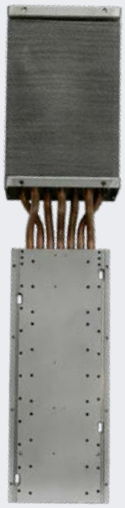
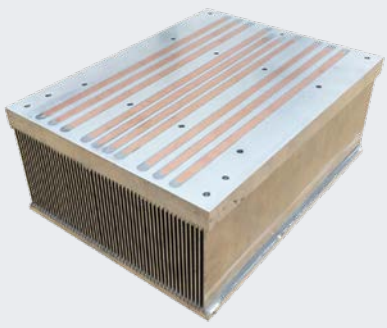
Ferraz Shawmut | Eldre | Idealec | FTCAP

SOLUTIONS FOR
POWER MANAGEMENT

COOLING SOLUTIONS FOR BATTERY AND POWER ELECTRONICS





MERSEN ANSWERS YOUR TOUGHEST THERMAL APPLICATION CHALLENGE

MAXIMIZED PERFORMANCES WITH CUSTOMIZED COOLING SOLUTIONS, HIGH TECHNICAL EXPERTISE AND DEDICATED SUPPORT

Mersen integrates its extensive cooling expertise and patented heat sink technology into semiconductor applications and battery systems to make them more efficient, reliable and profitable. Mersen's engineering team is dedicated to supporting you at every stage. From identifying innovative cooling solutions to co-designing performance parameters and even simulating your application before a prototype is built. With our unique expertise in air, phase change, and liquid-cooled heat sinks, we work closely with you to ensure the optimal thermal protection solution for your specific needs.

Quality and performance for various markets

Mersen has a keen understanding of the unique challenges customers face in each of the markets we serve. We deliver extensive product expertise and unbeatable applications support, enabling our customers to optimize their market performance.

We are experts in designing, simulating, manufacturing and testing cooling solutions to serve AC and DC power electronics applications where Wide Band Gap (SiC, GaN) and Silicon (IGBT, Thyristors) technologies are used for power conversion. We are tailoring our solutions to the specific needs of the most demanding markets and applications:

- Industrial Power Conversion
- Rail, aero, marine
- UPS and Motor Drives
- Renewable Energy (wind and solar)
- Silicon Carbide (SiC) Applications
- Military and Defense
- Heavy Duty (EV, HEV, Stradle carrier, mining)
- Electrical Energy Storage
- Telecommunication and data center
- Power transmission / HVDC
- Medical









GLOBAL COMPANY, LOCAL FOOTPRINT

With industrial operations in all major economic regions of the globe, Mersen offers global service with close-to-the-customer support. Each location brings in a specific product expertise. As a global company, Mersen has experts well-versed in both regional codes and international regulations, with quality processes recognized worldwide. Most of the Group's sites are certified for their management systems and adhere to additional industry standards.

La Mure **France**

In Europe, our historic plant is a center of excellence for liquid-cooled and heat-pipe solutions. This facility also serves as an R&D hub, where our experts drive innovation and develop cutting-edge cooling technologies.

Macedon **New York**

In North America, our design and manufacturing plant is a center of excellence for air cooled and heat-pipe solutions. The site is ITAR and can address aerospace and defense markets projects

Shanghai **China**

In Asia, our facility manufactures both air and liquid cooled solutions, helping customers improve their global competitiveness.

