

LDR5409 Manual mobile power applications

REV2.1

Version History

REV1.0	Version Created	2014-01-01
REV2.0	Change the power measurement mode is Coulomb calculation	2014-06-20
REV2.1	Increased digital application program	2014-08-08

Shenzhen City Music Technology Co., Ltd. was Rui

www.legendarry.net.cn

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1 Brief introduction

The program uses self-developed Swiss happy OTP devices LDR5409 charging and discharging the entire process as a whole management system master chip. And with a digital display driver, which can be accessed LED, LCD monitor or scheme has high efficiency, low ripple, system security, the characteristics of high stability, since the main chip has a reference voltage correcting function, when mass production can Consistency. Compared with the traditional discrete solutions and hardware solutions triple, triple happy to Swiss synchronous rectification scheme taking into account the high efficiency, low heat, low cost requirements.

2 Features

2.1 main chip features

- ◇ operating voltage of 2.2V ~ 5.5V
- ◇ set charging management, synchronous boost, power measurement, the display driver in one
- ◇ integrated digital integrating circuit, coulometric calculation method can accurately metered quantity
- ◇ operating voltage of 2.2V ~ 5.5V
- ◇ sleep mode current is less than 1uA
- ◇ package SSOP20

2.2 Program Features

- ◇ input 5V / 2A; output 5V / 2.1A ◇ automatic load detection, USB charging
- detecting insertion protection mechanisms ◇: over-discharge protection, overcharge protection, short circuit protection function ◇ overcurrent buck
- ◇ 2A (3.7V) output ripple is less than 100mV
- ◇ KeyPressVector, battery indicator, lighting and other functions can be
- customized static power consumption is less than 50uA ◇ ◇ machine can be
- accessed digital, the LCD display
- ◇ machine BOM less components, system stability, cost-effective

2.3 Technical Specifications

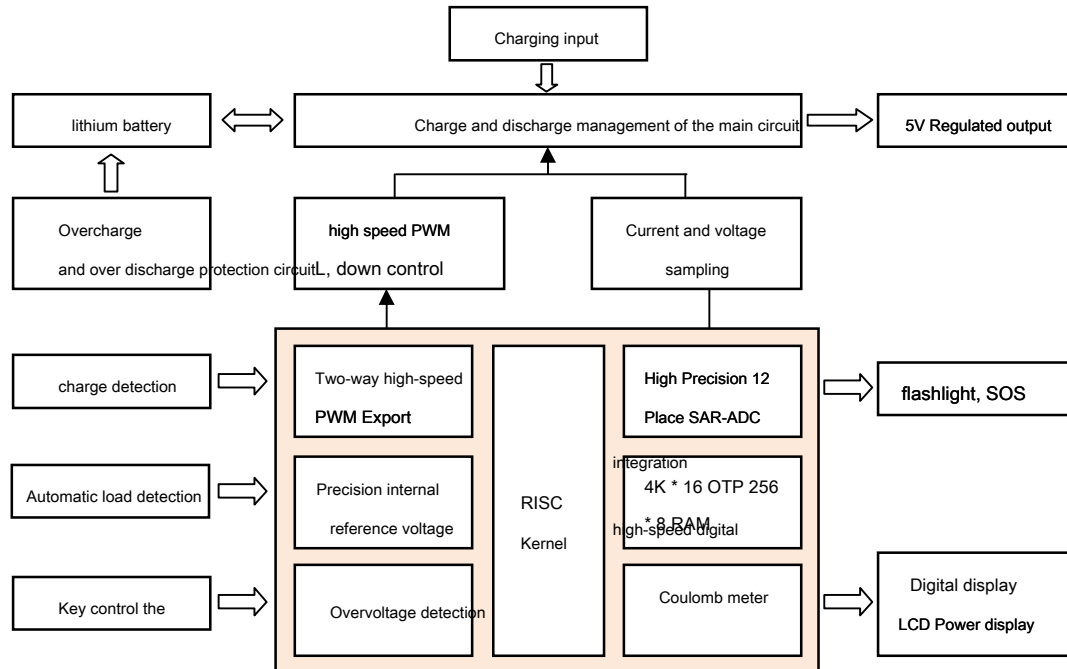
Table 1 specifications of charge and discharge

