

Woodstock Rechargeable LiPo Battery

Using a USB-C Charger

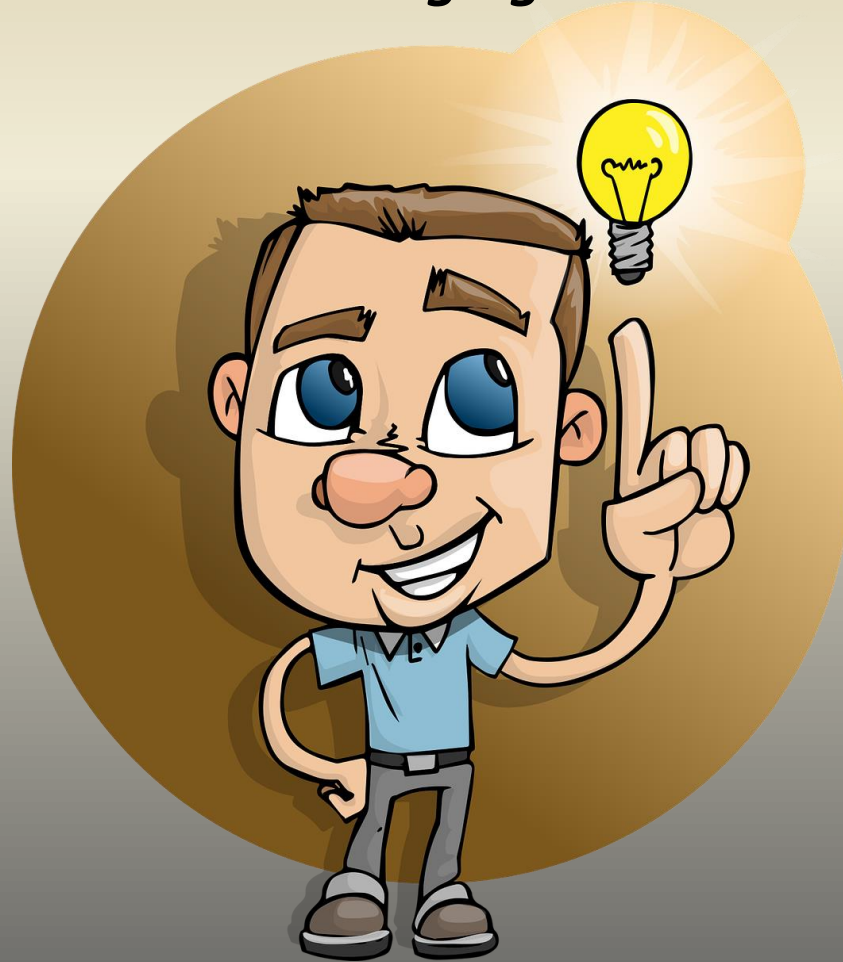
Presented by: Jim Johnson

HP Handheld Conference 2024 – Nashville, TN

September 21-22, 2024

Woodstock Rechargeable LiPo Battery

The Problem with Charging Woodstock Batteries



Woodstock Rechargeable LiPo Battery

The Problem with Recharging Woodstock Batteries

A WORD OF



Never attach the charger of a Woodstock series unit to the calculator without a known, good rechargeable battery in place. An AC charger connected to an HP Woodstock with a bad battery, bad contact or without a battery in place, has a high degree of certainty that the excess voltage will destroy or damage the ACT device, if not the RAM and/or ROM I.C.'s.



Woodstock Rechargeable LiPo Battery

Challenges with Charging Woodstock Batteries

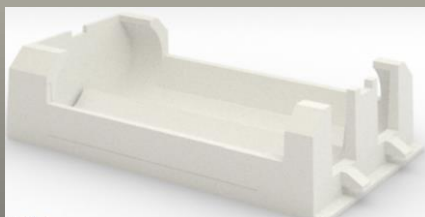
- If you charge your NiCad or NiMH battery pack inside of your calculator, with the HP charger, you risk damaging the ACT device, as well as the RAM/ROM integrated circuits.

