Linear Lithium-ion Battery Charger

Description

TN4054 is a complete single lithium ion battery with constant current/constant voltage linear charger. Its SOT package and small number of external components make the TN4054 ideal for portable applications. TN4054 can be suitable for USB power and adapter power supply work.

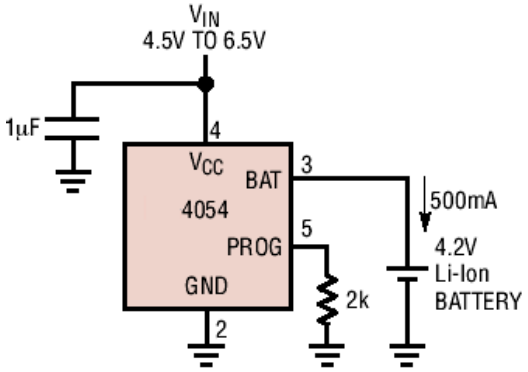
Due to the internal PMOSFET architecture, plus the anti-inverted charging circuit, there is no need for external detection resistor and isolation diode. Thermal feedback adjusts the charging current to limit chip temperature at high power operation or ambient temperature conditions. The charging voltage is fixed at 4.2V, and the charging current can be set externally through a resistor. When the charging current reaches the final floating charging voltage and drops to the set value of 1/10,TN4054 will automatically terminate the charging cycle.

When the input voltage (ac adapter or USB power supply) is removed, TN4054 automatically enters a low current state, reducing the battery leakage current below 2uA.TN4054 can also be placed in stop mode to reduce the power supply current to 45uA.Other features of the TN4054 include a charging current monitor, undervoltage latching, automatic recharging, and a status pin to indicate the end of charging and input voltage access.

Features

- 800mA programmable charging current;
- No MOSFET, test resistor or isolation diode required;
- A complete linear charger with sot-23-5 package for single lithium ion battery;
- Constant current/voltage operation, with thermal regulation function;
- Charge single lithium ion battery directly from USB port;
- 4.2V charging voltage is preset;
- Output of charging current monitor for battery quantity detection;
- C/10 Charge termination, automatic recharging;
- Power supply current in standby mode is 45uA;
- Soft boot limits the surge current;
- 2.9V trickle charge device version

Applications

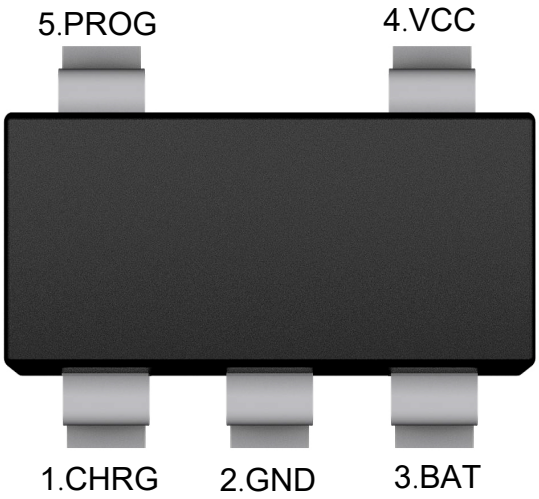


Rprog resistance and charging current Ibat corresponding table

Rprog	Ibat
$I_{bat}=1000/R_{prog}$	
10K	100mA
5K	200mA
3.3K	300mA
2.5K	400mA
2K	500mA
1.65K	600mA

