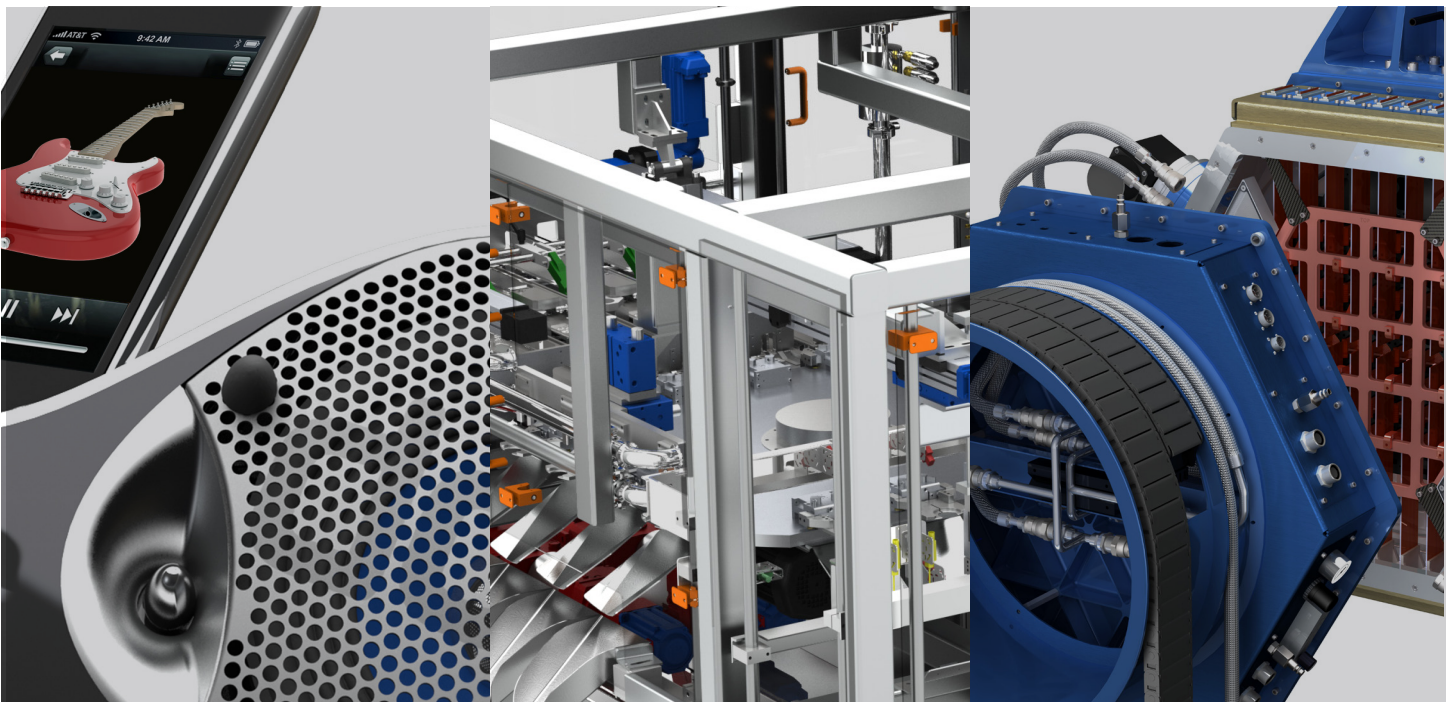

RECHARGE ELECTRONICS AND HIGH-TECH PRODUCT DEVELOPMENT WITH SOLIDWORKS SOFTWARE

Overview

The increasingly rapid pace of technology development—with an abundance of electronic products and new technologies hitting the global market at an unprecedented rate—creates many challenges for manufacturers. To succeed in this competitive environment, developing innovative products more quickly, more cost-effectively, and at higher levels of quality has become more important than ever. With integrated SolidWorks® software solutions, you can refine, consolidate, and improve your development processes—and deliver new technology applications and innovative electronic products faster than the competition.



The challenges of hi-tech and electronic product design

High technology development—and its application in the steady volume of electronic products introduced over the past few decades—has resulted in increased customer expectations and greater market complexity. Unlike the early days when novelty alone drove consumer demand for computers, mobile phones, gaming consoles, global positioning systems (GPS), and other electronic gadgets, today's competitive landscape demands innovation, reliability, and efficiency in product development. As technology rapidly evolves, the global playing field is becoming populated with talented competitors who are working hard to create products that could potentially disrupt your business.

