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Low Cost Effective Power Adaptor Tester

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ABSTRACT

Initially we got some customer complain about receiving faulty power adaptor, we realize that we need to test the power adaptor although our vendor that supply us the adaptor suppose to give us good unit. Since this is quite a simple test, we do not really want to spend $3000 for a multimeter and $5000 for a computer to automate this test at back end. A simple test circuit was design to perform this test efficiently. This paper describe the simple circuit that able to reject bad adaptor that does not meet a certain spec.

INTRODUCTION

In order to automate the test setup to sort out bad power adaptor, a critical method is to hook up a computer to a dvm and the computer will read the measurement from the dvm to determine pass fail condition. However, this is not too cost effective.
Since the specification test limit for the power adaptor is not that critical for the measurement, A simple circuit design can actually replace the expensive setup mention above. This simple design is what we call the "Low Cost Effective Power Adaptor Tester" which we install in CT2 handset functional test station to sort out bad power adaptor. This paper basically describe the circuit design for this simple tester.

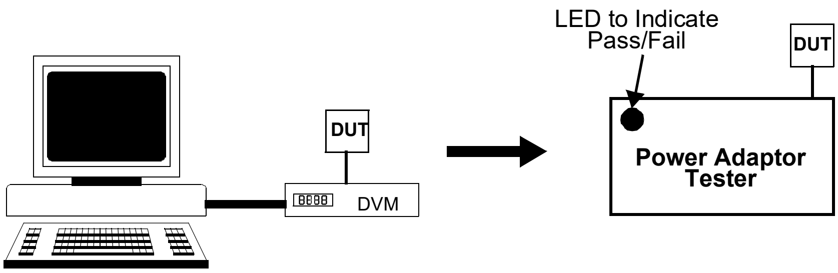

Fig -1 Power Adaptor Tester can replace a complicated test setup

THE POWER ADAPTOR TESTER

In order to sort out a good adaptor, we need to know what the voltage rating and what the spec limits are. Let's look at the specification before we start to look into the design.

The Power Adaptor Specification

The power rating for the power adaptor is 12V at 300mA. The voltage spec limit is 12 $^{+}/-$ 1 Volt. This basically spell out all the requirement needed for the tester setup.

The major component of the design circuit should be able to setup a voltage window in order to turn on a indicator if the input source supply meet the spec. Basically a simple comparator circuit can be use to setup this spec window. Let look at the comparator circuit in the next section.

Comparator Circuit

Fig-2a show a simple circuit for a comparator. When V_{in} is slightly more positive than V_{ref}, V_o will swing from V^-_{sat} to V^+_{sat}. The output will swing back from V^+_{sat} to V^-_{sat} as soon as V_{in} is slightly more negative than V_{ref}.

Fig-2b is a similar comparator circuit as in Fig-2a. However, the V_{ref} is set at the positive input of the op-amp. In this configuration, V_o will swing from V^+_{sat} to V^-_{sat} if V_{in} is more positive than V_{ref}. Likewise V_o will swing from V^-_{sat} to V^+_{sat} if V_{in} is more negative than V_{ref}.

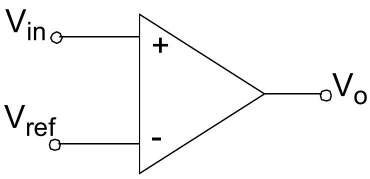

Fig-2a

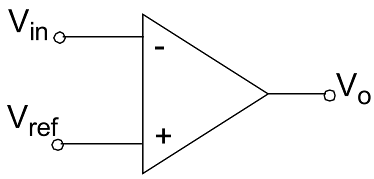

Fig-2b

Combination of these two circuit will generally setup the upper and lower voltage window for the tester to sort out bad adaptor. The next step is how to combine these two comparator to indicate pass/fail status through a LED indicator.

Power Adaptor Load

In order to get the power adaptor to source at the rated voltage, a load should be hook up to the adaptor. These load can be calculate using simple **V=IR** equation.

Given rated power as 12V, 300 mA:

$$\mathbf{R_L = V/R}$$

=> $R_L = 12/.3 = 40\ \Omega$

Size of the load resistor :

$$\mathbf{P = I\,V}$$

=> $P = 12 \times .3 = 3.6$ w

Therefore in order to measure the rated voltage, a 40 Ω, 4 w resistor is used to load down the source.

