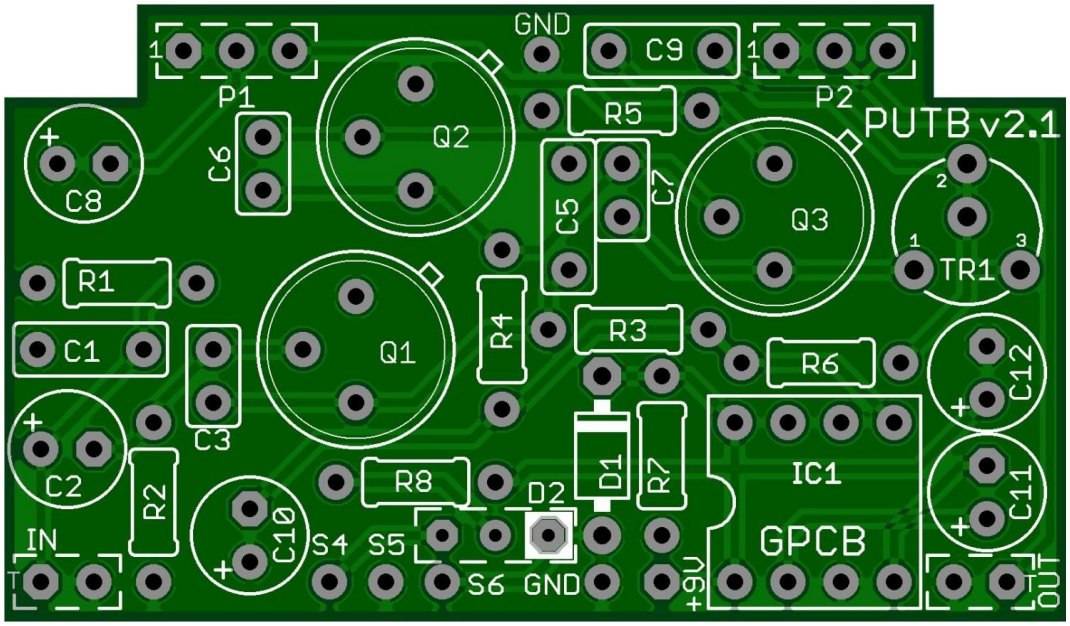
P.U.T.B. - TONEBENDER MKII PNP uses Charge Pump

The Classic Tonebender with a modern twist.

Pump'd Up means you can use it with other negative-ground pedals.

This re-designed board fits in a 1290NS/1590B or larger enclosure.

