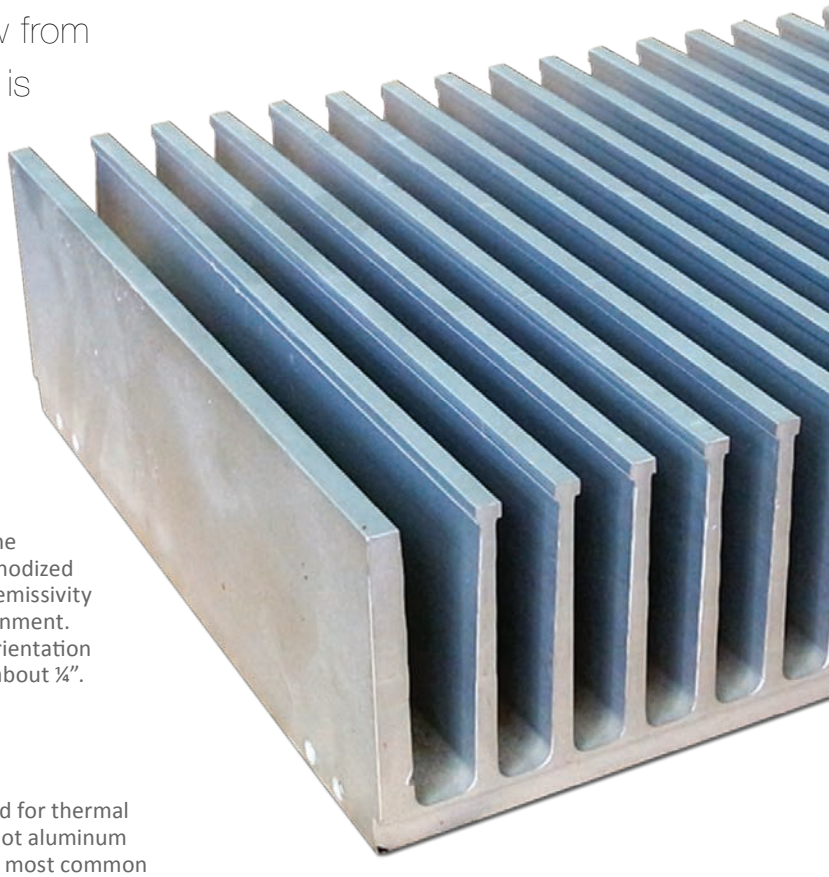
Natural Convection

[thermal cooling products]

Natural convection cooling describes a situation where there is no forced air flow from a fan, blower, or other source. Heat is conducted and radiated to the air within the heat sink's fins.



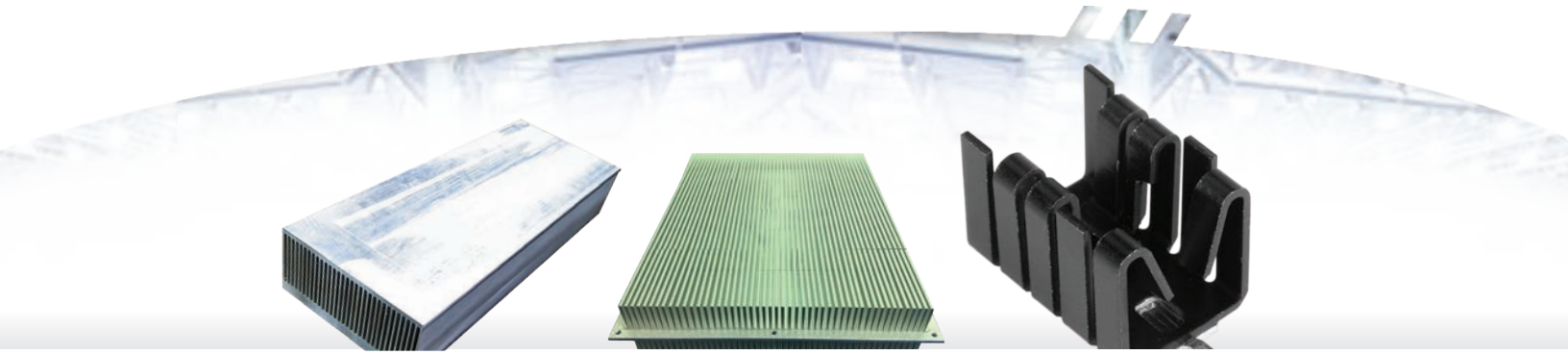
The higher temperature air is less dense than the surrounding air and rises out of the heat sink creating airflow that carries heat away from the heat sink fins.

