Smart Batteries

Smart Battery Management
SMBus v1.1

Rev 1.5
01.12.2014

Smart Battery Packs

STANDARD PACKS

CUSTOMISED PACKS

Hazardous failures of lithium-ion

1. Lithium ions travel through the separator from one electrode to the other during charging and discharging cycles, and electrons travel through an external circuit. However, if a metal particle pierces the separator, or if the particles accumulate (plate) onto an electrode and form dendrites that grow through microscopic pores in the separator, the electrodes come into direct electrical contact. That short circuit can cause the cells to discharge rapidly, leading to significant heat generation. Dendrites dissolve to electrolyte when battery voltage reaches too low and on charge puncture the separator.

2. One safety shortcoming of today's common lithium-ion cells is that upon overcharging or even moderate temperature excursions, the cathodes are prone to releasing oxygen, which can accelerate combustion of flammable electrolytes and other battery materials.

3. Electrolyte solution reacts on the surface of common carbon anodes and forms a passivating layer that's essential to good battery performance. If temperatures at the anode reach roughly 70 ℃, however, that layer begins to decompose and a fresh layer forms on the carbon surface via an exothermic reaction that raises the temperature further. The rapid formation and decomposition of the surface film can trigger an explosive chain reaction.

SES Strive to Minimize, Hazards

You have seen that Li-ion cells are sensitive to :

- Voltage
- Temperature
- State of Charge (SOC)

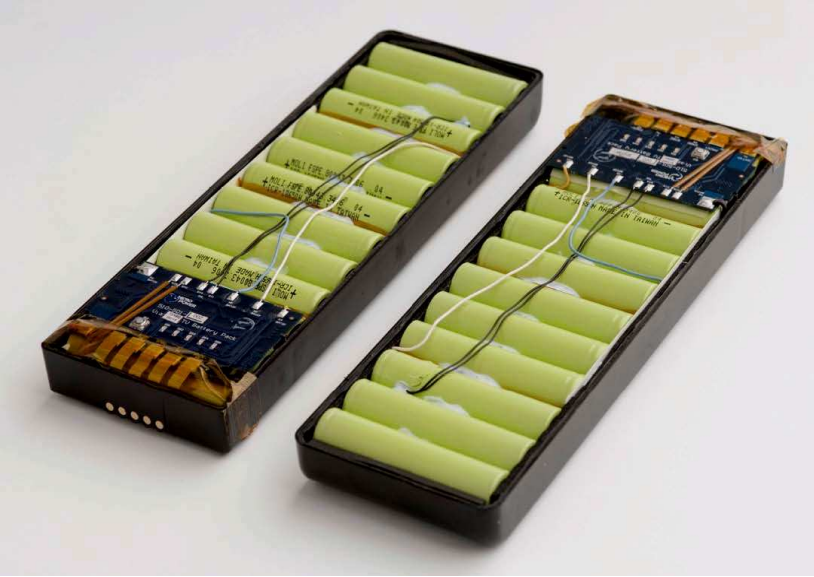
Solution :

