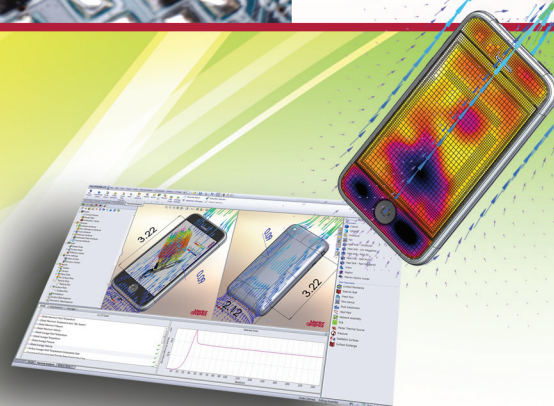
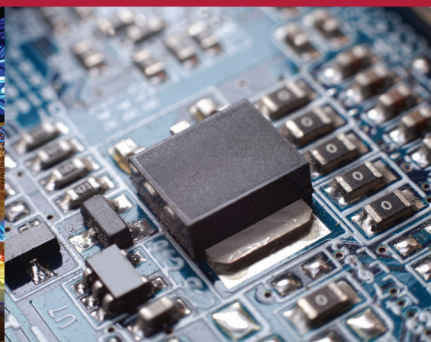
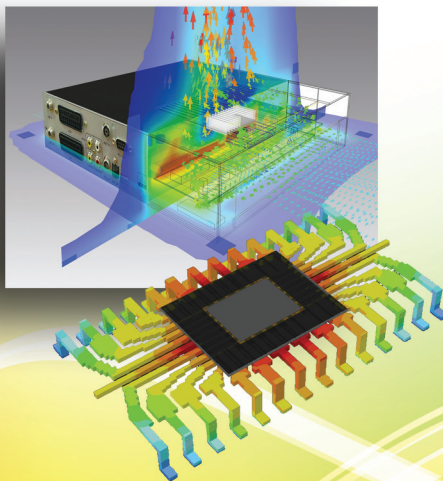


FlOThERm®

FlOThERm® XT | FlOThERm® PCB | FlOThERm® PACK | FlOThERm® IC



Mentor
Graphics®

M E C H A N I C A L A N A L Y S I S

www.mentor.com

One FloTHERM suite of solutions 'one size does not fit all'

The FloTHERM® family of products offers the most comprehensive solution for Electronics Cooling simulation. We have developed the suite considering the electronics cooling challenges our users face, it is not a one size fits all approach but a considered toolbox offering a solution tailored to give the best outcomes. With more users than all other competing analysis software combined, making it the clear market leader in thermal analysis software for the electronics industry, engineers skilled in FloTHERM technologies are in high demand and are at the cutting edge of Electronic Cooling simulation. The FloTHERM suite comprises FloTHERM, established over 25 years and the flagship tool for electronics cooling simulation. FloTHERM XT is a CAD enabled electronics cooling simulation tool built to be truly part of the product design process. FloTHERM PACK and FloTHERM IC are solutions for package-level model and metric creation whilst FloTHERM PCB excels at automating PCB-level thermal design.

The choice of electronics cooling software is not straightforward. Functionality is one important aspect of tool selection. However, product functionality alone does not necessarily translate into increased design productivity. It also depends on:

1. the background of the users (electrical engineers or mechanical engineers);
2. the extent to which they need to work with native MCAD data;
3. how central the MCAD system is to the company's overall design flow;
4. the CFD technology on which the thermal design tool is based. This in turn affects
5. how early in the product creation process electronics cooling software can be used effectively

Mentor Graphics provides the broadest portfolio of solutions for electronics cooling applications and we strongly advocate that you work with your Mentor Graphics' Account Manager who will be able to guide you in your choice of electronics cooling software.

FloTHERM is the market-leading electronics cooling simulation software with more installed seats than all other electronics cooling CFD software. For over 25 years FloTHERM has been used by a huge customer base, including almost all the major blue-chip electronics companies in the world. FloTHERM supports chip, package, board and system design, and even extends out to datacentres. It is designed as a vertically-specialised solution for the electronics thermal market through its innovative SmartPart technology, extensive libraries, tailored and stable solution technology, state-of-the-art compact thermal modelling techniques and parametric analysis & optimization functionality. FloTHERM features advanced interfacing technologies for working with EDA data from Mentor Graphics, Cadence and Zuken and is backed by a family of ancillary solutions for PCB (FloTHERM PCB) and package modelling (FloTHERM PACK and FloTHERM IC).

FloEFD™ is a general-purpose CFD code capable of analysing a wide variety of fluid flow and heat transfer phenomena across various industries and applications. It is unique in that it is available as an embedded solution for most popular MCAD systems, and thus fully integrates into mechanical design engineering workflows. For electronics applications, FloEFD's Electronics Cooling Module offers a subset of thermal simulation capabilities tailored for mechanical design engineers who encounter electronics cooling alongside other design challenges in product development and require some capabilities to reside inside their MCAD design environment for consistency and productivity reasons.

FloTHERM® XT, like FloTHERM, has been designed from the ground up as a full-scale, vertical solution with a customized GUI and focused functionality appropriate for electronics thermal applications. Building on FloTHERM's ethos and success, and FloEFD's meshing and solver technology, FloTHERM XT supports the SmartPart and Library functionality that first evolved in FloTHERM, but brings a CAD centric approach to thermal engineering through its best-in-class CAD connectivity and advanced CAD modelling capabilities. It also features advanced EDA interfacing technologies with best-in-class interoperability with Mentor's Xpedition Enterprise suite. FloTHERM XT offers seamless simulation capabilities for all stages of the mechanical design process (concept, architecture, detailed optimization, verification). It enables a true integration between EDA and MCAD design flows, through concurrent engineering simulation, and extends our reach in addressing the needs of a rapidly evolving electronics thermal sector.