Pin Distribution

SOT-23-5



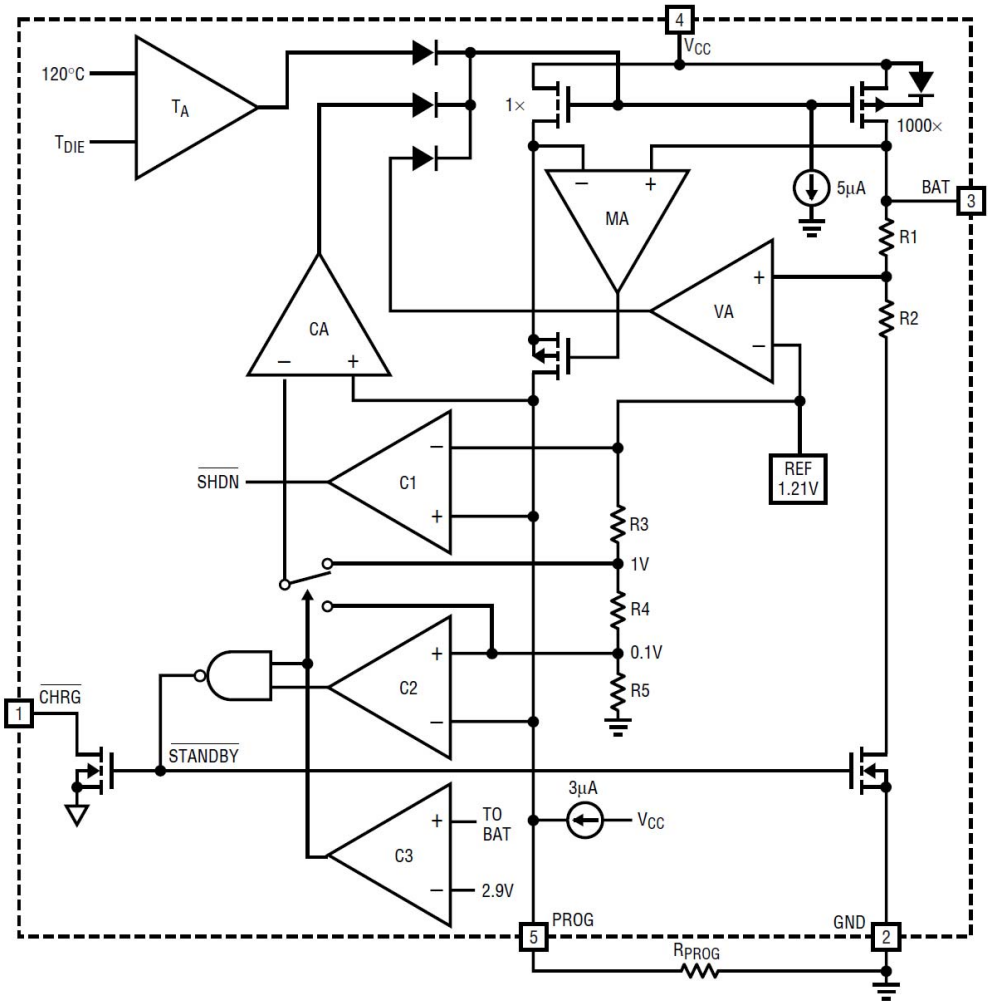
Pin Function

CHRG（Pin1）	Output of open drain charging state. The CHRG pin is pulled to low level by an internal N-channel MOSFET during battery charging. When the charging cycle ends, CHRG pin is off and all lights are off. When TN4054 detects an under voltage blocking condition, the CHRG pin is forced to a high impedance state.
GND（Pin2）	GND
BAT(Pin3)	Charging current output.The pin provides charging current to the battery and adjusts the final floating charging voltage to 4.2V. A precise internal resistance voltage divider of the pin sets the floating charging voltage. In the shutdown mode, the internal resistance voltage divider is disconnected.
VCC（Pin4）	Positive input power voltage.This pin supplies power to the charger.VCC shall vary from 4.25v to 6.5v and shall be bypassed by at least one 1uF capacitor.When the VCC drops to less than 30mV of BAT pin voltage,TN4054 enters the stop mode, and the Ibat falls below 2uA.
PROG（Pin5）	Charging current setting, charging current monitoring and stop pin.The charging current can be set by connecting a 1% precision resistor Pprog between the pin and the ground.When charging in constant current mode, the voltage of this pin is maintained at 1V. In all modes, the voltage on this pin can be used to calculate the charging current. The formula is Ibat=(Vprog/Rprog)*1000.Short connect the set resistor to the ground, and an internal 2.5ua current pulls the PROG pin to a high level.When the voltage of this pin reaches the stop threshold voltage of 1.22v, the charger enters the stop mode, the charging stops and the input power current drops to 45uA.Reconnecting the Rprog to the ground will restore the charger to normal operation.

