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(54) **METHODS AND APPARATUS FOR CHARGING A BATTERY IN A PERIPHERAL DEVICE**

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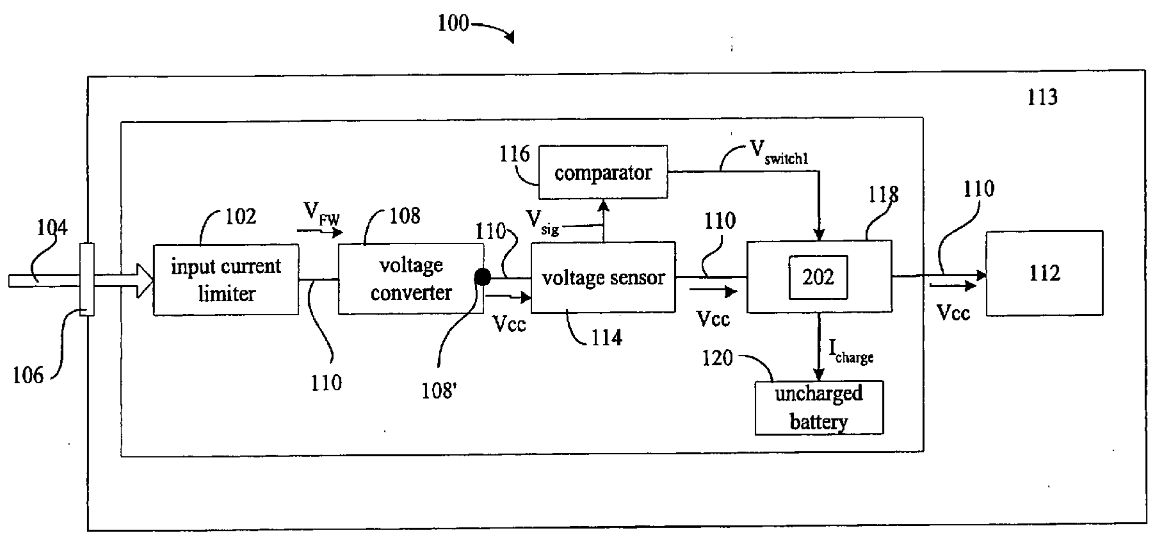
(57) **ABSTRACT**

A power manager for managing power delivered to a battery operated peripheral device is disclosed. The power manager includes an input current limiter arranged to suppress a power surge associated with an insertion event by a power cable arranged to provide an external voltage. A voltage converter unit coupled to the input current limiter converts the received external voltage to a supply voltage that is transmitted by way of a main bus to a voltage sensor unit coupled thereto. During the insertion event, a comparator unit coupled to the voltage sensor, sends a first switching signal to a switchover circuit that responds by connecting the peripheral device and an uncharged battery to the main bus such that the supply voltage is provided thereto. When the battery is substantially fully charged, the switchover circuit responds by electrically disconnecting the battery so as to not overcharge the battery.



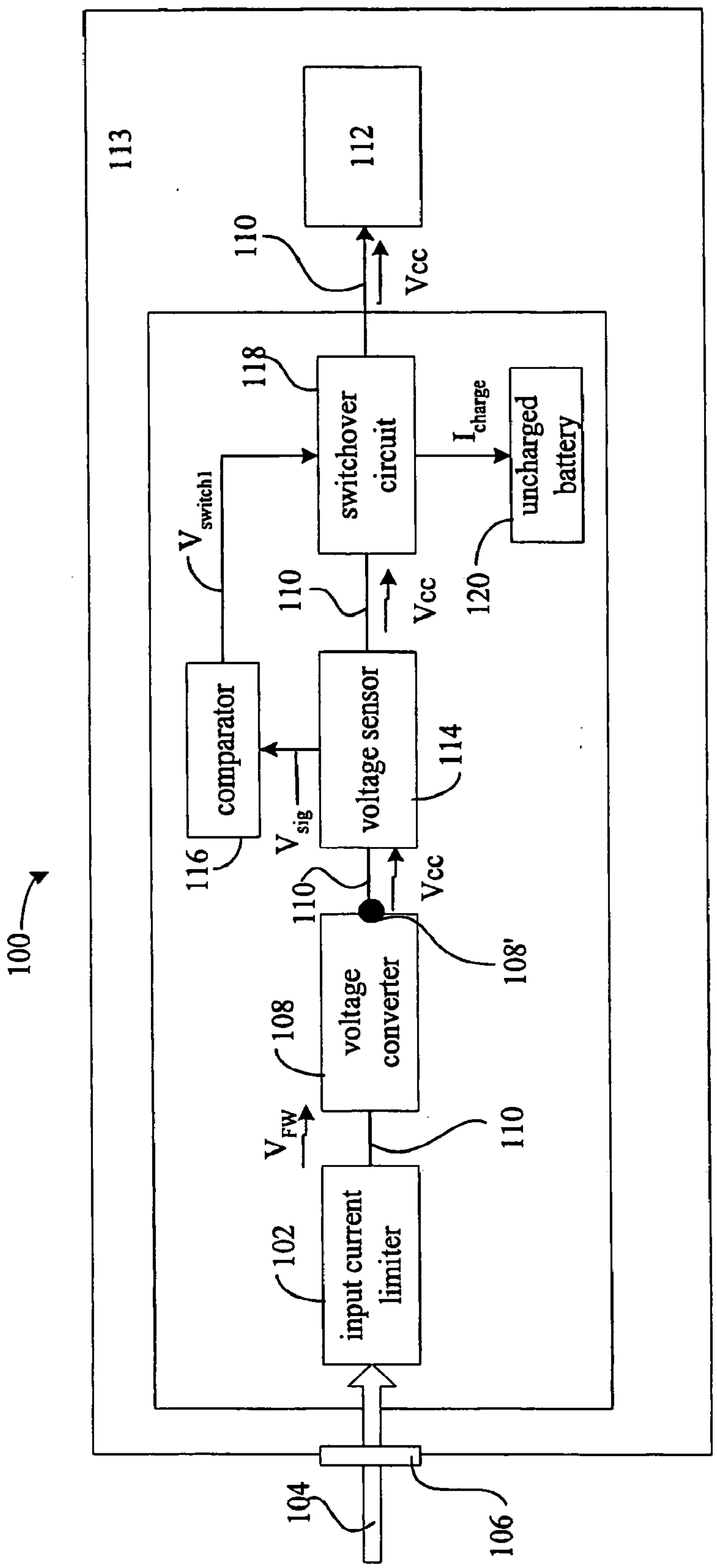

100
113
112
110
Vcc
118
switchover circuit
I_{charge}
uncharged battery
120
$V_{switch1}$
110
Vcc
comparator
voltage sensor
114
116
V_{sig}
110
Vcc
108'
voltage converter
108
V_{FW}
110
input current limiter
102
104
106

