

Thermal Design Solutions



INTRODUCTION

As functionality and complexity increases in today's electronic devices and systems, achieving performance within power budget constraints and maximizing efficiencies requires a thorough understanding of thermal characteristics and managing their impact.

Vishay's ThermaSim is a free on-line tool that designers can use to obtain detailed thermal simulations of Vishay Siliconix power MOSFETs, microBUCK® power ICs, and DrMOS products. Appropriate for any power design, ThermaSim will be especially useful in high power density, high ambient temperature applications such as automotive, fixed telecom, computer servers, desktop PCs, and laptop computers.

ThermaSim achieves simulation accuracy as a result of its extensive library of models, developed from finite element analysis techniques. In addition to specific Vishay Siliconix power MOSFETs, microBUCK® power ICs, and DrMOS products, ThermaSim allows users to define all heat dissipating components in an entire electronic system. The tool can then simulate the complete thermal interaction among these components and predict how they will affect the Vishay Siliconix products of interest.

RESOURCES

- ThermaSim Tool: <http://www.vishay.com/mosfets/thermasim/>
- More featured products: <http://www.vishay.com/landingpage/tradeshows/powermanagement/2011/mosfets.html>
- For technical questions contact:
 - MOSFETs: pmostechsupport@vishay.com
 - Power ICs: powerictechsupport@vishay.com



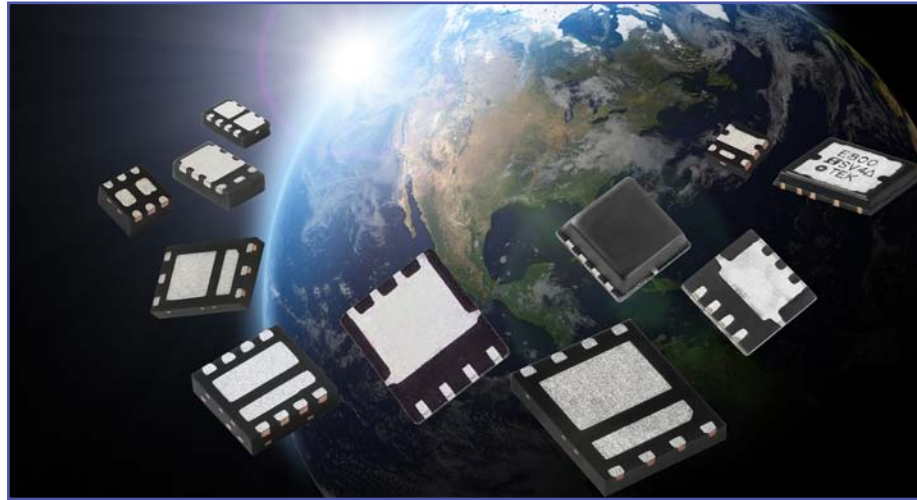


THERMASIM

Online Thermal Simulation



SILICONIX - On-Line Tool for Thermal Simulation



The Vishay Siliconix power product portfolio features devices in advanced thermal packaging, including the **PolarPAK**[®], **PowerPAK**[®] and **PowerPAIR**[®] families.

PolarPAK is the first power MOSFET package to combine double-sided cooling with an industry-standard leadframe and plastic encapsulation construction, ideal for increased power density applications with air flow.

The **PowerPAK** family of Vishay Siliconix power products has been well established in the industry for superior thermal performance. Offered in a diverse selection of package sizes from as large as 6 mm by 6 mm (PowerPAK MLF) to as small as 1.6 mm by 1.6 mm (PowerPAK SC75), the PowerPAK family of Vishay Siliconix power products provides an excellent choice for a wide range of applications and design criteria.

The **PowerPAIR** family represents an innovative package solution that combines optimized high-side and low-side power MOSFETs in a single package for outstanding performance in switching power supply applications.

ThermaSim supports these thermal package products as well as other Vishay Siliconix power products offered in conventional package options.



