MSKSEMI 美森科
SEMICONDUCTOR

ESD TVS TSS MOV GDT PLED

4056H

产品手册

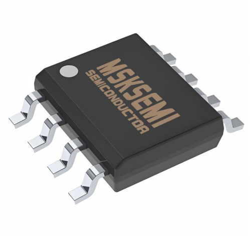
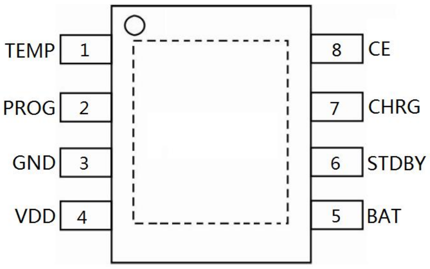
概述

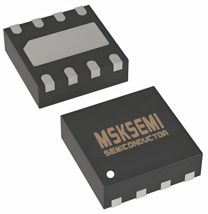
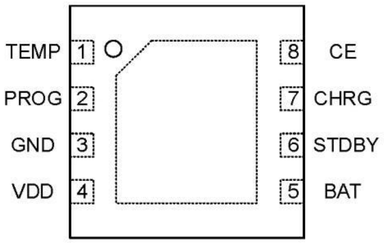
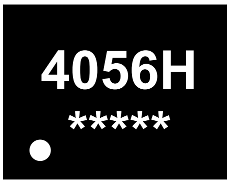
4056H 是一款输入耐压为 28V 的单节锂电池线性充电电路，采用恒流 / 恒压充电。4056H 采用内部 PMOSFET 充电管，浮充电压为 4.2V。当电池电压达到浮充电压进入恒压充电后，充电电流降到 1/10 后，充电过程结束。

产品特点

- 电源耐压 28V
- BAT 耐压 15V
- 电源电压 6.5V 以上触发过压保护
- 高达 1000mA 的可编程充电电流
- 充电过温保护
- BAT 防反接保护
- 封装形式：ESOP8/DFN-8(2x2)

封装脚位信息

ESOP8	引脚排列图	管体标记
		

DFN-8(2x2)	引脚排列图	管体标记
		

订单信息

型号	封装	包装
4056H-MS	ESOP8	4000PCS
4056HDA-MS	DFN-8(2x2)	3000PCS

引脚说明

引 脚	符 号	功 能
1	TEMP	电池温度检测信号输入
2	PROG	恒流充电电流编程
3	GND	地
4	VDD	电源
5	BAT	锂电池充电输出端口
6	STDBY	电路待机状态指示灯
7	CHRG	电路充电状态指示灯
8	CE	芯片使能端口，低电平关断