Fig. 1A

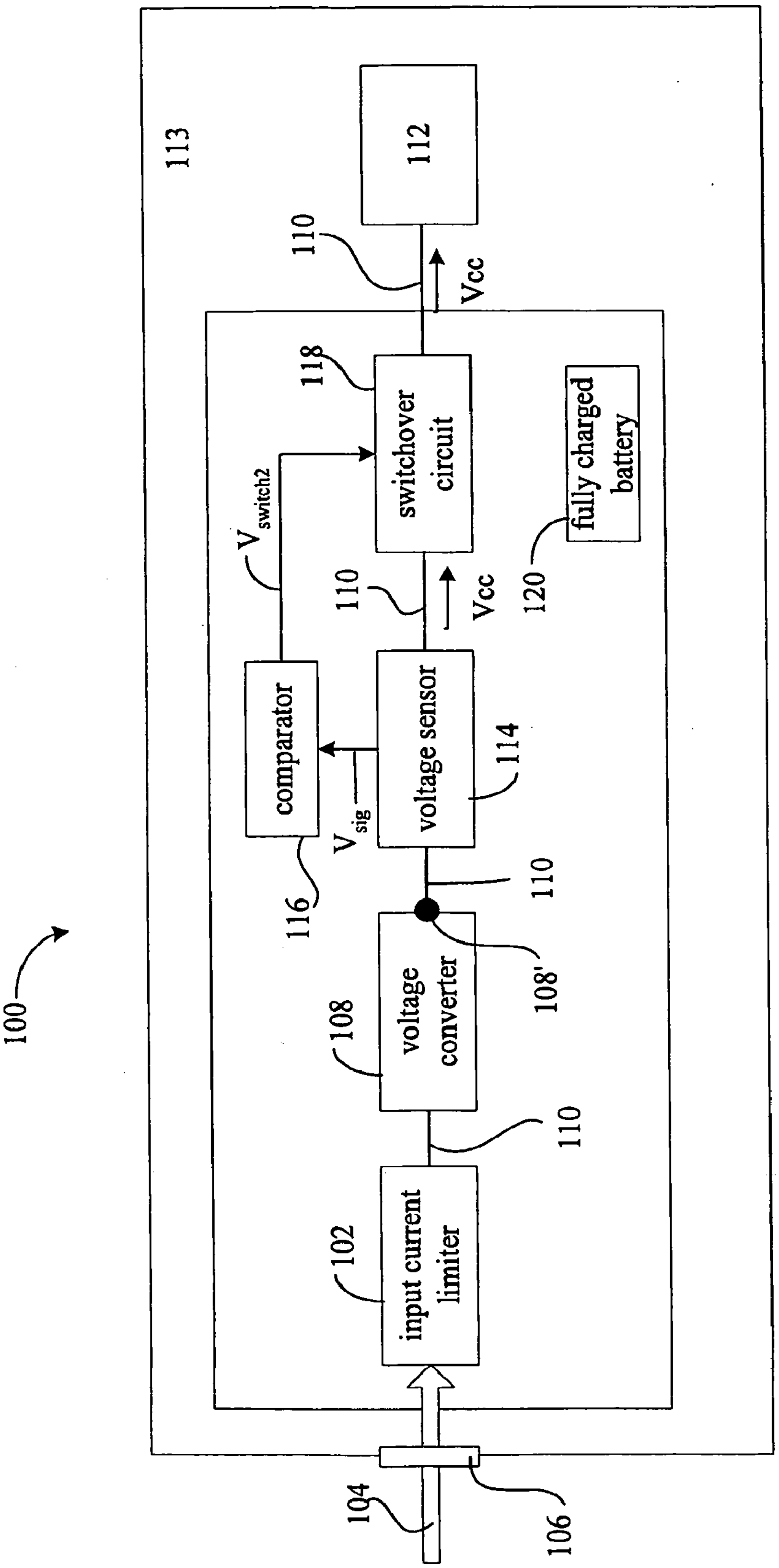
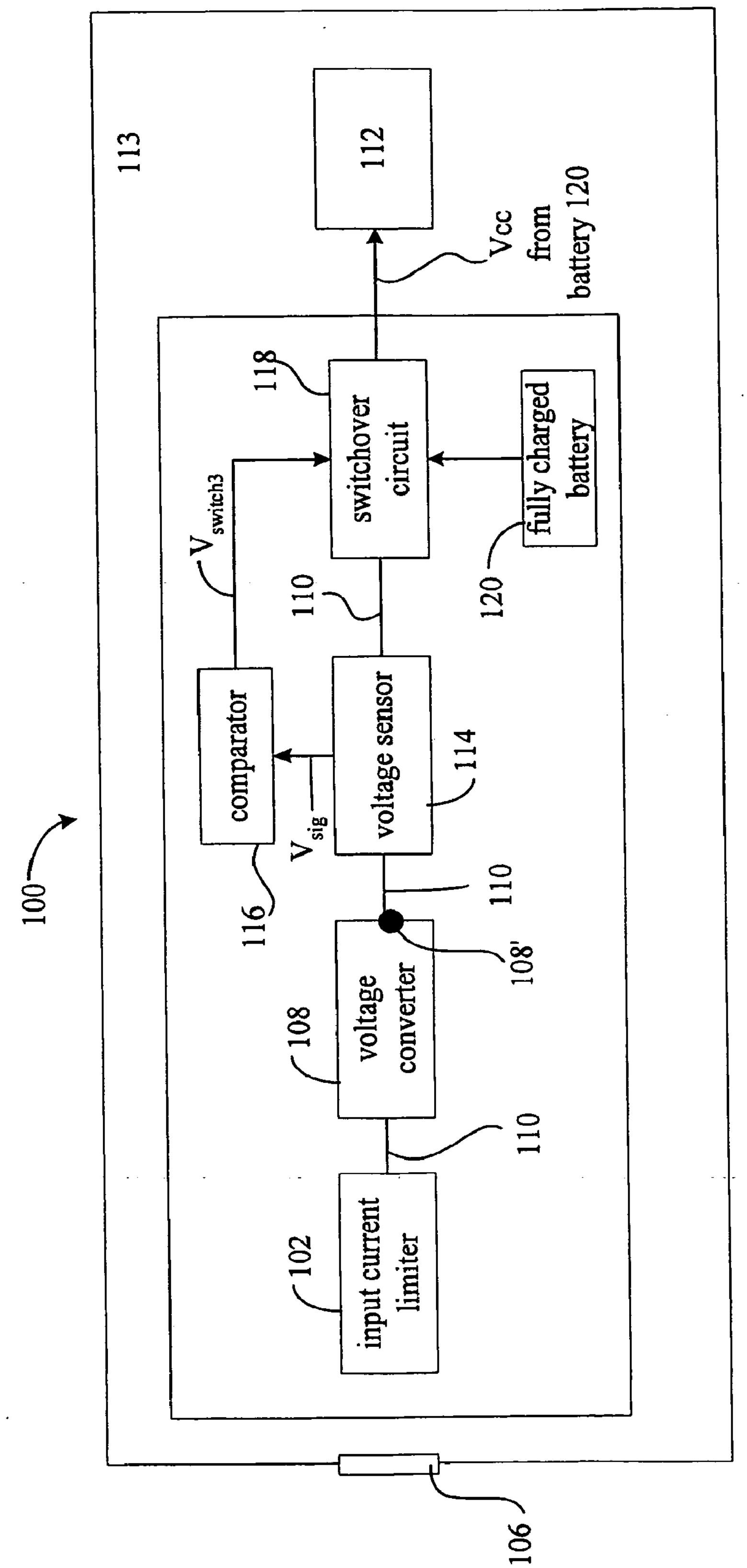

100
113
112
110
Vcc
118
switchover circuit
fully charged battery
120
$V_{switch2}$
110
Vcc
comparator
116
V_{sig}
voltage sensor
114
110
108'
voltage converter
108
110
input current limiter
102
104
106

Fig. 1B



100
113
112
Vcc from battery 120
118
switchover circuit
fully charged battery
120
$V_{switch3}$
110
comparator
voltage sensor
114
V_{sig}
116
110
108'
voltage converter
108
110
input current limiter
102
106

Fig. 1C

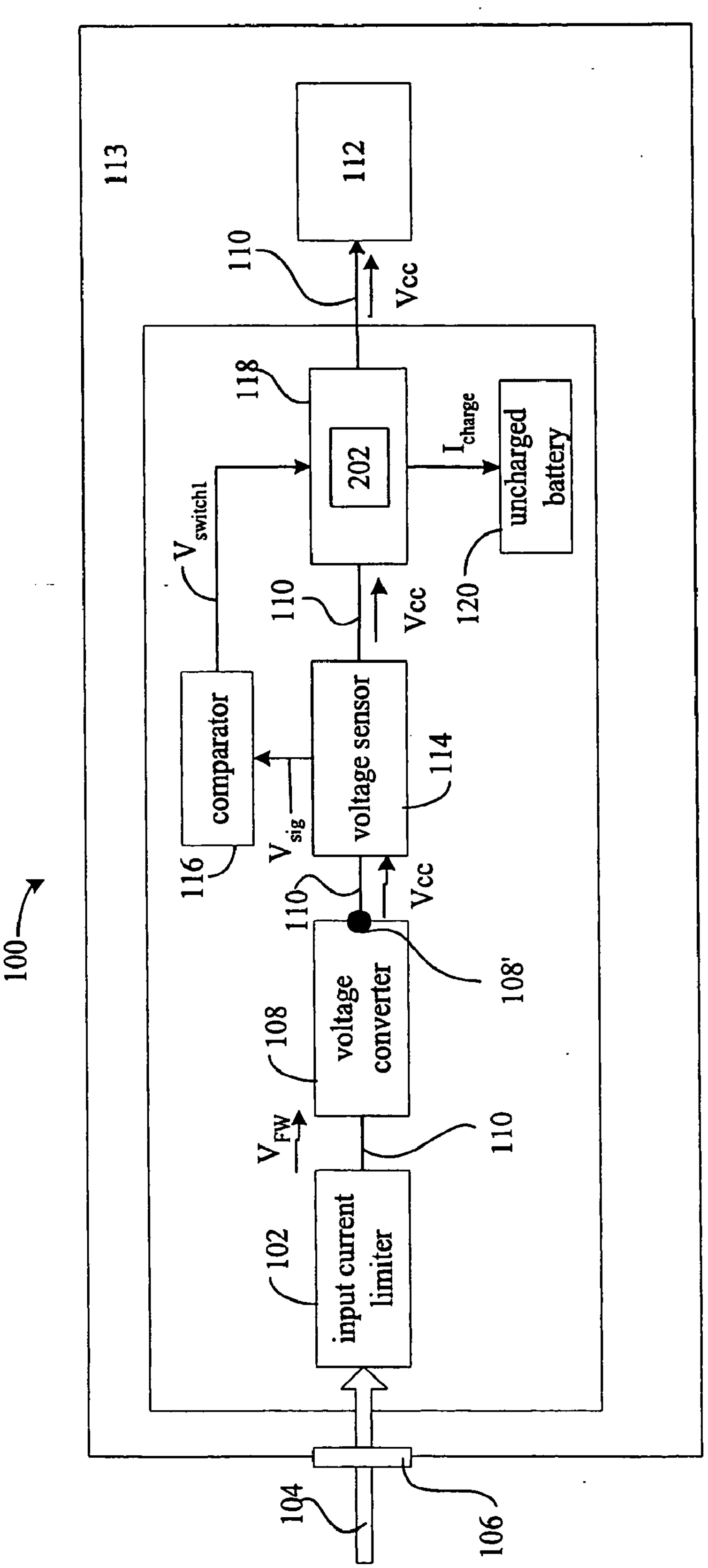

100
113
112
110
Vcc
118
202
I_{charge}
uncharged battery
120
$V_{switch1}$
comparator
116
voltage sensor
114
V_{sig}
108'
voltage converter
108
V_{FW}
input current limiter
102
104
106

