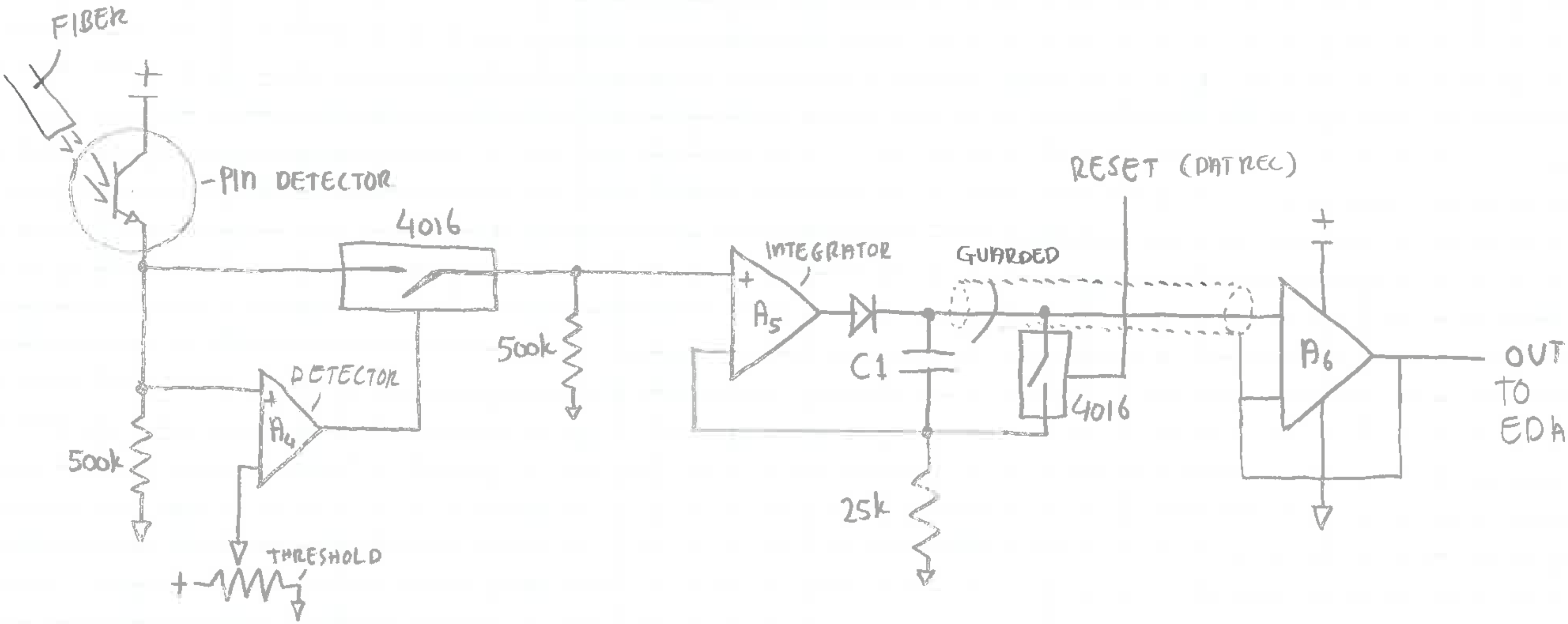
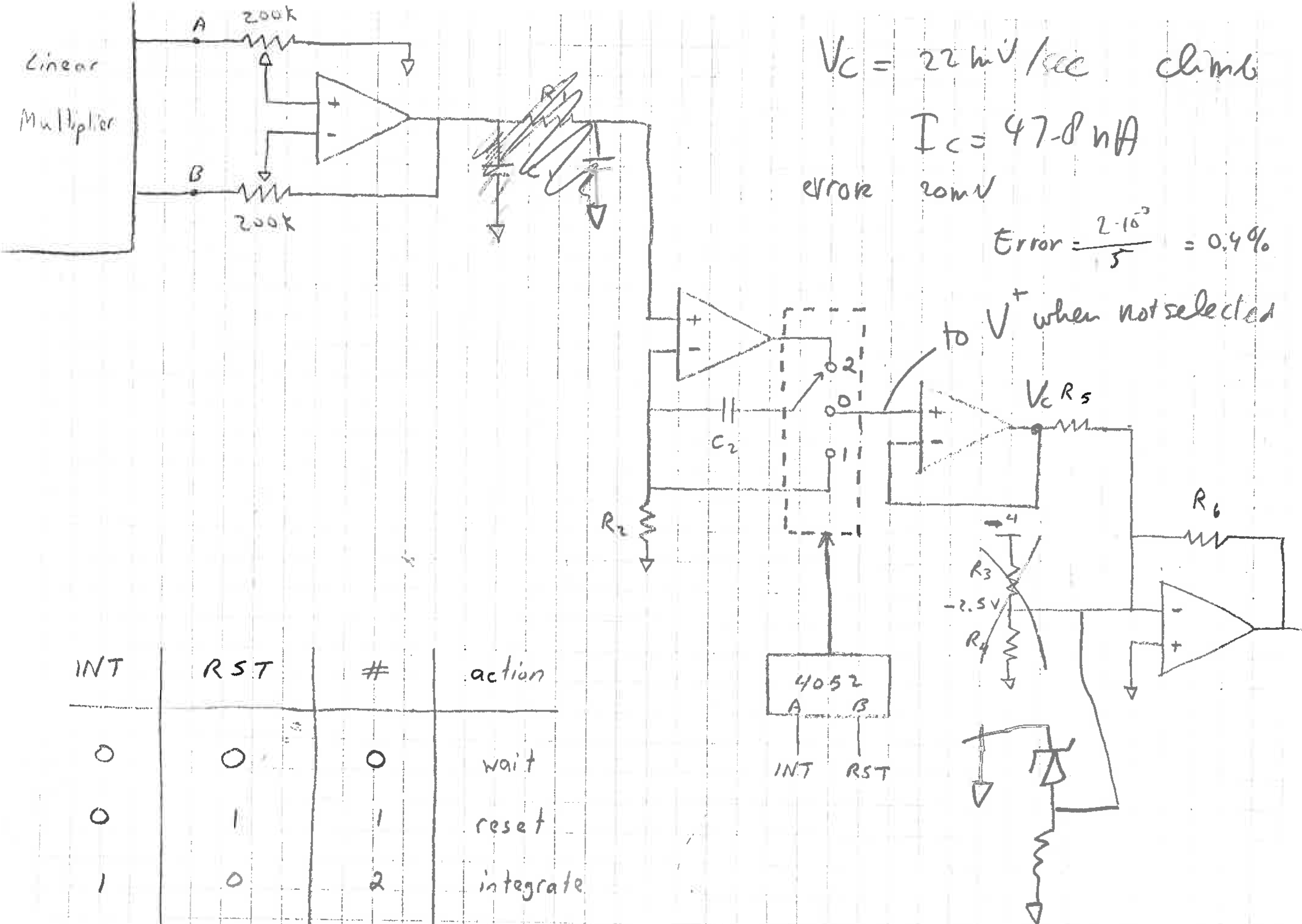
INTEGRATOR