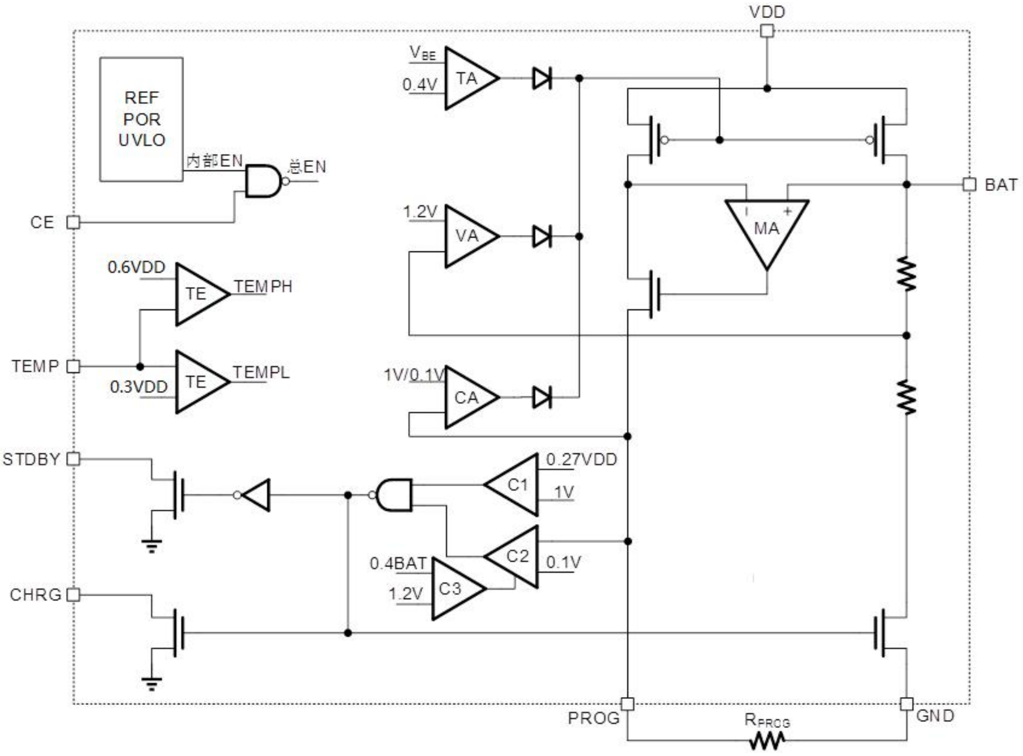
电特性

极限参数

除非另有规定，T_{amb}=25℃

参 数 名 称	符 号	条 件	额 定 值	单 位
电源电压	V_{dd}	—	-0.3～28	V
BAT 耐压	V_{BAT}	—	15	V
工作环境温度	T_{amb}	—	-40～85	℃
贮存温度	T_{stg}	—	-65～150	℃
焊接温度	T_L	10 秒	260	℃

功能框图



电气特性

（除非另有规定，T_{amb}=25℃，VDD=5V）

参 数 名 称	符 号	条 件	最小	典型	最大	单 位
工作电压	VDD	—	4.5	—	6	V
过压保护	OVP	VDD 由低到高	6.2	6.5	6.8	V
过压保护迟滞	V_{OVP_HY}	VDD 由高到低	300	400	500	mV
浮充电压	V_{FLOAT}	—	4.158	4.2	4.242	V
输入电源电流	IDD	充电模式，R_{PROG}=2K	—	300	500	μA
		待机模式	—	100	150	μA
		R_{PROG} 断开	—	80	150	μA
BAT 端输出电流	I_{BAT}	R_{PROG}=2K，V_{BAT}=3.6V	450	500	550	mA
		R_{PROG}=1.2K，V_{BAT}=3.6V	720	800	880	mA
		R_{PROG}=0.82K，V_{BAT}=3.6V	900	1000	1100	mA
		待机模式（V_{BAT}=4.2V）	—	-3	-6	μA
		停机模式（R_{PROG} 未连接）	—	±2	±5	μA
		睡眠模式，VDD=0	—	-1	-2	μA
涓流充电电流	I_{TRI}	R_{PROG}=1K，$V_{BAT}<V_{TRI}$	210	250	280	mA
涓流充电电压	V_{TRI}	V_{BAT} 上升	2.6	2.7	2.9	V
涓流充电迟滞电压	V_{TRI_HY}	V_{BAT} 下降	300	400	500	mV
欠压保护电压	V_{UVLO}	VDD 由低至高	3.6	3.7	3.8	V
欠压保护迟滞电压	V_{UVLO_HY}	VDD 由高至低	100	200	300	mV
VDD-V_{BAT} 锁定电压	V_{ASD}	VDD-V_{BAT} VDD 上升	160	260	360	mV
		VDD 下降	160	260	360	mV
充电终止电流	I_{TERM}	R_{PORG}=2K	45	50	55	mA
		R_{PORG}=1.2K	72	80	88	mA
		R_{PORG}=0.82K	90	100	110	mA
PROG 引脚电压	V_{PROG}	R_{PORG}=2K，恒流模式	0.9	1.0	1.1	V
CHRG 输出低电平	V_{CHRG}	I_{CHRG}=5mA	—	0.6	0.8	V
STDBY 输出低电平	V_{STDBY}	I_{STDBY}=5mA	—	0.6	0.8	V
TEMP 端口高电平	V_{TEMP_H}	—	58	60	62	%VDD
TEMP 端口低电平	V_{TEMP_L}	—	28	30	32	%VDD
再充电电压差	ΔV_{RECH}	V_{FLOAT}-V_{RECH}	60	80	100	mV
过温保护	OTP	温度上升	—	170	—	℃
CE 输入高电平	V_{IH}	—	1.3	—	—	V
CE 输入低电平	V_{IL}	—	—	—	0.4	V
CE 输入漏电	I_{IH}	对电源	—	2.5	5.0	uA
	I_{IL}	对地	—	2.5	5.0	uA