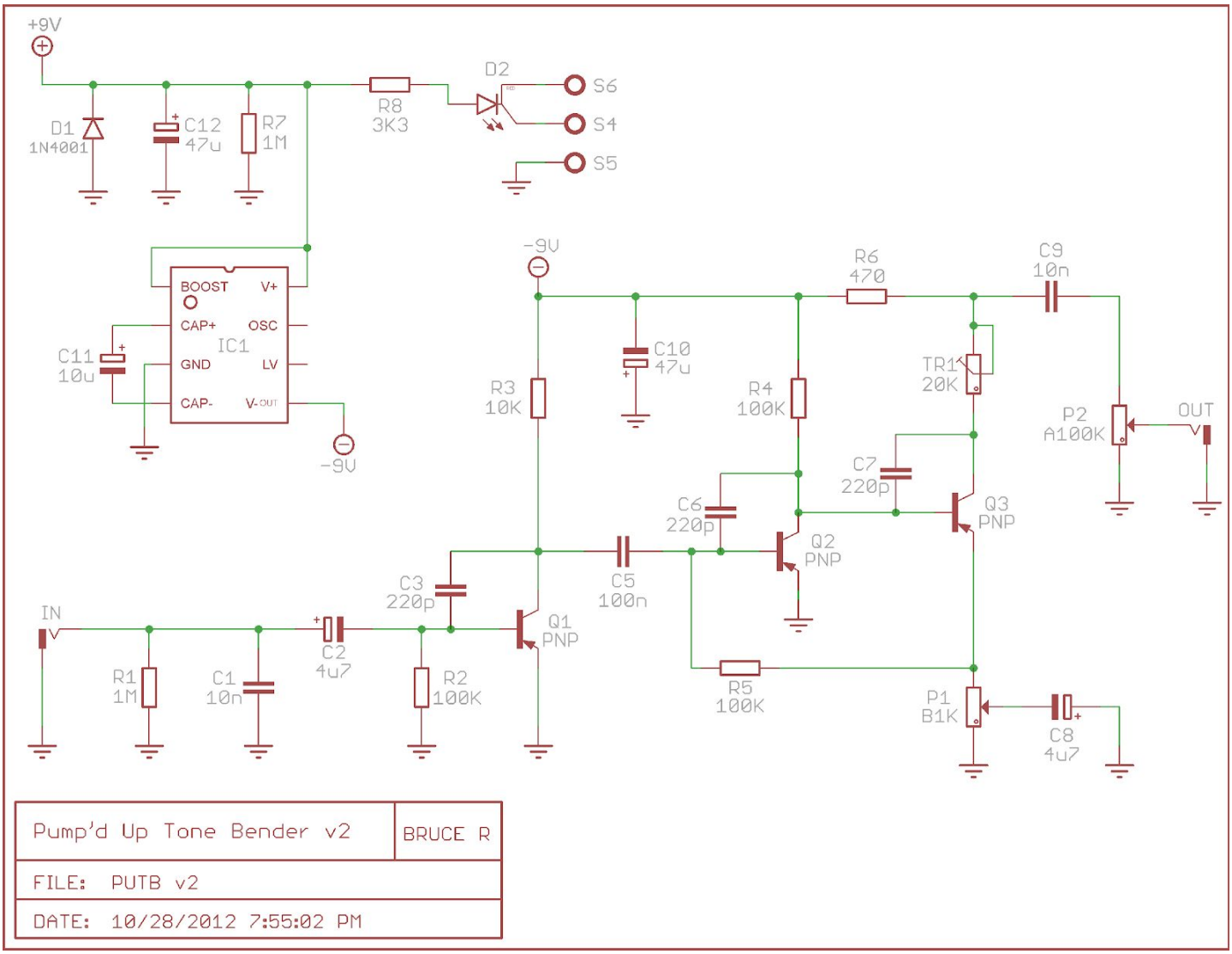
Because PNP fuzzes are positive-ground circuits, they must have a separate power supply from the rest of the effects in a chain. To overcome this limitation, a charge pump chip has been integrated to allow this board to be powered by the same source as all of your other effects. This is great for daisy-chained pedal boards, as well as integrating this into an enclosure with other effects circuits.



Board Dimensions (W x H): 2” x 1.16” i.e.: 29 x 51mm

Part	Value
R1	1M
R2	100K
R3	10K
R4	100K
R5	100K
R6	470R
R7	1M
R8	3K3
D1	1n4001
D2	Bi-Color LED Comm. Anode
TR1	20K
C1	10n
C2	4u7
C3	220p

