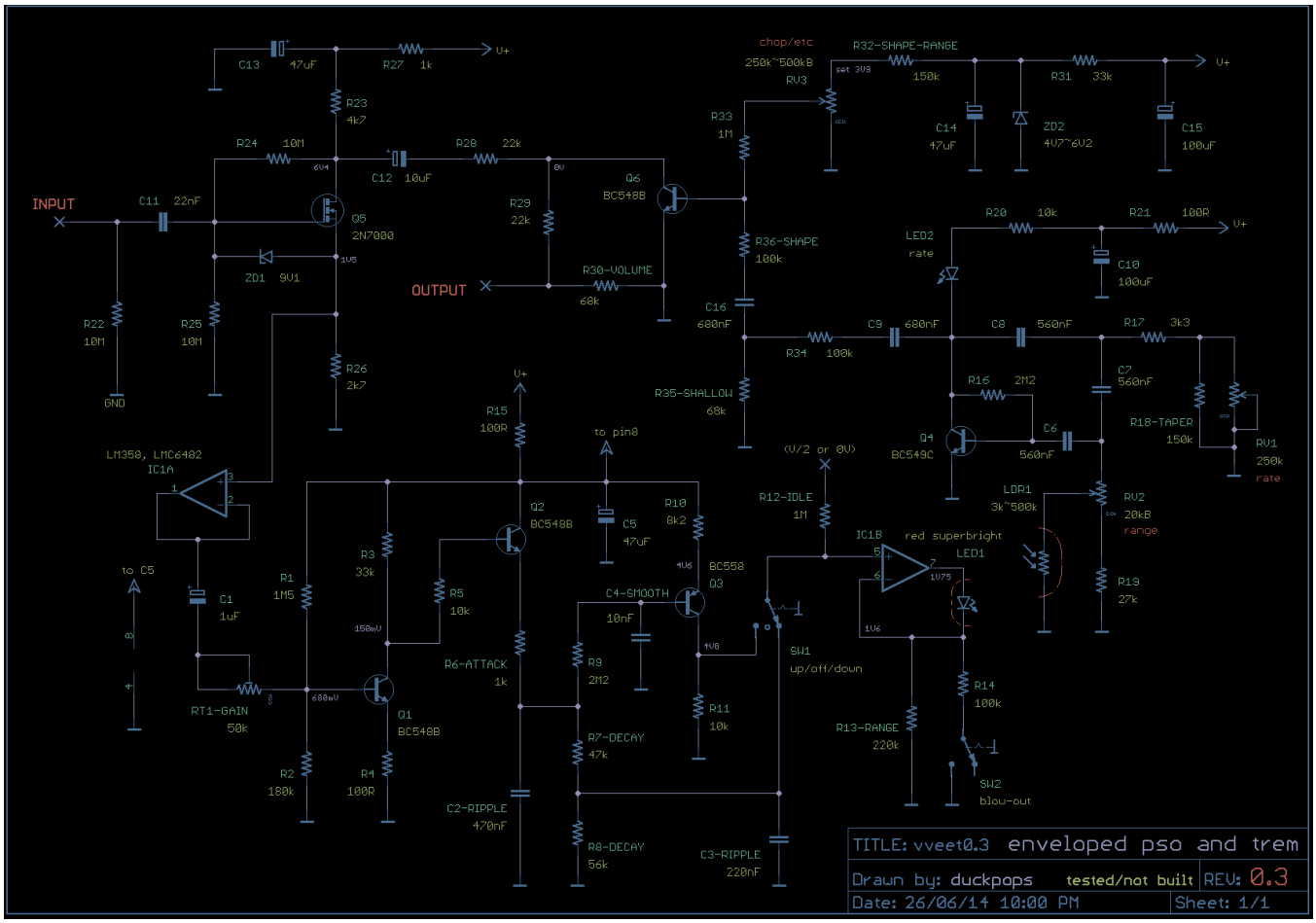
enveloped rate-control for trem or vibe – the “vveet”

if you've got a tremolo, vibe or something modulated with a phase shift oscillator, here is a method for envelope control of (in particular, but not limited to) the oscillator rate.

shown is the circuit for the "vveet" tremolo, with envelope-controlled lfo. a complete vero layout is shown, as well a version for the envelope section alone, for those who might like to add-it-on to something already built.