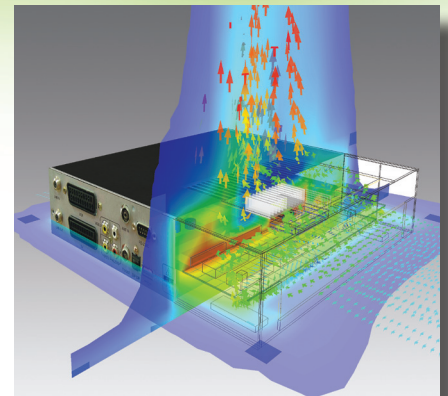
This brochure explains the technology, functionality, and productivity features of all the members of the FloTHERM product suite. Whether you are a new customer interested in purchasing your first electronics cooling software, or an existing customer at a company with a large suite of Mentor Graphics' electronics cooling solutions and looking to expand, this brochure will help you make the best choice to get the most value from your investment.

Optimizing the Thermal Design of Electronics

Small and large companies alike rely on FloTHERM to perform their thermal-fluid analysis confident of the return on their investment. FloTHERM is powerful 3D simulation software for thermal design of electronic components and systems. It enables engineers to create virtual models of electronic equipment, perform thermal analysis and test design modifications quickly and easily in the early stages of the design process well before any physical prototypes are built. FloTHERM uses advanced CFD (computational fluid dynamics) techniques to predict airflow, temperature and heat transfer in components, boards and complete systems.

Experience the benefits of using FloTHERM for electronic thermal design, that include:

- solving thermal problems before hardware is built;
- reducing design re-spins and product unit cost;
- improving reliability and overall engineering design; and
- significantly reducing time to market.



Parameterized models of common components found in electronics systems enables plug and play with library swapping as well as easy parametric variation.

KEY SMARTPART FEATURES:

- Complete set of SmartParts (intelligent model creation macros).
- Multi-level SmartParts (compact and detailed representations in a single object).
- Explorer-style Project Manager with drag-and-drop functionality.
- CAD-style, mouse-driven drawing board using simple draw, drag and drop operations to create and manipulate geometry.
- Structured Cartesian grid that can be "localized" and nested to minimize solve times and enable multi-scale modeling.
- Hundreds of objects and attributes available in an installed library including fans, blowers, components, heat sinks, materials, thermal interface materials and more.
- Object-associated grid that combines model creation and grid generation into a single step.

Model Creation

SmartParts®

FloTHERM features a comprehensive set of intelligent model creation macros (SmartParts) to allow a broad range of electronics cooling applications to be built quickly and accurately. SmartParts are available for:

- | | |
|---------------------------|------------------------------------|
| ■ Heatsinks | ■ Heat pipes |
| ■ Fans | ■ Perforated plates |
| ■ Printed circuit boards | ■ Dies |
| ■ Thermo-electric coolers | ■ Racks (Datacentre application) |
| ■ Enclosures | ■ Coolers (Datacentre application) |
| ■ Components | |

All SmartParts incorporate over two decades of electronics cooling modeling experience at Mentor Graphics' Mechanical Analysis Division, and are aimed at streamlining model creation, minimizing solution times, and maximizing results accuracy.

Integration with MCAD & EDA

FloTHERM also features advanced, tight integration with MCAD and EDA (Electronics Design Automation) software. Data from Creo Parametric, Solidworks, CATIA and other major MCAD tools can be imported, simplified and converted into FloTHERM objects. Interfaces to Board Station, Xpedition PCB, Allegro and CR5000 extract board outline and component information for import into FloTHERM.

FloMCAD™ Bridge

FloMCAD Bridge enables parts and assemblies from Mechanical Computer Aided Design (MCAD) software (such as Creo Parametric, SolidWorks, CATIA, etc.) to be transferred easily and rapidly to FloTHERM for thermal analysis.

FloMCAD Bridge is more than just an interface program - it intelligently filters the geometrical data for a particular part or assembly and creates a simplified "thermal equivalent" for analysis purposes. This is critical because production quality MCAD solid models contain a vast amount of thermally insignificant geometric detail (fillets, small holes, chamfers, screw threads, etc.) that provide no accuracy benefit if included but can drastically slow down the solution process. The ability of FloMCAD Bridge to defeature a part to match its thermal importance prior to translation into FloTHERM objects offers a massive improvement in the efficiency of the model creation work flow process.

"In half an hour or even less, we can construct a model that previously would have taken us two days to produce."
- Dr. Filip Christiaens, Alcatel

FloEDA™ Bridge

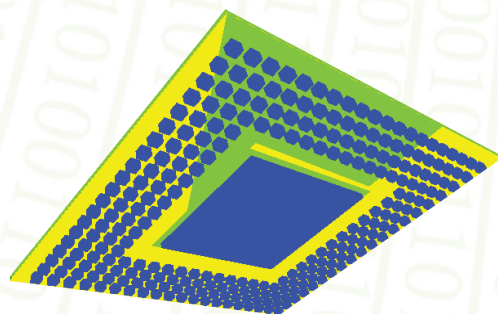
FloEDA Bridge enables both import of detailed PCB designs as well as the ability to quickly sketch out conceptual layouts.

Detailed PCB or BGA substrate designs can be imported in either the industry standard IDF format, or more detailed designs imported from our direct interfaces to the most common PCB design platforms. Full component layout, PCB stack-up and detailed descriptions of the metallic distribution on power, ground, signal and dielectric layers are loaded. A unique method for the capturing of the metallic distribution provides a user controlled ability to define the level of resolution of the thermal conductivity map. Block, 2R, DELPHI or 'Detailed' component modelling levels can be selected, including an automated ability to 'swap-in' higher fidelity models from an existing thermal model library.

Conceptual layouts can be quickly sketched out, stack-ups imported from a user defined library, then transferred to FloTHERM for preliminary thermal simulation investigations.

