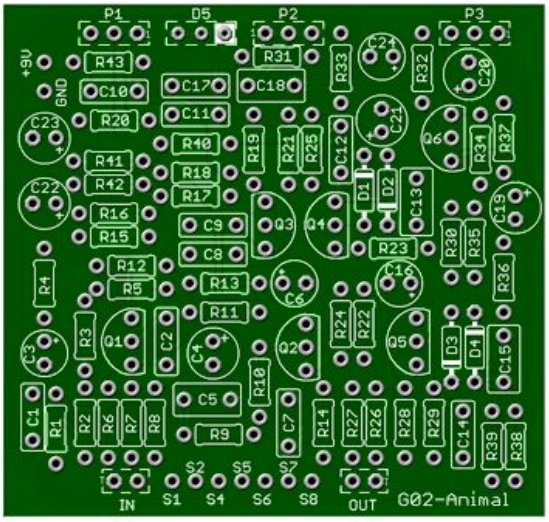
G-02 Animal by GuitarPCB

Compare to the infamous and practically unattainable Cornish G2™.

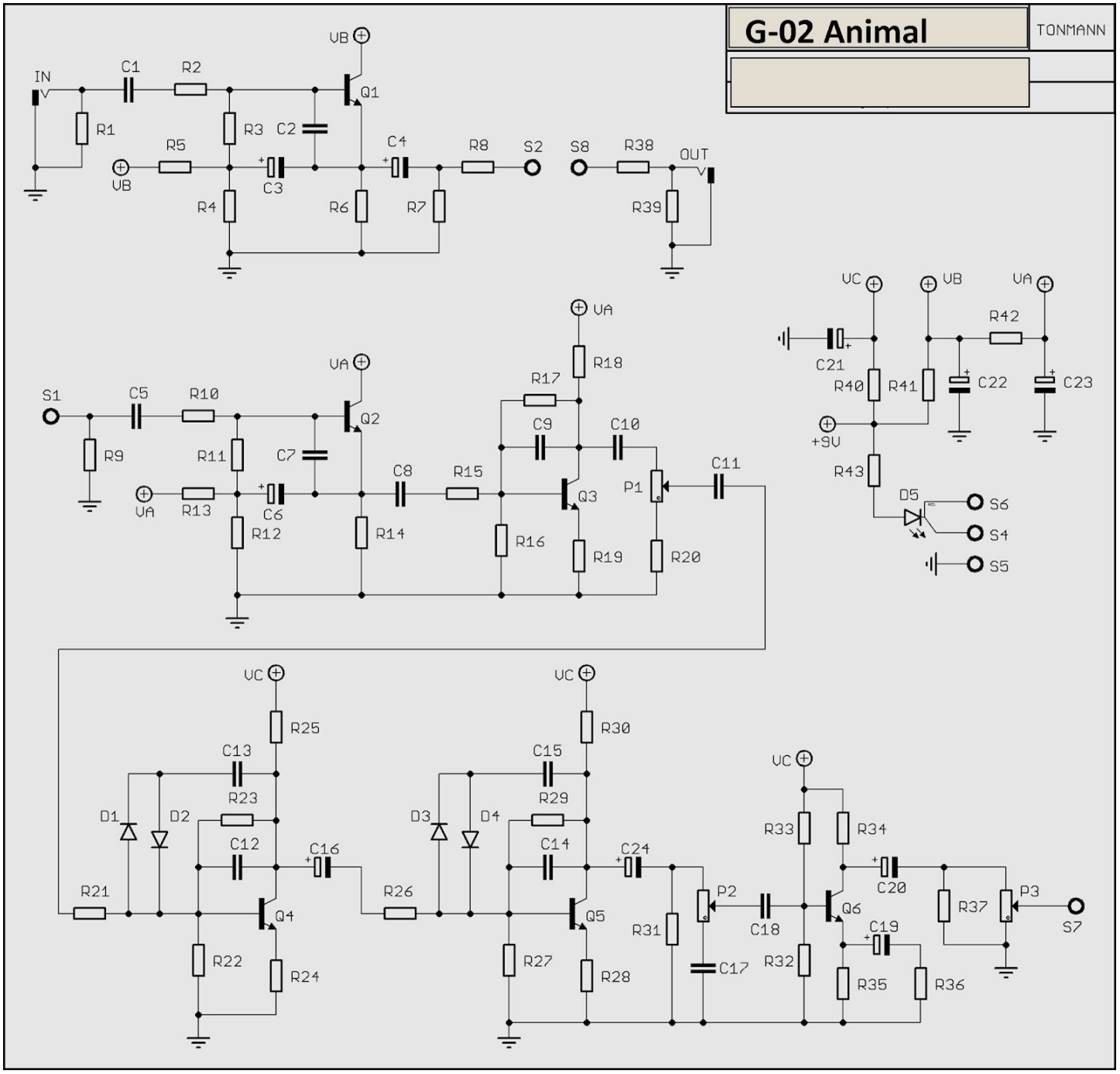
This is a superior sounding distortion unit. It features a four stage discrete transistor Class A circuit with additional Germanium diodes that provide warm sounding harmonics. This circuit provides a huge tone all on it's own creating a much more dynamic, harmonically rich effect.