Increased simulation accuracy, efficiency, and user friendliness

Improved simulation accuracy:

- Component pads/footprints are separated from the component model
- Higher internal/external meshing resolution
- New features
 - Users can now define and evaluate impact of solder thickness (from 100 % to 150 % of the nominal thickness of 0.1 mm)
 - Users can now define the thermal glue thickness between the component and a heat sink
 - Component model accounts for the air gap between the component and PCB surface where applicable
 - Additional materials for PCBs, heat sinks, and the thermally conducting insulators

Improved simulation efficiency:

- Improved meshing methods
- Smaller pdf file sizes

Improved user friendliness:

- Features several completed examples that can be downloaded to user environment, modified, saved, and used
- Offers user tips
- Parametric range limits and prevents wrong inputs
- Allows selection of steady-state, transient, or RC network simulations
- Better selection/manipulation
 - Same component in different location on PCB
 - Select/Edit internal PCB layers from side-view picture
 - Select/Edit via zones from top-view picture
 - Select/Edit solder thickness
- Better documentation capabilities
 - An expandable summary tree of the entire simulation is provided just before running the simulation
 - The filename and defined commenting text field are feedback on the simulation results



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SILICONIX - On-Line Tool for Thermal Simulation

ThermaSim is available to registered users of Vishay.com and can be accessed from Vishay's website, on the MOSFET gateway: www.vishay.com/mosfets or the IC gateway: www.vishay.com/power-ics/

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PRODUCTS APPLICATIONS COMPANY INFO

Products » MOSFETs

High Performance 40 V - 100 V Power MOSFETs

Ultra-low on-resistance next generation technology

- V_{DS} = 10 V and 4.5 V on-resistance ratings, include industry best on-resistance and FOMs

High performance 40 /mosfets/mosfet · [Market Street](#) · [Signatures](#) · [New Featured Products](#)

MOSFETs

Vishay is the world's number-one manufacturer of low-power MOSFETs. The Vishay Siliconix power MOSFET product line includes devices in more than 30 package types, including the chip-scale MICRO FOOT® and thermally advanced PowerPAK® families. Configuration options include co-packaged and single die MOSFET plus Schottky diode combination devices, as well as asymmetric PowerPAK® devices that combine optimized high- and low-side MOSFETs for synchronous buck converters in a single package. Click here for information on more [featured product families](#).

<p>Drain to source voltage (V_{DS})</p> <ul style="list-style-type: none"> N-channel (723) 5 V to 20 V (122) 21 V to 30 V (162) 31 V to 80 V (140) 81 V to 280 V (164) 251 V to 400 V (26) 401 V to 500 V (45) 501 V to 650 V (41) 650 V and above (22) <p>P-channel (329)</p> <ul style="list-style-type: none"> 5 V to 20 V (152) 21 V to 30 V (80) 31 V to 80 V (61) 81 V and up (56) <p>On resistance (R_{DS(on)})</p> <ul style="list-style-type: none"> 10 mOhms and below (198) 10 mOhms to 100 mOhms (379) 100 mOhms and above (397) 	<p>Package</p> <ul style="list-style-type: none"> MICRO FOOT® (19) SC-89 (25) SD-75A (6) PowerPAK® SC-75 (17) SC-70 (49) PowerPAK® SC-70 (35) SOT-23 (34) TSOP-5 and TSOP-6 (26) 1206-S ChipFET® (23) PowerPAK ChipFET (14) PowerPAK® 1212-8 (71) TSOP-8 (21) SO-8 (120) PowerPAK® SO-8 (115) PowerPAK® 6 x 3.7 (5) New PowerPAK® 6 x 3.7 (6) SOT-223 (8) SO-14 and SO-16 (2) TO-92 (2) 	<p>Type and configuration</p> <ul style="list-style-type: none"> Single (818) Dual (128) N & P pair (38) SkyFET (18) MOSFET + Schottky Combo (23) MOSFET + driver (DiMOS) (8) <p>Special applications</p> <ul style="list-style-type: none"> 1.5 V rated on-resistance (24) 1.2 V rated on-resistance (13) <p>Latest technology</p> <ul style="list-style-type: none"> Medium Voltage (11) TrenchFET® Gen II (122) TrenchFET® Gen II TurboFET™ (8) TrenchFET® Gen II P-Channel (21) ThunderFET® (8) <p>Enhanced Process Flows</p> <ul style="list-style-type: none"> Automotive MOSFETs (141) 	<p>Technical Materials</p> <ul style="list-style-type: none"> Package Comparisons Reliability Information Technical papers <p>More Featured Products Families</p> <p>Click Here</p> <p>More Featured Products</p> <p>ThermaSim</p> <p>Click Here</p>
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Links to ThermaSim