Fig. 2

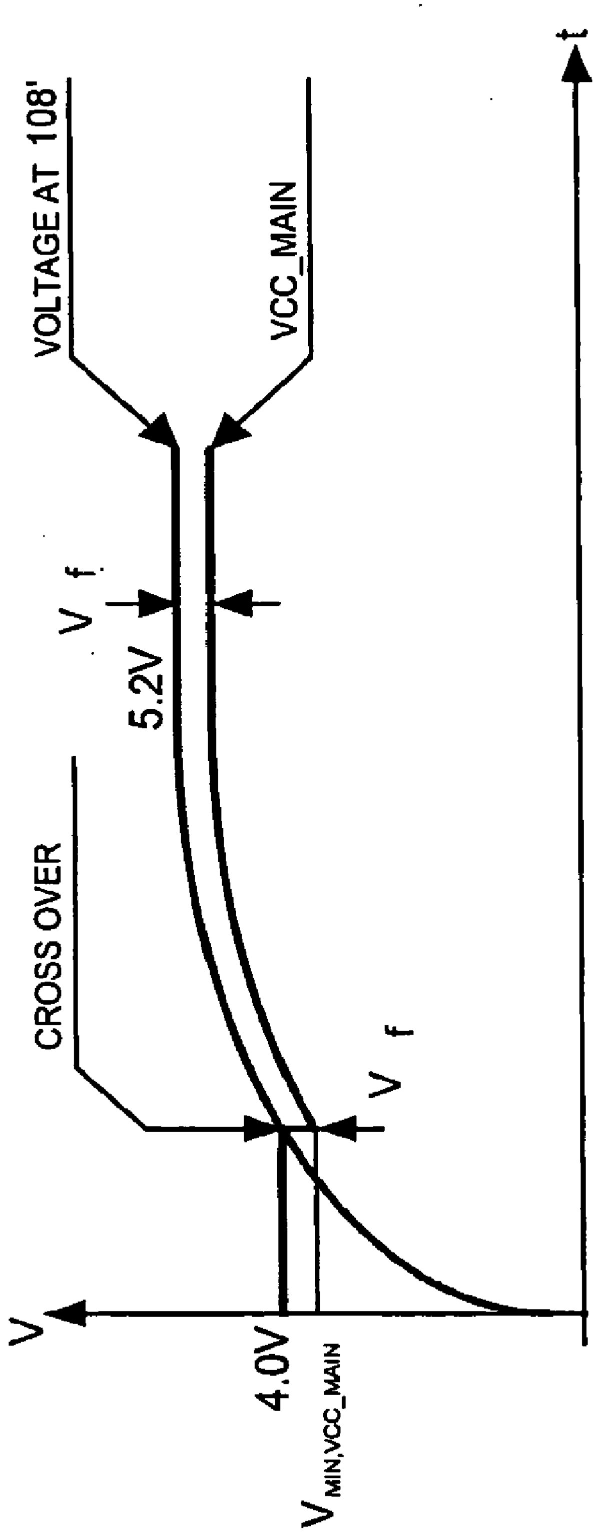

VOLTAGE AT 108'
VCC_MAIN
V f
5.2V
CROSS OVER
V f
V
t
4.0V
V MIN,VCC_MAIN

Fig. 3

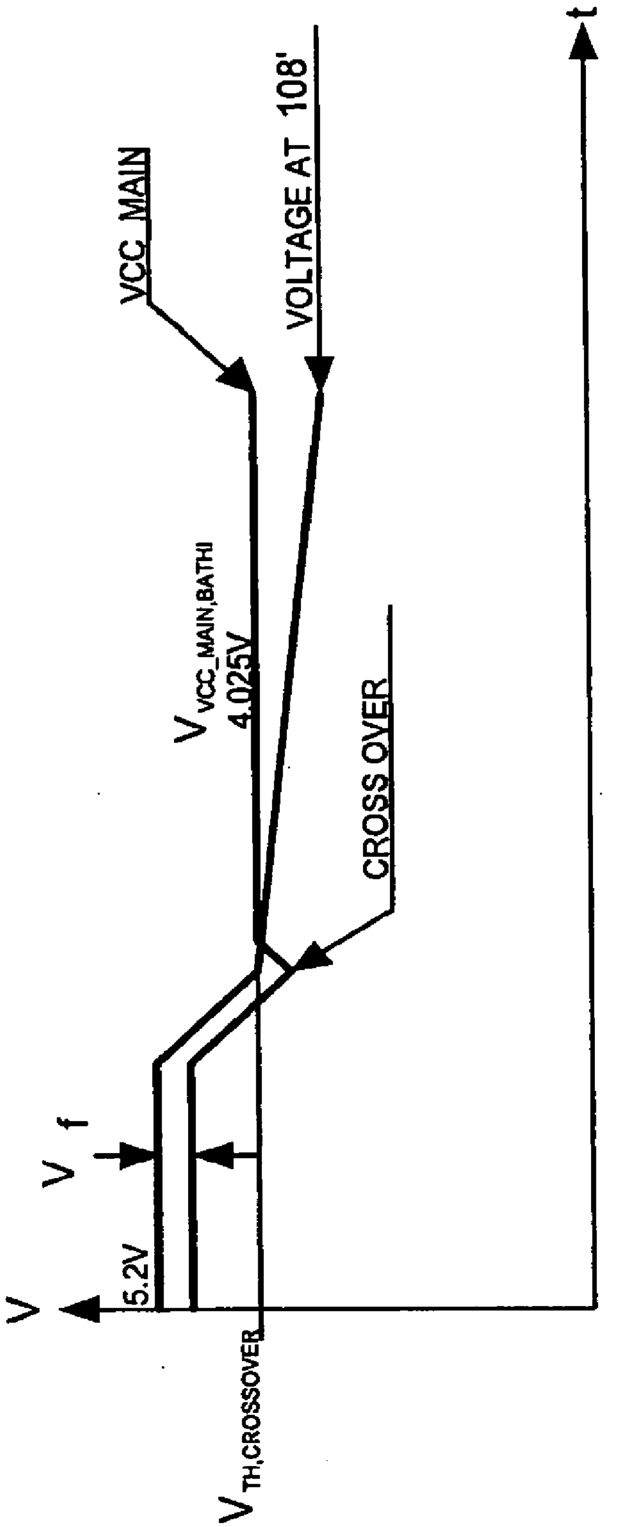

t
VCC_MAIN
VOLTAGE AT 108'
V VCC_MAIN,BATHI
4.025V
CROSS OVER
V f
V
5.2V
