Caliber Interconnect Solutions

Design for perfection

THERMAL ANALYSIS PROFILE

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Mission & Vision

Mission

"Provide dependable solutions to the satisfaction of the customers through intensive R&D and proven quality control procedures using disciplined workforce."

Vision

"Developing and applying technological solutions to the benefits of the society that will not affect the safety and living standards of our future generations."

Quality Policy

"CALIBER INTERCONNECT SOLUTIONS PRIVATE LIMITED is committed to meet and exceed customers expectations through timely delivery of cost effective quality designs through ever improving process and team work."

CONTENT

- Thermal Analysis & necessity
- Thermal Challenges
- Simulation Tools
- Analysis Inputs
- Analysis flow
- Deliverables

THERMAL ANALYSIS

- Excessive heat is the enemy of electronic parts, especially integrated circuits (ICs) in densely packed, power-hungry electronic devices.
- The art of thermal analysis involves using all available tools to support each other and validate their conclusions.

NEED FOR THERMAL ANALYSIS

- To ensure that all system component temperatures are maintained within the functional limits.
- To ensure the cooling on the printed circuit board is adequate under all possible load conditions.
- Performing precise thermal analysis is needed to increase component reliability and to ensure proper material selection.
- To reduce the possibility of the thermal failure and guarantee the electrical performance.

CHALLENGES…

- ✓ Avoid Thermal failures.
- ✓ To increase the Reliability.
- ✓ Decrease the Stress and fatigue of the component
- ✓ Increasing the electrical performance
- ✓ Avoiding Irreversible changes in the component operating characteristics.

