BYOC Digital Echo & Ping Pong Kit Instructions

Parts Checklist…….....…….....page 2 - 3

Populating the Circuit Board…….....page 4 - 11

Assembly…….....page 12 - 13

Wiring the jacks, footswitch, and battery snap.....page 14

Mounting the PCB.....page 15 - 17

Wiring the PCB…….....page 18

Finish up…….....….....page 19

Schematic, Understanding the circuit and Troubleshooting.....page 20 - 31

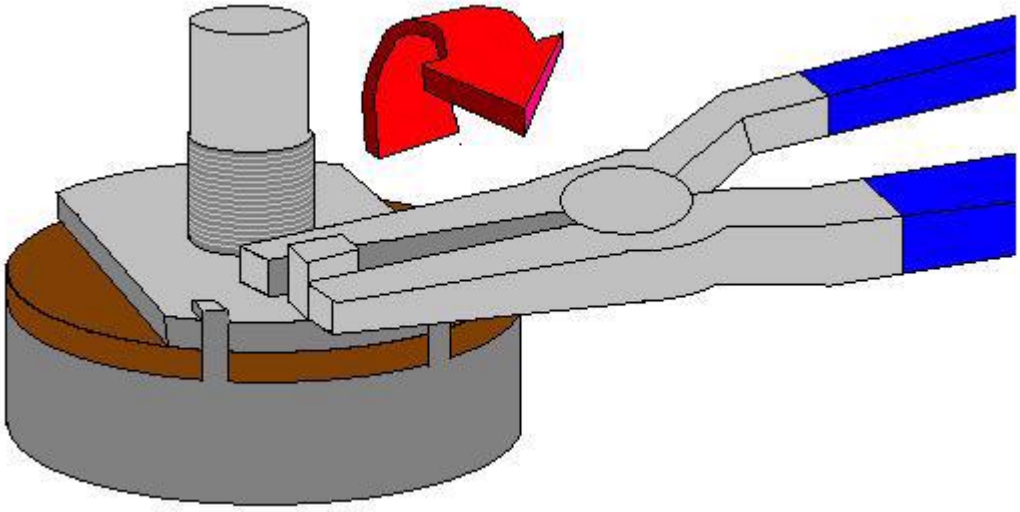
Please read through the instructions completely before beginning this project. This is one of our most difficult kits and it is a little different than other BYOC kits, so even if you are an experienced builder, take the time to look these instructions over...particularly the beginning of "populating the PCB" and "wiring the jacks, footswitch, and batterysnap".

Copyright 2008 Build Your Own Clone

Parts Checklist for BYOC Digital Echo & Ping Pong Kit

Resistors:
1 - 100ohm (brown/black/black/black/brown)only use this resistor if you want dedicated 18v operation
1 - 470ohm (yellow/purple/black/black/brown)
6 - 1k (brown/black/black/brown/brown)
2 - 4.7k (yellow/purple/black/brown/brown)
17 - 10k (brown/black/black/red/brown)
1 - 12k (brown/red/black/red/brown)
2 - 15k (brown/green/black/red/brown)
2 - 511k (green/brown/brown/orange/brown)
1 - 2.2M (red/red/black/yellow/brown)
Capacitors:
1 - 47pf ceramic disc
1 - 470pf ceramic disc(471)
4 - .0022uf film (222 or 2n2j)
7 - .01uf film (103 or 10nJ)
2 - .022uf film (223 or 22nJ)
4 - .082uf film(823 or 82nJ)
5 - .1uf tantalum
10 - 1uf aluminum electrolytic
3 - 100uf aluminum electrolytic
1 - 220uf aluminum electrolytic
Diodes:
1 - 1N4001
IC's:
1 - TL082, TL072, 4558 or other dual op amp
1 - 78L05 5 volt regulator (looks like a transistor)
2 - PT2399 echo chip
1 - DIP 8 socket
2 - DIP16 socket

Potentiometers: Be sure to snap off the small tab on the side of each pot.

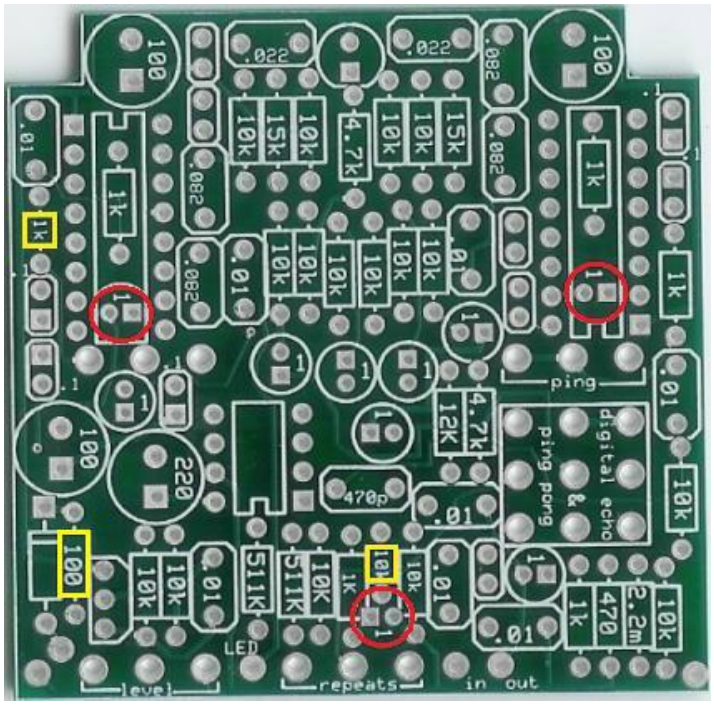


2 - B100k linear
2 - B50k linear

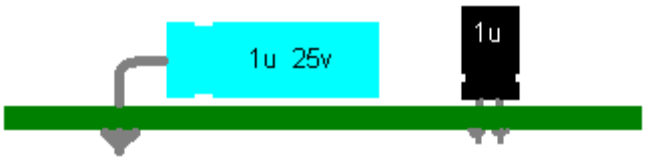
Hardware:
1 - drilled enclosure w/ 4 screws
1 - byoc pingpong kit circuit board
1 - 3pdt footswitch
4 - knobs
1 - AC adaptor jack
2 - ¼"stereoenclosed jack
1 - battery snap
1 - red LED
hook-up wire

Populating the Circuit Board

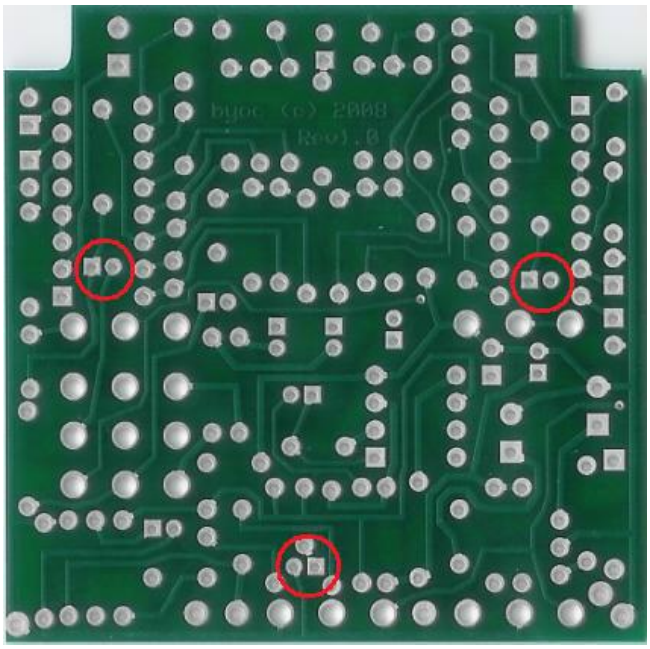
Before you begin: Be aware of a few peculiarities with this particular kit. There are two resistors that stand on end rather than laying flat and one that will need to be omitted and jumpered if using 9v. These three are highlighted here in yellow. There are three aluminum electrolytic caps that get mounted on the underside of the PBC highlighted here in red. And there are two 1k resistors that actually fit under the DIP16 sockets. Each of these thing will be discussed in this section of the instructions in due order. So even if you are an experienced builder, follow the instructions in order.



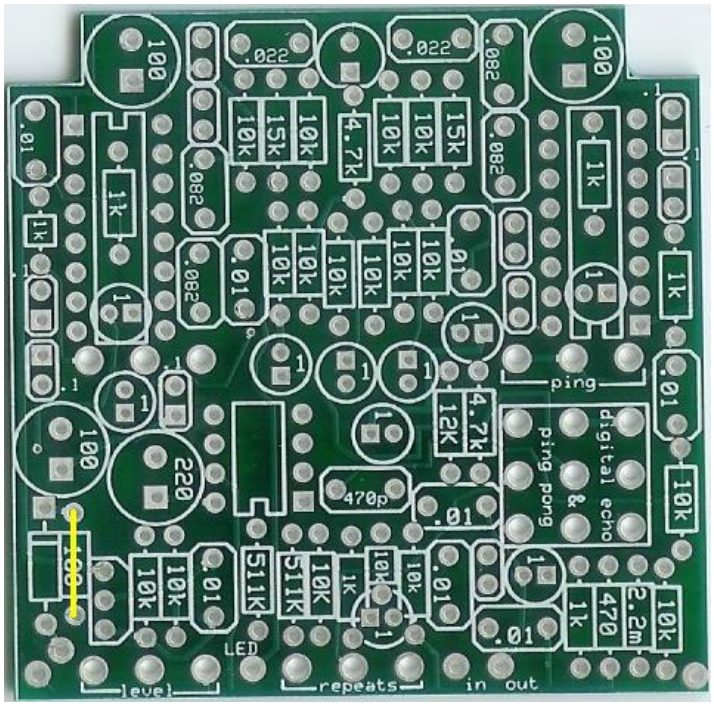
Step 1: Add the three 1uf aluminum electrolytic capacitors to the underside of the PCB. Aluminum electrolytic caps are polarized which means they have a positive side and a negative side. The positive side will have a longer lead and should go in the square solder pad.



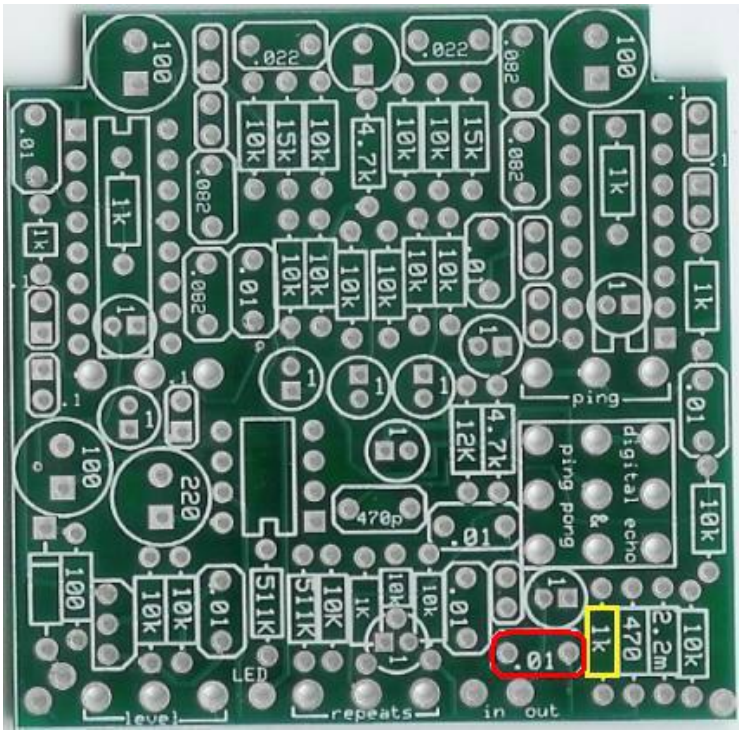
If your kit came with the small black aluminum electrolytic caps, just add them to the underside of the PCB normally. If your kit came with the larger aluminum electrolytic caps, you will need to bend them down so that they lay flat against the PCB. You will need to have the cap sticking up out of the PCB just a little when you solder it so that it will have enough lead to bend over. The larger caps may be several different colors but more than likely will either be light blue or black.

