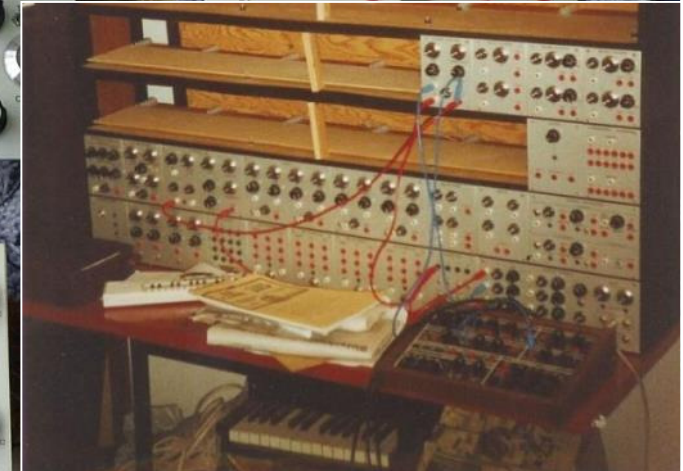
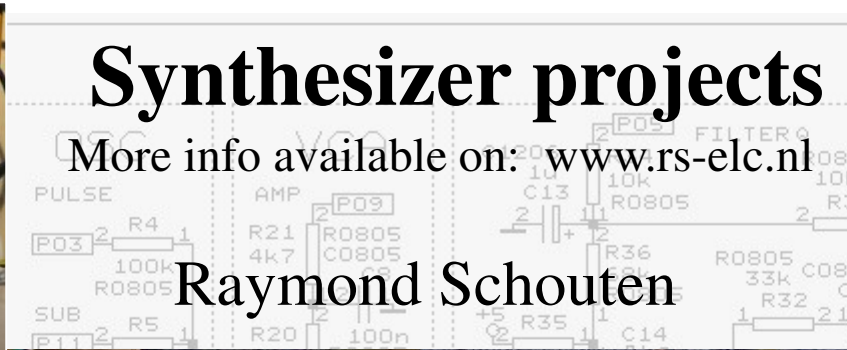
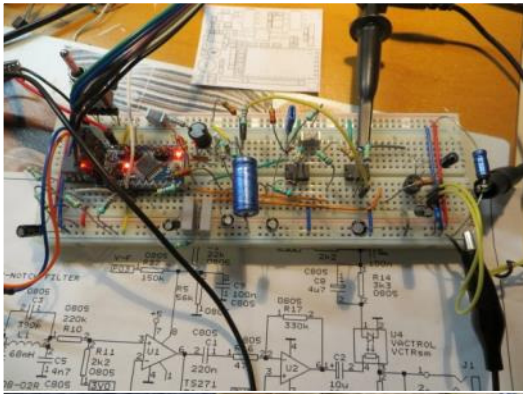


Synthesizer projects

More info available on: www.rs-elc.nl

Raymond Schouten



What defines a “good” synthesizer ?

One that can make every possible sound?

Well, just type 44100 numbers for each second of sound and you can create everything.

This is the most flexible instrument. →

but no one wants it !!

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00	0E	00	00	00	F2	00	00	00	52	49	46	46	B8	A5	00	00
01	57	41	56	45	00	1A	2B	00	00	5A	5F	44	41	4D	41	47
02	32	2E	57	41	56	00	18	55	00	00	5A	5F	4B	49	41	49
03	31	2E	57	41	56	00	00	B8	79	00	00	5A	5F	4B	49	41
04	49	32	2E	57	41	56	00	00	00	8E	00	00	5A	5F	4B	49
05	41	49	33	2E	57	41	56	00	00	EC	A2	00	00	5A	5F	4B
06	49	41	49	34	2E	57	41	56	00	00	3C	D4	00	00	5A	5F
07	4B	49	41	49	35	2E	57	41	56	00	00	3F	01	01	00	5A
08	5F	4B	49	41	49	36	2E	57	41	56	00	00	A8	2D	01	00
09	5A	5F	4B	49	41	49	37	2E	57	41	56	00	00	90	51	01
0A	00	5A	5F	4B	49	41	49	38	2E	57	41	56	00	00	4F	77
0B	01	00	5A	5F	4B	49	41	49	39	2E	57	41	56	00	00	DF
0C	B1	01	00	5A	5F	4F	55	54	2E	57	41	56	00	00	00	00
0D	FD	43	03	00	5A	5F	50	49	4E	43	48	2E	57	41	56	00
0E	00	48	A5	03	00	00	00	00	00	00	00	00	00	00	00	00
0F	00	00	52	49	46	46	20	2A	00	00	57	41	56	45	66	6D
10	74	20	10	00	00	00	01	00	01	00	22	56	00	00	22	56
11	00	00	01	00	08	00	64	61	74	61	FC	29	00	00	80	80
12	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
13	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80

A more useful design offers a compact set of powerful and intuitive parameters.

