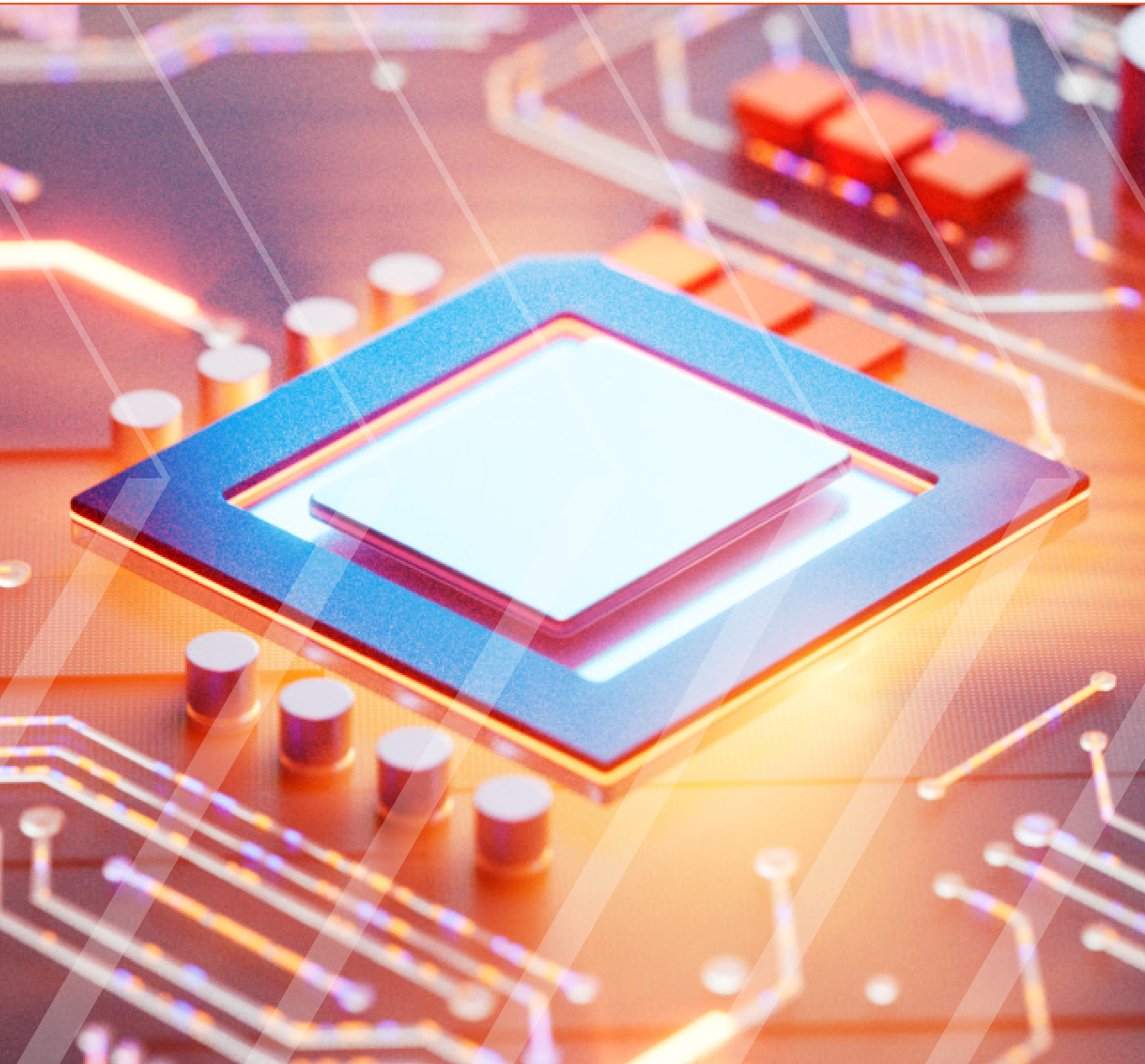
6 ELECTRONICS FAILURES YOU CAN PREVENT WITH AN INTEGRATED SIMULATION APPROACH



INTRODUCTION

When Good Designs Fail

Electronic devices today are remarkably reliable. While consumers may take reliability for granted, it is no accident. Behind every dependable product stands a team of talented designers and engineers, a commitment to quality, and a thorough and rigorous design process powered by advanced simulation and multiphysics analysis.

When companies skip or underinvest in simulation at the design stage, they take an enormous risk. Many design failures occur late in the design cycle, during testing, or, in the worst-case scenario, at customer sites, where they are enormously expensive to fix. Post-production failures can result in safety issues, costly recalls, and re-engineering efforts, often leading to lost revenue and serious reputational damage.

As devices become more compact, operate at higher power, and are engineered to greater performance standards and tighter tolerances, the complexity of design validation increases exponentially. Traditional single-domain analysis is no longer sufficient. Most real-world failures don't stem from isolated electrical, thermal, or mechanical issues—they emerge as the result of interactions between them. In other words, design errors are found in the "gaps" not fully addressed by siloed tools.

This guide explores six real-world failure modes that can be prevented with an integrated, multiphysics simulation strategy. From thermal runaway to mechanical stress fractures to gradual deterioration due to multiphysics interactions, each example highlights how Altair® SimLab®, together with other Altair tools such as Altair® PSIM™ (power simulation), can help identify risks early, reduce costly redesigns, and ensure robust performance from the first prototype.

The Microsoft XBOX 360 “Red Ring of Death”[1]

- Issue: Overheating led to widespread failure of XBOX gaming consoles between 2005 and 2009
- Root Cause: Inadequate thermal design and mechanical stress on solder joints during heat cycles
- Impact: Estimated USD 1.15 billion in warranty costs and repairs

[1] https://gamerant.com/microsoft-xbox-360-red-ring-of-death-explanation-why

PREVENTING COSTLY DESIGN FAILURES

1 THERMAL RUNAWAY IN POWER ELECTRONICS

Avoid system shutdowns, fire risk, and costly redesigns in EV and industrial applications.

The Business Risk

As power devices get smaller and more energy-dense, thermal runaway becomes a critical threat. It's not just a design flaw — it's a compounding risk that can lead to recalls, late-stage redesigns, or even safety hazards.

What's Really Happening

Thermal runaway is a self-reinforcing process. Power switches like insulated gate bipolar transistors (IGBTs), metal-oxide-semiconductor field-effect transistors (MOSFETs), and silicon carbide (SiC) devices generate heat through conduction losses (I^2R). As temperatures rise, resistance falls, current increases, and leakage currents spike exponentially — feeding more heat back into the system.