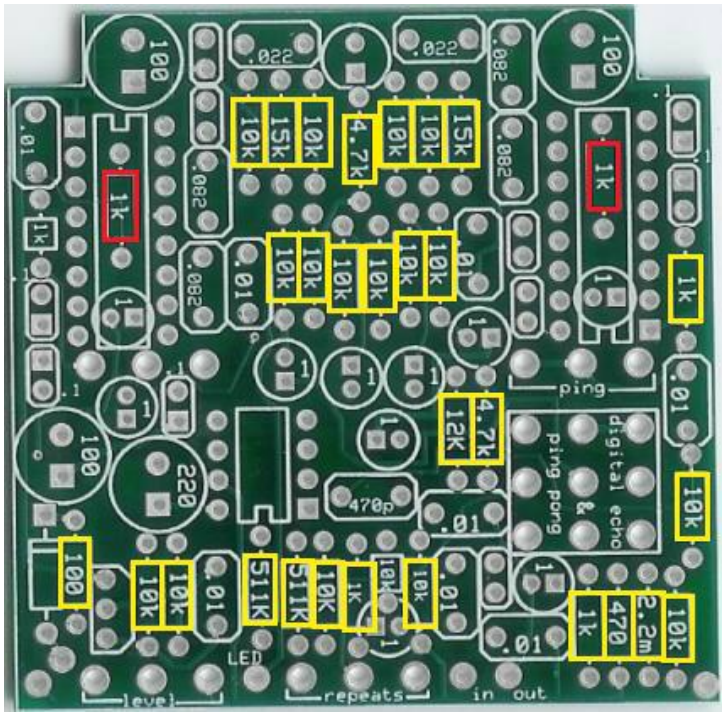


Step 2: Omitt the 100ohm resistor if you will be using 9v. Only add the 100ohm resistor if you want dedicated 18v wall adaptor operation. If you do want dedicated 18v operation, add the 100hm resistor. If you do not want dedicated 18v operation, you must replace the 100ohm resistor with a jumper. You can use some of the component clippings left over from the last step.

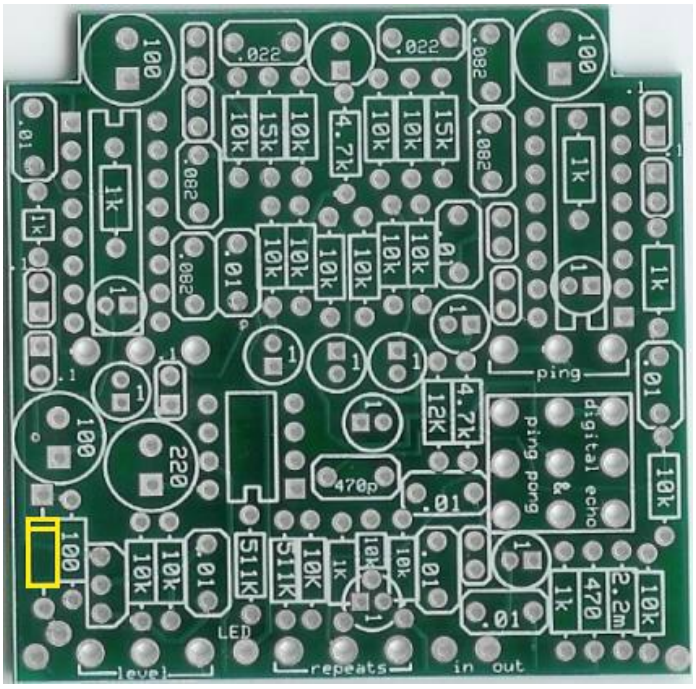


Step 3: Add the resistors. Resistors are not polarized and can be inserted into the PCB in either direction. The two 1k resistors highlighted in red will share space with the DIP16 sockets. Triple check to make sure that you are using the correct value resistors here, because once you install the DIP16 sockets, the resistors will be very difficult to remove. **Note - Omitt the .01uf cap highlighted in red completely.**

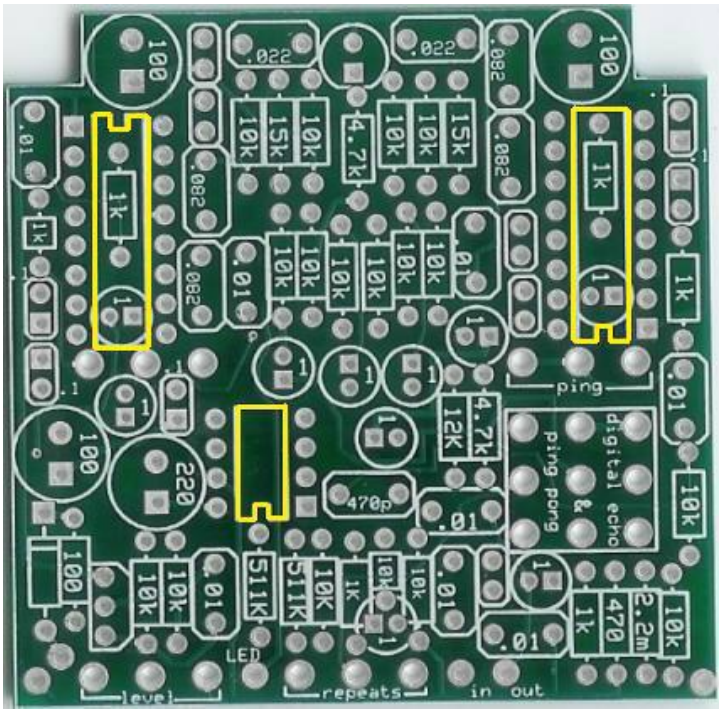




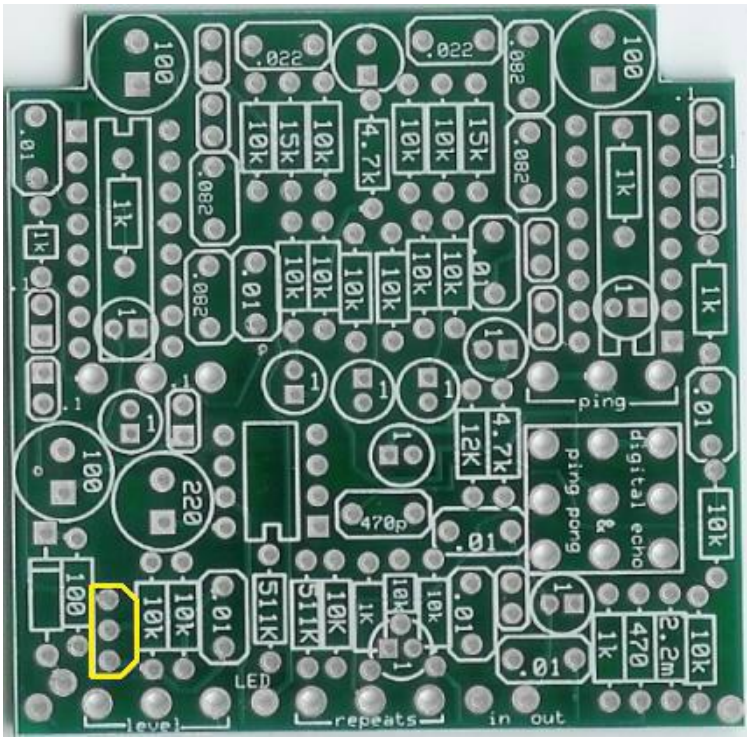
Step 4: Add the diode. The end with the stripe(cathode) goes in the square solder pad. The end with no stripe(anode) goes in the round solder pad.



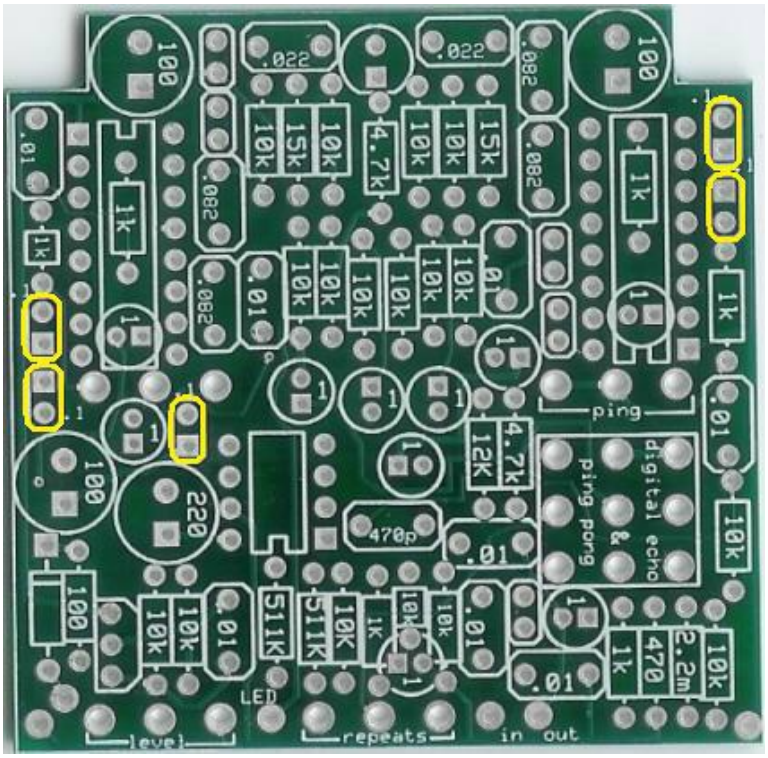
Step 5: Add the IC sockets. Be sure to match up the end of the socket with notch to the layout printed on the PCB with a notch. Your DIP16 sockets may not seat perfectly if you used too much solder on the 1uf caps that went on the underside of the PCB or didn't clip off enough of the excess lead. If your DIP16 socket does not seat perfectly, clean up your soldering on the 1uf caps. If it still does not seat perfectly, it's OK. Just as long as as the pins of the socket make it through the solder pads to the other side of the PCB so that you can solder them.



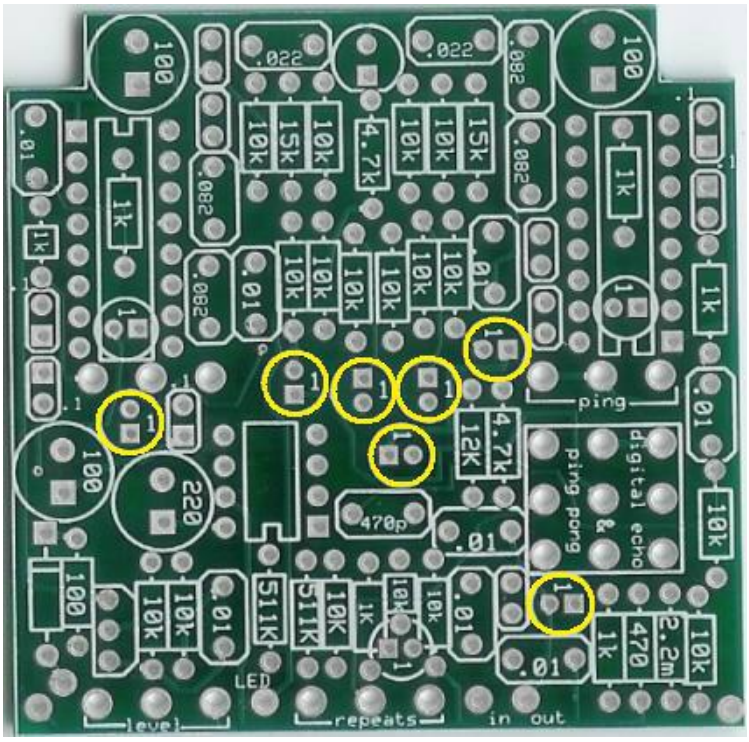
Step 6: Add the voltage regulator. Be sure to match the flat side of the component with the flat side of the layout printed on the PCB.



