1.0A, PFM Step-down, Single-cell NIZN Battery Charger IC

PRELIMINARY DATASHEET

General Description

FH53601 is afixed off-time PFM mode buck(step-down) battery charge management IC with operating voltage range between 2.7V to 6.5V. It is specially designed for single-cell NIZN battery charge management with fewer external components. FH53601 adopts constant current and maintenance mode to charge battery.

On power up, FH53601 enters constant current charging mode, the on-chip P-channel MOSFET is turned on, inductor current rises. When inductor current reaches upper threshold, the P-channel MOSFET is turned off, a low-side switch is turned on, inductor is discharged, then the P-channel MOSFET is turned on again after 1.5us off time.

When battery voltage rises to 1.9V(Typ.), FH53601 enters maintenance mode, in which the inductor current's upper threshold is reduced, in the meantime a timer is started.

The charge process will not be terminated until the time out occurs. In termination mode, the P-channel MOSFET is turned off, there is no current flowing into battery.

When BAT pin voltage falls below recharge threshold, the FH53601 enters charge mode again. FH53601's switching frequency can be up to 500kHz, which makes a small-profile inductor usable.

The other features include 2 open-drain status indications, chip over temperature protection, inductor current's upper threshold selection, battery temperature monitoring, etc.

FH53601 is available in 10-pin SSOP package.

Key Features

- Input Voltage Range: 2.7V to 6.5V
- Operating Current: 320uA @ VIN = 5.0V
- Switching Frequency up to 500kHz
- Maintenance Charge Mode to Guarantee Fully-charged Battery
- Selectable Upper Threshold of Inductor Current
- Charging terminated by Timer after reaching 1.9V(typ.)
- Automatic Recharge
- Battery Over Voltage Protection(OVP)
- Chip Over Temperature Protection(OTP)
- Battery Temperature Monitoring Function with external NTC
- 2 Open-drain Status Indications
- Operating Temperature: -40°C to 85°C
- Available in SSOP-10L Package
- Lead-free, rohs-Compliant and Halogen Free

Applications

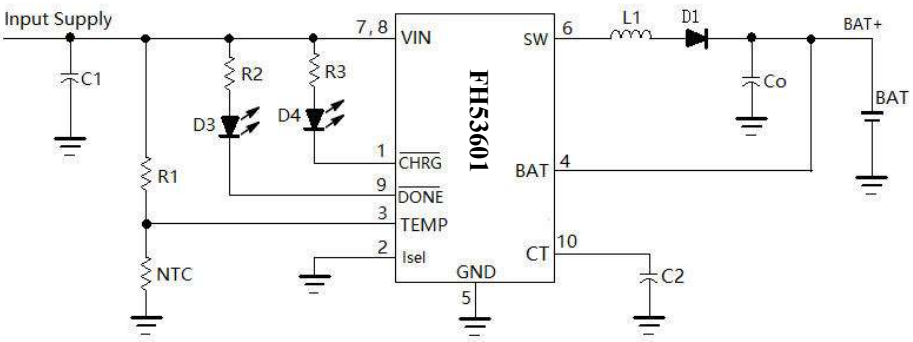
- Toys
- Car Models
- Standalone NIZN Battery Charger
- Devices powered by AA or AAA Batteries

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
FH53601	SSOP (10L)	5.10mm × 4.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Typical Application Circuit



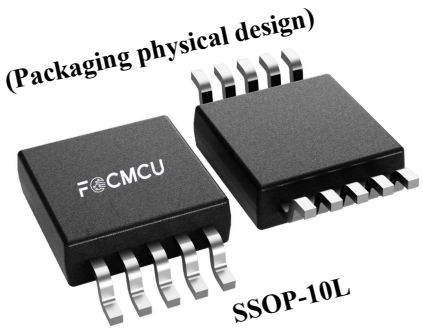
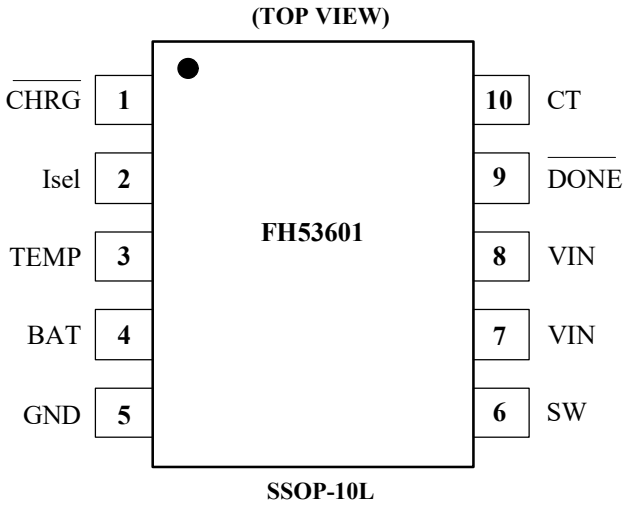


