

Overview

TP4054It is a single-cell lithium-ion battery constant current/constant voltage linear charger. The simple external application circuit is very suitable for portable equipment applications.USB The device works with power supply and adapter power supply, and adopts internal anti-reverse charging circuit, without external isolation diode. Thermal feedback can automatically adjust the charging current to limit the chip temperature under high power operation or high ambient temperature conditions.

TP4054The charging cut-off voltage is4.2VThe charging current can be set by an external resistor.1/10hour,TP4054Will

The charging process ends automatically.

When the input voltage is removed,TP4054Automatically enters low current standby state, reducing the standby current to3uA.

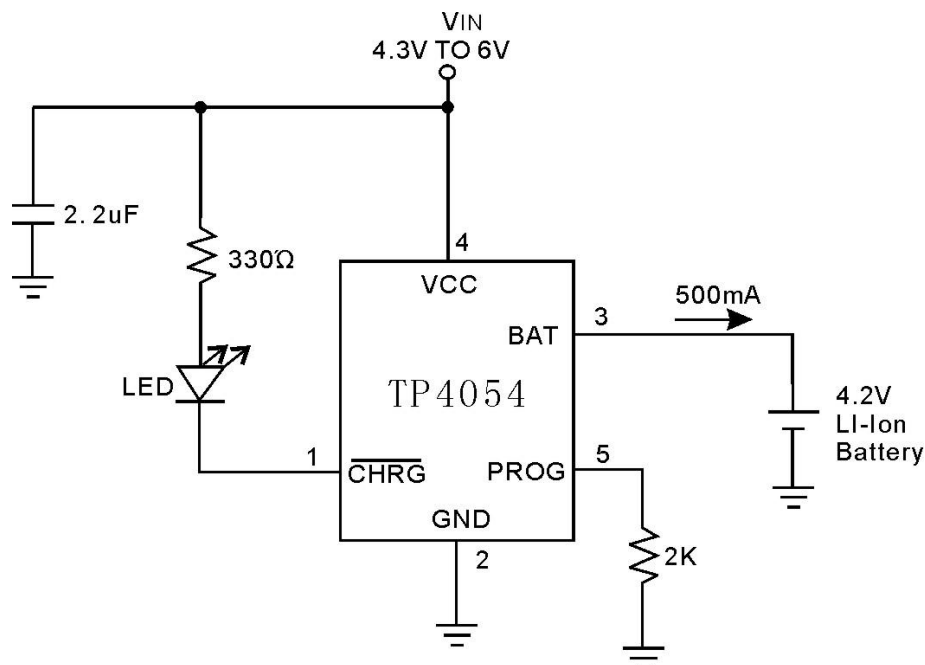
Features

- Maximum charging current:600mA
- The indicator light flashes when the battery contact is poor
- No needMOSFET, Detection resistorandIsolation diode
- Intelligent thermal regulation maximizes charging rate
- Smart recharging function
- Pre-charge voltage:4.2V±1%
- C/10Charge Termination
- 2.9VTrickle charge threshold
- Package:SOT23-5

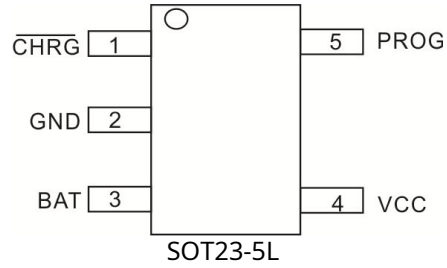
application

- cell phone,PDA,MP3/MP4
- Bluetooth earphone,GPS
- Charging station
- digital camera,MiniPortable devices such as speakers

Typical application circuit



Pins



Ordering Information

Encapsulation	Order model	package style	Product Printing
SOT23-5L	TP4054	Tape and Reel	TP4054

Limit parameters (Note1)

symbol	parameter	Rating	unit
VCC	Input power voltage	- 0.3~7	V
PROG	PROGFoot voltage	- 0.3~0.3	V
BAT	BATFoot voltage	- 0.3~7	V
CHG	CHGFoot voltage	- 0.3~7	V
T _{BAT_SHT}	BATFoot short circuit duration	continuous	-
I _{BAT}	BATFoot current	600	mA
I _{PROG}	PROGFoot current	600	uA
T _{OP}	Working temperature	- 40~85	°C
T _{STG}	Storage temperature	- 65~125	°C
ESD	HBM	2000	V
	MM	200	V

Note1: The maximum limit value means that the chip may be damaged if it exceeds this working range.

