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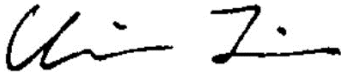
To whom it may concern:

I, Chris Yien, a translator fluent in the Chinese and English languages, on behalf of Questel, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

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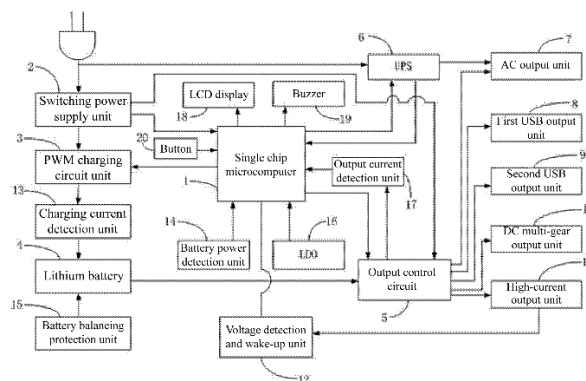
2 pages of claims, 7 pages of description, and 4 pages of drawings

(54) Title of Invention

MOBILE POWER SUPPLY AND CONTROL METHOD
THEREFOR

(57) Abstract

The present invention provides a mobile power supply, comprising a single-chip microcomputer (1), an output control circuit (5), a lithium battery (4), and a high-current instantaneous output module, wherein the output control circuit (5) is separately connected to the single-chip microcomputer (1) and the lithium battery (4); the high-current instantaneous output module comprises a high-current output unit (11) connected to the output control circuit (5) and a voltage detection and wake-up unit (12) connected to the high-current output unit (11); the high-current output unit (11) is configured to be connected to an electrical device; the voltage detection and wake-up unit (12) is connected to the single-chip microcomputer (1); the voltage detection and wake-up unit (12) comprises an electrical device voltage detection unit (121) configured to check a voltage of the electrical device, and the electrical device voltage detection unit (121) controls a power supply state of the high-current output unit (11) according to the detected voltage.



MOBILE POWER SUPPLY AND CONTROL METHOD THEREFOR

TECHNICAL FIELD

[0001] The present invention relates to the field of power supplies, and in particular, to a mobile power supply and a control method therefor.

BACKGROUND ART

[0002] In real life, with the rapid development of science and technology and the improvement of people's living standards, cars have become an extremely important communication tool. However, cars often encounter the problem of failure of ignition, especially when traveling. It is difficult to ignite the cars due to insufficient battery power, which brings a lot of inconvenience to users.

SUMMARY OF THE INVENTION

[0003] To solve the above technical problem in the prior art, the present invention provides a mobile power supply and a control method therefor.

[0004] The present invention provides a mobile power supply, comprising a single-chip microcomputer, an output control circuit, a lithium battery and a high-current instantaneous output module, wherein the output control circuit is separately connected to the single-chip microcomputer and the lithium battery; the high-current instantaneous output module comprises a high-current output unit connected to the output control circuit and a voltage detection and wake-up unit connected to the high-current output unit; the high-current output unit is configured to be connected to an electrical device; the voltage detection and wake-up unit is connected to the single-chip microcomputer; the voltage detection and wake-up unit comprises an electrical device voltage detection unit configured to check a voltage of the electrical device, and the electrical device voltage detection unit controls a power supply state of the high-current output unit according to the detected voltage.

[0005] As a further improvement of the present invention, the mobile power supply further comprises a DC output module connected to the output control circuit, the voltage detection and wake-up unit further comprises a wake-up unit, and when the electrical device is connected to the high-current output unit, the wake-up unit notifies the single-chip microcomputer that the electrical

device has been connected, and the single-chip microcomputer issues an instruction to cause the high-current output unit to output a current.

[0006] As a further improvement of the present invention, the mobile power supply further comprises an AC output module; the AC output module comprises an uninterruptible power system ups and an AC output unit; the ups is connected to the single-chip microcomputer, and the two transmit signals interactively; and the output control circuit is connected to the AC output unit, and the AC output unit is connected to the UPS.

[0007] As a further improvement of the present invention, when the high-current output unit outputs a current for working, the single-chip microcomputer cuts off power supply of the lithium battery to the AC output module and the DC output module.

[0008] As a further improvement of the present invention, the mobile power supply further comprises a switching power supply unit, a PWM charging circuit unit, a charging current detection unit, and a battery power detection unit; the switching power supply unit is separately connected to the single-chip microcomputer, the output control circuit and the PWM charging circuit unit; the PWM charging circuit unit is separately connected to the single-chip microcomputer and the charging current detection unit; the charging current detection unit is separately connected to the lithium battery and the single-chip microcomputer; and the battery power detection unit is separately connected to the lithium battery and the single-chip microcomputer.

