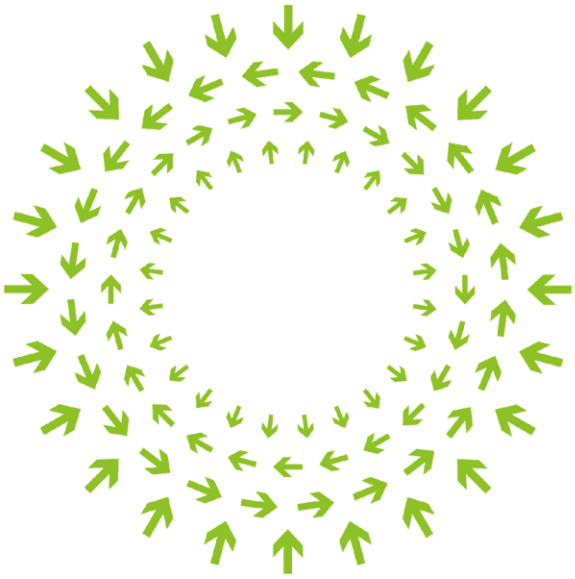

OPEN

Compute Project

Full Width HPM Form Factor (M-FLW) Base Specification

Part of the

Datacenter – Modular Hardware Systems (DC-MHS) Rev 1.0 Family

Version 0.90

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Revision 1.0 Authors/Contributors:

Dell, Inc: Corey Hartman, Sanjiv Sinha, Shawn Dube

Google LLC: Siamak Tavallaei, Jim Levins, Mike Branch

Hewlett Packard Enterprise Company: Vincent Nguyen, David Paquin, Binh Nguyen

Intel Corporation: Brian Aspnes, Drew Damm, Gene Young, Brendan Pavelek, Cliff DuBay

Meta Platforms, Inc: Damien Weng Kong Chong, Todd Westhauser, Michael Haken

Microsoft Corporation: Priscilla Lam, Mark Shaw; Priya Raghu, Luke Gregory

Advanced Micro Devices, Inc: Paul Artman, Ravi Bingi, Andy Junkins, Greg Sellman

Note: For questions about this specification please contact Corey Hartman and / or Brian Aspnes at dcmhs@opencompute.org

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1.2. Acknowledgements

The Contributors of this Specification would like to acknowledge the following companies for their feedback:

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2. Version Table

Date	Version #	Description
4/22/2022	0.70	Initial Public Release
06/07/2022	0.75	• Added Spec Compliance Table Section 4 • Added 9.75mm to board under PSU Connectors • Moved OCP NIC Connector 6mm to left. (from 204.29mm to 210.29mm) • Moved IO Riser Connector #3 to left 5mm. Moved KOZ and Mount hole accordingly (From 136.02mm to 141.02mm) • Rotated PIC Power Connectors 180° • Defined Pins S1 & S12 on Pic Power Connectors and Rear Power Connectors and revised dimensioning scheme to Pin S1 • Figure 18, Defined IO Connectors Pin A1 & A77. • Defined Pins OB1 & B70 on NIC & DCSCM Connectors • Defined Pins OB1 & B70 and Pins B1 & B70 on Alternate NIC Connectors • Defined Control Panel Connector Pins A1 & A10 • New location for USB connector Zone • Moved Retention Hardware Height Restriction Zone note to Detail L • Combined 1U & 2U PCIE Mount Holes to one sheet • Revised references to “KIZ” to “Height Restriction Zone” • Revised Bottom Side KOZ shape for Tempan to rectangle. Revised Y-dimensioning scheme to center of rectangle • Added KOZ to Bottom side Mount Holes. Preliminary size at 13.8mm x 13.8mm. • Changed Figure 3 to support OCP NIC move of 6mm • Changed Figure 4 to show pads and KOZs around mounting holes • Updated Figure 6 for clarity • Changed Figure 10 to move OCP NIC by 6mm. • Changed Figure 11, Control panel connector orientation, and primary/secondary designations. • Changed Figure 12, USB Zone moved. • Combined Figure 17 and 18 into a new Figure 17. Moved 1U PCIe Riser Mount holes down 7.5mm and left 4mm. Added Mount Hole detail with Ø8.0mm Pad size, Ø16mm Component KOZ. • Changed Figure 21 to update Secondary size KOZs for mounting holes and chassis hooks

		• Updated Figure 29 for UBB outline updates • Added Figure 32 for UBB connector locations • Changed description of Adapted HPM in Section 13 • Figure 26 changed, rotating PIC Power connectors 180 degrees • Relocated power plane fusing requirements to M-PIC spec in Section 11.2 • Clarified minimum power plane recommendation in Section 11.2
06/27/2022	0.80	• Modified Table4 in Section 11.1 to describe zone power and range of supported power • Clarified minimum power plane recommendation in Section 11.2 • Renamed Figure 22 • Figure 19, Sec 10.13, Changed primary side height restriction zones • Sect 10.12, Figure 18 change KOZ around Riser retention holes • Sect 10.8, Figure 12, moved Intrusion connector to same zone as USB • Figure 21, updated MH KOZs on bottom / secondary side. • Updated UBB Adapted outline in Figure 29 to update cutout options for cabled HSIO at far edge. • Figure 33 updated, based on connector feature updates from vendors • Figure 35, updated text in drawing • Figure 25, updated title in drawing • Added Guide pin part number to Sect 13.1.6 • Added bullet 6 to section 10.10.1 • Figure 18, 19, updated KOZ around riser retention holes • Figure 22, updated Thermal solution Bracketry KOZ • Section 10.8, new section for PDB to HPM header • Moved section 12 into existing sections and deleted it • Moved section 13.1 into Section 12 “Adapted HPMs” for spec clarity.
8/22/2022	0.9	• Updated MH drawing Figure 4 • Added New handle hole geometry required dimensions, Figure 9 • Updated OCP NIC and DC SCM positions, Figure 10 • Moved PDB Management conn zone, Figure 15 • Moved boot connection zone, and modified to accommodate new HPM retention hole location and its associated KOZ, Figure 17

