



AAVID
THERMALLOY

*Successfully delivering electronics
cooling solutions since 1964*

POWER Thermal Solutions



Thermal Management Solutions
for Power Electronics
Around the World

www.aavidthermalloy.com



Power Thermal Solutions

Power Thermal Solutions was formed in 2008 as a subsidiary division of Aavid Thermalloy, the world's foremost provider of thermal solutions.

In order to meet the specific issues facing design engineers in the Power Electronics Market, Power Thermal Solutions seeks to combine the experience of its Global Sales, Engineering, and Manufacturing presence to provide optimal thermal solutions to key markets and customers which are both cost effective and easy to produce.

Power Thermal Solutions has identified specific applications where its unique blend of know-how and manufacturing expertise can be of particular benefit to its customers. They include but are not limited to:

- » *Traction Drives*
- » *UPS*
- » *Green/Renewable Energies*
- » *Electric and Hybrid Vehicles*

By more effectively partnering its key customers and providing a better understanding of the system level requirements, Power Thermal Solutions is able to:

- » *Maximize Thermal Efficiency*
- » *Minimize Weight*
- » *Minimize System Cost*
- » *Reduce System and Component Size*

With its divisional headquarters based near to Bologna, Italy, Power Thermal Solutions has manufacturing facilities in Europe, North America and Asia alongside local sales and design support in each of these regions.

Manufacturing and Design Locations



Bologna , Italy



Dong Guan, China



Laconia, USA



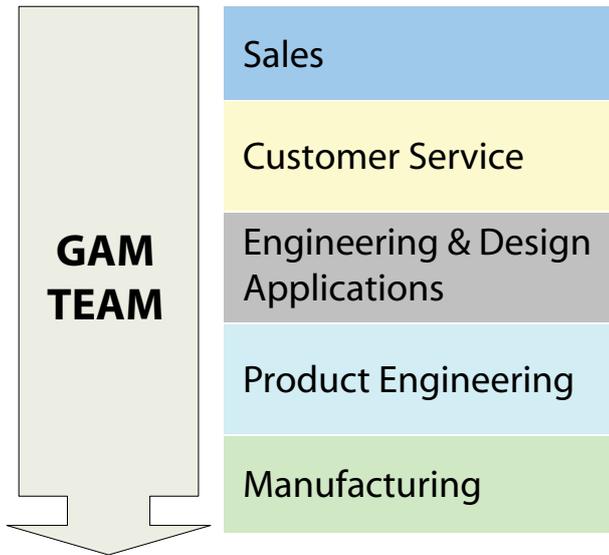
Shanghai, China



Vadadora, India

Global and Key Account Management

Dedicated Global Account Management (GAM) Teams comprising Sales, Engineering and Manufacturing personnel provide key customer focus and enable hassle free, co-ordinated project roll out on a worldwide basis.



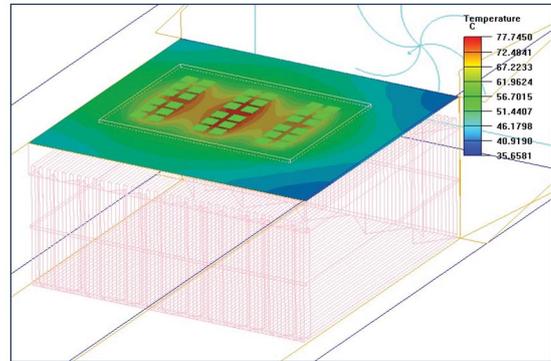
Engineering Resource

By employing recognized, market-leading thermal design expertise, coupled with investment in the correct design tools and backed up by its own test laboratories, Power Thermal Solutions is able to develop, test and verify its own designs for its customers.

Specialization is key to gaining a full understanding of customer needs and expectations. Power Thermal Solutions has engineers dedicated to each of its key markets to provide this understanding as a starting point for all its project analysis.