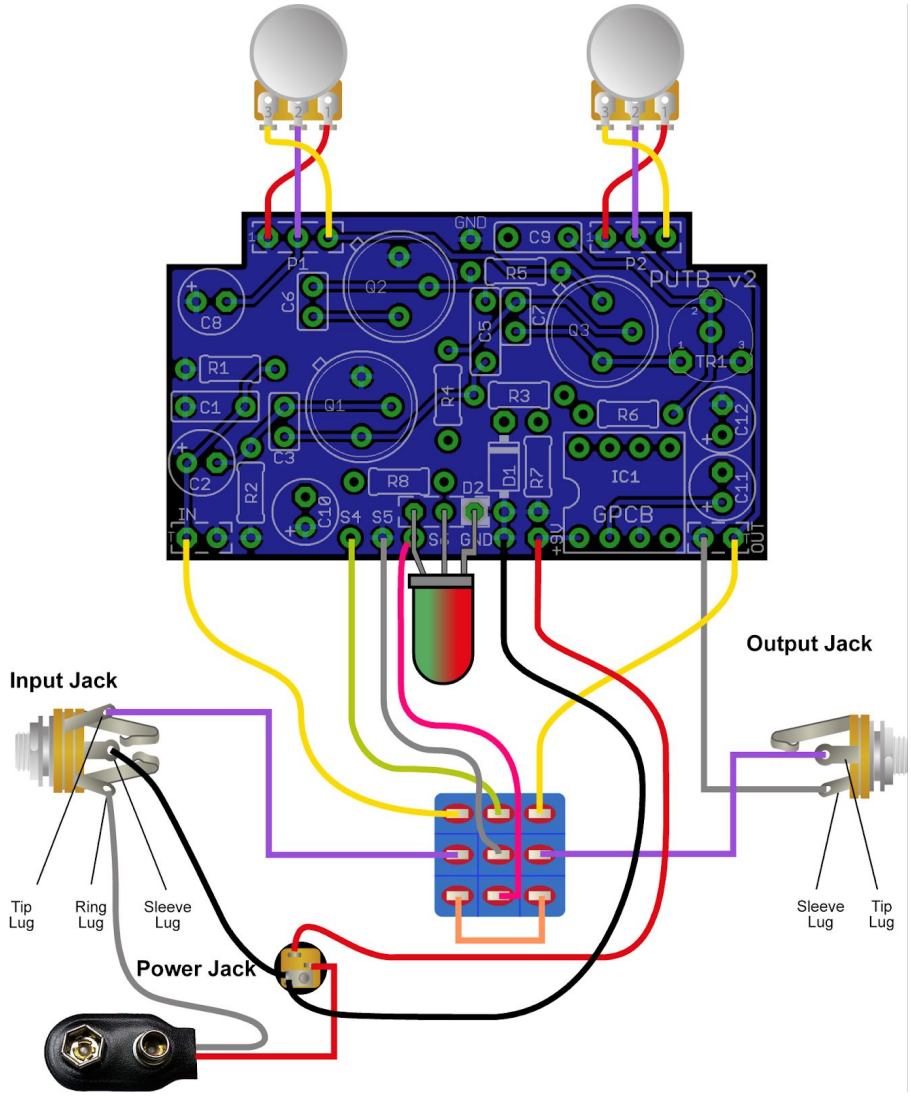
Part	Value
C5	100n
C6	220p
C7	220p
C8	4u7
C9	10n
C10	47u
C11	10u
C12	47u
Q1	PNP
Q2	PNP
Q3	PNP
IC1	MAX1044
P1 - Attack	B1K
P2 - Level	A100K



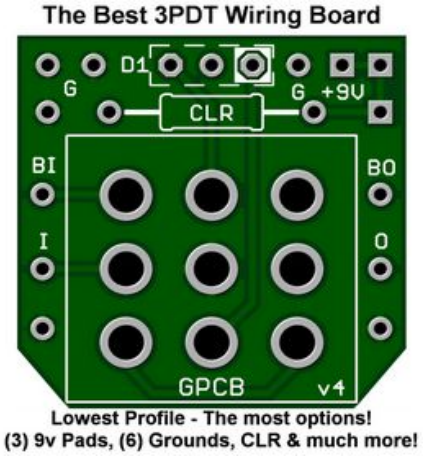
Biasing

In order to have this circuit sound like a Tone Bender, you must use transistors in the recommended gain (hFE) ranges and bias the circuit. There is a 20K trimmer potentiometer on this board designed to help you adjust the bias. Using your digital multimeter (DMM), measure the voltage between ground and the collector pin of Q3, and turn the trimmer to the right until your DMM reads around -7V. The board layout has each pin of the transistors marked if you look closely enough (zoom in or print this document). The bias can be adjusted up or down by a volt or so to your personal liking. There have been reports of some original vintage tone benders having the bias as high as -8.5V, while other germanium fuzz pedals like the fuzz face were biased at around -4.7V. In addition to a slight change to the tone, a larger negative bias value will increase the circuit's output level, which may factor into where you decide to set the bias.

Wiring Diagram



You may also choose to use a handy 3PDT Wiring Board from GuitarPCB in which case you can mount your LED to it and thus you will not need to install R8 or D2 on the Main Board or connect S4, S5 and S6.

