

USB Lilon charger

Version 1.0

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Last year I bought an excellent little RC quadcopter for my son.



http://www.banggood.com/New-Version-Upgraded-Hubsan-X4-H107-2_4G-4CH-Remote-Control-RC-Quadcopter-p-71838.html

In order to have enough good quality spare batteries I've ordered 10 pcs of Turnigy nano-tech 300mah 1S 35~70C Lipo Packs.



http://www.hobbyking.com/hobbyking/store/_20384_Turnigy_nano_tech_300mah_1S_35_70C_Lipo_Pack_Fits_Nine_Eagles_Solo_Pro_100_.html

After only 2 charges of one of the batteries started to swell. This is a clear sign that something is wrong with the charger.

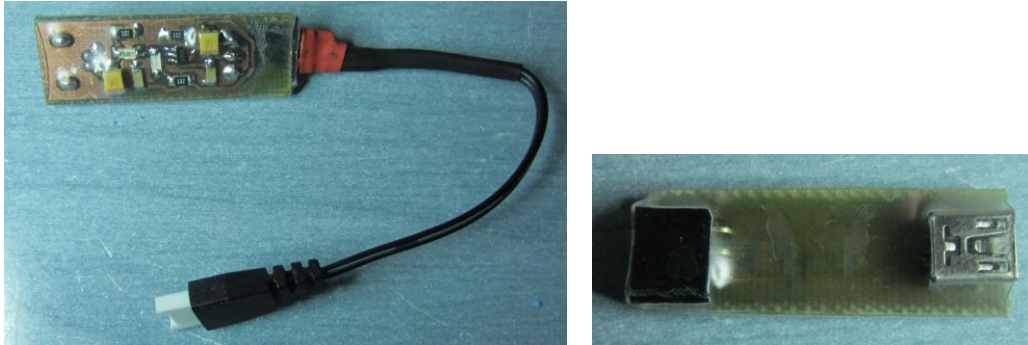
The quad comes with a small USB charger able to charge the battery to full capacity in around 2h.



After I dismantle the charger, I've seen that the schematic is far from the one recommended to charge a Lilon cell in good and secure conditions .

I decided to build my own USB charger based on a specialized integrated circuit from Microchip (MCP73831).

At the end the will look like in the following pictures.



The components

First let's see where we can find the main components for a cheap price.

1. **Mini USB Female 5Pin PCB Socket Connector** (< \$0.1) at:

<http://www.ebay.co.uk/itm/180599038309>



2. **1206 Super Bright DASH SMD SMT LED (red and green)** (~ \$0.3/pcs.) at:

<http://www.ebay.co.uk/itm/New-SMT-SMD-0603-0805-1206-LED-Chip-White-Red-Blue-Green-Orange-Yellow-Kelly-/171205070385>



3. **MCP73831T-2ACI/OT - LI-ION/LI-POLY CHARGE CONTROLLER** (~ \$0.8) at:

<http://export.farnell.com/microchip/mcp73831t-2aci-ot/li-ion-li-poly-charge-controller/dp/1332158?Ntt=1332158>



4. **10uf - 16v Tantalum SMD NRC106K16R** (~ \$0.7) at:

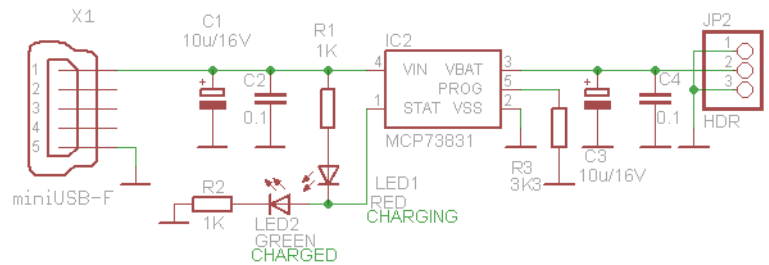
http://www.ebay.co.uk/itm/10uf-16v-Tantalum-SMD-NRC106K16R-Pack-10pcs-/300348384625?pt=UK_BOI_Electrical_Components_Supplies_ET&hash=item45ee28a571#ht_500wt_1054



