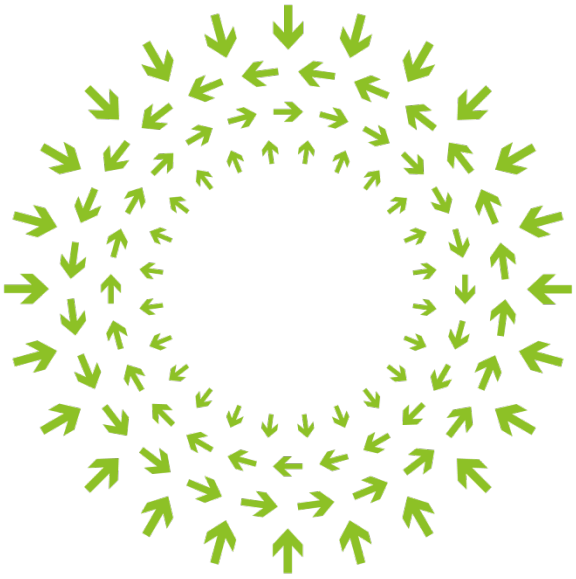

OPEN
Compute Project

Applied Micro
Micro-Server Micro-Module
Hardware v0.3
MB-draco-arrakis-0.3

Author: Applied Micro

1 Scope

This document defines the technical specifications for the AppliedMicro® ARM®64 Micro-Module motherboard used in Open Compute Project servers.

Note-1: This document was based on the OCP Micro-Server Card Specification V0.1 and is subject to change.

Note-2: Sections of this document are dependent on completion of the OCP Micro-Server Card specification, which is currently under review and is available on the OCP website at http://opencompute.org/project_category/server-technology/.

2 Contents

3 Overview

This document describes the Open Compute Project Micro-Server Micro-Module based on the Applied Micro ARM64 SOC. The Micro-Module design takes advantage of device integration on the SOC to achieve a high level of optimization for power, density and compute. Like previous generations of OCP motherboards, only required features are implemented to achieve optimization goals.

3.1 License

As of Jan 16, 2013, the following persons or entities have made this Specification available under the Open Web Foundation Final Specification Agreement (OWFa 1.0), which is available at http://www.openwebfoundation.org/legal/the-owf-1-0-agreements/owfa-1-0:

Applied Micro Circuits Corporation

You can review the signed copies of the Open Web Foundation Agreement Version 1.0 for this Specification at http://opencompute.org/licensing/, which may also include additional parties to those listed above.

Your use of this Specification may be subject to other third party rights. THIS SPECIFICATION IS PROVIDED "AS IS." The contributors expressly disclaim any warranties (express, implied, or otherwise), including implied warranties of merchantability, non-infringement, fitness for a particular purpose, or title, related to the Specification. The entire risk as to implementing or otherwise using the Specification is assumed by the Specification implementer and user. IN NO EVENT WILL ANY PARTY BE LIABLE TO ANY OTHER PARTY FOR LOST PROFITS OR ANY FORM OF INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY CHARACTER FROM ANY CAUSES OF ACTION OF ANY KIND WITH RESPECT TO THIS SPECIFICATION OR ITS GOVERNING AGREEMENT, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE), OR OTHERWISE, AND WHETHER OR NOT THE OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

4 Micro-Module Features

The motherboard, built with the Applied Micro X-Gene™ SOC, was designed as the Micro-Module component of the OCP compliant Micro-Server chassis. For more details on the OCP Micro-Server chassis and components, see http://opencompute.org/project_category/server-technology/

4.1 Block Diagram

Figure 1 illustrates the functional block diagram of the Micro-Module board.

Placeholder for card Block Diagram

Figure 1 Micro-Module Functional Block Diagram

4.2 Form Factor

The motherboard's form factor conforms to the Micro-Server Card Specification on the OCP Website.

4.3 Placement

Figure 2 illustrates board placement. The placement shows the relative positions of key components, while exact dimension and position information is available in the mechanical file. Form factor, DIMM position, SOC position, and keepout area should be followed strictly, while other components can be shifted based on layout routing.