To succeed, technology developers and manufacturers of electronic products must address the challenges of a very dynamic market that demands faster time-to-market, greater innovation, and higher quality. Achieving these goals requires integrated tools at each stage of the development process—from electronic and mechanical design to prototyping and testing, to manufacturing and assembly—and an effective strategy for managing development data at each step. Integrated solutions can facilitate the collaboration that is necessary to foster innovation, boost productivity, and reduce development costs.

Today's hi-tech designs are increasingly complex and require denser packaging, more sophisticated cooling systems, and more reliable functionality. They must also look “cool”—adding the need for creative styling and packaging aesthetics to the mix—and must address the growing requirements for recyclable components, such as the European Union's Restriction of Hazardous Substances Directive (RoHS), which restricts the use of certain hazardous materials in electronics and electrical designs. Overcoming these challenges requires access to a range of robust design, simulation, and data management capabilities as part of a single, integrated development environment.

ECAD/MCAD integration generates benefits

What came first: the printed circuit board (PCB) or its housing? With some electronic product designs, electrical engineers design the PCB. Their mechanical counterparts then develop the packaging that surrounds and contains the board. However, at other times, industrial designers first create a stylistic housing for aesthetic reasons. This and other mechanical considerations, such as connectors and switches, take priority over the PCB design.

In either case, the historical lack of collaboration among electrical engineers, who design the PCB board; mechanical engineers, who design the housing; and industrial designers, who create the overall look of the product, represents the weakest link in the process. Lack of communication can lead to confusion, misunderstandings, and design errors, resulting in costly delays. Fortunately, powerful tools are now available that facilitate ECAD/MCAD integration and encourage collaboration between mechanical and electrical engineers.

By collaborating more closely and sharing compatible design data between electrical and mechanical design systems, engineers can improve the quality of designs, reduce costs, and accelerate time-to-market. ECAD/MCAD integration—especially when PCB models are fully associative—helps engineers to quickly pinpoint potential collisions between PCB and enclosure designs. It also enables them to strategically position key electrical components for optimal performance, and effectively merge the electrical, mechanical, and industrial design aspects of hi-tech products.



...a case in point

InFocus Corporation pioneered the mobile projection market by introducing the first portable system for projecting computer displays onto large screens. The company's technology supports presentations to large and small groups in both commercial and educational settings.

InFocus uses CircuitWorks™ software to facilitate collaboration between mechanical engineers—who use SolidWorks software to develop the product housing, mechanical components, and electrical footprint—and electrical engineers, who develop printed circuit boards. Using CircuitWorks to integrate populated circuit boards into SolidWorks software models is helping InFocus develop smaller, lighter projectors faster and more cost-effectively. As a result the manufacturer has reduced its design software costs by 70 percent and its hardware costs by 75 percent.

"Because we are more efficient, we may use CircuitWorks to go back and forth between electrical and mechanical engineers two to four times. It's just easier to work in SolidWorks software. Our transition to the new system was very smooth, and we have seen a 50 percent decrease in the time that it takes to get a new user up and running effectively."

*David Mulholland
Senior Application Engineer
InFocus Corporation*

Assess cooling and sustainability requirements

Effective cooling of heat-generating electronic components is a key requirement for effective hi-tech products. As the size and shape of electronic enclosures continue to decrease, the need to evaluate how well your cooling system performs becomes increasingly important. With less physical real estate with which to work, you need greater insight into how effectively your cooling system functions and how the positioning of heat sinks and other cooling features impacts your design. The need to assess the thermal effects of using alternative materials for heat sinks and housing features—to meet emerging environmental requirements—can further complicate your appraisal of cooling system effectiveness.

While competitive pressures prohibit spending the time and incurring the costs required to create and test physical prototypes, integrated simulation capabilities can help you assess cooling system performance more quickly and more cost-effectively.

With an integrated flow simulation tool, you can determine how well your cooling system design dissipates heat. By analyzing the rate of cooling in your design, you can optimize the size, number, and placement of cooling components, such as fans, vents, thermoelectric coolers, and heat sinks. You can then validate the impact of design modifications to determine whether they improve or degrade performance.

