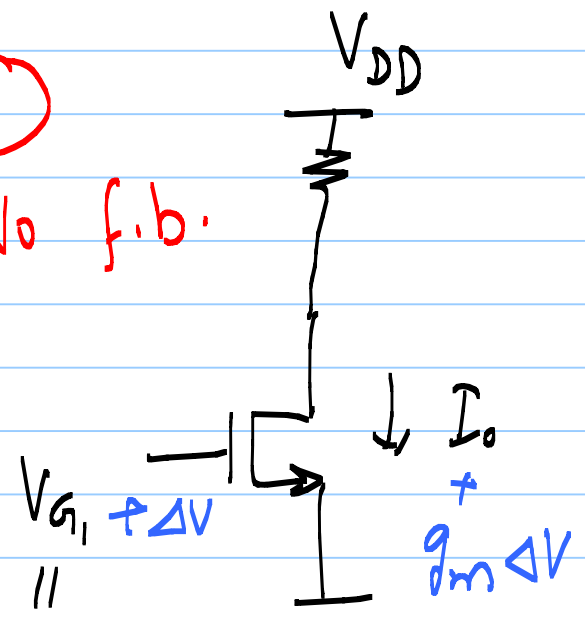


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Lecture 17

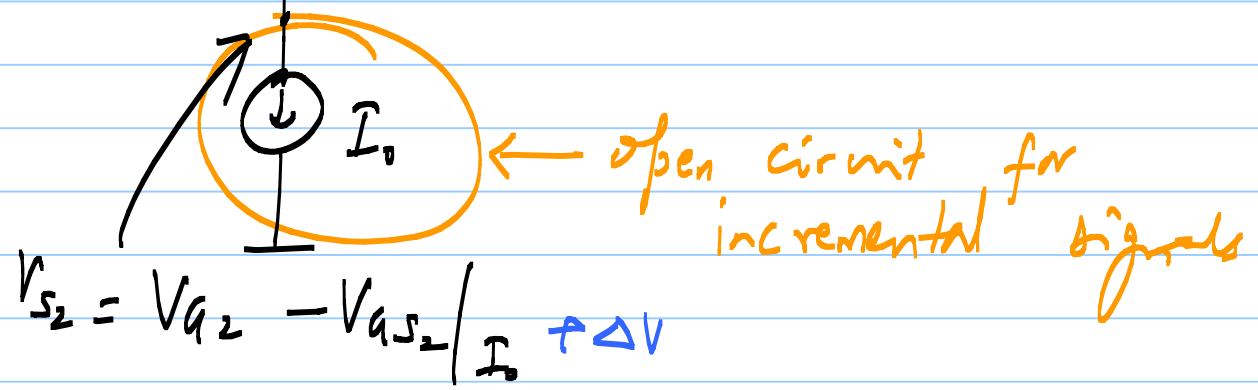
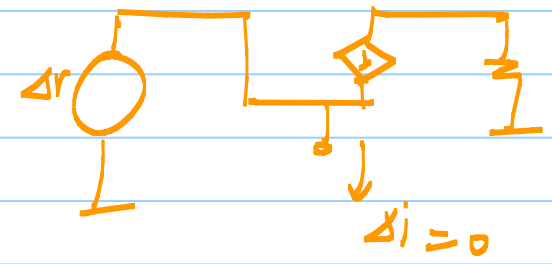
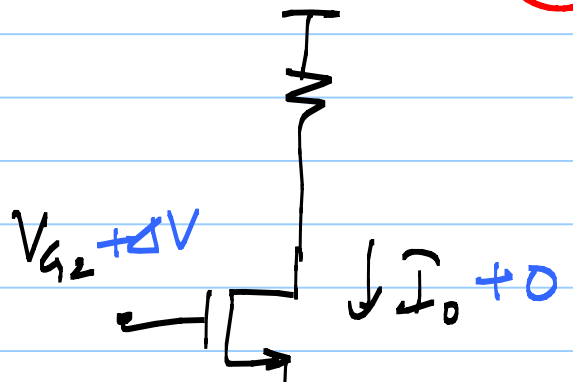
Very Strong f.b.