In high-power applications like electric vehicle (EV) charging or industrial inverters, this feedback loop can quickly push systems past safe operating limits, damaging components and exposing the organization to cost, compliance, and reputational risks.

How Industry Leaders Are Solving It

MyWay Plus Corporation, headquartered in Yokohama, Kanagawa, Japan, is a global leader in power electronics and electrical energy solutions, manufacturing solutions for EV charging, renewable energy, and industrial automation. MyWay integrated PSIM and SimLab to simulate and validate the thermal behavior of its inverter designs. The simulation results closely matched thermocouple measurements, enabling:

- Confident removal of excessive thermal design margins
- Faster thermal validation cycles
- Better alignment between electrical and mechanical teams

Why It Matters

This workflow helped MyWay proactively eliminate thermal failure risk — not through trial-and-error, but by using simulation to predict temperature distributions early in the design process.

Learn more by downloading the case study, Next-level Thermal Management.

Predict and mitigate risks of thermal runaway early in the design cycle to improve device reliability and safety.

2 ELECTROMAGNETICS AND WARPAGE IN 3D IC PACKAGING

Overcome physical and performance limitations while enabling better energy efficiency and greater integration density.

The Business Risk

As the semiconductor industry reaches the physical and economic limits of traditional 2D scaling, companies are turning to three-dimensional integrated circuit (3D IC) packaging to extend performance and integration without the need to shrink transistors. By stacking dies vertically, designers can integrate more functionality into a smaller footprint. But these gains come at a cost. Thermal buildup, signal interference, and mechanical stress are now deeply intertwined. Left unaddressed, they can delay time-to-market, increase development costs, and impact reliability.

What's Really Happening

3D IC design disrupts the thermal and electrical balance that 2D architectures rely on. Heat becomes trapped between vertically stacked dies, creating hotspots that degrade performance and reduce lifespan. At the same time, densely routed interconnects — including through-silicon vias (TSVs), microbumps, and package traces — introduce electromagnetic parasitics that distort high-speed signals and increase power losses.

These parasitics behave like unintended resistors, capacitors, and inductors, increasing coupling and crosstalk between layers, distorting signal timing, and degrading power delivery. The added resistance from parasitics contributes to I^2R losses, generating localized joule heating that worsens thermal gradients and further stresses the package.

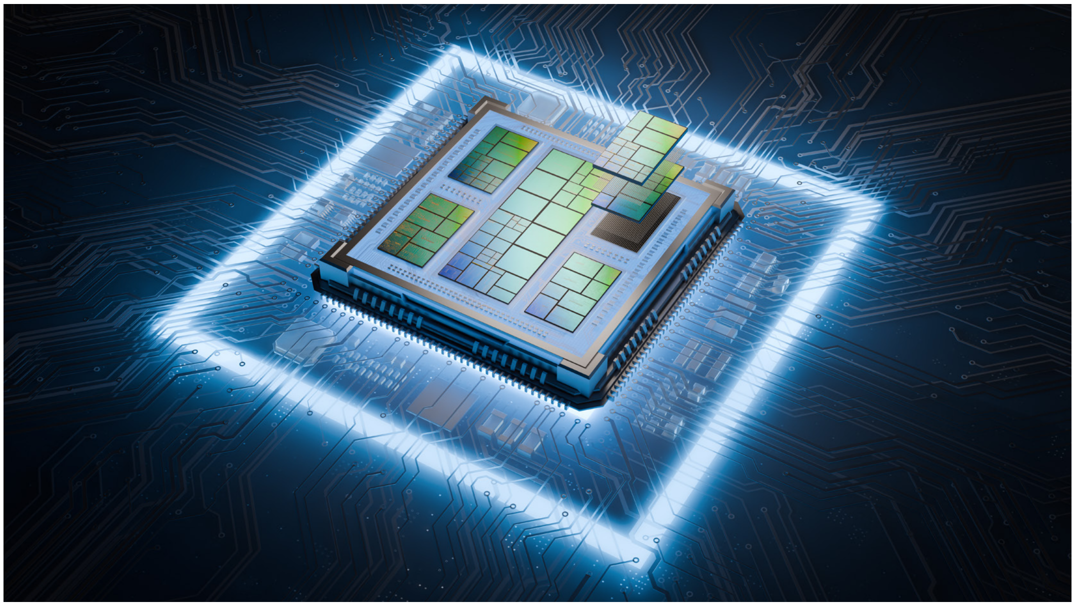
These thermal and electrical effects don't act in isolation. Rising temperatures cause differential material expansion, which leads to mechanical warpage. This deformation can misalign interconnects, crack solder joints, and reduce yield, turning localized heat or signal issues into full-system failure.

How Industry Leaders Are Solving It

With thermal, electrical, and mechanical risks now tightly intertwined, leading engineering teams are moving away from siloed simulation workflows. They're adopting integrated, multiphysics tools that let them anticipate these challenges early — when design changes are faster, cheaper, and far more effective.

SimLab offers that integration. Unlike traditional tools that treat thermal or electromagnetic (EM) effects as isolated steps, SimLab brings together thermal, structural, and electromagnetic simulation in a single workflow — allowing teams to:

- Identify and mitigate thermal hotspots across stacked dies
- Optimize layout decisions with thermal-aware floor planning — for example, distributing heat-generating blocks away from each other and closer to heatsinks to reduce local hotspots
- Evaluate warpage based on material expansion and temperature cycling
- Simulate real-world parasitics and their impact on power and signal integrity



Why It Matters

As IC designs become more compact and complex, the cost of catching issues late has never been higher. Traditional test cycles can't keep up with the thermal-electrical-mechanical complexity of 3D integration.

SimLab, paired with tools like Altair® Flux® (for electro-thermal and EM analysis) and Altair® HyperSpice™ (for RLC-based parasitic modeling and circuit-level signal integrity analysis), forms a tightly integrated simulation platform — built for first-pass design success.

The result? Fewer surprises, faster development cycles, reduced cost of quality, and a scalable path to innovation, without compromising reliability.

