

## Standalone Linear Li-Ion Battery Charger with Thermal Regulation

PRELIMINARY DATASHEET

### General Description

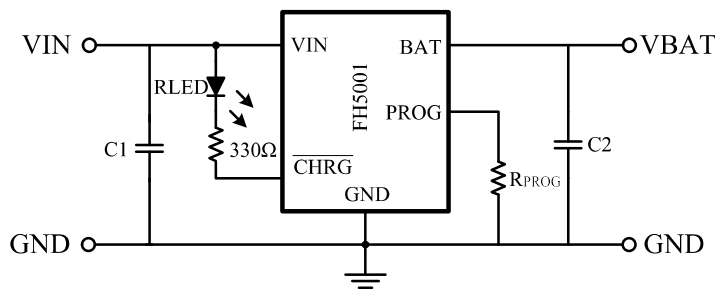
The FH5001 is a complete constant-current /constant -voltage linear charger for single cell lithium-ion batteries. Its ThinSOT package and low external component count make the FH5001 ideally suited for portable applications. Furthermore, the FH5001 is specifically designed to work within USB power specifications.

No external sense resistor is needed, and no blocking diode is required due to the internal MOSFET architecture. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The FH5002 automatically terminates the charge cycle when the charge current drops to 1/10<sup>th</sup> the programmed value after the final float voltage is reached. When the input supply (wall adapter or USB supply) is removed, the FH5002 automatically enters a low current state, dropping the battery drain current to less than 2.0µA. The FH5002 can be put into shutdown mode, reducing the supply current to 25.0µA.

When battery reversed, the internal protected the BAT pin throughout about 0.7mA current from GND. Also, The BAT pin has a 7KV ESD (HBM) capability.

Other features include charge current monitor, under-voltage lockout, automatic recharge and a status pin to indicate charge termination and the presence of an input voltage.

### Typical Application Circuit



Note: C1=4.7µF, C2=10µF, I<sub>BAT</sub>=(V<sub>PROG</sub>/R<sub>PROG</sub>)\*1000

Figure 1. FH5001 Typical Application Circuit

### Features

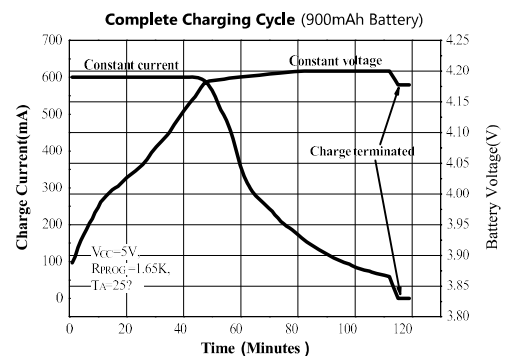
- Programmable Charge Current Up to 300mA
- No MOSFET, Sense Resistor or Blocking Diode Required
- Complete Linear Charger in ThinSOT Package for single Cell Lithium-Ion Batteries
- Constant-Current/Constant-Voltage Operation with Thermal Regulation to Maximize Charge Rate Without Risk of Overheating
- Charges Single Cell Li-Ion Batteries Directly from USB Port
- Preset 4.2V Charge Voltage with ±1 % Accuracy
- Charge Current Monitor Output for Gas Gauging
- Automatic Recharge
- Charge Status Output Pin
- C/10 Charge Termination
- Supply Current in Shutdown:25.0µA
- 2.9V Trickle Charge Threshold (FH5001)
- Soft-Start Limits Inrush Current
- Battery reversed protection
- 7KV ESD(HBM) capability
- Available in 5-Lead SOT-23 and SOT-89 Package

### Package

- SOT-23-5L
- SOT-89-5L

### Applications

- Cellular Telephones, PDAs, MP3 Players
- Charging Docks and Cradles
- Bluetooth Applications



## Pin Configuration



## Pin Assignment

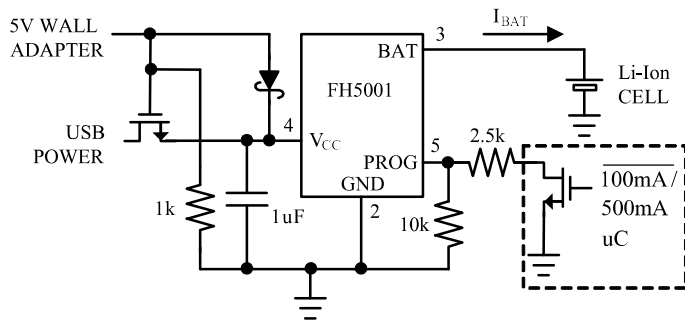
Pin Number		Pin Name
SOT-23-5L	SOT-89-5L	
1	1	CHRG
2	2	GND
3	3	BAT
4	4	VIN
5	5	PROG