Thermal Simulation

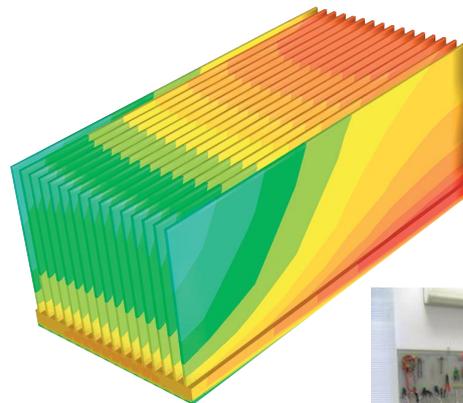
Our engineers have at their disposal the very latest CFD modeling software including Icepak, Qfin, Flotherm as well as its own in house packages.

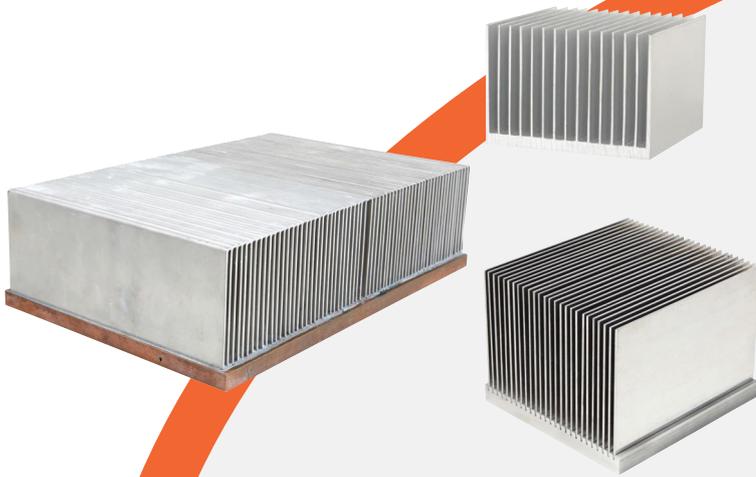


By carrying out simulations at heat sink or system level, our engineers are able to ascertain what critical issues face the designer and optimise the solution quickly and cost effectively to reach a prototype stage.

Laboratory Testing

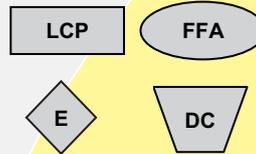
Power Thermal Solutions is able to offer in house testing of prototypes in support of its CFD designs including wind tunnel and thermal imaging for high fin density products. Liquid Cold Plate (LCP) product testing includes Pressure, Pressure Drop and Rth.





UPS

- » Cooling of IGBT or SCRs
- » Rectifier
- » Inverter
- » Static Switch



MOTOR DRIVES CONTROLS

Cooling of IGBTs or SCRs used for power switching in the drive circuit.

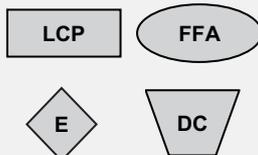
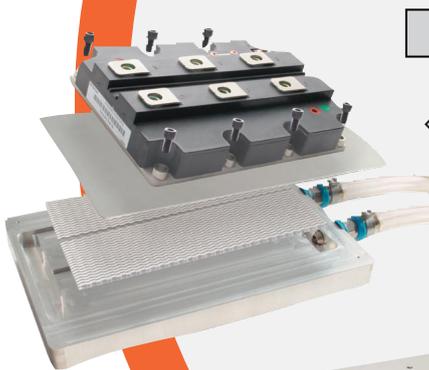
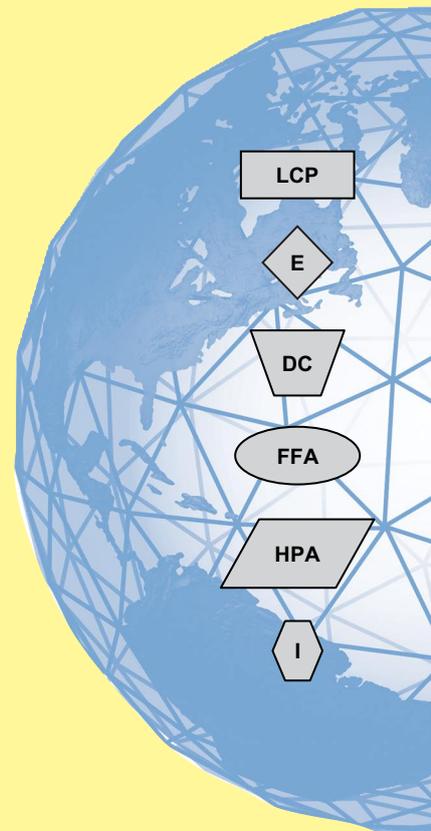


