Thermal Challenges Overview

• Background – What’s the problem?
  – Module Power
  – Mezzanine Module Power

• Integrated Module Solutions
  – Air Cooled Vita 48.1
  – Conduction Cooled Vita 48.2
  – Air Flow-ByTM VITA 48.7

• VITA 48 Sub-System Solutions
  – Quick reaction development platforms
  – Long term deployment solutions

• Summary
The Creation of SW&P Opportunities...

How do we do more with less?

Size :  ===

Weight :  ↓

Power :  ↑

“Captain…. I’m giving you all she’s got!!!”
VME to VXS to VPX Module Power Progression

Module Power Progression

- Carrier Modules
- Compute Modules
- Graphic Modules

- 1990’s
- 2000’s
- Present
Mezzanine power has doubled every 4 years for the past 8 years!!!
Cooling Technology Effectiveness
A/C vs. C/C vs. AFB

Many of today’s high powered modules cannot be cooled using legacy cooling approaches.
Mercury Module Cooling Techniques

• Air-cooled VITA 48.1
  – Minimize air leakage and bypass areas by increasing effective heatsink area
  – Utilize 3-dimensional integrated heat-sinks
  – Increase air flow (CFM) across the heat-sinks

• Conduction Cooled VITA 48.2
  – Module to chassis interface thermal reduction
  – Improve Wedge-lock performance
  – Control the thermal path for heat dissipation

New Air Flow-By™ VITA 48.1 & 48.7
Integrated XMC Thermal Solutions – Air Cooled

• **Need:** Standards based approach to bring heat from the mezzanine modules to the carrier modules heatsink.

• **Solution:** Add “hooks” for a thermal bridge between the carrier module heatsink and the mezzanine module heatsink.

• **Result:** A thermal solution that is compliant to standards and allow for a wide range of mezzanine modules to be placed on a host while limiting any potential changes to a single component.
Air-Cooled Thermal Analysis Comparison

Without Integrated thermal bridge

With Integrated thermal bridge

5°C Processor Thermal Reduction
½ Order of Magnitude
Impact on MTBF
Integrated Thermal Solutions – Conduction Cooled

• Need: Standards based approach to bring heat from the mezzanine modules to the carrier module cold plate.

• Solution: Take advantage of allowances in ANSI/VITA 20 specification to allow for the thermal ribs to be removable. Add a mezzanine cold plate that is attached to the carrier module cold plate.

• Result: Staying compliant to standards allows for a wide range of mezzanine modules to be placed on a host while limiting any potential changes to a single component.
Integrated Thermal Solutions – Conduction Cooled
“New Solution”

- **Max mezzanine module power:**
  - From: 5-7 Watt Maximum
  - To: 30-50 Watt Maximum

- **Cooling method:**
  - From: Indirect path from a component to the PCB to the cold plate.
  - To: Direct path from the component to the integrated cold plates.

- **Thermal interface area:**
  - From: 2 square inches (legacy solution)
  - To: 12 square inches (new solution)
VITA 48.7 / VITA 48.1 Circuit Card Assembly

- Air is blown over the external covers for dual sided cooling.
- AFB covers wrap around existing modules to maximize re-use.
- 1” pitch modules.
- 200+ W per slot cooling capacity in rugged deployments.
- Designed for optimization of C-SWAP.
VPX Air Flow-By (AFB) QRC Versatility

- AFB modules can be used in commercial VITA 48.1 chassis or in rugged VITA 48.7 compliant chassis.
- AFB modules can be used side by side with standard A/C modules in a VITA 48.1 chassis.
- AFB chassis are capable of providing C/C slots for ease of transition from legacy technologies.

“Oh Captain, she’ll give us over 200 watts per slot!”
AFB provides subsystem level flexibility to allow for higher max ambient OR increased heat load OR decreased fan power...

Mercury AFB Deployment Systems
(11-slot and 13-slot available)

AFB Deployed 13-Slot System Impacts:
• Conduction Cooled to AFB modular upgradability.
• Weight reduction of over 20% (18.4 lbs.)
• Reduced system power by greater than 5%.
• MTBF increased by ½ an order of magnitude.
• Equivalent system footprint to provide a drop-in upgrade.
Thermal Challenges Summary

• By focusing on standard VITA based solutions for cooling today’s high powered modules, Mercury is uniquely positioned to maximize 3rd party leverage and product velocity.

• Mercury is able to apply these solutions across a wide range of products (carriers, high compute devices, graphic modules…) across multiple use cases (air-cooled, conduction cooled, AFB….)

• These thermal solutions allow for VPX systems to be deployed in more extreme environments, operate more efficiently, and last longer than legacy solutions.

Learn more at http://download.mrcy.com/thermal

Air Flow-By is a trademark of Mercury Systems, Inc.
Q & A

Thank You