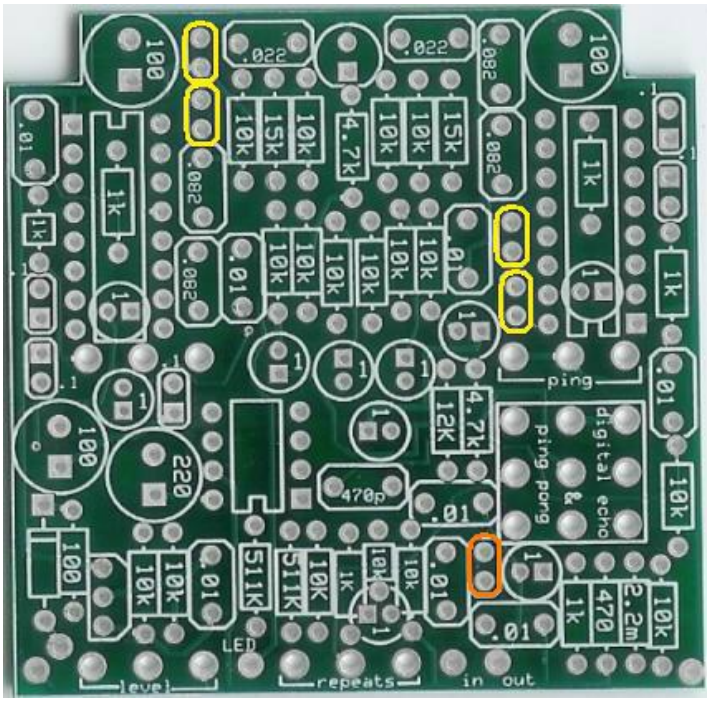
Step 7: Add the .1uf tantalum capacitors. Tantalum capacitors are polarized. The positive side will have avery small "+" symbol printed on the capacitor and should go in the square solder pad.



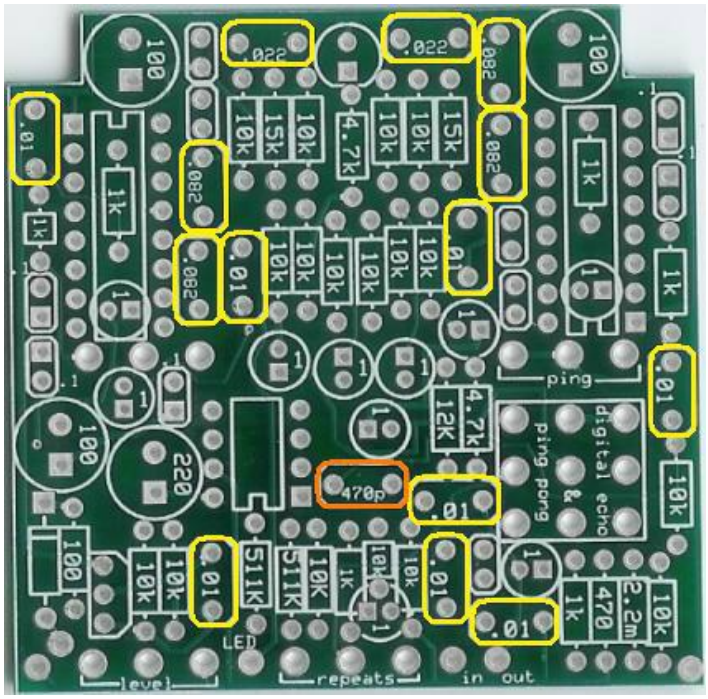
Step 8: Add the remaining seven 1uf aluminum electrolytic caps. Remember that they are polarized and the positive end goes in the square solder pad.



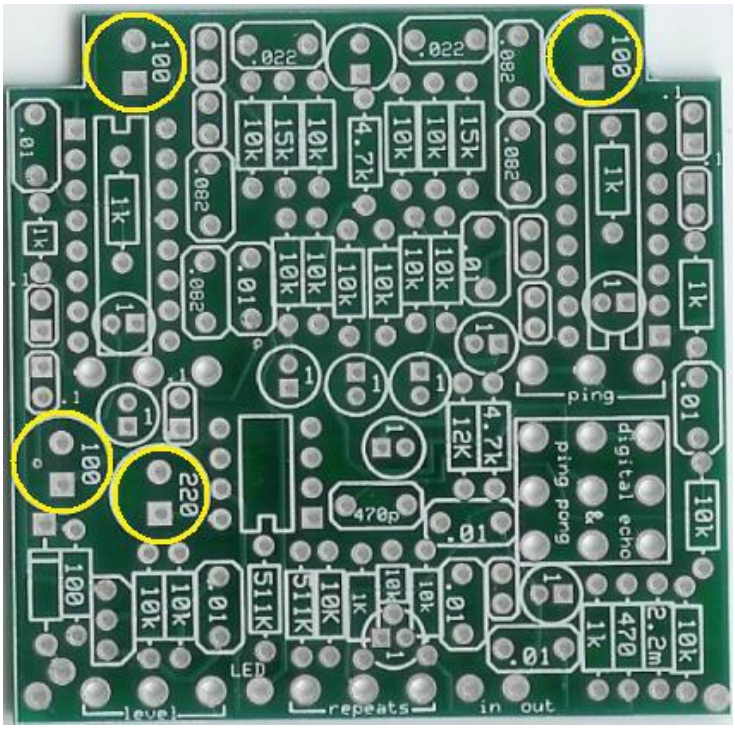
Step 9: Add the four .0022uf film caps (small green caps) highlighed in yellow and the one 47pf ceramic disc cap(small round orange cap)



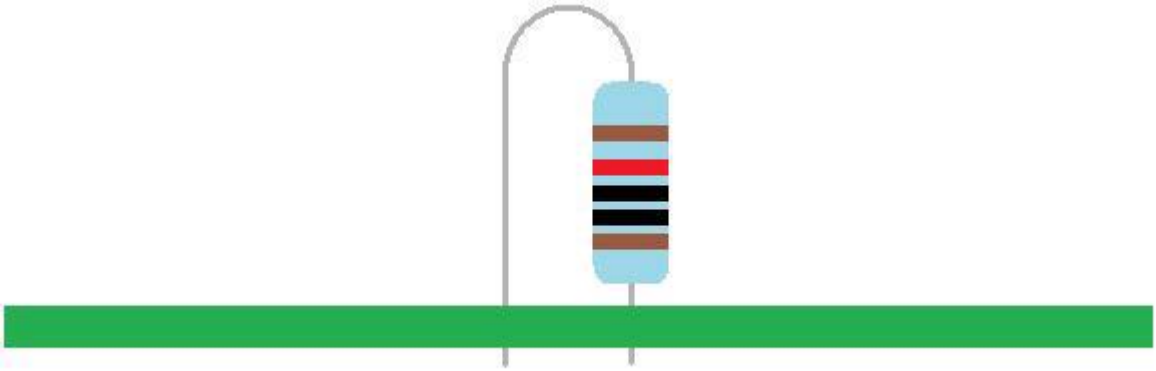
Step 10: Add remaining fourteen film caps (yellow box caps) highlighted in yellow and the one 470pf ceramic disc cap (highlighted in orange)

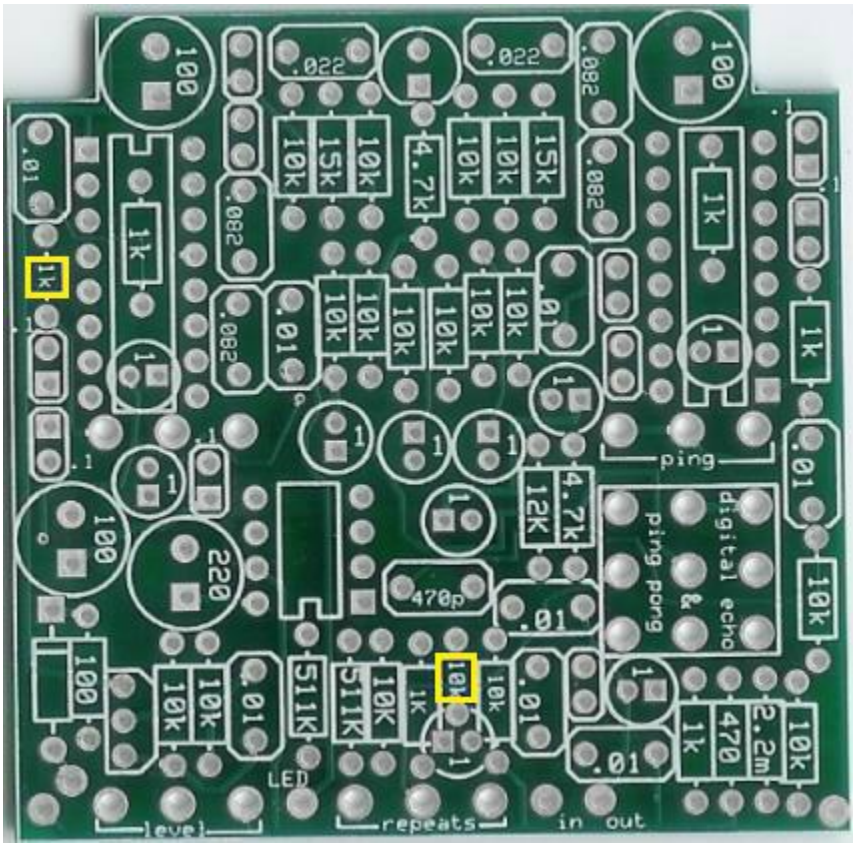


Step 11: Add the larger aluminum electrolytic capacitors. Remember that these are polarized and the positive end with the longer lead goes in the square solder pad.

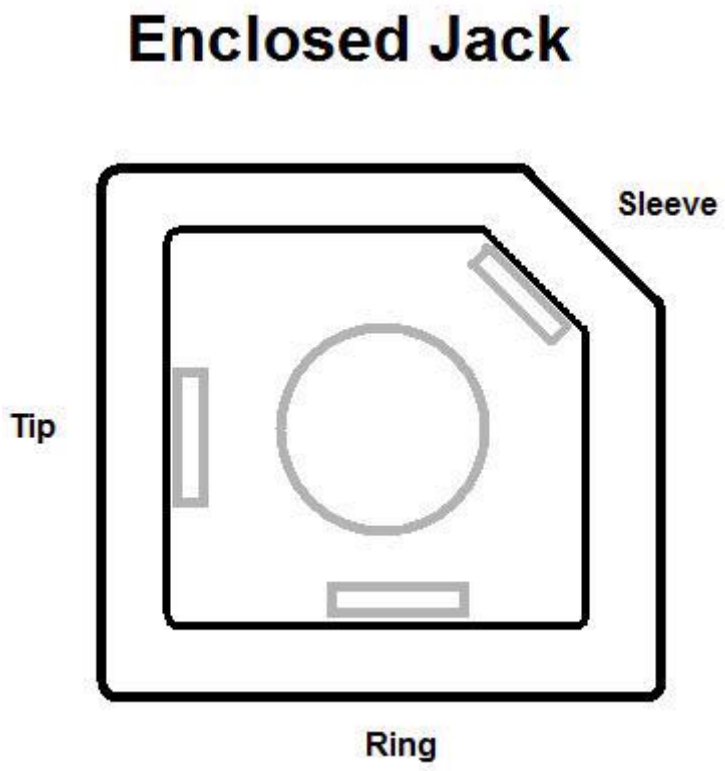


Step 12: You should have two resistors left - a 1k and a 10k. These need to be mounted vertically . They are not polarized, so it does not matter which end goes where.