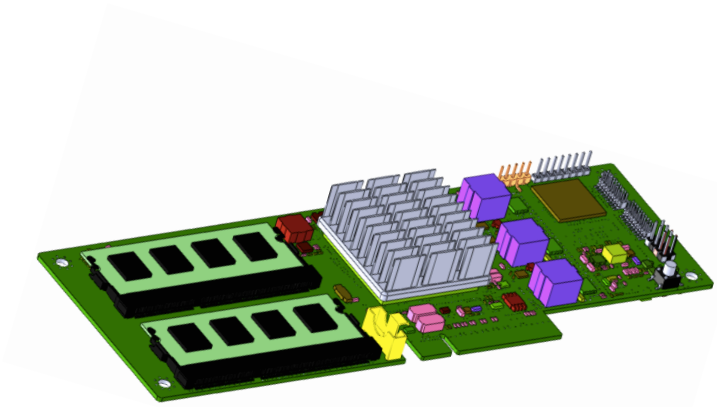

Figure 2 Micro-Module Board Placement

Micro-Module card thickness, as shown in Figure 3, with an attached SOC heatsink, is restricted based on the thickness of the card, height of components, and distance between Micro-Modules (Figure 4) when inserted into the baseboard. Each baseboard (concept shown in Figure 5) accommodates up to 10 Micro-Modules.

