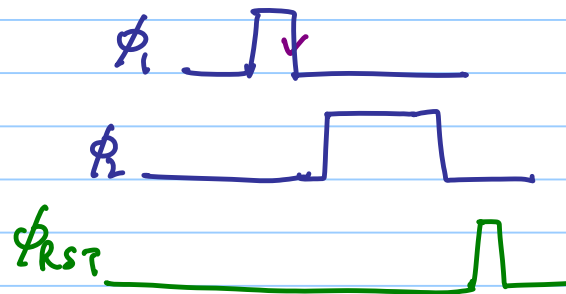
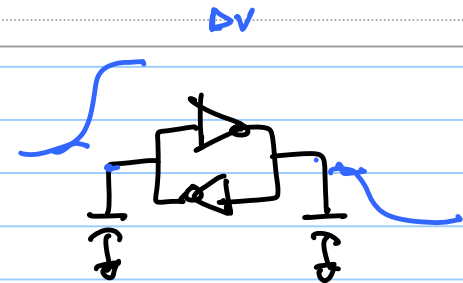
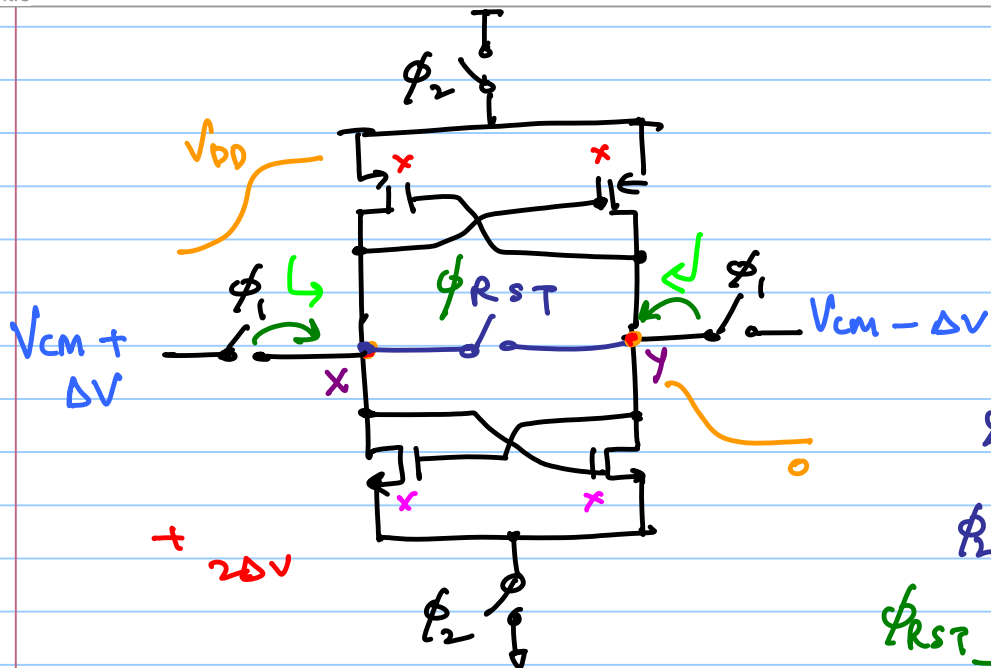
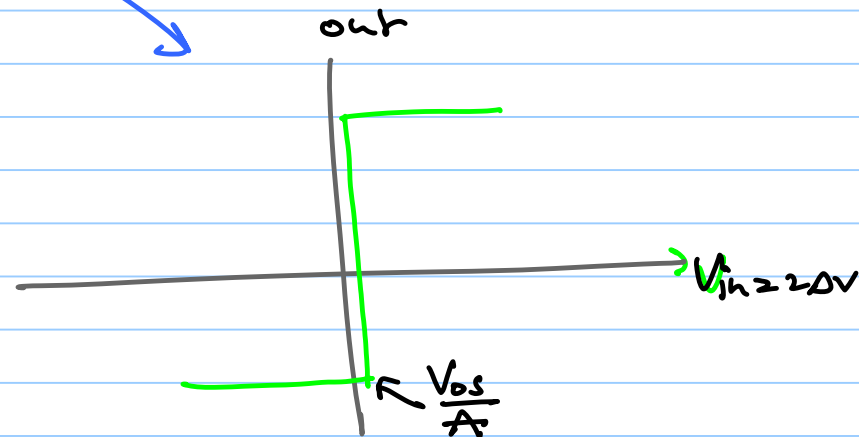