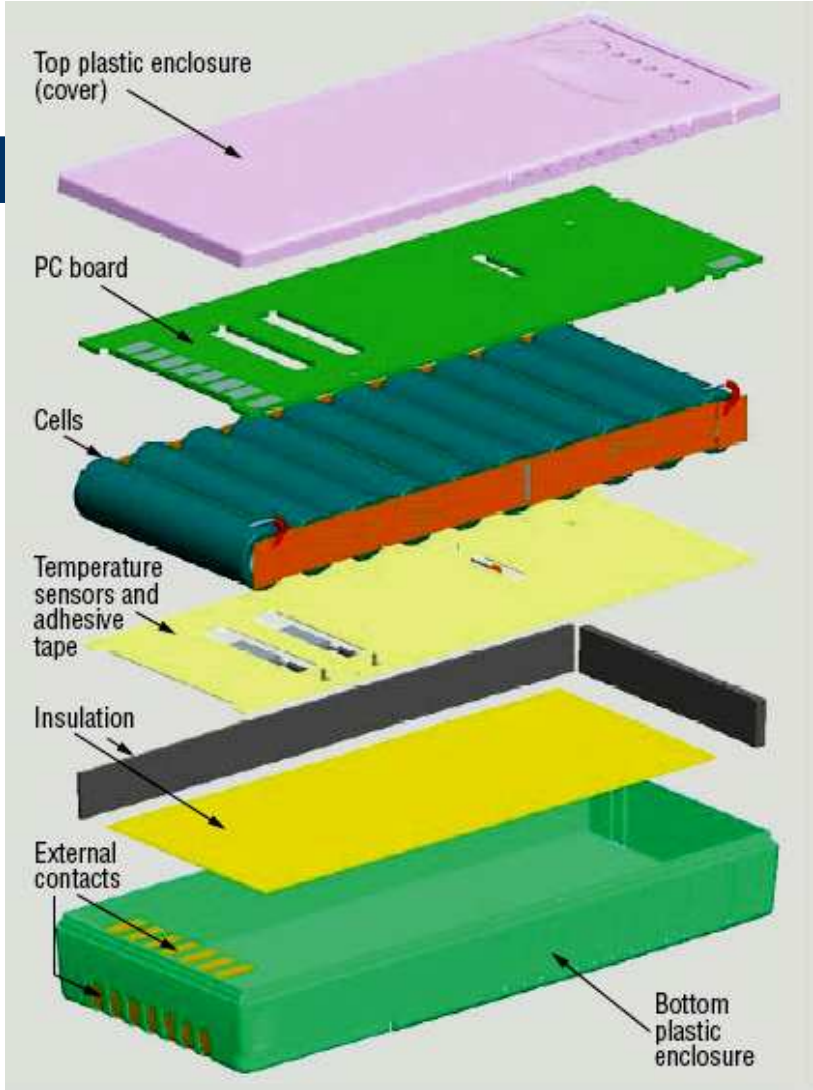
SES has designed the **BMS** to watch these conditions. Real-time monitoring of voltage, temperature and state of charge enables highest safety to hazardous problem. Advance programmable IC and MCU enables Computation of readings. BMS report all the above data to an external device, using serial Communication links, like **SMBus** / I2C / CAN Bus. All these provide optimum protection to li-ion batteries and devices to any hazardous condition.

SES have deep roots in chemical engineering, table with cell manufacturer to get customized cells, using high standard components. And safety enhancing solutions like titanate-based system.

Inside Battery

A typical battery inside - cells, BMS (PC Board), sensors, insulations, plastic enclosure and contacts.





Battery Configuration

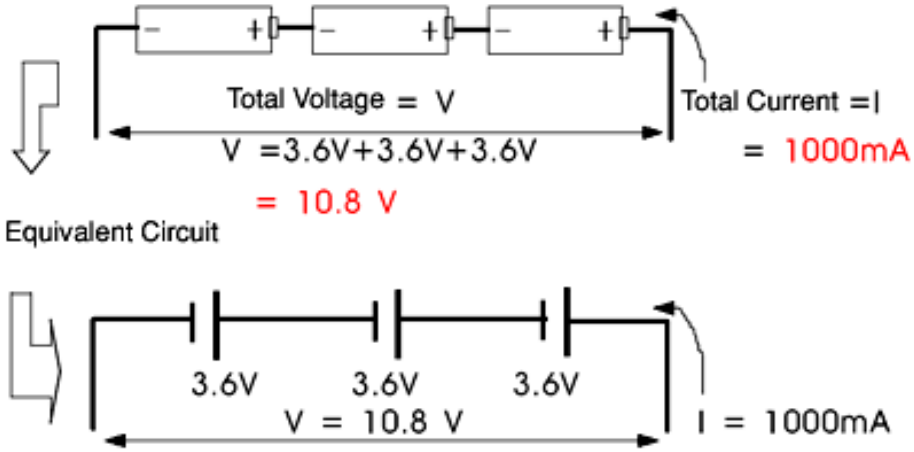
1-1 Serial Configuration:

Connecting cells in serial configuration (increases the voltage)

- The voltage will increase three fold.
- The current remains the same.

