Design and Implementation of Temporary Portable Power Supply

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Abstract

Nowadays, most people are using smart phones and using power banks as backup power sources. However, most of the power banks on the market are heavy and inconvenient to carry. When traveling far away, power is not easy to obtain. When power is needed temporarily, a mobile power bank can come in handy. The motivation for making the hardware in this article is that when the mobile phone is out of power and needs power temporarily, it can be charged immediately. The hardware uses AA batteries to achieve the charging effect through a boost circuit. You can also bring your own rechargeable battery as a charging battery. If the battery runs out, just go to a convenience store to buy batteries and you can continue to charge your phone. Although the charging speed is not fast, it can reach the minimum maintenance power required for temporary emergency calls.

Keywords: mobile phone, power bank, charging

1. Introduction

Nowadays, almost all people use smart phones and rely heavily on them. Whether they are working or needing to communicate with things, they need mobile phones. In an era when smart phones are becoming more and more common, power supply is very important. What we need Even when you are temporarily out of power and need power, a power source is available everywhere. You only need to go to a convenience store to buy a battery and it can be charged. It will not make people worry about what to do if the phone is out of power.

Mobile phones are a very important invention for mankind. From the beginning, mobile phones required two mobile phone batteries to be placed in a cradle for replacement and charging. Nowadays, smart phones can be quickly charged by simply connecting them to a mobile phone charging cable. Pull out the phone case to take out the phone battery, making charging the phone more and more convenient. However, if you are traveling far away and need to charge temporarily but cannot find a place that provides power, it will be very inconvenient. Our temporary power supply solution can easily obtain power. We use AA batteries to charge through a boost circuit. Boost the voltage of the battery for charging. Generally, AA batteries can be bought at convenience stores. If you need temporary power, you can get power immediately. Our "portable temporary power supply" is mainly for convenient power supply and is easy to carry. [1-5]

2. Experimental and Results

As shown in Figure 1, this work uses a boost circuit to boost the voltage of AA batteries or rechargeable batteries to 5V for charging. Connect the battery holder to the boost circuit, and then charge via the USB socket. As shown in Figure 2, the CE8301 series is a CMOS boost DC/DC controller composed of a reference voltage source, oscillation circuit, comparator, PFM control circuit, etc. This series of products uses PFM control circuit to automatically switch the duty ratio according to the load (light load: 50%, high output current: 75%), and can achieve low output ripple and low output over a wide range with high efficiency. The CE8301 series is a step-up DC/DC controller constructed using external components such as inductors, capacitors, and diodes. The built-in MOSFET uses a protection circuit that automatically cuts off when the switching crystal current exceeds the control value to prevent damage.

We used a breadboard to test many parts first, and then selected suitable parts as parts of the boost

circuit. We tested three ICs and finally selected CE8301. Because its maximum output current can reach 400mA, this is also the IC required for our solution.

After we determined the parts, we began to charge the mobile phone battery. We found that we originally wanted to use one AA battery to charge but could not charge it. One AA battery was not enough, so we switched to using two AA batteries connected in series, as shown in Figure 3. As shown, only in this way can stable charging be carried out. As shown in Figure 4, this is a discharge test using a mobile phone battery. Use two three-watt light bulbs to discharge the mobile phone battery. It will stop discharging in about 15-20 minutes.

As shown in Figure 5, a meter is used to measure the discharge voltage during the discharge process. Through the measurement, more accurate data can be obtained to determine the battery consumption of the finished product, and can also be used as a reference for subsequent battery data testing.

Rechargeable battery 1.2V, mobile phone battery 3.8V, mobile phone battery discharge voltage 3V. As shown in Figure 6, the charging test was carried out using a battery. We used a battery to charge the mobile phone battery. It is found that the charging time of a battery can be about one hour, and the current is only 90mA because of the boost voltage. The circuit will slowly reduce the amount of current along with the battery's power, so only 90mA cannot be used for continuous charging. Today's smart phone batteries have very large capacities. One battery can be used in old-style mobile phones, but Nowadays, most people are slowly replacing their smartphones, so the test results show that it is better to use more than two AA batteries for charging.

We will conduct tests to compare which battery has a longer charging time and the amount of charge. We will use three types of batteries: rechargeable batteries, alkaline batteries and carbon-zinc batteries for experimental testing. The following are our test results.

