

PAPER MOSQUITO MK II

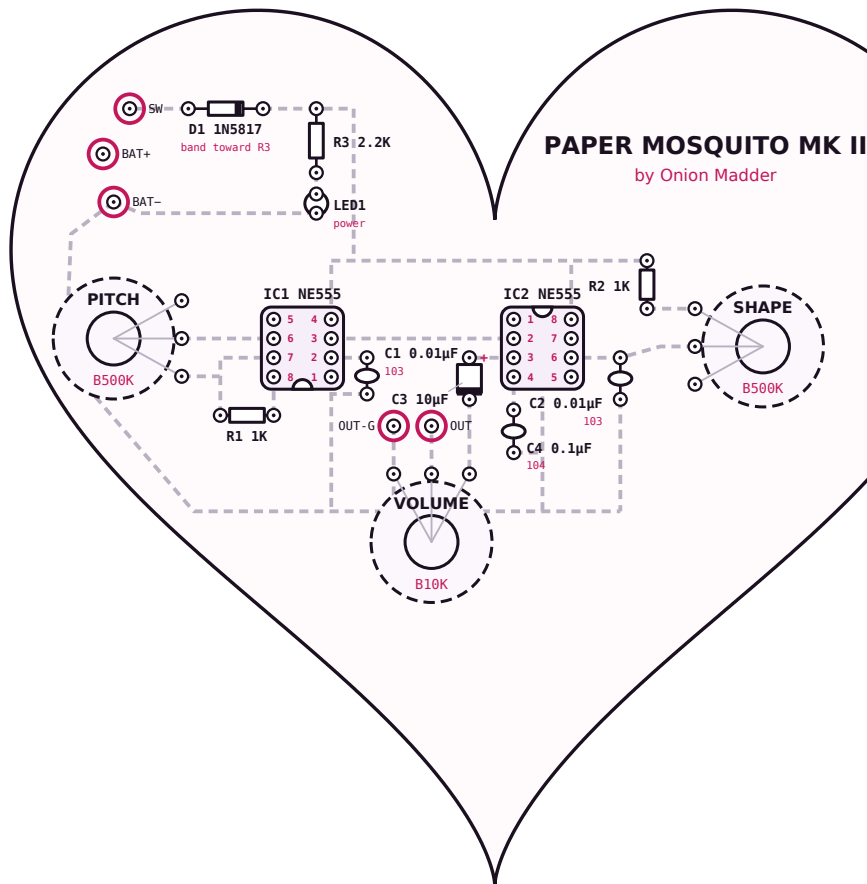
the Atari Punk Console on two NE555s as a paper circuit · fold sheet, print at 100% / Actual size

Onion Madder // messopedals.com · paper-circuit method after Peter Blasser / Ciat-Lonbarde



