Using the HT82A620R for Battery Charger Applications

D/N：HA0275E

Introduction

The HT82A620R is an 8-bit high performance RISC-like microcontroller with an integrated USB SIE compatible with the USB 2.0 Full Speed Mode. The USB charger using the HT82A620R as the core contains constant current control, multiple fully charged detection, multiple charge display and multiple protect functions etc. This USB charger uses the USB 2.0 version for which the USB hub must be able to provide 500mA current.

The content includes USB Charger hardware principles, software flowchart and description, PCB Layout and so forth will also be introduced for the user‘s reference for using the HT82A620R for product development.

Features

The HT82A620R is an 8-bit high performance RISC-like microcontroller designed for USB applications especially suitable for USB or SPI interface touch panels, USB or SPI interface touch keys, PS2 joysticks, XBOX joysticks, USB mouse keyboards and joystick product applications. The halt mode can be used to reduce power consumption.

- Operating Voltage:
  f_{SYS}=6MHz : 2.2V~5.5V
  f_{SYS} =12MHz : 4.0V~5.5V
- Up to 24 bidirectional I/O lines
- One I/O pin-shared with external interrupt input
- 16-bit programmable timer/event counter with overflow
- Oscillator (6MHz or 12MHz)
- Watchdog timer
- 4096×15 Program Memory ROM
- 160×8 Data Memory RAM
- HALT and wake up function to reduce power consumption
- Up to 0.33μs instruction cycle with 12MHz system clock at V_{DD}=5V
- 6-level subroutine nesting
- 16 channel 12-bit resolution A/D converter

- 3 channel 12-bit PWM output shared with three I/O lines
- SIO (synchronous serial port) function
- Interrupt, control and bulk transfer function supported
- USB 2.0 full speed compatible
- Max. 4 endpoints supported -- endpoint0 included
- All endpoints except endpoint0 can be configured as 8, 16, 32, 64 FIFO size
- Bit manipulation instruction
- Table read instruction with 15 bytes table content
- 63 powerful instructions
- All instruction executed in one or two instruction cycles
- Low voltage reset function

USB Charger Function

- Two Independent Charger Stands
  The HT82A620R (28-pin SSOP) includes a 12 channel 12-bit AD converter and three PWM outputs. The USB charger is designed for two independent charger stands with separate charging and discharging control.
- AA or AAA Battery Auto-recognition
  Each charge stand can be setup for AA or AAA batteries. The charger can auto-identify the battery part number and calculate the remaining time for charging based on the battery type.
- Multi type Battery-full Detect Function
  - 0-delta detect function
  - Minus Delta detect function
  - Maximum voltage restrict function (greater than 1.5V then auto stop charging.)
- Non-rechargeable Battery Identification Function
  For a general battery or alkaline cell, the voltage in the charging process rises fast. The possibility of rising to 1.5V in a short period of time is used to identify whether it is a non-rechargeable battery. Once it is identified, the PC port will display a non-rechargeable battery message.
- Quick Identification for wrong polarity battery placement
  If the battery is placed with the wrong polarity, it will be detected by an input voltage of zero.
- USB Over-current Protection Function
  If the voltage of the USB interface reduces due to a large load consumption etc., when the USB interface voltage is smaller than 4V, the charge function will be disabled automatically and then enter the protection state and an LED will flash. It will then be necessary to re-plug in the USB for charging after this condition is detected.
- Auto-Current Distribution Function
  The maximum current for the USB is 500mA. When both charging stands are in use, the current for each stand will automatically be restricted to 250mA so as to protect the USB hub. If only one charge stand is in use, the current will automatically be restricted to 500mA so as to meet the needs of quick charging.
- Auto Calculation of Excessive Charge Time Function
  The excessive charge time calculation method is:
  {Maximum time - [{maximum time / {1.5V-0.0V)* (present voltage-0.0V)] }

- Battery Capacity Calculation
  The battery capacity calculation method is: Battery under load (load resistance is 5Ω) voltage divided by the theoretical full battery voltage, multiplied by 100 to get the battery capacity percentage.

  $$x\ \% = ((Vl / V1.2) \times 100$$

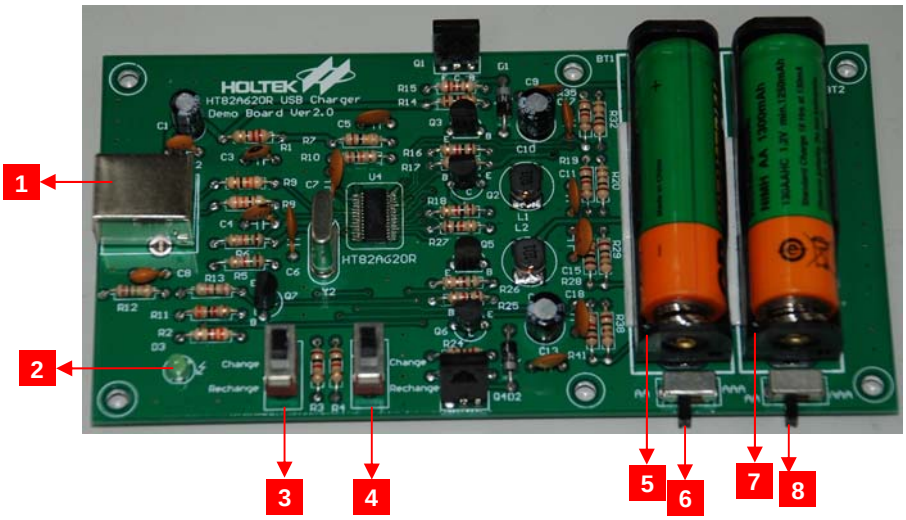
  x %: Battery capacity (use percentage)
  V1.2: Theoretical full voltage
  Vl: Present battery voltage with 5Ω load for testing
- Discharge Function
  Each battery holder has a selection switch. When the switch is ON, after the battery is placed in the holder, a discharge operation will first take place. When the battery voltage reaches a value lower than 0.8V, then the charge process will start automatically. When the switch is OFF, the discharge process will not take place and a charge process will directly start.
- Charging process function LED indicator
  - Process Indication
    When the charge is connected to the PC USB interface, the LED will illuminate to indicate that the process has started. When the process has ended the LED will extinguish.
  - Charging status indicator
    For the two charge stands, when any one of them is operating then the LED will be illuminated.
  - Error indicator
    Any of the following conditions will cause the LED to flash.
    USB overcurrent, a non-rechargeable battery detection, wrongly inserted battery.
    When the error source has been corrected, the charger should be unplugged to reset.
- PC terminal display function

As shown in the figure:

- The Battery 1 frame indicates the condition of the first charger location.
  During charging this will display the battery voltage and the calculated battery capacity value. The battery capacity value will be displayed as a percentage value.
  When the battery stand does not contain a battery, then a ″No battery″ message will be displayed.
  If the battery is inserted the wrong way round, then a ″Bat Reverse″ message will be displayed.
  If a non-rechargeable type of battery has been inserted, then an ″Alkaline or Bad Battery″ message will be displayed.
  When the battery is fully charged then a ″Charge complete″ message will be displayed.
  When the battery is in the discharge process, a ″Discharge″ message along with the battery voltage will be displayed.
- The Battery2 frame indicates the condition of the second charger location.
  During charging this will display the battery voltage and the calculated battery capacity value. The battery capacity value will be displayed as a percentage value.
  When the battery stand does not contain a battery, than a ″No battery″ message will be displayed.
  If the battery is inserted the wrong way round then a ″Bat Reverse″ message will be displayed.
  If a non-rechargeable type of battery has been inserted, then an ″Alkaline or Bad Battery″ message will be displayed.
  When the battery is fully charged than a ″Charge complete″ message will be displayed.
  When the battery is in the discharge process then a ″Discharge″ message along with the battery voltage will be displayed.
- The HOUR and MIN display frame display the remaining charging time for each of the charging locations.
- Windows Button Functions:
  Hide Clicking this button will hide he dialogue window
  Skin Clicking this button will change the appearance of the window
  Option allows the window to be opened automatically when the charger is on
  holtek.com.cn allows connection to the Holtek website

USB Charger Demo Board

Circuit Board Description



1 -- USB Interface

2 -- LED

3 -- S1 is the first battery location discharge switch, when the battery voltage falls below 0.8V the charger will automatically switch to the charging state.