FloTHERM® PACK

FloTHERM PACK (www.flothermpack.com) is a web-based software program which produces reliable, accurate thermal models of IC packages and associated parts with the minimum of effort. Designed to fulfill the industry's need for a rapid response to innovations in packaging design, FloTHERM PACK is a web-based application that contains a parametrically-driven menu for each part type. To take advantage of FloTHERM PACK, you use your standard web browser to enter data describing the IC package you want to use. For example, if you want to build a model of a ball grid array (BGA) package, the typical data entry items would include: number of balls, substrate conductivity, die size, and substrate metal layer thickness and coverage.



Automation

FloXML

FloTHERM's geometry and model data can be created by external scripts and utilities, for subsequent import into FloTHERM. The FloXML file format can hold any data that could be manually created in FloTHERM itself. Including objects, attributes, mesh and solver control settings. For standardized applications that would require repeated manual definition in the FloTHERM GUI, such FloXML generating scripts can drastically reduce the effort required for generation of ready-to-solve models and modeling data.

FloSCRIPT

Actions performed in FloTHERM are logged to a FloSCRIPT file. This file can be re-played so as to repeat those actions in a FloTHERM session. This offers additional automation opportunities whereby changes to an existing model can be created by bespoke external scripts and utilities, further reducing what would otherwise be time consuming manual model interventions.

Meshing

FloTHERM mesh is structured Cartesian - the most stable and numerically efficient type of mesh available. The ability to localize is also included for finer resolution where it is needed, minimizing solution time.

Mesh in FloTHERM is associated with SmartParts and is generated as part of the model assembly process with refinement under user control. This methodology is intuitive and straightforward enabling engineers to focus on design rather than analysis.

Meshing is instantaneous and reliable in FloTHERM, as compared to traditional tools that require significant time and expertise to master. Finally, FloTHERM is the only analysis software with object-associated mesh that eliminates re-meshing for each model modification.

KEY SOLVER FEATURES:

- Concurrent solution for convective, conductive and radiative heat transfer.
- Solution termination optionally based on convergence of user defined monitor points.
- Multi-fluids capability.
- Ability to simulate either turbulent, laminar and transitional flow.
- Definition in transient variation in terms of linear ramping, power increase, exponential increase, sinusoidal, periodic or imported .csv pointwise variations.
- Fully automatic radiation exchange and view factor calculation.
- Automatic solar loading boundary conditions.
- Transient thermostatic control.
- Interfacing to FEA tools for thermo-mechanical simulation.

Solver

For over 25+ years, the FloTHERM solver has specifically addressed electronics cooling applications. The solver produces the most accurate results possible and the fastest solution time per grid cell. Massive disparities in geometric length scales are resolved using the unique 'localized-grid' technique which allows for integrally matched, nested, non-conformal grid interfaces between different parts of the solution domain. The conjugate nature of heat transfer within electronic systems is concurrently solved using a preconditioned conjugate residual solver together with a flexible cycle multi-grid solution technique. Pragmatic, unique and accurate solution termination criteria produce useful results in engineering, not academic, time scales.

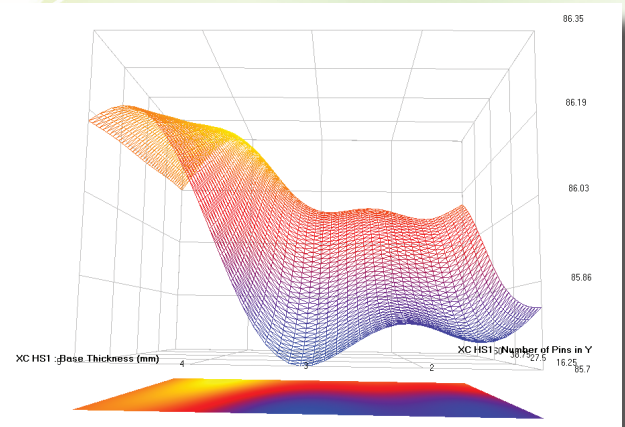
Transient Analysis

The powerful transient analysis capabilities in FloTHERM also allow for prediction of a number of different transient behaviors. Time dependent power dissipation in components can be defined via .csv import of power versus time data. An accurate prediction of the thermal response of the component temperature, in time, may then be produced without the conservative assumption of constant "steady state" power consumption.

Transient thermostatic control modeling can be performed via the ability to have a model input vary, not only as a function of time, but also optionally as a function of a monitored temperature during the transient solution. This allows for temperature controlled fans to be considered as well as determination of power derating and thermal mitigation strategies.

Post-Processing

The FloTHERM visualization toolset is developed specifically to maximize productivity for design of electronics cooling. Fully rendered models, 3D flow animation and tools for dynamic manipulation of temperature and flow results, enable engineers to pinpoint thermal issues and visualize design improvements quickly and effectively. Texture mapping and AVI output enables communication of thermal-design concepts with non-technical colleagues.



Pressure Drop vs Heat Sink Parameters

KEY VISUALIZATION FEATURES:

- Particle animation to visualize complex, 3D airflow.
- Contour animation to visualize heat transfer paths.
- Isosurfaces and surface temperatures.
- Airflow representation by vectors or ribbons colored by temperature or speed.
- AVI output of flow animation.
- Dynamic particle tracking allowing the user to gain a better understanding of complex flows.
- Image texturing for realistic visualization.

