AQUAVITE

A new hybrid idea on the design of a head-phone-amp

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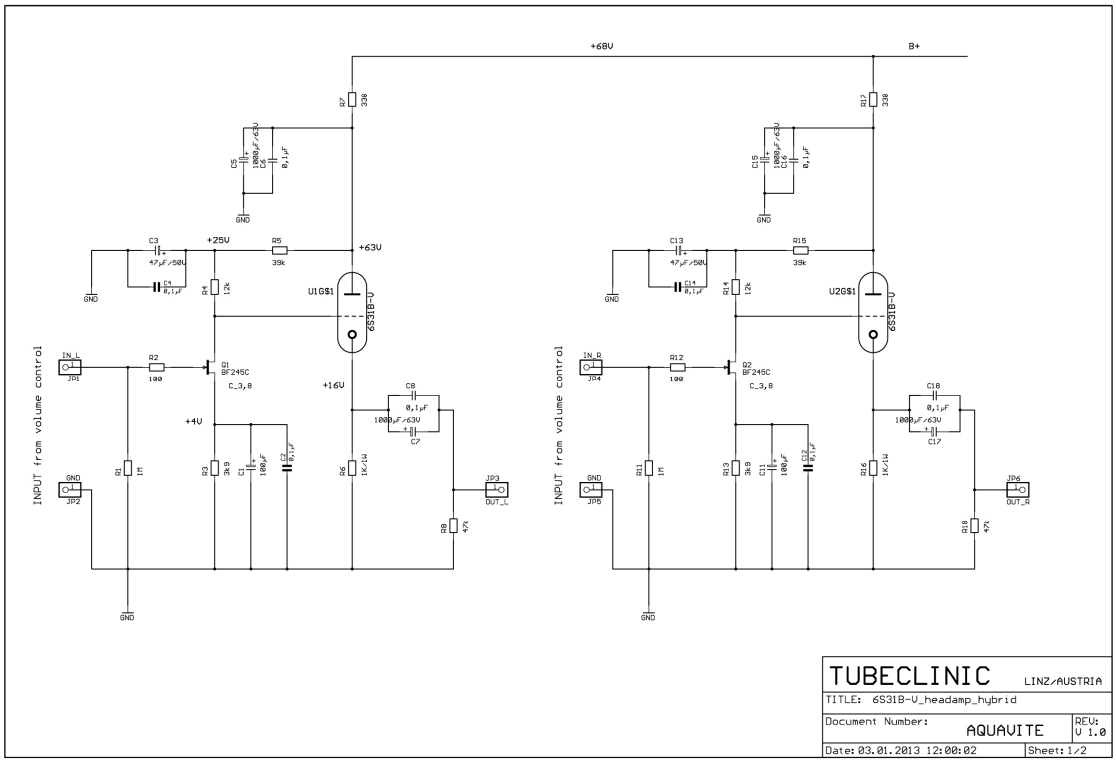
This design was made to show the benefits of a hybrid circuit,
utilizing the benefits of JFET and tube as well.
*I also introduce a real masterpiece of a triode - the Russian subminiature **6S31B-V**.*

The *"AquaVite"* is the attempt to realize a simple to build but fine sounding headphone-amp, intended for feeding classic dynamic headphones showing app. 600Ω impedance. Clearly, it had to be a tube-design after having done experiments with combinations from JFET and MOSFET alike my FETishizator circuit, which did not show the "magic" of a triode's sound. These designs are good, but there was something of this little difference, that makes a superb hybrid design better than anything else you could build …

As for the headphone, I used my K180 from AKG, of which I believe it is one of the best ever manufactured. I compared the final headphone-amp design to my 845-SET too and there was some difference in "magic", this "neat" Russian triode delivered – when compared to other triodes. My tests included E88CC, 6DJ8, 6SN7GT, ECC82 and even an EL84 in triode mode. No one of them was able to compete with the 6S31B-V.

Have a look at the schematic:



You can see, that the initial amplification is done by a JFET (BF245C_3,8 according to my classification). That means that all voltage gain derives from only one solid-state element. The power comes from the triode, which is hard coupled by its grid to the drain of the JFET. The configuration is a cathode follower, showing app. 15mA of quiescent current drain. Altogether, this is a pure “class A” design.

As we know, JFETs produce a beautifully detailed sound-pattern but they lack in driving capabilities. Their best sounding drain current value is close around 1mA, so they cannot drive a heavy load. The triode itself will load the JFET only to a very low extent, mainly by its grid capacitance only. This again will diminish somewhat of the JFETs crispy sound, which all-in-all leads to an absolutely brilliant and detailed performance. It shows low undistorted bass, glittering highs as well as no coloring or peaky behavior in between. All instruments and voices can be detected in their place, leaving air around them like you would expect when compared to a live situation of a purely acoustical performance.

Function:

As shown above, all the gain comes from the JFET. Due to the characteristics of a JFET, it will only give K2 (first harmonic, twice the frequency of the basic wave) in its output signal, when overdriven. To do not so, a device with an Ugs of -3,8V was chosen. Although K2 will rise with output voltage, during “normal” operation it will keep THD figures to very small values. Since any BF245 will only stand a drain voltage (Ud) of 30VDC max., I feed it via a resistive divider (39k). Because of this configuration odd order harmonics will not appear.