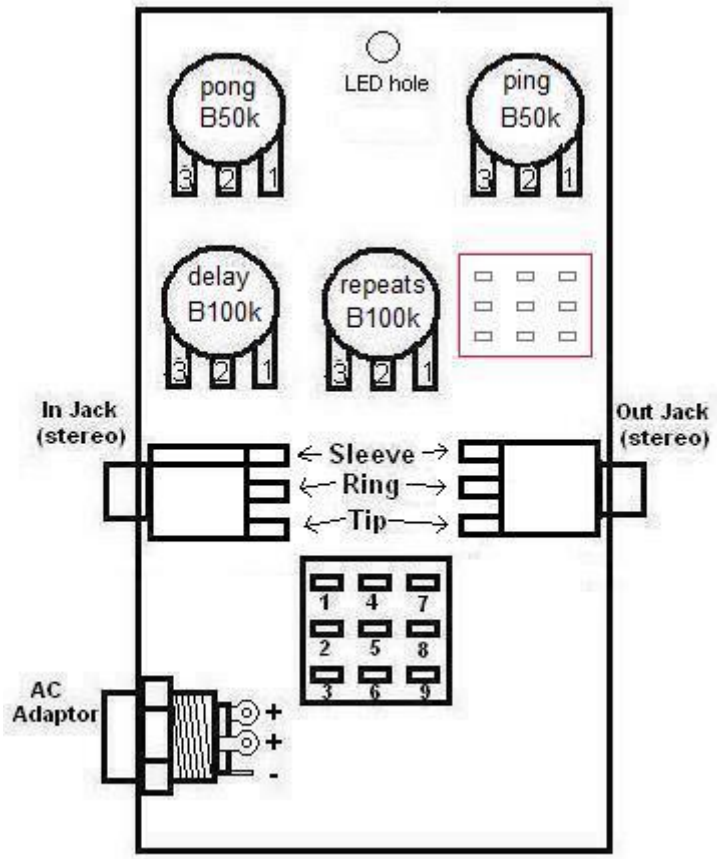




Assembly



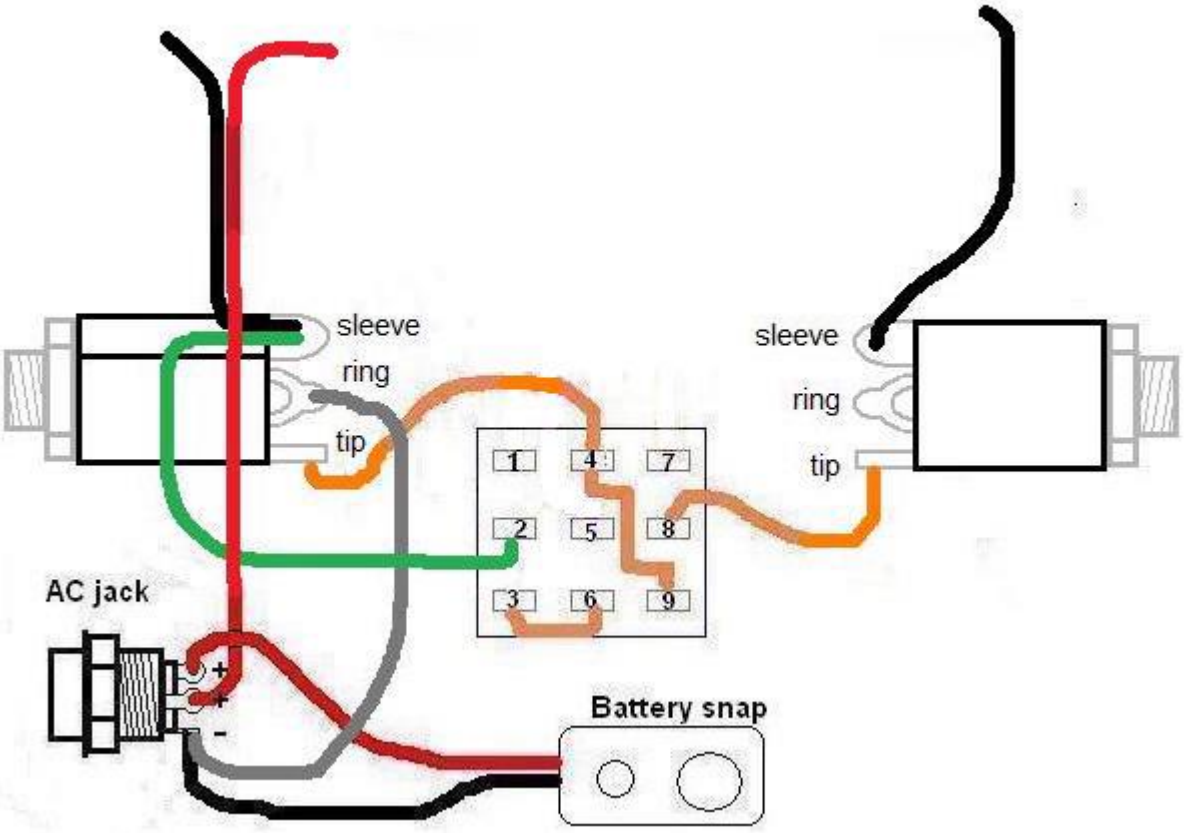
1. Install the jacks first. If you are looking down inside the enclosure, the out jack goes on the right side and the in jack goes on the left. Place the washer on the outside of the enclosure. Use a 1/2" wrench to tighten. Orient the jacks so that if you are looking at the solder lug end of the jack, the bevelled “sleeve” end would be pointing at 2 o'clock , and the sleeve of the out jack would be pointing at 7 o'clock. The out jack only needs to be mono so the ring is not used. We use two stereo jacks because it's cheaper for us to buy twice as many of the more expensive part than it is to buy half as many of the cheaper part :)



2. Install the AC adaptor jack. The bolt goes on the inside. Use a 3/4" or 14mm wrench to tighten
3. Install the potentiometers so that the solder legs are facing towards the “footswitch side”. The washers go on the outside. Use a 10mm wrench to tighten but only snug. Do not over tighten the pots. You should leave the pots somewhat loose until they are soldered to the PCB so that it will be easier to mount them.
4. Install the 3PDT toggle switch. It does not matter which side you designate as the "leading edge" of the switch as long as you orient it so that the flat sides of the solder lugs are aligned in horizontal rows, not vertical columns and the bat of the switch flips up and down and not side to side.
5. Install the footswitch. The first bolt and metal washer go inside. The plastic washer and second bolt go on the outside. It does not matter which side you designate as the "leading edge" of the footswitch as long as you orient it so that the flat sides of the solder lugs are aligned in horizontal rows, not vertical columns.

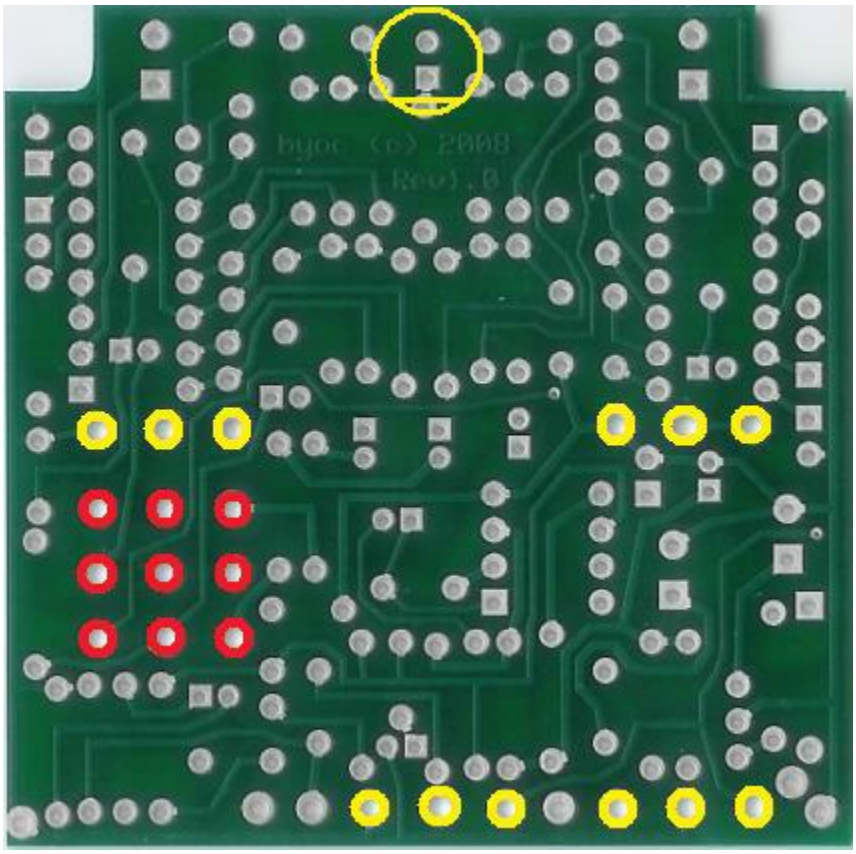
Wiring the jacks, footswitch, and battery snap

Because it's a little difficult to get to the solder lugs of the enclosed style jacks once the circuit board is mounted, it's a good idea to wire this portion of the build and leave the ground and +V wires loose before mounting the PCB.

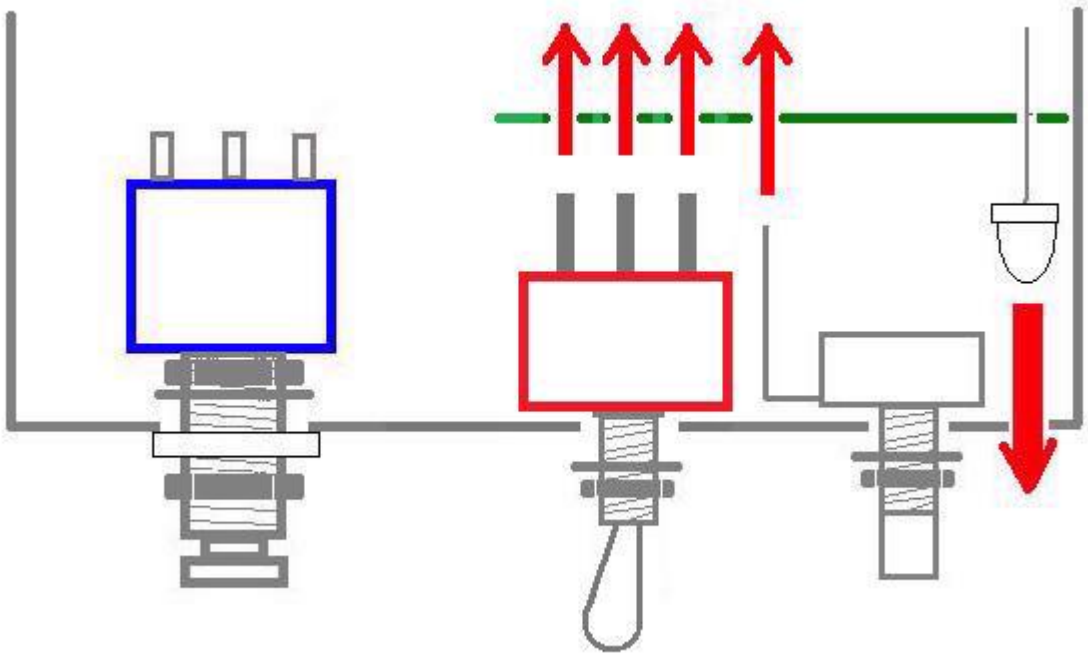


Mounting the Circuit Board

Step1: Understand that the LED, potentiometers, and toggle switch will be mounted and soldered directly to the underside of the PCB. You should do the actual soldering on the topsid of the PCB. Read through all the steps in this portion before doing anything so that you can get the "big picture".