PARAMETRIC ANALYSIS AND OPTIMIZATION

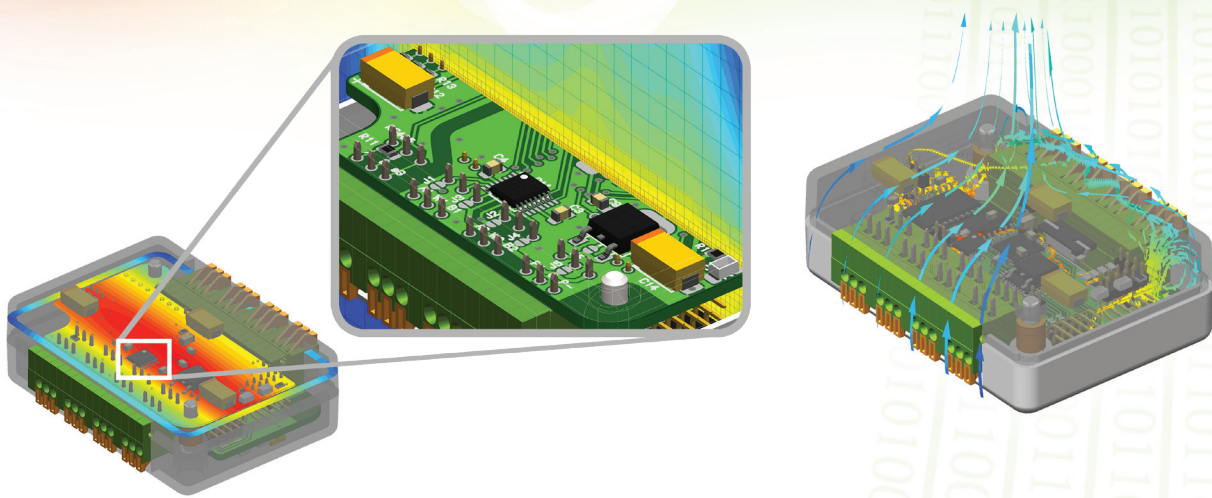
SmartPart-based modeling and structured Cartesian grid enable Design of Experiments technology to be applied to a FloTHERM model. Design of Experiments (DoE) is a structured method for determining the relationship between design parameters (e.g., number of heatsink fins, location of vents, etc.) and results (component temperatures, fan flow rate, etc.). FloTHERM's Design of Experiments implementation efficiently explores the design space by building and solving variants of the initial model. This provides critical information regarding the sensitivity of the thermal results to changes in the design parameters while minimizing the number of simulations to be solved and serves as the foundation of the powerful response surface and sequential optimization design tools. To assist with the solution of the Design of Experiment cases, the user may optionally use a distributed network of computers using 'Volunteer' solution technology.

FloTHERM extends this concept by computing response surfaces for all results of interest. Response surfaces are mathematical equations derived from the DoE results that estimate the thermal solution anywhere in the design space instantaneously. The user may interact with the constructed Response Surfaces with real-time 2D and 3D plots that have slider bars to control the design parameter values. Mathematical optimization of a user defined cost function is fully supported with the Response Surfaces as well, enabling the optimal solution to be estimated without solving additional cases.

Automatic sequential optimization of the cost function can be performed as well. This gradient based approach will build and solve additional variants of the initial model to explicitly determine and confirm what the optimal thermal solution is. Sequential optimization is able to understand design constraints (such as maximum component temperatures) and incorporate them into the presented optimal configuration.

FloTHERM® XT

FloTHERM® XT - Leading Innovation in Electronics Cooling



FloTHERM XT has been developed to facilitate electronics thermal design from concept to verification, with a consistent data model throughout and the seamless ability to import data from other mechanical design automation (MDA) or EDA sources as required in a particular design process. This design lifecycle support is inherent in FloTHERM XT's design and infrastructure: using SmartParts to build a simple concept model in minutes; work with complex mechanical parts directly from MCAD; create your own CAD geometry easily and efficiently; and use detailed electronic assemblies from EDA.

In designing FloTHERM XT we have recognized that one size does not fit all and the software has a configurable user interface that can be used readily by both full-time thermal experts and by engineers for whom thermal is just one of their responsibilities.

What is FloTHERM XT?

Developed to complement within the FloTHERM suite, FloTHERM XT utilizes the powerful EFD solver and mesher as an enabling technology to give the broadest possible coverage of both simple and complex electronics systems. It is also delivered with CircuitWorks, an elegant and powerful IDF, PADS and ProStep import add-on. The software also introduces a new generation FloEDA Bridge module with a direct interface to Xpedition Enterprise and IDF, including a powerful update function to keep models concurrent with the latest board design as it evolves.

FloTHERM XT works with non-Cartesian geometry, supporting non-standard form factors, novel heatsink designs and with arbitrary, non-aligned or curved geometry. The software comes enabled with full SmartPart support for electronics modelling, including:

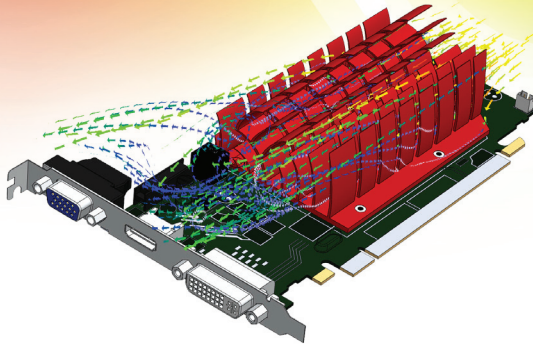
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|---------------------------|---------------------|
| ■ Heatsinks | ■ Enclosures |
| ■ Fans | ■ Components |
| ■ Printed circuit boards | ■ Heat pipes |
| ■ Thermo-electric coolers | ■ Perforated plates |

We also support the import of either detailed or compact package models generated from FloTHERM PACK or IC. In addition, using the CAD capabilities inherent in the software, any imported parts or SmartParts can be positioned at any arbitrary angle.

