

## **Dirty Electronics: Mute Synth**

**John Richards 2011**

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The Mute Synth is a hand-held touch and tilt instrument with copper etched artwork and contoured printed circuit board that was designed in collaboration with Mute and graphic designer Adrian Shaughnessy. The instrument brings together many Dirty Electronics aesthetics and instrument designs into one device in particular creating an instrument 'of the hand' (in terms of both playing and building), a noise-based device that utilises feedback, and exploring the relationship between artwork and circuit board. It combines sound synthesis with a sequencer/pulser, and it is 'knobless'. The Mute Synth is controlled by using the conductivity of the human body to complete the instrument's circuit when the copper etching is touched. There are touch 'points' on both sides of the circuit board, and the instrument is designed to be played with thumbs and fingers. Two tilt switches on different planes allow for gestural control of the sequencer. Pulsating brilliant white noise and grunge in the hand!

Three integrated circuits (ICs) are used for sound generation, sequencing and switching/routing. The sound generation is modelled on the Dirty Electronics 4049 Study that includes the Skull Etching and Pinboard. The Mute Synth provides another variation on this theme. The sequencer/pulse generator, like the ICA Solder a Score instrument, takes the idea of cascading NAND gates, the difference being the Mute Synth sequencer is controlled by touch electrodes and tilt switches. The third IC, triggered by the sequencer, gates/switches the sound generation on and off.

### **Features**

Touch and tilt control, Two oscillators, Feedback network, Distortion, Filter, Sequencer, Contoured shape, Jack output.

### **Playing the Instrument**

Find your own way to play the instrument. Some tips. There are independent switches for power (SW1) and the sequencer (SW2): see

Board Layout (Appendix 1). The red LED will light when the sequencer is on.

The touch electrodes are predominantly grouped in pairs, and arranged in two (left/right hand) manuals/groupings (see Appendix 1). In general, the moister the thumbs and fingers the more responsive the instrument. Too much moisture will cause the instrument to sound when not touched. The sound will cease when the saliva on the touch controls has dried. A more sensitive control is also gained through using one finger or thumb to bridge the electrodes. For example, with the sequencer off, lick your left thumb and bridge electrodes A and B. Oscillator 1 should sound. The greater pressure on the touch electrodes A and B the higher the pitch. Touching electrodes E and F create a noisy feedback loop. These electrodes work in reverse: the greater the pressure the lower the pitch. In isolation E may produce radio interference or hum. Interesting and sometimes unpredictable modulations will occur when these pairs (A and B, E and F) are touched simultaneously.

Other touch pads: K (back/right) provides a low pass filter for the feedback loop (E, F and K). A low pass filtered oscillator (Oscillator 2) is created by touching I and J (back/left). All these touch electrodes can be touched simultaneously and in various combinations to create different sounds.

NOTE: this type of touch instrument is by design dysfunctional in that a myriad of signal paths come together through the body. Each function is not discrete and cannot be considered in isolation. In many ways this is the beauty of the instrument. For example, Oscillator 1 and 2's paths would cross when their electrodes are touched. This can lead to very unpredictable and often indeterminate results.

The sequencer/pulser is turned on/off by SW2. The sound produced by touching the electrodes described above will now be gated

rhythmically. No touch, no sound. Four pulses are fed into each other to create a complex rhythmic pattern. Two pulses have a fixed speed/frequency (Pulse 2 and 3), whilst the speed/frequency of Pulse 1 and 4 can be altered by touching electrodes C and D, G and H respectively (see Schematic Appendix 2).

Two tilt switches provide additional control of the sequencer. Tilting the instrument forward will bypass Pulse 3: the rhythmic pattern will be made-up of three pulse streams. A different rhythmic pattern will be produced. Tilting the instrument to the side (right hand down) will feed the pulse stream back into itself to create yet another pattern. Touching the sequencer electrodes may also change the sound. The tilt switches consist of rolling ball bearings that touch metal contacts to make a connection.

The switches may produce crackles.

Collins, Nicolas. *Handmade Electronic Music: The Art of Hardware Hacking*. New York [etc.]: Routledge, 2006

Horowitz, Paul and Hill, Winfield. *The Art of Electronics*. 2nd Edition, Cambridge University Press, 1989.

Lancaster, Don. *CMOS Cookbook*. Indianapolis: H.W. Sams, 1977

Richards, John. "Getting the Hands Dirty," *Leonardo Music Journal* (18) 2008.

