

Power Bank Battery 48V

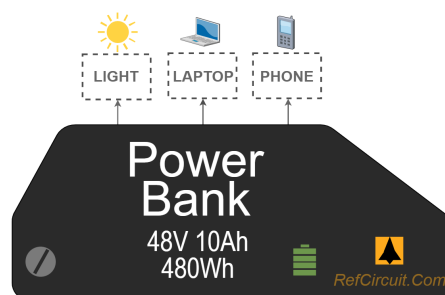
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Summary



 Huge power bank station with using 48V battery – <https://refcircuit.com/articles/edit/832>

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Introduction

If you have got an electric bike battery, this means you have a huge electrical energy storage. For example, if your battery is 48 volts with capacity 10 amp hours, the total energy is:

$$E = 48V \times 10Ah = 480Wh$$

Assume, that the essential electronic devices for you is laptop, smartphone and light source, so let's calculate how many times it can charged and worked:

- The average laptop battery has a battery 60Wh to 100Wh capacity
- The average smartphone has a battery is 10Wh to 20Wh capacity
- Sufficient light-diode illuminance source is 10W to 15W

So, considering the power losses you can charge your laptop twice, your smartphone five times, and have a good light for 6 to 10 hours. It's not bad for rolling blackouts.

Structural diagram

First, I designed a structural diagram, so let's just look at the draft that represents the basic parts and connection sequence of required components to understand the architecture of an autonomous power supply system.

The main component is battery pack, that has a voltage level indicator and could be charged with an external charger.

For safety and easy complete shutdown of the system voltage converters connected through fuse and button switcher. First stage converter step down voltage to approximately 19V, that is convenient for most common laptops with DC socket input. Then 19V is suitable for connecting many DC-DC modules, such as 5V with USB socket and converter with constant current mode for supplying LEDs.

Real battery pack

Overview

Let's look at the energy storage device. It's a big ebike battery with standard plastic case. The power connector is not convenient for us but we will solve this problem.

Charging port

If you have an ebike, that means you have a charger, so just use it.

Voltage level indicator

Very useful to know the current voltage level to don't over discharge your battery and sustain optimal charge value 50%-75%.

Custom contacts for battery

My battery has widespread and convenient connector for fast installation on bike, but not convenient for custom electrical connection. To solve this problem I made contacts with FR-4 soldered textolite and a couple of wires, then isolated it with a heat shrink tube.

Only two contacts (positive and negative) of five used in my battery are used.

Converters

DC-DC 60V

Typically electrical vehicle battery have a high voltage to achieve high travel speed and strong traction, so my battery nominal voltage is 48 volts, the type of internal elements is lithium ion cells, so I have 13 elements connected in series, and the total minimum voltage is:

$$U_{min} = 13 \times 3.7V = 48.1V$$

And maximum voltage is:

$$U_{max} = 13 \times 4.2V = 54.6V$$

The battery voltage range is very important because affect the main DC-DC selection. So, I choose synchronous buck converter with input voltage up to 60V and output current 15A with additional cooling and convenient screwed terminals.

If you have an old laptop with DC input voltage just adjust output voltage to 19.4 volts (check your AC charger for exact value) and use appropriate DC jack (double check polarity before connection!).

But even if you have got a modern laptop with USB-C power delivery input it's not a problem, because there are many special devices with PD protocol full compatibility, including 20V 5A 100W, like PDS-100.

DC-DC CC 3A

To properly supply LED panels I choosed DC-DC with CC (Constant Current) mode, so even if you use long wires and when boards heat up, the current will stay stable.

DC-DC 5V

This DC-DC is not just a buck converter 5V, but supports QC and other protocols with higher output voltage for faster phone charging. Module has only one USB-A output, but there are many similar boards with two to four outputs.

Light source

To make a light source you can use four LED strip 12V connected in series, but I have got a special board panels. On this PCBs many LED connected in parallel, so for properly supply panels without driver I need a DC-DC converter with constant current mode. Typical power of big panel is 10W, but this limited only by heat dissipation.

Button switch

Button switch should be able to commute high current, 15A minimum, but bigger value is recommended, because input capacitance of first DC-DC is big.

Functional diagram

According to the concept from the structural diagram, all real parts are selected for quick assembly of the power bank system.

Assembly

Now all parts are assembled together (except fuse).

Screwed terminals give a chance to connect most parts without soldering.

It's recommended to use 1.5mm²-2.5mm² wire to have enough electrical and mechanical safety. And don't use a wooden base, like I.

Demonstration

Not ideal, but it works.

Custom contacts connected always, to turn the system change position of toggle switch to right. Now light is illuminate, that means first DC-DC works and you can charge the laptop using the external DC jack. Second DC-DC with CC also works and you can regulate brightness by trim variable resistor on the board. The blue light on the DC-DC 5V also lights, that means you can charge your phone/tablet or other small electronic device.

Conclusions

The battery from an electrical vehicle could be very useful, because [является] stores valuable energy in comparison to typical electronic devices and with some additional converters could be used as an emergency huge power bank system.