4 -- S2 is the second location discharge switch, when the battery voltage falls below 0.8V the charger will automatically switch to the charging state.

5 -- First cell charging location

6 -- First AA or AAA cell switch button

7 -- Second cell charging location

8 -- Second AA or AAA cell switch button

Running the PC terminal USB Charger Display Program

Double click the icon shown below to run the USB charger software.

(For the PC terminal software installation method, see the accompanying instruction manual)

After running the application program the following icon will be displayed:

Connecting the Charger to the PC USB Interface

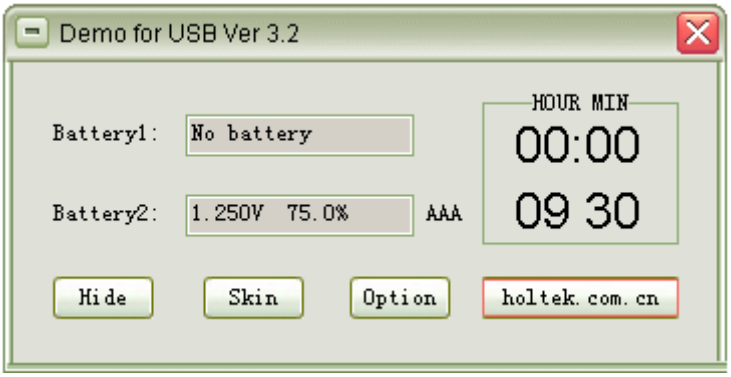
When a battery is connected to the charger and the charger is connected to a USB socket on the PC, the charging process will start.

Note the following points:

The first battery location can only accept one kind of either AA or AAA type cells, two different kinds of cell cannot be connected.

The second battery location can also only accept one kind of either AA or AAA type cells, two different kinds of cell cannot be connected.

The dialogue window will be displayed automatically as shown below.



The condition bar has two displays as shown below:

The figure on the left indicates that the dialogue window is opened, and the figure on the right indicates that the charging location has a battery inserted.

When no battery is inserted into the battery holder, the following will be shown:

Charging Process LED Description

Enumeration Process Indicator

When the charger is connected to the PC USB interface, the LED will illuminate indicating that the enumeration process is in progress.

Charging Condition Indicator

When any charging location is operating the LED will be illuminated.

Error Display

Any of the following conditions will cause the LED to flash.

USB over-current, non-rechargeable battery detection, wrongly inserted battery.

After the source of the error has been corrected, the charger should be disconnected to reset.

Charging Process PC Terminal Display Description

Battery1 and Battery2 Windows

- During the charging process the two windows will display the voltage of the batteries being charged and the battery capacity calculated value as a percentage indication.
- If no battery is inserted then the window will display a ″No Battery″ message.
- If a battery has been inversely inserted, then the window will display a ″Bat Reverse″ message.
- If a non-rechargeable battery type has been detected, then the window will display an ″Alkaline or Bad Battery″ message.
- After the battery has been fully charged, the window will display a ″Charge complete″ message.
- During the discharge process the window will display a ″Discharge″ message.

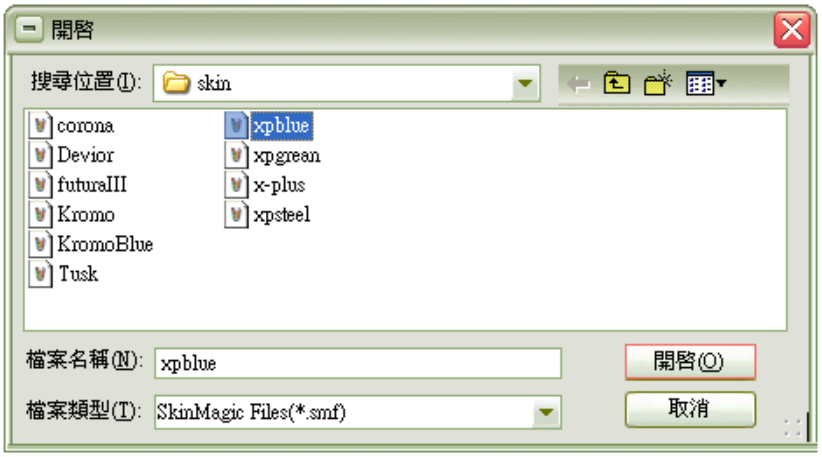
HOUR MIN Window

This window displays the first and second charging location's remaining charge time.

Switch Description

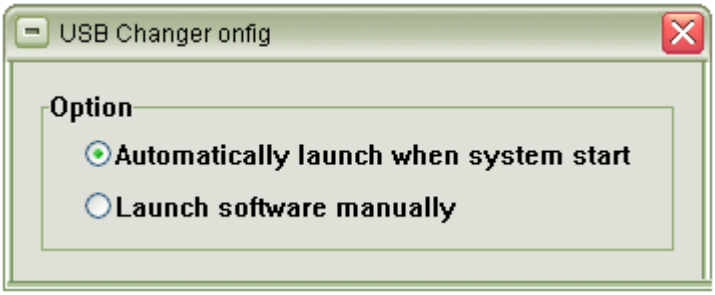
Hide Clicking this button will hide the dialogue window

Skin Clicking this button will change the appearance of the window. The skin path is C:\Program Files\USB Charger\skin.

