HM8050 Series 1mA~200mA Linear Li-Ion Battery Charger

GENERAL DESCRIPTION

The HM8050 is a complete constant current & constant voltage linear charger for single cell lithium-ion batteries. Its DFN2x2 package and low external component count make the HM8050 Series ideally suited for portable applications. Furthermore, the HM8050 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/4.3V/4.35V/4.4V, and the charge current can be programmed externally with a single resistor. The HM8050 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 HM8050 automatically enters a low current state, dropping the battery drain current to less than 2uA. The HM8050 Series can be put into shutdown mode, reducing the supply current to 50uA.

Other features include Battery temperature monitor, under-voltage lockout, automatic recharge and two status pins to indicate charge and charge termination.

FEATURES

Programmable Charge Current Up to 200mA
No MOSFET, Sense Resistor or Blocking Diode Required
 Complete Linear Charger in DFN2x2 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/4.3V/4.35V/4.4V Charge Voltage with ±1% Accuracy
Charge Current Monitor Output for Gas Gauging
Automatic Recharge
Charge state pairs of output, no battery and fault status display
 C/10 Charge Termination
 50uA Supply Current in Shutdown
 2.9V Trickle Charge Threshold
Soft-Start Limits Inrush Current
Battery temperature monitoring function
ESD HBM 4KV
Available in DFN2x2-8 Package

APPLICATIONS

Wearable device
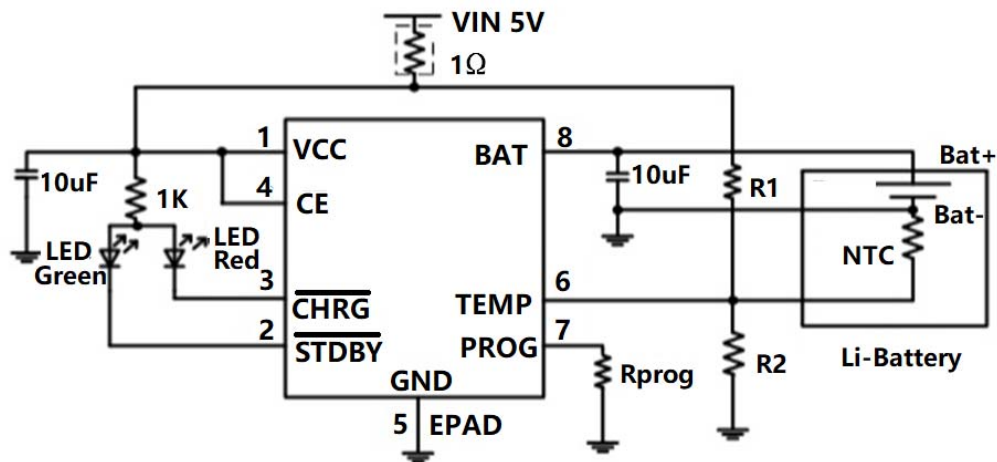Small capacity battery charger application
Bluetooth 、GPS Applications

Figure1 . Typical Application Circuit

ORDERING INFORMATION

PART NUMBER (note1)	VBAT	MARK (note2)
HM8050A	4.2V	5017AYW
HM8050B	4.3V	5017BYW
HM8050C	4.35V	5017CYW
HM8050D	4.4V	5017DYW

Note1：In HM8050X description, X may be A or B or C or D

Note2: "YW" is manufacture date code, "Y" means the year, "W" means the week
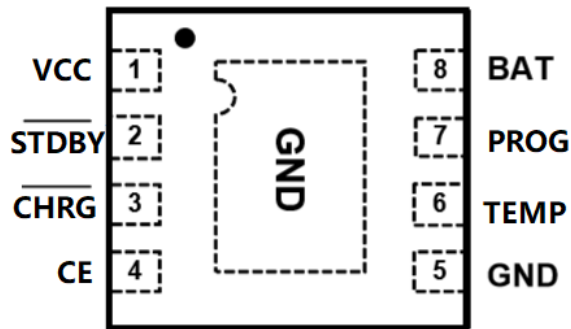
PIN CONFIGURATION

Figure 2. PIN Configuration

PIN DESCRIPTION

PIN NUMBER	PIN NAME	PIN DESCRIPTION
1	VCC	Positive Input Supply Voltage.
2	/STBY	The completion of battery charging instructions side.
3	/CHRG	Open-Drain Charge Status Output.
4	CE	Chip enable input.
5,EPAD	GND	Ground
6,	TEMP	Battery temperature detection input, do not let this pin float.
7	PROG	Charge Current Program, Charge Current Monitor and Shutdown Pin.
8	BAT	Charge Current Output.

ABSOLUTE MAXIMUM RATINGS

(Note: Do not exceed these limits to prevent damage to the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

PARAMETER	VALUE	UNIT
Input Supply Voltage VCC	VSS-0.3 ~ VSS+11	V
PROG pin Voltage Vprog	VSS-0.3 ~ Vcc+0.3	V
BAT pin Voltage Vbat	Vss-0.3 ~ 7	V
CHAG/STDBY pin Voltage Vchrg、Vstdby	VSS-0.3 ~ VSS+12	V
BAT pin Current Ibat	0.25	A
PROG pin Current Iprog	2.5	mA
Operating Ambient Temperature	-40 to 85	°C
Maximum Junction Temperature	150	°C
Storage Temperature	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)	260	°C

