

描述 / Descriptions

AP4056一款完整的恒定电流/恒定电压线性控制单节锂离子电池充电器，具有电池正负极反接保护功能其 ESOP-8 封装与较少的外部元件数目使得AP4056成为便携式应用的理想选择。AP4056可以适合 USB 电源和适配器电源工作。

由于采用了内部 PMOSFET 架构，加上防倒充电路，所以不需要外部检测电阻器和隔离二极管。热反馈可对充电电流进行自动调节，以便在大功率操作或高环境温度条件下对芯片温度加以限制。充满电压固定于 4.20V，而充电电流可通过一个电阻器进行外部设置。当电池达到 4.20V 之后，充电电流降至设定值 1/10，AP4056将自动终止充电。

当输入电压（交流适配器或 USB 电源）被拿掉时，AP4056自动进入一个低电流状态，电池漏电流在 3 μ A 以下。AP4056的其他特点包括充电电流监控器、欠压闭锁、自动再充电和两个用于指示充电结束和输入电压接入的状态引脚。

AP4056 is a complete CC/CV linear charger for single cell lithium-ion batteries, It has the function of positive and negative electrode protection for battery. Its ESOP-8 package and low external component count make the AP4056 ideally suited for portable applications. Furthermore, the AP4056 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 PMOSFET 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 AP4056 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 AP4056 automatically enters a low current state stopping the battery drain current to less than 3 μ A. Other features include charge current monitor, under voltage lockout, automatic recharge and two status pins to indicate charge and charge termination.

特征

- ◆ 预设 4.20V \pm 1%精度的充电电压
Preset 4.20V charge voltage with \pm 1% accuracy
- ◆ 最大输入电压：8V
Maximum input voltage is 8V
- ◆ 具有BAT-VIN防倒灌功能
With BAT-VIN anti-backflow function
- ◆ 线性充电模式，内置1A MOSFET，涓流/恒流/恒压三段式充电，充电电流外部可调
Linear charge mode, built-in 1A MOSFET, Trickle / Constant current / Constant voltage three stage charging, externally adjustable charging current
- ◆ 支持对0V电池充电
Supports 0V battery charging
- ◆ 短路保护，电池正负极反接保护
Short circuit protection, battery polarity reverse polarity protection

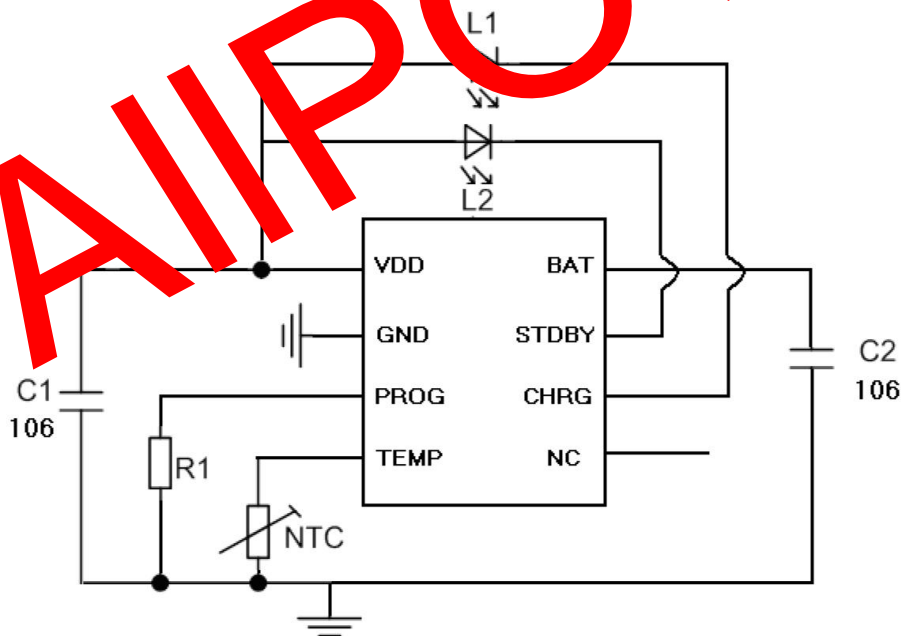
特征

- ◆ 智能温控技术，充电电流会随温度升高而降低，130度开始下降，最低可降至0
Intelligent temperature control technology, charging current will decrease with increasing temperature, 130°C began to decline, the lowest can be reduced to 0
- ◆ 软启动限制了浪涌电流
Soft-Start limits inrush current
- ◆ 可直接从USB端口给单节锂离子电池充电
Charges single cell Li-ion batteries Directly from USB port
- ◆ 自动再充电
Automatic recharge
- ◆ 4KV ESD
- ◆ 无卤产品。
Halogen-free Product.

