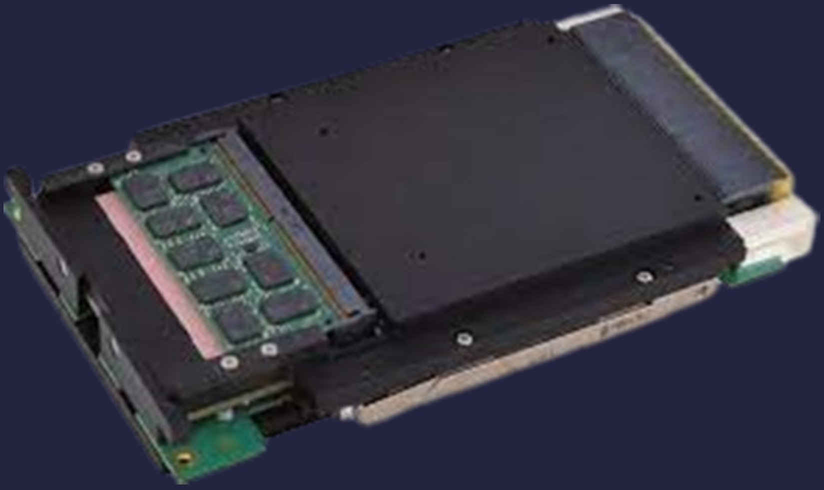
VITA 48.2 Conduction Cooled Sky Lake Module



Intel Xeon E-1505M "Skylake"

3U VPX

45W Thermal Design Power

55°C
Cold wall temperature **increase**

0.3lb
Total mass increase

ZERO
PCB layout changes

About Our Partner

Our customer is a multimillion-dollar international corporation that combines more than 50+ years of process and control experience with high-tech computer design. They design and manufacture high-performance embedded computing products for CPCI, VME and VPX systems, as well as SWAP-optimized customisable computers for deployable missions.

Acromag wanted to **improve the products in their portfolio with minimal cost or impact to their customers.**

Changing products which are already certified and in customers hands can be concerning for some, and so Acromag took the necessary steps to use trusted partners who had **delivered proven quality work on similar products.**

Zero Customer Impact

Our customer already delivers a wide range of high performance industrial embedded products to a wide market and have identified the Defence VPX sector as space to grow into and share their expertise.

Their current VPX COTS product is based on the 6th Gen Intel "Skylake" Xeon E processor. While this system is successfully deployed in a number of avionics programs, our customer recognised that applying retrospective improvements to the thermal solution would incur **minimal impact on existing customers while greatly increase the viability of the product in the wider market.**

The module employed a novel multi-mezzanine approach for the Intel architecture which greatly increased the available area for functionality and I/O, and flexibility of the module functionality, however placed additional strain on the thermal solution implemented.

The module was showing good capability but certainly had room for improvement on the thermal side.

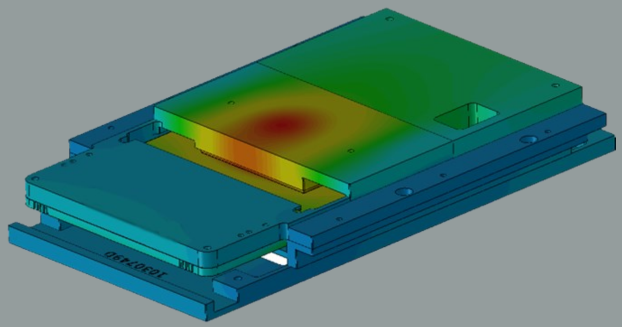
In order to ensure their customers were not impacted and that any re-qualification was kept to an absolute minimum, **no changes we allowed to the board layout or architecture whatsoever.** The thermal solution Entropy could apply must be limited to the interface between the critical devices and the external cold wall clamped at the retainer edge.

Our customer needed a redeveloped yet **impactful thermal solution that did not increase BOM cost or hinder the customer experience.**

Validating Against Test

Having validated our capabilities by supporting our customer on achieving high-performance solutions on newer Intel architectures, Entropy were selected to extend our support to this project as well.

With available assembly information and test data, we had an ideal opportunity to gain first hand feedback on how the unit already operated. Using this information, we constructed a detailed thermal model of the real system allowing us to clearly identify the areas of greatest thermal resistance.



Surface plot showing temperature variations across the heatsink. A solution requiring transfer from the rear cover as well as tight tolerance controls on the thermal interface was required.

STEP 1: **Interpret existing assembly and manufacturing drawings** for materials used and good practise .

STEP 2: **Develop a detailed thermal model** representing the current unit conditions.

STEP 3: **Determine areas of high thermal resistance** or temperature loss using this model which will be the focus of new study.

STEP 4: **Evaluate available technical options** using both good fundamental principles and our market expertise. This step requires outstanding knowledge of the modules being developed and first-hand experience of implementing solutions, to determine the performance impact of each.

STEP 5: **Discuss and communicate the relevant impact of each solution** with our customer for validity. Solutions which drastically impact mass for example are not viable for an avionics application .

STEP 6: **Mechanical design and delivery of manufacturing drawings**. Solutions need considered mechanical design to correctly function through bring up and deployment. Our support includes tolerance stacking, manufacturing reviews, material supply chain support and assembly feedback.

A More Rugged Product

The uniquely interchangeable nature of the mezzanine card provided additional difficulties for a typical VPX design. Raising the position of the CPU with respect to the Primary Board Surface restricts the available material for conduction, while power hungry components on the rear side of the carrier card (Primary Board) needed a parallel conduction solution to extract the heat all the way round the board to the wedgelocks. This multi-board approach created a considerable tolerance stack which would typically be minimised in new designs.

Careful consideration of the interface materials chosen, and precise control of machined surfaces and thicknesses, allowed a multi-part assembly to be developed which minimised thermal barriers and mass, while did not increase complexity of assembly or manufacture.

Maximising the available material space and applying world-class interface controls at the CPU **increased the operating temperature of the module at full performance by 55°C** from the existing design, a significant improvement on existing operating capability with only a slight increase to the overall module mass.

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