Absolute Maximum Rating

Input Voltage	4.5V～6V
PROG	-0.3V～VCC+0.3V
BAT	-0.3V～7V
CHRG	-0.3V～10V
BAT short-circuit period	Continue
BAT Pin Current	800mA
PROG Pin Current	800uA
Maximum Junction Temperature	145℃
Operating Temperature Range	-20℃ ~ 85℃
Storage Temperature	-65℃ ~ 125℃
Pin temperature (welding time: 10s)	260℃

Block Diagram

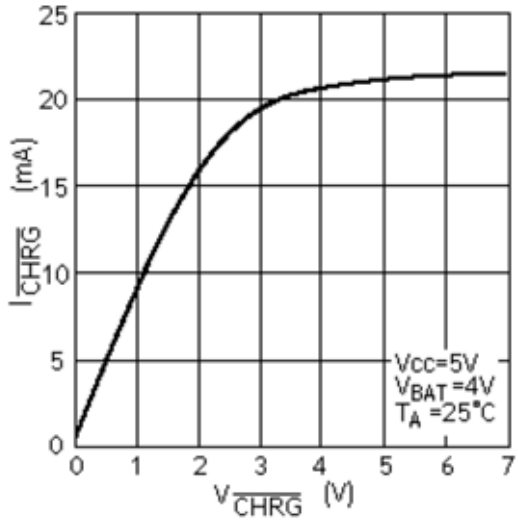


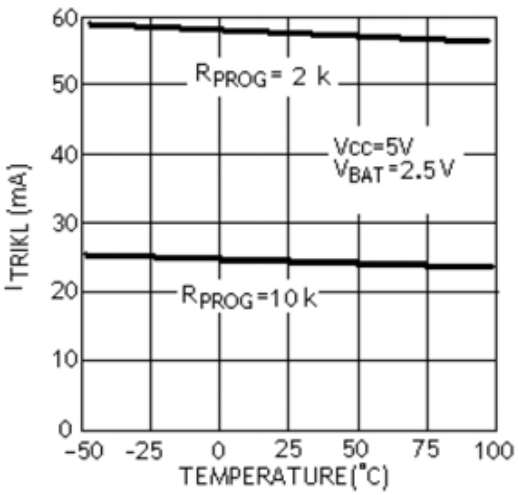
Electrical Characteristics

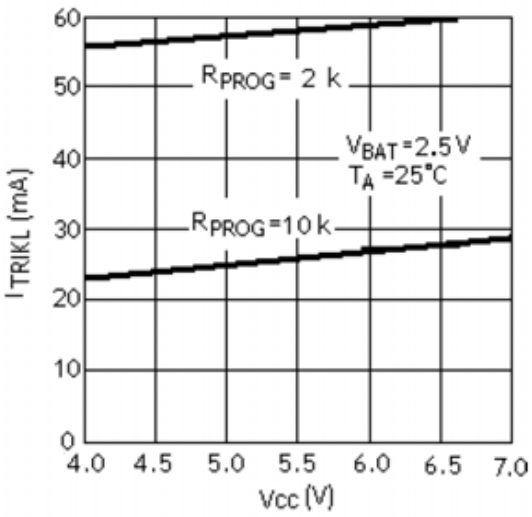
(TA =25℃ unless otherwise specified. , Vcc=5V)

