SC4054E

Micro linear battery management IC

Features

- ◆Programmable charging current up to 500mA.
- ◆No MOSFET, sensing resistors, and blocking diodes are required.
- ◆Small size to achieve full linear charge management of lithium ion batteries.
- ◆Constant current/constant voltage operation and heat regulation allow for maximum battery management effectiveness without the risk of overheat.
- ◆Manage a single lithium-ion battery from a USB port.
- ◆The preset charging voltage: 4.2V±1%
- ◆Charge current output monitoring.
- ◆Charging status indicator.
- ◆Charging current terminates 1/10
- ◆Provide 25μA current when stopped working.
- ◆Trickle charging threshold voltage:2.9V.
- ◆Soft start limits surge current current.

Application

- ◆ Mobile phone，PDA，MP3
- ◆ Bluetooth application

Description

SC4054E is a perfect single-chip constant current/constant voltage linear power management chip for lithium ion batteries.Its thin size and small outer packaging make it easy for portable applications.What's more, the SC4054E is specifically designed to work with USB power supply specifications. Thanks to the internal MOSFET structure, external resistors and blocking diodes are not required for applications. During high energy operation and high peripheral temperature, thermal feedback can control the charging current to reduce the chip temperature.

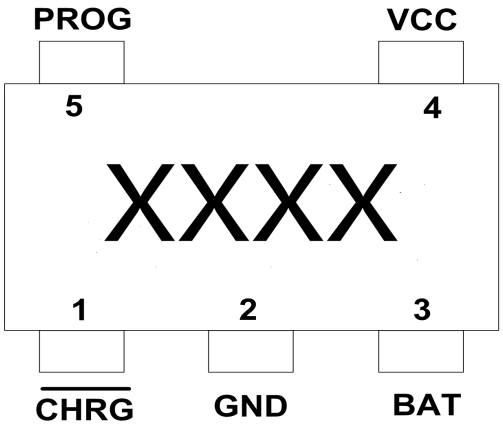
The charging voltage is limited to 4.2V and the charging current is regulated by an external resistor. After reaching the target charging voltage, the SC4054E will automatically end the charging process when the charging current is reduced to 1/10 of the set value. When the input terminal (the plug or USB power supply) is removed, the SC4054E automatically enters the low current state, and the battery leakage current is less than 2μA. The SC4054E can be set to stop working, and the power supply current is reduced to 25μA.

SC4054E ensures that the chip automatically enters the protection state when the battery is reversed. This ensures that the IC will not be broken down and the battery self-discharge may cause accidents.

Other features include: charge current monitoring, input low voltage latching, automatic recharging and charging full and start signs.

Pin Configuration and Functions

SOT-23-5L



NO.	NAME	Description
1	CHRG	Drain open charging state output.
2	GND	Ground terminal
3	BAT	Charging current output
4	VCC	Provide a positive voltage input
5	PROG	Charge current programming, charge current monitoring and shutdown terminal

Pin Functions

CHRG（Pin 1）： Drain open charging state output. When charged, the CHRG port is placed at low potential by a built-in n-channel MOSFET. When charging is complete, the CHRG presents a high resistance state. When SC4054E detects a low electrical locking condition, the CHRG presents a high resistance state. When there is a capacitor of 1μF between the BAT pin and the ground, the indicator of whether the battery is properly connected can be completed. When there is no battery, the LED light will blink quickly.

GND（Pin 2）： Ground terminal

BAT（Pin 3）： Charging current output. The charge current is supplied to the battery and the floating voltage is controlled to finally reach 4.2V. When the battery is reversed, the internal protection circuit protects the ESD diode of the VBAT from being burned out, and the current between GND and BAT is about 0.7mA.

VCC（Pin 4）： Provide a positive voltage input. Power the charger. VCCS can range from 4.25V to 6.5V and must have a bypass capacitance of at least 1μF. If the pressure difference between the BAT pin terminal voltage and VCC is reduced to less than 30mV, SC4054E enters the shutdown state, and the BAT current is reduced to less than 2μA.