The circuit input utilizes a High Impedance, Unity Gain, Buffer Preamp allowing the pickups to always operate at their optimum and the Unity Gain Buffer also prevents "Ghost Tones" being audible while in Bypass Mode. Use it with other distortion circuits like the Super Sonic SS-02 without having to worry about tonal loss even with longer cable runs. The tone control operates much like that of a Guitar in that you should start with it turned up full and then dial it back to your final desired tone.



Board Dimensions (W x H) 2.33” x 2.2” ca. 59.1mm x 55.9mm

R1	10M	R16	100k	R31	100k	C1	100n	63V	C16	4µ7	16V	P1	47k Log
R2	1k	R17	470k	R32	100k	C2	1n	63V	C17	10n	63V	P2	25k Lin
R3	120k	R18	15k	R33	390k	C3	4µ7	16V	C18	220n	63V	P3	10k Log
R4	200k	R19	680R	R34	8k2	C4	22µ	16V	C19	22µ	16V		
R5	120k	R20	1k	R35	2k2	C5	220n	63V	C20	22µ	16V		
R6	7k5	R21	8k2	R36	620R	C6	4µ7	16V	C21	220µ	16V		
R7	20k	R22	100k	R37	39k	C7	10n	63V	C22	220µ	16V		
R8	51R	R23	470k	R38	91R	C8	47n	63V	C23	100µ	16V		
R9	1M	R24	680R	R39	50k	C9	1n	63V	C24	4µ7	16V		
R10	1k	R25	15k	R40	100R	C10	47n	63V					
R11	120k	R26	8k2	R41	100R	C11	47n	63V	Q1-Q6	See Text			
R12	150k	R27	100k	R42	120R	C12	1n	63V					
R13	68k	R28	100R	R43	3k3	C13	220n	63V	D1-D4	See Text			
R14	8k2	R29	470k			C14	1n	63V	D5	Bi-colour LED			
R15	39k	R30	15k			C15	220n	63V					



Component Changes

The only component changes to the original concern the transistors Q1 – Q6 and the diodes D1- D4.

For the transistors we have changed from BC549s to 2N5088s. If you wish to use BC549s, the transistor pin-out is reversed – **the transistors must be rotated 180° on the board**.