V TH,CROSSOVER

Fig. 4

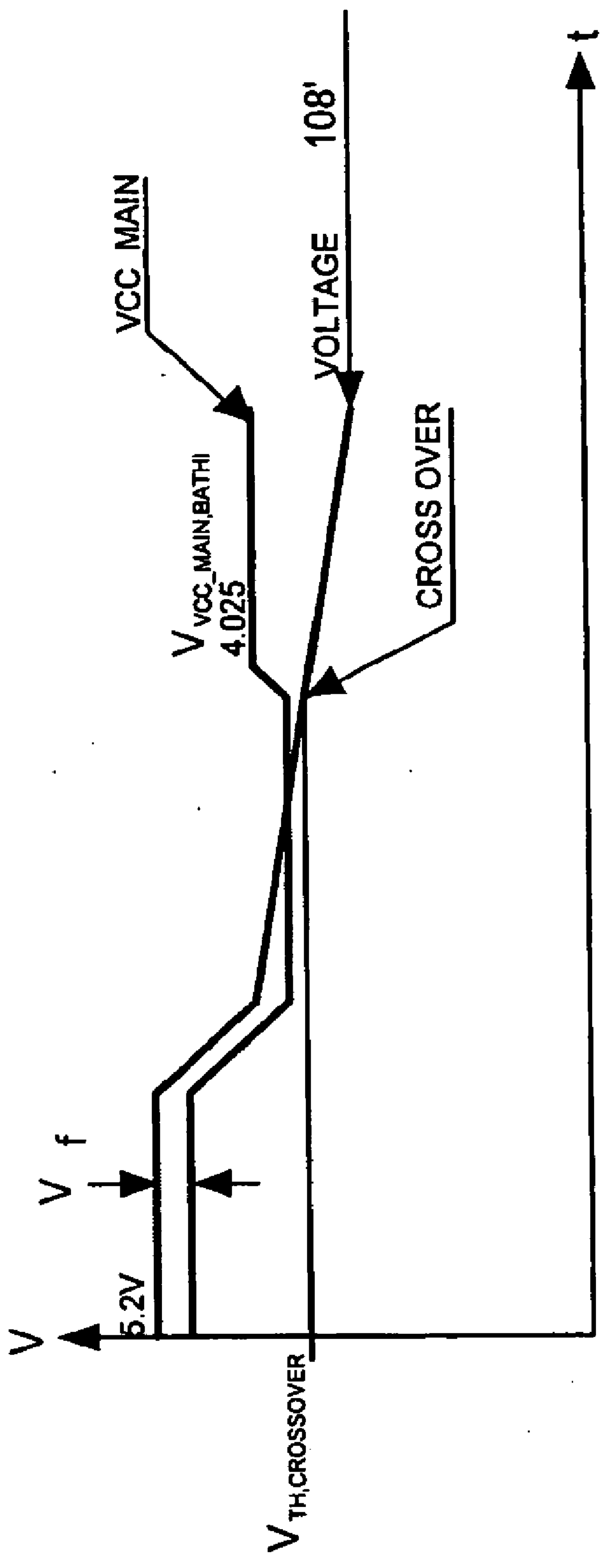

VCC_MAIN
VOLTAGE 108'
CROSS OVER
$V_{VCC\_MAIN,BATHI}$
4.025
V_f
V
5.2V
$V_{TH,CROSSOVER}$
t

Fig. 5

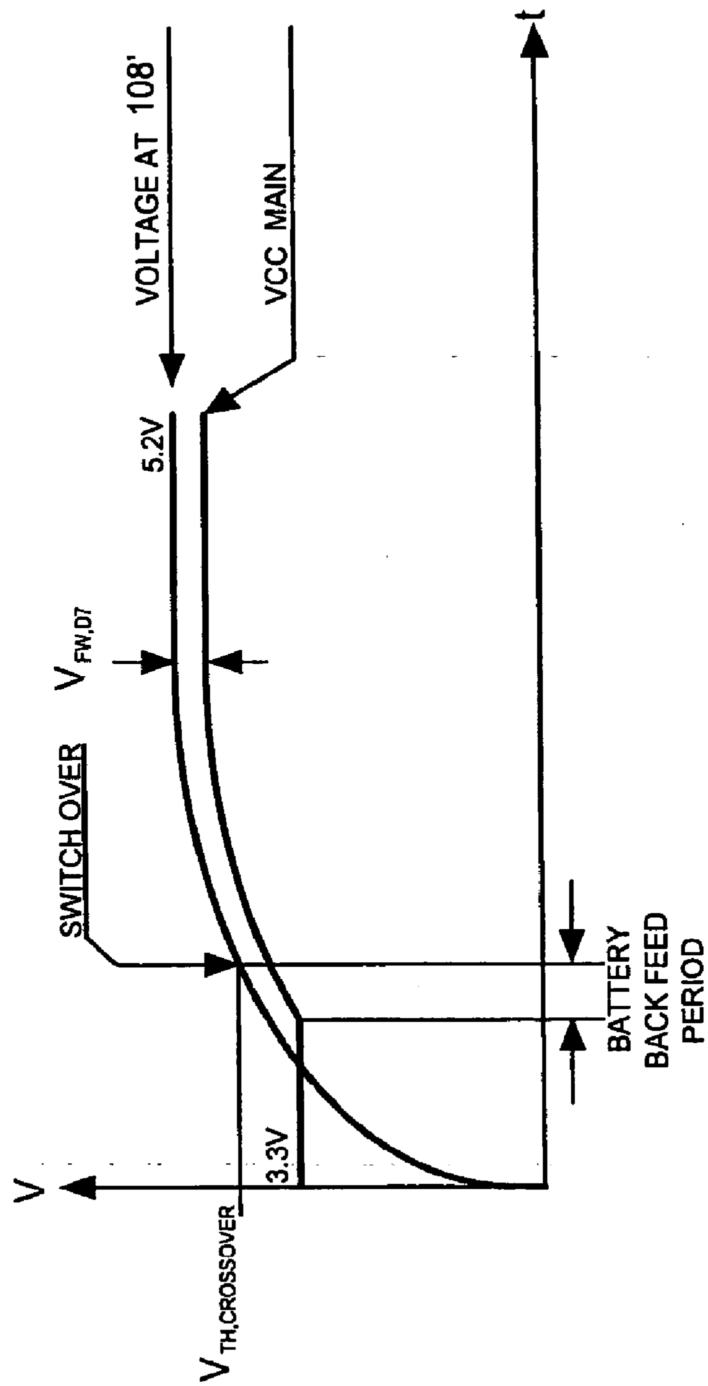
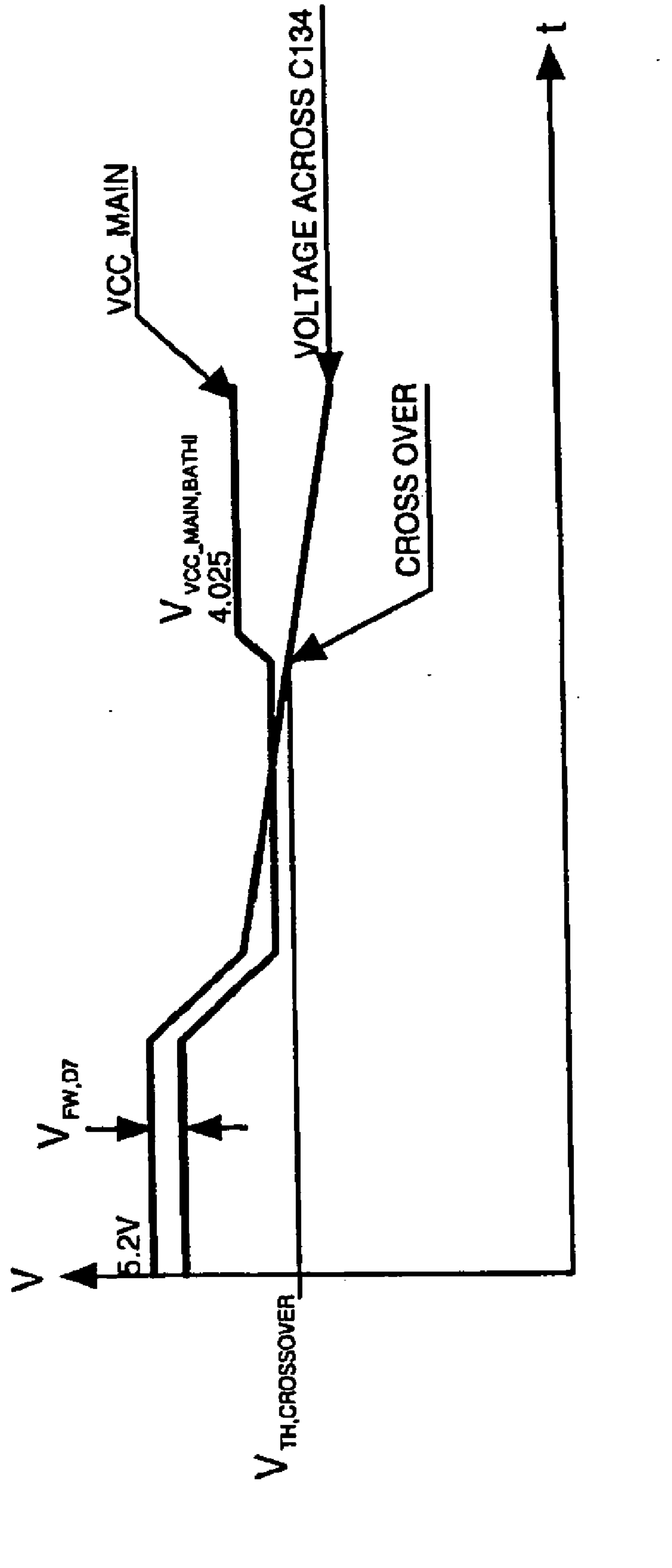