SIMULATION TOOLS…

- ✓ Hyperlynx thermal
- ✓ Ansys
- ✓ Sigrity-power DC
- ✓ Pak-Si-TM
- ✓ Algor

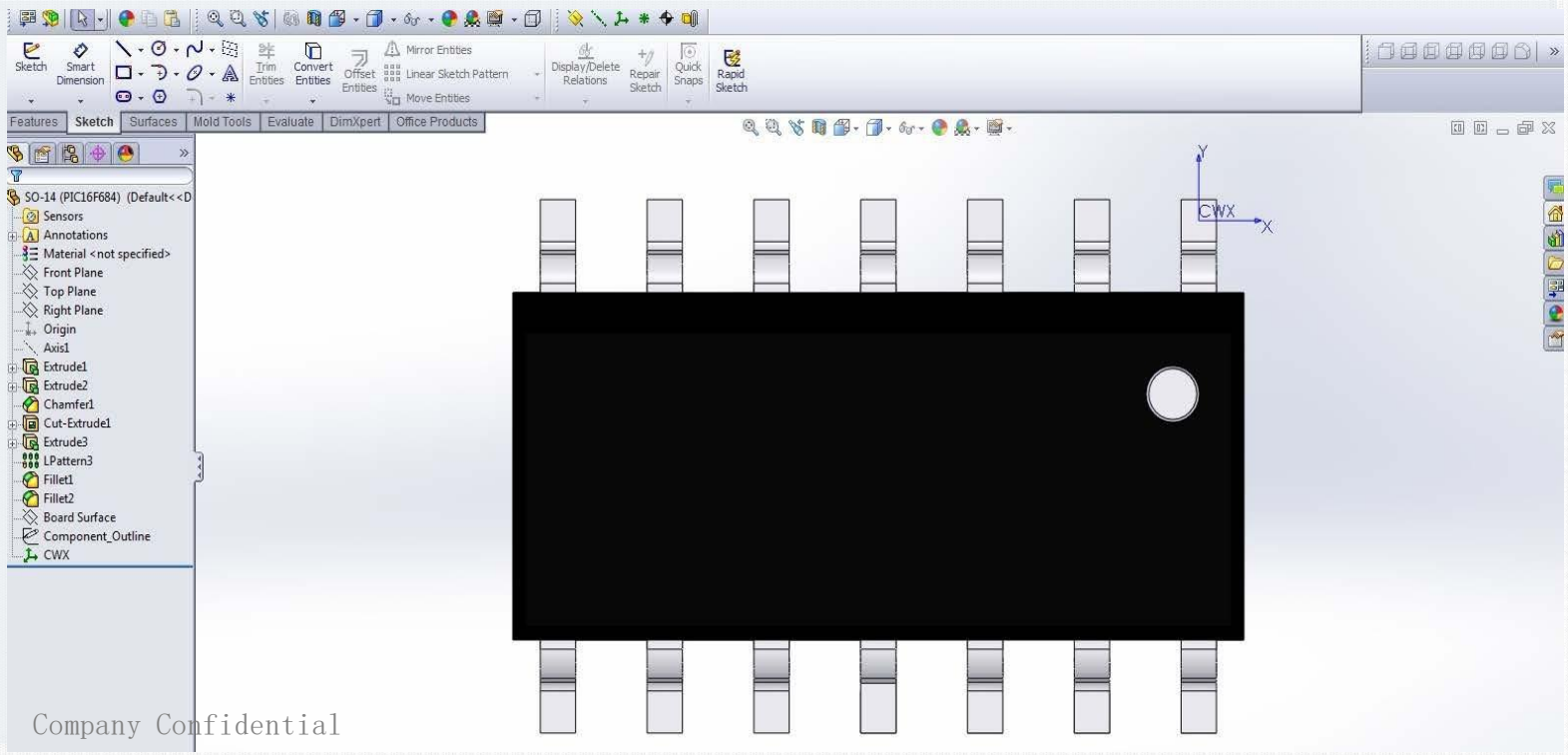
REQUIRED INPUTS

- ✓ Local ambient temperature at the component
- ✓ Airflow over the component and surrounding board
- ✓ Physical constraints at, above, and surrounding the component that may limit the size of a thermal enhancement
- ✓ Packaging materials (effective thermal conductivity)
- ✓ Presence of a thermal cooling solution
- ✓ Thermal conductivity
- ✓ Power density of the substrate/package, nearby components and circuit board to which it is attached.

ANALYSIS FLOW

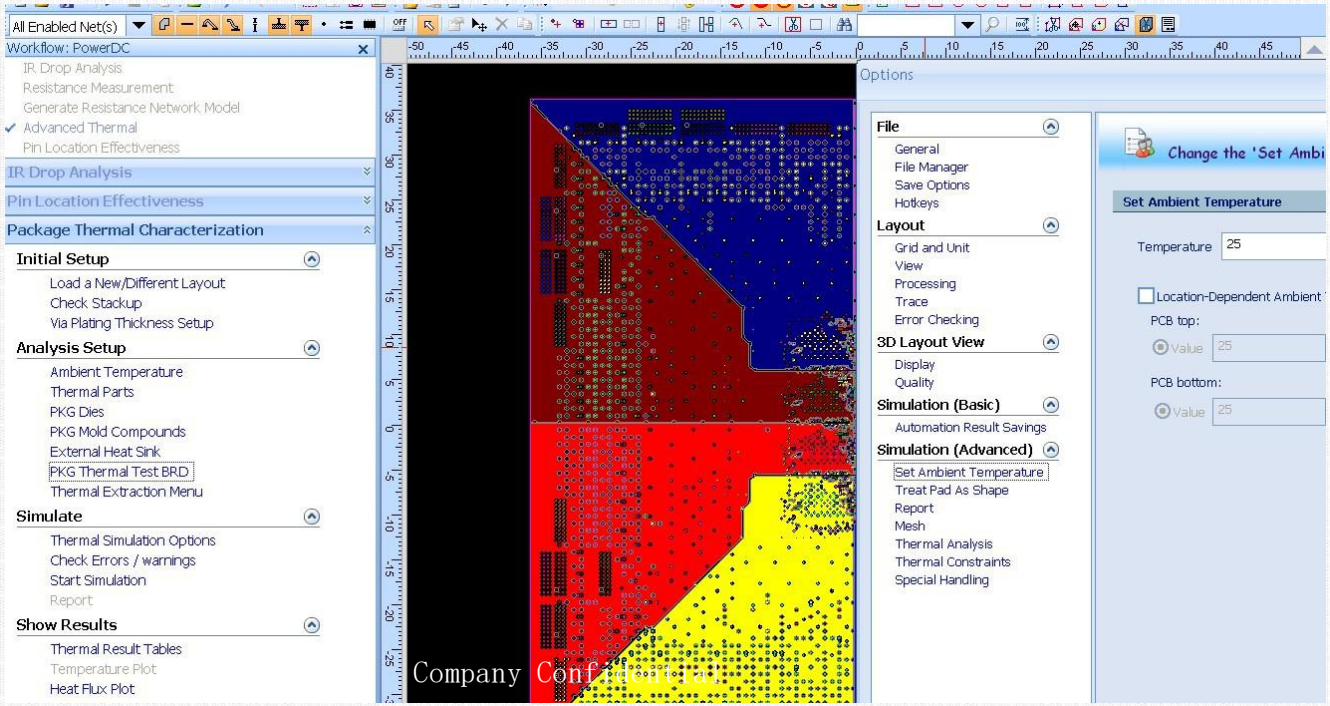
- Modeling component models if no CAD geometry available
- Importing layout with Geometry
- Model manipulation
- Constant and time varying temperature loads
- Meshing and Simulation
- Results generation

