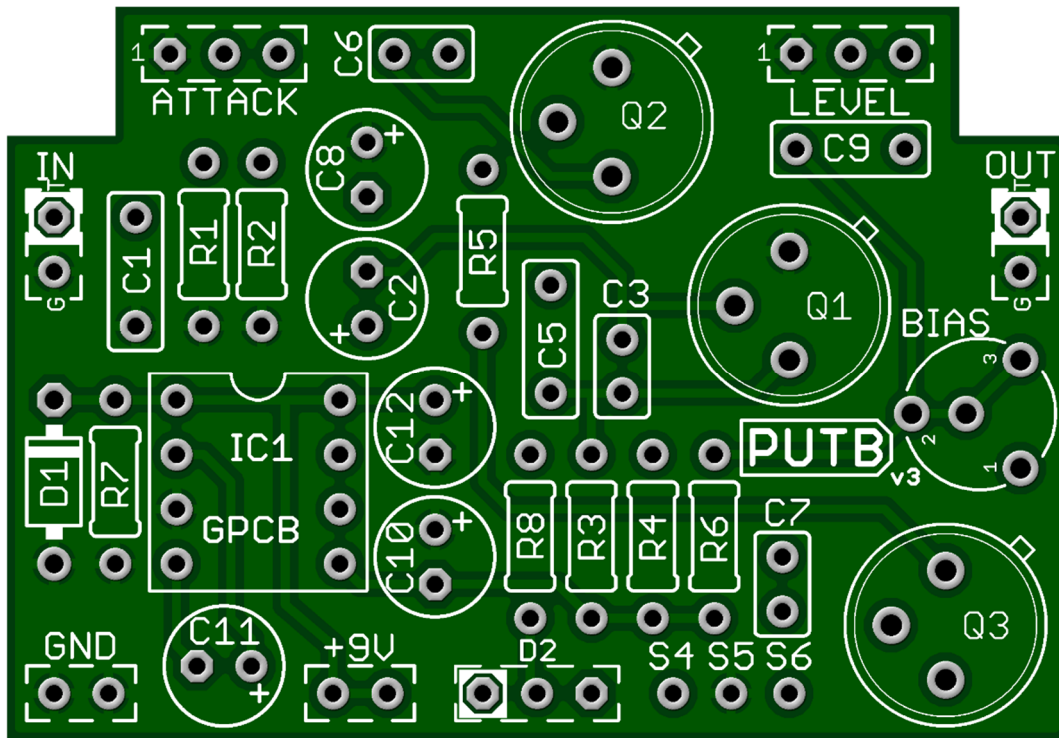


P.U.T.B. - TONEBENDER MKII PNP

The Classic Tonebender with a modern twist. Pump'd Up means you can use this circuit with other negative-ground pedals. Because the power section has no effect on the Audio Path our circuit will in no way alter or change the unique tone of a Tonebender.

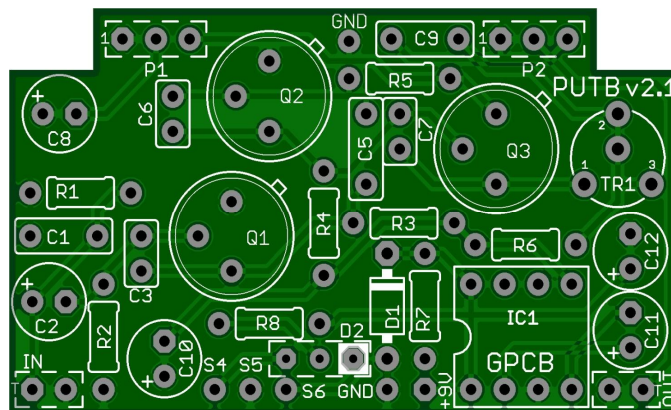
Original PNP fuzzes are positive-ground circuits and as a result they required a separate power supply. To overcome this limitation, a charge pump chip has been integrated to allow this board to be powered by the same source as all of your other effects. This is great for daisy-chained pedal boards, as well as creating Combo Builds.

This is our latest Version 3 Board. Changes are purely cosmetic. Note placement of Transistors.



Board Dimensions (W x H): 1.95" x 1.35"

If you have an earlier version of the board here is the layout for your convenience.