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PRODUCTS APPLICATIONS COMPANY INFO

Products » Power ICs

2A, 1.2V, Slew-Rate-Controlled Load Switches

In compact SC70-5, TDFN4, and TDFN8 packages

- 1.1 V to 5.5 V operation voltage range
- Low Switch on-resistance at 1.2V input

SP32411, SP32413, SP32414 · [SP32411 DS](#) · [SP32413/14 DS](#)

POWER ICs

Vishay Siliconix power ICs include switching regulators, drivers, battery management ICs, and bus interface devices, as well as single-package microBUCK® buck converter and DiMOS solutions.

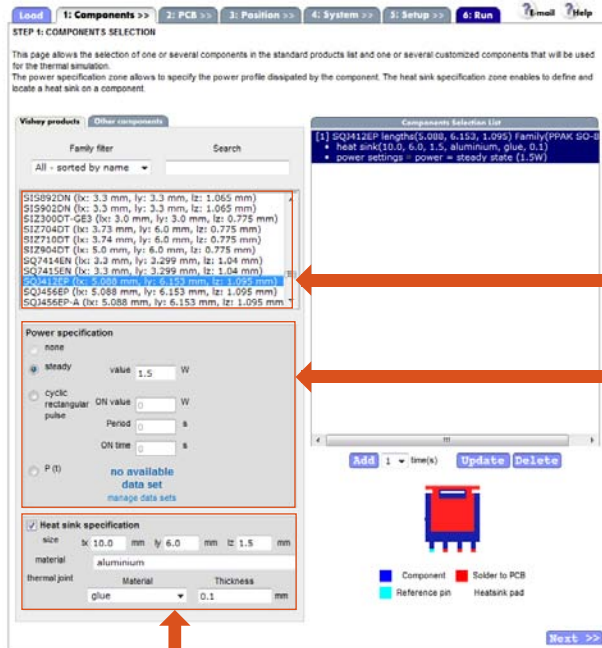
<p>DC DC Isolated Power Supplies</p> <ul style="list-style-type: none"> PWM Controllers (13) PWM Regulators (7) <p>DC DC Switching Regulators (Non-Isolated)</p> <p>Integrated Switch</p> <ul style="list-style-type: none"> microBUCK®-Integrated MOSFET (3) Step-Down Regulators (10) Step-Up Regulators (6) Buck-Boost Regulators (3) <p>External Switch</p> <ul style="list-style-type: none"> Step-Down Controllers (6) Step-Up Controllers (6) Multi Output Controllers (4) <p>Drivers</p> <p>Integrated Switch</p> <ul style="list-style-type: none"> Integrated MOSFET and Driver (8) <p>External Switch</p> <ul style="list-style-type: none"> MOSFET Drivers (3) Motor Drive (6) PowerIndustrial Drivers (2) 	<p>Power Distribution</p> <ul style="list-style-type: none"> Load Switch (9) Current Limiter (1) PC Card Interface Switches (3) <p>Battery Management</p> <ul style="list-style-type: none"> Battery Protection (1) Battery Charger (1) <p>Bus Interface</p> <ul style="list-style-type: none"> Transceivers (3) <p>Linear Regulators</p> <ul style="list-style-type: none"> Low drop out (LDOs) (1) 	<p>Application</p> <ul style="list-style-type: none"> Automotive (3) Wireless Communication (14) Fixed Communication (24) Computers (19) Industrial (13) Portable (9) LED Drivers (3) <p>Integrated Power Products</p> <ul style="list-style-type: none"> microBUCK® (3) DiMOS (4) 	<p>CONTACT US</p> <p>Sales, Technical Questions...</p> <p>BUY NOW</p> <p>Check Distributor Stock</p> <p>Enter Part Number</p> <p>Submit</p> <p>Latest Press Release</p> <p>Related Information</p> <p>ADDITIONAL RESOURCES</p> <p>Application Notes</p> <p>Demo Boards</p> <p>Quality Information</p> <p>Additional Resources</p> <p>ThermaSim</p> <p>Click Here</p>
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Online Thermal Simulation for Vishay Siliconix Power Products

