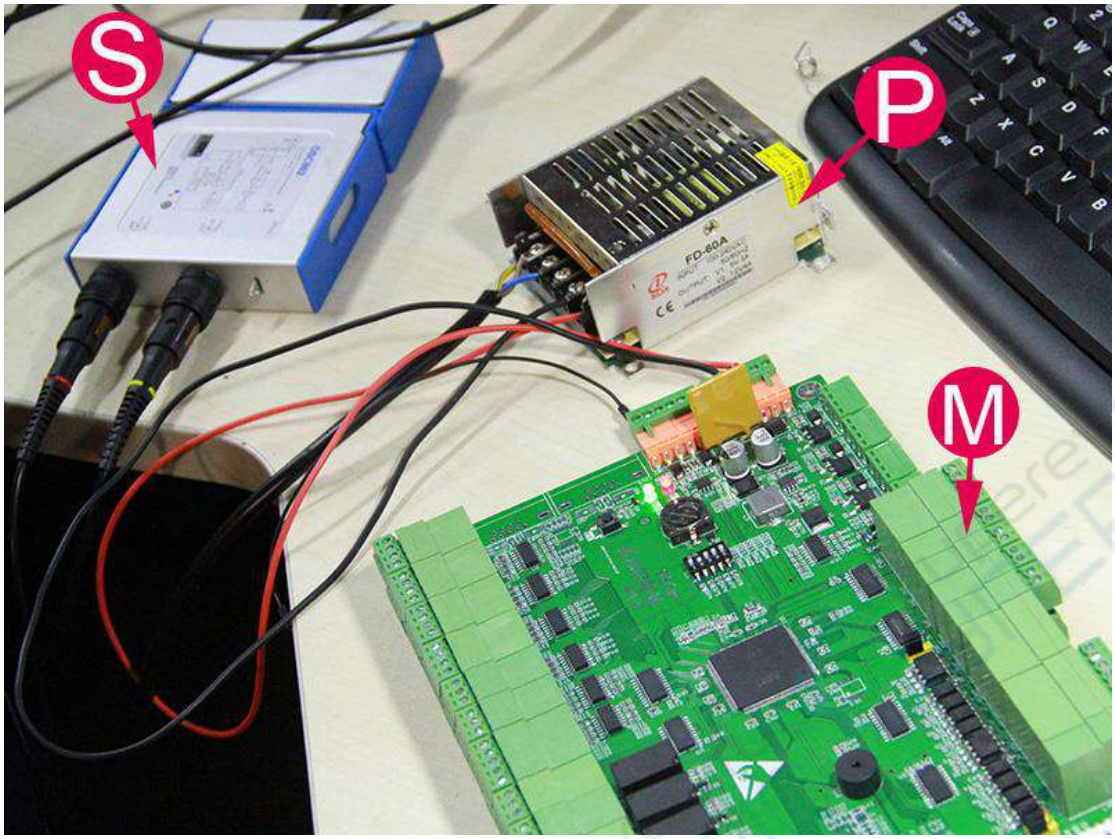
LOTO Test power supply ripple correctly and elegantly OSC802

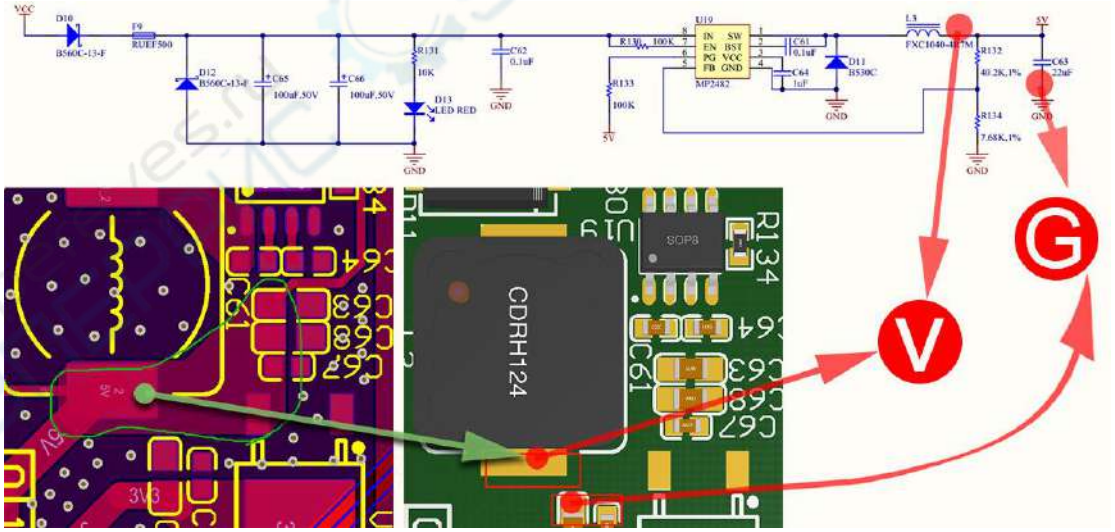
The requirement to measure power supply ripple is becoming more common, not onlyfor power engineers. Ripple is the core indicator of power supply, and power engineersneed pay attention to ripple at all times. Hardware engineers in other fields also have todeal with power ripple. Because as our experience accumulates, we will recognize howimportant a clean power system is to a stable circuit.