project	regulation	grid
1. Charging part:		
1.1 Input Voltage	5V / 2A	
1.2 Constant Current	When the battery voltage $\geq 3.0V$: 2000mA $\pm$ 50mA	
1.3 Constant Pressure	4.2V $\pm$ 1%	
1.4 saturation condition determination	voltage and the current $\leq 180mA$ $\geq 4.2V$	
2. Discharge portion:		
2.1 Output Voltage	Click the button to view power, while the output open	
2.2 output load current 5V / 2A	1A	
2.3 discharge efficiency	3.7V@1A average efficiency $\geq 92\%$, 3.7V @ 2A average efficiency $\geq 88\%$	
2.4 overcurrent protection	USB $\geq 2.3A$ limiting buck, 3.0A cut output	
2.5 Output Ripple	3.7V@2A ripple less than 100mV	
2.6 Low-voltage protection in the discharged state	the battery voltage is below 2.8V, automatic shutdown	

Table 2 Other specifications

project	specification	
3. LCD / LED significant illustrates part:		
3.1 Charge level LCD / LED display	3.0V <Voltage <full	Charge percentage LCD display, IN
	full	LCD power display 100%, IN
	3.0V <Voltage <full	LED battery indicator percentage
	full	LED power display 100
3.2 discharge capacity LCD / LED display	Voltage <3.0V	LCD display 1%, OUT
	3.3V <voltage <4.2V	Charge percentage LCD display, OUT, 1A and 2A indicate
	Voltage <3.0V	Digital display 1%
	3.3V <voltage <4.2V	Digital display battery percentage
3.3 under the charged state, LCD backlight / LED lights up automatically		
3.4 click the button back light up, backlight off after 42 seconds		
3.5 charging end, no load, no input voltage, the machine enters the standby state		
4. Key:		
Under the sleep mode, press the button, click on the button 42 seconds after the LCD backlight brightness closed; while the output opening, then closing the no-load output 42 seconds, press the key twice, bright lights, and then press the button twice in short, lighting lamp, press button 2 seconds off.		
The battery protection board claim :		
5.1 overcharge protection voltage	4.2V ± 50mV	
5.2 overdischarge protection voltage	3.0V ± 50mV	
6. Other:		
6.1 Machine static power ≤50μA		

3 System Block Diagram



3.1 system block diagram illustrating

A, overcharge and over discharge protection circuit using a dedicated lithium battery protection chip, the lithium battery can be avoided due to overcharging, over-discharge, excessive current decreased battery life or battery is damaged, the voltage detection with high accuracy the time delay circuit.

B, charging management, including pre-charge, trickle, constant current and constant voltage four processes, LDR5409 by high precision ADC charging current and battery voltage sampling can be achieved self-regulating charging current, the charging process is reliable, efficient, current uniform. Charging voltage, the charging current can be set via a free program, in order to meet the needs of a variety of products.

C, including discharge management overshoot protection, excessive discharging protection current, constant voltage output. LDR5409 speed by PWM and PFM rate control algorithm requires fewer external components can control the output ripple 100mV or less.

D, a battery LCD / LED indication, easy for users to check the battery condition. With bright LED lights, can be used as sparingly as sparingly flashlight LED flashlight, the flashlight comes SOS customized outdoor flash.

E, keys for testing or the discharge power-off control.

F, USB insertion detection:

USB charging access, via the resistor divider, the master IC to the high level is detected, the system automatically enters the charging management.

G, power display (customizable)

Light through the LCD / LED or LCD display flickering patterns indicate the current battery charge mode, the current operating state.

H, KeyPressVector (customizable)

Button mainly used for user interaction with the system. Click the button system boost, lights indicate the current battery charge, double-click the button light or flashlight off.

I, the protection circuit

The system uses a dedicated lithium battery protection chip, can effectively avoid the lithium battery due to overcharge, overdischarge, overcurrent decreased battery life or battery being damaged.