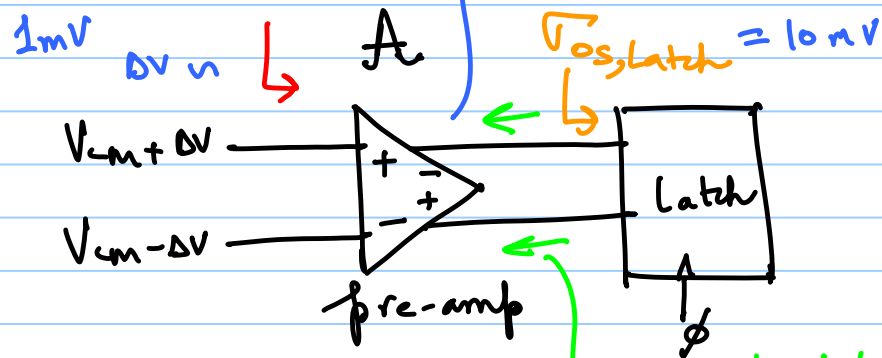
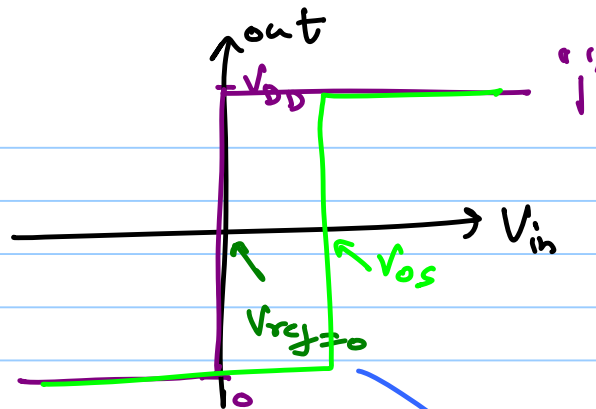
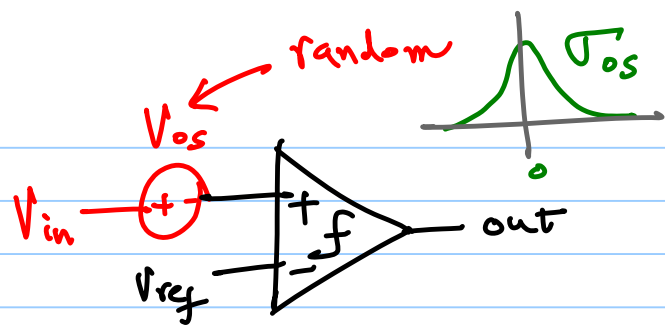