Figure 1 shows a battery pack with 3 Lithium Ion cells in series.

Adding cells in a string increases the voltage (10.8V), the current remains the same.



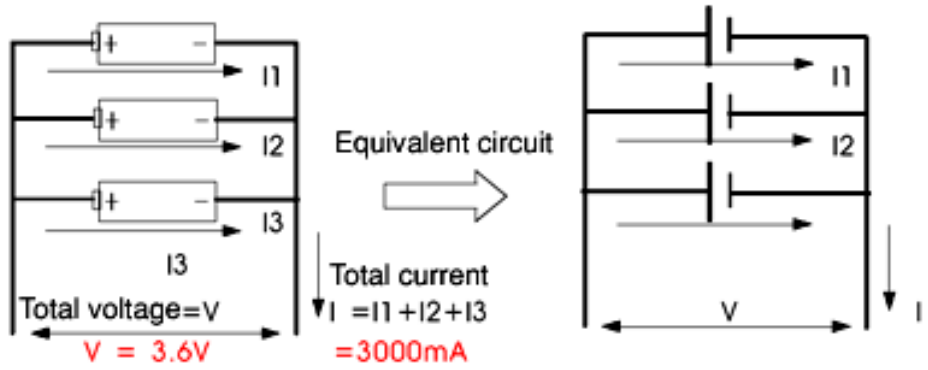
Battery Configuration

1-2 Parallel Configuration :

Connecting cells in Parallel configuration (increases the current)

- Voltage will remain the same.
- Current will increase three fold.

Figure 2 shows a battery pack with 3 Lithium Ion cells in parallel. The voltage remains the same (3.6V) however the current handling is increased.



* When attempting to connect serial and parallel configuration, you must make sure the maker, voltage, and current of the cells are equivalent. (This might cause problem in safety and effect capacity)

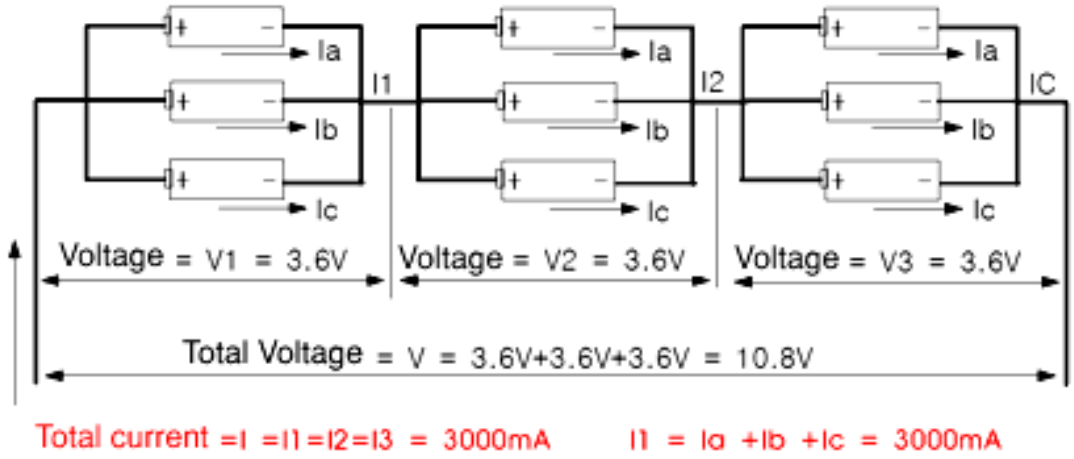
Battery Configuration

1-3 Serial, Parallel Configuration :

Connecting cells in both serial and Parallel configuration increases the current as well as voltage

- The voltage will increase in accordance to the configuration.
- The current will increase in accordance to the configuration.

