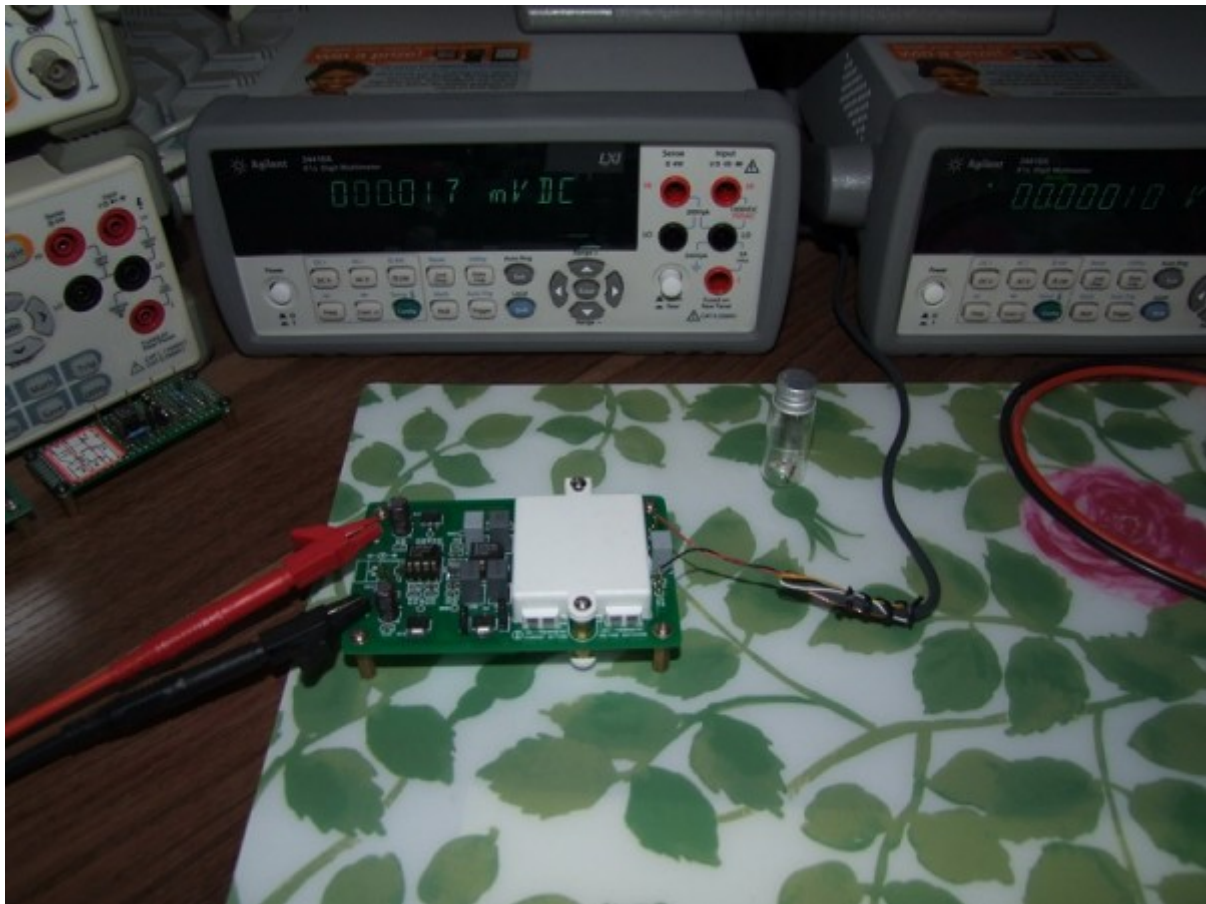


The ninth step: Go to the LTZ1000 on the stage. Two power supplies are made on the board. One is for the LTZ1000 reference and op amp, and the other is for the thermostatic bath in the LTZ1000. It is a power circuit made of separate components. After testing, Both noise and stability are one order of magnitude higher than those of 7815 and 317! Only need to connect a DC voltage above 13V externally to output a stable voltage of about 7V at the right end.



