

## Powering JYE Tech Oscilloscopes With Used Cellphone Batteries

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Nowadays you are likely have some old cellphones floating around. Many of them contain batteries that are still working. These batteries are great for powering your electronic devices. Making use of these batteries is not only fun but also a help to protect the environment. In this article we will describe how to use these batteries as power supplies for JYE Tech portable oscilloscopes DSO 094 and DSO 096.

### Find the right battery

#### 1. Battery type and voltage

The battery to be used must be **Li-Ion battery with specified voltage being 3.6 - 3.7V**. This is because the on-board charger works for this type of battery only.

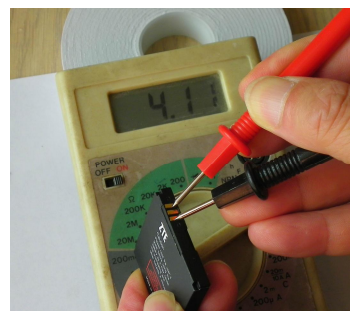
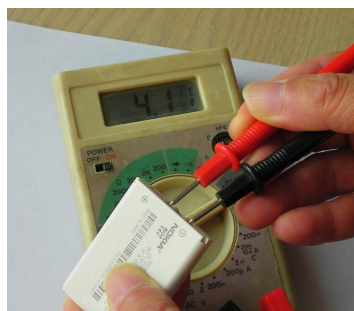
#### 2. Battery dimensions

The size of battery has to be fit to the installation place. The most important is its thickness. For DSO 094 the **battery thickness should not be more than 7mm (0.25")**. For DSO 096 it can be 1 - 2 mm thicker. The length can be 60 -70mm (2.3" - 2.7") or shorter and the width be 40 - 45mm (1.6" - 1.8") or smaller.



### Check battery condition

We hope there still some juices in the cell we found, which should be true in most cases. Here is a basic checking in case you are unlucky to hit a real dead one. Get a volt meter and measure the voltage at its terminals. You may read 0 volt if the phone has long time not been used. In this case put the battery back to cellphone and charge it for one night or longer (hopefully you can still find the right charger). After charging check the voltage again. Normally they should read around 4V. The photos below show the charged voltage of the two batteries shown above. Both read 0V before charging and now they are 4.1V.

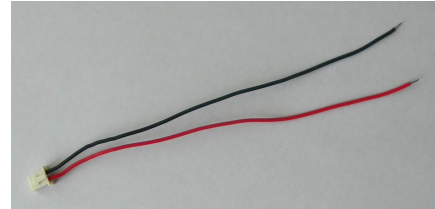


Please note the voltage doesn't indicate how much remaining capacity of the battery has. You need to check that with oscilloscope connected (see below).

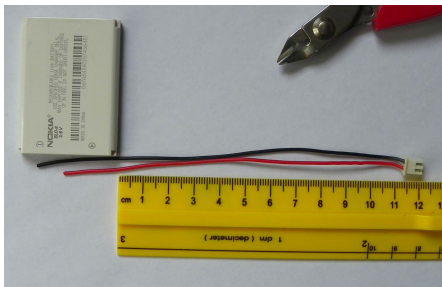
**Note: Before proceeding to next steps it is highly recommended to have battery fully charged with the original charger. This will help you estimate battery remaining capacity later. Once wires are soldered to battery you will no longer be able to use the original charger to charge it.**

### **Solder wires to battery**

The no- battery versions of DSO 094 and 096 come with connecting wires that have matching socket to the pin-header on PCB (photo at right). You only need to solder the wires to battery terminals.