MODELING OF COMPONENTS



Modelling of a sample IC for checking thermal simulation

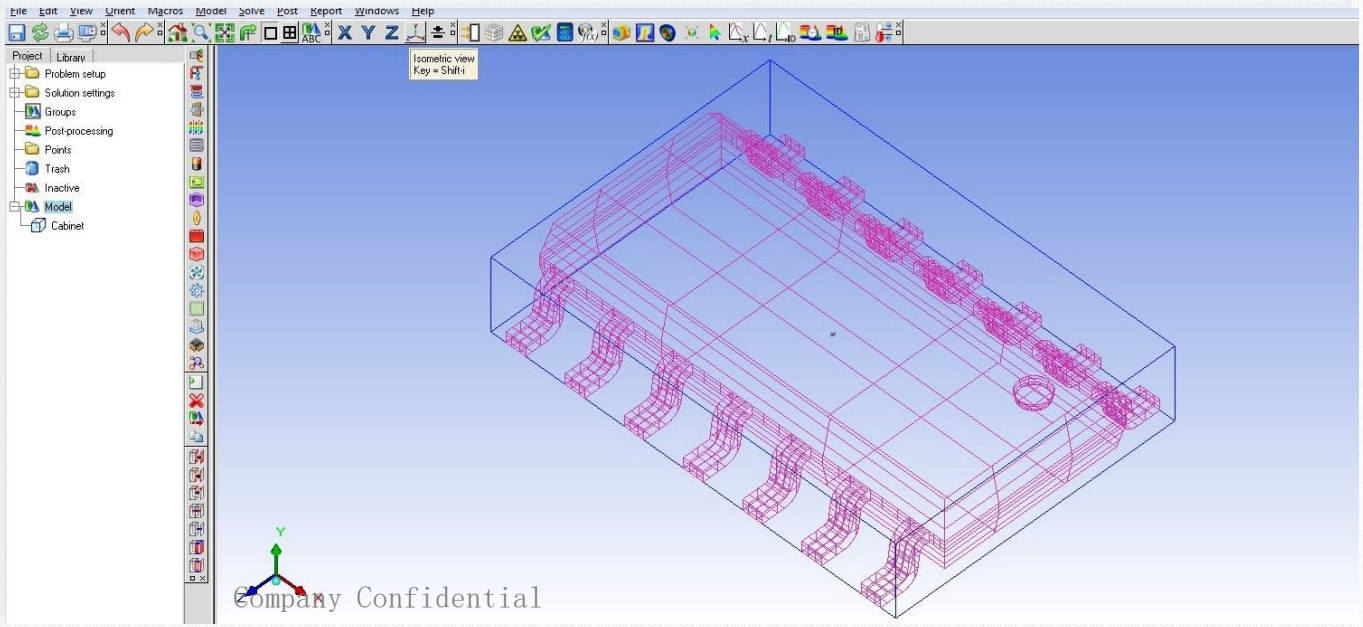
LAYOUT IMPORT AND SIMULATION SET UP



A sample substrate imported in Sigrity power DC to simulate the thermal analysis for IC packages.

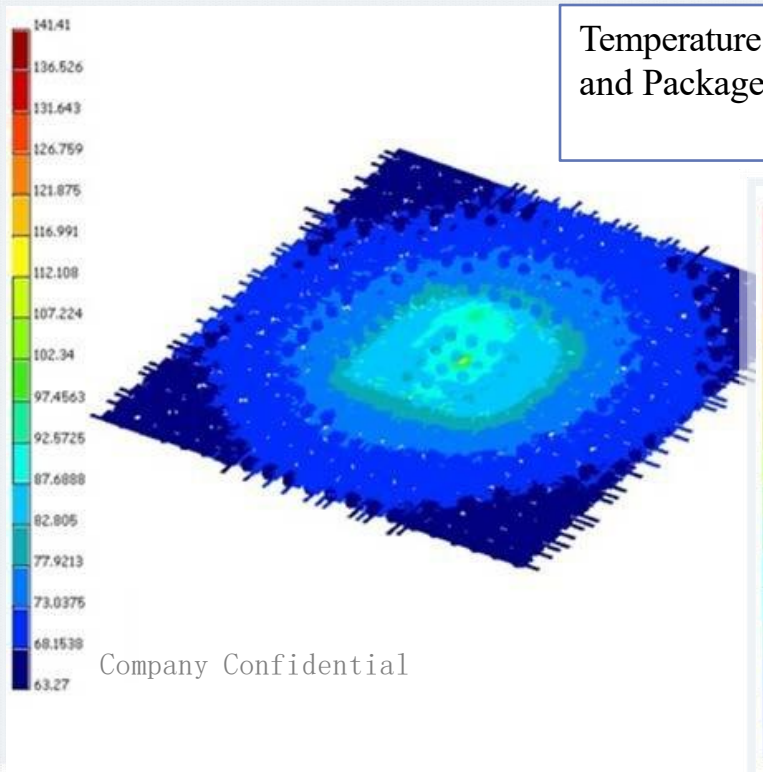
COMPONENT SIMULATION

- Ansys Icepak is used to simulate the thermal analysis for IC packages to obtain the temperature distribution, thermal gradients of the packages.

