**5** OSCILLATOR GLIDE FREQUENCY DIVISION

**6** WAVEFORM SELECTION SAWTOOTH GEN. PWM LFO

**8** FILTER

**10** VCA & VCA ENV. GEN. OUTPUT AMP POWER

**4** NOTE DIVISION ENCODING

**7** LFO

**9** FILTER CONTROL & ENVELOPE

**2** KEYBOARD MULTIPLEXER & DIGITAL INTERFACE

**3** KEYBOARD TRIGGERS & CLOCK NOISE

WAVESHAPE

KYBD VOLTAGE

FILTER IN

VCA IN

FILTER CONTR 2

P0–P7

PITCH MOD

N4, N5

N0, N1, N2, N3

KYBD VOLTAGE

FILTER MOD

NOISE

FILTER TRIG

VCA GATE

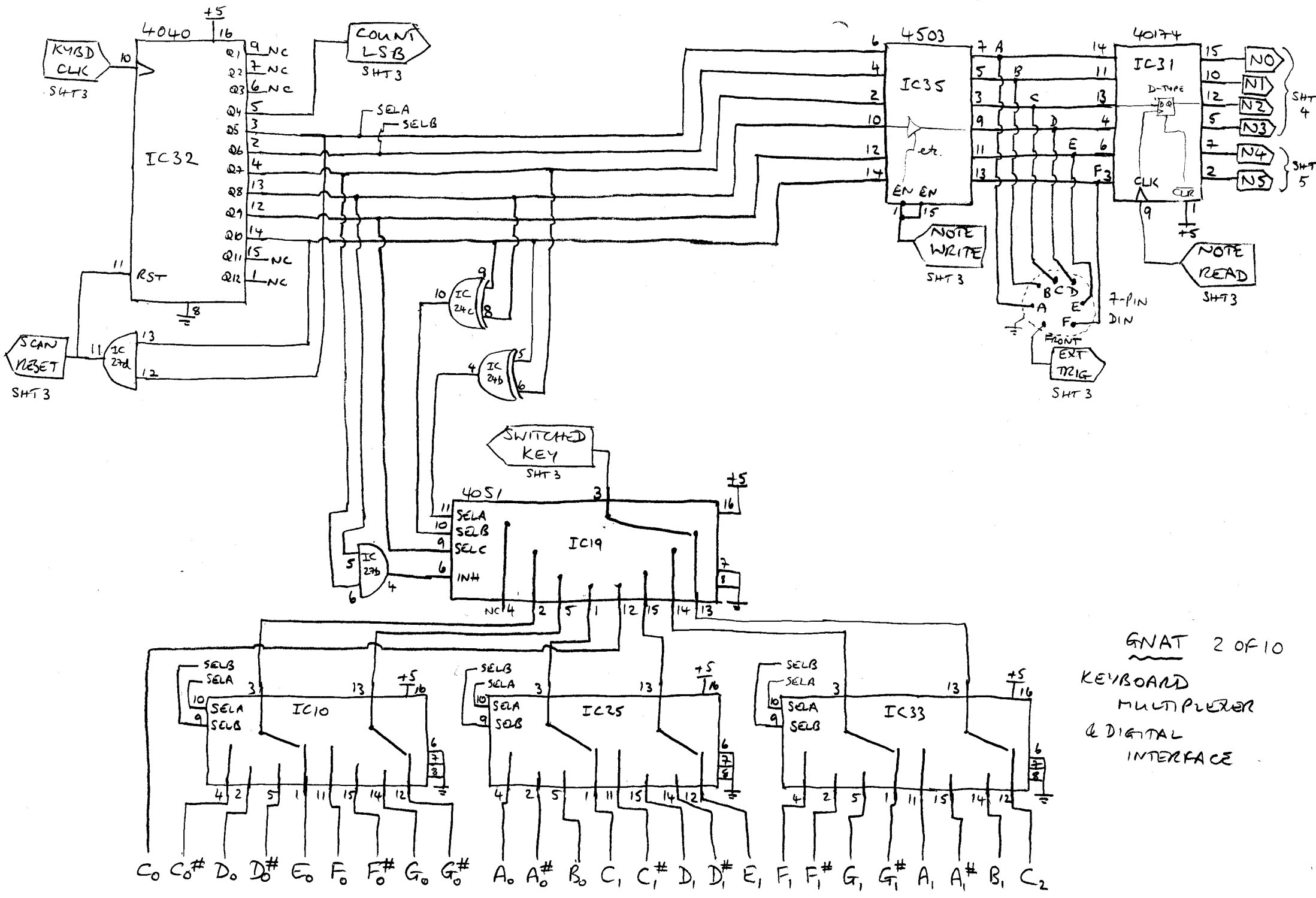KYBD CLOCK, NOTE READ, NOTE WRITE

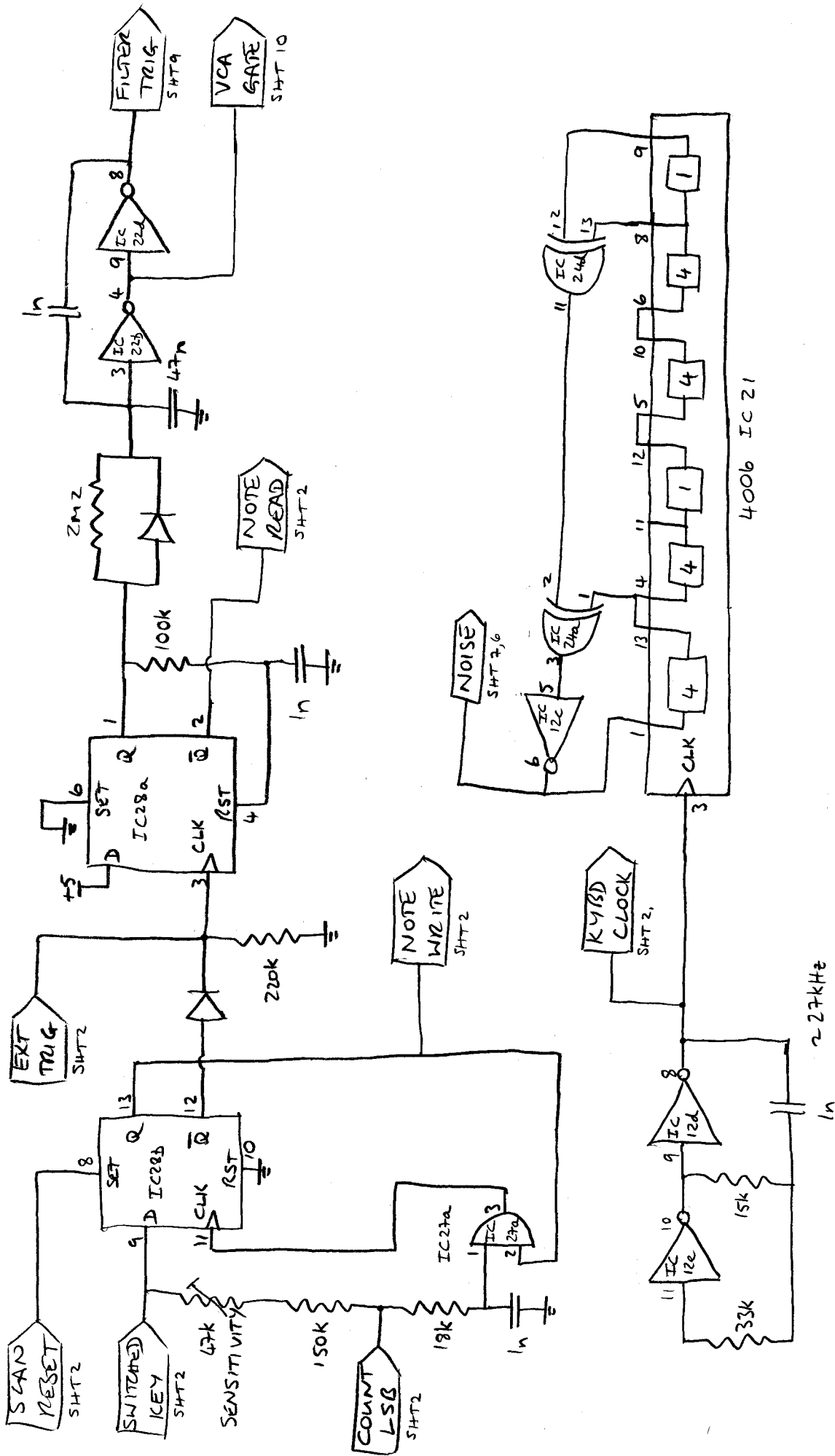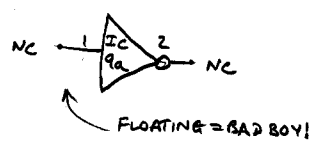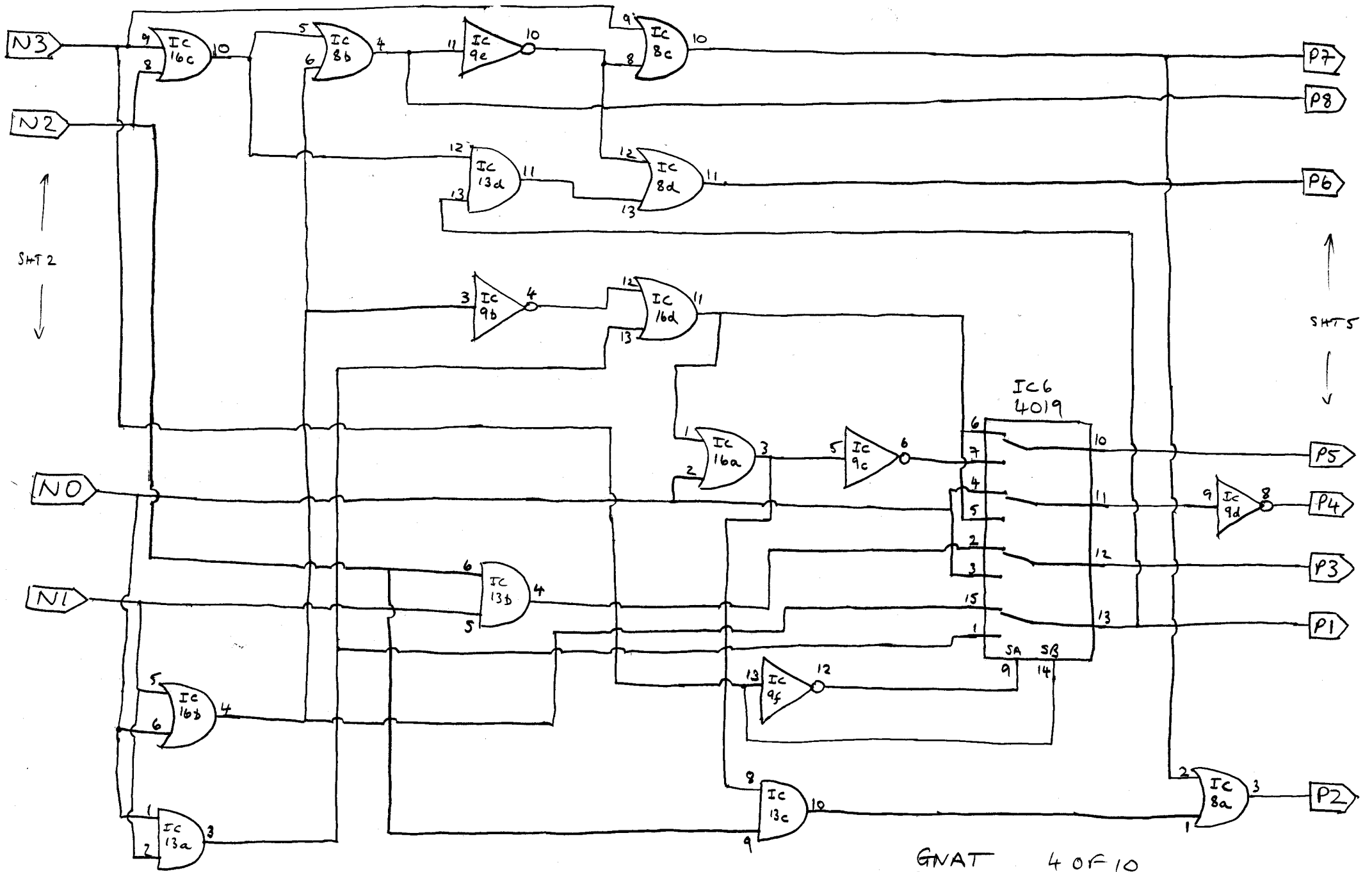SWITCHED KEY, SCAN RESET, COUNT LSB, EXT TRIG