Don't do it! Use an external charger.

- Bad or corroded battery contacts or old batteries that will not hold a charge.
- NiCad's that have charging memory issues.
- AA batteries work but need to be replaced when depleted.
- Rechargeable AA batteries with a built-in USB connector are an alternative and can be charged, one at-a-time, with battery pack removed.



Original HP
Battery Case



Woodstock
3D Printed
Battery
Holder

Rechargeable AA
USB-C Battery



AA Alkaline Battery

Ni-MH AA Battery



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Some Quick Woodstock Battery Health Checks

1. Check battery pack. It should read 2.1 – 2.7 vdc. If not, charge the battery pack.
2. Check the calculator battery terminals that contact the battery pack. You may need to use sandpaper and/or white vinegar to remove corrosion.
3. If battery is charged and terminals are good, insert battery and turn on HP Calculator. Pay attention to the positive (+) battery orientation when inserting battery pack (facing bottom of calculator).
4. The first thing you should see is “0.00” in the display, if the batteries had been previously discharged or removed.
5. If no LED display, then either the batteries are discharged, the battery contacts are bad or there may be internal corrosion, due to battery leakage, or there could be other electrical issues with the calculator.
6. If you have some skills at repair, you can open the case to examine the pc boards and make some quick measurements.

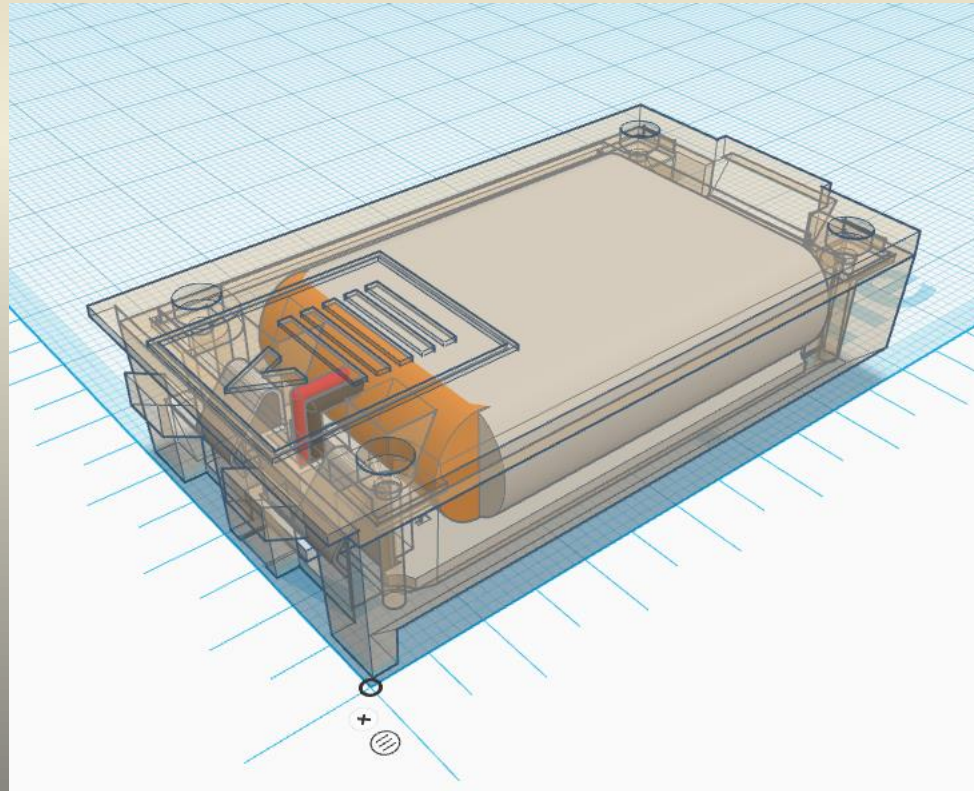
HP21, HP22, HP25, HP25c, HP27, HP29c
Battery Pack



Bottom line....avoid charging a Woodstock battery pack while inside the calculator.