PROG（Pin 5）： Charge current programming, charge current monitoring and shutdown terminal. The charging current is controlled by a resistance to the ground with an accuracy of 1%. This port provides a voltage of 1V at constant charging current. In all states, the port voltage can be calculated by the following formula:

$I_{BAT} = (V_{PROG}/R_{PROG}) \times 1000$。

The PROG port can also be used to turn off the charger. By separating the programming resistance from the ground end, the PROG port voltage can be raised by pulling up the 2μA current source. When the limit shutdown voltage of 1.21V is reached, the actuator enters the stop working state, the charging ends, and the input current drops to 25μA. This port clamp off voltage is about 2.4V. Voltage supplied to this port in excess of the clipping voltage will yield a high current of 1.5mA. The combination of PROG and ground end will return the charger to normal state.

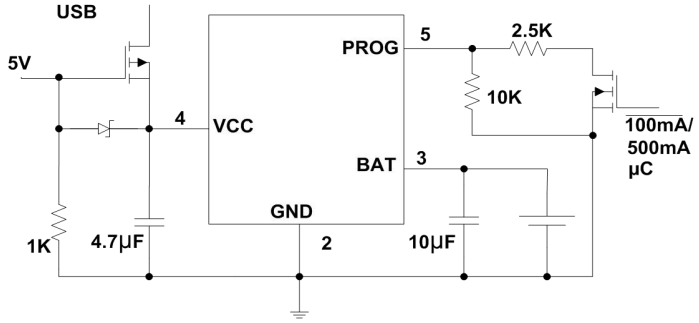
Absolute Maximum Ratings (1)

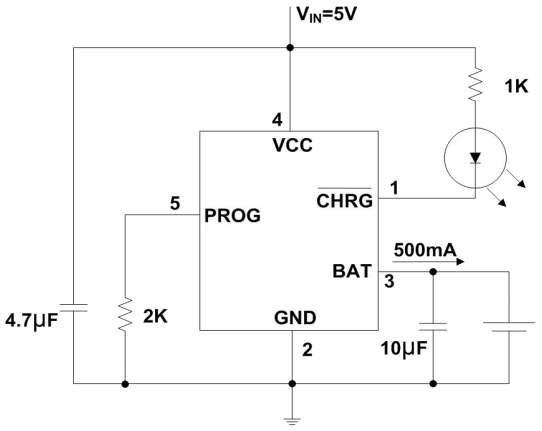
symbol	Description	Range	UNIT
V_{CC}	Input voltage	Vss-0.3~Vss+7	V
V_{PROG}	PROG voltage	Vss-0.3~Vss+0.3	V
V_{BAT}	BAT voltage	Vss-0.3~7	V
V_{CHRG}	CHRG voltage	Vss-0.3~Vss+1	V
P_{DMAX}	Power consumption	250	mW
I_{BAT}	BATcurrent	500	mA
I_{PROG}	PROG current	800	μA
V_{ESD}	Human body mode ESD capability	2	kV
T_{OPA}	Operating peripheral temperature	-40~+85	℃
T_{STR}	Storage temperature	-65~+125	℃

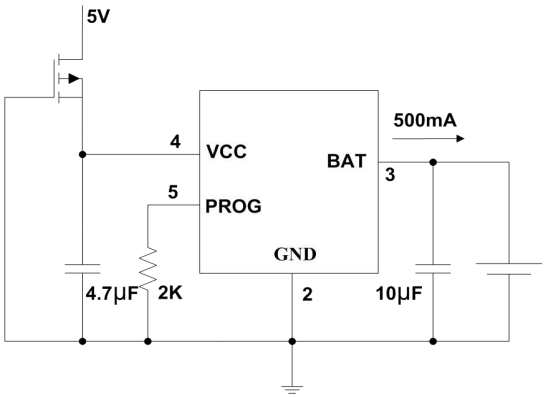
NOTE 1: Devices outside the maximum range may be damaged. The device can work within the recommended operating range, but its characteristics are not guaranteed. The DC and AC characteristics indicated by the electrical characteristics are measured under certain conditions and their characteristics can be guaranteed. This feature assumes that the device operates within the recommended operating range. Not shown does not guarantee its performance. Typical values are optimal performance points.