Image source © Siemens AG 2009, All rights reserved*

TRACTION

There are 3 main areas that require cooling in traction applications:

- » Auxiliary Converters providing the power to the car
- » Main Drives providing the power to the train
- » Main Converters

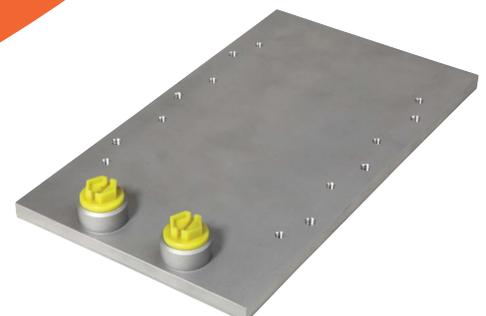
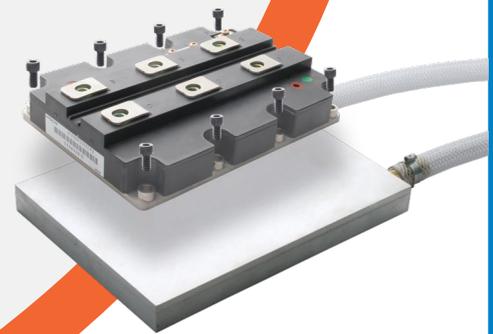




GREEN ENERGY – SOLAR

Thermal management is critical in a number of areas of a solar energy system:

- » *Cooling of the PV cell of the solar collector to maximising its efficiency*
- » *Cooling of the solar inverter IGBT modules*
- » *Cooling of electronic monitoring or control modules used to optimize the way that the inverter processes energy from the PV panels*



Liquid Cold Plates

Extrusions

Die Castings

Fabricated Fin Assemblies

Heat Pipe Assemblies

Electrically Isolated



GREEN ENERGY – WIND

Large scale wind farms or individual turbines both require cooling of the inverter IGBT modules to convert the energy generated by the windmill with the grid.