Woodstock Rechargeable LiPo Battery

Rechargeable Woodstock LiPo Battery Design
by CYUL



Woodstock Rechargeable LiPo Battery

LiPo Solution
(Internal PC Board)

Stepdown DC-DC Converter
Converts +5vdc USB-C to +2.5vdc
ADP2108

USB-C Conn. +
charging resistors

LiPo Battery
Conn.



Ideal diode
reverse battery and
thermal protection
MAX40200AUK
5.1V Zener Diode

Battery Charging Circuit
MCP73831-2-OT

Charging LED

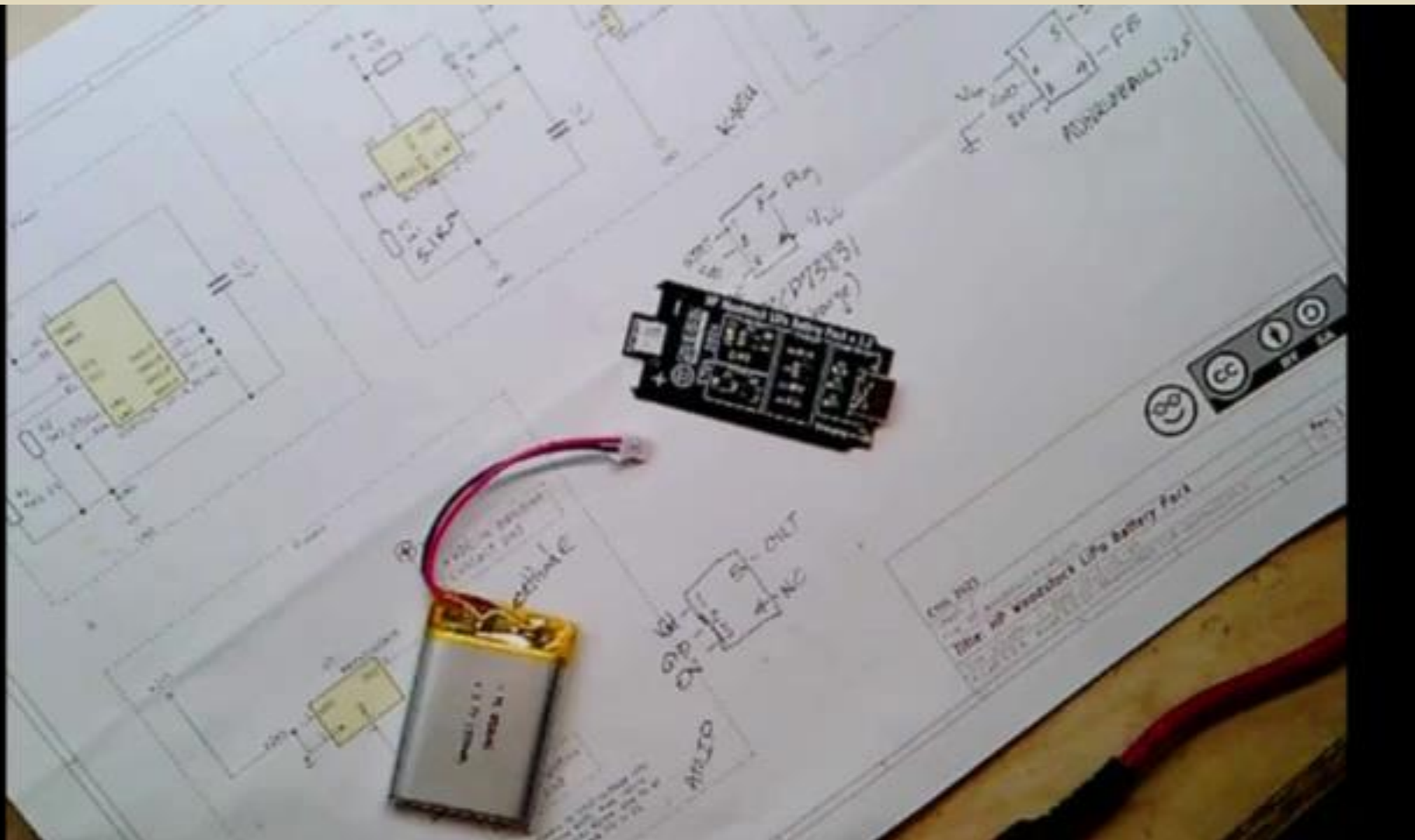
* Photo used by permission of Philippe Caïric