Op-Amps : 357
SLEW 50 V/µs
BW 15 MHz
JFET INPUT
OR EQUIVALENT

4016 QUAD CMOS
BILATERAL SWITCH

FORS MQP ED CHEUNG



$V_C = 22\,mV/sec$ climb

$I_C = 47.8\,nA$

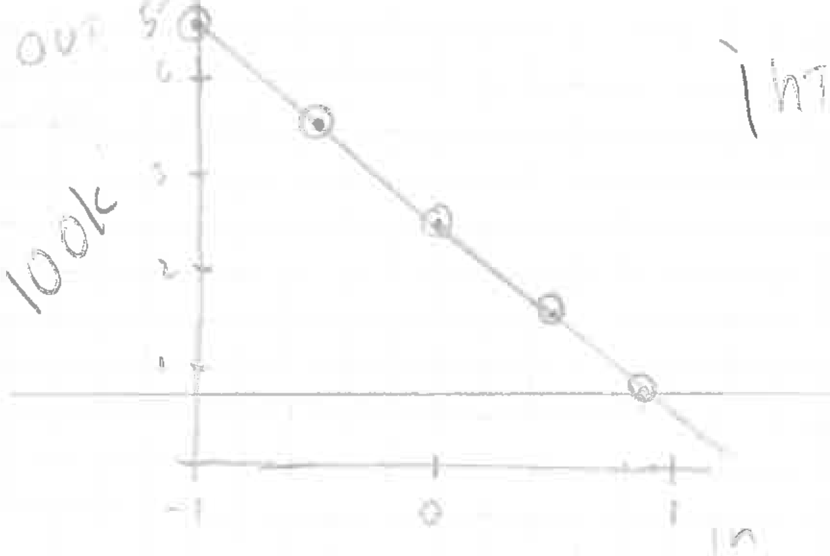
error 20mV

$Error = \frac{2 \cdot 10^{-3}}{5} = 0.4\%$

INT	RST	#	action
0	0	0	wait
0	1	1	reset
