Behringer TD-3 Modifications Guide

by Maffez and other slutz

with schematics by Nordcore

Version 1.1515

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CONTENTS

CREDITS & DISCLAIMER

Many of the pieces of info and mods gathered here have been collected from pages on classic TB303 alterations, dedicated XoXboX-ers, and contributors to the TD-3 modifications thread on gearslutz. Nordcore @ GS did an excellent job transferring the TB schematics to TD part numbers for many sections of the TD-3 and proved to be unerring when it comes to 303 circuits. GS user El-Folie was the first to report and implement a modification of the square wave in the VCO and also well documented some tests on the VCA envelope. I took the liberty to add to the classics a couple of my own findings, such as portamento, a filter mod and accent to pitch, and others chimed in as well, not least Robin Whittle himself, who recommend parts for performance mods (and to declared interest in possibly offering Devilfish boards for the TD in the future).

Some few mods I left untested as to yet (marked brown). For some mods you might want to use different values because tastes differ. There's not one fixed recipe for what to mod and what to leave, so spending some time on planning what to use how after experimenting.

Finally, and most importantly, solder responsibly and at your own discretion. Many mods here are relatively easy to accomplish, yet if stuff goes wrong, don't forget that there are professional service technicians capable of salvaging your unit. The info here is open source, so please be kind to others and our environment.

Pages of interest:

http://dl.lojinx.com/analoghell/RolandTB303-ServiceNotes.pdf

http://www.timstinchcombe.co.uk/index.php?pge=diode2

http://www.firstpr.com.au/rwi/dfish/

https://www.ladyada.net/wiki/x0x/x0xd0x

https://www.subatomicglue.com/x0xl0g/mod%20guide/mod%20guide.html

http://23.235.199.139/~re303c5/forum/

https://www.gitarrebass.de/workshops/boss-ds-1-keeley-mod/

Pictures of the TD-3: https://imgur.com/a/MMNifIr

Demos of modifications: https://soundcloud.com/uibkmedan/sets/td-3-modifications

Td-3 mod thread on gearslutz (with transferred schematics and frequent updates): https://www.gearslutz.com/board/modular-mania-all-things-eurorack-and-modular-synths-effects/1289500-behringer-td3-diy-mods-1.html

TECHNICAL INFORMATION

Part of the power supply in the TD is, like in the original, provided by opamps (IC9). The microprocessor handling the sequencer, midi, and pitch and gate, is an ARM 32P, type GD32F350C8T6**.** Pitch CV, including slide, is generated by software in the TD-3 by a timer output (10kHz PWM), with IC10 as filter and amp, not the CPU DAC (this was in via Nordcore). Slide itself is scaled with tempo. A change of this behavior is a matter of firmware changes. The rest of the VCO is realized according to Tb303 schematics. The VCF is a SMD recreation, yet with very minor deviations (a couple of capacitor values). The VCA is like the Open Music Labs clone of the Roland BA662. Envelopes and accent are faithful to the Tb303 schematics. The added distortion is mostly equivalent to the Boss DS-1.

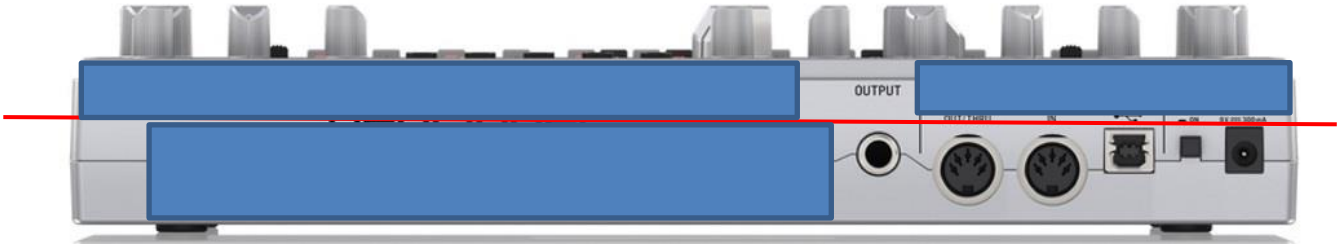
TEST POINTS ON BACK OF PCB

TP01 GND
TP02 Main out (post-V14, pre “Mixer” network P5 303 service notes)
TP03 Power after diode 5
TP04 CV Output
TP05 Gate Output
TP06 Selected Wave Output
TP07 BA662-clone control input pin
TP08 ENV Output
TP09 Filter Output
TP10 VCA Output
TP11 +9V Distortion (post D26)
TP12 +4,5V (Distortion, Headphones)
TP13 filter ladder first cap
TP14 VCO SAW output
TP15 15V (= top of R172 on front)
TP16 3,3V (CPU supply)

Further signals at X12 (white connector next to the output socket, as mapped by Nordcore)

PIN1 Filter output
PIN2 VCO output (post waveform select)
PIN3 Main envelope output
PIN4 +5.333V
PIN5 Ground

PLACES FOR SWITCHES, SOCKETS AND POTENTIOMETERS

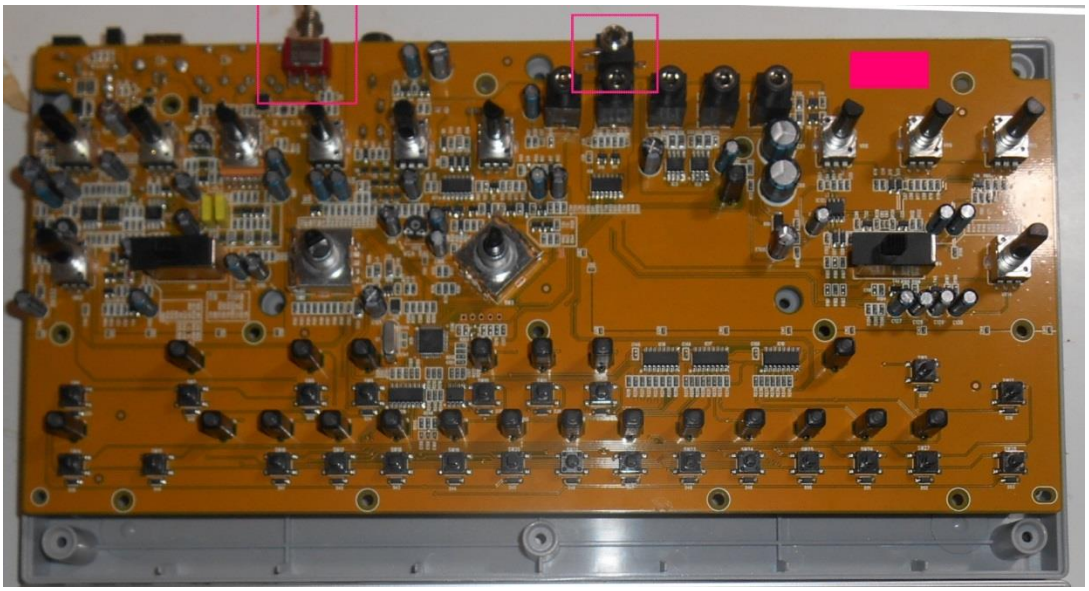


Red line indicates position of PCB. Areas marked blue fit components.

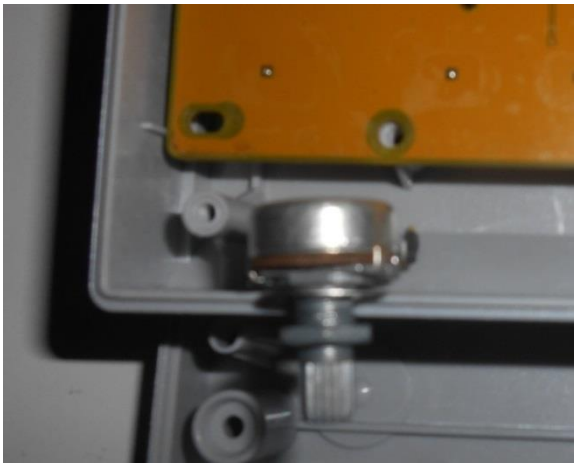
Backside: There space for sub-miniature switches on the back just over the DC input socket, USB and midi sockets. Over the decay potentiometer there are two e-caps, so unless you relocate them, there is no space here. There is space over the pots of the distortion section. Finally there is enough space on the lower part of the backside under the PCB.