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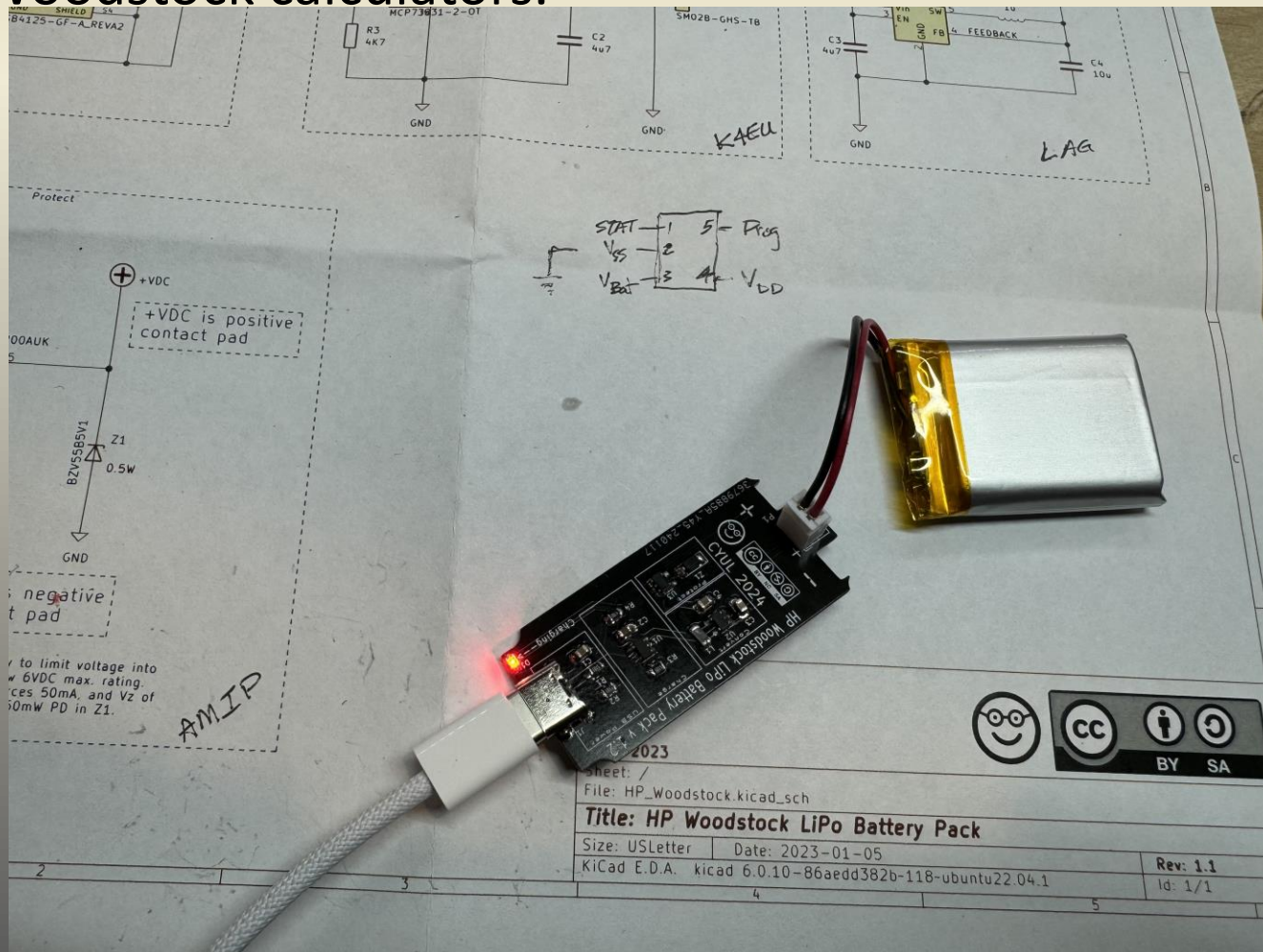
Completed PC Board



