A.N.T. Amber Headphone amplifier

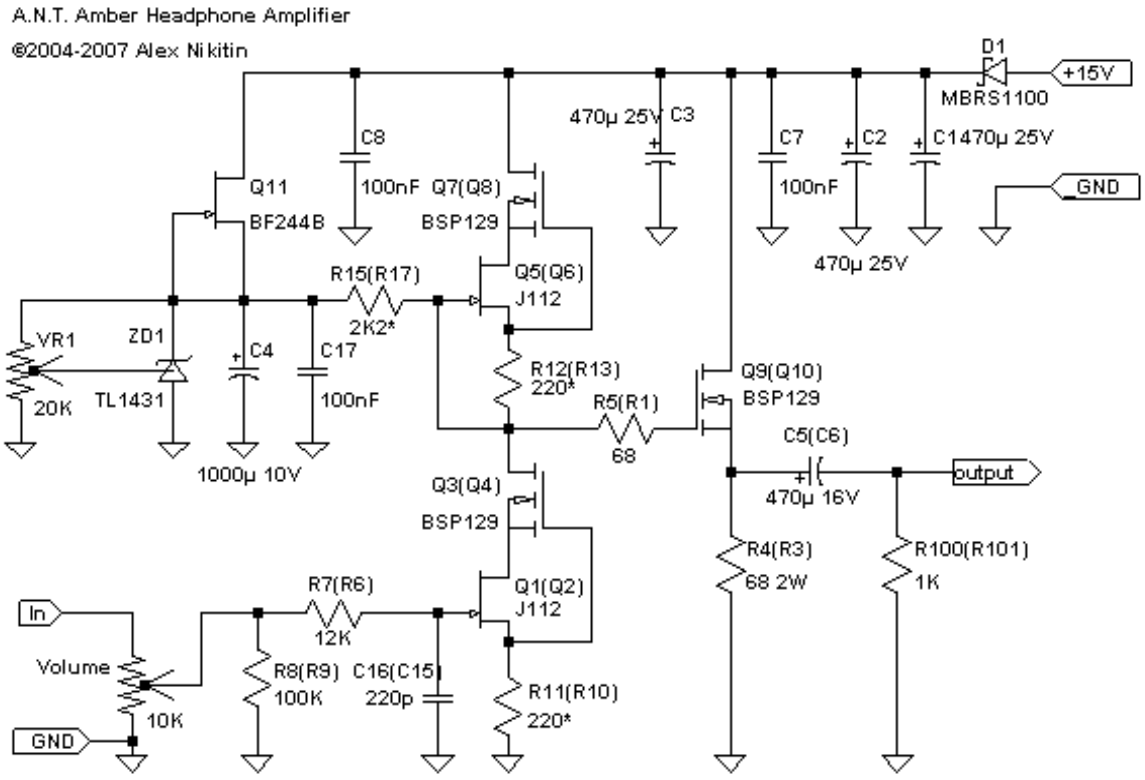
I've designed this amplifier in 2004, three years ago. After I've moved the house last year I had to stop my home "production line" for a while. Now that I am almost ready to release a new, updated version of the "Amber" - let's call it "Amber 2" , I've decided to offer the details of the original "Amber" design in this article.

"Amber" was first product to incorporate the distortion compensation mechanism by cascoding a JFET with another FET so that the first one worked in a "linear" region, below the "knee" on the output characteristic. I've called it "parametric linearisation" and described this approach in a short paper published in 1994:
http://www.ant-audio.co.uk/Theory/Parametric_Linearisation.pdf

In 2005 Nelson Pass used this idea, calling it "load line optimization", in his Zen v8 and v9 designs:
http://www.passdiy.com/pdf/ZV9.pdf

RMAA test of the "Amber":
http://www.ant-audio.co.uk/Data/Amber_0015.htm

Below is a complete circuit of one channel of the "Amber":



Circuit is for left channel and shared part, component numbers for Rch are in brackets.

Let's look at the circuit in detail. It contains two main parts – a unique voltage amplifier stage (VAS) and a conventional MOSFET output follower on Q9(Q10). VAS is DC coupled and it's temperature stability is provided by a careful selection and matching of transistor quads: Q1, Q2, Q7, Q8 J-FETs and Q3, Q4, Q7, Q8 depletion mode MOSFETs. Values of the resistors R11, R10, R12, R13 are chosen during the selection and matching process for the best linearisation effect, i.e. minimum THD. Because the transconductance of the main amplification device Q1(Q2) varies with the value of R11(R10) – in practice R11(R10) could be between 0 and 360 Ohm, the load resistance R15 (R17) needs to be selected to provide the required gain (x7=17dB). This complex process pays off by making a very stable, low noise and distortion VAS with no overall negative feedback and no capacitors in the signal path. For the only one capacitor in the signal path – on the output of the follower - C5(C6) I've used ELNA Starget and BlackGate capacitors with good results. VR1 is adjusted for 6.5-7 V on the output FET source, providing about 100 mA current in the output follower.

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