Standalone Linear Li-ion Battery Charger with Thermal Regulation

General Description

The FH5006 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 FH5006 ideally suited for portable applications.

Furthermore, the FH5006 is specifically designed to work within USB power specifications.

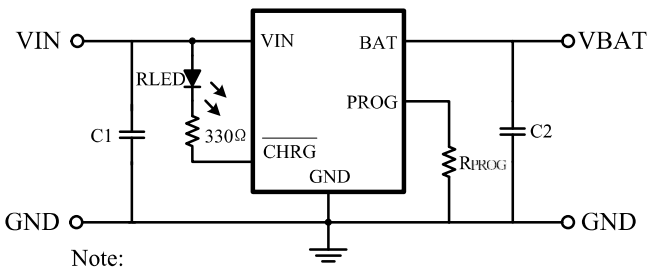
No external sense resistor is needed, and no blocking diode is required due to the internal MOSFET architecture. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The FH5006 automatically terminates the charge cycle when the charge current drops to 3/10th the programmed value after the final float voltage is reached.

When the input supply(wall adapter or USB supply)is removed, the FH5006 automatically enters a low current state, dropping the battery drain current to less than 1uA. The FH5006 can be put into shutdown mode, reducing the supply current to 25uA.

When battery reversed, the internal protected the BAT pin throughout about 0.7mA current from GND. Also, The BAT pin has a 6KV 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=4.7uF, C2=10uF,
IBAT = (VPROG/RPROG)* 200

Features

- Constant-Current/Constant-Voltage
- Charges Single Cell Li-ion Batteries Directly from USB Prot
- Preset 4.20V Charge Voltage with 1% Accuracy
- Charge Current Monitor Output for Gas Gauging
- Automatic Recharge
- Charge Status Output Pin
- 3/10 Charge Termination
- 25uA Supply Current in Shutdown
- 2.90V Trickle Charge Threshold (FH5006)
- Soft-Start Limits Inrush Current
- Battery reversed protection
- 6KV ESD(HBM) capability

Applications

- wearable devices
- Bluetooth Applications

Package

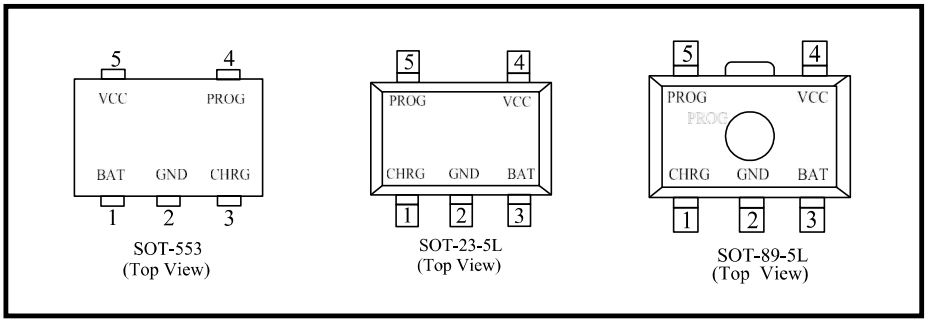
- SOT-23-5L
- SOT-89-5L

Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating		Unit
Input Supply Voltage	V_{cc}	V_{SS}-0.3 ~ V_{SS}+7		V
PROG pin Voltage	Vprog	V_{SS}-0.3 ~ V_{cc}+0.3		
BAT pin Voltage	Vbat	Vss-0.3 ~ 7		
CHAG pin Voltage	Vchrg	V_{SS}-0.3 ~ V_{SS}+7		
Power Dissipation	P_D	SOT-553	350	mW
		SOT-23-5L	250	
		SOT-89-5L	500	
BAT pin Current	Ibat	200		mA
PROG pin Current	Iprog	800		uA
Operating Ambient Temperature	Topa	-40 ~ +85		°C
Storage Temperature	Tstr	-65 ~ +125		

Caution:
The absolute maximum ratings are rated values exceeding which the product could suffer physical damage.
These values must therefore not be exceeded under any conditions.

Pin Configuration



Pin Assignment

Pin Number			Pin Name
SOT-553	SOT-23-5L	SOT-89-5L	
1	3	3	BAT
2	2	2	GND
3	1	1	CHRG
4	5	5	PROG
5	4	4	VCC

Pin Function

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 20μA is connected to the CHRG pin, indicating an "AC present" condition. When the FH5006 detects an undervoltage lockout condition, CHRG is forced high impedance.

GND: Ground.

BAT:

Charge Current Output. Provides charge current to the battery and regulates the final float voltage to 4.20V. 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.

VCC:

Positive Input Supply Voltage. Provides power to the charger. VCC can range from 4.25V to 6.5V and should be bypassedd with at least a 1uF capacitor. When VCC drops to within 100mV of the BAT pin voltage, the FH5006 enters shutdwon mode, dropping IBAT to less than 2uA.