Bangalore **India**

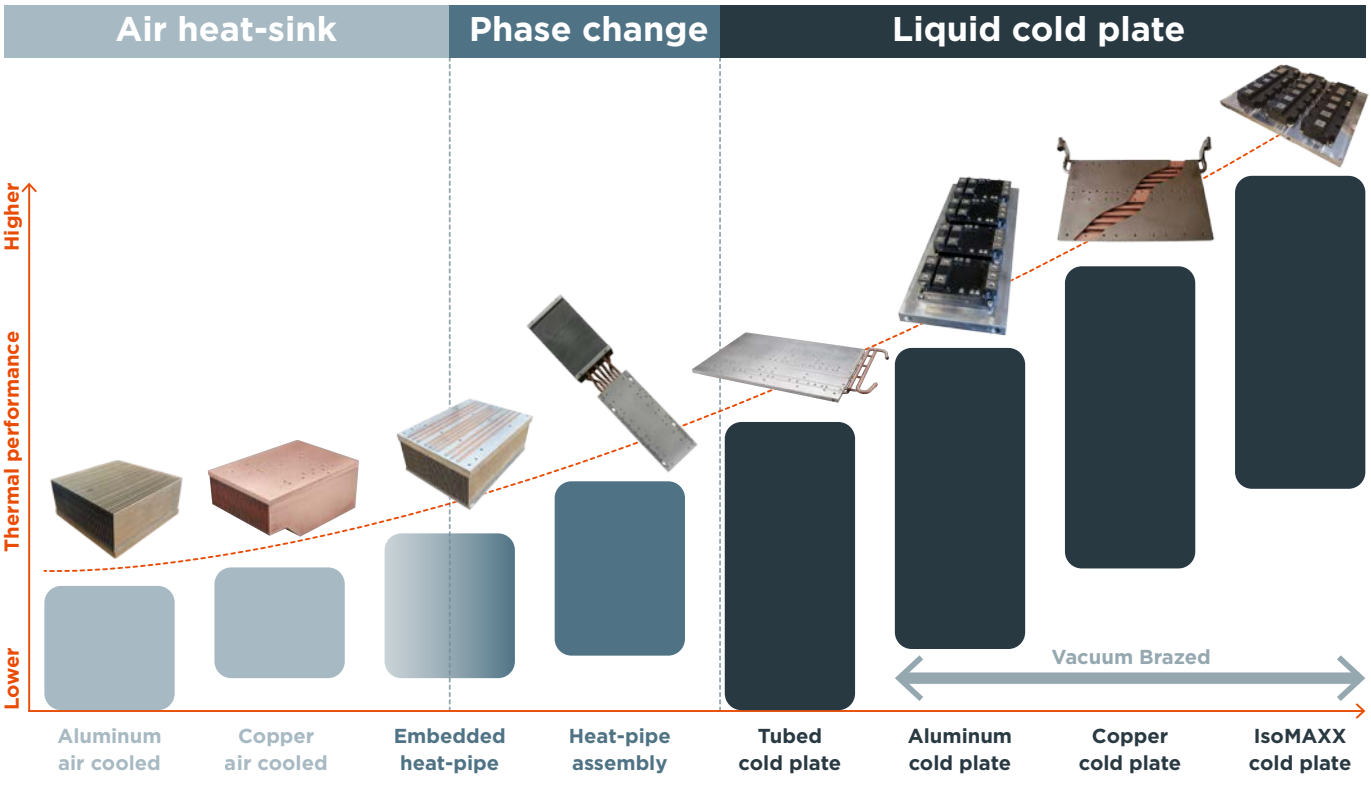
In India, the plant now houses a brand-new production line of air and liquid cooling solutions.

LA MURE, FRANCE	MACEDON, USA	SHANGHAI, CHINA	BANGALORE, INDIA
ISO9001	ITAR	ISO9001	ISO9001
ISO14001	ISO9001	ISO14001	ISO14001
EN9100	AS9100		IRIS

STREAMLINE YOUR COOLING NEEDS WITH A SINGLE, EXPERT PROVIDER

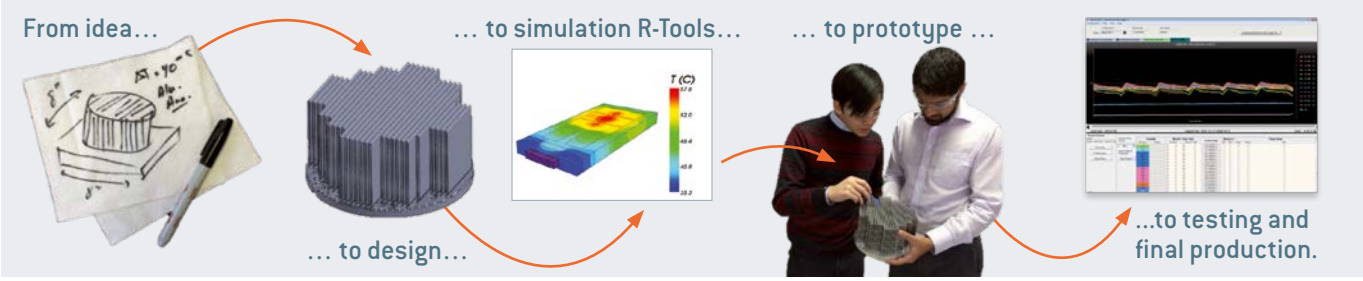
Mersen integrates its extensive cooling expertise and patented heat sink technology into semiconductor and battery-related applications to make them more efficient, reliable and profitable. Mersen's engineering team will help you find innovative cooling solutions, work with you to design the performance boundaries and even simulate your application before a prototype is built. Our unique knowledge of air, phase change and liquid cooled heat sinks enables Mersen to help you find the right thermal protection solution for your application.