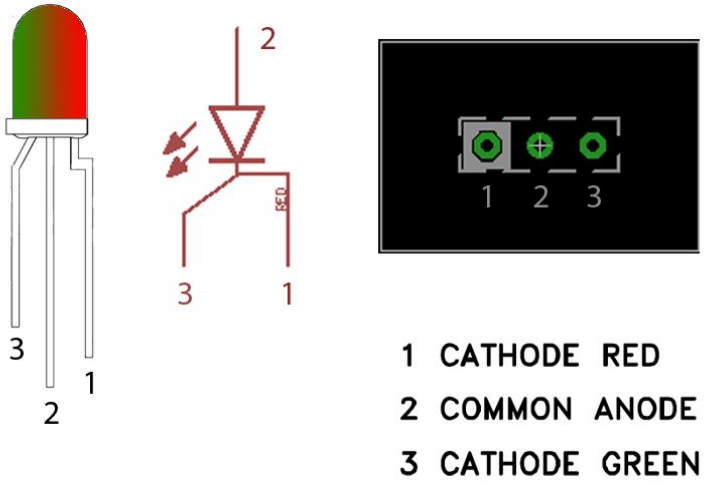
For the diodes D1 – D4 we decided on silicon fast switching diodes, 1N914 (1N4148). Install sockets and try other types of diode – LED, Shottky diodes, or germanium diodes.

For those people who don't have a wide range of resistor values, the following suggestions might prove helpful and shouldn't have a great effect on the circuit.

R1	10M	1M and Upwards
R4	200k	180k /220k
R6	7k5	8k2
R7	20k	22k
R8	51R	100R
R36	620R	Lower Value -Higher Gain
R38	91R	100R
R39	50k	47k
R42	120R	100R
R43	3k3	LED CLR

STATUS LED

D5 is a common anode bi-colour LED



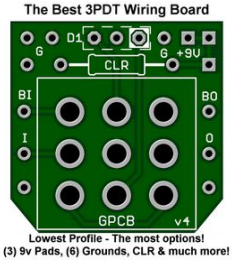
The diagram above shows the pin-out, schematic symbol and pad connection for a common anode LED. The pin-out for the bi-colour LED is as follows:

1st Colour Cathode 90 degree bend in the lead
Common Anode Middle lead
2nd Colour Cathode 45 degree bend in the lead