J, the charging current sampling resistor

When the mobile power charging, by the pressure difference between the detected current sampling resistor to the charging current is determined, whereby magnitude of the current control IC operation accordingly, trickle, constant current or constant voltage control.

K, battery detection

The master IC pin VDD can be used as a detection of the battery, saving 1 / 0 and the external battery voltage detecting circuit dividing.

L, charge and discharge circuit

Synchronous rectification discharge management, can effectively improve the power conversion efficiency.

M, resistor network

Power applied to the resistor network for mobile phones of different brands, different manufacturers phone charging current required for this network configuration is different.

N, output current sampling resistor

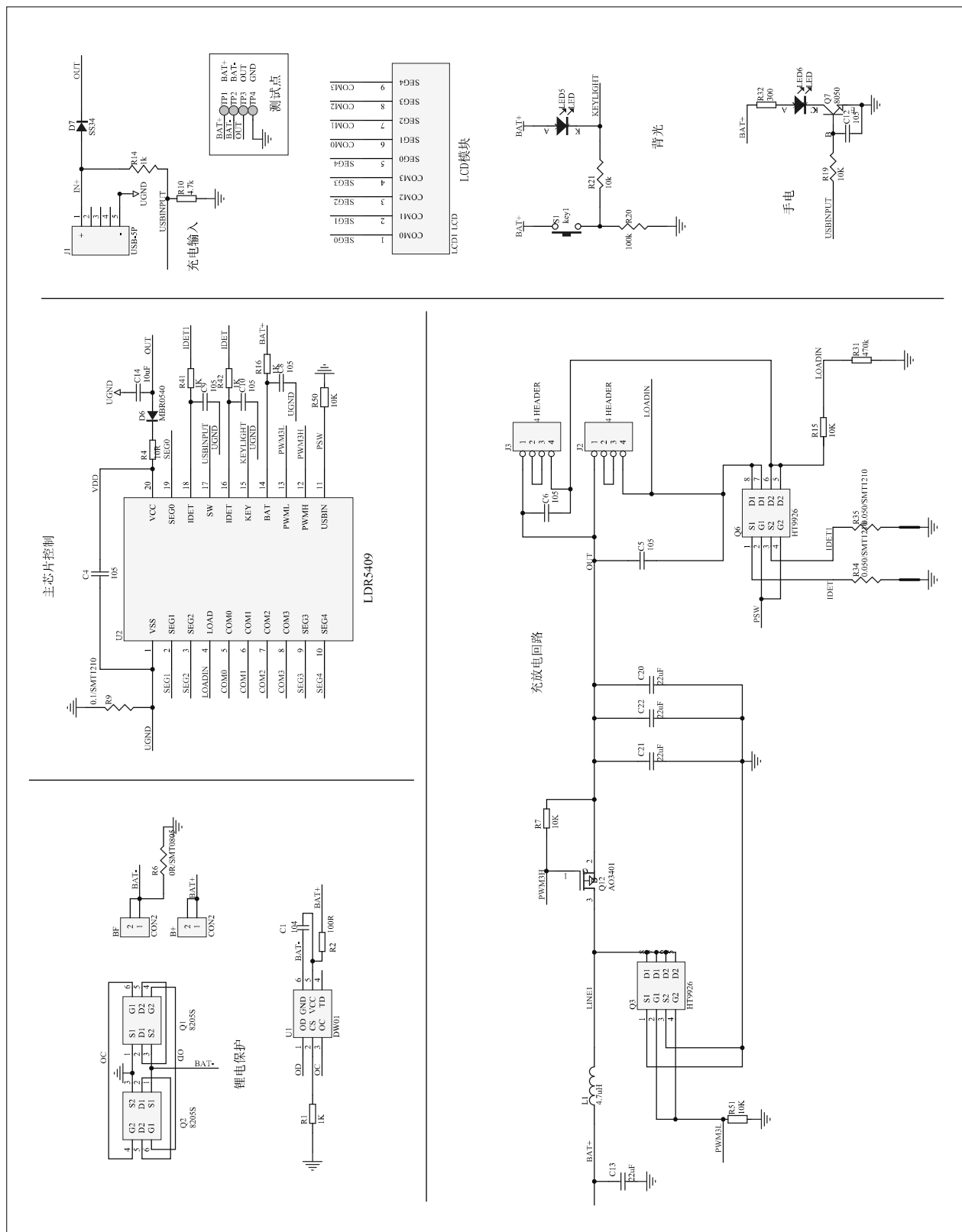
When the mobile power to the load discharge, detected by the pressure difference between the current sense resistor to determine the size of the discharge current, the magnitude of the current control IC accordingly controlled accordingly.