功能介绍

4056H 是一款耐压最高达到 28V 的单节锂离子电池或锂聚合物电池线性充电电路，采用涓流、恒流和恒压充电流程。其充电电流由外置的 PROG 电阻设定，最大持续充电电流可达1000mA。4056H设置有两个开漏状态指示灯，充电状态指示灯CHRG和充电完成指示灯STDBY。

当电池电压低于2.7V，芯片采用涓流充电模式；若电池电压大于 2.7V 且小于 V_{FLOAT} 时，芯片进入恒流充电模式，此时恒流充电电流由 R_{PORG} 电阻决定；当电池电压接近于V_{FLOAT}时，进入恒压充电模式。恒压充电模式下，充电电流逐渐较小，当充电电流小于 C/10 时，充电结束，CHRG端口输出高阻态，STDBY端口输出低电平。

不同工作状态下指示灯状态如下：

工作状态	红灯 CHRG	绿灯 STDBY
BAT 端接 10μF 电容，无电池	闪烁	亮
充电中	亮	灭
充饱	灭	亮
异常状态（欠压/过压等）	灭	灭

恒流充电电流

恒流充电电流由连接在 PROG 引脚与地之间的电阻设定，充电电流与 R_{PROG} 关系参考如下：

$$I_{CHARG}=1000/R_{PROG}$$

充电终止

当充电电流下降到设定值的 1/10 以下后，充电流程结束，4056H 进入待机模式。

欠压保护

4056H 设置了欠压保护功能，当电源电压低于欠压阈值时，充电电路进入停机模式。

手动停机

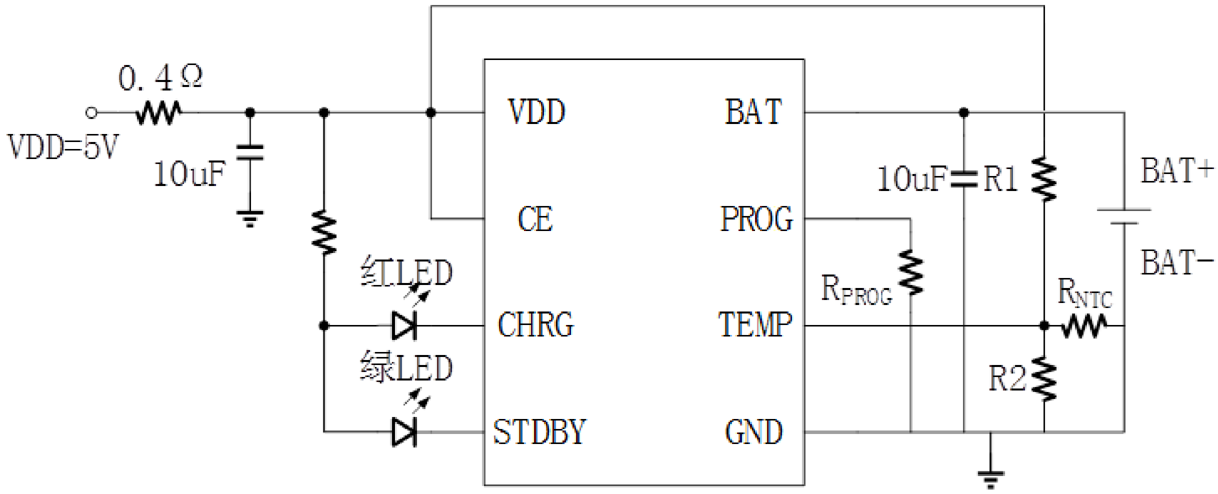
充电过程中如果去掉 R_{PROG} 电阻，4056H 则停止充电，进入停机模式。