[0009] As a further improvement of the present invention, the mobile power supply further comprises a battery balancing protection unit connected to the lithium battery, and the mobile power supply further comprises a button, an LCD display and a buzzer separately connected to the single chip microcomputer.

[0010] As a further improvement of the present invention, the mobile power supply further comprises a low dropout regulator LDO separately connected to the lithium battery and the single-chip microcomputer, and an output current detection unit separately connected to the output control circuit and the single-chip microcomputer.

[0011] As a further improvement of the present invention, the mobile power supply further comprises an input identification circuit; the DC output module comprises a first USB output unit,

a second USB output unit and a DC multi-gear output unit; and the first USB output unit, the second USB output unit and the DC multi-gear output unit are separately connected to the output control circuit.

[0012] As a further improvement of the present invention, the wake-up unit comprises a transistor Q6 and voltage dividing resistors R59 and R60 configured to sample, and the electrical device voltage detection unit (121) comprises detection resistors R38 and R41.

[0013] The present invention further provides a control method for a mobile power supply, wherein: when the single-chip microcomputer is working, the UPS is in a sleep state; before the high-current output unit outputs a current, the single-chip microcomputer control to turn off all other current outputs; when an electrical device is connected to the high-current output unit, the voltage dividing resistors R59 and R60 perform sampling, a transistor Q6 is controlled to turn on, the single-chip microcomputer is notified that the electrical device has been connected, the single-chip microcomputer controls a relay K1 to engage, and instantaneous output of a high current starts; and detection resistors R38 and R41 divide and detect a voltage of the electrical device, and when the voltage of the electrical appliance returns to normal, the relay K1 is automatically turned off, and the high-current output unit stops outputting a current.

[0014] The beneficial effects of the present invention are as follows: because the high-current output unit is configured to be connected to an electrical device, the voltage detection and wake-up unit is connected to the single-chip microcomputer, and the electrical device voltage detection unit controls the power supply state of the high-current output unit according to the detected voltage, the mobile power supply not only ensures the output of a high current, but also ensures that the lithium battery will not be damaged.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a block diagram of the principle of present invention.

[0016] FIG. 2 is a schematic diagram of a single-chip microcomputer and an LCD display part of the present invention.

[0017] FIG. 3 is a circuit diagram of charging management and input identification of the present invention.

[0018] FIG. 4 is a circuit diagram of a high-current instantaneous output module of the present invention.

[0019] FIG. 5 is a circuit diagram for DC buck output control of the present invention.

[0020] FIG. 6 is a circuit diagram for DC boost output and current detection of the present invention.

[0021] FIG. 7 shows a USB buck output and current detection circuit of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] As shown in FIGS. 1 and 2, a mobile power supply is disclosed in the present invention. The mobile power supply includes an AC output module, a DC output module, and a high-current instantaneous output module (car ignition module). The mobile power supply realizes the management of the three modules.

[0023] The mobile power supply includes a single-chip microcomputer 1, an output control circuit 5, a lithium battery 4 and a high-current instantaneous output module. The output control circuit 5 is separately connected to the single-chip microcomputer 1 and the lithium battery 4. The high-current instantaneous output module includes a high-current output unit 11 connected to the output control circuit 5 and a voltage detection and wake-up unit 12 connected to the high-current output unit 11. The high-current output unit 11 is configured to be connected to an electrical device. The voltage detection and wake-up unit 12 is connected to the single-chip microcomputer 1. The voltage detection and wake-up unit 12 includes an electrical device voltage detection unit 121 configured to check a voltage of the electrical device, and the electrical device voltage detection unit 121 controls a power supply state of the high-current output unit 11 according to the detected voltage. The power supply state refers to allowing the high-current output unit 11 to continue supplying power or to cut off power.

[0024] As shown in FIG. 4, the mobile power supply further includes a DC power output module connected to the output control circuit 5, the voltage detection and wake-up unit 12 further includes a wake-up unit 122, and when the electrical device is connected to the high-current output unit 11, the wake-up unit 122 notifies the single-chip microcomputer 1 that the electrical device has been connected, and the single-chip microcomputer 1 issues an instruction to cause the high-current output unit 11 to output a current. The wake-up unit 122 includes a transistor Q6 and

voltage dividing resistors R59 and R60 configured to sample, and the electrical device voltage detection unit 121 includes detection resistors R38 and R41.

