# Prototyping

## Modeling & Simulation – Design – Hardware

Service Portfolio

Modeling and simulation are essential for rapid system prototyping, allowing the demonstration of the latest technologies in application prototypes without the need for lengthy iterative design cycles. State-of-the-art laboratory equipment for in-house hardware and software rapid prototyping ensures a swift development process and facilitates early-stage testing within real-world application environments.

The Division Power Electronics provides services around the following topics using its state-of-the-art facilities for:

- Detailled modelling of active and passive components
- Multi-domain and coupled simulations for power electronic systems
- High density and optimal system design and integration
- Rapid prototyping workflows and code generation for different control platforms
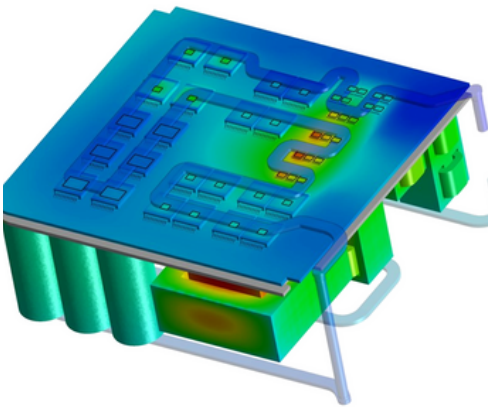

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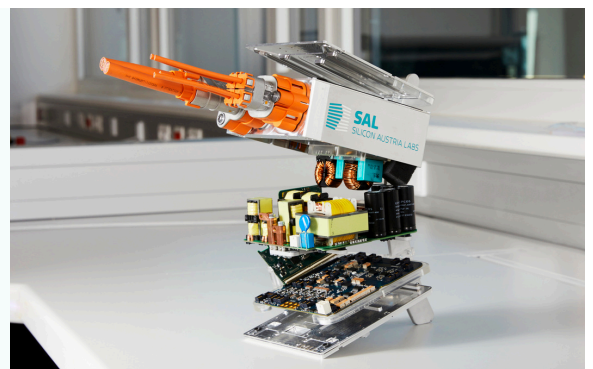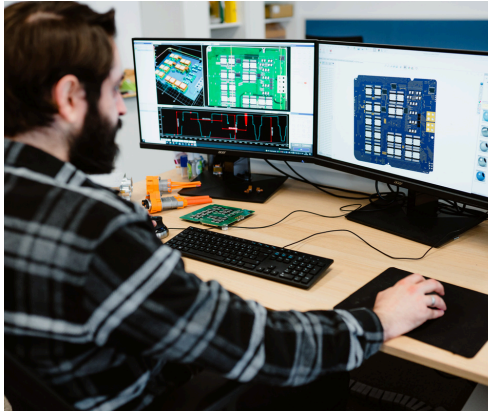
Components and System Modelling

Components Analysis and Modelling

- Mechanical geometrical analysis and modelling
- Material parameter modelling
- Preparation of simulation ready 3D models
- Simplification of models for transient system simulations

Cooling System Simulation and Optimization

Thermal System Analysis

- Cooling system optimization with FEA and CFD analysis
- Generation of reduced order models for more advanced transient simulations
- 3D system modeling with high fidelity components
- Thermal and mechanical package analysis (e.g. thermal cycling analysis incl. mission profile of the system)
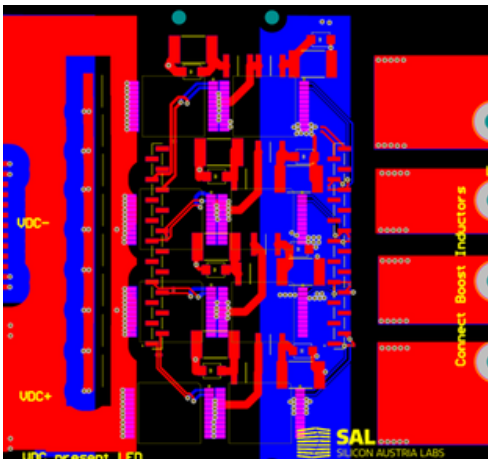
Electrical System Design & Topology Optimization

Electrical System Design including:

- Topology optimization (pareto front analysis)
- Optimal device technology and components selection
- Electrical simulations with state-of-the-art software (PLECS, Spice…)
- Schematic design
- Layout optimization using newest PCB technologies e.g. thick copper, copper inlays
- Magnetic component design and optimization
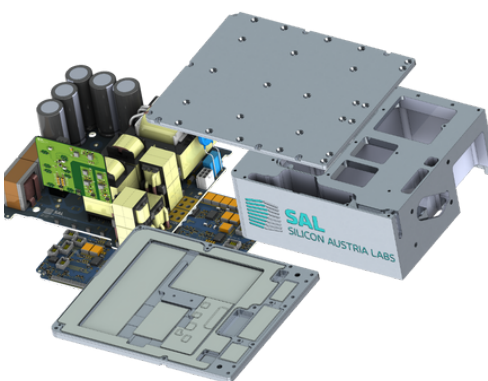
Mechanical System Design & Simulation

Mechanical System Design is carried out in a ECAD/MCAD Co-design procedure to improve the mechanical integration procedure.

