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CHARGING CONTROL METHOD AND APPARATUS, AND ELECTRONIC DEVICE

Abstract

A charging control method and apparatus, and an electronic device, are provided. The method includes: when a charger is connected, detecting values of a first flag and a second flag of a charging chip register, where the first flag is used to indicate a charging status, and the second flag is used to indicate a magnitude relationship between a battery voltage and a system voltage; and changing a current charging stage based on a change in a value of at least one of the first flag and the second flag.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of International Application No. PCT/CN2023/127461, filed on Oct. 30, 2023, which claims priority to Chinese Patent Application No. 202211406693.5, filed Nov. 10, 2022. The entire contents of each of the above-referenced applications are expressly incorporated herein by reference.

TECHNICAL FIELD

[0002] This application pertains to the field of communication technologies, and specifically relates to a charging control method and apparatus, and an electronic device.

BACKGROUND

[0003] In a charging process of a terminal, an Analog-to-Digital Converter (ADC) module needs to detect a change process of an external signal, to control progress of different charging stages.

[0004] For a charging chip or Integrated Circuit (IC) without an ADC module, one solution to implement a charging function is to build a detection circuit outside the charging chip to detect a change process of an external signal. As shown in FIG. 1, a voltage division network is constructed by using a pull-up resistor R1 and a pull-down resistor R2, and the voltage division network is connected to a General Purpose Input/Output (GPIO) interface (this interface has an ADC function) of a system IC, to provide a power supply for the system IC.

[0005] However, when a battery voltage Vbat is greater than zero (the GPIO interface is already electrified) and a system voltage Vsys is zero (a power supply chip does not normally supply power), hardware of the system IC fails, or the terminal cannot be powered on.

SUMMARY

[0006] Embodiments of this application aim to provide a charging control method and apparatus, and an electronic device.

[0007] According to a first aspect, an embodiment of this application provides a charging control method. The method includes: [0008] in a case that a charger is connected, detecting values of a first flag and a second flag of a charging chip register, where the first flag is used to indicate a charging status, and the second flag is used to indicate a magnitude relationship between a battery voltage and a system voltage; and [0009] changing a current charging stage based on a change in a value of at least one of the first flag and the second flag.

[0010] According to a second aspect, an embodiment of this application provides a charging control apparatus, including: [0011] a detection module, configured to: in a case that a charger is connected, detect values of a first flag and a second flag of a charging chip register, where the first flag is used to indicate a charging status, and the second flag is used to indicate a magnitude relationship between a battery voltage and a system voltage; and [0012] a control module, configured to change a current charging stage based on a change in a value of at least one of the first flag and the second flag.

[0013] According to a third aspect, an embodiment of this application provides an electronic device. The electronic device includes a processor, a memory, and a program or an instruction that is stored in the memory and that may be run on the processor. When the program or the instruction is executed by the processor, the method according to the first aspect is implemented.

[0014] According to a fourth aspect, an embodiment of this application provides a readable storage medium. The readable storage medium stores a program or an instruction, and when the program or

the instruction is executed by a processor, the method according to the first aspect is implemented.
[0015] According to a fifth aspect, an embodiment of this application provides a chip. The chip includes a processor and a communication interface, the communication interface is coupled to the processor, and the processor is configured to run a program or an instruction to implement the method according to the first aspect.

[0016] According to a sixth aspect, an embodiment of this application provides a computer program product. The program product is stored in a storage medium, and the program product is executed by at least one processor to implement the method according to the first aspect.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0017] FIG. 1 is a schematic diagram of a principle of a charging chip without an ADC module in the related art;

[0018] FIG. 2 is a schematic flowchart of a charging control method according to an embodiment of this application;

[0019] FIG. 3 is a first schematic diagram of charging control logic according to an embodiment of this application;

[0020] FIG. 4 is a second schematic diagram of charging control logic according to an embodiment of this application;

[0021] FIG. 5 is a third schematic diagram of charging control logic according to an embodiment of this application;

[0022] FIG. 6 is a schematic diagram of a structure of a charging control apparatus according to an embodiment of this application; and

[0023] FIG. 7 is a schematic diagram of a hardware structure of an electronic device according to an embodiment of this application.

