UTAC THERMAL ANALYSIS SERVICES

1. UTAC Thermal Analysis Overview

UTAC RnD has been established for more than 10 years and has developed strong thermal analysis expertise, broad range of thermal simulation capabilities, measurement facilities and amassed over 400 thermal analysis reports. A simplified thermal analysis flow chart is illustrated in Fig.1, where thermal services are available for a wide array of packages ranging from memory, power application, analog, mixed signal, wireless communication packages etc.

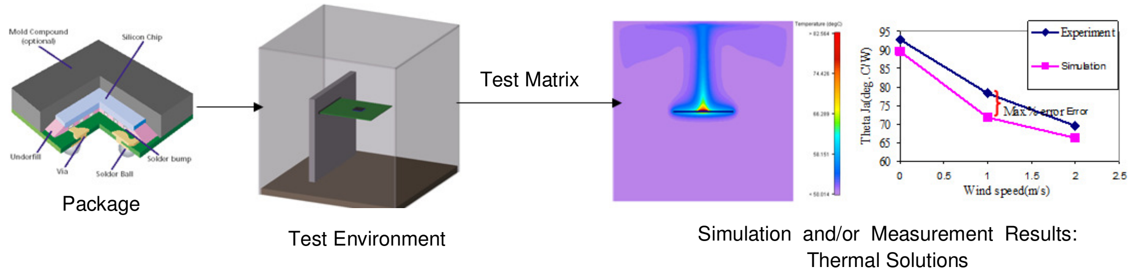


Fig.1: Simplified Thermal Analysis Flow Chart

2. UTAC Thermal Simulation and Measurement Tools and Services

UTAC has a comprehensive suite of advanced analysis tools to offer a wide variety of analysis services specially designed to meet our customers' needs, as summarized in Fig.2 and Fig.3. UTAC team is dedicated to deliver timely and quality solutions to best meet customers' increasing challenging packaging needs.

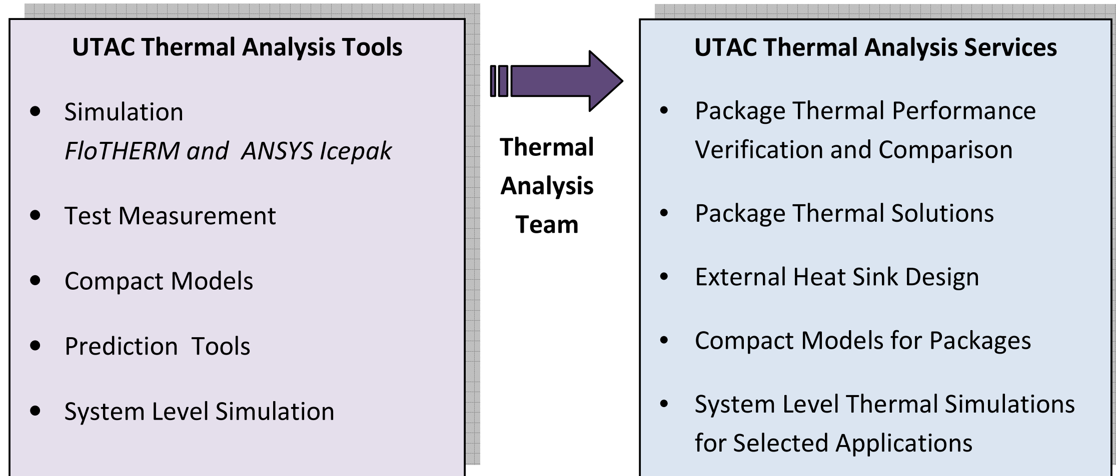


Fig.2: Thermal Analysis Services Summary

Software
FloTHERM PACK
FloTHERM,
ANSYS DesignModeler
Workbench,
ANSYS Icepak

Thermal Measurement Lab (Hardware)		
Test Environments	**Standard**	**Thermal Parameter**
Still Air JEDEC Enclosure	JESD 51-2A	Theta JA, Psi JT and Psi JB
Wind Tunnel for Forced Air Convection	JESD 51-6	Theta JMA, Psi JT and Psi JB
Ring Cold Plate	JESD 51-8	Theta JB
Top Cold Plate	NA	Theta JC

Fig.3: Thermal Analysis Software and Thermal Measurement Lab

2.1 Simulation: 3D Computational Fluid Dynamics (CFD)

UTAC thermal models created using 3D CFD software have consistently shown at least 90% accuracy compared against measurement data, as demonstrated on international conferences/ journals.