- the envelope and led drive -

the envelope started with the circuit shown in "Following envelopes with transistors" by jatalahd, with bits of the "Mini-Mu" by RRing, both since modified. IC1A provides impedance-buffering and isolation for the clamping-amping-rectifier, Q1, which swings close enough rail-to-rail. Q2 buffers and drives the smoothing caps, C2 and C3, via the attack-setting R6. R7 and R8 set the decay time and provide a divider to reduce the smoothed "up" envelope-peak to a bit more than V+/2, the ratio adjustable for more/less swing.

R9, with C4 providing additional smoothing, feeds the full envelope to Q3, an upside-down phase-splitter. the "down" envelope appears at the collector, and swings from just above V+/2 to near 0V. how much above V+/2 can be adjusted via the ratio R10 to R11, reduce R10 for greater swing. (both up and down envelopes are available at the same time.)

centre-off switch SW1 selects envelope up, down or no, and feeds the selected to IC1B, which drives the LED1 in its feedback loop, with R13 selected for appropriate led brightness. connecting R12 to 0V will correctly *park* the IC1B input when SW1 is in the centre "envelope off" position.

the blow-out SW2 is used with R14 to shift the LED1 brights and the osc-range swept, and to trick the LDR1 such that it may or may-not kill the (slow)

oscillator, with peak-brights producing a too-low "fixed R" value. sweeping-ring modulation effects can be faked with the blow-out producing very fast oscillator rates.

the only gain-control provided is RT1. an apparent "step" in the envelope decay can be adjusted out with this control. more *rectifier gain* can be had by increasing R3, or shorting R4, which will affect how RT1 works. more *signal in* can be had by taking the pin3 input to the drain of Q5.

- the oscillator -

the oscillator is a standard phase shift design, straight from an EA tremolo or a million other similar, and the basis of the univibe osc, used here in an attempt to overcome some of the VV's shortfalls. its "fixed R" leg provides a constant, sweepable option not readily available in opamp osc designs.

high-gain transistor Q4 with R16 feedback resistor provides reliable osc performance. C6, C7 and C8 set the oscillator frequency, made variable with the RV1 rate pot. RV2 and R19 form the "fixed R" oscillator leg, the osc-rate sweep is achieved by the LDR1 parallel with the "fixed R" leg, the swept-width controlled via the RV2 range setting.

with a slow "rate" and a wide "range" set, the oscillator *may tend to stopping* on envelope peaks. recovery to full osc-output can be slow, resetting either control level may help. used carefully with the blow-out can produce a spiffing of the tremolo.

the osc output, via C9, is level-set with the R34//R35 voltage divider to a similar swing as the original VV osc. LED2 provides a visual indication of oscillator rate, it may be omitted if R20 is increased to 15k.

- the tremolo -

the tremolo is a simple shunt-to-ground transistor, as used in the Vico Vibe and millions of others. an "Orman" type high-impedance mosfet front-end, Q5, is added *to prevent any tone-sucking*, in the same manner seen in Midwayfair's "Blue Warbler" design. output from the source is fed to the envelope buffer, with DC bias adequate for that stage; output to the Q6 tremolo transistor is taken from the drain, with some signal gain due to the ratio of R23 to R26.

R31, ZD2 and C14 provide a stable voltage reference for the Suarez pot RV3; a more usable bias-knob range is produced by the divider formed with R32, keeping the voltage available to the Q6 base within its usable-bias limits. Q6 is biased part-on via R33 and is modulated with signal from R36, progressively shunting signal at its collector to ground as it turns on.

R28 isolates the buffer and the shunt, R29 isolates the shunt and output signal and provides with R30 a volume control to compensate Q5 gain, with this string referring to ground DC blocking C12, eliminating bypassing pops.