DETAILED DESCRIPTION

[0024] The following describes embodiments of this application with reference to accompanying drawings in embodiments of this application. It is clear that the described embodiments are a part rather than all of embodiments of this application. All other embodiments obtained by a person of ordinary skill in the art based on embodiments of this application shall fall within the protection scope of this application.

[0025] In the specification and claims of this application, the terms “first,” “second,” and so on are intended to distinguish between similar objects but do not indicate a specific order or sequence. It should be understood that the data termed in such a way is interchangeable in proper circumstances so that embodiments of this application can be implemented in orders other than the order illustrated or described herein. Objects distinguished by “first” and “second” are generally of a same category, and a quantity of objects is not limited. For example, there may be one or more first objects. In addition, in the specification and the claims, “and/or” represents at least one of connected objects, and the character “/” generally represents an “or” relationship between associated objects.

[0026] FIG. 2 is a schematic flowchart of a charging control method according to an embodiment of this application. As shown in FIG. 2, an embodiment of this application provides a charging control method, applied to an electronic device. The electronic device may be a terminal, for example, a mobile phone. The method includes the following steps:

[0027] Step **201**: In a case that a charger is connected, detect values of a first flag and a second flag of a charging chip register, where the first flag is used to indicate a charging status, and the second flag is used to indicate a magnitude relationship between a battery voltage and a system voltage.

[0028] Step **202**: Change a current charging stage based on a change in a value of at least one of the

first flag and the second flag.

[0029] In some implementations, a charging process may be divided into a Secondary Boot Loader (SBL) stage, a Unified Extensible Firmware Interface (UEFI) stage, and a kernel (kernel driver loading) stage. The SBL stage and the UEFI stage belong to a pre-charging state (also referred to as a pre-charging mode), and the kernel stage belongs to a fast charging state (also referred to as a fast charging mode, that is, a constant current and constant voltage state). In this embodiment of this application, a new charging solution is implemented by configuring a register flag in an internal controller of a charging IC.

[0030] A transition point voltage from the SBL stage to the UEFI stage is a first voltage threshold, denoted by $V1$, and a transition point voltage from the UEFI stage to the kernel stage is a second voltage threshold, denoted by $V2$. $V2$ is greater than $V1$.

[0031] FIG. 3 is a first schematic diagram of charging control logic according to an embodiment of this application. As shown in FIG. 3, in a charging process of a first stage of charging, a first flag and a second flag are used to perform determining. In a case that a charger is connected, if a value of the first flag is a first numerical value (for example, the value of the first flag is equal to 1), indicating that the charging process is still in a pre-charging state, and a value of the second flag is a second numerical value (for example, the value of the second flag is equal to 1), indicating that a battery voltage (denoted by V_{bat}) is less than a system minimum fixed voltage (denoted by V_{sysmin}), in this case, it is determined that a current battery voltage is still relatively low, and it may be considered that the current battery voltage does not reach $V1$. Therefore, an SBL stage is entered and maintained for charging.

[0032] If the value of the first flag is a third numerical value (for example, the value of the first flag is equal to 2), indicating that a fast charging state is entered, or the value of the second flag is a fourth numerical value (for example, the value of the second flag is equal to 0), indicating that V_{bat} is greater than V_{sysmin} , in this case, it is determined that a voltage condition is met. Therefore, a UEFI stage is entered and maintained for charging.

[0033] The value of the second flag is related to magnitudes of V_{bat} and V_{sysmin} . When V_{bat} is greater than V_{sysmin} , the value of the second flag is equal to 0, and when V_{bat} is less than V_{sysmin} , the value of the second flag is equal to 1, where $V1$ is less than V_{sysmin} . V_{bat} and V_{sysmin} are connected to an input pin of a comparator module in a charging IC. The input voltage value V_{bat} is compared with the specified reference voltage value V_{sysmin} . As the voltage V_{bat} continuously increases in the charging process, whether V_{bat} is greater than or less than V_{sysmin} is determined.