Other simulation tools can help you assess the environmental impact of hi-tech products throughout their life cycles. Understanding how the use of certain hazardous materials in electronic designs carries environmental ramifications—in terms of product recyclability or disposal—can help you to formulate a design philosophy and sustainability strategy that best positions your products. In addition to helping you meet regulatory requirements, sustainable design practices are becoming increasingly important from sales, marketing, and business standpoints.



...a case in point

ioSafe, Inc., leveraged SolidWorks design, simulation, and fluid-flow analysis software to solve the technical challenges associated with developing a disaster-proof external hard drive, which protects data from the damaging effects of fires, floods, and earthquakes.

A thin, metalized, heat-conductive yet waterproof barrier surrounds the hard drive, protecting it from water, while the heat created by the hard drive passes through the waterproof barrier and into a cavity within the enclosure, protecting the device through outward steam flow during a fire. Using SolidWorks Flow Simulation to optimize the balance of air flow for cooling and outward steam flow for fire protection saved ioSafe \$15,000 in prototyping costs and cut time-to-market by 75 percent.

"With SolidWorks software, we brought our design time down from four months to a single month, reclaiming three months of potentially lost sales of a high-demand product. What we've done wouldn't have been possible without integrated CAD and simulation software for quickly iterating virtual prototypes."

*Robb Moore
CEO
ioSafe, Inc.*

Automate routing of wires, cables, and distributed lines

Once your PCB, housing, and cooling system designs are in place, it's time to determine where all the wires go and address interconnections. While the routing of wires, cables, and other distributed systems—such as hoses, hydraulic lines, ducts, and pipes—is often treated as an afterthought, it is a critically important step in the design process. When it isn't done right, it can negatively affect design performance.

Does your wiring, or the harnesses used to bundle it, have any clearance issues? Will the placement of wiring or other distributed lines compromise how well your cooling system works? Have you positioned your wiring in such a way as to provide for easy product assembly, maintenance, and repair? Answering questions like these requires the use of integrated design visualization and simulation tools.

With a 3D routing design tool, you can automate the path selection and positioning of wires, cables, and distributed lines within your design, as well as visualize how they will be accessed and serviced. You can then use an integrated flow simulation package to determine how wiring, tubing, or piping placement affects your cooling system. Using integrated design visualization and simulation tools not only enables you to ensure that wiring placement and routed system layouts have no negative effects on your design, but also helps you to save time by automating the process.



"The more time we can save, the better. SolidWorks software has proven to be a good tool for helping us do that."

Gregor Cadman
Engineer
Terrafugia, Inc.

...a case in point

Terrafugia, Inc., has turned the flying car—or, more accurately, the drivable plane—into a reality. Established in 2006, the company developed the Transition® Roadable Aircraft, a personal airplane that converts into an automobile.

During development, Terrafugia engineers relied on SolidWorks® software, including SolidWorks Routing, which automates the design of distributed systems. Instead of manually modeling every wire, cable, and hose in the vehicle, the company's engineers used SolidWorks Routing to automatically route electrical wiring, brake lines, fuel lines, cooling hoses, and control cables, ensuring the design provided the necessary room for these systems as part of efforts to conserve material and reduce weight.

Ensure reliable performance in a dynamic environment

As the trend toward miniaturization in electronic product design continues, the need to make sure that products function properly despite frequent exposure to vibration-inducing motion becomes even more crucial. Many portable electronic devices are susceptible to frequent drops, impacts, and movements. As these devices get smaller, new challenges in dynamics arise involving how to cushion impacts and dampen vibration caused by everyday use in a very tight space. The use of electronic components in other moving systems—such as automobiles and aircraft—also demands reliable performance in a dynamic environment.

To make sure that your design does not vibrate, resonate, or deflect in a way that deteriorates performance, you need access to the capabilities of integrated structural dynamics. By understanding the natural frequencies of your parts and assemblies, you will be able to modify your designs or select different materials in order to dampen vibration, avoid resonance, or minimize deflection in critical areas, thereby improving performance. You can use random vibration analysis in place of shake tests and perform simulated drop tests to assess the effects of impacts, saving time and money in the process.

Dynamics analysis is a key step for ensuring the reliable operation of your product. This is particularly important in hi-tech designs when minimizing vibration is of the utmost importance, such as with sensitive instrumentation, or when you want to control vibration with a high degree of precision, such as with computer disk drives.