Figure 1. FH53601 Typical Application Circuit

Pin Assignment



Pin Description

No.	Symbol	Description
1	$\overline{\text{CHRG}}$	**Open-Drain Charge Status Output.** When the battery is being charged (Constant current mode or maintenance mode), this pin is pulled low by an internal switch. Otherwise this pin is in high impedance state.
2	Isel	**The Selection Pin of Upper Threshold of Inductor Current.** A high input will set the upper threshold of inductor current in constant current mode at 1.19A(typ); A low input will set the upper threshold of inductor current in constant current mode at 0.62A. The Isel pin can be driven by TTL or CMOS logic level.
3	TEMP	**Battery Temperature Sense Input.** Connect this pin to external resistor divider formed by an NTC thermistor and a resistor to sense the battery temperature. If TEMP voltage falls below 44.5% of input voltage, then the charging is suspended, no current flows to battery from input supply. This feature can prevent the battery being charged at high battery temperature. When the voltage at BAT pin is higher than 44.5% of input voltage by 40mV, the charging is resumed.
4	BAT	**Battery Positive Terminal Input.** Battery voltage is feedback to the FH53601 through this pin. The FH53601 determines the charge mode based on the BAT pin voltage.
5	GND	**Ground.** The negative terminal of input supply and battery.
6	SW	**Inductor Connection Pin.** The inductor is tied to this pin. Internally SW pin is connected to a P-Channel MOSFET and an N-Channel MOSFET.
7	VIN	**Positive Terminal of Input Supply.** FH53601's internal circuit is powered by this pin.
8	VIN	
9	$\overline{\text{DONE}}$	**Open-Drain Termination Output.** When the charging is terminated, this pin is pulled low by an internal switch. Otherwise this pin is in high impedance state.
10	CT	**Timing Capacitor Connection Input.** The timing capacitor should be connected between CT pin and GND. The timing function is started once FH53601 enters maintenance mode, and the timing time is determined by the following equation: $t_{timing} = 12.18 \times 10^9 \times C2$ Where C2 is the capacitance of capacitor C2 in Figure.1.

PFM降压模式单节镍锌电池充电管理集成电路

器件概述

FH53601是一款固定关断时间的PFM模式降压单节镍锌电池充电管理集成电路。FH53601输入电压范围2.7V到6.5V，外部元器件少，应用简单，非常适合单节镍锌电池充电管理应用。

FH53601采用恒流和维持充电模式对单节镍锌电池进行充电。上电以后，FH53601先采用恒流模式对电池充电，当电池电压达到 1.90V 后，进入维持充电模式，同时启动内部定时器。在维持充电模式，只有定时结束后才进入结束状态。在结束状态，没有电流流入电池。当电池电压下降到再充电阈值以下时，自动进入再充电模式，开始新的充电周期。

FH53601的开关频率可达500KHz，可以使用小外形的电感和电容。

其他功能包括两个漏极开路状态指示输出，电池过压保护，电池过温保护和芯片过温保护等。

FH53601采用10管脚SSOP封装。

电气特性

- 输入电压范围：2.7V 到 6.5V
- 工作电流：320uA@VIN=5V
- 开关频率高达500KHz
- 维持充电模式可以保证充满电池
- 可选择的电感电流峰值(i_{peak})
- 电池电压达到1.9V后通过定时器结束充电
- 自动再充电功能
- 电池过压保护
- 芯片过温保护
- 电池过温保护
- 两个漏极开路状态指示输出
- 工作环境温度范围：-40℃ 到 85℃
- 采用封装：SSOP-10L
- 产品无铅，满足rohs，不含卤素

极限参数

VIN 和 Isel 管脚电压	-0.3V to 7.0V
BAT 管脚电压	-0.3V to 7.0V
$\overline{CHRG}$ 和 $\overline{DONE}$ 管脚电压	-0.3V to VIN
TEMP, SW 和 CT 管脚电压	-0.3V to VIN
最高结温	150℃
工作环境温度	-40℃ to 85℃
存储温度	-65℃ to 150℃
焊接温度(10秒)	260℃