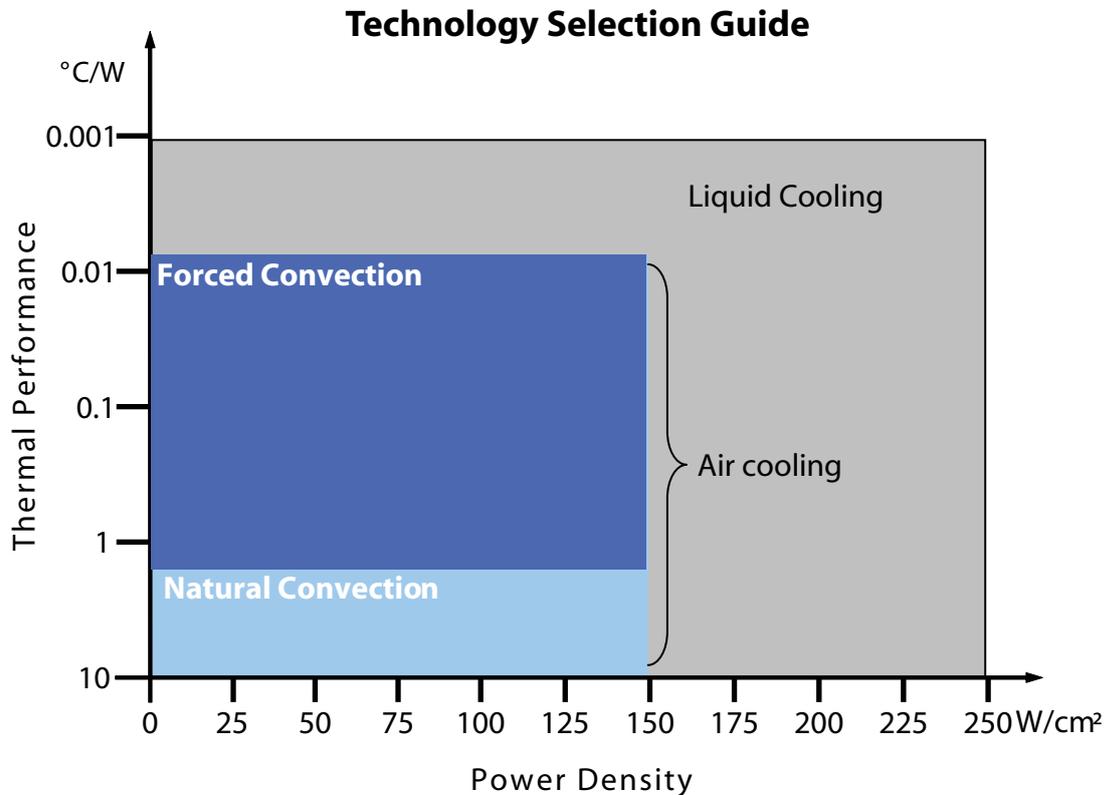
ELECTRIC AND HYBRID VEHICLES

Applications requiring cooling include:

- » *Motor Drive controls*
- » *Battery systems*
- » *Battery chargers*

In all cases weight reduction is critical.





Heat Sink Technology

The adoption of new IGBT technology driven by the goal of increasing efficiency is creating the need for more creative cooling solutions. While extruded heat sinks still form an important part of our portfolio, they no longer meet the requirements of higher performance applications. Power Thermal Solutions has the products and design capability to meet this challenge.

As the diagram above illustrates, as power density increases there is a progression from using solutions made from extrusion under natural convection to forced air cooling using Fabricated Fin Assemblies (FFA) with higher fin densities and ultimately Fabricated Fin Assemblies (FFA) using embedded heat pipes. Liquid Cold Plates will be utilized in only the most severe applications.

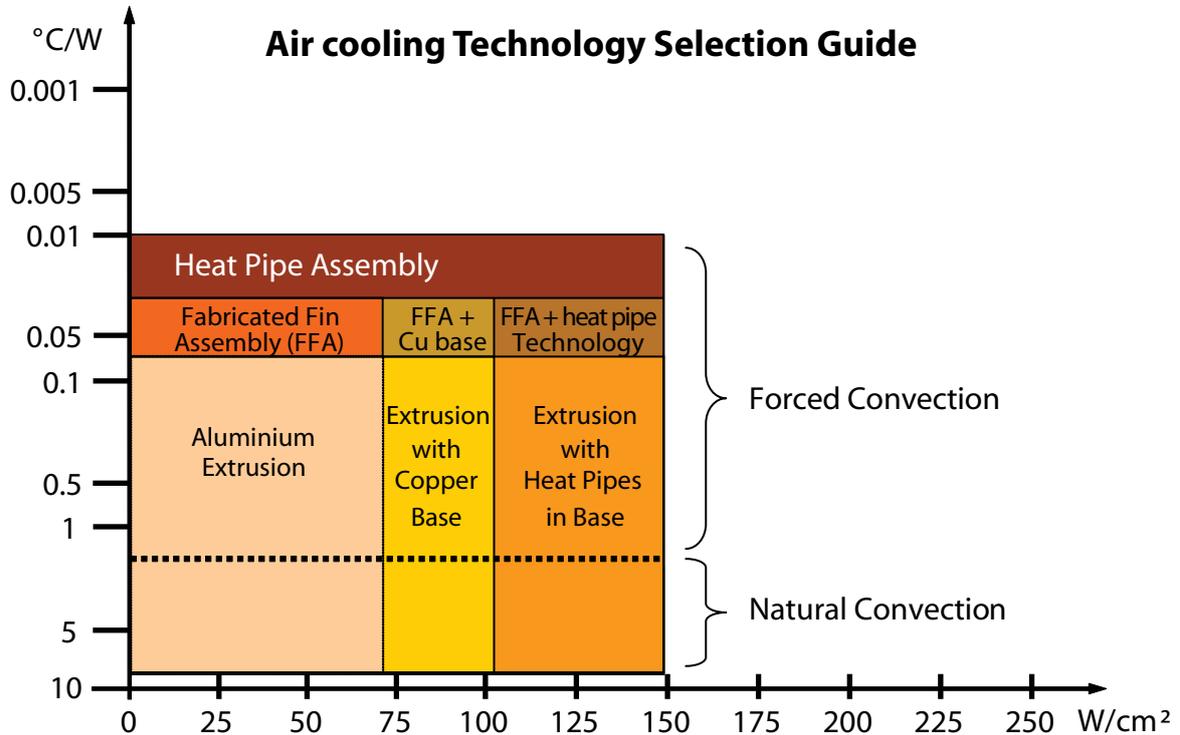
Whether it is air cooled or liquid cooled, brazed solutions set the performance benchmark in the market today. The most cost-effective brazing process serving the majority of market requirements is that of Controlled Atmosphere Brazing (CAB). After several years of development, Aavid Thermalloy was able to evolve the process of Controlled Atmosphere Brazing to a point where today it is unique in being able to offer a range of Fabricated Fin Assemblies and Liquid Cold Plates using this manufacturing method. For specific market applications we can also offer Vacuum Brazed products.