This is the complete list of parts (BOM):

Part	Value	Device	Package	Description
C1	10u/16V	CPOL-EUB/3528-21R	B/3528-21R	POLARIZED CAPACITOR
C2	0.1	C-EUC1206	C1206	CAPACITOR
C3	10u/16V	CPOL-EUB/3528-21R	B/3528-21R	POLARIZED CAPACITOR
C4	0.1	C-EUC1206	C1206	CAPACITOR
IC2	MCP73831	MCP73831	SOT23-5	Miniature single cell, fully integrated Li-Ion, Li-polymer charge management controller
JP2	HDR	PINHD-1X3/90	1X03/90	PIN HEADER
LED1	RED	LEDCHIPLED_1206	CHIPLED_1206	LED
LED2	GREEN	LEDCHIPLED_1206	CHIPLED_1206	LED
R1	1K	R-EU_R1206	R1206	RESISTOR
R2	1K	R-EU_R1206	R1206	RESISTOR
R3	3K3	R-EU_R1206	R1206	RESISTOR
X1	miniUSB-F	MINI-USB_SHIELD5P2-32005-601	32005-601	MINI USB-B R/A DIP 5pol.

The schematic



The schematic is composed from:

- the miniUSB female connector used to power the charger, only for the +5V line;
- circuit around MCP73831 is the charging circuit for the Li-Ion cell. It provides the right voltage /current and stop the charging when the voltage is at 4.2V. The red LED lights during charging. The green LED lights when the charging cycle is complete (signaling that you can disconnect the battery and the charger from the USB port);

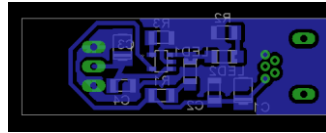
How to build

1. Build the PCB module

A single side PCB is used for this charger (the Eagle files are available by request, just send me an e-mail).



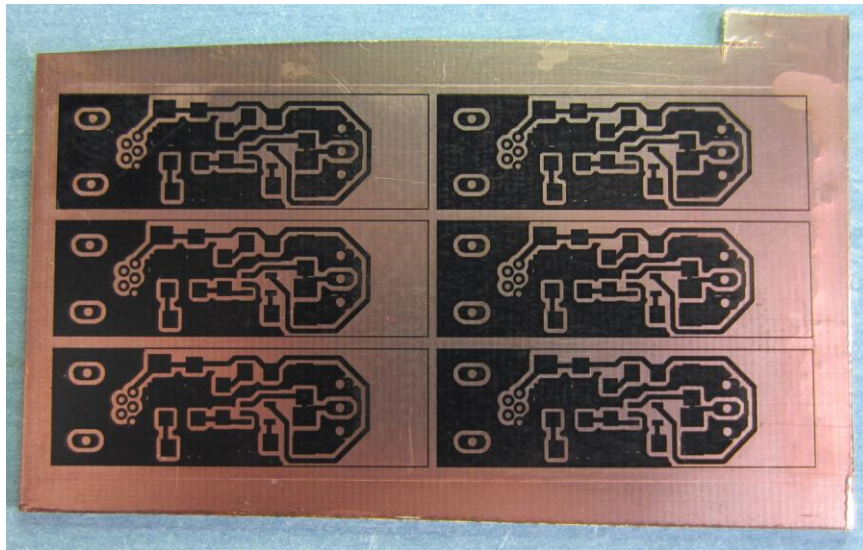
All the SMD components are placed on the bottom side (blue).
Next you can see the components placement.