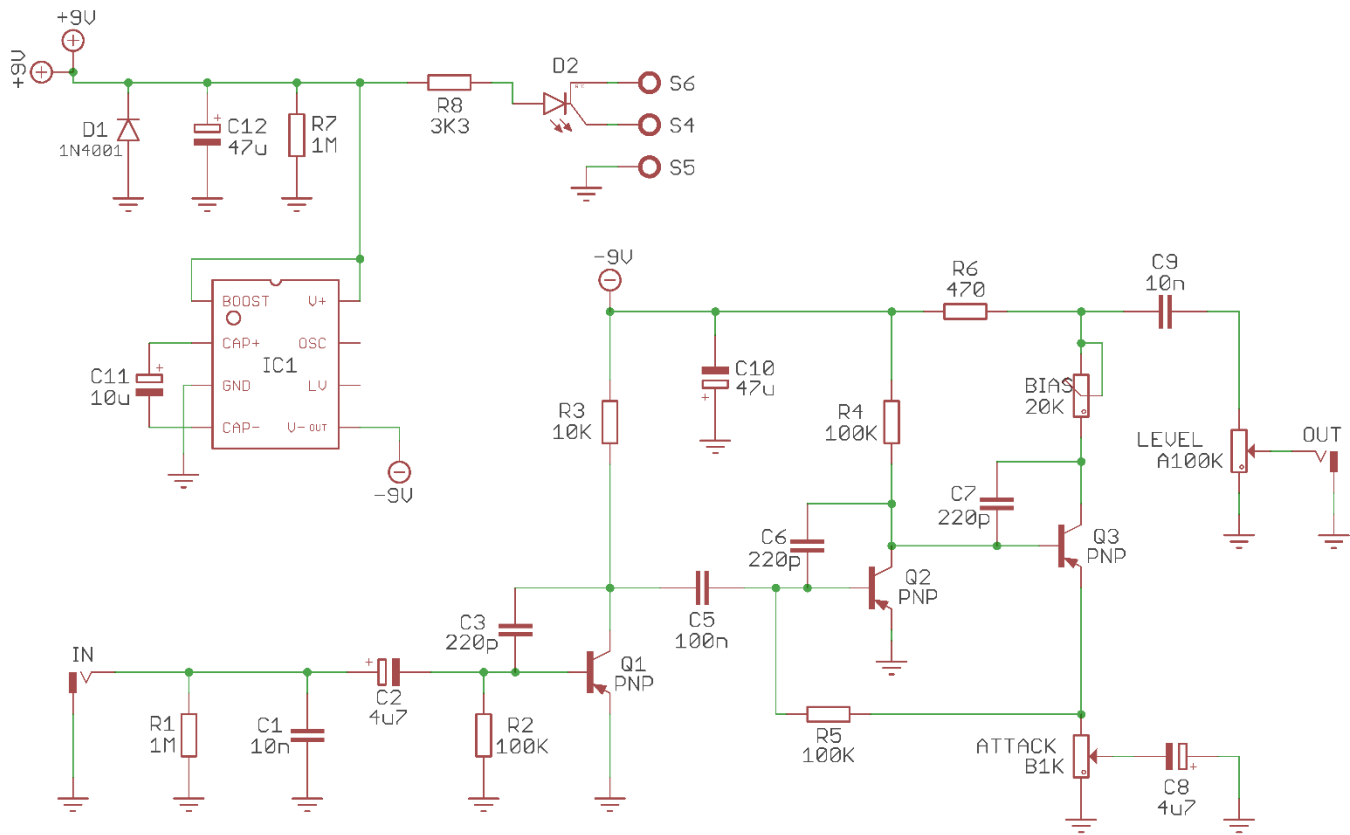
Board Dimensions (W x H): 2" x 1.16"

Bill of Materials

Part	Value
R1	1M
R2	100K
R3	10K
R4	100K
R5	100K
R6	470R
R7	1M
R8	3K3
D1	1n4001
D2	Bi-Color LED CA
TR1	20K thru 50k
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	TC7660S
P1 - Attack	B1K
P2 - Level	A100K

Schematic



Pump'd Up Tone Bender v2	BRUCE R
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Build Notes:

Biasing

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. 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.

Popular hFE suggestions for each of the three transistors:

