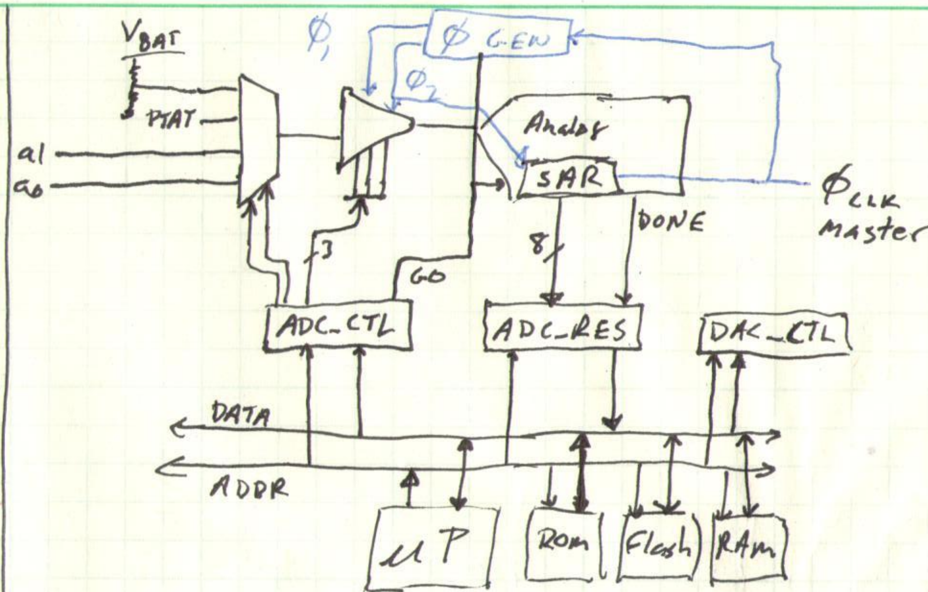
uP interface

timing

switch issues

forward biasing diodes

charge injection

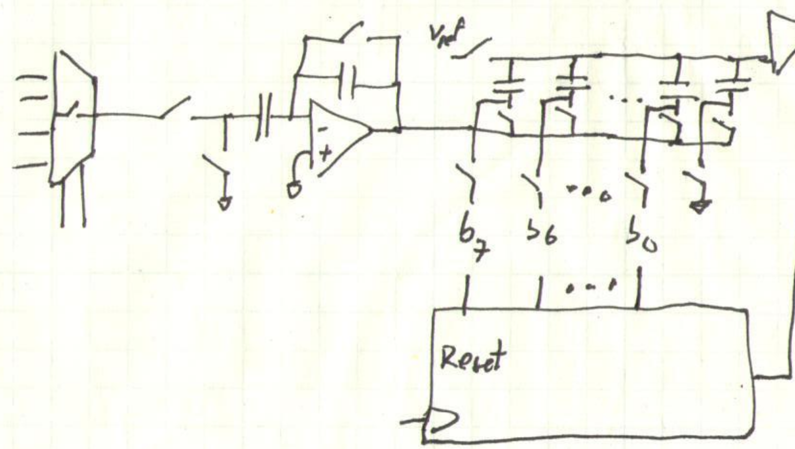


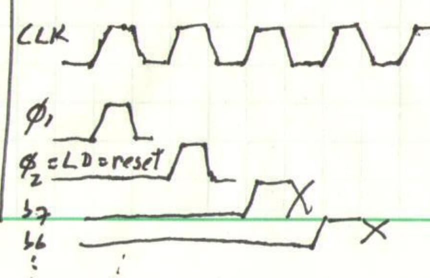
pseudo-C code

```
#define  ADC_CTL   0x1000
#define  ADC_RES   0x1004    // 32 bit words, 4 bytes
#define  DAC_CTL   0x1008
#define  BATTERY   3
int gain = 4;  // 1..8

   mux = BATTERY;

   go = 1

  *ADC_CTL = (gain-1)<<4 | mux<<1 | go;

  *ADC_CTL = *ADC_CTL & (~1) ;// reset "go"

   for (i=0; i<100; i++);  // wait 100 cycles of 10 MHz
                              → times cycles/loop

   x = *ADC_RES;
```