Top: You have enough space for an insulated solder lug potentiometer or horizontal print potentiometer in places where there are no capacitors underneath the chassis (see backside). There is plenty of space in the area of the Behringer logo underneath the led.

The PCB allows for installing a second row of sockets over the existing one (you need to scrape off a bit of the plastic spacer over the filter input socket if you want to have a socket there too, but the rest is easy). Installing 3.5 mini jacks (Tayda) vertically is okay if you bend the solder lugs. Common sub miniature switches also fit if you bend their legs.



When installing jack sockets as shown below, you need to bend their lugs, and do so slowly and steadily. Also, you want to protect your PCB below against shortages - sticky tape!



Front: Like on the RD8, there is quite some space between the PCB and the front of the chassis, which means larger components can be placed here most easily.

Sides: Components may be best placed underneath the PBC. You could implement trimmers (glued to the underside of the PCB) for resonance, V/OCT calibration and square wave pulse-width that can be accessed with a small screwdriver from little holes on the side of the chassis. This way you don't need to open the box if you want to make adjustments.

NOTES ON DRILLING

Before you drill always triple check your location! Will the component fit or are spacers, capacitors or other things in the way?

Make a little dent in the center of your hole to be – drills can slip easily and scratch your plastic surface while doing so. A little dent helps them staying in place.

Go from small to big: for plastic I personally like metal 2, wood 3 and 4, then metal/concrete 5 and finally metal 6 for jack sockets or metal 7.5 for big potentiometers. Use a reamer to smooth the edges. If you don't have one, a round file or even a pencil tip can be of use...

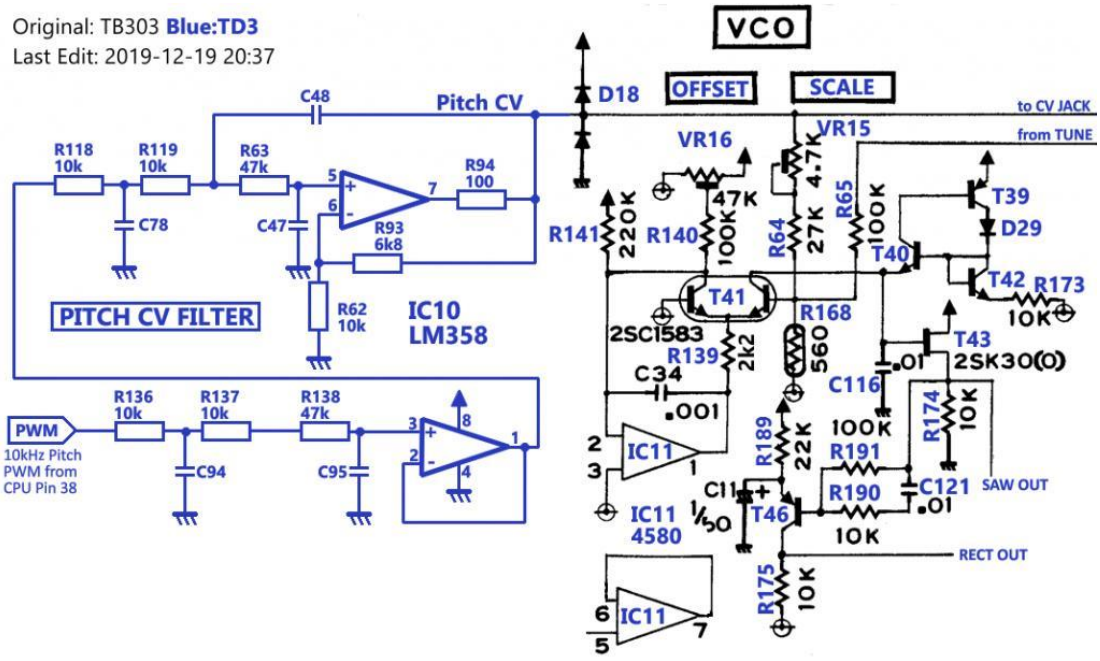
Drilling makes dirt and holes, so have something underneath your drilling area if you don't like holes in your kitchen table. Equally, drilling takes patience, and a many an insight into being tranquil (and possibly on ketamine) can be gained by watching Abel Ferrara's 1979 film *Driller Killer*, which *must* be watched with the director's audio commentary (DVD version).

NOTES ON SMD SOLDERING

Components are small and can burn if heated for too long. Best watch some tutorials. For adding caps or resistors to existing ones, I find it easiest to solder female Dupont wires to the terminals of the existing components: a small solder blob goes onto the wire first (clip the wire/solder if the blob is too big), and is then then fastened to the component. The liquid solder will easily suck onto the existing solder area of your component. For shielding bare wire around those areas, some heat shrink tube might be helpful and if you lead the wire over a longer distance before you bend it to the back of the PCB, mind holes for spacers and components that might squeeze the wire if you reassemble your unit. Capacitor/resistor legs easily fit into the female Dupont connectors. This way you can also change the values of added components more easily. Unsoldering SMD parts, on the other hand, works best for me if I heat the terminals alternatingly and when warm enough lifting them up from one side first with my soldering iron. Maybe not super pro but saves me a heat gun.

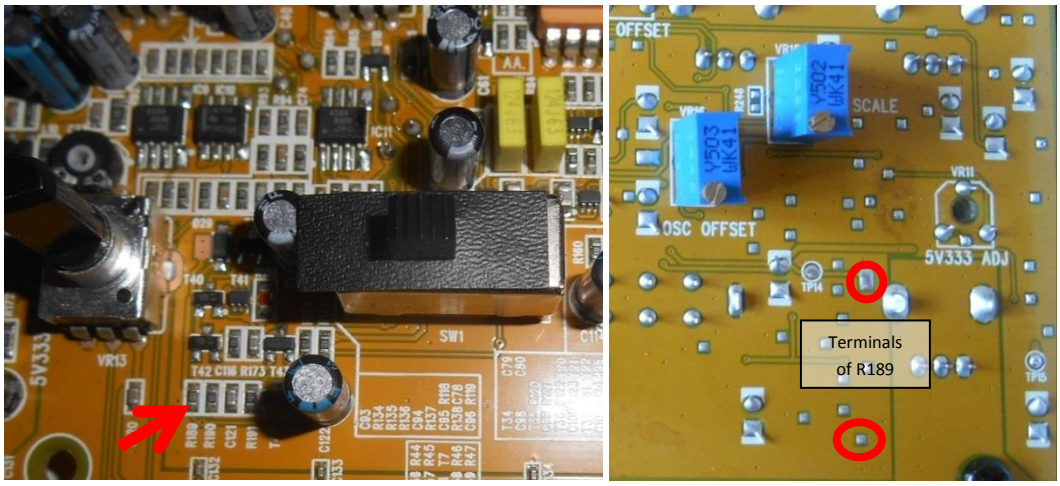
SOUND MODIFICATIONS

VCO



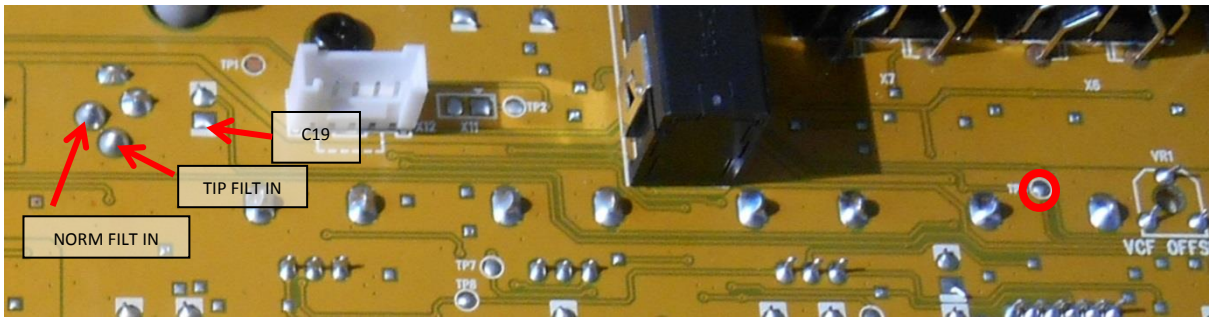
Transferred schematic courtesy of Nordcore