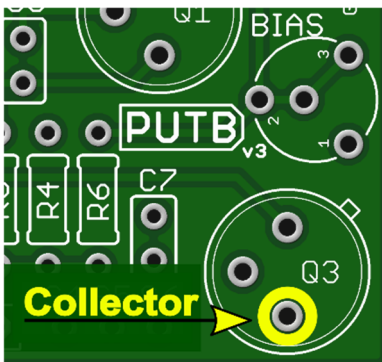
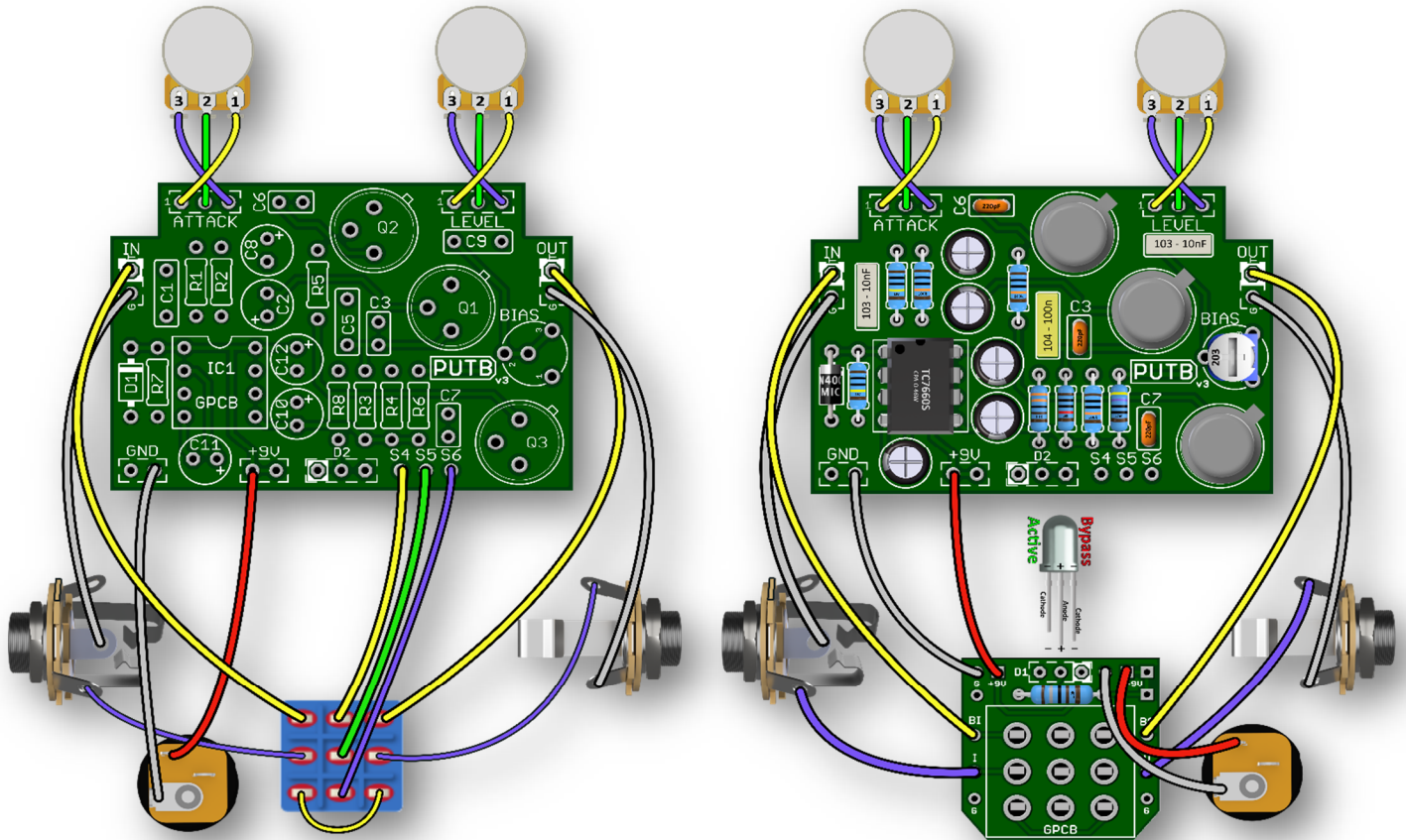
Q1 55-80 hfe, Q2 70-100 hfe and Q3 100-150+ hfe

Charge Pump: The charge pump you use must be compatible with the **7660S**/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 **7660S** to avoid any whine or clock noise. **Make sure it is 7660S w/ the S.**

More 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.
- 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.
- Consider using a Hybrid PNP transistor configuration: Q1 Germanium PNP, Q2 Silicon PNP & Q3 Silicon PNP for the best of both worlds.
- 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.
- 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 will not reduce the level of any of the highest-pitched guitar notes. You can build this project without these, and determine if they are needed. 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 from vintage circuit designs. This will not affect your tone whatsoever.
- 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.