		• Near IO connector and associated retention holes moved in Figure 18 and Figure 19 • Updated Sect 10.3, HPM Board and Assembly thickness section, to include details and tolerance allowance for the Secondary Side Exception Heights. • Updated locations of Near side PIC Power (decreased pitch); maintained 10mm gap between pins of Near side Power connectors. Far Side PIC Power connectors moved outward to increase usable Far Edge space for CPU IO and VRs., Figure 29 • Updated Primary side height restrictions, Figure 20, Changed 20mm zone to 22mm and added note that numbers indicate max tol condition. Fixed an unattached dimension. • Added Platform Custom Zone options of 2x OCP NIC SFF, or single LFF with recommended placements, or direct dock E1.S boot, Section 10.7 • Updated Figure 3 with updated Near side outline • Updated Section Near Side IO Connectors 10.12, rewrite of requirements. • Updated CRPS Connector location (near OCP NIC), Figure 27 • Update location of HPM retention hole, Figure 7 • Updated image for latest outline, Figure 42 • Updated Secondary side KOZ's for chassis hooks (board pan interfaces), to allow for more flexibility in DIMM socket placement. Reduced HPM-chassis retention KOZ from 29 to 21mm long. Figure 22 • DC SCM Y position adjusted by 0.18mm, to correct mistake. This correction aligns DC SCM with OCP NIC at rear wall. • Changed Power Zone E rating to 160W • Changed Power Rating Zone C to 250W per Near IO Connector instance • Added Section 10.7 to define Platform Custom zone and a couple standard options that could be utilized. These drawings were in the Supplemental Info section, previously. • Added E1.S enablement option, Figure 13 • Fixed KOZ around chassis retention hole to 21x21mm, Figure 22 • Added implementors note about HPM handle hole and Mounting holes Figure 22. HPM Secondary Side HPM Zero-Height Keepout Zones • Deleted chapter 12.2, which had old, adapted options that were pulled into the new Platform Custom Zone.

		• Added introduction paragraph including units and tolerances to Section 10, matching M-DNO content. • Changed 11.1 Zone B connector to Vertical only (removed R/A option) • Intrusion Switch and USB Conn zone updated, to ensure it does not overlap in the 11.3mm height restriction zone, Figure 16. • Created new chapter for Far Side Panel Mount HPM in Supplemental Section 13.3. Moved and renamed this content out of the Adapted HPM section. • Changed Zone B Section 11.1.2 to include ingress power option per M-PIC specification

3. Scope

This document defines technical specifications for the Server Product used in Open Compute Project. This document shall comprise the hardware product types complete technical specification. Any supplier seeking OCP recognition for a hardware product based on this spec must be 100% compliant with all features or requirements described in this specification.

3.1. Items Not in Scope of Specification

- Compute Core (CPU/Memory/Voltage Regulators/SMP routing between CPUs)
- JTAG/Debug connectors for the Compute Core
- CPU, Memory, Heatsink, Liquid and any other thermal solutions
- Reliability requirements and design-in details
- BOM Population requirements
- Cooling System Connections (Fans, etc).

3.2. Typical OCP Sections Not Applicable

Open Compute documents are typically expected and desired to contain common document Sections. The DC-MHS specifications are comprised of Base Form Factor Specifications and Supporting Platform Connectivity specifications, and are structured such that the typical OCP document structure does not apply to this Base Form Factor Spec. This specification will not contain the following Sections.

- Rack Compatibility (See **Section 13.1 Rack and Chassis Depth Stackup Assumptions**)
- Physical Specifications
- Thermal Design Requirements
- Rear Side Power, I/O, Expansion
- Onboard Power System
- Environmental Regulations/Requirements
- Prescribed Materials
- Software Support
- System Firmware
- Hardware Management
- Security

The content expected in these subject areas is expected to be documented in future private and/or public Design Specifications and/or Product Specifications.

4. Specification Compliance Table

(Not Fully Updated for v0.9, Subsequent Section Requirements supersede this until 1.0 Release.)

The following table is intended summarize the list of attributes and requirements for a design to be DC-MHS M-FLW Base Specification compliant.

Table 1. Specification Compliance Summary Table

#	Technical Specification	Document Reference
1	Base Mechanical Outline	Figure 3 and Section 10.1
2	Minimum of 6 board mounting holes implemented	Figure 4 Section 10.2
3	Mounting Hole pad and KOZ requirements	Figure 4, Section 10.2
4	Maximum HPM Board thickness of 3.18mm, assuming 10% max tolerance	Section 10.3
5	HPM Thickness + Backing plate shall not exceed 5.86mm	Section 10.310.15.3
6	In the Secondary Side height restriction exception zones (defined in Section 10.15.3 HPM Board and Assembly Thickness), HPM thickness + Secondary side components shall be a maximum of 5.66mm	Section 10.3
7	Required Board hole for HPM retention to chassis	Figure 7, Section 10.4
8	KOZ required on top and bottom sides around HPM Retention hole	Figure 20, Figure 22, and Section 10.4.1
9	HPM requires a hole at Far side for interface to mechanical handle	Section 10.5
10	The hole geometry for board handle shall follow the required dimensions and KOZ in Figure 9.	Figure 9, Section 10.5
11	HPM must fix OCP NIC R3 and DC-SCM R2 locations as defined	Figure 10, Section 10.6
12	HPM shall implement 2 instances of Control Panel Interface connectors per defined locations	Figure 14, Section 10.8,
13	HPM PDB Management Connector placement	Figure 15, Section 10.9
14	HPM Shall implement Internal USB connection and Intrusion Switch connector in defined zone	Figure 16, Section 10.10
15	The Required connector for Near IO positions shall be SFF-TA-1033.	Section 10.12.1, Figure 18
16	Near IO Connector shall be placed at locations defined in Figure 18	Figure 18, Section 10.12.1
17	Mounting hole requirements for IO module retention	Figure 19, Section 10.12.2
18	High Speed IO connector choices for the Far Side Shall meeting the Height Restriction requirements	Section 10.13
19	Primary side component height restriction zone shall be implemented	Figure 20, Section 10.14
20	If a cable connection (power, High speed IO, etc) is placed in the component height restriction zone, the max height restriction shall apply to the mated height of the plug and cable assembly, including component and assembly tolerances.	Section 10.14
21	The back side or secondary side of the HPM shall have a universal height restriction of 1.6 mm, unless otherwise specified in the areas of 0 height zones.	Section 10.15.1, Figure 22

22	HPM shall support chassis to board bracketry (board pan) 0-Height KOZs	Section 10.15.2, Figure 22
23	No two instances of a secondary side exception shall be closer than 10mm, as to not drive excess cutouts in Chassis-to-HPM bracketry	Section 10.15.3
24	The HPM shall have zones and provide HPM Secondary Supports that are 1.78mm +/- 0.10mm thick.	Figure 23, Section 10.16
25	HPM shall implement KOZ's on Far side mounting holes for Thermal solution brackets	Section 10.17, Figure 24
26	Locations of M-CRPS connectors shall be placed as defined in Figure 27	Figure 27, Section 0
27	HPM 2x6+12s PICPWR connector placement	Figure 29, Section 0
28	Minimum HPM Power Supply Rail Requirements per PCIe CEM Slot	Table 6, Section 1.1.1
	Note, additional Compliance Requirements from Section 11.2 have been omitted for 0.9 rev because they are likely to change for 1.0.	