- hacks, tricks, dumb things -

- envelope

IC1A can be any type op-amp, but IC1B needs to include 0V input, so needs to be (part of) LM358, LMC6482, TLC272, TLC2262, M5223, LM324, etc. the transistors are as ordinary as you have, any should work. matching these transistors **will degrade performance**.

I haven't done hardly any fiddle with the attack and release aspects of the envelope, it seems to follow the input adequately. increase the value of C2 and/or C3 if envelope-ripple becomes a problem. up and down are probably both misnamed, the "up" setting produces a slowing trem rate *as the envelope decays*, while the "down" produces a faster trem rate *with envelope decay*. I've stopped trying to think-out the two names.

the R12 idle resistor provides some fun. with a centre-off switch, take this to 0V to park the LED1 at min brights (LED1 off, normal trem). by using a multi-position switch, R12 on a switch position taken to 0V volts, and extra resistors taken to a voltage/s of your choosing (R32//RV3 or R31//R32), the RV1 range is *shifted* (faster), with the shift variable via RV2. this might work as bandspread on the high end of the rate pot, or it might make it un-usable, I haven't quite got a handle on this yet. the blow-out switch shifts everything again.

the 220k R13 suits a waterclear superbright red LED1 and was determined using the "stroke your leds" method, threaded elsewhere. if driving a pair of leds, include a series resistor (470R is fine) with each, then wire in parallel as per LED1.

- oscillator
the phase shift oscillator has an output best at *a* frequency determined by the R/C values *and their matching*, and will vary in level (and distortion) as its frequency is varied by resistance changes in either R leg. use a high gain transistor at Q4 for best output. it will lose interest and stop oscillating as the value of the R legs go further imbalanced; lower-gain parts will work, but stop more readily. the value of feedbacker R16 can compensate slightly.

use poly caps for C6, C7, C8, even if you need to go as high as 1uF (would be ponderously slow for helicopter), as their better-than-electros tolerance can provide better matching, and oscillation will continue at lower rate-pot settings. you won't need to worry about polarity, either; the caps **will** be correctly oriented at all times, and I don't mean east.

the pso has buckets of usable level, the Vico Vibe uses a twin-tee osc, described as "crazy fast", with a crummy low output swing, and results in depth disappointment. a standard mod, as here, seems to be to fix the depth at max, with an external bias pot for trem-env variety. the minimum oscillator rate here is a good deal slower than it would normally be with 560nF or 680nF fitted, because of the increased resistance values in the "fixed R" leg, obviously, but is also quite fast at envelope peak.

for the rate set pot use a 100kC as normal, a 100kA backwards, a 100kB (and just put up with it), or a 250kB with a 150k or 180k tapering resistor for a semi-reverse log taper, and a *little* more slow range, at the risk of more low-settings that will to stopping. *at any time* IC1B input is not parked at 0V, the setting of RV2 can noticably affect the oscillator rate.

I'm using an unknown, 4mm dia, coarse-channel type LDR1, min light resistance ~4k. GL5516 should be perfectly adequate (maybe GL5528 with reduced sweep or increased brights). vactrol users might provide a suitable substitute part #. I chose a fixed R leg of about 50k, because a 20k pot with 27k fixed gives good sweep and pot settings, and is still half the max "variable R" leg value. the RV2 value is not critical, 20k or 25k will be usable, or 10k pot with 39k of R19. replacing R19 and RV2 with a 50k pot will result in a range pot only half usable.

LDR1, part of the fixed R leg, should be in close contackt with LED1, especially with a (dimm) 220k for brightness. it should also be shielded from any spurious light from bypass or rate indicators. a proper vactrol obviates these problems.

