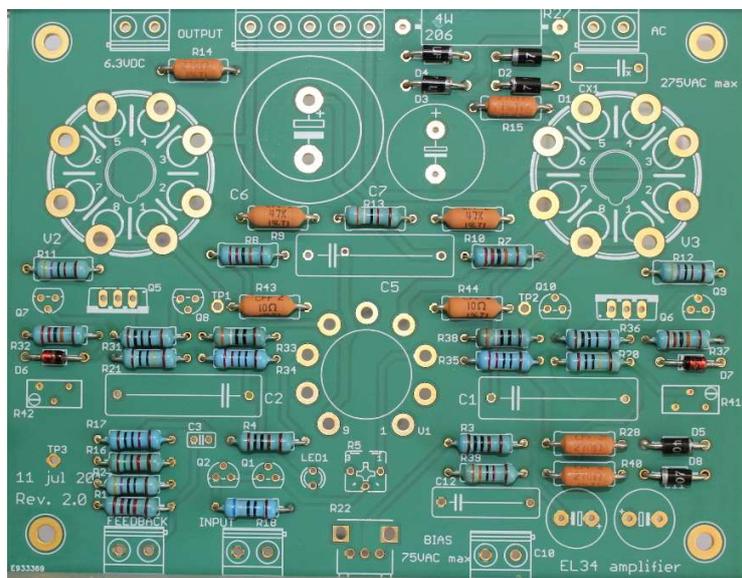


# How to build the amplifier

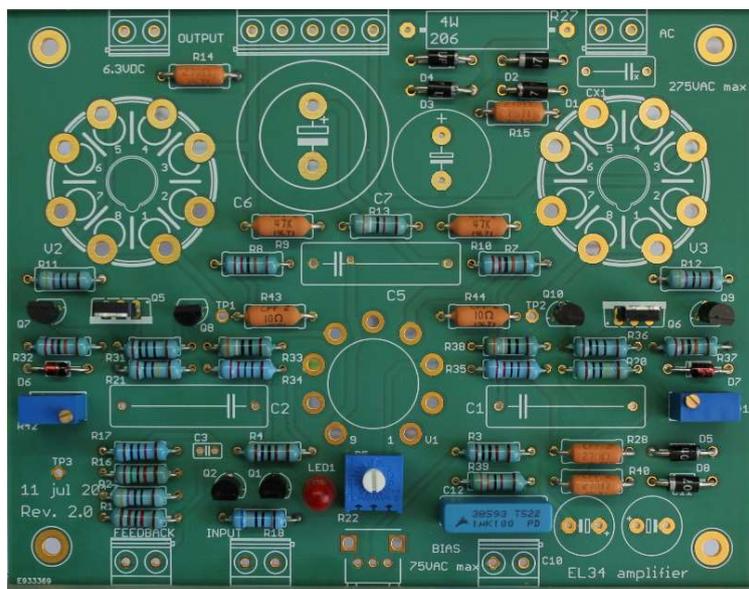
January 27, 2018

First, you need to check carefully all components since the PCB is made in double side with plated through holes, it is very difficult to remove components by desoldering in case of mistake!

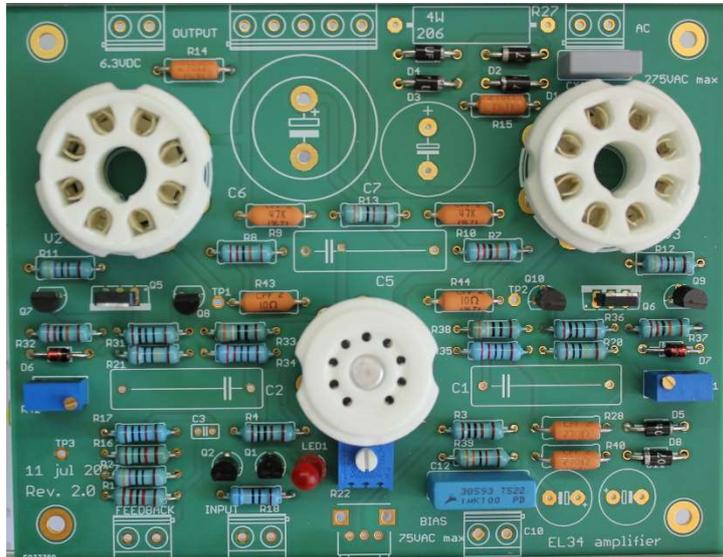
To set all part without problem, you must start with smaller ones, and later solder the bigger ones. First we will place small resistors and the little diodes. WARNING, when fitting the diodes, take care of the orientation, the line indicating the cathode must be on the side indicated on the serigraph, you can also check with the photo below:



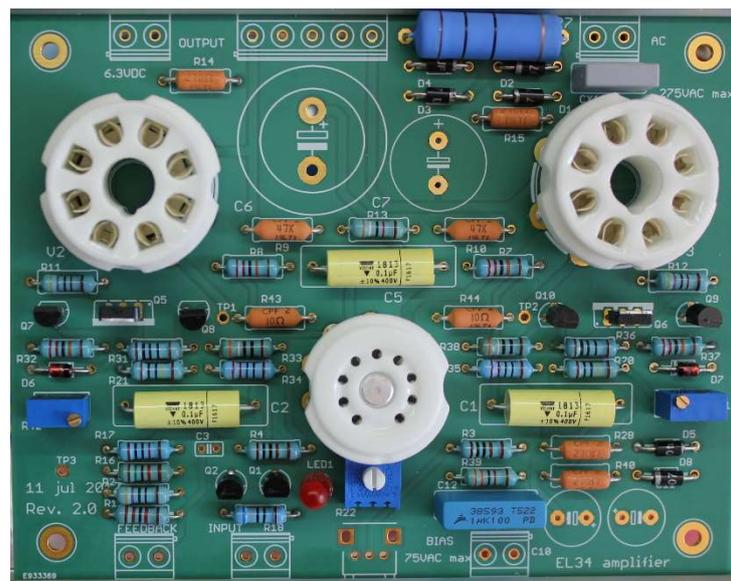
After you will place transistors, trimmers, and the LED. Again be careful with the polarity of the LED, the longer lead is for the anode and the flat side package indicate the cathode!



Next, we will put the tubes sockets and the small capacitors. During the socket soldering be careful to warm up the contact enough to fill completely the holes because the sockets must handle strong effort when the tubes are inserted and even more when they are removed, therefore they must be strongly soldered!



After you must install the larger parts which can still goes on the top side of the PCB (however in some case these components can also be mounted on the bottom side), these are the inter-stages and decoupling film capacitors as well as the power resistor. You must check carefully that the height of these parts will not exceed the available distance between the PCB and the top plate of the amplifier.



Finally it is possible to place the components that are too big to fit on the top side, mainly the electrolytic capacitor, **WARNING** again be careful with the polarity of these devices, the white

band indicate the negative side!!! We will also solder the connector, or the wires directly if we do not plan modifications or other test later.

The volume potentiometer is optional, if the amplifier should be used with a preamplifier it can be used as an input trimmer but if we want to make an integrated amplifier it is possible to use a stereo potentiometer on the front panel and to connect it to the PCB with shielded wires in the potentiometer holes.