GNAT   1 OF 10

BLOCK DIAGRAM
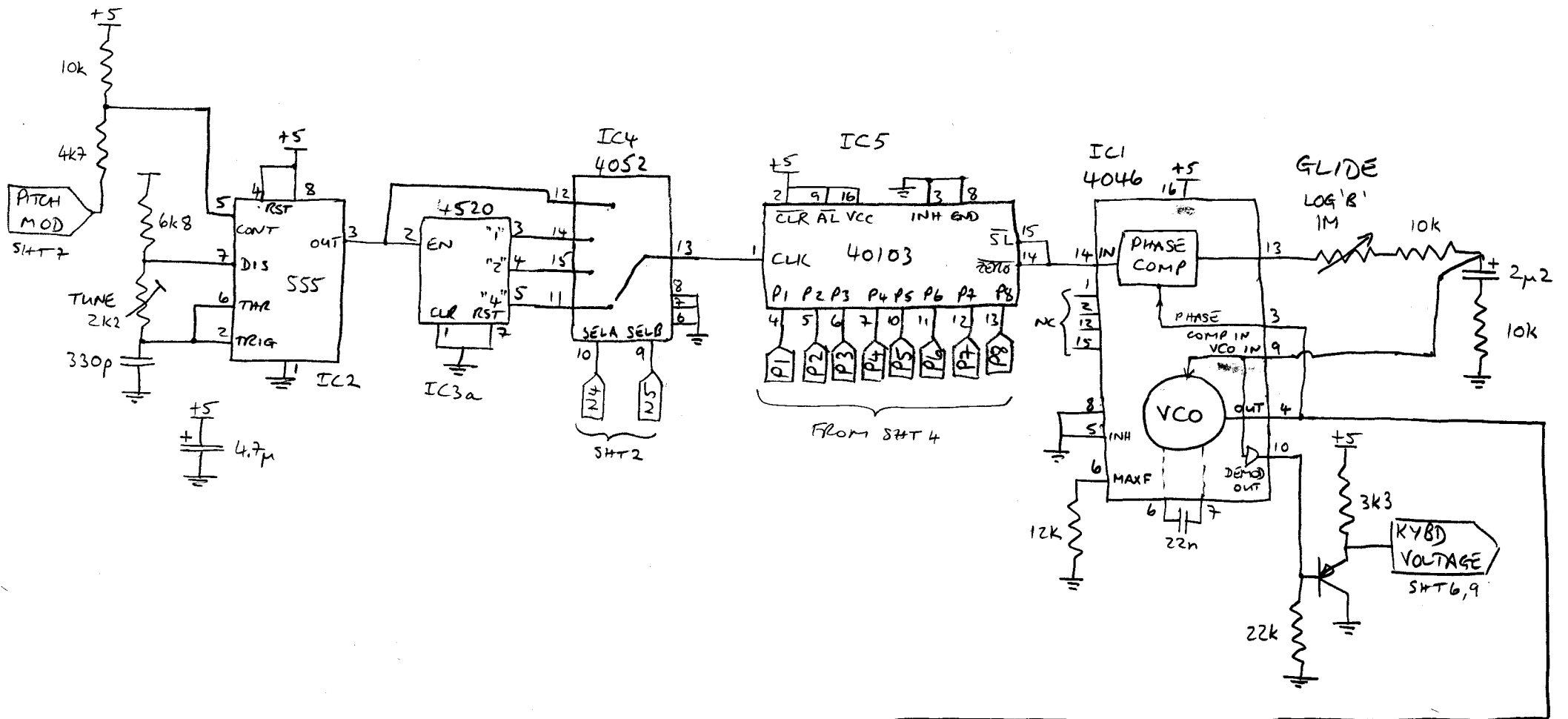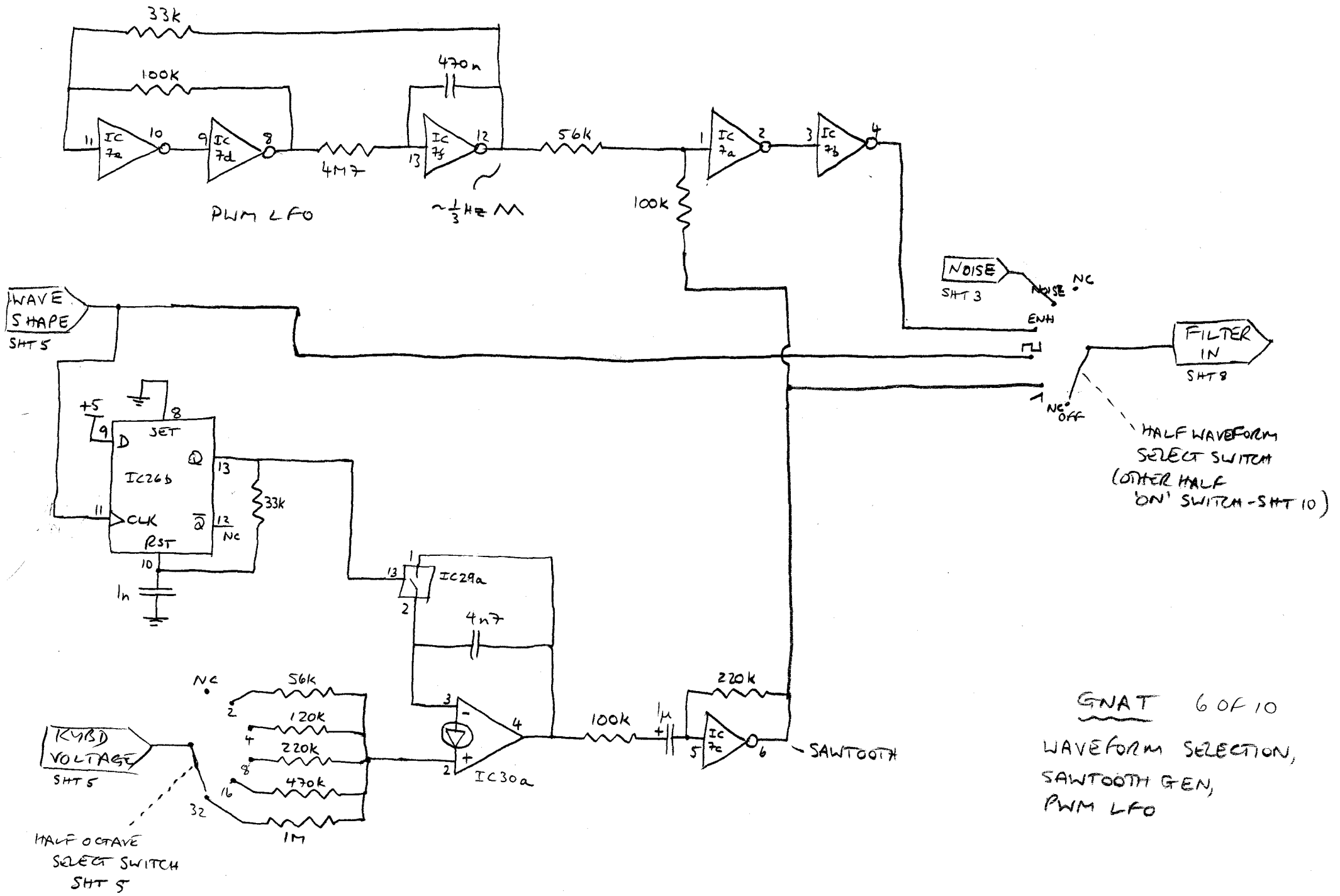
GNAT 2 OF 10