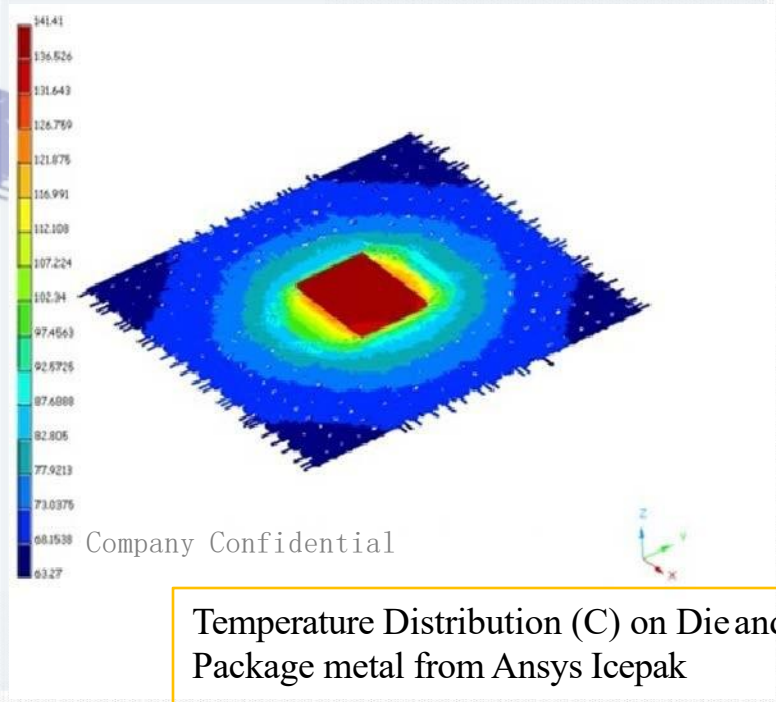


Asnapshot for component simulation set up in Ansys

TEMPERATURE DISTRIBUTION (SAMPLE PKG)



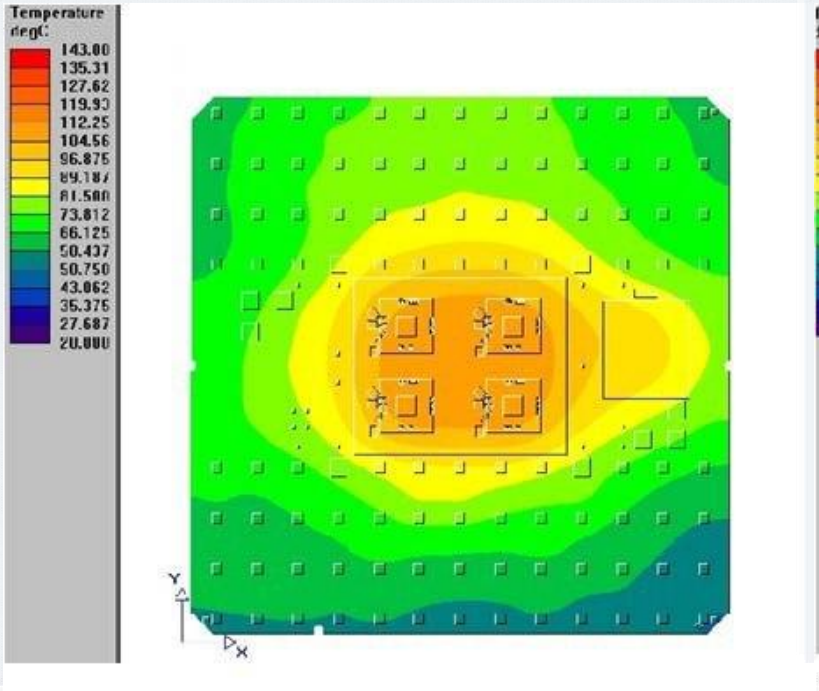
Temperature Distribution (C) on Solder and Package metal from Ansys Icepak



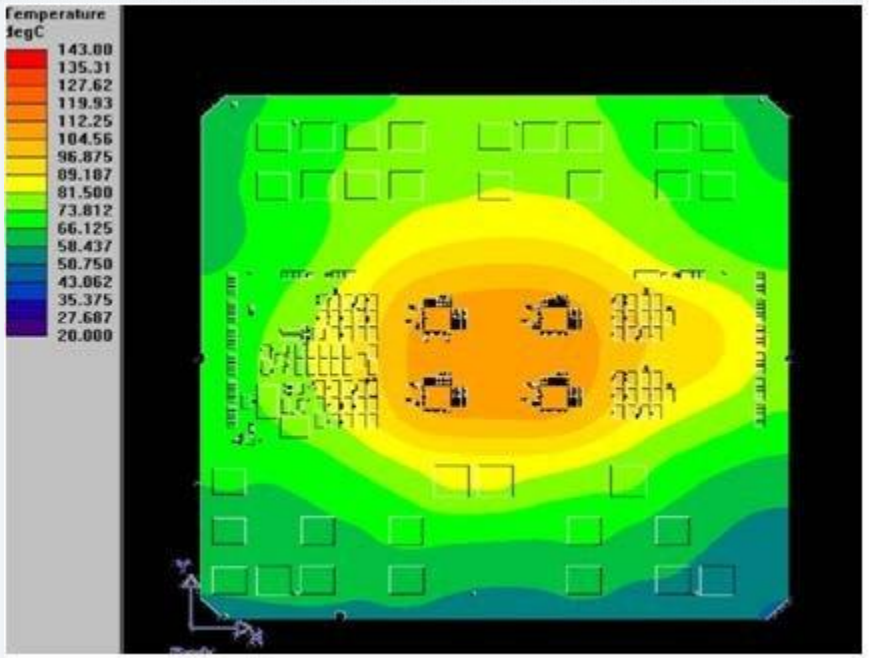
Temperature Distribution (C) on Die and Package metal from Ansys Icepak