O, automatic load detection

When a load is automatically inserted, this setting will wake up the system, the system into operation to load and discharge, eliminating the need to re-press the button system was cumbersome load discharge.

4 Typical applications

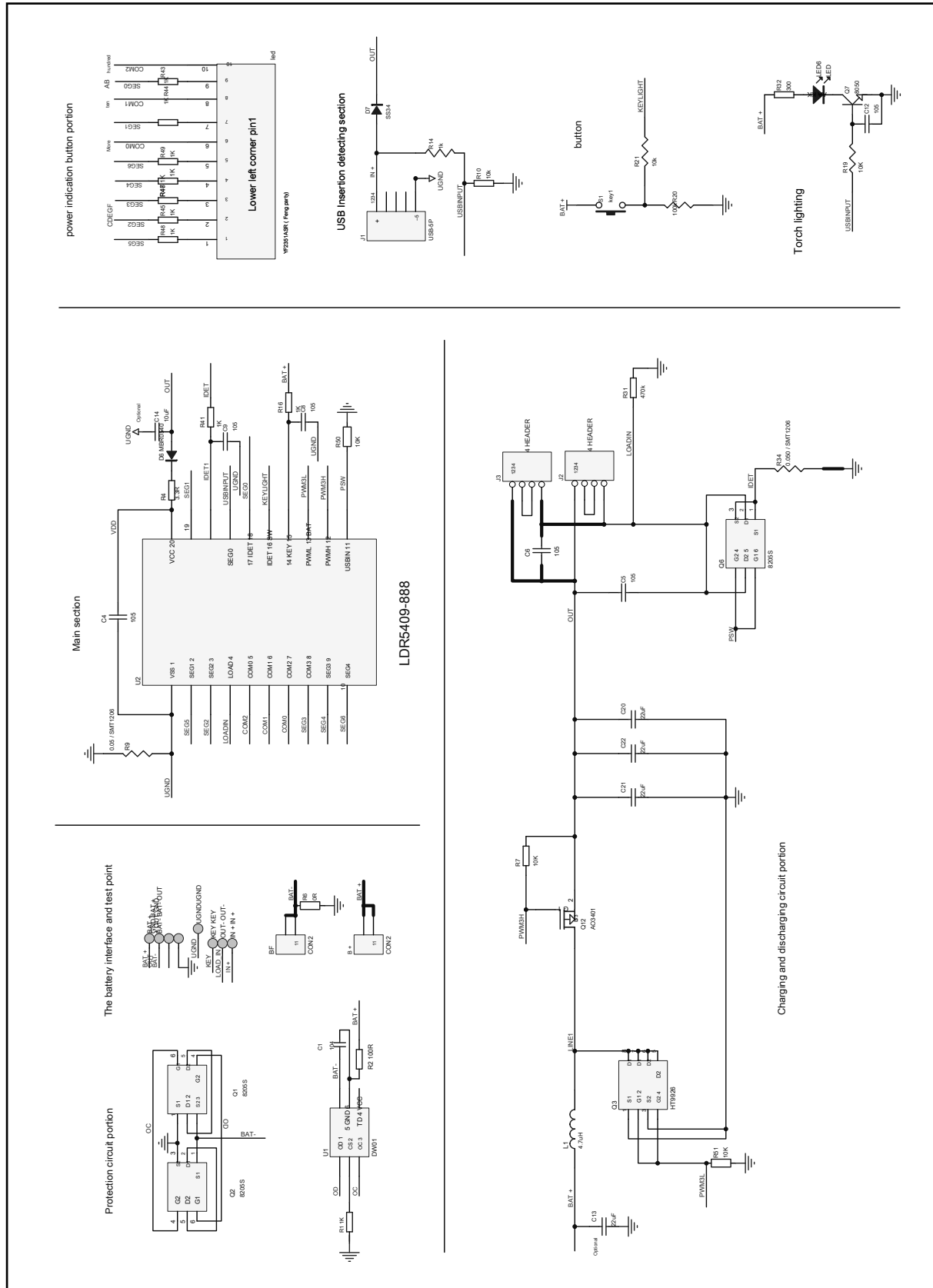
4.1 LCD display solutions



4.2 LCD display scheme BOM

NO	STABLE	P / N	PK	QTY
1	U2	LDR5409	SOP20	1
2	R34, R35, R9	0.05Ω / ± 1% / 1 / 4W	1206	3
3	R6	0Ω / ± 5%	0805	1
4	R31	470K / ± 5%	0603	1
5	R20	100K / ± 5%	0603	1
6	R10	4.7K / ± 5%	0603	1
7	R21, R15, R50, R51, R7	10K / ± 5%	0603	5
8	R4	10Ω / ± 5%	0603	1
9	R41, R42, R14, R16	1K / ± 5%	0603	4
10	C4, C5, C6, C9, C10, C8	105 / 1uF / 6.3V	0603	6
11	C20, C22, C21	226 / 22uF / 6.3V	0805	3
12	L1	4.7uH	CD75	1
13	Q3, Q6	HT9926	SOP8	2
14	Q12	A03401	SOT23	1
15	LED5	backlight		1
16	S1	button		1
17	LCD1	LCD screen		1
18	D6	MBR0540 / S4 diode SOD-123/1206		1
19	D7	SS34	DO-214	1
20	J1	USB-5P	MICRO-USB	1
twenty one	J2, J3	USB-4P-03	USB female head	2
<u>TOTAL</u>				39
<u>flashlight</u> Lighting unit				
1	R32	100Ω / ± 5%	0603	1
2	C12	105 / 1uF / 6.3V	0603	1
3	R19	10K / ± 5%	0603	1
4	LED6	LED flashlight		1
5	Q7	S8050	SOT23	1
<u>TOTAL</u>				5
<u>note:</u> R6 = 0R (0805), and compatible with lithium protection unit, wherein only a selection;				
<u>Paul lithium</u> Care unit				
1	U1	DW01	SOT23-6	1
2	Q1, Q2	8205S	SOT23-6	2
3	R1	1K / ± 5%	0603	1
4	R2	100R / ± 5%	0603	1
5	C1	104 / 0.1uF / 10V	0603	1
<u>TOTAL</u>				6

4.3 digital display program type -888 (customizable 88,188,188C type)