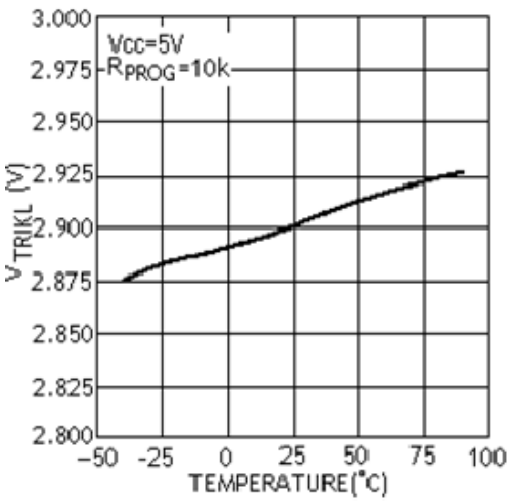
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input Voltage	VCC		4.5	5	6	V
Input Current	ICC	charging mode，Rprog=10K		150	500	uA
		standby mode（Charge termination）		45	150	
		stop mode（RPROG ununited）		45	150	
		VCC<Bbat or VCC<Vuv		45	150	
Stable Output Voltage	VFLOAL	0℃≤TA≤85℃，Ibat=40mA	4.13	4.2	4.255	V
BAT Pin Current	IBAT	RPROG=10K, current mode	93	100	107	mA
		RPROG=2K, current mode	465	500	535	
		standby mode，Vbat=4.2V	0	-2.5	-6	uA
		stop mode（RPROG ununited）		±1	±2	
		sleep mode，VCC=0		-1	-2	
Trickle Charging Current	ITRIKL	VBAT<VTRIKL，Rprog=2K	30	50	70	mA
Trickle Charging Threshold Voltage	VTRIKL	RPROG=10K，Vbat up	2.8	2.9	3	V
Trickle Charging Hysteresis Voltage	VTRHYS	RPROG=10K	60	150	200	mV
VCC Undervoltage Locking Threshold	VUV	VCC from low to high	3.7	3.9	3.99	V
VCC Undervoltage Atresia Hysteresis	VUVHYS		150	250	300	mV
Manual Shutdown Threshold Voltage	VMSD	PROG pin level up	1.15	1.21	1.3	V
		PROG pin level down	0.9	1	1.1	
Blocking Threshold Voltage	VASD	VCC from low to high	70	100	140	mV
		VCC from high to low	5	30	50	
C/10 Termination Current Threshold	ITERM	RPROG=10K	0.085	0.1	0.115	mA
		RPROG=2K	0.085	0.1	0.115	
PROG Pin Voltage	VPROG	RPROG=10K，current mode	0.93	1	1.07	V
Pin Output Low Voltage	VCHRG	ICHRG=5mA	0.1	0.35	0.6	V
Recharging Battery Threshold Voltage	ΔVRECHRG	VFLOAT-VRECHRG	100	150	200	mV
Junction temperature in a finite temperature mode	TLIM			120		℃
Power FET On Resistance	RON			660		mΩ
Soft Start Time	Tss	IBAT=0 toIbat=1000/Rprog		100		us
Recharging Comparator Filter Time	tRECHARGE	VBAT from high to low	0.75	2	4	ms
Stop Comparator Filter Time	tTERM	IBAT below Ichg/10	0.8	1.8	4	ms
PROG Pin Pull Current	IPROG			3		uA