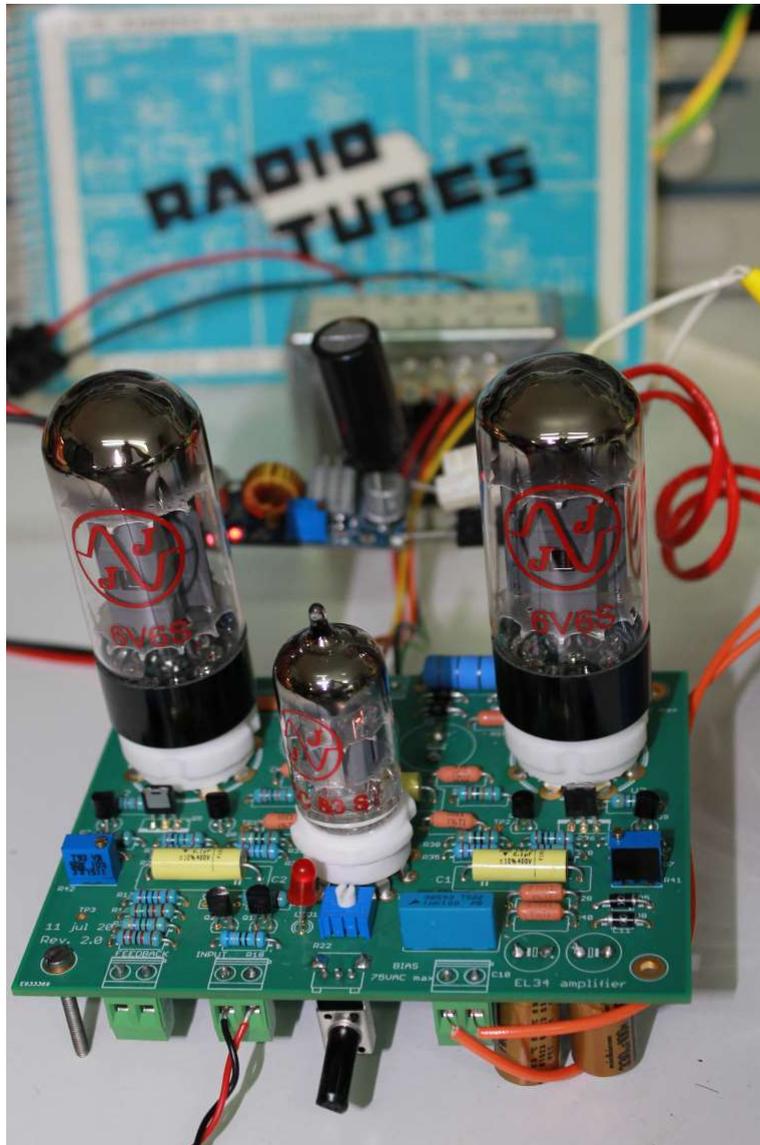
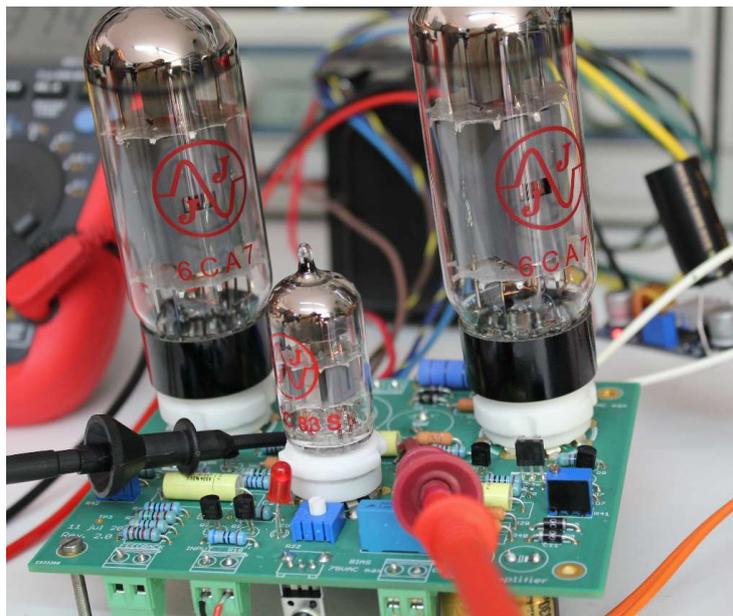


Photo of a finished amplifier channel with 6V6S tubes from JJ TESLA and a 5 A switching power supply module bought on eBay for the heater 6.3 V DC



Photo of a finished amplifier channel with old EL34 tubes, a Hammond 1650N output transformer, impedance = 4,3 k ohms, power = 60 W and a 230 V AC / 6.3 V 10 A switching power supply (enough for two channel, recommended solution)



Another photo of a finished amplifier channel with 6CA7 tubes from JJ TESLA, the Hammond 1650N output transformer and the 5 A switching power supply module

When the assembly is finished, you must check that all connections are correctly made and that there is no short circuit ! You have to be careful when using PCB instead of point to point wiring because parts are much more closer and it is much more difficult (even impossible some times) to modify the wiring !

# Powering up!

WARNING when powering up the tubes amplifier, you should remember that there is high voltage of several hundred of volt that can be lethal...

