

# Specification of standard electronic cell control and sensing chip

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D3.4.



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<b>Project</b>	INCOBAT	<b>Project Number</b>	608988

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## 1 Publishable Executive Summary

This document is about the specification of dedicated silicon ASIC solution for BMS satellite sensing and controlling module. In the form of a target specification that defines key features, operating conditions of voltage, current and timing. This deliverable D3.4 is part of the work package 3 „Battery Management Technology and Hardware“. This document is the basis for the Software development for the OIKOS platform and for the development of the next generation of battery management satellite boards. The next activities will be verification on Chip level and on system level and the design of an optimized satellite board.

In order to achieve the major project goals of INCOBAT (cost reduction, industrialization, etc.) the realization of the local hardware demonstrates an efficient solution in terms of cost and functionality. Miniaturization and integration of system functions is instrumental in this solution.

The TCB31 is a Lithium-Ion Battery Monitoring and Balancing IC for Automotive and Industrial applications. It monitors the Temperatures and the Voltages for up to 12 cells synchronously, and balances the charge across the cells using active balancing or passive balancing.

The ICs are stackable to monitor large battery blocks of up to 720 cells, and communicate together using a robust differential 2-wire communication bus (IBCB). The Interface does need capacitors or transformers as isolators and can operate up to 10 meters over twisted pair cables.

The IBCB Interface is EMC tested and robust up to 200mA BCI currents.

The TCB31 contains 12 parallel extremely precise 13-bit Delta Sigma Converters for Voltage reading with an accuracy of 1.5mV.

The TCB31 also contains a parallel secondary measurement path using a SAR ADC with 10-bits to measure all voltages and the 5 temperature sensors. The Temperature reading has a resolution of 0.1K depending on the connected NTC.

The TCB31 is also designed supporting a lot of ISO26262 features.

The TCB31 supports top and bottom active balancing that permit to balance quickly the cells using a Sumida fly back Transformer with 5A. Active balancing is compensating the cell capacity variations in moving energy from the strong cells to the weaker cells, so that the vehicle can drive up to 10% longer on the same battery charge, saving a very significant amount of battery costs and weight compared to a larger battery. The battery lifetime can be extended.

### Abstract of the Key Features

- Monitors up to 12 Series Connected Cells
- 12 ADCs for Simultaneous Voltage Measurement of All Cells
  - Delta Sigma Converters with Built In Noise Filter
  - 13 Bit Resolution
- 5 Temperature Sensor Inputs to Monitor Battery Temperature
- Internal Temperature Sensor
- Supports Passive and Active Cell Balancing
  - Passive Balancing with Internal or External Transistors
  - Active Balancing within Battery Block
- Integrated Low Ohmic Balancing MOSFETs (1Ω typ.)
- High Speed Differential Serial Interface for Communication Between Battery Blocks (IBCB Bus)

- Comprehensive Diagnostic and Protection Features
- Tolerates Random Connection of Cells (Hot-Plugging)
- Low Standby Current
- Green Product (RoHS Compliant)
- AEC-Q100 Qualified

**ISO26262 supporting Features**

- Two Independent Internal Voltage References
- Secondary Monitoring of Each Cell by a 10 Bit SAR ADC
- CRC Error Detection and Watchdog for IBCB Communication and Internal Registers
- CRC and Parity Bits for Detection of SPI communication Errors
- Fault Output Pin