5. Overview

The objective of this specification is to specify the requirements of a Full Width Host Processor Module (HPM). This is for use within products designed for minimum 19" rack, also known as compliant with EIA-310-E but can also accommodate larger 21" racks. This form factor enables a full width HPM usage for CPUs, DIMMs, and related features. This full width form factor generally allows for maximum IO of the CPUs to be offered and brought to accessible slots (although exceptions could occur in the future). This specification will NOT reference a specific CPU or memory technologies. The goals and success criteria of this specification is so that multiple generations of CPU/Memory (Compute Core) designs can be designed into this form factor specification, so that chassis and system designs can be reused as desired. This should have the benefits of reduced design investment, reduced validation investment, and faster development cycle time.

This specification shall define attributes and design requirements that are common and critical to the use and deployment of customers and vendors of Enterprise and Cloud Full Width Server rack products. Examples include mechanical form factor, placement guidance of common subsystems and placement guidance of motherboard Input-Output (IO) connections.

6. References

The **D**ata **C**enter – **M**odular **H**ardware **S**ystem (DC-MHS) family of specifications are written to enable interoperability between key elements of datacenter and enterprise infrastructure by providing consistent interfaces and form factors among modular building blocks. At the time of this publication there are the following specification workstreams:

M-FLW (**M**odular Hardware System **F**ul**L W**idth Specification) – Host Processor Module (HPM) form factor specification optimized for using the full width of a Standard EIA-310-

D Rack mountable server. The specification is not limited to use within the EIA-310 Rack but is used to serve as a template for a common target where the design is expected to be utilized.

M-DNO (**M**odular Hardware System Partial Width **D**e**n**sity **O**ptimized Specification) – Host Processor Module (HPM) specification targeted to partial width (i.e. ½ width or ¾ width) form factors. Such form factors are often depth challenged and found not only in enterprise applications but also in Telecommunications, Cloud and Edge Deployments. While the EIA-310 Rack implementation is chosen as a key test case for use, the specification is not limited to use within the EIA-310-D Rack but is used to serve as a template for a common target where the design is expected to be utilized.

M-CRPS (**M**odular Hardware System **C**ommon **R**edundant **P**ower **S**upply Specification) – Specifies the power supply solutions and signaling expected to be utilized by DC-MHS compatible systems.

M-PIC (**M**odular Hardware System **P**latform **I**nfrastructure **C**onnectivity Specification) – Specifies common elements needed to interface a Host Processor Module (HPM) to the platform/chassis infrastructure elements/subsystems. Examples include power management, control panel and cooling amongst others.

M-XIO (**M**odular Hardware System E**x**tensible **I**/**O**) – Specifies the high-speed connector hardware strategy. An M-XIO source connector enables entry and exit points between sources such as Motherboards, Host Processor Modules & RAID Controllers with peripheral subsystems such as PCIe risers, backplanes, etc. M-XIO includes the connector, high speed and management signal interface details and supported pinouts.

M-PESTI (**M**odular Hardware System **Pe**ripheral **S**ideband **T**unneling **I**nterface) – Specifies a standard method for discovery of subsystems, self-describing attributes, and status (e.g., versus a priori knowledge/hard coding firmware and BIOS for fixed/limited configurations). Examples: vendor/module class, physical connectivity descriptions, add-in card presence, precise source to destination cable coupling determination.

To access additional DC-MHS specification please visit OCP Server WIKI

Additional References

This specification also relies on the following Open Compute Project specifications

- OCP Server Network Interface Card (NIC) R3.0 – Specifies NIC card form factors targeting a broad ecosystem of NIC solutions and system use cases.
  Mezz (NIC) » Open Compute Project

- OCP Datacenter Secure Control Module (DC-SCM) R2.0 – Specifies a SCM designed to interface to an HPM to enable a common management and security infrastructure across platforms within a data center.
  Hardware Management/Hardware Management Module - Open Compute

7. Terminology

Standardized Term	Meaning	Alternative Terms
Shall	Indicates a requirement for spec compliance	
HPM (Host Processor Module)	PCB or PCBA form-factor being defined by this spec	Motherboard, board
PCB	Printed Circuit Board	
DC-SCM	Datacenter Secure Control Module Rev 2.0 as defined by OCP DC-SCM Rev 2.0 spec	
CPU	Central Processing Unit	
IO	Input Output, commonly referring to high speed connections to a CPU socket.	
PCIe	Peripheral Component Interconnect Express	
CXL	Compute Express Link, open standard for CPU to device and CPU to Memory connections.	
Chassis-Board Bracket	Bracket that attaches to a HPM assembly, that enables a variety of board outlines and hole locations to change over time, and still fit within same chassis base.	Board Pan Sub-pan
Near	Board location or zone, related to section of board containing DC-SCM Rev 2.0, Management subsystem	
Far	Board location or zone, opposite of location of Management Subsystem	
Platform	Complete system including HPM, power, peripherals, etc	
Compute Core	Elements of board design that are critical to processor and memory support, inclusive of CPU and Memory sockets. Examples are Voltage Regulators, High Speed IO routing, High speed trace routing between multiple processors, high speed trace routing between processors and memory, etc	
Platform Custom Zone	Area of system board where space is allotted for Platform designers to implement custom features.	
HSIO	High Speed IO, commonly referring to PCIe routing, PCIe connectors, CXL routing/connectors, etc.	
OCP	Open Compute Project	
OEM	Original Equipment Manufacturer	Enterprise
Platform Infrastructure Connectivity Spec	A Specification that defines Platform Interconnect details for features that are common across many HPM Form Factors. Examples connectivity features include fans, backplanes, and control panels.	M-PIC spec
KOZ	Keepout Zone, a design term for PCB designs that defines area of a board design where no components may be placed, usually to enable mechanical attachments or mechanical features.	
Compliant HPM	An HPM which meets every item listed in the M-FLW specification compliance table.	
Adapted HPM	An HPM which has strong correlation to base spec requirements but does not meet every item in the base specification compliance table.	
HPM Designer	The person or organization designing an HPM (whether compliant or adapted) which implements the M-FLW specification.	
System Designer	The person or organization designing a system which incorporates M-FLW HPMs (whether compliant or adapted) into the system design.	

