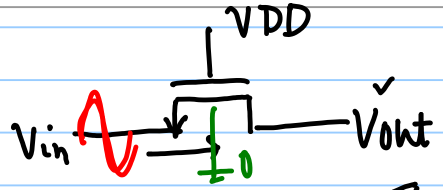
Note Title 24-04-2019

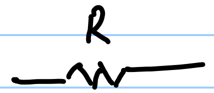
Lecture #47

D- Distortion.

SNDR

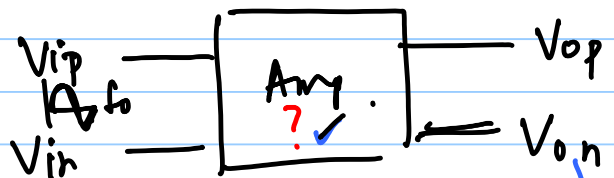
SNR , - $\dfrac{\text{Signal Power}}{\text{Noise Power}}$



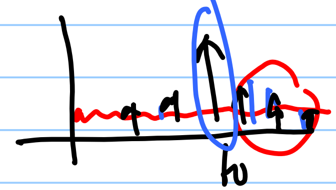


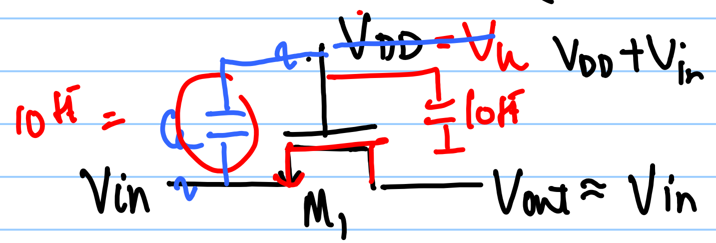
$$I = \mu_n C_{ox}\left(\frac{W}{L}\right)\left[\left(V_{DD} - V_{out} - V_t\right)\left(V_{in} - V_{out}\right) - \frac{\left(V_{in} - V_{out}\right)^2}{2}\right]$$

$$R = \frac{\partial V_{DS}}{\partial I_{DS}} \approx \frac{1}{\lambda I}$$



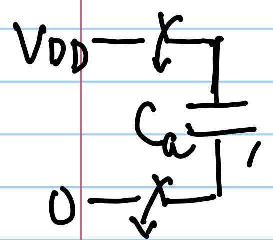
$$V_{th} = V_{th0} + \gamma\left(\sqrt{2\phi_B + V_{SB}} - \sqrt{2\phi_B}\right)$$





