Replacing the Li-Ion Cells of the PSP Battery
by Cristi Caciuloiu, 19 Sep 2014

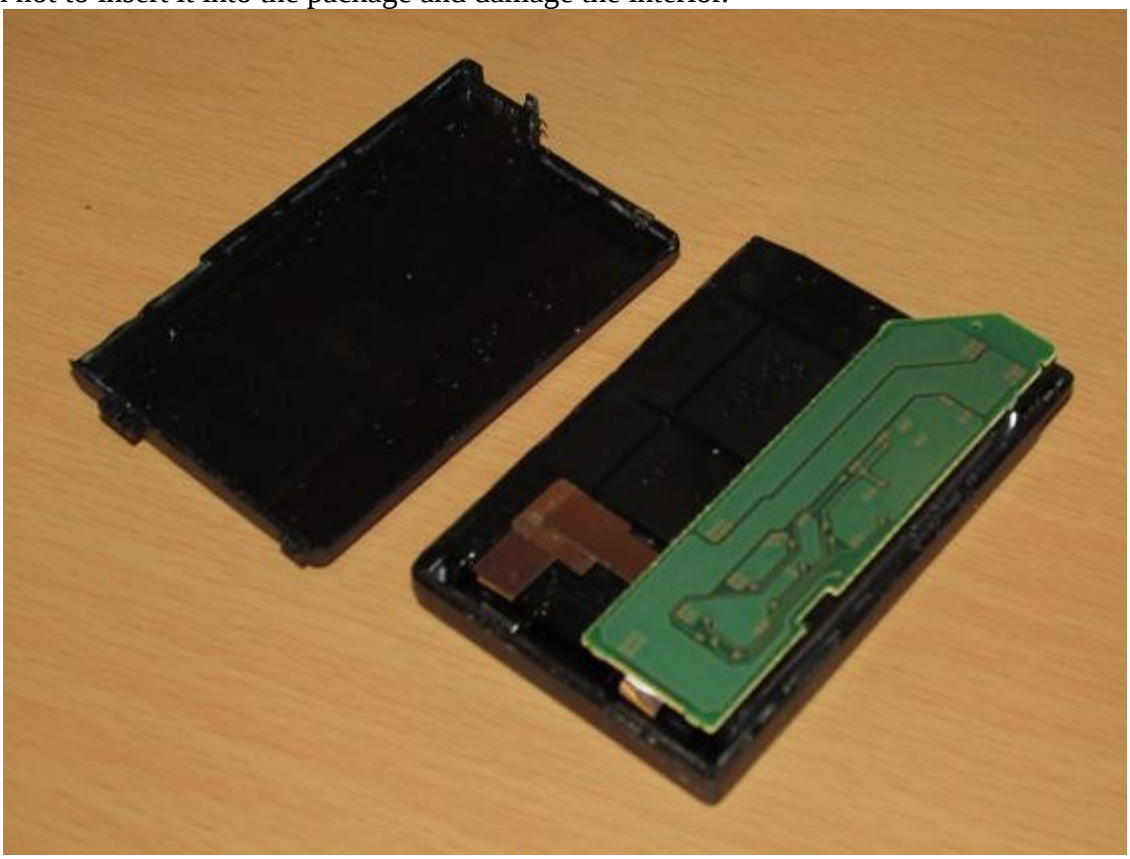
The following report presents the effort of a PSP fan (that would be me) to keep this old companion alive. With the Lithium-Ion batteries passing the test of time, it should be known already to everyone using them that they are likely to suffer significant capacity loss over time. Their life expectancy depends on many variables including the temperature and the charge level during storage, the number of full discharge/recharge cycles, the depth of the discharge (the shorter the discharge level, the longer its life will be), etc. One will have to accept the permanent capacity loss and the need to find a replacement once the battery starts to provide increasingly shorter energy.