用途 / Applications

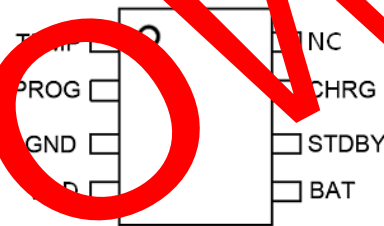
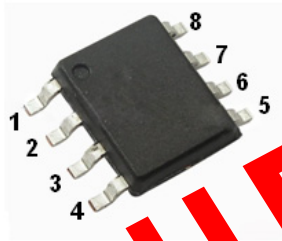
适用于 USB 电源和适配器电源，蓝牙应用及其他便捷式设备。
Suitable for USB power and adapter power, Bluetooth applications and other portable devices.

典型应用电路图 / Typical Application



指示灯工作状态表 / Indicator light working state

| 充电状态 | L1 (CHRG) | L2 (STDBY) |
|---|----------------------------|---------------|
| 正在充电/Charging | 亮/Light | 灭/Lights off |
| 电池充满/Battery full | 灭/ Lights off | 亮/ Light |
| 欠压, 电池温度过高, 过低等故障状态, 或无电池接入 (TEMP使用) Undervoltage,battery temperature is too high,too low or other fault conditions,or no battery access(use TEMP) | 灭/ Lights off | 灭/ Lights off |
| BAT端接10 μ F电容, 无电池 (TEMP=GND) BAT terminated with 10uF capacitor,no battery | 闪/Flashing light T=1-4s | 亮/ Light |

引脚排列 / Pinning


| 引脚 | 名称 | 描述 |
|----|-------|---|
| 1 | TEMP | 外部温度感应引脚/External temperature sensing pin |
| 2 | PROG | 充电电流调整端/Charge current regulator |
| 3 | GND | 芯片地/Chip ground |
| 4 | VDD | 外部输入直流5V/External input DC 5V |
| 5 | BAT | 电池输入端/Battery input |
| 6 | STDBY | 电池充电完成指示灯/Battery charge completion indicator |
| 7 | CHRG | 充电指示灯/Charging indicator |
| 8 | NC | 悬空/Vacant |

电性能参数 / Electrical Characteristics(除非特别指定, Ta=25°C)

| 参数 Parameter | 符号 Symbol | 测试条件 Test Conditions | 最小值 Min | 典型值 Typ | 最大值 Max | 单位 Unit |
|-----------------|---------------|-------------------------------------|------------|------------|------------|-------------|
| 输入电压范围 | V_{DD} | | 4 | 5 | 6 | V |
| V_{DD} 从低到高 | V_{DD} 掉电监测 | $V_{DD} > BAT$ | | 100 | | mV |
| V_{DD} 从高到低 | | $V_{DD} > BAT$ | | 30 | | mV |
| 浮充门槛电压 | V_{BAT} | $V_{DD} = 5V$ | 4.158 | 4.20 | 4.242 | V |
| BAT倒灌电流 | I_{BAT} | $V_{CC} = 3.5V$ $V_{bat} = 4.2V$ | | ± 0.5 | ± 5 | μA |
| 涓流转恒流 | V_{TRKL} | V_{BAT} 从低到高 | | 2.8 | | V |
| 涓流充电迟滞电压 | V_{TRHYS} | | | 10 | | mV |
| V_{DD} 欠压闭锁门限 | V_{UV} | V_{DD} 从低到高 | | 3.7 | | V |
| V_{DD} 欠压闭锁迟滞 | V_{UVHYS} | | | 50 | | mV |
| 手动停机门限电压 | V_{msd} | | | 2 | | V |
| 手动停机迟滞电压 | V_{msdHYS} | | | 50 | | mV |
| 涓流时PROG电压 | V_{prog1} | | | 0.1 | | V |
| 大电流时PROG电压 | V_{prog2} | | | 1.0 | | V |
| 过温恢复 | OT | $V_{DD} = 5V$ | | 130 | | $^{\circ}C$ |