Change pulse width of square wave: some TD users reported on the square wave of the TD-3 not sounding as “hollow” as the TB303 square. You can adjust this by exchanging R189 (22k) with a 25k resistor. Credit to GS user El-Folie for finding this. Best use a 10k resistor and 15k trimmer in series, so you can fine-tune to taste. You can access both terminals of R189 also from **the back of the PCB**, so having removed the resistor, you can use the points indicated below for wiring! BTW, many points can be accessed from the back of the PCB, especially audio and CV inputs and outputs.

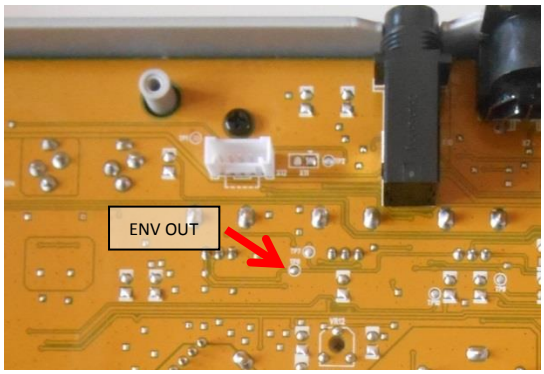


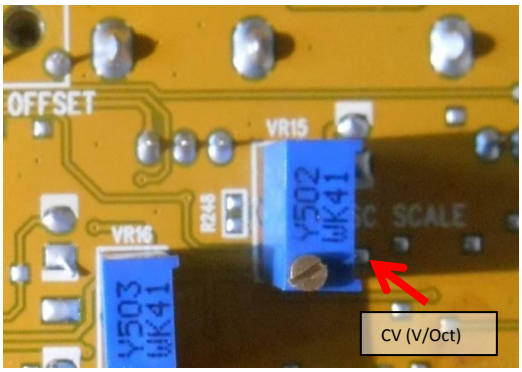
Second wave input (easy version): Firstly, note that the VCO signal is not buffered, i.e. always have some resistance in between and never fully ground it. If you don’t want to

replace SWITCH 1 by a balance potentiometer, route SAW (TP14 or the SAW PIN of SWITCH 1) to an ON-OFF switch, which goes to the filter input. This way, when SWITCH 1 is on PULSE, you can also activate SAW. As for the filter input, you have several options. Wire your second wave to the normal PIN (or the top of R29) of the FILTER IN socket. This way, the additional wave signal is disconnected when a jack is plugged into the FILTER IN socket. If you want volume control for your additional wave (as well as external input), replace R27 with a 250k potentiometer. A more destructive mod would be to replace SWITCH 1 with a balance potentiometer (100k-200k with SAW and PULSE on the outer lugs and output on the wiper lug, which then goes to top of R23).



Envelope to pitch (from xoxbox wiki): If you want to follow the original mod, then wire as follows: TP8 to a diode, the cathode of which goes to a 100k resistor, which goes to a 100k potentiometer, which goes to PIN5 of IC11. This can only be accessed from the front of the PCB (component side) but the advantage of your ENV to pitch CV also being sent out to the pitch CV output socket. Alternatively, go for the V/Oct point, which means, wire TP8 to diode to 1M resistor to 200k potentiometer to the bottom terminal of R64 (OG junction R100/R118), which has the advantage of access from the **back of the PCB** (see picture on the right below), but has no effect on the pitch CV output.



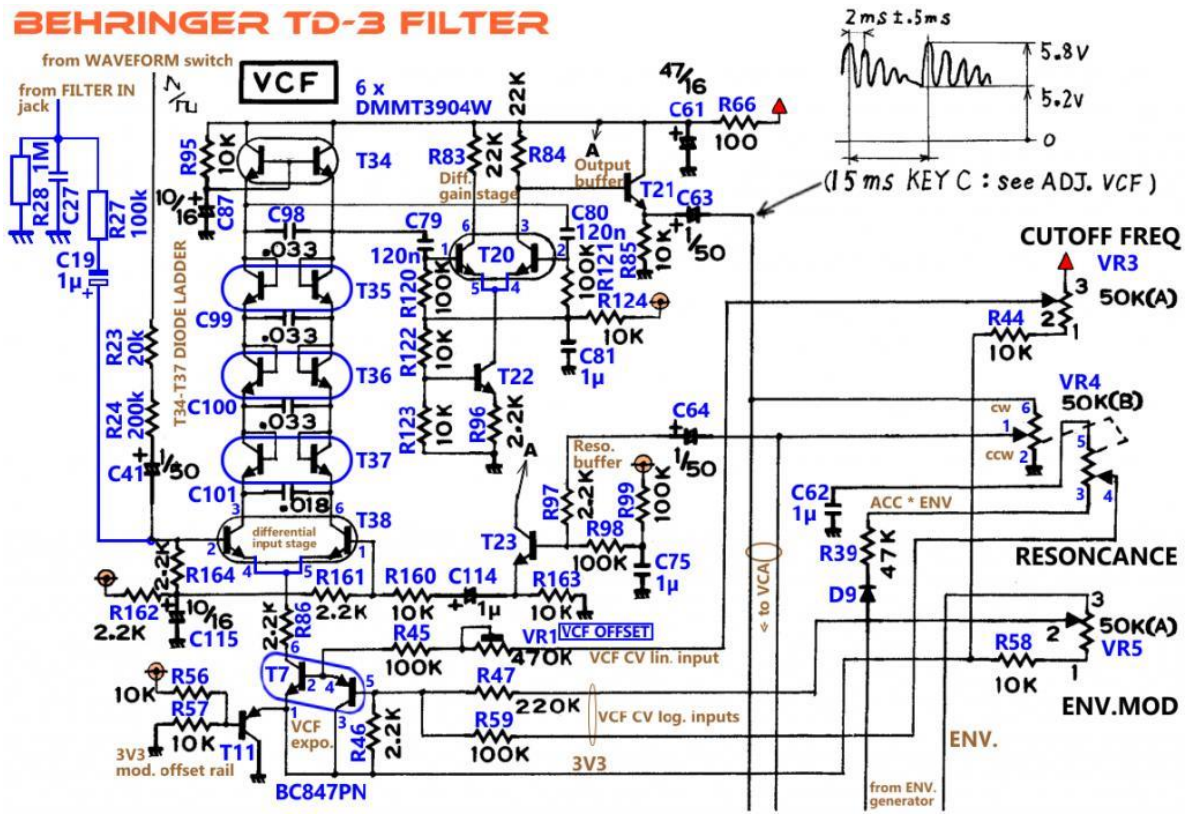


Accent to pitch: As far as I know, accent on the 303 was meant to simulate a bass slap, so, if your reference point is a fretted bass, it makes sense that pitch does not change under accent. Yet, despite its engineers' intentions, and the 303 frequently having been conceptually framed as a "barking" animal, why not do just that? I wired the middle pin of the accent potentiometer to a diode, a 2M potentiometer and a little voltage divider

circuit (1M resistor and 100k resistor, with the 100k going to ground and the junction of both resistors to the V/Oct point). Alternatively, feed your signal to Pin5 of IC10 rather than the V/Oct point as this sends your CV also to the pitch CV output socket. If you use a lower value potentiometer, also reduce the value of your 100k dividing resistor.