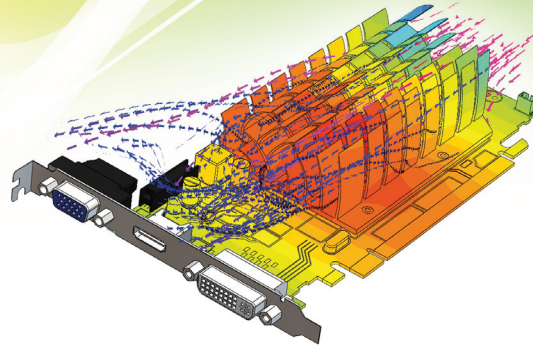
Who Can Use FloTHERM XT?

FloTHERM XT can be used by Thermal Design Specialists and Researchers, Thermal Designers, Mechanical Design Engineers and CAD users with thermal design responsibility. The user interface versatility has been specifically engineered to serve a diverse user group.

FloTHERM® XT



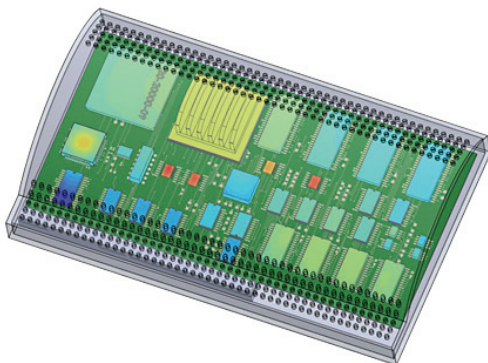
High-end graphics cards require novel cooling solutions – in this case, a heatsink with curved geometry has been designed to fit the enclosure.



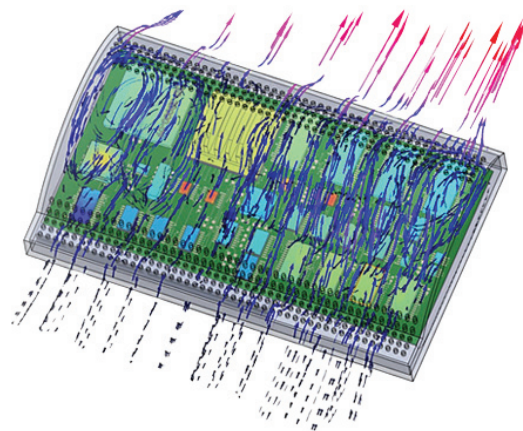
Surface temperatures and 3D particle plots can be used to assess the effectiveness of the new heatsink design.

KEY FEATURES:

- A CAD-centric solution supporting the electronics thermal sector, complementary to FloTHERM.
- Supports axis-aligned, angled and arbitrary geometry.
- An appropriate tool for design engineers familiar with MCAD environments, with a CAD-centric UI, geometry engine and controls.
- Supports FloTHERM style SmartPart and Library functionality.
- Supports the import of FloTHERM project and assembly data, as well as direct support for FloTHERM material libraries.
- Supports direct interfaces with all major MCAD vendors and supports all MCAD neutral file formats.
- The new FloEDA Bridge module supports Xpedition Enterprise directly as well as IDF (V2, V3) and includes an innovative update function to keep pace with evolving board layouts.
- Supports the import of IDF (V2, V3, V4), PADS and ProStep data via CircuitWorks.
- Can leverage package libraries – detailed, 2-R or DELPHI - from www.flothermpack.com.
- Automatic report generation via HTML, PDF and Microsoft (DOCX, XLSX).



The surface temperatures on the PCB will quickly identify those devices which are non-compliant with thermal specifications.



Further understanding of the cooling performance can be achieved by examining the 3D flow field using the animated particle post-processing feature.

FloTHERM® PCB

Optimizing Collaborative PCB Design by Simulation

Software for Collaborative Conceptual Design of Printed Circuit Boards

What is FloTHERM PCB?

FloTHERM PCB is a unique, software program for streamlining concept development of printed-circuit boards (PCBs), while ensuring good thermal design and accelerating the PCB design process. FloTHERM PCB facilitates collaboration between Product Marketing, Electronic Engineers and Mechanical Engineers on PCB design, particularly during the conceptual phase of the design process.

FloTHERM PCB serves as a common platform that Electrical Engineers and Mechanical Engineers can use to collaboratively create and thermally evaluate multiple proposed board layouts quickly and accurately, as it supports:

- Creation of board layouts and cooling solutions (heat sinks, thermal vias, copper fills) with provided SmartParts;
- Import of layout data from EDA layout tools in several formats: IDF, CSV, or via direct interfaces for Xpedition, Boardstation, Allegro, and CR5000;
- Creation of an orthotropic material map of the board based on copper distribution;
- Import power dissipations in CSV format;
- Property sheet description of typical thermal environments in which the board will reside. Forced Air, Still Air, Conduction Cooled, and Card Slots can be used, as well as directly importing a 3D set of thermal boundary conditions from a pre-solved FloTHERM analysis;
- Fast, robust, 3D predictions of temperature and air flow. No traditional CFD constructs (meshing, boundary conditions, solving settings) are required;
- Import of FloTHERM and FloTHERM Pack component models to facilitate PCB definition;
- Side-by-side views of thermal results for multiple layouts to easily compare benefits and drawbacks of various designs;
- Automatic, configurable report generation;
- Command line support for model construction, solving, and report generation allowing FloTHERM PCB to be embedded in your organizations workflow;
- Thermal model transfer to FloTHERM to easily transition from the conceptual design stage to considering more detailed thermal design tasks and thermal verification; and
- Layout transfer to MCAD and EDA design flows via IDF, CSV, or EDA layout tool specific placement files.

FloTHERM PCB is designed to be used by all those involved in the conceptual design of PCBs, including Product Marketing, Systems Architects, Hardware Designers, and Mechanical/Thermal Engineers.

Who can use FloTHERM PCB?

FloTHERM PCB is designed to be used by all those involved in the conceptual design of PCBs, including Product Marketing, Systems Architects, Hardware Designers, and Mechanical/Thermal Engineers.