...a case in point

Reutech Radar Systems uses SolidWorks Simulation to solve complex nonlinear structural problems, including advanced dynamics analyses. The company's radar structures are mounted on land, on aircraft, and on ships, and sustain a wide variety of loads, including wind, temperature, deflection, seismic vibration, weight, and motion.

By using simulation tools to understand complex structural, such as vibration, the company produces a more accurate, higher-quality product. Simulation tools are also more flexible and cost-effective than physical prototypes and allow Reutech to factor in the impact of wind-induced deflection and ship motion. SolidWorks software enabled Reutech to reduce time-to-completion by 50 percent and cut prototype/testing costs by 30 to 60 percent.

"The combination of our expertise, the integration of SolidWorks Simulation, and the software's range of capabilities has allowed us to cut development time in half."

*Carel Kriek
Chief Mechanical Engineer
Reutech Radar Systems*

Manage data and processes more efficiently

The number of steps, iterations, and modifications related to the development of hi-tech and electronic products requires a solution for managing the diverse processes and various types of design data involved. How do you control revisions? How do you manage ECAD, MCAD, and simulation data? How do you execute engineering change orders (ECOs)? Are your collaborative efforts well coordinated? Are you making the most out of design reuse?

Having access to the right integrated tools provides efficiency and quality improvements. However, without an easy-to-use and -administer product data management (PDM) system, you may not realize potential productivity gains—and quality safeguards—to their fullest extent. By using an integrated PDM system, you can manage collaboration, control revisions, track validation data, refine workflows, and coordinate ECOs. In other words, an integrated PDM system provides the foundation for tying all of the individual steps together in a cohesive process.

PDM provides additional benefits outside of the design process. You can configure your PDM system to manage access to data and automate workflows related to quoting and purchasing, manufacturing and assembly, and documentation and quality control. While integrated tools are important, a PDM system allows you to maximize individual increases in efficiency, so you enhance your productivity from concept development through market introduction.



...a case in point

NEXX Systems, Inc., delivers products specifically designed to meet the evolving demands of the advanced wafer-level packaging market. They are ideally suited for a wide range of deposition applications that support smaller, faster electronic devices.

To address a greater volume of development activity and related engineering change orders (ECOs) more efficiently, the company implemented SolidWorks Enterprise PDM software. With this PDM solution, NEXX Systems was able to quickly work through its backlog of ECOs and accelerate development through tighter revision control and improved workflow automation. In addition to improving development throughput, the PDM system enables the company to drive design data throughout the enterprise and to support purchasing, manufacturing, and field-service functions.

"Before we implemented SolidWorks Enterprise PDM, changing a dimension indicated in an ECO could take a lot of time and labor because we had to rename all related references and links manually. It's easier to make changes with SolidWorks Enterprise PDM because the system automatically updates all related files. What used to take a day, we can now do in an hour."

*Jim Mueller
Director of Product Engineering
NEXX Systems, Inc.*

Streamline hi-tech and electronic product design with SolidWorks software

To succeed in today's hi-tech and electronic product industries, manufacturers must bring more innovative and higher-quality products to market faster and more cost-effectively than the competition. Organizations can achieve these goals and gain a competitive advantage by transitioning from individual silos of productivity to a more integrated and more collaborative approach to product development.

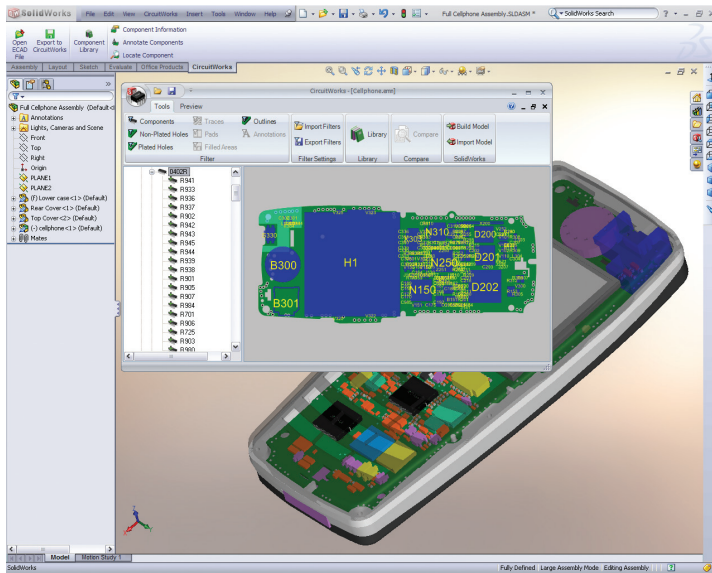
By using a single, compatible design environment to complete each step in the development process—from PCB/housing design to cooling system development, routing of distributed systems, and vibration studies—you can streamline development and realize the efficiency gains and cost savings that are critical factors for success. You can maximize productivity and cultivate collaboration even further through the use of a PDM system that is completely integrated with all of your design tools.

