28V Input Voltage, OVP Function, 1.0A Linear Battery Charger

PRELIMINARY DATASHEET

Datasheet Brierf

DESCRIPTION

The FH4056H is a cost-effective, fully integrated high input voltage single-cell battery charger. The charger uses a CC/CV charge profile required by Li-Ion battery. The charger accepts an input voltage up to 28.0V but is disabled when the input voltage exceeds the OVP threshold, typically 6.5V, to prevent excessive power dissipation. The 28.0V rating eliminates the over-voltage protection circuit required in a low input voltage charger.

The charge current and the end-of-charge (EOC) current are programmable with external resistors. When the battery voltage is lower than typically 2.9V, the charger precondition the battery with typically 18% of the programmed charge current. When the charge current reduces to the programmable EOC current level during the CV charge phase, an EOC indication is provided by the $\overline{CHRG}$ pin, which is an open-drain output. An internal thermal foldback function protects the charger from any thermal failure.

Two indication pins ($\overline{PROG}$ & $\overline{CHRG}$) allow simple interface to a microprocessor or LEDs. When no adapter is attached or when disabled, the charger draws less than 1.0uA leakage current from the battery.

The FH4056H is available in Green 8-Pin DFN2*2/ESOP, packages and is rated over the -40℃ to +85℃ temperature range.

FEATURES

- 28.0V Maximum Voltage for the Power Input
- Programmable Charge Current Up to 1000mA
- Preset 4.2V/4.35V Charge Voltage with ±1% Accuracy
- 2.9V Trickle Charge Threshold
- 6.5V Input Over-Voltage Protection
- C/10 Charge Termination
- Supports 0V battery charging
- Complete Charger for Single-Cell Batteries
- Integrated Pass Element and Current Sensor
- No External Blocking Diode Required
- Low Component Count and Cost
- Programmable Charge Current
- Programmable End-of-Charge Current
- Charge Current Thermal Foldback for Thermal Protection
- Power Presence and Charge Indications
- Less than 1uA Leakage Current off the Battery When No Input Power Attached or Charger Disabled
- Available in Green DFN2*2-8L, ESOP-8L(Expose Pad) Packages

APPLICATIONS

- Mobile Phones
- Blue-Tooth Devices
- PDAs
- MP3 Players
- Stand-Alone Chargers
- Other Handheld Devices

Typical Application Topology

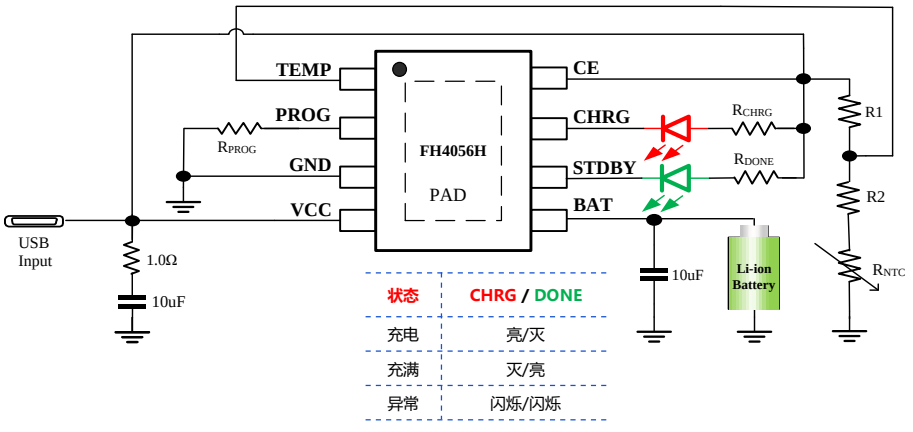
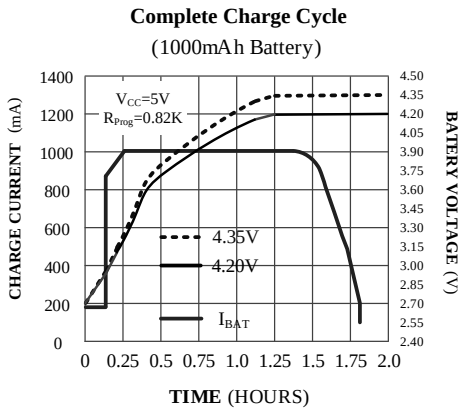
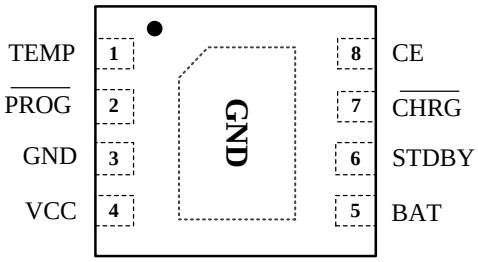