8. Background and Assumptions

This Full Width HPM Form Factor specification is created to enable typical platform feature sets for both Front and Rear Management, in 1U and 2U chassis applications. Some of the platform features that are common in the industry, and influence the Form Factor constraints are:

- Chassis installation within minimum EIA-310-D racks (but not limited to).
- PCIe (Version 5.0 and future) Card configurations typically offered by Enterprise OEMs/Hyperscalers. See **Figure 33. Typical 1U and 2U PCIe Slot Configurations**.
- In the 1U PCIe offering, only Half-Length PCIe cards (167.6mm) are considered. This does not prevent Three-Quarter Length (254mm) cards, but support for Three-Quarter Length cards would require more restrictive Compute Core placement (not defined).
- HPM enabled minimum 75W of power per PCIe slot, with ability to scale up to 600W for some slots (likely 3~4).
- The specification details support for the Open Compute peripherals directly connected to board
    - OCP NIC R3.0
    - DC-SCM R2.0
    - *Note: A S*ystem is not limited to 1 device of each type; configurations with >1 OCP NIC R3.0 or DC-SCM R2.0 are possible, but outside the scope this specification will cover.
- Thermal Design Points considerations includes keepout zone to enable air cooling thermal solutions that extend beyond the CPU and Memory sockets. Memory TDPs under consideration are in the 20-25W range.
- Considerations for Liquid cooling solutions, including CPU cold plates and DIMM liquid cooling manifolds.
- Considerations for Power Delivery to important chassis subsystems.

8.1. Rear Management (ie, OEM) Architecture Assumptions

a. Chassis depth constraints in consideration of Power Distribution Units placed approximately 780mm from front EIA mounting flange.
b. Enterprise Storage and Fan subsystems requiring approximately 220mm. (See **Figure 32. Rack Depth Constraints)**
c. Sliding rack rails that require a max overall chassis width of 434mm, with interior chassis width/opening of minimum 427mm.
d. Considerations for Power and High-Speed IO Cabling
e. Considerations for Ease of Installation and Removal of motherboard in a chassis.
f. Adequate delivery power through HPM to enable typical Storage configuration power loads (See **Section 1**)

8.2. Front Management (ie, Hyperscale) Architecture Assumptions:

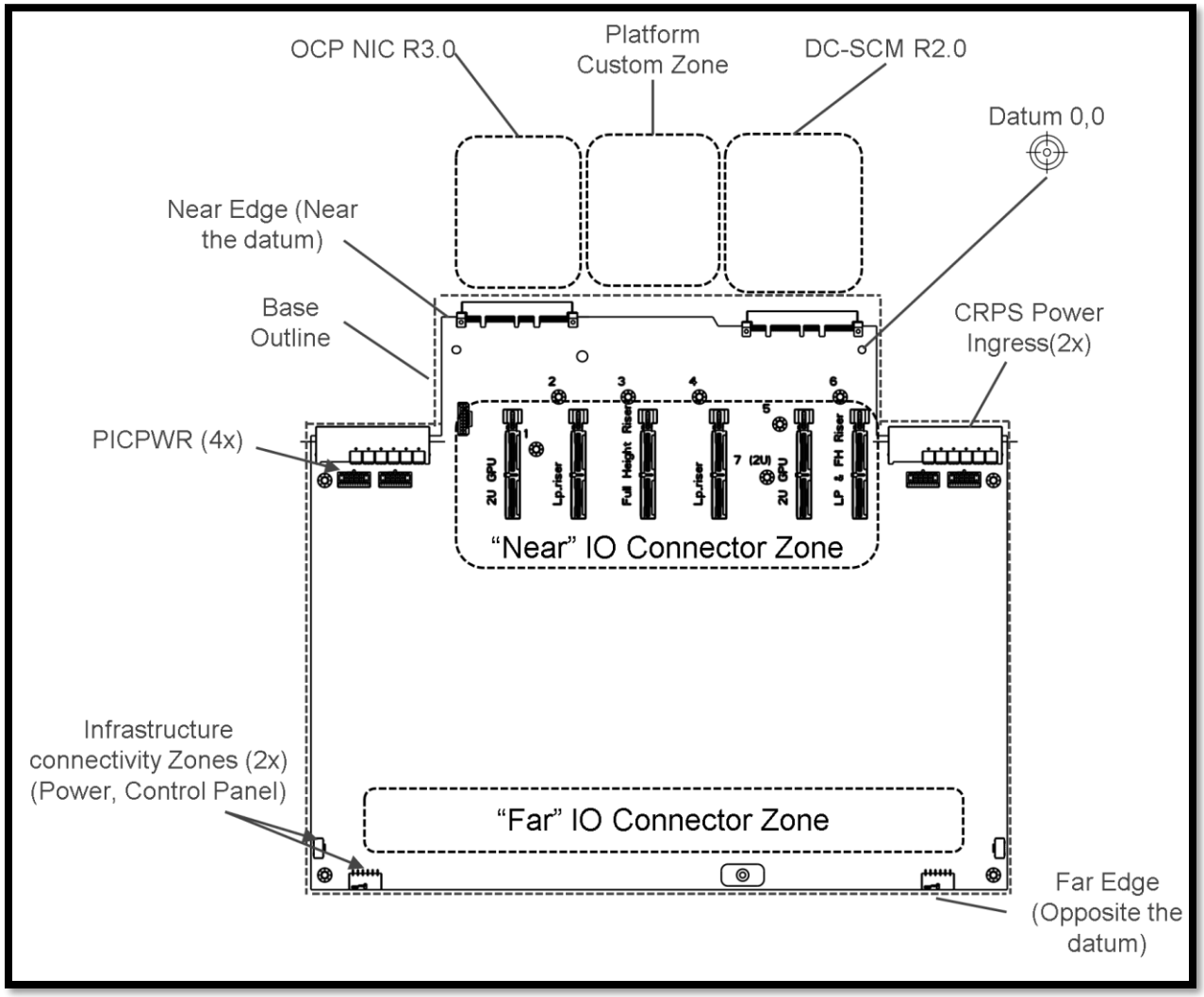
a. 1070mm rack depth
b. All IO generally on cold aisle but may also include some architectures with hot aisle IO. Assuming Front/Near end of system supports IO devices such as PCI CEM, OCP NIC R3.0, SSD's, etc
c. PCIe also distributed at Far end, such as to backplane, OAI – Universal Baseboard, and other items.
d. AC or DC rack power supplied by rack from the hot aisle
e. If PSUs are used, they are not hot serviceable

9. HPM Layout

The following **Figure 1** shows the layout and approximate locations of major subsystems in the Enterprise and Hyperscale M-FLW HPM.