[0034] The value of the first flag determines a charging status by using a current threshold and a voltage threshold, and a register in an internal controller of the charging IC indicates different charging states: A value 00 (binary) of the register indicates that charging is turned off, a value 01 (binary) of the register indicates the pre-charging state, a value 10 (binary) of the register indicates the fast charging state (a constant current and constant voltage state), and a value 11 (binary) of the register indicates that charging is completed.

[0035] FIG. 4 is a second schematic diagram of charging control logic according to an embodiment of this application. As shown in FIG. 4, in a process of a second stage of charging, a charging stage is determined based on the value of the second flag. In the charging process, the value of V_{bat} may fluctuate. If the value of the second flag is the second numerical value, indicating that V_{bat} is less than V_{sysmin} , in this case, it is determined that a current voltage is still relatively low. In this case, if a voltage $V2$ is greater than the voltage value V_{sysmin} , the UEFI stage continues to be maintained for charging. If the value of the second flag is the fourth numerical value, it indicates that V_{bat} is greater than V_{sysmin} . In this case, if V_{bat} is greater than a voltage value of $V2$, a kernel stage is entered and maintained for charging; and if V_{bat} is less than or equal to the voltage value of $V2$, the UEFI stage continues to be maintained for charging.

[0036] FIG. 5 is a third schematic diagram of charging control logic according to an embodiment

of this application. As shown in FIG. 5, in a process of a third stage of charging, after the kernel stage is entered, the voltage Vbat and a current are collected by using an electricity meter IC, and electric power calculation is performed inside the electricity meter IC. The voltage Vbat and the current are reported to a processor by using an Inter-Integrated Circuit (IIC) serial communication bus, and charging progress is displayed. For example, a charging percentage may be displayed, or a charging percentage animation may be displayed.

[0037] In embodiments of this application, a current charging stage is changed based on a change in values of a first flag and a second flag of a charging IC register. This avoids a case that hardware of a system IC fails or a terminal cannot be powered on because a current is mistakenly injected into the system IC, thereby improving reliability of the terminal.

[0038] FIG. 6 is a schematic diagram of a structure of a charging control apparatus according to an embodiment of this application. As shown in FIG. 6, an embodiment of this application provides a charging control apparatus, and the apparatus includes a detection module 601 and a control module 602.

[0039] The detection module is configured to: in a case that a charger is connected, detect values of a first flag and a second flag of a charging chip register, where the first flag is used to indicate a charging status, and the second flag is used to indicate a magnitude relationship between a battery voltage and a system voltage.

[0040] The control module is configured to change a current charging stage based on a change in a value of at least one of the first flag and the second flag.

[0041] When the battery voltage is less than a system minimum fixed voltage, a value of the second flag is a second numerical value.

[0042] In a pre-charging state, a value of the first flag is a first numerical value.

[0043] In some implementations, the control module is specifically configured to: in a case that the value of the first flag is the first numerical value and the value of the second flag is the second numerical value, enter and maintain a secondary boot loader stage for charging.

[0044] In a fast charging state, the value of the first flag is a third numerical value.

[0045] When the battery voltage is greater than the system minimum fixed voltage, the value of the second flag is a fourth numerical value.

[0046] In some implementations, the control module is specifically configured to: in a case that it is detected that the value of the first flag is the third numerical value or the value of the second flag is the fourth numerical value in a charging process of the secondary boot loader stage, enter and maintain a unified extensible firmware interface stage for charging.

[0047] In some implementations, the control module is specifically configured to: in a case that it is detected that the value of the second flag is the second numerical value and a second voltage threshold is greater than the system minimum fixed voltage in a charging process of the unified extensible firmware interface stage, continue to maintain the unified extensible firmware interface stage for charging, where the second voltage threshold is a transition point voltage from the unified extensible firmware interface stage to a kernel driver loading stage.