The fluid velocity is very low in natural convection which limits the ability of the heat sink to transfer energy to the environment. To improve the heat sink ability, the surface area of the heat sink should be as large as permitted by the application.

Radiation also plays a major role in the performance of the heat sink and so the heat sink should be treated, either anodized or painted. This surface treatment improves the surface emissivity or its ability to radiate heat to other objects in the environment. When designing a heat sink for natural convection, the orientation should be vertical and the fins should be widely spaced, about ¼".

Thermal Extrusions

Extruded heat sinks are the most common heat sinks used for thermal management today. They are manufactured by pushing hot aluminum billets through a steel die to produce the final shape. The most common aluminum alloy is 6063-T5, but other 6XXX alloys can also be examined as needed. When the material is extruded, the initial sticks are 30-40 feet in length and are very soft. The material is stretched by grabbing both ends to produce a straight stick. After stretching, the material can be either air or over aged depending upon the required final hardness of the material.



Product Examples (from left to right): Stacked Fin, Folded Fin, Heat Sink

Board Level & BGA Heat Sinks

Board Level heat sinks are so named because they are generally attached both to the device and the PCB. Usually constructed as either a stamping or an extrusion, these heat sinks are designed for common package sizes like T0220, T0247, and D2pak.

BGA heat sinks are mounted to BGA devices, but are actually just simple extrusions. BGA heat sinks are usually crosscut to convert the extruded fins into pins which allow them to be used in more diverse application. The number and size of the crosscuts are dependent upon the environment.

LED Heat Sinks

LED applications are thermally challenging because of their small size, high power dissipation, complex environment and cost restrictions. LEDs are small in size and can be clustered together to produce more/brighter light. The small size means that the spreading of the heat from the LED into the heat sink is extremely important. To improve the spreading, many LEDs are mounted to metal-clad PCBs. While LEDs are electrically efficient, they are only about 30% efficient from a thermal prospective and that leads to thermal challenges.

Folded, Bonded, Stacked Fin

Folded Fin heat sinks are a good solution when looking for a medium to high density fin structure that is short in height (<2”). Generally formed from either copper or aluminum, a long sheet of material is folded back and forth to produce the fins. Depending upon the fin spacing and height, the fin tips can be flat or rounded. There are also special configurations like lanced offset and wavy which can be used to improve the heat transfer ability.

Find Out More:

About Natural Convection products:
wakefield-vette.com/products/natural-convection
About wakefield-vette and other thermal solutions:
wakefield-vette.com

Heat Frames

Wakefield-Vette, Rugged and Defense Products located in Cary, North Carolina, has extensive experience in manufacturing milled aluminum heat frames for use with electronics designed to meet or exceed rugged specification requirements.
Heat frames are CNC precision-machined out of solid aluminum (or copper) and precisely match the topography or skyline of an electronic printed circuit board being ruggedized.

Contact Us

Wakefield-Vette is Global. Global presence means our engineering, design, sales and support are close to our customers, in the Americas, Europe, Middle East and Asia. It means multi-national manufacturing and delivery. And it means a global Wakefield-Vette supply chain that can deliver, and provide support quickly, anywhere, with the highest quality solutions at the lowest landed cost.

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