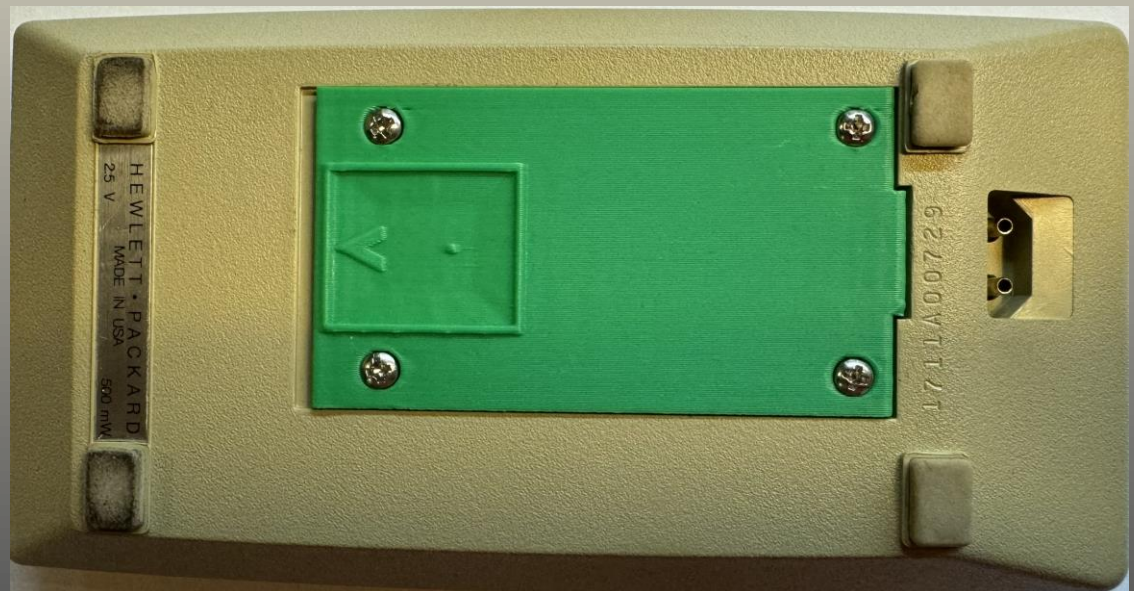
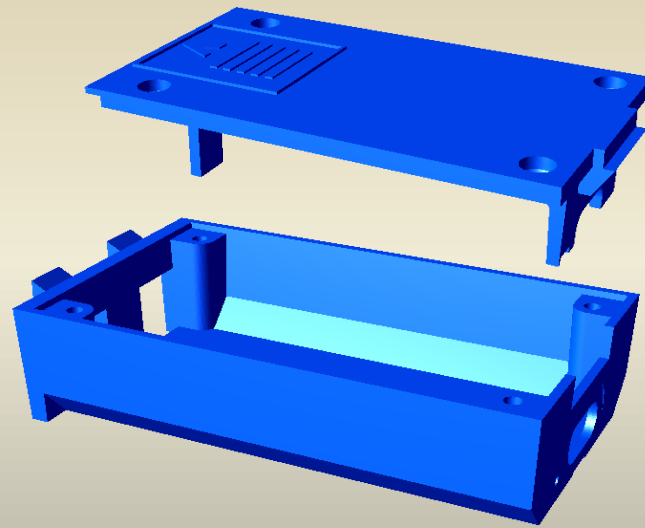
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Woodstock LiPo Battery Charger Using USB-C

- Building and testing the USB-C chargeable LiPo battery for Woodstock calculators.