Static Brazing oven



Fast Flow Brazing Lines



Max Clip Solutions

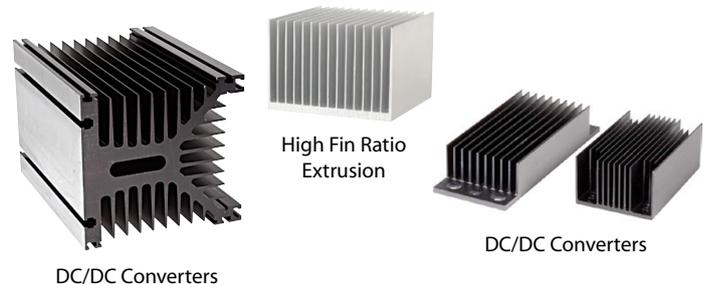
The Max Clip System™ provides mounting for discrete power semiconductors.

- » No drilled holes, reducing heat sink cost
- » Push fit clip reduces assembly time and cost
- » Clip design improves thermal performance
- » Screw fix or solder pin attachment to board



Extrusions

Extruded aluminium heat sinks remain the most straightforward and cost effective solution for the majority of low to medium power applications. Select from the many standard profiles already available or talk to our engineers about a custom solution to your specification.



Double welded / brazed extrusion profiles

Joining 2 extrusion profiles together using a single welded or brazed joint is an effective way for smaller profiles to be used to create a large heat sink which would otherwise incur very high tooling costs or not be achievable as single piece extrusion.





Fabricated Fin Assemblies



These High Fin Density heat sinks are designed to provide additional surface area for cooling. Fins are physically attached to the base which are both closer together and taller than is possible with for a standard extruded profile. They are for use under forced convection. Aavid Thermalloy is able to offer the following types of Fabricated Fin Assembly:

- » *Epoxy Bonded Fin offer a good level of performance with a wide range of off the shelf base profiles already tooled.*



- » *Brazed Fin heat sinks offer the highest performance assembly due to the use of a metal joint filler with lowest thermal resistance.*



- » *The highest heat fluxes require the use of copper for rapid X-Axis heat spreading combined with aluminium fins. This can be achieved with brazing.*

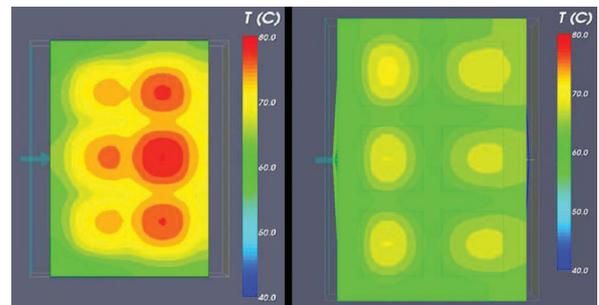


- » *Tapersink is a brand new concept in high fin density products. Aluminium coil fins are pressed into the extruded base to form a robust, high performance, low cost solution.*



Brazing 3D shapes

By using a 3D fin structure and only using fins where necessary we are able to save weight and optimise airflow to maximise heat sink performance.