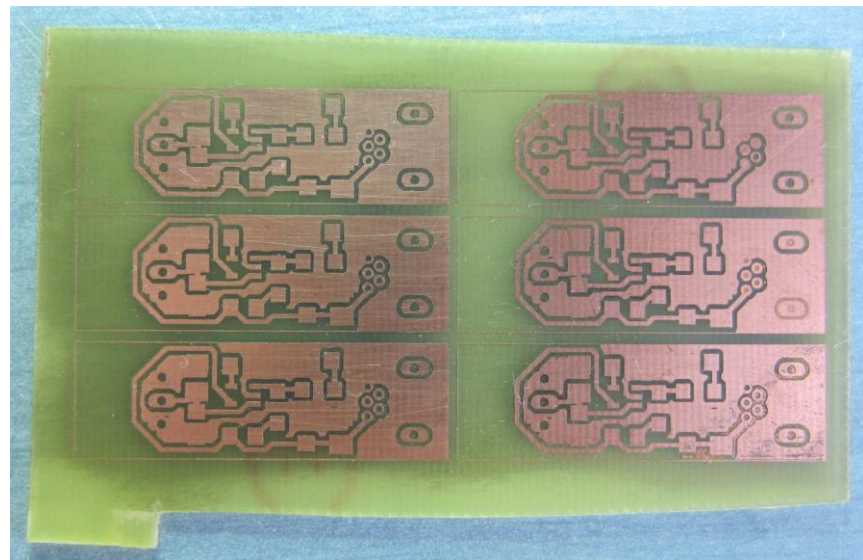
You can use the preferred method to make the PCB. I've used the toner transfer method, using a laser printer, glossy photo paper and a GBC Docuseal 40 mini laminator.

This is how my PCB looks like (without components).

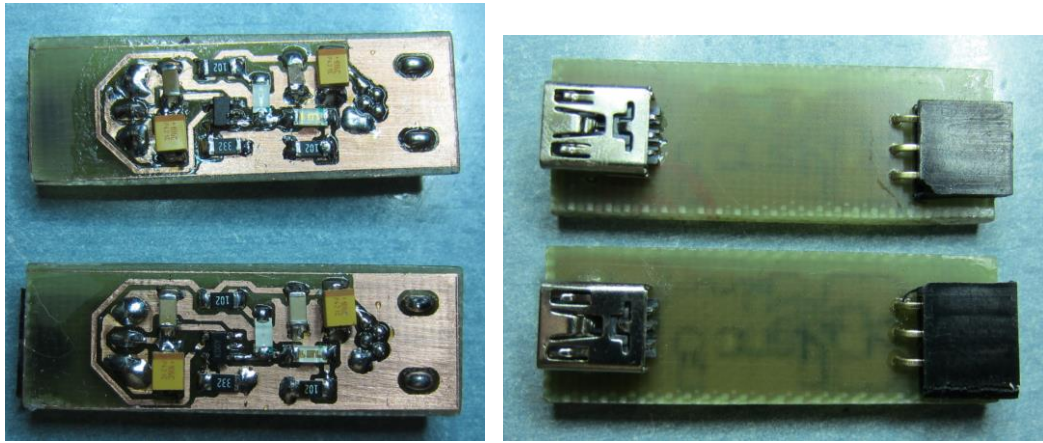
After toner transfer but before etching:



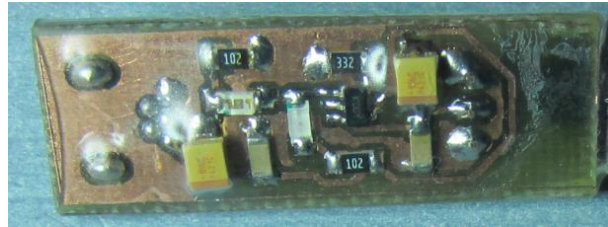
After etching:



With components:



Just insert the module in a piece of transparent heat shrink tube and you're done.



You can use this charger to charge larger Lilon batteries. Same cheap "one transistor" schematic is used for some 18650 batteries chargers available on eBay:



I've removed the original circuit and inserted the one built by me. The charger will look at the end like in the following picture (the SMFD leds replaced by some standard 3mm LEDs fixed in the charger case):



Bibliography

MCP73831 datasheet: <http://ww1.microchip.com/downloads/en/DeviceDoc/21984c.pdf>

Document History

Initial version of the document (v1.0).

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