## Pin Function

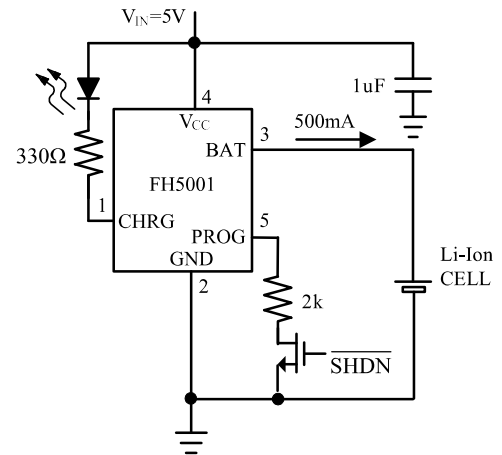
Pin Number	Pin Name	Functions
1	CHRG	Open-Drain Charge Status Output. When the battery is charging, the CHRG pin is pulled low by an internal N-channel MOSFET. When the charge cycle is completed, a weak pull-down of approximately 20.0µA is connected to the CHRG pin, indicating an "AC present" condition. When the FH5001 detects an undervoltage lockout condition, CHRG is forced high impedance.
2	GND	Ground.
3	BAT	Charge Current Output. Provides charge current to the battery and regulates the final float voltage to 4.2V. An internal precision resistor divider from this pin sets the float voltage which is disconnected in shutdown mode. When the battery reversed, Internal protection circuitry to protect the chip will not be burned. And about 0.7mA current flows from GND to BAT.
4	VIN	Positive Input Supply Voltage. Provides power to the charger. VIN can range from 4.25V to 6.5V and should be bypassed with at least a 1.0µF capacitor. When VIN drops to within 30mV of the BAT pin voltage, the FH5001 enters shutdown mode, dropping I <sub>BAT</sub> to less than 2.0µA.
5	PROG	Charge Current Program, Charge Current Monitor and Shutdown Pin. The charge current is programmed by connecting a 1% resistor, R <sub>PROG</sub> , to ground. When charging in constant-current mode, this pin serves to 1.0V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula: $I_{BAT} = (V_{PROG} / R_{PROG}) \cdot 1000$ The PROG pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a 3.0µA current to pull the PROG pin high. When it reaches the 1.21V shutdown threshold voltage, the charger enters shutdown mode, charging stops and the input supply current drops to 25.0µA. This pin is also clamped to approximately 2.4V. Driving this pin to voltages beyond the clamp voltage will draw currents as high as 1.5mA. Reconnecting R <sub>PROG</sub> to ground will return the charger to normal operation.

## Typical Applications Circuit

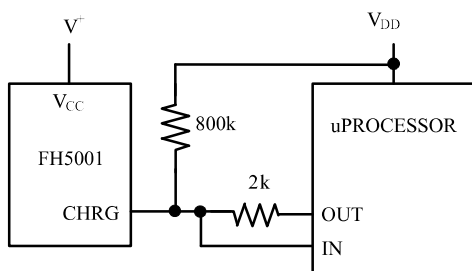
**USB/Wall Adapter Power Li-Ion Charger**



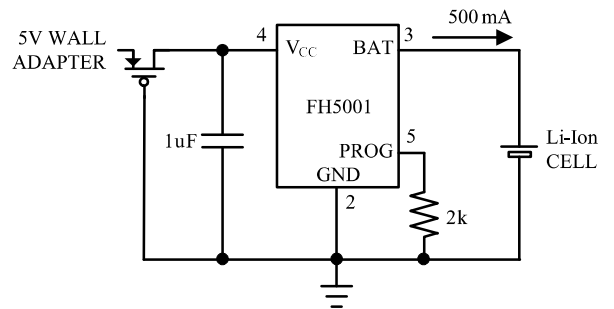
**Full Featured Single Cell Li-Ion Charger**



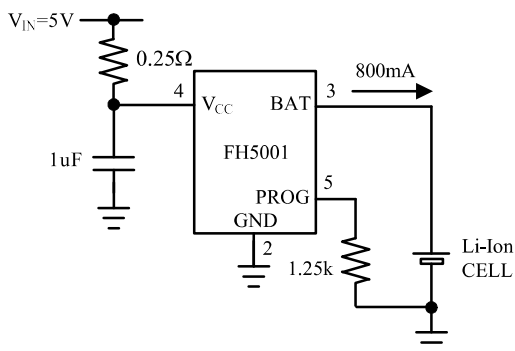
**Using a Microprocessor to Determine CHRГ State**