In my case, the battery for the PSP-3004 model held fairly well for at least three years of daily use but eventually its capacity decreased rather suddenly to around 15-20 minutes. Here are the options one has today for this problem:

1) Try to find a new replacement for the PSP battery. Sony officially discontinued the PSP 3000 models in 2014. It is rumored that the battery production was stopped even earlier than that. One would be very lucky to find an original PSP S110 battery for the slim model in retail shops. If found, it is likely that the their production date is already pretty old. They are expensive too, in the 30$ range.
2) Try your luck with a generic replacement battery. Some of them claim to be original and it is difficult to be recognized as generic. Most comments I found on the Internet claimed issues with such batteries. The Power Management IC of these generic battery is not the Sony's equivalent and the battery does not hold its capacity over time while used in the PSP. My experience with the STAMINA battery pack of 1200mAh was pretty dire: the production date was 2007, the storage conditions and the charge level uncertain but the capacity loss observed immediately after unpacking was severe (the battery lasted 40 minutes after a full recharge), the power management circuit was functional only one week when exposed to the charging pulses generated by the PSP (the battery suddenly failed while the PSP was turned on and charging over the USB port and it was no longer recognized nor charged by the PSP).
3) Choose an external battery pack. There are some models specifically aimed for the PSP which have proper connections for the 5V port of the PSP and they can be charged with the PSP's external charger. Others are generic and have a mini-USB port which will have to be adapted to the PSP's power supply wires and will require rewiring of the 5V external charger to an USB connector. Either way, this option will make your PSP bulkier and heavier. Unless you opt for an expensive battery pack that would contain its own charge level indicator, you will loose this feature of the PSP. Either way, you will loose the auto-standby feature when the battery charge drops below a threshold.
4) Putting a new heart into your faithful old PSP battery. I was very excited about the idea of replacing the Lithium-Ion pouch cells of the original PSP S110 battery with newer ones. If successful, the transplant would give PSP a new life with all its functions up and running. The report continues with details on my successful operation.

The first picture presents the internals of the generic PSP battery. It can be seen that the power management IC used in the design is a 10-pin circuit.

The second picture presents an original S110 battery. The plastic cover is glued and it must be open very carefully not to break the thin plastic material. A plastic screwdriver is very useful and care must be taken not to insert it into the package and damage the interior.



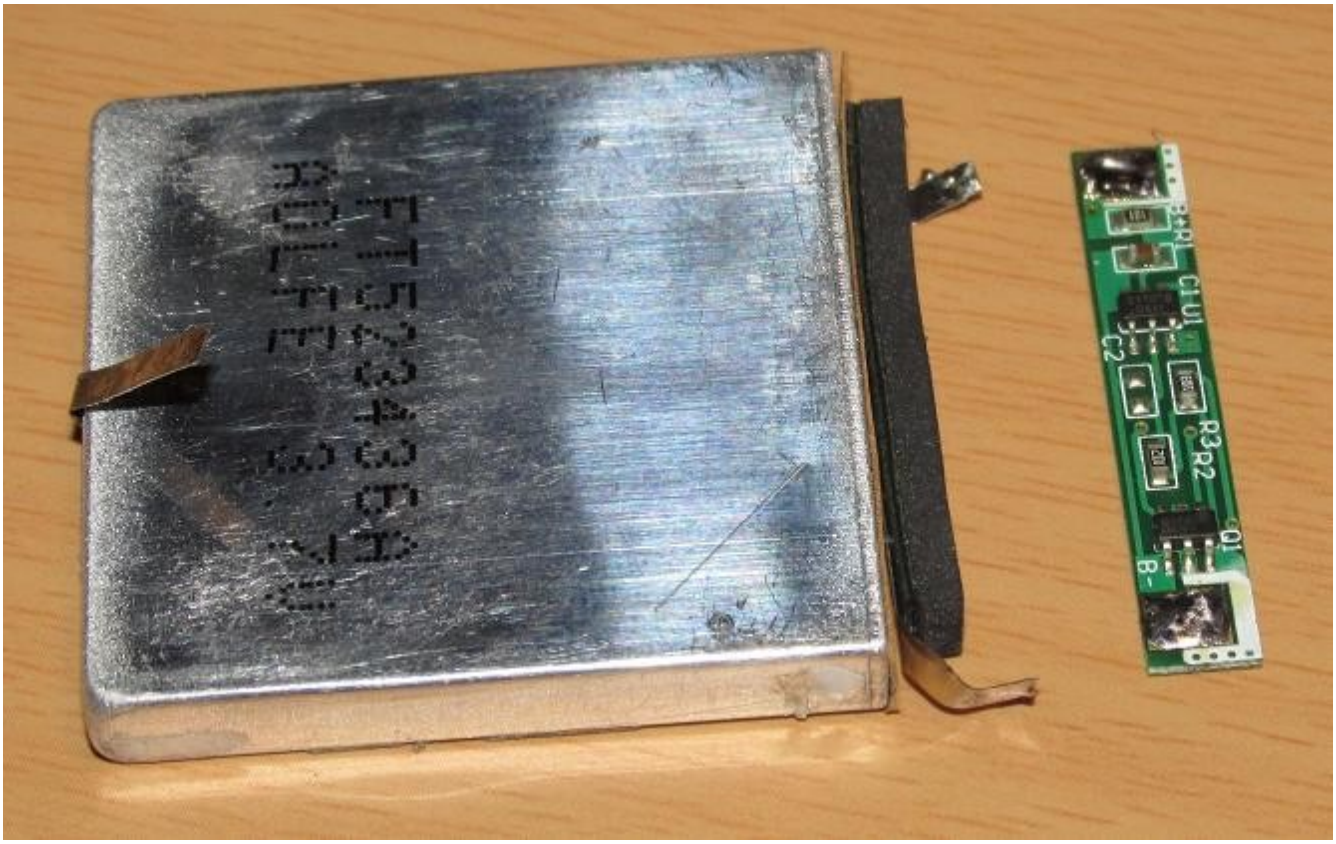
The PCB is separated from the Lithium-Ion pouch cell by a thin plastic cover. The board can be raised from its position from the end where the external electrical contacts to the PSP are located. Once rotated and the inner plastic insulator removed, the following picture shows the more complex power management IC that is labeled with the code 16808C18SC (Internet traces seem to indicate this to be

