Entry: 001 **Date:** 1/27/2011 **Version:** 1.00 **Title:** Defining requirements

After the overwhelming success of the Class-D audio amplifier, it was decided to pursue an impoved, less experimental version. Some ideas for the revised circuit include using entirely surface mount parts (reduced size and potentially increased performance), a higher supply voltage (increased power output), and an output inductor with a lower series resistance.

Other ideas brought forward for consideration are the use of a different class, such as Class G, Class H, Class I, or Class T. These ideas were rejected due to potential copyright/patent issues and complexity.

Entry: 002 **Date:** 1/29/2011 **Version:** 1.00 **Title:** Initial BOM

This post is duplicated from the NBitWonder Forums.

After some research, I've arrived at a partial bill of materials.

- MOSFETs - DMN4009
- Gate driver - IRS2004
- Comparator - LM311
- Integrating error amp - TL082

The amplifier will, like the prototype, be a self-oscillating type. My hope is that with proper construction techniques, the operating frequency will be quite high, ideally upwards of 500kHz. To that end, the output filter has been designed as a second-order Butterworth filter with a cutoff of 50kHz when operated with an 8-ohm speaker, a common value for home use. An inductor has been identified with a very low series resistance, which should help efficiency improve over the prototype.

The MOSFETs selected for use this time are cheaper than the IRL520Ns used last time and have a much lower on-state resistance, which should lead to increased efficiency. The MOSFET gate driver is cheaper than the one used for the experiment, but supports a lower drive current and a lower maximum voltage – but at the voltages slated for use in this project, this becomes a non-issue.

The input stages (TL082 and LM311) are slated to be unchanged from the previous iteration, since the parts are already low-cost and well-suited for the task at hand.

Expected power output, based on a +/-18V supply and an 8-ohm speaker, is $\frac{18^2}{8\times 2} = 20W$ RMS under ideal conditions. Peak power (ie, turning on one MOSFET or the other and allowing the output filter to reach steady state) is arrived at with $\frac{V^2}{R}$; the extra factor of 2 converts peak power to RMS. To support this power output, the power supply should be capable of delivering $\sqrt{\frac{20W}{8\Omega}} = 1.58$ amps per channel.

Entry: 003 **Date:** 1/30/2011 **Version:** 1.00 **Title:** PCB Layout

Today saw significant work on the PCB layout.

Entry: 004 **Date:** 1/31/2011 **Version:** 1.00 **Title:** More PCB Layout

The PCB layout was finished today. A secondary version was created that features RCA input jacks instead of the more compact and lower cost 3.5mm stereo minijack.

Entry: 005 **Date:** 3/5/2011 **Version:** 1.00 **Title:** Prototype tweaks

While waiting for the PCBs to come in, I worked on the breadboarded prototype a little bit. I discovered that by changing the resistor and capacitor in the integrating feedback loop to 1M and 0.001uF respectively, power output increased greatly before audible distortion set in. Thankfully, implementing this on the PCB does not require any changes in the layout.

Entry: 006 **Date:** 3/6/2011 **Version:** 1.00 **Title:** Continued prototype work

Today, I constructed a duplicate amplifier circuit on the breadboard to have stereo capability, making sure to incorporate the changes from yesterday. Testing with my laptop as a signal source produced good results, though it seems that clipping sets in at a lower level now. My theory as to the cause is that the power supply I am using for testing cannot supply enough current to run both stereo channels at a high volume simultaneously.

With the 'laptop test' complete, I moved the amp to the living room to try it with my TV. Upon powering on the circuit, a loud 60Hz buzz permeated the room. It was determined that the cause of the buzz was a ground loop – the TV and amp were both grounded, and the signal cable between them also had a ground connection. Removing the AC ground from the power supply used on the amplifier solved the problem by eliminating all directly-connected paths between the two circuit grounds.

