BEE 332 Additional hints on your 0.5 W amplifier design project

Nicole Hamilton

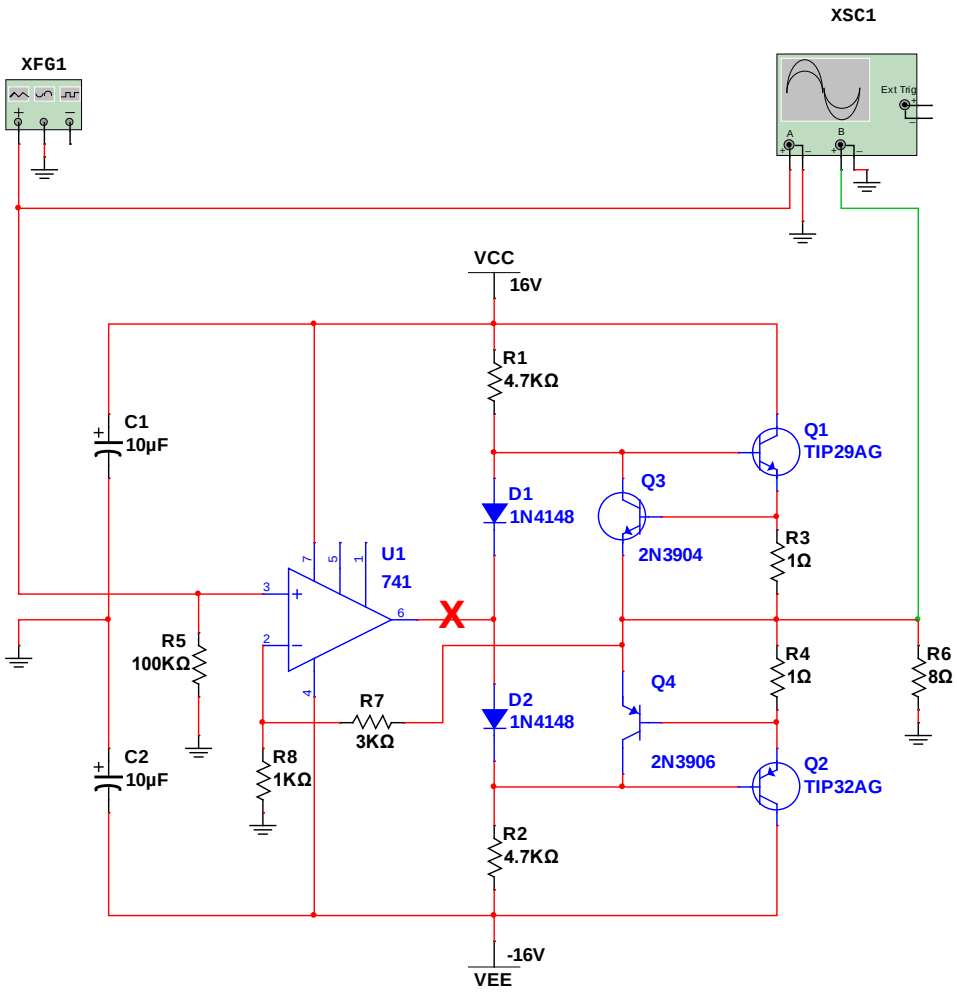
December 3, 2014

Having a circuit that should work and making that happen on a breadboard are two different things. If you're still having trouble, here are some additional hints that may be helpful.

1. A lot of problems are mechanical, one wire off by one hole or a wire not pushed in enough to make good contact. I don't like this part of debugging my own boards so, sorry, I'm not here to help you with this part of yours. But I do feel your pain.

2. If you're not getting any output at all, separate the stages and debug your output stage first. Because you have a negative feedback loop from your output to your input, if you're not getting any output, the feedback loop will ensure it stays that way, making it impossible to debug.

   Disconnect the input stage from the output stage where I've marked the X and inject a signal from your function generator directly into the output stage and make the output work first.



3. If you're getting output but one of your output transistors is a lot warmer than the other, it probably means the quiescent bias voltages for Q1 and Q2 aren't set right. One is turned on all the time and the other not at all. With the input grounded, measure the voltages relative to ground between D1 and D2 and across the output, R6. Those should be zero or close to it and if they're not, try substituting a 5 KΩ potentiometer in place of R1 or R2. I found I had to do this to make mine work.

4. If you're getting clipping, there are a couple of ways this could happen. One is that the short circuit protection transistors Q3 or Q4 are turning on, limiting the base currents (and thus, the emitter currents) of Q1 or Q2. (If you pull Q3 or Q4 and the problem goes away, that obviously is the problem.) The other is that Q1 or Q2 is saturating. In either case, the usual reason is the bias is set wrong and needs to be trimmed, again by replacing R1 or R2 with a 5 KΩ potentiometer.

With the 5 KΩ potentiometer, here's what mine did, putting out just over 0.5 W into 8 Ω at 1 KHz. Vout = 6.63 Vpp = 2.34 Vrms. $P = E^2/R$ = 686 mW. The output is quite clean and there's no DC bias. Gain was quite flat past 20 KHz, beginning to fall off and become quite distorted by around 50 KHz.