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ASX Announcement

GCM White Paper Reports VHD Mass-Normalised Thermal Advantage

Highlights

- GCM has released a technical white paper comparing two VHD air-cooled heat sinks against selected commercial aluminium and copper products.
- In the BGA comparison at 200 linear feet per minute (LFM), the VHD heat sink recorded the highest mass-normalised thermal conductance, more than four times the selected copper product and between 5% and 133% above the selected aluminium products.
- In the half-brick DC/DC comparison at 300 LFM, the VHD heat sink recorded a mass-normalised thermal conductance 60% and 129% above the two low-cost extruded aluminium products and remained competitive with a premium aluminium design while using 18% less mass and carrying a 29% lower indicated unit cost.
- Mass-normalised thermal conductance data is relevant where thermal performance must be balanced against payload, range, energy, shock, vibration and board-loading constraints. This may include industries such as aviation, space, defence and mobility systems.

GCM Corporation (ASX:**GCM** or the "**Company**") announces completion of a technical white paper, titled '*VHD Air-Cooled Heat Sinks - Efficient thermal management for BGA devices and DC/DC converters'*. The paper compares representative commercial off-the-shelf heat sinks with two VHD alternatives designed and manufactured by GCM. The comparison presents both absolute thermal resistance and the amount of cooling delivered for each gram of heat sink mass.

Commenting on the white paper, CEO and Managing Director Clinton Booth said: *"These results quantify the system metric that matters in weight-constrained electronics: how much heat can be removed for every gram added to the assembly."*

"In the BGA comparison, VHD produced the highest conductance per gram, including more than four times the selected copper part. In the DC/DC comparison, VHD outperformed the two low-cost aluminium parts on the same measure and remained competitive with the premium aluminium design at lower mass and indicated cost."

"That distinction is important for aviation, space and mobility applications. A heat sink is not assessed in isolation: mass affects payload, vehicle range, energy consumption, structural support, vibration response and the load transferred into circuit boards and solder joints."

White Paper Scope and Methodology

GCM selected two common air-cooled heat sink applications, one for BGA chips and one for half-brick DC/DC converters, and tested a VHD product in each category (images 1 and 2) against standard commercial alternatives available through mainstream electronics distributors.

Competitor performance figures were taken directly from manufacturer datasheets. VHD performance was derived from in-house computer modelling, using industry-standard thermal simulation software, run at

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equivalent airflow conditions. To validate the modelling approach, GCM verified its modelled predictions against published data for eight commercial heat sinks across a range of designs, with results agreeing within ±6%.

All products were assessed on the same basis - how much heat they remove relative to the temperature rise at the contact surface, measured at 25°C. The modelling reflects steady-state conditions and does not capture manufacturing variation, interface degradation over thermal cycling or transient behaviour. The thermal performance of each heat sink, on a thermal resistance basis, was normalised against the product's mass. This produces the metric conductance per gram (C1), which captures how much useful cooling is delivered per gram of heat sink added to an assembly.

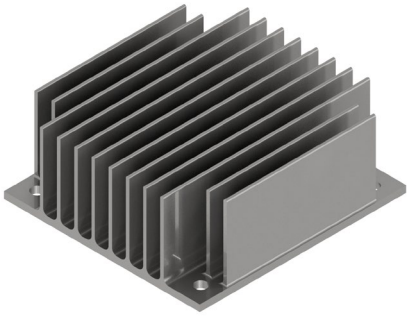

***Image 1**: HSK-FCA-VHD-NAT-017-013, half-brick DC/DC converter heat sink*

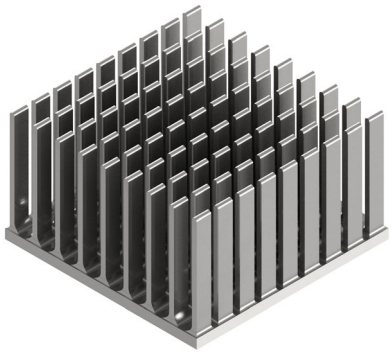

***Image 2**: HSK-FCA-VHD-NAT-009-007, 40 mm square BGA heat sink*

BGA Heat Sink Results - Highest Conductance Per Gram

The BGA comparison measures cooling delivered per gram of weight. This is the metric of interest in aviation, drones and mobility applications.

The VHD heat sink weighs 16.6g, whereas the copper comparator weighs 105g - more than six times as much. The aluminium comparators ranged from 24.4g to 48.4g. When cooling performance is measured per gram, the VHD product leads this field at 0.021 (W/K)/g.

