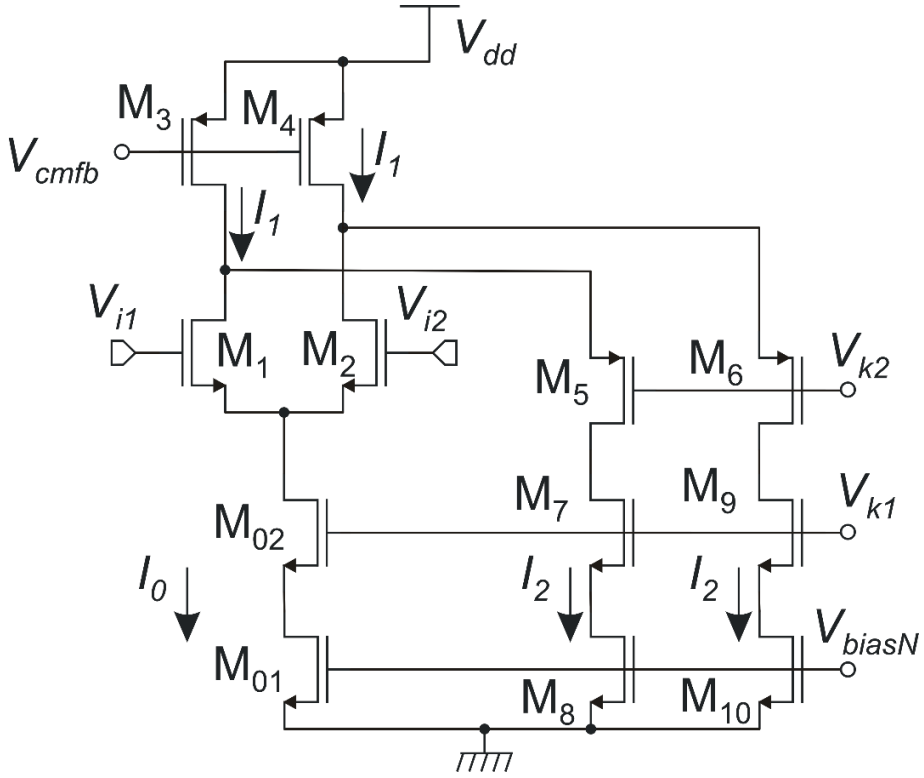
Description of the schematics

1) Opamp_core



Bias choices:

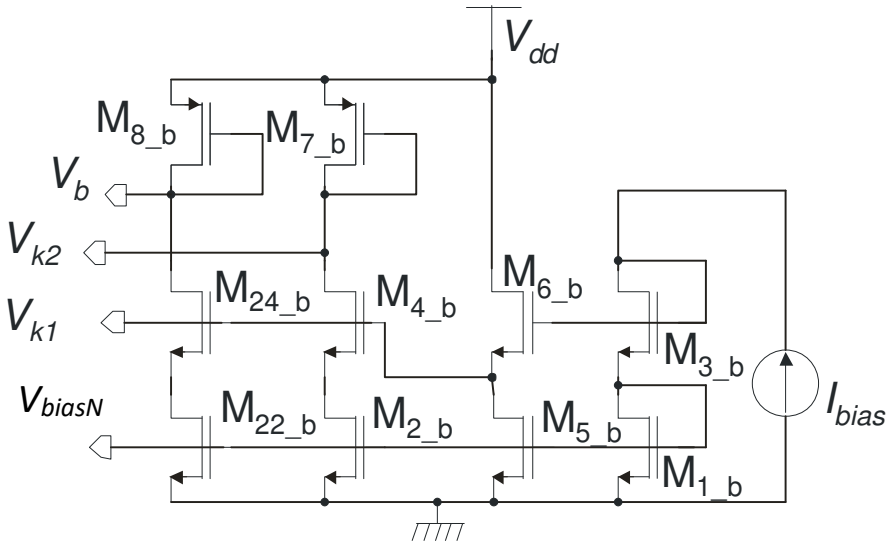
I_0=100 µA, I_2=50 µA thus: I_1=100 µA

W_{10}/L_{10} =20u/2u, W_{01}/L_{01}=40u/2u In order to have nearly V_{GS}-Vt=200 mV

W_1/L_1=50u/2u: in order to have nearly V_{GS}-Vt = 100 mV

W_3/L_3=150u/2u, in order to have V_{GS}-Vt nearly 250 mV

2) Bias generator.



Choices: Use smaller currents than in the opamp_core, in order to save power.

