Bob Parker ESR

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Valores de ESR típicos para condensadores (por uF / V)2

Capacidad 10V 16V 25V 35V 63V 160V 250V

1uF - - 5 4 6 10 20

2.2uF - - 2.5 3 4 9 14

4.7uF - - 6 3 2 6 5

10 uF - 1.6 1.5 1.7 2 3 6

22 uF 3 0.8 2 1 0.8 1.6 3

47 uF 1 2 1 1 0.6 1 2

100 uF 0.6 0.9 0.5 0.5 0.3 0.5 1

220 uF 0.3 0.4 0.4 0.2 0.15 0.25 0.5

470 uf 0.15 0.2 0.25 0.1 0.1 0.2 0.3

1000 uF 0.1 0.1 0.1 0.04 0.04 0.15 -

4700 uF 0.06 0.05 0.05 0.05 0.05 - -

10000 uF 0.04 0.03 0.03 0.03 - - -

When you are evaluating the capacitors on a motherboard with issues, the problem you will be faced with is that capacitors do not always show visible signs of failure. Therefore it is very useful to have an instrument that will tell you which capacitors are causing the problem. That instrument is an ESR meter.

The Bob Parker ESR Meter Design

One of the most widely used designs and indeed a very good one is one made by Bob Parker. Bob Parker is an Australian electrical engineer and he designed several DIY projects which were published in Electronics Australia magazine. One of these projects was the ESR and Low Ohms meter which was published in the January 1996 edition as the MKI version. Later the design was revised and the MKII version was published in Silicon Chip magazine during 2004.

The kit was also distributed in Australia via Dick Smith Electronics but around Feb/07 the kit began to be sold at a heavily discounted price according to them there was not enough interest in the kit but this is incorrect. Interestingly the new low price of 15 euro made several badcaps forum members scramble to get their orders done quickly in case the kit became out of stock. Later they discontinued the kit.

Other companies around the world still sell this product in kit and assembled form. One of these is EVB electronics of Portugal which sells quality units which are already assembled and calibrated. I purchased one in Jan/06 and will review it below.

EVB ESR Meter of Bob Parker Design - Review

Here is what I received. The device, the test leads, a 100 ohm resistor, a manual and a two year warranty. The cost was 68 euro plus shipping so 74 euro which is a reasonable price to pay for such a useful tool.

Since then I have received reports that the product is not being shipped as complete as the above version. Now there is no leads, no resistor and the manual has to be downloaded from the site. Personally it would be nice if they still supplied the leads but there is a new lower price because of the missing items which is 62 euro plus shipping 68. It is a fine price really.

The leads are basically multimeter leads which can be obtained from most electronics shops. It is important not to purchase retractable leads (the ones which have cables which are curled like a telephone cord) because their inductance will give inaccurate readings.

The Packaging

The meter was received well packaged in a cardboard shipping box with the meter covered with foam cloth and the leads were wrapped in cellophane (not shown). I have received a report from one purchaser that their unit was not packaged as nicely as mine so I guess it depends how they feel when they ship it. Still the service is very good with shipping from Portugal to Greece taking 5 days. The EVB site notes that they ship only every Tuesday and Friday at 5pm so it would be a good idea to take that into consideration if you buy.

The ESR Meter

The meter has an attractive case with the usual table of expected measurement values on it that Bob Parker defined. The top part is basically a big thick sticker but its fine. The table of values is not that useful at all for computer applications as it is rare to see failure in capacitors below 330uf. Anyway no matter because I will explain how to take and interpret the readings.

Inside

The case of is held together with tabs so it is a little difficult to prise it open. Care has to be taken not to break one of the tabs when you open the case to change the battery, I did. That is definitely one of the shortcomings with this product but I know how difficult it is to source appropriate cases for electronic projects. Like most instruments the unit is powered with one 9v battery.

Side View

The PCB has obviously been manufactured for EVB. It is very nice.

The PCB up close

The product has been hand soldered but the soldering job is very nice, all nice shiny joints.