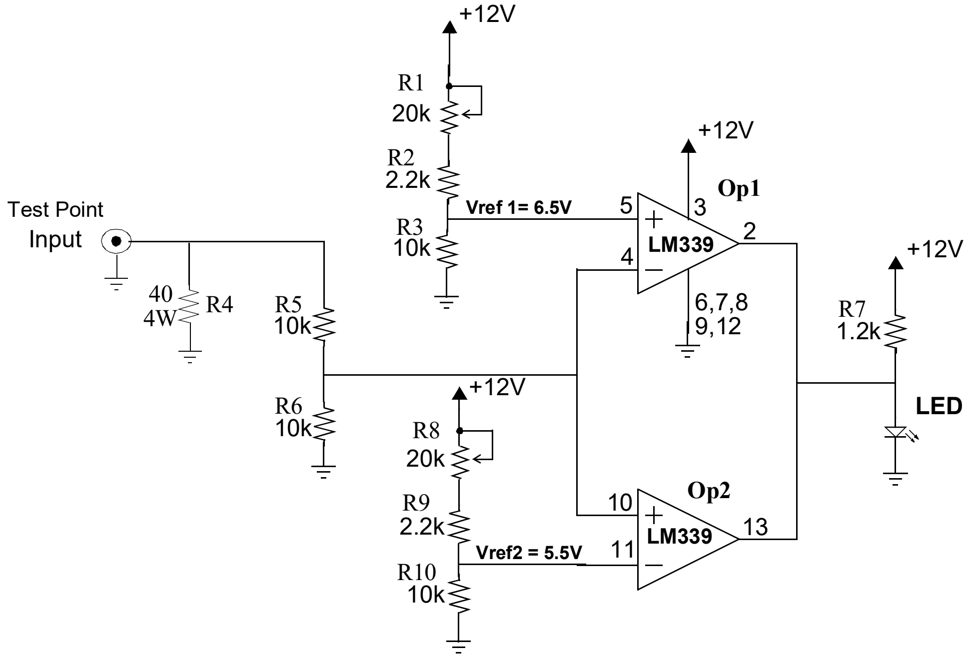

Fig -3 Circuit for the power adaptor tester

The complete design of the power adaptor tester

Fig-3 show the complete design of the power adaptor tester. Test point input is the point where the output of the adaptor should plug in. R4 is the load resistor R_L that load down the incoming source from power adaptor to the rated voltage. The voltage from the incoming voltage source is than further divide by 2 by the voltage divider R5 and R6 in order to get a better dynamic range. This divided voltage is than feed into a set of comparator Op1 and Op2 to check if the incoming source meet the specification limit. V_{ref1} is set to gate the upper limit and V_{ref2} is set to gate the lower limit. V_{ref} basically can be set using the equation show in Fig 4 :

$$\mathbf{Vref} = \mathbf{Vcc}\,\frac{\mathbf{Ra}}{\mathbf{Ra + Rb}}$$

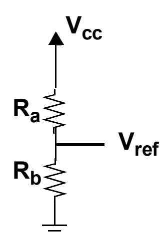

Fig -4

In Fig-3 V_{ref1} is setup using R1, R2 and R3 and V_{ref2} is setup using R8, R9 and R10. A variable resistor R1 and R8 are use in order to adjust V_{ref} to the required spec. Here

V_{ref1} is set to 6.5V and V_{ref2} is set to 5.5V rather than 13V and 11V because the incoming source has been divided by two by R5 and R6. Therefore the spec limit is dived by two as show in the design.

When the test point input is between 11V and 13V, Output from Op1 and Op2 are both pull high. That basically will drive the LED in forward bias and light up the LED to indicate PASS condition. If the test point input is less than 11V, Op2 will be pull low. That will drive the LED in reverse bias causing the LED to turn off to indicate FAIL condition. If the test point input is more than 13V, Op2 will be pull low. That will drive the LED in reverse bias causing the LED to turn off to indicate FAIL condition.

The output from the Op1 and Op2 basically are open collector therefore require R7 as pull up resistor.

CONCLUSION

At time a tester do not really required expensive equipments and computer to automate the test setup. If the spec limit and test measurement is not too critical, simple circuit design can actually replace expensive equipments. “Low Cost Effective Power Adaptor Tester” is a critical example here. If computer and dvm are used here for the test setup, it will cost $8000. The simple circuit design describe in this paper actually cost less than $50. That is a cost saving of $7950.

REFERENCES

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[2] Louis Nashelsky, Robert Boylestad, “Device Discrete and Integrated”, Prentice Hall, Inc., England Cliffs, New Jersey 07632, pp 387-394, 1981.