1.0MHz, PFM Step-up, 2-Cell Lithium Battery Charger IC

Datasheet Brierf

PRELIMINARY DATASHEET

Description

FH5412 is a PFM mode boost(step-up) battery charge management IC with operating voltage range between 2.7V to 6.5V. It is specially designed for #2 cell Li-ion battery charge with fewer external components.

FH5412 adopts constant current and quasi-constant voltage mode to charge battery. On power up, FH5412 enters charging state, the external N-channel MOSFET is turned on, inductor current rises. When inductor current reaches upper threshold, the N-channel MOSFET is turned off, inductor is discharged, the energy stored in inductor is transferred to battery.

When the inductor current is discharged to its lower threshold, the N-channel MOSFET is turned on again. When BAT pin voltage reaches 8.40V (typ.) for the first time, FH5412 enters CV mode, in which the charge current is reduced. The charge process will not be terminated until BAT voltage reaches 8.40 for the second time. In termination mode, the N-ch MOSFET is turned off.

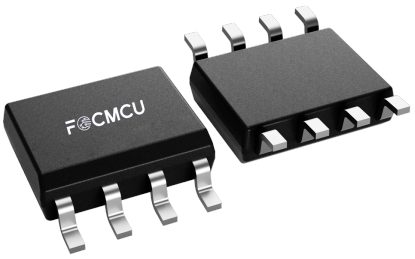
When BAT voltage falls below recharge threshold, the FH5412 enters charge mode again. FH5412's switching frequency can be up to 1.0MHz, which makes a small-profile inductor usable.

If battery voltage is lower than input voltage by a diode drop, FH5412 will increase the off time to 5us to reduce the charge current as a protection for battery with the joint action of external N-channel and P-channel MOSFET.

The other features include chip enable input, status indication, etc. FH5412 is available in 8-pin SOP package.

Features

- Input Voltage Range: 2.7V ~ 6.5V
- Operating Current: 280uA @ VIN=5.0V
- Inductor Current Detection
- Switching Frequency up to 1.0MHz
- CV mode to Compensate for the Voltage Loss on Battery Internal Resistance and Trace Resistance
- Automatic Recharge
- Output Power up to 35W
- Protection for Low Battery Voltage and Short Battery
- Automatic Adaptability to Input Supply with Limited Driving Capability
- Chip Enable Input
- Battery Over-voltage Protection
- Status Indication
- Operating Temperature: -40℃ ~ 85℃
- Available in SOP-8L Package
- Lead-free, Rohs-Compliant and Halogen Free



Applications

- Audio System
- Standalone Charger
- Power Bank, POS, Electric Fan
- 2 cell Li+ Battery Charging Management

Typical Application Circuit

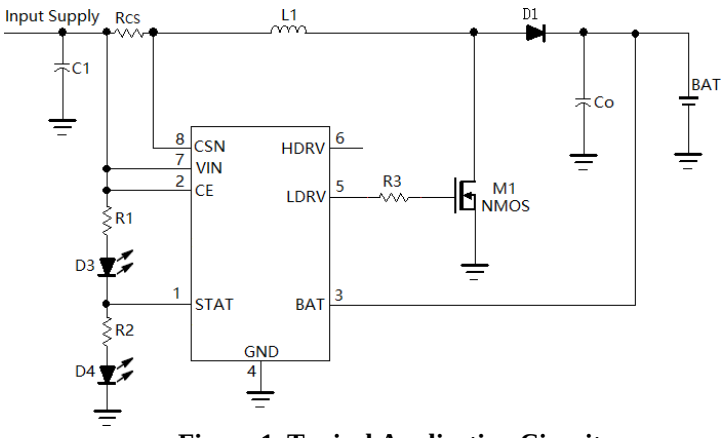


Figure 1. Typical Application Circuit
(No protection for low or short battery)

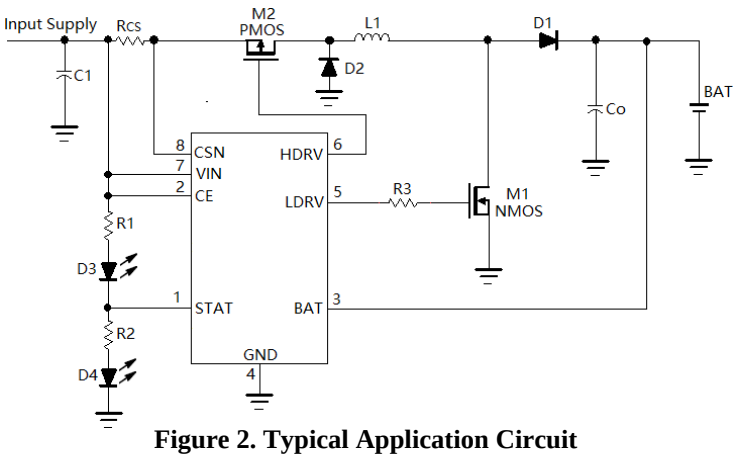


Figure 2. Typical Application Circuit
(Protection for low or short battery)