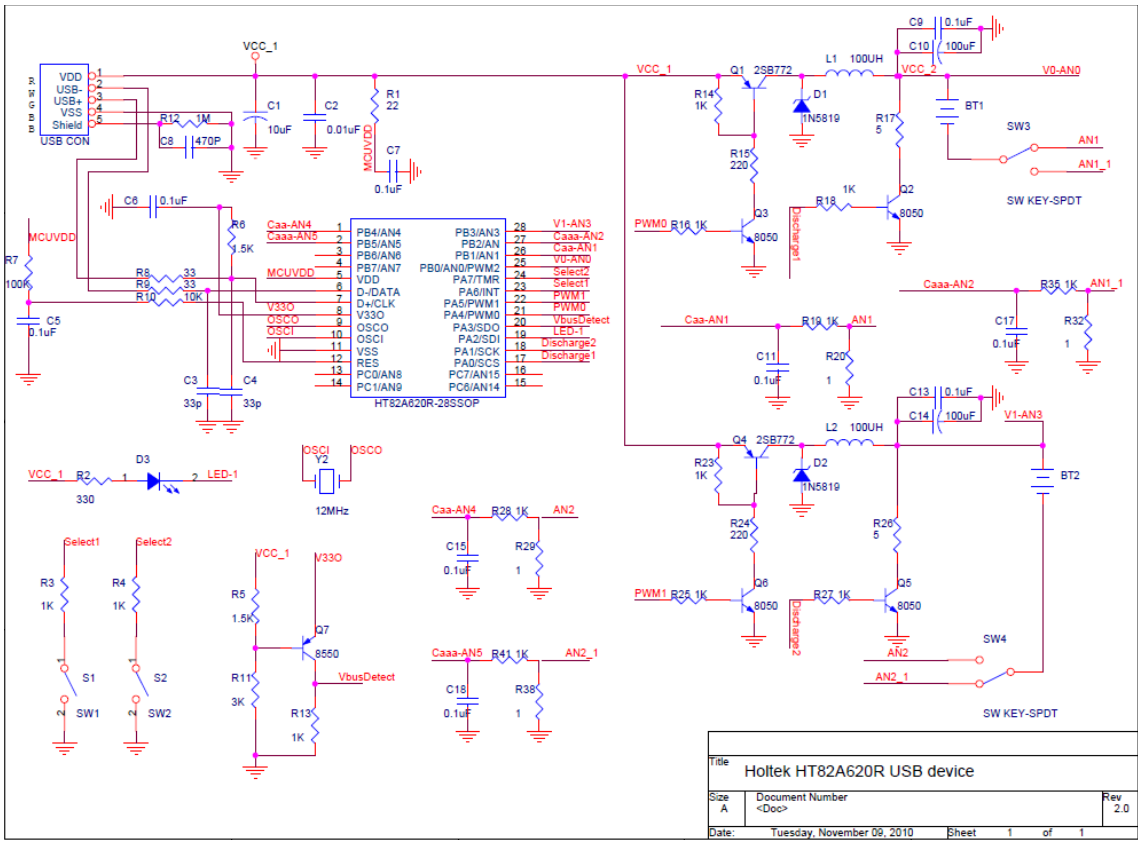


Option Clicking this button will allow the dialogue window to automatically start when the charger is switched on.

Option Provides two choices, one is for the automatic program execution when the charger is connected, the other is for a manual program execution.



Hardware Circuit

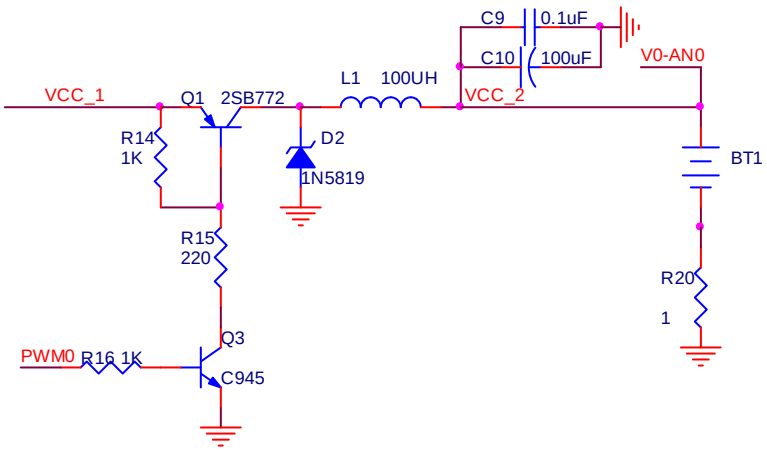


Hardware Description

In this USB charger, two independent charging locations are provided allowing two batteries to be independently charged. Each charging location can accept either an AA or AAA type battery. In the circuit diagram BT1 and BT2 indicates the first AA or AAA cell. BT3 and BT4 indicates the second AA or AAA cell.

The other sections are formed from the USB interface circuit, PWM constant current control circuit, USB voltage detect circuit, current sampling circuit, discharge circuit, which are described below:

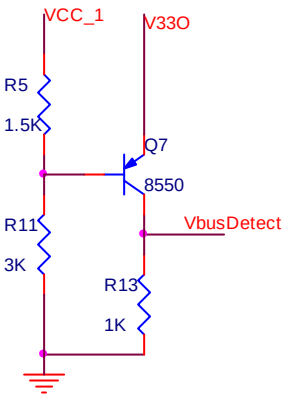
- PWM Constant Current Control Circuit



The PD0/PWM0 pin is connected to a C945 NPN transistor via a resistor, which is used to control the 2SB772 PNP transistor. When the PWM0 output is high, the NPN and PNP transistors will both be in their conducting state, and the 5V supply is used for charging via the inductor. When the PWM output is low, the NPN and PNP transistors will be in their non-conducting state and the 5V supply will not be connected to the inductor.

Now the inductor will continue to supply a discharge current via the 1N5819 diode. When the PWM duty cycle is controlled, then the amount of energy stored in the inductor can be controlled which can be used for constant current control.

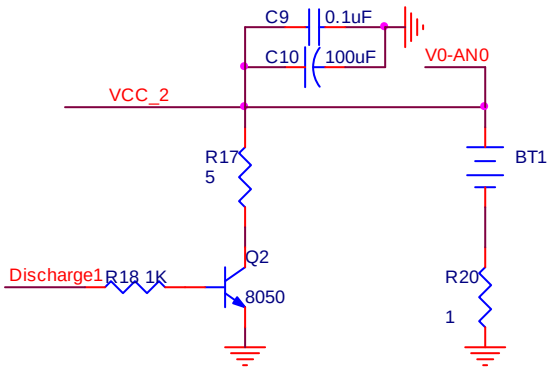
- USB Detect Circuit



When V+ is equal to 5V, then Vb = R30 / (R28+R30) × 5 = 3 / (1.5+3) × 5 = 3.33V. Because Ve has a regulated voltage of 3.3V, then the 8850 transistor will not be turned on and the VbusDetect input in the HT82A620R will be at a low level.

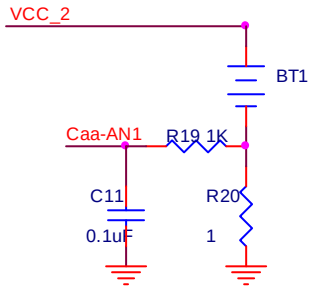
When V+ is equal to 4V, Vb = R30 / (R28+R30) × 4 = 3 / (1.5+3) × 5 = 2.67V. Because Ve has a regulated voltage of 3.3V, the 8550 will be on and the VbusDetect input in the HT82A620R will be at a high level. When the HT82A620R detects that VbusDetect is high, then the PWM output will be switched off and the LED will flash to indicate an error situation

