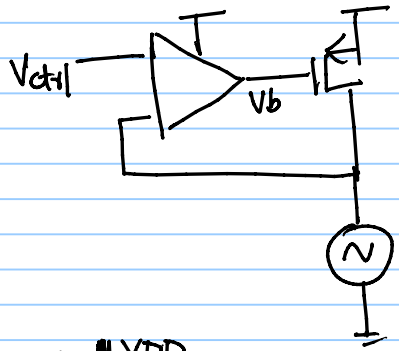
Lecture # 28

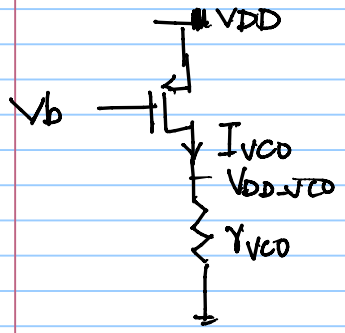
Note Title 10/3/2018

PSRR for voltage reguled osc.



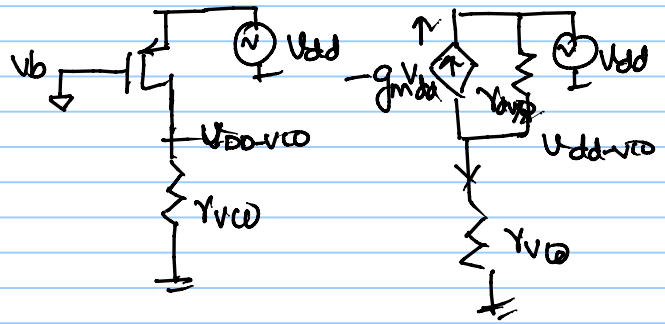
Amplifier : NMOS / PMOS

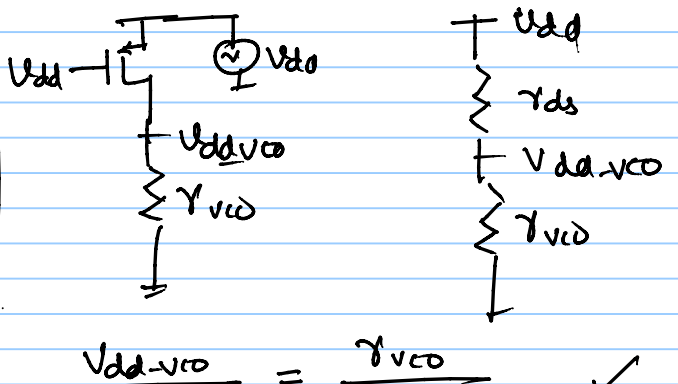
Pass transistor : NMOS / PMOS



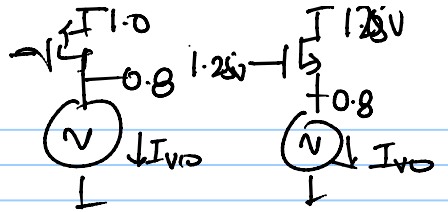
$$r_{VCO} = \frac{V_{DD-VCO}}{I_{VCO}}$$

$gmp(0 - V_{dd})$





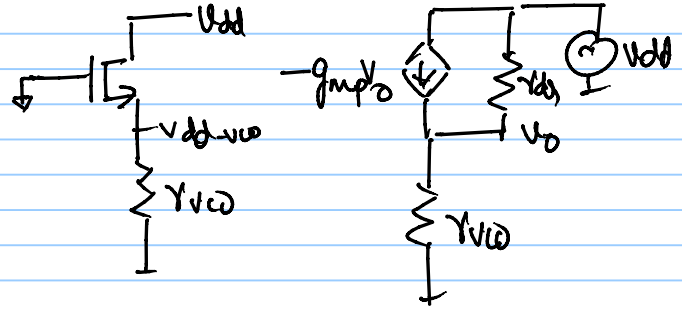
$$\frac{V_{dd-VCO}}{V_{dd}} = \frac{r_{VCO}}{r_{VCO} + r_{ds}}$$ ✓



