

HINTS FOR SETTING THE DISCRETE TOOLE SHUNT REGS

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Steen and myself decided to search for a simple but good shuntreg to be easily set and built, very stable with not too many parts that could be used on most of our lineamps and CDP's projects. Surfing the web was frustrating not a single one there that met our objectives so we went looking, where else, DIYAudio.com where we found a design by our member Cetoole (Colin Toole) that seemed to have the right topology for our intent and settled to do some prototypes which confirmed to be the one we were looking for.

This particular regulator has the advantage of using the same PCB for either polarities, positive and negative and can be set to regulate, as far as we have test it, from 15 to 30V, but later additions from Colin has shown that with certain mods these regs can regulate from 5V up. Raw supply should be about 5 to 10VDC over the intended regulated voltage, this means that if we want to have 24V at the output we need a PSU with some 29 / 34VDC.

For our test we have been using a simple CLC PSU as the raw supply, the inductor is a small one with only 22 to 50 uH enough to filter most of the undesirable spikes from the diode bridge. We have done simple inductors winding magnet wire (25Ga. or smaller) over a 12mm mandrel by 8 or 9mm long for an outside diameter of 22 mm or less with 70 turns yielding around 50uH. Steen has tested some smaller ones also using sawing machine spools (the small plastic ones which are about 20mm on the outside) those give about 20uH. On the raw supply PCB's which are now part of the boards going on a group buy there is provision to use a commercial cored choke from muRata #18R473C (47uH) available from DigyKey.

The whole supply before the regulator is actually a CLCLC if we add the Ferrite Bead (FB on the layout files) and the decoupling cap found on the regulator board itself.

Well this is supposed to be hints to set the regulator so lest go to the point.

Most shunt regs, as this one too, are composed by two mayor sections a CCS (constant current source) and the shunt circuit portion.

In the Toole reg the CCS is composed by R6, R5, R3, Q5, Q6 and D1. To set the desired current we want set R6 according to the table supplied on the schematic file which gives the approximate current it will supply, but please take in consideration that parameters for D1 (red LED) vary quite a bit from sample to sample, type and manufacturer so the mentioned table is only indicative. Steen has used LED's that he had on hand I believe and has work with no problems: in the other hand Colin says that we should be looking for some 1.75

of forward dropping voltage with load. The circuit when correctly working will light both LED's.

To set the output voltage we will use the value shown on the schematic notes for R4. For dialing in the exact voltage you will set the trimpot VR15 which has been added to the circuit for easy settings.

On the shunt side of the circuit we have Q2 to do the current shunt function and thus regulate the output voltage.

As an example we will set a regulator to supply 24VDC to one channel of an NS10 circuit (load) that sinks approx 13mA which is very low compared to other lineamps around.

We will assume you have installed a 8.7K R4 or there abouts for the needed 24V and a 30 Ohms for R6 to set the CCS at around 78mA.

So we have 78mA coming from the CCS and a load of 13mA that leaves an excess of 65mA left to be burned by the shunt element (Q2).

You may play with all this values experimenting different setting but keep an eye on device dissipation and heatsink temperature on the medium power transistors. For this lower demand example on the regulators you may use small heatsinks or use chassis heatsinking placing mica insulators to the transistors. Just remember that all heatsinks need air circulation (convection) to function properly.

Caps C1 and C3 are critical values so don't fiddle with them since they may cause oscillations at the MHz range and they will alter the nice and flat output impedance. C1 is a 1nf (1000pf or 0.001uf) and C3 is 10nf (10,000pf or 0.01uf). These cap are suggested as MKP's or FKP's types but can also use mylar's if you decide so.

If you build this regulators as shown on the documents you most probably end up with one of the best regulators around. My favorite quote from Steen: "He-he, all the others don't know what they are missing out on. They won't even know what hit 'em, when they hear a preamp with Toolereg's"

Please direct all questions to the thread and we will do our best effort to answer them.

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