$V_{ov} = V_G - V_S - V_t \rightarrow 0.5$

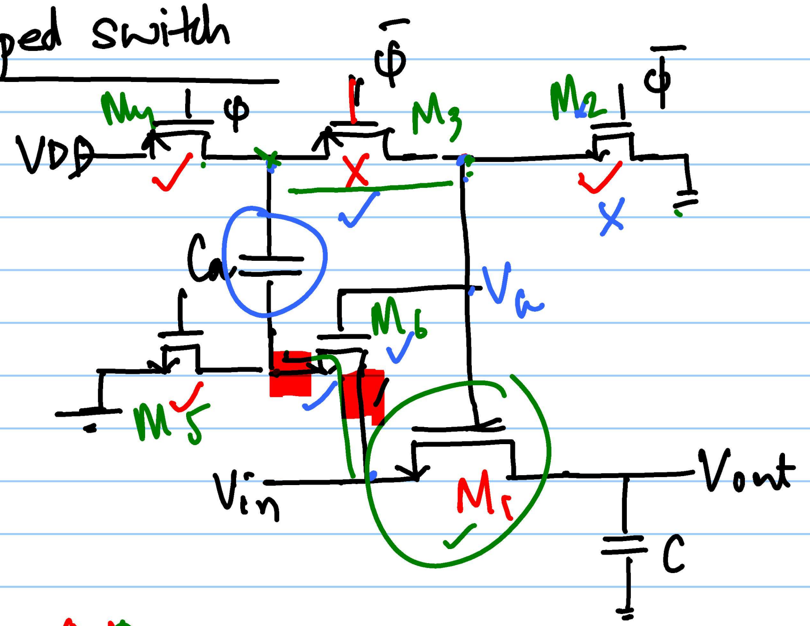
1.8V　　0 - 0.2 V

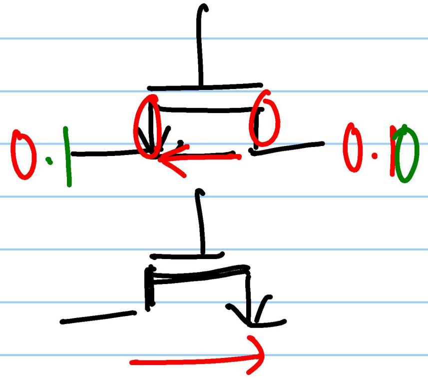


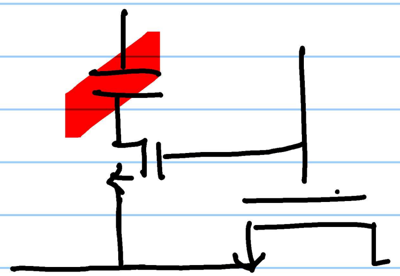
$$V_{ov} = \left(V_{DD} + V_{in}\right) - V_{out} - V_t$$