Because the integrated SolidWorks software development platform addresses all of the challenges related to designing hi-tech products, it can help you to design more innovative and higher-quality products and consolidate your development processes.

ECAD/MCAD integration with CircuitWorks

Helping electrical and mechanical engineers work more closely together is the sole purpose of CircuitWorks software. Using industry-standard Intermediate Data Format (IDF) files, the software enables engineers to exchange PCB models between all leading ECAD software and the SolidWorks CAD software system.

In addition to establishing an innovation-inspiring collaborative design environment, this integration provides benefits for both types of engineers. Electrical engineers can more easily create preliminary PCB layouts, including complex board shapes that fit the housing, and transfer them into the ECAD system. Circuit layouts and “keep out/keep in” areas can also be defined in SolidWorks software, and then imported into ECAD. This allows for precise component placement and positioning. Mechanical engineers can leverage CircuitWorks to avoid collisions, address the positioning of key electrical components, and perform additional studies, such as cooling system evaluations and vibration analysis.



It is critically important to ensure that hi-tech electronics not only function properly, but also perform reliably over the long term.

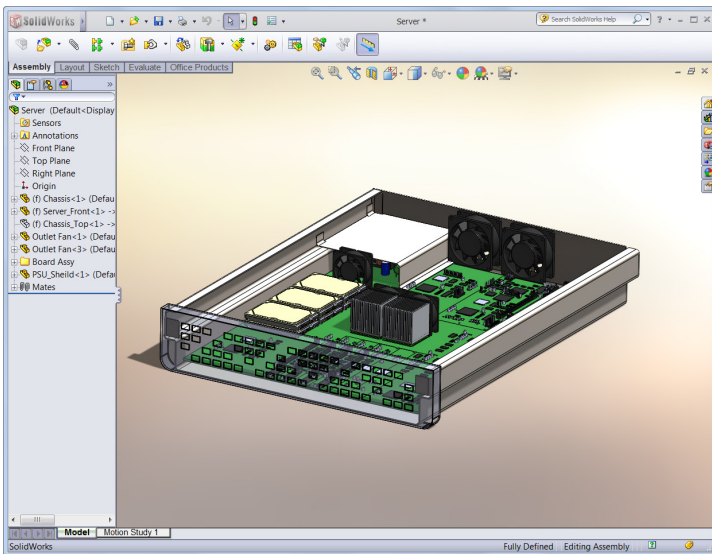
CircuitWorks software provides integration between all major ECAD software and the SolidWorks CAD software system, facilitating collaboration between electrical and mechanical engineers.

Simulate cooling systems with the PCB Cooling Module

Once you have completed your electromechanical design, you can use the SolidWorks Simulation PCB Cooling Module to address cooling requirements. It is critically important to ensure that hi-tech electronics not only function properly, but also perform reliably over the long term. With this module, you will be able to validate the thermal aspects of PCB design, optimize airflow, position heat sinks, and select and size cooling components.

Specific capabilities include the analysis of Joule heating effects, which is useful in many power electronics applications. You can use the two-resistor models of standard JEDEC (Global Standards for the Microelectronics Industry) package outlines, a compact heat pipe model, and an extensive library of IC Package components to simulate heat transfer in your design.

In addition, you can use the PCB Generator tool to obtain the biaxial thermal conductivity values for multilayer PCBs and to model PCBs with an angled orientation.