First cut the wires to appropriate length. Make sure the black and red wire lengths are match with battery terminal positions and leave about 12cm free length as shown in the photo below (left). Then carefully solder the wires to the terminals (photo below right). **Pay special attention to make sure red wire is soldered to the positive terminal and black wire to negative terminal.**



### **Check battery capacity**

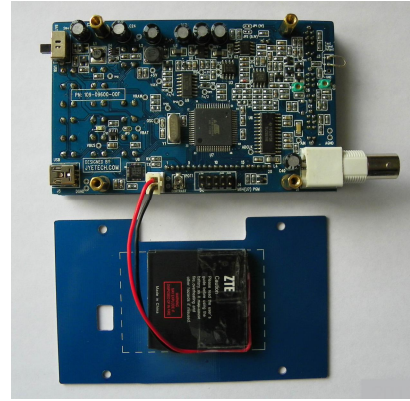
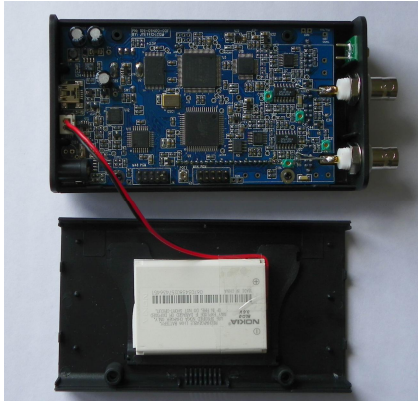
Now it's good time to check battery capacity. Plug the battery to the header on oscilloscope PCB. Power up the oscilloscope and leave it running to discharge the battery. Record the time for how long the battery lasts. Multiply the time with oscilloscope consumption current (see user manual for its value) you will get a rough idea how much the battery capacity is. Please note that it is important to have the battery fully charged before discharging. Otherwise, the result is not accurate.

### **Attach battery to oscilloscope**

Before attaching battery to oscilloscopes wrap the terminals and wires with adhesive tapes as shown in the photos below. This serves to two purposes, insulating and providing stress relief for the wires.



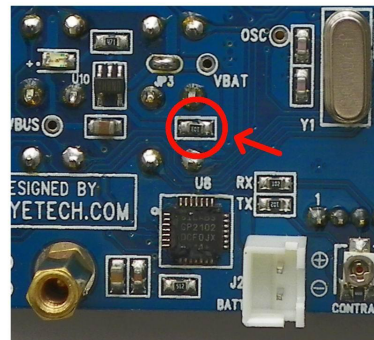
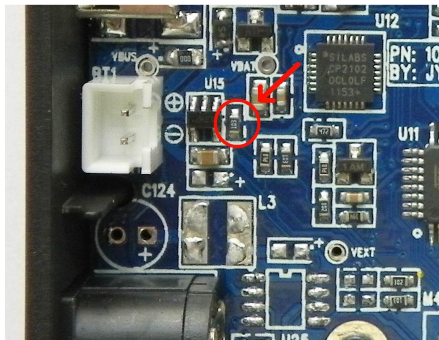
The battery is to be attached to the inner side of back cover (for 094) or back plate (for 096) with double-sided adhesive foam. This adhesive foam is included in purchase and has been put in place before shipment. You need first determine battery position and orientation so as the connecting wire is run smoothly (see photos below as examples). Then peel off the protection paper on foam and press battery firmly on to it.



### About the on-board battery charger

Both DSO 094 and 096 have built-in charger which is specifically for 3.7V Li-ion batteries. This charger can detect battery state and start/stop charging automatically. Because the charging current has been pre-programmed to 200mA (for 094) and 100mA (for 096), the time to fully charge a cell could be longer or shorter depending on the capacity of battery used. Normally this is fine and you don't need to change anything. But in case you want to change charging current you can do so by replacing one resistor. The following photos indicate which resistor to replace for DSO 094 and 096 respectively. To determine the resistor value you need please refer to the datasheet of LTC4054 (<http://www.jyotech.com/Products/095/LTC4054.pdf>) and the manual of 095 board. ([http://www.jyotech.com/Products/095/Manual\\_095A.pdf](http://www.jyotech.com/Products/095/Manual_095A.pdf)).

**Note: We do not encourage users to do the change unless they know what they are doing and have sufficient skill to do it.**



### Revision History

Version	Date	Descriptions
01	2012.08.22	First release