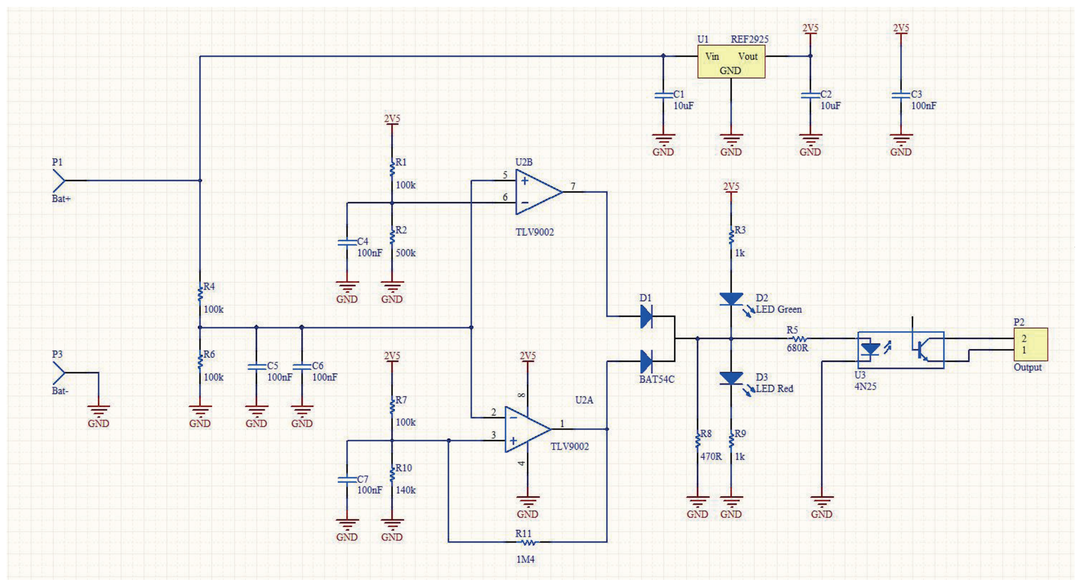
Low Power, Small Size and Cost-Effective Battery Cell Protector for Multi-Cell Battery Applications

Introduction

Nowadays thanks to electrical vehicles and mobile devices, battery applications are increasing significantly. Also for some practical reasons, multi-cell batteries are started to be used currently and demand is increasing as well. Thus, cell-level protection becomes more important to consider about it.
In this context, we have designed low power battery cell protector for multi-cell battery applications that is small size and cost effective as well. The developed protector aims to find optimum solution to protect multi-cell battery systems also for existing systems with minimum cost.



• *Figure 1: Application Circuit Diagram of The Proposed Protector.*

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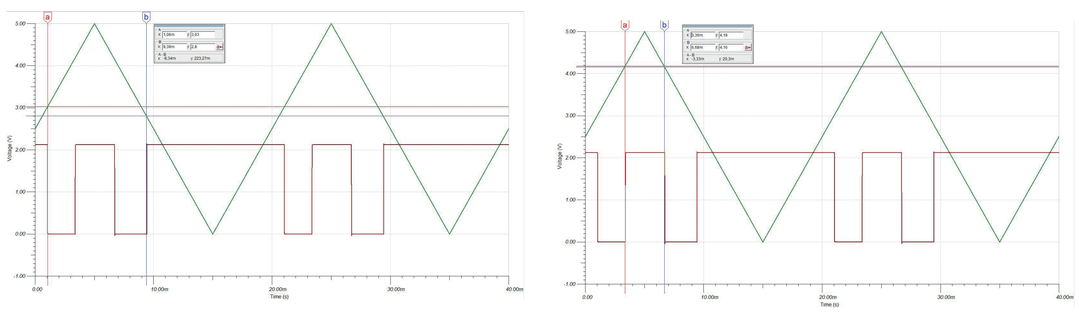
Figure 1 shows application circuit for the proposed protector. As you can see the protector basically consists of two comparators those monitors battery voltage.

Simulation

Before realizing the protector design, simulation performed. Figure 2 shows simulation results for the protector.



• *Figure 2: Simulation Results of The Proposed Protector. a-Overdischarge, b-Overcharge*

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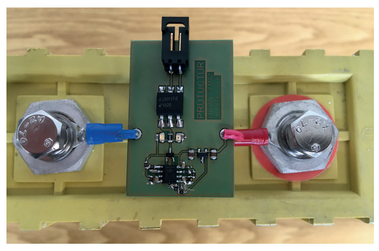
At Figure 2 a and b green line represents variable battery terminal voltage. Red line represents output of the protector as well. So according to overcharge or overdischarge situations output of the protector changes.

Design Prototype

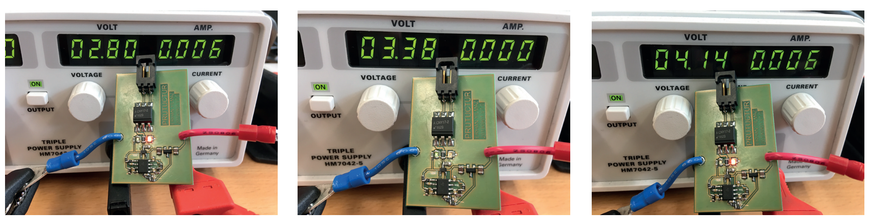


• *Figure 3: Prototype and Connection of the Proposed Protector on Battery Cell*

Figure 3 shows prototype of the proposed protector and how to connect it. Proposed protector has small size and easy installation. Size of the PCB is 30mm x 45mm and rectangular shape as well. Since it has ring cable connectors for battery cell connection it reduces contact resistance as well. Two pins output connector provide easy connection for parallel connection between battery cells as well.

Results

Figure 4 shows experimental results of the proposed protector. Test results well matches with simulations results as well.



• *a- Overdishcharge* *b-Normal Operation* *c- Overcharge*

Figure 4: Test Results of The Proposed Protector

Figure 4-b represent normal operation that there is no overcharge or overdischarge, so green LED is lit always. Figure 4-a and 4-c represent overdischarge and overcharge situations respectively. In these cases, red LED lit as visual warn. As we mentioned protector circuit consumes low-power. Figure 4-b shows in normal operation the protector consumes less than 1mA current.

Conclusion

As we can see the designed protector works well and consumes low-power as well. Thus, that would be optimum for practical applications. To sum up designed protector would provide low-power, low-size and cost-effective protection for multi-cell battery architectures. Also, it would provide easy and low-cost installation for existing systems.

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