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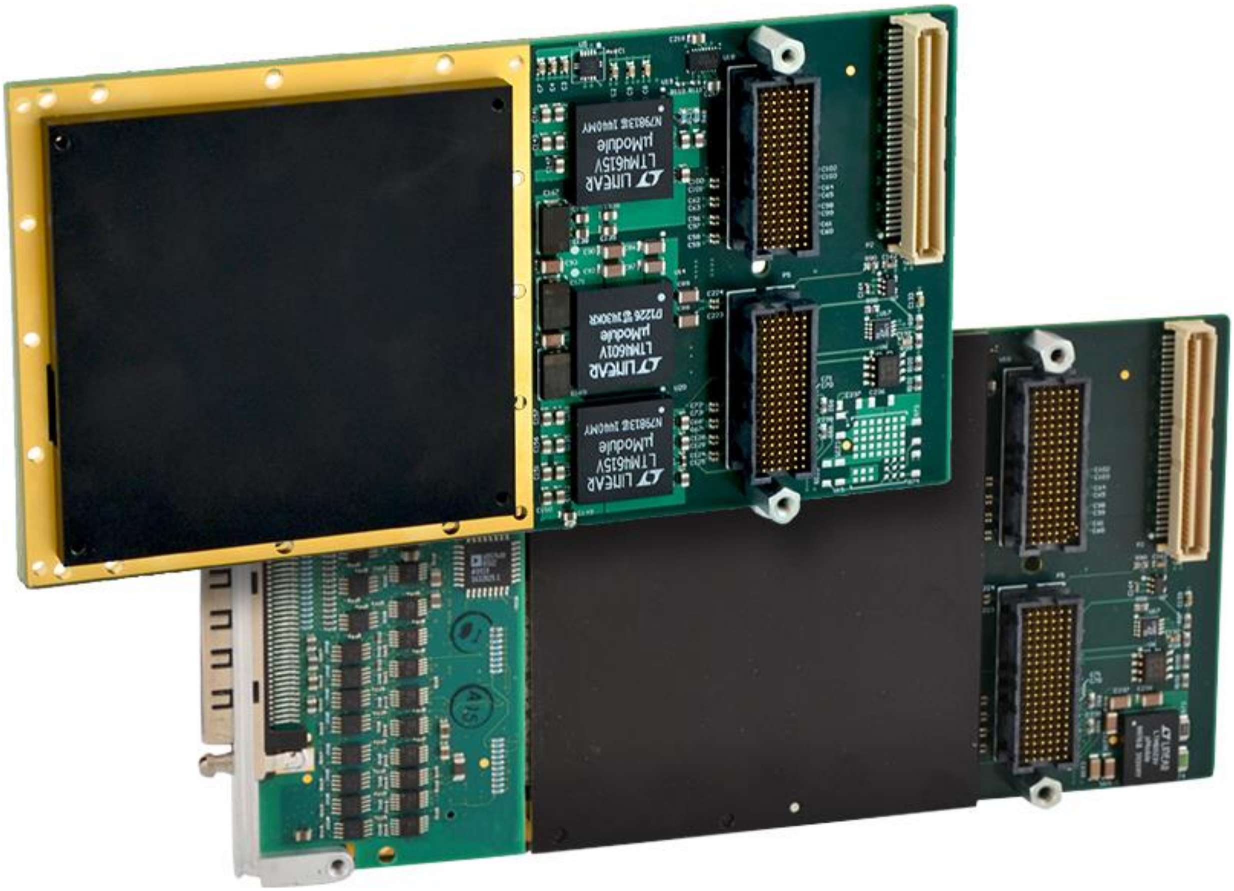
Keeping Heat in Check: Conduction Cooling Expands Application Boundaries

Current application demands of XMC Mezzanine Card (XMC) modules have grown from the simple addition of I/O and low-level communications to the servicing and off-loading of high performance software defined radio (SDR), digital signal processing (DSP), co-processing, and now re-configurable FPGA-based computing with gigabit interfaces. This trend of putting more and more processing power on XMC modules has led to new challenges keeping these computer hot rods cool. Standard, or commercial-grade, modules typically accommodate operation in lower temperature environments while industrial-grade models will tolerate a higher temperature range. However, many applications require additional steps to keep board temperatures within acceptable ranges.

High performance computing applications generally consume more energy and thus generate more heat, yet these same applications often require condensation into smaller physical sizes which complicates cooling. When these electronics are installed in mobile military machinery such as Humvees, tanks and UAVs which are regularly exposed to extreme environments, the risks of overheating are compounded. Uncontrolled heat buildup can quickly destroy high priced computers.

A number of technologies have been developed to deal with heat buildup, including forced air cooling, conduction cooling, and liquid cooling. Of these strategies, conduction cooling is the one technology which has been deployed and standardized to meet these new demands and make it possible for system design engineers to keep generated heat in check.