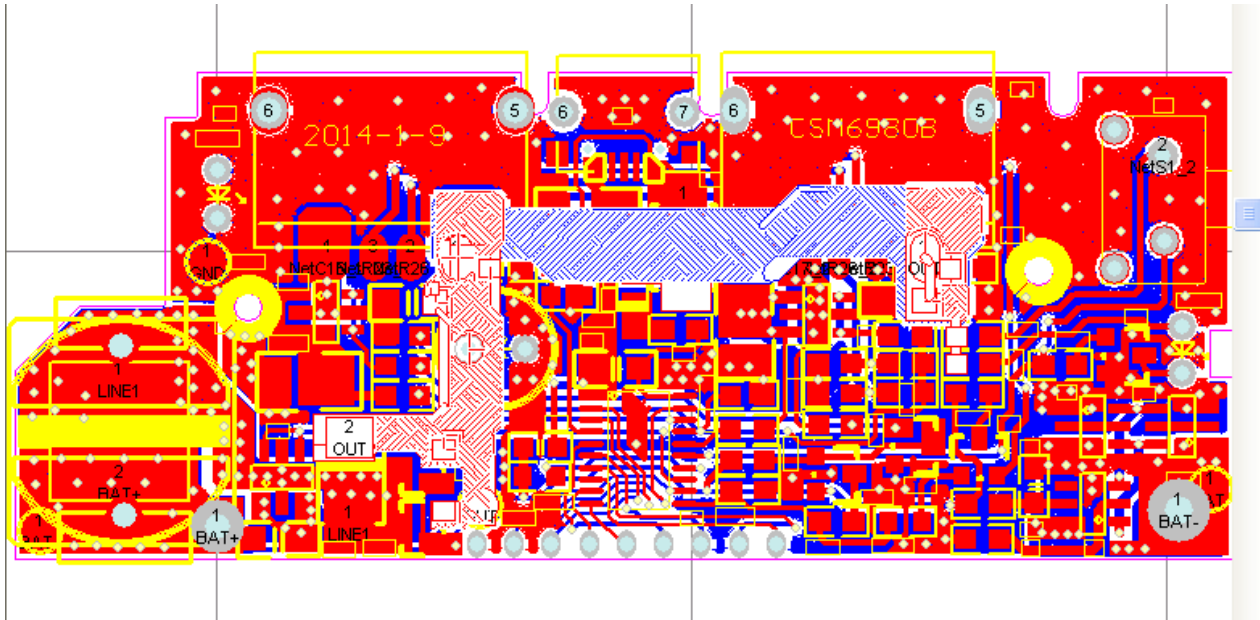
4.4 digital display program -888 type BOM (customizable 88,188,188C type)

NO	STABLE	P / N	PK	QTY
1	U2	Happy Swiss LDR5409-888	SOP20	1
2	R34, R9	0.05Ω / ± 1% / 1 / 4W	1206	2
3	R6	0Ω / ± 5%	0805	1
4	R31	470K / ± 5%	0603	1
5	R20	100K / ± 5%	0603	1
6	R10	4.7K / ± 5%	0603	1
7	R21, R50, R51, R7	10K / ± 5%	0603	4
8	R4	3.3Ω / ± 5%	0603	1
9	R43, R44, R45, R46, R47, R48, R49, R41, R14, R16	1K / ± 5%	0603	10
10	C4, C5, C6, C9, C8	105 / 1uF / 6.3V	0603	5
11	C20, C22, C21	226 / 22uF / 6.3V	0805	3
12	L1	4.7uH	CD54	1
13	Q3	9926	SOP-8	1
14	Q6	8205S	SOT23-6	1
15	Q12	A03401	SOT23	1
16	S1	button		1
17	D1	Digital Tube		1
18	D6	MBR0540 / S4 diode	SOD-123/1206	1
19	D7	SS34	DO-214	1
20	J1	USB-5P	MICRO-USB	1
twenty one	J2, J3	USB-4P-03	USB female head	2
<u>TOTAL</u>				41
flashlight unit				
1	R32	300Ω / ± 5%	0603	1
2	R19	10K / ± 5%	0603	1
3	C12	105 / 1uF / 6.3V	0603	1
4	Q7	S8050	SOT23	1
5	LED5	flashlight	5MM	1
<u>TOTAL</u>				5
note: R6 = 0R (0805), and compatible with lithium protection unit, wherein only a selection;				
Paul lithium Care unit				
1	U1	DW01	SOT23-6	1
2	Q1, Q2	8205S	SOT23-6	2
3	R1	1K / ± 5%	0603	1
4	R2	100R / ± 5%	0603	1
4	C1	104 / 0.1uF / 10V	0603	1
<u>TOTAL</u>				6