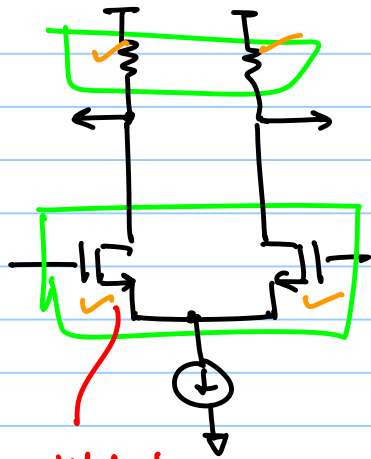
ECE 517 - Lecture 9

Note Title

2/14/2017

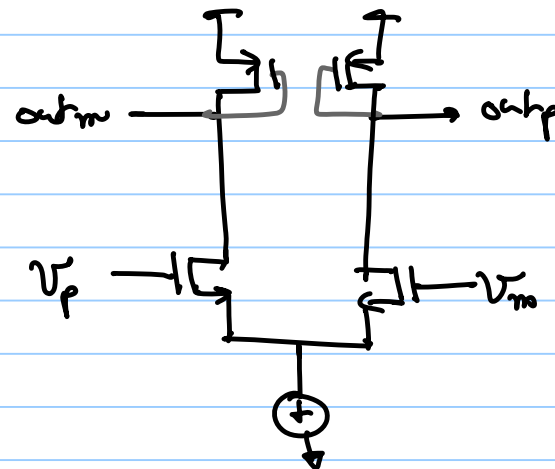




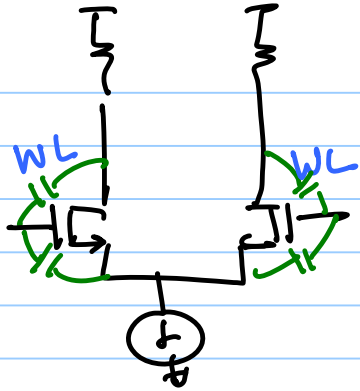


Large W & L

good layout techniques to reduce mismatch



$$V_{os} = \underline{\underline{V_{os,pre}}} + \frac{V_{os,latch}}{A_{pre}}$$

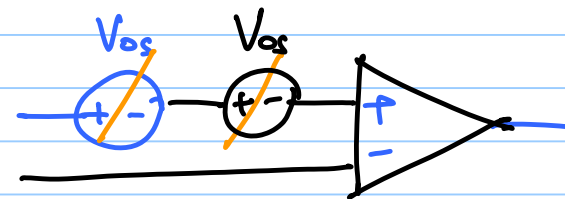
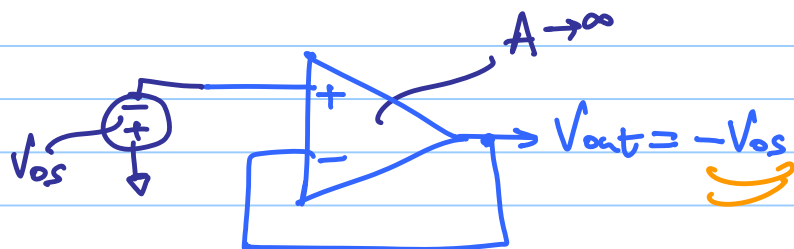
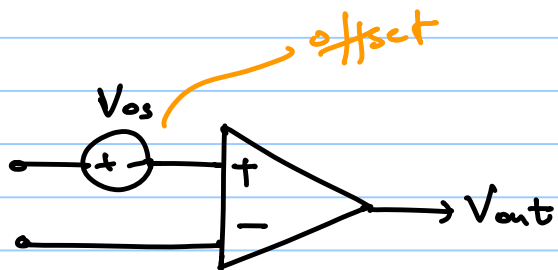


$$\sigma_{os}^2 = \sigma_{os,pre}^2 + \frac{\sigma_{os,latch}^2}{A_{pre}^2} \leftarrow \text{Variances}$$

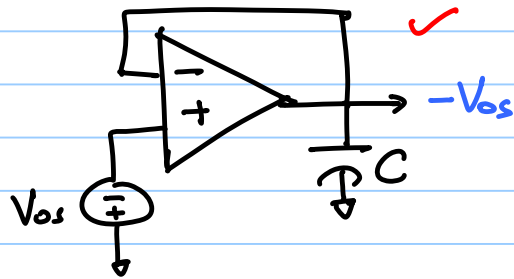
$A \uparrow$

Large size input transistors to reduce $\sigma_{os,pre}$

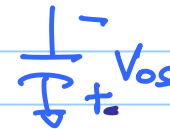
Offset Cancellation:



① find the offset and store it



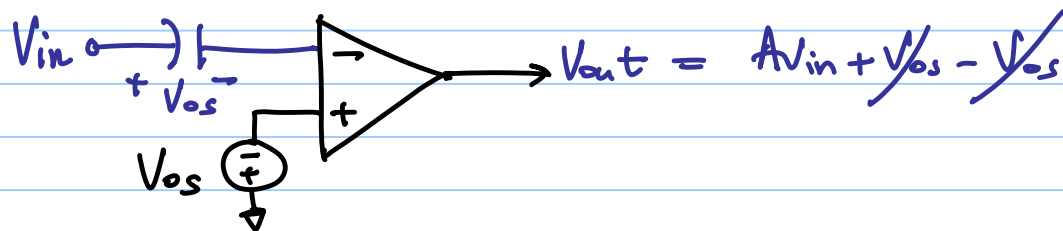
$\Rightarrow$



Disconnect capacitor

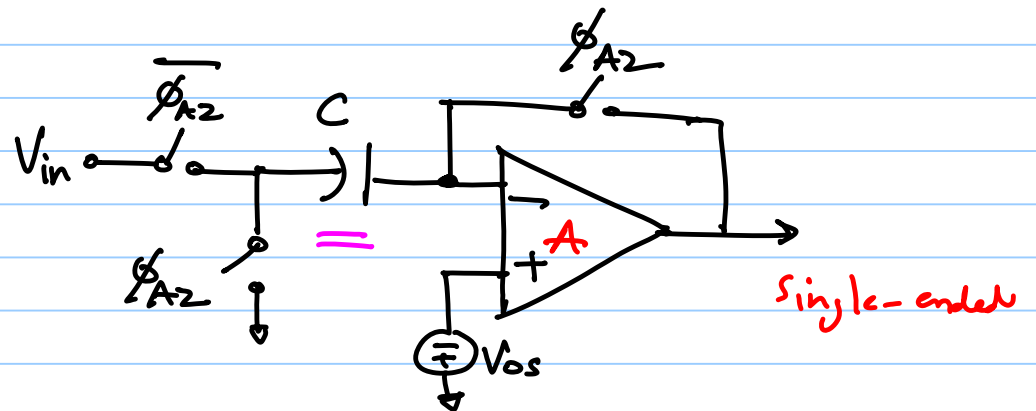
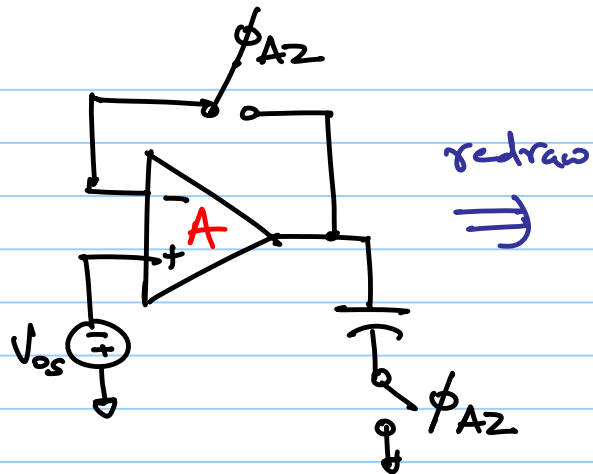
$\hookrightarrow$ holds the charge like a battery

② Use switches to reconfigure the capacitors



Autozeroing (AZ)