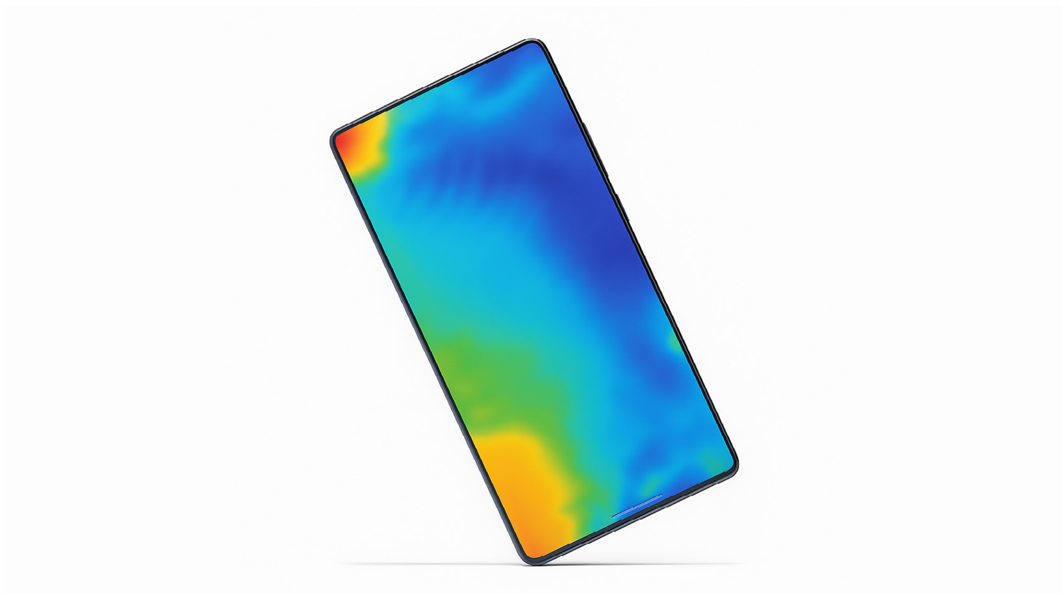
3 DROP-INDUCED MECHANICAL FAILURE IN CONSUMER DEVICE

Ensure devices can withstand the mechanical shocks and impacts encountered during shipping, handling, and everyday use.

The Business Risk

Today's consumer electronics, from smartphones to wearables to home devices, must withstand the mechanical shocks of shipping, handling, and daily use. Drop-induced failures not only damage brand trust, they also lead to costly redesigns, warranty claims, and missed market windows.

But validating durability isn't just about running a simulation. Drop test workflows are often delayed by complex pre-processing tasks, from CAD cleanup to contact definition and meshing. These manual steps consume time, introduce errors, and create misalignment between design and simulation teams. The result? Slower development cycles, higher costs, and increased risk of late-stage surprises.



FOR 3D IC DESIGNS, ALTAIR SIMLAB CAN HELP WITH THERMAL-AWARE FLOORPLANNING AND AVOID WARPING RESULTING IN BETTER YIELD, PERFORMANCE, AND RELIABILITY.

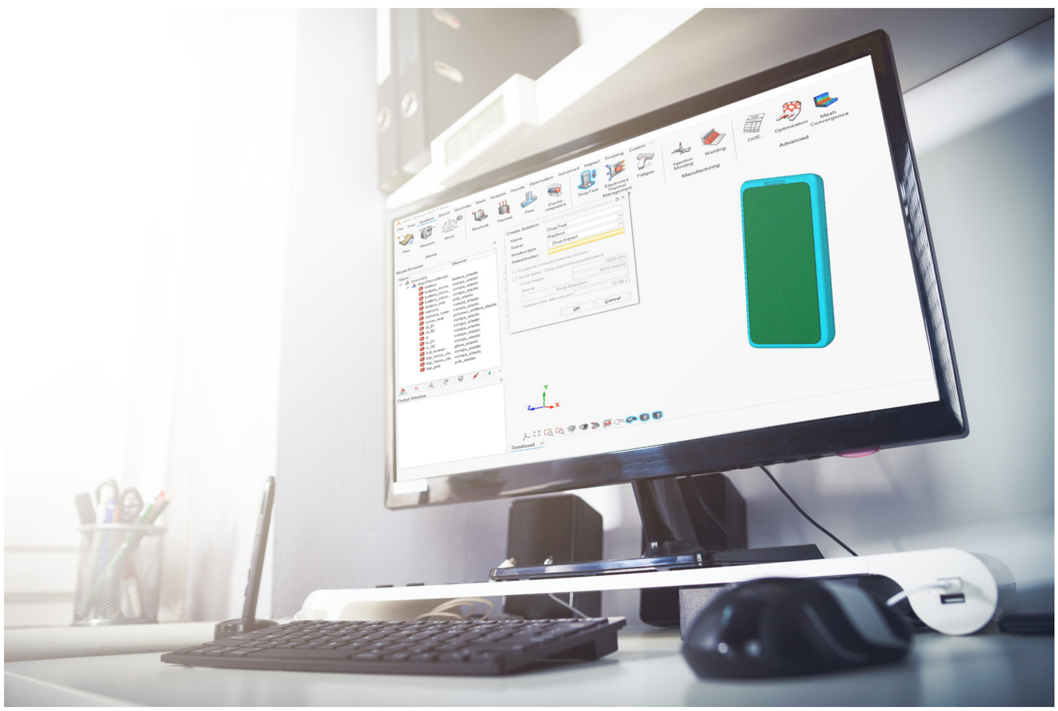
What's Really Happening

Behind every delayed drop test is a workflow bottleneck — but the technical complexity goes deeper. When a device is dropped, the resulting impact forces depend on factors like drop angle, surface hardness, internal mass distribution, and material damping properties. These forces can induce:

- Stress concentrations around joints, cutouts, or screw bosses
- Crack initiation in brittle materials like glass or plastic
- Component detachment due to poor mounting or solder joint fatigue
- Dynamic deformation that affects functional alignment or integrity

To simulate this accurately, engineers must build models with precise contact conditions, material properties under high strain rates, and fine meshing in failure-prone areas. Traditional pre-processing tools make this process slow and error-prone — consuming time on tasks like geometry cleanup, mesh refinement, and manually defining impact constraints.

These delays limit how many designs can be tested under varied real-world scenarios, making it harder to detect failure risks early. Too often, drop-related weak points are only discovered during physical prototyping — or worse, when products are in customers' hands.



