(Battery) Backup System for CPU09RAM

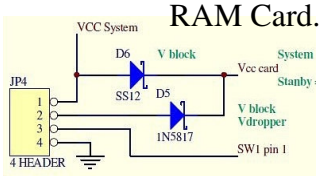
Using the following data:

The 74HCxxx VCC from 7V - 2V
The GAL VCC from 7V - 0.5V
The RAM VCC from 5.5V - 1.5V data retention
Li cell from 3.0V - 4.2V (fully charged)

Because there are too many chips on the VCC trace, it is too complex to modify the board to use standby for just the ram chips.
So we just put the whole board in standby !

1: Connect a small 5V/200mA adaptor with:
Plus to pin 2 (VCC ram)
Minus to pin 4 (ground)

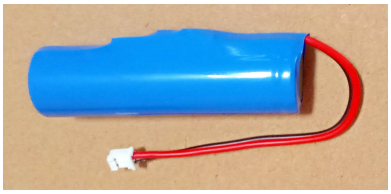
RAM Card.



2: On CPU09BP7 and PC power supply connect the +5VSB pin 9 to pin 2 (VCC ram).
Handy for the UniFLEX systems.

3: We use a Li-cell from 3.0V - 4.2V, we need to charge the cell outside the system.
And we have to test ourselves that the cell does not drop below the 3V.
Backup RAM voltage will be from ~ 2.4V - 3.5V.

Place a Li cell:
Li cell plus to pin 2 (VCC ram)
Li cell minus to pin 4 (ground)

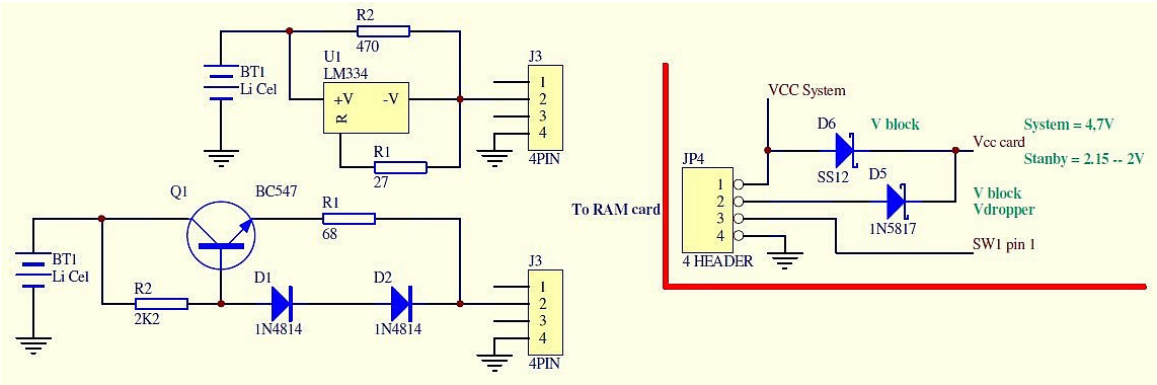


18650 3.7V 3600mA with protection

Expected standby on Li cell 3600 ~ 60 hour.
The ram card will use less power when the voltage drops.

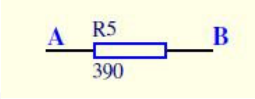
4: If we keep the voltage just above the 2V the 74HCxxx chips will remain there status.
And use one of these circuits:

RAM Card.



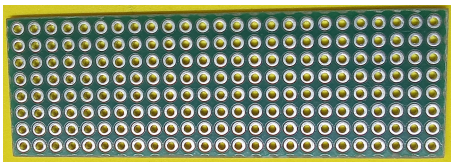
We apply an average current of ~4.5mA to pin 2 (VCC ram).
Expected standby ~400 hour.

5: After a lot of testing this is the most simple:
A to Li Cell , B to pin 2
Current average 3.5mA. Expected standby ~500 hour.

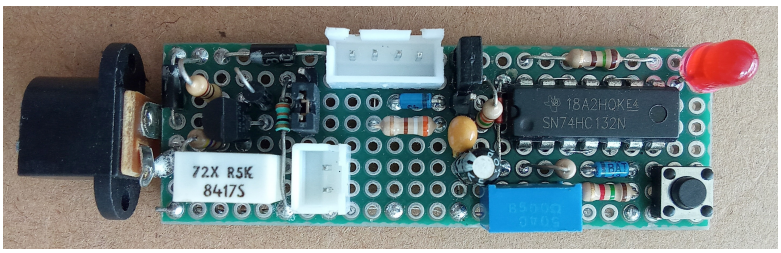


6: Use the RAM UPS – CHARGER-1 - Limiter-1
See 'RAM UPS.pdf'.
A backup system to charge the cell when the system is on
and an external 5V charging option.
It also generate a battery low signal and has a reset function.
After restarting and loading FLEX and VIRTUAL, the driver will test for low battery.