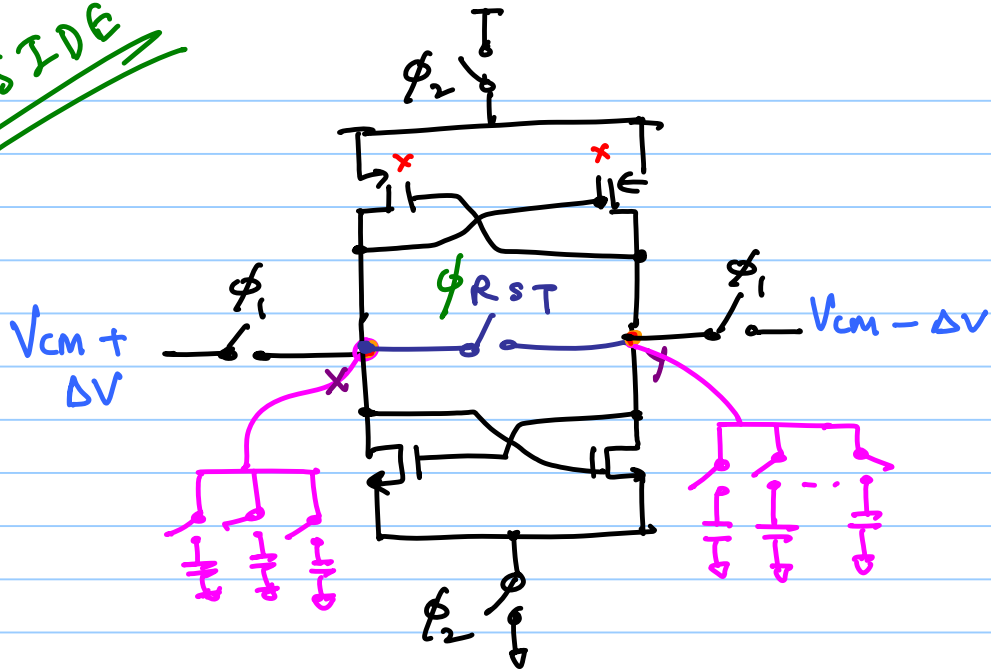
Switched Capacitor circuit



$\Rightarrow$ offset cancellation process $\Rightarrow$ Autozeroing (A2)

* How does a finite gain (A) of the preamp affect offset cancellation?

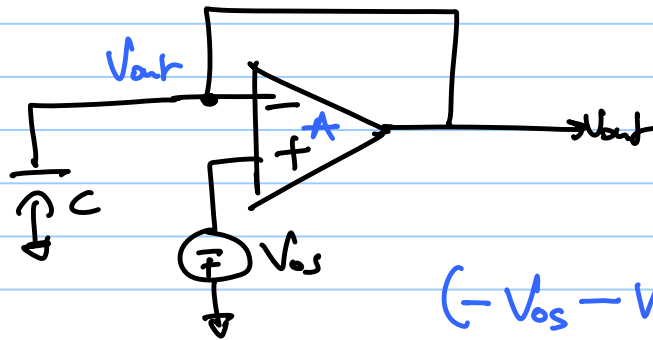
ASIDE



Digital offset compensation techniques

offset trimming

During ϕ_{A2}



$$(-V_{os} - V_{out})A = V_{out}$$

$$\Rightarrow V_{out} = -V_{os} \cdot \frac{A}{A+1}$$

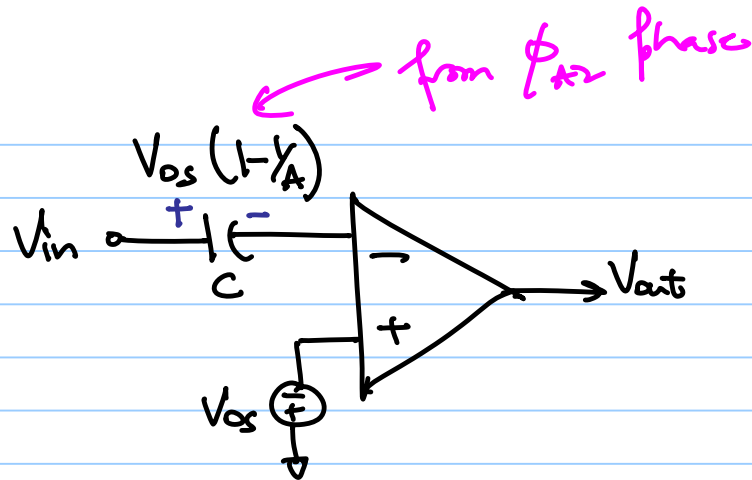
$$= -V_{os} \left(\frac{1}{1 + \frac{1}{A}} \right) = -V_{os} \left(1 + \frac{1}{A} \right)^{-1}$$

error of $\frac{V_{os}}{A}$ $\underbrace{\quad}_{= -V_{os} \left(1 - \frac{1}{A} \right)}$

$$|x| \ll 1$$

$$(1+x)^{-1} \approx 1-x$$

During $\overline{\phi_{AZ}}$:

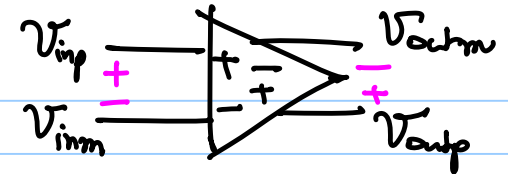


Equivalent offset $\Rightarrow \frac{V_{os}}{A}$

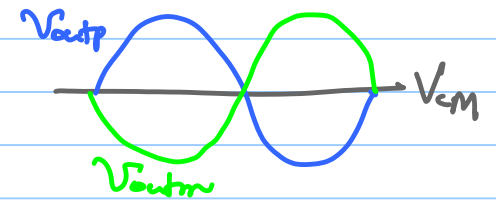
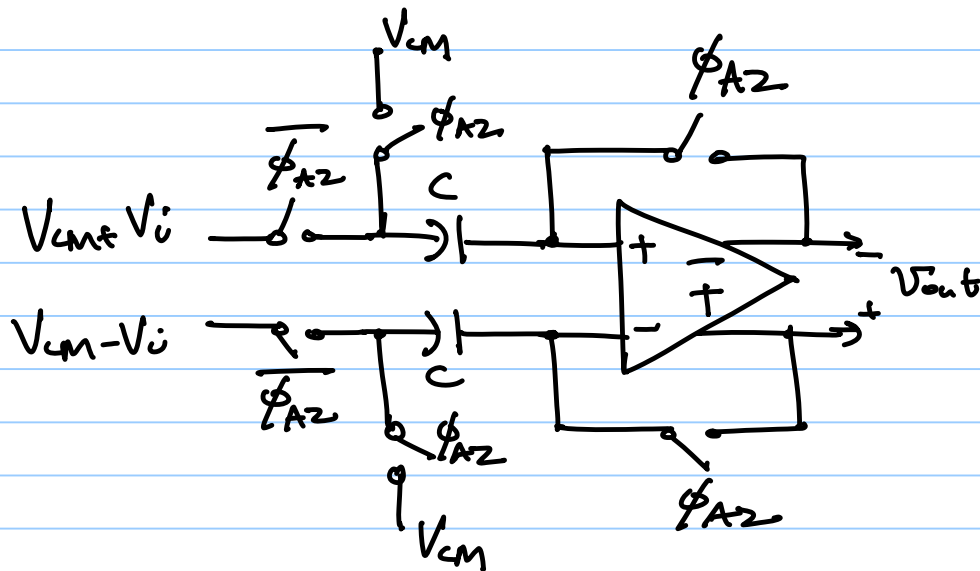
$\rightarrow$ pre-amp should have large DC gain.