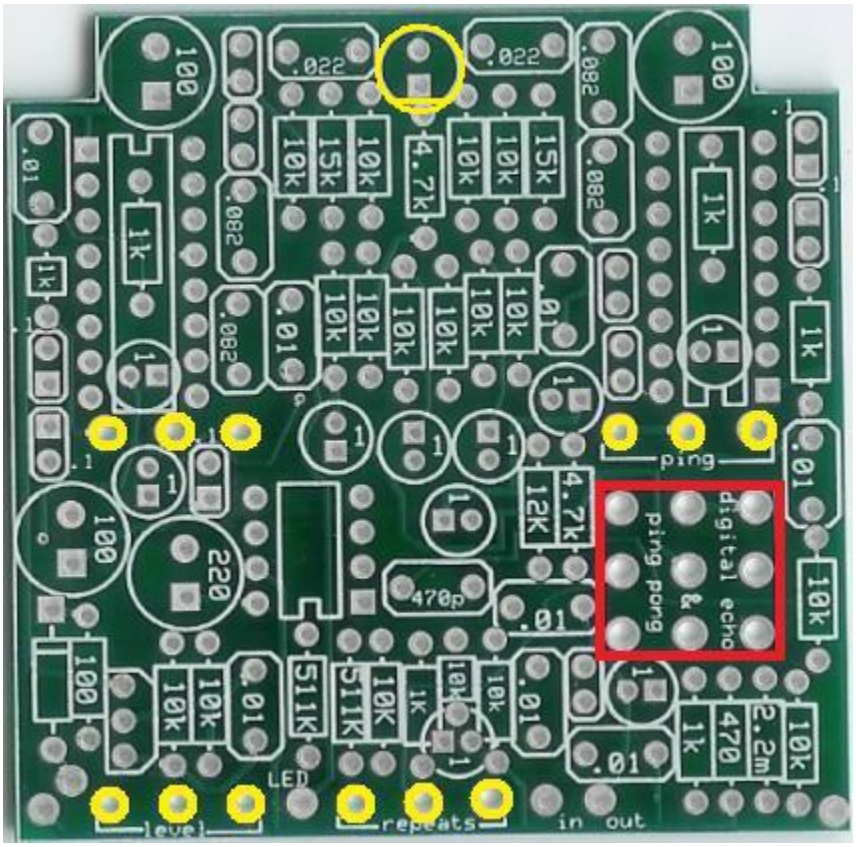
Step 2: Install the LED but do not solder it or clip the leads. You will insert the LED into its eyelets. Make sure the longer lead goes in the round eyelet and the shorter lead goes in the square eyelet. Yes this is correct! Longer lead in the round eyelet. Shorter lead in the square eyelet. Now bend the leads of the LED so that it will not fall out of the PCB when you flip it over.



Step 3: Now mount the PCB with LED onto the leads of the potentiometers and toggle switch. This move may take a little finess. It's best to leave them somewhat losely mounted to the enclosure so that you can easily move them to line up with the eyelets on the PCB. You may need to bend the leads of the pots into place if they were bent in shipping.

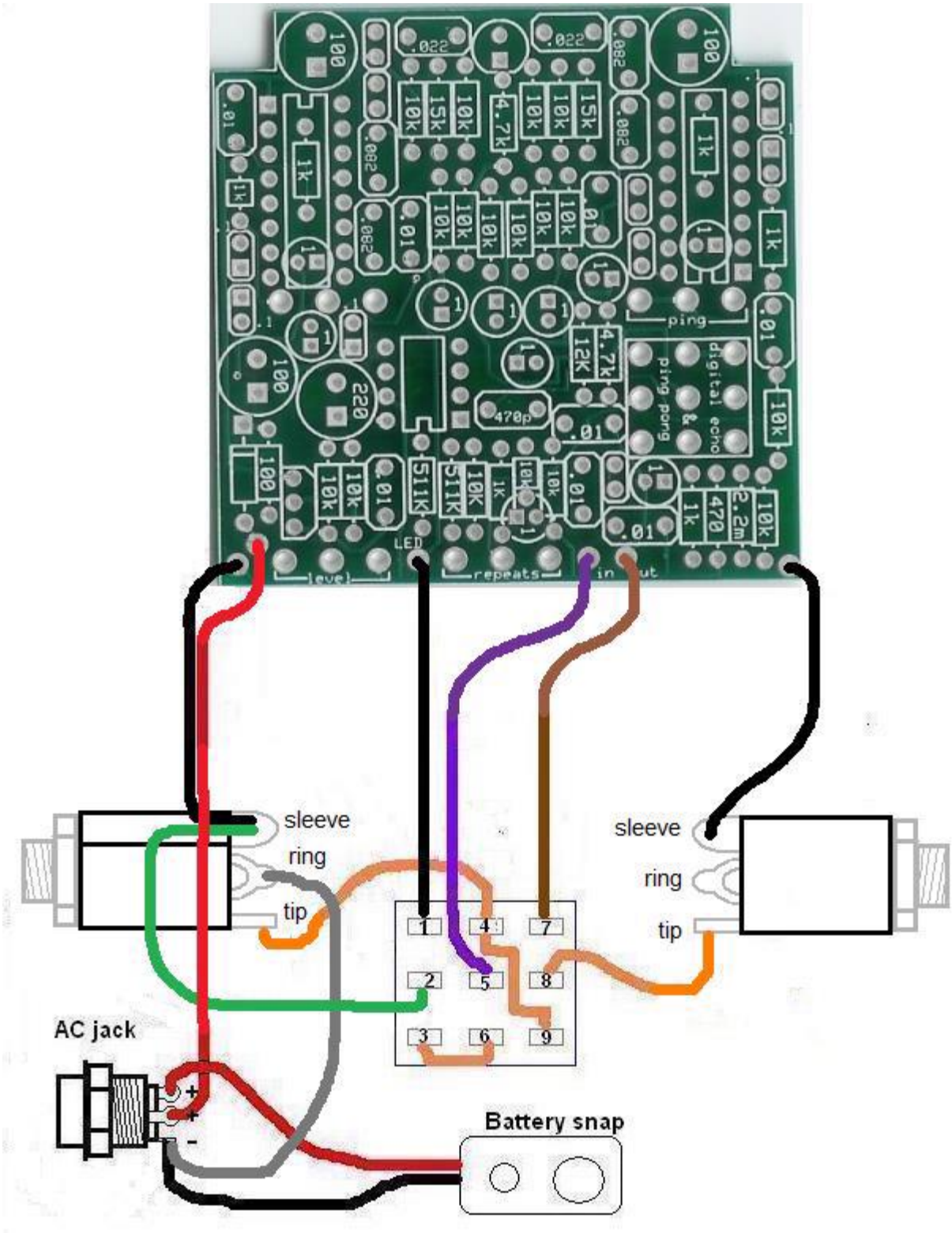
Step 4: once you have the PCB in place, snug the nuts of the pots and toggle switch with your fingers.

Step 5: Move the LED into place by guiding it with the leads that are sticking out of the top side of the PCB.



Step 6: Solder the LED, toggle switch, and pots on the top side of the PCB. Clip the excess LED leads. Do not clip the leads of the pots.

Wiring the PCB



Finishing Touches

Install the chips. NOTE: The PT2399 chip will likely have a “dot” on one end that is not a marker that should be used for orienting the chip. Refer to the u-shaped notch when orienting the chip. The DIP8 dual op amp may have a u-shaped notch, a dot in one corner, or both for orienting. If the chip has both, always refer to the u-shaped notch first.

Install the base of the enclosure with the 4 screws that came with your kit. Add the rubber bumper feet...unless you're a velcro person. Add the 2 knobs. Be sure not to tighten the set screw inside the knobs too tight or you may strip them. If you've got any problems that you can't figure out yourself, visit board.buildyourownclone.com for technical support. Please read the trouble shooting guide first.

Schematic, Understanding the Circuit, and Trouble shooting

Checking your wiring

1. **NO POWER:** If you have a completely dead pedal and your LED will not light up, this is usually a good sign that you are not getting power to the circuit. First you need to make sure that you are using a fresh battery or good power supply. Even though this pedal can run on 12v - 18v, let's use 9v for trouble shooting purposes to keep things simple. Also make sure you have a plug in the IN jack. This acts as your power switch. Now let's make sure you have a good ground. Set your Digital MultiMeter to test for continuity. Continuity is the setting where the meter makes a noise when you touch the two probes together. Now test the "G" locations in the wiring diagram and make sure that there is continuity between all.

***If you don't get continuity between all 3 locations, you likely have a bad connection somewhere in the black wire.**

Now set your meter to test for 9VDC. Make sure you do not set it to test for AC. And if you do not have an auto-ranging meter you will need to set it for the proper voltage. You want to set it to test for the lowest voltage without going under 9V. This will probably be 20V on most meters. With the pedal/footswitch in the engaged position, you should get approximately 9VDC when you touch the red probe to the POS eyelet and the black probe to the LED eyelet. You will probably get a little more than 9V with an adaptor and a little less than 9V with a battery.

If you are not getting a reading here, keep the red probe on the POS eyelet and move the black probe to one of the "G" locations.

***If you do not get a reading now, you likely have a bad connection somewhere along the red wire.**

If you don't get a 9V reading at the POS and LED eyelets, but you do get a 9V reading at the POS eyelet and one of the "G" locations, there is a possibility that you have a faulty footswitch or a bad connection at lugs 1 and/or 2 of the footswitch. Test for continuity between lugs one and two of the footswitch. Make sure to press the footswitch on and off so that you are certain that you are engaging the throw between lugs 1 and 2 one way or the other.

***If you are getting continuity between lugs 1 and 2, then you likely have a bad solder joint at lugs 1, 2, and/or the LED solder pad.**
***If you are not getting continuity between lugs 1 and 2 regardless of what state the**

footswitch is in, then you likely have a faulty foostswitch.

2. NO BYPASS: Set your DMM to test for continuity. Touch the probes to the "A" locations which would be the TIPS of the 1/4" jacks. When your footswitch is in the bypass state, you should have continuity between the two "A" locations. Test lugs 8 and 9 of the footswitch for continuity.

***If you get continuity between lugs 8 and 9, but no continuity between the 2 "A" locations, then you likely have a bad solder joint somewhere along the orange wiring. This also includes the jumper connection between lugs 4 and 9.**

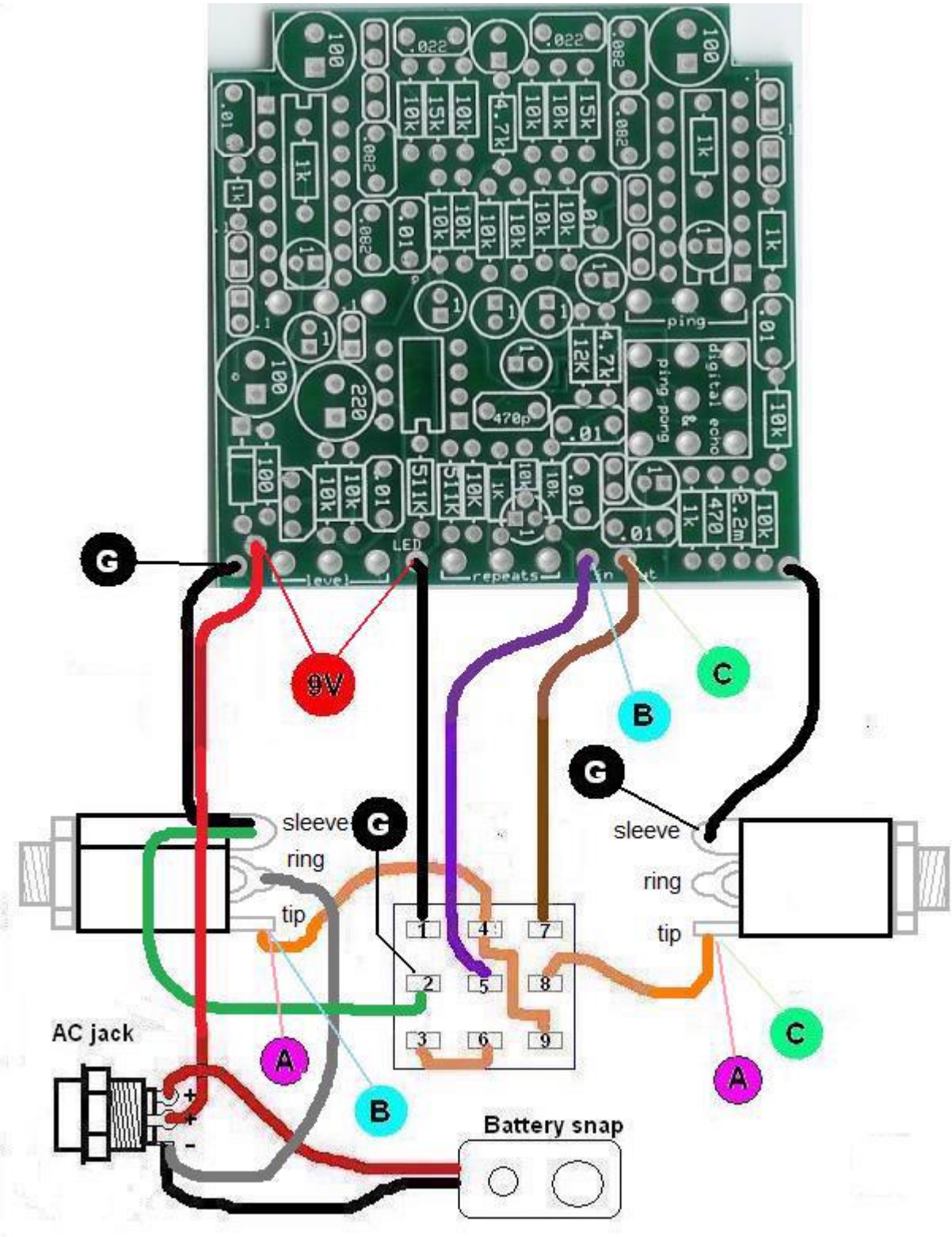
***If you do not get continuity between lugs 8 and 9 and you are certain that the footswitch is in the bypass state, then you likely have a faulty footswitch.**