工作原理 / Description of the Principle

AP4056 是专门为一种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1.2A, 不需要使用阻流二极管和电流检测电阻。AP4056 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和电池充满指示输出端STDBY。

芯片内部的功率管理电路在芯片的结温超过130°C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, AP4056 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, AP4056 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2.8V, 充电器用小电流对电池进行预充电。当电池电压超过2.8V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, AP4056 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3 μA , 从而增加了待机时间。

充电电流的设定 / Programming Charge Current

充电电流是采用一个连接在PROG引脚与地之间的电阻器来设定的,设定电阻器和充电电流采用下列公式来计算。根据需要的充电电流来确定电阻器阻值。

The charge current is programmed using a single resistor from the PROG pin to ground. The program resistor and the charge current are calculated using the following equations.

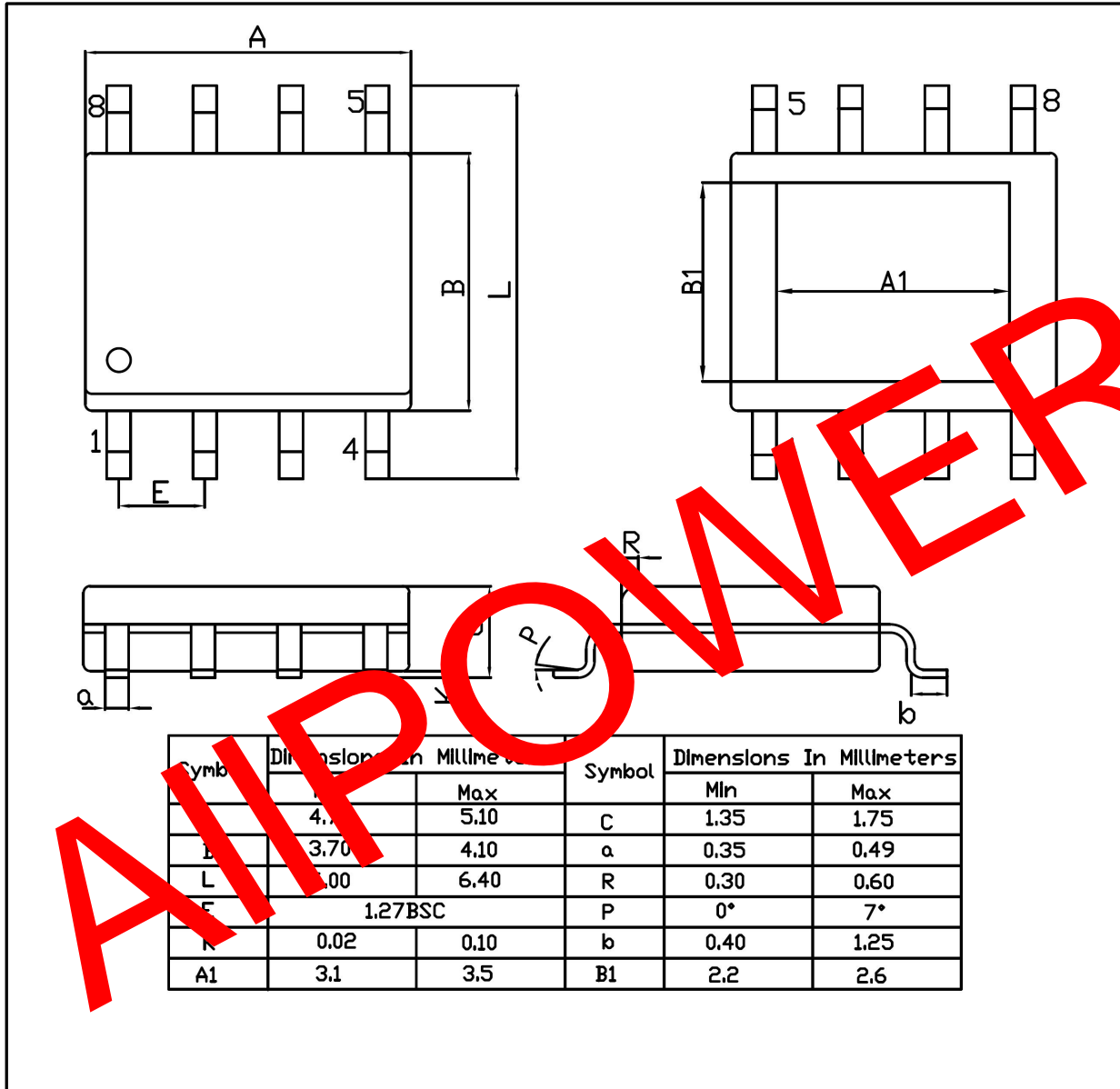
$$R_{\text{prog}}(\text{kohm}) = \frac{1200}{I_{\text{bat}}(\text{mA})} \quad (\text{误差} \pm 10\%)$$