Cooling Technology	Characteristics
Air Cooling	Mersen's air cooled heat sinks come in a variety of sizes and materials. Our Fabfin® design incorporates our patented swaging technology so that the fins are mechanically secured to the base plate, eliminating the need for less efficient bonding or gluing agents.
Embedded Heat Pipe	By incorporating heat pipes onto the surface of an air cooled heat sink, high concentration of heat from power electronics can be spread out over a larger area are very quickly. This cooling technology is ideal for SiC and Power Amplifier applications.
Heat Pipe Assembly	Our Heat Pipe Assembly Technology provides a robust, long lasting and self-sustaining cooling solution in applications where more cooling performance than standard air cooled heat sinks is required
Liquid Cooled Cold Plates	Mersen's Cold plates are selected where there is availability of coolant and/or superior cooling performance is required. Both tube and vacuum designs are available.
Heat Frames & Chassis	Ruggedized heat frames and conduction-cooled chassis are engineered for aerospace and defense applications, providing essential protection against shock and vibration while ensuring efficient thermal dissipation.



ENGINEERING SERVICES

FROM DESIGN, TO PROTOTYPE, TO PRODUCTION



Mersen is ready to assist customers throughout the development of the solution they need: from the earliest stages of identifying needs right through production and logistics at the end of the process. Participation in thermal research groups and design work on several demanding thermal applications all over the globe, means we can offer the widest variety of adapted competitive designs.

Mersen is capable of completing thermal testing for all air cooled products and heat pipe assemblies in-house using their new thermal lab.

Mersen designs, builds and thermal test prototypes to ensure our customers' performance needs are met.

Find out how we can help you, contact us today at:

North America – USA

Email: cooling.roc[a]i.mersen.com
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Europe - France

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Applications Support Tel: +33 0 4 76 81 45 45

Asia - China

Email: sales.songjiang[a]mersen.com
Applications Support Tel: +86 21 6760 2388

Asia - India

Email: Rohit.mokashi[a]mersen.com
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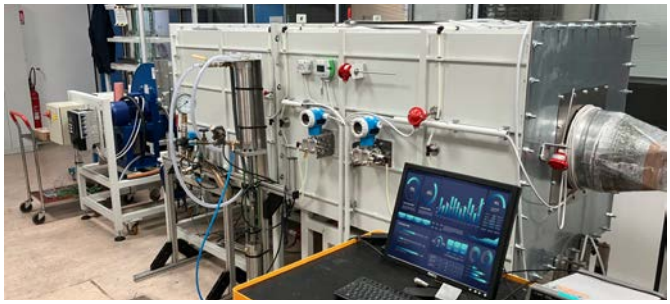
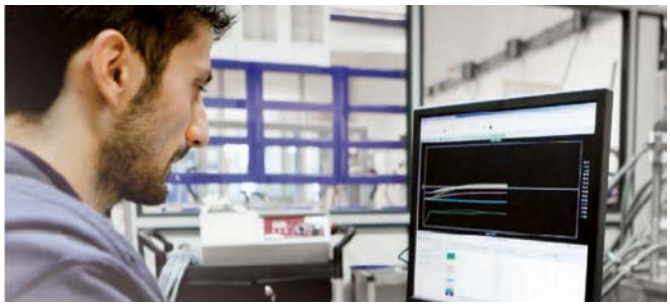
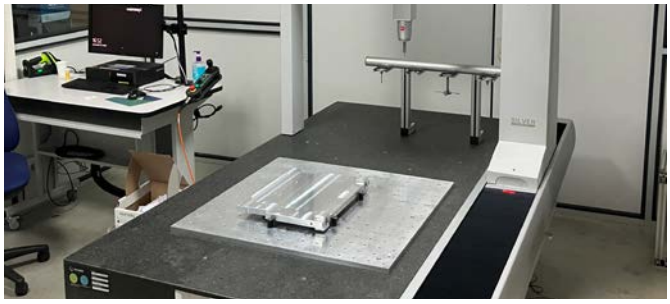
Wind tunnel testing lab & Liquid cooling loop