- Discharge Circuit



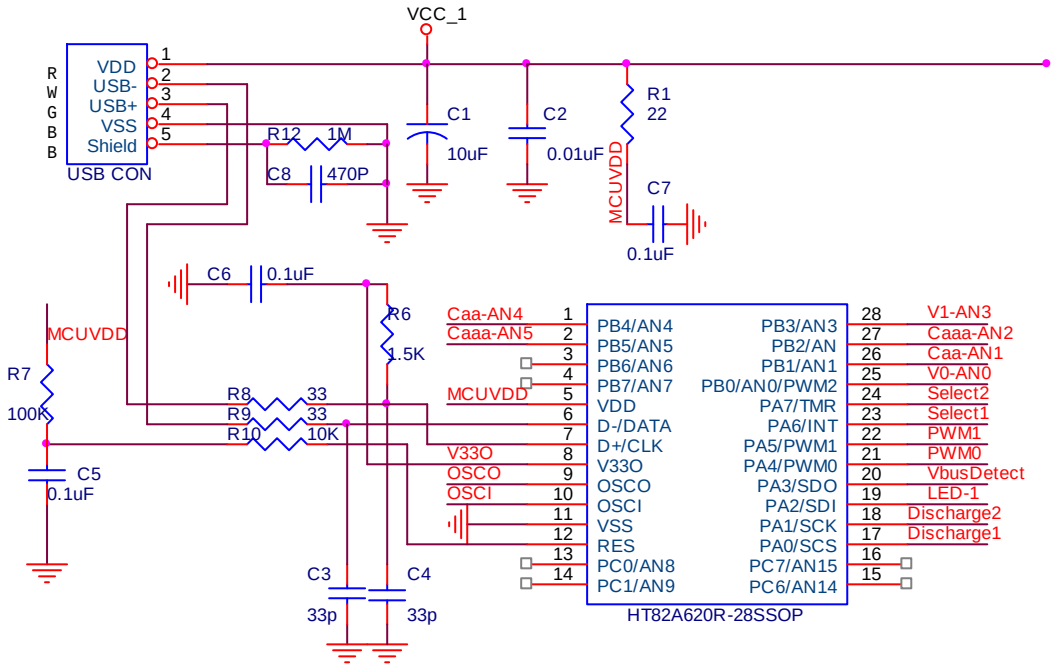
The discharge circuit uses an 8050 NPN transistor. When the Discharge1 output is high (set to around 4.3V) the NPN transistor 8050 Ibe current will be = (4.3V-0.3V) / 1K = 4mA. If the 8050 NPN transistor current gain is = 100, then the transistor 8050 C-E specified current will be about 400mA. With a battery voltage of 1.2V and because the 8050 NPN transistor conducting C-E voltage is 0.3V, then the discharge current, Ice, will be = (1.2V-0.3V) / 5+1) = 150mA.

- Current Sampling Circuit



The current sampling circuit has four parts as follows: the first battery location AA battery sampling, AAA battery current sampling, the second battery location AA battery current sampling and the AAA battery current sampling. The current sampling method is to connect a 1-ohm resistor in series with the negative battery terminal and ground. In this way the battery current will be converted into a voltage and can be transmitted to the HT82A620R ADC input. R19 and C11 form an RC filter circuit.

- USB Interface Circuit



The USB interface circuit has two sections:

The first section is the power source for the HT82A620R, and is a filter circuit formed from C1,

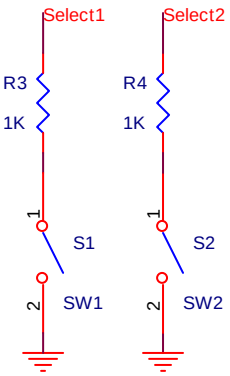
R1 and C7, and is used to ensure the HT82A620R has a stable power supply

The second section is the data lines of the HT82A620R and the USB interface. One of these two lines, D+, is connected to a 1K5 pull-high resistor, which is connected to the V330 pin in the HT82A620R. C6 is the filter capacitor for the V330 output.

- Discharge Select Circuit

When S1 is On, the first battery location will discharge. When the battery voltage falls below 0.8V, the charger will automatically enter the charging condition.

When S2 is On, the second battery location will discharge. When the battery voltage falls below 0.8V, the charger will automatically enter the charging condition



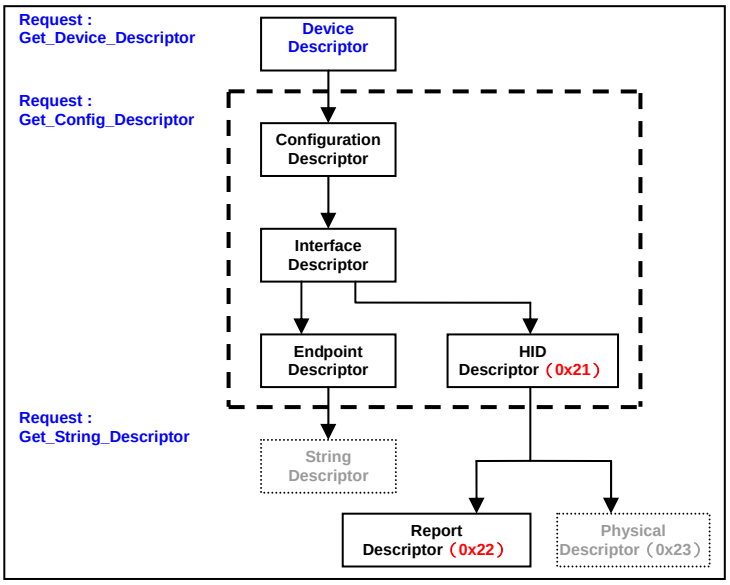
USB Charger Descriptor Introduction

USB devices are required to be defined by a set of descriptors which describe the device function and characteristic fixed structures. The USB device use these descriptors to report their characteristics to the USB host. The USB host interrogates the device according to this descriptor for recognition, and provides the related user service program.

USB devices are subdivided according to the interface categories as follows: Audio, Mass_Storage, Printer, HUB etc. The HT82A620R is a USB device belonging to the HID category, and its descriptor must be in accordance with the HID rules.

The USB charger descriptor details will be described as follows:

HID Category Device Descriptor Structure Diagram



Device Descriptor

Field	Position	Size	Name	Example
bLength	0	1	Describe bit length	0x12
bDescriptorType	1	1	Describe bit type	0x01
bcdUSB	2	2	USB version	0x0110
bDeviceClass	4	1	Device class	0x00
bDeviceSubClass	5	1	Device sub class	0x00
bDeviceProtocol	6	1	Device protocol	0x00
bMaxPacketSize0	7	1	Max. packet size	0x08
idVendor	8	2	Vendor I.D.	1241D(0x04d9)
idProduct	10	2	Product I.D.	0xe001
bcdDevice	12	2	Device Version	0x0100
iManufacturer	14	1	Vendor Name	0x01
iProduct	15	1	Product Name	0x00
iSerialNumber	16	1	Product Serial No.	0x00
bNumConfigurations	17	1	Configuration	0x01

Device descriptor given provides general information about the USB device, the important information includes:

- Descriptor length 12H (18)
- Descriptor category 01 (01 indicates the device descriptor)
- Manufacturer's ID (VID) [1241D(0x04D9)]
- Product ID (PID) (E001)
- Endpoint 0 (0) largest packet size (8)
- Accompanying device descriptors (1)