PROG:

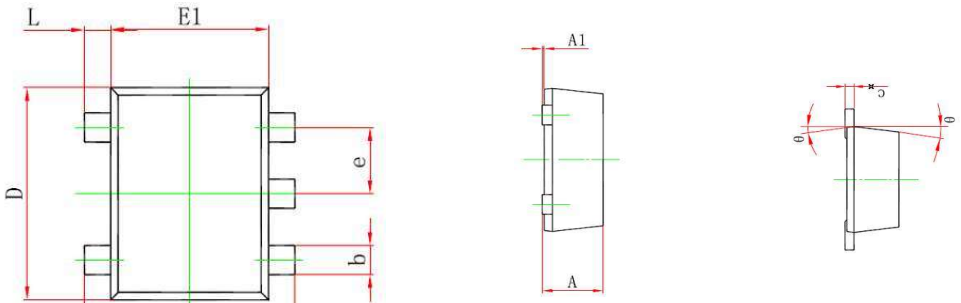
Charge Current Program, Charge Current Monitor and Shutdown Pin. The charge current is programmed by connecting a 1% resistor, RPROG, to ground. When charging in constant-current mode, this pin servos to 1V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula:

$$IBAT = (VP_{ROG}/R_{PROG}) \bullet 200$$

The PROG pin can also be used to shutdown the charger. Disconnecting the program resistor from ground allows a 3μA 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 25μA. This pin is also clamped to approximately 2.4V. Driving this pin to voltage beyond the clamp voltage will draw currents as high as 1.5mA. Reconnecting RPROG to ground will return the charger to normal operation.

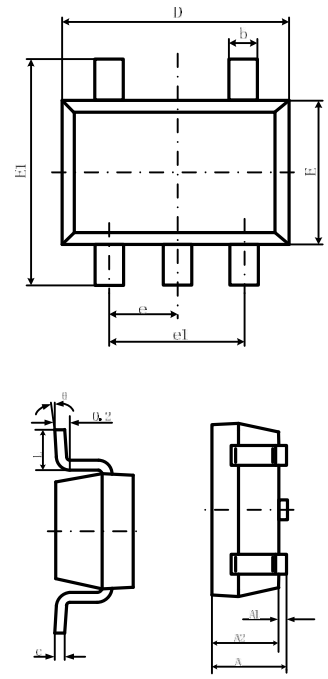
Package Information

- **SOT-553**



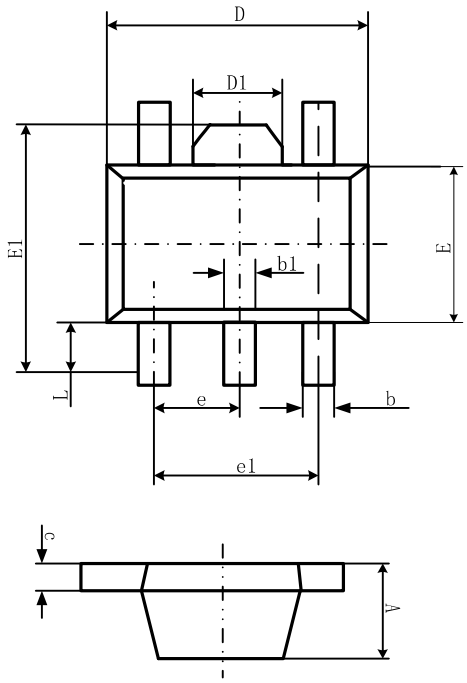
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.525	0.600	0.021	0.024
A1	0.000	0.050	0.000	0.002
e	0.450	0.550	0.018	0.022
c	0.090	0.160	0.004	0.006
D	1.500	1.700	0.059	0.067
b	0.170	0.270	0.007	0.011
E1	1.100	1.300	0.043	0.051
E	1.500	1.700	0.059	0.067
L	0.100	0.300	0.004	0.012
θ	7 °REF.		7 °REF.	

- **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
θ	0°	8°	0°	8°

- **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

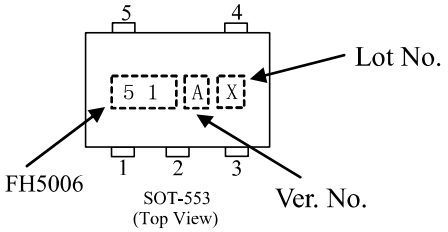
■ Ordering Information

FH5006 ① ②

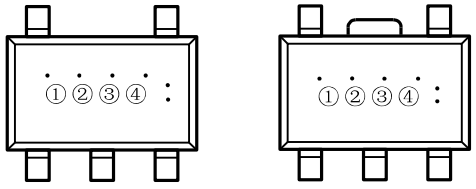
Designator	Description	Symbol	Description
① ②	Packaging Types	K5	SOT-553
		M5	SOT-23-5L
		P5	SOT-89-5L
The regulator Output Voltage: 4.20V Accuracy of Output Voltage: ±1%			
Device Orientation		R	Embossed tape: Standard feed
		L	Embossed tape: Reverse feed

■ Marking Rule

- **SOT-553**



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



SOT-23-5L (TOP VIEW)

SOT-89-5L (TOP VIEW)

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