Typical Application

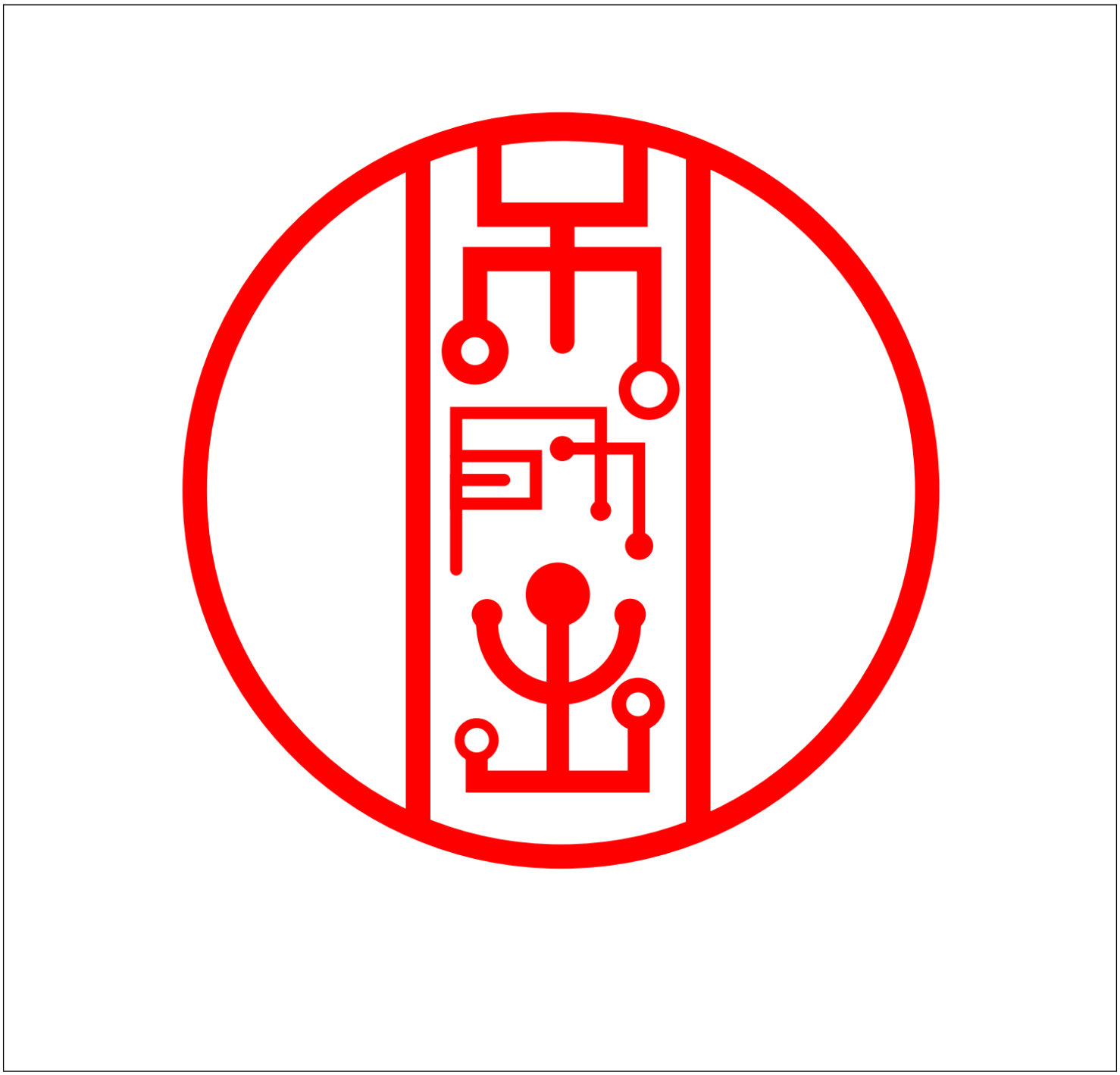
Typical circuit







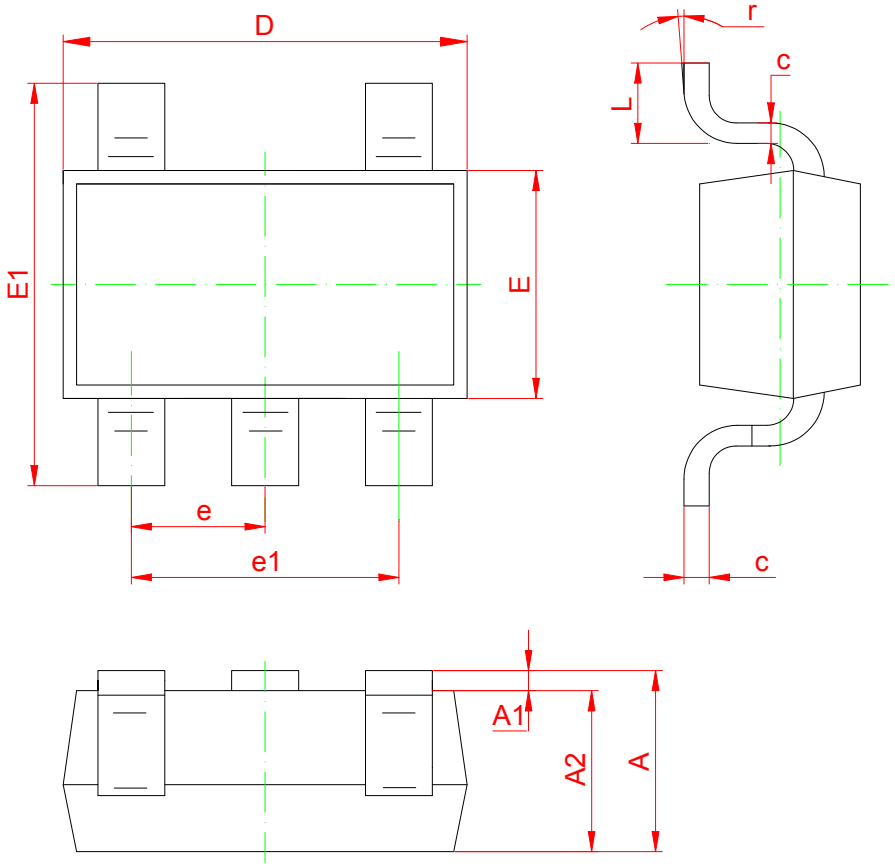
Functional Block Diagram



Electrical Characteristics

Symbol	Description	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{CC}	Input voltage		4.2		6.5	V
I_{CC}	Input current	Turn-on mode(R_{PROG}=10KΩ)		300	2000	μA
		Standby mode		200	500	μA
		Turn-off mode（R_{PROG} not connected,V_{CC}<V_{BAT} or V_{CC}<V_{UV})		25	50	μA
V_{FLOAT}	Output control voltage	0℃<Ta<85℃，Ibat=40mA	4.158	4.2	4.242	V
I_{BAT}	BAT current	R_{PROG}=10K，Current mode	93	100	107	mA
		R_{PROG}=2K，Current mode	465	500	535	mA
		V_{BAT}=4.2V，Standby mode	0	-2.5	-6	μA
		Turn-off mode		1	2	μA
		V_{BAT}= - 4V,Reverse connection		0.7		mA
		V_{CC}=0V，Sleep mode		1	2	μA
I_{TRIKL}	Trickle charging current	V_{BAT}<V_{TRIKL}，R_{PROG}=2K	40	50	60	mA
V_{TRIKL}	Trickle charging limit voltage	R_{PROG}=10K，V_{BAT} Go up	2.8	2.9	3.0	V
V_{TRHYS}	Trickle charge hysteresis voltage	R_{PROG}=10K	60	80	110	mV