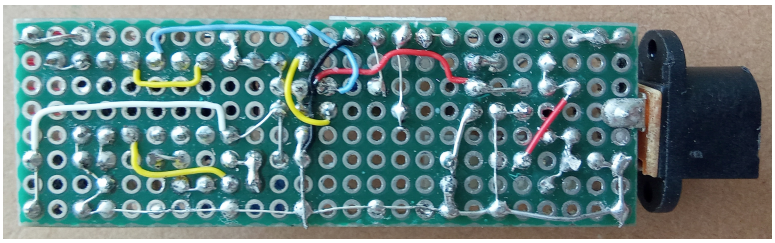
The proto board:



The top:



The bottom:



Li-cell charged to 4.1V, the capacity will be 7% less, cell dropout voltage 2.5V.

Test results

Jumper J2 to 1-2.
Cell voltage at 3.0V, LED turns on and VCC RAM switch off, battery low bit on.
We need to use VDISK.
Estimated standby time ~500 hours.
Cell 1.6V, LED turns off and VCC RAM stays off, battery low bit stays on.
Estimated LED on time ~10 hours..

Jumper J2 on 2-3.
Cell voltage at 3.0V, LED turns on and VCC RAM stays on, battery low bit on.
Estimate standby time ~500 hour.
Cell 1.6V, LED turns off and VCC RAM stays on , battery low bit stays on.
Estimate LED on time ~10 hour.
The RAM disk will stay intact with a Cell voltage down to 1.2V.
We need to use VDISK.

We can not let the Cell voltage of the Li Cell drop so low without damage to the cell !
So if the LED is on switch on the system or the external 5V supply as soon as possible.
The Cell charging current at the 3.0V level will be ~100mA and drops to ~0 when at 4.1V
.Charging the almost empty cell will take because of the low current many hours.

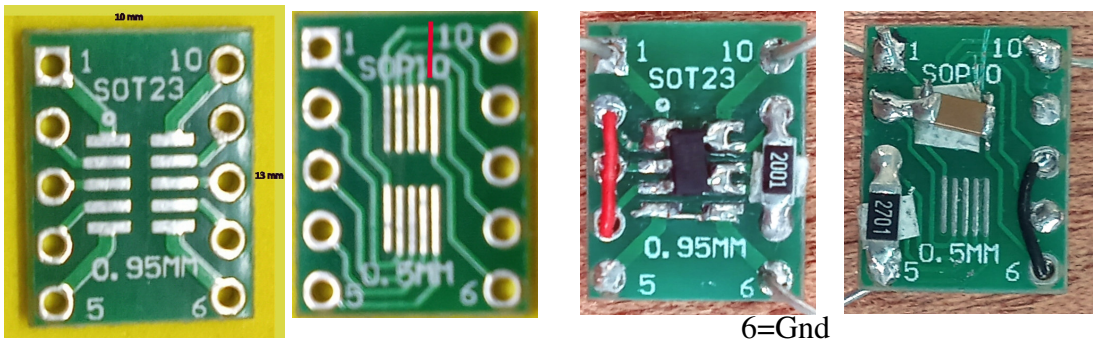
When the system is switched on and the LED is on
boot FLEX, load VIRTUAL and it will start VDISK.
When the cell voltage reaches 3.5V, press the reset button.
Otherwise, the "Low Battery" area will remain lit and the battery low bit will remain on.

Note: Use any external 5V 200mA supply.

7: Use the RAM UPS – CHARGER-2 - Limiter-2
See 'RAM UPS.pdf'.