- tremolo
use your favourite mosfet for Q5, and anything for Q6, as ordinary, etc. the value of ZD2 is **not critical** (any from 4V7 to 6V8, or two leds to ground, remove R32). the value of the Suarez pot RV3 (any from 100k to 1M) is scaled via R32, providing a voltage divider such that the maximum usable bias voltage of 3V9 appears at the top of the pot and not the middle.

in the original VV design, the input and output connections are symmetric, identical and interchangeable, a rare thing indeed. those connections are here represented by R28 and R29.

the circuit is easily modified to a more traditional style with a bias trim and depth-on-panel by replacing R34 and R35 with a pot. using the bias-variable setup provides degrees of chop, if that is the sound you like. smooth/subtle or yanging helicopter, but not both, unless the depth-pot of the original is re-instated.

tremolo-envelope wise, as presented, 47k at R35 gives a shallower, narrow-valley low-speed response and deeper fast response. 68k lessens the differences, and the trem shape becomes more square-sided. 100k at R36 gives deep and square trem envelope, **the helicopter value**. 330k gives an uneven trem-envelope shape, with a broadly rounded under-half and peaky, greatly attenuated, top-half waves.

as the oscillator rate varies, so does its output level/shape. this effect is only fairly slight but may become apparent while sweeping. bias adjustment may compensate. the values of C9 and C16 may be increased to overcome any level falloff at low osc rates. they may also be decreased, to increase the tonal effects of sweeping, with a greater trem depth at higher rates.

- the vero -
the vero layout is presented in two forms: the complete vveet schem shown above, and a second version comprising just the envelope section, from IC1 across to LED1. this can be grafted to any cod-ordinary pso based effect you may wish ~~to make totally unusable~~ to modify.

the 2 layouts are my first fully-flat. there is a million cuts, and loads of hidden links, and tracks going up-under-and-back (it looks a lot like a perf layout), but everything is *laid flat*. doesn't mean I'm happy seeing all that wasted copper, mt holes ..... the layouts are a riot of colour in every direction; what's your method for reducing errors? any linked tracks are coloured so they can be clearly followed from end to end.

in order to keep audio-ground from IC-ground, separate tracks are provided. there needs to be 3 flying links installed between each pair of coloured spots right-hand side. their locations were chosen to be closer to the clean +9 and 0V in.

R12 is shown connected to an off-board "V idle". if the *bandspreading feature* is not being used, either shorten R12 upwards to a 0.2" span OR link V idle **to the ground-track above it** OR omit the cut next it (which will mix your earths some).

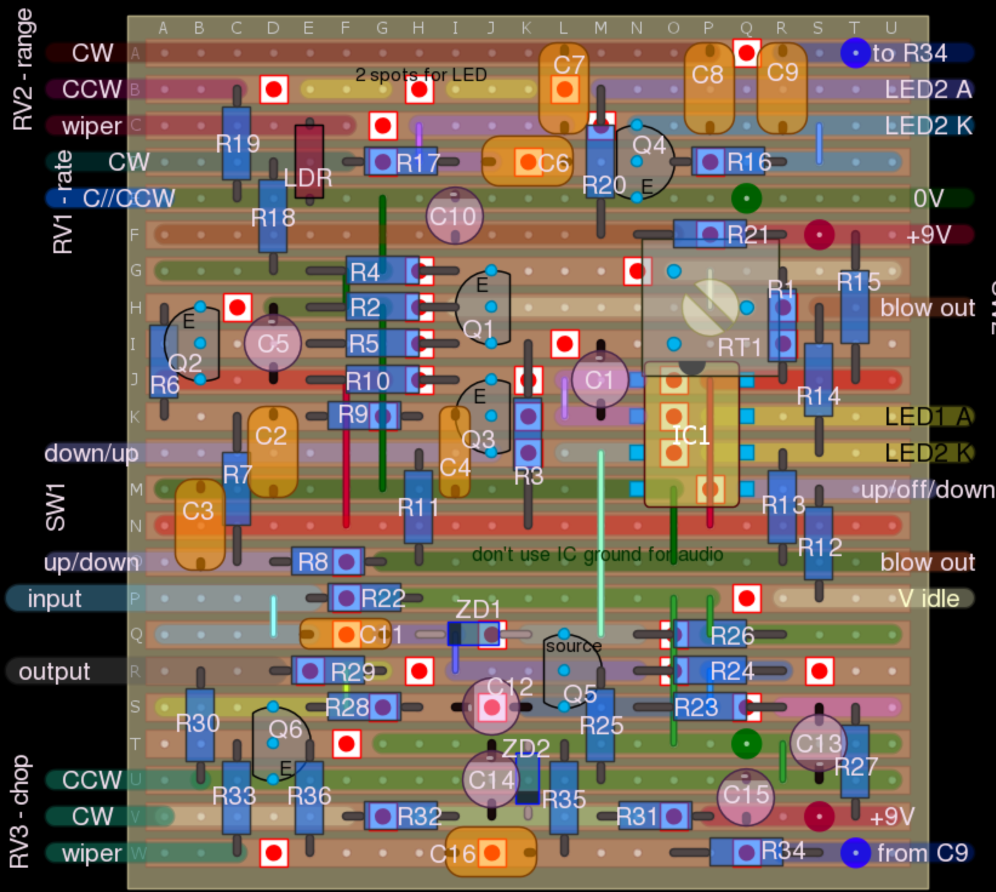
the board is fairly clearly divided into 3 sections: the oscillator (or another of your choice) entirely above the line of RT1, the envelope between +9V and the V idle line, and the audio/tremolo (or your chosen replacement/s) below the bottom IC ground track. each section has its own power supply RC filter. this may be overkill, but seems to work ok. polarity protection is left to the builders discretion. same for bypass, use your favourite.