Portamento: Wire a 0.1uf-1uf capacitor and switch between PIN5 (non-inverting input) of IC10 (LM358 op amp) and ground. This, of course, is not the most refined portamento, yet, I personally find 220nf with a momentary ON cool enough for performance effects. Installing this at PIN5 of IC 10 (just as the accent to pitch mod) rather than the V/Oct point has the advantage of your mods also being sent out at the CV output 3.5mm jack.

VCF



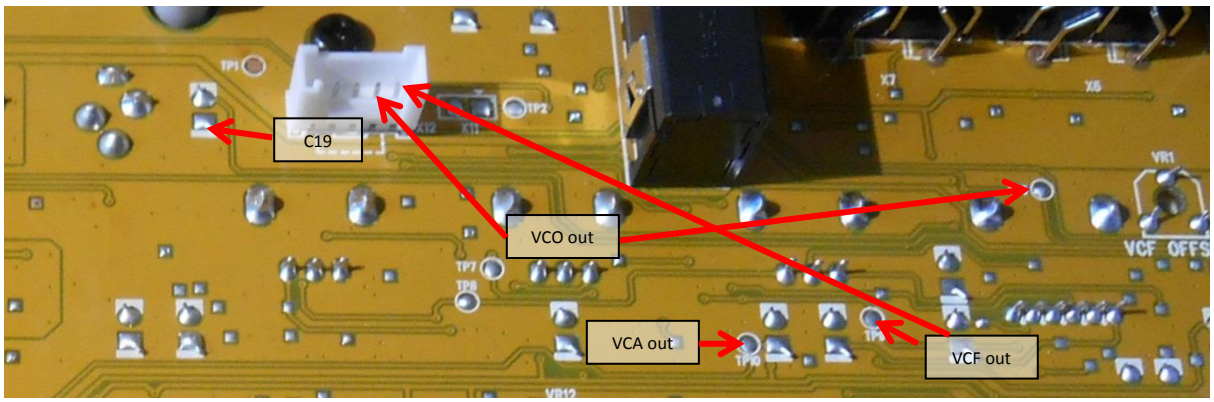
Transferred schematics courtesy of Nordcore

Change external FILTER INPUT level: replace R27 (100k) with a 20K resistor (for minimum protection) and a 250k potentiometer (higher, if you want greater variable attenuation).

Pre-filter overdrive (devilfish-ish): in the TD-3 a 20k and an additional 200k resistor are used (R23 and R24) rather than one single 220K resistor (OG R62). This choice makes it very easy to install overdrive by adding a 500K log potentiometer parallel to R24. If your potentiometer is at zero there is only a marginal increase in volume, which saves you a switch. Alternatively, remove R24 and wire a 200k log potentiometer in its place – this way R23 gives the circuit still well enough protection if you tear away.

Model D-style filter feedback: wire TP9 to a 500k potentiometer (ungrounded, i.e. just one lug and wiper connected) and this to the normal in PIN of your FILTER IN socket. When no cable is plugged, you have filter feedback, while a plugged cable breaks the feedback connection, just like on the Behringer Model D. With resonance the overdriven sound thins out rather quickly. For a stronger effect, see the following mod. NB using the VCA output instead of the VCF output also yields interesting results.

Filter Overdrive Deluxe: this one goes quite beyond the classics and is also the least destructive in that you do not need to remove any components. Wire VCO output, VCF output, and VCA output to a 4-position switch (position 1 stays unconnected), which goes to a 15K resistor (any lower value will muck with the SAW wave pitch on pre-filter overdrive mode), which goes to a 200k potentiometer (ungrounded), which then goes to the cathode of C19. When your switch is on VCO input, you have the classic pre-filter overdrive, and when it is on VCF input, you have Model D-style filter feedback, when on VCA input, you have a different flavor that ads crunch especially on accent.



Extended Filter mode: wire TP6 to a switch, a 150k resistor and switch in series, and then to the bottom of R123 for phasey, bandpassy effects. This feeds the raw wave to a point after the ladder filter stages.

Lower filter cutoff (adapted from Xoxbox wiki): If adjusting VR1 just isn't enough for you, you can lower cutoff even more. Wire just some wire or a 4.7K-15k resistor in parallel with R44 (OG R47, 10k) – the lower the value of your R, the lower the cutoff. The range of the cutoff potentiometer on the TD-3 is wide enough to "catch up" at higher values.

Higher resonance (xoxbox wiki): Wire a switch and a resistor (between 2.2k to 7.5k) in parallel to R160 (OG R97, 10k). I find 4k7 nice. Alternatively, you could replace R97 with a 15k trimmer. For lower resonance, swap R97 for a higher value or turn the knob less.

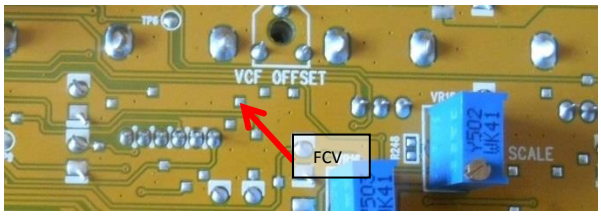
C64 character mod (AKA Barker): Even though capacitor C64 (OG C13, 1uf) is mostly known via the accent sweep mod in the Devilfish pack, you can mod it to change the character of the resonance even when accent is not on. The sound becomes more nasal and driven and accent "barks" more. Resonance also goes higher (so, if need be, reduce this via

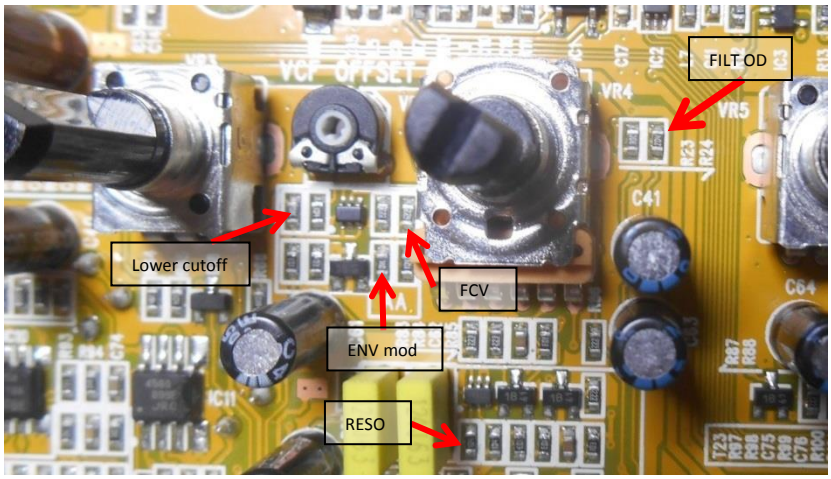
R160). Test different smaller (below 1uf) capacitor types and values (tantal, film box and ceramic sound all different) - I use a 560nf film box and a 47nf ceramic disk in parallel on a switch. This harmonizes very well with Model D-style filter feedback!