$$= V_{DD} - V_t + \underset{\approx 0}{\left(V_{in} - V_{out}\right)}$$

Boot-strapped switch

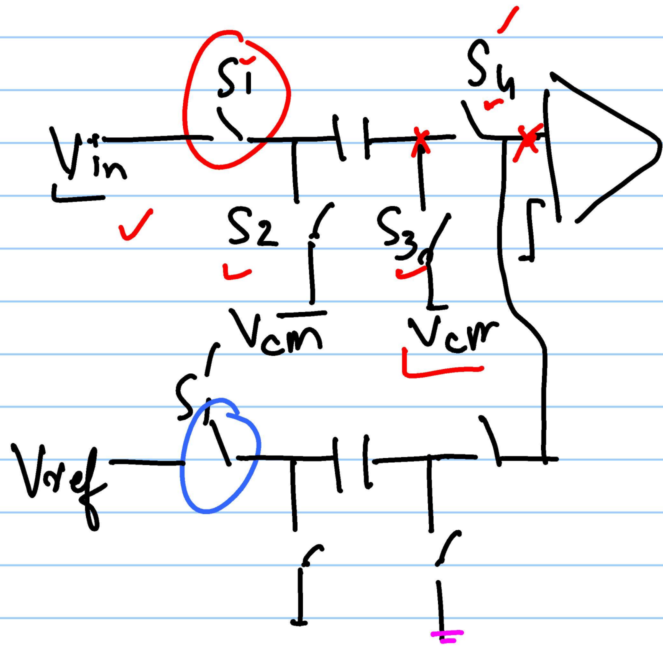




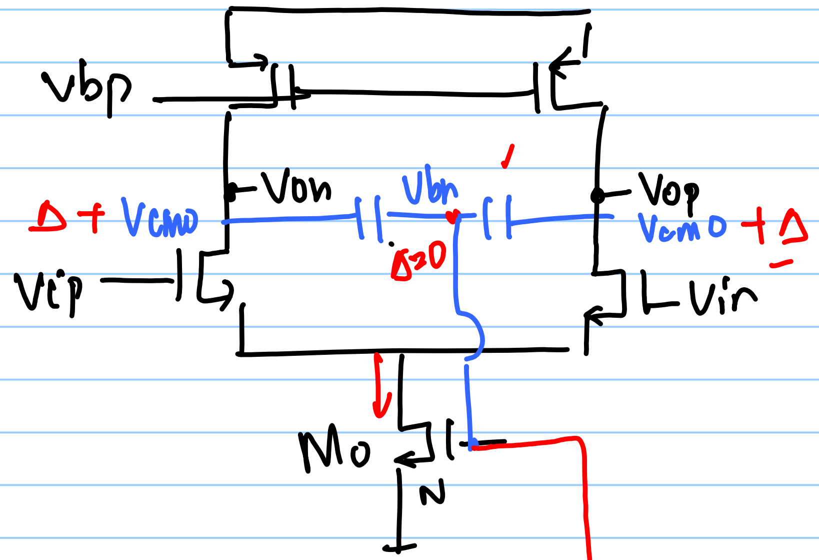


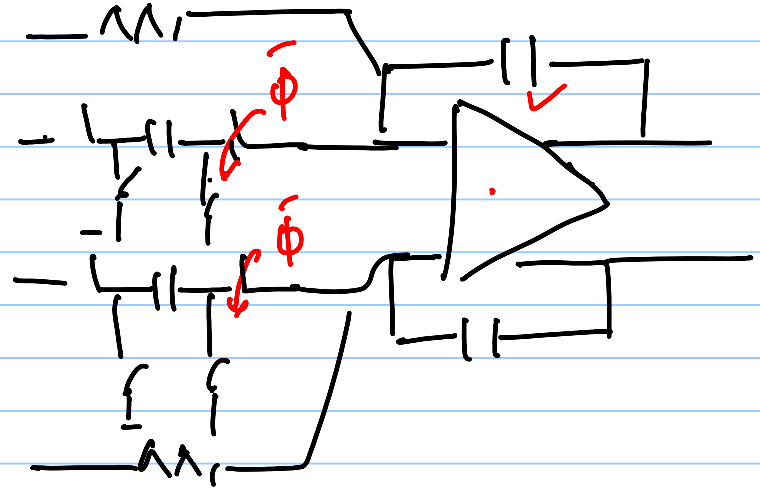
ϕ is low :

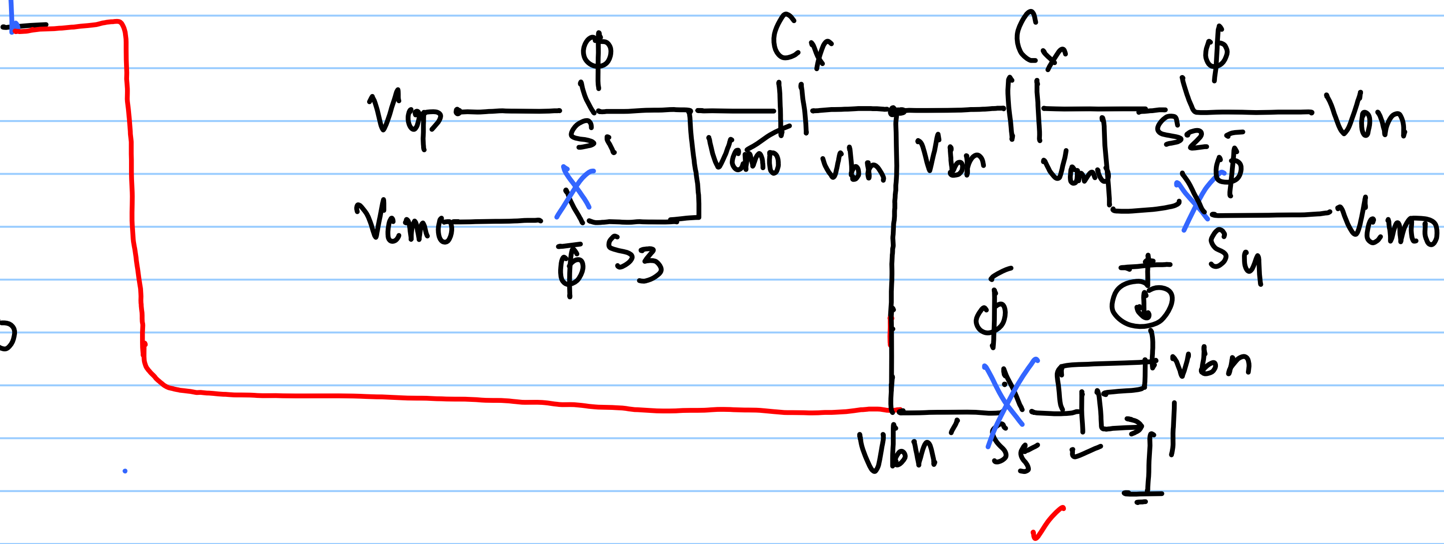
ϕ is high :



Switched-capacitor CMFB







$V_{op} = V_{on} = \underline{V_{cmo}}$

$\Delta\left(\frac{V_{op}+V_{on}}{2}\right) \neq 0$

>0

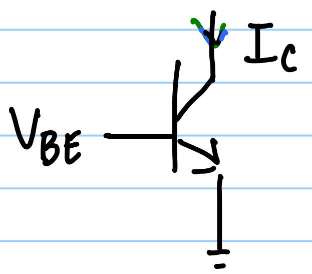
$\bar{\phi}$ is low.