Accompanying Device Descriptor

Field	Position	Size	Name	Example
bLength	0	1	Descriptor Length	0x09
bDescriptorType	1	1	Descriptor Type	0x02
bTotalLength	2	2	Descriptor Total Length	0x0022
bNumInterfaces	4	1	Number of Interfaces	0x01
bConfigurationValue	5	1	Configuration Number (one base)	0x01
iConfiguration	6	1	Configuration Name Index	0x00
bmAttributes	7	1	Attributes	0x80
bMaxPower	8	1	Maximum Power (units are 2mA)	0xFA (250*2mA=500mA)

bmAttributes

D7	D6	D5	D4	D3	D2	D1	D0
1	Auto supply power	Terminal Wake-up	0	0	0	0	0

Accompanying Device supplies device specially setup devices, note:

- Descriptor length (09H)
- Descriptor category (02)
- Supported interface number (1)
- Device current consumption (units of 2mA)
- Supply type: composite or external supply
- Terminal wake-up

Interface Descriptor

Field	Position	Size	Name	Example
bLength	0	1	Descriptor length	0x09
bDescriptorType	1	1	Descriptor type	0x04
bInterfaceNumber	2	2	Interface number (zero base)	0x00
bAlternateSetting	3	1	Alternative settings (zero base)	0x00
bNumEndpoints	4	1	No. of endpoints	0x01
bInterfaceClass	5	1	Interface class (HID)	0x03
bInterfaceSubClass	6	1	Interface sub class	0x00
bInterfaceProtocol	7	1	Interface protocol	0x00
iInterface	8	1	Interface name index	0x00

Interface descriptor describe different device interface characteristics of which the important points are:

- Descriptor length (0x09)
- Descriptor class (0x04)
- Interface endpoint number (1) (not including endpoint 0)
- Interface class (0x03 indicates HID class)

BinterfaceSubClass: 0x00 indicates no class

bInterfaceProtocol: 0x00 indicates no protocol; 0x01 indicates keyboard; 0x02 indicates mouse

bInterfaceClass (interface class indication):

Interface Class	bInterfaceClass (Code)
Audio	0x01
CDC-Control	0x02
HID	0x03
Physical	0x05
Image	0x06
Printer	0x07
Mass-Storage	0x08
HUB	0x09
CDC-Data	0x0A
Chip/Smart Card	0x0B
Content-Security	0x0D
Diagnostic Device	0xDC
Wireless Controller	0xE0
Application-Specific	0xFE
Vendor-Specific	0xFF (requires driver)

HID Descriptor

Field	Position	Size	Name	Example
bLength	0	1	Descriptor length	0x09
bDescriptorType	1	1	Descriptor type	0x021
bcdHID	2	2	HID Class spec. release number	0x0010,0x0001
bCountryCode	3	1	Country code	0x00
bNumDescriptors	4	1	Following descriptor number, only used for registration descriptor	0x01
bDescriptorType	5	1	Following descriptor as registration descriptor	0x022
wEntityLength	6	1	Descriptor Length	0x035=53

The HID descriptor is an HID class device with the following descriptor:

- Descriptor length (0x09)
- Descriptor class (0x21)
- Following descriptor number (1)
- Following descriptor class (0x22 as reporting descriptor)
- Reporting descriptor length (0x35)

Endpoint Descriptor

Field	Position	Size	Name	Example
bLength	0	1	Descriptor length	0x07
bDescriptorType	1	1	Descriptor Type	0x05
bEndpointAddress	2	1	Endpoint number	0x81
bmAttributes	3	1	Endpoint Attribute	0x03
wMaxPacketSize	4	2	Maximum Packet Size	0x0008
bInterval	6	1	Interval Timer (units are ms)	0x0a (10ms)

Endpoint descriptor describes the data transmission type, transmission direction, data package size and endpoint number etc.

- Descriptor length (0x07)
- Descriptor class (0x05)
- Endpoint order number (0x81 indicates endpoint 1 is input breakpoint)
- Endpoint FIFO buffer size (0x08)
- Host convey time (0x0a indicated 10ms)
- bmAttributes (endpoint transmission type, 0x03 interrupt type)

00	01	02	03
Control transmission	Wait transmission	Bulk Transmission	Interrupt Transmission

Reporting Descriptor

Reporting descriptor is an HID class device special descriptor:

Table_ReportDescriptor:
DW006H, 009FFH, 03F01H, 001A1H

DW00295H, 00875H, 0015H, 03F26H, 03FFFH, 03F00H
DW00409H, 00509H, 002B1H

; INTPUT
DW00015H, 03F26H, 03FFFH, 03F00H
DW01019H, 01729H
DW00895H, 00875H, 00281H

; OUTPUT
DW 00015H, 03F26H, 03FFFH, 03F00H
DW01819H, 01F29H
DW00895H, 00875H, 00291H

DW03FC0H

USB Charger Host Communication Protocol

After completion of the USB device enumeration, the USB host will configure the device. When the HT82A620R breakpoint 1 is setup as an interrupt transmission type, the interrupt time will be set to 10ms. Here the host will request data from the device every 10ms. The SIE will send an interrupt request to the MCU, and during the interrupt the data can be written into the FIFO buffer.

Each buffer data includes USB charger and application program internal fixed protocol, the content of which is as follows:

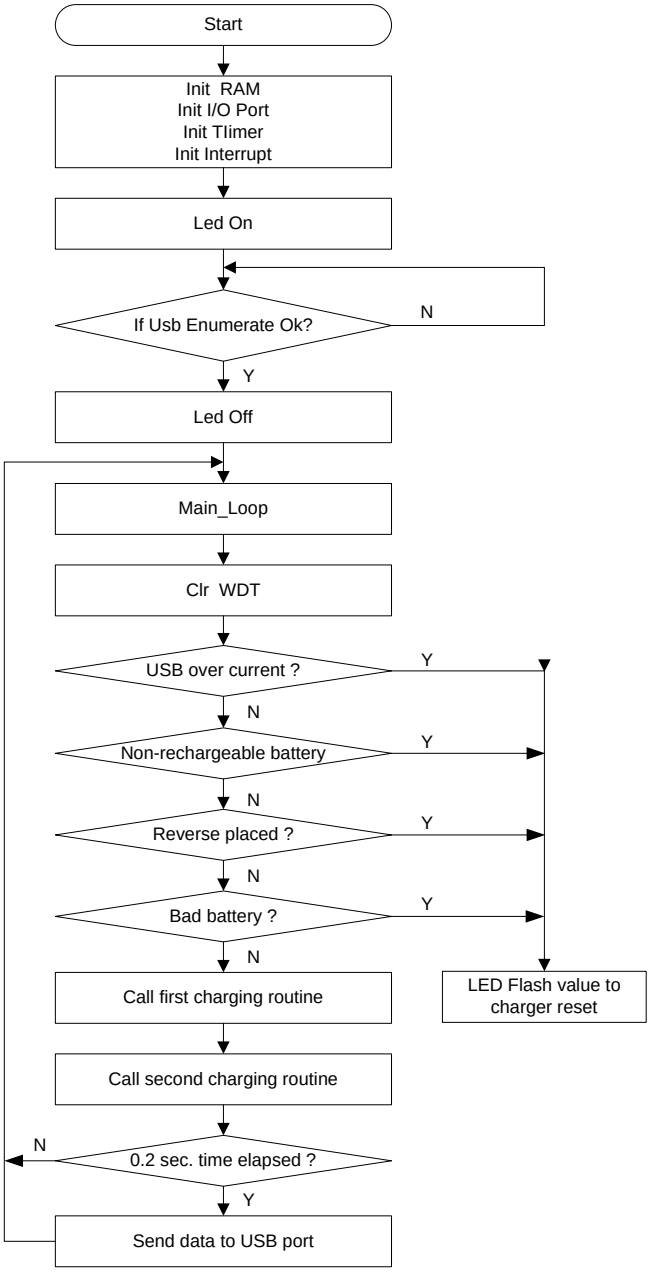
First Charger Location								
BUF0	**B7**	**B6**	**B5**	**B4**	**B3**	**B2**	**B1**	**B0**
	IF 1, Indicates Already charged	IF 1, Indicates battery reverse insertion	IF 1, Indicates non rechargeable battery type	IF 1, Indicates charging in progress	IF 1, Indicates discharge in progress	IF 1, Indicates charging in progress	IF 1, Indicates AA cell	IF 1, Indicates AAA cell
BUF1	B7--B0							
	Battery Voltage High 8bits							
BUF2	B7--B6	B5-B0						
	Battery Voltage Low 2bits	Charging time Min						
BUF3	B7-B4	B3-B0						
	Battery Capacity Parameter	Charging time Hour						
Second charger location								
BUF4	**B7**	**B6**	**B5**	**B4**	**B3**	**B2**	**B1**	**B0**
	IF 1, Indicates already charged	IF 1, Indicates battery reverse insertion	IF 1, Indicates non rechargeable battery type	IF 1, Indicates charging in progress	IF 1, Indicates discharge In progress	IF 1, Indicates charging in progress	IF 1, Indicates AA cell	IF 1, Indicates AAA cell
BUF5	B7--B0							
	Battery Voltage High 8bits							
BUF6	B7--B6	B5-B0						
	Battery Voltage Low 2bits	Charging time Min						
BUF7	B7-B4	B3-B0						
	Battery Capacity Parameter	Charging time Hour						

