# Single Chip 50 Watt / 8 Ohm Power Amplifier

Rod Elliott - ESP (From Design Notes from National Semiconductor)

## Circuit Description

There are many instances where a simple and reliable power amplifier is needed - rear and centre channel speakers for surround-sound, beefing up the PC speakers, etc.

This project (unlike most of the others) is based almost directly on the "typical application" circuit in the National Semiconductor specification sheet. As it turns out, the typical application circuit is not bad - I would not go so far as to say hi-fi in the audiophile sense, but it has good noise and distortion figures, and is remarkably simple to build - if you have a PCB!

**26 Sept 2000**
From testing the prototype boards, I was a little more critical of everything than previously, and I have to revise my previous statement. The sound quality is excellent! As long as the protection circuitry is *never* allowed to operate, the performance is exemplary in all respects.

The new version of the circuit has connections for a SIM (Sound Impairment Monitor), and if the amp is going to be used anywhere its limits, I strongly recommend that you use the add-on SIM circuit. I am about to simplify the "simple" version of the SIM so that it can be used more easily for exactly this purpose.

Figure 1 shows the (newly updated) schematic - this is almost the same as in the application note (redrawn), polyester bypass capacitors have been added, and the mute circuit has been disabled (this function would more commonly be applied in the preamp, and is not particularly useful anyway IMHO).

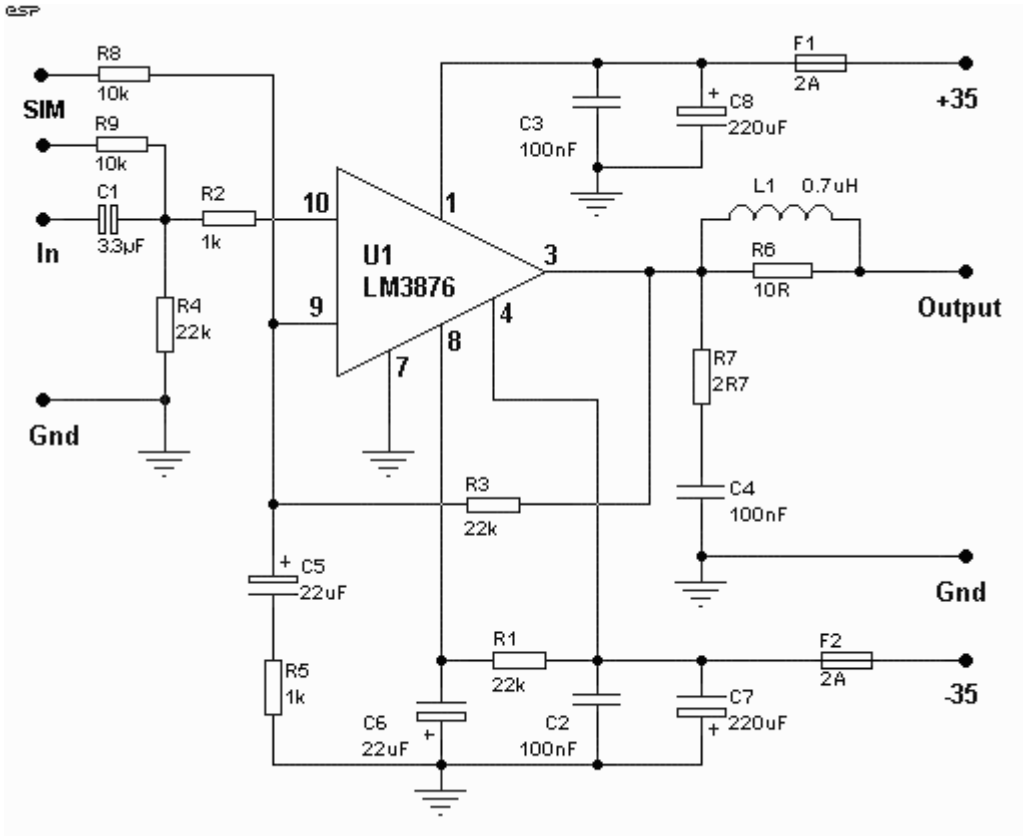



**Figure 1 - LM3876T Power Amplifier Circuit Diagram**

Voltage gain is 27dB as shown, but this can be changed by using a different value resistor for the feedback path (R3, currently 22k, between pins 3 and 9). The inductor consists of 10 turns of 0.4mm enamelled copper wire, wound around the body of the 10 Ohm resistor. The insulation must be scraped off each end and the wire is soldered to the ends of the resistor.