TEMPERATURE DISTRIBUTION (SAMPLE BRD)

- ✓ PCB thermal analysis can be done by using hyper lynx thermal simulation tool.
- ✓ Hyper lynx tool allows to simulate the thermal analysis of pcb and other semiconductor devices.



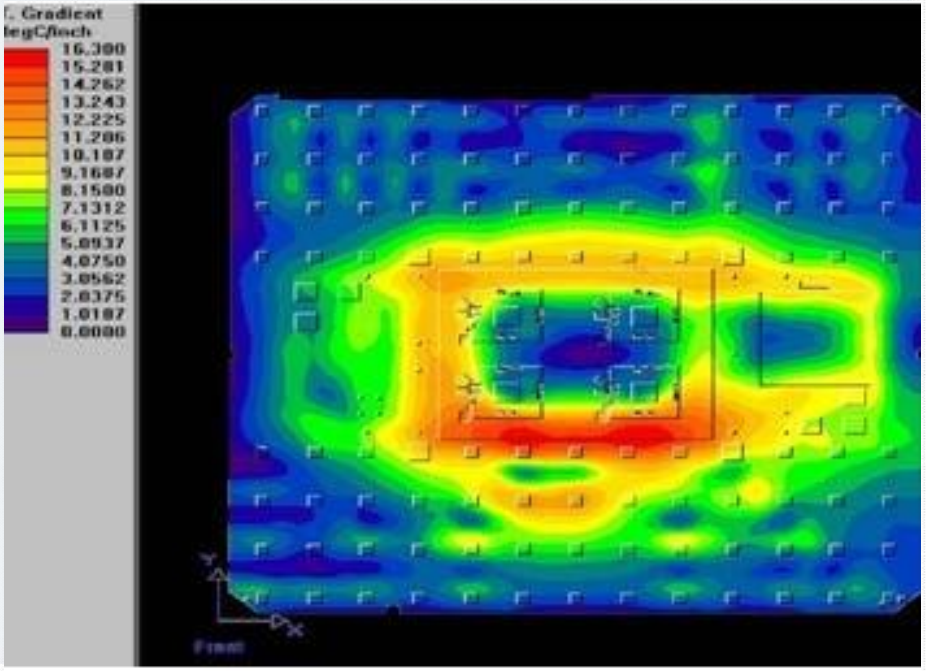
Temperature Distribution of a sample board front side from Hyperlynx



Temperature Distribution of a sample board back side from Hyperlynx

TEMPERATURE GRADIENT (SAMPLE BRD)

- Thermal Analysis calculates temperature Distributions and related Thermal quantities in the system or component as:
  1) Temperature distributions
  2) Amount Of heat lost or gained
  3) Thermal gradients