Conventional fin structure hotspots can be eliminated with a 3D structure.

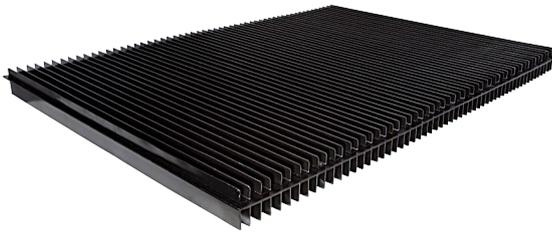


Heat sinks for traction applications

FFA

Developed specifically for the demands of the traction market, Power Thermal Solutions is able to offer the following:

- » Large heat sinks/cabinet doors
- » Very large but light weight heat sinks using a combination of riveting and CAB process.



- » Electrically Isolated heat sinks



For high voltage applications upto 15 kV where electrical isolation of components is Required ie. Traction applications.

Aavid Thermalloys' patented 'AA Blue' resin provides an isolating layer between the heatsink and the component mounting block. By varying the layer thickness different degrees of isolation may be achieved.

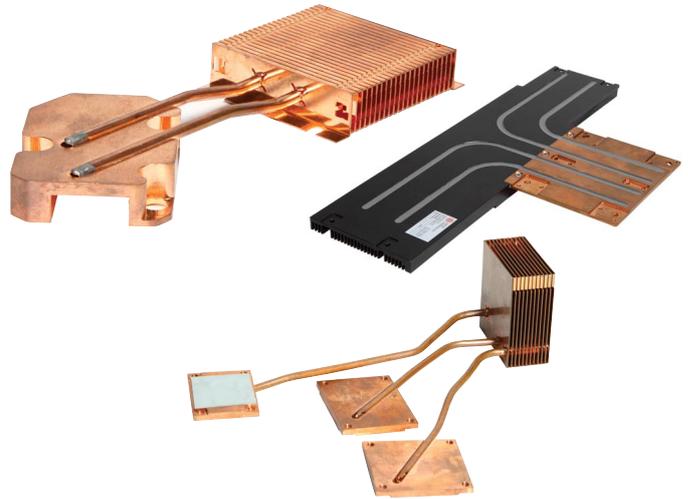


Heatpipe Assemblies

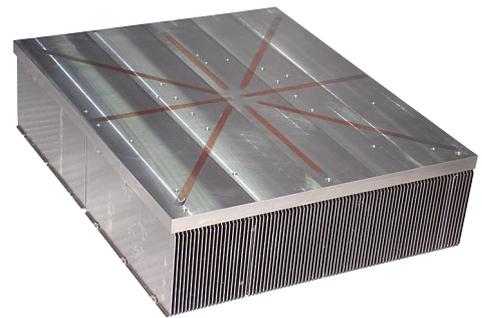
HPA

Due to the large variety and diverse nature of customer requirements, most heat sinks using integrated heat pipes are developed specifically for the application. Recommended for use with heat fluxes upto 120W/cm² to provide:

- » Heat transfer from a space constrained area, position of obstructed airflow or sealed enclosure



- » Weight saving -replacing a copper base with an aluminium base an integrated heat pipes