AIIPOWER

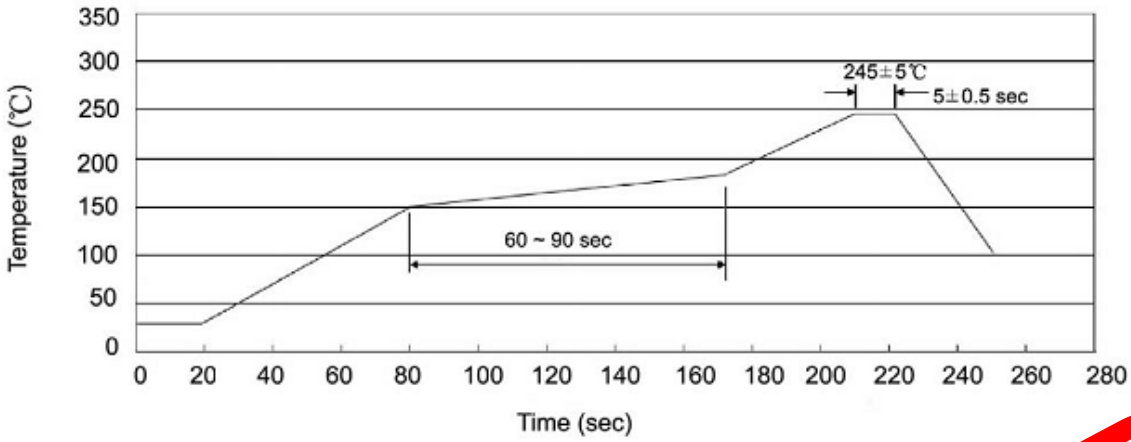
外形尺寸图 / Package Dimensions

ESOP-8

Unit:mm



回流焊温度曲线图(无铅) / Temperature Profile for IR Reflow Soldering(Pb-Free)



说明：

- 1、预热温度 150~180°C，时间 60~90sec;
- 2、峰值温度 245±5°C，时间持续为 5±0.5sec;
- 3、焊接制程冷却速度为 2~10°C/sec.

Note:

- 1.Preheating:150~180°C, Time:60~90 sec.
- 2.Peak Temp.:245±5°C, Duration:5±0.5 sec.
- 3.Cooling Speed:2~10°C/sec.

耐焊接热试验条件 / Resistance to Soldering Heat Test Condition

温度：260±5°C 时间：10±1 sec 温度：260±5°C Time:10±1 sec

包装规格 / Packaging Specification

卷盘包装 / REEL

| Package type 封装形式 | Units 包装数量 | | | | | Dimension 包装尺寸 (unit: mm ³) | | |
|----------------------|-------------|------------------------|------------------------|------------------------------|------------------------|---|-------------|-------------|
| | Reel 只/卷 | Units/Inner Box 只/盒 | Units/Inner Box 只/盒 | Inner Boxes/Outer Box 盒/箱 | Units/Outer Box 只/箱 | Reel | Inner Box 盒 | Outer Box 箱 |
| ESOP | 4,000 | 2 | 8,000 | 6 | 48,000 | 13" ×12 | 360×360×50 | 380×335×366 |

使用说明 / Notices