Further current reducing is possible with Limiter-2.
Until now the only SMD part is the SS12 on the RAM card.
And for this we need SMD parts, sorry but the LDK220 is a SOT23-5 package.
I did use a SOT23/SOP10 to DIP conversion print :

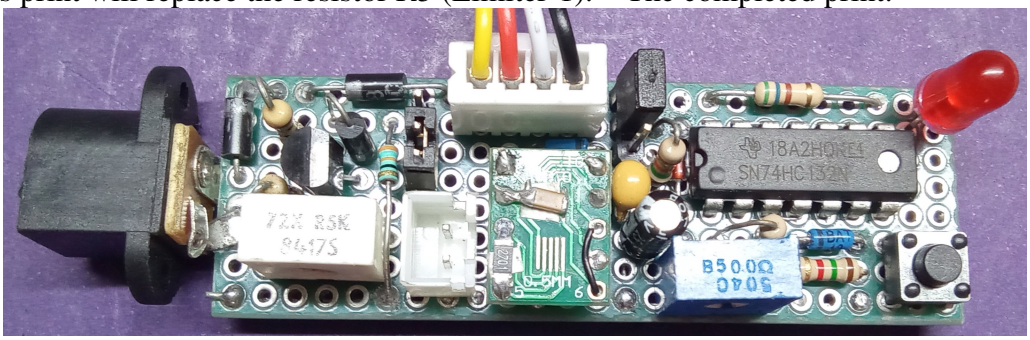
CUT 1=A 10=B



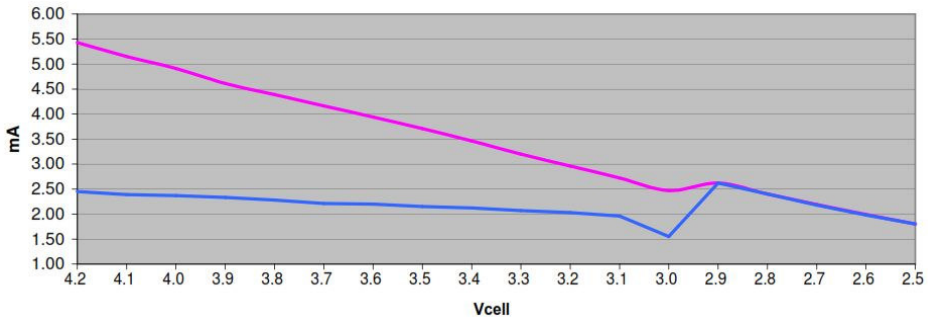
6=Gnd

We now put a 2.0V constant standby voltage on the RAM card.
The ram card will now use over the Cell voltage range 4.1V – 2.5V about 1mA.
The LDK220 dropout is 2.5V. To reduce the LED on current we change R9 in 560 Ohm.

This print will replace the resistor R5 (Limiter-1). The completed print.

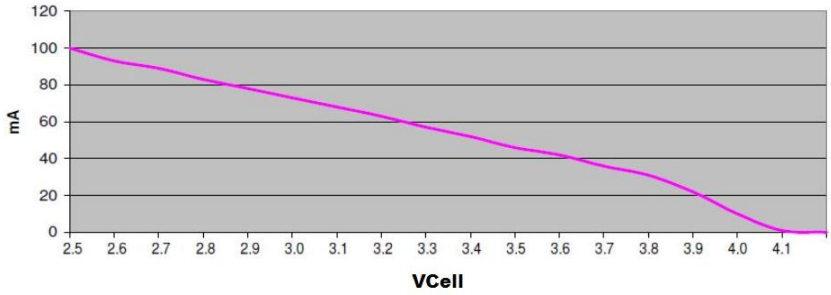


Limiter-1 Cell current **Limiter-2 Cell current**



Estimate standby time ~800 hour. Estimate LED on time ~50 hour.

Li Cell charging:

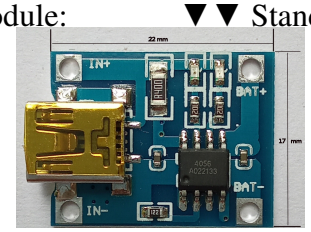


Note: Use any external 5V 200mA supply.

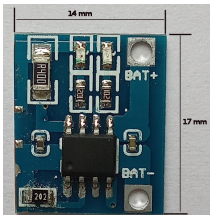
8: Use the RAM UPS – 500mA / 1000mA CHARGER-2
See 'RAM UPS.pdf'.

