

Standalone Linear Li-Ion Battery Charger with Thermal Regulation

Features

- Programmable Charge Current Up to 800mA
- No MOSFET, Sense Resistor or Blocking Diode Required
- Complete Linear Charger in ThinSOTTM 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
- Automatic Recharge
- 25 A Supply Current in Shutdown
- 2.9V Trickle Charge Threshold
- Available in 5-Lead SOT-23 Package

Applications

- Charger for Li-Ion Coin Cell Batteries
- Portable MP3 Players, Wireless Headsets
- Bluetooth Applications
- Multifunction Wristwatches

Description

The UN8HX 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 UN8HX ideally suited for portable applications. Furthermore, the UN8HX 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 UN8HX automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.

When the input supply (wall adapter or USB supply) is removed, the UN8HX automatically enters a low current state, dropping the battery drain current to less than 2 A. The UN8HX can be put into shutdown mode, reducing the supply current to 25 A. Other features include charge current monitor, undervoltage lockout, automatic recharge and a status pin to indicate charge termination and the presence of an input voltage.

The UN8HX converters are available in the industry standard SOT-23-5 power packages (or upon request).

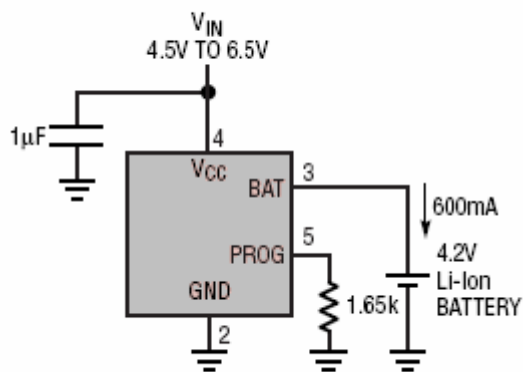
Order Information

UN8HX - ① ② :

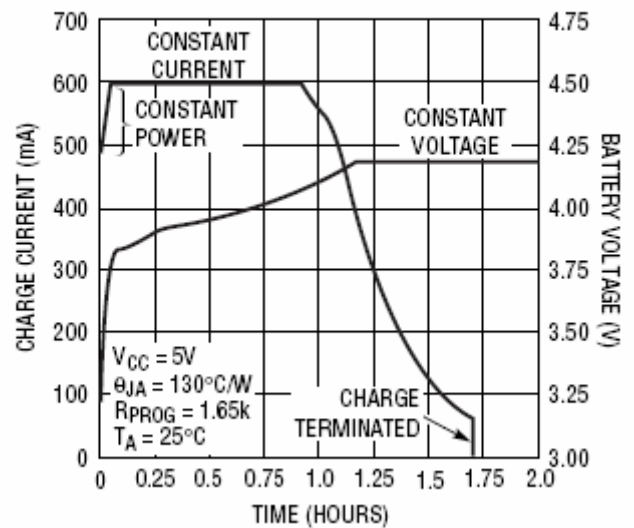
SYMBOL	DESCRIPTION
①	Denotes Output voltage: 4.2V
②	Denotes Package Types: E: SOT-23-5

Typical Application

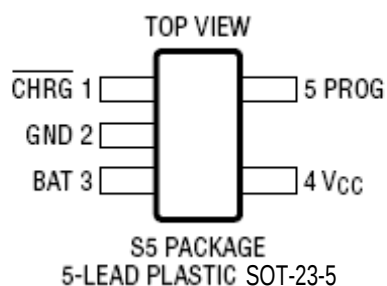
600mA Single Cell Li-Ion Charger



Complete Charge Cycle (750mAh Battery)

