Pocket Tutor

Build a handheld version Of the Morse Code Tutor

Part 4: Audio

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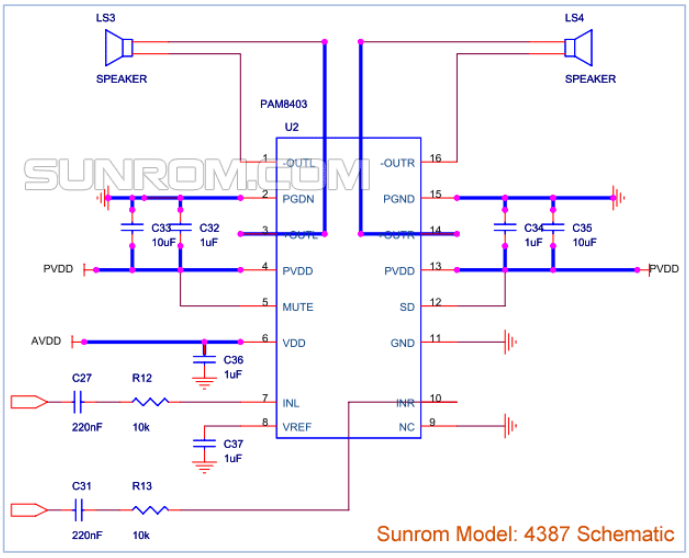
The original Morse Code Tutor produces its sound using the dirt-cheap PAM8403 Stereo Amplifier module, available on eBay for about a dollar. It is hard to find a full-fledged amplifier for less. The frugal ham in me approves.

PAM8403 Module

Unfortunately, these modules vary in quality and character from one vendor to the next. For example, some squeal when turned on/off; others do not. The module contains one PAM8403 chip and a handful of passive components. Since we only need mono output, half of this chip is unused. Could we build a similar device, using a smaller mono-amplifier and less passive components?

The answer, of course, is yes. As inexpensively as the PAM8403? Yes. A genuine PAM8302 from Digi-Key costs only $0.62, and $0.53 in lots of 10.

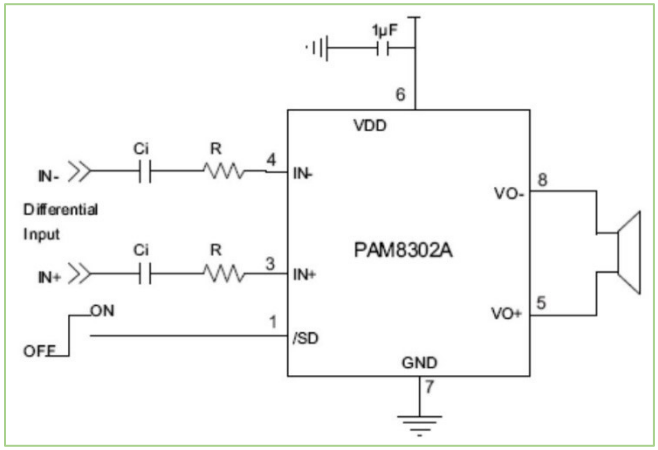
In Part 2 of this series, I described my adventure and misadventure in designing a decent power supply. It took longer than anticipated. So, for the audio circuit, I decided to use a known design.



An example schematic for the PAM8403 module is shown here. There are 8 capacitors and 2 resistors for a total of 11 components. We could use this as a basis for our audio circuit, and it would work, but it uses more components than necessary.

Instead, I chose another circuit, based on the PAM8302 mono-amplifier. The IC is physically smaller, and requires fewer passive components (6). And it still generates room-filling sound.

Schematic from the PAM8302 datasheet



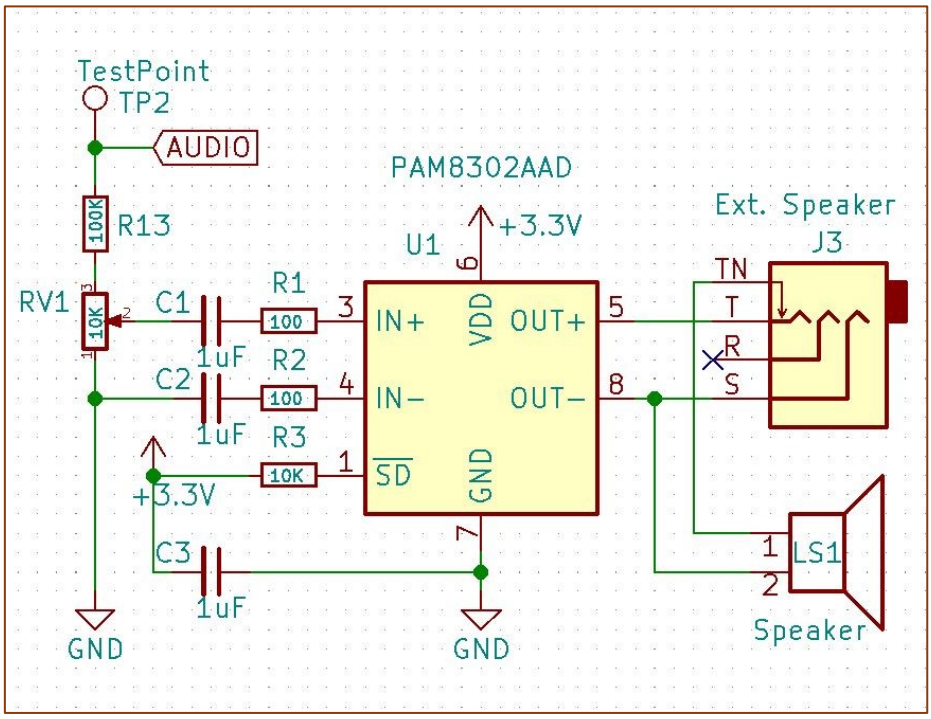
The PAM8302 datasheet gives us a simple design to work from. Interestingly, it is mono output with differential inputs. We do not need differential inputs in our application, so we will tie input IN- to ground.

A shut-down pin (SD) gives us a mute option, if desired, and can be controlled by the microcontroller. I elected to hold this line high (amplifier always enabled) via a 10K resistor.

The datasheet gives further information on how to reduce electromagnetic interference on the output lines, via ferrite beads and shunting capacitors, if necessary.

We also need a volume control. As in the Morse Code Tutor, a 10K potentiometer was used on the IN+ input.

Finally, it is necessary to reduce the amplitude of the signal coming from the microcontroller. The amplifier is very sensitive and is overloaded by the 3V microcontroller signal. A 100K resistor in series with the 10K potentiometer forms a 10:1 voltage divider, giving us a manageable 0.3V signal input. You can change the volume range by modifying R13's value.



I chose a surface-mount speaker for on-board audio, which is bypassed when an external speaker is plugged in. Unfortunately, surface-mount speakers are pricey ($7). This component may be left out if desired.

More to come. Stay tuned.

73, Bruce.