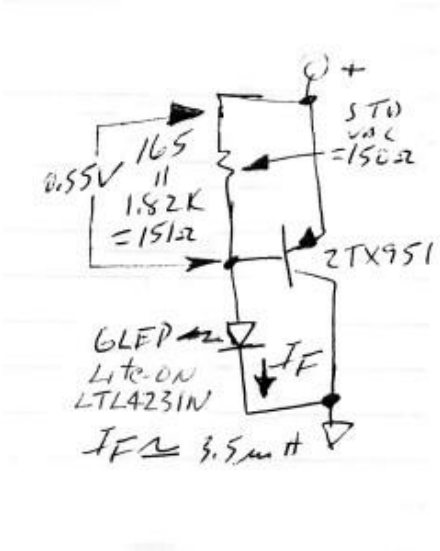
REFERENCES AND REGULATORS, WHATS NEW

GLED431: AN ULTRA LOW NOISE LED REFERENCE CELL

DECEMBER 18, 2015 | WALT JUNG | 1 COMMENT

Looking for a low noise reference circuit for an audio regulator, at 2.5V? But you've found bandgap circuits too noisy? Read on!

Consider the simple circuit to the right, which I call the GLED431. Just 3 low cost parts, all easy to get. It acts like an extremely low noise 2.5V zener. On my setup, noise measures around 2nV/√Hz, so if you take out the measuring system noise, the actual noise is likely below 1nV/√Hz. Really quite good. We'll have more on this later on, in 2016.



This GLED431 circuit is very simple, and works as a 2.5V shunt reference with ultra low noise.

While the GLED431 performance is very high for noise, you will need to apply about 5mA (or more) to make it work. Yes indeed, this current threshold is much higher than that of the TL431. But, it also has around 1/100 the noise! ***Caveat(1): The voltage won't be as tight as typical bandgap ICs, nor as low for temperature drift. Those are conscious tradeoffs.***

Here are some Vout measurements on a sample set of 5 LTL-4231Ns, in the lab prototype shown, after 1 minute warmup:

#1: **2.5094V,** #2: **2.5093V,** #3: **2.5069V,** #4: **2.5019V,** #5: **2.5062V**

Not too shabby! In the schematic, the leftmost R values are just as shown from lab tests, as trimmed for the 2.500V target Vout. Obviously, just use a single 150Ω RN60D unit for this R. Note that the forward voltage of the LTL-4231N green LED (LiteOn) and the Vbe of the ZTX951 (Diodes Inc.) conveniently add,

In use, if you are building say, a 5V regulator, select a series resistor so that 5mA is supplied to the GLED431 cell (499Ω). With this, also be sure to select a very low noise op amp, and reduce all the surrounding resistances, so as to minimize *their* noise contributions. Finally, be careful to minimize capacitive loading.

I am now releasing this simple version, as a Christmas present to the readers. Stay tuned for more, have fun with the GLED431, and have a great holiday!

Walt Jung

December 24, 2015

DIY STUFF

ONE THOUGHT ON "GLED431: AN ULTRA LOW NOISE LED REFERENCE CELL"

★ Walt Jung

JANUARY 18, 2016 AT 11:17 AM

From the DIYaudio thread by Jack Walton.

Quote: **"Is there any particular reason to use ZTX951? How about BC560 low noise PNP?"**

Response: Caveat 2 is the answer re the ZTX951 for the target Vout, plus the fact that it also offers lowest noise. This isn't just theory, it was tested.

Comments about dynamic Z aren't relevant to the cited application, where the GLED431 cell is operated within a regulator with the ref cell biased from the output (i.e., the example 5V reg, with a 499 ohm feed R from 5V).

COMMENTS ARE CLOSED.