How Industry Leaders Are Solving It

Leading electronics companies like Jabra®, a Danish brand owned by GN Audio specializing in audio equipment and videoconferencing systems, are streamlining drop test workflows with SimLab. Known for designing and manufacturing a wide range of wireless and corded headsets for mobile users call center offices, Jabra adopted SimLab to transform their simulation process and:

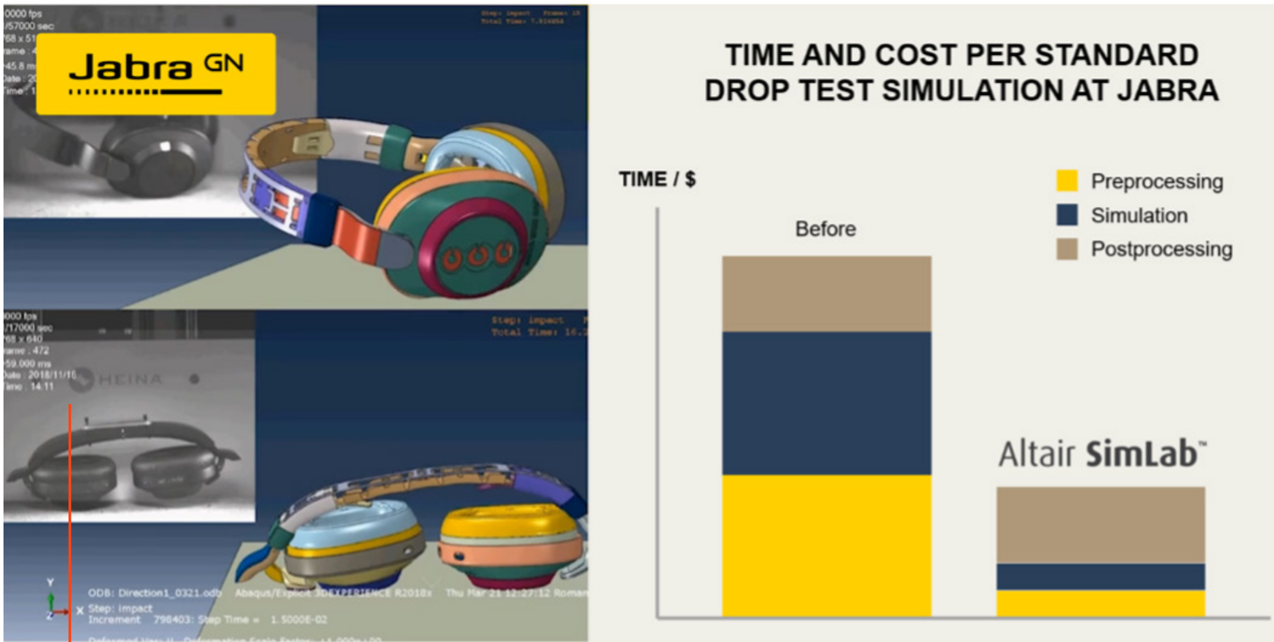
- Automate complex model setup, reducing time spent on CAD cleanup, mesh refinement, and contact definition
- Run faster iteration cycles to evaluate different materials, geometries, and internal layouts
- Leverage parametric studies and design of experiment (DOE) tools to rapidly explore material, geometry, and impact variations for optimal performance
- Use multiphysics simulation to account for structural, thermal, and material behavior under real-world impact scenarios
- Optimize product design with integrated tools for layout, mass distribution, and structural reinforcement

Coupled with other simulation solutions like Altair® Radioss®, Altair® OptiStruct®, Altair® AcuSolve®, Altair® Inspire™, and other HPC offerings, Jabra now performs more simulations in less time, improving confidence while accelerating product delivery.

Why It Matters

For fast-moving consumer markets, speed and durability are non-negotiable. Jabra's use of SimLab allowed engineers to rapidly test various geometries, materials, and impact conditions. By automating simulation workflows and enabling faster design feedback, SimLab helps companies ship better products, faster — with less risk, lower cost of quality, and greater confidence in mechanical, thermal, and electrical durability, all while keeping design tradeoffs like cost, weight, and aesthetics in balance.

Learn more about how Jabra uses Altair to avoid drop-induced mechanical failure in their full range of consumer electronics products.



"Altair® SimLab® has helped us dramatically reduce the time and effort required for drop-test simulations, enabling us to design and engineer better-quality products faster."

Alice Lin, Manager of Mechanics, GN Audio (China) Ltd.

4 ACOUSTIC PERFORMANCE DEGRADATION FROM MULTIPHYSICS INTERACTIONS

Utilize integrated simulation to ensure sound quality is built into product designs from the beginning.

The Business Risk

In audio-enabled products, like smart speakers and e-motors, acoustic quality is a key driver of customer satisfaction and brand perception. But in real-world use, sound performance often degrades due to thermal expansion, material stress, or vibration, effects that aren't always accounted for early in design.

Too often, acoustic flaws only surface after launch, when they're expensive to fix and damaging to user confidence. The result: warranty claims, negative reviews, and costly rework that could have been avoided with earlier integrated validation.

What's Really Happening

Acoustic degradation is rarely caused by a single factor. In real-world products, vibration, thermal expansion, and structural deformation interact in complex ways, shifting resonance frequencies, amplifying unwanted noise, and distorting sound quality over time. Changes in stiffness and enclosure geometry alter natural frequencies, which in turn shift resonance modes and affect acoustic response curves.

For example, heat can cause material expansion, altering the geometry of speaker housings or enclosures. Vibration can induce fatigue or loosen joints, changing how components resonate. Even minor deformations can lead to buzzing, rattling, or reduced acoustic fidelity. Over time, additional contributors like material aging, corrosion, environmental exposure, or degraded acoustic seals can also increase noise levels or reduce sound clarity.

Traditionally, these issues are analyzed using separate tools for NVH, structural, and thermal analysis, often across different teams. This siloed approach increases the chance of missing cross-domain effects that only emerge under combined loading conditions, delaying optimization and putting acoustic quality at risk.

How Industry Leaders Are Solving It

To address these challenges, leading teams are adopting SimLab's integrated multiphysics environment. Instead of managing separate models for acoustic, thermal, and structural analysis, engineers can evaluate all three domains together, within a single, streamlined workflow.

