

# Battery safety

## Single cell protection circuit (15 Amps)

This protection circuit is specifically designed to meet the requirements of customers needing a stable continuous output current, combined with reliability, safety and protection for the Saft Li-ion MP series aluminium prismatic cells.

### Application

Saft 1s protection circuits are specifically designed to provide optimum protection for Li-ion batteries consisting of series assemblies from one to eight cells with a maximum number of one to six cells in parallel, depending on the maximum voltage.

Other configurations are possible, please contact Saft for further information.

### Benefits

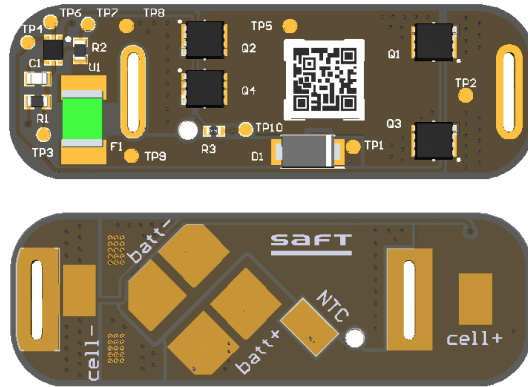
- Safety management for battery assemblies.
- Balancing during discharge depending on load.
- Active mode and sleep mode.
- Temperature performance from -40°C to +85°C.
- Easy assembly into multi-cell batteries with the large accessible solder pads.
- High reliability.

### Key features

- Over voltage protection.
- Under voltage protection.
- Over current protection.
- Short circuit protection.
- Over temperature protection.
- Fuse protection as an option.
- NTC integrated in circuit.
- Zero (0V) battery protection.
- UL94-V0.
- **Designed and made in France.**

### Typical applications

- Industrial equipment.
- Medical devices.
- Tracking applications.
- Military applications.
- Commercial applications.
- Specialised industrial equipment.



Electrical characteristics - Voltage	Typical
Voltage upper limit (VUL) at +25°C	4.275 ±0.020 V
Voltage hysteresis upper limit (VHUL) at +25°C	4.075 ±0.050 V
Delay time for VUL (TUL) at +25°C	1.00 ± 0.30 s
Voltage lower limit (VLL) at +25°C	2.30 ± 0.050 V
Voltage hysteresis lower limit (VHLL)	0 ± 0.000 V
Delay time for VLL (TLL) at +25°C	0.128 ± 0.038 s

Electrical characteristics—Current (I)	Min	Max
Maximum current		15 A (60°C) 10 A (85°C)
Over current 1 detection (Oc) +25°C	17 A	29 A
Over current 1 detection (Oc) +25°C	8ms ± 2.0ms	
Over current 2 detection (Oc) +25°C	47 A	90 A
Over current 2 delay time (Ocd) +25°C	280µs ± 90µs	
Reverse charge current limit		1 A
Charge inhibition voltage	≤ 1.2 ± 0.3V	

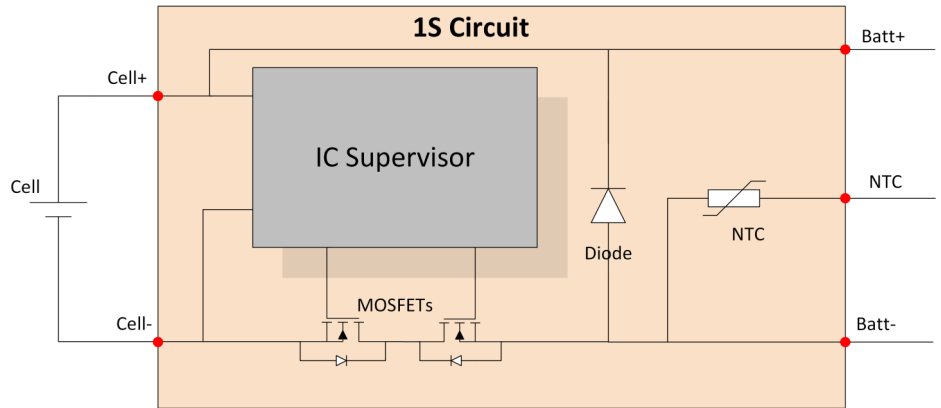
Operating characteristics	Value
Temperature sensor (NTC) @ +25°C	10kΩ
Maximum circuit consumption at +25°C	10 µA
Maximum sleep mode circuit consumption	0.1 µA
Operating temperature range	-40°C to +85°C
Maximum voltage	6.0 V
Dimension L x W x D (mm) (D=5.2mm with thermal fuse)	42.65 x 14.15 x 2.10
Operational MTBF	2.23 M hours

## Functions and operations

- 0V Battery protection.** For user safety, the battery cannot be recharged if the cell voltage falls below 1.2V ( $\pm 0.3V$ ).
- Over and under voltage.** Battery voltage is monitored continuously and if the threshold is exceeded for a period longer than the Delay time, then the charge or discharge MOSFET is switched off interrupting the current. When the battery voltage falls back to the recovery threshold, the circuit will automatically reset.
- Over current protection.** There are two levels of protection against overcurrent in discharge, the first is from the charge and discharge MOSFET's and optionally a thermal fuse or micro fuse directly on the circuit board. The temperature may also be externally monitored via the NTC thermistor.
- Cell balancing.** Brings a reduction to the cells' charge differences during the end of discharge when the current drops to  $\leq 1$  Amp. Batteries assembled from the 1s circuit may also be rebalanced after long periods of storage or use by discharging until 0V at  $\leq 1$  Amp. A well balanced multicell battery will have a longer runtime, and retain more capacity from cycle to cycle.
- Storage.** In the case of long duration storage, it is strongly recommend recharging the battery every 6 months to a level of 50% State of Charge. The storage area should be clean, cool (preferably not exceeding  $+30^{\circ}C$ ), dry and ventilated.

Protection circuit 15A	(1) NTC
GP32003	Yes

(1) The NTC thermistor is fitted to all variants of the circuit board as a standard component. Its connection to and use by the end application is optional.



**Derating curve for 1s 15A circuit**

