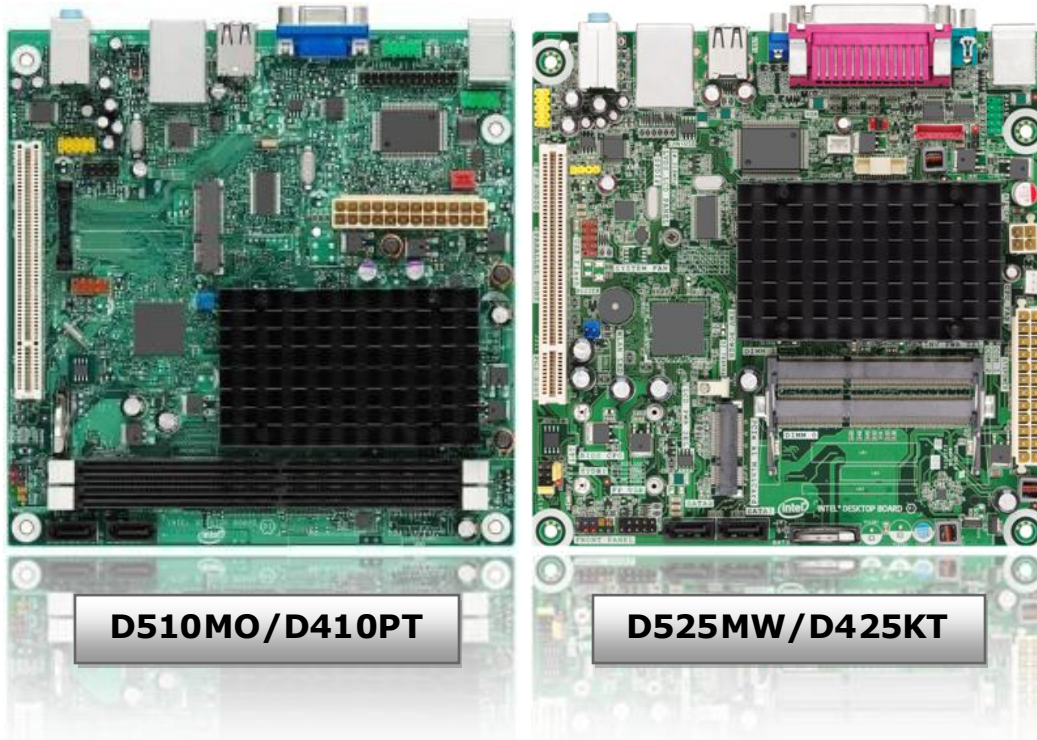


Chassis Thermal Design Recommendations for Intel® Atom™ Processor Based Boards

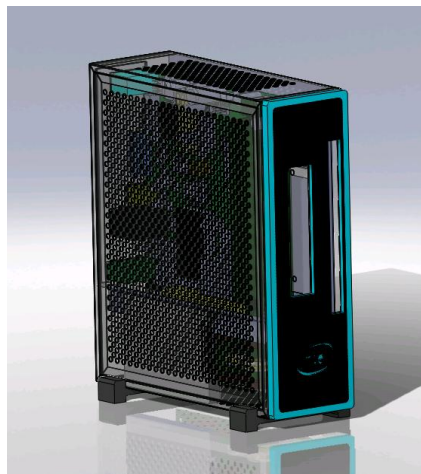


D510MO/D410PT

D525MW/D425KT

The Intel® Atom™ platform for 2010 (codenamed Pinetrail) enables cost effective entry level desktop systems which can be build in a fan-less system configuration for most common usage models. For optimal thermal performance in a 35°C environment or heavy usage scenario, a system fan is recommended.