an old NEC power management circuit but it may very well be a custom ASIC based on a micro-controller which includes the charging and monitoring functions).

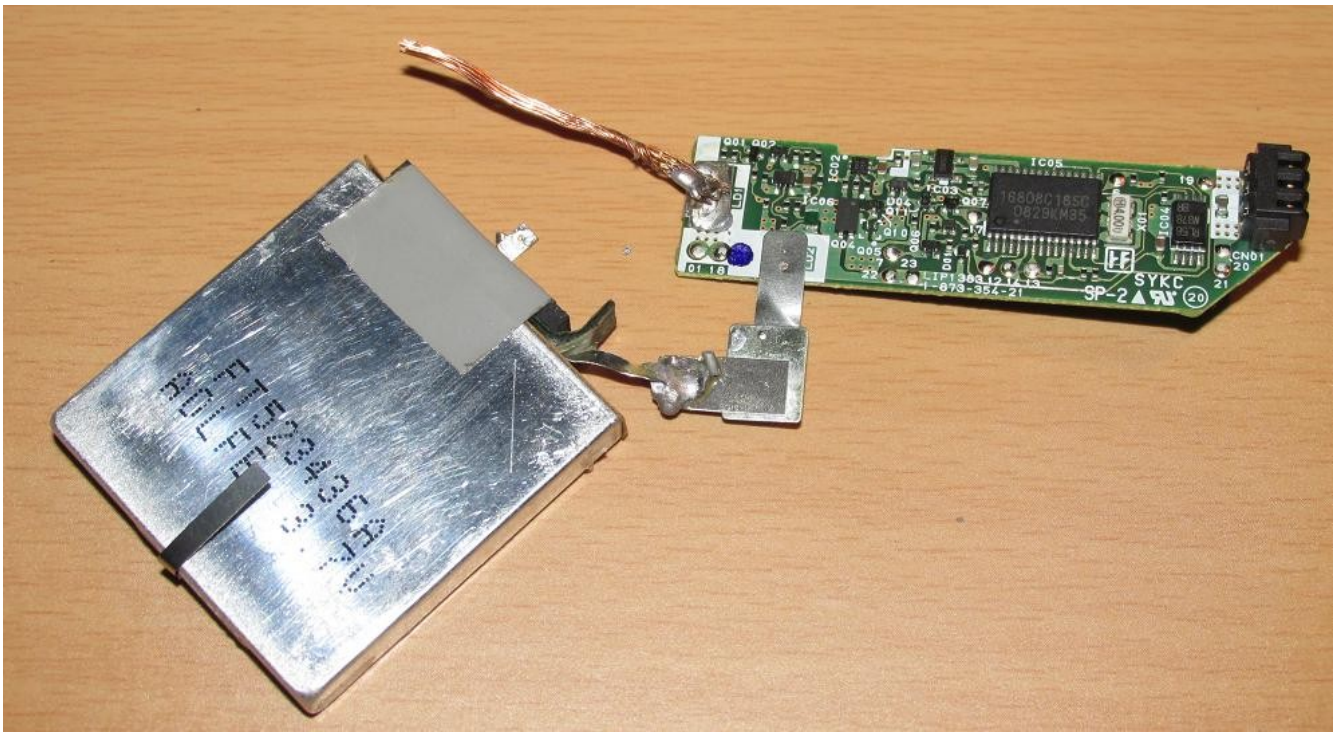
The pouch cell is connected to the board using two conductive tapes. They could be simple metal foils but are not from copper. The “donor” battery that will provide the replacement Lithium-Ion cells is proposed to be the Canon compatible NB-6L. This battery has a very reduced protection circuit inside the battery (and the rest is supplied as part of the charger) and the cells are more easier to extract. In fact, the battery is no longer “pouch” but the “prismatic” type. However, the metal case fits perfectly inside the plastic cover of the S110 battery. The voltage is 3.7V instead of 3.6V and that only indicates a different chemical choice for the Sony's battery design. I hoped that the power management IC would