Due to the flash of the camera and the shooting angle, the screen on the left watch feels aging, but the brightness is the same when viewed with the naked eye.

The LTZ1000 in this reference board is selected so that the output of the board is not much different from the original LM399 reference voltage, so the temperature coefficient of the LTZ1000 itself is not the best among my many LTZ1000 devices.

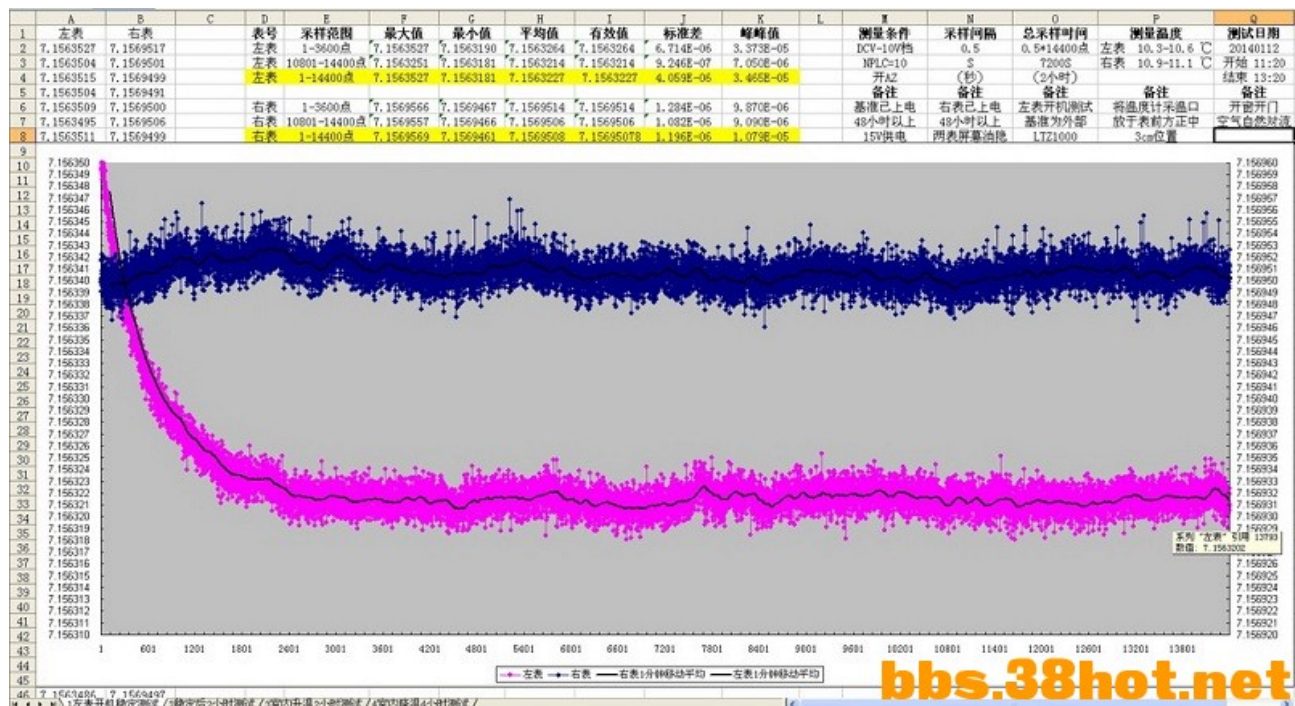
There is also an LTZ1000 board that has been powered on for more than 48 hours. The LTZ1000 has very good characteristics. I have tested it today. At 10 °C, the top of the white plastic box is continuously heated evenly (the tin foil is stable, and the LTZ1000 and the 8 metal foil resistors), until the internal constant temperature of LTZ1000 is out of balance (about 55 °C) and the external temperature is about 45 °C, the output of this board only drops by less than 7uV, of course, the op amp is not heated, and the overall temperature drift is not clear.