t
VOLTAGE AT 108'
VCC MAIN
5.2V
$V_{FW,D7}$
SWITCH OVER
BATTERY
BACK FEED
PERIOD
3.3V
V
$V_{TH,CROSSOVER}$

Fig. 6



V
5.2V
$V_{FW,D7}$
$V_{TH,CROSSOVER}$
VCC_MAIN
$V_{VCC\_MAIN,BATHI}$
4.025
VOLTAGE ACROSS C134
CROSS OVER
t

Fig. 7

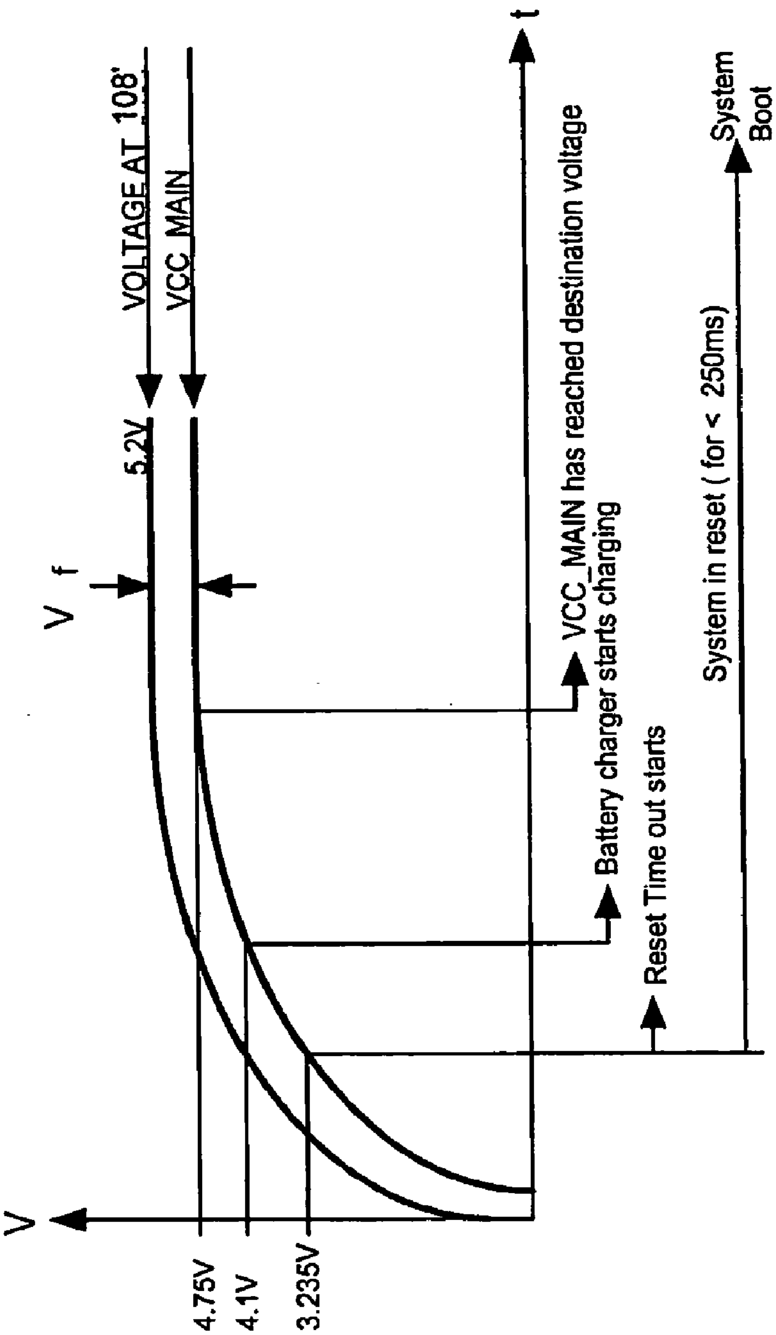
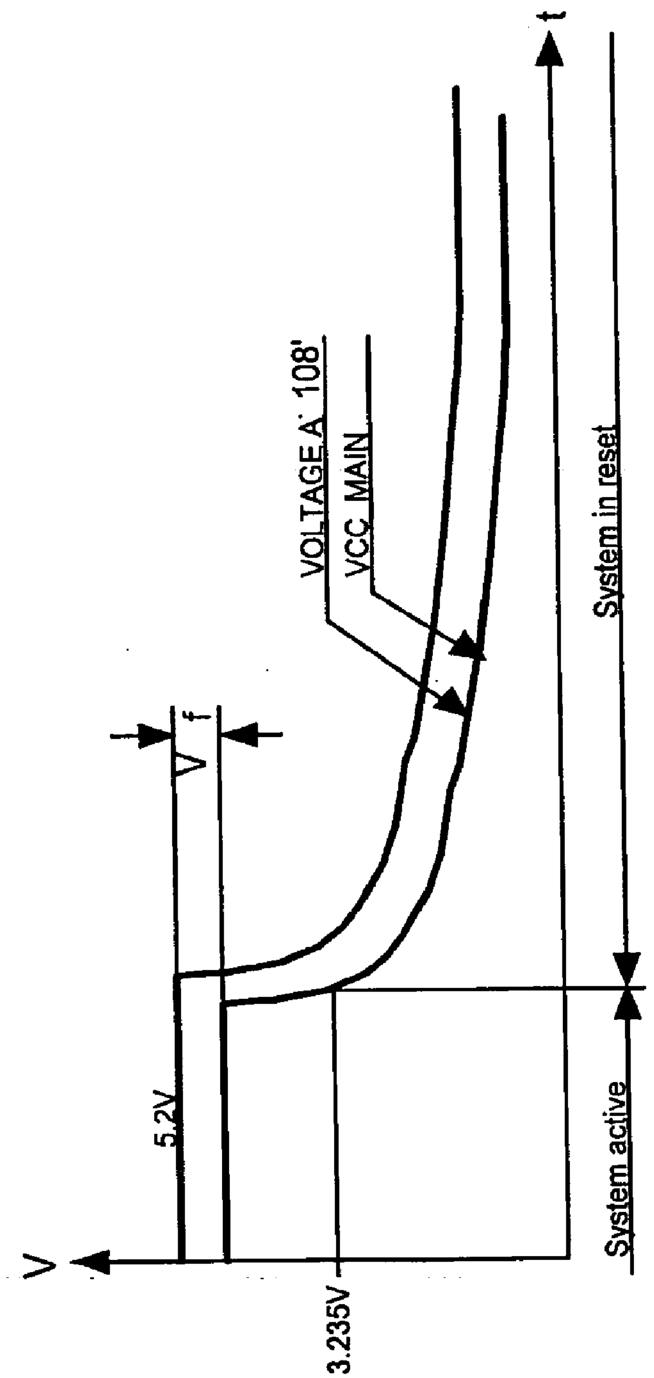

VOLTAGE AT 108'
VCC_MAIN
5.2V
V f
t
V
VCC_MAIN has reached destination voltage
Battery charger starts charging
Reset Time out starts
System in reset (for < 250ms)
System Boot
4.75V
4.1V
3.235V

Fig. 8



V
5.2V
3.235V
V f
VOLTAGE A' 108'
VCC MAIN
t
System active
System in reset

Fig. 9

METHODS AND APPARATUS FOR CHARGING A BATTERY IN A PERIPHERAL DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 11/270,901 (Attorney Docket APL1P224C1) entitled “METHODS AND APPARATUS FOR CHARGING A BATTERY IN A PERIPHERAL DEVICE,” filed Nov. 10, 2005, which is a continuation of U.S. patent application Ser. No. 10/278,752 (Attorney Docket APL1P224) entitled “METHODS AND APPARATUS FOR CHARGING A BATTERY IN A PERIPHERAL DEVICE” filed Oct. 22, 2002 and which issued as U.S. Pat. No. 6,995,963 on Feb. 27, 2006, which are incorporated herein by reference, and which, in turn, claim the benefit of priority under 35 U.S.C. § 119(e) to U.S. Provisional Patent Application No. 60/345,253, entitled “METHODS AND APPARATUS FOR CHARGING A BATTERY IN A PERIPHERAL DEVICE VIA A FIREWIRE CABLE” filed on Oct. 22, 2001, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of Invention

[0003] This invention relates generally to computing systems. Specifically, a method and apparatus for managing power delivered by way of a FireWire cable to a battery operated peripheral device.

[0004] 2. Description of Related Art

[0005] FireWire is an IEEE1394 compliant High Performance Serial Bus that provides two types of data transfer: asynchronous and isochronous. Asynchronous is for traditional load-and-store applications where data transfer can be initiated and an application interrupted as a given length of data arrives in a buffer. Isochronous data transfer ensures that data flows at a pre-set rate so that an application can handle it in a timed way while providing the bandwidth needed for audio, imaging, video, and other streaming data. Isochronous service means it guarantees latency or the length of time between a requested action and when the resulting action occurs which is a critical feature in supporting real time video, for example. FireWire provides a high-speed serial bus with data transfer rates of 100, 200, or 400 Mbps as well as a single plug-and-socket connection on which up to 63 devices can be attached with data transfer speeds up to 400 Mbps (megabits per second). In this way, FireWire offers a standard, simple connection to all types of consumer electronics, including digital audio devices, digital VCRs and digital video cameras; as well as to traditional computer peripherals such as optical drives and hard disk drives.

