

# The DAO SE, an All-FET, Zero- Global-Feedback, Pure Class A Headphone Amplifier (Part 3)

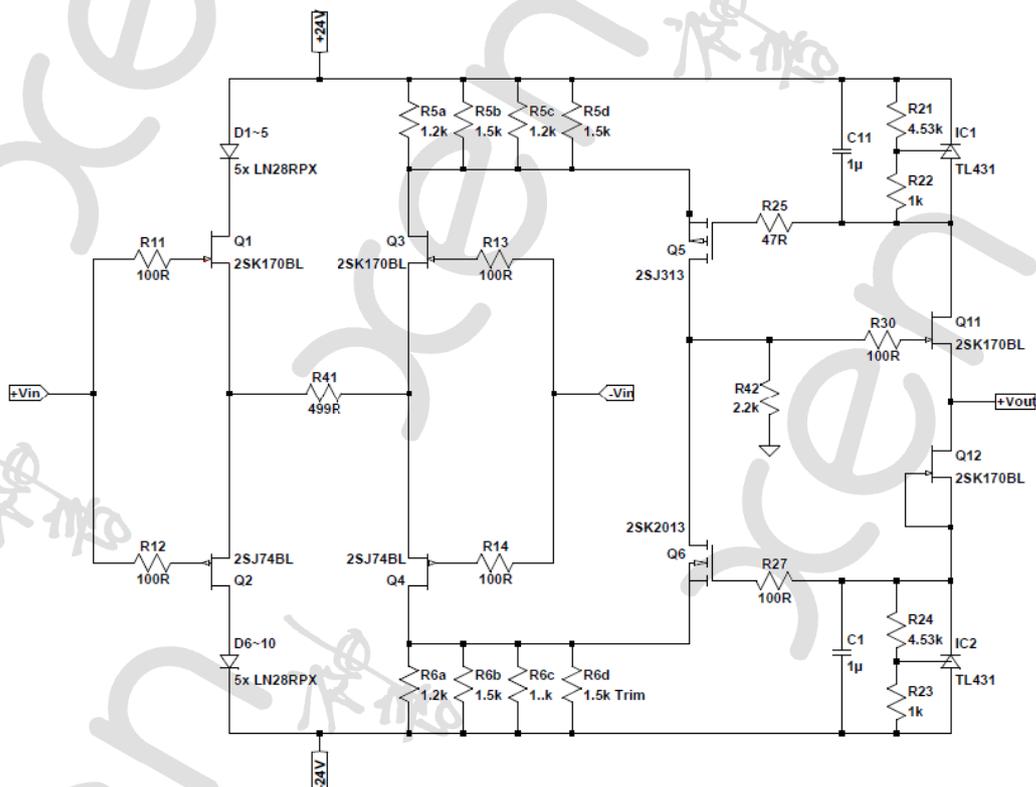
XEN Audio  
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## HAGS

HAGS stands for Headphone Amplifier Gain Stage, and is an abbreviation we used for a line level preamplifier with a gain of 4 and no global feedback that we developed to precede the DAO Follower. The motivation for this gain stage was that one team member of XEN Audio has a headphone of 120 ohm, and he thought a gain stage with a gain of 3 to 6 would give him more voltage headroom for the attenuator.

The HAGS is based on our XCEN balanced to single-ended converter. It is essentially the same circuit with the negative input connected to Gnd. We set the default gain to 4, and wanted to keep the gain setting resistors to well below 2.5k. To do so, high transconductance devices have to be used for both 1<sup>st</sup> and 2<sup>nd</sup> stages. The first stage used 2SK170BL/2SJ74BL JFETs, whereas 2SK2013/2SJ313 MOSFETs (or equivalent) are chosen for the second stage. The first stage is biased at  $I_{dss}$  of the JFETs, and the second stage at about 35mA.

As in the XCEN, the output of the HAGS can be taken at the output gain setting resistor R42, or after the integrated JFET buffer.



XEN Audio Head Amp Gain Stage (HAGS)

### **Cross-Feed Filter with JFET Buffer**

Most headphone enthusiasts are familiar with the Meier or Linkwitz cross-feed circuits. We chose to use the passive Meier cross-feed for its pure simplicity. In our PCB design, jumpers are used to select three levels of cross-feed, as well as no cross-feed. This passive filter network is followed by a simple JFET follower buffer to drive the HAGS input stage with low impedance.

Since the cross feed circuit is not our intellectual property, we shall only refer the readers to Mr. Meier's very informative publications :

[http://www.headwize.com/projects/meier\\_prj.htm](http://www.headwize.com/projects/meier_prj.htm)

### **Power Supply**

As already mentioned, there is a choice of battery power or mains power. In both cases some form of HF filtering is quite useful. Since the both LU1014 JFETs are also cascoded, PSRR is excellent. Thus we chose to use a simple CRC passive filter to reduce power supply noise or ripples after the rectifier. Should one prefer to use e.g. a TO220 regulator of some sort, it is entirely feasible to wire them with a bit of jumper in place of the resistors in the original CRC PCB.

The capacitors are standard snap in-types with 10mm pitch, 35mm diameter x 35mm height, e.g. Panasonic TS-HA 15000uF 35V. For the resistors we just used 2 x 20R 2W metal films in parallel to make up a 10R 4W resistor with half the inductance.

The same supply also feeds the HAGS. While the JFETs of the Cross-Feed Buffer will also take the same supply voltages, a pair of low-current regulators can be used to advantage to reduce raw voltage ripple as well as excessive dissipation on the JFETs.