Power supply ripple is the most intuitive manifestation of power supply performance andis the fluctuation of the power supply output voltage. If it is a switching power supply, the output ripple is a regular swing, and the frequency of the swing is equal to theswitching frequency. The ripple is formed because the current flows through the outputcapacitor at the ESR of the capacitor. The pulsating current in the switching power supply flows through the capacitor, so the frequency of its ripple is equal to the switchingfrequency. The ripple noise of the power system is transmitted to the power pins of thechip, affecting the performance of the chip.

Take the power system test of a motion control board as an example to show you the test process and method of power supply ripple. As shown in the figure below, M is motion control board, P is the switching power supply for M, and S is the USB oscilloscope OSC802.

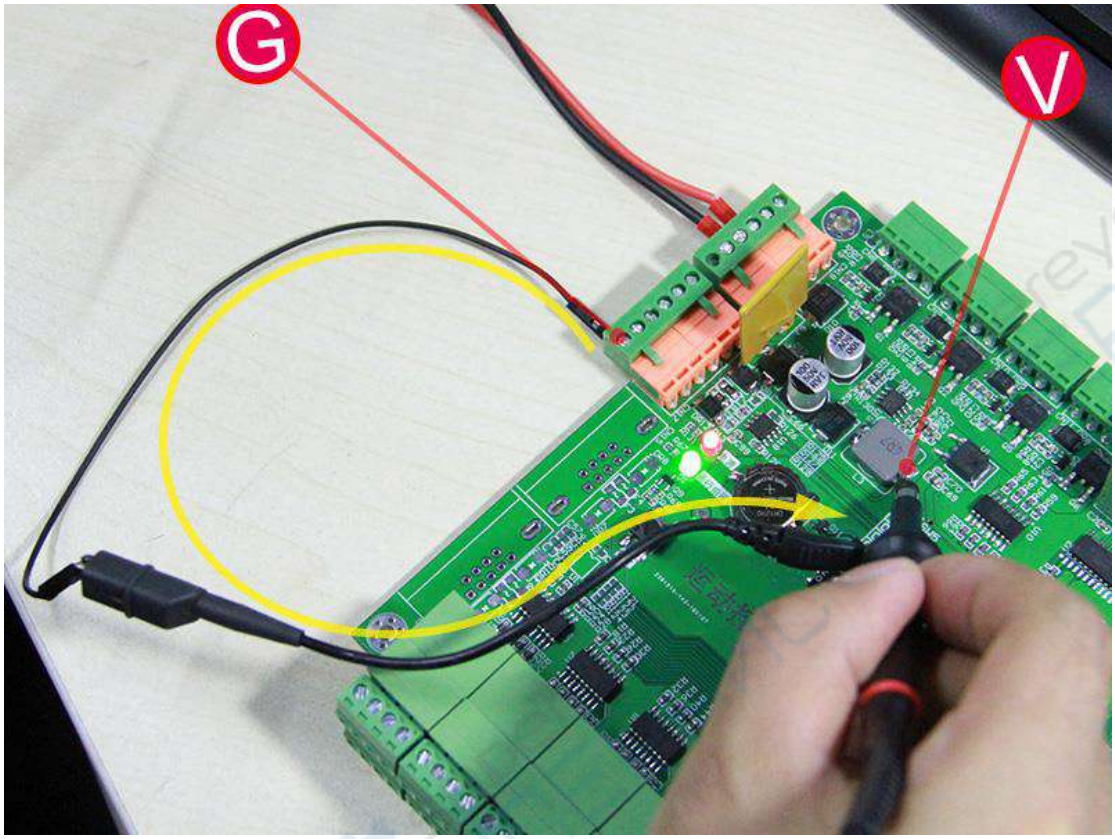


The schematic diagram and PCB layout of the power supply section of the motion control board M are as below,