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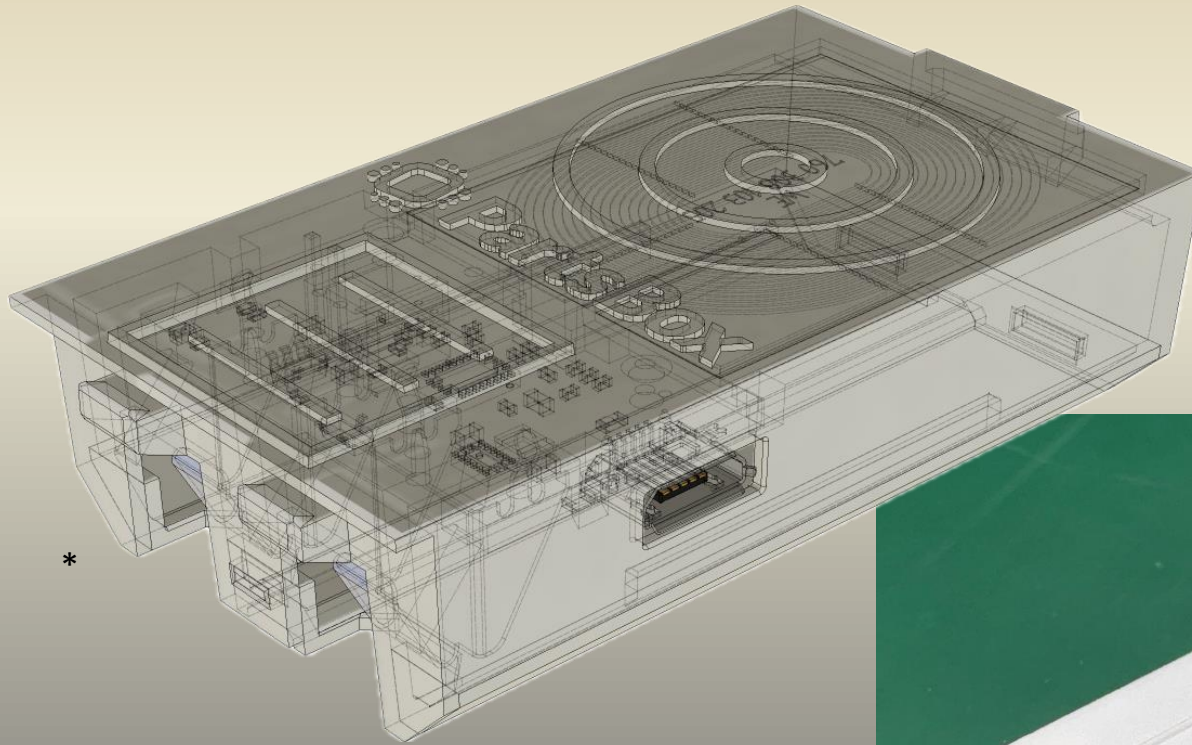
Woodstock Rechargeable LiPo Battery

The USB-C Charger is nice, but.....

- How can we improve charging the battery?
- By placing the Woodstock calculator on a charger....
...just like charging a mobile phone.
- Wireless charging via a Qi Charger

Woodstock Rechargeable LiPo Battery

A wireless Qi charger with optional USB backup!



Woodstock Rechargeable LiPo Battery

A Woodstock Battery with Qi Wireless Charging

PartsBox – Jan Rychter

The design assumptions were:

- Should replace the original battery pack
- No modifications to the calculator itself
- WPC/Qi wireless charging
- USB connector for wired charging
- Li-Po battery lasting for at least multiple days of normal use
- Low-battery indicator