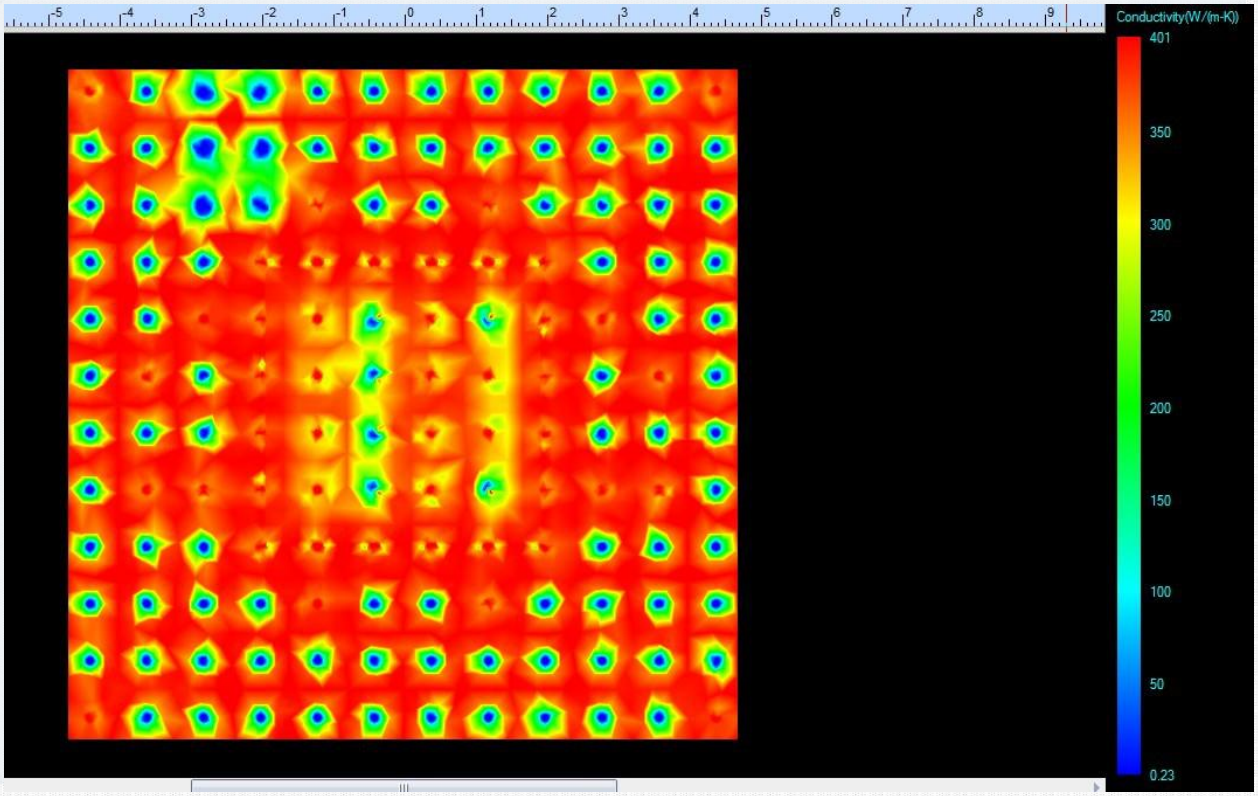


Temperature Gradient for a sample PCB board from Hyperlynx

CONDUCTIVITY PLOT

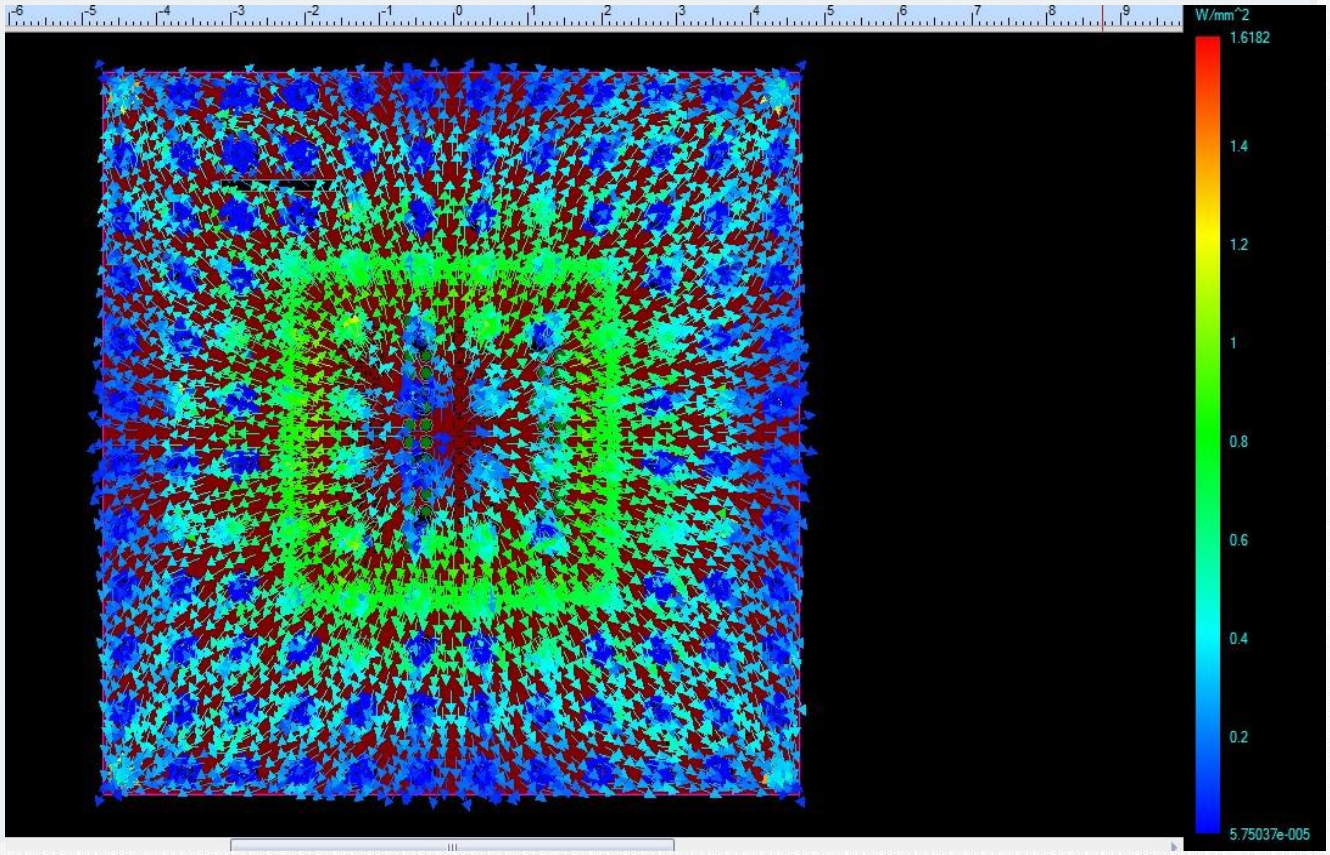
✓Conductivity Plot gives the current conductivity characteristic in the layout.