\_\_\_\_\_. "Skull Etching" 3rd ed., 2010 <<http://www.dirtyelectronics.org>>

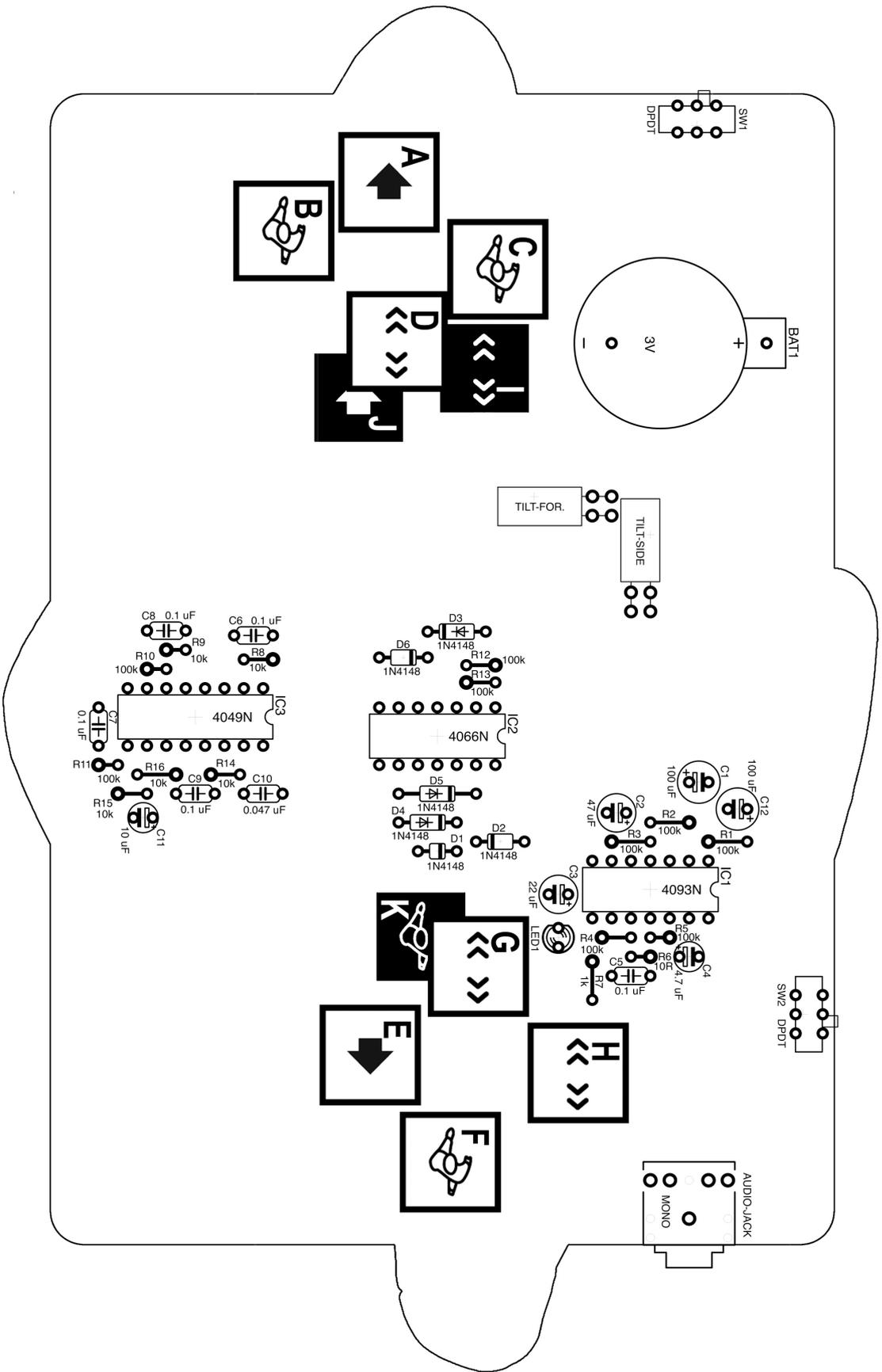
\_\_\_\_\_. "Lead & Schemas," *Roland: ICA Magazine*, Issue 9, 2011

\_\_\_\_\_. "ICA Solder a Score" 2nd ed., 2011 <<http://www.dirtyelectronics.org>>