Electrical parameters (Note2,3)

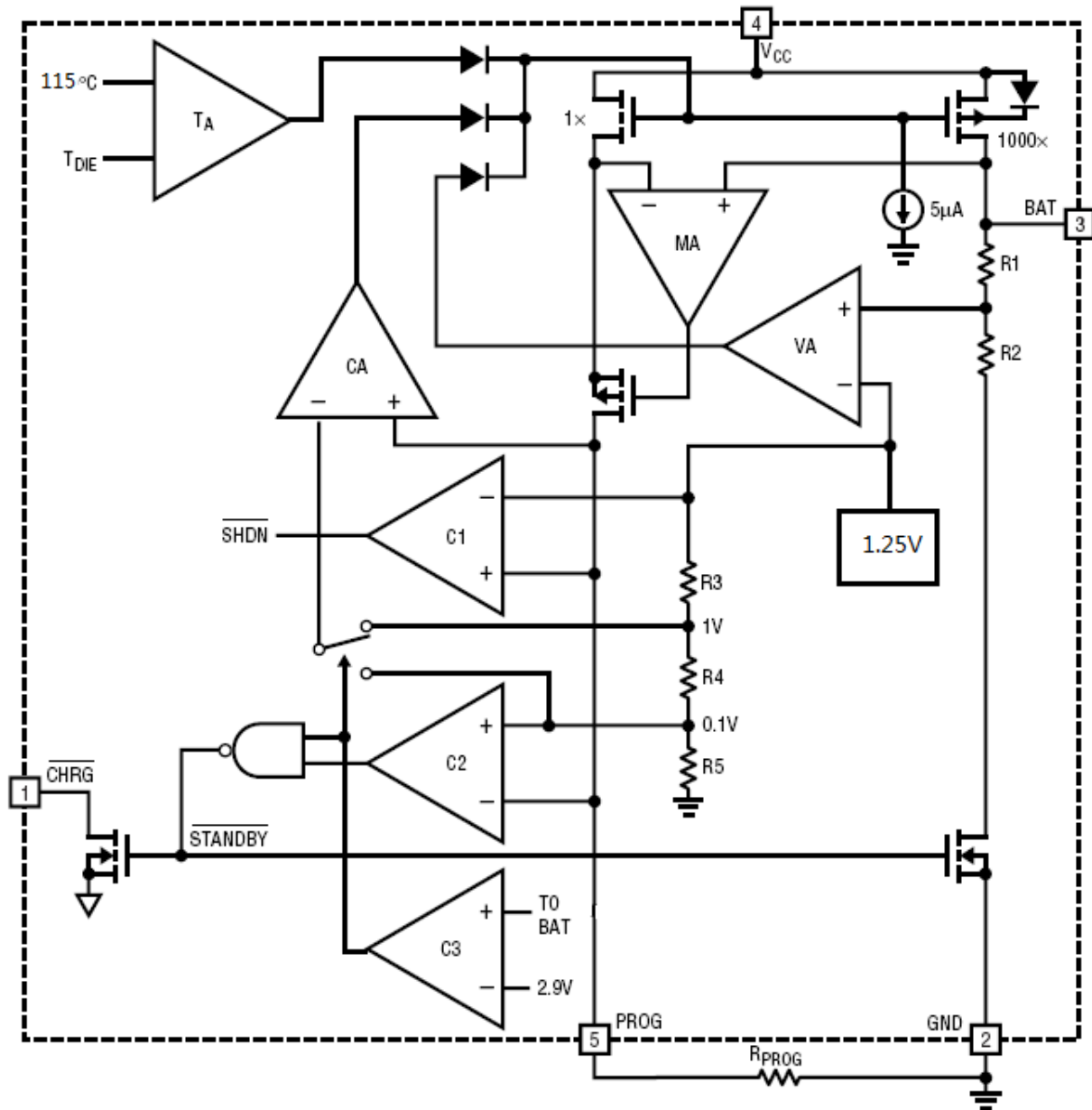
No special instructions, VIN=12V, Ta=25°C