- Simulation backed mechanical design for high density integration and cooling system integration
- System Simulation and thermal cross-talk analysis of sub-systems and components
- Connectors interface and high current busbar design
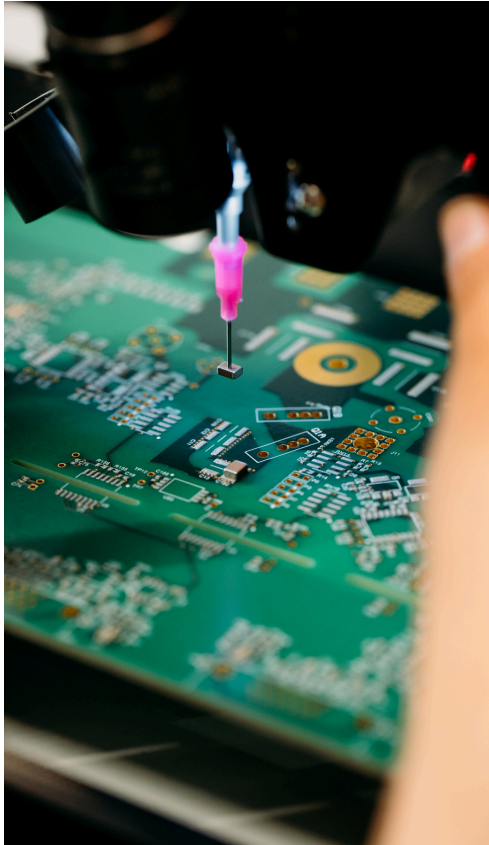
Hardware Prototyping

SAL offers in-house capabilities for system rapid and high-quality Prototyping.

- In-house PCB manual and semi-automatic assembly and vapor phase reflow
- Inspection and electrical commissioning of prototype assemblies
- Mechanical prototyping capabilities for
- CNC machining of components (Metals, Alloys, Composites and Plastic)
- Dry and wet CNC Machining processes
- FDM and SLA 3D Printing with options for thermally conductive materials or high temperature resistant materials such as PEEK
- Laser Cutting and Engraving
- Cutting and processing of Ferrite Materials
- System assembly and commissioning for fast prototype development cycles
- Mechanical parts fast turn-over and re-design cycles
- Custom cold plate machining and cooling performance evaluation
- Vacuum potting and selective coating equipment for passive components and PCB assemblies (available 2026)

Rapid Control Protoying, Control Deployment & HiL testing

Development of custom solutions for Rapid Control Prototyping from concept phase to deployment:

- Initial laboratory testing of novel control concepts using state-of-the-art rapid control prototyping platforms (on-click control model deployment)
- Implementing and automating workflows for control model code generation for different MCU platforms
- Supporting model development for C and HDL code generation
- Building custom firmware for SoC devices with dual C and HDL Code deployment, including data exchange logic
- Implementing firmware components such as ADCs, DACs and fast communication interfaces
- Testing of control model implementations on any platform using available HiL environments
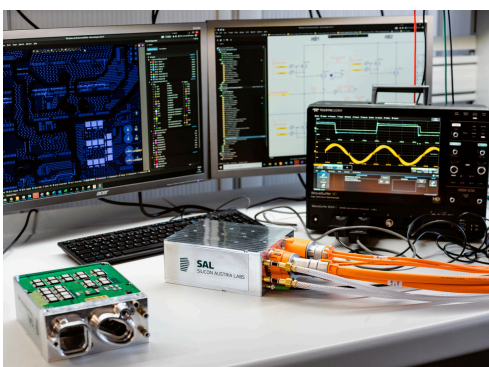
Hardware commissioning and testing

System assembly and commissioning for fast prototype development cycles

- Efficiency and thermal measurements on a system prototype
- High power testing possibilities
- Transient behavior analysis and thermal cycing capabilities
- Conducted EMI analysis

Prototyping

Key equipment and infrastructure

- Profilometer and microscope
- Mechanical measurement tools
- Mechanical machining infrastructure
- Imperix rapid control prototyping
- 3D printers
- Hioki and Yokogawa power analyzer
- Water cooling for prototyping setups

- Multi-domain simulations including CFD
- Solidworks, Altium Designer
- Typhoon & PLECS RT Box HiL
- Vapor phase
- Regatron/ITECH power supplies
- Thermostream

ABOUT SAL

Silicon Austria Labs (SAL) is a top European research center for Electronics and Software Based Systems (ESBS). The application-oriented center offers cooperative research & services at three locations – Graz, Linz and Villach – in the pioneering research areas of Sensor Systems, Microsystems, Intelligent Wireless Systems, Power Electronics and Embedded Systems. | www.silicon-austria-labs.com

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