① No f.b.



$$V_T + \sqrt{\frac{2I_0}{\mu_n C_{ox} \left(\frac{W}{L}\right)}}$$

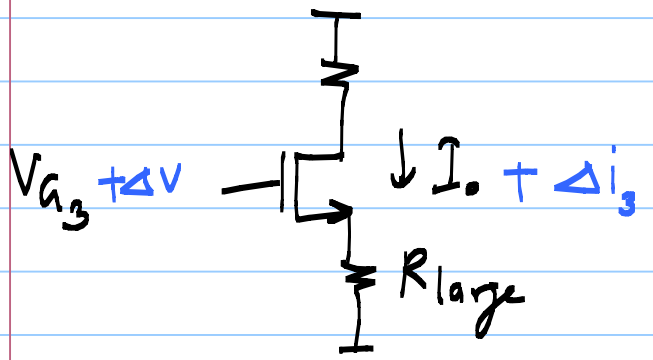
②



$$V_{S2} = V_{G2} - V_{GS2} \Big|_{I_0 + \Delta V}$$

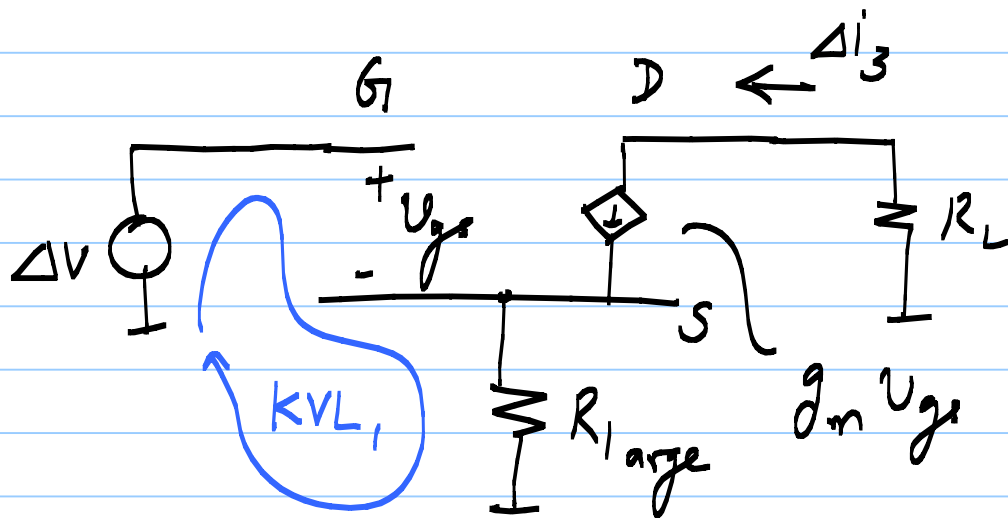
DC point: $V_{S3} = I_0 \cdot R_{large}$

$$V_{G3} = V_{S3} + V_{GS} \Big|_{I_0}$$



③ Intermediate f.b.