As shown in Figure 7(a), after testing the rechargeable battery, we found that it is the battery that can charge the longest and the most power. We used two mobile phone batteries with different battery capacities for testing. The rechargeable battery took longer to charge than the other two. It takes a long time to come, but the disadvantage is that the way to obtain it is not so convenient, so it can only be used as a preparation battery before going out. The comparison table of charging time and battery capacity of rechargeable batteries is shown in Table 1.

As shown in Figure 7(b), the carbon-zinc battery test found that its effect is not better than the other two batteries, but it is the worst one. Not only is its charging time short, but it also charges very little

power. However, if a power supply is temporarily needed, it can still be done, but the effect is not that obvious. The comparison table of charging time and capacity of carbon-zinc battery is shown in Table 2.

As shown in Figure 7(c), alkaline batteries are relatively average among the three types of batteries and are more in line with our ideal battery. Although it does not have the same endurance as rechargeable batteries, it is more convenient to obtain power than rechargeable batteries. The duration and charge capacity are also good, so it's the ideal battery for us. The alkaline battery charging time and battery capacity comparison table is shown in Table 3.

3. CONCLUSION

This thesis implements a set of circuits that meet the above functions, and uses the implementation results to verify the operation of the designed circuit and meet the required functions. After selecting the parts and confirming the circuit, after many comparisons and subsequent assembly of the finished product, although there were bottlenecks and many problems encountered along the way, they were overcome. The finished product may still have imperfections, but it is close to The original design concept is the same, and the finished product results and boost circuit diagram are shown in Figure 8 to Figure 10.