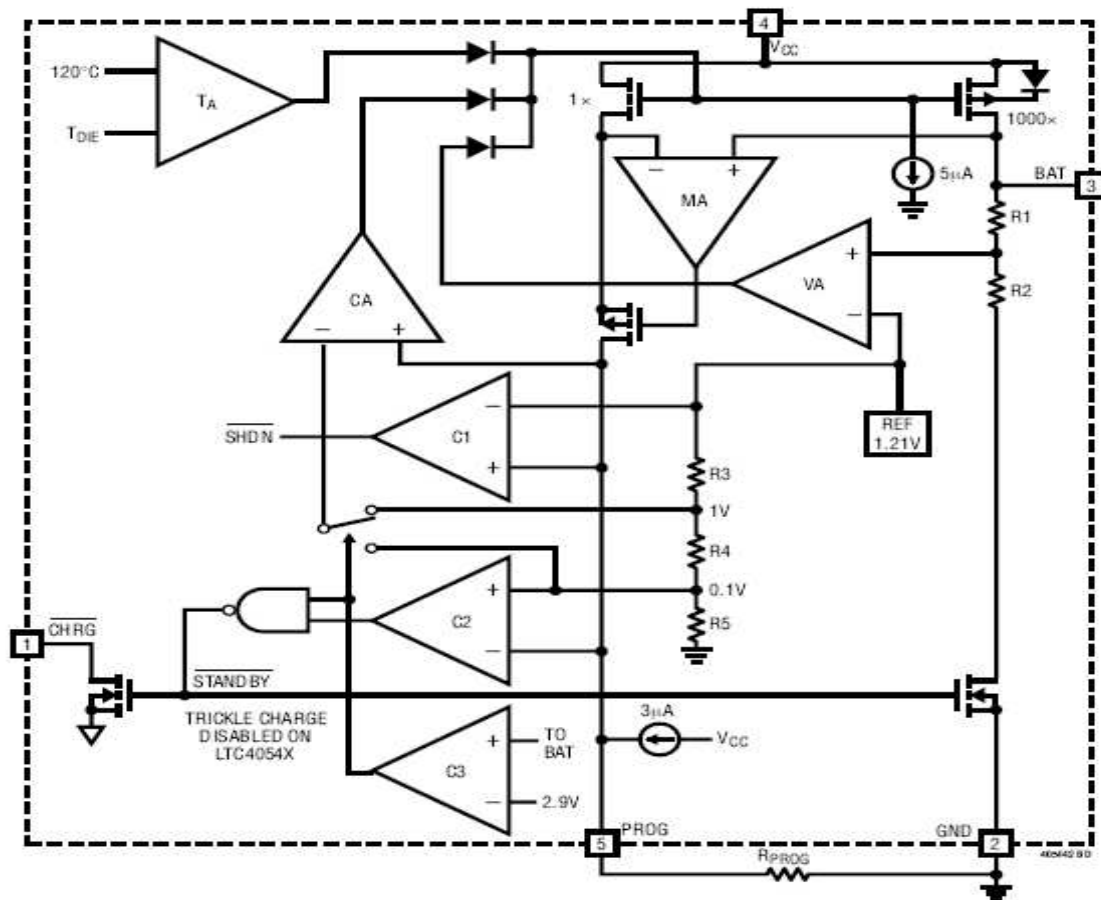


Pin Assignment



PIN NUMBER SOT-23- 5	PIN NAME	FUNCTION
1	CHRG	Open-Drain Charge Status Output
2	GND	Ground
3	BAT	Charge Current Output
4	V _{CC}	Positive Input Supply Voltage.
5	PROG	Charge Current Program, Charge Current Monitor and Shutdown Pin

Functional Diagram



Absolout Maximum Ratings

Input Supply Voltage (VCC)	-0.3V to 10V
PROG.....	- 0.3V to VCC + 0.3V
BAT	-0.3V to 7V
CHRG.....	-0.3V to 10V
BAT Short-Circuit Duration	Continuous
BAT Pin Current	800mA
PROG Pin Current	800 A
Maximum Junction Temperature	125 C
Operating Ambient Temperature Range.....	-40°C to 85°C
Storage Temperature Range	-65 °Cto 125°C
Lead Temperature (Soldering, 10 sec).....	300°C

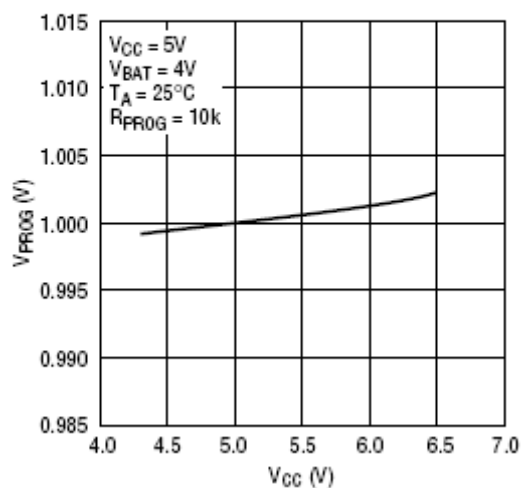
Electrical Characteristics

Operating Conditions: $T_A=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$ unless otherwise specified.