not care about such differences.

Once the above paper cover and an adhesive hard plastic board are removed very easily from the donor battery, the prismatic cell can be studied. It has a very small circuit protection board on top of the cell which must be unsoldered. The one cable that can be seen in the top-right corner of cell is externally attached to the metal case (it can be seen on the left side).



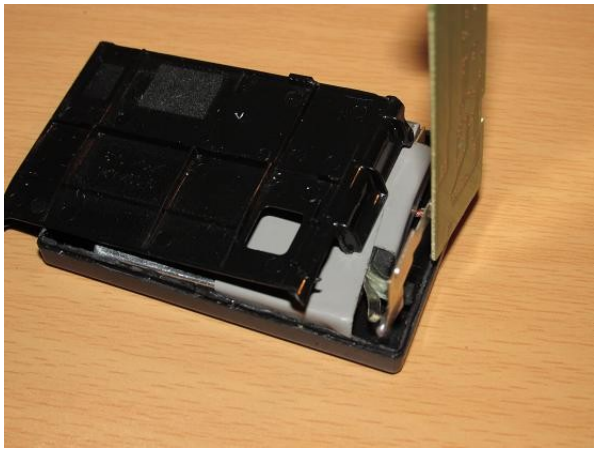
The two conductive foils attaching the pouch cell of the original battery were cut with a precision scissor. A copper based conductor was soldered on one power terminal of the board with the intention of fixing it externally to the metal case. The second power terminal was soldered to the prismatic cell's own terminal. If you plan to follow this tutorial, I cannot stress enough to take all the steps humanly possible to make sure you connect the correct polarity of the cell to the board. The steps I took were: pictures taken of the original design, measure with a voltmeter the correct polarity of the original design, take notes but check again and again, verify the polarity to be the correct one when you solder the new prismatic cell.