The 10 Ohm and 2.7 Ohm resistors must be 1 Watt types, and all others should be 1% metal film (as I always recommend). All electrolytic capacitors should be rated at 50V if at all possible, and the 100nF (0.1uF) caps for the supplies should be as close as possible to the IC to prevent oscillation.

The supply voltage should be about +/- 35 Volts at full load, which will let this little guy provide a maximum of 56 Watts (rated minimum output at 25 degrees C). To enable maximum power, it is important to get the lowest possible case to heatsink thermal resistance. This will be achieved by mounting with no insulating mica washer, but be warned that the heatsink will be at the -ve supply voltage and will have to be insulated from the chassis. For more info on reducing thermal resistance, read the article on the design of heatsinks - the same principles can be applied to ICs - even running in parallel. I haven't tried it with this unit, but it is possible by using a low resistance in series with the outputs to balance the load.

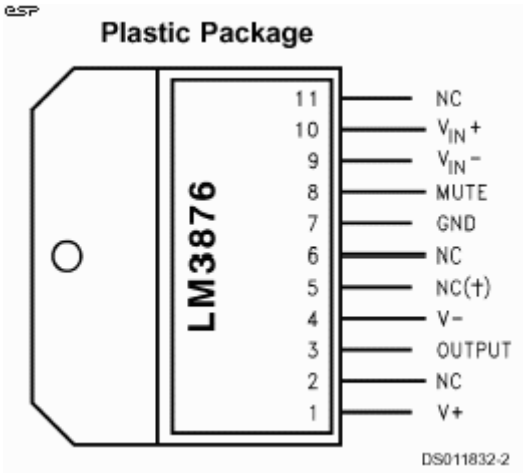
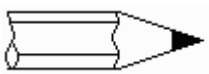



**Figure 2 - IC Pinouts**

Figure 2 shows the pinouts for the LM3876, and it should be noted that the pins on this device are staggered to allow adequate sized PCB tracks to be run to the IC pins. The 3886 has (almost) identical pinouts, and can be used instead if a little more power is required.



If the LM3886 is used, Pin 5 must be connected to the +ve supply - if you have the PCB, a link is necessary to make the connection, as it is not provided on the board.

The PCB for this amp is for a stereo amplifier, is single sided, and supply fuses are located on the PCB. The entire stereo board including four fuses is 115mm x 40mm (i.e. really small).


**Photo of Completed Amplifier (Without Heatsink)**

To reiterate a point I have made elsewhere, never operate this amp without a heatsink (this applies to nearly all amplifiers). It will overheat very quickly, and although the internal protection will shut the amp down to protect it from damage, this is not something you want to test for no good reason.

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## How Does It Sound?

The sound quality is quite good - as I said at the beginning, I would not call it audiophile hi-fi (but then again - I might, with caveats), but provided the amp is ***never*** allowed to go anywhere near clipping it sounds fine. This is the rub - because of the comprehensive overload protection (which I have never liked in any form) this amp provides more and nastier "artefacts" as it clips than a "normal" amplifier.

The protection circuitry is called SPiKe™ by National - this stands for **S**elf **P**eak **i**nstantaneous Temperature (°**Ke**) and will protect the amp from almost anything. Although in theory this is a good thing, it's not so good when the protection circuits operate, so make absolutely sure that the amp is only used in applications where clipping will never occur.

This might sound like a tall order, but for rear speakers in a surround system, or to put some serious grunt into those 400W PMPO PC speakers (with the 5W RMS amplifiers - I'm not kidding), this amp is a gem.

It could also be used as a midrange and/or tweeter amp in a tri-amped system - there are a lot of possibilities, so I will leave it to you to come up with more.