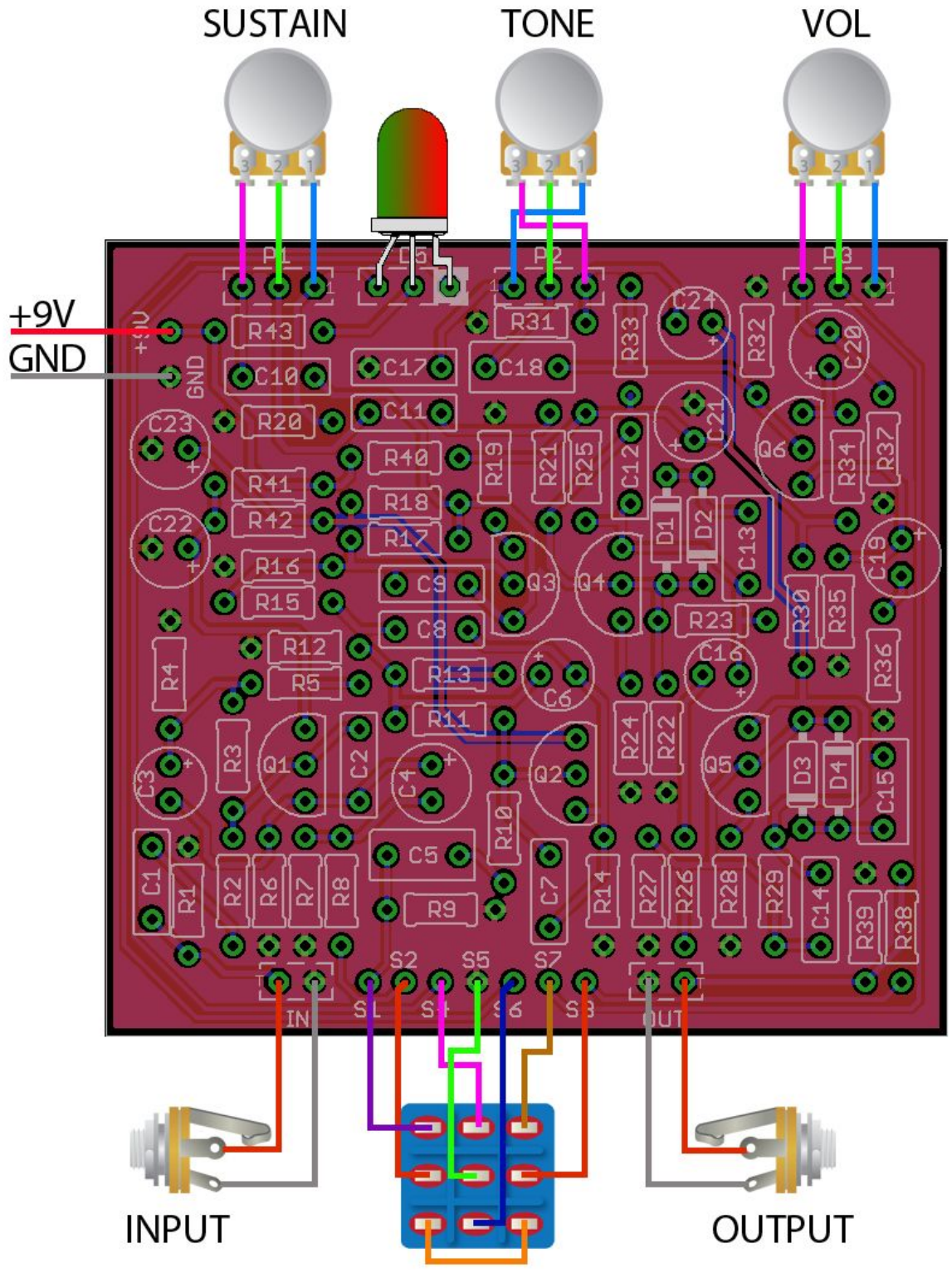
The pad for lead 1 on the circuit board is marked with a white box.
When connected correctly D5 will light red when power is applied and the circuit is in bypass mode and light green when the circuit is in effects mode.

If you wish to use a standard LED the anode is connected to the middle pad and the cathode to the left (non-white) pad.

If you are using one of GuitarPCB's 3PDT Wiring Boards pads S4, S5 and S6 are ignored, D5 and R43 are not installed.