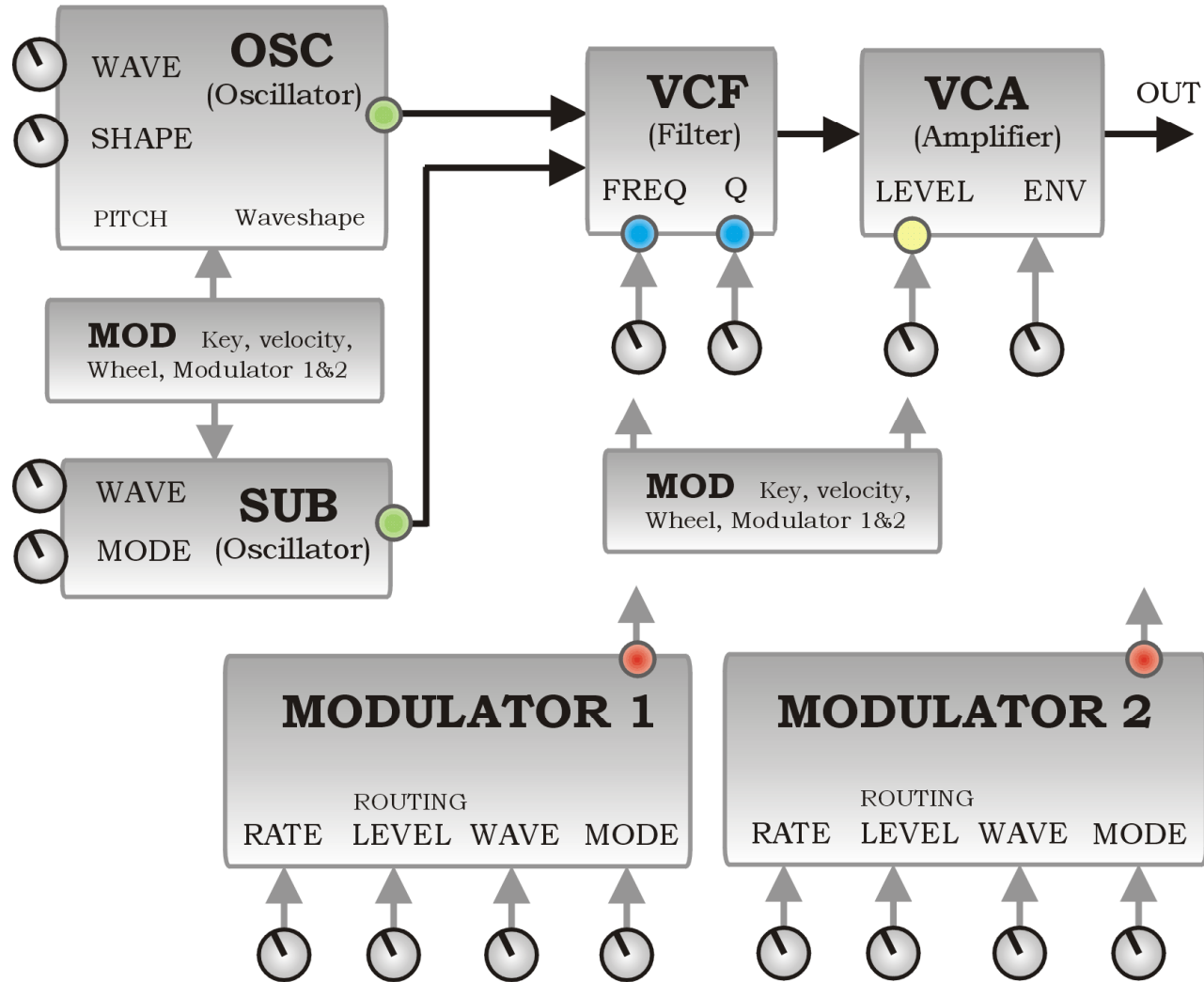
Any static sound (static waveform) is boring.

Only dynamic parameter variation makes sound interesting.

Analog voltage controlled circuitry comes with some advantages: smooth parameter sweep/modulation and build-in imperfections (like distortion) give parameter variations “for free”. (like acoustic instruments)

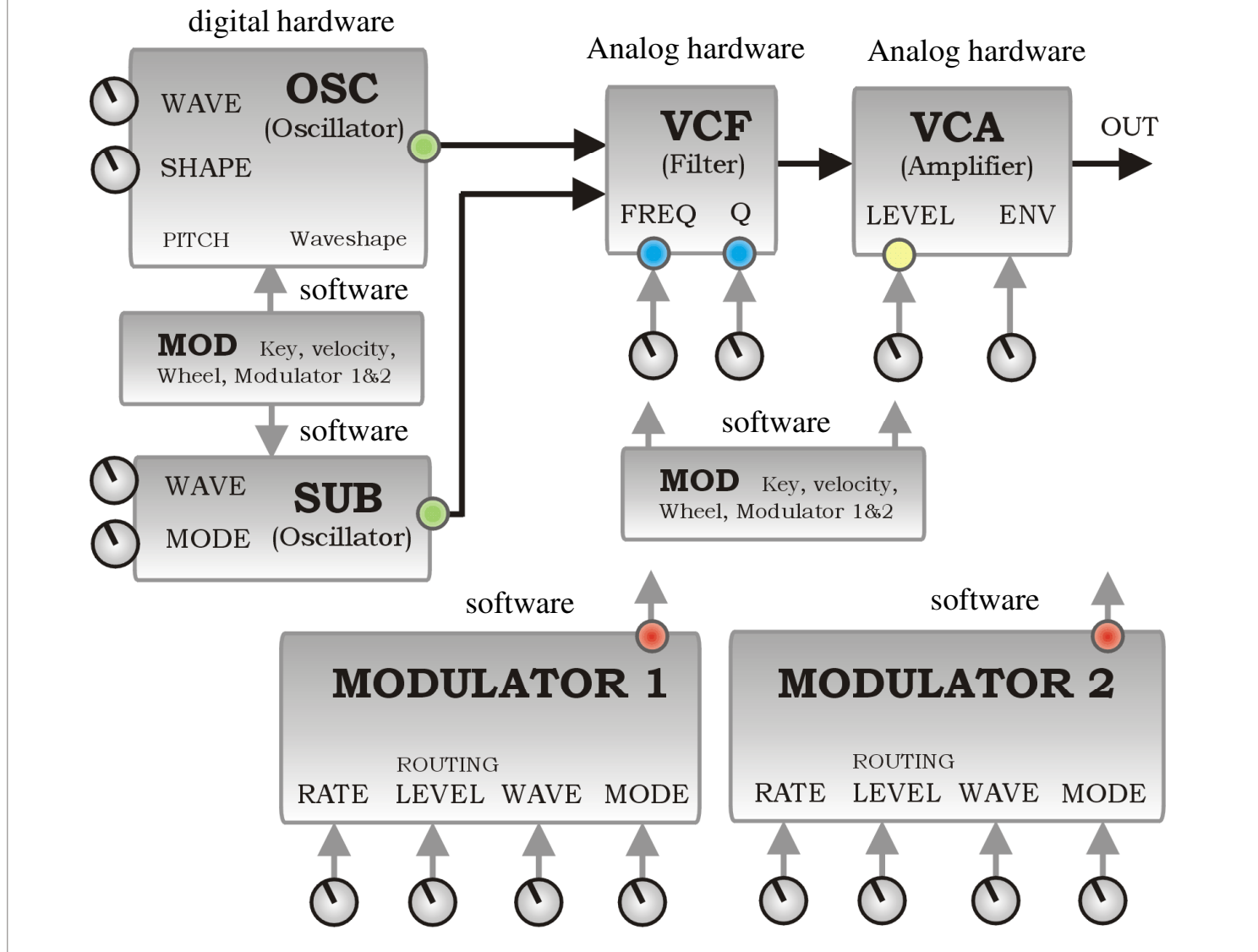
Designing this myself makes it possible to explore and realise these concepts

