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Outline

HX4054A Is a single lithium ion battery constant current / constant linear charger circuit is very simple

external application for portable device applications, for USB

Power supply and power adapter, the internal charging passage anti-down, no external blocking diode.

Thermal feedback to automatically adjust the charging current to limit the die temperature during high

power operation or high ambient temperature conditions.

HX4054A Charge-cutoff voltage 4.2V, The charging current can be set by an external resistor. When the

charge current drops to a value of 1/10 Time, HX4054A Automatically ends the charging process. When the

input voltage is definite displacement, HX4054A Automatically enters a low current standby state, the

standby power to 1uA the following. HX4054A When the input power can also be put into shutdown mode,

whereby the current to the range 30uA .

Feature

- Lithium reverse polarity protection   (In the case of no charging)
- Maximum charge current: 500mA
- **No need MOSFET , Detection resistor with Isolation diode**
- Smart thermal regulation functions may be implemented to maximize the charge rate
- Smart recharging function
- Precharge voltage: 4.2V ± 1%
- C / 10 Charge termination
- 4C / 10 Trickle charge current
- stand-by current 30uA
- BAT Ultra-low consumable 1uA
- 2.9V Trickle charge threshold
- Separate charging, the LED of the control signal
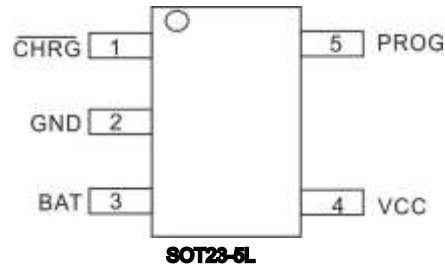- Package: SOT23-5

application

- **Phone, PDA , MP3 / MP4**
- Bluetooth earphone, GPS
- Charging Dock
- Digital cameras, Mini Stereos and other portable devices

Typical application circuit
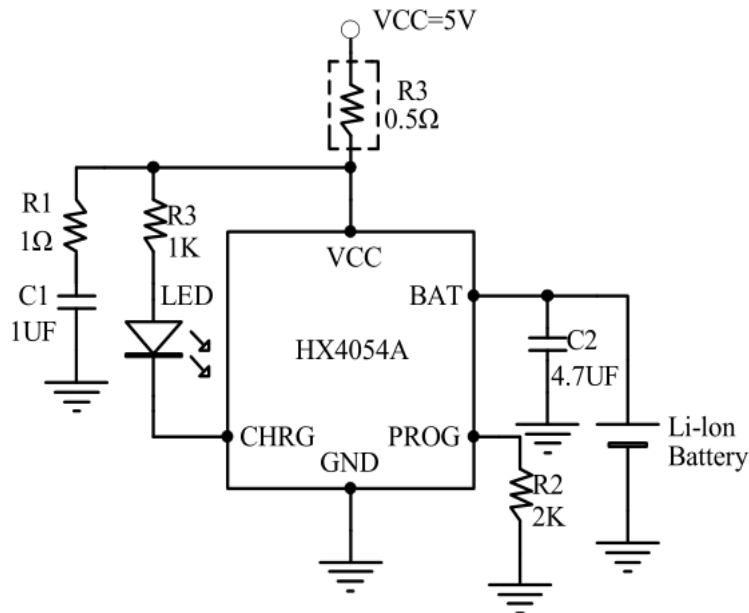
Note: R1 Resistance is not recommended columns and province C1 Structure RC Filtering prevent overcharging voltage. in case R1 Resistance is not connected C1 use 10UF More capacitance. A typical application circuit for reference only, Other subject to the actual application.

Pin

SOT23-5L

Ordering Information

Package	Order Type	package style	Products are printed
SOT23-5L	HX4054A		

Limit parameters (Note 1)

symbol	parameter	Ratings	unit
VCC input supply voltage		-0.3 to 7	V
PROG PROG Pin voltage		-0.3 to 0.3	V
BAT	BAT Pin voltage	-0.3 to 7	V
CHRG CHRG Pin voltage		-0.3 to 7	V
T_{BAT_SHT}	BAT Foot short circuit duration	continuous	-
I_{BAT}	BAT Pin Current	600	mA
I_{PROG}	PROG Pin Current	600	uA
T_{OP}	Working temperature	- 40 to 85	℃
T_{STG}	Storage temperature	- 65 - 125	℃
ESD	HBM	2000	V
	MM	200	V

Note 1 : Absolute Maximum Ratings indicate that operating beyond the chip may be damaged.