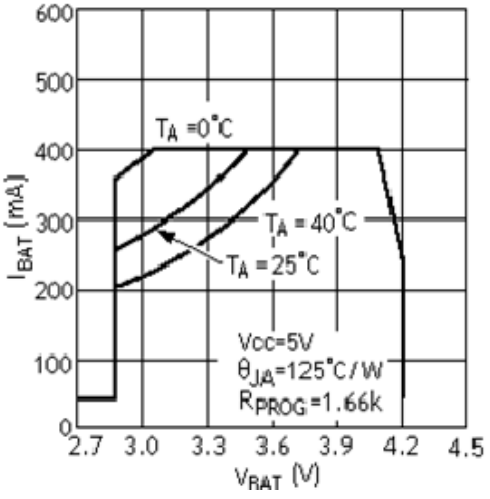
Electrical Characteristics Curves

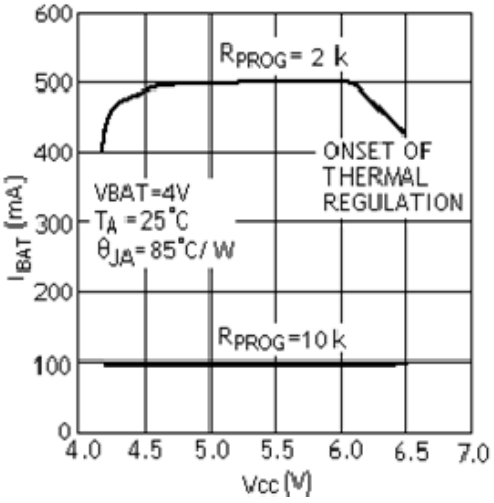


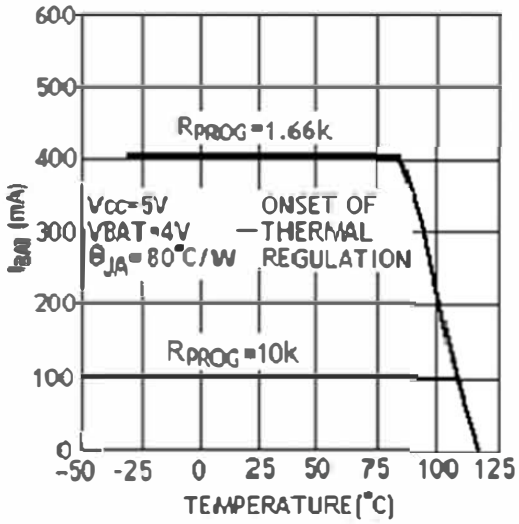


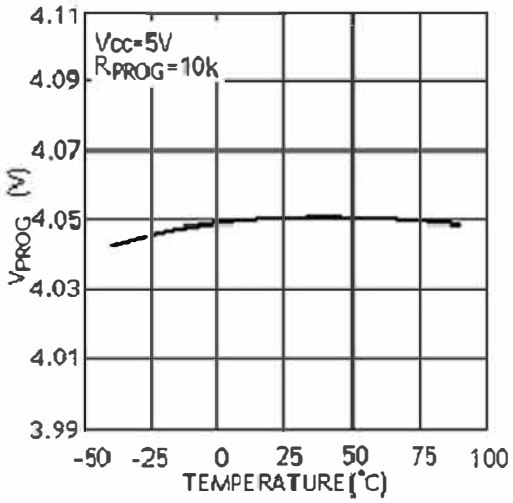


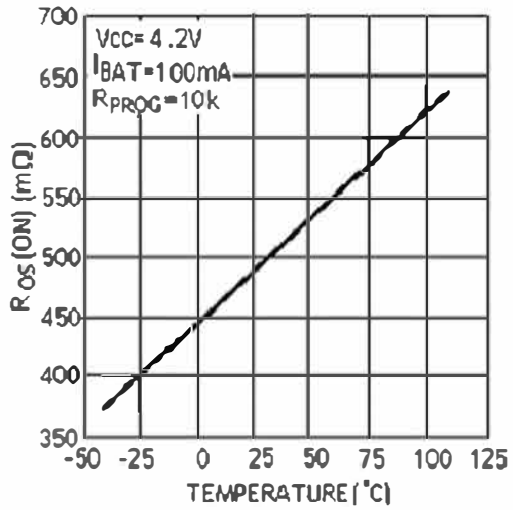


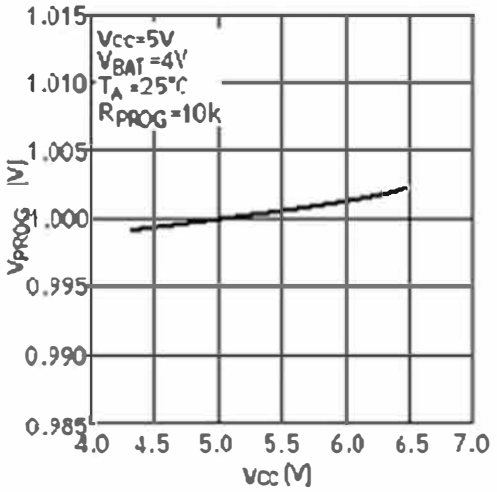


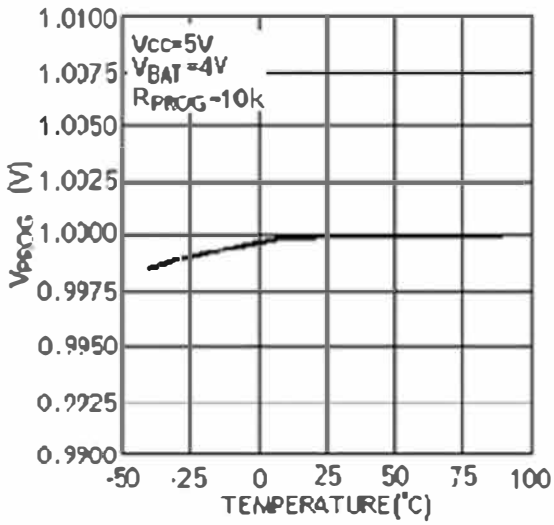


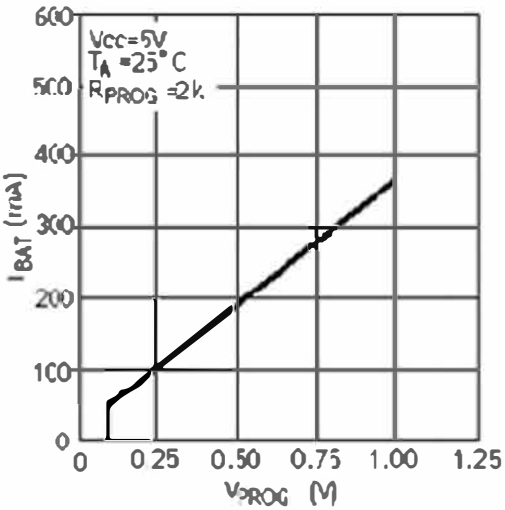