"Near" and "Far" are reference naming conventions to the side of the board and Compute Core, as to orient the reader as to which portion of the board and Compute Core is being referred to. This specification refers to the Near Side as where DC-SCM R2.0 Management subsystem resides as a board peripheral. This is also typically referred to Rear IO location for Enterprise products, in which products are designed with IO in the hot aisle of a rack deployment (air exit). This is also typically referred to Front IO location for Hyperscale products, in which products are designed with IO in the cold aisle of a rack deployment (air inlet).

Figure 1. Full Width HPM Layout Diagram



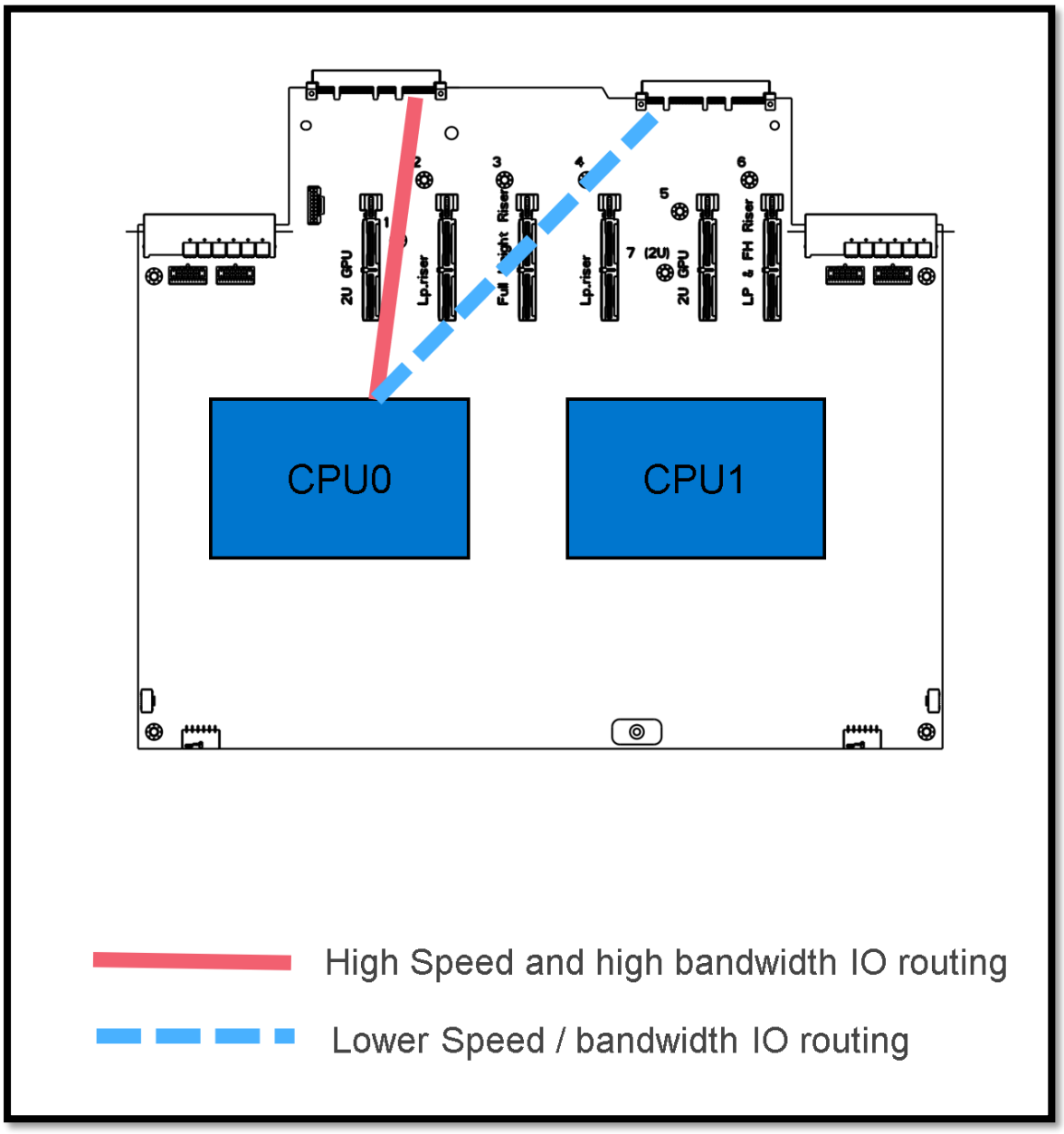
9.1. Two Socket (CPU) Assumptions

The OCP NIC R3.0 subsystem is positioned on the left based on two assumptions:

- In a 2S (CPU) system, the First/Boot CPU in a two CPU HPM is positioned on left.
- OCP NIC R3.0 is directly routed through the motherboard to the first/boot CPU.

The OCP NIC R3.0 is intended to be closer to this boot CPU to best enable the high-speed IO routing. The OCP NIC R3.0 will usually require higher bandwidth routing, and thus should be optimized for material selection and cost impacts. The routing from first/boot CPU to management subsystem (DC-SCM R2.0) has lower bandwidth requirements, and thus should not be the determining factor in board material selections and routing strategy. See **Figure 2**.

Figure 2. First CPU position relative to OCP NIC R3.0 and DC SCM R2.0



In this specification the CPU and Memory locations are intentionally not specified. This is for future flexibility in CPU/Memory quantities, locations, sizes, etc. The board area between DC-SCM R2.0 and OCP NIC R3.0 is designated as a “Platform Custom Zone”, as shown in **Figure 1. Full Width HPM Layout Diagram**. The goal is to provide board area and system volume for individual platforms to provide system specific features.

9.2. One Socket Assumptions

In theory, for a one socket (CPU) platform, the OCP NIC R3.0 location does not have a strong affinity to either side. *The OCP NIC R3.0 shall remain in the specified HPM location for chassis compatibility for all Full Width HPM products. The second OCP NIC shown in the Platform Customization Zone is optional, the OCP NIC on the left must always be populated.*

10. Mechanical Requirements

400 In addition to the drawings and details within this document, DFX/CAD files will be provided for further detail. Unless otherwise specified all units are in mm. The following standard tolerances apply to all drawings unless otherwise specified. Unless otherwise specified, PCB dimensions shown in this specification shall comply to the following table.

