

## Re: Help with power supply noise., Please.

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- *From:* legg <legg@xxxxxxxxxxxxxxxxxx>
  - *Date:* Sat, 04 Aug 2007 14:42:31 -0400
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On Wed, 01 Aug 2007 15:28:02 -0400, Mike <nomtrxspam@xxxxxxxxxxxx> wrote:

I am building a homebrew bench power supply and it is working very well except for too much noise on the output. It is a single output with adjustable CV from 0 to 40V and adjustable CC from 0 to 4A. I have posted a schematic of the regulator section and a digital photo of the noise waveform under no load on a.b.s.e in PDF format. I posted it using the same subject line. I would greatly appreciate it if someone could give me some ideas of what to try in order to reduce the noise. I fear it is doomed to have a noisy output since it is point to point wired on perfboard, but I sure hope not. I tried very very hard to get the ground connections right and have rearranged them to try minimize the noise, but those changes didn't affect it much either way. This noise is very stable in that it doesn't change much from no load to the full 4A load, It gets fuzzy under full load, maybe from some low level high frequency oscillation. It doesn't change with output voltage. I increased the value of C5 to .047uf to get the noise down to where it is now. With C5 at 2200pf the noise is about 2 1/2 times what it is now and increasing C5 further decreases the noise very little.

There is another curious thing that happens that has me stumped. I intended to use an OPA2277 for U1. With the 2277 installed the transition from CV to CC mode in very abrupt, I.E. with a 10ohm load resistor connected, the voltage set to 20v, and the current set to 2.5A it draws 2A as expected. When I lower the CC setting it has no affect on the output untill it is set to about 400ma below the current being drawn or 1.6A in this case. The current then snaps down to 1.6A and decreases smoothly from there down. It did this no matter what current level I used to test it. It also does it if I increase the output voltage to exceed the CC setting. With an LM6132, LF412, or a TL082 installed it transitions to CC mode quite

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smoothly.

The fact that the noise is largely independent of load suggests that it does not originate in the unregulated input rail, as this source would increase with load-induced ripple.

You may be able to spot its earliest source – it should not be present in the outputs of U2. The higher frequency stuff might benefit from a little miller capacity around Q4 (picofarads) or an emitter resistor there, (not enough to affect source rejection).

You might try re-orienting your mains transformer, with respect to your circuit board, while monitoring the output noise. You may find that the lower frequency line fundamental and harmonics vary favourably under some circumstances. The steel leadframes used in many semiconductor packages (including the reference, tend to be affected by magnetic fields that have a predictable orientation, and which reduce rapidly in strength with increasing distance.

It was once demonstrated feasible to reduce output noise of some models in a commercial series of linear power supplies into the microvolt region, simply by mounting the regulator board assemblies at right angles to convention, on the unchanged industry-defined chassis's metalwork.

All the longer connections to pots, or larger-bodies pots themselves are subject to pick-up. Perhaps R11 should be grounded, and not used as a voltage pick-off point and C5 should have a small resistor in series. C4 or a similar part might be more effective on the actual output terminals.

A more smooth transition between current and voltage regulation might be possible if U3 had reduced influence. It does, after all, only have to over-ride a milliamp from the output of U2B, using its full output voltage compliance, to zero U1A input pin3.

RL

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