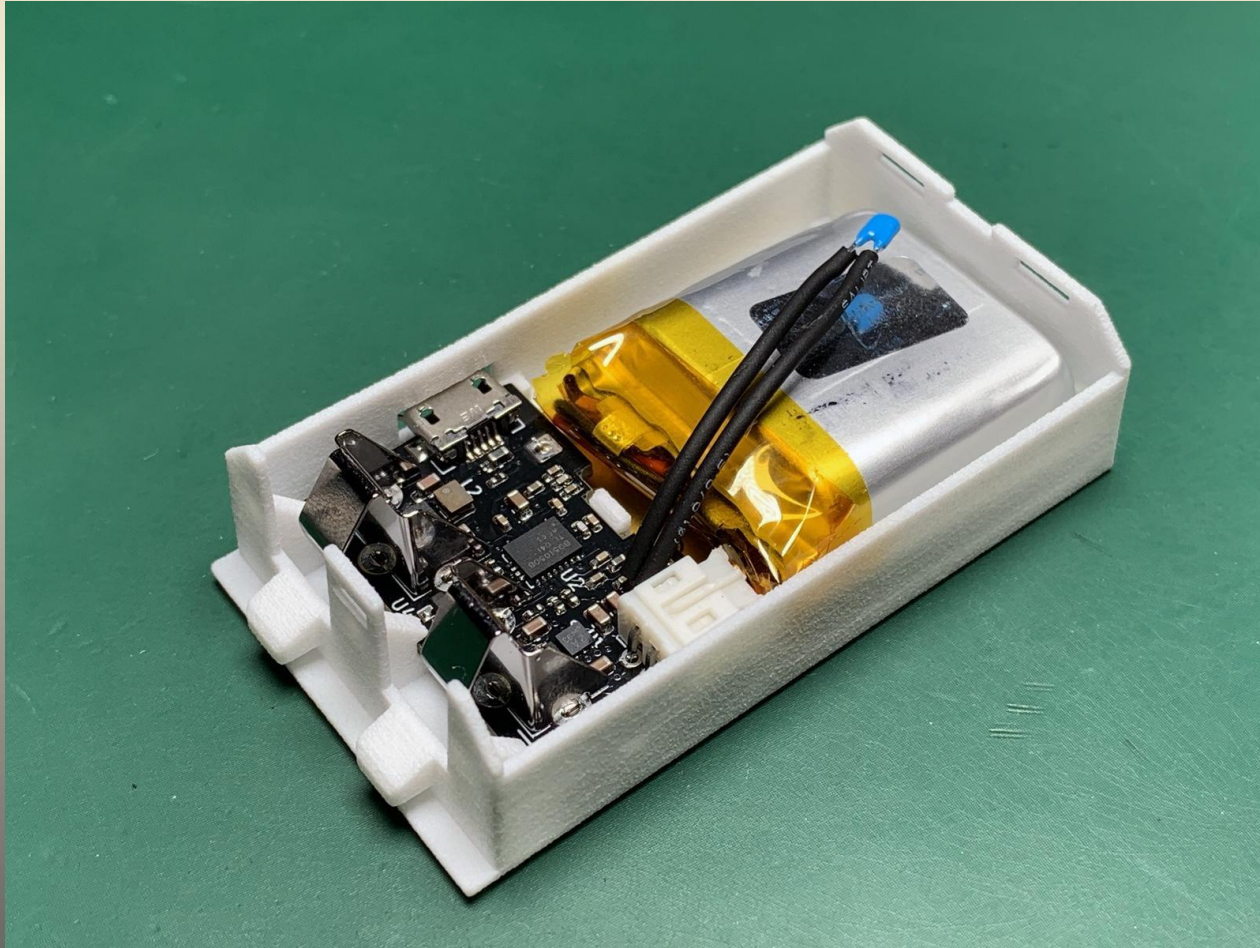
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<https://partsbox.com/blog/wireless-charging-for-a-hp-25-calculator-05-2021.html>

Woodstock Rechargeable LiPo Battery

What Can Be Improved?

A Woodstock battery with Qi wireless charging!

