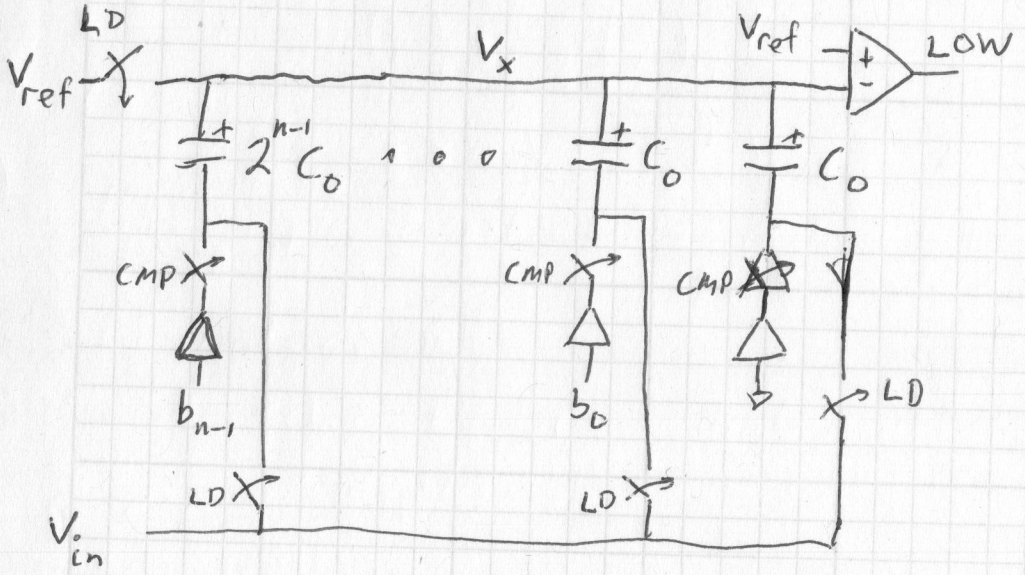
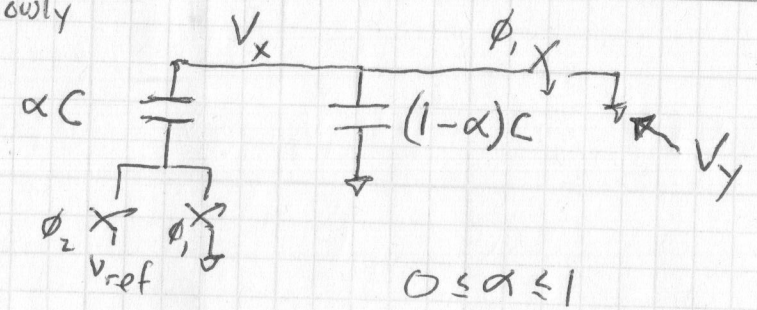
ADC

PGA

Switches



Previously



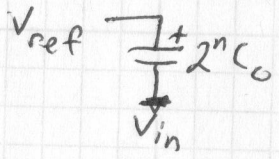
$0 \le \alpha \le 1$

$\phi_2 : V_x = \alpha V_{ref}$ use binary array to create α

if $V_y \neq 0$ then

$\phi_2 : V_x = \alpha V_{ref} + V_y$

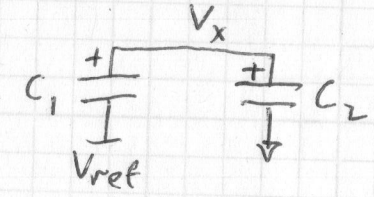
LD phase:



$Q_x = (V_{ref} - V_{in}) 2^n C_0$

once LD goes low, Q_x fixed

CMP phase:



$Q_{x+} = Q_{1+} + Q_{2+}$

$= C_1(V_x - V_{ref}) + C_2 V_{ref}$

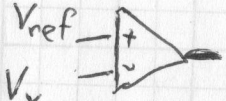
$= (C_1 + C_2) V_x - C_1 V_{ref}$

must be same charge as above, $(V_{ref} - V_{in}) 2^n C_0$

$$Q_{x,LD} = Q_{x,cmp} \Rightarrow (V_{ref} - V_{in})\underbrace{2^n C_0}_{C_1+C_2} = (C_1+C_2)V_x - C_1 V_{ref}$$

$$V_{ref} - V_{in} = V_x - \frac{C_1}{C_1+C_2} V_{ref}$$

$$V_x = V_{ref} + \frac{C_1}{C_1+C_2} V_{ref} - V_{in}$$



$$V_{id} = V_{ref} - V_x = V_{in} - \frac{C_1}{C_1+C_2} V_{ref}$$

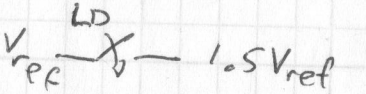
$$= V_{in} - \frac{B}{2^n} V_{ref}$$

note that V_x can go above V_{ref}.

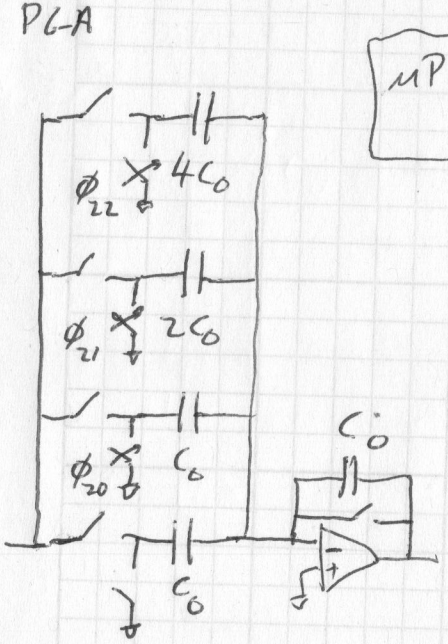
Worst case: $V_{in} = 0$ 1st SAR guess is 10000...0

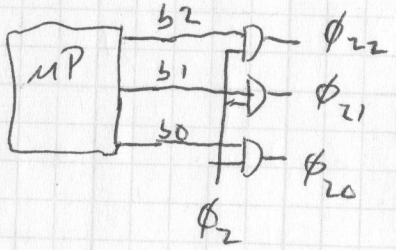
$$\Rightarrow V_x = V_{ref} + \frac{1}{2} V_{ref}$$

possibly challenging for design of 1 switch

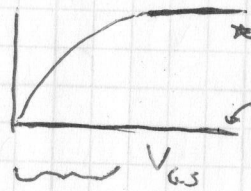


PG-A





Switches



modeled as a resistor

≈ const current

$$V_c(t) = V_0 e^{-t/\tau}$$

$$\frac{dV_c}{dt} = \frac{-I}{C} = \text{const}$$