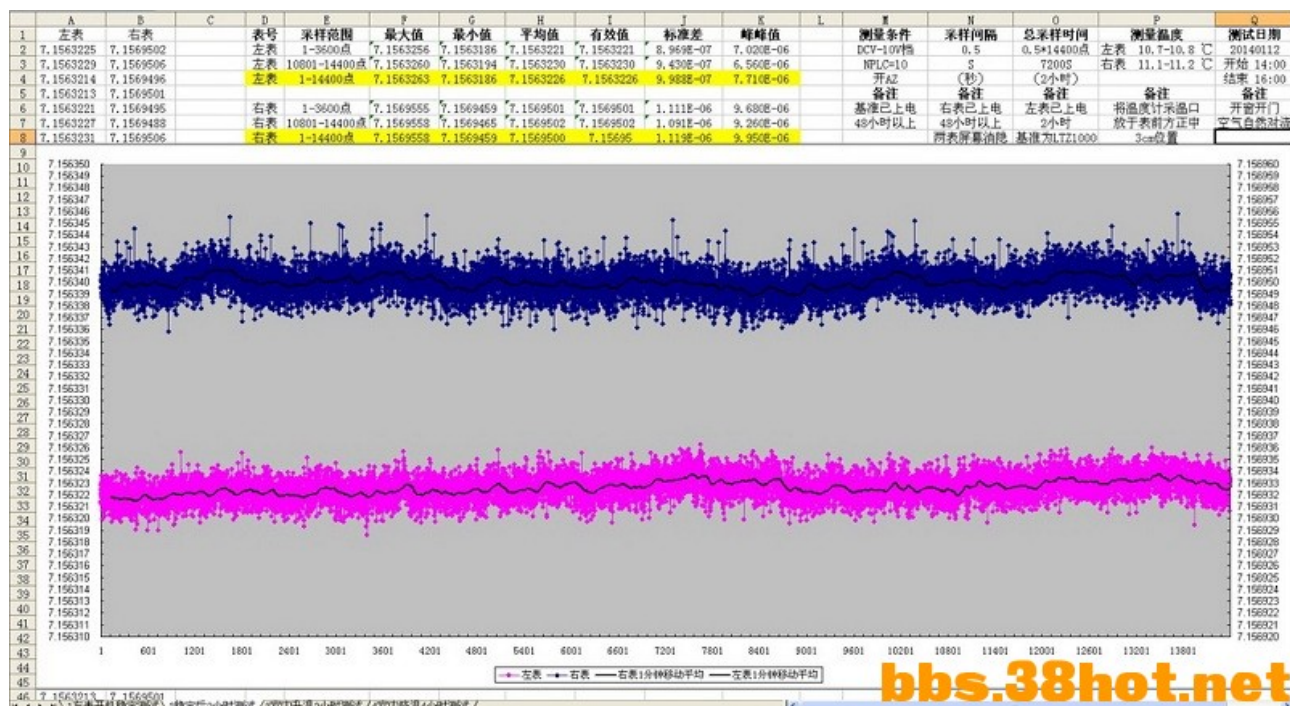
If the benchmark is changed and the readings are expected to be consistent, it is impossible. Note that when modifying the test, first power on the external reference LTZ1000 board, and then turn on the power of the multimeter, and the power is off!

Step 10: Tested, after a day, the lower reference and the right watch in the picture have been powered on, the display of the watch is blanked (the display of the watch is a considerable heat source), and then the external reference of the left watch and the watch are turned on and tested. Stabilization time, the LTZ1000 benchmark in the lower part of the figure and the table on the right have been powered on for more than 48 hours.



Data were collected continuously for 2 hours, NPLC=10, and the data interval was 0.5 seconds. It can be seen that the boot stability time modification effect is very obvious: look at the purple curve in the picture, 2400X0.5 seconds = 1200 seconds (20 minutes) to stabilize at the uV level, while the original watch used LM399 It took almost 3 hours to be stable at uV level. And after the reading is basically stable, it is more stable than the curve without modification!