Recommendations for fan-less chassis:

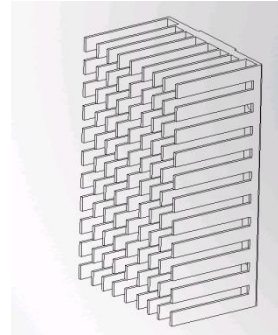


Fan-less Reference Chassis for D5xx/D4xx Motherboards

1. **Board Orientation:**

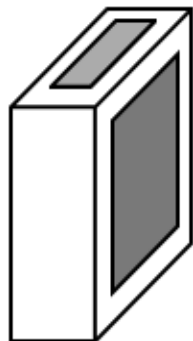
- a. The passive pin fin heat sink design covering the CPU and PCH works best in a vertical orientation with natural convection heat flow. To best support this, the long-axis of the heat sink should be oriented vertically.
- b. Designers should include permanent design features to help promote use of the system in a vertical orientation. (e.g. non removal chassis feet)

Buoyancy Airflow

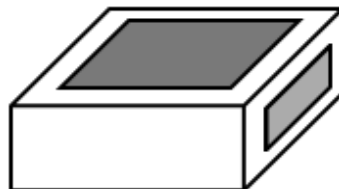


2. **Venting:**

- a. More venting is better for fan-less.
- b. A minimum of 5"x5" vent is recommended with a >45% free area ratio which translates to an open area of $(0.45 \cdot 25 \text{ in}^2) = 11.25$ square inches.
- c. Vents on the top and bottom chassis walls are required in vertical orientation.
- d. A horizontally oriented chassis will reduce the CPU heat sink's cooling capacity by 3W and have a higher CPU T_{amb} .



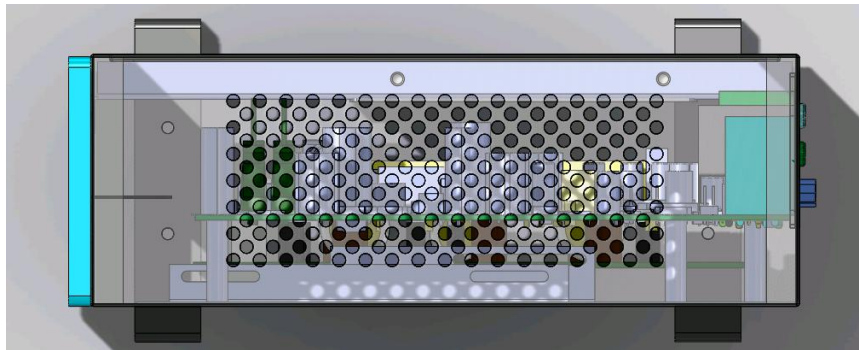
Vertical Orientation



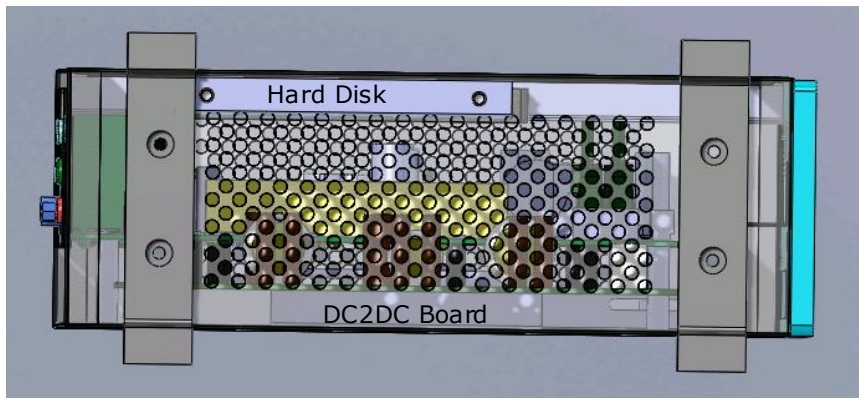
Horizontal Orientation

3. System Component Placement:

- a. DC-DC Converter board: Place near inlet vent (for lowest ambient temperatures). Orient the DC-DC converter board parallel to the motherboard in a location as to not block inlet air.
- b. Hard Drive: Place near inlet vent (for lowest ambient temperatures). Orient the HDD parallel to the motherboard in a location as to not block inlet air. Placing it beneath the motherboard is a good option also.
- c. Optical Disk Drive: Ensure that the ODD does not block airflow between the vents and the CPU. Locating the ODD beneath the motherboard is a good option. Cables should be situated so that they do not block air flow.