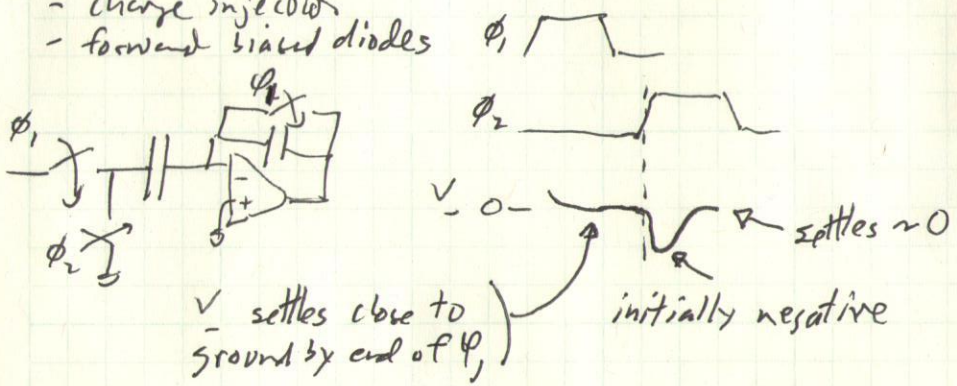
there are better ways to do this

timing

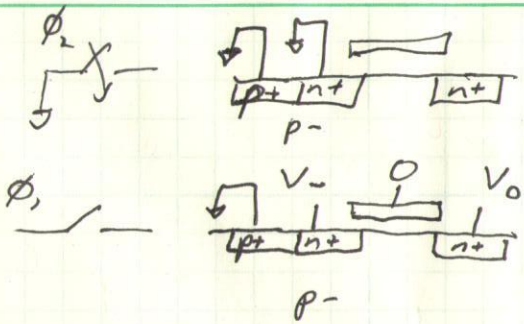




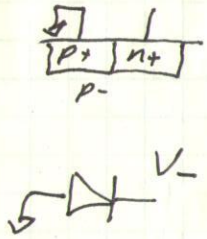
Issues w/ switches
- charge injection
- forward biased diodes

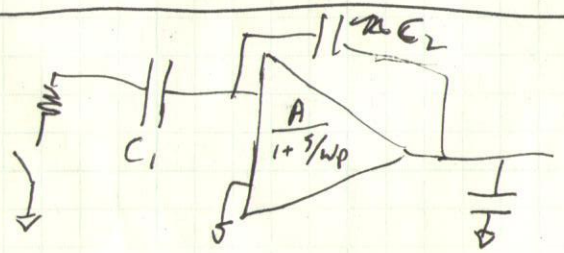


if there were no op-amp, when ϕ_2 goes high
V_- would go to $-V_{in}$, e.g. $-0.8V$



what if $V_- = -0.1V$?
$= -0.5V$?



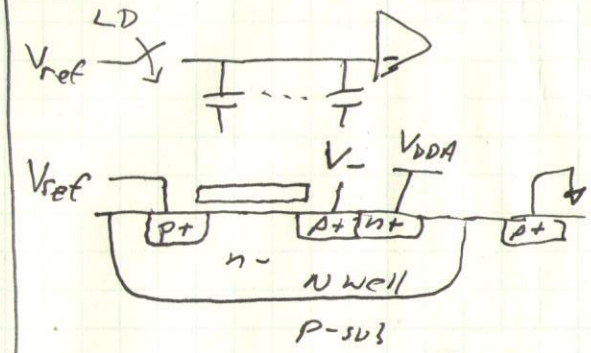


worse if $C_1 >> C_2$ ($G = 8$)

$\tau_{switch} = R_{ON}(C_1 \text{ series } C_2) < \tau_{amp}$ (slowest when $G = 8$)

V_{in} is large

ϕ_2 has a fast edge



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

if $V_{in} = 0$ and $B = 0xFF$, $V_- \tilde{=} 2V_{ref}$

never happens, but if $B = 0x80$ (1000 0000)

$V_- \approx 1.5 V_{ref} = 1.2V$