**DO NOT ATTEND TO TEST THIS AMPLIFIER IF YOU HAVE NOT ENOUGH EXPERIENCE OF WORKING WITH ELECTRONIC CIRCUIT USING VOLTAGE OF 400 VOLT!!!**

To begin the test, it is better to use an auto-transformer or a transformer with a lower voltage rating like 115 V AC which will facilitate first checking with lower power dissipation before to switch to the final working voltage. This amplifier include already a diodes bridge and a C-R-C filter cell for the high voltage input, therefor it can be directly powered with the AC output of a power transformer but the voltage should not exceed the value recommended by the tubes manufacturer and never exceed 275 V AC ( $275 \times 1,4 = 385$  V DC peak) with the recommended 400 V electrolytic capacitors which are specified at 400 V DC max... This transformer must supply 150 to 200 mA for a 6V6 version and 300 to 400 mA for 6CA7 or EL34 version.



You will also need an other power supply for the MOSFET driver stage and the negative bias of the output tubes, typically a small 10 W transformer with a voltage between 48 and 65 V and 50 mA current will be enough. Again the amplifier include the rectifiers and filters on board.

Last but not the least, heaters must be powered with 6.3 V... It is better to use DC supply to avoid all hum at 50 Hz (or 60 Hz), however if you are using an AC power supply there will be no damage for the amplifier. Beware that the output tube are consuming a lot depending of which ones are used it can go up to 1.6 A per tube, that mean nearly 7 A (including input tubes) for a stereo amplifier !!! On my amplifier I am using a small switching power supply directly connected to the main.

# Set up the amplifier!

To adjust the amplifier you will need at least a good multi-meter, if possible with auto-ranging, switched on voltmeter mode and the right sensibility depending on the test, it is always better to start with the highest range of the equipment like 600 to 1000 V (if the meter have no auto-ranging feature).

1. Connect the meter with the range 1000 V DC\* to the leads of C5, check the DC high voltage, you should read + or - 250 to 385 V depending of your transformer and the side of the capacitor where the where the red and black probe are connected.
2. Connect the **black negative probe on TP3** (Test Point 3 = GND = 0 V) and the **red positive probe on TP1** (Test Point 1 = V2 cathode), check cathode voltage of V2 with the meter on range 20 V DC\* first and 2 V DC\* later for a better precision. Now you have to adjust the trimmer **R41** (bias V2) to read the voltage on the resistor connected between the output tube and the GND, since we have a 10 ohms resistor the voltage will indicate 10 times the tube current (by example a voltage of 600 mV will indicate a current of 60 mA). You must adjust the trimmer in relation with the specifications of the output tubes and the level of bias that you like for a class AB push-pull. Remember that if the output current is higher, the consumption and the temperature of the amplifier will increase significantly, moreover, the tubes life will be reduced! Depending of the output tubes, a bias between 30 mA and 60 mA is reasonable...
3. Make the same procedure for V3 by connecting the red probe on TP2 (Test Point 2 = V3 cathode) and adjust the trimmer **R42** (bias V3) like before... As you may have understood the trimmers are on the opposed side of the test points and the adjusted tube!!! It is my only mistake on the routing, but finally it is easier to have one hand on each side :)
4. Connect the meter probes to the leads of C1 and C2 which are connected to the plates of the 12AX7 / ECC83 input tube (the lead close to C1 and C2 serigraph near the socket) and check the voltage on range 20 V DC\*, you need to adjust R5 to have the same current in both side of the differential amplifier and the same voltage on both anodes, therefor you should read a value close or equal to 0 V DC. It is also possible to check the voltage of these plates by plugin the black probe to the GND (TP3 by example) and the red probe on C1 or C2 leads (range 600 V DC or 200 V DC\*), normally you must read between 150 V and 200 V DC depending of your high voltage level.

\* recommended setting for manual meter without auto-ranging

At this point, if everything's has been correctly checked, you should be able to enjoy the very pleasant sound of this amplifier, probably because of the vacuum tubes and the absence of global feedback due to the specific architecture of the Baby-Huey concept. In case of instability, what I have never seen with UL transformer, but can happen when using output transformer without UL connections, it is possible to use the feedback input from the secondary of the transformer.

Now, you only need to make a nice enclosure for your new amplifier...

Marc Marinello