✓Conductivity Plot for a sample layout

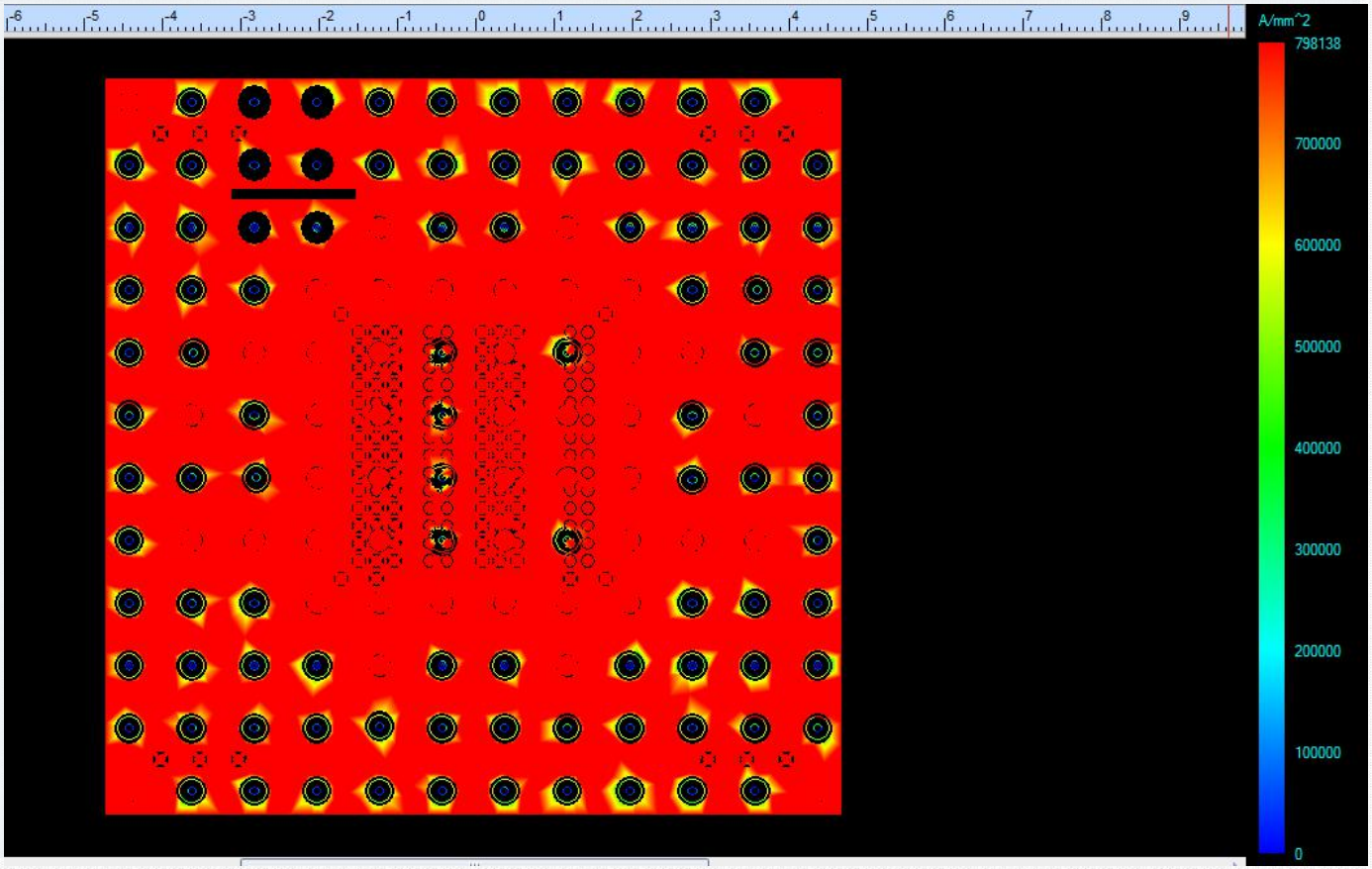


HEAT FLUX PLOT

- ✓Heat Flux plot can give the heat transfer characteristic in the given layout.
- ✓Heat Flux Plot for a sample layout