(My) Synthesizers basic structure



Max 16 knobs control all the sound parameters (also remote)

(My) Synthesizers basic structure



Control, user interface, setup storage done by digital hardware/software

MonoLadder1, synthesizer with Moog-style ladderfilter



Battery inside

MIDI input

Headphone out

MONOLADDER 1

MODULATOR 1

MODULATOR 2

SET VALUE

Select parameter

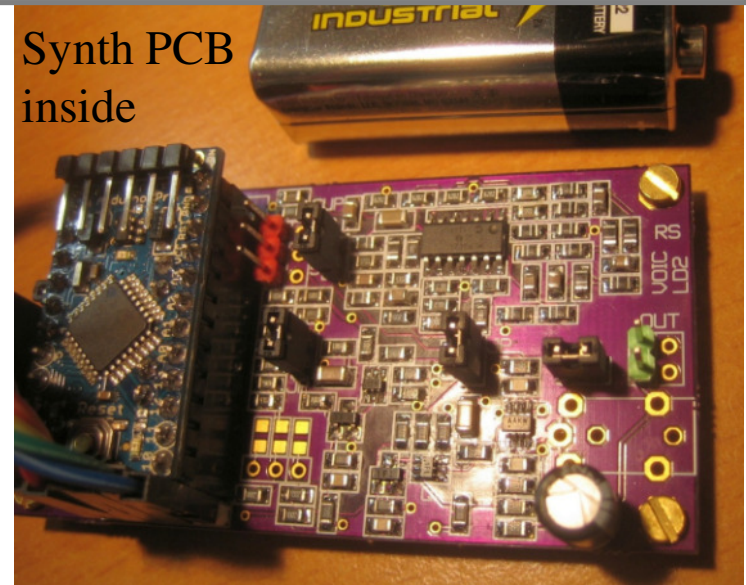
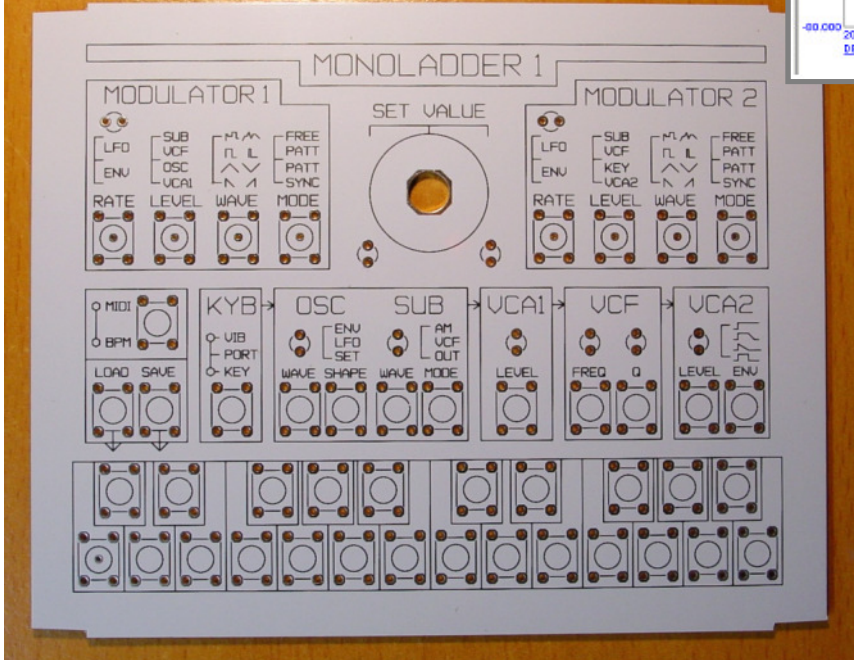
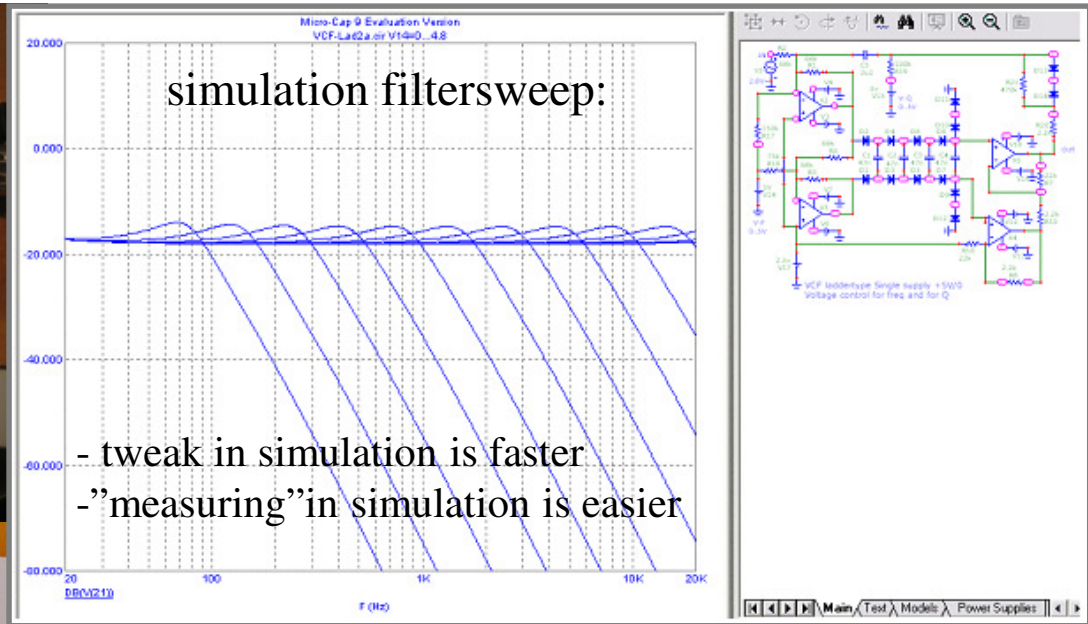
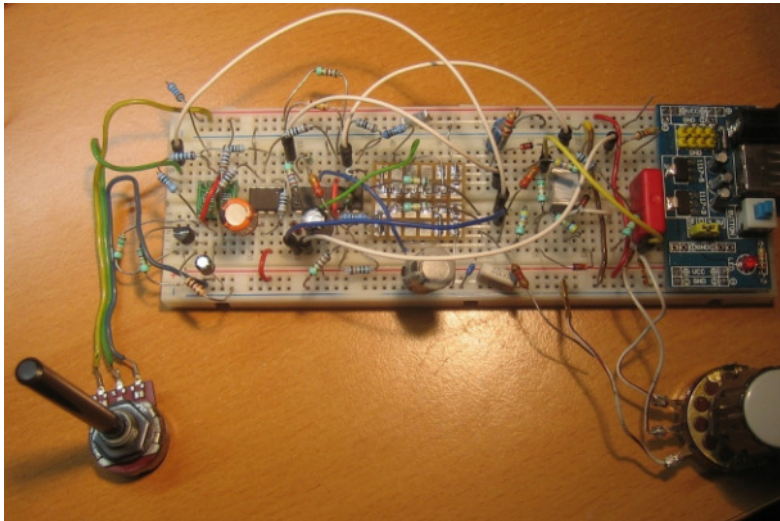
Select parameter