热功耗调节

为减小充电时的芯片热功耗，可以在输入电源与 VDD 之间串联一个 0.4Ω 的功率电阻或正向导通压降低于 0.5V 的二极管，从而降低热功耗。

R1、R2值的设定

如下图，R1 和 R2 可设定电池温度监测范围，其阻值由温度范围和热敏电阻确定。



设电池正常温度范围为$T_L \sim T_H$，R_{TL} 为热敏电阻 R_{NTC} 在温度 T_L 时的阻值，R_{TH} 为热敏电阻 T_H 时的阻值。则在温度 T_L 时 TEMP 端电压为：

$$V_{TEMP\_H} = \frac{R2 // R_{TL}}{R1 + R2 // R_{TL}} \times VDD$$

在温度 T_H 时 TEMP 端电压为：

$$V_{TEMP\_L} = \frac{R2 // R_{TH}}{R1 + R2 // R_{TH}} \times VDD$$

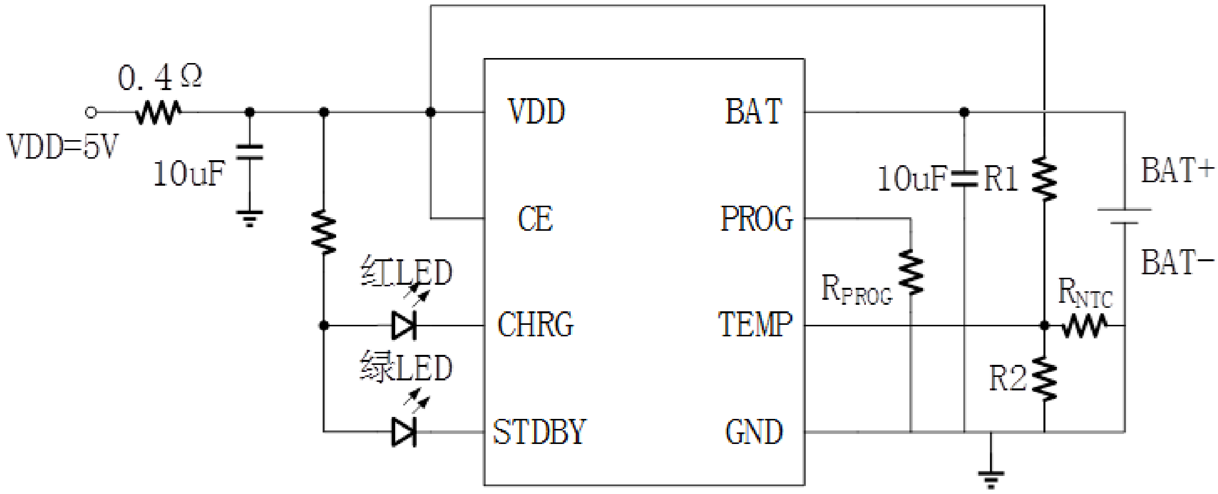
由 VTEMP_H=0.6VDD 和 VTEMPL=0.3VDD，可得：

$$R1 = \frac{(0.6-0.3)R_{TL}R_{TH}}{0.6*0.3(R_{TL} - R_{TH})}$$

$$R2 = \frac{(0.6-0.3)R_{TL}R_{TH}}{(0.3-0.6*0.3)\ R_{TL} - (0.6-0.6*0.3)\ R_{TH}}$$

