



Amulaire Thermal Technology | Company Fact Sheet

OVERVIEW: THE HEAT PROBLEM

Today's high-performance semiconductors, which lie at the heart of the computing, communications and electronics products that drive our modern lives, are generating more and more heat. At the same time, shrinking circuit sizes are compounding and accelerating an increase in power density (i.e., the amount of heat that must be dissipated per unit area).

The fundamental problem of hot-running semiconductor-based products is not new; witness the fans in desktop computers, liquid cooling for high-power products and other cooling solutions. What has changed, however, is the scale of the problem. As a result, the challenges are mounting to develop high-performance heat dissipation solutions that are cost-effective and practical – which might mean smaller, or quieter, or unusually shaped or with new levels of thermal performance.

As the challenges of heat dissipation increase, so does the complexity of the solution required. As recently as four or five years ago, an inexpensive, extruded aluminum heat sink with a few fins was sufficient to cool the semiconductor boards of the most high-performance desktop PCs. But as CPUs and graphics boards feature higher-performing, higher-power chips, a "standard" aluminum heat sink with fins often is insufficient to dissipate the heat generated.

In many applications, air cooling of any kind fails to dissipate heat adequately, causing designers to turn increasingly to liquid cooling approaches. Liquid cooling offers better thermal performance and quieter operation – important as, for example, PCs are used for entertainment in living and family rooms – but currently at higher costs. As liquid cooling technology matures and its initial hurdles are overcome, it will move into the mainstream of consumer electronics.

The goal of thermal management today must be to counteract the growing proportion of time and money that designers of high-performance products must spend to solve their heat problems.

THE AMULAIRE DIFFERENCE

Amulaire has extensive capabilities in material science and proprietary manufacturing processes that enable the company to bring unprecedented flexibility in helping customers solve their heat dissipation challenges.

Amulaire's unique manufacturing and assembly processes, including Advanced Molding Technology (AMT) mean that Amulaire can create in copper, mixed metal and metal/non-metal materials combinations essentially any shape that can be created in plastic. Amulaire's technology processes add tremendous flexibility to customers' product development, increase reliability and enable designers to trade off between factors such as thermal performance, part size and weight, and cost.

Amulaire can deliver the following advantages:

Shape Flexibility: Unprecedented flexibility to work metallic shapes to reduce size or weight, increase thermal performance or manufacture one-of-a-kind unusually shaped solutions, in volume, to meet a particular design challenge

High Volume: The ability to produce in high volume parts that previously required time-consuming and expensive individual machining – which can lower overall costs while improving time to market

Simplicity: Simpler designs that require no soldering or crimping or additional plating for fins

Strength and Reliability: Fewer and stronger mechanical and thermal interfaces – which increases performance and reliability of the finished part and reduces materials cost, while streamlining the manufacturing process so that customers get the parts sooner

Materials Flexibility: Using a powdered metallurgy technology means the ability to produce injection-molded parts that mix essentially any combination of metals, including but not restricted to copper, to precisely meet customer needs for thermal performance, cost reduction or size



PRODUCTS AND MARKETS

Amulaire's design flexibility and technical advances lend themselves to a number of applications where overheating is an issue. Amulaire offers a wide range of custom and semi-custom products, which can be produced in volume, that include the following:

- Liquid-cooling cold plates for desktop PCs and IGBTs (insulated gate bipolar transistors), which are used to switch electrical power to mechanical power and that are used in products as diverse as refrigerators, electric motors, hybrid cars, fuel cells, windmills, elevators and escalators, and power supplies
- Air-cooled heat sinks for desktop PCs and high-brightness LEDs (light-emitting diodes)
- Complex semiconductor packaging, such as laser diodes

The customers served by Amulaire's high-volume heat dissipation products include semiconductor companies, PC manufacturers and makers of other high-performance semiconductor-based systems.

COMPANY INFRASTRUCTURE

Because the majority of Amulaire's global customers need customized products and personalized service, Amulaire is structured with a sales office and R&D team in the U.S., as well as another sales office and design team in Taiwan.

The two sales offices provide the close attention and application support that customers require. The R&D operation comprises thermal and material experts who work to develop next-generation processes and products to make sure that Amulaire's customers are always one step ahead of their thermal challenges.

The design team in Taiwan is integrated with the manufacturing operations, to ensure the timely and close communication needed to optimize the manufacturing of customers' heat dissipation products.

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