

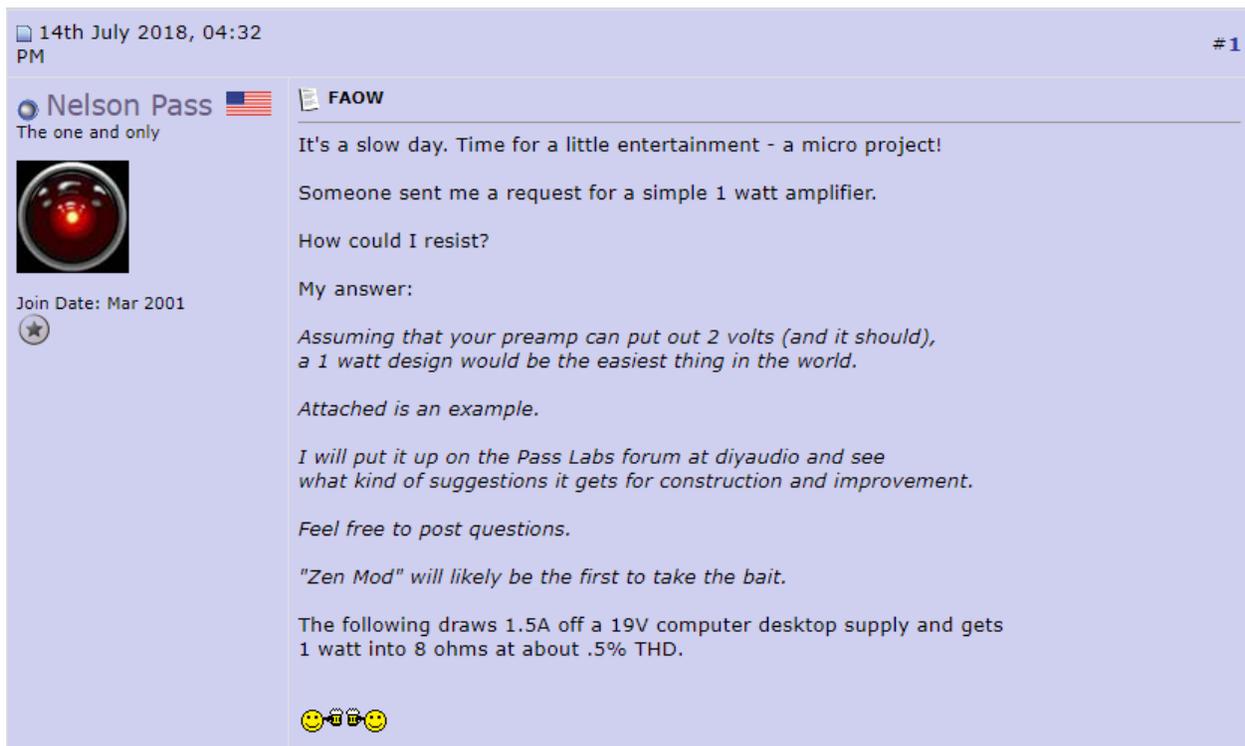
# FAOW Variation #2

By Mike Rothacher

## It Was a Slow Day at Sea Ranch

My friend Nelson Pass is an unusually busy guy, and a long time can pass without word from his secret clifftop lab. He's also bit of a paradox, equal parts artist and engineer, logical and intuitive, chilled-out and frenetic. So, when he posted an offbeat micro project on a rare slow day at Sea Ranch, it came as a pleasant and welcome distraction to me. The project was a little entertainment piece, part puzzler, part challenge. It came in response to someone who had asked for a simple 1 watt amplifier.

Here's Nelson's post:



14th July 2018, 04:32 PM #1

**Nelson Pass**  **FAOW**

The one and only



Join Date: Mar 2001

It's a slow day. Time for a little entertainment - a micro project!

Someone sent me a request for a simple 1 watt amplifier.

How could I resist?