reg-vth
low-vth.
native

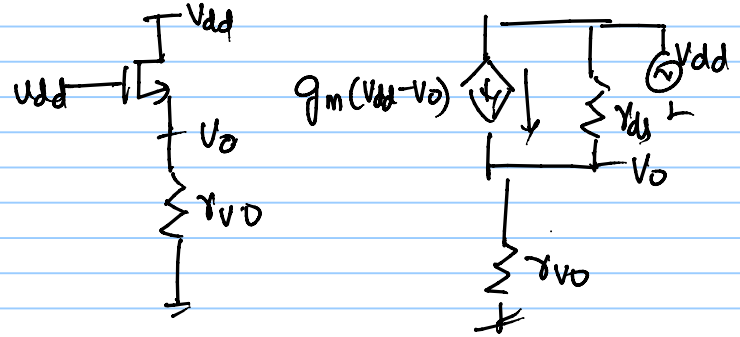
$$\frac{V_{dd}-V_{dd\_VCO}}{r_{ds}} + g_{mp}V_{dd} = \frac{V_{dd\_VCO}}{r_{VCO}}$$

$$\frac{V_{dd\_VCO}}{V_{dd}} = \frac{1+g_{mp}r_{ds}}{1+\frac{r_{ds}}{r_{VCO}}} \approx \frac{g_m r_{ds}}{1+\frac{r_{ds}}{r_{VCO}}} = \frac{r_{VCO}}{r_{VCO}+r_{ds}} \times (g_{mp}r_{ds})$$



$$-g_{mp}V_o + \frac{(V_{dd}-V_o)}{r_{ds}} = \frac{V_o}{r_{VCO}}$$

$$\frac{V_o}{V_{dd}} = \frac{1/r_{ds}}{\frac{1}{r_{ds}}+\frac{1}{r_{VCO}}+g_{mp}} \approx \frac{1}{1+r_{ds}/r_{VCO}+g_{mp}r_{ds}}$$



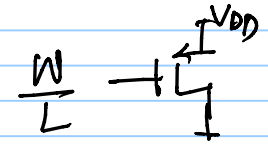
$$\frac{V_o}{V_{dd}} = \frac{r_{VCO}}{r_{VCO}+(r_{ds}\|\frac{1}{g_m})}$$

$$\frac{v_o}{v_{dd}} = \frac{1}{\left(1+\frac{r_{ds}}{r_{VCO}}\right) + g_{mp} r_{ds}} \checkmark$$

$$\frac{V_o}{V_{dd}} = \frac{r_{VCO}}{r_{VCO} + \left(r_{ds} \| \frac{1}{g_m}\right)} \checkmark$$

$$\frac{r_{VCO}}{r_{VCO} + r_{ds}} \checkmark$$

$\frac{W}{L}$ $\quad$ $\frac{2W}{2L}$



$$\frac{V_o}{V_{dd}} \downarrow \Rightarrow r_{ds} \uparrow \Rightarrow L \uparrow \Rightarrow C_g, V_{DS} \uparrow$$

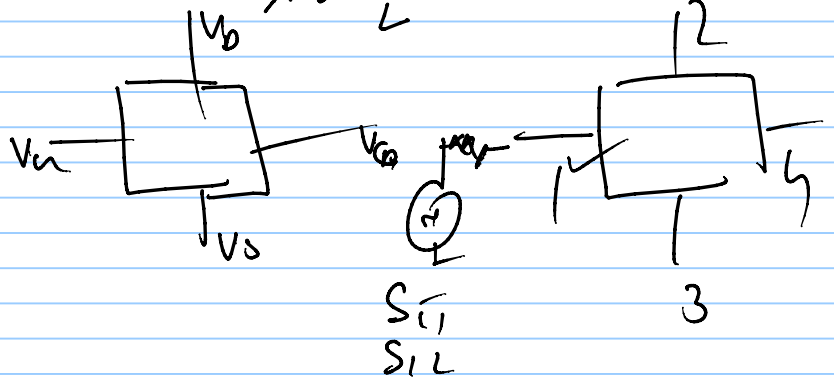
$$I = \frac{KW}{2L}(V_{GS} - V_{th})^2 (1+\lambda V_{DS}) \checkmark$$

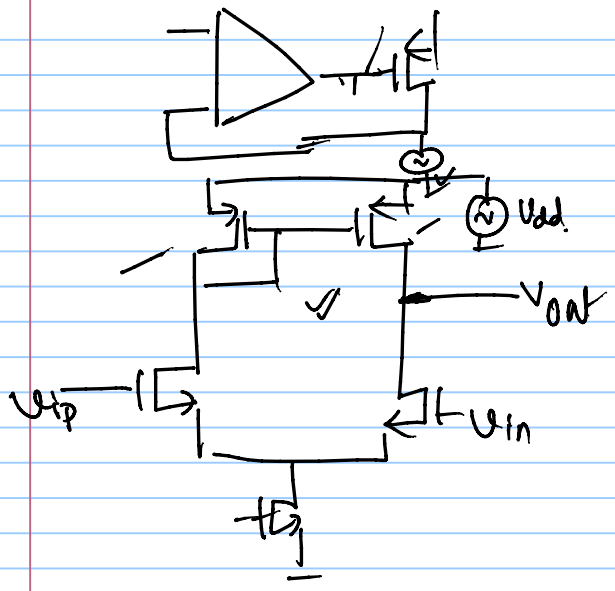
$$V_{DS} > V_{GS} - V_{th} \qquad v = \mu E$$