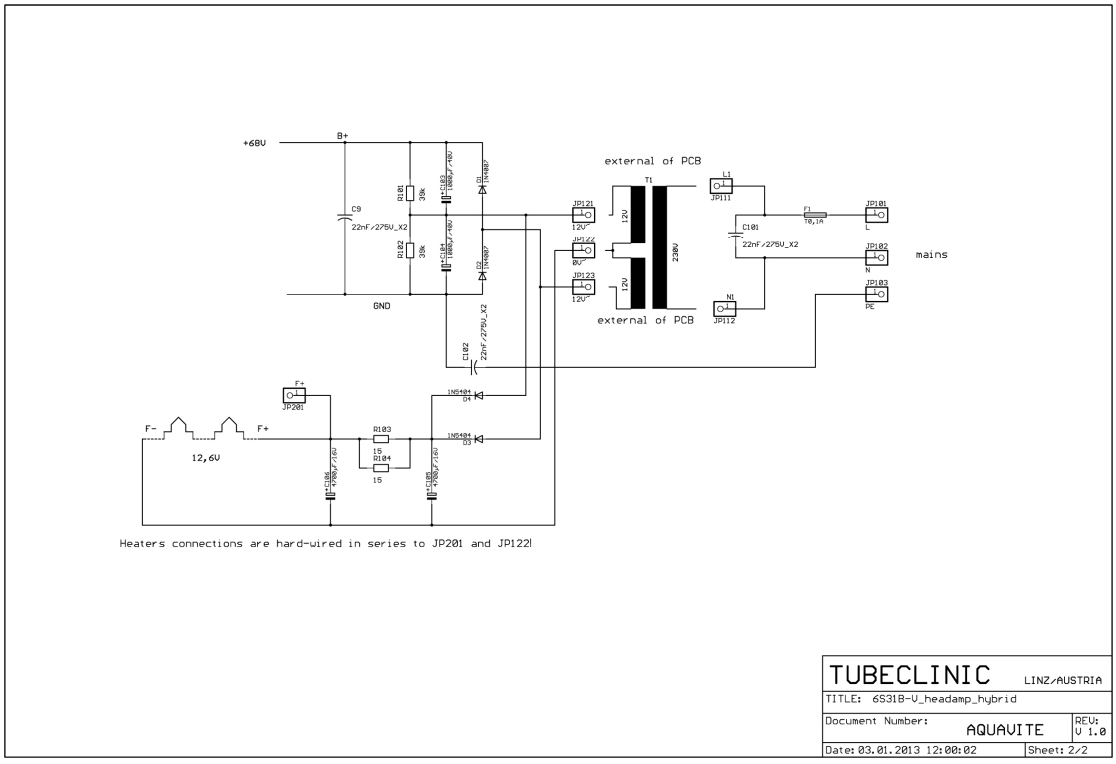
The subminiature power triode (6S31B-V) is connected directly by its grid to the drain of the JFET. This type of triode will serve marvelous at relatively low plate voltages. A look

into its datasheet shows an operating point of Ua = 50V and Ia = 40mA together with gm = 18mA/V and μ = 17. This fact makes it a perfect output device for our headphone-amp. The shown cathode follower configuration does not have any gain (tested app. 0,94x), so the signal at the drain of the JFET will nearly appear at the cathode of the tube as it was. Committed, since the designated load of the tube should be approximately 600 ohms, the quiescent current of 15mA is big, but doing so will not only make it possible to drive lower impedance headphones also, but as well increase precision for the 600 ohms items.

The headphone-amp is intended to be situated in between the pre- and the power-amp. Only install two RCA-jacks in parallel per channel to feed the signal through the head-amp. If you find it necessary to adapt the volume, due to a large output signal from the pre-amp, you should consider a 2x 500k ohms stereo potentiometer with Audio taper (i.e. ALPS blue) in front of the circuitry or solve the issue by using a resistor divider instead of the pot.

The power supply:

As written above, this certain triode was chosen for its fine properties at lower plate voltage. Therefore, the supply voltage could stay relatively small. I used a standard PCB-transformer (2x 12V/16VA) from the market, which would serve for the B+ as well as for the heater supply. The transformer is not on the enclosed PCB because of its weight and size. It has to be mounted elsewhere within the housing. Please twist all three pairs of AC-wires thoroughly to keep interference low.



The B+ - supply is won via voltage doublers from the 2x 12VAC (24VAC) giving app. +68VDC, while the heater supply is done via a full-wave rectifier, giving the needed +12,6V. Half of the B+ voltage relate both supplies, so the heater supply's negative is set to an exact level of +34VDC. This is a fine solution, because the cathode of the triode is also at

app. +15VDC level in idling condition. Ripple voltage is so low, that no further gyrator will be needed for this application.

This circuit shows no connection between GND and earth, but it will be grounded by the signal cables from the output of pre-amp as well as to the GND of the power amp. Therefore, I established a small cap of 22nF/X2 between GND and earth terminal to make sure, that an AC connection to earth is existent. This means will again increase S/N-ratio for some dB, while it will not act as a ground loop.

As you know – all information about the printable, full-size schematic and the PCB is again situated in a binder enclosed to this website.

If you have any further question, you can contact me via support@tubeclinic.com .

The first issue of this head-amp was built as a gift for an Audiophile friend of mine - and you can believe me – he was very fond of his gift!