3. BYPASS WORKS, BUT THE EFFECT DOES NOT: This could be any number of problems located on the PBC, but let's check your offboard wiring first and make sure that you are getting signal to and from the PCB to rule that problem out. Set your DMM to test for continuity. Make sure your footswitch is in the "ENGAGED" state. You should get continuity between the two "B" locations and between the two "C" locations. If you do not get continuity between the "B" locations, check for continuity between lugs 4 and 5. If you do not get continuity between the "C" locations, check for continuity between lugs 7 and 8,

***If you get continuity between lugs 4 and 5, but no continuity between the "B" locations, then you likely have a bad solder joint along the purple wire.**

***If you get continuity between lugs 7 and 8, but no continuity between the "C" locations, then you likely have a bad solder joint along the brown wire.**

***If you don't get continuity between lugs 4 and 5, or lugs 7 and 8, and you are certain that your footswitch is in the engaged state, then you likely have a faulty footswitch.**

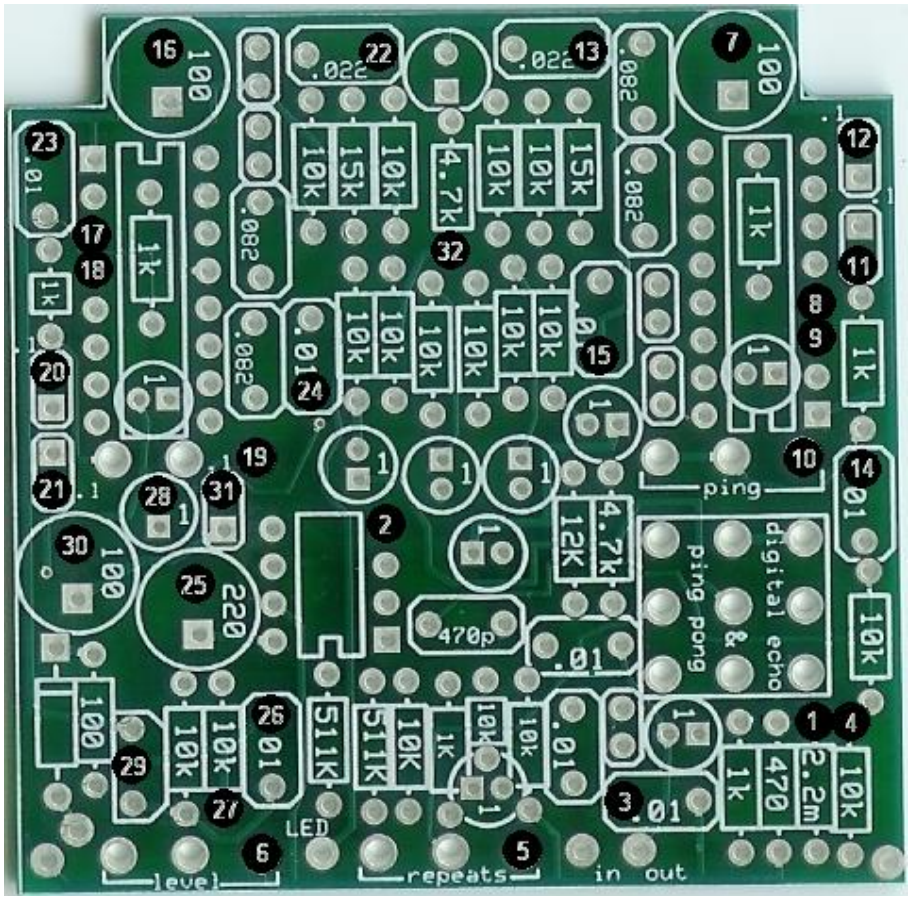

G
9V
C
B
G
sleeve
ring
tip
G
sleeve
ring
tip
1
4
7
2
5
8
3
6
9
AC jack
A
B
C
A
+
+
-
Battery snap

Checking your PCB

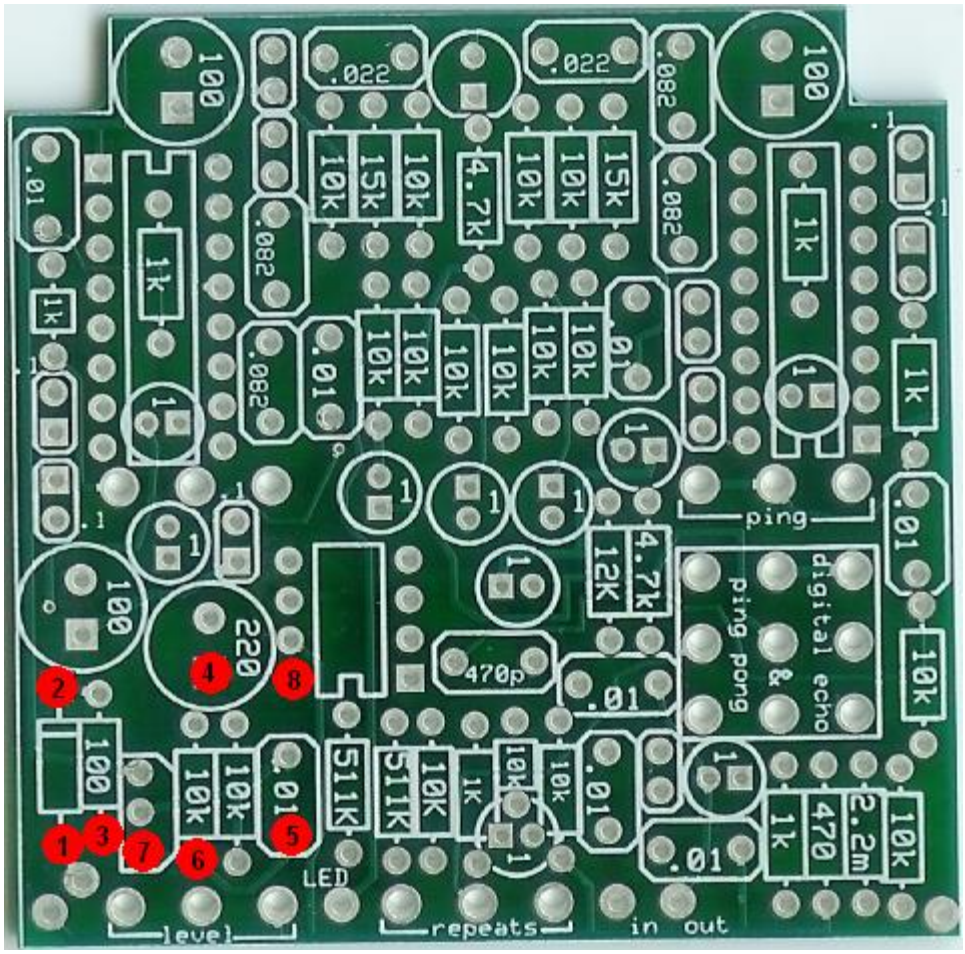
Ok....So Now you know bypass is working, signal is getting to and from the PCB, and that the PCB also has a connection to +9V and ground. If you're still haveing trouble, it's time to check your work on the PCB. Keep in mind that the PCB is simply a means of connecting one component or wire to another component or wire. So when you touch your probe to the test location, you want to touch the probe to the exposed component or wire lead at that location and not to the PCB solder pad if possible. If you are testing these various locations by touching the probe to a solder joint, then you must be certain that the solder joint is sound.

USE A 9V POWER SUPPLY AND SET THE DELAY FOR NORMAL ECHO MODE, NOT PINGPONG. ALL VOLTAGE READINGS WILL BE IN DC, NOT AC.

1. Check all ground connections. Set your DMM to test for continuity. Touch one probe to the sleeve of either jack and touch the other probe to the various "BLACK" test locations on the PCB.

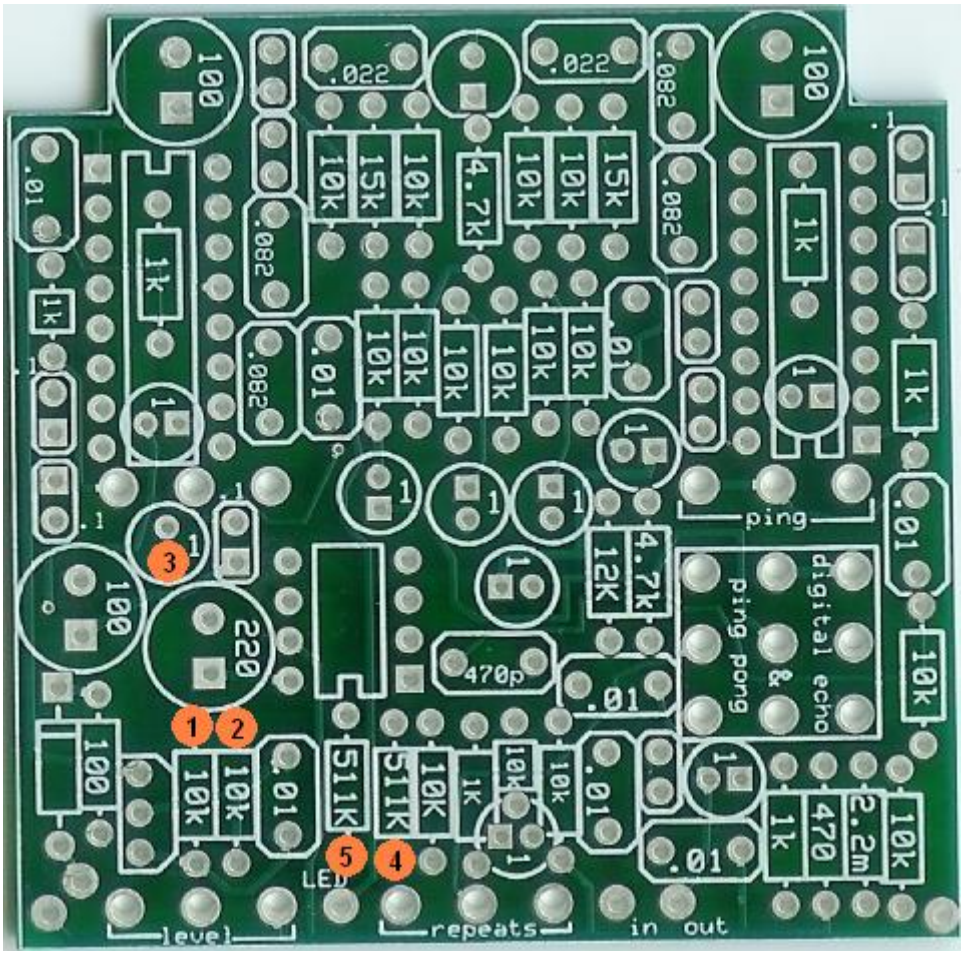


2. Check all Full Positive Voltage connections. The term "Full Positive Voltage" is used, because after D1 and R33, the voltage will be slightly diminished. Your positive voltage may be 9V at "RED" location 1, but drop to 8.5V at location 2, and then drop again to 8.2V at location 3. This is to be expected. But "RED" locations 3 - 8 should all remain constant and should be somewhere between 9V and 8V if you are using a 9V power supply. Set your DMM to test for 9VDC. Touch the black probe to the sleeve of either jack. Touch the red probe to the various "RED" test locations on the PCB.