$$\Delta i_3 = ?$$



KVL_1

$$\Delta V = v_{gs} + \Delta i_3 \cdot R_{large}$$

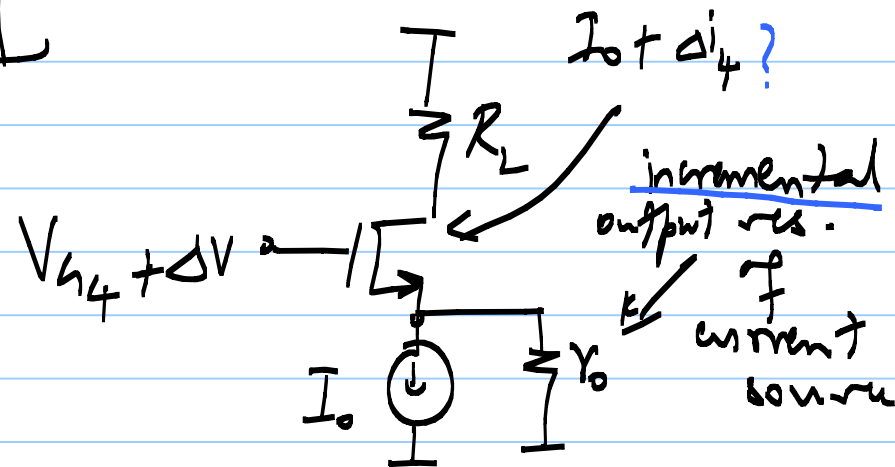
$$\Delta i_3 = g_m v_{gs}$$

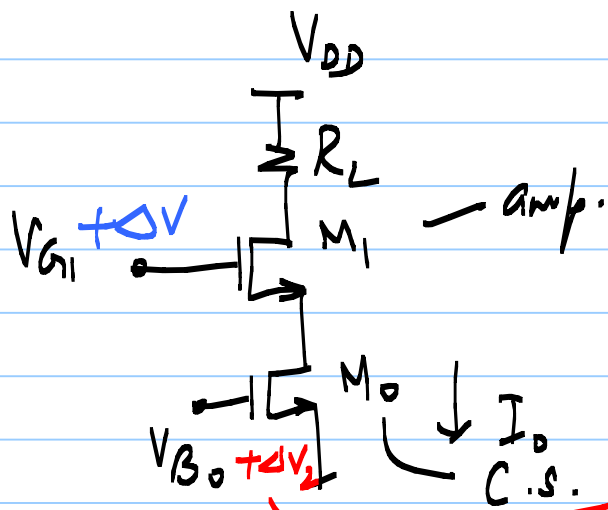
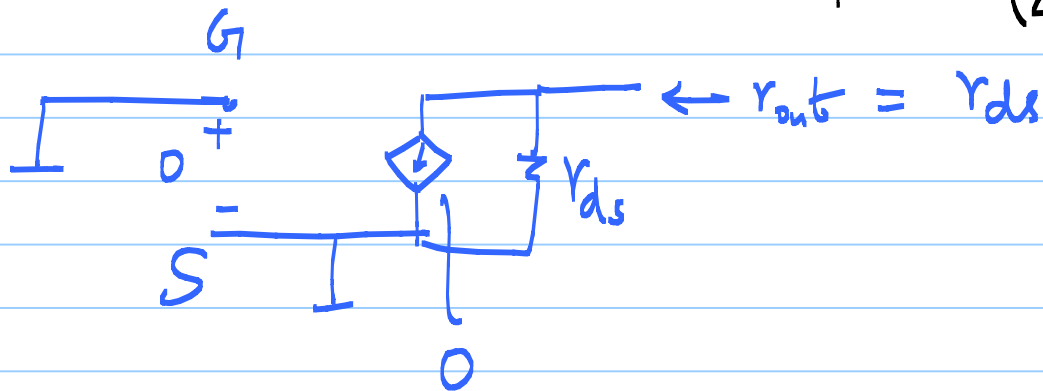
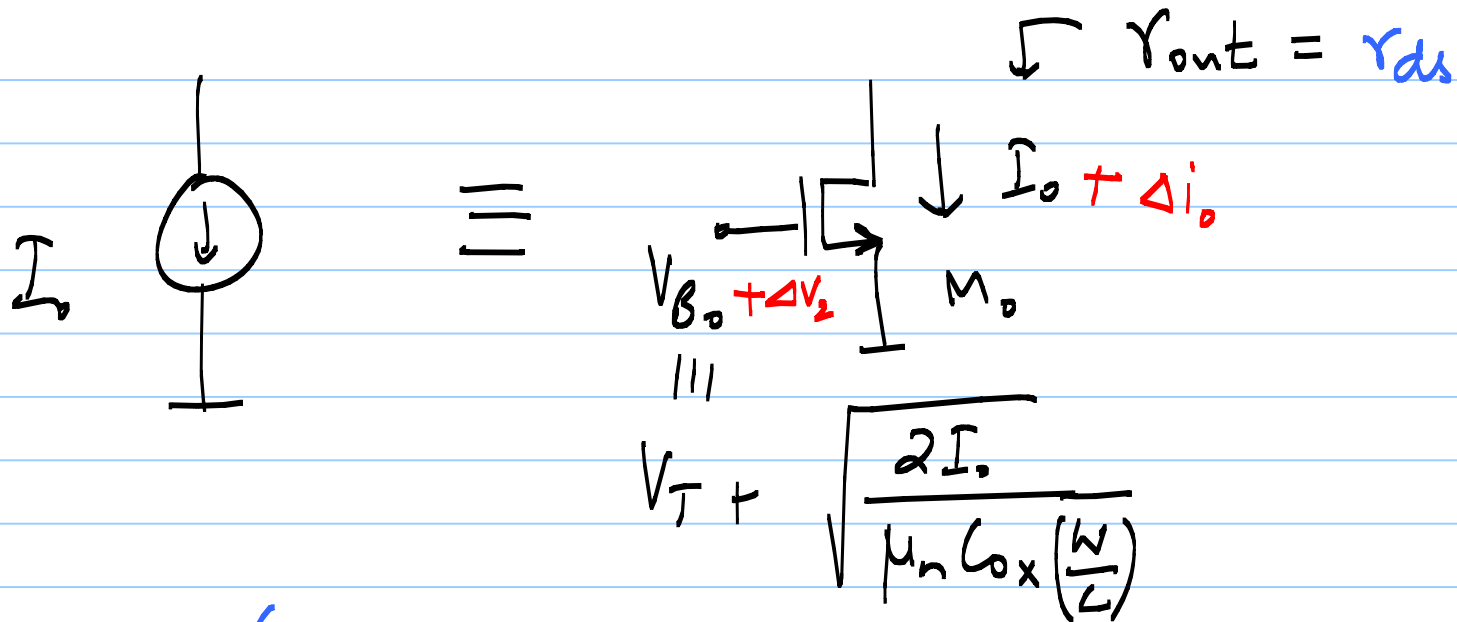
$$\Delta V = \frac{\Delta i_3}{g_m} + \Delta i_3 R_{large}$$