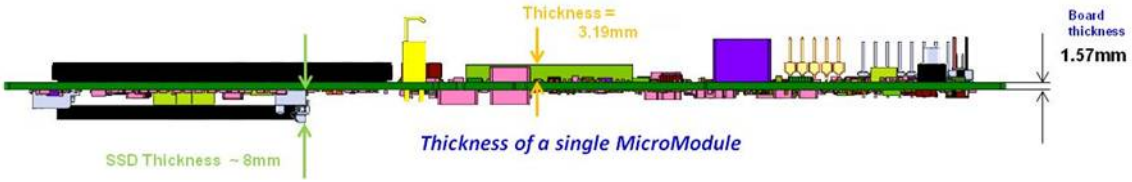

Figure 3 Micro-Module Card Thickness

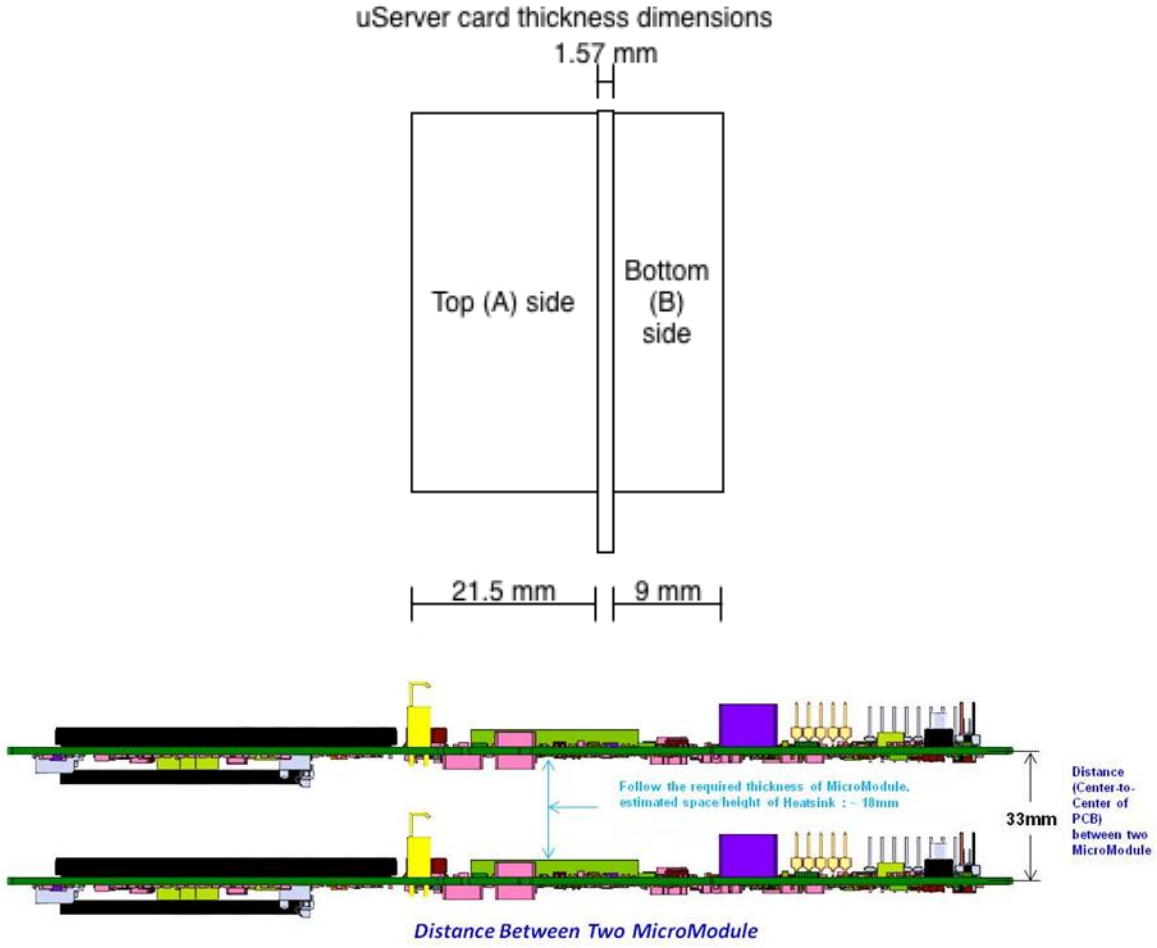

Figure 4 Distance between Two Micro-Module Cards on Baseboard

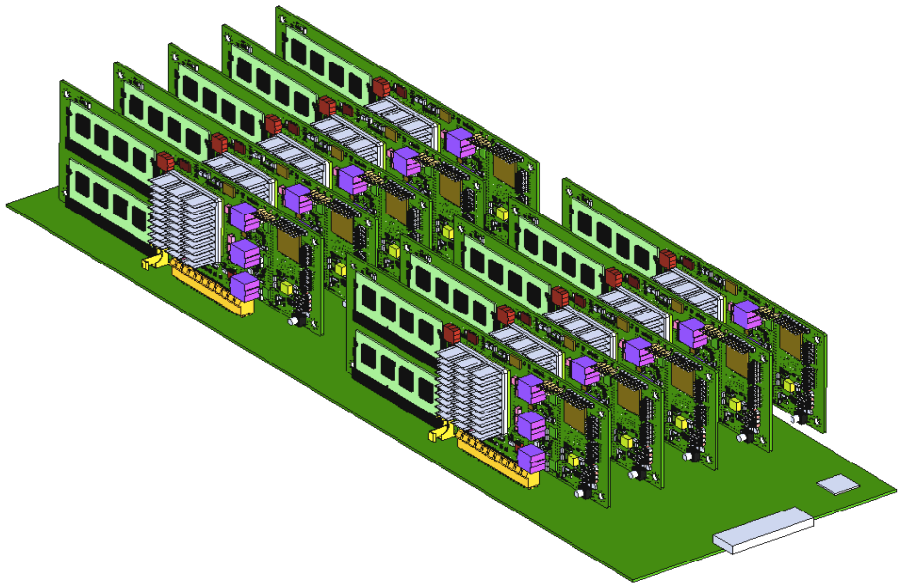

Figure 5 OCP Micro-Server Baseboard Concept with APM X-Gene Micro-Modules

4.4 PCB Stackup

The board's PCB stackup is defined in the following table. Board PCB Stackup

	Subclass Name	Type	Material
1		SURFACE	CONFORMAL_COAT
2	TOP	CONDUCTOR	COPPER
3		DIELECTRIC	FR-4
4	L2_GND1	PLANE	COPPER
5		DIELECTRIC	FR-4
6	L3_SIG1	CONDUCTOR	COPPER
7		DIELECTRIC	FR-4
8	L4_SIG2	CONDUCTOR	COPPER
9		DIELECTRIC	FR-4
10	L5_PWR1	PLANE	COPPER
11		DIELECTRIC	FR-4
12	L6_GND2	PLANE	COPPER
13		DIELECTRIC	FR-4
14	L7_SIG3	CONDUCTOR	COPPER
15		DIELECTRIC	FR-4
16	L8_SIG4	CONDUCTOR	COPPER
17		DIELECTRIC	FR-4
18	L9_GND3	PLANE	COPPER
19		DIELECTRIC	FR-4
20	BOTTOM	CONDUCTOR	COPPER
21		SURFACE	CONFORMAL_COAT

Figure 6 PCB Stackup

4.5 Processor SOC

The motherboard uses Applied Micro X-Gene™ SOC with the following features:

- X-Gene processor cores
  - High-performance, superscalar 64-bit X-Gene ARM cores
  - 4 wide out-or-order superscalar microarchitecture
  - Native support for ARM64, ARM32, Thumb
- DDR3 memory controllers with ECC (72-bit)
- High-Speed Interfaces
  - 10-Gbps Ethernet (10GE)
  - PCI Express Gen 3 ports
  - USB 3.0
  - SATA Gen 3
- Other Interfaces
  - I2C
  - UART
  - JTAG / trace

4.6 Memory Support

The memory support matrix for the Micro-Module board is described in Figure 7.