[0006] The standard FireWire cable consists of six wires in which data is sent via two separately-shielded twisted pair transmission lines that are crossed in each cable assembly to create a transmit-receive connection. Two more wires carry power (8 to 28 v, 1.5 A max.) to remote devices. In some cases, such as with DV camcorders manufactured by the Sony Corporation of Japan, a 4 conductor FireWire cable is used (configured as the 6 wire cable but without the power wires) that terminate in smaller, 4 prong connectors. To connect a four prong device, such as the Sony DV camcorder with a standard IEE1394 FireWire device or interface card, an adapter cable is required having 4 prongs on one side and 6 on the other. In this way, the data lines are connected while omitting the power connection.

[0007] In those situations, however, when a battery operated six prong peripheral device is coupled to a FireWire cable, it is important for the power delivered to the device (typically 1.8 v, 3.3, or 5.0 v) to be both stable and reliable especially when the FireWire cable is either connected or disconnected.

[0008] Therefore, what is required is a method and apparatus for managing power delivered by way of a FireWire cable to a battery operated peripheral device.

SUMMARY OF THE INVENTION

[0009] According to the present invention, methods, apparatus, and systems are disclosed for managing power in a battery powered portable device is disclosed.

[0010] In one embodiment, an apparatus is described that includes at least a circuit, a battery, a port that includes a power line and serial data line, and a power management unit, coupled to the circuit, the battery, and the port. In the described embodiment, the power management unit contains instructions that when executed by the power management unit: (i) powers the circuit with the battery if the power line does not provide power; and (ii) powers the circuit and charges the battery with power provided by the power line if the power line provides power to the apparatus.

[0011] In another embodiment, a method for providing power to a circuit contained within a portable device from either a battery contained in the device or an external power source when plugged into a port configured to receive both power and data at the device, the method is carried out by performing at least the following operations. Ascertaining if the external power source is plugged into the port of the device, and either: providing power to the circuit from the battery when the external power source is not plugged into the device, or providing power from the external power source to the circuit and the battery used to at least recharge the battery when the external power source is plugged into the device and when the output of the battery is below a supply voltage by more than a threshold, or providing power from the external power source only to the circuit when the external power source is plugged into the device and the output of the battery is within the threshold of the supply voltage.

[0012] In still another embodiment, a battery powered device is described that includes at least a rechargeable battery, a serial port that interfaces with a serial bus cable for transmitting data to or from the device that includes a plurality of data pins and at least a power pin, a voltage sensor that senses a voltage on the power pin, and a battery charging circuit that draws a charging current through the power pin of the serial port to charge the battery when the battery is substantially uncharged.

[0013] In still another embodiment, a method for charging a battery of a peripheral device, is described. The method is carried out by performing at least the following operations: inserting a serial bus cable into a serial port of the peripheral device, the serial port comprising a power pin and a plurality of data pins through which data can be transmitted to or from the peripheral device, sensing that the voltage at the power pin of the serial port is above a selected threshold, and drawing a charge current through the power pin of the serial port to charge the battery of the peripheral device.

[0014] Another embodiment describes a system that includes a battery powered device having a rechargeable battery and a battery charging circuit, and a serial bus cable coupled to the battery powered device where the serial bus cable includes at least a power transmission line and a plurality of data transmission lines and can transmit data to or from the battery powered device over the data transmission lines. The battery charging circuit of the battery powered device draws a charging current through the power transmission line of the serial bus cable if the rechargeable battery is not fully charged.

[0015] A method for managing power delivered to a battery-operated peripheral device by way of a cable that includes a number of lines at least one of which is a power line arranged to carry electrical power from an electrical supply to the device is also described. The method includes at least the following operations: detecting a status for the device, wherein the status is based on whether a first condition relating to a battery in the device has occurred and whether a second condition relating to connection of the cable to the electrical supply has occurred, drawing electrical power from the electrical supply at a first current if the device has a first status, and drawing electrical power from the electrical supply at a second current level if the device has a second status.

[0016] A portable consumer electronic product includes a sensor unit arranged to detect a status for the device, wherein the status is based on whether a first condition relating to a battery in the device has occurred and whether a second condition relating to connection of the cable to the electrical supply has occurred, and a switchover circuit arranged to draw electrical power from the electrical supply at a first current if the device has a first status, and to draw electrical power from the electrical supply at a second current level if the device has a second status.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention will be better understood by reference to the following description taken in conjunction with the accompanying drawings.

[0018] FIG. **1**A shows a power manager unit with a fully discharged battery coupled to an active FireWire cable in accordance with an embodiment of the invention.

[0019] FIG. **1**B shows the power manager unit of FIG. **1**A where the battery is fully charged in accordance with an embodiment of the invention.

[0020] FIG. **1**C shows the power manager unit of FIG. **1**B where the FireWire cable of the invention.

[0021] FIG. **3** shows an exemplary response waveforms for the switchover state where the battery is fully charged.

[0022] FIGS. **4** and **5** show exemplary response waveforms for the switchover state where the battery is full and the Fire Wire is unplugged in two separate scenarios.

[0023] FIG. **6** shows an exemplary response waveforms for the switchover state where the battery is low and the FireWire is plugged.

[0024] FIG. **7** shows an exemplary response waveforms for the switchover state where the battery is low and the FireWire is unplugged.

[0025] FIG. **8** shows an exemplary response waveforms for the switchover state where the battery is empty and the FireWire is plugged.

[0026] FIG. **9** shows an exemplary response waveforms for the switchover state where the battery is empty and the FireWire is unplugged.

DETAILED DESCRIPTION OF SELECTED EMBODIMENTS

[0027] Reference will now be made in detail to a preferred embodiment of the invention. An example of the preferred embodiment is illustrated in the accompanying drawings. While the invention will be described in conjunction with a preferred embodiment, it will be understood that it is not intended to limit the invention to one preferred embodiment. To the contrary, it is intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

[0028] In a battery powered FireWire compatible device, a method and apparatus for supplying power to the device that can be used to either operate the device of charge the device's battery are described. In one embodiment, various power signals on a FireWire data bus coupled to the device, provide for operating the device and/or charging the device's internal battery over a prescribed range of supply voltages. In a particular embodiment, the apparatus includes a built in surge suppression unit as well as a FireWire power/battery switchover unit to ensure that a stable and reliable power supply is provided the device. In this way, additional power connectors are substantially eliminated thereby saving product cost and reducing product size.

[0029] The invention will now be described in terms a FireWire peripheral power management unit suitable for supplying power to any FireWire compatible device. Such devices include, for example, personal digital assistants, personal MP3 player/recorders, and the like.

[0030] Accordingly, FIG. **1**A shows a power manager unit **100** with a fully discharged battery coupled to an active FireWire cable in accordance with an embodiment of the invention. The power manager unit **100** includes an input current limiter **102** for suppressing a power surge caused by a FireWire cable insertion event related to voltage transients (i.e., ground bounce) associated with an insertion of a powered FireWire cable **104** to an input port **106**. It should be noted, that this phenomenon is only applicable to those peripheral devices capable of receiving a FireWire cable having a power wire included therein (such as a six prong type FireWire cable). The input current limiter **102** is, in turn, coupled to a voltage converter unit **108** having an output **108'** arranged to convert a received external voltage V_{ext} (in the form of a FireWire voltage V_{FW} having a range of between 8 volts and 28 volts provided by the FireWire cable **104**) to a supply voltage V_{cc} provided to a main bus **110**. Typically, the supply voltage V_{cc} can be approximately 1.8 volts, approximately 3.3 volts, or approximately 5.0 volts each of which is suitable for driving an active circuit **112** included in a battery operated peripheral device **113**.

[0031] In the described embodiment, the voltage converter unit **108** is coupled to a voltage sensor **114** arranged to provide a voltage signal V_{sig} to a comparator unit **116**. The comparator unit **116**, based upon the voltage signal V_{sig}, provides a switchover signal V_{switch} to a switchover circuit **118**. In those cases where the voltage signal V_{sig} is above a voltage threshold V_{th} (indicative of a FireWire insertion event having had occurred at the input port **106**), the comparator unit **116** provides a first switchover signal $V_{switch1}$ to the switchover circuit **118**. The switchover circuit **118**, in turn, responds to the first switchover signal $V_{switch1}$ by connecting the main bus **110** to the active circuit **112** (and thereby the supply voltage V_{cc}) and to a battery **120** when the battery **120** is substantially uncharged so as to provide a charging current to the battery **120**. As shown in FIG. 1B, in those cases where the battery **120** is substantially fully charged, the comparator circuit **116** sends a second switchover signal $V_{switch2}$ that causes the switchover circuit **118** to disconnect the battery **120** from the main bus **110** so as to avoid overcharging the battery **120**.