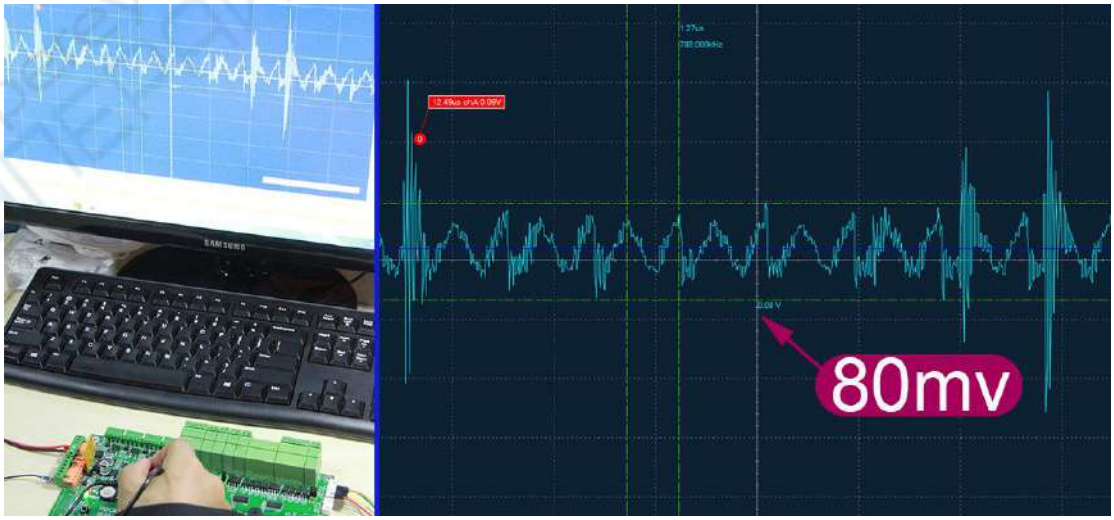


We need to test the ripple at both ends of V and G to verify that the power system meets the design requirements. First we use oscilloscope's AC-coupling to test the ripple

size and remove the DC component we don't care about. For convenience I used the long ground wire of oscilloscope probe, as below,

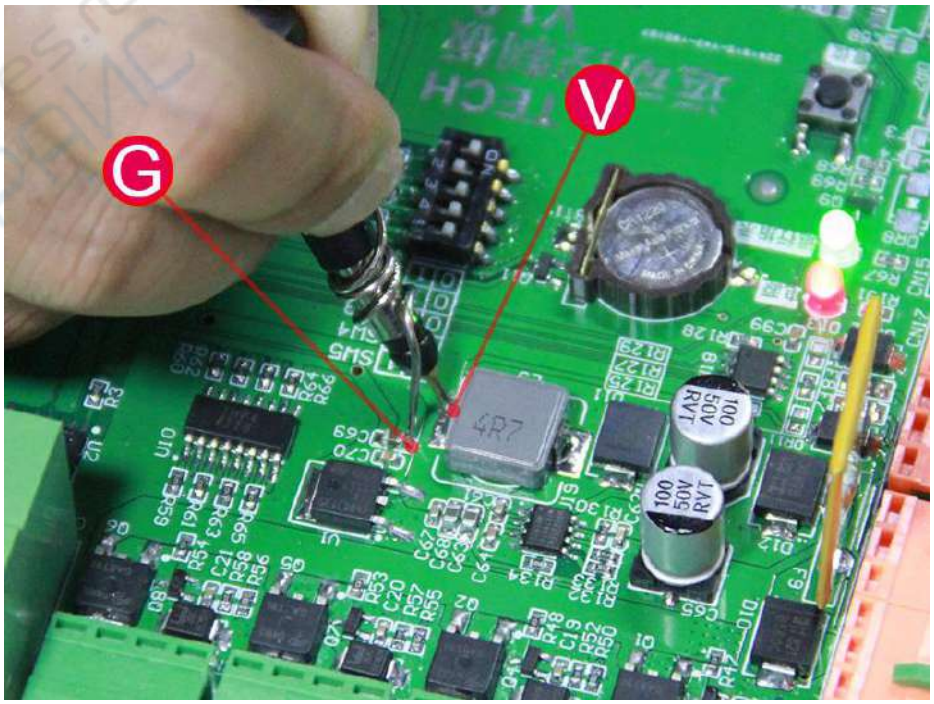


The ripple of the power supply may be small, but due to the long ground line, the circulation path shown by the yellow line will absorb the radiation interference in this area and superimpose it on the real ripple. In this case, my test results as below,