Cell charging with constant-current/constant-voltage using a TP4056 SMD part.
Don't mount the parts: R1, R2, R3, P1, D3, V1.
The TP4056 has a SOP8 package with exposed pad,
but we can use a e-Gimo Battery Charger like module:

▼ Charging red LED
▼▼ Standby blue LED

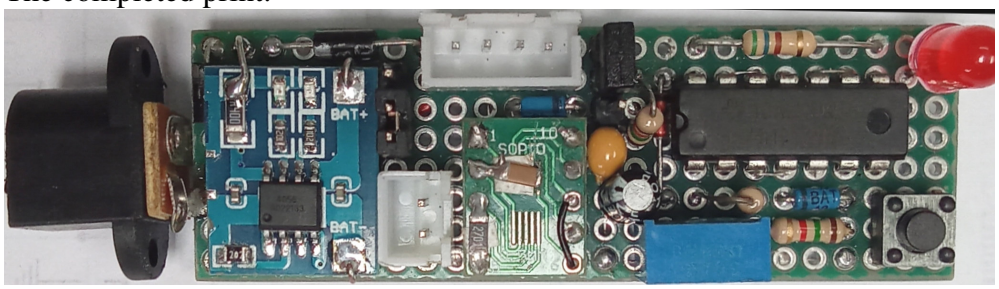


Remove the USB connector and cut the print:

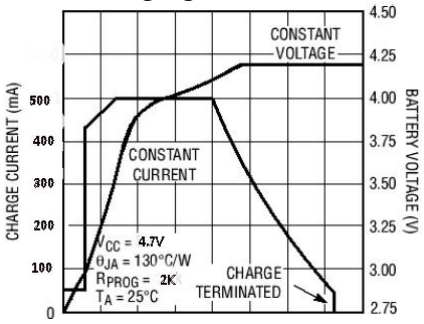


▲ Change into 2K (805 SMD). For 500mA.

The completed print.



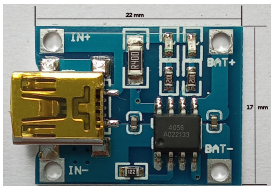
Li Cell charging:

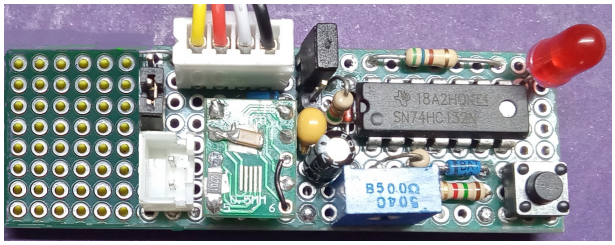


Note: The TP4056 will charge the cell up to 4.2V and stop charging at C/10 ~ 50mA.
It can draw up to 500mA from the system supply.
It should be better to adjust the cell voltage monitor with P2 on a 3.1 or 3.2 Volt.
The TP4056 use a 3.0V low level.
Use any external USB 5V 600mA supply.

9: Use the RAM UPS – 1000mA CHARGER-2
See 'RAM UPS.pdf'.

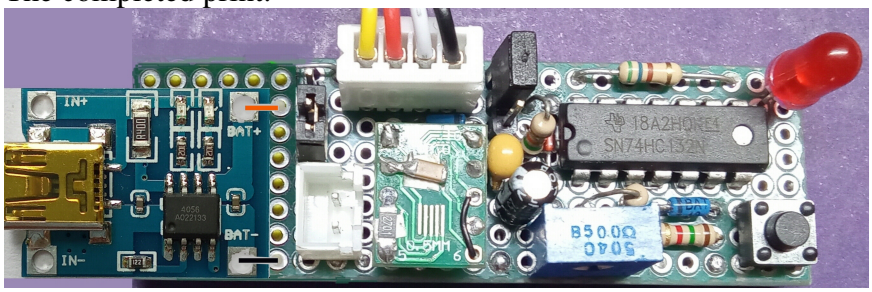
Cell constant-current/constant-voltage charge with e-Gimo Battery Charger module.
If you don't want to change the TP4046 module then this is an option.
Don't mount the parts: J3, D1, D2, D3, R1, R2, R3, P1, V1.
Use any external USB 5V 1A supply (**no charging from the system**).
And place the complete module on the print.





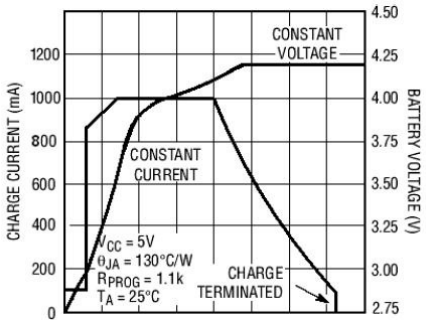
▲ Place for 1Amp module.

The completed print.



▲ To mount print
use 2 plastic screws.