Figure 1. FH4056H Typical Application Circuit with USB Input



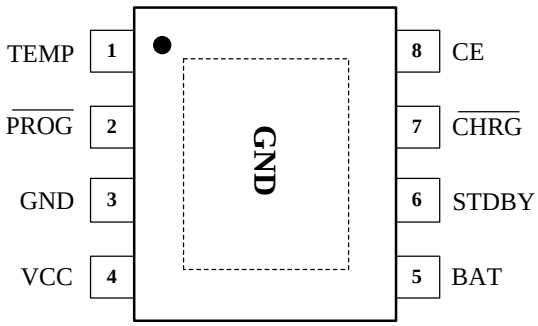
PIN CONFIGURATIONS

(TOP VIEW)



DFN-2×2-8L

(TOP VIEW)



ESOP-8L (Exposed Pad)

PIN DESCRIPTION

引脚序号	引脚名称	功能简述
1	TEMP	电池温度检测引脚。 将 TEMP 引脚接到电池的 NTC 传感器的输出端。如果 TEMP 引脚的电压小于输入电压的 45%或者大于输入电压的 80%，意味着电池温度过低或过高，则充电被暂停。如果 TEMP 引脚接地或浮空，电池温度检测功能取消，其他充电功能正常。
2	PROG	恒流充电电流设置和充电电流监测引脚。 外部连接 1% 精度电阻器到地来设置充电电流。300mA 以上设置公式：I_{BAT} = 1000 / R_{PROG}，300mA 以下设置为：I_{BAT} = 900 / R_{PROG}。 举例：1K 对应 1A 充电电流；2K 对应 0.5A 充电电流；3K 对应 0.3A 充电电流。
3	GND	芯片接地。
4	VCC	电源输入引脚。 连接至电源正极，使用至少 10uF 有效值的陶瓷电容器尽量靠近旁路 VCC 和 GND。
5	BAT	电池充电输出引脚。 连接至电池正极，放置至少 10uF 有效的陶瓷电容器到地。
6	STBDY	充电状态指示引脚。连接至 LED 指示灯负极，电池充满时，引脚输出低电平，指示灯亮。
7	CHRG	充电指示引脚。连接至 LED 指示灯负极，电池充电时，引脚输出低电平，指示灯亮。
8	CE（EN）	使能输入引脚。连接至 VCC 或 MCU 控制，高电平使能充电，低电平关闭充电。
EP	PAD	封装底部散热焊盘，可与芯片 GND 连接到一起，连接到大的覆铜平面，达到较好的散热。

输入 28V 耐压具有 OVP 功能 1.0A 线性锂电池充电芯片

器件概述

FH4056H 是一款输入耐压高达 28V，具有电源 OVP 功能的 1.0A 单节锂离子电池线性充电器，其采用了恒定电流/恒定电压的充电模式。FH4056H 的 CE、TEMP、CHRG、STDBY 端口的耐压最高也可达到 28V。

FH4056H 采用了内部 PMOSFET 架构，加防倒充电路，不需要外部隔离二极管。热反馈可对充电电流进行自适应调节，以便在大功率操作或高环境温度条件下对芯片充电电流加以限制。充满截止电压为：4.20V/4.35V。而充电电流可通过一个电阻器进行外部设置。

当充电电流在达到最终浮充电压之后降至设定值 1/10 时 FH4056H 将自动终止充电循环。当输入电压掉电后，FH4056H 自动进入一个低电流状态，将电池漏电流降至 0.1uA 以下。

FH4056H 的其他特点包括电池温度检测、CE 使能端输入控制、欠压闭锁、自动再充电和两个用于指示充电、结束的 LED 状态引脚。

FH4056H 采用底部带有散热片的 8-Pin ESOP8/DFN2*2 两种封装形式。FH4056H 可以用于 USB 电源和适配器电源。

电气特性

- 输入电源端口最高耐压可达 28.0V
- 输入电源电压 6.5V 时芯片 OVP（过压保护）
- 高达 1000mA 的可编程充电电流
- 恒流/恒压操作，有温度自适应可实现充电速率最大化
- 充电状态双输出、无电池和故障状态显示
- 精度达到±1%的预设充电电压
- 自动再充电
- C/10 充电终止
- 2.9V 涓流充电
- 软启动限制了浪涌电流
- 电池温度监测功能