Filter FM from VCA output (devilfish-ish): I find FFM from VCA nicer than from VCO. Route the output of the VCA (TP10) to a 0.1uf capacitor (for AC coupling), this to a switch and a to a 100k log potentiometer in series; this goes to a 20k resistor, which finally goes to the bottom of R47. For the solder point on the **back of the PCB** see entry on filter tracking. NB my values for pots and resistors differ slightly from Devilfish and Subatomicglue. I tested and liked the following version: TP10 to a 01.uf cap, a 22k resistor and 200K potentiometer. I have FFM normalled to a filter CV in socket, so when I plug external FM modulation in, I can use the potentiometer for attenuation.

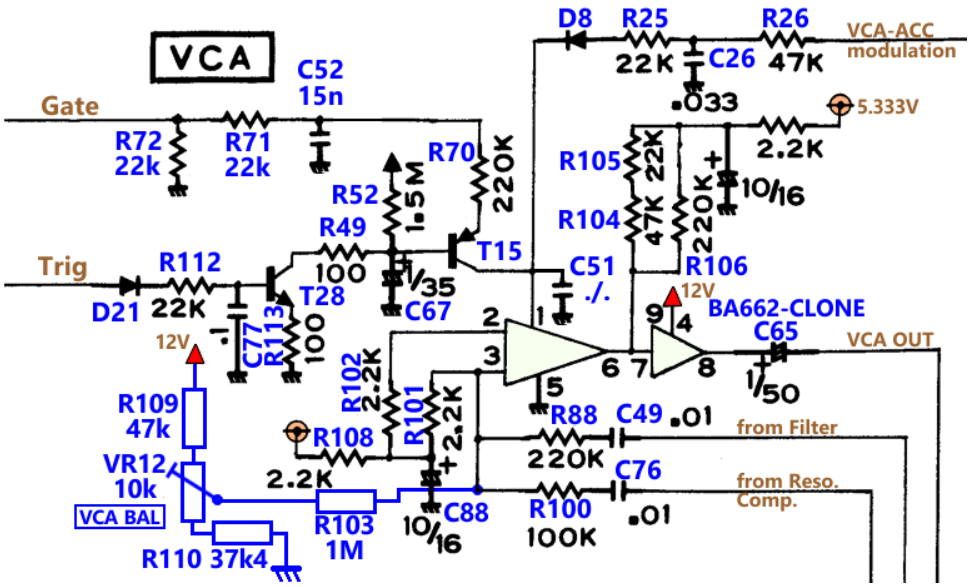
Filter FM from VCO output (xoxbox wiki): Wire TP6 to a 0.1uf capacitor (for AC coupling), this to a switch, a 20kk resistor and a 100k log potentiometer in series. The wiper of the latter goes to the bottom of R47. For the solder point on the **back of the PCB** see entry on filter tracking. NB my values here also differ from the classic mods.

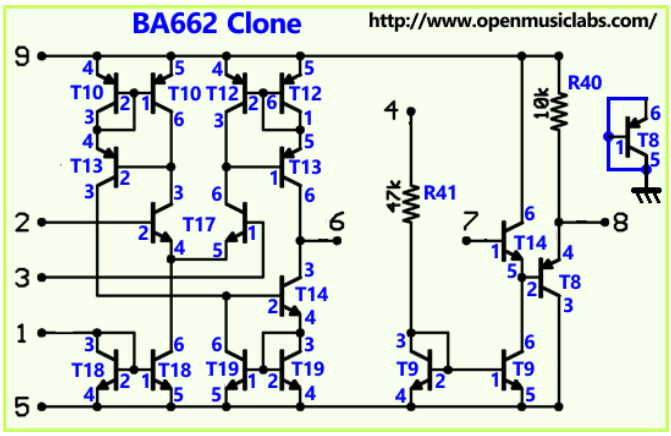
Filter tracking (xoxbox wiki): connect the tip pin of the TD-3 CV output socket to a 100k resistor, this to a switch, and this to the bottom of R47/ FCV pointon the **back of the PCB**.





VCA





Transferred schematics courtesy of Nordcore

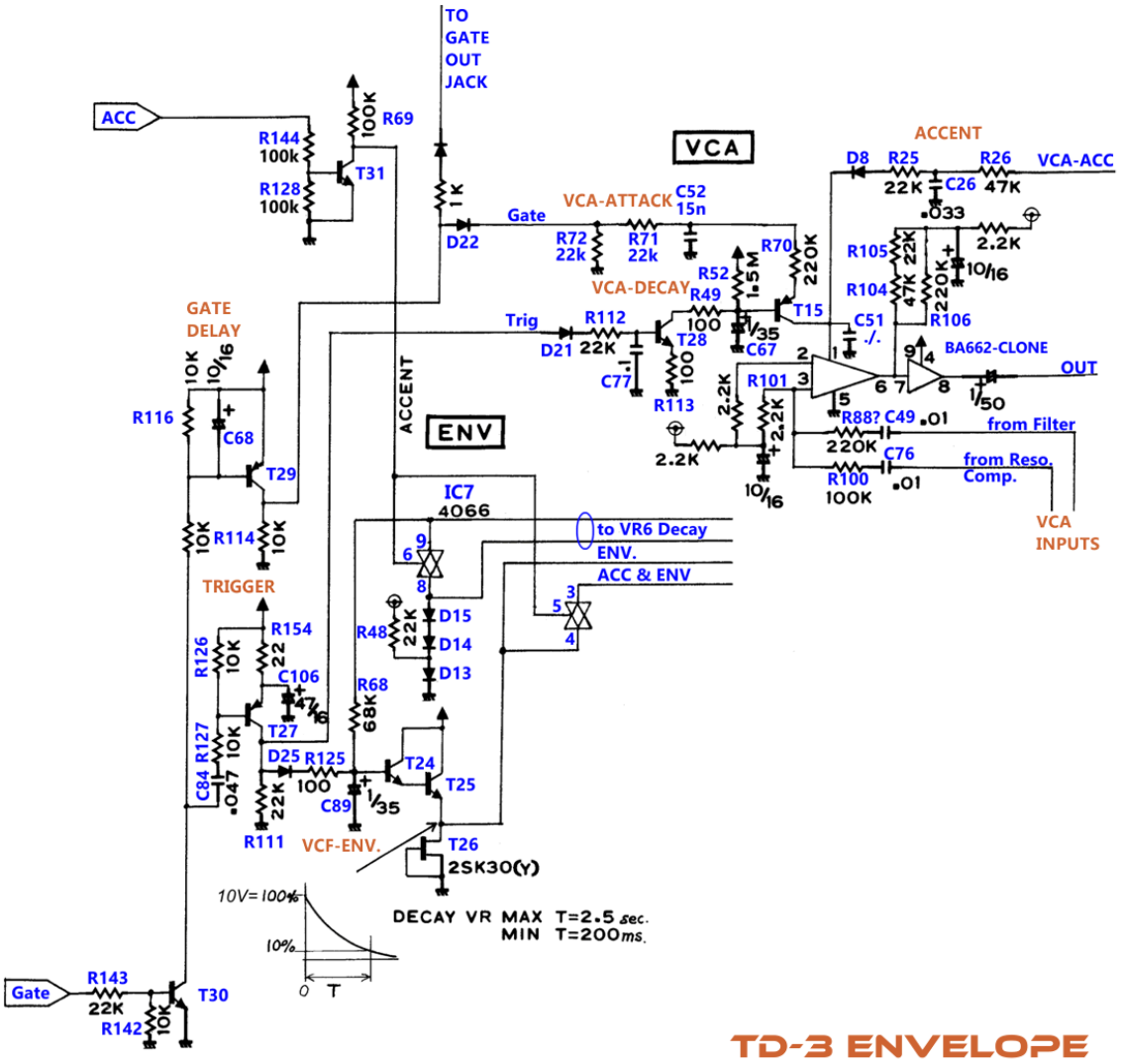
C52 mod (AKA magic cap, AKA fröhlichefolie): technically it softens the attack of the VCA a little, which might also result in hearing effects to the extent of "glue". Replace C52 (10nf) with a 47nf cap or ad another cap that gets you around 47nf. Nordcore was extremely helpful in explaining this chance discovery as he had invented a mod to de-click the XoXboX VCA (B might even have been inspired by his work).