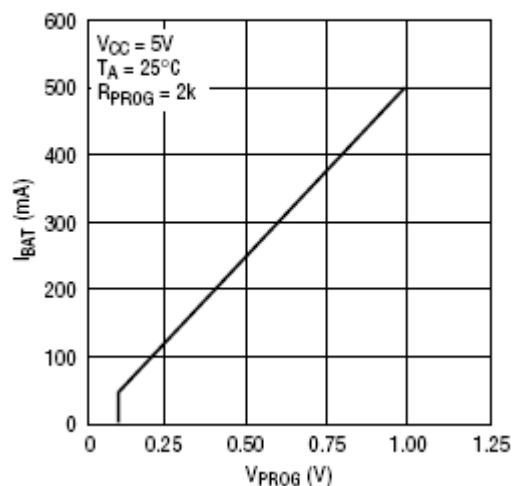
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{CC}	Input Supply Voltage		4.5	5.0	6.5	V
I_{CC}	Input Supply Current	Charge Mode, $R_{PROG} = 10\text{k}$ Standby Mode (Charge Terminated) I Shutdown Mode (R_{PROG} Not Connected, $V_{CC} < V_{BAT}$, or $V_{CC} < V_{UV}$)		300 200 25	2000 500 50	μA μA μA
V_{FLOAT}	Regulated Output (Float) Voltage	$0^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$, $I_{BAT} = 40\text{mA}$	4.158	4.2	4.242	V
I_{BAT}	BAT Pin Current	$R_{PROG} = 10\text{k}$, Current Mode $R_{PROG} = 2\text{k}$, Current Mode Standby Mode, $V_{BAT} = 4.2\text{V}$ Shutdown Mode (R_{PROG} Not Connected) Sleep Mode, $V_{CC} = 0\text{V}$	93 265	100 300 7.5 7.6 0.4	107 335	mA mA μA μA μA
I_{TRIKL}	Trickle Charge Current	$V_{BAT} < V_{TRIKL}$, $R_{PROG} = 2\text{k}$	20	39	70	mA
V_{UV}	V_{CC} Undervoltage Lockout Threshold	From V_{CC} Low to High	3.7	3.77	3.92	V
V_{UVHYS}	V_{CC} Undervoltage Lockout Hysteresis			100		mV
V_{MSD}	Manual Shutdown Threshold Voltage	PROG Pin Rising PROG Pin Falling	1.0 0.9	1.1 1.0	1.3 1.1	V V
V_{ASD}	$V_{CC} - V_{BAT}$ Lockout Threshold Voltage	V_{CC} from Low to High V_{CC} from High to Low		8 80		mV
I_{TERM}	C/10 Termination Current Threshold	$R_{PROG} = 2\text{k}$		111		mA
V_{PROG}	PROG Pin Voltage	$R_{PROG} = 10\text{k}$, Current Mode	0.93	1.04	1.07	V
R_{ON}	Efficiency	Power FET "ON" Resistance (Between V_{CC} and BAT)		636		$\text{m}\Omega$

Typical Performance Characteristics

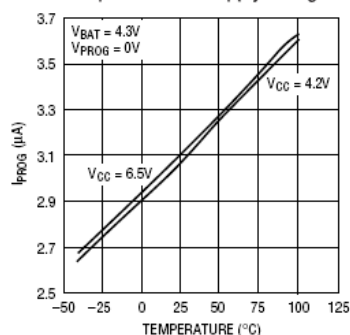
PROG Pin Voltage vs Supply Voltage (Constant Current Mode)