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Figures

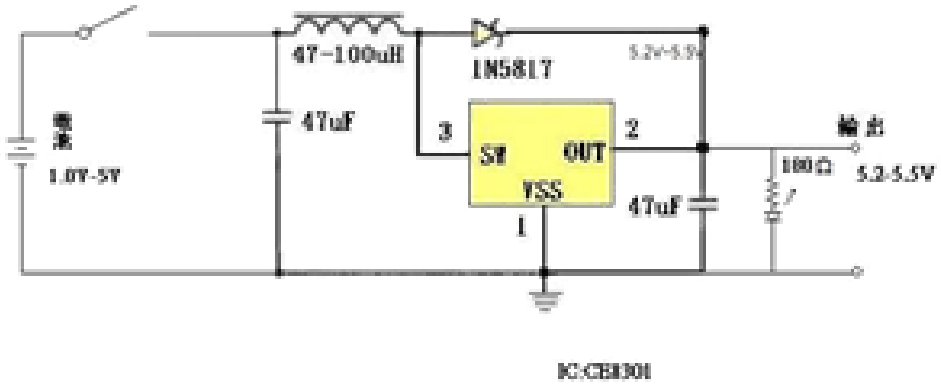

Fig. 1 Boost circuit diagram

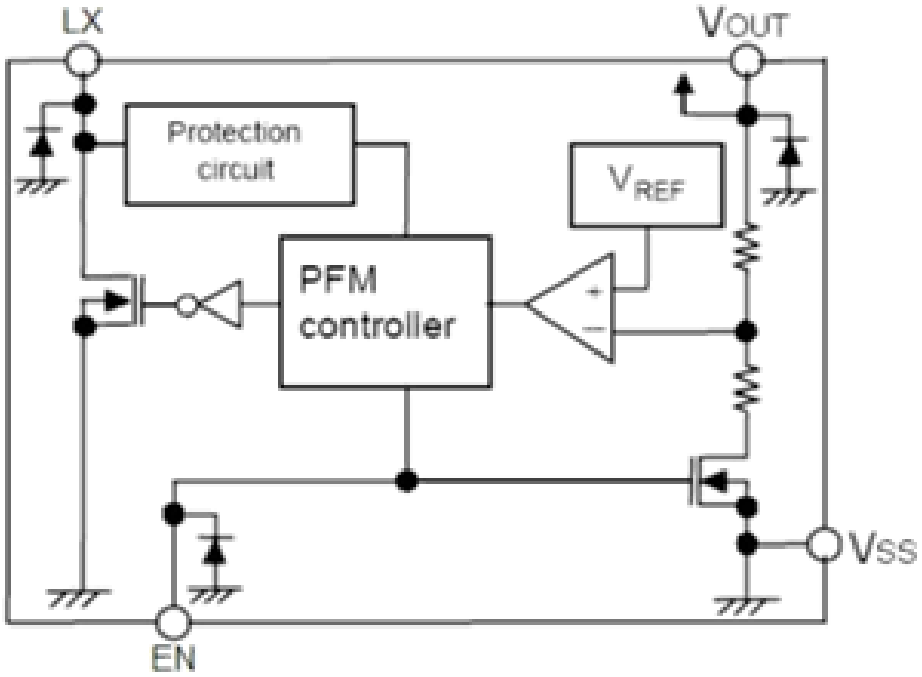

Fig. 2 IC CE8301 circuit principle and block diagram

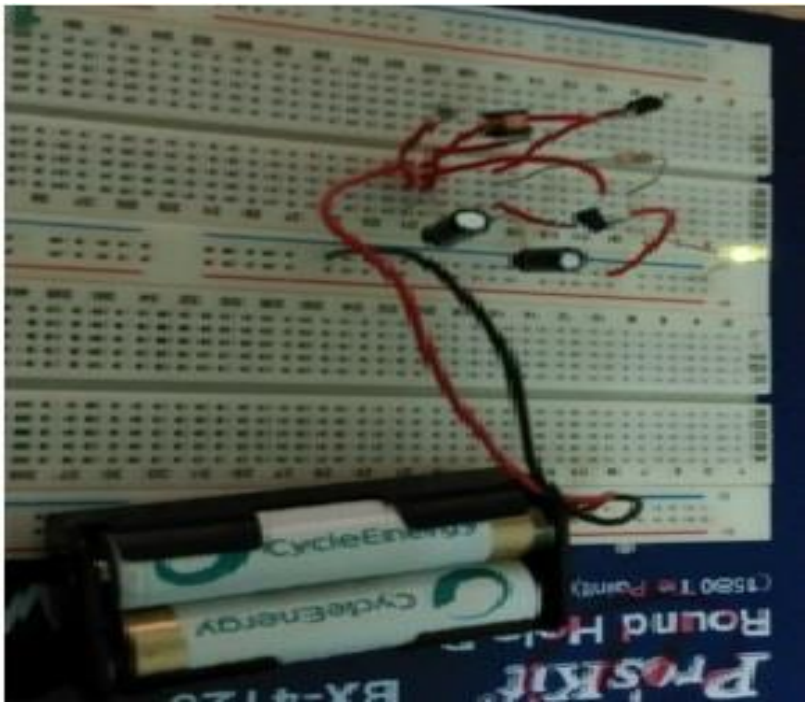

Fig. 3 Breadboard testing and parts

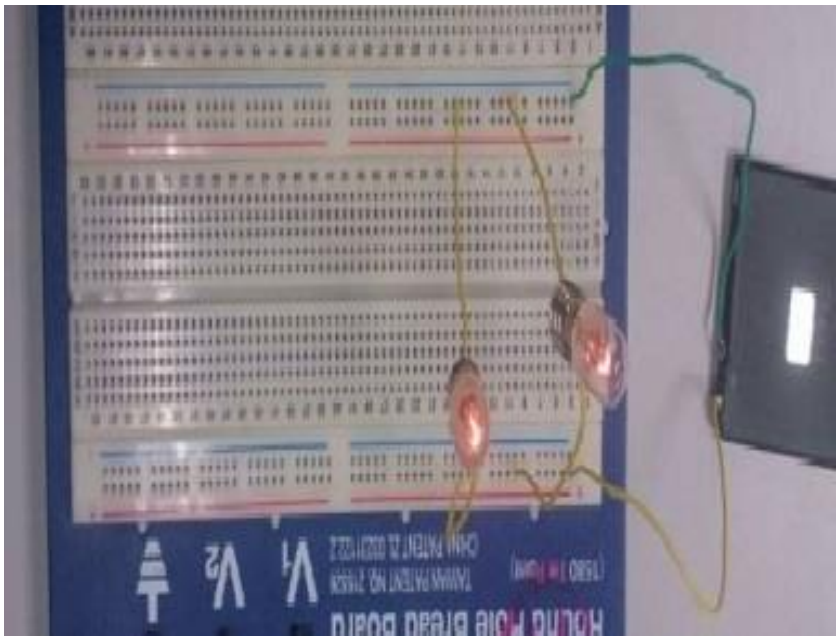

Fig. 4 Test breadboard experiments

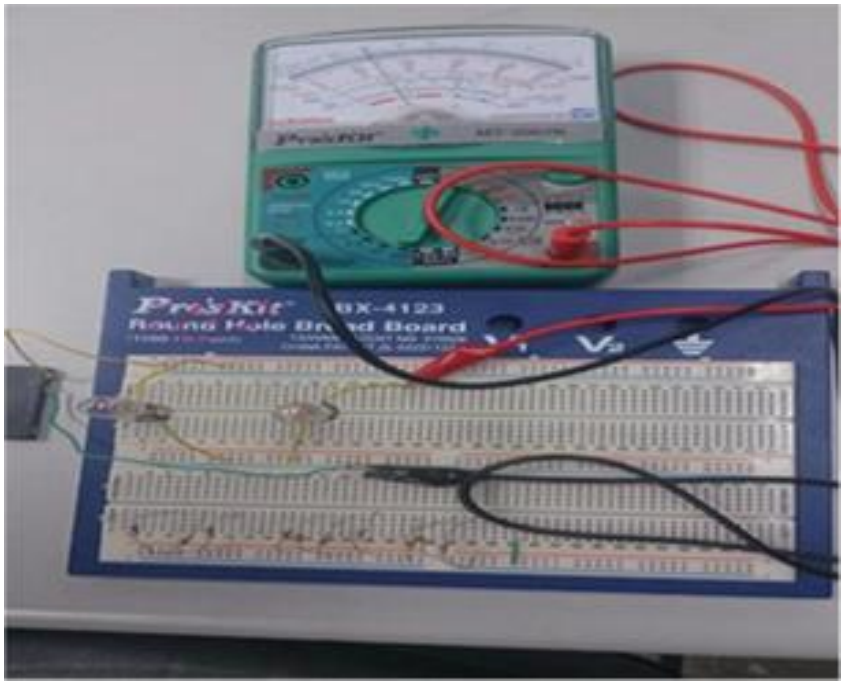

Fig. 5 Discharge testing experiment

