Cyberperiscope

Kenji, JJ1BDX, watching the world from somewhere through a hidden periscope

Saturday, December 02, 2006

cmoy headphone amp - my version

Chu Moy (cmoy) publicized his own OPamp-based headphone amplifier on his site HeadWize.com. This is my version of his amplifier, introducing the virtual ground circuit. I have worked on the amplifier units during 2000 to 2001.

Technical backgrounds:

Chu Moy discovered Burr-Brown's (now Texas Instrument's) OPamp OPA132, a predecessor of OPA134, a general-purpose high-grade OPamp which can transmit high-quality sound to the headphones. OPA2134 has two OPA134-equivalent circuits inside the chip, and is replacable with many other similar chips.

I tested many other cheaper OPamps, such as JRC's NJM4580, TI's TL072, JRC's (originally Signetic's) NJM5532 for this purpose. While those OPamps were not bad, their performance were insufficient for the hi-fi amplifiers.

On cmoy's circuit, I have found out that you needed to have at least an FET-input OPamp, to keep the input impedance of the non-inverting amplifier high enough so that the coupling capactors' value could be kept small as possible.

You also need to minimize the bias current leaking from the input terminal to keep the offset voltage to the output as close to zero as possible. DC offset voltage on the output of the amplifier may cause damage to the headphones.

Also, each OPamp has to be able to drive the fairly large amount of capacitance load (of 100pF to 1nF), which parasitically exists on the connection cables. So the transient driving capability is important.

Recently I tested an improved version of TL072 called TLE2072. This OPamp seems to be good enough for a line-level driver (with the impedance of a few kiloohms), from my experience to use TLE2074, the four-circuit-in-a-chip version, as a replacement of TL074 in ART DI/O audio A/D and D/A converter. Too bad TI discontinued OPA4134, the four-circuit version of OPA134/ OPA2134.

After burning-in the chip for a few hours, however, I had to conclude that a single-circuit OPamp of TLE2072 did not meet the

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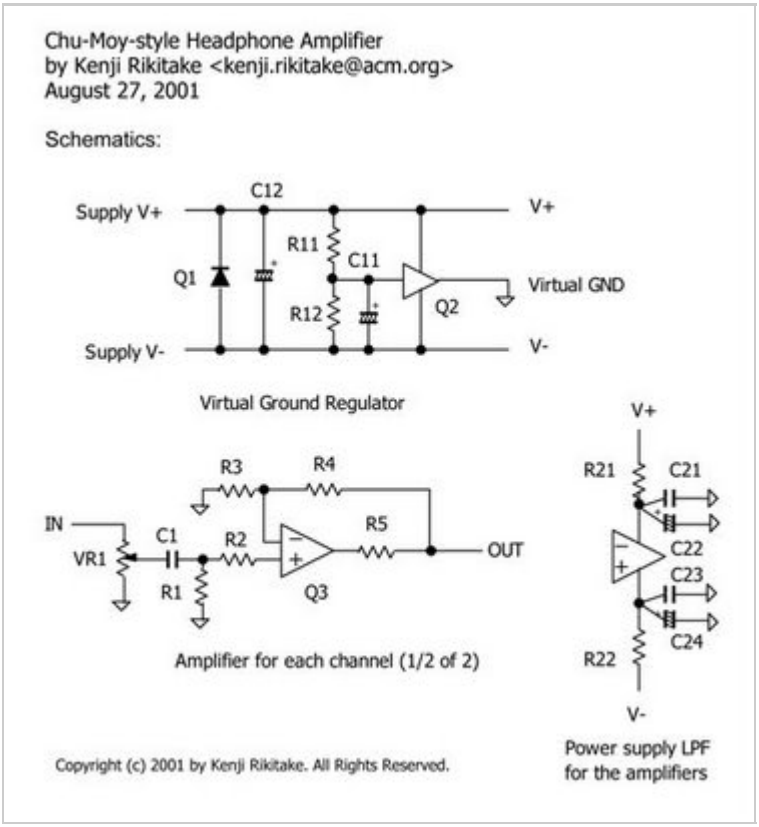
quality of the OPA134/OPA2134, due to a lack of sound clarity especially in the higher-frequency range. The sound got a bit darker too. Maybe I need to redesign the circuits to increase the load-driving capability of the amplifier, but that's not for this project.