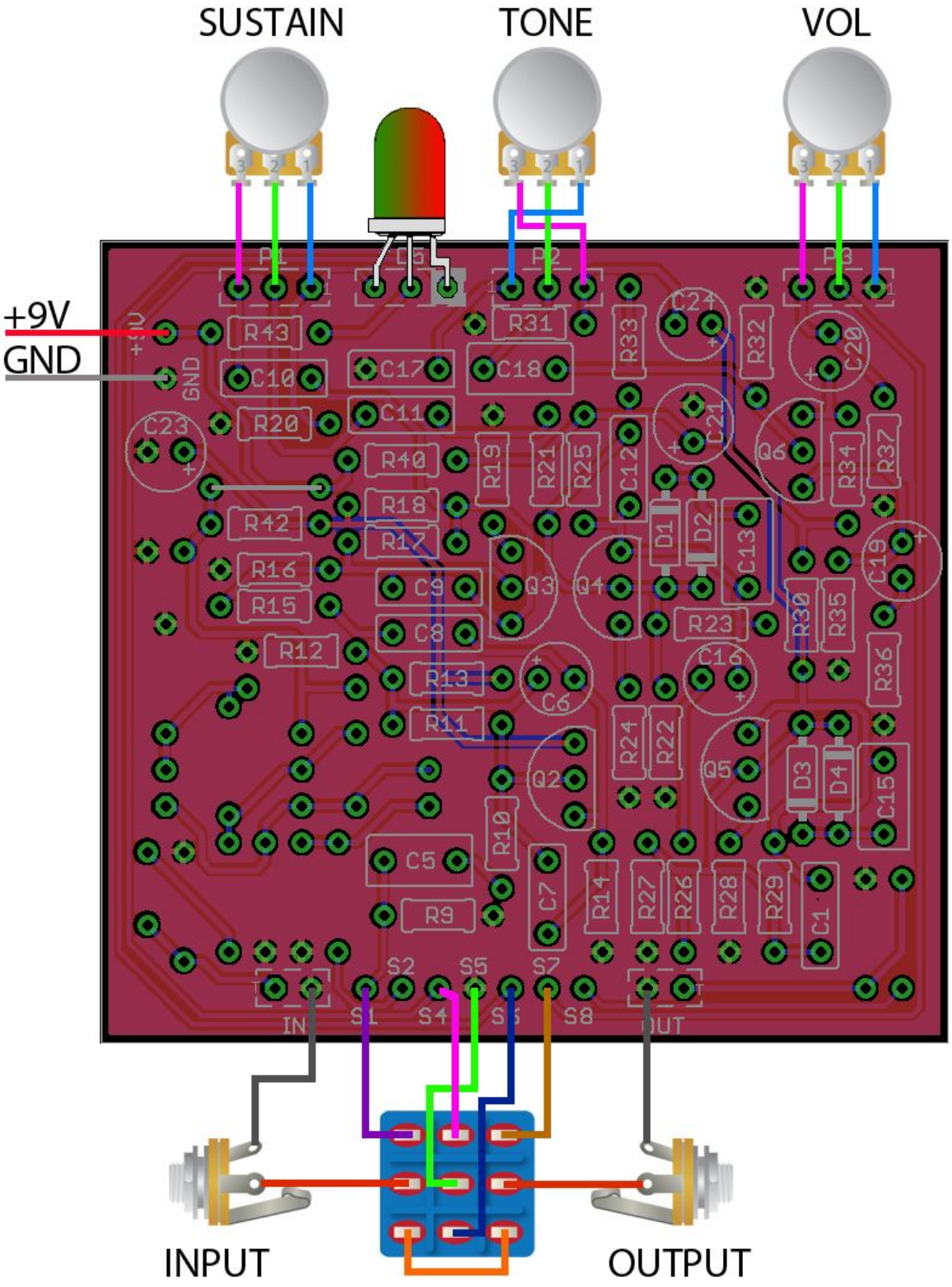
WIRING



The standard circuit employs a buffer stage (Q1 stage) that is permanently connected even when the circuit is in bypass mode i.e. the circuit is not a true bypass system.

While not advisable due to its usefulness if you still wish to convert the circuit to true bypass the Q1 stage is not needed any can be removed by doing the following:

Don't install R1 to R8, C1 to C4, Q1, R38 & R39, replace R41 with a wire jumper and don't install C22. You would then wire the circuit board as below.



A super detailed analysis of the circuit courtesy of Tonmann:

The pedal is basically a **Big Muff** (Q3 - Q5 sections), with a couple of buffers (Q1 -Q2) tacked onto the front, a very basic high pass/low pass filter (C24 - C17) instead of a Pi filter and a slightly different recovery stage from a **standard muff**.
We do not make clones, we make what sounds best to our ears. If you choose to use different components that is up to you. Since this is based highly off a Muff circuit there will be little difference between transistor choices typically used in any Muff circuit.

The input buffer has no gain and shouldn't color the signal (flat frequency response) going into the first stage (Q3), the amount of signal reaching the first stage is determined by R15 - lower value means more signal. This Q3 stage is the first one that provides gain and cuts a bit of the high frequency off - Q4 and Q5 are basically the same gain stages as Q3 (except they have the clipping sections) and Q5 provides a bit more gain than Q4. The tone stage is nothing spectacular and just provides a means of cutting the high frequencies (tone pot and C17). The gain from the recovery stage is quite high, due to C19.