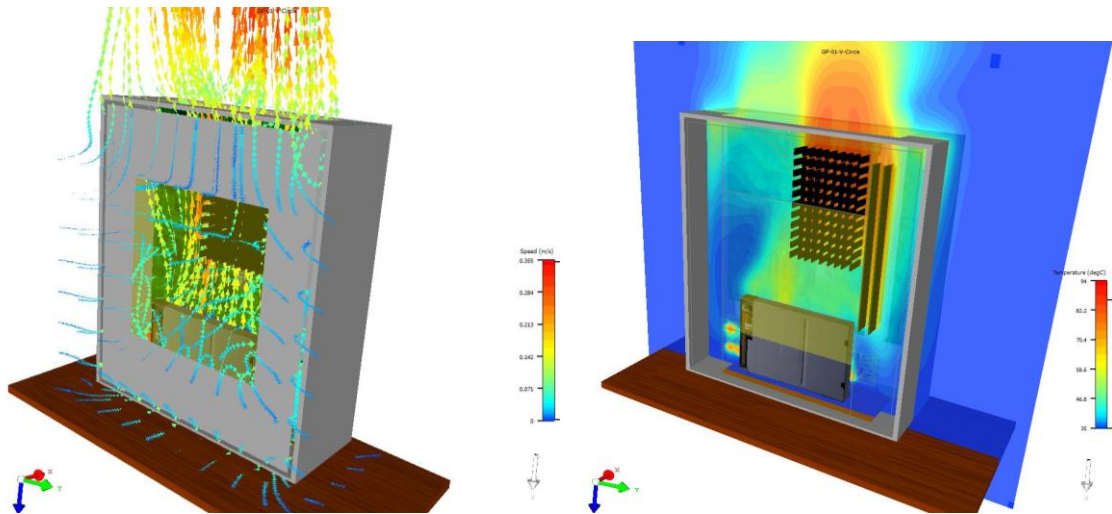
Top View



Bottom View

4. System Thermal Results:

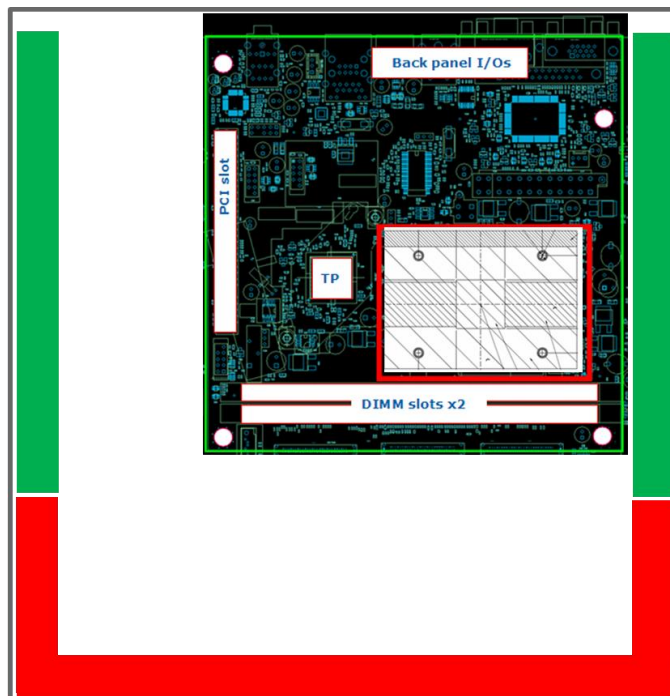
The thermal simulation below shows the upward movement of air through the chassis. The system temperature distribution shows that the hot spot will be the area above the heat sink thus demonstrating the necessity of having a vent on the top of the chassis.



The above are recommendations made to chassis designers who want to design a fan-less chassis. As mentioned in the introduction, a system fan is recommended for optimal thermal performance in harsh environments (35°C or above) or heavy use scenarios.

System Fan placement recommendations:

1. For best chassis thermal performance system, fans should be placed in the green regions shown below so that air is pulled across the board.
2. Chassis with system fans in the red region generally do not produce good thermal performance, as they are too far from the board or obstructed by internal components.



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