VITA 48.2 Heat Pipe Ice Lake Module

Intel Xeon Idaville LCC 10 "Ice Lake"

3U VPX

70W+ Thermal Design Power

85°C
Cold wall temperature

100%
Power dissipation increase

FULL
Ice Lake Thermal Power Managed

About Our Partner

Our customer designs a range of high-performance Intel processor boards, switches, networking, storage and software products for use in embedded computing solutions. Their products are used by many of the world's leading integrators within the Defence, Security & Industrial markets and are designed to be operated in a range of temperatures and environments, from benign to extreme rugged.

Standing Out

In a never-ending search for more power and functionality, utilising Intel's server class devices on a VPX module is a holy grail for developers who want truly market leading performance. Our customer identified the potential of the Intel Ice Lake architecture as an **opportunity to stand out from the rest of the field**, as the increased processing power from this CPU offered the change to outstrip other modules.

In order to keep their hard-eared reputation as a rugged supplier, our customer looked to extract the maximum performance out of a device which typically limits the system to a more benign environment. To achieve this they sought out **expertise from partners who had a proven record in implementing heat pipes** into embedded systems, thus minimising the risk of adopting this new technology.

Do It Right

Our customer needed a high-performance solution that worked. It was important to them that development time was minimised and technical risk mitigated, to avoid the pitfalls other adopters had encountered when attempting to utilise heat pipes. Importantly it was key that the design process was transparent to our customer so they learned from it, and could implement heat pipes across their product range when the need arose.

Our customer had found that while many third parties were able to support them in developing a heat pipe solution, **accessing the IP for themselves and self-educating the department was not an option**, thus diminishing the value to their business.

Using Proven Class

To ensure a fully functional solution, the third party solution needed to consider the full range of a heat pipe design process, from design integration to supply chain quality.

Entropy's engineers have delivered fully validated heat pipe solutions to a number of leading embedded VPX

entropy

Entropy Headquarters
Silverstone Innovation Centre
Technology Park, Silverstone,
United Kingdom, NN12 8GX

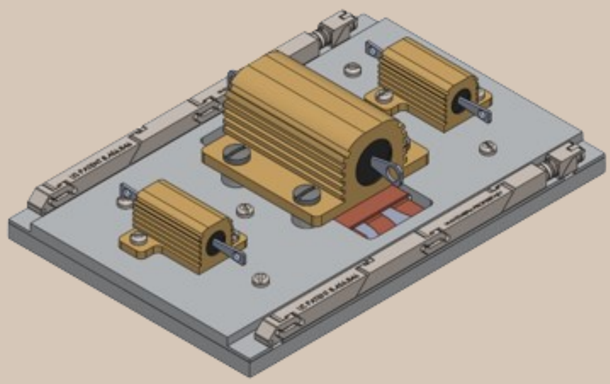
Contact:
T: +44 (0) 1327 760 021
E: info@engineeringentropy.co.uk
www.engineeringentropy.co.uk

developers. With our open and communicative practises, we were able to provide our customer with clear descriptive information of how the design is developed and how quality should be identified and maintained. With our history of delivering these solutions, we were able to pair our customer with a suitable manufacturing partner who could not only deliver a full heat frame, but would be able to deliver consistent quality of performance which is often the downfall of an idealistic design.

The design process for ideal heat pipes considers a number of factors to ensure optimal performance:

- **Component position** is obviously key, as tall devices may physically block the available routing of the heat pipe through the heat frame.
- **Pipe diameter & geometry** must be selected for both thermal performance and mechanical constraints. Bend radius, sealing port length, wall thickness and wetted area are all considerations which may contradict simply the highest power carrier.
- **Number of pipes** must be considered carefully. Increasing the pipe count increases the total power carrying capacity, however makes it difficult to spread the heat to all evaporator zones.
- **Orientation & acceleration** must be considered in the routing of the pipes. High G loading for avionic applications impact the power carrying limit of the pipes, and the design must allow for this.
- **Minimising system resistance** by controlling contact surfaces and interface materials maximises the heat flow in and out of the pipe. This allows maximum efficiency and the lowest possible temperature drop.

It's Not Just About the Pipes



Isometric view of the thermal load rig created to test and validate the heat pipe frame. Isolated testing such as this is key to validate the performance & quality of the heat pipes themselves as supplied.

Calculating and sizing the correct heat pipes is only part of the overall challenge. Ensuring the heat reaches the working fluid of the pipe and can get to the cold wall is the bigger battle. Incorrectly integrating the heat pipes, or **poor thermal management of the devices can create a large thermal resistance stack-up which invalidates the heat pipe functionality** – and sometime even renders the solution worse. This often creates the false pretence that "heat pipes don't work". Entropy are able to prove this statement incorrect, and helped our customer develop testing rigs and instructions to maintain and monitor excellent pipe performance at source. This quality control **saved a huge amount of anticipated engineering time** debugging thermal issues, while **minimised the technical risk of adopting new technologies**.

Ultimate Performance

We delivered a heat frame design which could support extraction of above 70W thermal power with a system temperature drop of just 6°C. This performance allows lidded devices such as the Intel Ice Lake to **operate at full frequency at the maximum operating temperature of +85°C cold wall.**

With this design, the training provided to their engineering team, and quality assurances with supply chain, our customer is now **ready to implement extremely high performance** across their product range to continue their push to be one of the world's leading integrators.

Entropy Headquarters
Silverstone Innovation Centre
Technology Park, Silverstone,
United Kingdom, NN12 8GX

Contact:
T: +44 (0) 1327 760 021
E: info@engineeringentropy.co.uk
www.engineeringentropy.co.uk