1	0	2	integrate

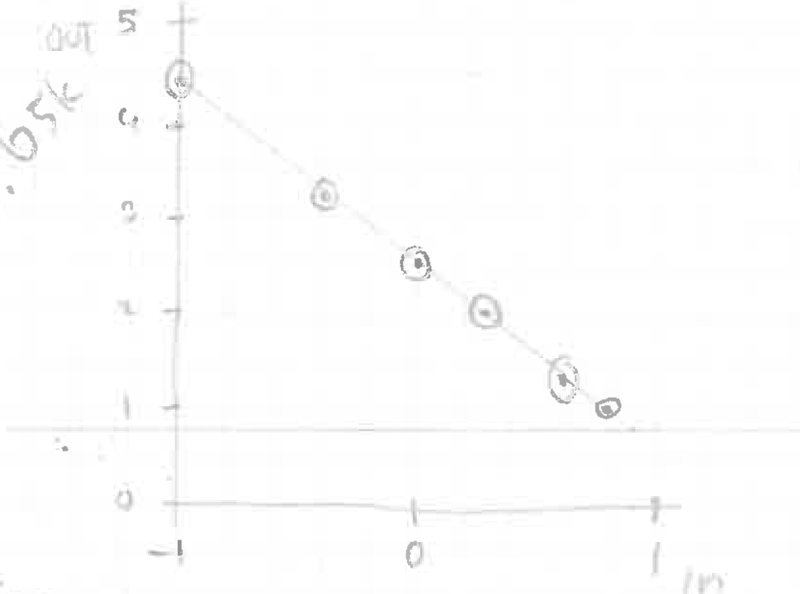
INTEGRATOR only

R = 100k

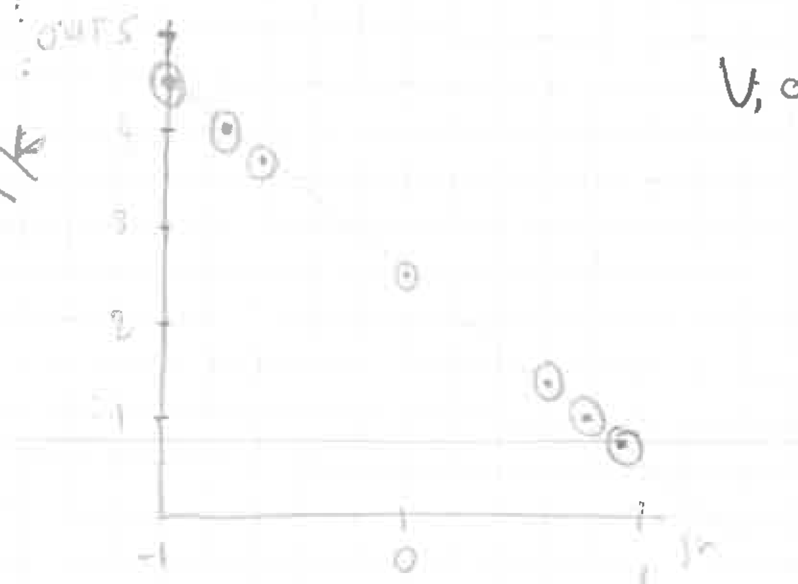


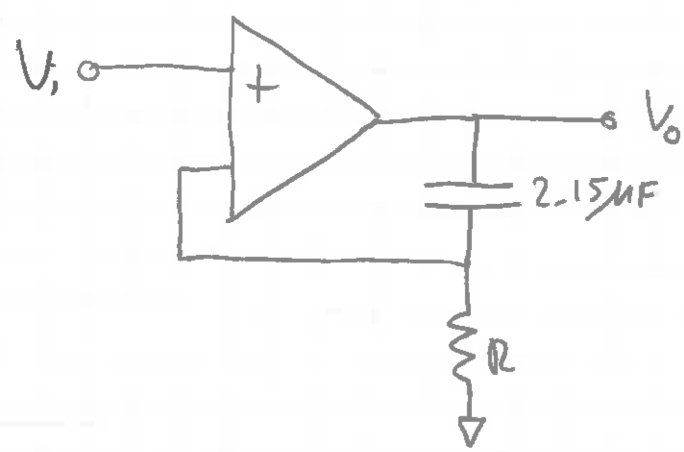
~~mission SFE early~~

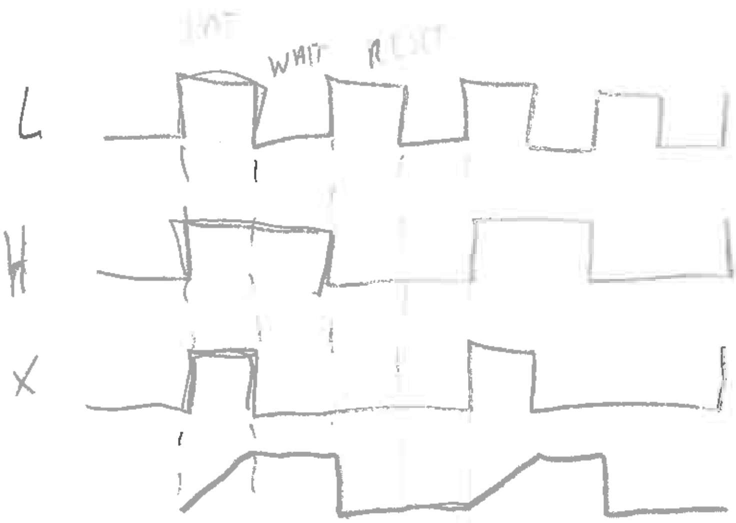
10.65k

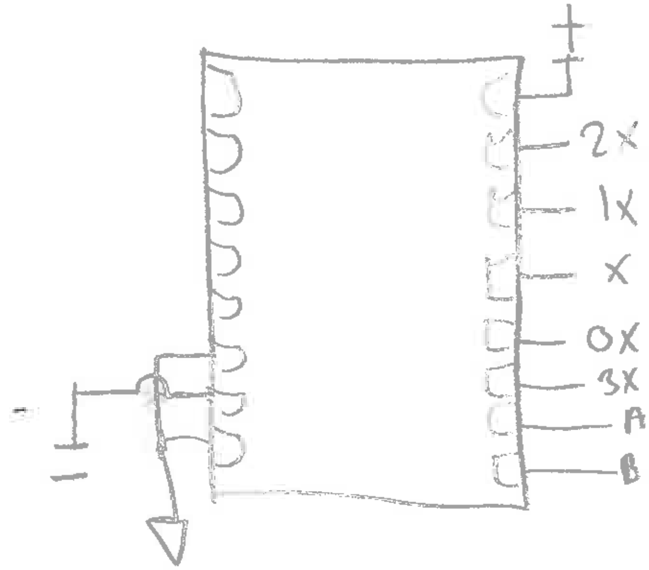