ϕ is high.

$$V_T = kT/q$$

Bandgap Ref

$$\frac{dV_{REF}}{dT} = 0 \qquad \frac{dV_1}{dT} > 0 \qquad \frac{dV_2}{dT} < 0$$



$$I_c = I_s \exp\left(\frac{V_{BE}}{V_T}\right)$$

$$I_s \propto \mu k n_i^2$$

$$\mu \propto \mu_0 T^m \quad , \; m = -3/2$$

$$n_i^2 \propto T^3 \exp\left(\frac{-E_g}{kT}\right) \quad , \; E_g = 1.12\,eV$$

$$I_s = bT^{m+4} \exp\left(\frac{-E_g}{kT}\right)$$

$$V_{BE} = V_T \ln\left(\frac{I_c}{I_s}\right) ✓$$

$$\frac{dV_{BE}}{dT} = \frac{dV_T}{dT}\ln\left(\frac{I_c}{I_s}\right) + \frac{V_T}{I_c/I_s}\boxed{\frac{dI_c}{dT}} \times \frac{1}{I_s}$$

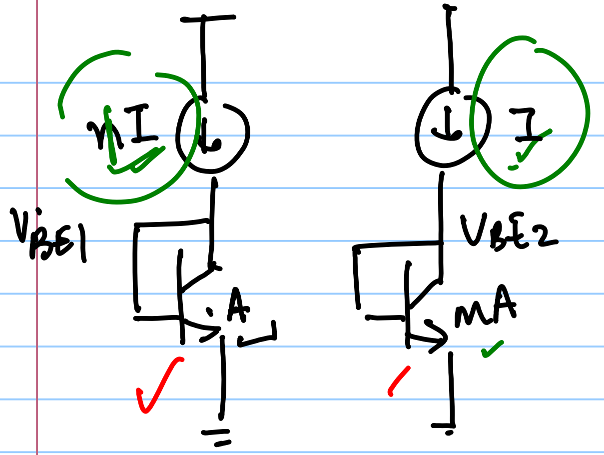
$$+ \frac{V_T}{I_c/I_s} \cdot I_c \cdot \frac{-1}{I_s^2}\frac{dI_s}{dT}$$

$$\frac{dV_{BE}}{dT} = \frac{V_{BE} - (4+m)V_T - E_g/q}{T}$$

$$= -1.5\,mV/K ✓$$

$V_{BE} = 0.75\,V$

$T = 300\,K.$



$$V_{BE1} = V_T \ln\left(\frac{nI}{I_s}\right)$$

$$V_{BE2} = V_T \ln\left(\frac{I}{m I_s}\right)$$

$$V_{BE1} - V_{BE2} = V_T \ln(nm)$$

$$\Delta V_{BE} = V_T \ln(nm)$$

$$\frac{d(\Delta V_{BE})}{dT} = \frac{k}{q} \ln(nm)$$

$$V_{BE} = V_T \ln\left(\frac{I_c}{I_s}\right)$$

$$\frac{k}{q} = 0.087\,mV/K$$

$$V_{REF} = \alpha_1 V_{BE} + \alpha_2 (\Delta V_{BE})$$

$$\frac{dV_{REF}}{dT} = \alpha_1 \frac{dV_{BE}}{dT} + \alpha_2 \frac{d(\Delta V_{BE})}{dT}$$

$-1.5\,mV/K$ $\qquad$ $0.087 \ln(nm)\ mV/K$

$$-1.5 + [\alpha_2 \ln(nm)]\,0.087 = 0$$

$$\alpha_2 \ln(nm) = \frac{1.5}{0.087} = 17.2$$