405 Note: This table is preliminary for V0.9 and subject to change for V1.0.

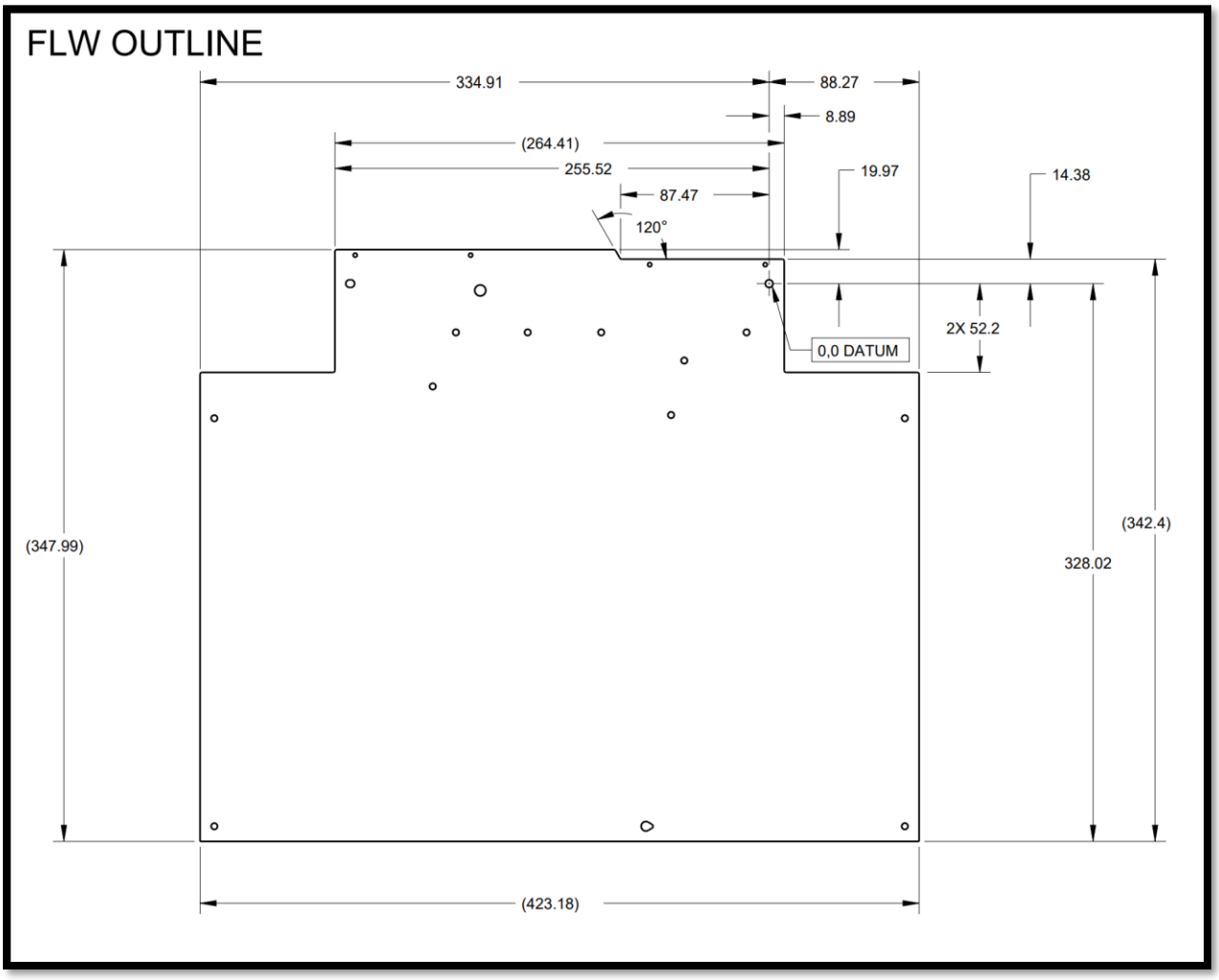
Dimension Type	Tolerance, unless otherwise specified
Drilled hole (origin) to round fiducial	+/- 0.076mm (+/- 0.003 inch)
Drilled hole (origin) to profiled card edge	+/- 0.254mm (+/- 0.010 inch)
Drilled hole (origin) to drilled hole	+/- 0.127mm (+/- 0.005 inch)
Profiled card edge to profiled card edge	+/- 0.127mm (+/- 0.005 inch)
Feature of size (hole diameter, slot width, etc.)	+/- 0.100mm (+/- 0.004 inch)
PCB thickness	+/- 10% of nominal

10.1. HPM Outline

*The Full Width HPM (M-FLW) outline is defined in **Figure 3** and shall be followed for a M-FLW Base Specification compliant HPM.* This defines the outline and peripheral locations to fit compute core and IO elements in an FLW compliant chassis. This is intended to fit a wide variety of platform and chassis applications.

The M-FLW HPM Outline is defined in Figure 3 below. The intent is to show overall dimensions of board outline. DFX/CAD file link will be in **Section 13.8 CAD files** section and provided in future specification releases.