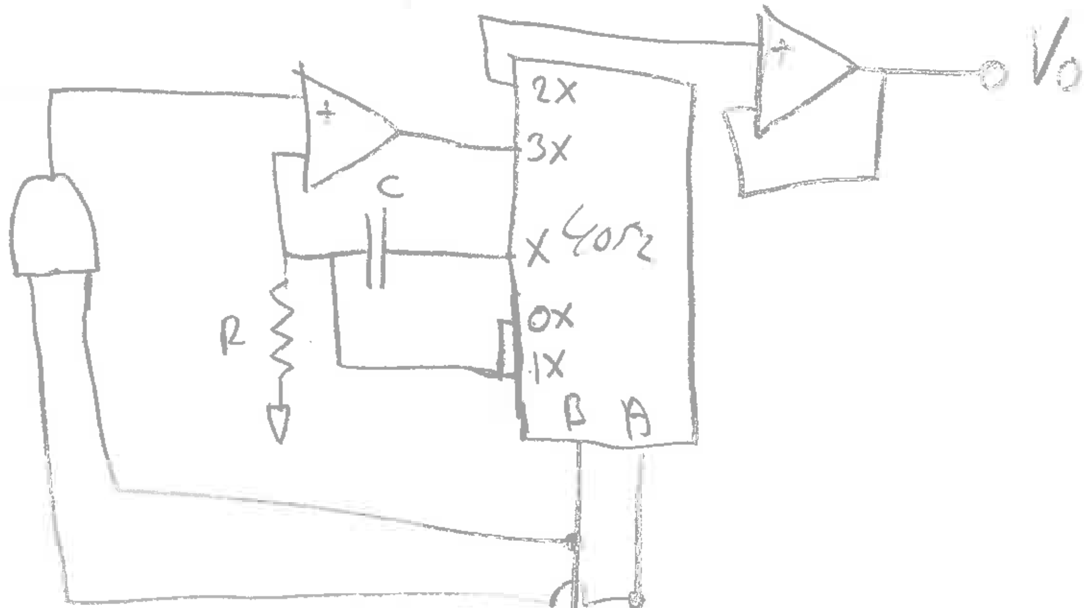
111k

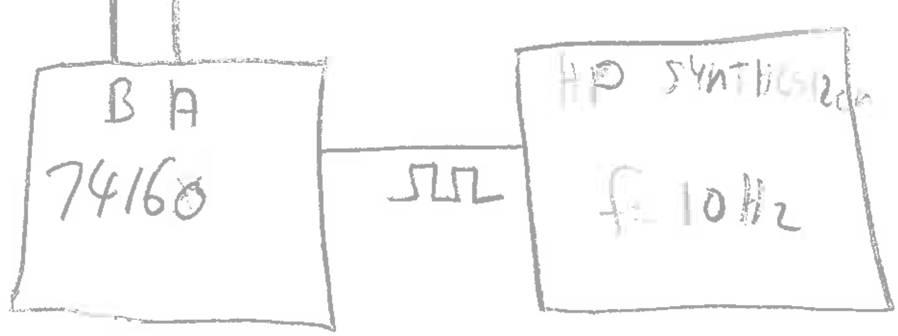








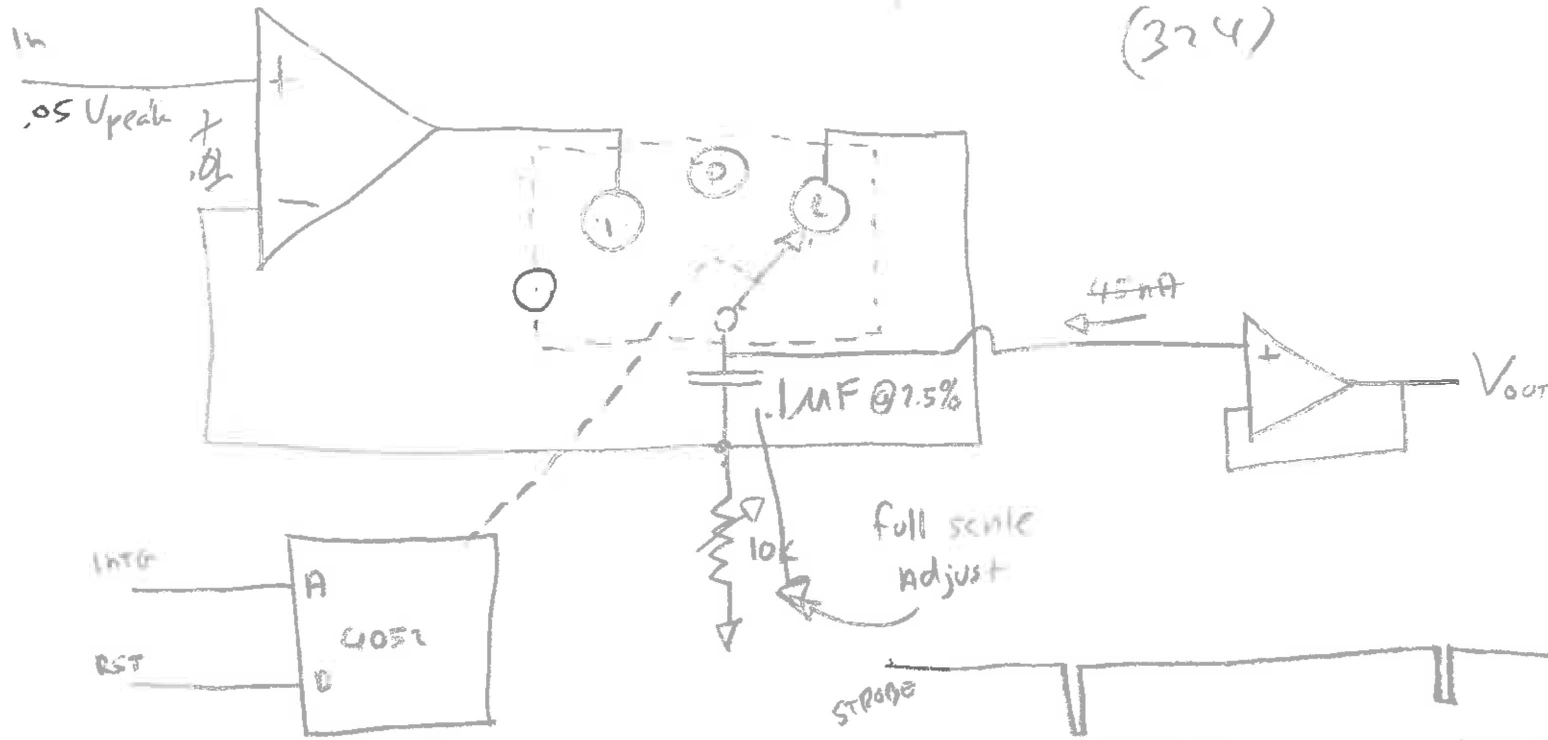




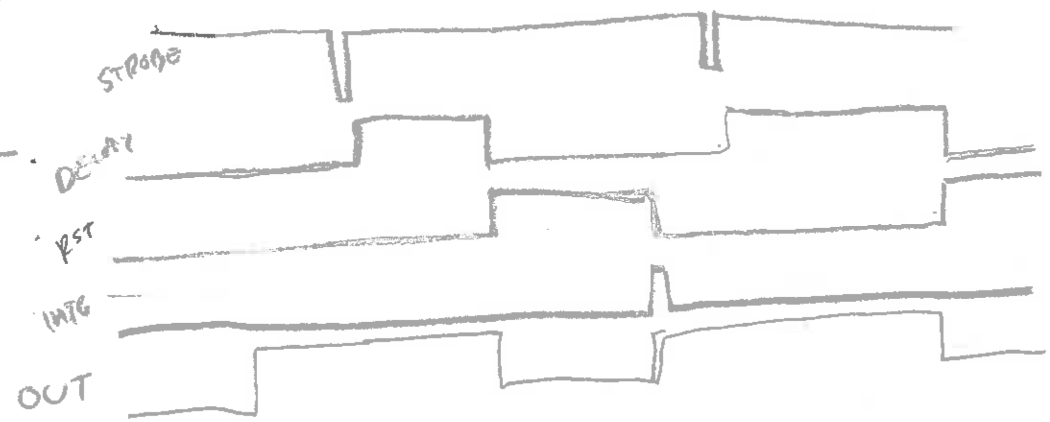
TEST
V_{CC}
MAX OUTPUT
WHEN CLIPPING

INTEGRATOR DETAILED

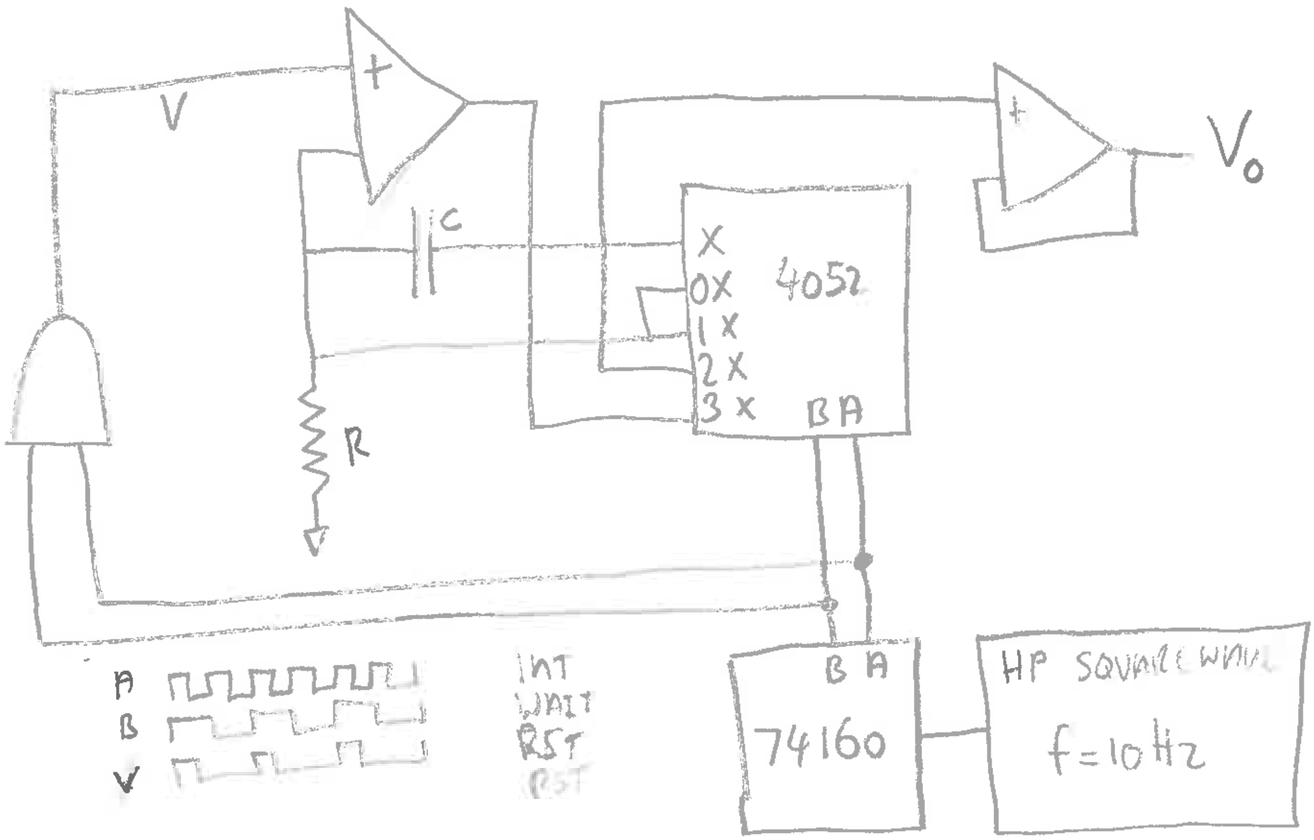
op amps : 24
(324)