Li Cell charging:

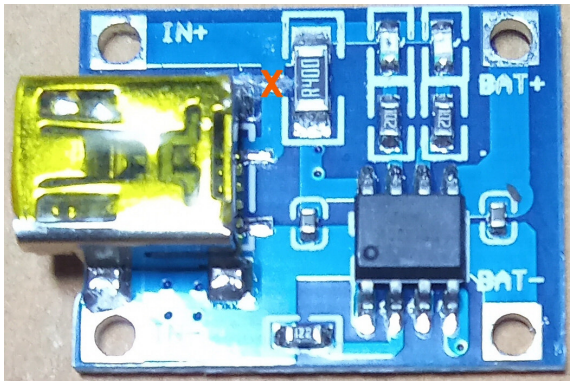


If you not want soldering SMD parts then number 9 with limiter-1 is a good option.

Note: The TP4056 will charge the cell up to 4.2V and stop charging at C/10 ~ 100mA.

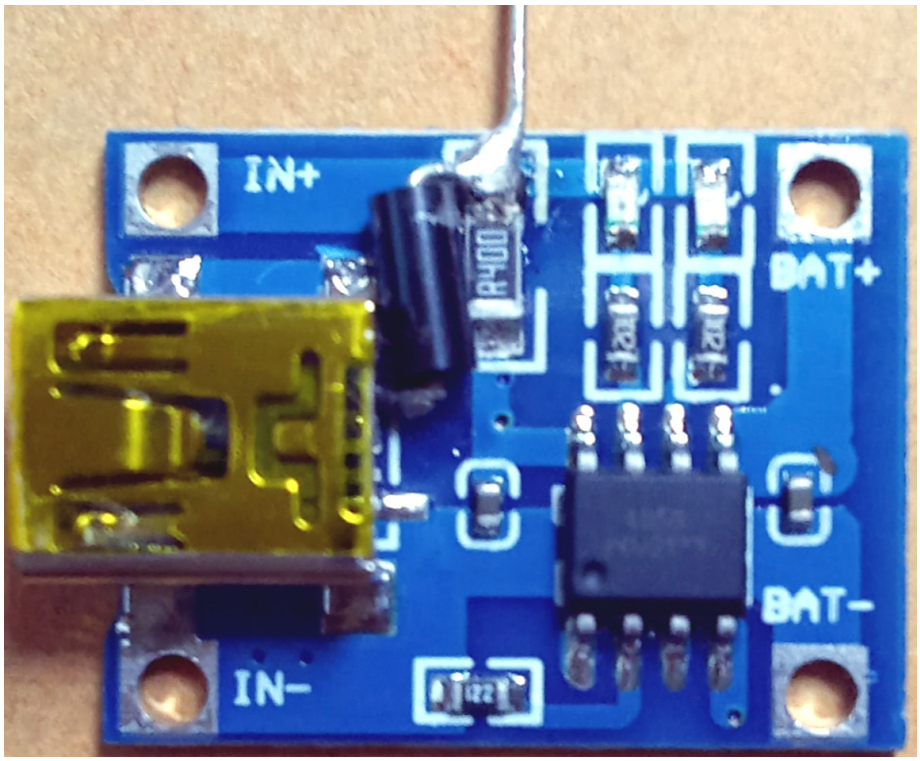
10: Use the RAM UPS – 1000mA CHARGER-2
See ‘RAM UPS.pdf’.

Cell constant-current/constant-voltage charge with e-Gimo Battery Charger module.
If you want also charging from the system change the TP4046 module.
Don’t mount the parts: J3, D1, D3, R1, R2, R3, P1, V1. D2 must be mounted
Use any external USB 5V 1A supply.
And place the complete module on the print.



X cut trace.

Bend D1 - 1N5817 like this.



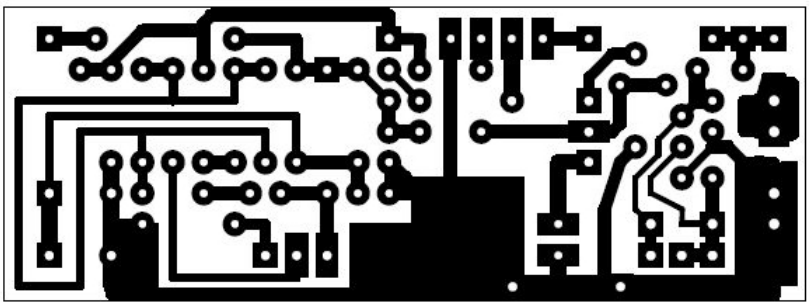
Solder the diode on the print ^. Connect the wire from the diode to the **X** hole.