Measure the collector and base voltages of Q3 to Q6. The collector voltages should be around the 4V - 5V range and the base voltages around the 700mV - 1V range, except the base of Q6, this should be about 1.5V - 2V. You could also check the emitter voltage of Q2 which should be in the 4V - 5V range.

Clip your audio probe to lug 3 of the sustain pot, guitar at the input and you should be getting a boosted signal (gain of about 4.5) that sounds a bit low to mid-range. Don't change any component values yet, but bear in mind:
You can increase the signal amplitude to the first clipping stage by changing the amount of signal you let in or out of the first stage or by increasing the gain of the first stage:

Reduce the value of R15 to let more signal through to the transistor stage.
Increase the value of the sustain pot (100 kΩ to let more signal out of the transistor stage.
Decrease the value of R19 and/or increase the value of R18 to increase the gain of the stage (if the output at lug 3 becomes distorted when doing this, check the collector voltage).
Increasing the value of C8 will let more bass frequencies into the transistor stage, increasing C10 will let more bass frequencies out of the transistor stage. Reducing the value of C9 will increase the high frequencies coming out of the stage.
We'll leave the two clipping stages for the moment.

Checking the recovery stage. You can either check the recovery stage alone by disconnecting the wire from lug 2 of the tone pot and connecting your guitar to the wire, or, an easier way is disconnect the wires from lug 2 of both the sustain and tone pots and connect the tone pot wire to lug 2 of the sustain pot, so you have a circuit consisting of the first stage and recovery stage, bypassing both clipping stages. Guitar at the input socket, output socket connected to amp.

You should have lots of gain here (calculates to a gain of about 50).

If you need more gain from the recovery stage:
Reduce the value of R36 - making this a wire jumper will give maximum gain.
For a few dBs more, you could change the volume pot to 100 kΩ and remove R37.

All of the above covers the "pure gain" of the circuit, which I would do first before looking at the clipping stages.

As with the first stage, the amount of gain is not spectacular, but then again, if you are using germanium diodes it doesn't need to be very large to get the diodes to clip.

Rather than changing the gain of the clipping stages, it is better to change the amount of signal applied to each stage. This is done by lowering the values of R21 and R26 for more gain, or increasing the values for less gain.
Two more changes to look at:
Lowering the value of C11 will let more bass frequencies through to the first stage (C16 is already very low and shouldn't need decreasing). Reducing C12 and C14 will increase the high frequency content of the signal at the output.

This just leaves the diodes and the two capacitors, C13 and C15. I would socket the diodes and possibly the capacitors as well. Although there is not a lot to say here, I would suggest the following.

Get a pile of germanium diodes and measure the forward voltages with a DMM and sort them into pairs. Use the pair with the highest forward voltage for D1 and D2 and the pair with the lowest forward voltage for D3 and D4. Doing this (at least in theory) will:
Clip the low frequency end but not the high frequency end of the signal in the first clipping stage.
Clip the low frequency end even more (heavily clipped) and lightly clip the high frequency end in the second clipping stage.

Changing the values of C13 and C15:
As they are - you should be getting a signal that looks like a square wave signal with rounded shoulders. If you reduce the value of these capacitors enough the signal will start to look like a triangle (with an increase in amplitude). Increasing the values will make the signal look a bit like a church with a steeple on the left hand side (sorry, I can't think of a better way to describe it). It might be fun to experiment with these capacitors.

Proper Voltages of a correctly built circuit.

