Quick and Dirty Piezo Preamps

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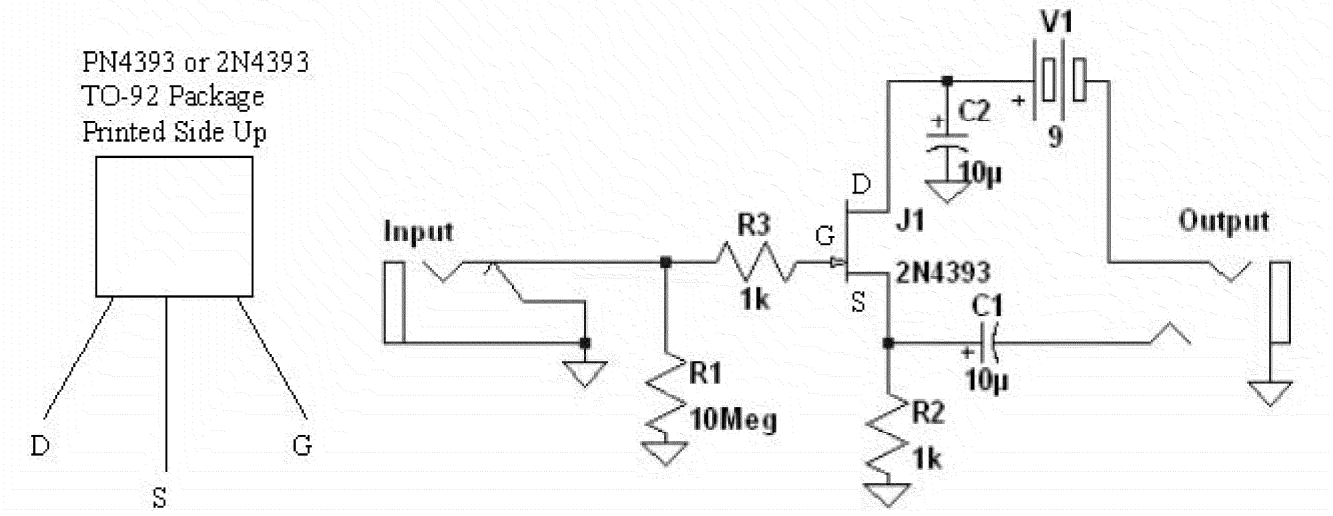
A number of people on the TalkBass forum have discussed building a homemade preamp, so I decided to share my designs. The first one (click here) was pretty elaborate, with multiple inputs, tone controls, and the works. It requires a printed circuit board, and is definitely an "advanced" electronics project.

At the other end of the spectrum is this little gadget, a simple preamp for piezo pickups. I literally wanted something so simple that it would not be worth the bother to design a printed circuit board, and it had to be "photogenic" so a beginner could hook it up by looking at the picture. First, the schematic:



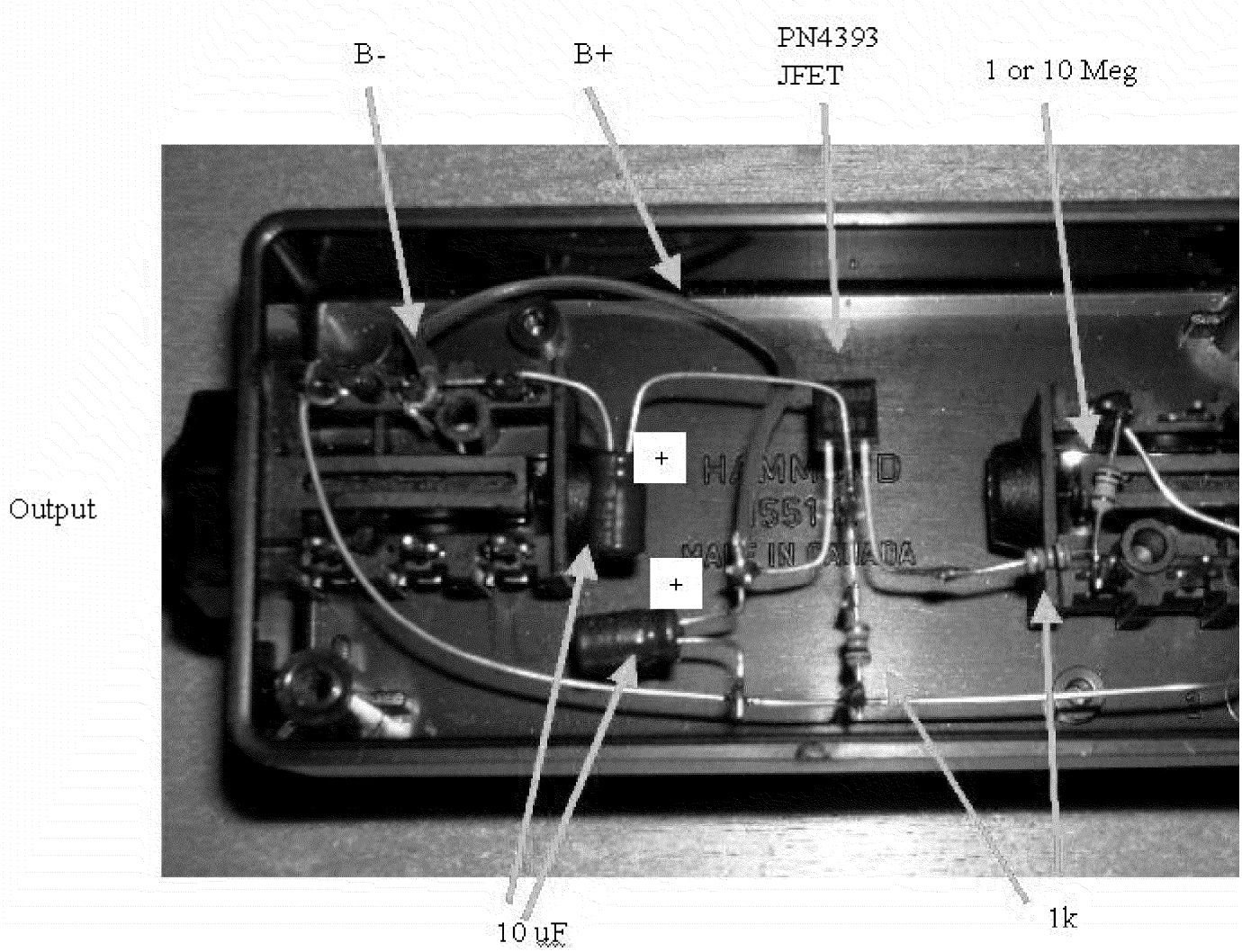
You can see there's not much to it. The 2N4393 (or PN4393) is a low noise JFET, wired as a source follower. The biasing of the JFET is such that no input blocking capacitor is needed, though I would caution against using the preamp for anything but a piezo pickup. R1 sets the input impedance. R3 protects the JFET from damage in case of temporary overloads. The output passes through blocking capacitor C1 to the "tip" terminal of a TRS phone jack. The "ring" terminal is grounded when you insert a 2-conductor plug, applying power to the circuit. This power switching technique is as old as the hills, and is still used on guitar stomp boxes.

Update: 2N5486 looks like a better candidate for the JFET, offering more dynamic range.

The circuit operates at a relatively high drain current (around 1 mA), resulting in "studio quality" noise performance. Indeed, this preamp will generate less noise than the input electronics of practically any mainstream bass amp. Gain is 0 dB, because in my experience, piezo pickups have fairly high output, and we don't want to saturate the front end of the bass amp. With a 9-V 500-mAh battery, you should get hundreds

of hours of battery life. The maximum input level is somewhere around 2 V peak-to-peak.

Now for the construction detail. I hooked this up so that it could be easily photographed:



That's it. What you don't see is the battery holder, which is underneath the box. Power comes in via the brown and red wires. You could just use a standard battery snap instead (red = +), and hold the battery on with a rubber band or velcro strap. Observe the polarity of the capacitors. Typically, the "minus" lead is marked on the case, and the "plus" lead is noticeably longer.

On the input jack, you can see where I wired the input resistor, over to the switching terminal of the jack. As a result, the input gets shorted out when there is nothing plugged in. It helps to minimize any possible "pop" if the input is accidentally disconnected.