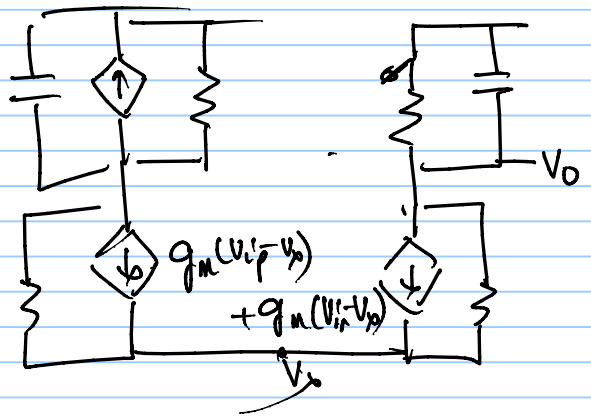
$$V_{DS} > V_{DS,sat} \checkmark$$

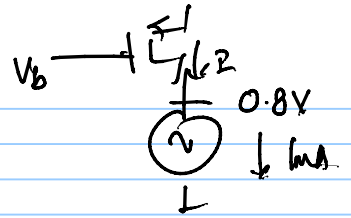
$$V_{ds,sat} < V_{GS} - V_{th} < V_{DS}$$

$\lambda \propto \frac{1}{L}$

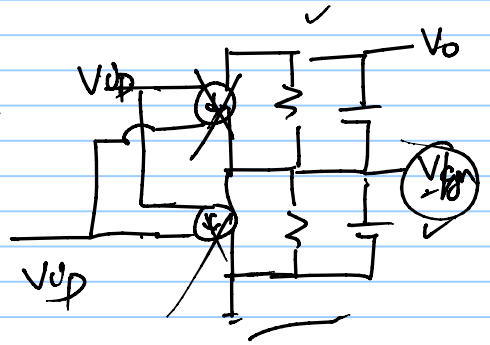


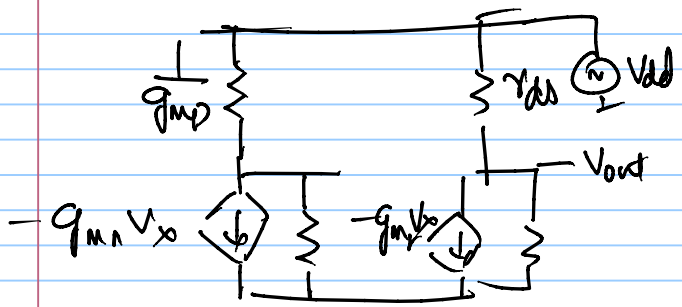




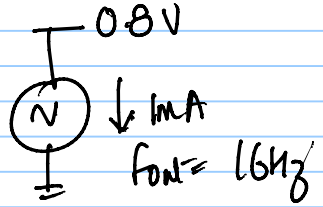


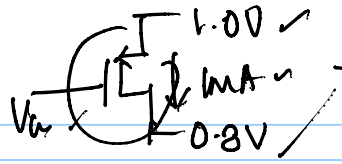
$$\frac{V_o}{V_{ip}-V_{in}} = \frac{A_{DC}}{1+s/\omega_p}$$



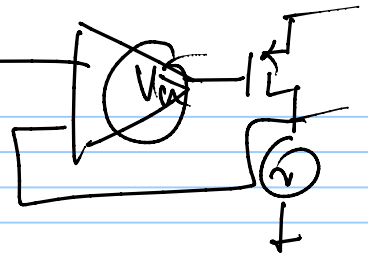


$V_o \approx V_{dd}$.





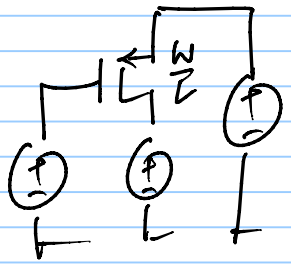
V_{GS}, $\frac{W}{L}$



$A_{dc} = \frac{0.5\,V}{A_{DC}}$

$0.5 + \frac{A_d \Delta V}{A_{DC}}$

$\frac{40\,mV}{A_{DC}}$



$L \rightarrow V_{th} \rightarrow V_{GS}$

V_{GS}