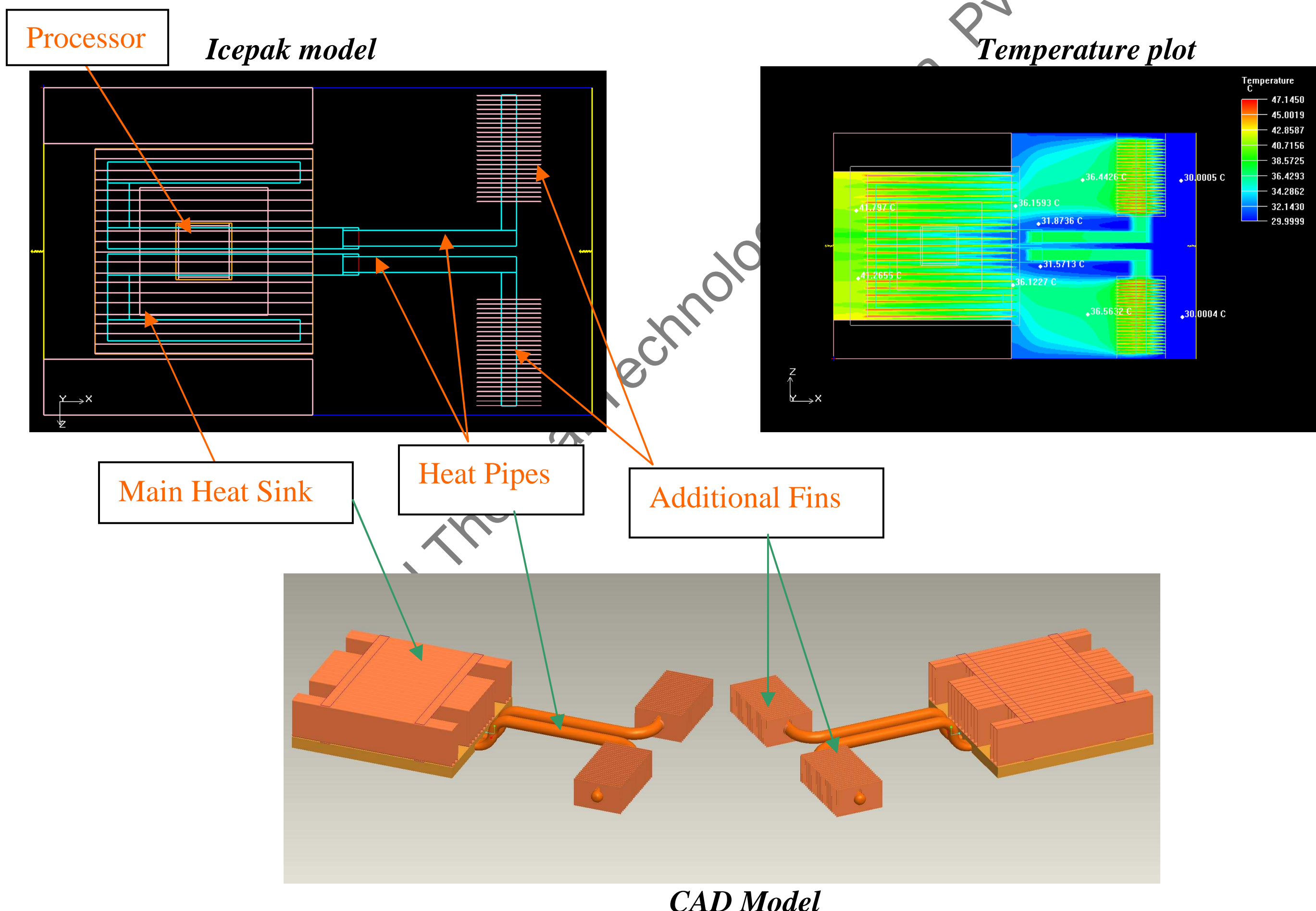
Effective Heat Pipe utilization in a heat sink

Applied Thermal Technologies has been developing cooling solutions for the Electronics industry for the past nine years, and for various global customers. With its vast experience in development of cooling systems, Applied Thermal Technologies understands the need of current generation microprocessors. With many components being installed around the processor for various capabilities, space has been a main constraint. Also due to high noise levels customers prefer to reduce number of fans, so it becomes a challenge to contain rise in temperature. Because of this, pressure drop in the system becomes a main constraint as the same air is also used to cool other components in the system.
Below is a classic example of one such case where Applied Thermal Technologies has effectively used heat pipes to meet the specifications from a customer which includes all the above mentioned constraints.

Work Description:
The work involved developing a cooling solution for a 85 W processor and generate mechanical CAD design for the solution.

Boundary Conditions:
Limitation on space around processor, temperature rise of < 20ºC above ambient (30ºC) and pressure drop limit.



CAD Model

Solution provided for:

1. <u>Limitation on space</u>: The heat pipes were embedded into the base of the heat sink which carried heat to a location away from the heat sink. The space in vicinity of heat sink was occupied by other important components. However space was available at some distance from heat sink for providing additional fins, as seen in figure above.

2. Temperature rise: Heat was removed from the heat Sink at two stages. One was from the extended fins and the second from the main heat sink fins. This enabled the air from stage one to mix up with fresh air - get cooler – then enter the stage two, thus limiting the rise in temperature. The figure above shows air temperature contours as it flows through the heat sink.
3. Pressure drop: As we could add fins in the extended portion of the heat sink we were able to use lower fin density on the main heat sink portion. This resulted in a large reduction in pressure drop of heat sink, thus allowing us to meet the pressure constraint.

Results:

1. Heat pipes served two purposes – efficient spreading of heat in heat sink base, and carrying some portion of heat to remote fins.
2. Heat source temperature was maintained within specified limits.
3. Air pressure drop within specified limits.
4. Optimal utilization of space.
5. Mechanical CAD design was developed for this heat sink, with proper mounting for the heat sink to suit the motherboard. The extended portion was supported on an additional mounting, which was provided in the system chassis.

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