I_{bias} = 10 µA

$M_{24\_b}=M_{4\_b}=M_{6\_b}$

$M_{1\_b}=M_{5\_b}=M_{2\_b}=M_{22\_b}$

$I_{D5\_b}=I_{D2\_b}=I_{D22\_b}=I_{bias}$=10 µA

Then: $(W/L)_{2\_b}=(W/L)_{01}\ I_{D2\_b}/I_0=(W/L)_{01}\ I_{bias}/I_0=(W/L)_{01}/10 = 4u/2u$

$(W/L)_{8\_b}=(W/L)_3 I_{bias}/I_1=(15u/2u)$

V_{k1}:

In order to maintain M_{2_b}, M_{22_b} (and then M_{01}, M_8, M_{10} in the opamp) with $V_{DS}=V_{DSAT}$ (condition for mirror wide dynamic), we need to make:

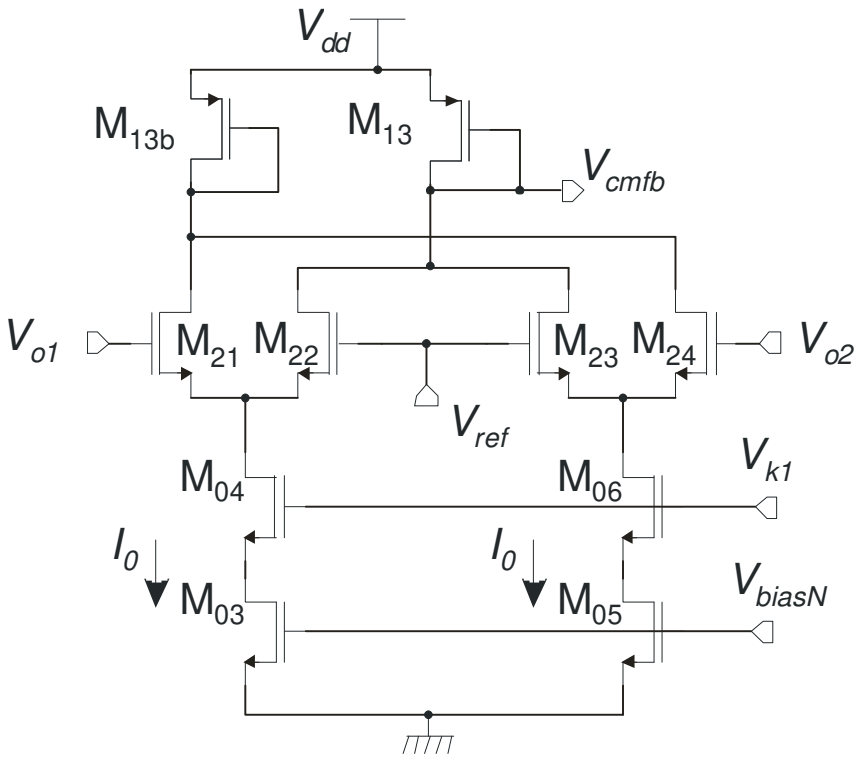
$V_{DS2\_b}=(V_{GS}-V_t)_{1\_b}+V_{t1\_b}+(V_{GS}-V_t)_{3\_b}+V_{t3\_b}-(V_{GS}-V_t)_{6\_b}-V_{t6\_b}-(V_{GS}-V_t)_{4\_b}-V_{t4\_b}=(V_{GS}-V_t)_{2\_b}$

$(V_{GS}-V_t)_{3\_b}=(V_{GS}-V_t)_{6\_b}+(V_{GS}-V_t)_{4\_b}$.

Since we chose to make $M_{4\_b}=M_{2\_b}$, this would require: $(W/L)_{3\_b}=(W/L)_{2\_b}/4$. We chose to make $(W/L)_{3\_b}=(W/L)_{2\_b}/10$ in order to have more margin and keep V_{DS2_b} far from saturation.

V_{k2}: The condition is: $(V_{GS}-V_t)_{7\_b}=V_{DS3}+(V_{GS}-V_t)_5$. In order to make $V_{DS3}=(V_{GS}-V_t)_3=V_{DSAT3}$, we would need to make $(W/L)_{7\_b}=(W/L)_{8\_b}/4$ (because M_{8_b} is used to bias M_3), so that $V_{GS8}=V_{GS3}$ and we chose $(V_{GS}-V_t)_5=(V_{GS}-V_t)_3$ in the op-amp. In this case we made $(W/L)_{7\_b}=(W/L)_{8\_b}/4.5$.

3) CMFB control



The CMBF control has been implemented using the conventional static approach. We have chosen to make the circuit work with the same currents as the core op-amp. In particular, the two differential pairs M_{21}-M_{22} and M_{23}-M_{24} are biased by the same nominal current flowing into M_3 and M_4 of the op-amp (I_1). For the choices made in the op-amp design, these currents are equal to I_0. M_{13} (and M_{13b}) are identical to M_3-M_4 of the op-amp. M_{21}-M_{24} have been designed to have a large V_{GS}-V_t, in order to provide enough differential input range to the pairs, to guarantee a large enough output swing for the opamp.

In particular: W_{21}=8u, L_21=2u. The resulting V_{GS}-V_t is nearly 300 mV.