ELECTRICAL CHARACTERISTICS

(V_{CC}= 5.0V, Vbat=3.5V T_A= 25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range	VCC		4.4		9.0	V
Input supply current	Icc	Charge mode, RPROG =1K		200	320	uA
		Standby mode		150	250	uA
		Shutdown mode(RPROG not connected,Vcc<Vbat or Vcc<Vuv)		50	100	uA
BAT pin Current	Ibat	R_{PROG} =1k,Current mode	90	100	110	mA
		R_{PROG} =2k,Current mode	45	50	55	mA
		R_{PROG} =10k,Current mode	9	10	11	mA
		Standby mode,Vbat=4.4V	0	-2.5	-6	uA
		Shutdown mode		1	2.5	uA
		Sleep mode,Vcc=0V		0.3	2.5	uA
Regulated Charge Voltage(HM8050A)	Vfloat	0°C≤ TA≤ 85°C, Icharge = 4mA R_{PROG} =10k,	4.158	4.2	4.242	V
Regulated Charge Voltage(HM8050B)			4.257	4.3	4.343	V
Regulated Charge Voltage(HM8050C)			4.307	4.35	4.394	V

Regulated Charge Voltage(HM8050D)			4.356	4.4	4.444	V
PROG pin Voltage	Vprog	R_{PROG} =10k, Current mode	0.92	1.0	1.08	V
Trickle charge current	Itrikl	Vbat=2V,Rprog=2k	4.5	5	5.5	mA
Trickle charge Threshold Voltage	Vtrikl	R_{PROG} =10K , Vbat Rising	2.7	2.9	3.0	V
Trickle voltage hysteresis voltage	Vtrhys	R_{PROG} =10K	60	80	110	mV
Recharge Battery threshold Voltage	ΔVrecg	V_{FLOAT} - V_{RECHRG}		150	300	mV
CHRG pin Output low voltage	Vchrg	Ichrg=5mA		0.35	0.6	V
STDBY pin Output low voltage	Vstdby	Istdby=5mA		0.35	0.6	V
Enable Threshold		VCC=4.4V~6.5V	0.3	1	1.5	V
Enable Leakage Current			-0.1		+0.1	uA
TEMP pin voltage of the high-end flip	Vtemp-h			80	82	%Vcc
TEMP pin voltage of the low-end flip	Vtemp-l		43	45		%Vcc

PIN FUNCTION

VCC (PIN 1):   Positive Input Supply Voltage.

Provides power to the charger, VCC can range from 4.4V to 9.0V and should be bypassed with at least a 10uF capacitor. When VCC drops to within 30mV of the BAT pin voltage, the HM8050 Series enters shutdown mode, dropping IBAT to less than 2uA.

STDBY (PIN 2):   The completion of battery charging instructions side.

When the battery charge is complete, STDBY pulled low by internal switches, indicating the completion of charging. In addition, STDBY pin will be in a high-impedance state.

CHRG (PIN 3):   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, CHRG pin will be in a high-impedance state.

CE OR EN (PIN 4):   Chip enable input.

High input level will make HM8050 Series in normal working condition; low input level so that HM8050 Series is prohibited charging status. CE pin can be TTL or CMOS level-level driver.

GND & EPAD (PIN 5):   Ground. Please connect with mass metal

TEMP (PIN 6):   Battery temperature detection input.

TEMP pin to receive the battery NTC sensor output.

If the TEMP pin voltage is less than the input voltage is greater than 45% or 80% of the input voltage means the battery temperature is too low or too high, then the charge has been suspended.

If the TEMPdirect access GND, battery temperature detection canceled, the other charged and functioning properly.

Please do not let this pin float.

PROG (PIN 7):   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:
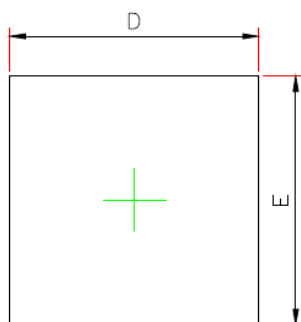
IBAT = (VPROG/RPROG) x100.

The PROG pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a 0.05uA 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 50uA. 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.

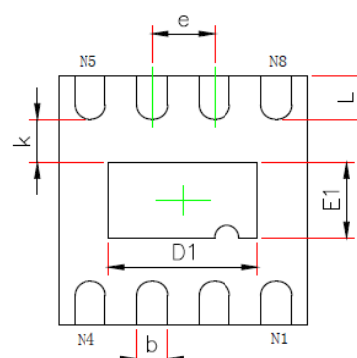**BAT (PIN 8):**   Charge Current Output.

Provides charge current to the battery and regulates the final float voltage to 4.2V/4.3V/4.35V/4.4V. An internal precision resistor divider from this pin sets the float voltage which is disconnected in shutdown mode.
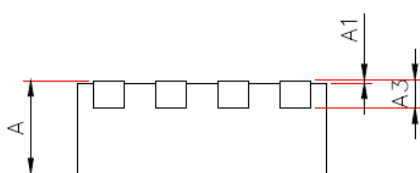
PACKAGE OUTLINE

DFN2X2-8 PACKAGE OUTLINE AND DIMENSIONS

TOP VIEW

SIDE VIEW

BOTTOM VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.950	2.050	0.077	0.081
E	1.950	2.050	0.077	0.081
D1	1.150	1.250	0.045	0.049
E1	0.550	0.650	0.022	0.026
k	0.350REF.		0.014REF.	
b	0.200	0.300	0.008	0.012
e	0.500BSC.		0.020BSC.	
L	0.300	0.400	0.012	0.016