SimLab allows teams to simulate:

- Vibration and acoustic behavior under realistic operating conditions
- Heat-induced material expansion and its effects on enclosure integrity and sound quality
- Structural deformations that impact acoustic performance and component alignment
- Full-system dynamics to capture how different domains interact under real-world loads
- Modal responses to identify natural frequencies and shift them outside critical operating ranges
- Frequency responses across a broad spectrum to reveal amplification, damping, or distortion points
- Design variations through automated DOEs to optimize geometry, materials, and acoustic sealing

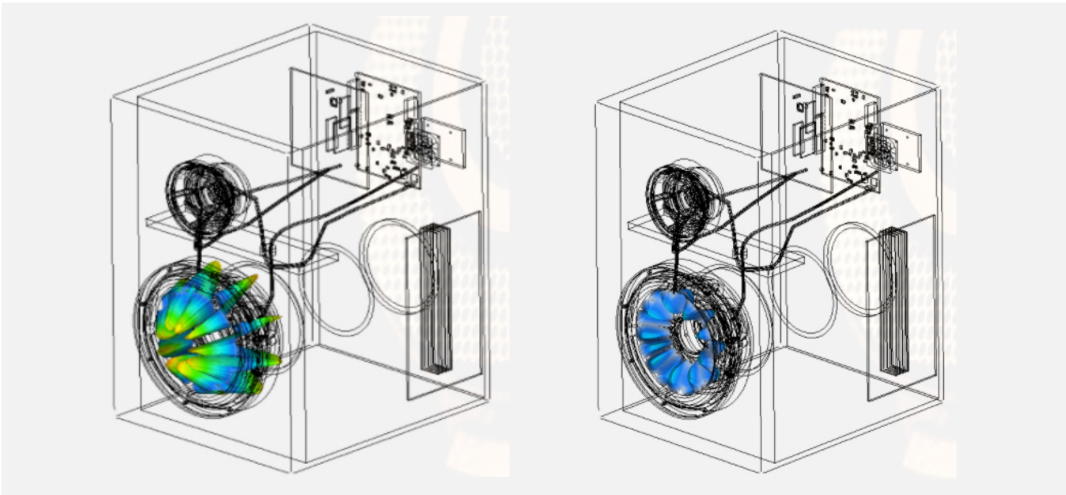
When paired with OptiStruct, teams can also perform structural optimization while maintaining or improving acoustic performance, reducing the risk of design tradeoffs between durability and sound quality.

Why It Matters

Sound quality isn't just a design detail; it's a key differentiator in today's competitive product landscape. With SimLab and OptiStruct, engineering teams can identify and address acoustic and structural risks early, avoiding the high costs of post-launch fixes or compromised user experience.

By unifying acoustic, thermal, and structural simulations into a single workflow, SimLab empowers teams to design for long-term performance and brand consistency, not just to pass a test bench.

Learn more in Sound and Simulation: Designing a Smart Speaker



Altair® SimLab® empowers designers to manage complex acoustic simulations in a single unified environment, improving speed, accuracy, and product performance.

5 DESIGN-INDUCED OVERHEATING IN EV CHARGER MODULES

Accelerate EV innovation by identifying thermal risks early in the design cycle.

The Business Risk

When EV charger modules overheat, the consequences extend beyond failed hardware. Your business case is at risk, including launch timelines, customer trust, regulatory compliance, and your ability to scale with confidence.

Thermal failures in high-power components like onboard chargers (OBCs) can lead to recalls, safety issues, or late-stage redesigns that erode profit margins. As EV programs grow in complexity and urgency, design accuracy becomes a competitive differentiator, not just an engineering concern.

What's Really Happening

Designing EV chargers involves multiple disciplines, including PCB layout, thermal management, signal and power integrity, and EMI/EMC compliance — all of which must be considered together to ensure reliable system behavior.

EV chargers, especially OBCs, operate under demanding electrical and thermal loads. As power density increases and space constraints tighten, even small design oversights can lead to thermal hotspots, inefficient heat paths, and eventual overheating.

Overheating in OBCs often stems from a combination of:

- High current flow through compact traces, causing I^2R (joule) losses
- Inadequate thermal interface materials (TIMs) or poor airflow design, preventing effective heat spreading
- Dense component placement or insufficient copper pours and thermal vias, leading to localized heating on the PCB
- Clamping forces or air gaps between components and heat sinks that degrade thermal conductivity
- Coefficient of thermal expansion (CTE) mismatches between materials causing stress and delamination under thermal cycling

Traditional simulation approaches often isolate these factors, analyzing thermal, electrical, and mechanical domains separately — making it difficult to anticipate how they'll interact under real-world load conditions. By the time issues are identified through physical testing, the design window has already narrowed, forcing late-stage changes that increase cost and delay launch.

How Industry Leaders Are Solving It

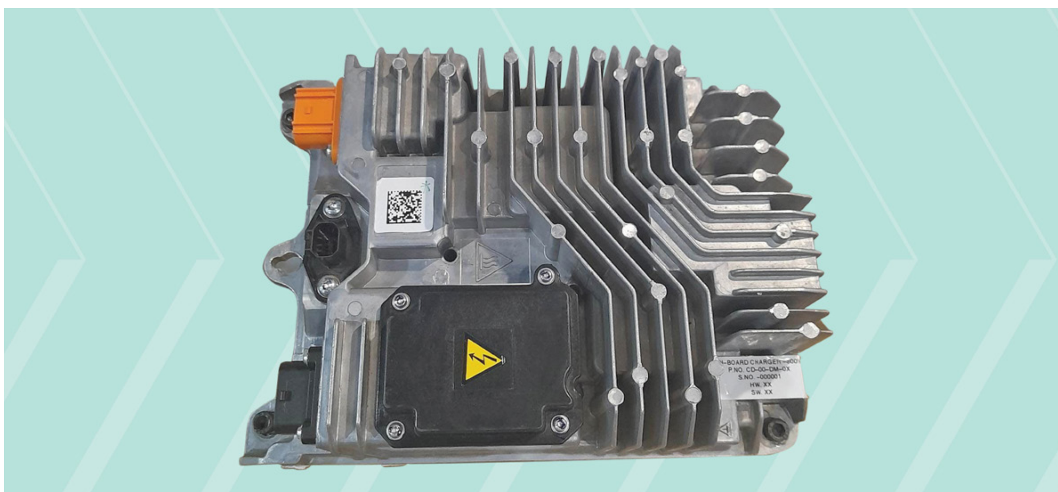
Global tier 1 automotive supplier UNO MINDA tackled these multiphysics challenges by bringing SimLab into the earliest stages of their design process. Instead of waiting for late-stage testing to reveal thermal issues, they used simulation to drive proactive decisions from the start.