V_{UV}	The voltage of the power supply is lower than the cut-off threshold	VCC goes up from low	3.7	3.8	3.93	V
V_{UVHYS}	Low hysteresis voltage of the power supply		150	200	300	mV
V_{MSD}	Manually turn off the threshold voltage	PROG Go up	1.15	1.21	1.30	V
		PROG Go up	0.9	1.0	1.1	V
V_{ASD}	V_{CC}-V_{BAT}Stop working threshold voltage	V_{CC} From low to high	70	100	140	mV
		V_{CC} From high to low	5	30	50	mV
I_{TERM}	C/10Terminal threshold current	R_{PROG}=10K	0.085	0.10	0.115	mA/ mA
		R_{PROG}=2K	0.085	0.10	0.115	
V_{PROG}	Voltage of PROG	R_{PROG}=10K，Current mode	0.93	1.0	1.07	V
V_{CHRG}	Minimum output voltage of CHRG terminal	I_{CHRG}=5mA		0.35	0.6	V
ΔV_{RECG}	Battery recharging hysteresis voltage	V_{FLOAT}-V_{RECHRG}		100	200	mV
t_{RECHG}	Charging comparator filter time	VBAT from high to low	0.8	1.8	4	mS
t_{TERM}	Terminating comparator filtering time	The IBAT dropped below ICHG/10	0.63	1.4	3	mS
I_{PROG}	PROG foot pull-up current			2		μA

Package Outline：SOT-23-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
r	0°	8°	0°	8°