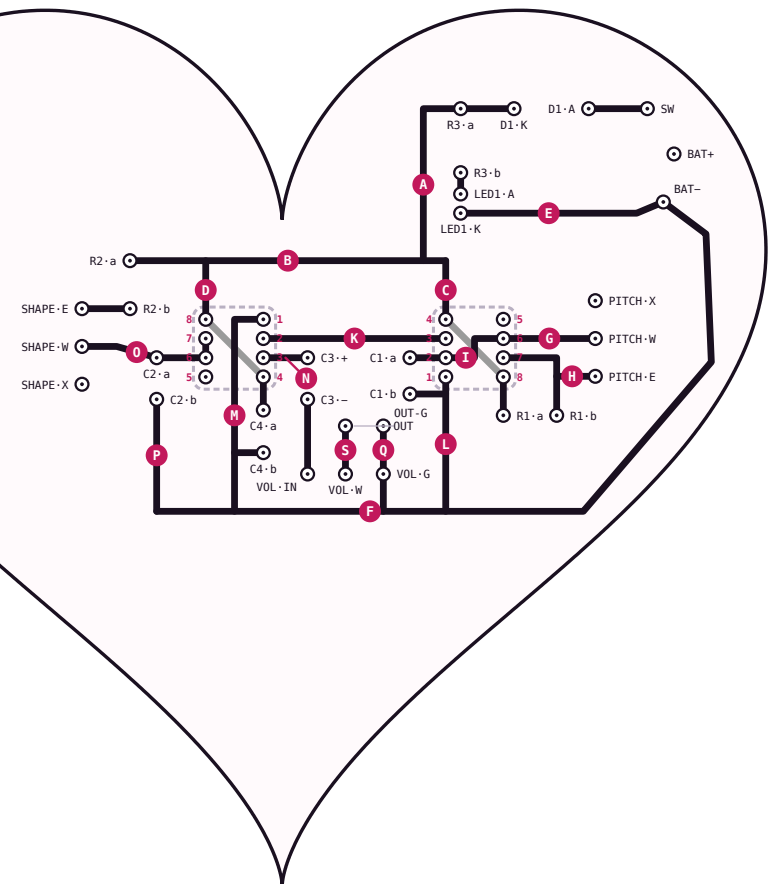
FRONT - parts side

parts go in from this face · IC1 notch DOWN, IC2 notch UP · knobs up



BACK - solder side

folds behind the front · mirror image · bare wire along every line



∞ glue up first, then cut along the heart outline through all four layers · don't cut the fold

build-up: blank sheet folded + glued as the core, then this sheet folded around it and glued = 4 sheets thick

Paper Mosquito Mk II

the Paper Mosquito redrawn as a heart, on two NE555s

A paper circuit is a circuit board you print: the drawing is the board, the holes are poked with an awl, and the traces are bare wire laid along the lines on the back. This is the **Paper Mosquito**, redrawn as a heart: an Atari Punk Console, one timer ticking and a second one turning every tick into a little pulse whose width you set. PITCH sets the tick, SHAPE the pulse, VOLUME how much of it gets out.

This version runs on two NE555s instead of an NE556. A 556 is two 555s in one package, so each 555 here is one half of it, part for part. The board is four sheets of paper thick, a 1N5817 means a backwards battery does nothing, an LED tells you it is on, and the battery snap solders straight to the board.

68 steps. Page 1 is the fold sheet; everything after it is the recipe.

Reading the sheet

Front: each part is drawn where it sits, with its value printed next to it. The faint dashed lines are only a preview of what connects on the back. The ringed holes are for wires going off the board: BAT+, BAT– and SW for power, OUT and OUT-G for the jack. Each pot has three holes for its three lugs; on PITCH and SHAPE the X hole is the lug that stays empty.

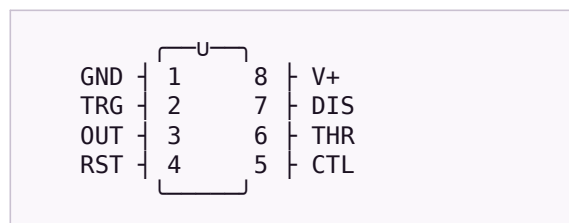
Back: every bold black line is bare wire or a bent part leg. The lines with a pink letter are bare wire, and the steps name them by that letter; the short unlettered ones are a part's own leg, bent along the line. The two gray diagonals are the insulated wires J1 and J2. Small pink numbers beside the chip holes are pin numbers.

The APC descends from Forrest M. Mims III's "Stepped Tone Generator." The paper-circuit method is Peter Blasser's / Ciat-Lonbarde's. This layout and the words are Onion Madder's.