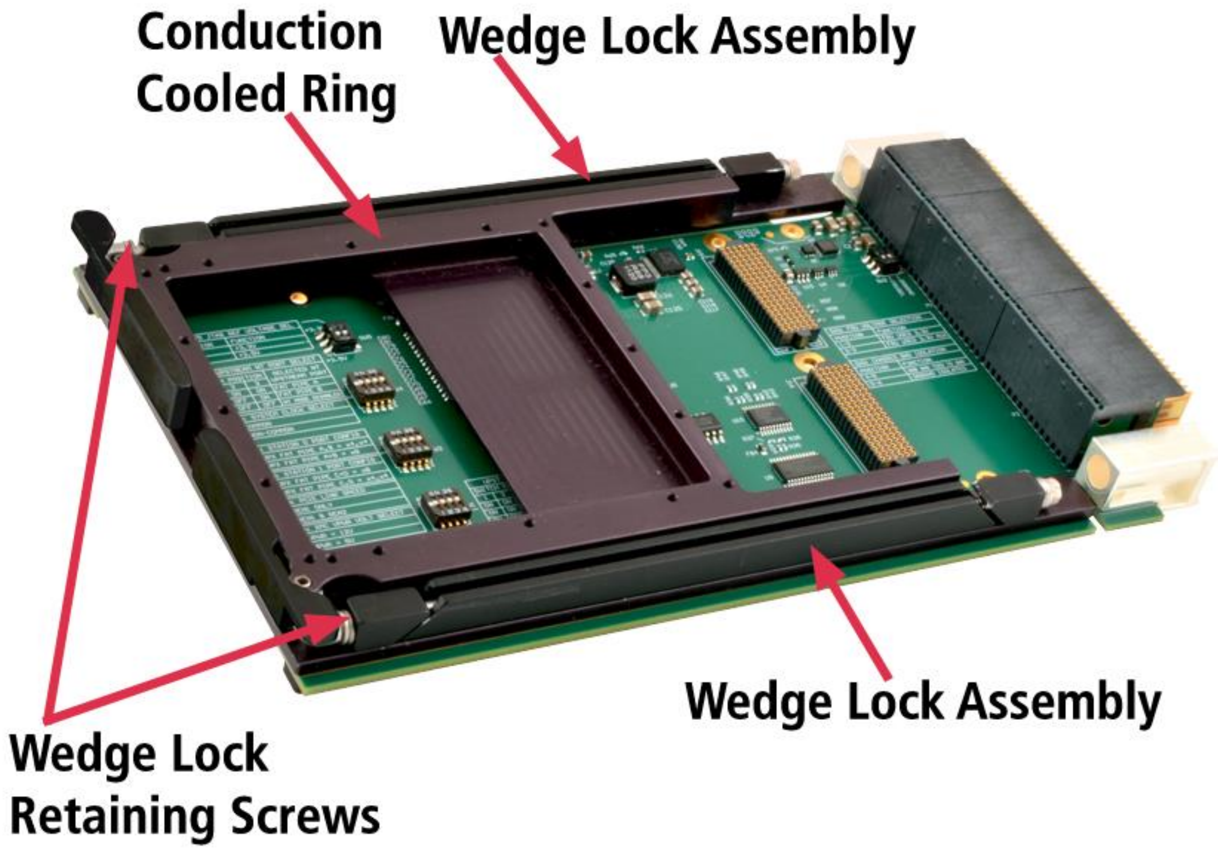
The ANSI/VITA 20 Conduction-Cooled XMC (CCXMC) Specification is designed so that heat generating components on XMC modules are connected to metallic thermal planes within the XMC. These thermal planes connect to a conduction-cooled ring surrounding an area dense with high-energy components. In conventional conduction-cooled applications, I/O is mapped to the rear I/O connector and front I/O is not used.



Acromag FPGA XMCs shown with and without plug-in AXM I/O extension modules

Despite the presence of the conduction-cooled ring on the XMC, these modules may be used in both conduction-cooled and convection-cooled applications.

CCXMC carrier cards have a mating component fixture for the conduction-cooled ring found on the CCXMC. When the CCXMC module is secured to the CCXMC carrier card, heat generated on the module conducts through the thermal plane, to the conduction-cooled ring, into the mating fixture, and then to the wedge lock assembly of the carrier card. When the carrier card inserts into a conduction-cooled chassis, screws located at opposite sides of the carrier secure the wedge lock assembly creating a contact thermal conduction path for dissipation of heat from the CCXMC. The conduction-cooled chassis serves as a thermal energy reservoir which, when appropriately cooled, initiates the conductive cooling process for the CCXMC module.



Acromag's VPX4812A-CC-LF 3U VPX Conduction Cooled XMC Carrier Card.

In the photo above of Acromag's 3U VPX carrier card, notice the wedge lock assembly at the two edges of the carrier card, the retaining screws at the front edge, and the conduction-cooled ring which mates with the CCXMC. Several Acromag 6U VPX carrier cards (VPX4821A Series, VPX4840 Series, and VPX4850 Series) include options for holding two CCXMCs are also available and follow the same principles.