VCA Drive (R106 MOD via Nordcore**)**: if you remove R106, this increases the VCA level by 2db and slightly overdrives the final mixing stage when your main volume is at full level. This does not need a switch as you can dial everything back with the main volume knob.

Bass boost (devilfish-ish/ xox): the signal enters the VCA through C49 and C76 (OG C21 and C22, both 0.01uf), with C49 carrying the signal from the filter and C76 being resonance level compensation (both are small caps near the blue e-foil caps under the ENVELOPE pot). A classic mod is replacing them with 0.1uf film box capacitors, although the effects of this as well as the most sensible values for replacement capacitors have been debated.

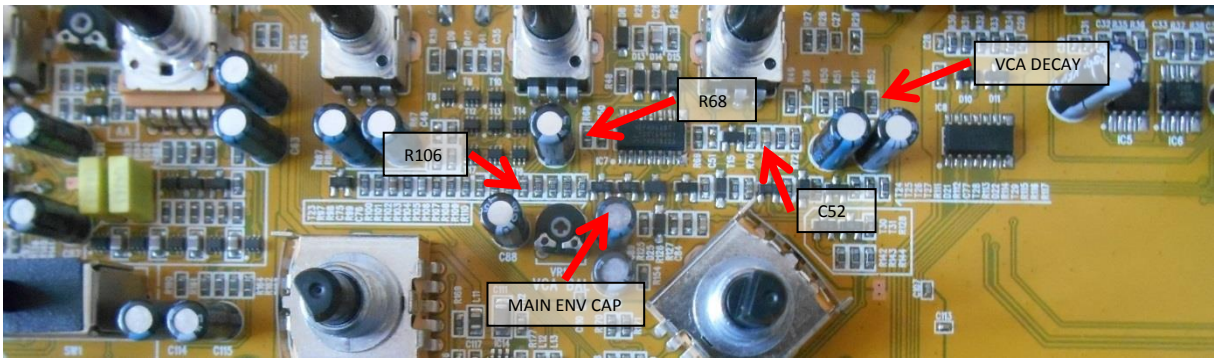
ENVELOPES

The Td-3 has two envelopes (main ENV with variable decay and a fixed one for the VCA).



TD-3 ENVELOPE

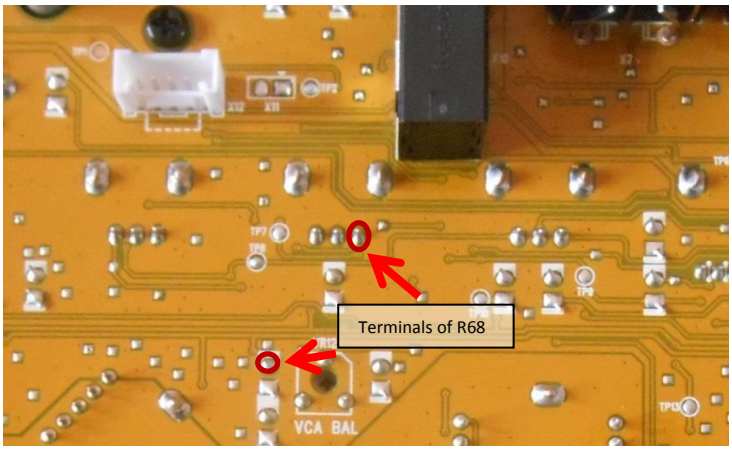
Transferred schematic courtesy of Nordcore



Different speeds for main envelope (xoxbox wiki): exchange C89 with capacitors of different values to taste. For folks who think the TD3 decay could be snappier, put in smaller cap values. Using a switch, you can toggle between speeds. Longer also makes accent swing in – I added 1uf to the existing 1uf with an ON-OFF switch.

Variable VCA decay (xoxbox wiki): VCA decay is fixed at ca. 3 seconds and set by R52 (OG R123, 1.5mega). Higher values for R52 give you longer decay times, lower values shorter ones. You can replace R52 with a 500k resistor and a 1M potentiometer. You could also wire a potentiometer or resistor and switch across R52 to toggle between longer and shorter notes.

Lowest possible decay time (Nordcore): R68 (68K) sets the minimum decay time of the main envelope, so if you replace this resistor (smaller values = shorter) with a 100k potentiometer or a lower value resistor, you can play with min. decay time, while keeping you overall ENV speed. Solder to the **back of the PCB**. Since on accent, the ENV decay is at minimum, you can make the accent vanish/appear with this mod. Using this, it makes much sense to also do the variable accent decay mod.



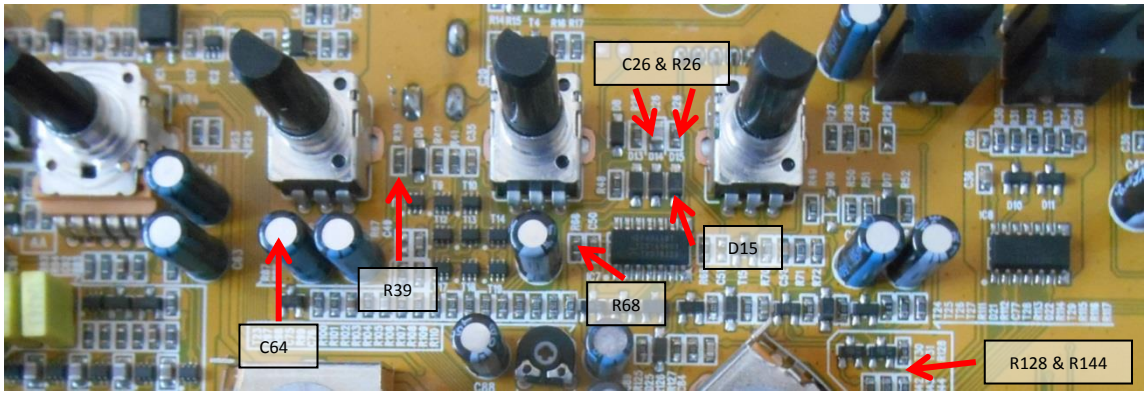
Bypass ENV to VCF (devil/ xox): wire switch to both terminals of R58 (OG R61, 10k), so you can bypass envelope modulation entirely. This is a classic Devilfish mod. IMO it makes maybe sense to implement a momentary ON switch to deactivate ENV to VCF with a simple push for individual notes.

Main envelope slew (R45 mod): the 303 is so famous for its twittering ENV modulations that even the German neologism *Zwitschergewitter* was introduced. If you want to be hipster and have a more rubbery 303 sound, wire a 1uf-2uf capacitor between bottom of R45 and ground, with a switch in between. The higher your cap value, the more rubber duck.

Inverted ENV to VCF (accent remains positive): This is maybe not super prim and proper but gives you awesome effects without the need to cut traces and/or install active components. Wire TP8 to a 470ohm/1K resistor, this to an ON-OFF switch and this to the rightmost pin of the cutoff potentiometer as seen from the back of the PCB. The envelope affects cutoff in an inverted manner and when you increase ENV amount, positive CV is also added, resulting in an attack-decay curve modulation. ENV, DECAY and ACCENT interact very nicely with this. Backwards sound anyone?

ACCENT

Accent boosts resonance and VCA level separately in the TD-3. On details, see Devilfish descriptions: http://www.firstpr.com.au/rwi/dfish/303-unique.html.



Variable Accent decay (adapted from Xoxbox wiki): lift top of D15 (= anode of OG D28), and wire a 1M log potentiometer between the lifted top and the freed solder pad on the PCB. Alternatively cut the trace between PIN3 of the decay pot and the top of D15. For simple fine-tuning of accent decay rather than variable decay, use a resistor or a trimmer. NB that the accent decay can never exceed the decay as set by the main envelope.