[0048] In some implementations, the control module is specifically configured to: in a case that it is detected that the value of the second flag is the fourth numerical value and the battery voltage is greater than the second voltage threshold in the charging process of the unified extensible firmware interface stage, enter and maintain the kernel driver loading stage for charging.

[0049] In some implementations, the apparatus further includes a display module.

[0050] The display module is configured to: obtain the battery voltage or a current in a charging process of the kernel driver loading stage, and display charging progress.

[0051] In some implementations, the foregoing charging control apparatus provided in this embodiment of this application can implement all steps implemented in the foregoing method embodiment executed by the electronic device, and can achieve same technical effects. Parts and beneficial effects in this embodiment that are the same as those in the method embodiment are not

specifically described herein again.

[0052] The charging control apparatus in this embodiment of this application may be an apparatus, or may be a component, an integrated circuit, or a chip in a terminal. The apparatus may be a mobile electronic device, or may be a non-mobile electronic device. For example, the mobile electronic device may be a mobile phone, a tablet computer, a laptop computer, a palmtop computer, an in-vehicle electronic device, a wearable device, an Ultra-Mobile Personal Computer (UMPC), a netbook, a Personal Digital Assistant (PDA), or the like. The non-mobile electronic device may be a server, a Network Attached Storage (NAS), a personal computer, a television, a teller machine, a self-service machine, or the like. This is not specifically limited in this embodiment of this application.

[0053] The charging control apparatus in this embodiment of this application may be an apparatus with an operating system. The operating system may be an Android operating system, may be an iOS operating system, or may be another possible operating system. This is not specifically limited in this embodiment of this application.

[0054] In some implementations, an embodiment of this application further provides an electronic device, including a processor, a memory, and a program or an instruction that is stored in the memory and that may be run on the processor. When the program or the instruction is executed by the processor, processes in the foregoing charging control method embodiment are implemented, and same technical effects can be achieved. To avoid repetition, details are not described herein again.

[0055] It should be noted that the electronic device in this embodiment of this application includes the foregoing mobile electronic device and the foregoing non-mobile electronic device.

[0056] FIG. 7 is a schematic diagram of a hardware structure of an electronic device according to an embodiment of this application. As shown in FIG. 7, the electronic device **700** includes but is not limited to components such as a radio frequency unit **701**, a network module **702**, an audio output unit **703**, an input unit **704**, a sensor **705**, a display unit **706**, a user input unit **707**, an interface unit **708**, a memory **709**, and a processor **710**.

[0057] A person skilled in the art may understand that the electronic device **700** may further include a power supply (for example, a battery) that supplies power to each component. The power supply may be logically connected to the processor **710** by using a power management system, to implement functions such as charging management, discharging management, and power consumption management by using the power management system. The structure of the electronic device shown in FIG. 7 does not constitute a limitation on the electronic device, and the electronic device may include more or fewer components than those shown in the figure, or combine some components, or have different component arrangements. Details are not described herein.

[0058] It should be understood that in this embodiment of this application, the input unit **704** may include a Graphics Processing Unit (GPU) **7041** and a microphone **7042**. The graphics processing unit **7041** processes image data of a static picture or a video obtained by an image capture apparatus (for example, a camera) in a video capture mode or an image capture mode. The display unit **706** may include a display panel **7061**. The display panel **7061** may be configured in a form of a liquid crystal display, an organic light-emitting diode, or the like. The user input unit **707** includes at least one of a touch panel **7071** and another input device **7072**. The touch panel **7071** is also referred to as a touchscreen. The touch panel **7071** may include two parts: a touch detection apparatus and a touch controller. The another input device **7072** may include but is not limited to a physical keyboard, a function key (for example, a volume control key or an on/off key), a track control, a mouse, and a joystick. Details are not described herein. The memory **709** may be configured to store a software program and various data. The memory **709** may mainly include a first storage area for storing a program or an instruction and a second storage area for storing data. The first storage area may store an operating system, an application or an instruction required by at least one function (for example, a sound playing function or an image playing function), and the