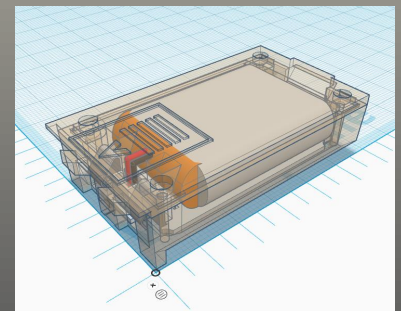


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Woodstock Rechargeable LiPo Battery

Summary and Conclusions

- Woodstock NiCd batteries have a propensity to not hold a charge, suffer from memory issues and eventually leak if left in the calculator.
- NiMH batteries are an improvement over NiCd with a long discharge curve but can still leak if discharged over a long time.
- Alkaline batteries are easily replaced when discharged, but you need to buy new AA batteries.
- LiPo batteries are rechargeable, and use of the USB-C charger is easy to use.
- A USB-C LiPo battery pack is a good solution to an age-old Woodstock problem allowing multiple recharges and long use time with low risk of leakage.
- The ultimate solution is to use a Woodstock Qi charger that can easily be recharged on a Qi compatible charging pad.



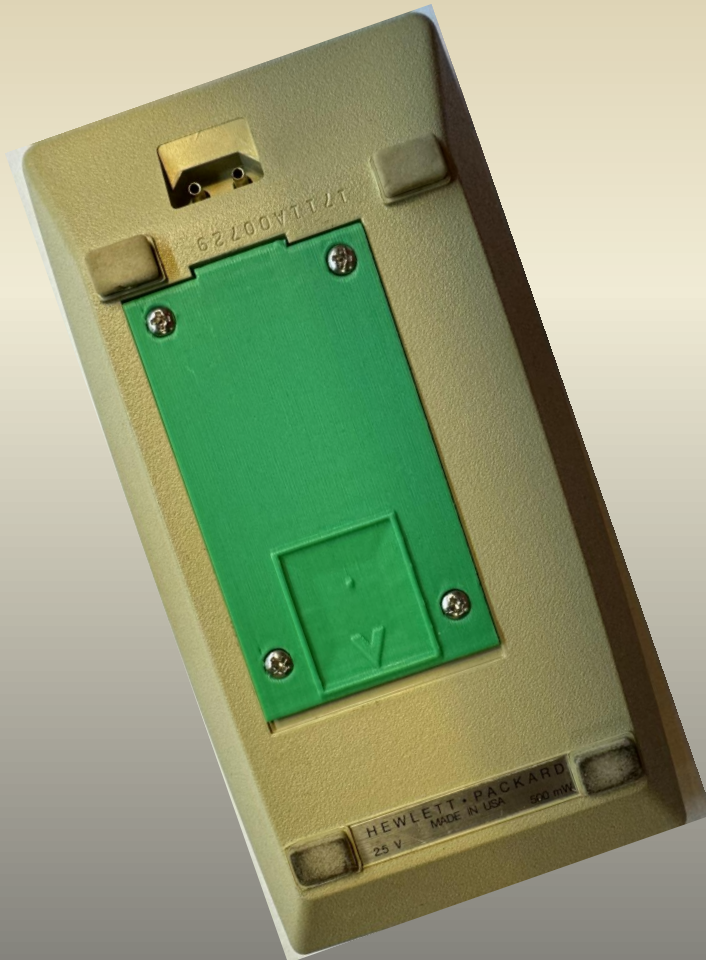
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Acknowledgements and Credits

1. CYUL - Philippe Caïric Woodstock LiPo battery charger design*.
2. Gene Wright and HP Forum.
3. Wikipedia: Woodstock series of calculators
4. Bernhard Emese (Panamatik) associated knowledge and notes about the HP25.
5. Tony (Teenix) on his extensive HP25 work.
6. Jacques Laporte extensive HP calculator power supply schematics and analysis.
7. Eric Smith's documentation on HP calculator integrated circuit identification.
8. Museum of HP Calculators (Dave Hicks) – various notes, comments, dialogues, photos and discussions on the Woodstock series of calculators.
9. Jan Rychter – <https://www.PartsBox.com>. Qi wireless Woodstock battery design
(all photos of Woodstock Qi charger are property of Jan Rychter)

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Thank you!