Electrical parameters (Note 2 , 3)

Unless otherwise noted, V IN = 5V , Ta = 25 ℃

symbol	parameter	Test Conditions	Min	Typ	Max	unit
V CC	Input supply voltage		4.0	5	6	V
I CC	Input supply current	Charging mode, R PROG = 2K		110	350	uA
		Standby mode (charge termination)		40	200	uA
		Shutdown Mode (R PROG not connected, V CC < V BAT, V CC < V UV, V CE = 0V)		30	200	uA
V FLOAT	Output float voltage	0 ℃ ≤T A ≤85 ℃	4.158	4.2	4.242	V
I BAT	BAT Pin current	R PROG = 10K The current mode	80	100	1200	mA
		R PROG = 2K The current mode	400	500	600	mA
		Shutdown Mode (R PROG Not connected or V CE = 0V)		0	2	μA
		Sleep mode, V CC = 0		0	2	μA
I TRIKL	Trickle charge current	V BAT < V TRIKL, R PROG = 2K		200		mA
		V BAT < V TRIKL, R PROG = 10K		40		mA
V TRIKL	Trickle charge threshold voltage	R PROG = 10K , V BAT rise	2.7	2.9	3.0	V
V TRHYS	Trickle charge voltage hysteresis	R PROG = 10K		100		mV
V UV	V CC Undervoltage protection threshold voltage V CC rise		3.5	3.7	3.9	V
V UVHYS	V CC Hysteresis voltage undervoltage protection V CC decline		3.5	3.7	3.9	V
V ASD	V CC- V BAT Threshold voltage	V CC rise		150		mV
		V CC decline		60		mV
V PROG	PROG Pin voltage	R PROG = 2K The current mode	0.9	1.0	1.1	V
V CHRG	CHRG Low voltage output pin I CHRG = 5 mA			0.3	0.6	V
I CHRG	CHRG Pins weak pull-down current V CHRG = 5V		8	20	40	μA
ΔV RECHRG	A rechargeable battery Threshold Voltage V FLOAT- V RECHRG		70	100	150	mV
T LIM	Defining a temperature model junction temperature			115		℃
R ON	power FET ON resistance			800		mΩ
T SS	Soft start time	I BAT = 0 to I BAT = 1000V / R PROG		20		uS
T RECHRG	Filter Time recharge V BAT decline		1	2	3	mS
T TERM	Comparator Filter Time End	I BAT Drops I CHG / 10 the following	1	2	3	mS
I PROG	PROG Pin pull-up current			2		μA

Note 2 : Typical parameter values 25 Standard parameter values measured under the conditions deg.] C. Note 3 : Specification of minimum, maximum range of test

specifications to ensure that the typical value of design, test, or statistical analysis.

Internal block diagram

working principle

HX4054A Is designed for a lithium ion battery or a lithium polymer battery charger designed linear, chip integrated power transistor, the charging current can be set with an external resistor, the charging current up to the maximum continuous 500mA,   Do not need Plus blocking diode and current sense resistor. HX4054A Comprising an open-drain output terminal status indication for indicating completion of charging or charging. Charging pin CHRG Outputs a low level indicates the charging progress, after the completion of charging, CHRG Pull-down current becomes 20uA . If the battery voltage is below 2.9V , HX4054A Pre-charging the battery with a small current. When the battery voltage exceeds 2.9V When using a constant current battery charge mode, the charge current from the PROG Pin and GND Resistance between R PROG determine. When the battery voltage is close to 4.2V Voltage, the charging current decreases,

HX4054A   Constant voltage charging mode. When the charge current is reduced to the charging end When the threshold value, the charging cycle is completed, CHRG End by the strong current becomes a drop-down 20uA Weak current pull-down. Charge end threshold is a constant charge current 10% .

When the battery voltage falls below the recharge threshold 4.1V Or less, HX4054A Automatically start a new charge cycle. Precision voltage reference source within the chip, the error amplifier and the resistor divider network to ensure the accuracy of the battery voltage in the modulator 1%
Or less, to meet the requirements of a lithium ion battery and lithium polymer batteries. When the input voltage is below the undervoltage lockout threshold voltage or the input voltage is below the battery voltage, the charger enters a low power sleep mode, the current consumption of the battery is less than the end 2uA .
HX4054A Intelligent internal temperature control circuit in the junction temperature of the chip exceeds 115 Automatically reduces the charge current ℃, this feature allows the user to use the maximum power handling capability of the chip, without fear of thermal damage to the chip or external components. Thus, when the charge current user may not consider the worst case, but only according to typical case because in the worst case, HX4054A It will automatically reduce the charging current.

Pin Function

CHRG (PIN1): Charge indicator status

When the battery is being charged, CHRG Internal switch pin is pulled low by charging in progress; when charging is ended, CHRG Pull-down current becomes 20uA ;when V_{CC} Input voltage is below the undervoltage lockout threshold or V_{CC} versus
BAT Is smaller than the voltage difference between pins 30mV Time, CHRG Pin is high impedance.