**Basic Li-Ion Charger with Reverse Polarity Input Protection**

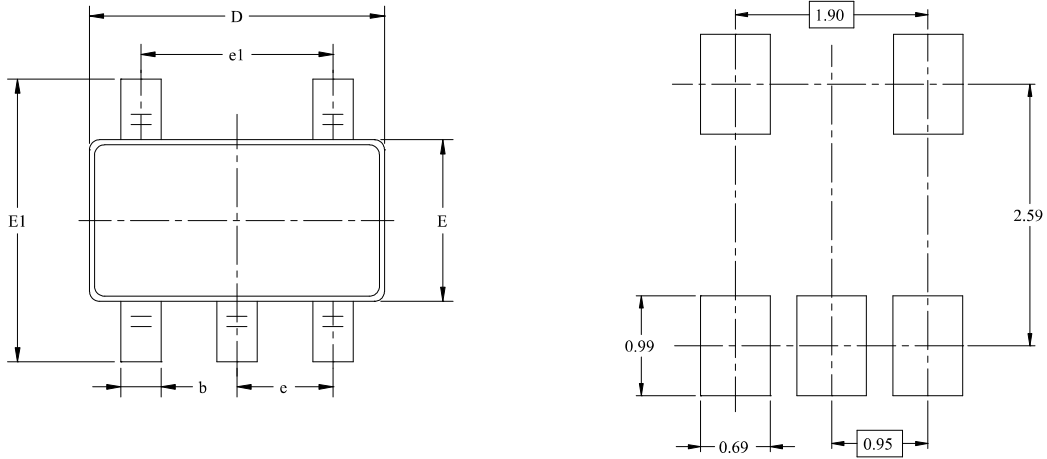


**800mA Li-ion Charger with External Power Dissipation**

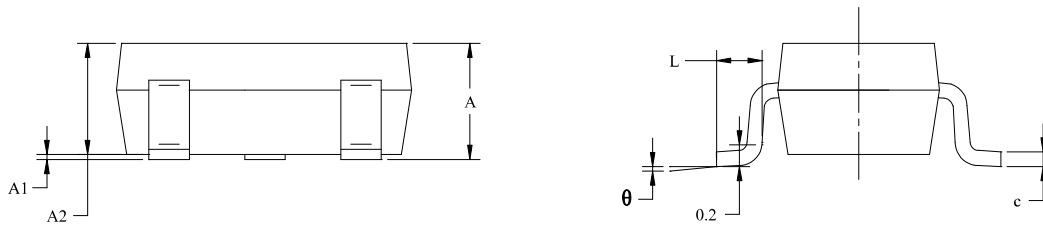


## Package Information

- SOT-23-5L



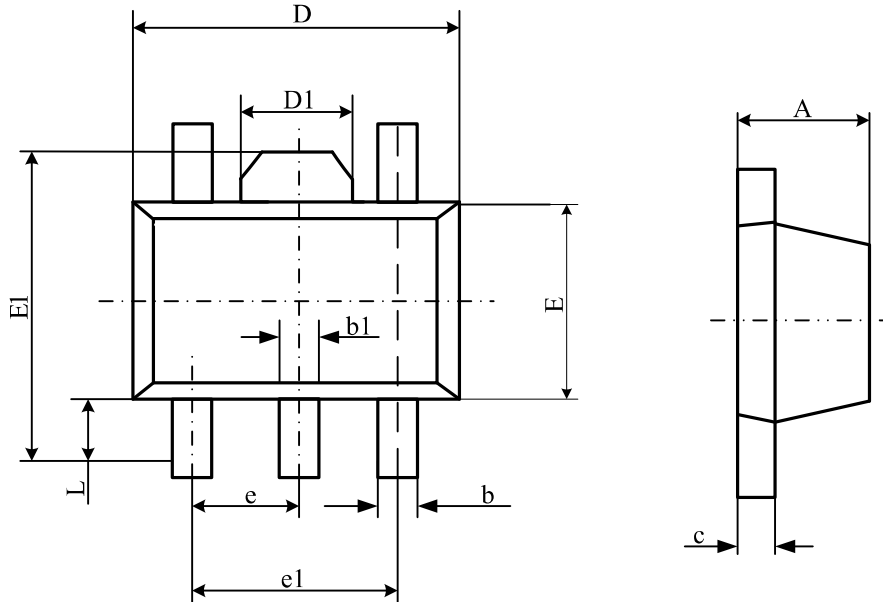
RECOMMENDED LAND PATTERN (Unit: mm)



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
e	0°	8°	0°	8°

## Package Information

- SOT-89-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.400	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043

## Ordering Information

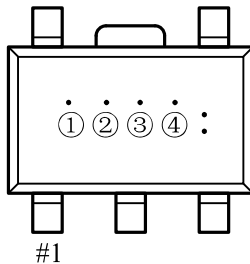
Part Number	Description	Storage Temperature	ESD(HBM) capability	Package	Top Mark	SPQ
FH5001M5	Output Voltag: 4.20V(±1%)	-65 ~ +125°C	7000V	SOT-23-5L	* * * *	3000PCS/Reel
FH5001P5	Linear battery charger			SOT-89-5L	* * * *	1000PCS/Reel

Note:

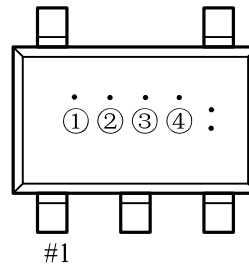
- 1) FH5001 devices are Pb-free and RoHs compliant.
- 2) The surface imprints of our chip devices may be modified during the production process and we will not apply separately without designing changes to electrical parameters.
- 3) If custom production is required, please contact our local business department.

## ■ Marking Rule

SOT-89-5L



SOT-23-5L



### ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.



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### Note:

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➤ Update by Arp.2019