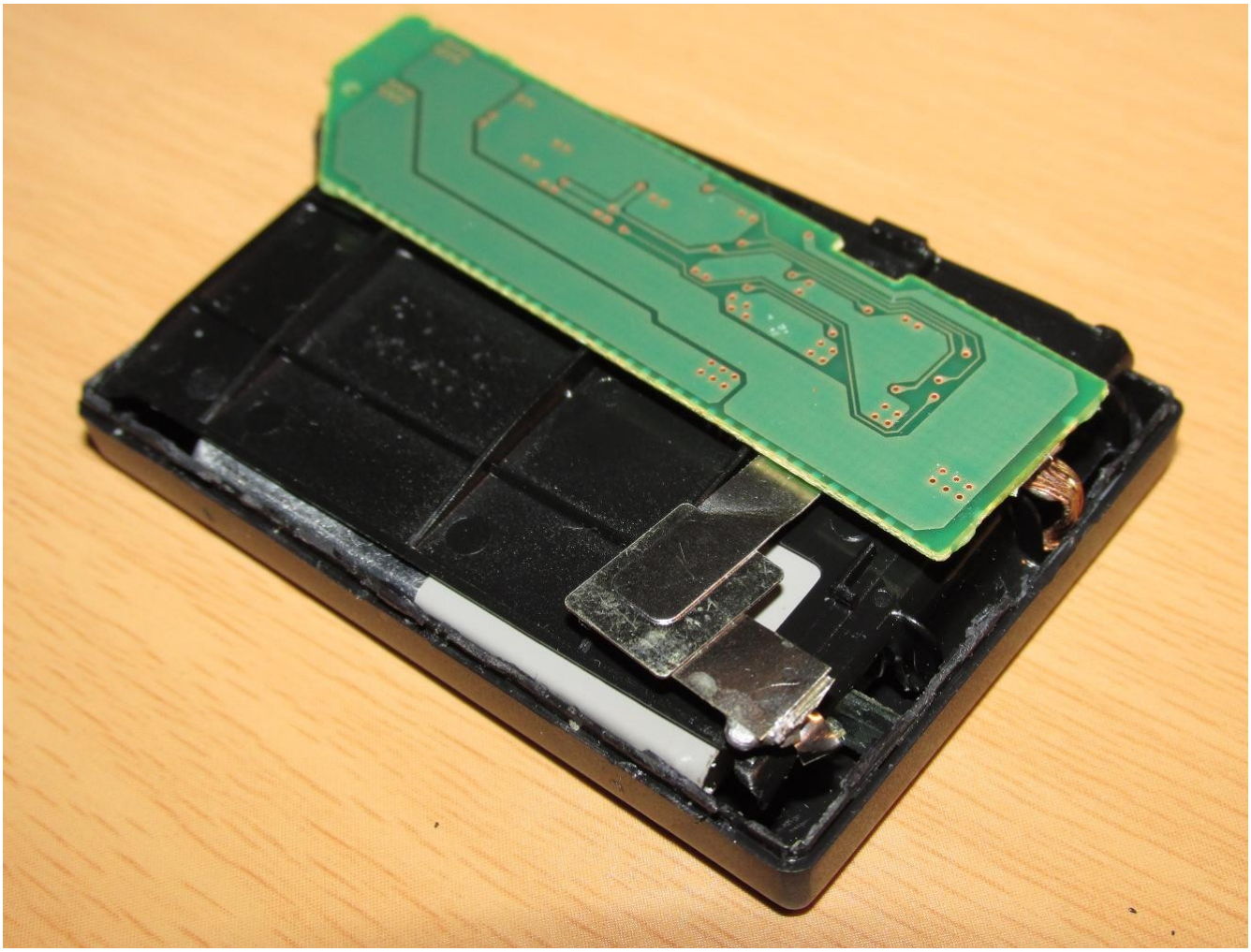
I added some electrical insulating tape in the areas of the cell where I feared that one pole could potentially touch the metal case. Just before encasing the prismatic cell, here is a final comparison.

It can be seen that the prismatic cell fits perfectly on the width of the plastic case of the S110 battery. The length is smaller than the replaced pouch cell.

The insulating inner plastic must be put back and some cuts needs to be made to it to allow the terminals to flex and give room to the protection board to rotate over the cells and allow full case enclosure. I made one small cut at the bottom-right corner of the case to allow room for the cell's terminal that is soldered on the board.



The final picture presents the circuit protection board rolled over the insulating plastic and with the external power socket plugged into the case. The cover was applied on top and fixed in place with a transparent adhesive tape. The thickness of the battery was hardly noticeable and it was mainly due to the adhesive tape, however the PSP battery cover did not have problems locking in its place once the battery was installed in the PSP.



At the time of writing this material, the battery was used in the PSP for one week, where the PSP was used for at least 3 hours per day. I performed three full discharge/recharge cycles just to evaluate the capacity of the battery but we all should know already that this is not a recommended manner to treat a Lithium-Ion battery. A fully charged “revitalized” battery was able to sustain 2 hours and 40 minutes of continuous operation of the PSP with the Wi-Fi turned on and actively transferring data (i.e. using remote play on a PS3). That is not bad considering that the “donor” battery was not fresh either (I did not want to risk a new battery but took it from an old compact digital camera – I believe it is 2-3 years old but with several tens of charging cycles). Everything else related to battery works on the PSP: it indicates the power left in the “Battery Information” system menu, it can be charged using the USB port of the PSP, it goes into Stand-by mode when the battery level drops too low. Just wonderful. I would think it would not be such a bad idea to grab one second hand original S110 battery to have for its precious power management board. As for the Lithium-Ion cell, fortunately, we have options, including the larger capacity NB-6LH of 1600 mAh made by SterlingTek.