INTG	RST	FUNCTION	no
0	0	WAIT	0
1	0	INTEGRATE	1
0	1	RESET	2
1	1	no GO	



INTEGRATOR TEST CIRCUIT



$I = \frac{V}{R}$ $\quad V_{OUT} = \frac{Vt}{RC}$ $\quad t = 50\,msec$

$V_{OUT} = \frac{I \cdot t}{C}$ $\quad$ assume $V_{OUT} = V$

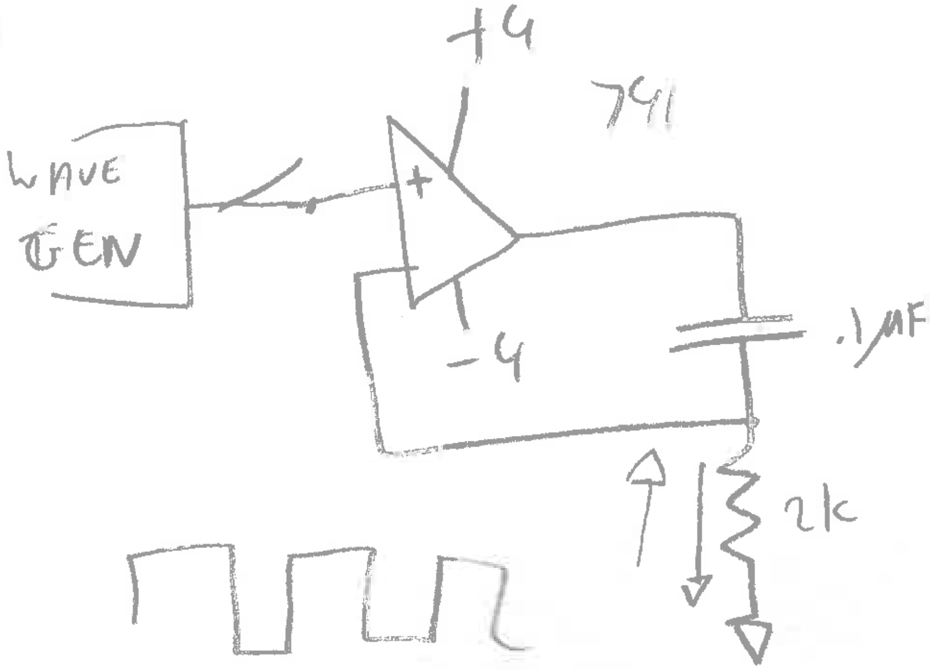
$RC = 50 \cdot 10^{-3}$

$C = 2.15\,\mu F$

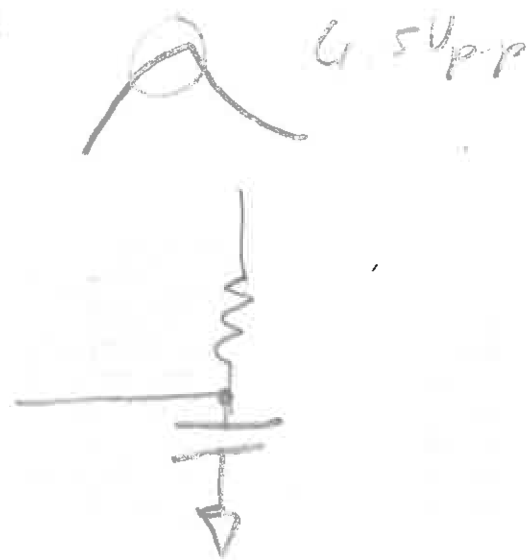
$R = 23,255\,\Omega$

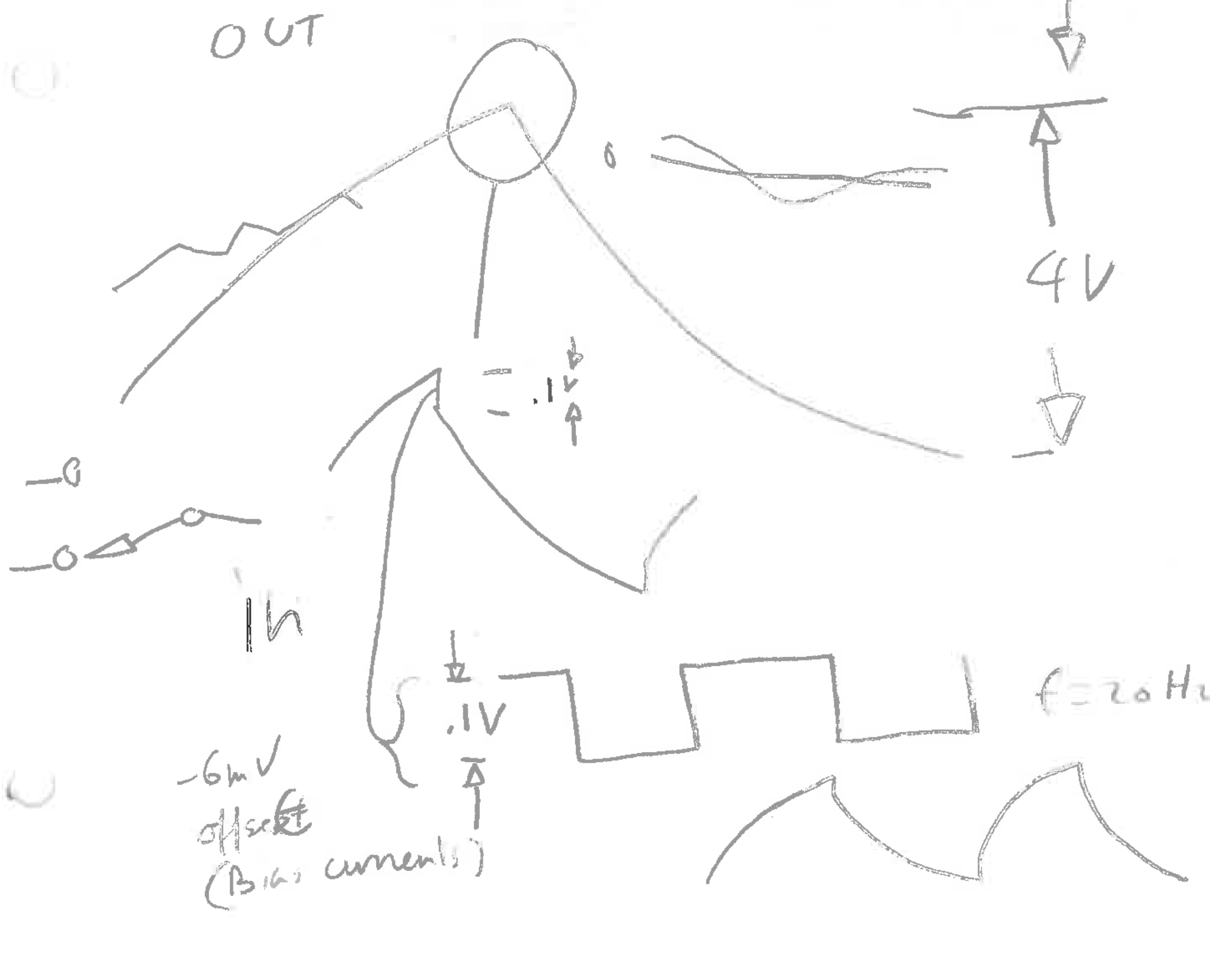
$R = 25\,k\Omega$

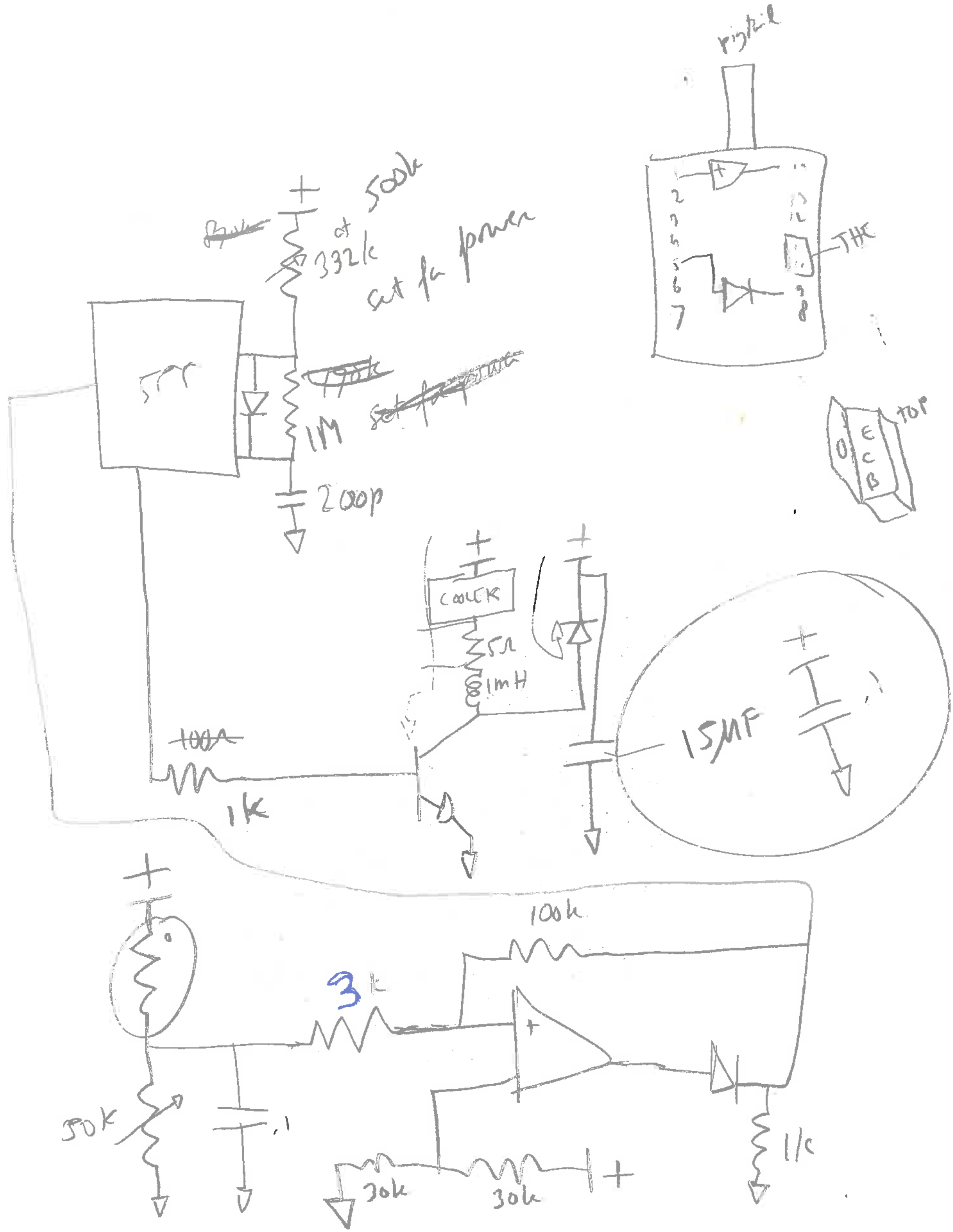
WORKING INTEGRATOR

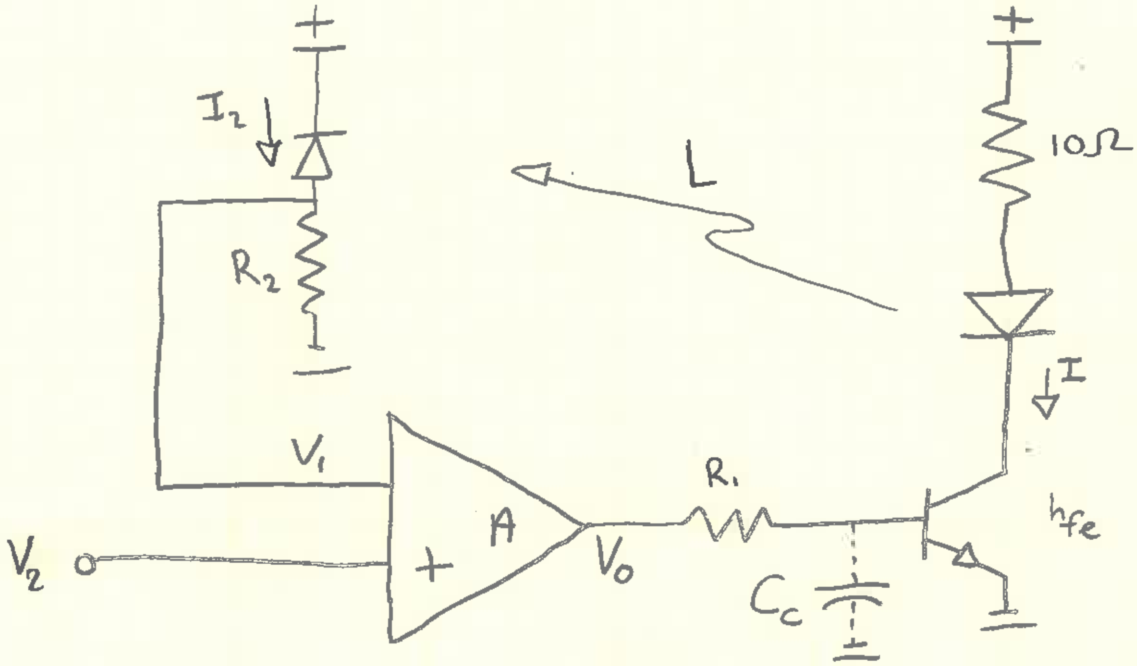


non linear at
217 Hz
6.5Vp-p






500k
at
332k
set for power
1M
200p
5Ω
1mH
15μF
1k
100k
3k
50k
.1
30k
30k
1k
THE
TOP
E
C
B



$$V_o = (V_2 - V_1)\,A$$

$$I = h_{fe}\left(\frac{V_o - 0.6}{R_1}\right)$$

$$L = D[I]$$

Light is a function (unknown) of current.

$$V_1 = I_2 \cdot R_2$$

$$I_2 = Q \cdot L$$

$$V_1 = Q \cdot L \cdot R_2$$

$$L = D\left[h_{fe}\left(\frac{V_o - 0.6}{R_1}\right)\right]$$

$$V_o = \frac{D^{-1}[L] \cdot R_1}{h_{fe}} + 0.6$$

$$\frac{D^{-1}[L] \cdot R_1}{h_{fe}} + 0.6 = (V_2 - Q \cdot L \cdot R_2) \cdot A$$