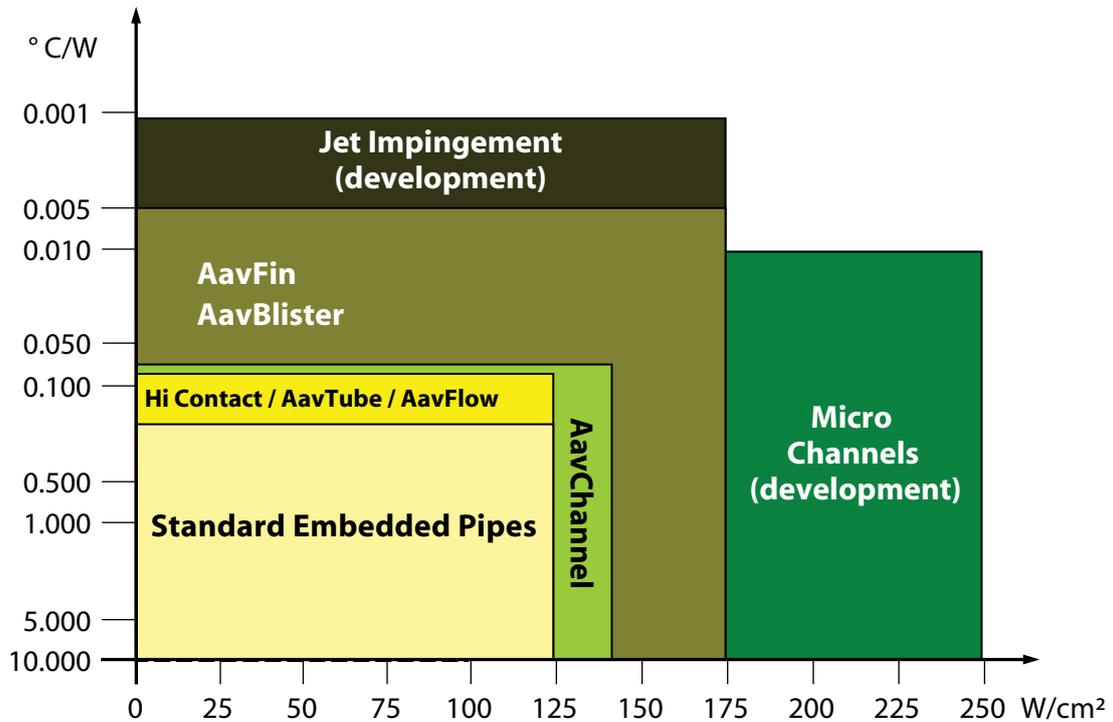


- » Heat spreading on the horizontal or vertical axis to maximise the surface area in the available space





Liquid Cooling Technology Selection Guide



Liquid Cooling LCP

Liquid cooling has become the choice of designers striving to manage the rising heat loads of high power electronics in the most demanding applications. Whether it's lasers, power generation and conditioning, medical equipment, transportation or military electronics, liquid cold plates offer performance advantages over air-cooled solutions.

LCP for Complex Electronic Systems

Liquid Cold Plates are the smart solutions to extract heat from multiple electronic components inside a complex electronic system.



LCP for High Heat Density per Volume Applications

Aavid Thermalloy is also able to offer custom LCP for demanding applications in reduced space (upto (T) 3 kW of heat per litre) such as Servers, Data Centers and Automotive Motor Drives.



Liquid Cold Plates for High Power Density Applications LCP

For the most demanding heat flux applications up to 250 W/cm² Aavid Thermalloy is able to offer a number of liquid cooling products to suit the customer criteria of cost and performance.

Low to Medium Power – Standard Solutions

Tube Cold Plates

- » *Tube mechanically locked into base plate*
- » *Thermal epoxy provides gap free thermal interface between plate and tube for increased performance*



Hi-Contact™ Cold Plates

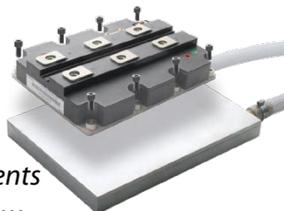
- » *Tube in direct contact with device base plate increasing performance*
- » *Patented mechanical attachment of tube into base*
- » *Thermal epoxy provides gap free thermal interface between plate and tube for increased performance*



Low to Medium Power – Custom Solutions

AavChannel

- » *Simple milled channels in base plate*
- » *Cooling pockets located to suit customer requirements*
- » *Lowest start up costs for low volume custom brazed solutions*