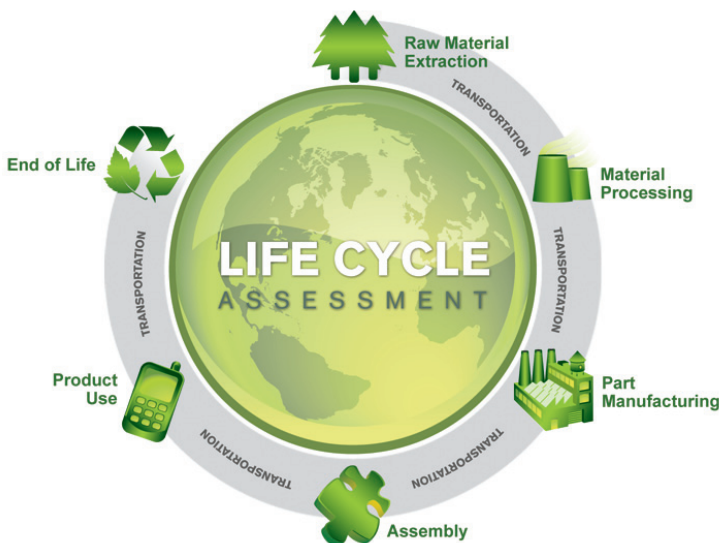
With the SolidWorks Simulation PCB Cooling Module, you can assess the thermal behavior and cooling performance of your design inside SolidWorks Sustainability software.

Understand environmental impacts with SolidWorks Sustainability

Sustainable design has become an important issue in the hi-tech and electronic products industry. Besides having to eliminate certain materials from products in order to sell them in the European Union and to comply with RoHS regulations, many manufacturers now understand that the environmental aspects of their products, including their recyclability and the nature of materials used to produce them, can have long-term consequences for their business.

SolidWorks Sustainability software enables you to learn the potential environmental impacts of a product design before it is made. The software can accurately predict the carbon footprint, total energy consumption, air emissions, and discharges into waterways related to a design by performing a Life Cycle Assessment (LCA). You can use this information to guide product development decisions, establish a general design philosophy, or create a sustainable design product development strategy. These insights can also help you to modify existing processes to reduce energy usage, lower costs, and minimize waste.

With SolidWorks Routing, you can automate the routing of distributed systems and spend your time on real engineering.

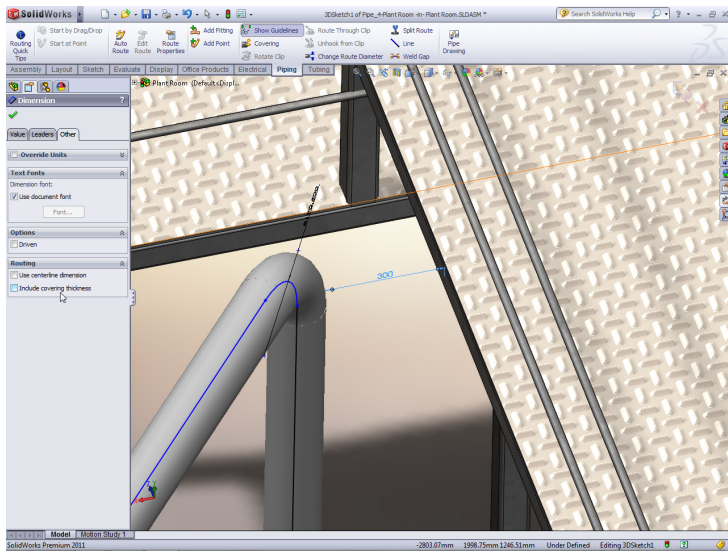


SolidWorks Sustainability software enables you to predict the potential environmental impacts of your design by performing a Life Cycle Assessment.

SolidWorks Routing automates wiring

With the SolidWorks Routing tool, you'll be able to automatically generate wiring, cables, harnesses, or other distributed systems throughout your design. The software does it for you, and includes flexible tools for repositioning wires, cables, and harnesses, giving you the control that you need to address clearance issues or improve access for service and maintenance.

When used in conjunction with the PCB Cooling Module, you can even determine whether the automated path of the wiring will impede or have no effect on your cooling system's performance. Wiring, cabling, and harnessing are necessary tasks in hi-tech and electronic product design, but do not have to be tedious, repetitive, and a waste of your valuable time. With SolidWorks Routing, you can automate the routing of distributed systems and spend your time on real engineering.