Product Marketing

Interact with all members of the design team rapidly and effectively, viewing and commenting on design concept changes in real time.

Systems Architects

Stay up to date with the conceptual design process with FloTHERM PCB. Communicate instantly with Product Marketing, Hardware Design and Mechanical / Thermal Engineers through graphical outputs and automatically-generated reports. One mouse-click allows you to flip between physical layout and thermal performance views. If thermal questions arise, instantly transfer models to your colleagues for more in-depth analysis. Receive feedback more quickly and accurately than ever before as your colleagues work alongside you within the FloTHERM PCB design environment.

Mechanical/Thermal Engineers

With FloTHERM PCB, you have the software to provide critical feedback on thermal issues in time to influence conceptual board design and layout. Receive design updates from Electrical Engineering and Product Marketing in real time. When concept design is complete, you have design information in a format that allows you to instantly start your detailed mechanical design in your CAD software, and thermal design in FloTHERM.

Hardware Design Engineers

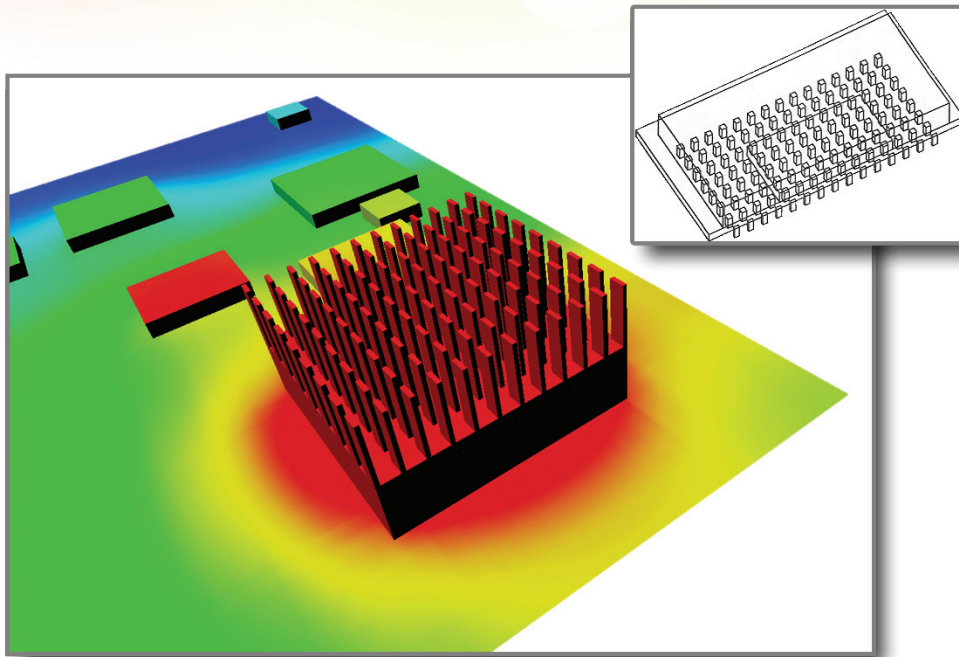
With FloTHERM PCB, you can influence concept development and find the right balance between concept and detailed design and manufacturing. At “concept commit”, you can export the final design information from FloTHERM® PCB directly into your mainstream EDA software.

How does FloTHERM PCB save my company money?

FloTHERM PCB saves your company money by addressing major inefficiencies in the board design process. On top of this, FloTHERM PCB minimizes the risk of board “re-spins” due to thermal problems. In a recent survey, 60% of Mechanical Engineers in electronics companies stated that thermal issues had forced board layout changes during the previous 12 months. Just one such re-spin costs many times the FloTHERM PCB license fee.

FloTHERM® PACK

FloTHERM® PACK Generates Optimized Thermal Models of Semi-conductor Packages... Fast



FloTHERM PACK (www.flothermpack.com) is a web-based software program which produces reliable, accurate thermal models of IC packages and associated parts with the minimum of effort. Designed to fulfill the industry's need for a rapid response to innovations in packaging design, FloTHERM PACK is a web-based application that contains a parametrically-driven menu for each part type. To take advantage of FloTHERM PACK, you use your standard web browser to enter data describing the IC package you want to use. For example, if you want to build a model of a ball grid array (BGA) package, the typical data entry items would include: number of balls, substrate conductivity, die size, and substrate metal layer thickness and coverage.

"FloTHERM PACK saved me about 7 hours of package model building time and another 2-3 hours of simulation time, compared to building the model manually."

- Mark Peterson, Applied Micro Circuits Corporation

If you don't have detailed information about the internal geometry of your part, the JEDEC Library SmartPart wizard in FloTHERM PACK lets you create "best guess" thermal models quickly and easily. All you need to do is answer three or four questions about your component. Utilizing built-in intelligent rules based on common industry design practices, the SmartPart wizard derives the rest of the information needed to generate the model.

FloTHERM PACK also enables you to preview models in 3D to verify that your input parameters are correct. After previewing, simply download the model to your local computer and drop it into your FloTHERM analysis model.

All of the capabilities in FloTHERM PACK mean an enormous productivity boost for you. Indeed you can cut your component modeling time by a factor of 20 or more! FloTHERM PACK does all the thinking required for model generation, freeing you to concentrate on optimizing your design. FloTHERM PACK supports just about all popular package styles in the industry including Ball Grid Arrays, Leaded packages, Pin Grid Arrays, Discrete Transistor Outline packages, Chip-Scale packages and Multi-Die packages.