KEYBOARD MULTIPLEXER & DIGITAL INTERFACE

GNAT 3 OF 10

KEYBOARD TRIGGERS A CLOCK, NOISE

GNAT 4 OF 10

NOTE DIVISION ENCODING
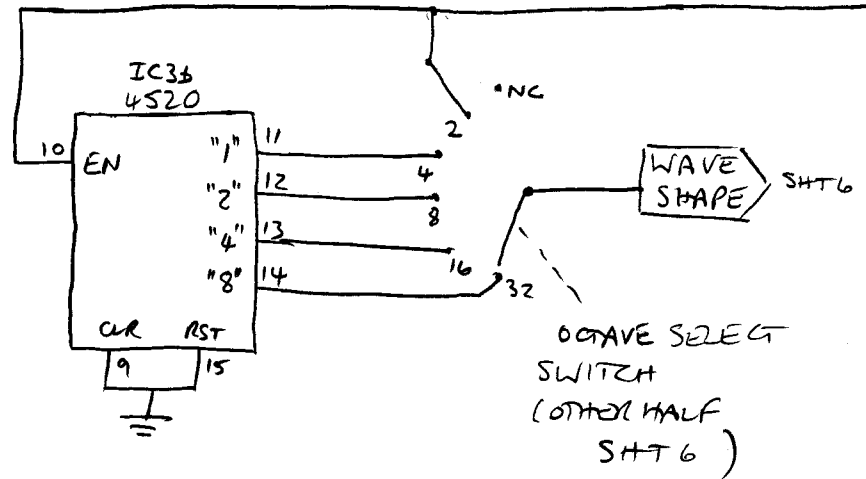
GNAT 5 OF 10
OSCILLATOR,
GLIDE,
FREQUENCY DIVISION

33k

100k

470n

$\frac{11}{10}$ IC 7a

9 IC 7d 8

4M7

13 IC 7f 12

$\sim\frac{1}{3}$ Hz

56k

1 IC 7a 2

3 IC 7b 4

100k

PWM LFO

NOISE
SHT 3

NOISE    NC

ENH

FILTER
IN
SHT 8

WAVE
SHAPE
SHT 5

+5

9 D    SET    8

IC26b

Q 13

Q̄ 12
NC

11 CLK

RST

10

1n

33k

NC

OFF

HALF WAVEFORM
SELECT SWITCH
(OTHER HALF
'ON' SWITCH - SHT 10)