Software Design Flowchart Description

Main Program Flowchart

The main program executes the following functions:

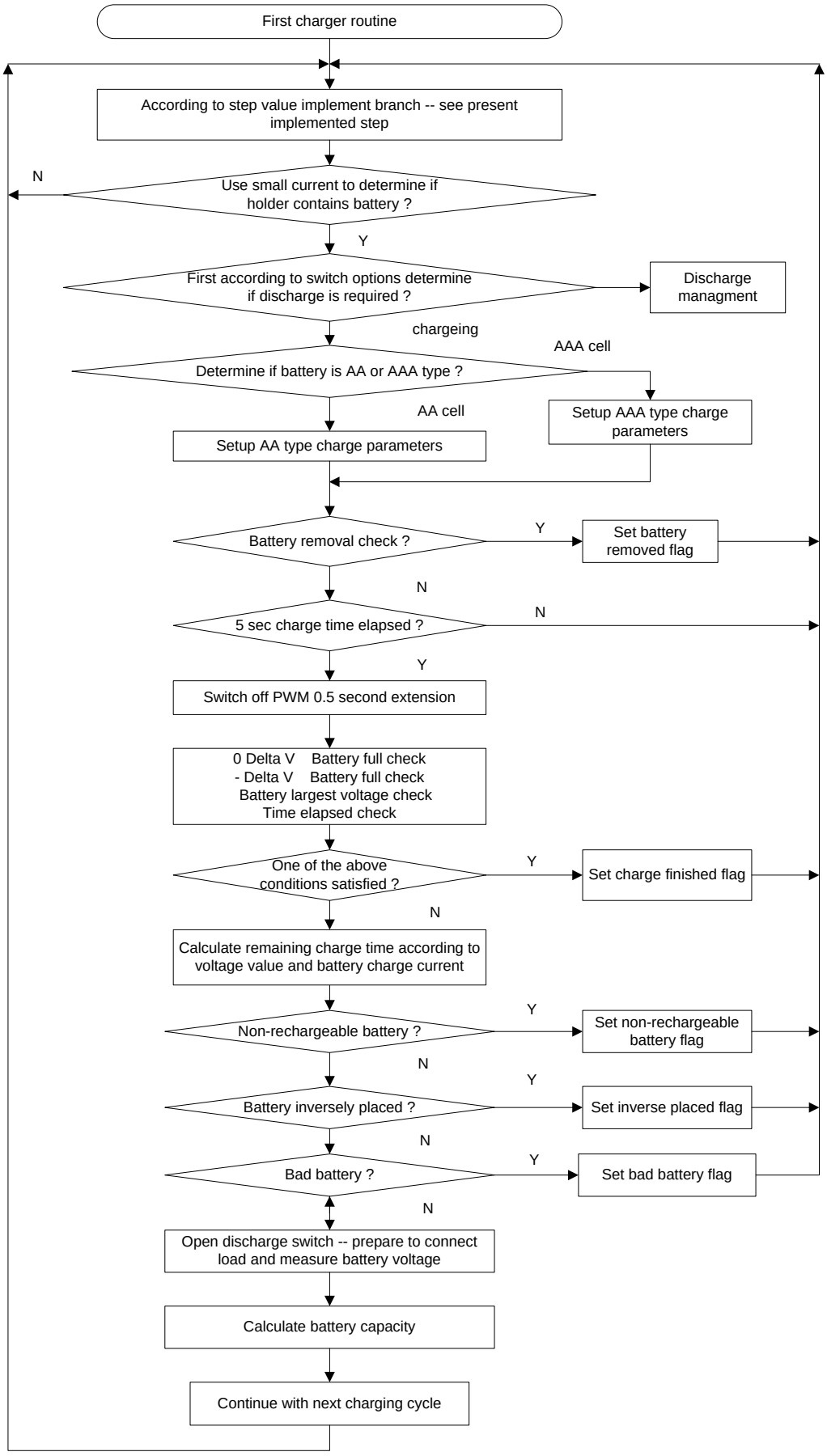
- Initialization
- USB communication
- Clear Watchdog timer
- USB over current checking, non-rechargeable battery type checking, wrong battery insertion. If any of these conditions occur, charging will stop and the LED will flash to indicate an error.
- Call two battery locations charging routines, each battery location handling program functions are described in detail later.
- Every 0.2 sec send data to the host.