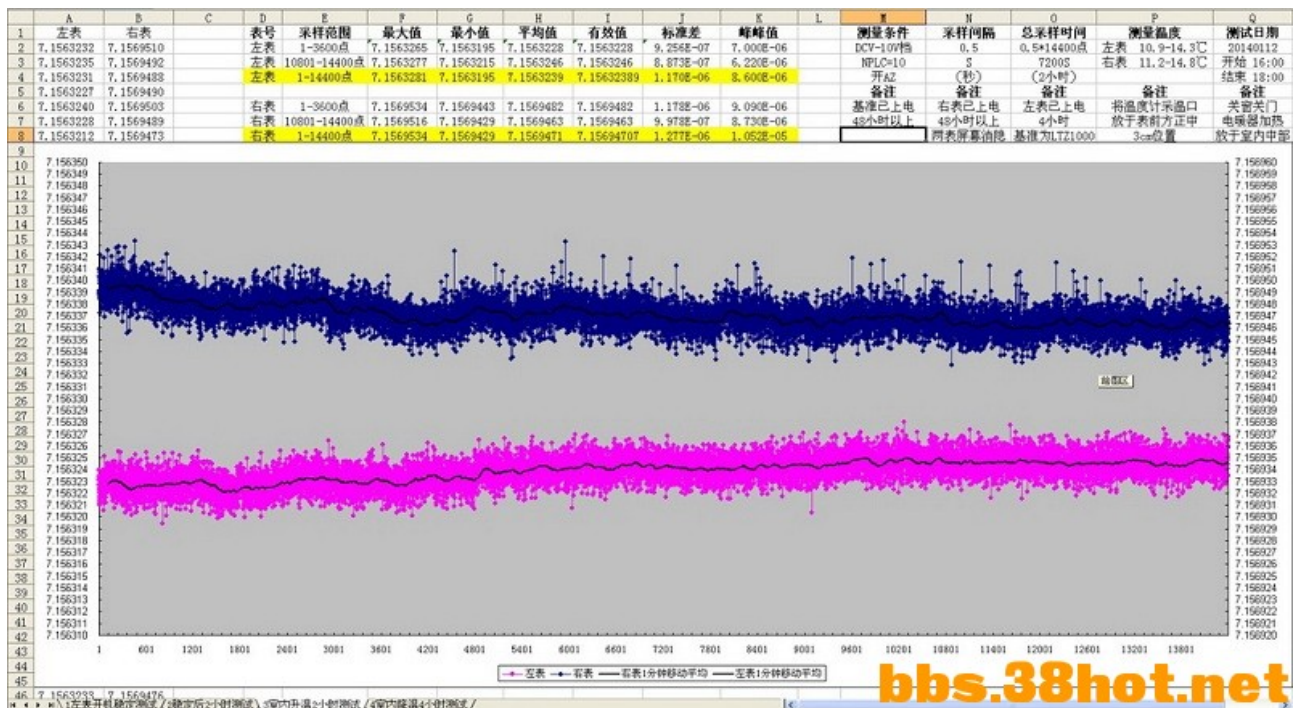
Then did another 2 hours of reading stability test



After the modification, the curve is relatively stable, and the noise does not change much, which is reduced by almost 1/4. No way, the noise now mainly comes from factors such as the internal op amp of the machine. If you want to reduce the noise, you have to change the op amp, which is too much work. Forget it, it is good to average the data, and make full use of statistics. Learning, as long as the test is highly repeatable. However, you can see that compared with the 34410A using the LM399 benchmark, the noise on both sides of the curve sampled by this modified table is much less scattered. Professionally, it should be: Gaussian distribution is more ideal.