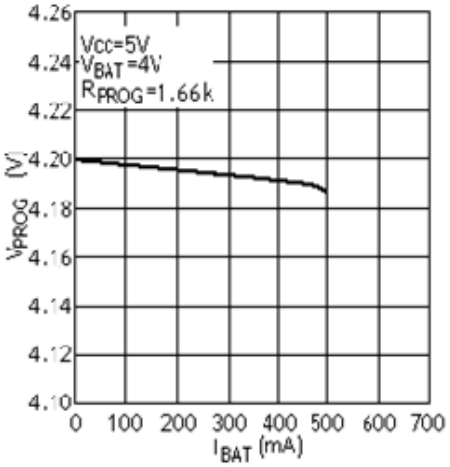


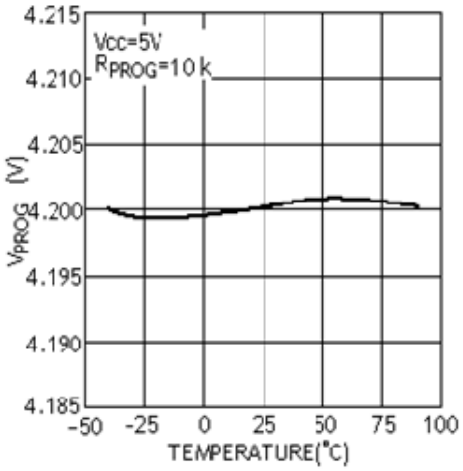


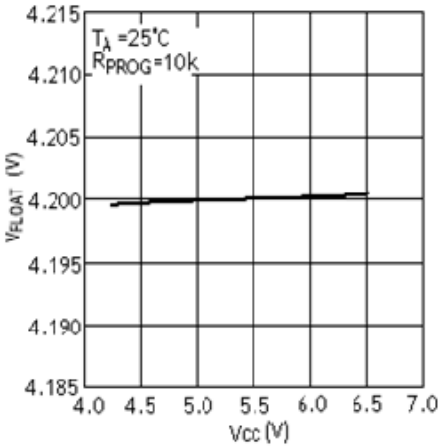






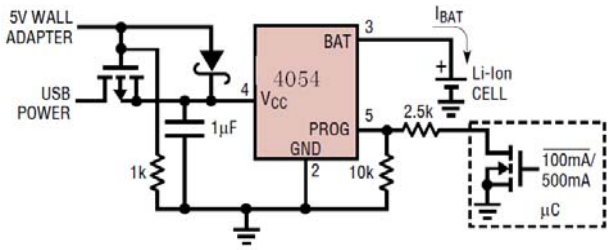




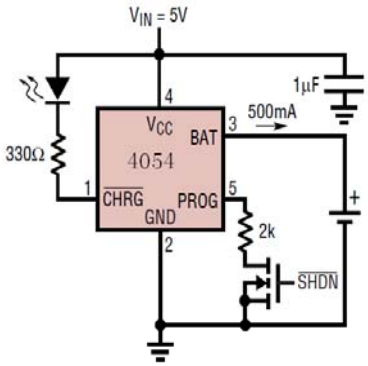


Typical Applications

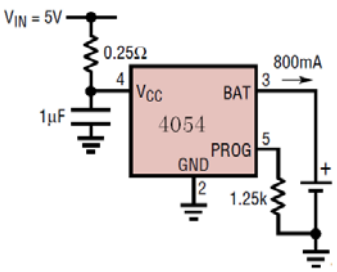
USB/交流适配器电源锂电池充电器



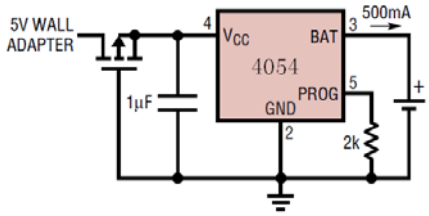
全功能单节锂电池充电器