symbol	parameter	Test Conditions	Minimum	Typical Value	Maximum	unit
V _{CC}	Input power voltage		4.0	5	6	V
V _{FLOAT}	Output float charge voltage	0°C ≤ T _A ≤ 85°C	4.158	4.2	4.242	V
I _C	Constant current charging current	R _{PROG} =2K, current mode	450	500	550	mA
I _{TRIKL}	Trickle charge current	V _{BAT} < V _{TRIKL} , R _{PROG} =2K	40	60	80	mA
I _{BAT}	BATCurrent	Standby mode (V _{CC} =5V, V _{BAT} =4.2V)		3	5	μA
		Sleep mode, V _{CC} =0		3	5	μA
V _{TRIKL}	Trickle charge threshold voltage	R _{PROG} =2K, V _{BAT} rise	2.8	2.9	3.0	V
V _{TRHYS}	Trickle charge hysteresis voltage	R _{PROG} =2K	60	80	100	mV
V _{UV}	V _{CC} Undervoltage protection threshold voltage	V _{CC} rise	3.5	3.7	3.9	V
V _{UVHYS}	V _{CC} Undervoltage protection hysteresis voltage	V _{CC} decline		0.1		V
V _{ASD}	V _{CC} -V _{BAT} Threshold voltage	V _{CC} rise	60	100	140	mV
		V _{CC} decline	5	30	50	mV
		R _{PROG} =2K	40	60	80	mA
V _{PROG}	PROGPin voltage	R _{PROG} =2K, current mode	0.9	1.0	1.1	V
V _{CHG}	CHGPin output low voltage	I _{CHG} =5 mA		0.3	0.6	V
ΔV _{RECHRG}	Rechargeable batteryThresholdVoltage	V _{FLOAT} -V _{RECHRG}	70	100	150	mV
T _{LIM}	Limited Temperature Mode Junction Temperature			115		°C
R _{ON}	powerFETOn-resistance			800		mΩ
T _{RECHRG}	Recharge comparator filter time	V _{BAT} decline	1	2	3	ms
T _{TERM}	End comparator filter time	I _{BAT} Drop to I _{CHG} /10the following	1	2	3	ms

Note2: Typical parameter values are standard parameter values measured under °C conditions.

Note3: The minimum and maximum specification ranges of the data sheet are guaranteed by testing, and the typical values are guaranteed by design, testing or statistical analysis.

Internal Block Diagram



working principle

TP4054It is a linear charger specially designed for one lithium-ion battery or lithium polymer battery. The chip integrates power transistors. The charging current can be set by external resistors. The maximum continuous charging current can reach600mA.No additional blocking diodes and current sensing resistors are required.TP4054Contains an open-drain output status indicator to indicate that charging is in progress or charging is complete.CHGOutput low level, indicating that charging is in progress. After charging is completed,CHGThe pin becomes high impedance.

If the battery voltage is lower than2.9V,TP4054Use a small current to pre-charge the battery. When the battery voltage exceeds2.9VWhen the battery is charged in constant current mode, the charging current isPROG Pins andGNDThe resistance betweenRPROGYes

When the battery voltage is close to4.2VWhen the voltage increases, the charging current gradually decreases. TP4054Enter the constant voltage charging mode. When the charging current decreases to the charge end threshold, the charging cycle ends. The charge end threshold is the constant current charging current.10%.

When the battery voltage drops to the recharge threshold4.1VWhen the following TP4054Automatically start a new charging cycle. The high-precision voltage reference source, error amplifier and resistor divider network inside the chip ensure the accuracy of the battery terminal modulation voltage within1% When the input voltage is lower than the undervoltage lockout threshold voltage or the input voltage is lower than the battery voltage, the charger enters a low-power sleep mode.