		1 DPC
1.5V	SR	
	DR	
1.35V	SR	
	DR	

Figure 7 Micro-Module Board Memory Support Table

4.7 Storage Support

An optional feature, mounted on the B-side of Micro-Module board, is support for a mini-SATA (mSATA™) card.

5 Electrical

5.1 Edge Connector

The connector is based on a standard PCIe x8, with pinout reconfigured. Pinout uses the default configuration specified in the OCP Micro-Server Card Specification section 4.1

5.2 Ethernet

Details pending final OCP Micro-Server Card Specification.

5.3 I2C

Details pending final OCP Micro-Server Card and Baseboard Card Specifications.

6 Power

6.1 VR Requirements

Details pending validation

7 Functional

7.1 Memory

The card supports two DDR3 low-voltage SODIMM SDRAM modules mounted on the A-side of the card via SODIMM sockets

7.2 Storage

An optional feature, mounted on the B-side of microserver card, is support for a mini-SATA (mSATA™) card.

7.3 EEPROM

The EEPROM is connected to I2C bus. The ODM will be responsible for managing all required information identified in the OCP Micro-Server Card Specification section 6.3.

7.4 BIOS

The ODM is responsible for supplying and customizing a BIOS for the motherboard. The BIOS source code comes from AMI or Phoenix. The ODM is responsible for maintaining the BIOS source code to make sure it has the latest version from the BIOS source code provider.

7.4.1 Configuration and Features

The BIOS will be optimized to minimize power consumption. Bios default options will be set to disable unused devices and interfaces. In addition, a bios configuration menu will expose the following configuration options for optimizing the SOC:

- 10G enable/disable
- PCIe enable/disable
- SATA enable/disable

7.4.2 Boot Options

PXE, SATA/SAS, USB….

7.4.3 Remote BIOS Update

Details pending final OCP Micro-Server Card and Baseboard Card Specifications.

7.4.4 Event Log

Details pending validation

7.4.5 Logged Errors

Details pending validation

7.4.6 Error Thresholds

Details pending validation

7.4.7 Post Codes

Details pending validation

7.5 Management

7.5.1 Serial Console

Details pending final OCP Micro-Server Card and Baseboard Card Specifications.

7.5.2 Power Control

Details pending final OCP Micro-Server Card and Baseboard Card Specifications.

7.5.3 Thermal Alerts

Details pending final OCP Micro-Server Card and Baseboard Card Specifications.

7.5.4 Sensors

Details pending final OCP Micro-Server Card and Baseboard Card Specifications.

7.6 LED

8 Mechanical

8.1 Open Compute Project Microserver Chassis Concept

Figure 7 shows a concept view of the Open Compute Microserver chassis.

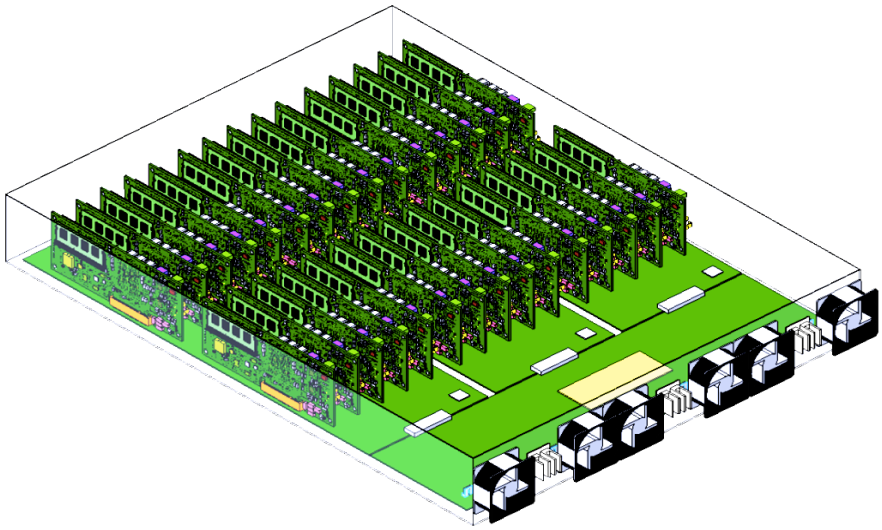

Figure 8 Open Compute Microserver Chassis Concept