AavBlister Cold Plates

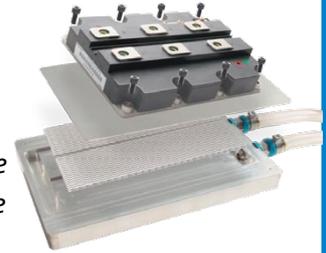
- » *Stamped channels in the cover reduce costs for high volume applications*
- » *Greater flexibility to drill mounting holes in base*
- » *Internal offset fin structures enhance performance*



High Power – Custom Solutions

AavFin

- » *Offset fin structures increase surface area in contact with cooling fluid enhancing thermal transfer performance*
- » *Highest thermal performance available*



Brazed LCP Solutions

Aavid Thermalloy Brazed LCP solutions are made using our Controlled Atmosphere Brazing process (CAB) which is the most cost effective manufacturing process and suitable for the vast majority of our customers applications. However, where the use of pure or de-ionized water is a pre-requisite we are able to offer Vacuum Brazed products.

Alternatively ,we are able to offer solutions with copper or stainless steel tubes for these applications.



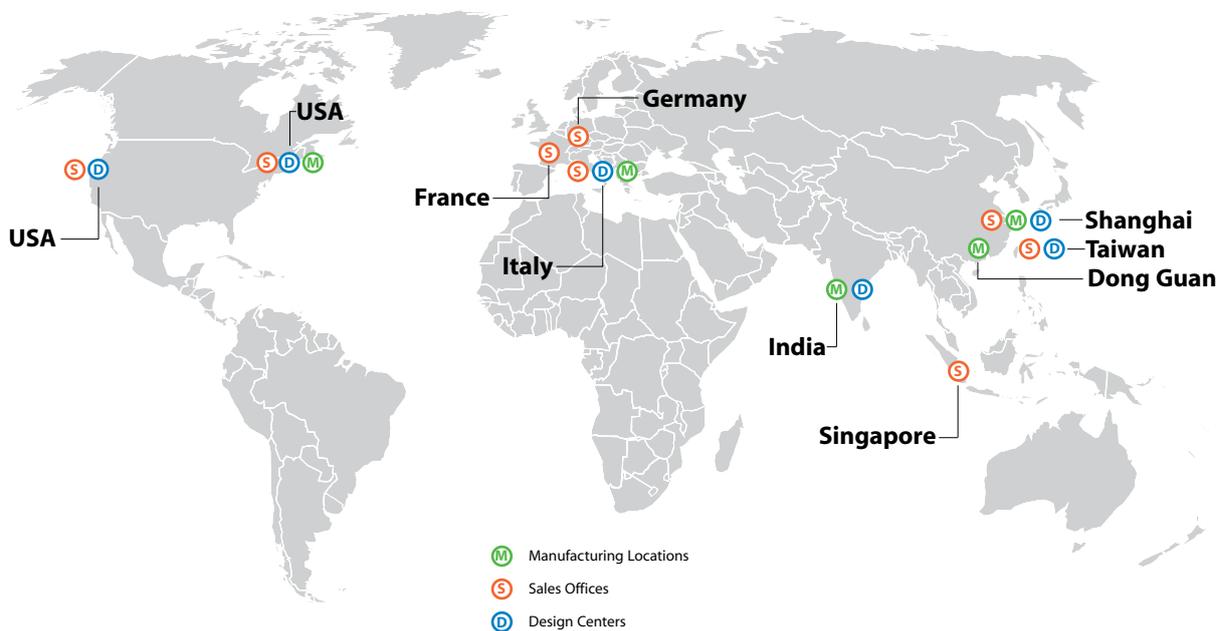


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THERMALLOY**

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cooling solutions since 1964*

Aavid has been a world leader of thermal solutions for the electronics industry since 1964. We serve the most diversified range of industries from automotive, to communications, information technology, lighting, medical, military, power electronics, solar, and many others. Our world wide staff includes industry leading experts in the fields of heat transfer and computational fluid dynamics.

Worldwide Locations



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