there is two cut tracks provided near the top of the board for LED mounting. it and the LDR may require some bending to face up, shuffle the LDR and R19/R18, I don't know what arrangement you might be vactrol-ing up for yourself.

a square-type RT1 will foul IC1; mine is narrow and tall, and fits ok. a vertical-mount, side adjust should fit, fit the white link to suit. fat poly caps should fit ok, many have some joggle-space provided. the layout fits my 10uF and 47uF caps 5mm spacing, and my 100uF 2.5mm. none of the electro values are critical, use what you have that fits, there is room for multiples.
---

vveet - tremolo with enveloped rate, layout by duckpops

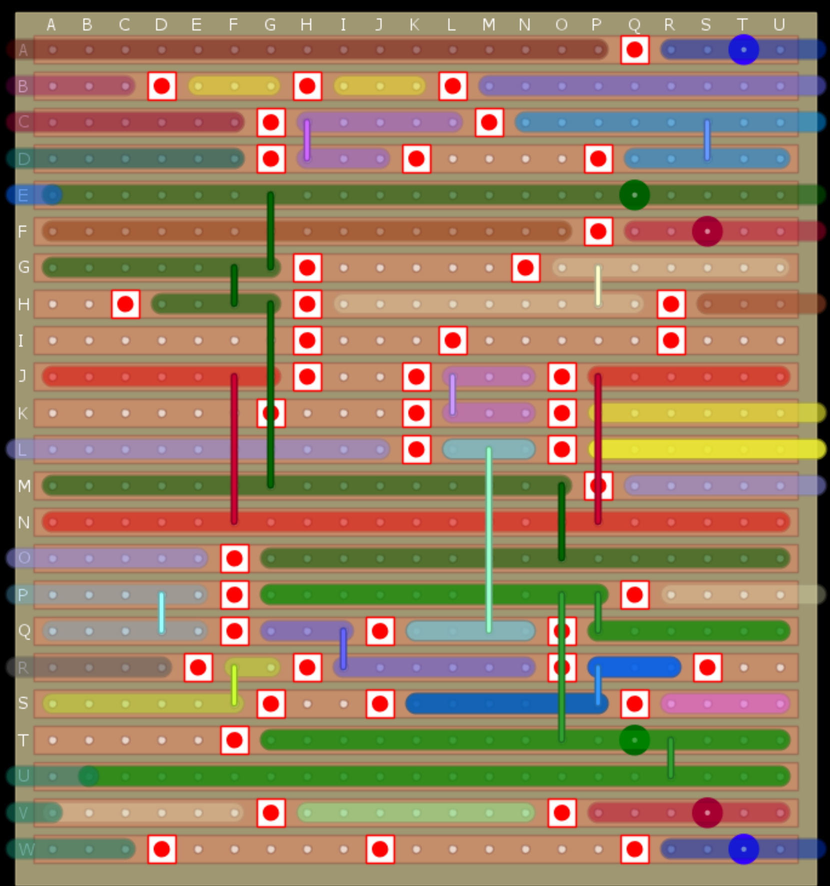
V0.3 - not verified - 27/06/2014



layout for BC series and 2N7000

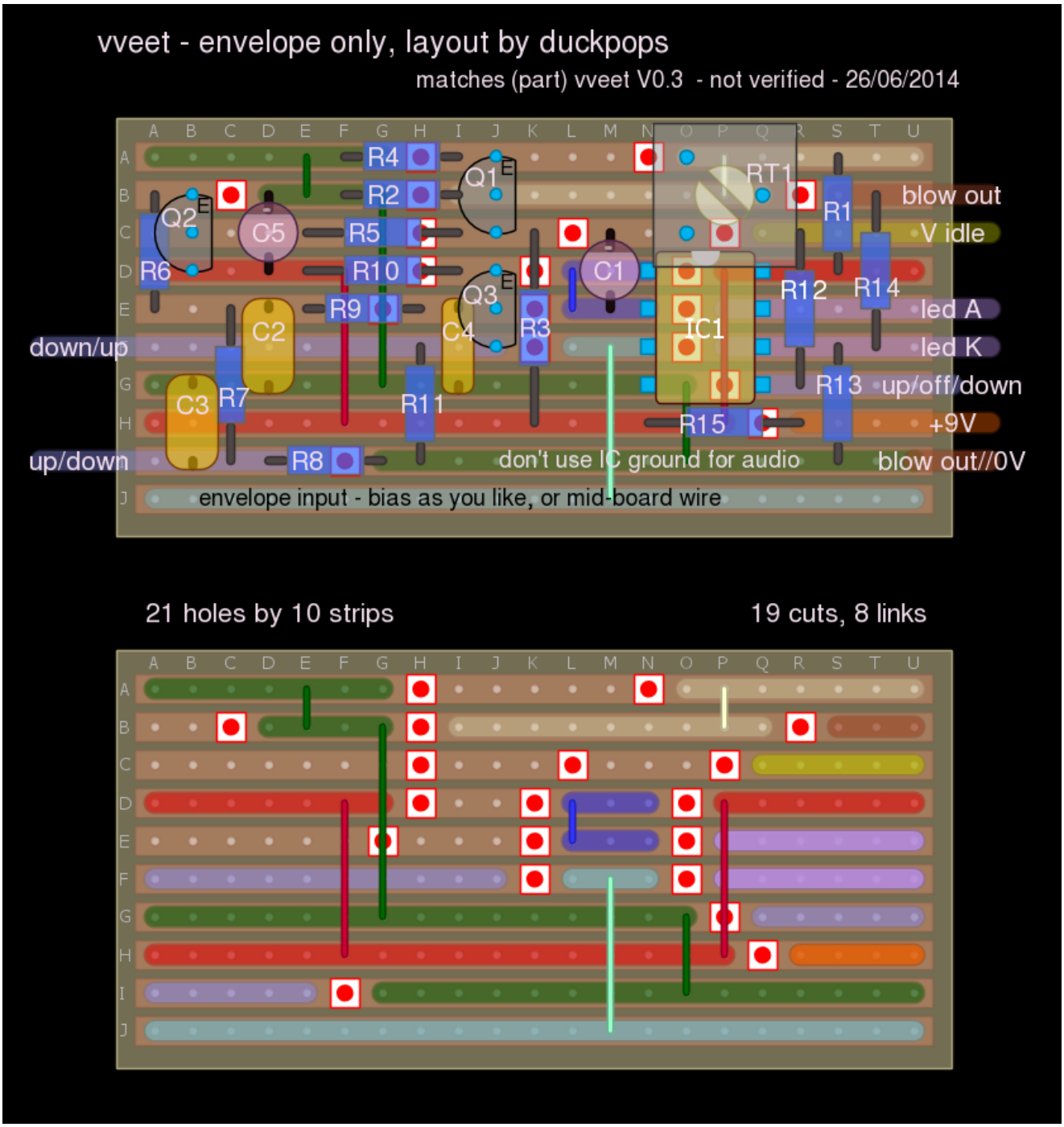
N-S = 23 strips, E-W = 21 holes

46 cuts, 18 links, 3 flying links

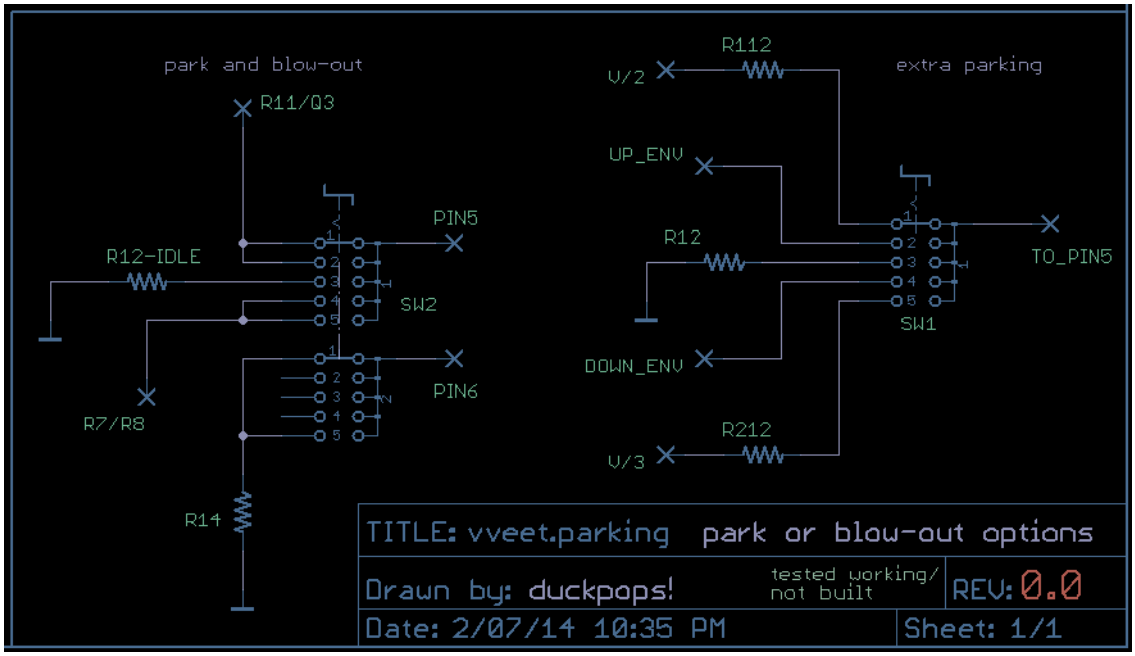


- the stand-alone envelope board -

some bias needs to be supplied to IC1A, whatever your buffer stage output sits at will be fine, or add some DC blocking cap and divider resistors. the bottom blue trace can be deleted if a mid-board wire connection fits your build rules. the R12 "V idle" connection needs terminating. if not bandspreading, it can be mounted east-west to connect pin4, or flying-linked to a ground trace.



---
below shows 2 methods of wiring a rotary switch. the left method uses a double-pole switch, and switches the blow-out resistor at the same time. this provides 2 up settings, and 2 down settings. the right method shows park-high and park-low positions, as well as up, down and none.



---
as of V0.3, the circuit has been tested on the breadboard, but neither layout has been built. eroors, feedback, abuse, etc please.

any threads referenced will be found at "diystompboxes.com".