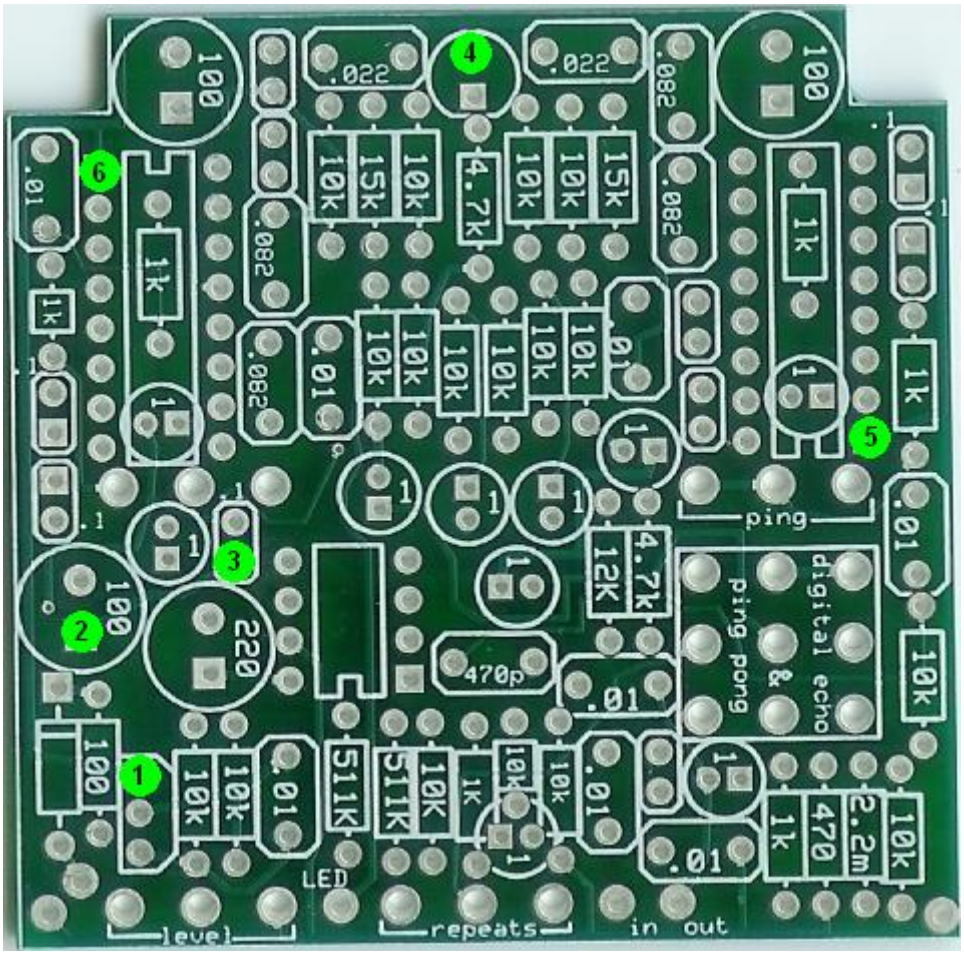
3. Test all Half Positive Voltage "ORANGE" locations. This reading should be approx. half of what your Full Positive Voltage is after RED3. 4.5V to 4V is to be expected. Set

your DMM to read 5VDC. Touch the black probe to the sleeve of either jack. Touch the red probe to the various "ORANGE" test locations on the PCB.



4. Test the Regulated 5V power supply. This is the power supply provide by the 78L05. 5 volt regulator. Touch the black probe to ground. Touch the red probe to the various

GREEN locations. They should all be approximately 5V.

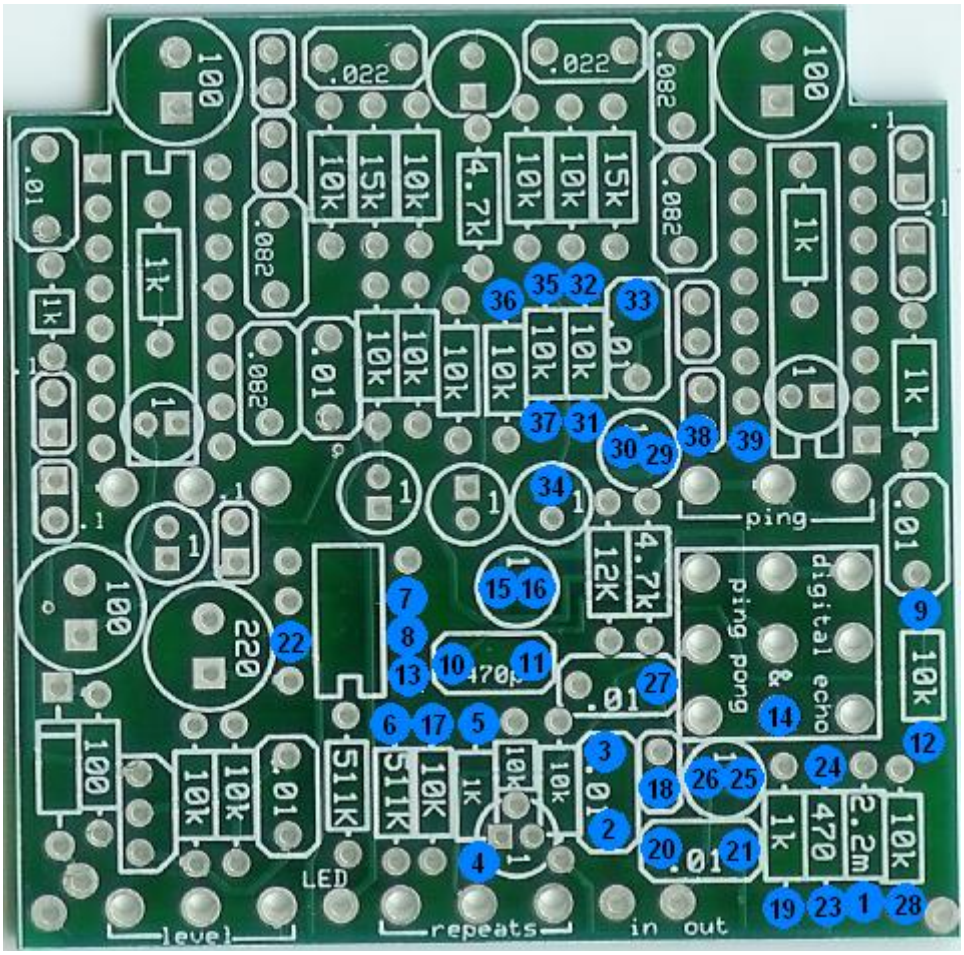


5. Test the dry audio signal path. Do this using a Signal Test Probe. If you look at the schematic, you'll see that “BLUE” locations 1 - 28 make up your direct dry audio signal

path in order between the INPUT of the circuit and the OUTPUT of the circuit. If you are getting no sound at all when the pedal is engaged, then this is the first place you need to look. First know the what the terms “wet” and “dry” mean and the difference between the two. Dry signal is your unaffected signal. Do not confuse this with your bypass signal. Dry signal is the guitar signal that passes through the input and output buffer circuits without changing the original tone at all(but the buffers may add or cut a very small amount of high frequency). Wet signal, is where the dry signal gets split after the input buffer and is sent to actual delay circuit.

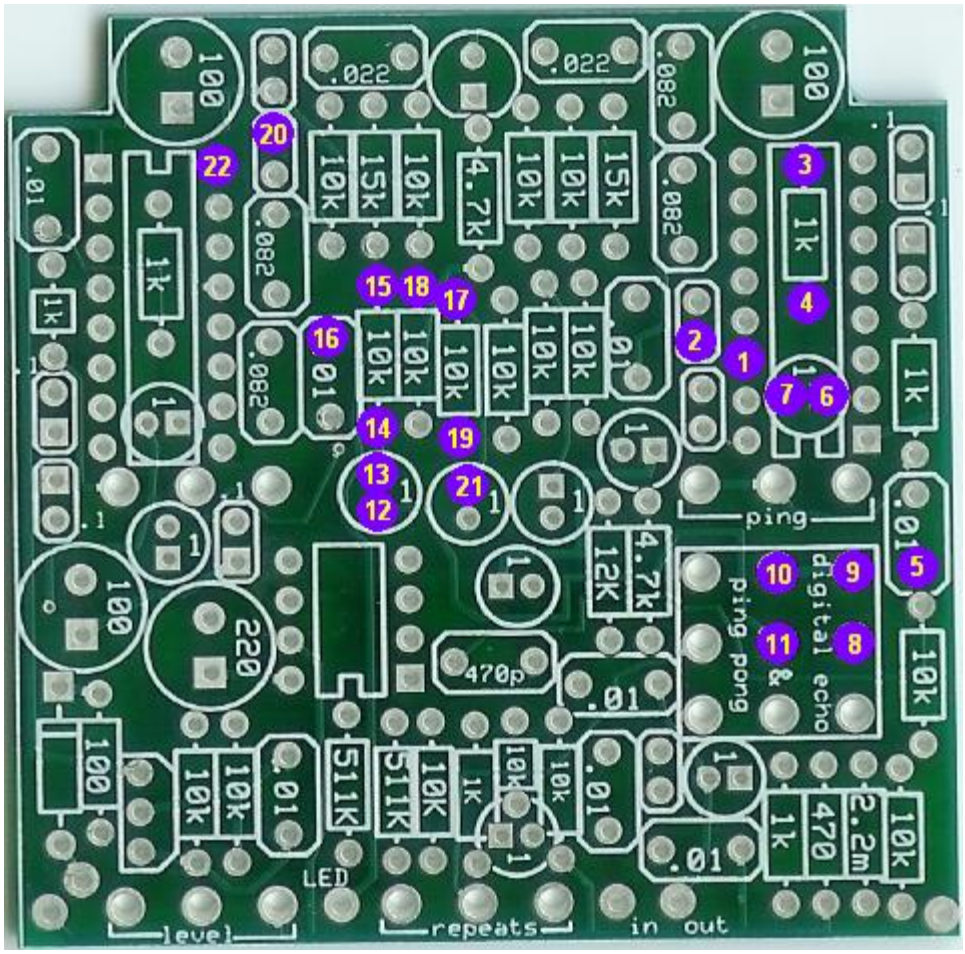
Your wet and dry signals are mixed back together at R5/R6, so when your delay is working properly, you should here both wet and dry signals at BLUE18 - 28. You will not hear any signal at any of the components that make contact with PIN6 of the ouput buffer op amp because of the nature of an inverting voltage gain configuration. You can check your work at these points by testing for continuity between the unlabelled ends of R5, 6, 10, 11 and C6 to PIN6.

BLUE29 - 38 is where your dry signal is splits after the input buffer and travels to the input of the first delay chip at PIN16 of the “ping” PT2399.