SimLab enabled them to:

- Simulate real-world thermal behavior across PCB, housing, and components
- Optimize thermal paths and improve heat conduction through layout changes
- Reduce charger weight by 20%, while maintaining thermal safety
- Cut experimental design time by 50%, accelerating time-to-market
- Achieve <5% variance between simulation and physical tests

SimLab also enables parametric design studies and automated DOE, helping teams evaluate different cooling strategies, material choices, and component placements early in the design cycle.

By integrating simulation into design, not just validation, UNO MINDA unlocked faster, more efficient innovation with greater confidence in performance.



Why It Matters

As EV platforms grow more complex, thermal risk is one of the most difficult and expensive issues to fix late in development. SimLab addresses this by enabling engineers to model thermal, electrical, and mechanical interactions in a unified workflow — catching failure modes before they cascade into reliability or compliance problems.

Tightly integrated with tools like Flux (for EM analysis), Feko (for EMI/EMC verification), and Altair® MotionSolve® (for system dynamics), SimLab helps teams close the gap between physical and virtual testing — enabling an end-to-end solution for performance, reliability, regulatory compliance, and first-pass design success in safety-critical systems like EV chargers.

Learn more by downloading the case study, Reducing EV Charger Deviation.

6 BATTERY CELL THERMAL RUNAWAY

Avoid dangerous chain reactions with predictive simulation.

The Business Risk

Thermal runaway in lithium-ion batteries isn't just a technical failure, it's a threat to your entire business. For manufacturers of electric vehicles, energy storage systems, or consumer electronics, the inability to accurately predict or mitigate battery failure risks can derail launch schedules and cut deep into margins.

The reputational and regulatory consequences of a battery fire or recall are severe, especially in safety-critical, high-visibility markets.

What's Really Happening

Lithium-ion batteries store high energy in dense configurations. In tightly packed modules, even one failing cell can trigger a cascade of chemical and thermal reactions, leading to fire, explosion, or structural damage.

Thermal runaway can be triggered by mechanical damage to battery packs, overcharging or short circuits, and thermal stress from inadequate cooling or high ambient temperatures.

Thermal runaway typically unfolds in four stages:

1. Initiation – Overheating from internal short circuits, mechanical damage, or external abuse starts a temperature climb.
2. Self-heating – Exothermic side reactions (such as solid electrolyte interphase (SEI) breakdown and electrolyte decomposition) rapidly increase the internal temperature. This phase also involves breakdown of the SEI layer on the anode, releasing additional heat and accelerating electrolyte decomposition.
3. Runaway – The separator melts, electrodes contact, flammable gases are released, and pressure builds.
4. Propagation – Neighboring cells are ignited, spreading the failure across the pack.

Key contributors to runaway risk include:

- Poor cell spacing and inadequate thermal insulation
- Insufficient venting or pressure relief design
- Inaccurate battery management system (BMS) algorithms that fail to detect abnormal thermal behavior
- Non-uniform temperature distribution across modules
- Lack of early thermal-electrochemical modeling during design

Traditional validation methods like abuse testing or calorimetry are reactive and expensive, and often too late to inform early design decisions. Without simulation, teams lack the ability to predict when, where, and how thermal runaway might occur.

How Industry Leaders Are Solving It

BeonD, an innovative European company that provides advanced engineering services for developing battery packs and battery management systems (BMS), aren't just hoping their batteries will hold up. They're virtually testing and validating designs before physical prototypes are built. Rather than relying solely on destructive testing, BeonD uses simulation to anticipate failure modes.

Their workflow combines:

- Accelerating rate calorimetry (ARC), a method used to measure the onset of self-heating and quantify heat release, pressure buildup, and gas generation. These parameters were then fed into SimLab to simulate thermal initiation, propagation, and containment.
- SimLab-powered multiphysics simulation using FEA and CFD to model heat flow, material decomposition, and propagation between cells. Results were validated against ARC test data, confirming the predictive accuracy of the model.

Simulated results aligned closely with experimental data, allowing BeonD to confidently model thermal runaway onset, behavior, and containment.

Why It Matters

Battery safety is non-negotiable. As energy density rises and regulatory pressure increases, companies must shift from reactive testing to predictive design. SimLab gives engineering teams the ability to evaluate thermal, structural, and chemical interactions together, catching risks before hardware is ever built.

Once simulation models are validated, SimLab can be used to simulate battery performance under abuse conditions like punctures or overheating, and test design variations for thermal containment strategies — all within a virtual environment.

For BeonD, that means faster development cycles, safer designs, and a stronger competitive position in the battery innovation space.

See the presentation by Luigi Scrimieri, CAE specialist engineer at BeonD, titled [How BeonD Identifies Cell Thermal Runaway Behavior with SimLab](#).

BONUS: ACCELERATING INNOVATION WITH AI-POWERED ENGINEERING

As simulation becomes more critical to product development, the demands on teams keep growing. More variants to evaluate. More physics to consider. Less time to deliver results. But simulation resources are limited, and running solvers on every design change isn't sustainable.

AI helps close that gap. Not by replacing physics, but by making better use of the simulation data teams already have.

What's Really Happening

Across Altair's technology platform, AI is used to reduce solver load, accelerate design studies, and uncover key drivers of performance earlier in the process. These models aren't built on assumptions, they're trained on real simulation and test results, so they reflect actual behavior.

That means engineers can predict how a design will respond to changes without remeshing or rerunning the full model. Teams are using AI to run "what-if" scenarios in seconds, reserve solvers for the most critical cases, and keep projects moving without compromising accuracy.

How Altair Does It Differently

Altair's approach is simple, seamlessly embed AI into the tools engineers already use, and make it work without extra coding or disconnected workflows.

- Teams can generate fast, simulation-trained prediction models using Altair® PhysicsAI™, which applies geometric deep learning to prior results. These models can run up to 1,000x faster than traditional solvers.
- For cloud-scale collaboration, Altair® PhysicsAI™ Studio gives simulation experts, designers, and data scientists a shared, browser-based environment to train, deploy, and use AI models — with scalable HPC and secure model sharing.
- For system-level studies, reduced-order models can be created without code using Altair® romAI™, turning high-fidelity 3D simulations into lightweight models for early evaluation or digital twin development.
- Other tools embed AI to support optimization, sensitivity analysis, and trade space exploration, helping teams move faster and make better decisions.

All of this is part of Altair's strategy: make AI native to simulation workflows, not bolted on.

Beyond Simulation

As simulation data becomes more valuable across the business, AI is used to bridge the gap between engineering and operations.