like. In addition, the memory **709** may include a volatile memory or a nonvolatile memory, or the memory **709** may include both a volatile memory and a nonvolatile memory. The nonvolatile memory may be a Read-Only Memory (ROM), a Programmable ROM (PROM), an Erasable PROM (EPROM), an Electrically EPROM (EEPROM), or a flash memory. The volatile memory may be a Random Access Memory (RAM), a Static RAM (SRAM), a Dynamic RAM (DRAM), a Synchronous DRAM (SDRAM), a Double Data Rate SDRAM (DDR SDRAM), an Enhanced SDRAM (ESDRAM), a SynchLink DRAM (SLDRAM), and a Direct Rambus RAM (DRRAM). The memory **709** in this embodiment of this application includes but is not limited to these and any memory of another proper type.

[0059] The processor **710** may include one or more processing units. In some implementations, the processor **710** integrates an application processor and a modem processor. The application processor mainly processes operations related to an operating system, a user interface, an application, and the like. The modem processor mainly processes a wireless communication signal, and for example, the modem processor is a baseband processor. It may be understood that the foregoing modem processor may alternatively not be integrated into the processor **710**.

[0060] The processor **710** is configured to: in a case that a charger is connected, detect values of a first flag and a second flag of a charging chip register, where the first flag is used to indicate a charging status, and the second flag is used to indicate a magnitude relationship between a battery voltage and a system voltage; and change a current charging stage based on a change in a value of at least one of the first flag and the second flag.

[0061] In some implementations, the processor **710** is further configured to: in a case that a value of the first flag is a first numerical value and a value of the second flag is a second numerical value, enter and maintain a secondary boot loader stage for charging. When the battery voltage is less than a system minimum fixed voltage, the value of the second flag is the second numerical value. In a pre-charging state, the value of the first flag is the first numerical value.

[0062] In some implementations, the processor **710** is further configured to: in a case that it is detected that the value of the first flag is a third numerical value or the value of the second flag is a fourth numerical value in a charging process of the secondary boot loader stage, enter and maintain a unified extensible firmware interface stage for charging. In a fast charging state, the value of the first flag is the third numerical value. When the battery voltage is greater than the system minimum fixed voltage, the value of the second flag is the fourth numerical value.

[0063] In some implementations, the processor **710** is further configured to: in a case that it is detected that the value of the second flag is the second numerical value and a second voltage threshold is greater than the system minimum fixed voltage in a charging process of the unified extensible firmware interface stage, continue to maintain the unified extensible firmware interface stage for charging, where the second voltage threshold is a transition point voltage from the unified extensible firmware interface stage to a kernel driver loading stage.

[0064] In some implementations, the processor **710** is further configured to: in a case that it is detected that the value of the second flag is the fourth numerical value and the battery voltage is greater than the second voltage threshold in the charging process of the unified extensible firmware interface stage, enter and maintain the kernel driver loading stage for charging.

[0065] In some implementations, the display unit **706** is configured to: obtain the battery voltage or a current in a charging process of the kernel driver loading stage, and display charging progress.

[0066] An embodiment of this application further provides a readable storage medium. The readable storage medium stores a program or an instruction. When the program or the instruction is executed by a processor, processes in the foregoing charging control method embodiment executed by the electronic device are implemented, and same technical effects can be achieved. To avoid repetition, details are not described herein again.

[0067] The processor is the processor in the electronic device in the foregoing embodiment. The readable storage medium includes a computer readable storage medium, such as a computer ROM,

an RAM, a magnetic disk, or an optical disc.

[0068] An embodiment of this application further provides a chip. The chip includes a processor and a communication interface, the communication interface is coupled to the processor, and the processor is configured to run a program or an instruction to implement processes in the foregoing charging control method embodiment, and same technical effects can be achieved. To avoid repetition, details are not described herein again.

[0069] It should be understood that the chip mentioned in this embodiment of this application may also be referred to as a system-level chip, a system chip, a chip system, a system on chip, or the like.