I can now report that a few TalkBass participants have built the preamp, and have indicated good results. Typical comments are that my preamp doesn't sound any better than the preamps built into high-end bass amps -- as expected -- but does help with amps that were not originally designed for piezo pickups.

Parts List

My supplier of choice these days is Mouser Electronics (www.mouser.com). The pickup element is listed, because it is described by another TalkBass member.

Description	**Part Number:**	**Price**:
1/4" slim line phone jacks (2)	550-20311	0.48
10 uF electrolytic capacitors (2)	647-UVR1C100MDD	0.18
1k resistors (2)	270-1k	0.011
10M resistor	299-10M	0.08
PN4393 JFET, TO-92 case	781-PN4393	0.48
Box	546-1551KBK	1.24
Battery snap	123-5004	0.36
Piezo pickup element (2)	824-LDT0-028K/L	0.75
Nut for jacks (2)	550-1005	0.12

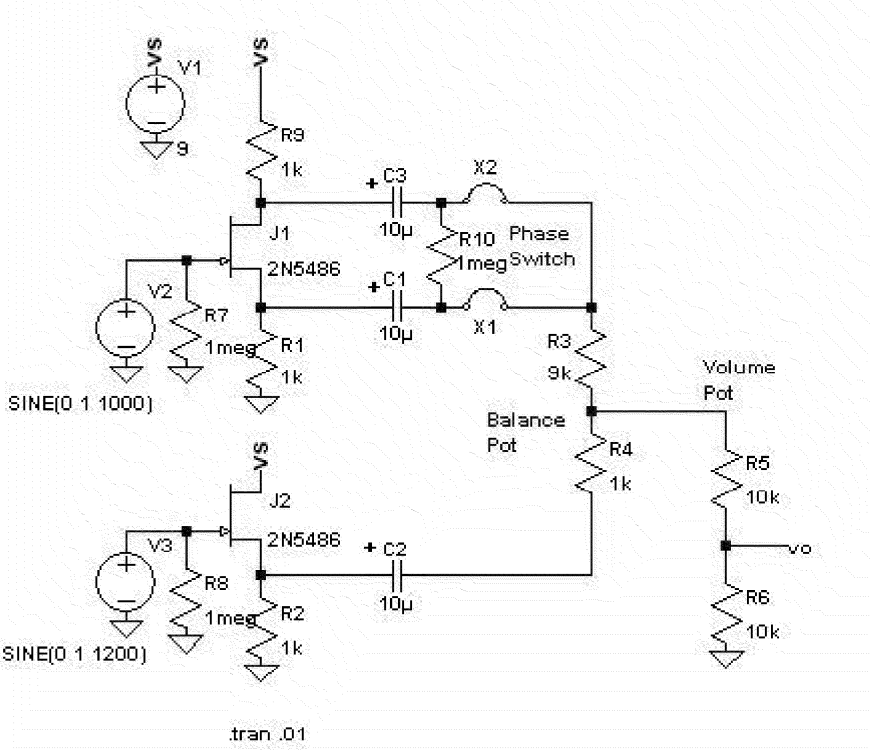
Warning

This circuit is only intended for use in a safe low-voltage environment. I am not an electrical engineer, and cannot guarantee the safety or reliability of these circuits.

Dual Channel Mix Preamp With Phase Switch -- Untested

Now this is getting insane. It has two input channels. X1 / X2 is a SPDT switch for selecting the phase of one channel. R10 merely prevents a "pop" when you flip the switch. The pot values are forgiving. We are almost getting to the point where an op amp circuit would have higher performance and fewer components. You can use the same power switching scheme as shown above. I did not show a 10 uF decoupling capactitor from Vs to ground, but you should use one.

Correction: R10 should be 100k to avoid a "pop" when flipping the phase switch.



PPPP -- Phantom Powered Piezo Preamp -- Tested

And for the ultimate in insanity, a preamp that runs on standard phantom power. This is typically 48 V sourced to both sides of an XLR jack through matched 6.8k resistors. On the preamp side, a classic phase inverter circuit produces a balanced low-impedance output. If your phantom power is 15 V, consider reducing R3 and R4 to somewhere around 6.8k. I did not show the XLR cable with a ground, which must be connected.