In other words, VHD performs more than four times better than the copper comparator, roughly double the heavier aluminium comparator, and 5% ahead of the closest aluminium comparator on the C1 metric. It also delivers more than three times the cooling per dollar spent compared to the copper product.

BGA heat sink	Mass (g)	Cost (USD)	C1 ((W/K)/g)
VHD - HSK-FCA-VHD-NAT-009-007	**16.6**	**8.10**	**0.021**
Copper - skived fins	105.0	37.80	0.005
Aluminium - extruded, cut fin	48.4	3.50	0.009
Aluminium - extruded, cut fin	24.4	5.70	0.016
Aluminium - elliptical pin fin	25.3	10.80	0.020

Source: VHD values are from GCM performed CFD modelling; Comparator values are manufacturer-published. Comparator pricing is from DigiKey.

Half-Brick DC/DC Heat Sink Results - Low Mass with Competitive Cooling

The DC/DC comparison included three aluminium products. Against the two low-cost standard options, VHD emerged superior on a per-gram basis, being 60% and 129% better, respectively.

Against the premium aluminium product, the picture is more nuanced. Aluminium achieves a slightly higher C1 (0.019 vs 0.016), but it is 21% heavier (52.6 g vs 43.3 g) and 42% more expensive (US$25.20 vs US$17.80). For an engineer choosing between them, VHD offers a meaningful weight and cost saving in exchange for a modest reduction in peak cooling performance, a trade-off that becomes increasingly attractive as weight constraints tighten.

DC/DC heat sink	Mass (g)	Cost (USD)	C1 ((W/K)/g)
VHD - HSK-FCA-VHD-NAT-017-013	**43.3**	**17.80**	**0.016**
Aluminium - high performance	52.6	25.20	0.019
Aluminium - low-cost extruded	90.9	8.10	0.010
Aluminium - low-cost extruded	68.6	4.70	0.007

Source: VHD values are from GCM performed CFD modelling; Comparator values are manufacturer-published. Comparator pricing is from Digikey.

Potential Applications to Aviation, Space and Mobility

Mass-normalised thermal performance data may be considered in applications where weight affects system performance, where every gram can have a system-level consequence.

In aviation, defence, drones, electric vehicles and spacecraft weight is a technical and commercial consideration. Additional mass on an aircraft or drone may affect payload or range. Lower mass on a circuit board reduces the structural load on mounting hardware and solder joints and this reduced load has the potential to improve reliability under vibration and shock.

VHD also expands and contracts less with temperature changes than aluminium or copper, a property known as coefficient of thermal expansion (CTE). VHD has a low in-plane CTE of approximately 1.3 ppm/K, closer to silicon at approximately 2.6-3.3 ppm/K, whereas aluminium CTE is approximately 23 ppm/K and copper approximately 17 ppm/K.

Repeated heating and cooling cycles cause materials to expand and contract, which, over time, can stress solder joints and connections. VHD's expansion behaviour is closer to that of silicon chips than that of aluminium or copper, which can reduce stress and improve long-term reliability in thermally demanding environments.

The heat sinks tested in this white paper are air-cooled, requiring moving air to function, and cannot be used directly in the vacuum of space. However, the underlying material properties that VHD offers (low weight, strong in-plane conductivity and low thermal expansion) may be applied to application-specific thermal components and controlled-environment electronics used in space programs.

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Authorisation

This announcement has been authorised for release to the ASX by the Board of Directors of GCM Corporation Limited.

Forward Looking Statements

This announcement contains general information about GCM's activities current as at the date of the announcement. The information is provided in summary form and does not purport to be complete. This release contains estimates and information concerning our industry and our business, including estimated market size and projected growth rates of the markets for our products. Unless otherwise expressly stated, we obtained this industry, business, market and other information from reports, research surveys, studies and similar data prepared by third parties, industry and general publications, government data and similar sources. This announcement also includes certain information and data that is derived from internal research.

While we believe that our internal research is reliable, such research has not been verified by any third party. Estimates and information concerning our industry and our business involve a number of assumptions and limitations. Although we are responsible for all disclosure contained in this announcement and believe the third-party market position, market opportunity and market size data included in this announcement are reliable, we have not independently verified the accuracy or completeness of this third-party data. Information based on projections, assumptions and estimates of our future performance and the future performance of the industry in which we operate is necessarily subject to a high degree of uncertainty and risk due to a variety of factors, which could cause results to differ materially from those expressed in these publications and reports.