5 LAYOUT Notes (with 913 plate type, for example)

5.1 an output terminal wiring

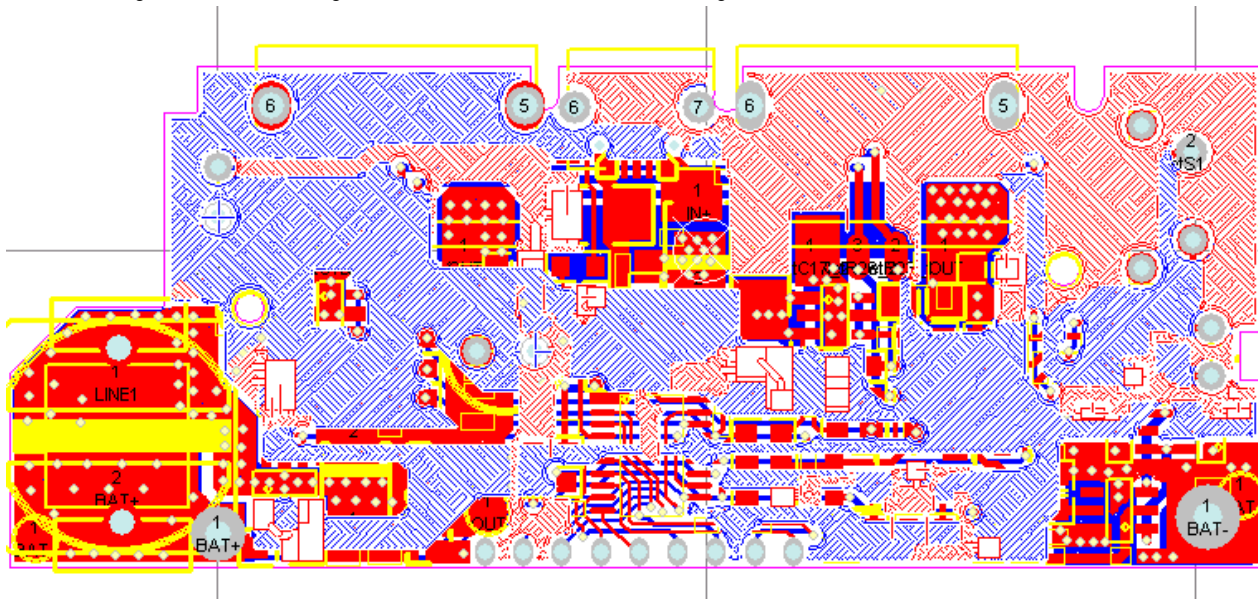
The figure is a schematic diagram of a network called network cabling OUT



We need to consider associated with this network device is placed in position, as close as possible, to avoid this network lines are stretched and cause can not be achieved 2mm cabling, network cabling other equally bold can do the same reference. By the large current charging circuit and discharging circuit, a number of devices as close as possible, as short lines, thick (2.4mm or more to reach as far as possible), as far as possible in the same layer. If the board due to limited, should give priority to these network lines, as related to electrical energy conversion efficiency of the entire system.

