CORRECTION

The Ed Frias EFE kit (March '06, p.27) obtained from Speaker City used the network that was designed by Ed Frias and *not* the upgraded version designed by GR Research. Measurements of the Ed Frias design and the upgraded GR Research crossover can be seen at www.gr-research.com/edspeaker.htm

MOUSE TUBE AMP

I have a question for Bob McIntyre ("Mighty Mouse: A PP 25L6 Amplifier," April '06, p. 34). First, I like the phase inverter circuit. Also, I thought the use of zeners to set bias was interesting, but I wonder whether there won't still be some degeneration, clipped .6V in one direction and more in the zener direction. Would it, perhaps, be a good idea to have a bypass capacitor across the zeners? Thanks for the good ideas!

Craig D. Merz
Silver City, N. Mex.

Bob McIntyre responds:

Thank you for your interest in the Mouse. I enjoyed designing it, and I hope you have fun building it.

The problem I had with the phase inverter was to come up with a simple circuit that would operate well with less than 150V, yet would have low distortion, low impedance, and could easily swing at least 30V. The 6DJ8 was the only tube I could think of that fit these requirements. As it is, I needed to run the tube a little lean in order to fit the current draw within the 10mA maximum rating of the LM334. In turn, I used the LM334 because of its high performance and low insertion loss. I'm glad you like the circuit!

You have a good point regarding the bypassing of the zener bias diodes. I had thought of bypassing them, but decided not to in order to make the circuit as simple as possible. This does not really become a serious problem, because the output stage never really cuts off, so the diodes stay within their zener region.

The reason that I would consider bypassing the zeners is that their impedance rises with frequency, and their voltage drop varies slightly with current. While I consider these effects negligible, I cannot say absolutely that they will have no audible effect, so bypassing them is a reasonable precaution.

You can determine which of these effects, if any, is dominant, by your choice of capacitors. If the frequency effect is most important, a film capacitor of a few hundred nanofarads will do the trick, while an electrolytic cap of a few hundred microfarads will smooth out the current effect.

SPEAKER SOLUTION

I'm writing with regard to "A Solid-State Single-Ended Power Amp" by Ed Simon in the April issue of *aX*. I can't resist unusual power amps, so as a result I have an 8′ rack full of them. I'm building yours and have designed a circuit board so boards will be available for other interested builders.

On page 25 you state "Unfortunately, there does not seem to be a loudspeaker that would use this (¼W) to produce a practical listening level." Perhaps you should take a look at our model TSMD-2, which has a sensitivity of 97dB. I regularly listen to a pair of them driven from Larry Lisle's "A Minimalist Amplifier Design" (*aX* 3/05), which produce just ¼W per channel.

Ron Tipton
TDL Technology, Inc.
www.tdl-tech.com

Ed Simon responds:

Thanks for the idea. Unfortunately, I blew them up a while ago, and the semiconduc-

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tors used in them are no longer available. The same part number exists, but the process has changed so they don't sound the same.

VU METER

Without using an integrated-circuit comparator, or an op amp, you should be able to make a bipolar transistor-based five-LED output VU or level display for an audio amp. In this case, though, I want the display to take its input at the preamp level signal as it is applied to a 10k volume pot, so that it indicates the level of input prior to the volume control and so is independent of the volume control. The response should be logarithmic.

I know how to do this with comparators and op amps, but not using *only* bipolar transistors as the log generator and LED drivers. I'd like to see a minimal parts count solution with the applicable math. The power amplifier in question (TEA-2025) has a +12V DC-to-ground supply, an input impedance of 30k, and gain of 45dB, so the applicable preamp level signal is derived from those parameters—having no way to measure it directly—and is fed from the wiper of the 10k volume control. An interesting old-school problem.

Stephen R. Clanahan
Coalinga, Calif.

Charles Hansen responds:

The design for even a modest five-step VU (volume unit) meter as described in this letter would have many parts, and is not a trivial design excercise.

In the days before LEDs, IC op amps, and comparators, VU meters were analog. The markings on the meter face did the conversion from a linear audio input signal to the nonlinear VU dB scale. Today you can build a ten-step or more digital VU meter using the National LM3916 dot/bar display driver, whose internal comparator voltage-divider resistors are scaled for VU dB (the 3914 has linear dividers and the 3915 has log dividers). In its simplest form you need to add only two resistors, a capacitor and ten LEDs. Go to www.national.com for the datasheet.

The discrete five-step VU that Mr. Clanahan requested will require five comparators. The simplest IC comparators that I knew of were the WE194 designed by Westinghouse Semiconductor (no longer around) and the Fairchild uA710, both designed in the early 1960s, and long out of production. The simplest modern IC comparator is probably the LM339.

The simplest discrete comparator requires a minimum of three transistors: a differential pair to compensate for signal and temperature variations and an output stage to drive the LED. You need seven resistors to provide the bias for the three transistors. You may also need an input buffer stage to be able to drive those five differential pairs without loading the source. The two differential pair transistors should be matched for good accuracy (see PassDIY for a test circuit that can perform the transistor matching).

The voltage-divider resistor values depend on the VU range you wish to display. The LM3916 with a 0-10V input has steps of +3, +2, +1, 0, -1, -3, -5, -7, -10, and -20dB. The National datasheet shows the resistor divider values used. You will also need a stable reference voltage for the divider network, which will take another differential pair amplifier configured as a voltage regulator. You need to select which five of the ten dB steps you want to use, then connect two additional scaling resistors to take the place of the five steps (resistors) you do not use.

Your VU meter can actually be scaled to any desired reference level. The most common reference level in the US is 0VU = +4 dBm, where +4 dBm equals 1.23V RMS measured across a 600Ω load. dBm is shorthand for dB with respect to 1mW, so 0dB is 1mW, or 0.775V across 600Ω. Because Mr. Clanahan is dealing with a much higher impedance, he can scale dB from his input voltage with respect to any DC reference voltage by

$$dBV = 20 \log (Vin/Vref)$$

HELP WANTED

I have a collection of vintage LPs that were stored in a damp basement and now have some mildew on them. Can someone recommend a product that will disinfect the records and album jackets without damaging them?

sle@galenalink.com

aX