Step 1: Select the Components

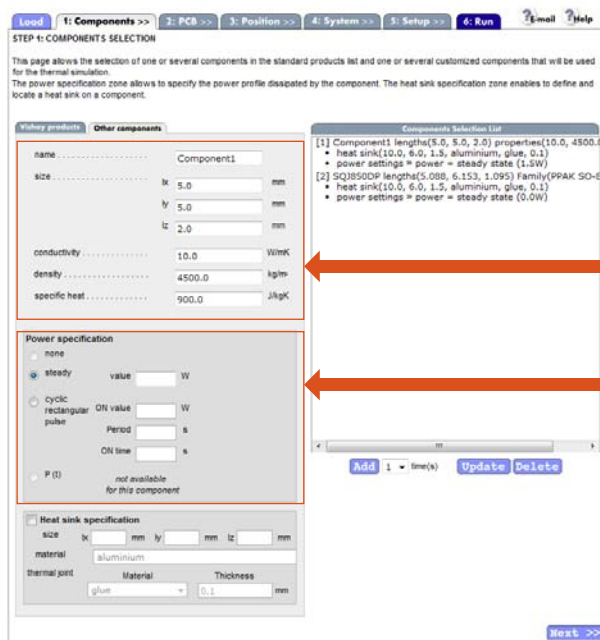
Select one or more devices for thermal simulation from a list of Vishay Siliconix power MOSFETs, microBUCK® or DrMOS products. You may define other heat-dissipating components that will be on the printed circuit board. The power specification zone allows you to input the power dissipation profile for these components.



Select MOSFET library model

Select power dissipation and profile

Design heat sink, material and attachment method

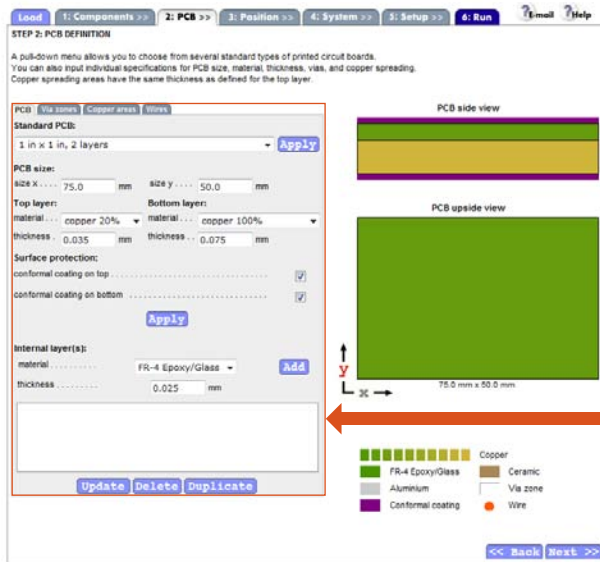


Design heat dissipating component

Select component power dissipation (steady state only)