[0025] In this embodiment, the electrical device is a car battery. When the car battery is connected to the high-current output unit 11, the wake-up unit 122 notifies the single-chip microcomputer 1 that the car battery has been connected, the single-chip microcomputer 1 controls the high-current output unit 11 to instantly output a high current for ignition, and then a battery voltage is detected by means of the electrical device voltage detection unit 121. If the battery voltage returns to normal, the high-current instantaneous output module is turned off. That is, when the mobile power supply is connected to the car battery, sampling is performed by means of the voltage dividing resistors R59 and R60 of the wake-up unit 122, and the transistor Q6 is controlled to turn on, and the single-chip microcomputer 1 is notified that the car battery has been connected. When the car ignites, high-current control components R1 to R6 instantly output a large current to complete the ignition. When the car starts, the voltage of the car battery is divided and detected by means of the detection resistors R38 and R41. When the battery voltage returns to normal, the relay K1 is automatically turned off to prevent long-term high-current output from damaging the lithium battery 4. When the high-current instantaneous output module is used for car ignition, it realizes high-current output protection, output short-circuit prevention control, automatic identification of connected cars, and automatic shutdown after ignition. The instantaneous output current of the large current output unit 11 is 200 A, which is sufficient for most household cars.

[0026] As shown in FIG. 7, the DC output module includes a first USB output unit 8, a second USB output unit 9 and a DC multi-gear output unit 10, and the first USB output unit 8, the second USB output unit 9 and the DC multi-gear output unit 10 are separately connected to the output control circuit 5. FIGS. 5 and 6 show DC boost and buck output control circuits. The buck is controlled by U4, and controlled by the single-chip microcomputer 1 through a switch Q11 to ensure minimum static power consumption. Q24 is an anti-reverse switch to improve output efficiency. U9 is a main chip for boost control, and is controlled by the single-chip microcomputer 1 through a switch Q15 to be connected to the lithium battery 4 to ensure the minimum static power consumption. U3B and D12 form an output power limit control to automatically prevent the output from being overloaded for a long time and damage the machine. The DC buck output control circuit completes the buck output of 5 V, 8.4 V and 9.5 V, and the DC boost output control circuit

completes the boost output of 12 V, 16 V, 19 V and 24 V. The two circuits complete the multi-gear voltage output of DC 5 V, 8.4 V, 9.5 V, 12 V, 16 V, 19 V and 24V.

[0027] The mobile power supply further includes an AC output module. The AC output module includes an uninterruptible power system ups 6 and an AC output unit 7. The ups 6 is connected to the single-chip microcomputer 1, and the two transmit signals interactively. The output control circuit 5 is connected to the AC output unit 7, and the AC output unit 7 is connected to the UPS 6. The ups 6 receives AC power of 190 V to 240 V, and AC equipment may be inserted into the AC output unit 7 to facilitate power supply to the AC equipment.

[0028] When the high-current output unit 11 outputs a current for working, the single-chip microcomputer 1 cuts off power supply of the lithium battery 4 to the AC output module and the DC output module, thereby ensuring the current supply to the high-current instantaneous output module.

[0029] As shown in FIGS. 1 and 3, to increase the service life of the lithium battery 4, the lithium battery 4 needs to be managed to prevent overcharge and over-discharge. Therefore, the mobile power supply further includes a switching power supply unit 2 and a charging management circuit. The charging management circuit includes a PWM charging circuit unit 3, a charging current detection unit 13 and a battery power detection unit 14. The switching power supply unit 2 is separately connected to the single-chip microcomputer 1, the output control circuit 5 and the PWM charging circuit unit 3. The PWM charging circuit unit 3 is separately connected to the single-chip microcomputer 1 and the charging current detection unit 13. The charging current detection unit 13 is separately connected to the lithium battery 4 and the single-chip microcomputer 1. The battery power detection unit 14 is separately connected to the lithium battery 4 and the single-chip microcomputer 1.

[0030] As shown in FIG. 3, the mobile power supply further includes an input identification circuit, which is connected to the single-chip microcomputer 1. The input identification circuit can realize automatic identification control of solar charging and power supply adaptation charging, and a wide range of charging voltages to adapt to different power adapters. The input identification circuit includes a solar/DC identification circuit 21, a charging voltage detection circuit 22 and a DC power-on wake-up circuit 23. When a charging device is inserted, it is controlled by the single-chip microcomputer 1 through Q17, R1, R16 and R20 to automatically identify different input

devices for different charging management. Charging is automatically started by identifying the charging insertion through Q1, R5, and R6, and a corresponding PWM control signal is issued by the single-chip microcomputer 1, and the charging management is completed through voltage and current detection.