Accent sweep speed (Devilfish-ish): this is different to the variable accent decay mod in that you add to or exchange capacitors for the accent capacitor C64 (OG C13, 1uf). Different capacitor values will not only affect the decay of accent but result in more differences, see http://www.firstpr.com.au/rwi/dfish/Devil-Fish-Manual.pdf. Easiest option is to do a "slow" accent mod. Try using 10uf (or higher) in parallel to C64: positive leg goes to the solder blob of the positive leg of C64 and negative leg (indicated by a white stripe on cap) goes to an ON/OFF switch, which, in turn is wired to the solder blob of the negative leg of existing C64. This way, when your switch is ON, your additional cap discharges together with the existing one, resulting in a longer charge phase and sweep action.

Manual Accent trigger (Devilfish): wire ground to one terminal of a momentary ON switch and the other terminal of the switch to the bottom of R128 (just right to the sequencer mode rotary). The point under R128 also goes to the **back of the PCB** (see I/O section).

Change accent to resonance amount (Xoxbox wiki): For resonance, the accent signal passes through R39 (OG R46, 47K). To increase the effect, you wire another resistor in parallel. To reduce the effect, replace R39 with a higher value or a 47k resistor and trimmer.

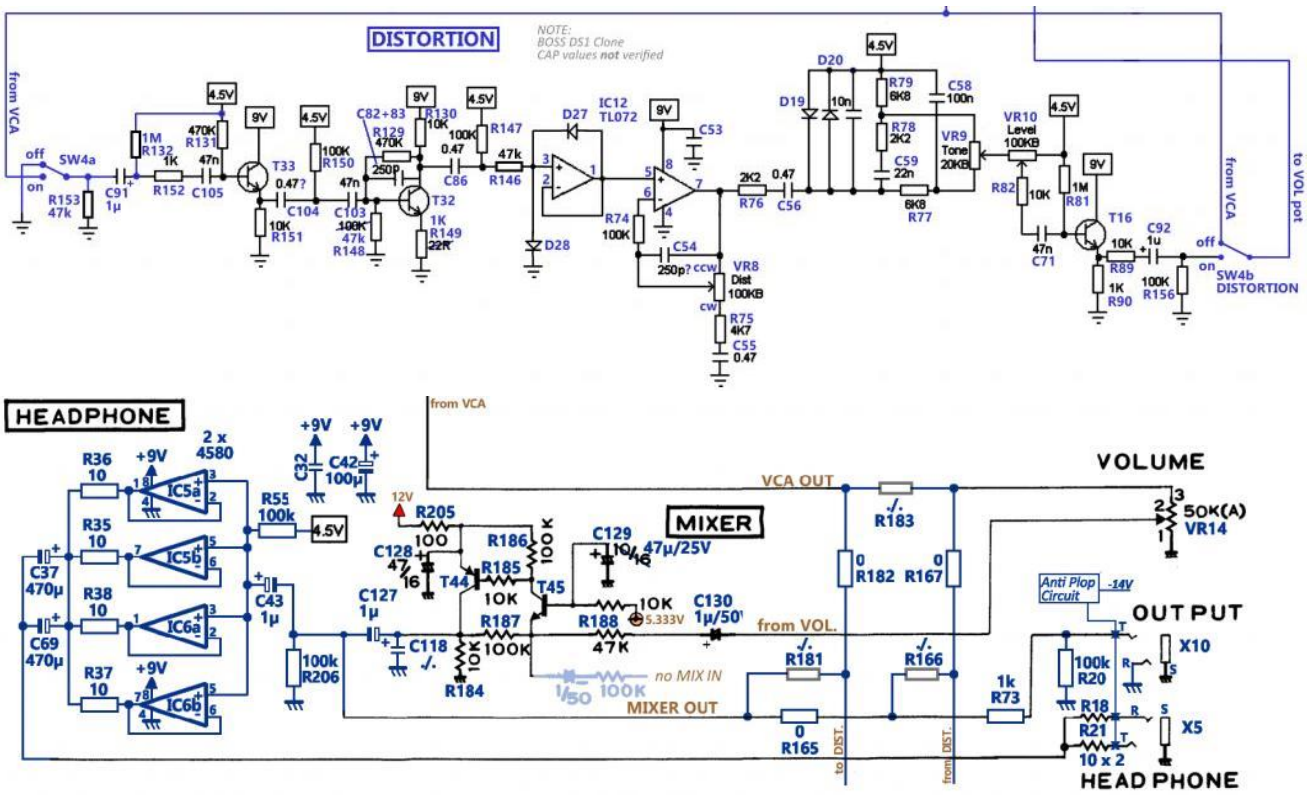
Change accent to VCA amount (xoxbox wiki): For the VCA, the accent signal passes through R26 (OG R119, 47K). To increase the effect of accent to VCA, you can wire another resistor in parallel to R26. To reduce the effect, replace R26 with a resistor of higher value or a resistor of the same value and a trimmer in series.

Accent resonance sweep slew (C39/D9 Mod): The sweep effect of accent **on resonance alone** can be altered by wiring a capacitor between the bottom of D9 **or** R39 (OG R46) and ground. Since D9 is just before R39, your additional capacitor can only discharge towards the VCF, which makes your “wow” effect on resonance sweep longer and, depending on you capacitor value, also affects the non-accented notes immediately after. This is different to the classic accent sweep mod in that it only affects the filter. The value of the new cap depends on taste: I like 440nf-2uf.

Accent to VCA slew (C26 MOD): after passing through R26, the accent signal for the VCA goes through C26 (OG C36, 0.0033uf), which very mildly filters the sweep. By enlarging the value of C26 you can soften the attack of the accent effect on VCA. With extremes values (1uf), you hear a very pronounced fade-in.

FX SECTION & OUTPUT SECTION:

The inbuilt distortion of the TD-3 is based on the Boss DS-1. General information about this classic foot pedal, including schematics, can be found here: https://www.electrosmash.com/boss-ds1-analysis. The DS-1 has been subject to elaborate modifications, most notably the so-called Keeley mod. My interest in this is very limited, so best check the GS thread.

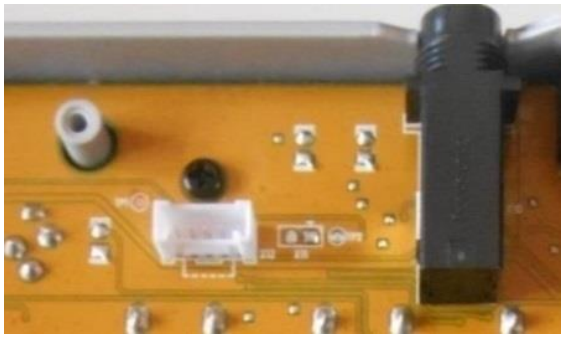


Transferred schematics courtesy of Nordcore

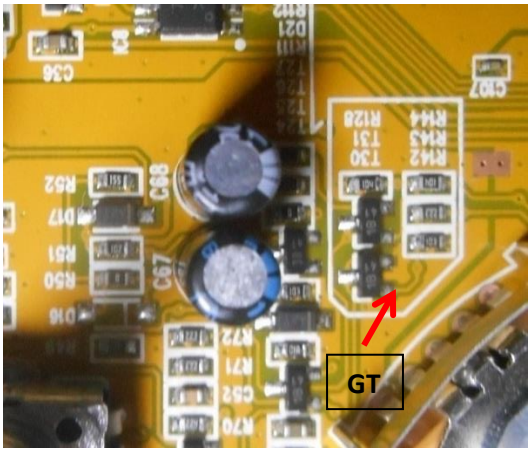
INS AND OUTS

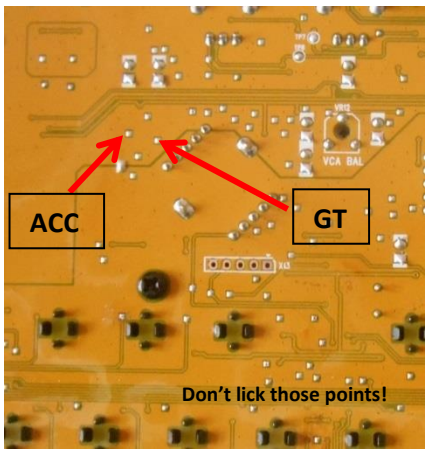
First of all you have some connections available at X12, i.e. the white connector next to the output socket. Nordcore mapped the pins, and they are, from right to left:

PIN1 Filter output
PIN2 VCO output (post waveform select)
PIN3 Main envelope output
PIN4 +5.333V
PIN5 Ground



Gate Input (adapted from xoxbox wiki): Tip lug of input jack socket goes to 22k resistor. The other end of 22k resistor goes to a diode, the cathode of which goes to base of T30. The junction between T30 and R142 goes to a solder point on the **back of the PCB**. This only works when physical ground is connected (i.e. output/usb cable plugged or ring lug of your CV input socket connected to TP1 or Pin5 of X12).





1V/Oct CV input (adapted from Doepfer): For proper V/Oct input wire to the bottom of R64 (or the point on the **back of the PCB** described in the VCO section) first a 27k resistor (Doepfer mistakenly wrote 7K) and then a 4.7k trimmer for fine-adjustment. If you have never calibrated VCO tuning, best check a (video) tutorial first – easy but takes patience.

Accent CV input (0V=on): tip lug of input jack socket goes to 100k resistor, which goes to the bottom of R128/ point on the **back of the PCB**. Mod adapted from xoxbox wiki.

Accent CV input (high=on, adapted from xoxbox wiki**)**: take PNP transistor and wire the emitter to the "from CPU" point on the **back of the PCB** (or bottom terminal of R144). Wire two 100K resistors to the base of the transistor and wire one 100k to +5V; the other

100k resistor goes to the tip lug of your CV input socket. Finally, connect a 100K resistor from the collector to the bottom of R128. The latter, also, goes to the **back of the PCB**.

Accent CV input (high=on, simple version): connect an **ungrounded** and **unpowered** CD4066 switch – in (PIN1) to bottom terminal of R128 (or **point on PCB back**), out (PIN2) to ground and control A (PIN13) to your CV input. Either positive or negative CV closes the switch, which shorts the accent CV point to ground and activates accent. This only works when physical ground is connected (see entry on Gate input).

Accent ON/OFF output (0V=on): tap the junction of R144 and R128, which you connect to the tip lug of your output jack socket. Point goes to **back of PCB**.

Accent sweep output (Avalon style): the accent signal ON shorts the decay of the main envelope to its minimum length and sends this signal through the accent volume pot. You can tap this short sweep at the right lug of the accent pot (as seen from PCB top, of course, you also can access the tips of the lugs from the **back of the PCB**); wire to a diode and a ca. 10k resistor or mirror the CV signal with a non-inverting op amp. I triggered gate on my Model D with this, and it should work for triggering the SH101 sequencer.

Filter CV input: wire tip lug of CV input jack socket to 100k resistor, which goes to the bottom of R47. For the solder point on the **back of the PCB** see entry on filter tracking. I use this in combination with FFM from VCA on a switched socket, so when I plug in an external modulator I have a potentiometer for FFM already in my TD. Apparently, as Pinkbox on Elektronauts found out, you can also just use the FILT IN socket for cutoff modulation: https://www.elektronauts.com/t/behringer-td-3-303-clone/110053/780

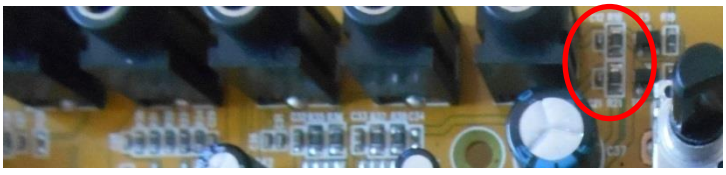
Envelope output: tap TP8 on the **back of PCB** or PIN3 of X12. Best go through diode.

VCO output: tap TP6 on **the back of PCB** or PIN2 of X12. Use protection (small value resistor). For separate outputs for saw and square wave, check the VCO schematic.

Filter output: tap TP9 on **the back of PCB** or PIN2 of X12. Use protection (small value resistor).

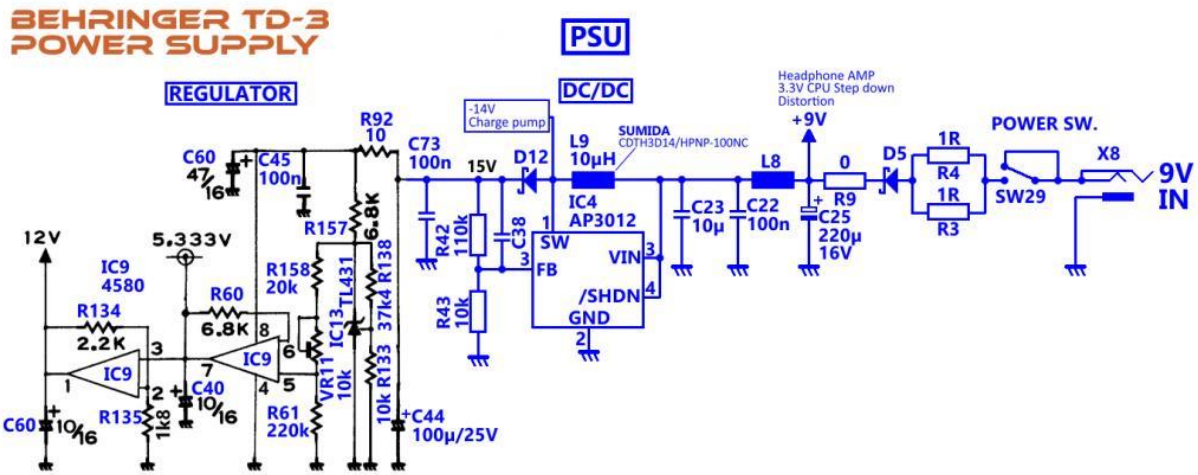
VCA output: tap TP10 on **the back of PCB**. Use protection (small value resistor).

Repurpose the headphones output: if you don't use it, you can decouple it by removing C12, C21, R18, and R21.



POWER SUPPLY

Crappy power supply mod (for the brave folks): wire Pin 2 of IC9 to a 1uf capacitor (can be film box or e-foil), which then goes to ground. This slightly destabilizes the supply voltage of 11.85V and results in an overall warbling, quite crappy sound. Honestly, though, think twice before you go there: https://soundcloud.com/uibkmedan/agemod-extreme?in=uibkmedan/sets/td-3-modifications. Better and safer version may come around later.



Schematics courtesy of Nordcore

RECYCLE OPAMPS:

The top half of IC11 is unused. If you don't use the internal distortion at all, you might be interested in recycling IC12. If you don't feel like using he headphones at all (and recycle the jack socket too – see I/O section), IC5 and IC6 are there for you. As for the pre-existing wiring on all three ICs, check the schematics on page 17. All in all, this gives you seven opamps for creative abuses. For potential applications, check this http://www.physics.unlv.edu/~bill/PHYS483/op-amps.pdf and this http://sound-au.com/dwopa.htm.

WHAT TO MOD AND WHAT NOT?

I don't know man, that's just like my opinion. Here's a lame joke instead:

When your modder fart it smell like Casio. When my modder fart it sound like System 500.