13 1 IC29a 2

4n7

220k

KYBD
VOLTAGE
SHT 5

NC    56k

2

120k

4

220k

8

470k

16

32

1M

3 − IC30a 4

2 +

100k

1µ

5 IC 7c 6    ~SAWTOOTH

HALF OCTAVE
SELECT SWITCH
SHT 5

GNAT  6 OF 10

WAVEFORM SELECTION,
SAWTOOTH GEN,
PWM LFO
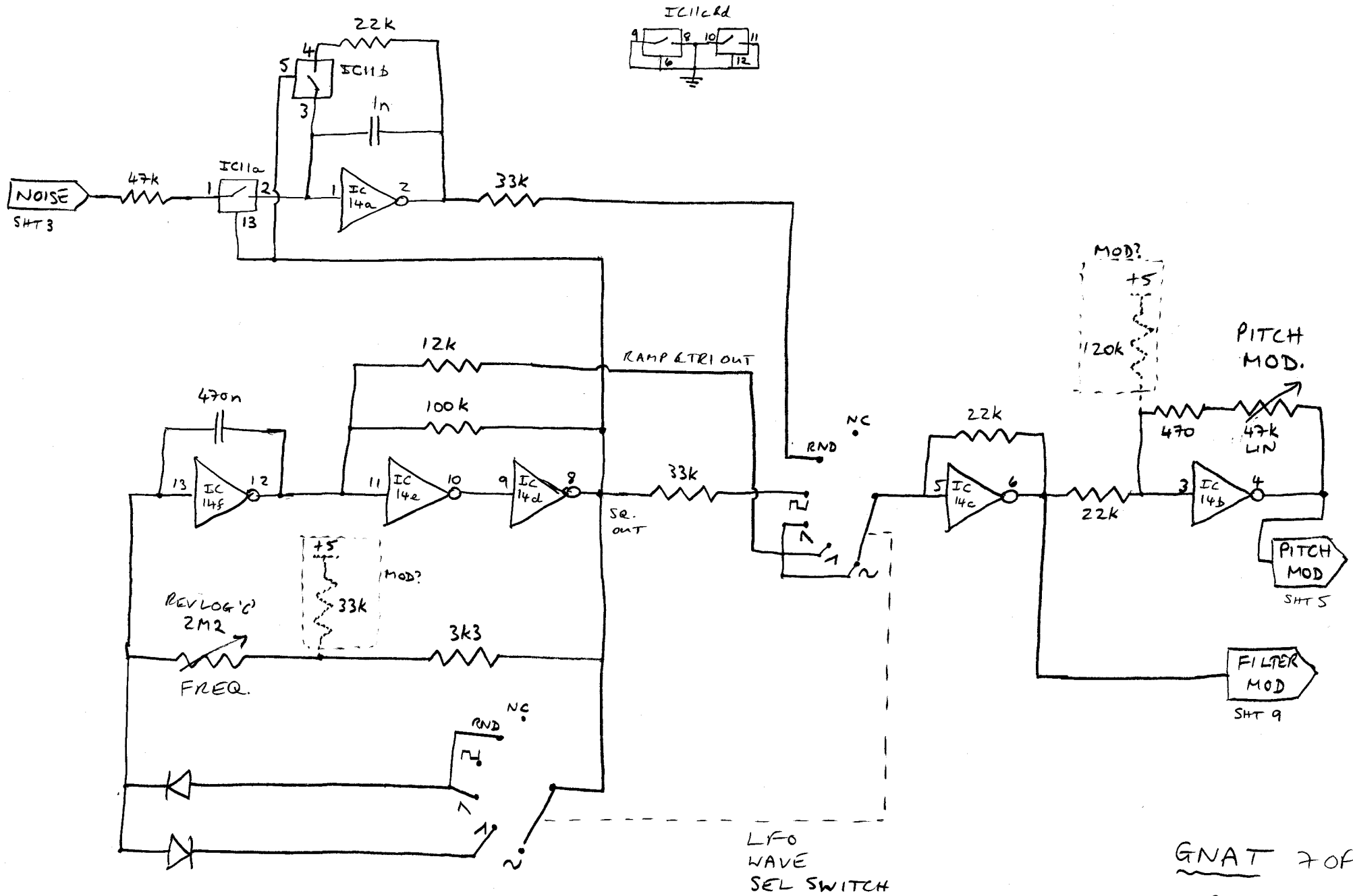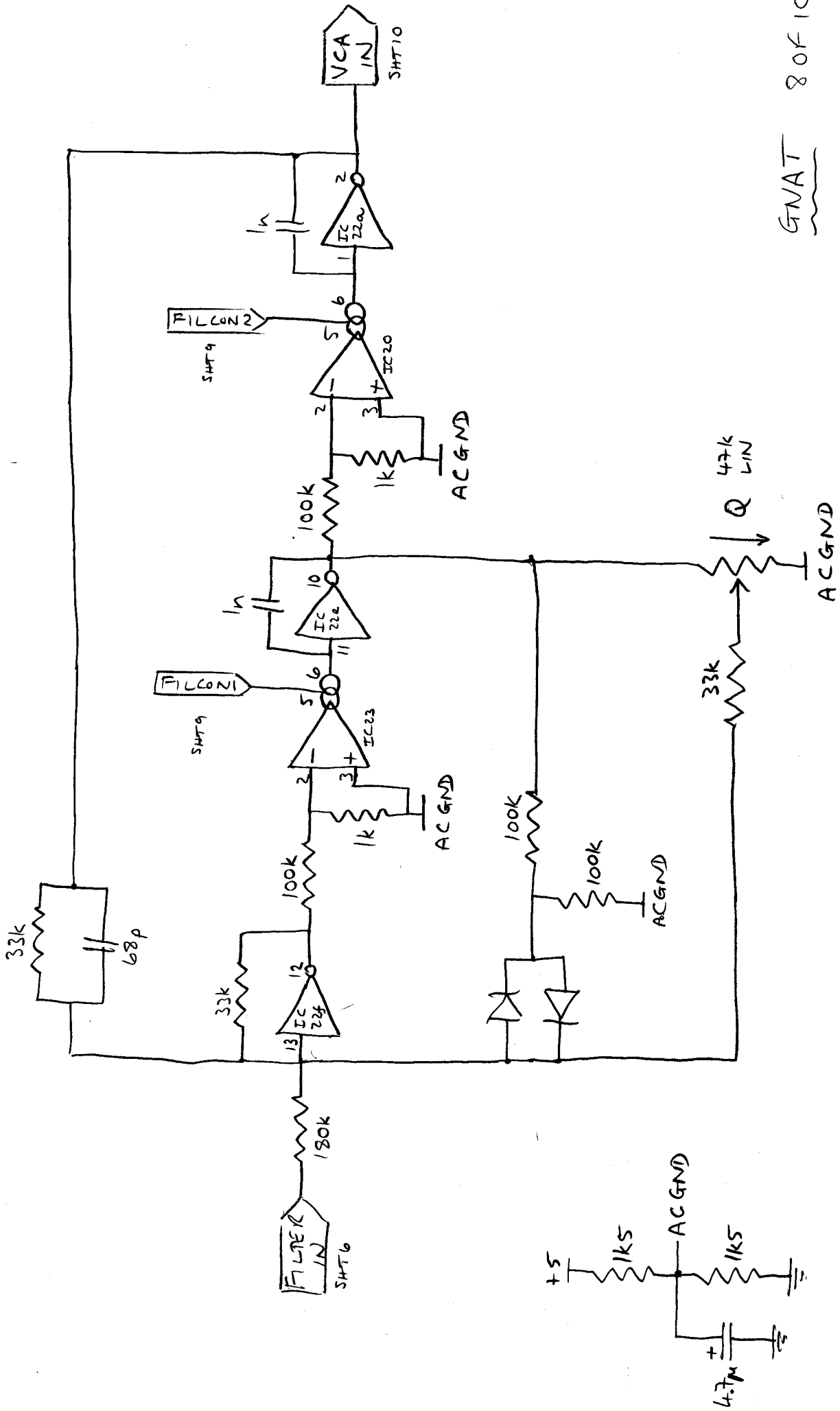
NOISE
SHT 3

