6U VITA 48.2 Conduction Cooled Coffee Lake

Intel Xeon E-2176M "Coffee lake"

6U VME

35W Thermal Design Power

10°C
Cold wall temperature increase

2.7GHz
Clock speed at maximum temperature

ZERO
PCB layout changes

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.

Leading From the Front

In a competitive COTS (Commercial-Off-The-Shelf) environment, **ensuring products keep pace with or even exceed functionality of the competition** is essential to ensuring winning program success.

To remain at the forefront of high-performance solutions, our customer looked to greatly improve the technical capability of their products in both wider operating window and flexible functionality by investigating new technologies and applications through which to diversify their portfolio. Our customer's prime goal was to increase their program win likelihood and, by extension, **expanding their potential operating limits**.

In order achieve this mission our customer began growing their onsite engineering expertise while re-evaluating the thermal capability of a number of their existing Intel boards. They started by identifying popular products whose market potential could be improved not necessarily by a root and acorn redesign, but by increasing the operating temperature at which they achieve maximum clock speed.

Finding the Right Talent

With over 35 active VPX, VME and CPCI products and a litany of mezzanine cards to support, our customer already have a broad product set for their engineers to maintain and manage. While maintaining excellence in ruggedization was a key company goal, they were also considerate that support to their extensive existing customer commitments must not be sacrificed. This created a resource and technical capability vacuum: **their engineering team was already working at high capacity**, restricting resource available to support new thermal and mechanical design, while the **non-recoverable cost of training and educating a non-specialised design bureau simply did not make sense**.

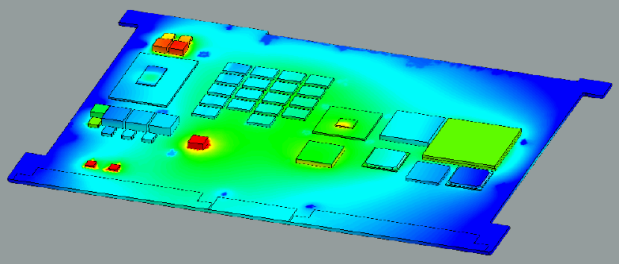
entropy

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

Sourcing a design partner who had **explicit expertise in the Military Embedded world and a proven track record of high-performance thermal design** was essential for our customer to ensure they would guarantee results, with minimal support needed from their team.

The VPB7x, an Intel Xeon E-2176M based VME 6U card, was an ideal candidate for a performance enhancement as it shared architectural similarities to other products in their range. A similar Coffee Lake card in our customer's portfolio had exhibited clock speed throttling at a +85°C cold wall and our customer **acted fast to find a resolution** that would pre-empt not only the upcoming VPB7x card, but ensured the design could be relayed back to the existing product issue.



Surface plot showing temperature variations across the PCB. The CPU temperature has been reduced significantly below other devices

The Entropy Process

Entropy were an ideal partner to support our customer in their endeavour for higher ruggedization, with the trust that onboarding of the design requirements and expectations would require minimal input.

We were able to quickly support our customer with creation and writing of a project Statement of Work (SoW) that suited both parties, allowing engagement to start just a short time after the initial approach.

STEP 1: **Exchange all component data** needed to complete a comprehensive thermal study, as detailed clearly in our **Data Requirement Document**

STEP 2: **Complete a Calibration Simulation Model** using real test data from a similar architecture using your standard Thermal Interface Materials and processes. This allows us to adjust model parameters to the test set-up giving an extremely high degree of accuracy.

STEP 3: **Create Lowest Common Model** using familiar processes and materials, with a focus on unit mass and cost. The more aligned we can be to your internal production processes and options, the easier technology integration will be.

STEP 4: **Identify Critical Thermal Chokes** is a key factor in thermal design. Resolving the thermal path closest to the CPU gives the best chance of optimal design. Understanding the pressure and loading required at the die interface to achieve low thermal resistance has been developed through numerous product iterations.

STEP 5: **Wedgelock Selection** can be an underrated factor in correct cooling applications, with a significant amount of heat lost across the dry boundary between card and rail.

STEP 6: **Optimise for Peripherals** by carefully considering the impact of additional thermal interfaces. Increasing the number of thermal contacts can increase assembly complexity, however just a **10°C increase in temperature can halve reliability and operating life.**

A More Rugged Product

Applying our expert knowledge of electronics cooling, the thermal resistance network of the solution was dropped significantly. The **operating temperature of the module increased by 10°C.**

A novel two material design assembly allowed utilisation of **up to 50W XMC loading without impact to the operating window**. This allows the module great functional flexibility when selecting additional mezzanine cards.

Entropy's high commitment to customer engagement gave our customer the opportunity to discuss and feed back test information as the product was built, and led to further collaborations on more challenging products.

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