PFM 升压型双节锂电池充电控制集成电路

器件概述

FH5412 是一款工作于 2.75V 到 6.5V 的 PFM 升压型双节锂电池充电控制集成电路。FH5412 采用恒流和准恒压模式对电池进行充电管理，内部集成有基准电压源，电感电流检测单元，电池电压检测电路和片外场效应晶体管驱动电路等，具有外部元件少，电路简单等优点。

当接通输入电源后，FH5412 进入充电状态，控制片外 N 沟道 MOSFET 导通，电感电流上升，当上升到外部电流检测电阻设置的上限时，片外 N 沟道 MOSFET 截止，电感电流下降，电感中的能量转移到电池中。

当电感电流下降到外部电流检测电阻设置的下限时，片外 N 沟道 MOSFET 再次导通，如此循环。当 BAT 管脚电压第一次达到内部设置的 8.4V(典型值)时，FH5412 进入准恒压充电模式，以较小电流对电池充电。在准恒压模式，当 BAT 管脚电压达到 8.4V 时，充电过程结束，片外 N 沟道 MOSFET 保持截止状态。当 BAT 管脚电压下降到再充电阈值时，FH5412 再次进入充电状态。

FH5412 最高工作频率可达 1.0MHz。当电池电压低于输入电压或电池短路时，FH5412 在片外 N 沟道 MOSFET 和 P 沟道 MOSFET 的共同作用下，用较小电流继续对电池充电，对电池起到保护作用。

其他功能包括芯片使能输入，管芯过温保护和状态指示输出端等。FH5412 采用 8 管脚的 SOP-8L 封装。

电气特性

- 输入电压范围：2.75V 到 6.5V
- 工作电流：280 微安@VIN=5V
- 输入电源自适应功能
- 支持太阳能供电
- 电感电流检测
- 高达 1.0MHz 开关频率
- 准恒压充电模式补偿电池内阻和电池连接线电阻产生的电压损失
- 自动再充电功能
- 高达 35W 输出功率
- 当电池电压低于输入电压或者电池短路时，以较小电流充电。
- 芯片使能输入端
- 管芯过温保护
- 电池端过压保护
- 状态指示输出
- 工作温度范围： - 40℃到 85℃
- 8 管脚 SOP8 封装
- 产品无铅，满足 rohs 指令要求

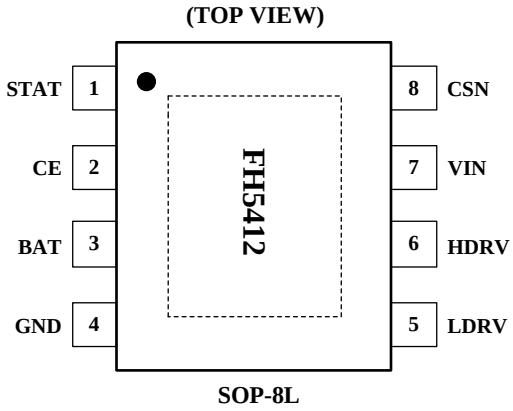
应用领域

- 双节锂电池充电控制
- POS 机，电风扇
- 音频多媒体设备
- 独立充电器

引脚功能

序号	名称	功能描述
1	STAT	充电状态指示输出端。 CMOS 输出端，当此管脚为高电平时，表示充电器处于充电状态；当此管脚为低电平时，表示充电器处于充电结束状态。
2	CE	芯片使能输入端。 高输入电平将使 FH5412 处于正常工作状态；低输入电平使 FH5412 处于被禁止状态。CE 管脚可以被 TTL 电平或者 CMOS 电平驱动。
3	BAT	电池电压反馈输入端。 此管脚可以直接连接到电池正极或通过一个外部电阻连接到电池正极，以检测电池电压。连接于 BAT 管脚与电池正极之间的电阻（图 8 中的 Rx）可以向上调整充电截止电压，也可以在电池驱动感性负载的情形下起到保护 FH5412 的作用，请参考“应用信息”部分。
4	GND	电源接地端。输入电源和电池的负极。
5	LDRV	芯片外置 N 沟道功率管栅极驱动端。 连接到外部 N 沟道场效应晶体管（MOSFET）的栅极。
6	HDRV	芯片外置 P 沟道功率管栅极驱动端。 连接到外部 P 沟道场效应晶体管（MOSFET）的栅极。当不需要考虑电池电压过低保护或者电池端短路保护时，不需要使用外部的 P 沟道场效应晶体管，此管脚悬空即可。
7	VIN	电源正输入端。 VIN 管脚为 FH5412 内部电路提供工作电源，同时也是电感电流（输入电流)检测的正输入端。
8	CSN	电感电流检测负输入端。 在 VIN 管脚和 CSN 管脚之间接一个电流检测电阻 RCS，用以检测电感电流（输入电流)。正常工作时，(VIN - CSN)的上限为 125 毫伏(典型值)，下限为 85 毫伏(典型值)。