$$V_2 - Q \cdot L \cdot R_2 = \frac{\frac{D^{-1}[L] \cdot R_1}{h_{fe}} + 0.6}{A}$$

As $\lim_{A \to \infty}$ this becomes

$$V_2 - Q \cdot L \cdot R_2 = 0$$

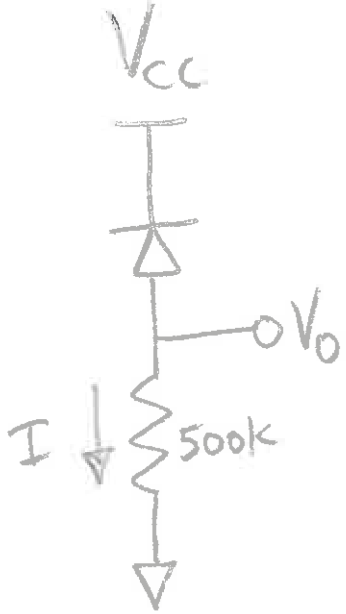
$$\boxed{L = \frac{V_2}{Q \cdot R_2}}$$

$$L = \frac{1}{Q \cdot R_2} \cdot V_2$$

$$L = k \cdot V_2$$

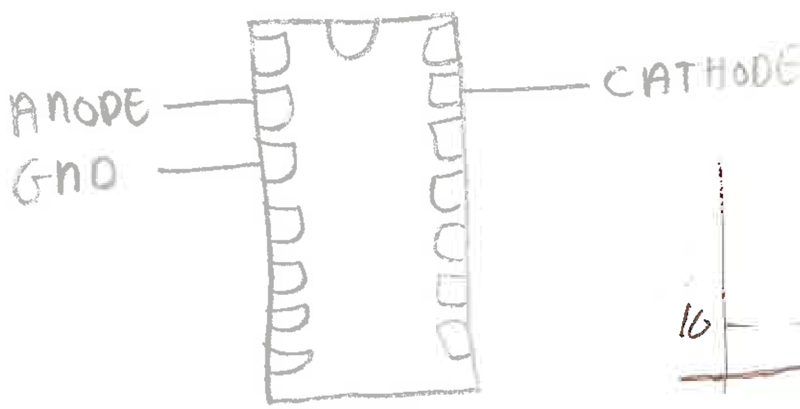
If efficiency of detector is constant over a large range, then light output will be proportional to V_2.

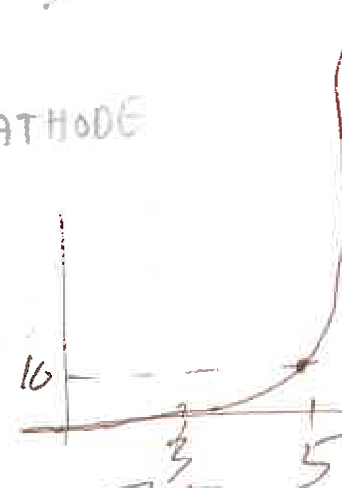
DETECTOR II

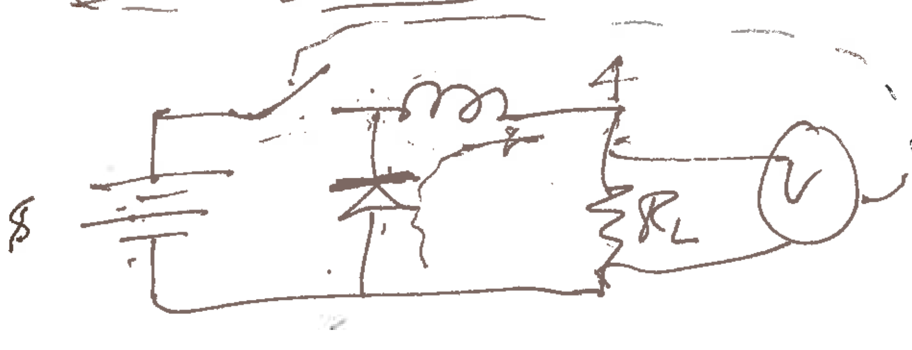


V_{cc}	V_0	I (µA)
4	4.37	8.74
5	5.38	10.76
6	6.36	12.72
7	7.35	14.70
8	8.34	16.68

light power ≈ 10 µWatts







INTO FIBER 100 μW

OUT FIBER 7 μW

LOSSES MEASURED 13 dB (mech. splices)

CALCULATED 11.6 dB

EFFICIENCY $\frac{I}{P} = 0.6$

Peak current ≈ 4.2 μA

~~$2 \cdot \phi_{max}$ ... sin ... = ...~~

$$P_{out} = \frac{1}{2} P_0 \left[J_1 (2 \phi_m \sin \pi f \tau) \sin(\epsilon) \right]$$

~~cos(πf t)~~

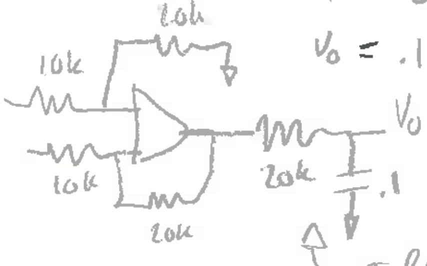
$\sin \pi f (t + \tau/2)$

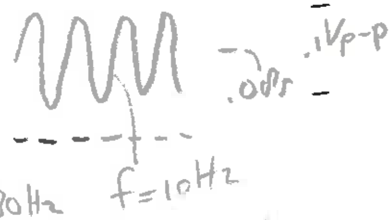
MC1tiplier

Detailed (works)