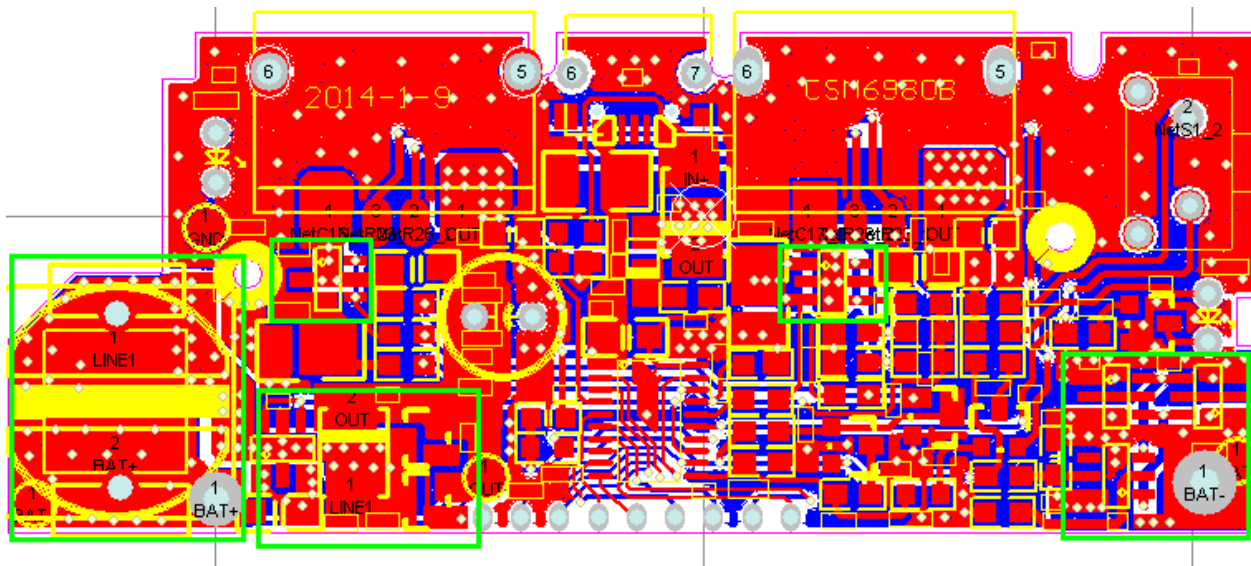
5.2 Ground

The figure is a schematic diagram of a network called GND network cabling



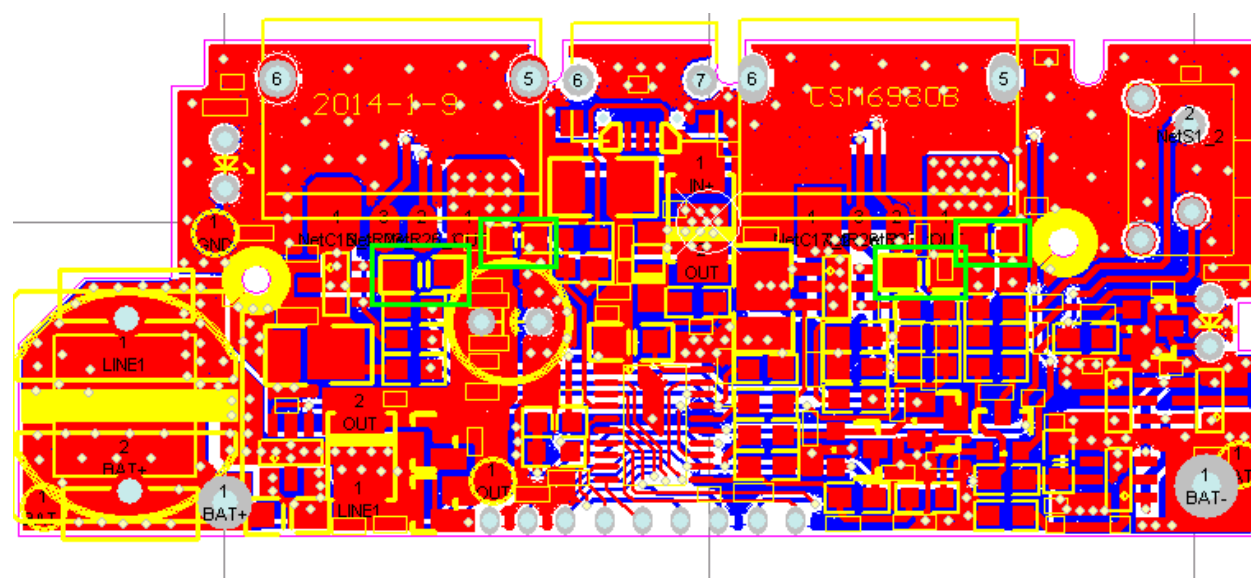
Chosen to shop copper, more conducive to the stability of the system as a whole

5.3 heat-generating components



System, there are several heat-generating components (FIG green block device): an inductor (L1), a diode (SS34), PMOS tubes 3401, 8205, DW01, the master IC should be far away from heat source, so as not to put the back inductance release of the active device, shop copper, sampling resistor close to the master IC.

5.4 filter capacitor



In order to reduce output ripple, the discharge output of the output filter capacitor should be as close to the USB port profile (as shown in black green)