Note: The TP4056 will charge the cell up to 4.2V and stop charging at C/10 ~ 100mA.
It can draw up to 1Amp from the system supply.

11: Some universal Single sided PCB's:

1a: Gerber files (RAM UPS gerber.zip). 2024-12-18 Drop this PCB.

2a: RAM UPC film.pdf (top view for toner transfer) generated from gerber.zip

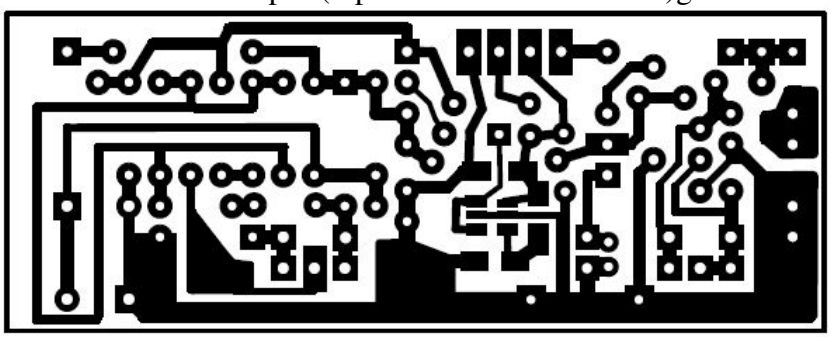


solder side
TL431 foot
incorrect.

With the Limiter-2 parts on the solder side. Latest corrected design.

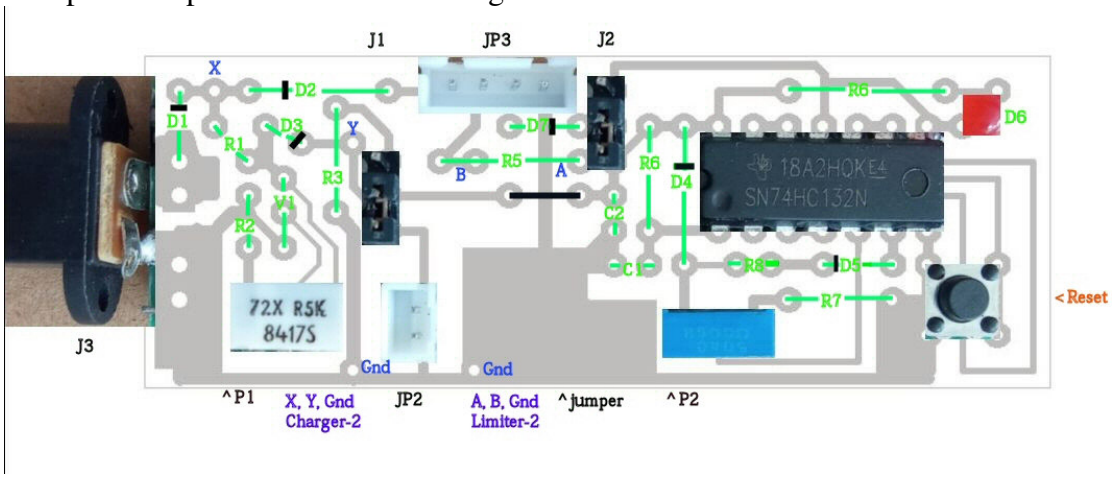
1b: Gerber files (SMD RAM UPS gerber.zip).

2b: SMD RAM UPS film.pdf (top view for toner transfer)generated from gerber.zip

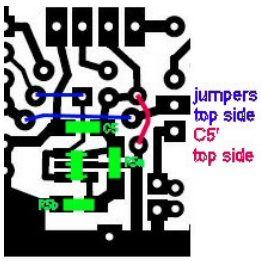


solder side

Component top view limiter-1 & charger-1:



SMD on solder side >



Remarks: When the system is off you can remove the RAM card.
The UPS will keep the drive intact.
Later with the system off put back the RAM card, boot FLEX, load VIRTUAL and the drive(s) plus data are back online.
To check the disk(s), run before and after a power shutdown disktest.cmd and check the checksum's.
SPRINT can import the gerber files for any modification on the prints.

All the prints will work on UniFLEX set SW2-4 to protect fs,
at the moment there is no fs overrule option except SW2-4.