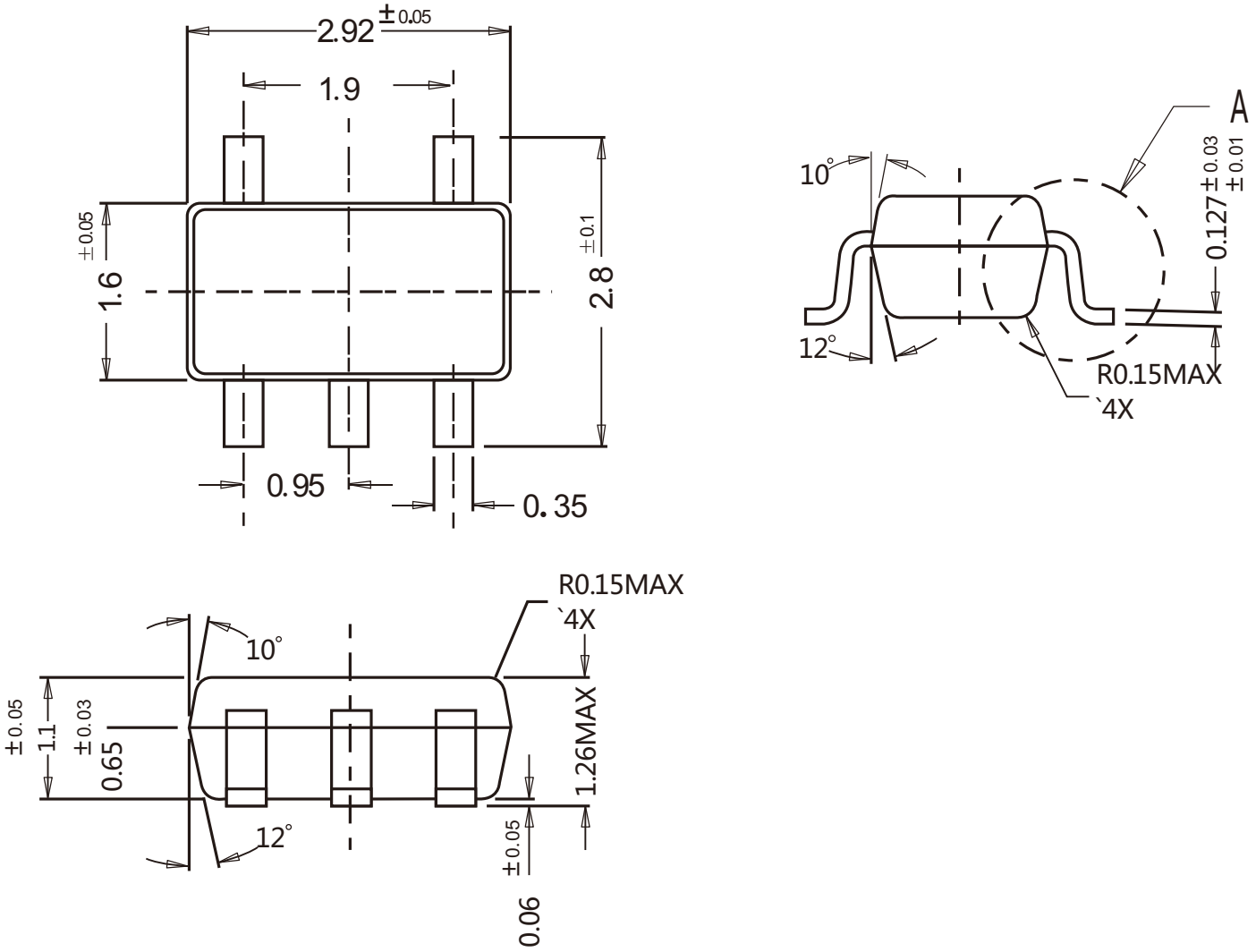
采用外部功率耗散的800mA锂电池充电器



具有反向极性输入保护功能的基本锂电池充电器



Package Outline
SOT-23-5
Dimensions in mm



Ordering Information

Device	Package	Shipping
TN4054	SOT-23-5	3,000/ Tape & Reel (7 inches)

Contact Information

TANI website: **http://www.tanisemi.com** Email:tani@tanisemi.com

For additional information, please contact your local Sales Representative.