2 octave keyboard

Touch slider adjusts filter

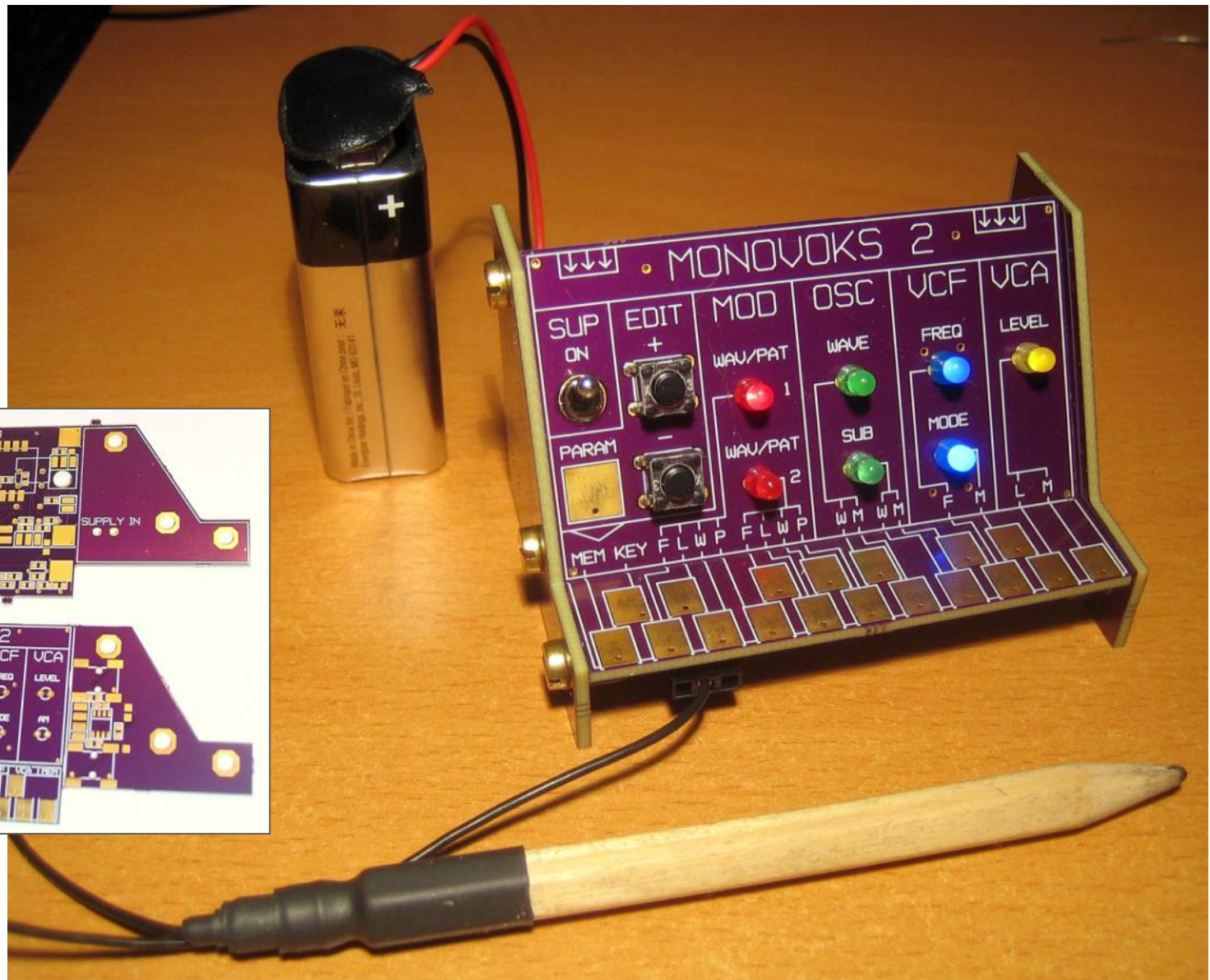
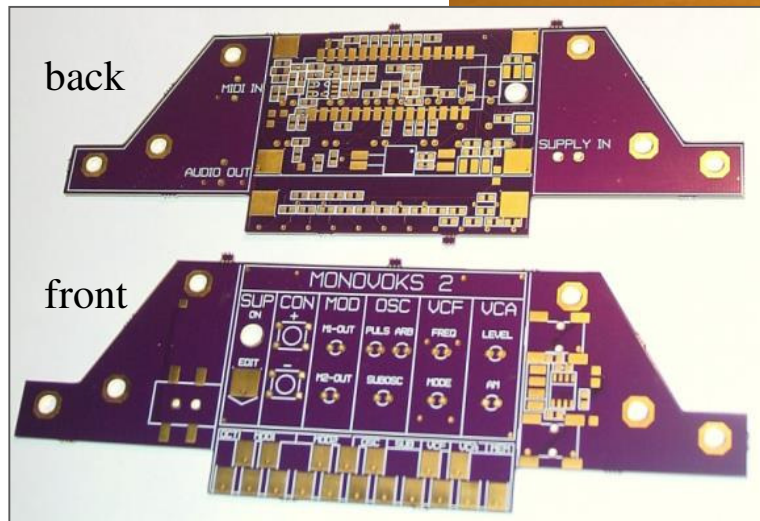
MonoLadder1, proto and PCB's