Step 2: Construct the PCB

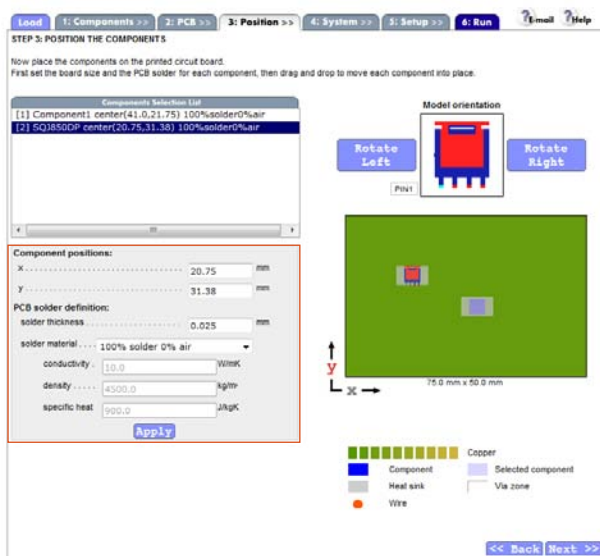
A pull-down menu allows you to choose from several standard types of printed circuit boards, or you can input individual specifications for PCB size, material, thickness, vias, and copper spreading. Set the pad size for each component.



Construct PCB size, layers, materials, thickness, vias and define PAD + copper area

Step 3: Position the Components

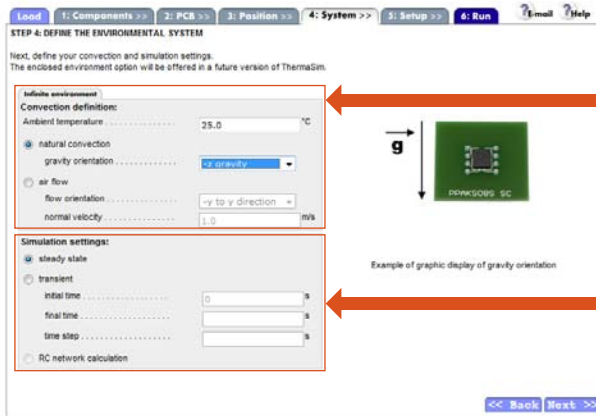
Now place the components on the printed circuit board. Specify or drag and drop to move each component into place. Specify solder thickness and quality.



Place component. Specify solder thickness and quality

Step 4: Define the Environmental System

Next, define your convection and simulation settings.

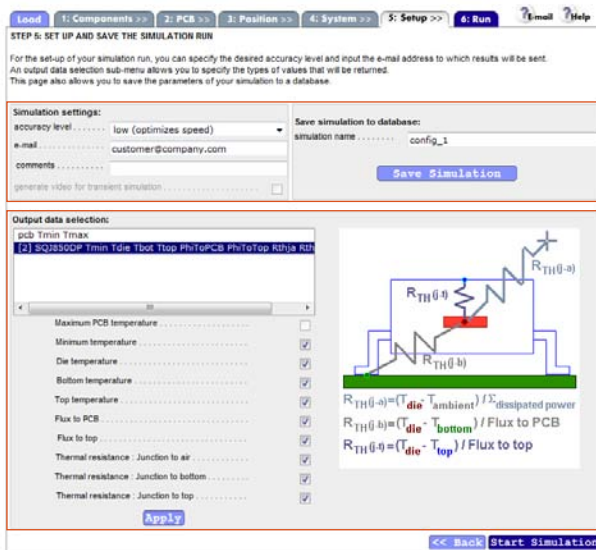


Identify system temperature and air flow

Choose simulation

Step 5: Setup and Save the Simulation Run

For the set-up of your simulation run, you can select between steady-state or transient runs, specify the desired accuracy level, and input the e-mail address to which results will be sent. This page allows you to save configurations into a database.



Set simulation accuracy (vs. speed), define email address, add comment to appear in results, and save design for future use

Set output data

Step 6: Review and Run



Review design data



Submit

Step 7: Get the Results

Thermal images and temperature data results will be e-mailed to you directly in PDF form.