My answer:

*Assuming that your preamp can put out 2 volts (and it should), a 1 watt design would be the easiest thing in the world.*

*Attached is an example.*

*I will put it up on the Pass Labs forum at diyaudio and see what kind of suggestions it gets for construction and improvement.*

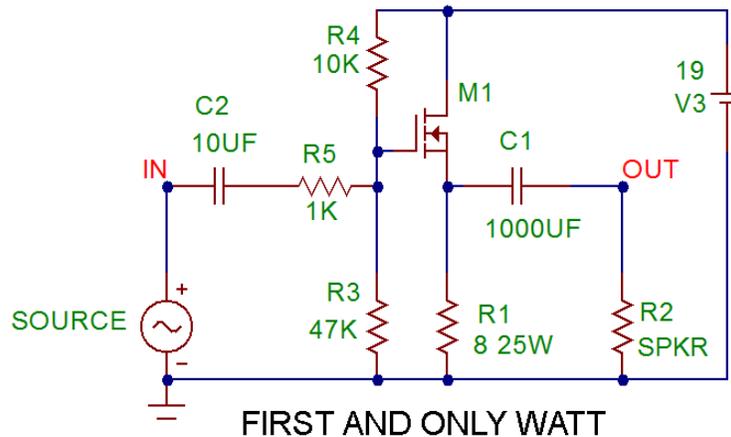
*Feel free to post questions.*

*"Zen Mod" will likely be the first to take the bait.*

The following draws 1.5A off a 19V computer desktop supply and gets 1 watt into 8 ohms at about .5% THD.



And here's his schematic:



It's a little MOSFET follower powered by a laptop power supply. Pretty neat, huh? It consists of a handful of cheap parts and can be built in an hour. Now, a 1 watt amplifier will demand really, really efficient speakers, but what better way to explore the limits of a single glorious watt?

I think Nelson and I share a similarly odd sense of fun. The point of the project, as I view it, is to create a simple design for an amplifier that clips at a just over a watt, hence the "first" and "only" watt. Yet, it still must deliver the sort of audiophile goods that members of the Pass Labs forum at [diyaudio.com](http://diyaudio.com) appreciate (no IC's please). It is an exercise in tightly constrained minimalism, a sort of amplifier design haiku.

Just one watt, no more.

Needs high-efficiency speaker.

Must sound beautiful.

## Once More into the Junk Box

Wanting to play along and contribute something of my own to the effort, I happily took the bait and started cobbling together bits from my graveyard of abandoned projects. It is easy enough to get good 1 watt performance out of a 50 watt amplifier, but it turns out to be a little trickier to get that sort of performance out of an amplifier that just makes it to a watt. I also aimed for something with a little bit of gain, which ups the performance challenge a bit. And, of course, it had to be quirky because quirky is fun.

Without further ado, here's the result:

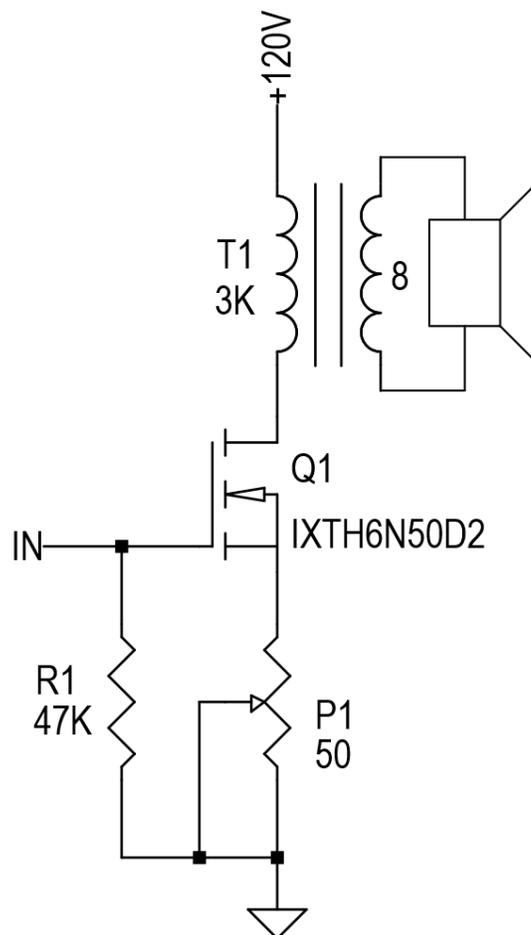


FIGURE 1

It only has four parts so there isn't a lot to talk about. Q1 is a depletion MOSFET, it is biased by R1 and P1. P1 allows the bias current to be adjusted. You will recall that a depletion MOSFET is always "on" and requires a negative voltage between its Gate and Source to control the flow of current from Drain to Source. R1 ties Q1's Gate to ground, so the voltage from Gate to Source will be minus whatever is dropped across R1. This arrangement is called self-bias.