Hint: Use breadboard prototyping but also simulation software (SPICE)



MonoVoks2, synthesizer with PoliVoks style filter

Made from one PCB:



The pencil is used to play the keyboard and to select parameters for sound editing

MonoVoks2 front control panel and keyboard (6 x 3,5 cm!!)

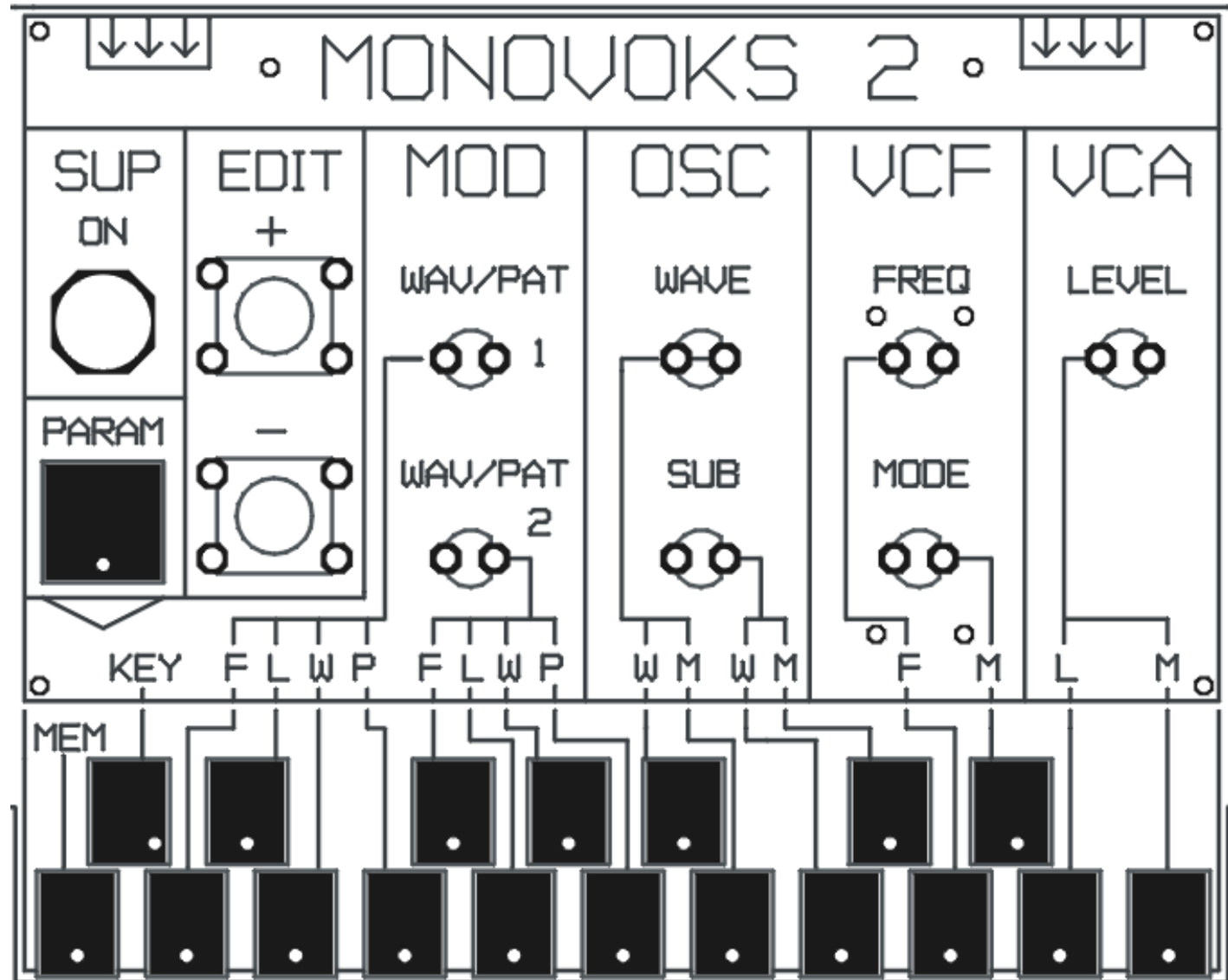
Light sensors on top detect hand movement

This interface allows for:
-playing the synth
-editing the parameters
-storing/recalling sounds