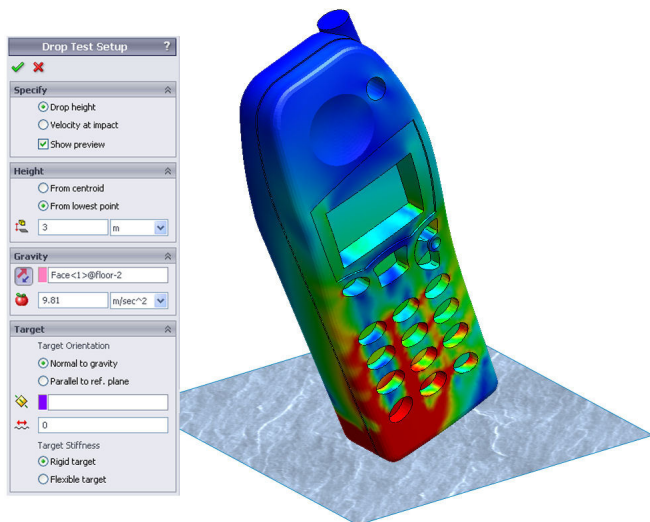


SolidWorks Routing enables you to automatically route distributed systems in your design, including wires, cables, harnesses, hoses, hydraulic lines, ducts, and pipes.

Study vibration and dynamics with SolidWorks Simulation

How many times have you dropped your MP3 player or mobile phone? Have you ever tried to use your laptop while riding in an off-road vehicle? Has your windshield-mounted GPS system ever fallen from its mount as a result of hitting a pothole? These are all examples of why understanding the effects of vibration, resonance, and deflection is so important for hi-tech and electronic product developers.

With the advanced dynamics analysis capabilities of SolidWorks Simulation, you can perform virtual drop and shaker tests, identify the natural frequencies of design components, and ensure that your designs will reliably perform in a dynamic environment. You can determine whether your design has any vibration issues—and save the time and money associated with testing physical prototypes—by using the modal, harmonic, random vibration, and drop test analysis capabilities of SolidWorks Simulation.



Using SolidWorks Simulation, you can conduct advanced vibration studies of your designs, including virtual natural frequency, shaker, and drop tests. This allows you to address the effects of vibration, resonance, and deflection.

Tie it all together with SolidWorks Enterprise PDM

Developing hi-tech products involves many contributors, processes, and types of design data. Traditionally, each functional discipline managed its own engineering information: electrical engineers handled ECAD files, mechanical engineers controlled MCAD data, and analysts took care of simulation results. The data handoffs among these groups were not very smooth, requiring file conversions, data translations, and model recreations.

With a single, integrated development environment like SolidWorks software, all file formats are fully compatible, and you can leverage data to support other engineering uses—such as ECAD/MCAD integration and various simulation requirements. To make your development process run smoothly, however, you need an integrated PDM system that can manage data, as well as more collaborative workflows. The SolidWorks Enterprise PDM system lets you tie it all together, enabling you to manage collaboration, control revisions, automate workflows, and coordinate the handling of ECOs. Moreover, you can use your use your valuable design data to drive business functions, such as quoting, purchasing, manufacturing, documentation, and quality control.

To really make your development process run smoothly, you need an integrated PDM system to manage both data and your more collaborative workflows.

Accelerate hi-tech design with integrated SolidWorks software

The development of successful hi-tech electronic products is more challenging than ever. As the industry matures, the pervasive reach of technology to nearly every corner of the globe creates an increasingly competitive market. Succeeding in this environment demands greater levels of efficiency, innovation, and collaboration. Manufacturers that can consistently develop more innovative, higher-quality products faster and more cost-effectively will win in the end.

To streamline, accelerate, and improve the performance of your development processes, you need access to an integrated development environment that can help you refine your processes and increase productivity. The SolidWorks software design system provides a complete suite of integrated tools that can help you address these critical challenges. SolidWorks software can help you save time and money as you create innovative, reliable, and quality products. From PCB development and housing design through the creations of cooling systems, you'll have the tools to validate thermal performance, dynamic behavior, and the environmental impacts of your products.

To learn more about how integrated SolidWorks software solutions can streamline high-tech and electronic product development, visit www.solidworks.com or call 1 800 693 9000 or +1 978 371 5011.

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