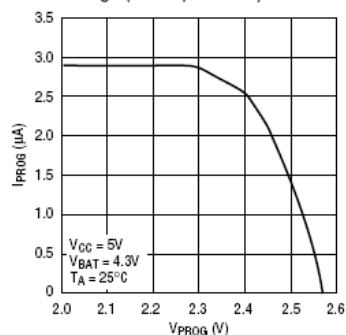
Charge Current vs PROG Pin Voltage



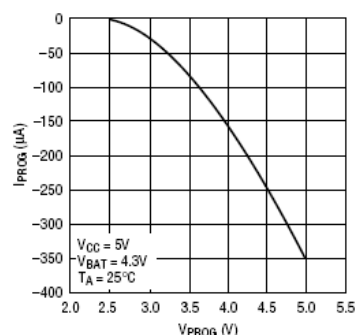
PROG Pin Pull-Up Current vs Temperature and Supply Voltage



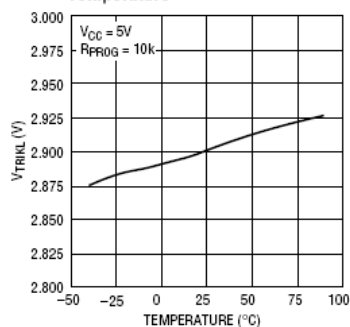
PROG Pin Current vs PROG Pin Voltage (Pull-Up Current)



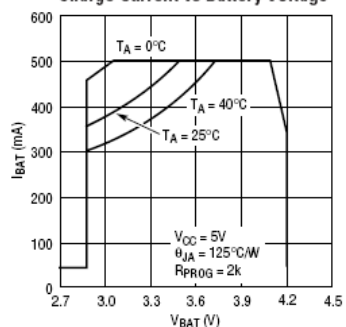
PROG Pin Current vs PROG Pin Voltage (Clamp Current)



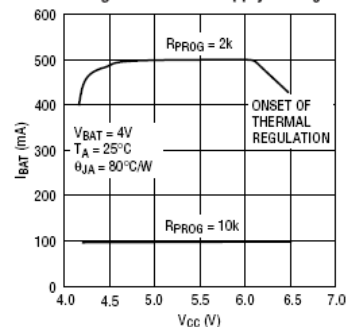
Trickle Charge Threshold vs Temperature



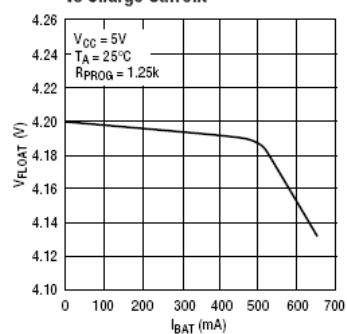
Charge Current vs Battery Voltage



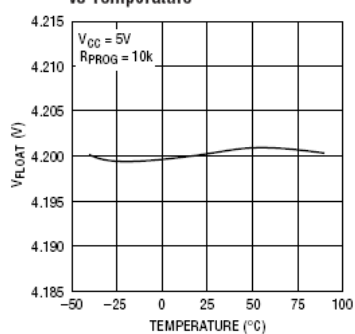
Charge Current vs Supply Voltage



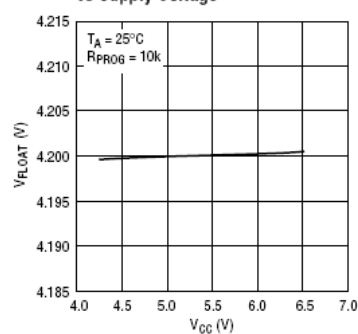
Regulated Output (Float) Voltage vs Charge Current



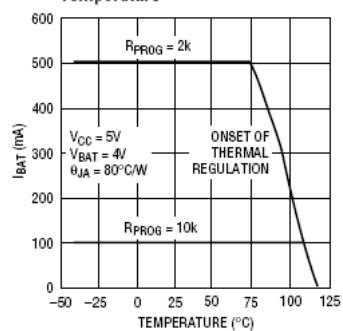
Regulated Output (Float) Voltage vs Temperature



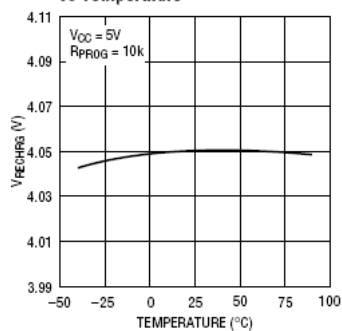
Regulated Output (Float) Voltage vs Supply Voltage



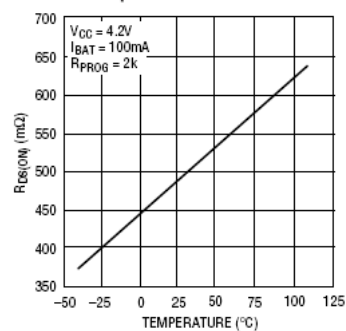
Charge Current vs Ambient Temperature



Recharge Voltage Threshold vs Temperature



Power FET "ON" Resistance vs Temperature



Application Information

PIN ASSIGNMENT

CHRG (Pin 1): 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 μ A is connected to the CHRG pin, indicating an “AC present” condition. When the UN8HX detects an under voltage lockout condition, CHRG is forced high impedance.