[0031] The mobile power supply further 4 includes a battery balancing protection unit 15 connected to the lithium battery 4, and the mobile power supply further includes a button 20, an LCD display 18 and a buzzer 19 separately connected to the single chip microcomputer 1. Switching of all functions is completed by means of the button 20. For example, the button 20 is pressed to switch from the AC output module to the DC output module. In a DC output module state, the first USB output unit 8 is in a working state by default. The button 20 is pressed again to switch from the first USB output unit 8 to the second USB output unit 9. The button 20 is pressed again to switch the second USB output unit 9 to the DC multi-gear output unit 10. The button 20 is pressed again to switch from the DC multi-gear output unit 10 to the high-current instantaneous output module. That is, the cyclic switching of various functions is completed by means of the button 20. Moreover, the working state of each module is displayed on the LCD for users to view. The buzzer 19 is used to warn the user. For example, when the mobile power supply is in the working state of the high-current instantaneous output module, the buzzer 19 emits a short beep sound. When the mobile power supply is in the working state of the AC output module, the buzzer 19 emits a long chirping sound.

[0032] The mobile power supply further includes a low dropout regulator LDO 16 separately connected to the lithium battery 4 and the single-chip microcomputer 1, and an output current detection unit 17 separately connected to the output control circuit 5 and the single-chip microcomputer 1. The LDO 16 provides a stable power supply for the single-chip microcomputer 1. Because it is directly connected to the lithium battery 4, and a static current is required to be very small, an ultra-low power LDO is selected. The output current detection unit 17 is used to detect the size of the output current, and its function is to complete the DC maximum output power limit.

[0033] The time for the mobile power supply to switch from the AC output module to the DC output module is less than 10 ms. When the input AC power is suddenly off, the voltage of a

voltage transformer suddenly changes, and an AC-DC-AC switch is quickly switched to a DC/AC output circuit. Since hardware switching is used, the switching time is fast.

[0034] Because the mobile power supply has an AC output module, a DC output module, and a high-current instantaneous output module, it may be used as a backup emergency power supply at home, or as a backup power supply for mobile devices when going out, and may also provide a certain power of AC power during camping and field trips.

[0035] A control method for a mobile power supply is further disclosed in the present invention. When the single-chip microcomputer 1 is working, the UPS 6 is in a sleep state. Before the high-current output unit 11 outputs a current, the single-chip microcomputer 1 control to turn off all other current outputs. When an electrical device is connected to the high-current output unit 11, the voltage dividing resistors R59 and R60 perform sampling, a transistor Q6 is controlled to turn on, the single-chip microcomputer 1 is notified that the electrical device has been connected, the single-chip microcomputer 1 controls a relay K1 to engage, and instantaneous output of a high current starts. Detection resistors R38 and R41 divide and detect a voltage of the electrical device, and when the voltage of the electrical appliance returns to normal, the relay K1 is automatically turned off, and the high-current output unit 11 stops outputting a current.

[0036] The present invention further provides a method to ensure minimum static power consumption. When there is no load on the output, the power supplies of all detection circuits, such as lithium battery 4 voltage detection, output load detection and other circuit power supplies, are cut off by means of the single-chip microcomputer 1 to ensure that the mobile device has the minimum loss in the static state. A detection reference power supply is not powered by the lithium battery 4, but is powered by an MCU pin. During sleep, the reference power supply is turned off to ensure the minimum static current.

[0037] When the mobile power supply has AC input, the single-chip microcomputer 1 is turned off, only the UPS 6 part works, and it completes battery charging. When the mobile power supply has no AC input, the single-chip microcomputer 1 works and the MCU of the UPS 6 sleeps. Only when the inverter output is manually selected, the MCU that wakes up the UPS 6 enters the working state. During car ignition, due to a high output current, the car enters the ignition state through automatic identification, and all outputs are turned off to ensure sufficient energy for ignition.

[0038] The above content is a further detailed description of the present invention in conjunction with specific preferred embodiments, and it cannot be concluded that the specific implementation of the present invention is limited to the description. For those of ordinary skill in the technical field to which the present invention pertains, several simple deductions or substitutions can be made without departing from the concept of the present invention, and all of them should be regarded as being within the scope of protection of the present invention.

