

Headphone driving circuit for soundcards

Computer soundcards typically have line level and speaker level outputs. Neither of those is usually not very suitable for driving headphones:

If you connect the headphones to the line level output you will usually lose the bass frequencies because of small coupling capacitors. Line output circuitry might be overloaded because of too low input impedance and this can cause distortion.

The speaker output is well capable of driving headphones and quite often does this somehow. The problem in speaker output is that the speaker output amplifiers used in soundcards are not of high quality. The main problem is usually the high level of hissing in the signal. Volume adjustment can also be a problem, because the speaker output can easily give out so much power that you get uncomfortably loud or even dangerous sound levels from your headphones if you turn the volume to any other than the lowest settings.

To solve the headphone interfacing problem I have designed some circuits to solve some common problems in headphone interfacing.

Information on driving headphones

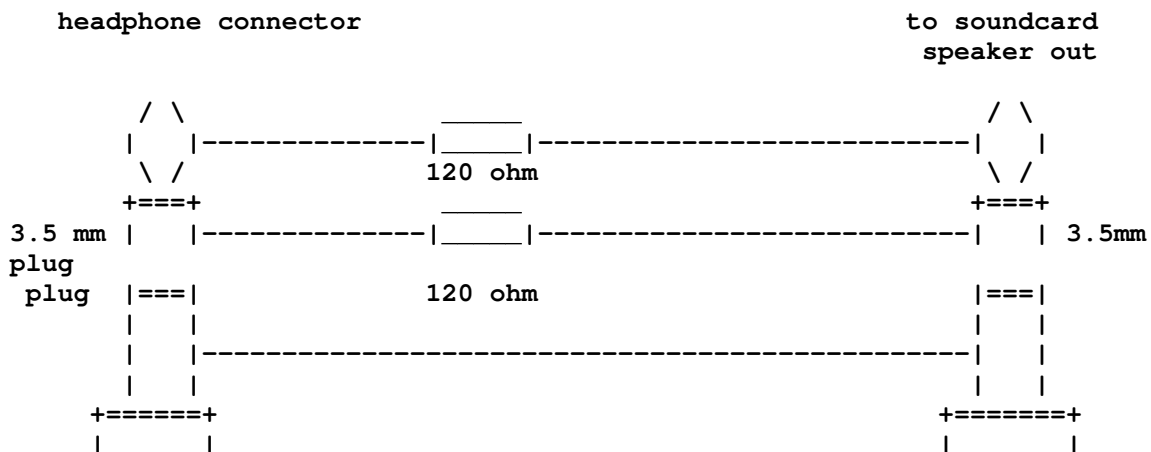
Headphone transducers are resistance-controlled, not mass-controlled like loudspeaker drivers above the main resonance. In any case 'damping factor' is largely nonsense.

The motional impedance of headphone transducers varies very little (or should vary very little - someone can always do it wrong!) with frequency, so the source impedance can be high with no ill effect.

International standard on audio interfaces, IEC 61938 (formerly IEC268-15) calls for an intermediate-impedance source of 120 ohms and a source voltage of 5 V rms, which provide reasonably satisfactory performance (sound level, frequency response, distortion) with headphones of any impedance over the range of 8 to 600 ohms at least.

Circuit meeting IEC 61938

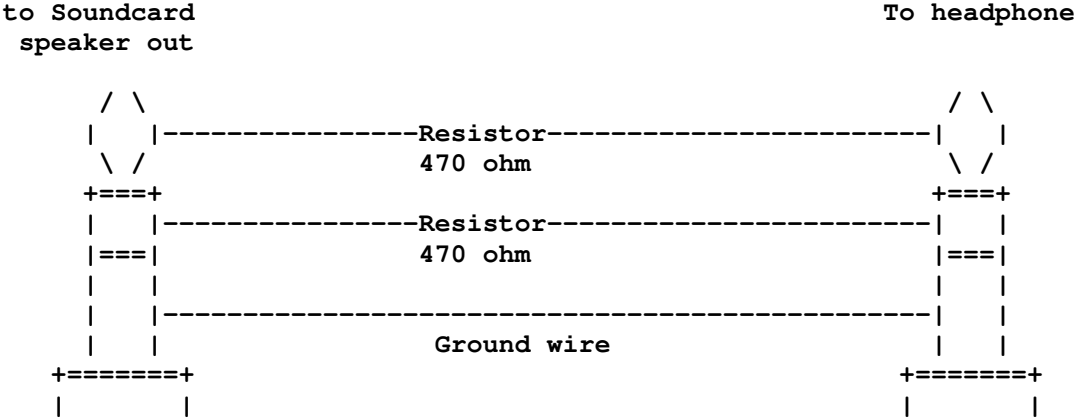
When the following circuit is connected to PC soundcard, you will get a headphone output which meets IEC 61938.



The idea of this circuit is to increase the output impedance by adding 120 ohm series resistance to the output which originally has a low impedance capable of driving normal speakers. The output level of typical 2-4W audio amplifier will meet the voltage levels specified in IEC 61938.

Modified headphone circuit

I have successfully used the following circuit for driving my headphones (Beyerdynamic DT311) out of my SB16 speaker output.



This circuit uses larger resistors than specified in IEC 61938. The main effect of this is that the larger resistors cause more attenuation, so lower levels are get form the speakers. The 470 ohm resistors cause os much attenuation that the volume will not be much too loud even if volume is at maximum, so I can easily use the full volume scale to adjust the volume. Because if extra attenuation, the normal background hissing of the soundcard ampliifer is quite much unhearable.