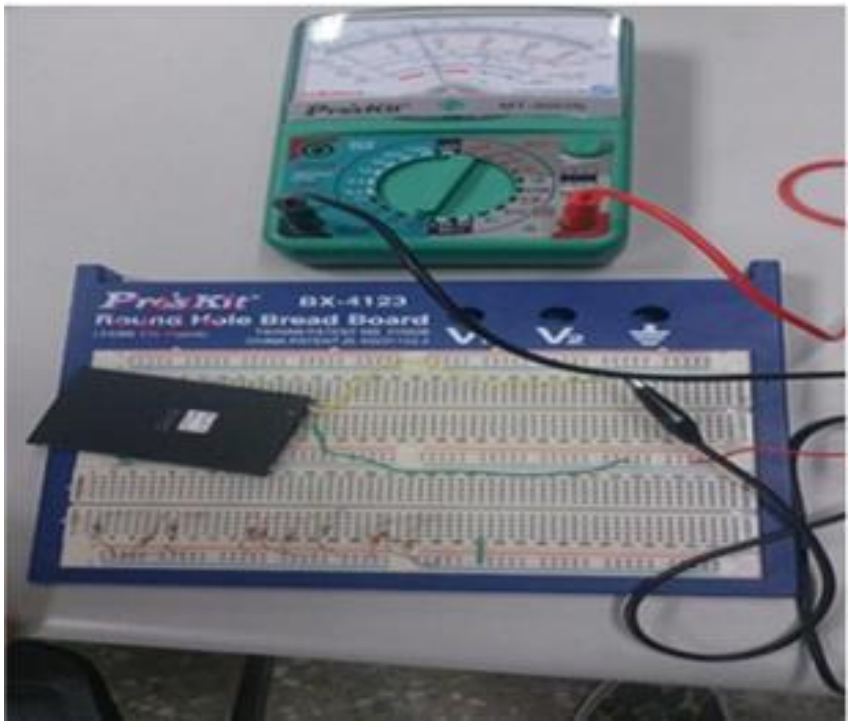

Fig. 6 Charge testing experiment

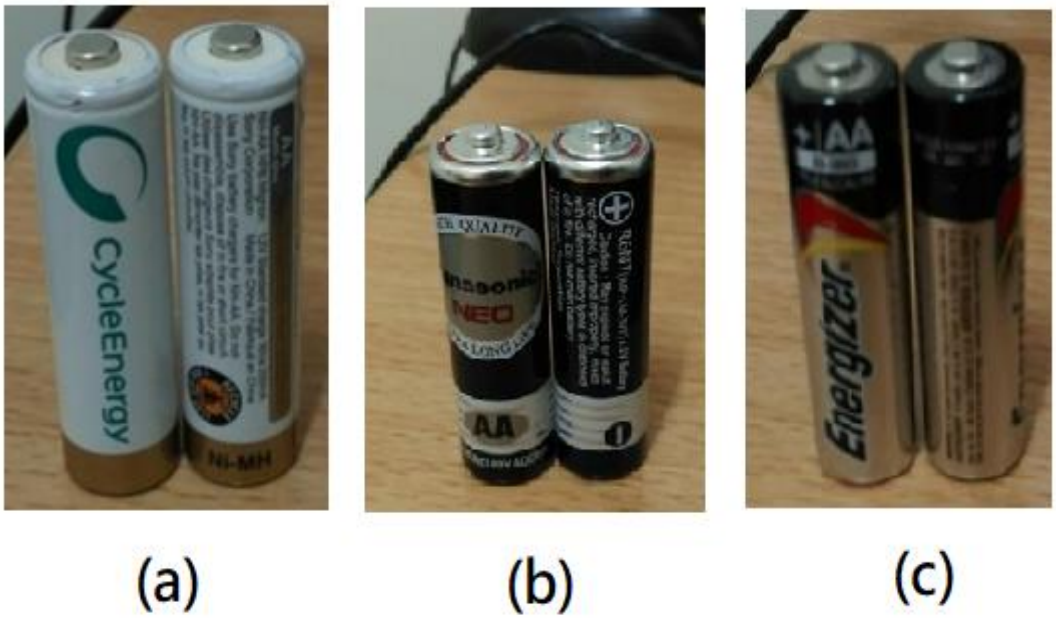

Fig.7 (a) rechargeable battery (b) carbon zinc battery (c) alkaline battery

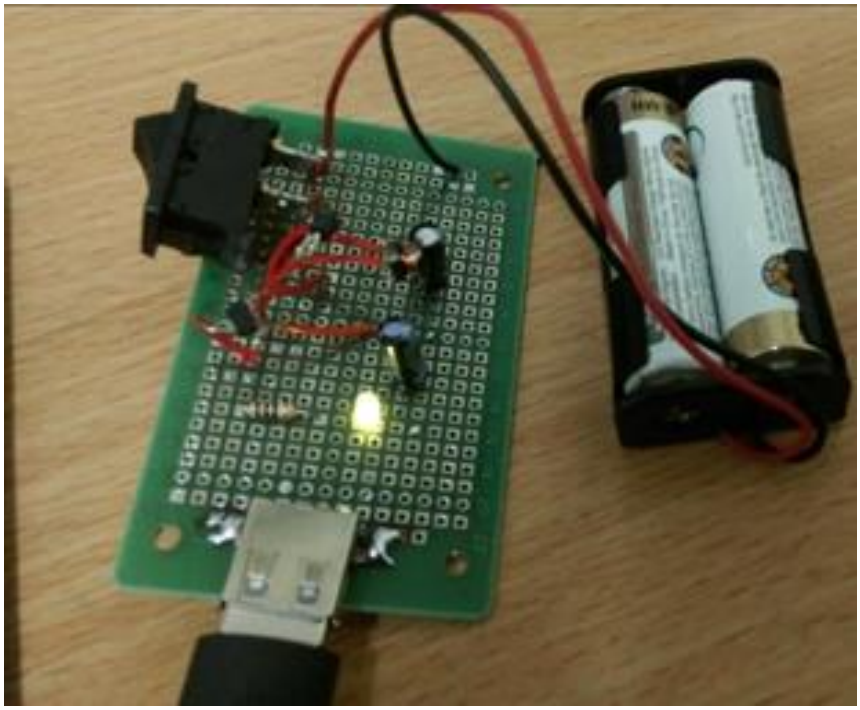

Fig. 8 Completed circuit board

Fig. 9 The circuit board is under charging

Fig. 10 Finished product completed packaging and under charging

Table1. Rechargeable battery charging time and capacity

HTC E8(2600mAh)		A2(1600mAh)	
Charge time	Charge ratio	Charge time	Charge ratio
0	21%	0	11%
60 min	27%	67 min	77%
120 min	33%	110 min	93%
150 min	35%		

Table2. Carbon zinc battery charging time and capacity

HTC E8(2600mAh)		A2(1600mAh)	
Charge time	Charge ratio	Charge time	Charge ratio
0	25%	0	21%
60 min	26%	60min	33%

Table3. Alkaline battery charging time and capacity

HTC E8(2600mAh)		A2(1600mAh)	
Charge time	Charge ratio	Charge time	Charge ratio
0	54%	0	1%
60 min	59%	7 5 min	25%
157min	64%	120 min	31%