THESIS ON INFORMATICS AND SYSTEM ENGINEERING C59

Battery Charging and Full-Featured Battery Charger Integrated Circuit for Portable Applications

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Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for any academic degree.

/ Sergei Strik /

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INFORMAATIKA JA SÜSTEEMITEHNIKA C59

Mobiilsete seadmete aku laadimine ja rikkalike omadustega akulaadija integraalskeem

SERGEI STRIK

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KIRJASTUS

Battery Charging and Full-Featured Battery Charger Integrated Circuit for Portable Applications

Abstract: A novel architecture of linear battery charger for fast, precise and safe lithium-ion (Li-Ion) battery charging process and for increasing its time life is described in the thesis. This structure is based on constant current/constant voltage (CC/CV) method of battery charging. Taking into account advantages and drawbacks of different types of battery chargers, two of them – linear and switching – are considered as the most appropriate for Li-Ion battery charging. Further analysis shows that maximum allowed charging current of widely used Li-Ion batteries is not very high and does not necessarily require switching charger type, as since power dissipation during battery charging will not overheat an integrated circuit. However existing linear charger solutions are not very efficient and power dissipation is approaching the maximum limit.

Proposed architecture has several features to improve battery charging process. The major advantage comparing to existing solutions is parallel current paths implementation, one for battery charging and second for supplying other parts of a portable device. This approach allows charging battery independently of the load, i.e. during battery charging process other functions of portable device are supplied from wall adapter. Power dissipation across integrated circuit is also lower comparing to conventional linear battery chargers.

The integrated circuit as a realization of the proposed architecture is manufactured tested and is successful at the market.