

Device capable of providing good temperature uniformity to the cooled object under variable and non-uniform heat flux

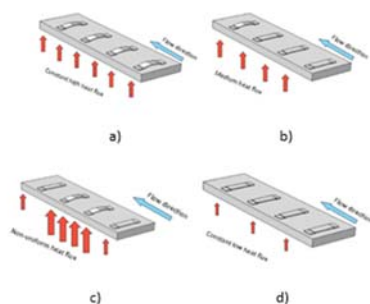


Figure. a) Uniform high heat flux b) Uniform low heat flux c) Uniform medium heat flux d) Hotspot region non-uniform heat-flux.

## BUSSINESS OPORTUNITY

Technology available for licensing.

## IP STATUS

PCT application filed

## TAGS

Heat Sink, Uniform Temperature, Cooling Device, Heat Exchange

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# SELF-REGULATED HEAT SINK DEVICE FOR UNIFORM TEMPERATURE DISTRIBUTION

## THE TECHNOLOGY

The invention consists of a **heat sink with an array of fins which** are parallel-oriented to the flow direction at low temperature but, as the temperature locally increases, **deform to perturb the flow**. The flow perturbation reduces the local thermal resistance, allowing high heat flux extraction without increasing the wall temperature.

## THE NEED

Current heat sink devices are mainly oriented to reduce the average temperature of a cooled device. In some applications, such as electronic systems or dense array photovoltaic receivers, the temperature uniformity is also required for good performance, for improving their reliability and/or their efficiency.

However, current cooling technologies - standard heat sinks and fans - are rapidly approaching their cooling capacity limit, and thermal management is becoming a critical step in enabling enhanced product functionality.

## THE MARKET

The thermal management market was valued at USD 8.99 Billion in 2016 and is estimated to reach USD 14.24 Billion by 2022, at a CAGR of 7.91% during the period 2017 and 2022. The industry is primarily driven by the growth in the emerging trend of miniaturization of electronic devices and components.

## ADVANTAGES

- › **Capacity to provide uniform or also other kinds of temperature distributions of a cooled object**, as required by the application, by using several materials and/or shapes for the fins.
- › Combined **use of fixed and self-regulated fins** is possible.
- › **Use of different materials with different ranges of temperature** for actuation, avoiding the design step as a nearly “universal” cooling device becomes useful for a large number of applications.
- › **Several ways to locally boost the heat exchange**, by creating a vortex or by increasing the heat exchange surface.
- › The **fins functionality is independent of external electrical power** or other energy sources.
- › **The pumping power needed for this cooling device is widely reduced with respect to existing solutions.**
- › **The solution is reliable** and can be easily integrated into large arrays.

## APPLICATIONS

The main applications of the device are computers, telecommunications, medical devices, industrial electronics, aerospace/military, concentrated photovoltaics, consumer electronics and automotive.