[0070] An embodiment of this application provides a computer program product. The program product is stored in a storage medium. The program product is executed by at least one processor to implement processes in the foregoing charging control method embodiment, and same technical effects can be achieved. To avoid repetition, details are not described herein again.

[0071] It should be noted that in this specification, the terms “include,” “comprise,” or their any other variants are intended to cover non-exclusive inclusion, so that a process, a method, an article, or an apparatus that includes a list of elements not only includes those elements but also includes other elements that are not expressly listed, or further includes elements inherent to such a process, method, article, or apparatus. Without more constraints, an element preceded by “includes a . . .” does not preclude the existence of additional identical elements in the process, method, article, or apparatus that includes the element. In addition, it should be noted that the scopes of the method and the apparatus in implementations of this application are not limited to performing a function in the shown or discussed order, and may further include performing a function in a basically simultaneous manner or in a reverse order according to a related function. For example, the described method may be performed in a sequence different from the described sequence, and various steps may be added, omitted, or combined. In addition, features described with reference to some examples may be combined in other examples.

[0072] Based on the foregoing descriptions of the implementations, a person skilled in the art may understand that the method in the foregoing embodiment may be implemented by software and a necessary universal hardware platform, or may be implemented by hardware. Based on such an understanding, the technical solutions of this application essentially or the part contributing to the related art may be implemented in a form of a computer software product. The computer software product is stored in a storage medium (such as a ROM/RAM, a magnetic disk, or an optical disc), and includes several instructions for instructing a terminal (which may be a mobile phone, a computer, a server, a network device, or the like) to perform the methods described in embodiments of this application.

[0073] Embodiments of this application are described above with reference to the accompanying drawings. However, this application is not limited to the foregoing specific implementations. The foregoing specific implementations are merely examples, but are not restrictive. Under the inspiration of this application, a person of ordinary skill in the art may further make many forms without departing from the objective of this application and the protection scope of the claims, and all these forms fall within the protection scope of this application.

Claims

1. A charging control method, comprising: when a charger is connected, detecting values of a first flag and a second flag of a charging chip register, wherein the first flag is configured to indicate a charging status, and the second flag is configured to indicate a magnitude relationship between a battery voltage and a system voltage; and changing a current charging stage based on a change in a value of at least one of the first flag or the second flag.
2. The charging control method according to claim 1, wherein the changing a current charging

stage based on a change in a value of at least one of the first flag or the second flag comprises: in a pre-charging state, a value of the first flag is a first numerical value; when the battery voltage is less than a system minimum fixed voltage, a value of the second flag is a second numerical value; and when the value of the first flag is the first numerical value and the value of the second flag is the second numerical value, entering and maintaining a secondary boot loader stage for charging.

3. The charging control method according to claim 2, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: in a fast charging state, the value of the first flag is a third numerical value; when the battery voltage is greater than the system minimum fixed voltage, the value of the second flag is a fourth numerical value; and when the value of the first flag is the third numerical value or the value of the second flag is the fourth numerical value in a charging process of the secondary boot loader stage, entering and maintaining a unified extensible firmware interface stage for charging.

4. The charging control method according to claim 3, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: when the value of the second flag is the second numerical value and a second voltage threshold is greater than the system minimum fixed voltage in a charging process of the unified extensible firmware interface stage, continuing to maintain the unified extensible firmware interface stage for charging, wherein the second voltage threshold is a transition point voltage from the unified extensible firmware interface stage to a kernel driver loading stage.

5. The charging control method according to claim 4, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: when the value of the second flag is the fourth numerical value and the battery voltage is greater than the second voltage threshold in the charging process of the unified extensible firmware interface stage, entering and maintaining the kernel driver loading stage for charging.

6. The charging control method according to claim 5, further comprising: obtaining the battery voltage or a current in a charging process of the kernel driver loading stage, and displaying charging progress.