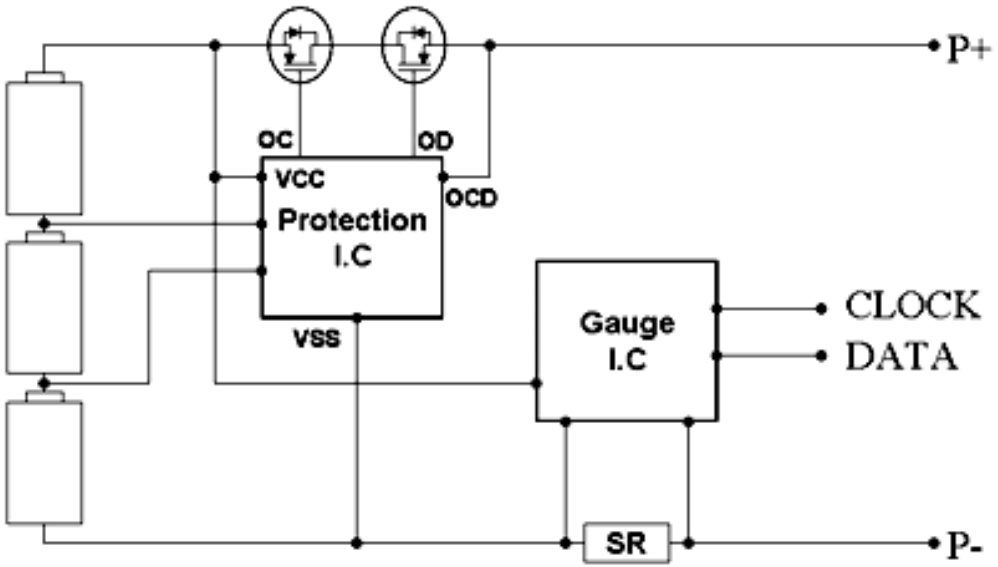
The configurations will provide the most suitable voltage and current



Battery Configuration

2-1 Smart Battery Pack

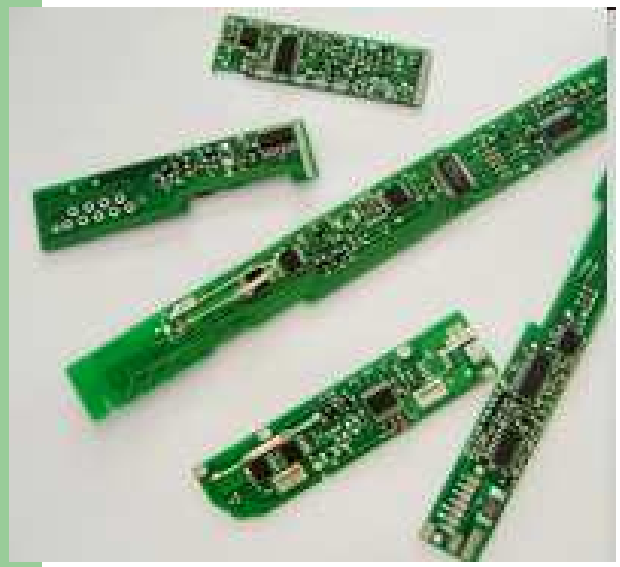
Composition – PCM (Protection Circuit Module) + Gauging (Smart Circuit)