First Battery Location Charger Control Flowchart

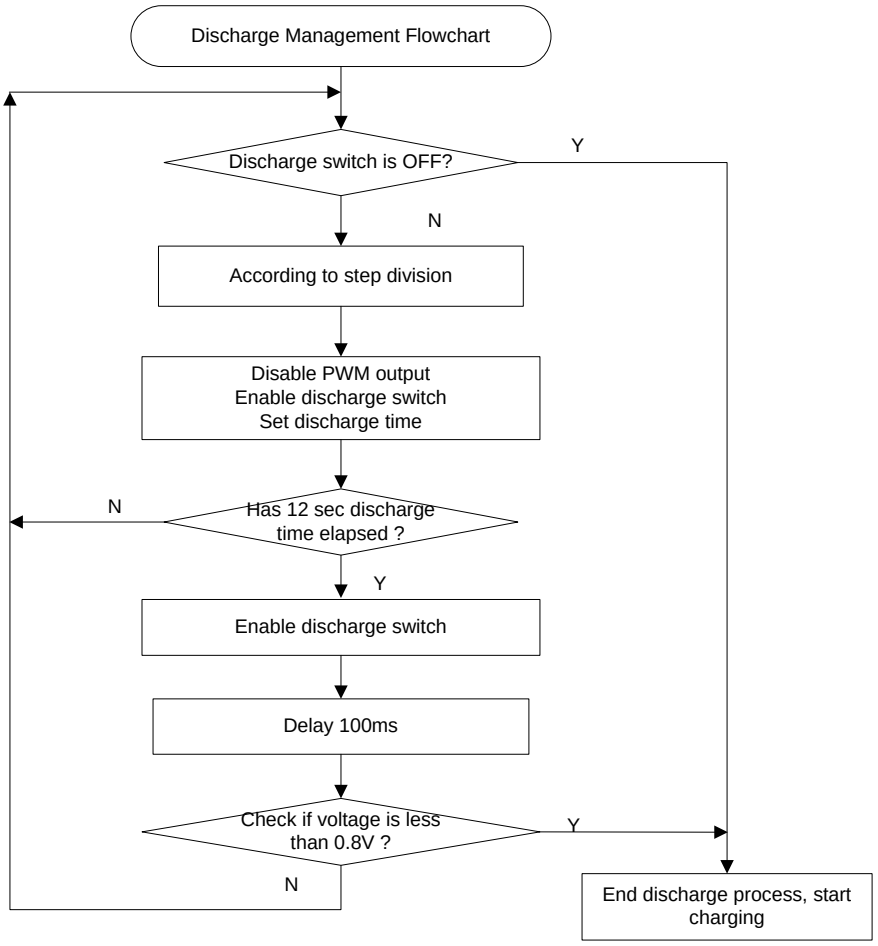
The first battery location software uses a step method for its execution. For example, the first step is to execute a charge or discharge check. If at the first step it is discovered that it is presently in the charging mode, then the second step will be used to determine if a battery has been placed in the battery holder. If a battery has been placed the next step to execute will be the charging operation. In this way the program proceeds step by step.

- First check if the battery location contains a battery. If a battery has been placed here then check if the charger is in a charging or discharging status, then enter the various program handling routines.
- If the charger is presently in the charging mode, then it must be determined if the battery is an AA or AAA type in order to setup the related charging current.
- After continually charging for 5 seconds, the PWM is switched off and the voltage measured, and a 0 Delta - Delta operation carried out to see if the battery is fully charged. If the battery is fully charged then the charging procedure will be terminated. If the battery is not fully charged, then the charging procedure will continue. Also, if a non-rechargeable battery is used or if the battery is inserted the wrong way round etc, then the related error flag will be set.
- For the battery capacity calculation, after charging continuously for 5 seconds, it is necessary to obtain the load voltage, to enable calculation of the battery capacity parameter.
- During the charging progress it is necessary to check if the battery has been removed. If the battery has been removed, then a no battery indication will be given.


First charger routine
According to step value implement branch -- see present implemented step
Use small current to determine if holder contains battery ?
N
Y
First according to switch options determine if discharge is required ?
Discharge managment
chargeing
Determine if battery is AA or AAA type ?
AAA cell
AA cell
Setup AAA type charge parameters
Setup AA type charge parameters
Battery removal check ?
Y
Set battery removed flag
N
5 sec charge time elapsed ?
N
Y
Switch off PWM 0.5 second extension
0 Delta V Battery full check
- Delta V Battery full check
Battery largest voltage check
Time elapsed check
One of the above conditions satisfied ?
Y
Set charge finished flag
N
Calculate remaining charge time according to voltage value and battery charge current
Non-rechargeable battery ?
Y
Set non-rechargeable battery flag
N
Battery inversely placed ?
Y
Set inverse placed flag
N
Bad battery ?
Y
Set bad battery flag
N
Open discharge switch -- prepare to connect load and measure battery voltage
Calculate battery capacity
Continue with next charging cycle

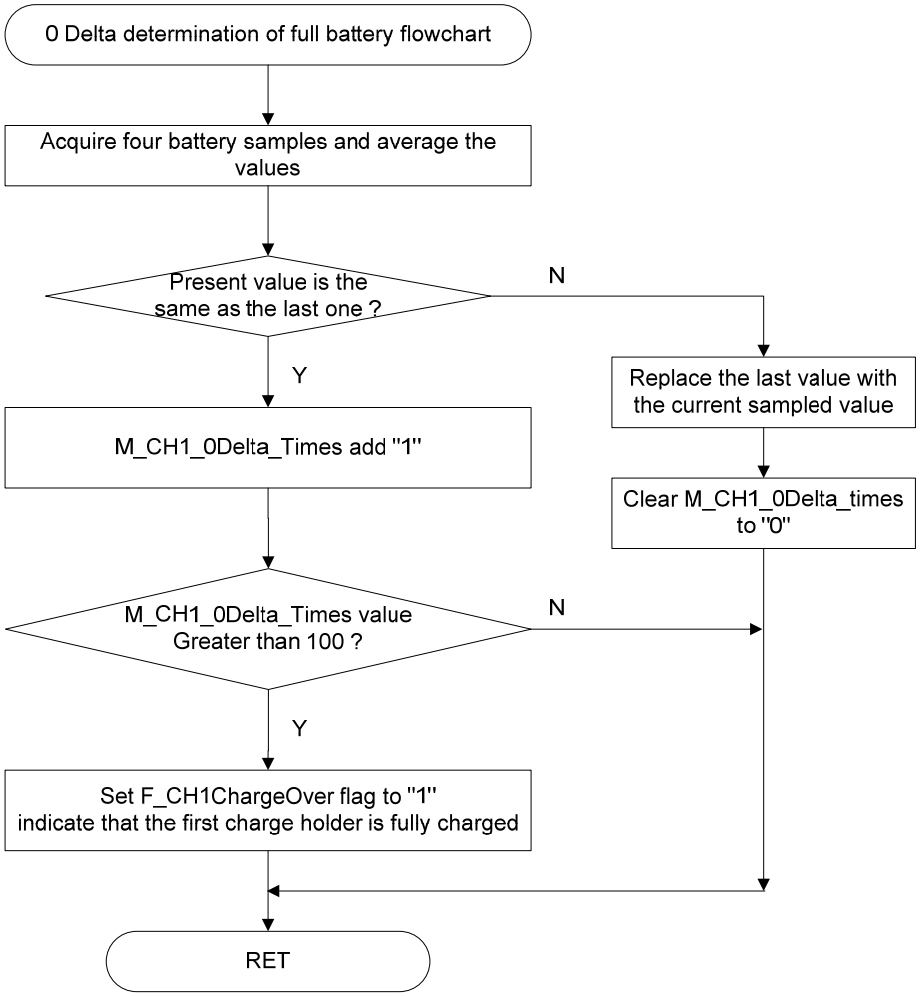
Discharge Management Flowchart

Whether it is before charging or during charging, if the discharge switch is On, then the discharge mode will be entered. During discharging, every 12 seconds, the battery voltage will be measured. During measurement, if the discharge switch is switched off, then if the battery voltage is les than 0.85V, the charger will automatically enter the charging mode.