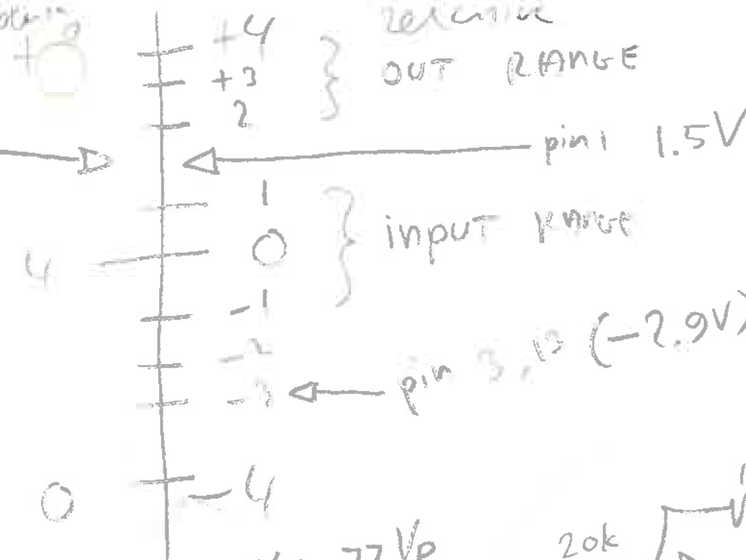
$V_{in} = 2 @ 1V_{p-p}$ $\Delta f = 10Hz$

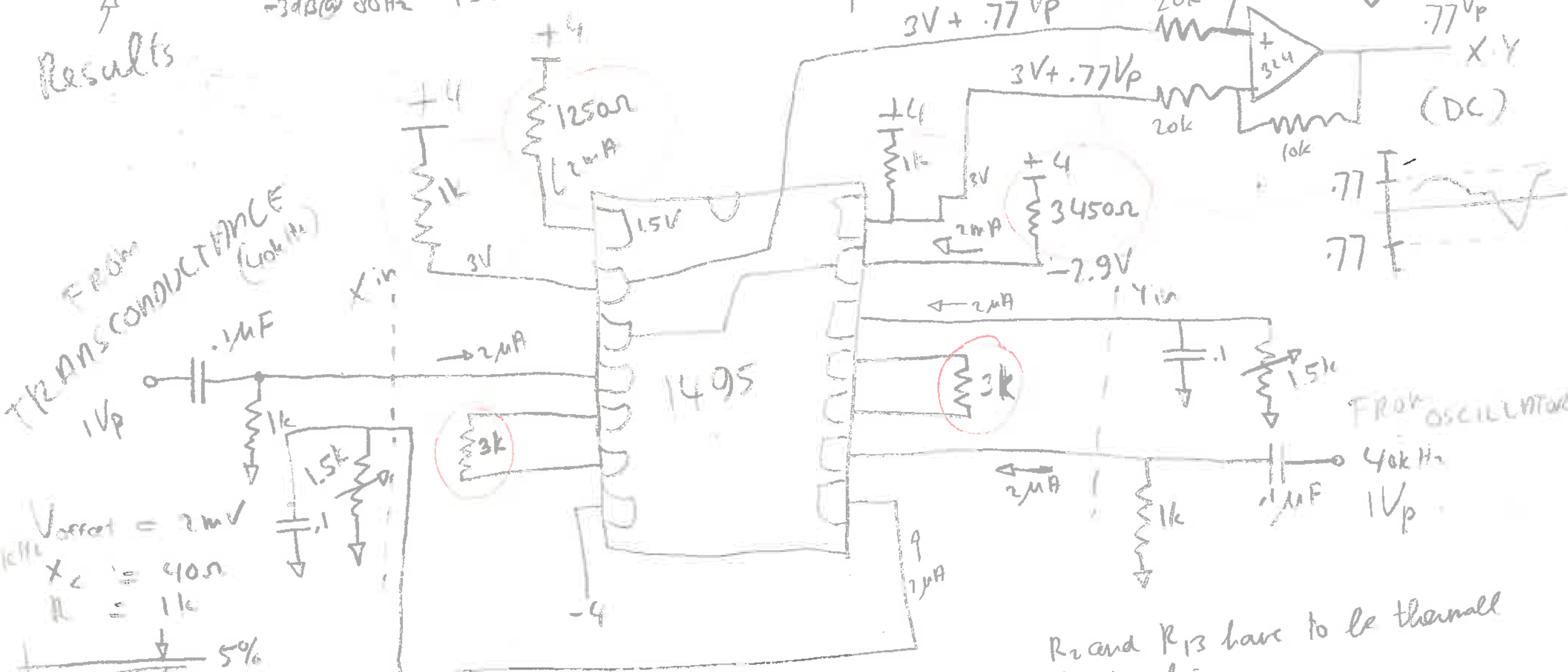
$V_o = .1 V_{p-p} @ .085 V_{off}$





↑ Results

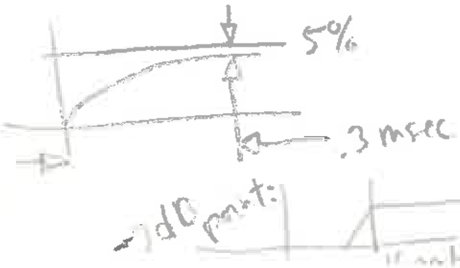




$V_{offset} = 2mV$

@1kHz $X_c = 40\Omega$

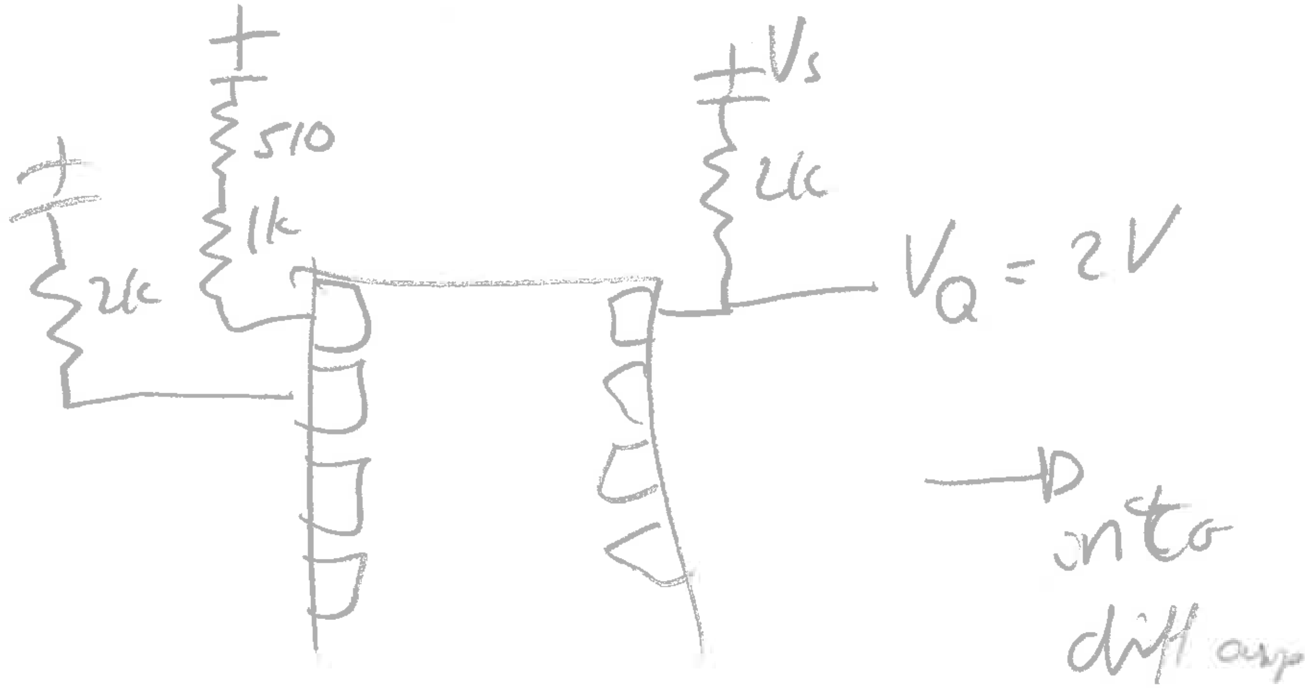
R = 1k



.6% of 50 msec
12 waves of 40kHz (2000 total)