Battery Configuration

2-2 PCM – Protection Circuit Module

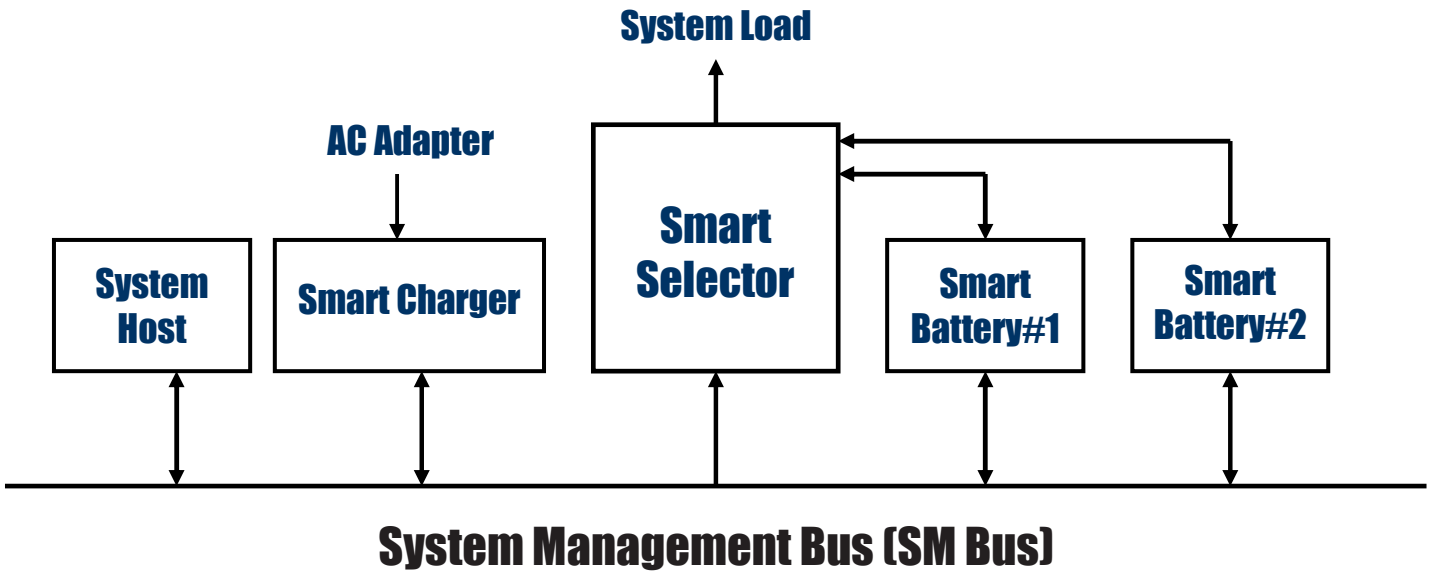
Never charge or discharge the battery without connecting appropriate protection circuit. The function of the Standard Lithium Ion Cell PCM are as follows:



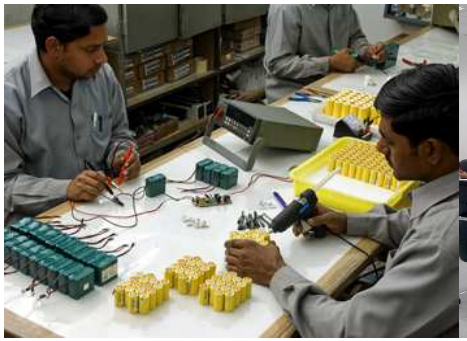
1) Protect against over charge.
2) Protect against over discharge.
3) Over current Protection.
4) Short Circuit protection, re-settable.
5) Cell Balancing function, during charging.
6) Independent Cell over voltage protection
7) Reverse current protection (on demand).
8) Chem Fuse, (optional)
9) Over Temperature protection.

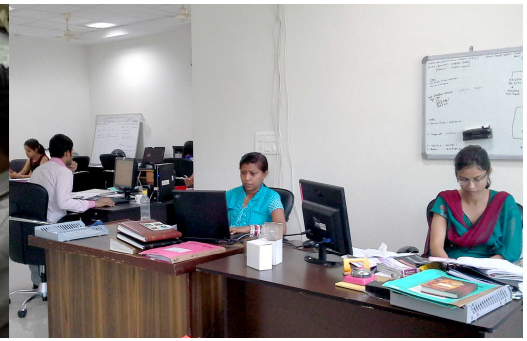
System Management Bus (SMBus)

Developed to de-couple charging technology from battery chemistry and support platform independence for interchangeable battery modules, The Smart Battery concept defines interfaces, a data set and behaviors of the Smart Battery, Battery Selector, Smart Charger, and Host elements in a Smart Battery System. Call us for more information on SMBus



Company Profile





- ISO 9001:2008 CERTIFIED
- CE CERTIFIED
- SME REGISTERED
- NSIC REGISTERED
- DRDO REGISTERED
- NAVAL REGISTERED
- MOD APPROVED VENDOR
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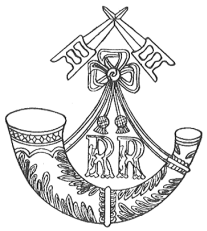
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