UTAC obtained both FloTHERM and ANSYS Icepak CFD software to continually develop advanced thermal simulation capabilities using/combining both software strengths. UTAC provides several modes of thermal simulation services:

2.1.1 Detailed Modeling

- Detailed models include details such as dies, traces, vias, solder balls, etc. Detailed 3D CFD models can more closely predict package performance especially in customized environments.
- Model optimization techniques as shown in Fig. 4 enhances accuracy, reduce simulation cycle time and expands the scope of services offered to customers

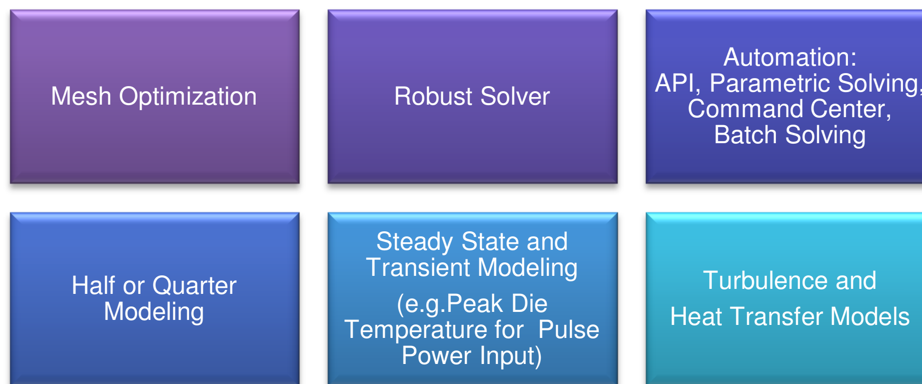
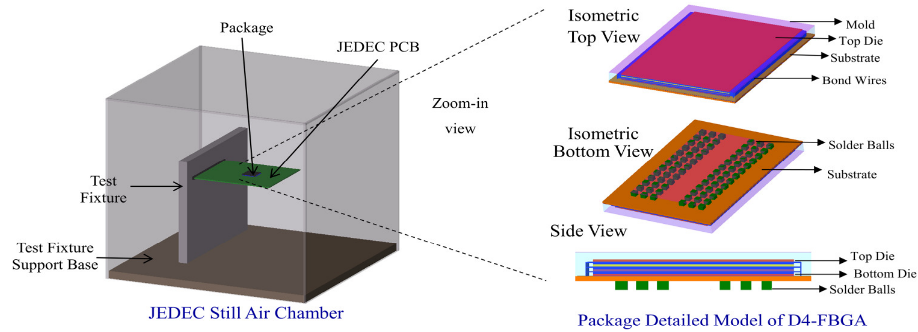


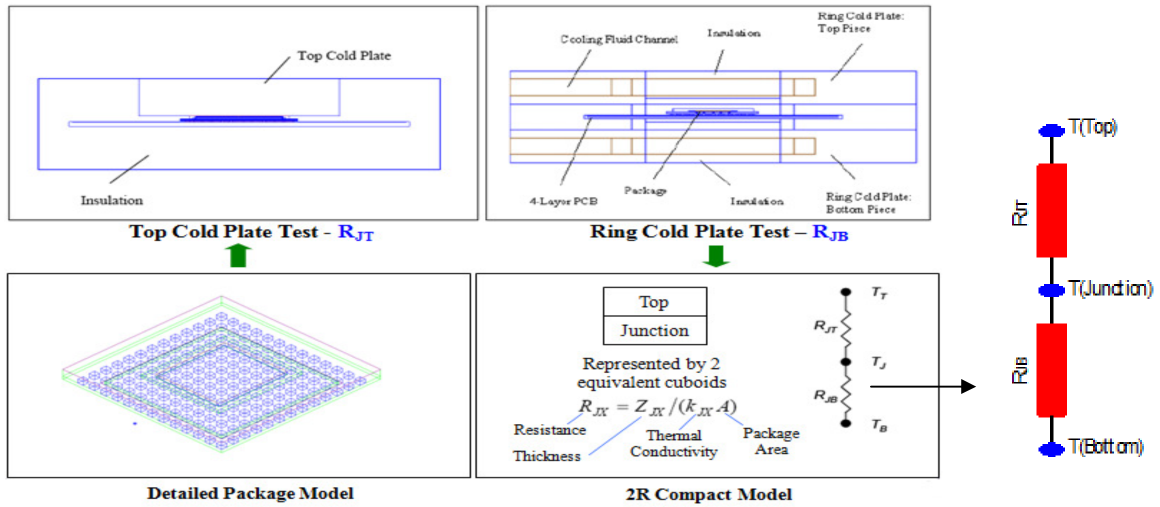
Fig.4: Thermal Modeling Optimization



Sample Detailed Model of Stacked Die Package in JEDEC Still Air Environment

2.1.2 Compact Modeling

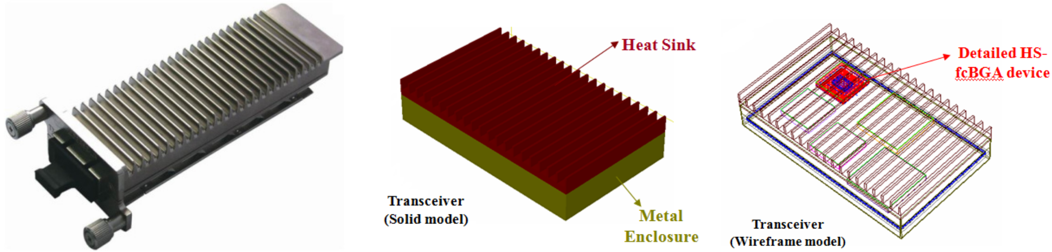
- UTAC provides 2R compact models that aims to accurately predict the temperature of the package at only a few critical points e.g. junction and case.
- Compact models simplify complex features in electronic packages with the aim to minimize computational requirements and conceal details for propriety reasons.
- It can be plugged onto a board or system to reduce the complexity of the model.