#### Partlist

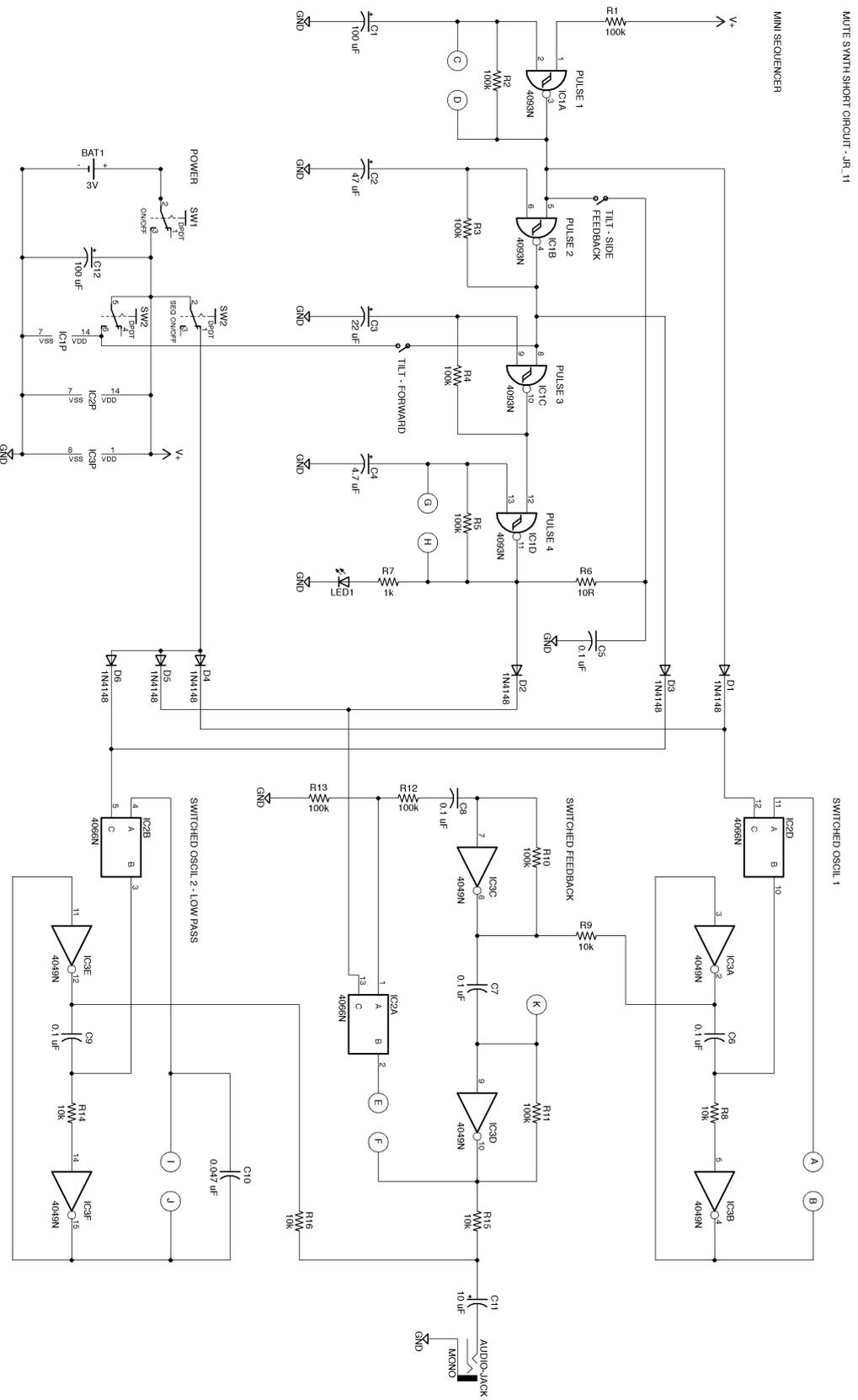
BAT1	CR2032 battery holder
CR2032	3v COIN CELL BATTERY
C1	100 uF
C2	47 uF
C3	22 uF
C4	4.7 uF
C5	0.1 uF
C6	0.1 uF
C7	0.1 uF
C8	0.1 uF
C9	0.1 uF
C10	0.047 uF
C11	10 uF
C12	100 uF
D1	1N4148
D2	1N4148
D3	1N4148
D4	1N4148
D5	1N4148
D6	1N4148
IC1	4093
IC2	4066
IC3	4049
DIL SOCKET	14 PIN
DIL SOCKET	14 PIN

DIL SOCKET	16 PIN
LED1	3MM
AUDIO-JACK	3.5MM JACK SOCKET
R1	100k (br/blk/blk/org/br)
R2	100k
R3	100k
R4	100k
R5	100k
R6	10R (br/blk/blk/gld/br)
R7	1k (br/blk/blk/br/br)
R8	10k (br/blk/blk/red/br)
R9	10k
R10	100k
R11	100k
R12	100k
R13	100k
R14	10k
R15	10k
R16	10k
SW1	DPDT
SW2	DPDT
TILT-FOR.	TILT SWITCH
TILT-SIDE	TILT SWITCH
FEET	RUBBER FEET X4



Appendix 1 : Board Layout

## Appendix 2: Schematic



### Appendix 3: Mute Synth Quick Reference