6. Test the wet signal path A with the signal test probe. PURPLE 1 - 22 is signal path of the wet delayed signal from the output of the first delay chip to the input of the second

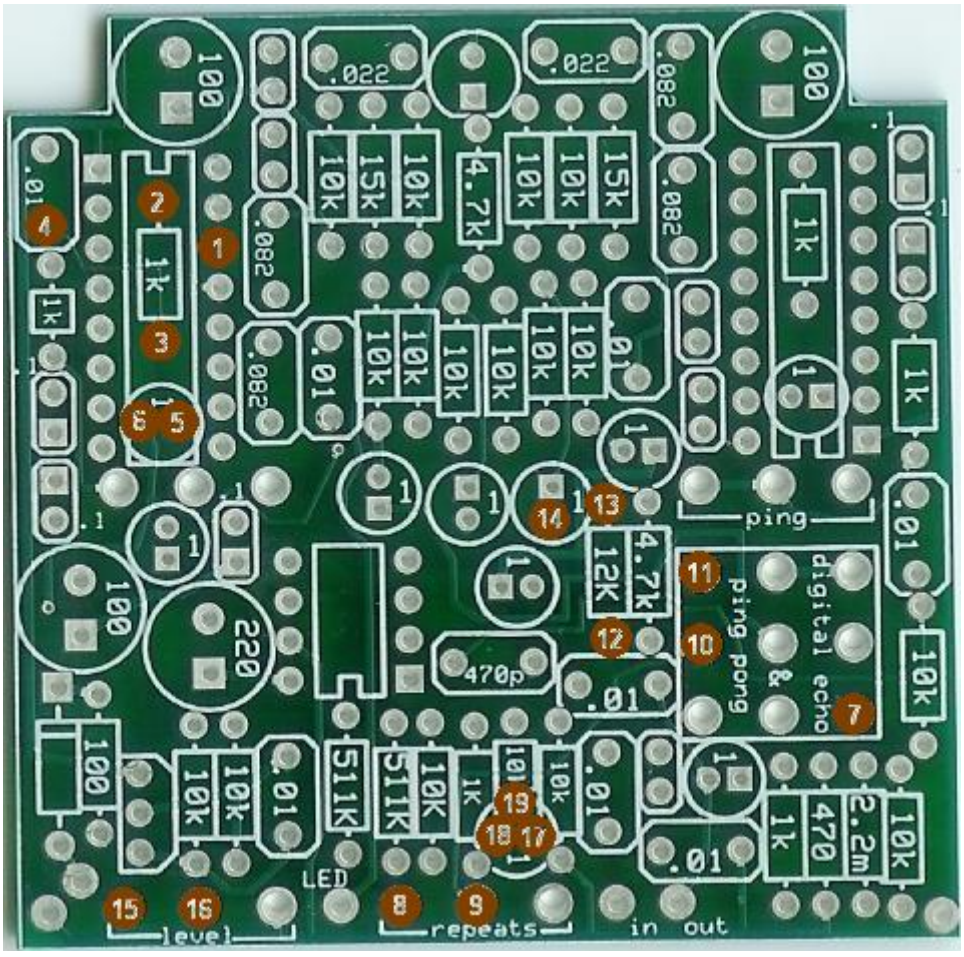
when the pedal is in normal echo mode, not pingpong mode. If the first delay chip is receiving dry signal to PIN16, but is not producing a delayed signal at PIN14, then there is a problem with the chip. Make sure it's oriented correctly.



7. Test the **wet signal path B** with the signal test probe. BROWN 1 - 19 is the signal

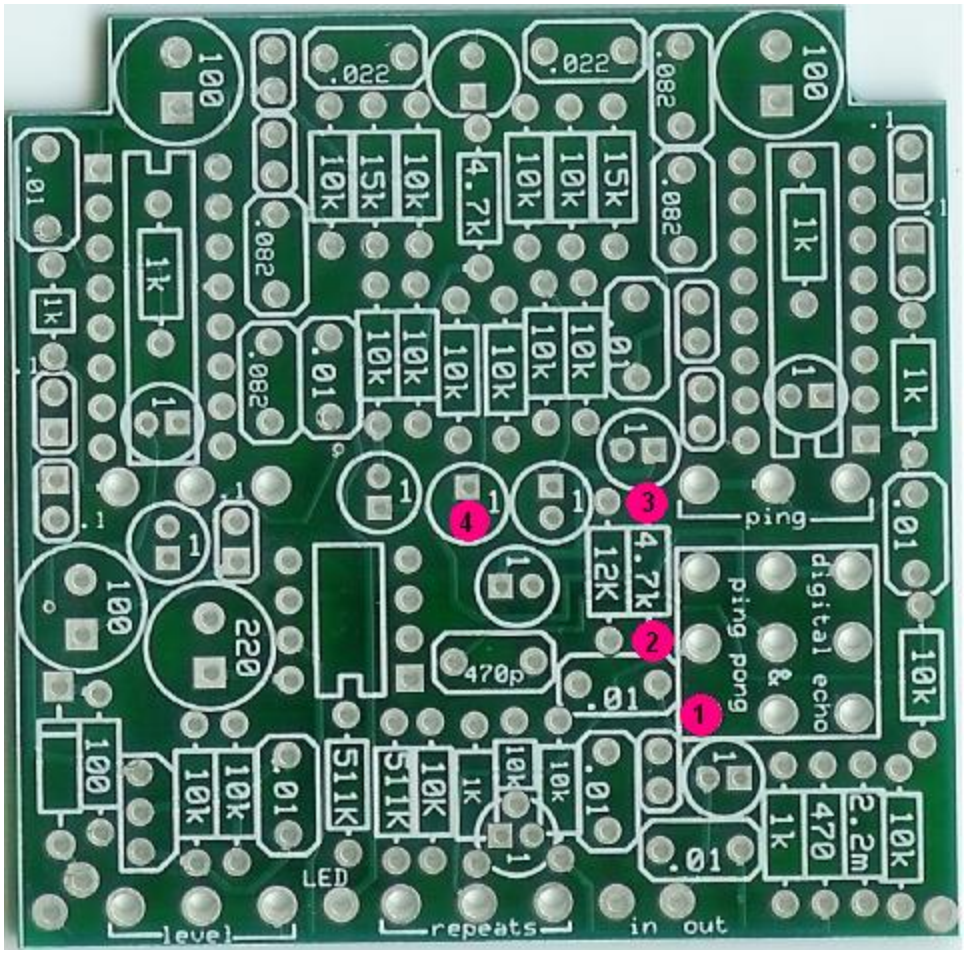
path of the wet delayed signal from the output of the second delay chip to the R5/R6 junction where the wet and dry signals are mixed together before entering the output buffer when the pedal is in normal echo mode, not pingpong mode. If the second delay chip is receiving wet signal A at PIN16, but is not producing a further delayed signal(delay time at output of chip B should be more than the delay time at the output of chip A) at PIN14, then there is a problem with the chip. Make sure it's oriented correctly.

IF YOU ARE ONLY GETTING ONE REPEAT WHEN IN NORMAL ECHO MODE: Check BROWN 8 - 14. This is the feed backloop. The repeats knob is essentially a volume knob within the feedback loop. It cuts the wet signal that goes back to the input of the delay circuit. Each repeat that gets reduced in volume a little everytime it passes through the feedback loop until there is no more signal left. Turning it down counter clockwise cuts more signal, so the repeats decay faster. Turing all the way counter clockwise allows no wet signal to feedback into the delay circuit, so you will only hear one "slapback" repeat. Turning the repeats knob up clockwise cuts less signal so the repeats will last longer. The wet delay signal of the delay chip is actually stronger than the unity gain dry signal, so when you turn the repeats knob all the way up and cut no wet signal, the wet signal will actually become amplified a litte more each time it passes through the feedback loop. This is what creates self-oscillation.



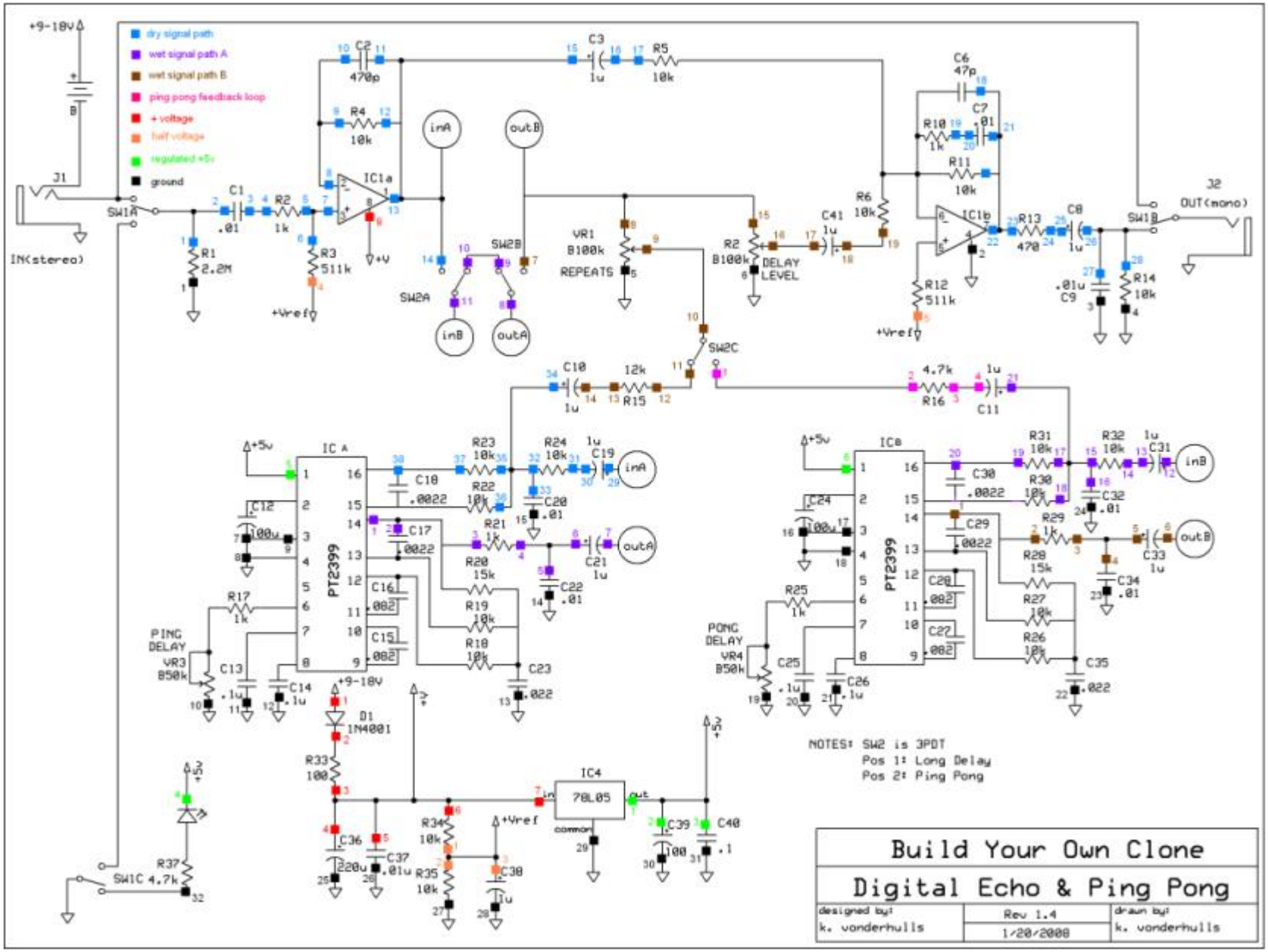
8. If everything else on your pedal is working, but you are only getting one repeat when in pingpong mode, test for audio signal at PINK 1 - 4. This is the pingpong feedback

loop. The concept is exactly as the normal echo mode feedback loop just discussed in step 7, but the outputs of both chip A and Chip B are being looped back in parallel into the input of chip B rather than the output of A and B in series being looped back into A.



click here to download extra large image of colormap/schematic

©2008 byoc, LLC


dry signal path
wet signal path A
wet signal path B
ping pong feedback loop
+ voltage
half voltage
regulated +5v
ground
+9-18V
J1
IN(stereo)
SW1A
SW1B
J2
OUT(mono)
IC1a
IC1b
inA
outB
inB
outA
SW2A
SW2B
SW2C
VR1 B100k
REPEATS
R2 B100k
DELAY LEVEL
+Vref
IC A
IC B
PT2399
PING DELAY
VR3 B50k
PONG DELAY
VR4 B50k
D1 1N4001
IC4
78L05
SW1C 4.7k
NOTES: SW2 is 3PDT
Pos 1: Long Delay
Pos 2: Ping Pong
Build Your Own Clone
Digital Echo & Ping Pong
designed by: k. vonderhulls
Rev 1.4
1/20/2008
drawn by: k. vonderhulls