Test Data collection and reports



Prototype and Production Quality Assurance

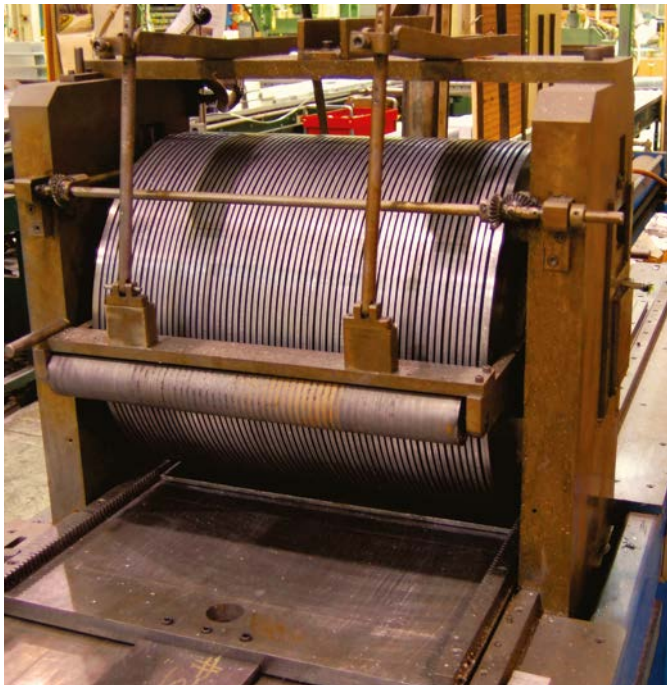


Close collaboration with customer at every stage of design

AIR COOLING SOLUTIONS

Our Swaging and crimping Process
For maximum thermal conductivity

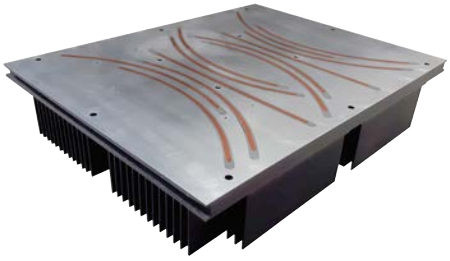
Developed and patented by Mersen, our swaging and crimping process boosts the efficiency of air-cooled heat sinks with thinner, longer fins on denser or mixed metals to get maximum thermal conductivity while keeping weight down. The swaging technology used on our Fabfin® heat sinks eliminates bonding or gluing interfaces between fins and base plate thus providing a much more robust design, suitable for use in higher operating temperature in Silicon Carbide (SiC) Applications. The glue-less swaging and crimping design ensures long life-time in harsh environments.



Mersen Embedded Heat-pipe air heat sink

- Best-in-class custom air cooling method for higher power density modules (latest IGBT gen. & SiC)
- Homogenous heat spreading across the baseplate. No hot-spot
- Cost and weight effective cooling solution vs. copper air cooled heat sinks
- Get the full thermal benefit of the size of the heat sink
- Maintenance-free, extremely robust against thermal cycling and shock & vibes
- Heat-pipe insertion and gluing performing up to 100°C
- Embedded Heat-pipe solutions able to meet the life test requirements
- Accurate simulation model now showing ±5% max. deviation between experimental and numerical results