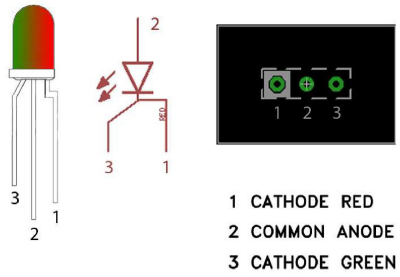


Notes about this build

- The original Sola Sound, Vox, and Colorsound Tone Bender units were equipped with OC81D transistors, which are not very readily available today, and those that do exist are quite expensive. Many of the most commonly available and affordable Germanium transistors available today come in a TO-5 metal canister, which this board was intended to accommodate. Examples of these include 2n404, 2n404A, 2n1305, 2n1307, 2n1309, CV7355, etc. Various Germanium transistors come in smaller packages as well, which fit on this board easily.
- While we're not pedal historians, it has been written that the Sola Sound, Vox and Colorsound Tone Benders, and the Marshall Supa Fuzz were all made by Sola Sound, with minor differences in components from one brand to the next. You are encouraged to try modifications, but the initial values we recommend (as seen in the parts list and schematic above) in this circuit are based upon those in the Colorsound version of the pedal. The Sola Sound values would be R4 = 100K and R6 = 470R, but the increased sustain of decreasing R4, and the additional voltage drop/headroom provided by increasing R6 makes the circuit sound better in our opinion.
- A charge pump has been added to allow this Positive-Ground circuit to share a power supply with negative ground pedals. Positive-Ground circuits typically cannot share a power adapter with negative ground pedals. This is ideal for pedal boards that use daisy-chained power and projects which contain multiple effects within a single enclosure.
- The charge pump you use must be compatible with the 7660/1044 pin layout. Some charge pumps have a frequency-boost feature which will increase the oscillator from the default 10kHz up to 35-45kHz. We recommend that you use a charge pump with this boost feature to avoid any whine or clock noise. We have seen a high failure rate with some manufacturers' MAX1044 chips, so we prefer the 7660S (e.g.: TC7660SCPA). While all 1044 chips seem to have the boost feature, on the 7660 chips, the "S" designation after the number indicates that it has the frequency boost feature, whereas the original 7660 (without an "S") chips did not.
- Germanium transistors can be damaged by heat. We recommend that you socket the transistor holes, and then insert the transistors into the sockets after the heat has dissipated. If you don't socket, we recommend that you use a small alligator clip on the component side of the lead to act as a heat sink while soldering.
- Vintage germanium transistors vary greatly from one piece to the next, including gain values, leakage, etc. Some of these transistors may generate some high-end hiss, which is not desirable. To account for this, this board layout includes 3 small capacitors which were not in the original circuit, C3, C6 and C7. These act as a filter for the hiss, but do not reduce the level of any of the high-pitch guitar notes. We recommend that you initially build this project without these, and determine if they are needed after performing a sound check. If used, recommended values are 100-220pf.
- Some minor modifications to original values were made to account for modern parts. As an example, 50uF capacitors were changed to 47uF capacitors.
- The Marshall Supa Fuzz was almost identical to the Tone Bender, but had a bit more bass. To change this board into a modern Supa Fuzz, change R1 to 10K, and C2 to 10uF.
- This PCB has a ground for each audio jack sleeve. If you use another wiring scheme to ground the sleeve of the audio jacks, such as a GuitarPCB.com 3PDT board, star wiring, etc, you may leave these empty and just use the "T" or "tip" pads. Just make sure that the board is connected to ground at some point or it will not work.

STATUS LED

D2 is a common anode bi-color LED. R8 is the current limiting resistor.



The diagram above shows the pin-out, schematic symbol and pad connection for a common anode LED. The pin-out for the bi-color LED is as follows:
The pad for lead 1 on the circuit board is marked with a white box.
When connected correctly the LED will light red when power is applied and the circuit is in bypass mode. The LED will light green when in effects mode.
If you wish to use a standard LED, connect the anode to the middle pad and the cathode to the right (non-white) pad to show the circuit in effects mode.