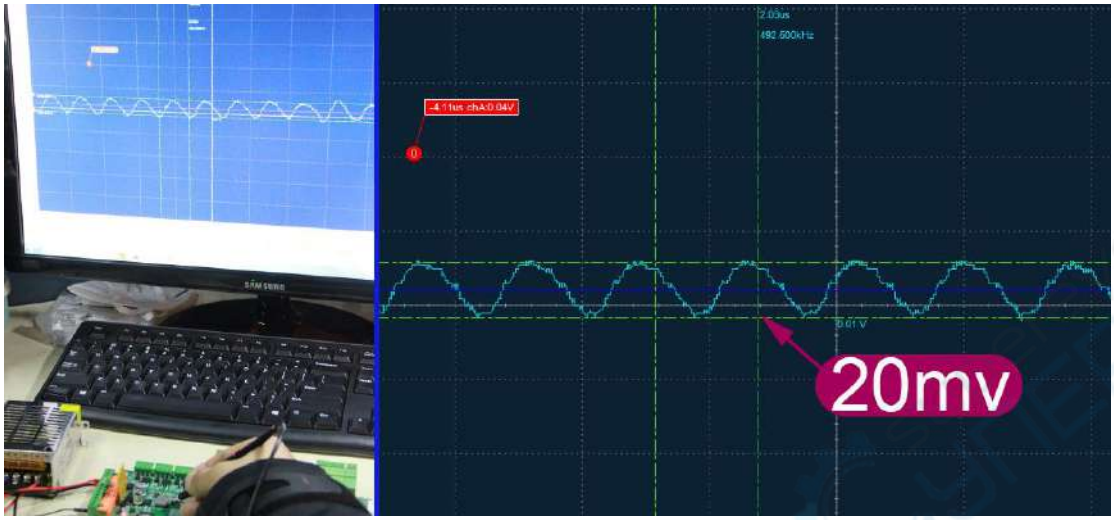


Approximately 80mv ripple is measured, and even more than 100mv of noise is added (using 50mv/div). Because noise interference of this loop path, I improved the test method to minimize this loop area and external interference. Measure area is very small by using a grounding spring. However, there is no grounding spring on hand, I straighten a clip and make a simple grounding spring.

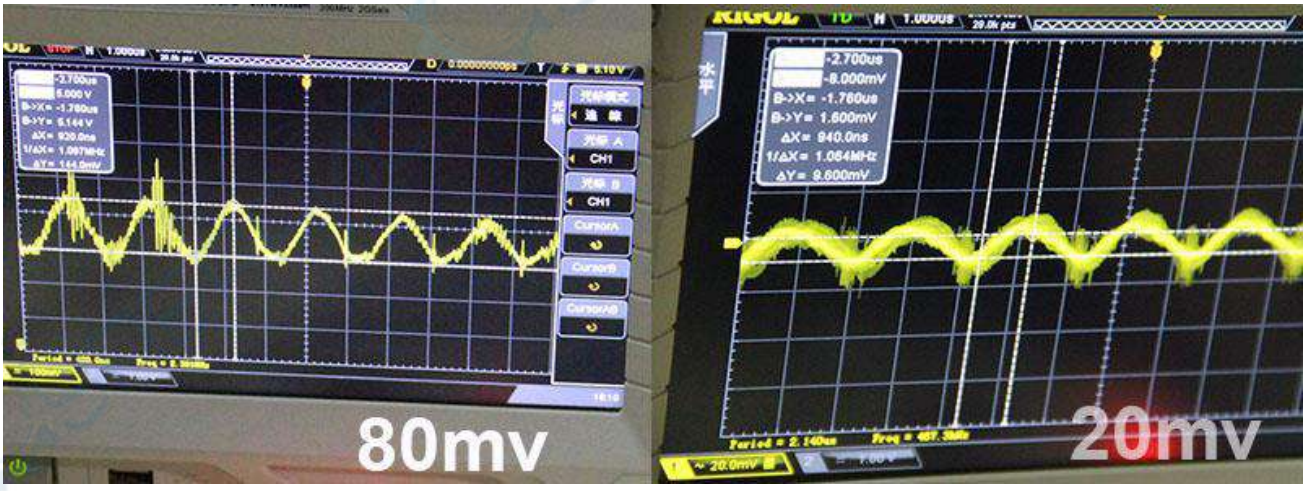
In this way, a small loop area can be used to measure the ripple between V and G.



The measurement results have improved a lot, the ripples become clean, about 20mv ripple has been measured (using 20mv/div) as shown below,



It seems that the ripple of the power system is relatively clean, and it is stable at around 20mv, which basically meets our original design requirements. The difference between the test results and the length of the ground line (in fact, the loop area was changed) was so great. To be cautious, I borrowed a bench oscilloscope Rigol DS1000Z and repeated the operation. The USB oscilloscope and the bench oscilloscope got the same result, which were 80mv and 20mv ripples respectively:



Therefore, it is certain that measuring the power supply ripple does require AC coupling, and grounding springs are used to connect to minimize the loop area. If there is no grounding spring, you can make one. In addition, using our USB oscilloscope measures

power supply ripples is simple and precise, 20mv ripple can be easily measured and clearly displayed.