This is a Common Source amp, having voltage and current gain. It needs about .8Vpk on the input to reach a watt. You could possibly drive this one with an iPhone. Just about anything will work. It clips just a little over a watt. It is a flea-watt amplifier indeed. One glorious little watt.

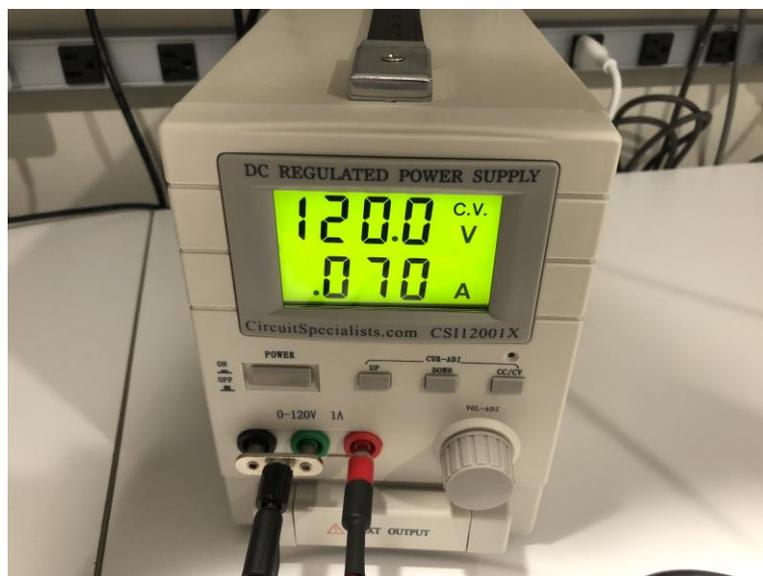
The speaker is coupled to the Drain of the MOSFET by a tube audio output transformer having a 3K primary impedance and an 8 ohm output tap. In this case, I used Edcor's \$20 XSE10-3K.

There are no coupling or bypass caps, so you can save your fancy-schmancy cap money for a better transformer such as Edcor's CXSE25-3K, which improves performance. I tried to stay away from unobtainium parts because I wanted this one to be accessible to anyone deranged enough, or morbidly curious enough to actually build it.

I can't imagine you'd want a PCB for this one. R1 is a ¼ watt resistor and P1 is a ¾ watt pot. Q1 is dissipating less than 10 watts, so you don't need a massive heatsink. Stick it all on board with some hot glue and revel in your creation. Adjust P1 for 70mA through the MOSFET, and adjust it again after an hour.

## **Performance**

The amp's input impedance is 47k ohms. Noise is around 100uV with the benchtop switching power supply I use (see photo below). I also tried a little CRC power supply with 1000uF caps, a 100 ohm resistor, a little isolation transformer, and bridge rectifier. I trust you'll choose a supply which matches your level of experience working with higher voltages, or find a friend who can help.



The bandwidth is limited by the output transformer. The Edcor XSE10-3K gets you an amp that's more suitable for midrange and up. If you want more you'll need the bigger iron Edcor (or possibly someone else) has to offer.

THD is .6% at 1 watt, all second harmonic baby!

I'm building some 15 inch Altec coaxials right now in 620 cabinets. A certain wizard is going to help me with the electronic crossover for them. These beauties come in at 100dB at a watt and I plan to use them as my test bed for more flea-watt experiments in the future.

Thanks for the inspiration, Nelson.

I leave you with another haiku:

Most important watt.

Loudspeakers sing joyfully.

Pass is happy now.