$$\Delta i_3 = \frac{g_m}{1 + g_m R_{large}} \cdot \Delta V$$

f.b. strength is
a function of R_{large}

$$\Delta i_4 = \frac{g_m}{1 + g_m r_o} \cdot \Delta V$$

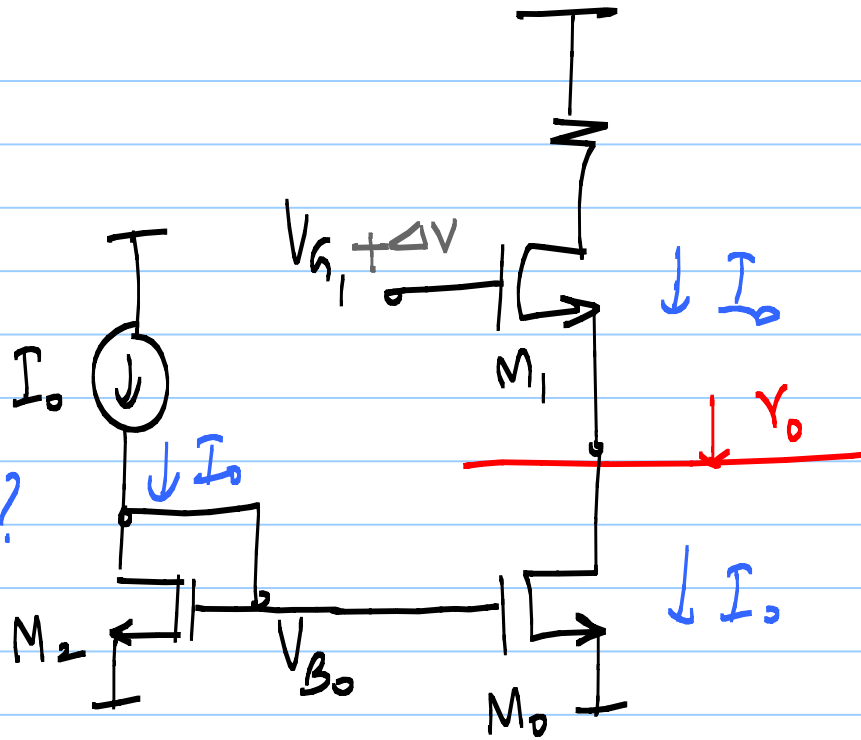




need f.b. to generate V_{B_0}

Hw 2

need an ideal C.S.?



draw incremental eq. circuit and verify $r_0 = r_{ds_0}$

* On any IC : one reference V_{ref} & I_{ref}

generated using a "Bandgap" circuit reference

e.g. $V_{ref} = f(\text{Si bandgap voltage})$

* Often need 1 single ^{off-chip} Resistor \Rightarrow low tolerance
 \Rightarrow low tempco