47k

IC11a

22k

IC11b

1n

IC 14a

33k

IC11cRd

RAMP & TRI OUT

NC ·
RND

MOD?
+5
120k

PITCH MOD.

22k

470 47k LIN

12k

100k

IC 14e

IC 14d

SQ. OUT

33k

IC 14c

22k

IC 14b

PITCH MOD
SHT 5

470n

IC 14f

+5
MOD?
33k

REV LOG 'C'
2M2

FREQ.

3k3

FILTER MOD
SHT 9

RND
NC ·

LFO
WAVE
SEL SWITCH

LFO

LOW-PASS FILTER
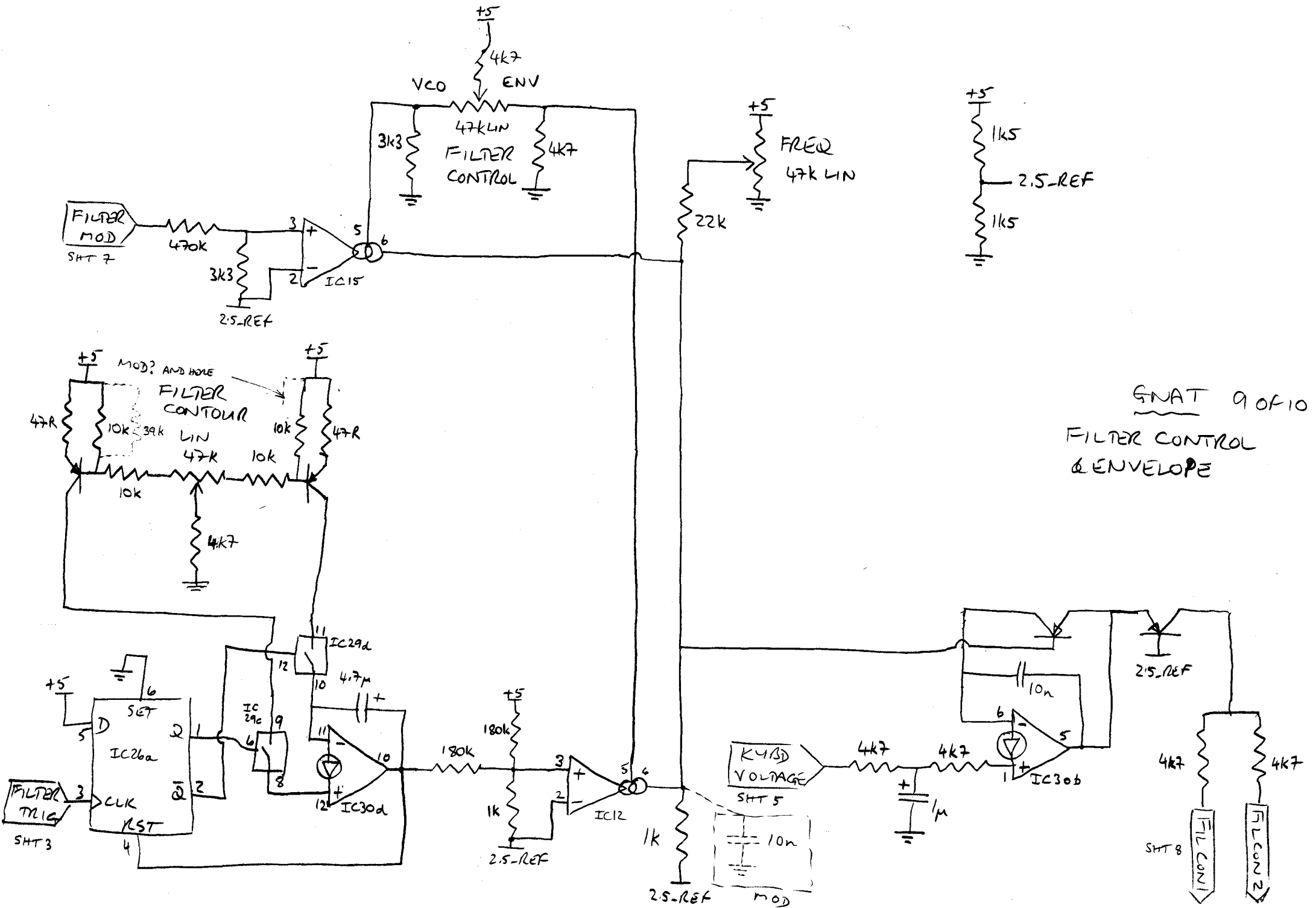
FILTER CONTROL
& ENVELOPE