Figure 3. Full Width HPM Outline

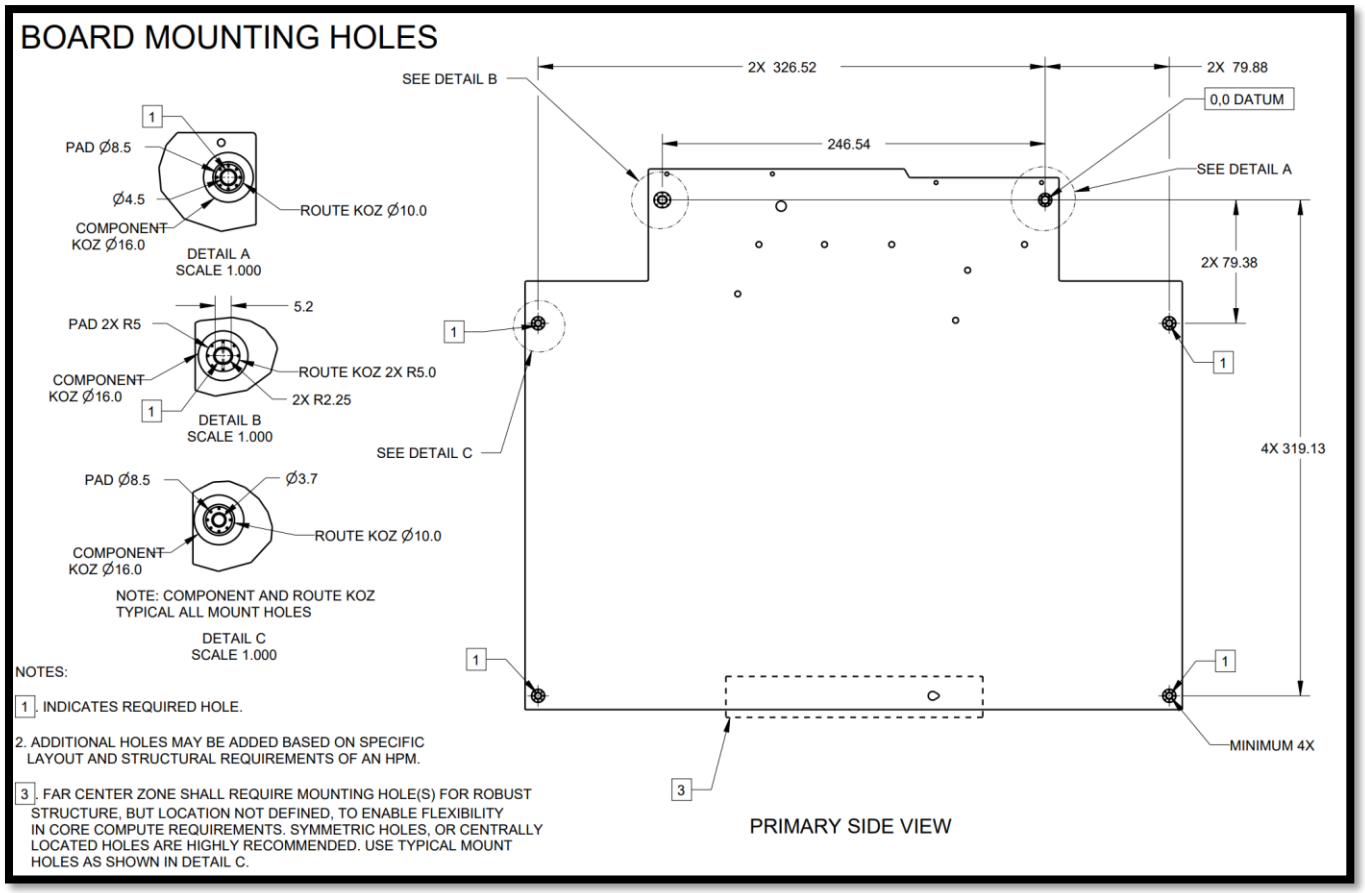


10.2. Board Datum and Mounting holes

*A set of six required board mounting holes specified shall be implemented around the board perimeter per **Figure 4** and represent the minimum mounting hole requirements.* These six boards mounting holes interface to the Chassis-to-Board Bracket (Board Pan). Additional mounting holes are allowed as needed, to ensure appropriate mechanical support of the Compute Core (not shown). These additional board holes are expected to interface to the board-chassis bracketry and should be designed in consideration of the bracket to chassis interface features, as defined in **Section 10.4 HPM to Chassis Retention.** A design should follow good engineering practices and in consideration of platform shock and vibration requirements. Shock and vibration requirements are not in scope of this specification.

*The mounting holes shall have a pad and component KOZ as defined in **Figure 4***. The component KOZ is intended to keep small components at risk of damage away from the hardware and assembly tools. If a component is larger than 10mm in any dimension, it is considered more robust, and an exception will allow such component to encroach on the Component KOZ's in **Figure 4**.

Figure 4. Board Mounting Holes with Pads and Keepout Zones (Top / Primary side view)



Implementors Note:

The PCB Datum hole (Detail A) is defined such that a collared standoff with tight tolerance fit can be used to control X-Y tolerances in HPM mounting. Additionally, a slotted hole (Detail B) is defined to control rotation around the datum, by allowing, as an example, a collared standoff to be used with tight fit to the top/bottom edge of the slot.

All other mounting holes follow standard mounting hole guidance (Detail C). These mounting holes are expected to have clearance fits to screw hardware.

10.3. HPM Board and Assembly Thickness

The maximum board thickness allowed shall be 3.18mm nominal, assuming +10% max tolerance. HPM Thickness choices may have impacts on chassis stackup. HPM thickness must consider the backing plate thickness and the secondary side components of a required Core Compute.

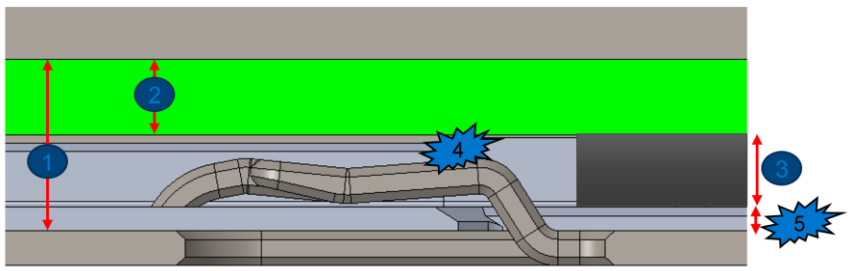
1. *M-FLW HPM shall have a maximum allowable HPM thickness + backing plate stackup of 5.86mm.* Backing plates are assumed to be allowed to protrude thru cuts in the Chassis-to-Board bracketry.

2. *In the Secondary Side height restriction exception zones (defined in **Section 10.15.3 HPM Board and Assembly Thickness**), HPM thickness + Secondary side components shall be a maximum of 5.66mm*

    a. Allowing for +/- 0.2 mm HPM mounting height tolerance in an assumed 5.86 HPM mounting height).

Figure 5 and **Table 2** below demonstrate example scenarios HPM designers should consider when choosing HPM thickness.

Figure 5. Board and Chassis Stackup Considerations



1. HPM Top Surface Height to Chassis base
2. HPM Thickness
3. Backing Plate Thickness
4. Gap from HPM to Mounting hook
5. Gap to chassis base (may cut thru sub-pan

Implementors Note:

Designers should consider that variations in HPM thickness can result in variation of the offset locations of OCP NIC R3.0 and DC-SCM R2.0 peripherals (relative to fixed chassis openings).

A common chassis design intended to support two different thickness HPMs may have to populate different 4C+ connector offsets.