Pin Assignment

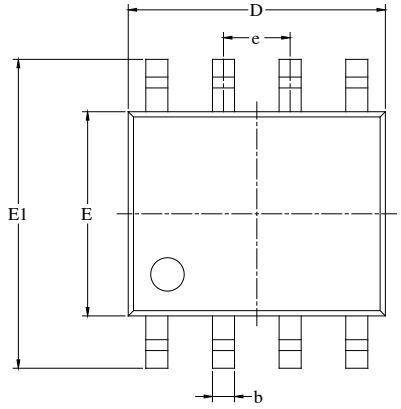


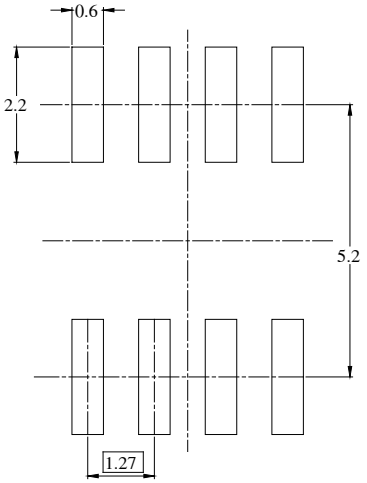
Pin Description

No.	Symbol	Description
1	STAT	**Status Indication Output.** CMOS output. STAT pin's being high means charger is in charging state; and charger is in termination state when STAT pin is low.
2	CE	**Chip Enable Input.** A high input will put the device in the normal operating mode. Pulling the CE pin to low level will put the FH5412 into disable mode. The CE pin can be driven by TTL or CMOS logic level.
3	BAT	**Battery Positive Terminal.** BAT pin should be tied to battery's positive terminal to monitor battery voltage.
4	GND	**GND.** Ground, namely the negative terminal of input supply and battery.
5	LDRV	**Gate Drive for external N-Channel MOSFET.** Connect LDRV pin to the gate of external N-Channel MOSFET.
6	HDRV	**Gate Drive for external P-Channel MOSFET.** Connect HDRV to the gate of external P-Channel MOSFET. If there is no need to consider the cases such as battery voltage being lower than input supply or short battery, then the P-Channel MOSFET is not needed, and leave HDRV pin floating.
7	VIN	**Positive Terminal of Input Supply.** FH5412's internal circuit is powered by this pin, VIN is also the positive terminal of inductor current sensing.
8	CSN	**Negative Terminal of Inductor Current Sensing.** A current sense resistor R_{CS} between V_{IN} pin and C_{SN} pin is used to sense inductor current, also the input current. In constant current mode, (V_{IN} - C_{SN}) is regulated between 85mV and 125mV.

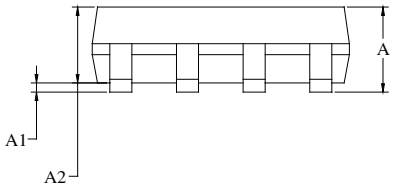
Package Information

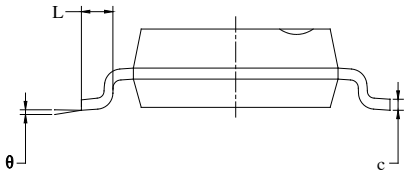
- Type: **SOP-8L**





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

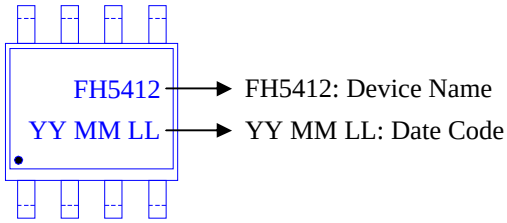
Ordering Information

Part Number	Voltage Range	Features	Operating Temperature	Package Type	Top Mark	SPQ
FH5412S8	2.7~6.5V	● Switching Frequency:1.0MHz ● P_D: 35.0W ● #2Cell Li-ion Battery ● Voltage reaches:8.40V	-40℃ to 85℃	SOP-8L	FH5412 YYMML	4000PCS/Reel

Note:

- FH5412 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.

Device Name: SOP-8L



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.

Product Folder | Order Now | Technical Documents | Tools & Software | Support & Community

Important Notice:

- The information described herein is subject to change without notice.
- FOCMCU Inc. is not responsible for any problems caused by circuits or diagrams described herein whose related industrial properties, patents, or other rights belong to third parties. The application circuit examples explain typical applications of the products, and do not guarantee the success of any specific mass-production design.
- Use of the information described herein for other purposes and/or reproduction or copying without the express permission of FOCMCU Inc. is strictly prohibited.
- The products described herein cannot be used as part of any device or equipment affecting the human body, such as exercise equipment, medical equipment, security systems, gas equipment, or any apparatus installed in airplanes and other vehicles, without prior written permission of FOCMCU Inc.
- Although FOCMCU Inc. exerts the greatest possible effort to ensure high quality and reliability, the failure or malfunction of semiconductor products may occur. The user of these products should therefore give thorough consideration to safety design, including redundancy, fire-prevention measures, and malfunction prevention, to prevent any accidents, fires, or community damage that may ensue.

▲ Update by Sep.2023