Sample 2R Compact Model Provision

2.1.3 Customized Thermal Simulations and Solutions

- UTAC provides thermal simulations and modelling for customized environments; including actual test boards, system environmental conditions and thermal interaction from neighboring devices.



Actual Transceiver   Transceiver Model and Simulation

Sample Customized System Simulation

- This may include laminate or leadframe design optimization, material property evaluation and board layout analyses.

2.1.4 Quick Thermal Calculators

UTAC sales and technical teams are equipped with quick thermal calculators for various packages. The thermal calculators were subject to rigorous testing with both detailed simulation and experimental data. The thermal calculators have consistently shown at least 80-85% accuracy compared against measurement data. Where more than half of the predictions showing 90% accuracy or more, as demonstrated on international conferences/ journals

Enter data

Click button

Obtain results

What is it?	What can the tool deliver?
Tool to provide quick estimation of package thermal performance by simple entry of (a) PCB & Test environment (b) Key package data	• Equip UTAC with quick data to communicate with customers • Upfront thermal design guidelines • Upfront identification of thermally critical packages to avoid iterative design process
What can it do?	**Key Benefits**
• Estimate if package meets customer requirement • Identify potential thermal solutions **Provide data Within Minutes Compared to Days by Simulation!!**	• Reduce overall cycle time to provide solutions to customers • Optimize computational & human resources

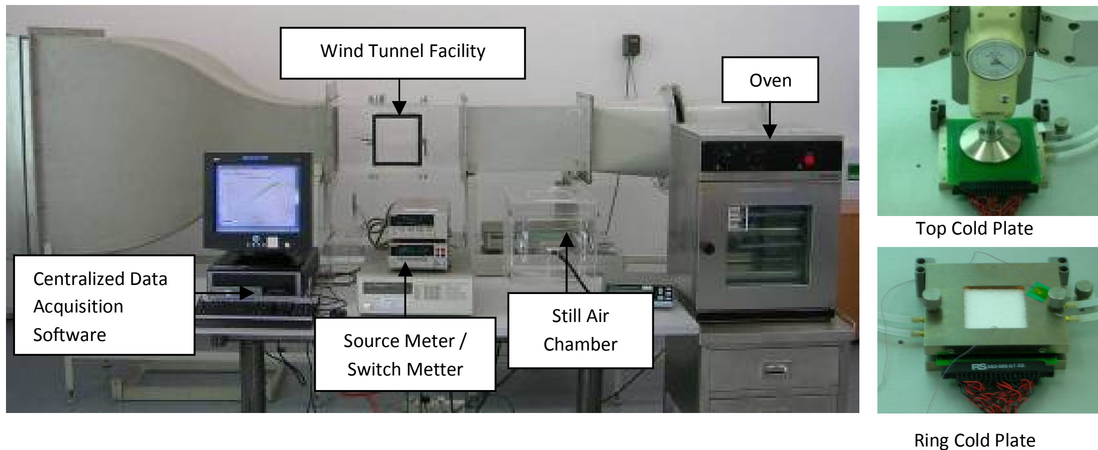
2.1.5 Custom Thermal Solutions

To meet the increasing needs of stringent thermal requirements on IC devices, UTAC has developed a systematic approach to provide customized thermal solutions based on individual customer needs. This may include laminate or leadframe package design optimization, material property evaluation and board layout analyses. UTAC has successfully identified various customized package solutions under complex conditions representative of actual application with feasible design, material, process, cost optimization under system or specified package constraints.

2.2 Thermal Measurement Facilities

UTAC has a complete integrated JEDEC compliant measurement set-up controlled by a centralized software to measure MCMs with up to 4 chips. UTAC has a library of validated results for:

- Lead Frame
- Flip Chip
- Wirebond Substrate (Including heat spreader)
- Stacked Die Packages



UTAC Measurement Facilities:
Complete integrated JEDEC compliant measurement set-up

3. Thermal Test Reports

UTAC amassed over 400 thermal analysis reports covering a wide array of packages ranging from memory, power application, analog, mixed signal, wireless communication packages such as array packages including FBGA, PBGA, HS-PBGA, XP-FBGA, LGA, stacked die packages such as D2-FBGA, D4 FBGA, leaded packages such as HQFP, QFP, SOIC, TSSOP, exposed pad packages such as QFNs, et-QFNs, and flip chip packages such as FC-CSP and FC-BGA. Thermal data includes Theta JA and Theta JMA over a range of power levels at flow velocities from 0.0 to 3m/s. Psi JT, Psi JB, Theta JB and Theta JC data are also available in many of these thermal reports.

For more information on our Thermal Package Characterization services, please contact UTAC's Sales Team (sales@utacgroup.com)