[0032] In those situations shown in FIG. 1C where the powered FireWire cable **104** has been disconnected from the port **106**, the voltage signal V_{sig} is below the voltage threshold V_{th} to which the comparator circuit **116** responds by providing a third switchover signal $V_{switch3}$ to the switchover circuit **118**. The switchover circuit **118** responds to the third switchover signal $V_{switch3}$ by disconnecting the main bus **110** from the active circuit **112** and connecting the battery **120** in such a manner as to provide a substantially uninterrupted supply voltage V_{cc} to the active circuit **112**.

[0033] Referring to FIG. **2**, the switchover circuit **118** includes a comparator **202** that helps to ensure a smooth transition from battery to FireWire power and vice versa. The switch over circuit **118** ensures that the voltage on the main supply bus **110** (VCC_MAIN) doesn't drop below a pre-determined minimum voltage V_{min} (at which point a reset signal is typically provided). Accordingly, the FireWire voltage converter **108** switches in/out when the voltage on the main bus **110** (V_{cc} MAIN) has risen/dropped above/below V_{min}.

[0034] FIG. **3** shows an exemplary response waveforms for the switchover state where the battery is full and the FireWire is plugged in. After the FireWire cable **104** is plugged into the port **106**, the output of the FireWire voltage converter **108** reaches its destination voltage within 15 ms. When the output of the FireWire voltage converter **108** reaches the switch over threshold V_{switch}, the comparator **202** disconnects battery power from the main supply bus **110**. For a short period of time, neither the battery **120** nor the FireWire voltage converter **108** supply power to VCC-_MAIN **110** and the voltage on VCC_MAIN **110** will drop until either of the voltage sensor **114** starts conducting such that the voltage cannot drop below the voltage V_{MIN}. Eventually the voltage sensor **114** starts conducting, pulling the voltage on bus **110** up to a pre-set voltage drop V_f below the destination output voltage of the FireWire voltage converter **108**.

[0035] FIGS. **4** and **5** show an exemplary response waveforms for the switchover state where the battery is full and the FireWire is unplugged in two separate scenarios. Initially, the voltage V_{VCC_MAIN} is V_f below the voltage of the FireWire voltage converter **108**. Due to the system load, the output voltage of the FireWire voltage converter **108** is going to drop rapidly as the voltage sensor **114** discharges into the main supply bus **110**. When FireWire **106** is unplugged the voltage at the output of the FireWire voltage converter **108** is going to drop rapidly until the voltage sensor **114** starts conducting. At this point the voltage at the output of the FireWire voltage converter **108** may or may not have not dropped below the switch over threshold Vswitch. There will be two possible scenarios:

[0036] In one scenario shown in FIG. **4**, the comparator threshold has been crossed in which case, the battery **120** has to make up for the voltage V_f. In a second scenario shown in FIG. **5**, the comparator threshold has not been crossed.

[0037] FIG. **6** shows an exemplary response waveforms for the switchover state where the battery is low and the FireWire is plugged. In the described embodiment, the battery is considered empty when it's voltage drops below 3.45V. For the purpose of this discussion only therefore, the battery voltage is considered to be at 3.3V. If the battery voltage drops below 3.45V the system is turned off and less than 2 mA are drawn from the battery. Therefore the voltage the main bus **110** is approximately equal to the battery voltage V_{BAT}=3.3V. After the FireWire connector **104** is plugged into the port **106**, output **108'** increases. If output **108'** increases above V_{VCC_MAIN} of 3.3V, the voltage sensor **114** starts conducting. The battery will be back fed from then on, until output **108'** reaches the switch over threshold.

[0038] FIG. **7** shows an exemplary response waveforms for the switchover state where the battery is low and the FireWire is unplugged. Initially, the voltage V_{VCC_MAIN} on the main bus **110** is V_f below the voltage of the FireWire voltage converter **108** resulting in the output **108'** dropping off rapidly. When output **108'** drops below the switch over threshold V_{switch}, voltage converter **108** is going to back feed into the battery until output **108'** drops below a level where voltage sensor **114** loses conduction. If the latter occurs, output **108'** is going to be discharged much slower as it is disconnected from the rest of the system. It has to be noted that this particular scenario is very rare as the battery voltage recovers within short periods of time to a level that is above the 3.45V system shut down threshold.

[0039] FIG. **8** shows an exemplary response waveforms for the switchover state where the battery is empty and the FireWire is plugged. When the battery is empty, V_{VCC_MAIN} is initially approximately ground level and the battery charger circuit is disabled. If output **108'** charges up, V_{VCC_MAIN} is approximately one diode forward voltage drop below output **108'**. (It should be noted that a reset circuit keeps the system **100** in constant reset below voltages of 3.135V) thereby enabling a battery charger circuit. If battery charger circuit supply voltage has exceeded the lockout voltage of 4.1V, battery back feeding is prevented because the battery **120** is disconnected from the system **100**. The battery charger is activated when it's supply voltage exceeds the under voltage lock out threshold of 4.1V. To enable the battery charger, the voltage at the output of the FireWire voltage converter **108** must be one forward diode drop above the lock out voltage of the battery charger. Therefore, output **108'** has to rise above approximately 4.6V to activate the charger.

[0040] FIG. **9** shows an exemplary response waveforms for the switchover state where the battery is empty and the

FireWire is unplugged. When the battery is empty and FireWire **104** is unplugged, the system **100** will run until VCC_MAIN drops rapidly below reset threshold voltage $V_{reset,TH}$. In reset, the battery disconnect circuitry disconnects the battery from the system **100** when the battery voltage drops below 3.1V to avoid deep discharge of the battery using a low voltage disconnect circuitry.

[**0041**] Although only a few embodiments of the present invention have been described, it should be understood that the present invention may be embodied in many other specific forms without departing from the spirit or the scope of the present invention. Therefore, the present examples are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims along with their full scope of equivalents.

[**0042**] While this invention has been described in terms of a preferred embodiment, there are alterations, permutations, and equivalents that fall within the scope of this invention. It should also be noted that there are many alternative ways of implementing both the process and apparatus of the present invention. It is therefore intended that the invention be interpreted as including all such alterations, permutations, and equivalents as fall within the true spirit and scope of the present invention.

What is claimed is:

1. An apparatus comprising:

a circuit;

a battery;

a port that includes a power line and serial data line; and

a power management unit, coupled to the circuit, the battery, and the port,

wherein the power management unit contains instructions that when executed by the power management unit:

(i) powers the circuit with the battery if the power line does not provide power;

(ii) powers the circuit and charges the battery with power provided by the power line if the power line provides power to the apparatus.

2. The apparatus of claim 1, wherein the power management unit further comprises a voltage converter to convert an external power source voltage to a supply voltage if the external power source voltage is received through the port and is provided to the circuit.

3. The apparatus of claim 2, wherein the voltage converter of the power management unit is a step down converter configured to step down the external power supply voltage to the supply voltage.

4. The apparatus of claim 2, wherein the power management unit further comprises a charge current generator to generate a charge current to charge the battery if the external power supply voltage is received through the port and a battery power source voltage is below the supply voltage by a threshold.

5. The apparatus of claim 4, wherein the power management circuit further comprises a comparator to compare the battery power source voltage to the supply voltage.

6. The apparatus of claim 5, wherein the comparator generates a first signal if the battery power source voltage is within the threshold from the supply, the first signal provided to a charge control circuit.

7. The apparatus of claim 6, wherein the first signal further causes the charge circuit to disconnect the external power supply voltage from the battery to prevent overcharging of the battery.

8. The apparatus of claim 5, wherein the comparator generates a second signal if the battery power source voltage is below the threshold of the supply voltage, the second signal causing a charge circuit to generate a charge current to charge the battery when the external power supply voltage is received through the port.

9. The apparatus of claim 2, wherein the supply voltage is one of the following voltages: approximately 1.8 volts, approximately 3.3 volts, approximately 5.0 volts; or 5.0 volts or less.

10. The apparatus of claim 1, wherein the power management unit further comprises a switch circuit configured to prevent substantial interruptions in providing power to the circuit when switching from the external power supply voltage to the battery power source voltage or vice versa.

11. The apparatus of claim 1, wherein the port is configured to receive at least one power line.

12. The apparatus of claim 1, wherein the port is configured to receive at least one data line arranged to form a transmit-and-receive connection with the external source.

13. A method for providing power to a circuit contained within a portable device from either a battery contained in the device or an external power source when plugged into a port configured to receive both power and data at the device, the method comprising:

ascertaining if the external power source is plugged into the port of the device, and either:

(i) providing power to the circuit from the battery when the external power source is not plugged into the device;

(ii) providing power from the external power source to the circuit and the battery used to at least recharge the battery when the external power source is plugged into the device and when the output of the battery is below a supply voltage by more than a threshold; or

(iii) providing power from the external power source only to the circuit when the external power source is plugged into the device and the output of the battery is within the threshold of the supply voltage.