Differential 1st Amp

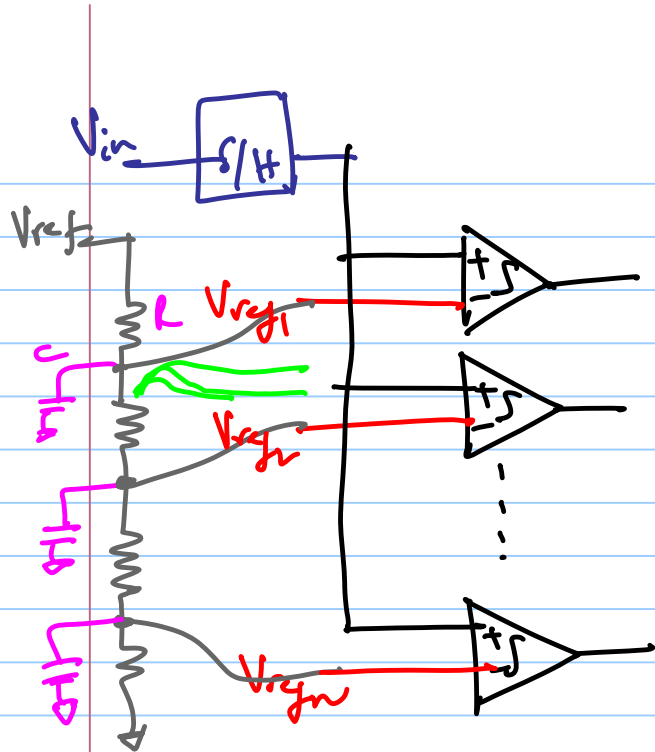
V_{cm}



$$\underbrace{(V_{outp} - V_{outm})}_{V_{out}} = A \underbrace{(V_{inp} - V_{inm})}_{V_{in}}$$

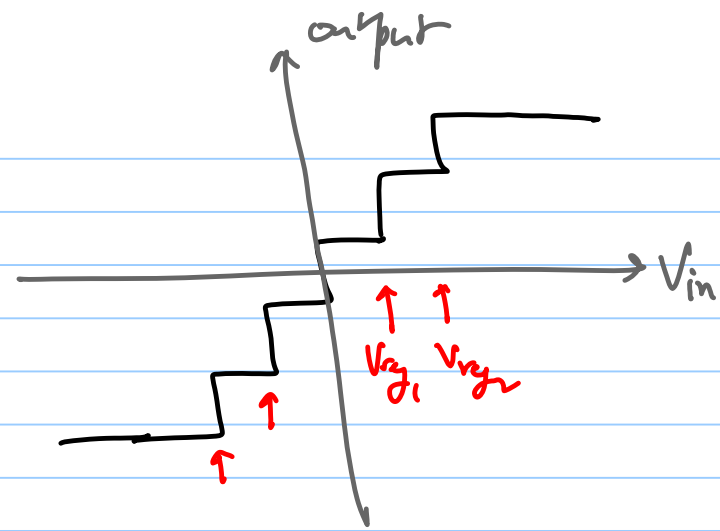


$$V_{cm} = \frac{V_{outp} + V_{outm}}{2}$$



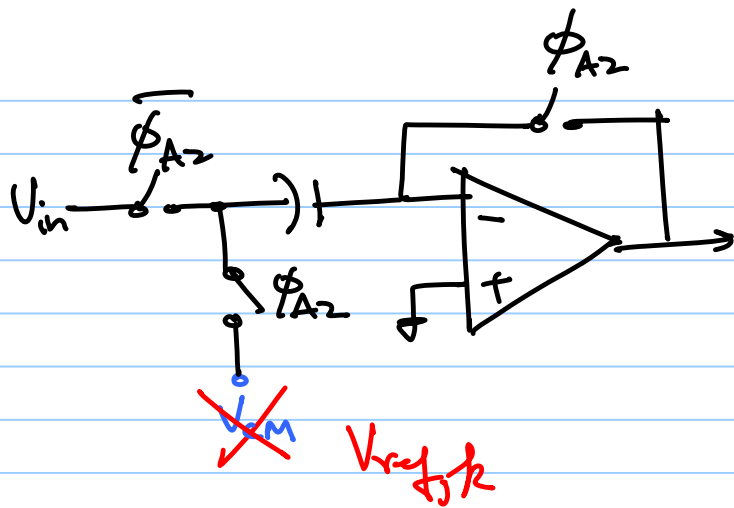
Resistor Ladder

Flash ADC



Flash-ADC

"Reference Subtraction"



$V_{ref,k}$

$k = 0, 1, \dots, N$

* References & Autogzero Can be stored at the same time