All this is also possible
Via MIDI

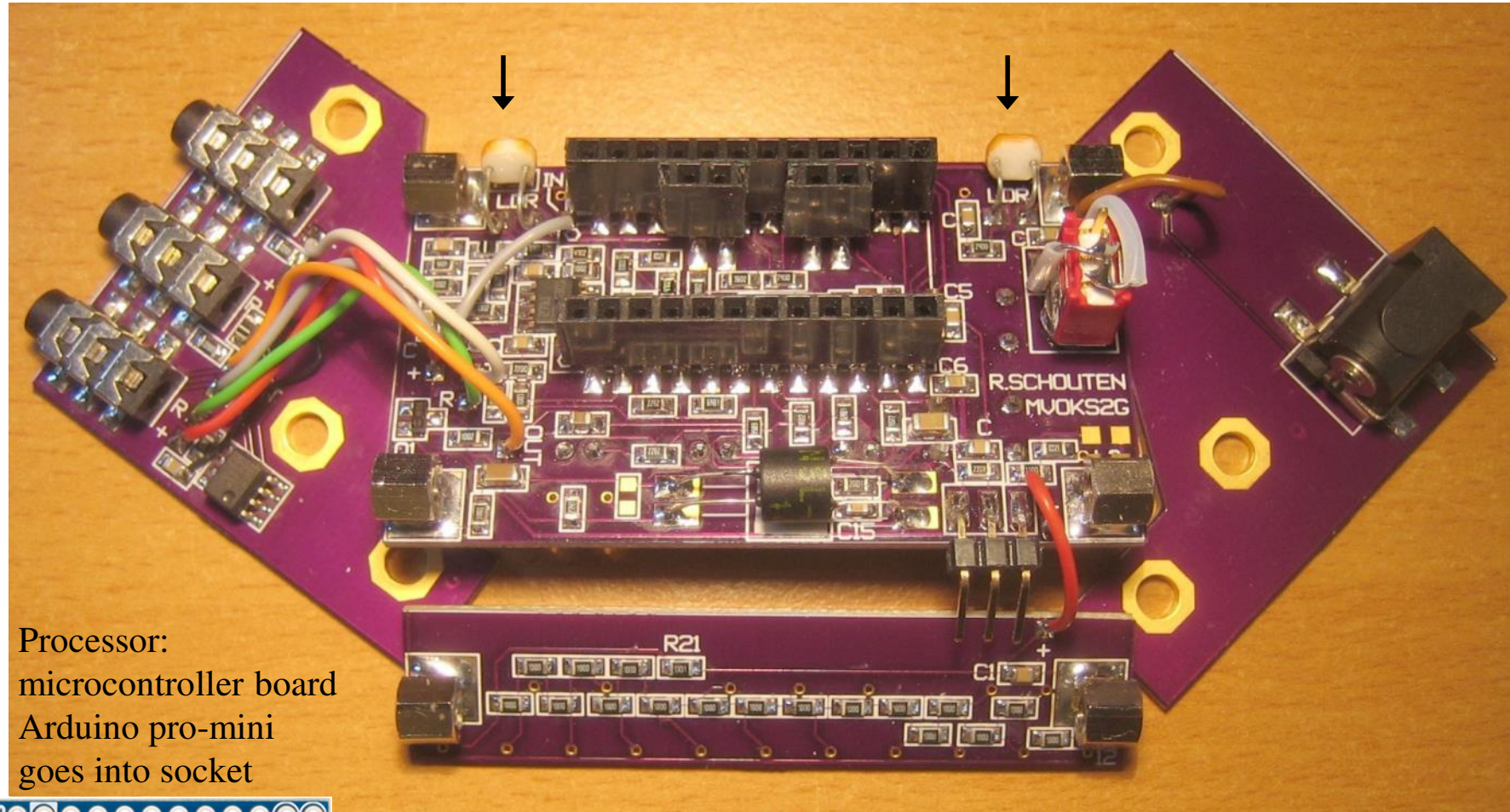


Keyboard
(stylus control)



MonoVoks2, inside view (processor not yet in socket)