Current is less than 3uA.

TP4054 The internal intelligent temperature control circuit will 115°C, this function allows users to maximize the use of the chip's power handling capabilities, without worrying about damage to the chip or external components due to overheating. In this way, when designing the charging current, users do not need to consider the worst case, but only design according to the typical case because in the worst case, TP4054 The charging current will be reduced automatically.

Pin Function

CHRG(PIN1):Charging status indicator

When the charger is charging the battery, CHG The pin is pulled low by the internal switch to indicate that charging is in progress; when charging is completed, CHG The pin is in high impedance state. If the charger is plugged in but no battery is connected, the indicator light will flash to indicate that the battery is not connected or the battery contact is poor.

GND(PIN2):Power Ground

BAT(PIN3):Battery positive connection

Connect the positive terminal of the battery to this pin. VCC After the battery is fully charged or enters standby mode, BAT The leakage current of the pin is less than 3uA, BAT The pin provides charging current to the battery and 4.2V. If the battery is not connected, then BAT The voltage of the foot is 4.6V about.

Vcc(PIN4):Input voltage positive terminal

The voltage of this pin is the working power supply of the internal circuit. Vcc The input voltage must be greater than the undervoltage lockout threshold and greater than BAT Voltage 100mV. Charging will not start until Vcc The input voltage falls below the undervoltage lockout threshold or Vcc and BAT The voltage difference between the pins is less than 30mV. hour, TP4054 The device will enter low power shutdown mode. BAT The current consumption of the pin is less than 3uA.

PROG(PIN5):Constant current charging current setting terminal

from PROG Connect a resistor to the pin GND The charging current can be set. The setting resistor and charging current are calculated using the following formula:

$$R_{PROG} = 1000V / I_{BAT}$$

The charging current required I_{BAT} To determine the resistor R_{PROG} During the trickle charge phase, the voltage on this pin is modulated at 0.1V; During the constant current charging stage, the voltage of this pin is fixed at 1V.

Application Notes

Charge Termination

When the charging current drops to the set value after reaching the final float charge voltage, 1/10 The charging process ends when the condition is determined by an internal filter comparator. PROG pin is monitored to detect when PROG The pin voltage drops to 100mV The following time exceeds 2ms When , charging is terminated.

Smart recharging

In standby mode, TP4054 right BAT pin voltage is monitored only when BAT The pin voltage is lower than the recharge threshold voltage 4.1V Hours (corresponding to battery capacity 80%~90%), a new charging cycle will begin and the battery will be charged again, which avoids unnecessary repeated charging of the battery and effectively extends the battery life.

Adding thermal resistors

reduce I_{CO} of Vcc and BAT The pressure drop across the two ends can be significantly reduced. IC This has the effect of increasing the charging current during thermal regulation. This can be achieved by Vcc Connect one in series 0.5Ω The resistance or forward voltage drop is less than 0.5V The diode dissipates part of the power.

Charge current soft start

TP4054 A soft start circuit is built in. When a charging cycle is started, the charging current will 20uS The time it takes for the charging current to gradually increase from zero to a constant current.

Charging status indicator

CHG It is an open-drain status indication output terminal. When the charger is in the charging state, CHG After charging is completed, CHG The pin is in high impedance state;

If the battery is not connected, plug in the charger BAT The foot voltage is 4.6V. Left and right, the indicator light will flash to indicate that the battery is not connected or the battery contact is poor;

If the status indication function is not used, CHG Floating or grounded.

Intelligent temperature control

TP4054 The intelligent temperature control function is integrated inside. 115°C, the charge current will be automatically reduced. This feature allows the user to increase the upper limit of the power handling capability of a given circuit board without damaging it. TP4054 The charging current can be set based on the typical (rather than worst-case) ambient temperature, with the assurance that the charger will automatically reduce the current under worst-case conditions.

Package dimensions

SOT23-5L