What you'll need

- **2× NE555 timers (IC1, IC2)** · *spot it:* NE555 printed on top; a notch or dot marks pin 1. They solder straight to the paper, no socket.
- **2× B500K pots (pitch and shape)** · *spot it:* marked B500K; B = linear taper, and the middle lug is the wiper (a B1M works too, just a wider range)
- **1× B10K pot (volume)** · *spot it:* marked B10K (B5K is fine)
- **1× 1N5817 Schottky diode (D1)** · *spot it:* small black body; the gray or silver band marks the cathode
- **1× LED, any color, and a 2.2K resistor (R3)** · *spot it:* the LED's long leg is +, the flat side of the rim is −; 2.2K is red-red-red (1K is brighter and drains the battery faster)
- **2× 1K resistors (R1, R2)** · *spot it:* bands brown-black-red; non-polar
- **2× 0.01 µF ceramic (C1, C2)** · *spot it:* tiny disc printed 103
- **1× 0.1 µF ceramic (C4)** · *spot it:* disc printed 104
- **1× 10 µF electrolytic (C3)** · *spot it:* a little can; the stripe marks the minus leg, and the long leg is plus
- **Bare tinned wire, and insulated wire** · *spot it:* bare for the traces on the back, insulated for J1 and J2
- **An SPST toggle, a battery snap, a jack or an 8Ω speaker, and a 9V battery or at least two vape cells in series** · *spot it:* the toggle and the jack hang off the board on wires
- **A second sheet of plain printer paper, a glue stick, and an awl** · *spot it:* the blank sheet becomes the core, and any sharp point works in place of an awl

The chip, from above



IC2 sits on the sheet exactly like this, notch toward the top edge. IC1 sits the other way up, notch toward the bottom edge, so its pin 3 ends up right beside IC2's pin 2 and one straight wire joins them. Go by the notch drawn on the sheet, not by habit.

Before you start

Paper burns. Keep the iron moving, quick joints, and don't rest it on the sheet. Work over something that isn't flammable, and keep a damp sponge handy.

Chips straight in. Both NE555s are soldered straight to the paper with no sockets, and most parts end at one of their pins. Keep each joint quick: touch, flow, lift.

The two chips face opposite ways. IC1's notch points down and IC2's points up. Check both against the sheet before you solder a single pin.

Bare traces on the back can short. The tightest spots are trace I under IC1 and trace M under IC2. Keep each one centered between the two rows of pins.

Loud and shrill. It's still an APC. Start with VOLUME low.

Print, fold, glue, poke

The sheet is the circuit board, and it's four sheets of paper thick. A plain sheet folded in half and glued to itself makes the core, then the printed hearts fold around the core and glue on, one heart on each face.

Print at 100% / "Actual size". Fit-to-page shrinks it and the holes stop matching the chips' legs.

STEP	DO
1	Print page 1 on plain printer paper at 100% / Actual size.
2	Measure the 100 mm bar at the top right of the sheet. If it isn't 100 mm, fix the print scale and print again.
3	Fold a second, blank sheet of printer paper in half.
4	Glue-stick the whole inside of the blank sheet, close it, and press it flat. That's the core: two sheets thick.
5	Fold the printed sheet along the FOLD line, printing on the outside, so the two hearts sit back to back.
6	Unfold it again and glue-stick the back of the FRONT heart.
7	Press the core onto the glued back of the FRONT heart.
8	Glue-stick the back of the BACK heart, fold it over onto the other face of the core, and press it flat. Now it's four sheets thick.
9	Let the glue set for a few minutes, then cut along the heart outline through all four layers. Don't cut across the FOLD hinge.
10	Poke the 16 chip holes from the front with an awl or other sharp point, straight down through all four layers.
11	Poke the other 32 dots the same way. Check the back and open any hole that didn't come all the way through.

Start in the middle: the two chips

Everything builds outward from the chips. They face opposite ways on purpose.

Quick dabs only. Paper scorches if you sit on it: touch, flow, lift.

STEP	DO
12	Push an NE555 into the IC1 holes from the front, notch toward the bottom edge (the drawn notch).
13	Push the other NE555 into the IC2 holes from the front, notch toward the top edge .
14	On the back, bend each chip's corner pins outward slightly so they can't fall out.
15	Insulated wire J1 from IC1 pin 4 to IC1 pin 8, across the chip. Solder at both pins.
16	Insulated wire J2 from IC2 pin 8 to IC2 pin 4, across the chip. Solder at both pins.

17	Trace K: bare wire from IC1 pin 3 straight across to IC2 pin 2. Solder at both pins.
18	Trace I: bare wire from IC1 pin 6, under the chip, to IC1 pin 2, centered between the two rows of pins. Solder at pin 6 and pin 2.
19	Trace L: bare wire from IC1 pin 1 down to the ground line. Solder at pin 1 only; the far end gets soldered with the ground line.
20	Trace M: bare wire from IC2 pin 1, under the chip, down to the ground line, centered between the two rows. Solder at pin 1 only.