Altair® RapidMiner® gives organizations a way to develop and deploy AI applications at scale — from supply chain and manufacturing to quality and customer analytics. With a low-code environment and enterprise-grade infrastructure, RapidMiner enables simulation-informed decisions across the product lifecycle.

In 2025, Altair was named a Leader in the Gartner® Magic Quadrant™ for Data Science and Machine Learning Platforms, reinforcing its role in enterprise-scale AI.

Why It Matters

The value of simulation has never been clearer, but its limits have never been more apparent. AI offers a way to extend simulation's reach: not by adding more tools, but by enabling better timing, better focus, and better judgment. When the right questions get answered earlier, everything downstream gets easier, and that's where the real advantage begins.

ONCE TRAINED, ALTAIR® PHYSICSAI™ MODELS CAN DELIVER PREDICTIONS UP TO 1,000X FASTER THAN SOLVER-BASED SIMULATIONS.

FUTURE PROOFING WITH DIGITAL TWINS AND REAL-TIME SIMULATION

Connect simulation, control, and real-world behavior across the product lifecycle.

Digital Twins: The Next Layer of Confidence

Digital twins extend the value of simulation beyond the design phase. More than a static model, a digital twin is a dynamic, virtual representation of a physical system that mirrors its behavior under real-world conditions — in real time or near-real time.

Using digital twins, engineers can test how designs respond to thermal stress, electrical load, or mechanical shock long before physical hardware exists. And once devices are deployed, sensor data from the field can be used to refine the twin, enabling predictive maintenance, performance optimization, and smarter next-gen designs.

For power electronics systems, where thermal reliability and control logic are tightly coupled, digital twins offer a way to continuously validate performance from design to deployment.

A Practical Example: SimLab + PSIM Co-Simulation

Altair supports digital twin development through an integrated workflow between SimLab and PSIM.

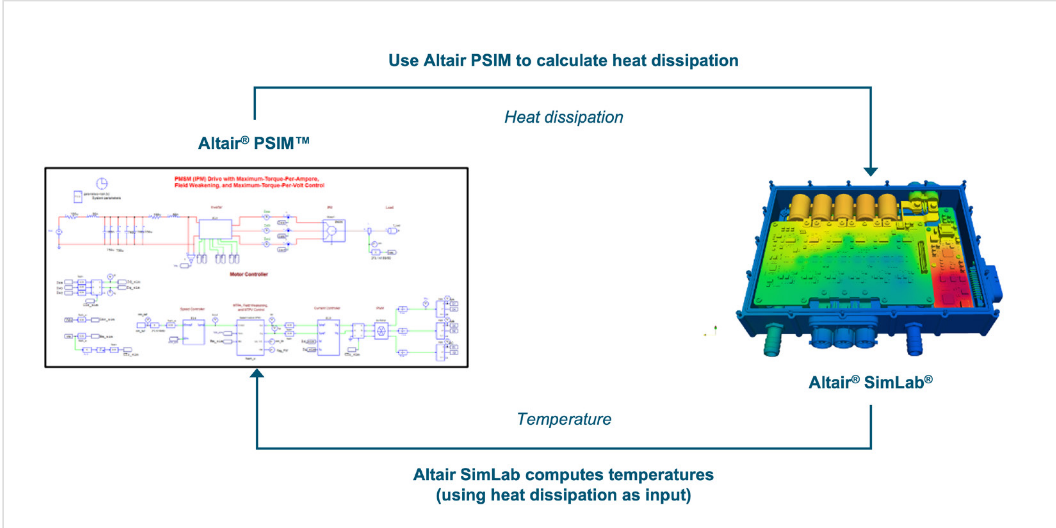
- SimLab handles high-fidelity multiphysics modeling — including thermal paths, heat dissipation, airflow, and structural behavior.
- PSIM models control logic, switching devices, and electrical performance — including power loss, EMI, and motor control behavior.

These two tools connect via co-simulation. Using functional mock-up units (FMUs) exported from SimLab, engineers can link high-fidelity physics models to PSIM's system-level controls. Signals are exchanged dynamically during simulation, closing the loop between physical behavior and control response.

For example:

- PSIM calculates switching and conduction losses in power devices like IGBTs or SiC/GaN transistors
- SimLab uses those losses to simulate heat generation, thermal gradients, and airflow effects in 3D
- The resulting temperatures feed back into PSIM, influencing control behavior for the next simulation step

This real-time exchange allows engineers to simulate cause and effect — not just in components, but across the full system.



For a detailed use case, see [Next-Level Thermal Management at Myway.]

Hardware-in-the-Loop: Bridging Design and Deployment

Digital twins also support testing beyond simulation. With hardware-in-the-loop (HIL) capabilities in PSIM, engineers can connect embedded control software to a simulated environment running in real time.

This enables teams to:

- Validate control algorithms before integrating physical subsystems
- Simulate fault conditions without risking physical hardware
- Use real telemetry data to test system response in software

Whether testing inverter controls, battery packs, or motor drives, HIL creates a safe and flexible environment for embedded validation, while maintaining the accuracy of the digital twin.