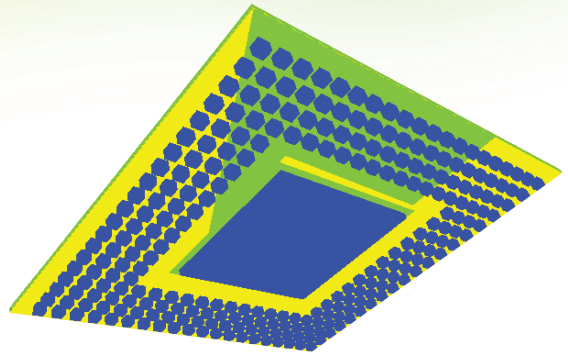
FloTHERM® PACK

Flexibility to Create Both Detailed and Compact Models

By default, FloTHERM PACK generates detailed models that include elements such as individual balls, individual thermal vias and metal layers in organic substrates. However, FloTHERM PACK also provides a variety of modeling options for each package, which allow you to simplify the detailed sub-models. For example, you may represent the effect of a ball grid array as an assembly of individual elements (more accurate but computationally expensive) or as a single block with lumped thermal properties.

Furthermore, FloTHERM PACK also allows you to generate compact models of your parts. Compact models are far more computationally efficient than detailed models, and are usually in the form of simple thermal resistance networks.

FloTHERM PACK supports 2-resistor compact models as well as boundary condition independent, DELPHI-style compact models.



A Product of 15 Years of R&D with Leading Component Makers

FloTHERM PACK is a direct outcome of Mentor Graphics, Mechanical Analysis' 25 years' experience working with the world's leading semi-conductor component manufacturers. Mentor Graphics has published more than 50 papers and technical articles in the area of modeling IC packages in CFD, and teaches the industry's only comprehensive training course in this field. Moreover, Mentor Graphics, Mechanical Analysis was the coordinating partner of the EU funded projects DELPHI and SEED, which laid the foundation for many of the modeling methodologies embedded within FloTHERM PACK. No other software company can claim as much depth of experience and knowledge in this area as Mentor Graphics.

"In half an hour or even less, we can construct a model that previously would have taken us two days to produce."

- Dr. Filip Christiaens, Alcatel

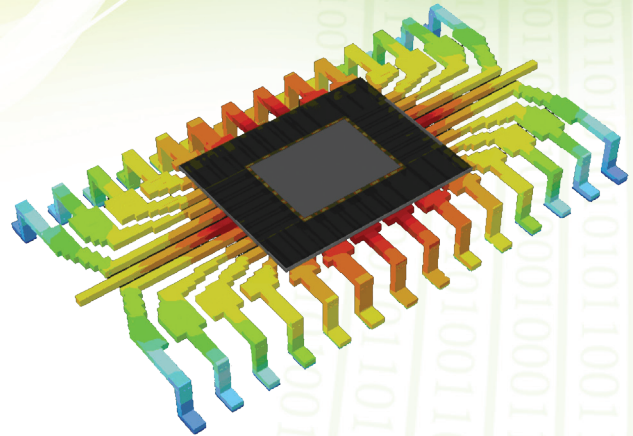
FloTHERM® IC

FloTHERM® IC

What is FloTHERM IC?

FloTHERM IC is a software product from Mentor Graphics that incorporates a high level of automation for key tasks related to Semi-conductor thermal characterization and design. An intuitive wizard-driven user interface, interoperability with package-level EDA tools, and enterprise-level data scalability and portability are the other key features of FloTHERM IC.

Built around FloTHERM® PACK, the well-established package Smartpart technology, and the industry leader FloTHERM's CFD solver technology, FloTHERM IC greatly boosts productivity of thermal analysis in the Semi-conductor industry.

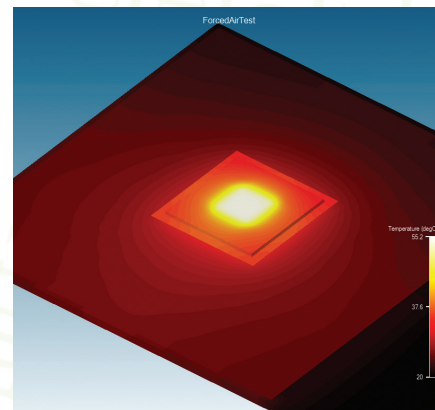
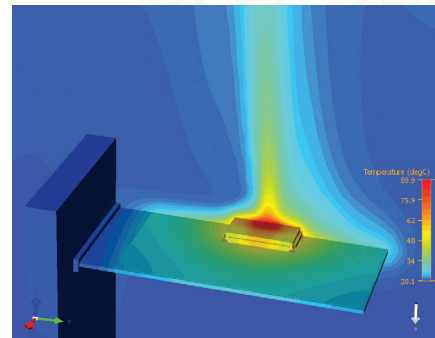


FloTHERM IC vs. FloTHERM PACK

FloTHERM IC builds upon the proven FloTHERM PACK technology of SmartParts but extends it much further. Here is a comparison of FloTHERM PACK and FloTHERM IC features:

Features	FloTHERM IC	FloTHERM PACK
Wizard-driven Interface	Y	Y
Model Preview	Y	Y
Detailed Models	Y	Y
Compact Models	Y	Y
JEDEC θ_{JA}/Ψ_{JA} Metrics	Y	-
CFD Solver	Y	-
Batch Characterization	Y	-
In-Built Design Parametrics	Y	-
Interface with Cadence APD	Y	-
Searchable Results Database	Y	-
Libraries for Package Elements	Y	-

Comparing FloTHERM IC with FloTHERM PACK



Who Can Use FloTHERM IC?

FloTHERM IC is designed to be used by all those involved in the thermal design and characterization of Semi-conductor packages.

How Does FloTHERM IC Save My Company Money?

Mentor Graphics' research reveals that a typical Semi-conductor thermal group spends approximately 60% of its time on standard package thermal characterization and design and the rest on customer specific simulations. FloTHERM IC drastically reduces the time spent on standard package thermal characterization and design, and saves around 25% of the time spent on customer-specific work. To see the savings for your group use the Return-on-Investment calculator opposite.