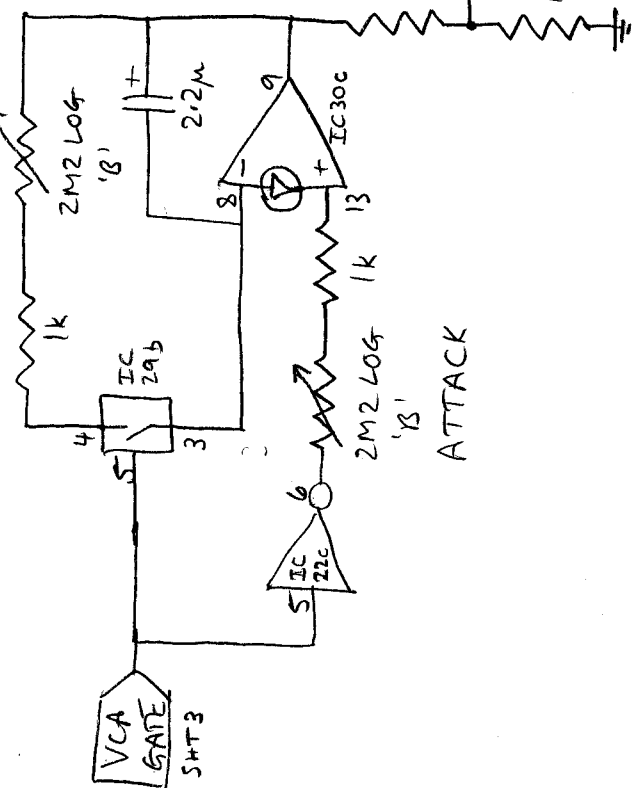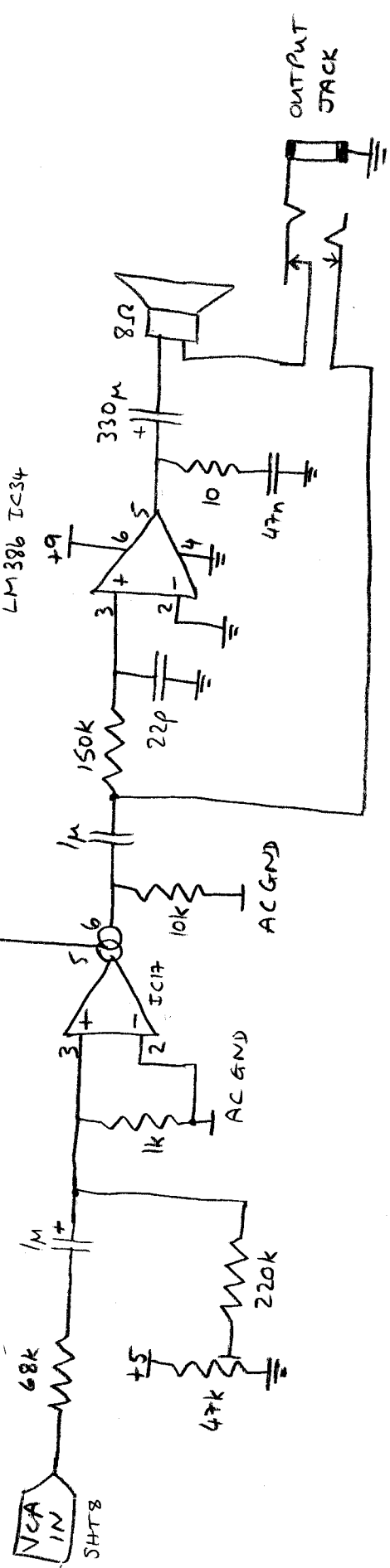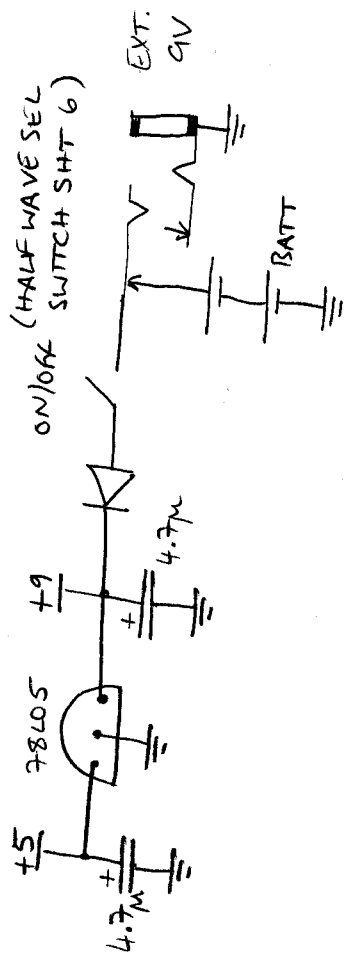
VCA
VCA ENV GEN
O/P AMP, POWER

ON/OFF (HALF WAVE SEL SWITCH SHT 6)

EXT. 9V

BATT

+9

4.7µ

78L05

+5

4.7µ

OUTPUT JACK

8Ω

330µ

LM386 IC34

+9

10

47n

150k

22p

1µ

10k

AC GND

IC17

AC GND

1k

1M

68k

+5

47k

220k

VCA IN
SHT8

DECAY

2M2 LOG 'B'

2.2µ

1k

IC 29b

IC 30c

IC 29c

ATTACK

2M2 LOG 'B'