典型应用电路

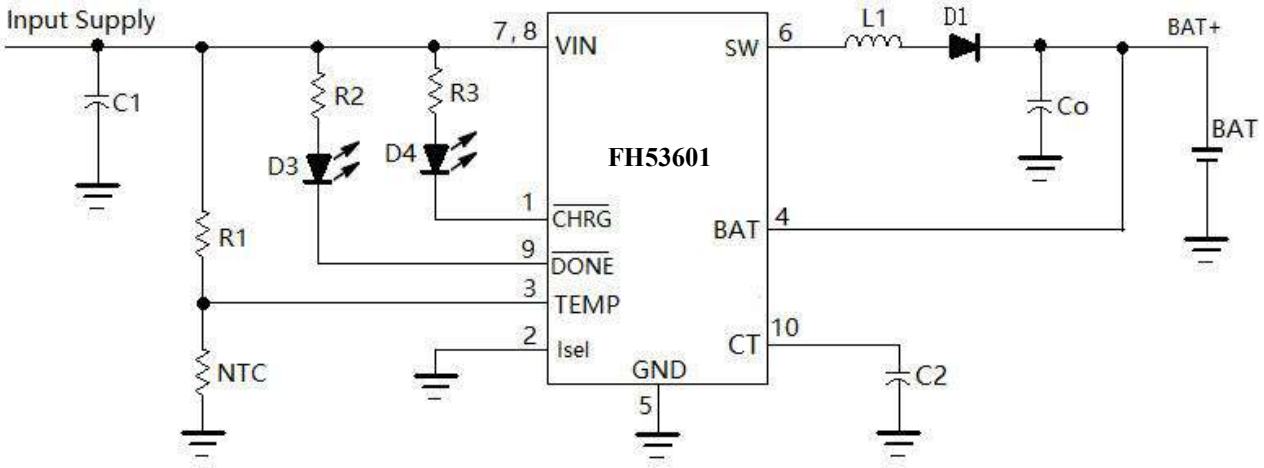
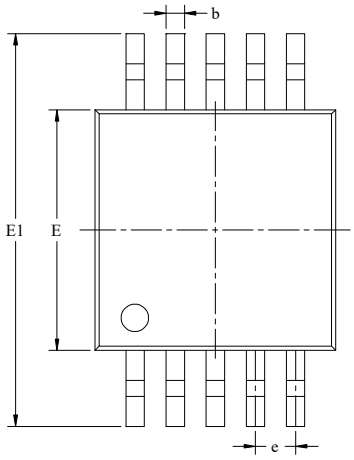
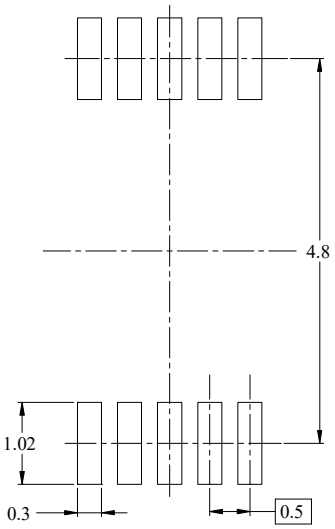


图 1. 典型应用电路

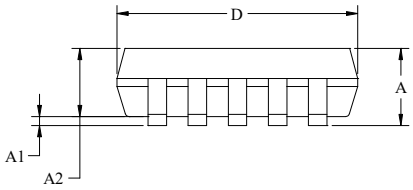
PACKAGE OUTLINE DIMENSIONS

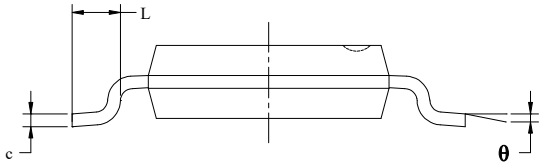
Type: SSOP-10L





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	0.300	0.450	0.012	0.018
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.000BSC		0.039 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	1°	8°

Ordering Information

Part Number	Input Voltage	Features	Operating Temperature	Package Type	Top Mark	SPQ
FH53601S10	2.7V ~ 6.5V	● #1 Cell NIZN battery charger ● PFM buck(step-down) mode ● Switch frequency: 500kHz ● OVP/OTP/NTC function ● #2 LED charge status	-40℃ to +85℃	SSOP-10L	FH53601 Y W L	4000EA/Reel

Note:

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▲ Update by Jun.2022