Wiring Diagram



Bias the Collector of Q3 (always verify Transistor Pinout) ->

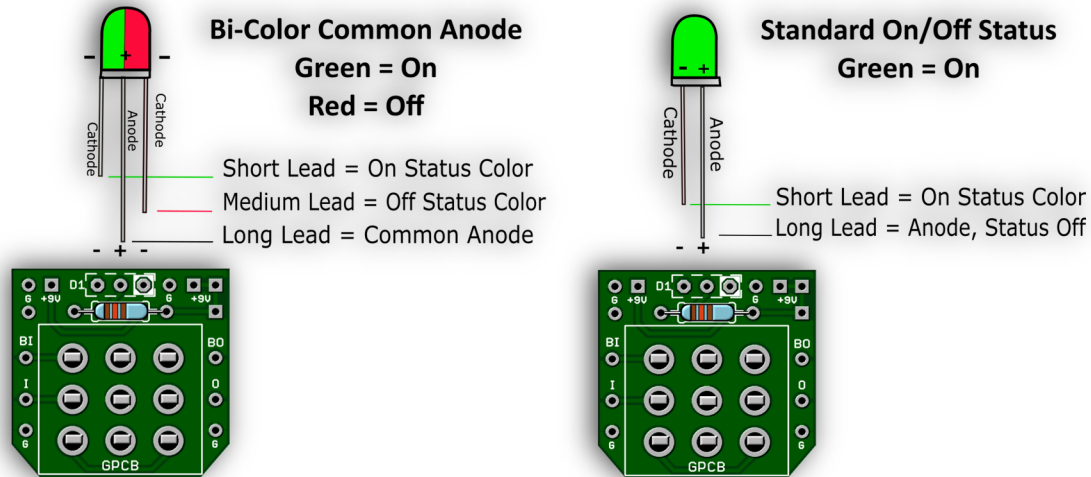
Using a 20K trimmer you can adjust the bias. Use a (DMM), measure the voltage between ground and the collector pin of Q3, and turn the trimmer to the right until your DMM reads around -7V. Easily make this an on-board potentiometer.

Reports of original vintage tone benders having the bias set as high as -8.5V, while other fuzz pedals like the fuzz face were biased at around -4.7V.

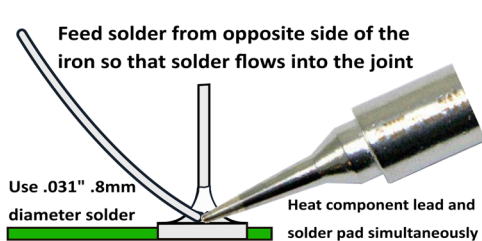


Be sure your In/Out Jack wiring is correct. A Stereo Jack (for battery use only) has a RING lug which is used to connect to the battery ground. If you do not intend to use a battery there is no need for a Stereo Jack. If using Stereo then only use the Tip and Sleeve lugs. S4, S5 & S6 is only needed when the LED is wired to the Main Board.

STATUS LED



If you are using one of GuitarPCB's handy 3PDT wiring boards, pads S4, S5, S6 and D2 would be ignored and R8 would not be installed.

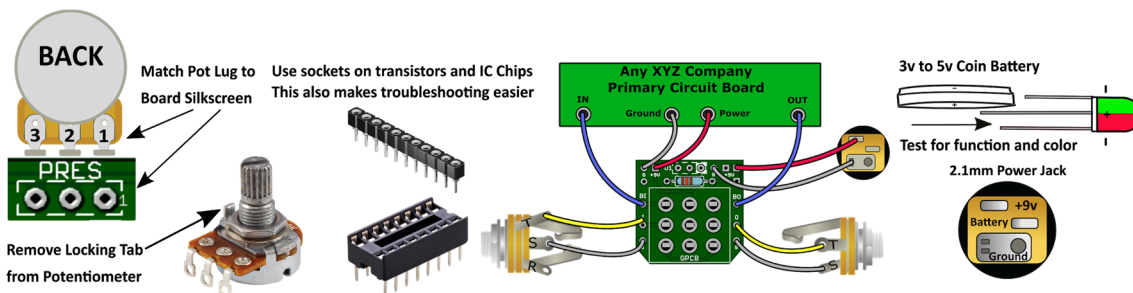


A good solder joint should be shiny and look like this:

- * Carefully re-flow suspect solder joints.
- * Clean and tin your Tip regularly.

When soldering wire to the board push the protective PVC jacket flush with the board and pad.

Use the right tools for the job and be patient.
If you need help ask questions first at the GuitarPCB forum.
We are there to help and we know our products best.



Need a kit?

USA – Check out [PedalPartsAndKits](http://PedalPartsAndKits.com) for all your needs.

Europe – [Das Musikding](http://DasMusikding.com) carries both boards and kits as a service to our Europeans friends.

Australia - PedalPartsAustralia.com carries GuitarPCB Boards and Kits direct.

If they do not have a KIT listed send them a note asking if they can help you out.



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