So far I've built three amplifiers of this design, and have been comfortably listening to the music using various kinds of earphones and headphones. This amplifier can drive Sennheiser HD414 Classic, HD250II, HD580; AKG K240 Studio; Sony MDR-CD900ST; Etymotic Research ER-4P and ER-4S. My wife and a musician/DJ friend have also used the amplifiers and they said they were quite satisfied with the sound.

So here comes the schematics:



And the parts list:

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[RSS1.0/RDF]

Parts Numbers and Values:

R1:	100kohm
R2:	1kohm
R3:	1kohm
R4:	4.7kohm
R5:	47ohm
R11:	10kohm
R12:	10kohm
R21:	47ohm
R22:	47ohm
VR1:	10kohm logarithmic (A-curve)
C1:	2.2uF Mylar
C11:	1uF 25V Electrolytic
C12:	1000uF 35V Electrolytic
C21:	0.1uF Ceramic
C22:	100uF 25V Electrolytic
C23:	0.1uF Ceramic
C24:	100uF 25V Electrolytic
Q1:	1N4002 (100V 1A Si Diode)
Q2:	Burr-Brown BUF634
Q3:	Burr-Brown OPA134 or 1/2 OPA2134

(All resistors are metal-film)

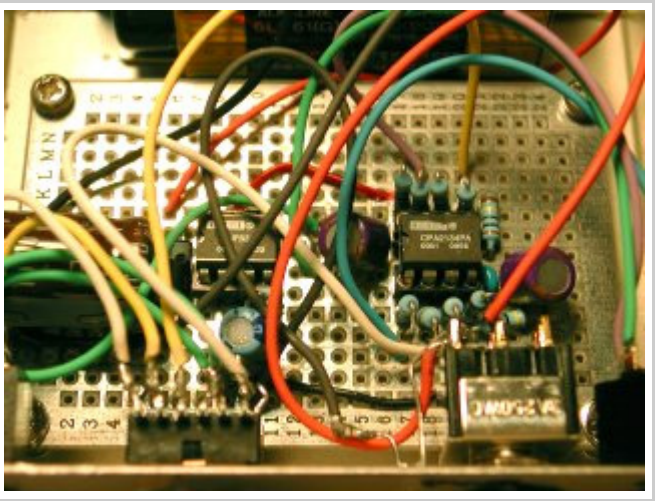
Photos:

Here's the OPA134x2 version (still in production-level use):

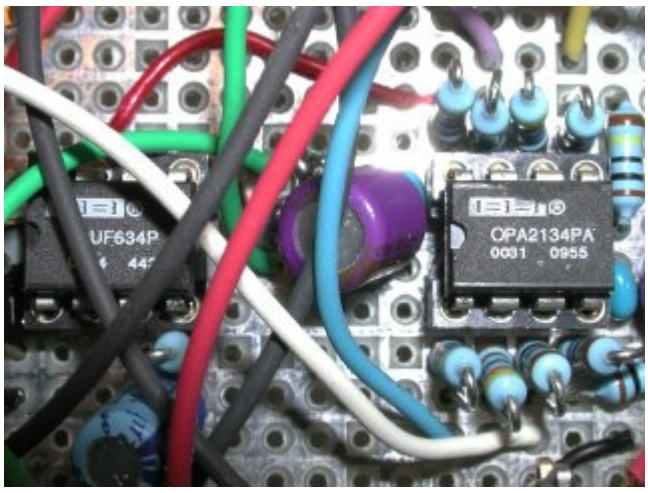
Here's the OPA2134x1 version (still used for my daily music listening):

The two amplifiers side-by-side:

An internal picture of OPA2134 version:



And a closer picture of the OPA2134 version circuit board.



Posted by Kenji JJ1BDX at Saturday, December 02, 2006

Labels: electronics, music

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