R_2 and R_{13} have to be thermall tracking

MULT II



1a ~~odd~~
voltage stability

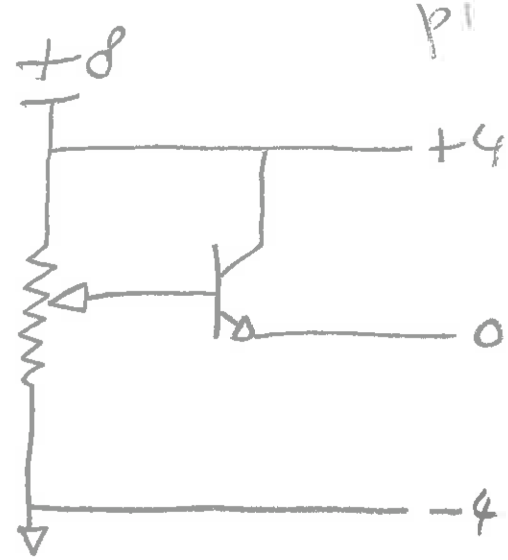
V_Q	V_{drift}
2	0.1

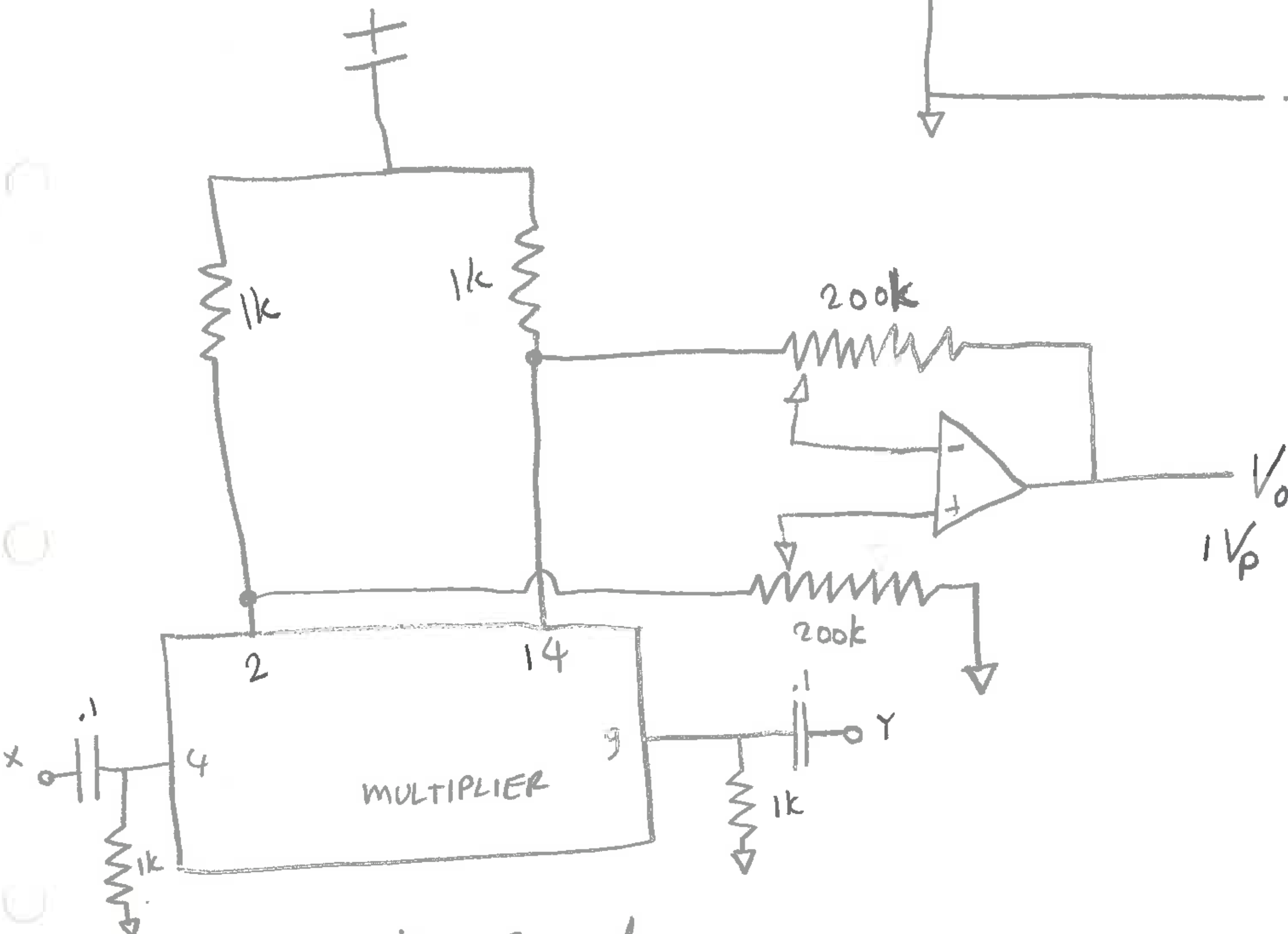
V_{supply} 3-4 V
2.3 V start of drift

10-30

Diff Amp

Bipolar supply:





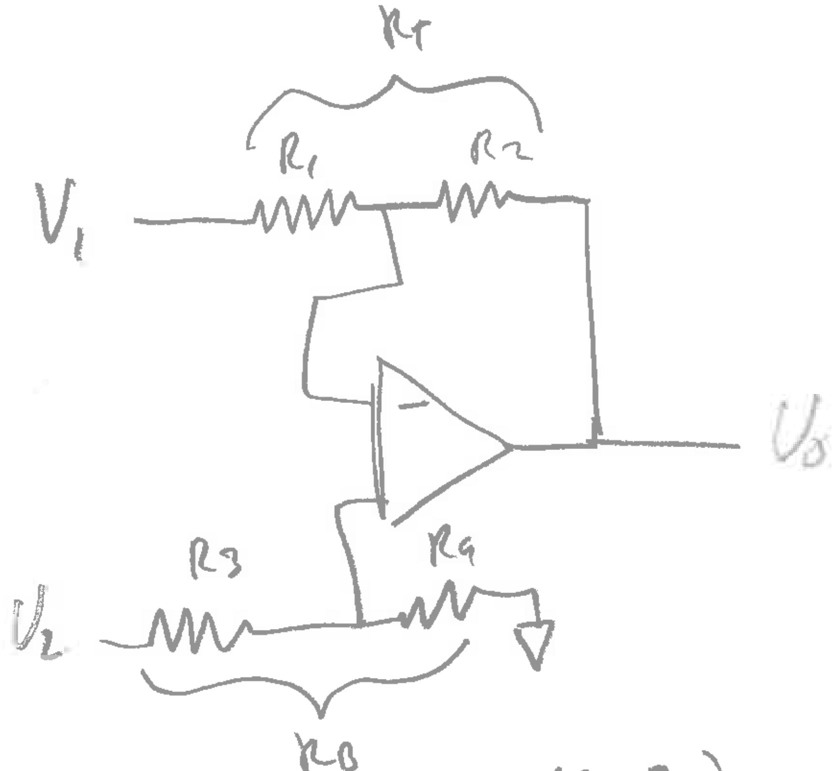
Adjustment procedure

I ground inputs

II adjust one pot to zero output

III move both pots together (keep offset in output at zero) to change gain.

Diff Amp cont'



$$V_0 = V_2 \frac{R_4(R_1+R_2)}{R_1(R_3+R_4)} - V_1 \frac{R_2}{R_1}$$

$$= \frac{1}{R_1}\left[V_2 \cdot \frac{R_T}{R_B} \cdot R_4 - V_1 \cdot R_2\right] \qquad \frac{R_T}{R_B} = x$$

$$= \frac{1}{R_1}\left[V_2 \cdot x \cdot R_4 - V_1 \cdot R_2\right] \qquad R_2 = x \cdot R_4$$

when balanced

with R_2, R_1 set:
adjust R_4 until $V_0 = 0$