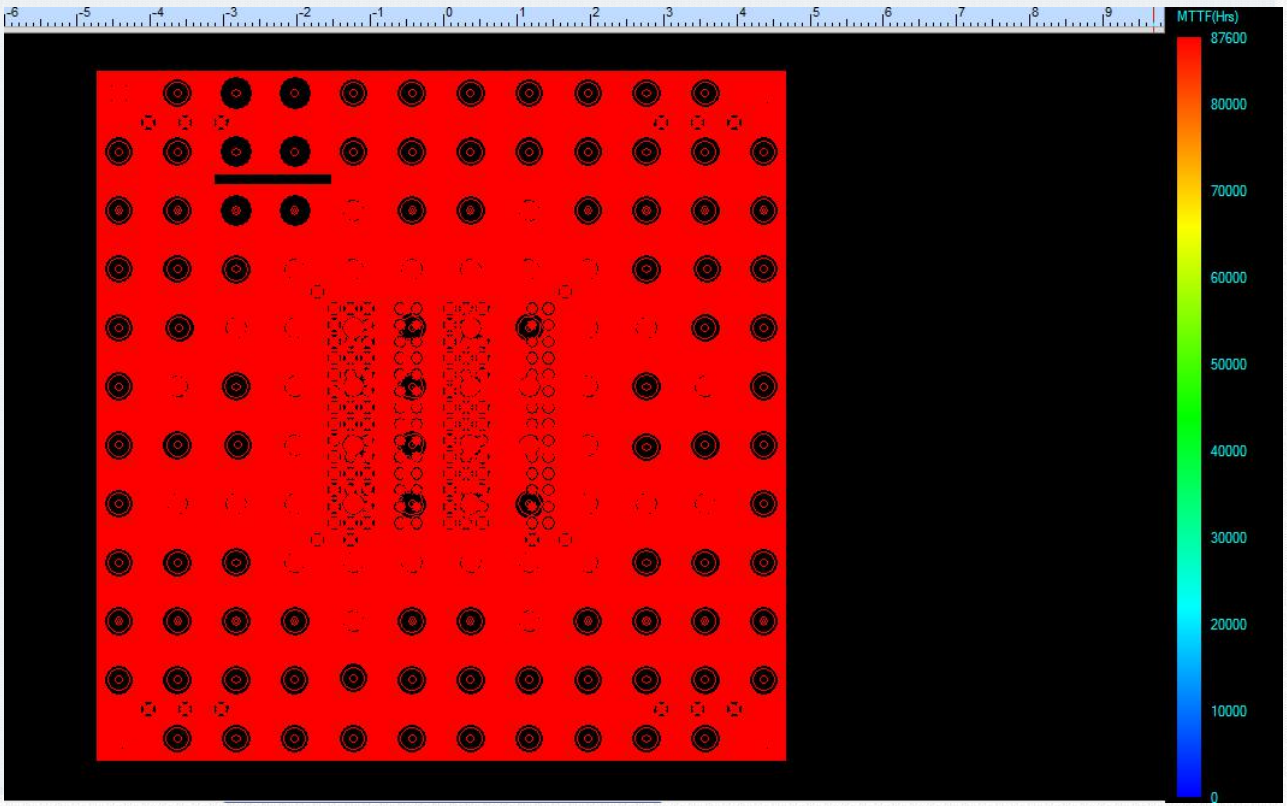
FUSION CURRENT DENSITY PLOT



Fusion Current density Plot for a sample layout

MEAN TIME TO FAILURE (MTTF) PLOT

✓MTTF of a system is the expected time a system will operate before the first failure occurs due to Electron migration.



MTTF Plot for a sample layout

THERMAL ANALYSIS RESULTS

Thermal Analysis Result Summary Table (sample layout):

Power (W)	Air Speed	Theta-JA (C/W) based on total power	Heat Dissipated from PWB (W)	Heat Dissipated from Package Top (W)	Heat Dissipated from Sides and Other Surfaces (W)
1.5	1	24.38	1.155	0.195	0.150
1.0	1	24.47	0.770	0.130	0.100

Thermal Resistance:

Theta ja = (Tj - Ta) / Power where, Tj = Junction temperature & Ta = Ambient temperature.

Psi-JT = 13.0 (Thermal parameter Junction to Top)

DELIVERABLES

- The temperature distributions plots
- The amount of heat lost or gained plots
- Thermal gradient plots
- Thermal fluxes plots
- Thermal Conductivity plots
- Fusion Current density
- Mean Time To Failure (MTTF)

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Thank You

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