14. The method of claim 13, further comprising converting an external power source voltage to the supply voltage within the device, wherein the supply voltage is one of the following: approximately 1.8 volts, approximately 3.3 volts, approximately 5.0 volts; or 5.0 volts or less.

15. The method of claim 14, wherein providing the external power to the circuit in the device and the battery to recharge the battery further comprises generating a charge current to charge the battery when an output voltage of the battery is below the supply voltage by more than the threshold.

16. The method of claim 15, further comprising comparing the battery voltage output to the supply voltage and either:

(i) generating a first signal if the battery voltage output is within the threshold from the supply voltage, the first signal causing power from the external power supply to be provided only to the circuit when the external power is received through the port; or

(ii) generating a second signal if the battery voltage output is below the threshold of the supply voltage, the second signal causing a charge current to be provided to the battery to charge the battery when the external power is received through the port.

17. The method of claim 15, further comprising disconnecting the external power supply voltage from the battery after the battery is charged.

18. The method of claim 15, further comprising switching between (i), (ii) and (iii) such that power provided to the circuit from either the battery or the external power source voltage is substantial without interruption.

19. The method of claim 15, further comprising transmitting and/or receiving data through the port of the device.

20. A battery powered device comprising:

a rechargeable battery;

a serial port that interfaces with a serial bus cable for transmitting data to or from the device that includes a plurality of data pins and at least a power pin;

a voltage sensor that senses a voltage on the power pin; and

a battery charging circuit that draws a charging current through the power pin of the serial port to charge the battery when the battery is substantially uncharged.

21. The battery powered device of claim 20, wherein the device comprises a personal digital assistant.

22. The battery powered device of claim 20, wherein the device comprises a personal MP3 player.

23. The battery powered device of claim 20, wherein the rechargeable battery comprises a lithium ion cell.

24. The battery powered device of claim 20, wherein the rechargeable battery operates within a voltage range of 3.7 volts to 4.2 volts.

25. The battery powered device of claim 20, wherein the serial port interfaces with a serial bus cable that transmits data to or from the device at a rate of at least 100 megabits per second.

26. The battery powered device of claim 20, wherein the serial port interfaces with a serial bus cable transmits data to or from the device in an asynchronous or isochronous mode.

27. The battery powered device of claim 20, wherein the serial port interfaces with an IEEE 1394 compliant serial bus cable.

28. The battery powered device of claim 20, wherein the battery charging circuit operates in a constant current mode.

29. The battery powered device of claim 20, wherein the battery charging circuit shuts off when its supply voltage is less than 4.2 volts.

30. The battery powered device of claim 20, wherein the battery charging circuit electrically isolates the battery if the battery is fully charged.

31. The battery powered device of claim 20, wherein the charging current is 750 mA.

32. The battery powered device of claim 20, wherein the voltage sensor and the battery charging circuit are coupled to the serial port via a main bus.

33. The battery powered device of claim 20, further comprising an inrush current limiter configured to limit an inrush current that flows into the battery powered device when a serial bus cable is inserted into the serial port.

34. The battery powered device of claim 20, further comprising a voltage converter configured to convert an external voltage received at the power pins of the serial port to an internal supply voltage within the range of 1.8 volts to 5 volts.

35. The battery powered device of claim 20, further comprising an active circuit operating at a supply voltage within the range of 1.8 volts to 5 volts.

36. The battery powered device of claim 20, further comprising a comparator coupled to the voltage sensor and configured to generate a switching signal based upon the sensed voltage.

37. The battery powered device of claim 20, further comprising a switchover circuit configured to supply power to an active circuit via the battery or a supply voltage received via the power pins of the serial port.

38. A method for charging a battery of a peripheral device, comprising:

inserting a serial bus cable into a serial port of the peripheral device, the serial port comprising a power pin and a plurality of data pins through which data can be transmitted to or from the peripheral device;

sensing that the voltage at the power pin of the serial port is above a selected threshold; and

drawing a charge current through the power pin of the serial port to charge the battery of the peripheral device.

39. The method of claim 38, wherein the peripheral device comprises a personal digital assistant.

40. The method of claim 38, wherein the peripheral device comprises a personal MP3 player.

41. The method of claim 38, wherein the battery operates within a voltage range of 3.7 volts to 4.2 volts.

42. The method of claim 38, wherein the battery is considered to be uncharged when its voltage drops below 3.45 volts.

43. The method of claim 38, wherein the serial port interfaces with a serial bus cable that transmits data to or from the device in an asynchronous or isochronous mode.

44. The method of claim 38, wherein the serial port interfaces with an IEEE 1394 serial bus cable.

45. The method of claim 38, wherein the charge current is 750 mA.

46. The method of claim 38, further comprising electrically isolating the battery if the battery is substantially fully charged.

47. The method of claim 38, further comprising suppressing a power surge caused by the insertion of the serial bus cable into the serial port.

48. The method of claim 38, further comprising converting an external voltage received at the power pins of the serial port to an internal supply voltage within the range of 1.8 volts to 5 volts.

49. A system comprising:

a battery powered device having a rechargeable battery and a battery charging circuit; and

a serial bus cable coupled to the battery powered device, the serial bus cable comprising a power transmission line and a plurality of data transmission lines, wherein the serial bus cable can transmit data to or from the battery powered device over the data transmission lines; and

wherein the battery charging circuit of the battery powered device draws a charging current through the power transmission line of the serial bus cable if the rechargeable battery is not fully charged.

50. The system of claim 49, wherein the battery powered device comprises a personal digital assistant.

51. The system of claim 49, wherein the battery powered device comprises a personal MP3 player.

52. The system of claim 49, wherein the rechargeable battery operates within a voltage range of 3.7 volts to 4.2 volts.

53. The system of claim 49, wherein the serial bus cable transmits data to or from the battery powered device at a rate of at least 100 megabits per second.

54. The system of claim 49, wherein the serial bus cable transmits data to or from the battery powered device in an asynchronous or isochronous mode.

55. The system of claim 54, wherein the serial bus cable comprises an IEEE 1394 compliant serial bus cable.

56. The system of claim 49, wherein the battery powered device electrically isolates the rechargeable battery when the battery is fully charged.

57. The system of claim 49, wherein the charging current is 750 mA.

58. The system of claim 49, wherein the battery powered device comprises an active circuit operating at a supply voltage within the range of 1.8 volts to 5 volts.

59. The system of claim 49, wherein the data transmission lines are separately-shielded twisted transmission type data lines.

60. A method for managing power delivered to a battery-operated peripheral device by way of a cable that includes a number of lines at least one of which is a power line arranged to carry electrical power from an electrical supply to the device, the method comprising:

detecting a status for the device, wherein the status is based on whether a first condition relating to a battery in the device has occurred and whether a second condition relating to connection of the cable to the electrical supply has occurred;

drawing electrical power from the electrical supply at a first current if the device has a first status; and

drawing electrical power from the electrical supply at a second current level if the device has a second status.

61. The method of claim 60, wherein the second condition is the attachment of the cable to another device.

62. The method of claim 60, wherein the second condition is the connection of the cable to another device such that a data transfer request is received by the battery-operated peripheral device.

63. The method of claim 60, further comprising converting the electrical power from an external voltage to a supply voltage by a voltage converter unit.

64. The method of claim 60, wherein the first condition is when a battery in the device is fully charged.

65. The method of claim 64, further comprising, if the battery is fully charged, providing the battery with electrical power from the electrical supply at a third current level.

66. The method of claim 65, wherein the third current level is essentially zero amps.

67. The method of claim 65, wherein the cable includes two twisted pairs of wires carrying data.

68. The method of claim 67, wherein the two twisted pairs of wires are separately shielded.

69. The method of claim 68, wherein the cable is an I.E.E.E. 1394 compliant cable.

70. A portable consumer electronic product comprising:

a sensor unit arranged to detect a status for the device, wherein the status is based on whether a first condition relating to a battery in the device has occurred and whether a second condition relating to connection of the cable to the electrical supply has occurred;

a switchover circuit arranged to draw electrical power from the electrical supply at a first current if the device has a first status, and to draw electrical power from the electrical supply at a second current level if the device has a second status.

71. The portable consumer electronic product of claim 70, further comprising a voltage converter unit arranged to convert the electrical power from an external voltage to a supply voltage.

72. The portable consumer electronic product of claim 70, wherein the switchover circuit is further arranged to, if the battery is fully charged, provide the battery with electrical power from the electrical supply at a third current level.

73. The portable consumer electronic product of claim 70, wherein the third current level is essentially zero amps.

74. The portable consumer electronic product of claim 70, wherein the cable includes two twisted pairs of wires carrying data.

75. The portable consumer electronic product of claim 74, wherein the two twisted pairs of wires are separately shielded.

76. The portable consumer electronic product of claim 75, wherein the cable is an I.E.E.E. 1394 compliant cable.

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