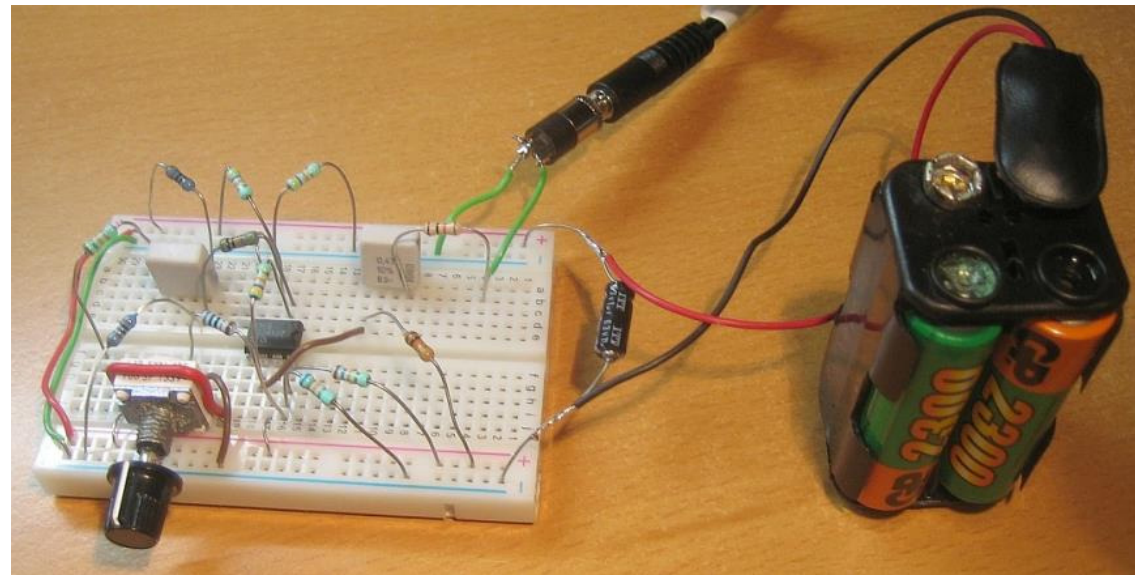
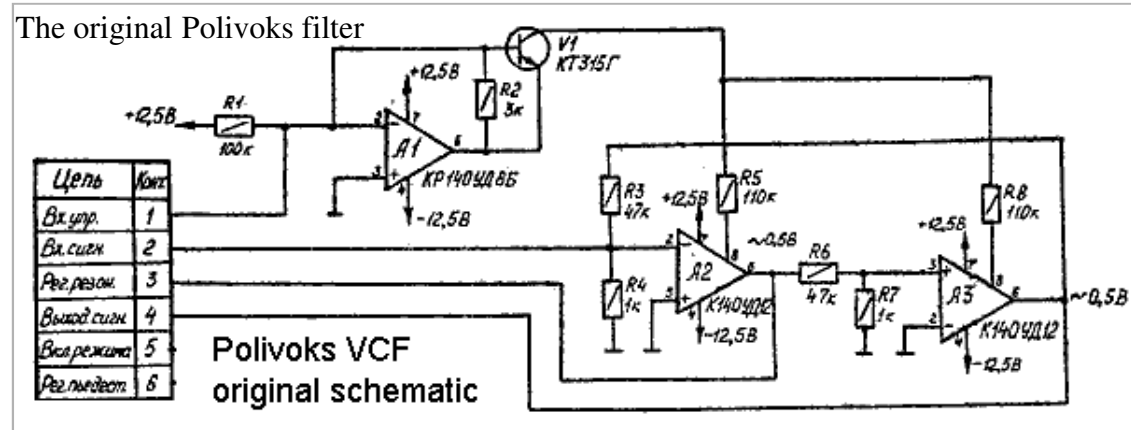
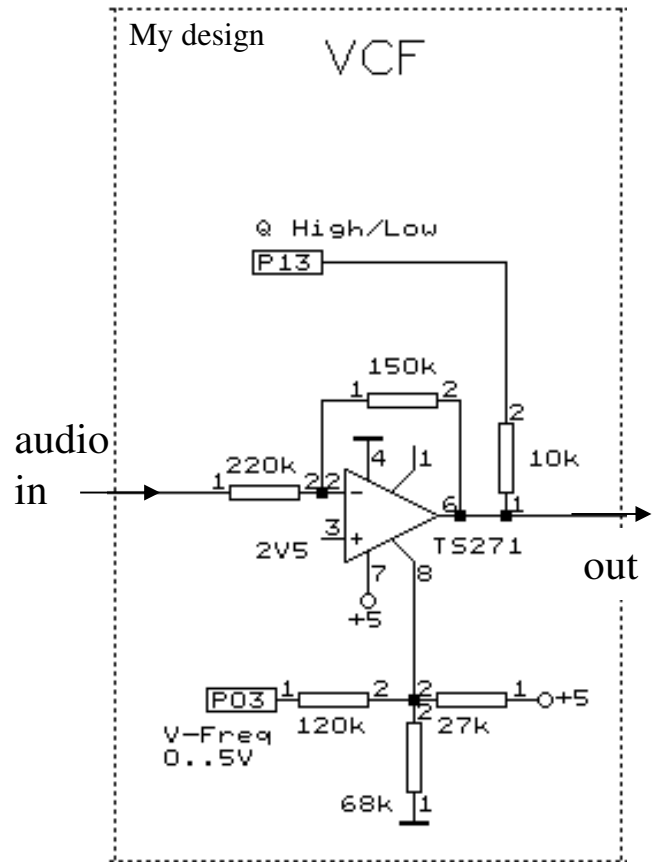
Control filter via hand movement above, 2 balanced Light Dependant Resistors (LDR)



Two LDR's are used in a balance circuit to be independant of the amount of ambient light

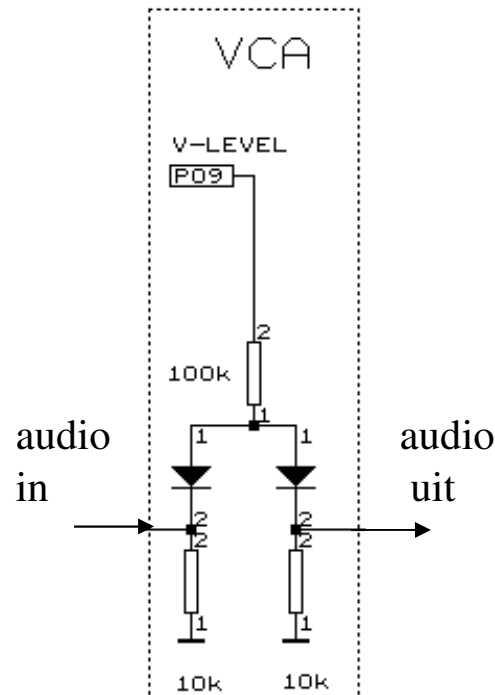
MonoVoks: Voltage controlled analog filter (VCF)

- Inspired by the Russian PoliVoks filter, I made a simpler version with 1 modern opamp
- The supply was also simplified to be 0, +5V (compatible with microprocessors)



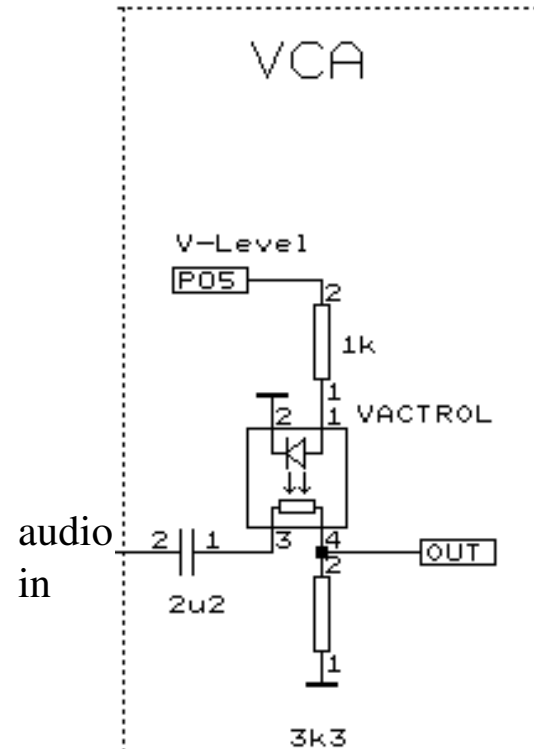
Creating complex solutions is easier than creating simple ones