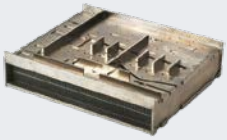
Air-cooled heat sink



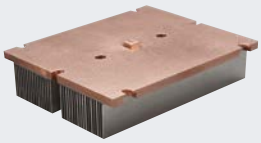
Embedded Heat Pipes Heat Sinks

Other customizable solutions available for specific customer needs

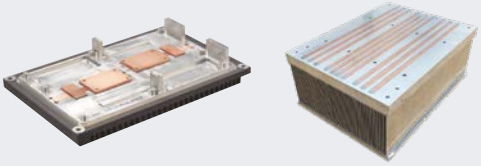
Copper



Integrated Module



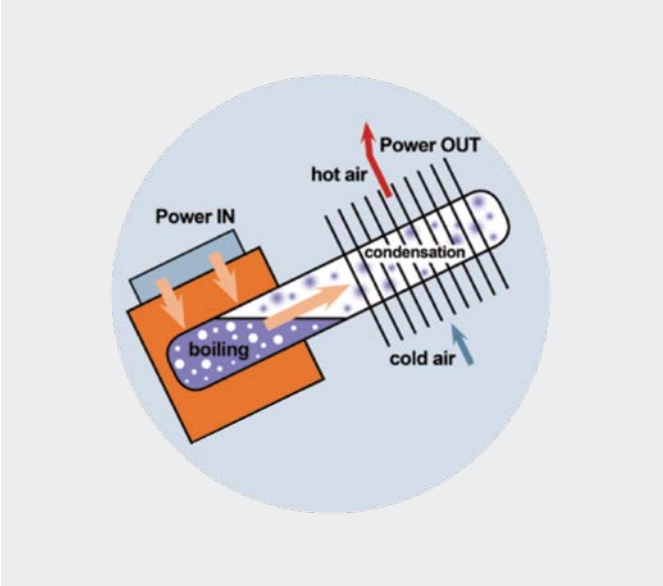
Mixed metals



Embedded heat-pipe solutions

PHASE CHANGE SOLUTIONS: HEAT-PIPE ASSEMBLIES

FOR FAST ACTING COOLING PERFORMANCE



Heat pipes - instantaneous cooling action

The high heat losses from press-pack, IGBT or SiC power devices can easily be conveyed outward via heat pipe cooling units. A heat pipe is a device that uses “phase change fluid” to efficiently conduct large amounts of heat between two solid surfaces.

A heat pipe consists of an enclosed tube containing a liquid (methanol, water) in a vacuum. The liquid absorbs thermal energy from the heat sources and boils rising towards the condenser. Air cools the condenser section, condensing the fluid back to a liquid which travels back to the evaporator by gravity. This is a sealed self sustaining process.

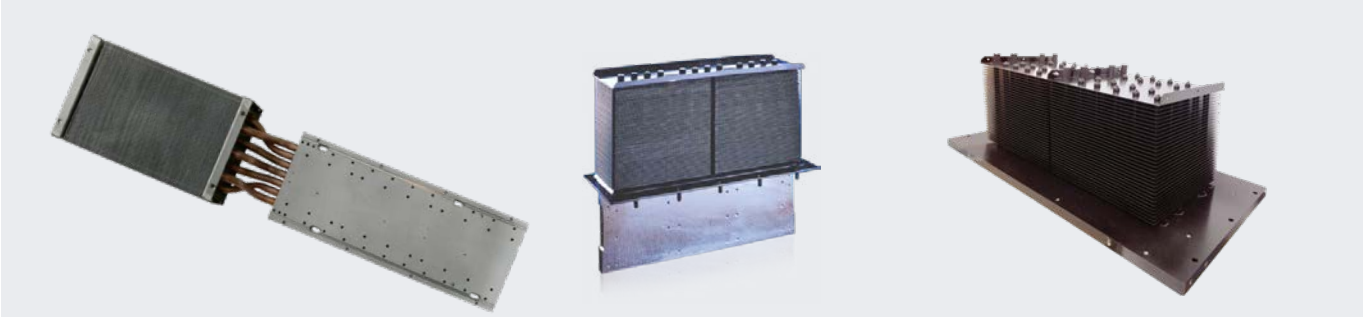
Best fit and function every time!