Q1 E: 4.72 B: 4.53 C: 9.18

Q2 E: 5.27 B: 5.10 C: 9.07

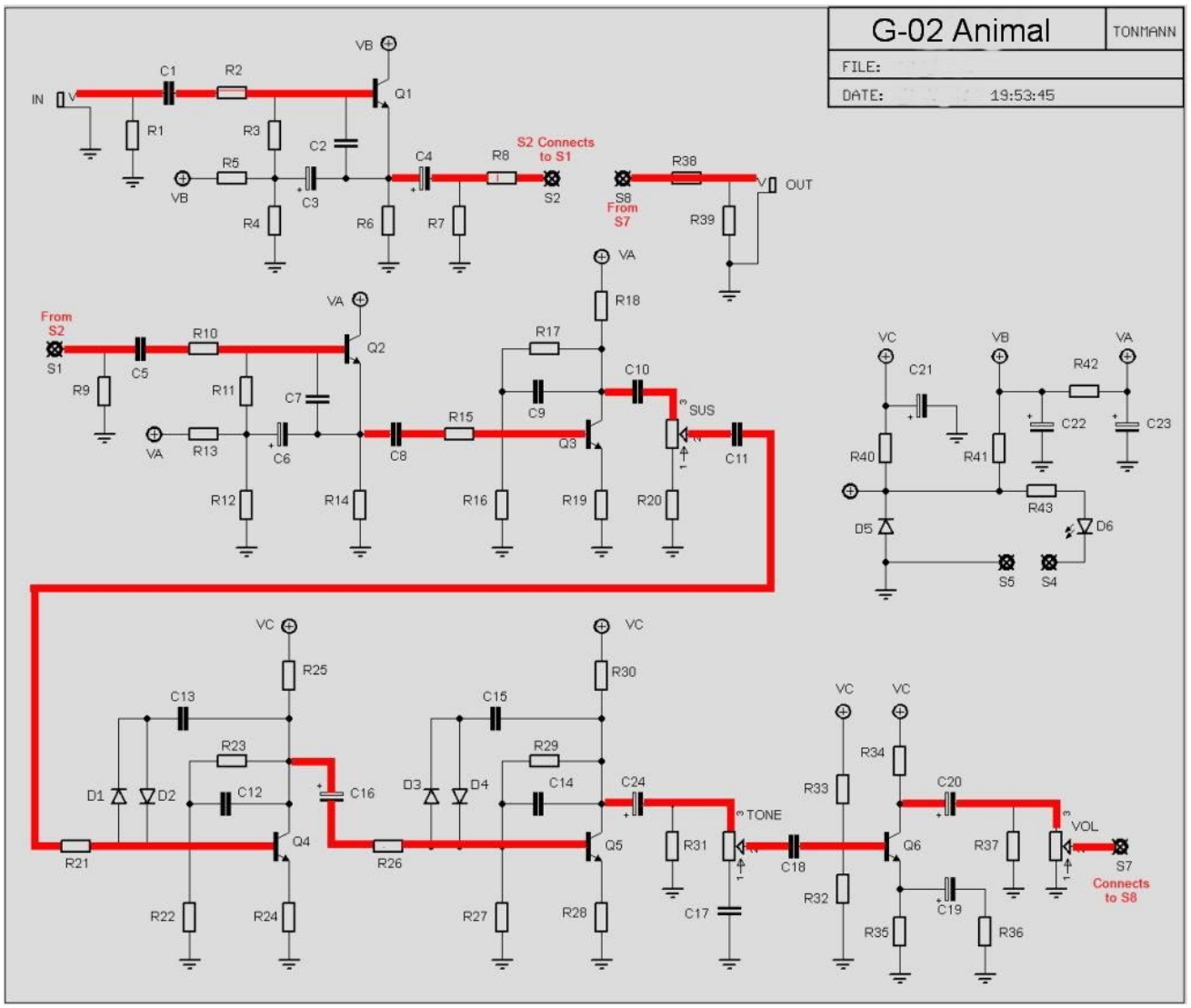
Q3 E: 0.18 B: 0.77 C: 4.87

Q4 E: 0.18 B: 0.77 C: 4.91

Q5 E: 0.03 B: 0.63 C: 4.15

Q6 E: 1.13 B: 1.63 C: 4.95

G-02 Animal Audio Path for debugging using an Audio Probe:



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Mod at your own risk. Mods do not come with kits.