Next ring out: the caps and resistors

R1 and C1 set IC1's tick. C4 sits on IC2's pin 4, and C3 carries the sound out.

STEP	DO
21	R1, 1K (brown-black-red): legs into R1·a and R1·b from the front.
22	On the back, bend R1·a's leg up to IC1 pin 8. Solder at R1·a and at pin 8.
23	Bend R1·b's leg up to the corner of its line. Solder at R1·b only; trace H joins it later.
24	C1, 0.01 μ F (marked 103): legs into C1·a and C1·b from the front.
25	On the back, bend C1·a's leg along the line to IC1 pin 2. Solder at C1·a and at pin 2.
26	Bend C1·b's leg across to trace L. Solder at C1·b and where it touches L.
27	C4, 0.1 μ F (marked 104): legs into C4·a and C4·b from the front.
28	On the back, bend C4·a's leg up to IC2 pin 4. Solder at C4·a and at pin 4.
29	Bend C4·b's leg across to trace M. Solder at C4·b and where it touches M.
30	C3, 10 μ F electrolytic: long + leg into C3·+, striped leg into C3·−, from the front. Lay the can flat over its drawing.
31	Trace N: bare wire from IC2 pin 3 to C3·+. Solder at pin 3 and at C3·+.
32	Bend C3·−'s leg down its line so its end sits over the VOL·IN hole. Solder at C3·− only; the volume pot joins it later.
33	C2, 0.01 μ F (marked 103): legs into C2·a and C2·b from the front. Solder both in their holes and leave the tails long.
34	Trace P: bare wire from C2·b down to the ground line. Solder at C2·b only.

Power corner and the +V line

Power comes in at the top. D1 only lets current through one way, so a battery clipped on backwards does nothing, and the LED says it's on. The +V line runs along above both chips.

D1's band goes in D1·K, toward R3.

STEP	DO
35	D1, 1N5817: band end into D1·K, plain end into D1·A, from the front.
36	On the back, bend D1·A's leg along the line to the SW pad. Solder at D1·A and at SW.
37	R3, 2.2K (red-red-red): legs into R3·a and R3·b from the front.
38	LED1: long leg into LED1·A, short leg (flat side of the rim) into LED1·K, from the front.
39	On the back, bend R3·b's leg to LED1·A. Solder at R3·b and at LED1·A.
40	Trace E: bare wire from LED1·K along the line to the BAT– pad. Solder at LED1·K and at BAT–.
41	R2, 1K (brown-black-red): legs into R2·a and R2·b from the front. Solder R2·a in its hole.
42	Trace A: bare wire from D1·K through R3·a, along, then down to the +V line. Solder at D1·K and at R3·a.
43	Trace B, the +V line: bare wire from above IC1 pin 4 across to R2·a. Solder at R2·a and where trace A meets it.
44	Trace C: bare wire from IC1 pin 4 up to the +V line. Solder at pin 4 and at the line.
45	Trace D: bare wire from IC2 pin 8 up to the +V line. Solder at pin 8 and at the line.

The ground line

One long ground wire runs from BAT– down the outside edge and along the bottom, and everything that goes to ground drops onto it.

STEP	DO
46	Trace F, ground: bare wire from the BAT– pad down the outside edge, then along the bottom line to where trace P comes down. The BAT– end is already soldered.
47	Solder trace F where traces L, M and P meet it.

The pots, outermost

Each pot's lugs go into its three holes from the front. PITCH and SHAPE use two lugs each and leave X empty.

With solder-lug pots, solder a short wire to each lug and push the wires through instead.

STEP	DO
48	PITCH pot, B500K: lugs into the PITCH holes X, W and E from the front, knob up.
49	Trace G: bare wire from PITCH W to IC1 pin 6. Solder at W and at pin 6.