应用领域

- 移动电话
- 数码相机
- 蓝牙应用
- 便携设备

工作原理

FH4056H 是专门为一节锂离子或锂聚合物电池而设计的线性充电器电路，利用芯片内部的功率晶体管对电池进行涓流、恒流和恒压充电。充电电流可以用外部电阻编程设定，最大持续充电电流可达 1A，不需要另加阻流二极管和电流检测电阻。

FH4056H 包含两个漏极开路输出的状态指示输出端，充电状态指示端 CHRG 和电池充电完成指示输出端 STDBY。芯片内部的功率管理电路在芯片的结温超过 165℃时自动降低充电电流，这个功能可以使用户最大限度的利用芯片的功率处理能力，不用担心芯片过热而损坏芯片或者外部元器件。这样，用户在设计充电电流时，可以不用考虑最坏情况，而只是根据典型情况进行设计就可以了，因为在最坏情况下，FH4056H 会自动减小充电电流。

当输入电压大于电源低电压检测阈值和芯片使能输入端接高电平时，FH4056H 开始对电池充电，CHRG 管脚输出低电平，表示充电正在进行。如果电池电压低于 3V，FH4056H 采用涓流对电池进行预充电。当电池电压超过 3V 时，充电器采用恒流模式对电池充电，充电电流由 PROG 管脚和 GND 之间的电阻 RPROG 确定。当电池电压接近 4.2V 电压时，充电电流逐渐减小，FH4056H 进入恒压充电模式。当充电电流减小到充电结束阈值时，充电周期结束，CHRG 端输出高阻态，STDBY 端输出低电位。

充电结束阈值是恒流充电电流的 10%。当电池电压降到再充电阈值以下时，自动开始新的充电周期。芯片内部的高精度的电压基准源，误差放大器和电阻分压网络确保电池端调制电压的精度在 1%以内，满足了锂离子电池和锂聚合物电池的要求。

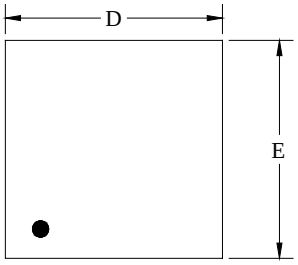
当输入电压掉电或者输入电压低于电池电压时，充电器进入低功耗的睡眠模式，电池端消耗的电流小于 0.1uA，从而增加了待机时间。如果将使能输入端 CE 接低电平，充电器停止充电。

RPROG 与充电电流参考表

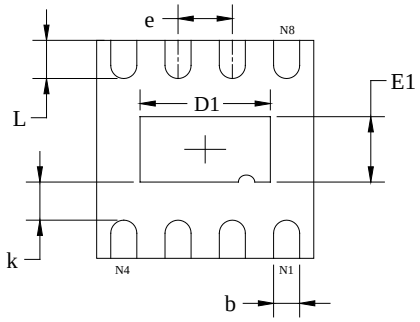
R_{PROG} (K)	I_{BAT} (mA)	R_{PROG} (K)	I_{BAT} (mA)
5.1	130	1.6	625
3.0	265	1.5	680
2.7	305	1.3	860
2.0	455	1.2	930
1.8	520	1.1	1000