CLAIMS

1. A mobile power supply, characterized by comprising a single-chip microcomputer (1), an output control circuit (5), a lithium battery (4), and a high-current instantaneous output module, wherein the output control circuit (5) is separately connected to the single-chip microcomputer (1) and the lithium battery (4); the high-current instantaneous output module comprises a high-current output unit (11) connected to the output control circuit (5) and a voltage detection and wake-up unit (12) connected to the high-current output unit (11); the high-current output unit (11) is configured to be connected to an electrical device; the voltage detection and wake-up unit (12) is connected to the single-chip microcomputer (1); the voltage detection and wake-up unit (12) comprises an electrical device voltage detection unit (121) configured to check a voltage of the electrical device, and the electrical device voltage detection unit (121) controls a power supply state of the high-current output unit (11) according to the detected voltage.
2. The mobile power supply according to claim 1, wherein: the mobile power supply further comprises a DC output module connected to the output control circuit (5), the voltage detection and wake-up unit (12) further comprises a wake-up unit (122), and when the electrical device is connected to the high-current output unit (11), the wake-up unit (122) notifies the single-chip microcomputer (1) that the electrical device has been connected, and the single-chip microcomputer (1) issues an instruction to cause the high-current output unit (11) to output a current.
3. The mobile power supply according to claim 1 or 2, wherein: the mobile power supply further comprises an AC output module; the AC output module comprises an uninterruptible power system ups (6) and an AC output unit (7); the ups (6) is connected to the single-chip microcomputer (1), and the two transmit signals interactively; and the output control circuit (5) is connected to the AC output unit (7), and the AC output unit (7) is connected to the UPS (6).
4. The mobile power supply according to claim 3, wherein: when the high-current output unit (11) outputs a current for working, the single-chip microcomputer (1) cuts off power supply of the lithium battery (4) to the AC output module and the DC output module.

5. The mobile power supply according to claim 4, wherein: the mobile power supply further comprises a switching power supply unit (2), a PWM charging circuit unit (3), a charging current detection unit (13), and a battery power detection unit (14); the switching power supply unit (2) is separately connected to the single-chip microcomputer (1), the output control circuit (5), and the PWM charging circuit unit (3); the PWM charging circuit unit (3) is separately connected to the single-chip microcomputer (1) and the charging current detection unit (13); the charging current detection unit (13) is separately connected to the lithium battery (4) and the single-chip microcomputer (1); and the battery power detection unit (14) is separately connected to the lithium battery (4) and the single-chip microcomputer (1).

6. The mobile power supply according to claim 5, wherein: the mobile power supply further comprises a battery balancing protection unit (15) connected to the lithium battery, and the mobile power supply further comprises a button (20), an LCD display (18), and a buzzer (19) separately connected to the single chip microcomputer (1).

7. The mobile power supply according to claim 6, wherein: the mobile power supply further comprises a low dropout regulator LDO (16) separately connected to the lithium battery (4) and the single-chip microcomputer (1), and an output current detection unit (17) separately connected to the output control circuit (5) and the single-chip microcomputer (1).

8. The mobile power supply according to claim 7, wherein: the mobile power supply further comprises an input identification circuit; the DC output module comprises a first USB output unit (8), a second USB output unit (9), and a DC multi-gear output unit (10); and the first USB output unit (8), the second USB output unit (9), and the DC multi-gear output unit (10) are separately connected to the output control circuit (5).

9. The mobile power supply according to claim 2, wherein: the wake-up unit (122) comprises a transistor Q6 and voltage dividing resistors R59 and R60 configured to sample, and the electrical device voltage detection unit (121) comprises detection resistors R38 and R41.

10. A control method for a mobile power supply, characterized in that: when the single-chip microcomputer (1) is working, the UPS (6) is in a sleep state; before the high-current output unit (11) outputs a current, the single-chip microcomputer (11) control to turn off all other current outputs; when an electrical device is connected to the high-current output unit (11), the voltage dividing resistors R59 and R60 perform sampling, a transistor Q6 is controlled to turn on, the single-chip microcomputer (1) is notified that the electrical device has been connected, the single-chip microcomputer (1) controls a relay K1 to engage, and instantaneous output of a high current starts; and detection resistors R38 and R41 divide and detect a voltage of the electrical device, and when the voltage of the electrical appliance returns to normal, the relay K1 is automatically turned off, and the high-current output unit (11) stops outputting a current.