All heat pipes assemblies are custom built in house to meet customers unique specifications:

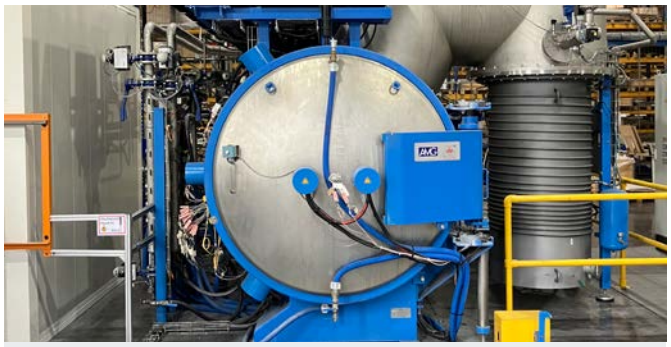
Advantages

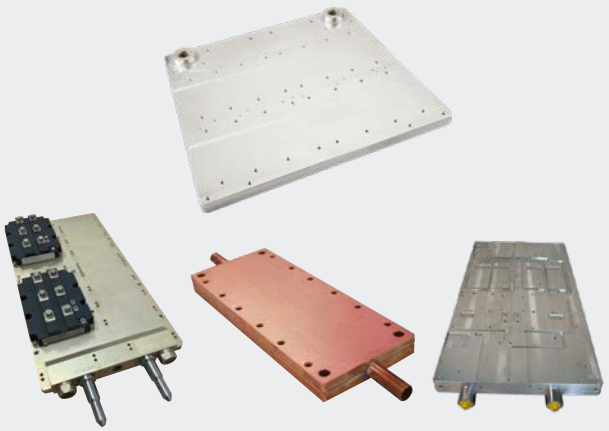
- High thermal performance – superior to standard air cooled products
- Convection boiling resulting in instant cooling action
- Uniform temperature distribution under components
- No maintenance compared to liquid cooling systems, as heat pipes are self sustained devices and require no external water pumps or tubing
- Used in Transportation, Military, or any application requiring a robust cooling solution

A range of phase change cooling solutions to meet your needs:

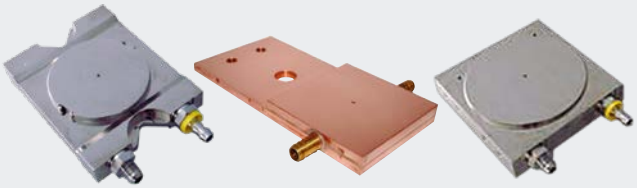


WORLD LEADER IN VACUUM BRAZING

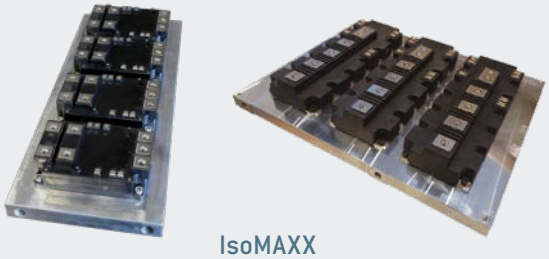




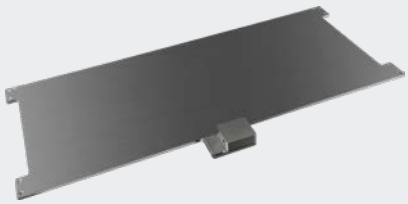
For screw mounted components



For press packed components



IsoMAXX



Battery cooling cold plate

Our vacuum brazing offers reliability and lasting performance

Power electronics components (SiC, IGBTs, thyristors) need a cooling solution that is both effective and reliable, especially when installed in a confined space. To ensure maximum reliability, Mersen has mastered vacuum brazing technology for liquid cooled solutions to achieve guaranteed water tightness with no seams, robustness, corrosion free, and excellent thermal performance.

Aquamax® - Aluminum and Copper

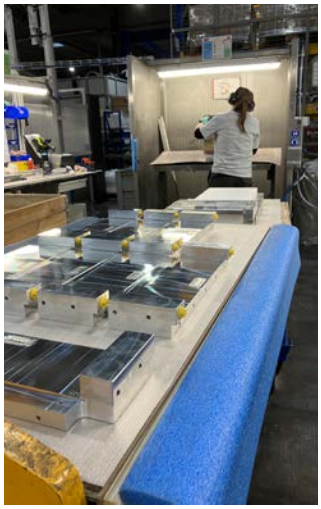
Aquamax technology in copper and aluminum versions provides maximum thermal performance employing proprietary channeling techniques to optimize coolant velocity at low head loss while providing uniform temperature across the mounting surface. Precision machining techniques used at the vacuum braze, flux free, interface ensure leak and corrosion free construction.