MonoVoks: Voltage Controlled “Amplifiers” (VCA)



drawbacks

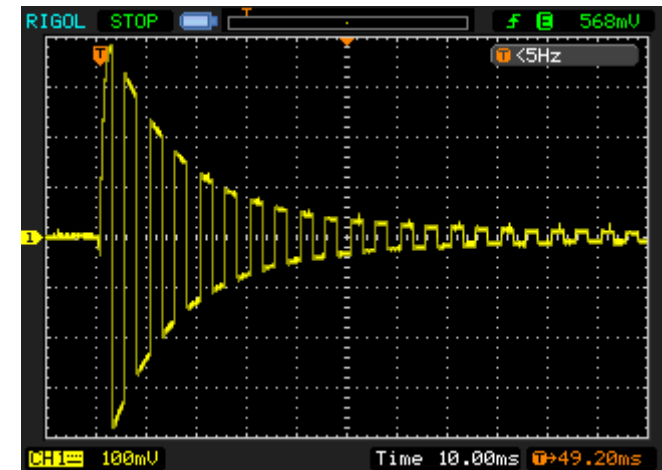
- control leakage to audio
- distortion >100mVpp



LED+LDR in one
=Vactrol



Vactrol: fast attack (3ms)
somewhat slower decay (20ms)
sounds “natural”

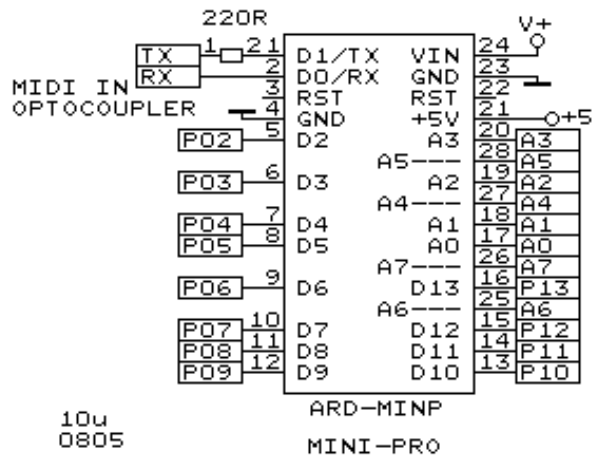


measured audio-envelope vactrol
switched on/off

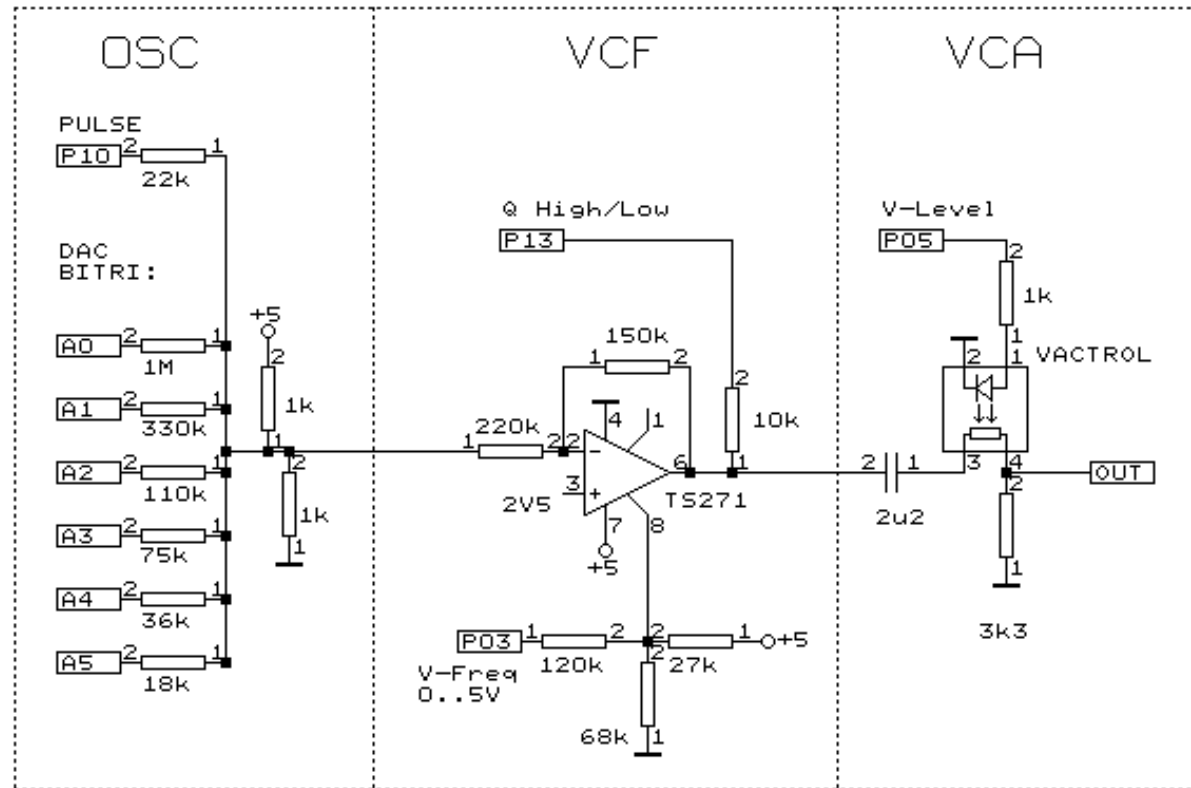
vactrol type: NSL-32SR3

Now combine a microcontroller with the VCF and VCA

Arduino microcontroller board:
Build-in hardware oscillator
sends the square waves and
pulses direct to an output pin
(no software loop involved)



Other waves and noise are created
via a resistor summation (DAC)



This way you get a **hybrid** synthesizer:

digital: oscillator (DCO), modulators, userinterface, MIDI

analog: keyboard, VCF, VCA, control voltages and signal path

(Future step: making a polyphonic synth by copying this 4 ..6 times)