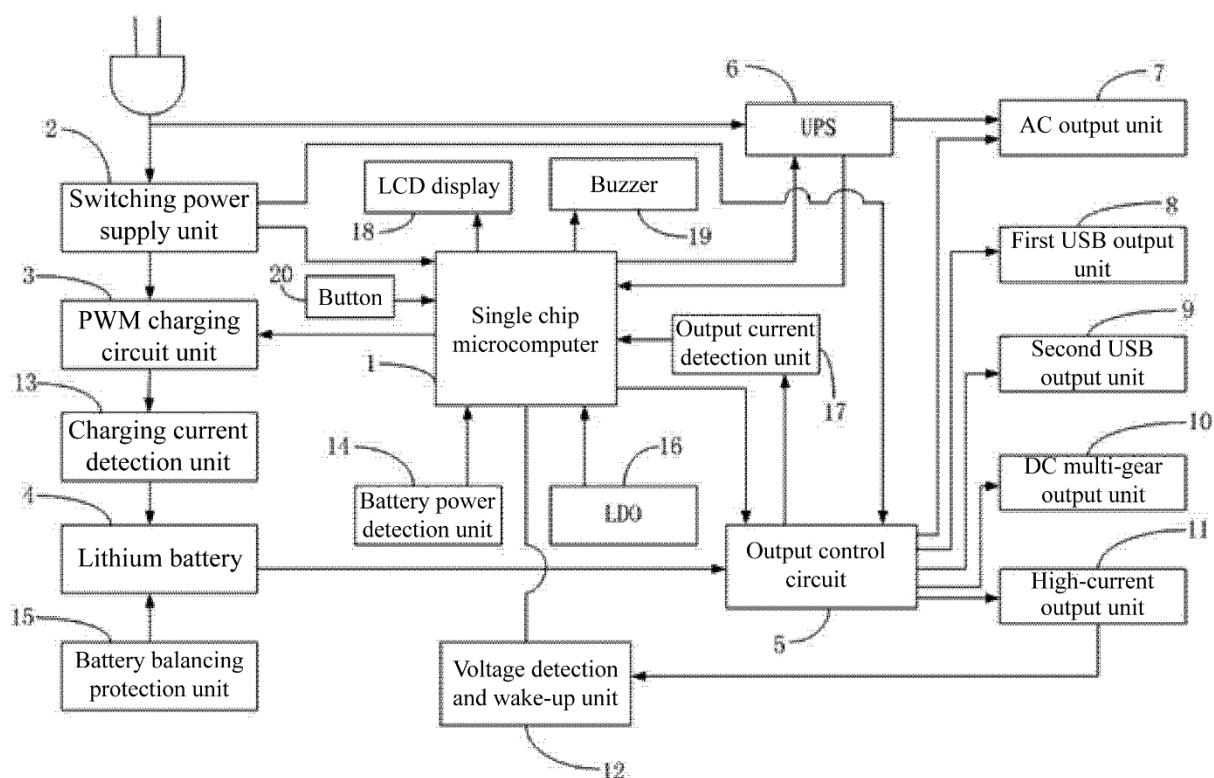


FIG. 1

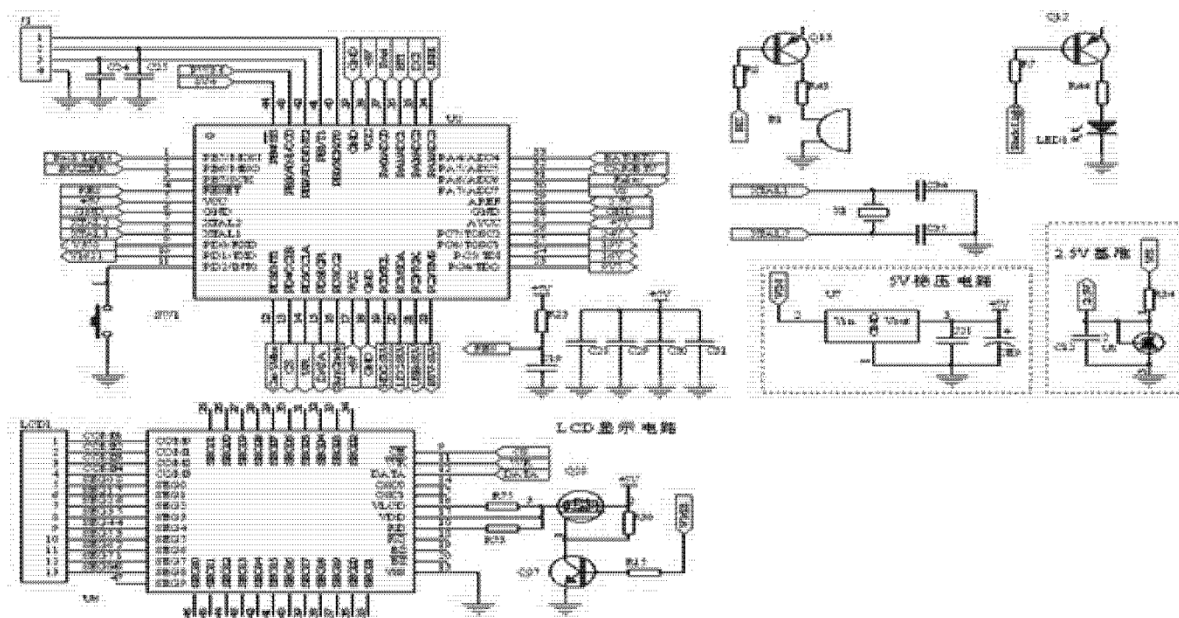