IsoMAXX / LV100 MAXX - Aluminum

IsoMAXX vacuum brazed cold plates are specifically designed to provide an efficient cooling pattern below the newest PrimePACK™ IGBT and LV100 modules.

Benefits

- Unparalleled thermal homogeneity
- Superior thermal performance
- Optimized pressure drop
- Compact design
- Modular solution
- Cost competitive



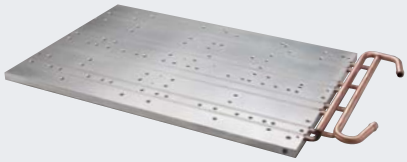
TUBED COLD PLATE COST-EFFECTIVE AND FLEXIBLE SOLUTIONS

Aquasurf technology offers low to medium performance requirements at cost effective solutions. Flexibility in design, customized tube patterns, two-sided cooling options on tube material (copper, aluminum and stainless steel) are all part of the many advantages of the Aquasurf line of cold plates. Copper, aluminum or stainless steel tubes are embedded in the surface of an aluminum plate to provide the lowest thermal resistance between the semiconductor mounting surface and the cooling liquid. Tubes can be bent into complex arrays to ensure the cooling surface is directly under the semiconductor chips.

Benefits

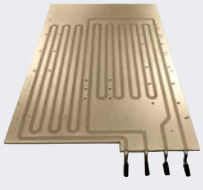
- Cost-effective design
- Lower weight than all-copper solution
- Flexibility in the tube layout and configurations
- Aluminum, copper and stainless steel available
- Tubes mounted flush with surface to minimize
- Thermal resistance to cooling fluid
- Two-sided cooling

More options for achieving the lowest thermal resistance...



copper tubes / copper-nickel

Aluminum tubes

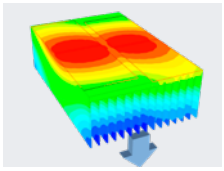


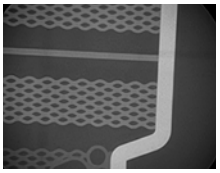
Stainless steel tubes

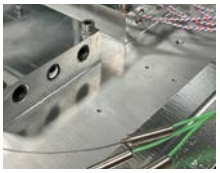
SIMULATION AND TEST CAPABILITY: COMPLETE TOOL-SET FOR COOLING DESIGN

MERSEN PROVIDES STATE-OF-THE-ART SIMULATION AND TESTING CAPABILITIES TO ENSURE OPTIMAL THERMAL MANAGEMENT.

Our dedicated thermal laboratory enables precise validation of cooling solutions, while our advanced R-TOOLS MAXX software offers rapid, data-driven thermal analysis for design optimization.







Thermal Laboratory Testing Capabilities

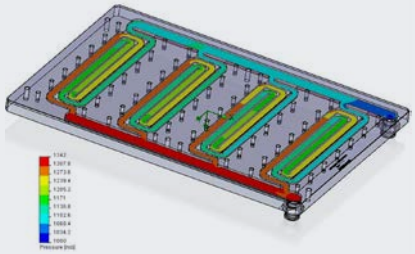
Type tests validate that the heatsink and cold-plates will meet the thermal requirements before and after completing life tests such as the following:

Thermal
- Thermal Resistance
- Temperature Cycling
- Thermal Shock
- Cold Start Test

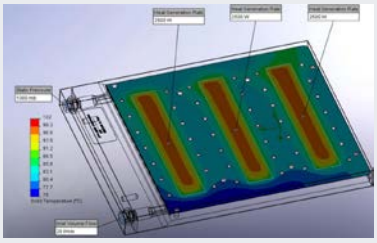
Fluidics
- Pressure Drop
- Pressure tightness
- Pulsating Pressure
- Burst Test

Mechanical & Electrical
- CMM
- XRAY imaging
- Micrography
- Ultra sonic test
- Dielectric measurement

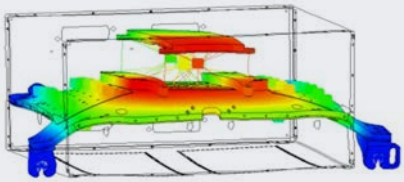
Computational Fluid Dynamics (CFD) Modeling & Simulation:



Hydraulic Simulation



Thermal Simulation



Mechanical Simulation

Interactive and Free on-line thermal design software

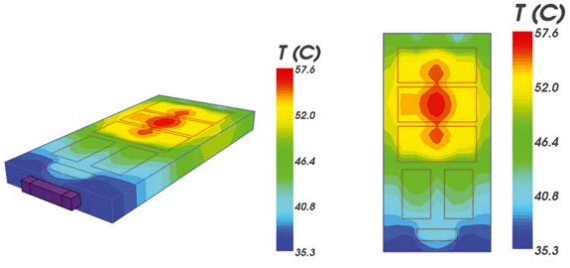
R-TOOLS MAXX is a no-charge, on-line simulation software that allows users to model the optimum air and liquid cooled heat sink solution tailored to their project requirements. The simulation results aid in reducing design time and increasing the reliability of the finished heat sink product, all before the first prototype is even built.

- Understand and communicate the thermal behavior of your designs with the aid of visualization tools
- Quickly & accurately model various heat sink configurations
- Convenient 24/7 online access
- Easy to use
- Test various designs before committing valuable resources

www.r-tools.com

R-TOOLS MAXX

AIR AND LIQUID COOLED HEAT SINK SELECTOR TOOL



Liquid Cooled Thermal Data

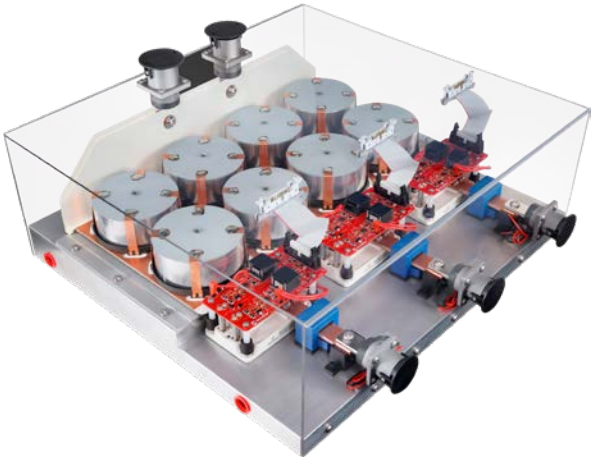
POWER STACK DESIGN, MANUFACTURING & TESTING - EVALUATION KITS

MERSEN SiC POWER STACK REFERENCE DESIGNS HELP INVERTER DESIGNERS

Save time and confusion in selecting individual components.

As a key partner for power electronics manufacturers, Mersen offers state-of-the-art solutions to improve system performance, efficiency and reliability or to capture the value of various new technologies. One of these achievements is the new SiC 150 kVA Power Stack Evaluation Kit V2.0. It aims at helping everyone taking quickly benefits of SiC while developing a new power conversion project.

When it comes to designing power inverters, our customers require power stages or power stacks with enhanced power density (kW/liter) while minimizing conversion losses (Efficiency %), reducing cost ($/kW) and shrinking size and weight of the overall system.



Thanks to its undisputed reputation in bus bar, cooling, high-speed fuses, capacitor design, and manufacturing, Mersen is your preferred partner to assist you during the development phase of your Silicon, Gallium Nitride, or Silicon Carbide-based Inverter/Stack, bringing a technical cross-expertise on these 4 key products to push the optimization to the limit.

150 kVA SiC Eval Kit V2.0: a pre-configured solution that streamlines development

The fully programmable Mersen SiC Power Stack Evaluation Kit enables inverter designers to accelerate their product development by relying on a pre-designed, pre-qualified industrial Power Stack. Augmented by imperix® control and development environment, the Power Stack can easily be programmed and operated, reducing the product development cycle.

150 kVA – 1.2 kV SiC Power Stack Evaluation Kit V2.0

WITH MERSEN HELP, DESIGNERS CAN GREATLY BENEFIT FROM A SOLUTION THAT IS OPTIMALLY PREDESIGNED FOR THEIR SPECIFIC APPLICATION.

MERSEN
Expertise, our source of energy

GLOBAL EXPERT
IN ELECTRICAL POWER
AND ADVANCED MATERIALS

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