TEMP脚接地或悬空，取消温度监测功能。

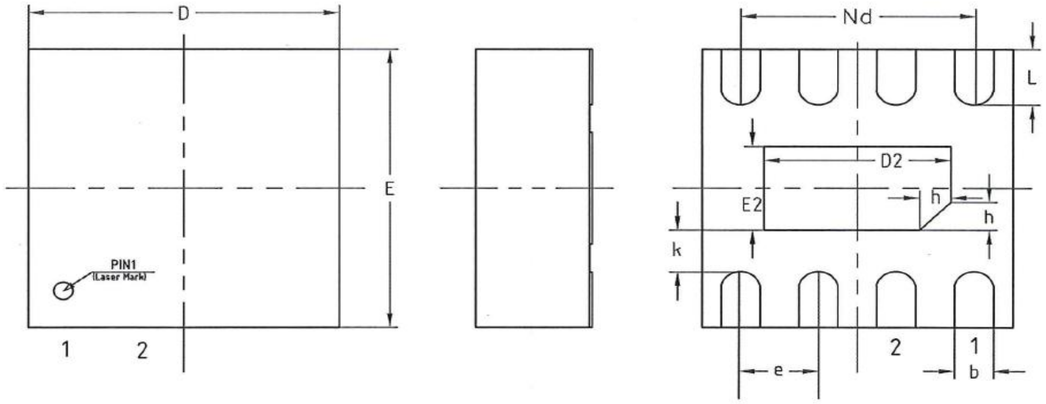
典型应用线路与说明

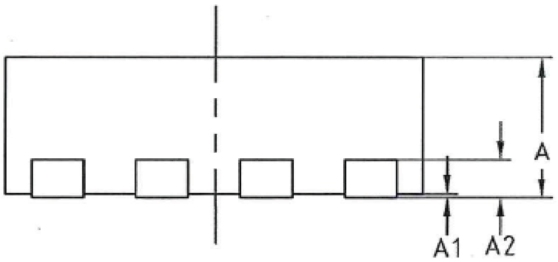


注：芯片 VDD 引脚与外部电源之间的串联电阻用于转移热功耗，可以减小芯片发热，小电流充电应用场景可不加。

封装尺寸与外形图

DFN-8(2x2)外形图与封装尺寸

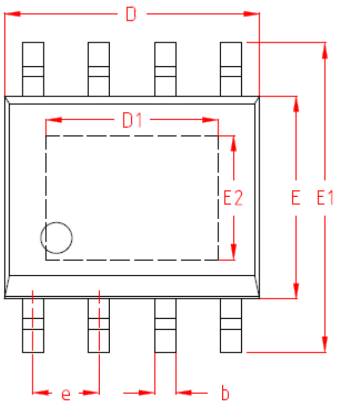




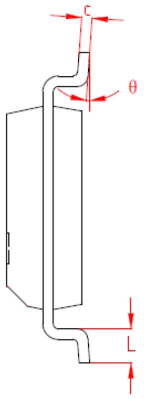
2025/03/B	Dimensions In Millimeters	
Symbol	**Min**	**Max**
A	0.70	0.80
A1	0.00	0.05
A3	0.20	
b	0.19	0.30
D	1.90	2.10
E	1.90	2.10
D2	0.60	0.85
E2	1.10	1.35
e	0.50	
L	0.30	0.40

ESOP8外形图与封装尺寸

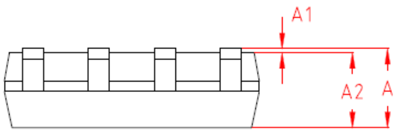
TOP VIEW
正视图



SIDE VIEW
侧视图



SIDE VIEW
侧视图



2023/12/A	Dimensions In Millimeters	
Symbol	Min	Max
A	1.42	1.70
A1	0.02	0.13
A2	1.30	—
b	0.31	0.51
c	0.19	0.25
D	4.70	5.10
D1	3.20	3.40
E	3.80	4.02
E1	5.80	6.25
E2	2.30	2.50
e	1.27	
L	0.40	0.90
θ	0°	8°

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