FIG. 2

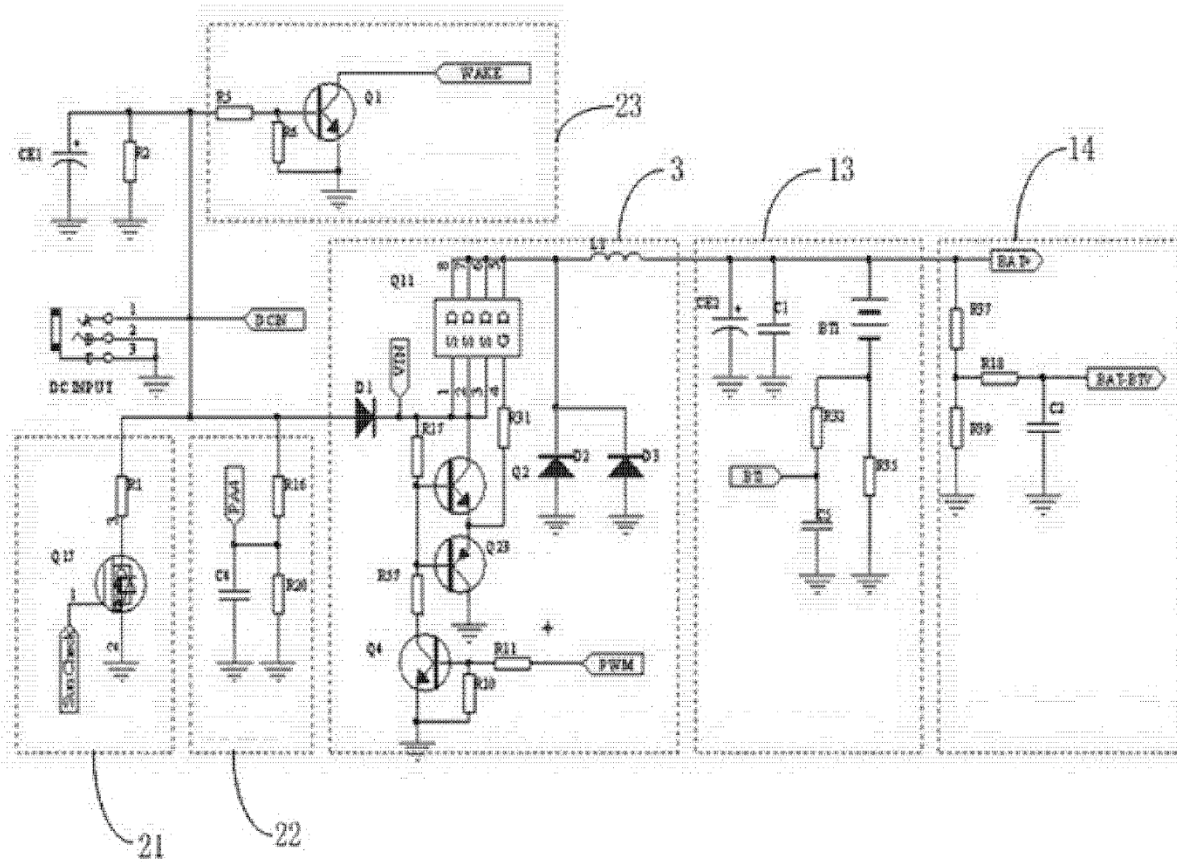


FIG. 3