7. An electronic device, comprising: a processor, a memory, and a program or an instruction that is stored in the memory and run on the processor, wherein when the program or the instruction is executed by the processor, cause the processor to perform operations comprising: when a charger is connected, detecting values of a first flag and a second flag of a charging chip register, wherein the first flag is configured to indicate a charging status, and the second flag is configured to indicate a magnitude relationship between a battery voltage and a system voltage; and changing a current charging stage based on a change in a value of at least one of the first flag or the second flag.

8. The electronic device according to claim 7, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag comprises: in a pre-charging state, a value of the first flag is a first numerical value; when the battery voltage is less than a system minimum fixed voltage, a value of the second flag is a second numerical value; and when the value of the first flag is the first numerical value and the value of the second flag is the second numerical value, entering and maintaining a secondary boot loader stage for charging.

9. The electronic device according to claim 8, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: in a fast charging state, the value of the first flag is a third numerical value; when the battery voltage is greater than the system minimum fixed voltage, the value of the second flag is a fourth numerical value; and when the value of the first flag is the third numerical value or the value of the second flag is the fourth numerical value in a charging process of the secondary boot loader stage, entering and maintaining a unified extensible firmware interface stage for charging.

10. The electronic device according to claim 9, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: when the value of the second flag is the second numerical value and a second voltage threshold is

greater than the system minimum fixed voltage in a charging process of the unified extensible firmware interface stage, continuing to maintain the unified extensible firmware interface stage for charging, wherein the second voltage threshold is a transition point voltage from the unified extensible firmware interface stage to a kernel driver loading stage.

11. The electronic device according to claim 10, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: when the value of the second flag is the fourth numerical value and the battery voltage is greater than the second voltage threshold in the charging process of the unified extensible firmware interface stage, entering and maintaining the kernel driver loading stage for charging.

12. The electronic device according to claim 11, wherein the operations further comprise: obtaining the battery voltage or a current in a charging process of the kernel driver loading stage, and displaying charging progress.

13. A non-transitory computer-readable medium storing a program or an instruction, wherein when the program or the instruction is executed by a processor, cause the processor to perform operations comprising: when a charger is connected, detecting values of a first flag and a second flag of a charging chip register, wherein the first flag is configured to indicate a charging status, and the second flag is configured to indicate a magnitude relationship between a battery voltage and a system voltage; and changing a current charging stage based on a change in a value of at least one of the first flag or the second flag.

14. The non-transitory computer-readable medium according to claim 13, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag comprises: in a pre-charging state, a value of the first flag is a first numerical value; when the battery voltage is less than a system minimum fixed voltage, a value of the second flag is a second numerical value; and when the value of the first flag is the first numerical value and the value of the second flag is the second numerical value, entering and maintaining a secondary boot loader stage for charging.

15. The non-transitory computer-readable medium according to claim 14, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: in a fast charging state, the value of the first flag is a third numerical value; when the battery voltage is greater than the system minimum fixed voltage, the value of the second flag is a fourth numerical value; and when the value of the first flag is the third numerical value or the value of the second flag is the fourth numerical value in a charging process of the secondary boot loader stage, entering and maintaining a unified extensible firmware interface stage for charging.

16. The non-transitory computer-readable medium according to claim 15, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: when the value of the second flag is the second numerical value and a second voltage threshold is greater than the system minimum fixed voltage in a charging process of the unified extensible firmware interface stage, continuing to maintain the unified extensible firmware interface stage for charging, wherein the second voltage threshold is a transition point voltage from the unified extensible firmware interface stage to a kernel driver loading stage.

17. The non-transitory computer-readable medium according to claim 16, wherein the changing a current charging stage based on a change in a value of at least one of the first flag or the second flag further comprises: when the value of the second flag is the fourth numerical value and the battery voltage is greater than the second voltage threshold in the charging process of the unified extensible firmware interface stage, entering and maintaining the kernel driver loading stage for charging.

18. The non-transitory computer-readable medium according to claim 17, wherein the operations further comprise: obtaining the battery voltage or a current in a charging process of the kernel driver loading stage, and displaying charging progress.