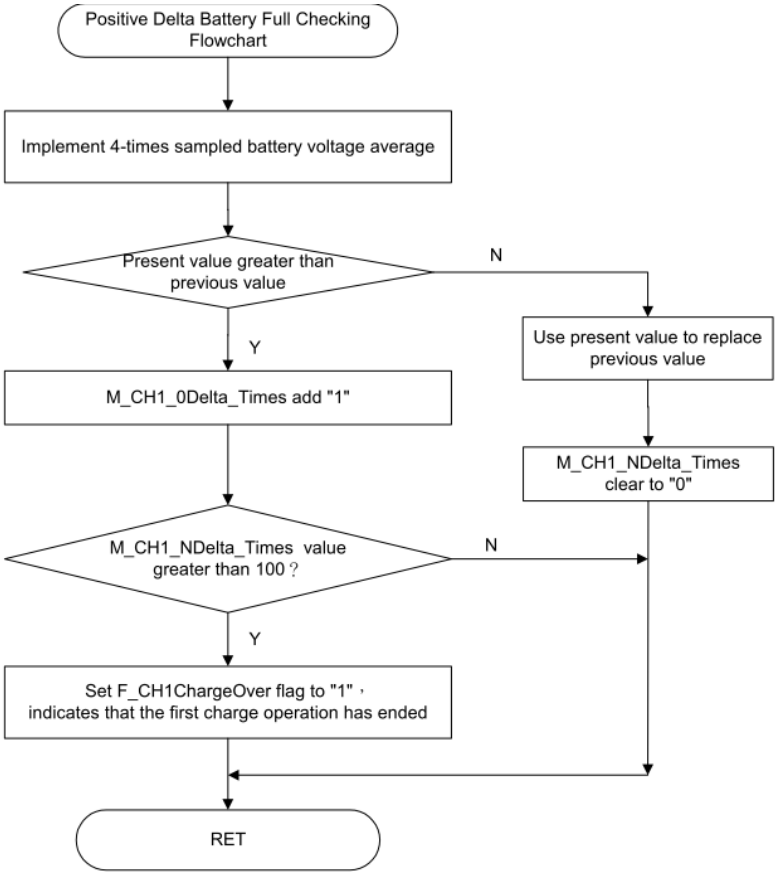
0-Delta Determination of Full Battery Flowchart

The 0-delta method of determining if a battery is fully charged is to look for a period of no overall battery voltage change within a fixed time interval. Before this time interval is reached if the previous two voltage measurements are not the same then the timer should be reset.



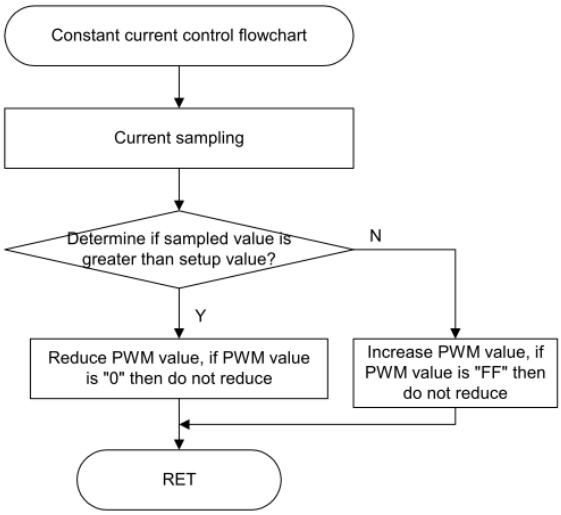
Negative Delta Determination of Full Battery Flowchart

The Negative Delta method of determining if the battery is fully charged is during charging to find the peak voltage value. After finding the voltage peak value, then, if within a predetermined time period, if the voltage falls to less than the peak value, then the battery is deemed to be fully charged.



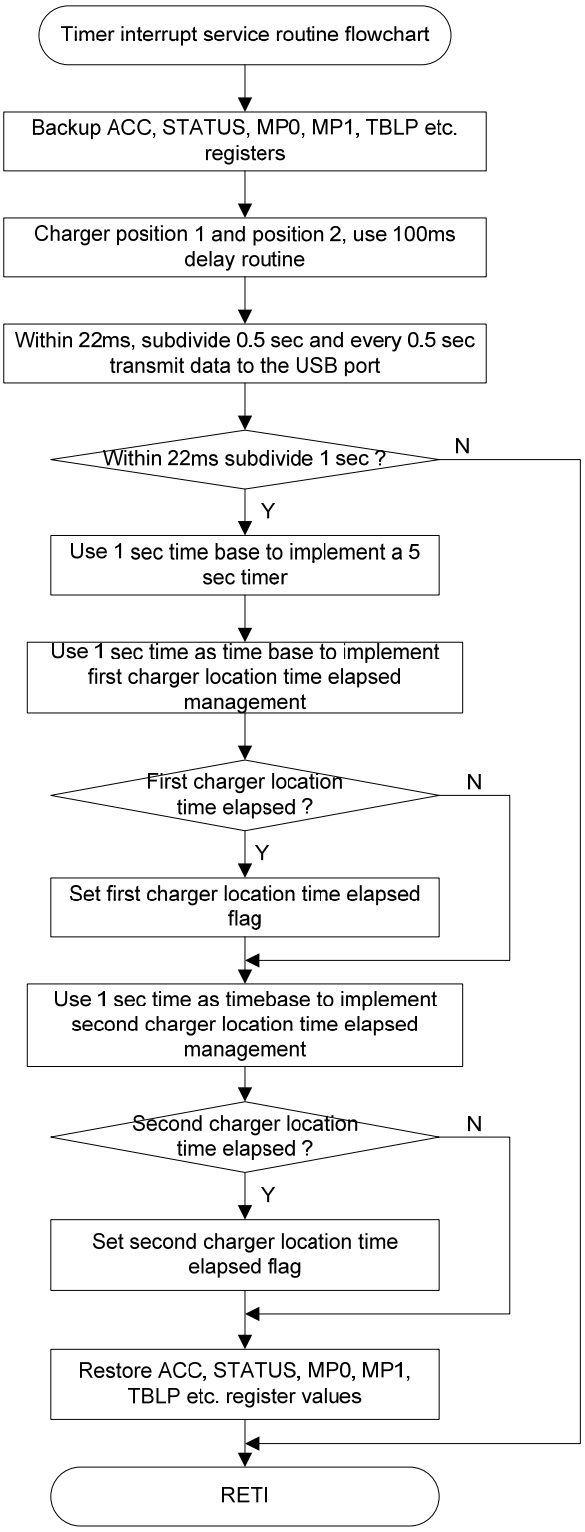
Constant Current Control Flowchart

The constant current control flowchart runs according to the sampled current value to adjust the PWM output to maintain a constant current value.



Timer Interrupt Flowchart

The timer interrupt routine main function is to manage frequency and time functions. Timer 1 has a time interrupt period of 22ms, and uses this time to create a 0.5sec. and 1 sec. time base. This base is the foundation for a 5 sec. timer and charge countdown function.



PCB Layout Points to Note

- D+ D- should be kept as parallel as possible
- The USB data line D+ and D- should be kept away from the PWM lines
- The V330 capacitor should be located close to the IC.
- The crystal should be located close to the IC.
- The RESET circuit should be located close to the IC.
- The capacitor between the power supply and ground should be located close to the IC.
- The USB interface shield should be connected to ground.

Appendix

HT82A620R-USB-Charger.zip

Reference

The HT 82A620R datasheet.

The above information can be downloaded at http://www.holtek.com.cn, http://www.holtek.com.tw