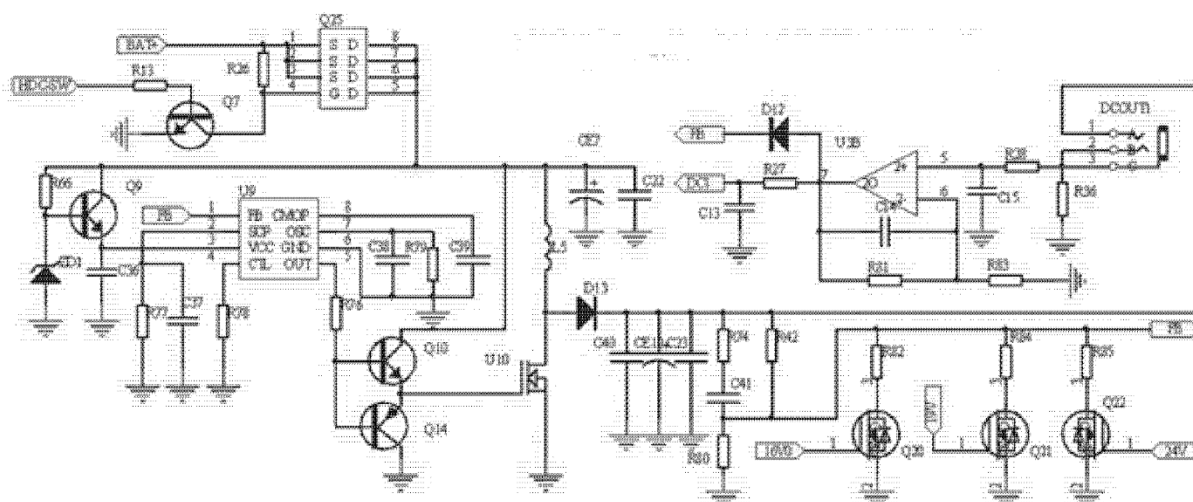


FIG. 6

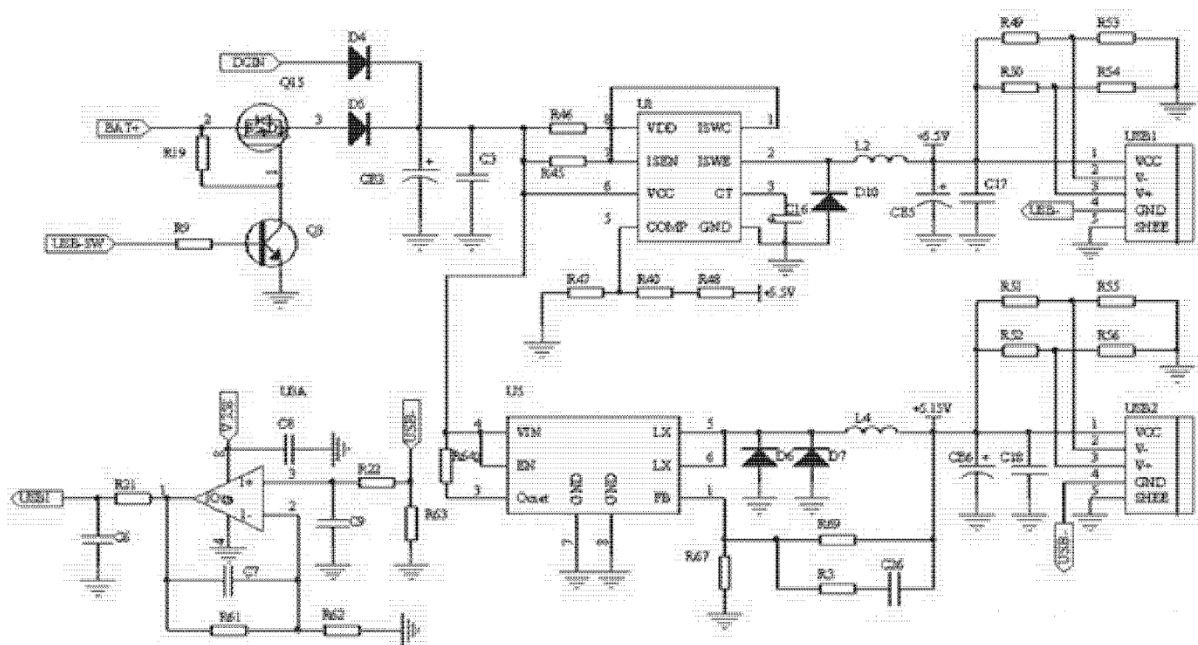


FIG. 7