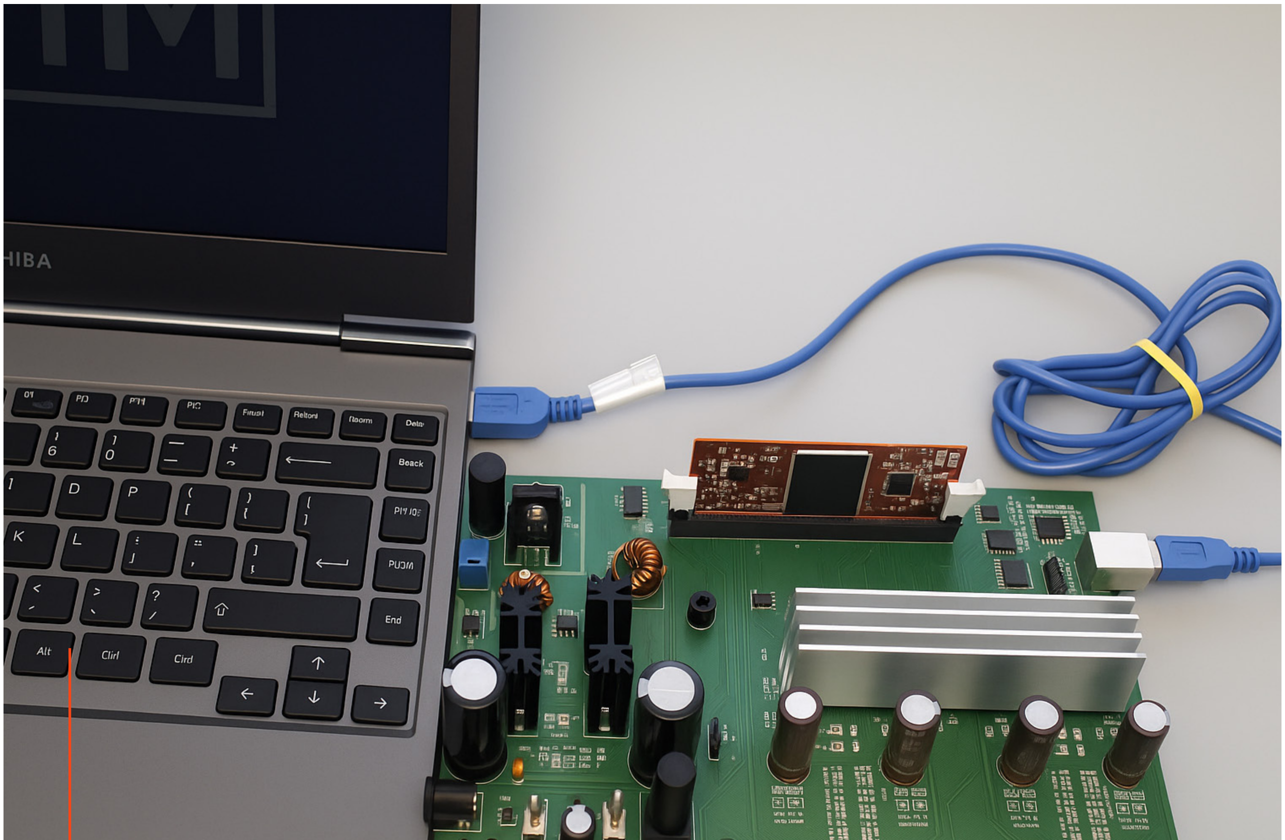
System-Level Integration with Altair® Twin Activate®

Altair's broader digital twin strategy is supported by tools like Twin Activate, which allows for the orchestration of system-level models, combining 1D simulation, control logic, FMUs, and real-world data into a cohesive digital twin architecture.

For teams developing embedded systems, power electronics, or intelligent products, Twin Activate provides a way to manage complexity, run scenario testing, and simulate the entire system before it's built.

Why It Matters

Digital twins aren't just a future-state capability, they're already helping teams simulate smarter, validate earlier, and test more safely. By integrating control, physics, and operational data into a connected workflow, engineers can reduce test cycles, shorten integration time, and design with real-world behavior in mind — from day one through deployment to in-service.



Many device failures in power electronics are not due to a “lack of simulation”—rather, they are due to a lack of coupled, system-level simulation early in the design phase.

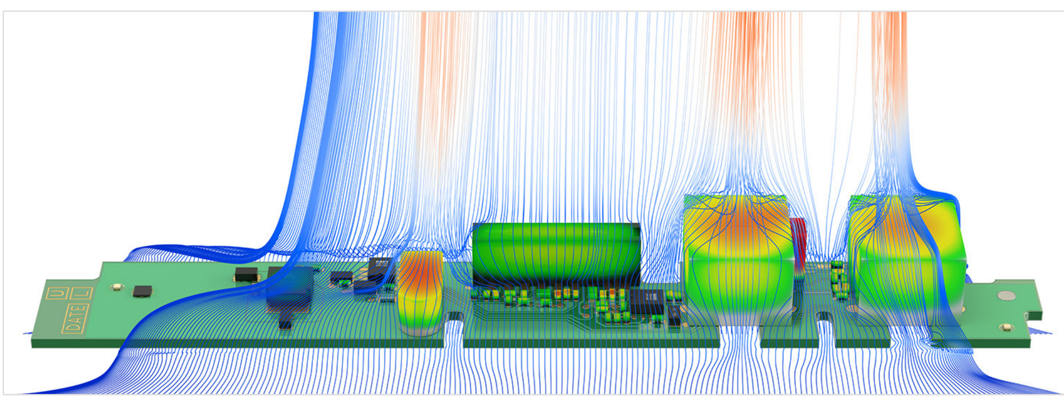
CHECKLIST: 5 SIGNS YOU NEED MULTIPHYSICS SIMULATION IN YOUR ELECTRONICS WORKFLOW

Most real-world failures in electronics devices don't stem from isolated electrical, thermal, or mechanical issues. Rather, they result from unanticipated physics interactions. Insufficient investment in multiphysics simulation at the design stage poses an enormous risk. Early-stage errors become exponentially more expensive to fix as the design progresses, and post-production failures can lead to costly recalls, brand damage, and safety issues

Below are some signs that your organization may need to incorporate more robust multiphyics analysis into your workflow:

1. You see unexpected failures in physical thermal, drop, or vibration testing
2. Your team uses separate tools for thermal, structural, and EM—and none of them talk to each other
3. You're redesigning products late in the cycle due to reliability issues
4. You want to explore "what-if" designs, but setup time makes this infeasible
5. You rely too much on physical testing to validate design changes

This real-time exchange allows engineers to simulate cause and effect — not just in components, but across the full system.



TAKE THE NEXT STEP

From early insight to system-level confidence — bring simulation forward in your development process.

Throughout this guide, we've shown how engineering teams are solving complex reliability, performance, and integration challenges — not by simulating more, but by simulating smarter. Whether it's avoiding thermal runaway in power modules, predicting mechanical failures before physical drop tests, or validating control logic with real-time system behavior, the goal remains the same: catch problems earlier, make better decisions faster, and reduce risk without slowing down development.

Altair's simulation tools, such as SimLab and PSIM, highlighted throughout this guide support an integrated multiphysics development approach. They enable teams to explore, optimize, and validate performance across electrical, thermal, electromagnetic, and structural domains in a connected, scalable way.

If you're ready to take simulation upstream, align your workflows across disciplines, or evaluate how these tools can accelerate your development process, we invite you to:

- **Try Altair SimLab or PSIM through the Altair One Marketplace**
- **Speak with an expert or schedule a live demo** of your specific simulation challenges
- **Explore additional case studies, videos, and technical guides**

Simulation is no longer just about validation, it's about making sure the right decisions get made early, so everything downstream goes faster, smoother, and with fewer surprises.

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