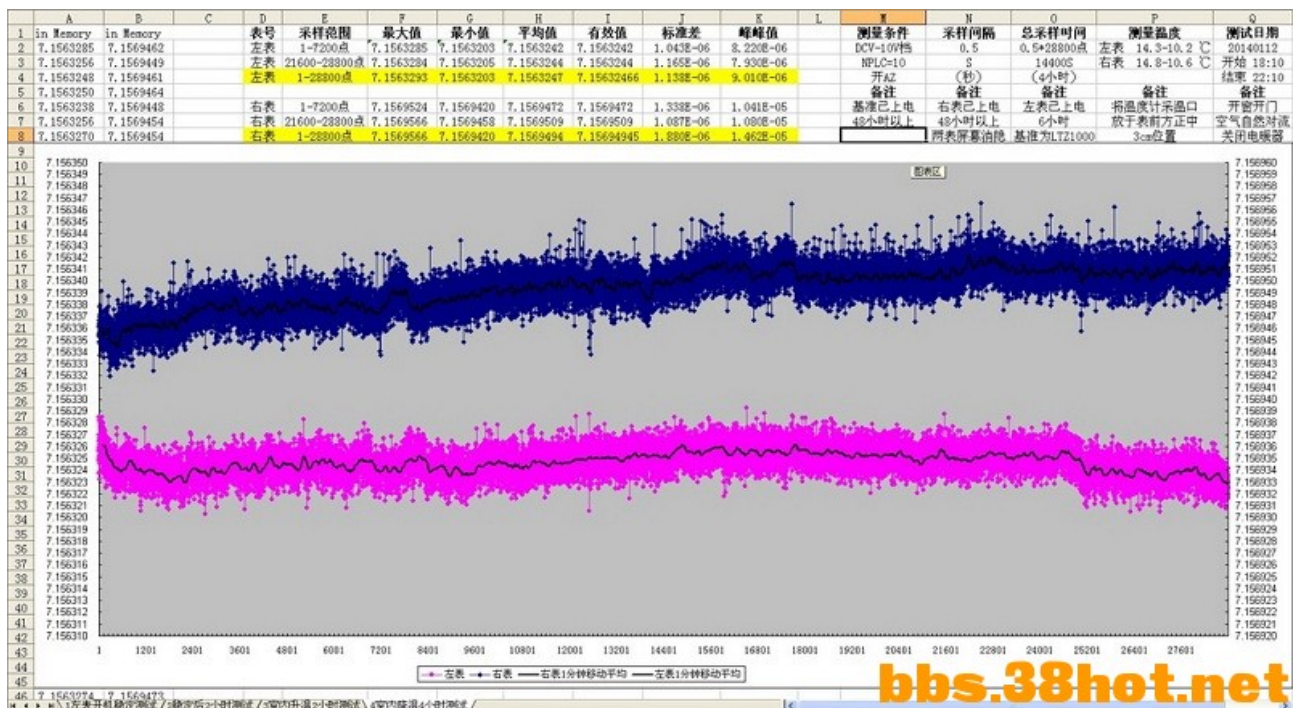
Compared with LM399, the advantages of LTZ1000's benchmarks are definitely temperature drift and long-term stability, so the indoor heating test was carried out: close the doors and windows, change a small study room with an almost 8-square-meter balcony, and use an 800W electric heater to empty the room. It was heated at high speed, and by the end of the test, the room temperature had risen by almost 3.5 degrees.





The change of the purple-red color is relatively gentle, the 1-minute moving average increases slightly by 1.5uV, and the blue-black curve fluctuates slightly and decreases by 3uV. This data is for reference only, because I don't know much about the temperature coefficient of the modified LTZ1000.

Then, began to cool down naturally, and tested the data for 4 hours



This curve is not very ideal. It is estimated that it is related to the hot air convection caused by opening the window and opening the door. After all, the modified LTZ1000 benchmark is outside the machine, and it is estimated that the sudden hot and cold convection is more serious. Just for a reference, but in any case, the data seems to be better than the LM399, relatively stable.

According to the above test, I think it is feasible and effective to change the benchmark to LTZ1000 for 34410A! Please pay attention to this year's completely modified 34410A machine test!