PACKAGE OUTLINE DIMENSIONS

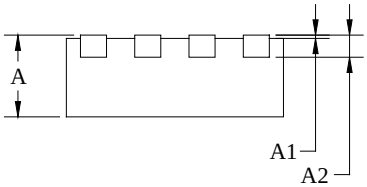
DFN2*2-8L



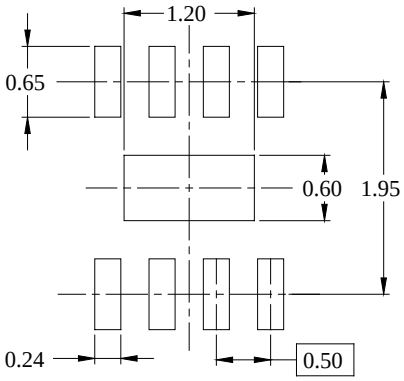
TOP VIEW



BOTTOM VIEW



SIDE VIEW

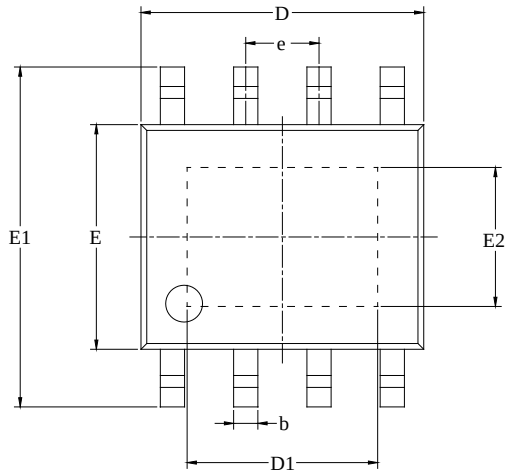


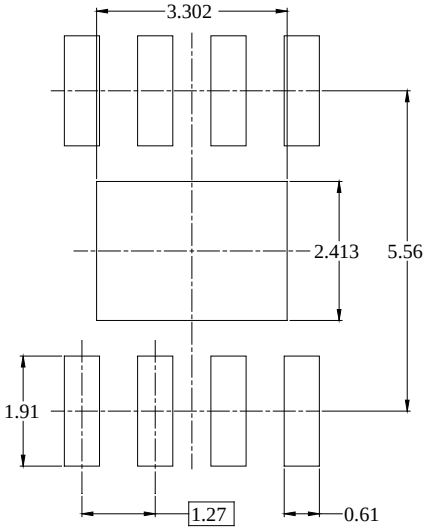
RECOMMENDED LAND PATTERN(Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.152 REF		0.006 REF	
D	1.924	2.076	0.076	0.082
D1	1.400	1.600	0.055	0.063
E	1.924	2.076	0.076	0.082
E1	0.700	0.900	0.028	0.035
k	0.250 MIN		0.010 MIN	
b	0.180	0.280	0.007	0.011
e	0.500 TYP		0.020 TYP	
L	0.224	0.376	0.009	0.015

PACKAGE OUTLINE DIMENSIONS

ESOP-8L (Exposed Pad)





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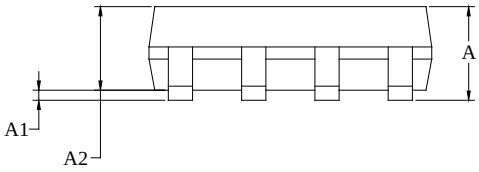

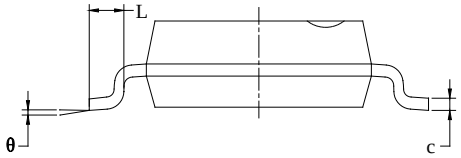

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.700		0.067
A1	0.0 00	0.1 00	0.00 0	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

ORDERING INFORMATION

Part Number	Input Standoff Voltage	Features	Operating Temperature	Package Type	Top Mark	SPQ
FH4056HAS8	~30.0V	● Linear Battery Charger ● Charger Current: 1.0A(typ.) ● V_{OVP}: 6.5V ● V_{BATT_REG}: 4.2V ● VBAT Rising:2.9V	-40°C to +85°C	ESOP-8L	NL Y Y MM LL	3000EA/Reel
FH4056HAD8	~30.0V		-40°C to +85°C	DFN2*2-8L	NN Y Y MM LL	3000EA/Reel
FH4056HHS8	~30.0V	● Linear Battery Charger ● Charger Current: 1.0A(typ.) ● V_{OVP}: 6.5V ● V_{BATT_REG}: 4.35V ● VBAT Rising:2.9V	-40°C to +85°C	ESOP-8L	4056E Y Y MM LL	3000EA/Reel
FH4056HHD8	~30.0V		-40°C to +85°C	DFN2*2-8L	4056E Y Y MM LL	3000EA/Reel

Note:

- **FH4056HA(4.2V)/FH4056HH(4.35V)** devices are Pb-free and RoHs compliant.
- The surface prints of our semiconductor devices are subject to change during the production process and do not involve changes in electrical parameters, and we will not separately state the notice.
- If you have any other custom purchase needs, please contact our sales department.
- ForDevices reserves the right to amend and legally interpret the electrical parameters of this chip device. (http://www.fordevices.com)

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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▲ Update by Dec.2022