Beyond the financial benefits, FloTHERM IC also enhances the quality, reliability and availability of package thermal models by providing a fast, simple, proven, automated process, reducing the risk of modeling errors.

FloTHERM IC ROI Calculator	Typical Group	Your Group
Number of engineers in group (a)	3	
Personnel cost per engineer, excluding overheads (b)	\$125,000	
% time on std. characterization/design (c)	60	
% time on customer-specific work [100-c] (d)	40	
Saving on std. characterization/design [80%*a*b*c]	\$180,000	
Saving on customer-specific work [25%*a*b*d]	\$37,500	
Total Savings per year from FloTHERM IC	\$217,500	

FloTHERM IC – KEY FEATURES

Extensive package catalogue

- More than 40 package families supported: BGAs (wire-bonded and flip-chip), CSPs, QFN, MicroBGATM, MicroStar BGATM, QFPs, PLCCs, TSOPs, etc., TOs, DPAKs, D2PAKs, SOTs, etc. plus stacked-die.

Part definition imported from package-level EDA software

- Import entire substrate designs from Cadence APD. An intelligent wizard helps select the appropriate package family and populate the relevant data sheet, automating model creation.

Part definition driven by Smartpart wizard

- Used in the initial, conceptual stages of the design when physical layout data may not be available, generating a representative model from high-level inputs such as the JEDEC outline, pincount, and power.

Automated generation of JEDEC thermal metrics

- FloTHERM IC allows a wizard-driven automatic generation of the complete set of JEDEC thermal data metrics for a single package or multiple packages in batch on standard and user-defined test PCBs with FloTHERM IC's powerful CFD solver technology. Metrics supported include θ_{JA} , θ_{JMA} (at various flow rates), Ψ_{JT} , Ψ_{JB} , Ψ_{JP} , θ_{JB} , θ_{JC} .

Automated compact thermal model creation

- Two-resistor (2-R) and DELPHI compact thermal models for single or multiple packages.

Sensitivity analysis capability

- Investigate the influence of key package parameters such as die size, power, die attach conductivity, lead pitch etc. on any JEDEC metric or compact model in just a few mouse clicks.

Searchable results database

- Use the advanced Results Database to select the optimal starting point for a new package design from your previous solutions.

Libraries

- Package constituents such as die, die attach, die attach pad, substrate, leadframe, lid etc. can be stored as separate library items, increasing the speed of new package creation.

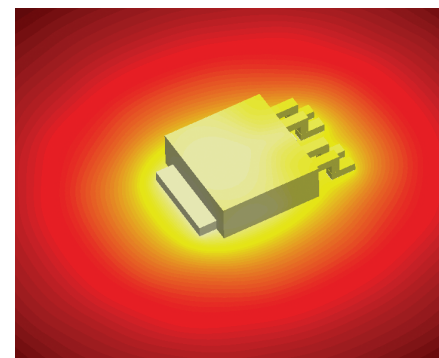
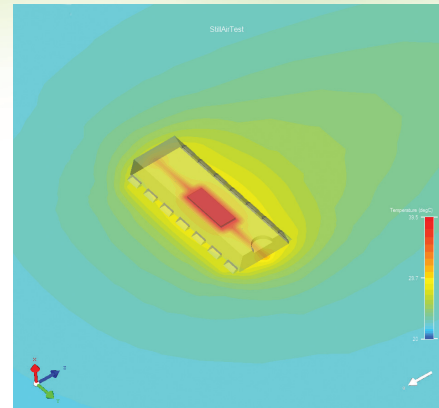
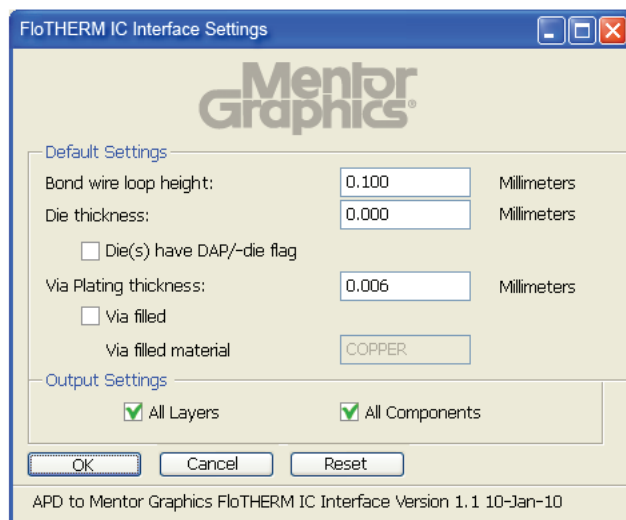
FloTHERM® IC

Results Visualization

FloTHERM IC allows the export of all metrics data as Excel-compatible CSV files. Detailed and Compact models can be exported into FloTHERM or FloTHERM® PCB. Vector plots, fill plots and animations of results can be generated using the Stand-Alone Visual Editor module included with a FloTHERM IC License.

Product Configuration

FloTHERM IC is currently available as a web-based product at www.flotherm-ic.com



References

1. 11 Top Tips for Energy-Efficient Data Center Design and Operation... A High-Level 'How To' Guide
2. 12 Key Considerations in Enclosure Thermal Design... A High-Level 'How To' Guide
3. 10 Tips for Streamlining PCB Thermal Design... A High-Level 'How To' Guide
4. 10 Tips for Predicting Component Temperatures... A High-Level 'How To' Guide



For the latest product information, call us or visit: www.mentor.com

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Corporate Headquarters

Mentor Graphics Corporation
8005 SW Boeckman Road
Wilsonville, OR 97070-7777
Phone: 503.685.7000
Fax: 503.685.1204

Visit www.mentor.com/company/office_locations/ for the list of Mechanical Analysis Division offices



Sales and Product Information

Phone: 800.547.3000
sales_info@mentor.com

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