1k

6k8

10k

VCA GATE
SHT 3

# Note Digital Encoding

| EDP desig | F | E | D | C | B | A | Gnat | | | | Wasp | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Digital encoding | | | | | | 4051 | | | | 4028 | | | | |
| | 4040 output pins: | | | | | | Inh | Sel C | Sel B | Sel A | D | C | B | A | active |
| Note | 14 | 12 | 13 | 4 | 2 | 3 | 13.4 | 12 | 13+14 | 14+4 | 14 | 12 | 13 | 4 | o/p |
| C (top) | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | q0 |
| B | 0 | 0 | 0 | 0 | 0 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | q0 |
| A# | 0 | 0 | 0 | 0 | 1 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | q0 |
| A | 0 | 0 | 0 | 0 | 1 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | q0 |
| G# | 0 | 0 | 0 | 1 | 0 | 0 | | 0 | 0 | 1 | 0 | 0 | 0 | 1 | q1 |
| G | 0 | 0 | 0 | 1 | 0 | 1 | | 0 | 0 | 1 | 0 | 0 | 0 | 1 | q1 |
| F# | 0 | 0 | 0 | 1 | 1 | 0 | | 0 | 0 | 1 | 0 | 0 | 0 | 1 | q1 |
| F | 0 | 0 | 0 | 1 | 1 | 1 | | 0 | 0 | 1 | 0 | 0 | 0 | 1 | q1 |
| E | 0 | 0 | 1 | 0 | 0 | 0 | | 0 | 1 | 0 | 0 | 0 | 1 | 0 | q2 |
| D# | 0 | 0 | 1 | 0 | 0 | 1 | | 0 | 1 | 0 | 0 | 0 | 1 | 0 | q2 |
| D | 0 | 0 | 1 | 0 | 1 | 0 | | 0 | 1 | 0 | 0 | 0 | 1 | 0 | q2 |
| C# | 0 | 0 | 1 | 0 | 1 | 1 | | 0 | 1 | 0 | 0 | 0 | 1 | 0 | q2 |
| | 0 | 0 | 1 | 1 | 0 | 0 | 1 | | | | 0 | 0 | 1 | 1 | |
| not | 0 | 0 | 1 | 1 | 0 | 1 | 1 | | | | 0 | 0 | 1 | 1 | nc |
| used | 0 | 0 | 1 | 1 | 1 | 0 | 1 | | | | 0 | 0 | 1 | 1 | |
| | 0 | 0 | 1 | 1 | 1 | 1 | 1 | | | | 0 | 0 | 1 | 1 | |
| C | 0 | 1 | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | q4 |
| B | 0 | 1 | 0 | 0 | 0 | 1 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | q4 |
| A# | 0 | 1 | 0 | 0 | 1 | 0 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | q4 |
| A | 0 | 1 | 0 | 0 | 1 | 1 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | q4 |
| G# | 0 | 1 | 0 | 1 | 0 | 0 | | 1 | 0 | 1 | 0 | 1 | 0 | 1 | q5 |
| G | 0 | 1 | 0 | 1 | 0 | 1 | | 1 | 0 | 1 | 0 | 1 | 0 | 1 | q5 |
| F# | 0 | 1 | 0 | 1 | 1 | 0 | | 1 | 0 | 1 | 0 | 1 | 0 | 1 | q5 |
| F | 0 | 1 | 0 | 1 | 1 | 1 | | 1 | 0 | 1 | 0 | 1 | 0 | 1 | q5 |
| E | 0 | 1 | 1 | 0 | 0 | 0 | | 1 | 1 | 1 | 0 | 1 | 1 | 0 | q6 |
| D# | 0 | 1 | 1 | 0 | 0 | 1 | | 1 | 1 | 1 | 0 | 1 | 1 | 0 | q6 |
| D | 0 | 1 | 1 | 0 | 1 | 0 | | 1 | 1 | 1 | 0 | 1 | 1 | 0 | q6 |
| C# | 0 | 1 | 1 | 0 | 1 | 1 | | 1 | 1 | 1 | 0 | 1 | 1 | 0 | q6 |
| | 0 | 1 | 1 | 1 | 0 | 0 | 1 | | | | 0 | 1 | 1 | 1 | |
| not | 0 | 1 | 1 | 1 | 0 | 1 | 1 | | | | 0 | 1 | 1 | 1 | nc |
| used | 0 | 1 | 1 | 1 | 1 | 0 | 1 | | | | 0 | 1 | 1 | 1 | |
| | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | | | 0 | 1 | 1 | 1 | |
| C (btm) | 1 | 0 | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | 1 | 0 | 0 | 0 | q8 |
| 4040 reset | 1 | 0 | 0 | 0 | 0 | 1 | 14 AND 3 | | | | q8 AND 3 | | | | q8 |

Notes:

1. The Gnat and Wasp both have 25 notes, so span 3 octaves: if the top two bits represent which octave, 4 bits are needed to cover the 12 notes within each octave. This leaves 16-12=4 numbers per octave that are not used. The way the Wasp and Gnat handle these gaps is quite different. The Gnat switches the keys through a 4051/multiple 4052 combination, and inhibits the 4051 during the unwanted counts. The Wasp uses a 4028/4016/multiple 4052 combination, and there are no connections at the 4028 at the unwanted counts.

2. In the 4051 column, the 'Inh', 'Sel C' etc. refer to the 4051 input lines; underneath are the 4040 pins driving these, in the appropriate combinations, e.g. '13.4' is 'pin 13 AND pin 4', '13+14' is '13 OR 14' etc.

3. In the 4028 column, the letters refer to the 4028 inputs; underneath are the 4040 pins driving them (just the columns at left repeated so the patterns can be seen). The 'qx' refer to the output line of the 4028 driven high according to the given inputs; 'nc' means that line is 'not connected' (to any 4016 switch).

4. In both the Wasp and Gnat the same 4052 select lines are driven by the same 4040 pins: 'Sel A' by pin 3; 'Sel B' by 2.

5. 'EDP desig' refers to the original designation of the equivalent of these lines at the tri-statable interface (i.e. between the buffers), as shown on the Wasp hand-drawn schematics.

6. Where obvious, some entries have been omitted for clarity.