In the background the test switch can be seen. This is another poor aspects of the device. The plastic tube can slip down making the button stuck under the case cover. This can be solved by inserting an appropriate sized screw into the tube so it is raised above the hole in the cover. More enterprising users could replace this switch with a nicer one and therefore solve the problem forever. The capacitors used in the unit are Nitai NP, Lelon REA 85oC and Jamicon TK. Funny to be testing for bad capacitors with capacitors from bad manufacturers in the unit.

Here is the microcontroller ZiLOG Z86E0412PSC 1866 running custom firmware and also the Kingbright GaAIA 7 segment led displays.

The calibration pots. Calibration is done by EVB before shipping but also the unit must be zeroed each time it is turned on. This is done by touching the leads together strongly and then pressing the test button.

Closer view of the nice Kingbright GaAIA 7 segment led displays.

The 100 ohm resistor

The 100 ohm resistor is used to discharge large capacitors like the primary capacitors in a power supply so they dont damage the meter. This can be obtained from any electronic shop.

After turning on the meter each time, you need to zero it and you would do that by touching the leads together strongly and pressing the on/zero button. Then it is ready to test a cap. You just touch one lead to each of the leads of the capacitor and the reading will be shown immediately. It is important to take a proper reading by having a strong metal to metal contact so the best way to do that is by having your fingers like in the photo. This doesnt affect the readings. Make sure you dont press the capacitor's leads together otherwise the reading will be wrong.

Sample ESR Readings

Here are some readings that I took of various capacitors which I had removed from motherboards or had not used yet (the Sanyo and Panasonic).

Brand
Capacitance
Voltage
ESR
Comment

Sanyo WG
2200uf
6.3v
0.0 ohm
(too small ESR to measure)

Panasonic FC
1000uf
50v
0.01 ohm
(new)

Panasonic FC
3300uf
6.3v
0.02 ohm
(new)

Ost
1000uf
6.3v
0.04 ohm
(not failed)

Chhsi
1000uf
6.3v
0.06 ohm
(not failed)

GSC LE
3300uf
6.3v
0.27 ohm
(bulging)

Gloria
1000uf
50v
1.1 ohm
(bulging)

Jackcon
1000uf
10v
1.5 ohm

(bulging)

Jackcon
1500uf
6.3v
1.6 ohm
(bulging)

JPCON
2200uf
6.3v
2.1 ohm
(bulging)

Lelon
1500uf
10v
2.78 ohm
(bulging)

Gloria
1500uf
6.3v
5.0 ohm
(bulging)

Analysis of Sample ESR Readings

If you compare the bulging capacitors which have failed with the ones which are not bulging, a great difference in ESR is seen. The Ost and Chhsi are capacitors which are unreliable brands but they have not failed yet and measure 0.04 and 0.06 ohms respectively, which are acceptable values for Low ESR capacitors.

All the bulging capacitors are of similar Low ESR specification to the Ost and Chhsi and therefore would measure about the same if they had not failed. But actually they measure from 0.27 ohm all the way to 5.0 ohms.

It is important to emphasise this great difference in ESR values between good Low ESR capacitors and failed ones. With a meter it is so obvious which one's have failed and there is really no need to start consulting specification sheets. For a motherboard we would want to use capacitors that are as far below 0.10 ohms that we can obtain.

Testing Capacitors Out of Circuit

The problem with testing capacitors in circuit is that there may be other capacitors connected in parallel with the capacitor you are testing. This can mean that the value tested is incorrect. There can be other components in the circuit affecting the value also. In ATX Power Supplies it can be quite difficult to locate the capacitor you want to test on the rear of the PCB. For best results and sometimes the only way is to desolder capacitors and test them out of circuit. Still with this meter there is no problem to test them in circuit when the power is disconnected from the device. You will not damage the motherboard or other device with this meter.

Another Version of this Unit, the Blue ESR Meter

In 2008 Bob Parker and Anatek in the US released a different version called the Blue ESR Meter. However that does not make the EVB version obsolete, it still is a great choice. You can keep up with news and availability of the Bob

Parker designed meters on his site.