- 50** Trace H: bare wire from PITCH E along the line, past the corner where R1·b's leg waits, to IC1 pin 7. Solder at E, at the corner, and at pin 7. X stays empty.
- 51** SHAPE pot, B500K: lugs into the SHAPE holes E, W and X from the front, knob up.
- 52** On the back, bend R2·b's leg along the line to SHAPE E. Solder at R2·b and at E.
- 53** Trace O: bare wire from IC2 pin 7 down to pin 6, then out through C2·a to SHAPE W. Solder at pin 7, pin 6, C2·a and W. X stays empty.
- 54** VOLUME pot, B10K: lugs into the VOL holes G, W and IN from the front, knob up.
- 55** Solder VOL·IN, where C3·—'s leg is already sitting.
- 56** Trace S: bare wire from VOL W up to the OUT hole. Solder at W and at OUT.
- 57** Trace Q: bare wire from the OUT-G hole down through VOL G to the ground line. Solder at OUT-G, at G, and at the line.
- 58** Snip every leg tail that sticks past its joint.

Off the board

The battery clips onto the board; the toggle and the jack hang off pads on flying leads.

Leave the battery unclipped until everything above is done.

STEP	DO
59	Battery snap red (+) to the BAT+ pad.
60	Battery snap black (–) to the BAT– pad.
61	A wire from the BAT+ pad to one lug of the SPST toggle.
62	A wire from the other toggle lug to the SW pad.
63	Jack tip (or speaker +) to the OUT hole.
64	Jack sleeve (or speaker –) to the OUT-G hole.

Check, then play

Meter it before you play it.

STEP	DO
65	Clip the battery on, toggle on with VOLUME low. The LED should light.
66	Meter IC1 pin 8 to IC1 pin 1: battery voltage minus about 0.3 V (the diode's drop).
67	Meter IC2 pin 8 to IC2 pin 1, then pin 4 to pin 1 on each chip: the same reading every time.
68	Bring VOLUME up. It should drone right away. Sweep PITCH, then SHAPE.

Voltage check

METER BETWEEN	EXPECT (toggle on, LED lit)
BAT+ pad → BAT− pad	battery voltage (9V, or 7.4V on two vape cells)
IC1 pin 8 → IC1 pin 1	battery voltage minus about 0.3 V
IC2 pin 8 → IC2 pin 1	the same
Pin 4 → pin 1, each chip	the same (the resets, through J1 and J2)
IC1 pin 3 → IC2 pin 2	continuity beep (trace K)

If it won't sing

SYMPTOM	CHECK
LED off, board dead	D1 in backwards (the band goes in D1-K), the battery snap reversed (D1 blocks it, nothing gets hurt), or the toggle wires not on BAT+ and SW.
LED on, but silent	First turn VOLUME up. Then the notches: IC1 down, IC2 up. Then J1 and J2: pin 4 of each chip must read battery voltage. Then trace K.
Silent, a chip warm	A chip in the wrong way around, or two bare traces touching on the back, most likely trace I or M brushing a pin. Hold the heart up to a light and look at the back under the chips.
Faint, or only a tick	C3 the wrong way around (+ goes in C3+), or C1 or C2 not reaching ground through traces L and P.
LED on but dim, or flickers with the sound	Normal-ish on a tired battery. A fresh 9V fixes it.
Putt-putt motorboating	C4 not soldered at both ends, or a cold joint on trace M.
A pot does nothing at one end	Normal: that is the 1K stopping it at zero. Does nothing at all: a lug in the wrong hole, or the wiper isn't in W.
Paper scorched or a hole tore	Glue a scrap of paper over the back, re-poke, carry on. It is paper.

Things to try

- **Body contacts:** solder a bare-wire staple onto trace G and another onto trace H, a few millimeters apart on the front. A fingertip across them bridges the pitch pot, so you play pitch by touch (works best with PITCH turned toward its slow end). An LDR across the same two points makes it follow light.
- **CV inputs:** pin 5 of each chip is left open, like the Mosquito. A 100K from either into a jack gives you the CV inputs from the Mosquito page.
- **One and a half:** hang a third NE555 one-shot off IC1 pin 3 for the “one and a half” mod. Draw its traces onto your sheet in pen first.
- **Color the front in.** Blasser's sheets are half schematic, half drawing, and nothing on the front side carries current.