ZL2PD No IC Audio Amplifier

A basic audio amplifier which uses a handful of widely available discrete components at practically no cost and avoids the need to rush out to purchase an integrated circuit such as the LM386.

Introduction

One day, I needed to build an audio amplifier stage for a receiver. As usual, I reached for my stockpile of LM386 chips…Hmmm….No chips in the parts bin.

Well, I though, I'll just use one of those old LM380 chips instead. No, I didn't have any of those in my junkbox either.

I went hunting for a couple of other alternatives. While I found a pair of 50W audio amplifier ICs, and a 5W audio IC that needed close to a dozen electrolytic capacitors and a bunch of resistors to make it go, I reckoned those choices were a bit of an overkill for my little battery powered receiver.

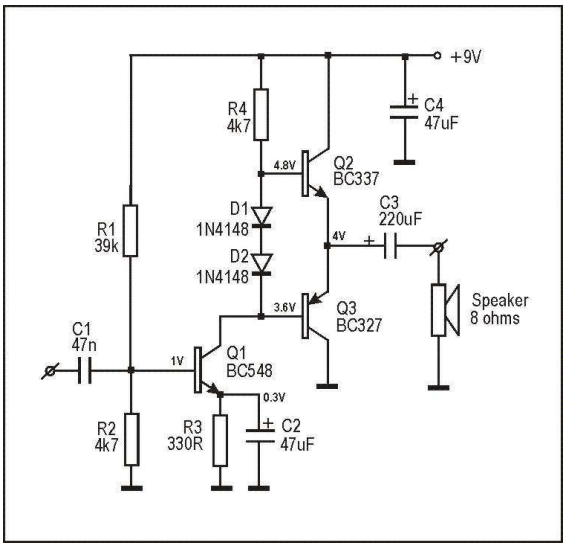
So, I decided to build an audio amplifier from a few general purpose transistors. I still wanted the benefits of the LM386-type amplifiers including minimal parts and reasonably low current drain. This circuit was the result.

It's hardly an original circuit, I know. Even so, I thought it worth adding to my website because I've found it so useful over the last few years. This doesn't mean I don't use IC amplifiers any more - I do! Mostly low voltage chips recycled from AM/FM transistor radios. But I continue to use this circuit from time to time, usually late at night when I've run out of LM386 chips once more.

The Design

With a gain of about 30dB, it can deliver more than 100mW into a small 8 ohm speaker. It can drive a compact 50mm diameter speaker, like those used in those cheap AM/FM transistor radios, to audio levels more than adequate for room level listening.

Most receiver IF stages I build have audio outputs of between 50mVpp (i.e. 50mV peak to peak) and 150mVpp, and this input level is enough with this circuit to produce up to 1.5Vpp across an 8 ohm speaker.



Initial Testing

When this circuit is first powered up, adjust R3 (4k7) to give a voltage on the emitter of Q2 close to half that of the supply rail. I seldom need to change this value myself from that shown, but some transistors may require a slight change. So, as you power this amplifier up, measure the current drain. It should be about 3mA with no input signal and about 20mA at full output. Currents as high as 50mA with the devices shown are perfectly acceptable.

The reason for measuring the current drain is that some transistors used at Q2 and Q3 can go into thermal runaway at high output volumes with some values of R3. Thermal runaway occurs when the current through Q2/3 just keeps on rising. Increased current results in a temperature rise in Q2 and Q3, and this permits the current to rise still further. This can continue until the devices fail. This is normally prevented by adding a low value resistor (e.g. 3R3 to 10R ohms) between each emitter and the common output on the positive side of C3. With these resistors in place, increasing current will increase the voltage drop across these resistors. This in turn starves the transistors of voltage, and so prevents this thermal runaway effect.

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I have not seen this runaway effect more than once in the dozen or so times I've used this circuit with component values close to those shown in the circuit diagram. I use this circuit due to the minimal number of parts required, and because it's so cheap and easy to build. Adding those extra parts also slightly reduces the output level. So, I tend not to put them in, and I've not had any problems.

But if you feel a bit nervous about this, then by all means add those two extra resistors. I won't complain.