GND (Pin 2): Ground.

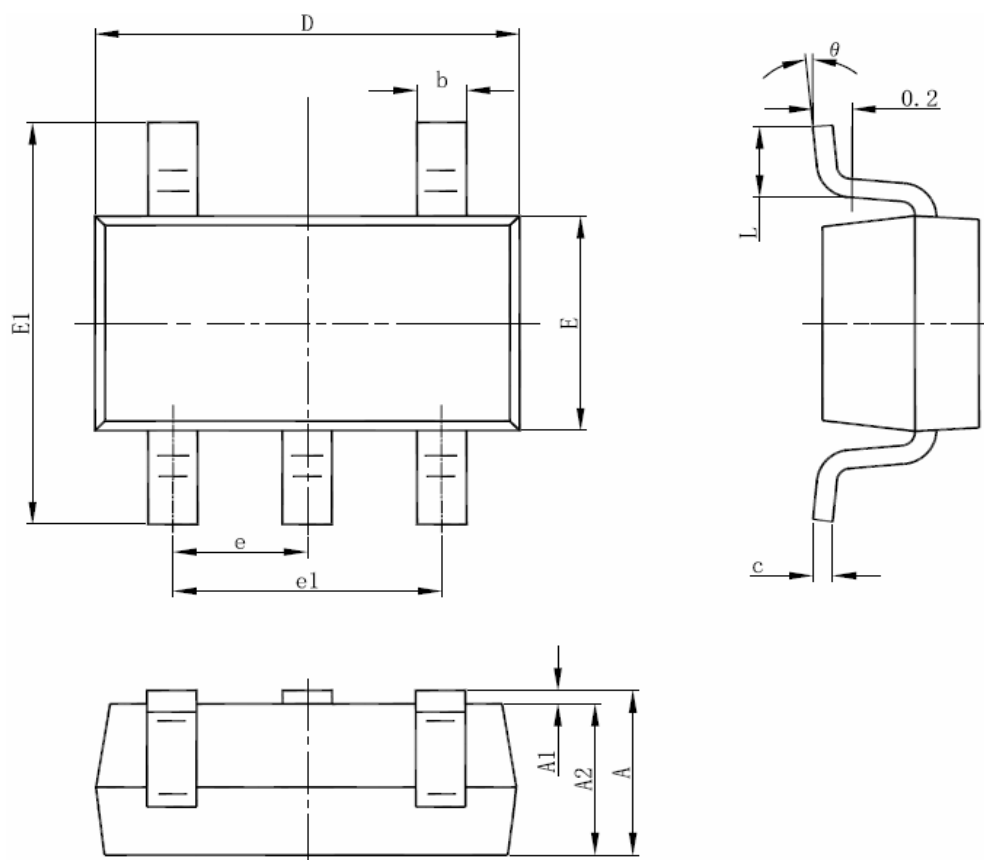
BAT (Pin 3): Charge Current Output. Provides charge current to the battery and regulates the final float voltage to 4.2V. An internal precision resistor divider from this pin sets the float voltage which is disconnected in shutdown mode.

VCC (Pin 4): Positive Input Supply Voltage. Provides power to the charger. VCC can range from 4.25V to 6.5V and should be bypassed with at least a 1 μ F capacitor. When VCC drops to within 30mV of the BAT pin voltage, the UN8HX enters shutdown mode, dropping IBAT to less than 2 A.

PROG (Pin 5): 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 serves to 1V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula: $IBAT = (V_{PROG}/R_{PROG}) \cdot 1000$. The PROG pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a 3 μ A 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 μ A. 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 RPROG to ground will return the charger to normal operation.

Packaging Information

SOT-23-5 Package Outline Dimension



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