GND (PIN2): Power Ground

BAT (PIN3): Battery positive terminal

The positive terminal of the battery is connected to this pin. In the chip disable mode or in sleep mode, BAT Pin leakage current is less than 3uA, BAT Pin provides charge current to the battery, and 4.2V Limit voltage.

$V_{CC (}$ PIN4): Voltage at the positive input terminal

This voltage is the power supply pin of the internal circuit. V_{CC} Input voltage must be greater than the undervoltage lockout threshold and is greater than at the same time BAT Voltage 100mV , The charge will begin. when V_{CC} Input voltage is below the undervoltage lockout threshold or V_{CC} versus BAT Is smaller than the voltage difference between pins 30mV Time, HX4054A Enters low power shutdown modes, then BAT Current consumption is less than the pin 2uA .

PROG (PIN5): Constant charging current setting terminal

From PROG A resistor connected to the pin GND The charge current can be set. And a charging current setting resistor is calculated using the following equation:
$R_{PROG} = 1000V / I_{BAT}$
The necessary charging current I_{BAT} Determining resistor R_{PROG} Resistance. In the trickle charge phase, the voltage at this pin is modulated 0.1V ; Constant-current charging phase, the voltage at this pin is fixed 1V .

Application Note

Charge termination

When the current reaches the final float charging voltage drops below a set value 1/10 When the charging process ends. This condition is achieved by using an internal filtered comparator PROG
Pin monitored to detect , when PROG Pin voltage
Drops 100mV For longer than 2ms When the charging is terminated. HX4054A
Enters standby mode, the input supply current is reduced to 30μA .

Smart recharging

In standby mode, HX4054A Correct BAT Pin voltage is monitored only when BAT Pin voltage is below the threshold voltage of the rechargeable 4.05V (Corresponding battery capacity 80% ~ 90%) , Will start a new charge cycle, re-charge the battery, the battery life which avoids unnecessary re-charge, effectively extending the battery.

Increasing the heat resistance adjustment

reduce IC of V_{CC} versus BAT The voltage drop across can be significantly reduced IC In consumption. When thermal conditioning, this has the effect of increasing the charging current. Implementations may be implemented with input power V_{CC} Between a series 0.3Ω Power resistor or forward voltage drop of less than 0.5V Diodes, so as to consume part of the power.

Charging current soft start

HX4054A Built-in soft-start road. When a charge cycle is initiated, the charging current 20uS Time is gradually increased from zero to the constant current charging current.

Charging status indicator

CHRG Indicates open-drain output terminal, CHRG Have 3 States indicates strong pull-down current (about 10mA), Weak pull-down current (20uA), High-impedance state. When the charger is in the charging state, CHRG Is strongly pulled low, after the end of charge, CHRG Pull-down current becomes 20uA , when V_{CC} Input voltage is below the undervoltage lockout threshold or V_{CC} versus BAT Is smaller than the voltage difference between pins
30mV Time, CHRG Pin is high impedance. If the indicator is not being used, the CHRG Floating or grounded.

Intelligent Temperature Control

HX4054A Internal integrated intelligent temperature control function high than the chip. When the temperature is 115 When ℃, it will automatically reduce the charging current. This feature allows the user to increase the maximum for a given power handling capability of the circuit board without damage HX4054A risks of. In ensuring the charger will automatically reduce the current in the worst case conditions of the premise, according to a typical (but not the worst case) the ambient temperature is set to the charging current.

Package Dimensions
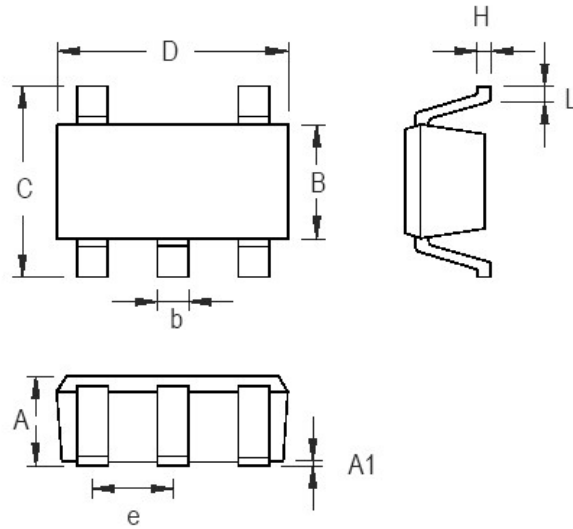
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-5 Surface Mount Package