Temperature Data Results

Global Output Results				
Min Temp	Max Temp	Flux Inside PCB	Min PCB Temp	Max PCB Temp
94.75°	139.95°	5.57 W	94.75°	138.21°

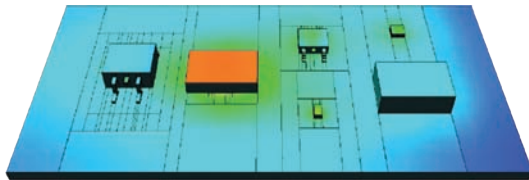
* Temperature (°C)

Powered by Rebeca3D

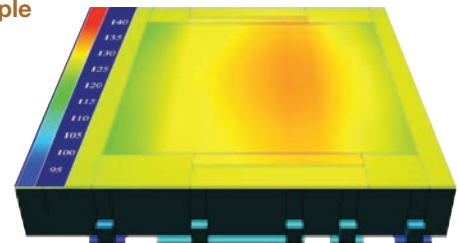
MOSFET Temperature Data (SiE800DF)					
Min Temp	Max Temp	Die Temp	Top Temp	Bot Temp	Flux to PCB
138.10°	145.79°	145.68°	145.72°	144.98°	2.44W

* Temperature (°C)

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Thermal Image Example



Step 8: Analyze the Results

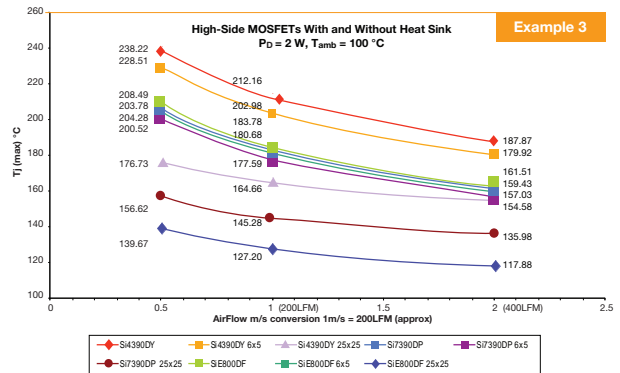
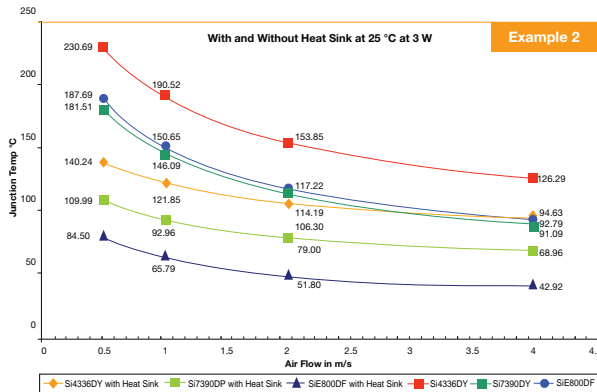
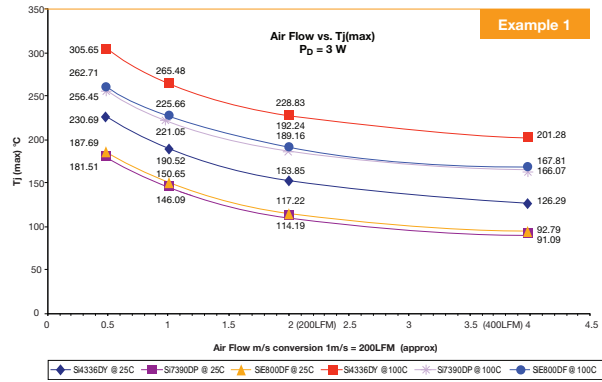
Download temperature data into Microsoft Excel®. You can run multiple simulations in which the product, package or other input data varies, then merge the results within Excel to compare and examine trends. We show three examples below, but the full range of possibilities is limited only by your imagination.

```

resu.txt - Notepad
File Edit Format Help

Minimum system temperature = 110.78°C
Maximum system temperature = 146.79°C
Tot flux PCB = 2.44W Tmin PCB = 110.78°C Tmax PCB = 145.00°C

Number of components = 1
SIE800DF Tmin = 138.10°C
SIE800DF Tmax = 146.79°C
SIE800DF Tdie = 146.68°C
SIE800DF Ttop = 145.72°C
SIE800DF Tbot = 144.98°C
SIE800DF PhitoPCB = 2.44W
    
```



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