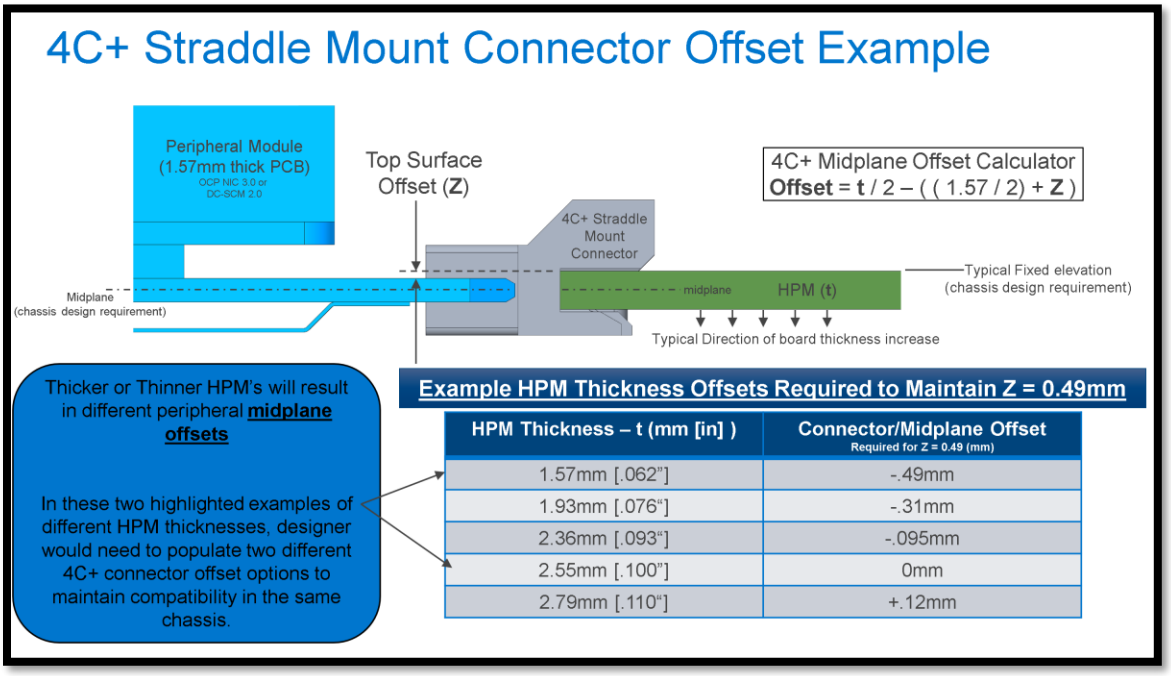
Designers may consult with vendors of SFF-TA-1002 4c+ to determine best options for their chassis application. See **Figure 6. HPM thickness and Straddle Mount Peripheral Offsets** below

Table 2. Board and Chassis Stackup Scenarios

(Dimensions in mm)	**1 HPM Height**	**2 HPM Thickness**	**3 Backplate**	**5 Gap Backplate to Base Chassis**
Typical Nominal Range	5.0 - 5.86	1.57 - 3.18	2.0 – 2.6	
Scenario 1 Nominal	5.2	2.6	2.2	0.4mm
Scenario 2 Nominal	5.86	3.18	2.6	0.08mm
Worst case Gap 5 scenario	5.5	3.5	~2.0mm	0

NOTE: Gap 4 not shown as it depends on customer chassis geometry

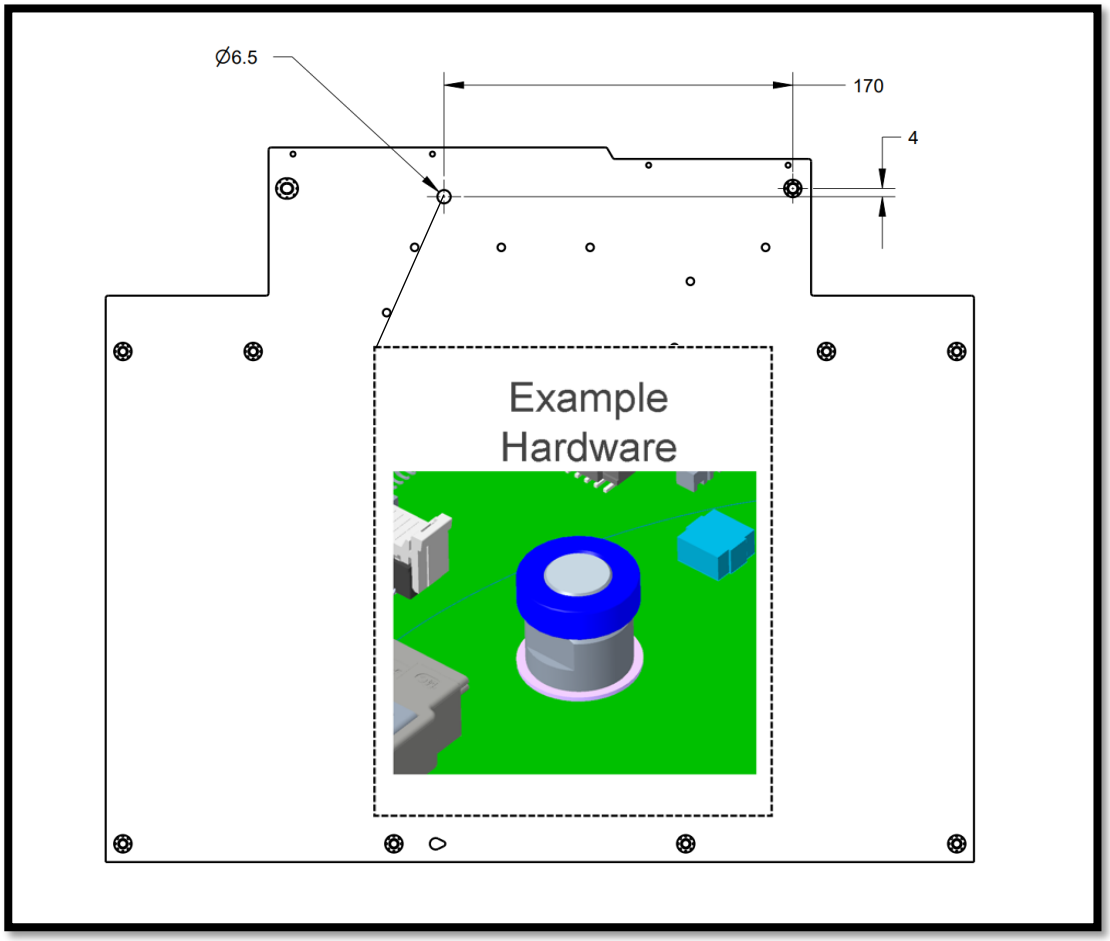
Figure 6. HPM thickness and Straddle Mount Peripheral Offsets



10.4. HPM to Chassis Retention

The HPM and Chassis-to-Board Bracket assembly requires retention to the chassis base. *There shall be a hole required in board to be used for HPM retention to the chassis, located at the required location in **Figure 7** below*. The hole is sized for common retention methods such as plungers, thumbscrews, etc.

Figure 7. HPM Assembly to Chassis Retention Enablement



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10.4.1. Keepout Zone for Retention Hardware

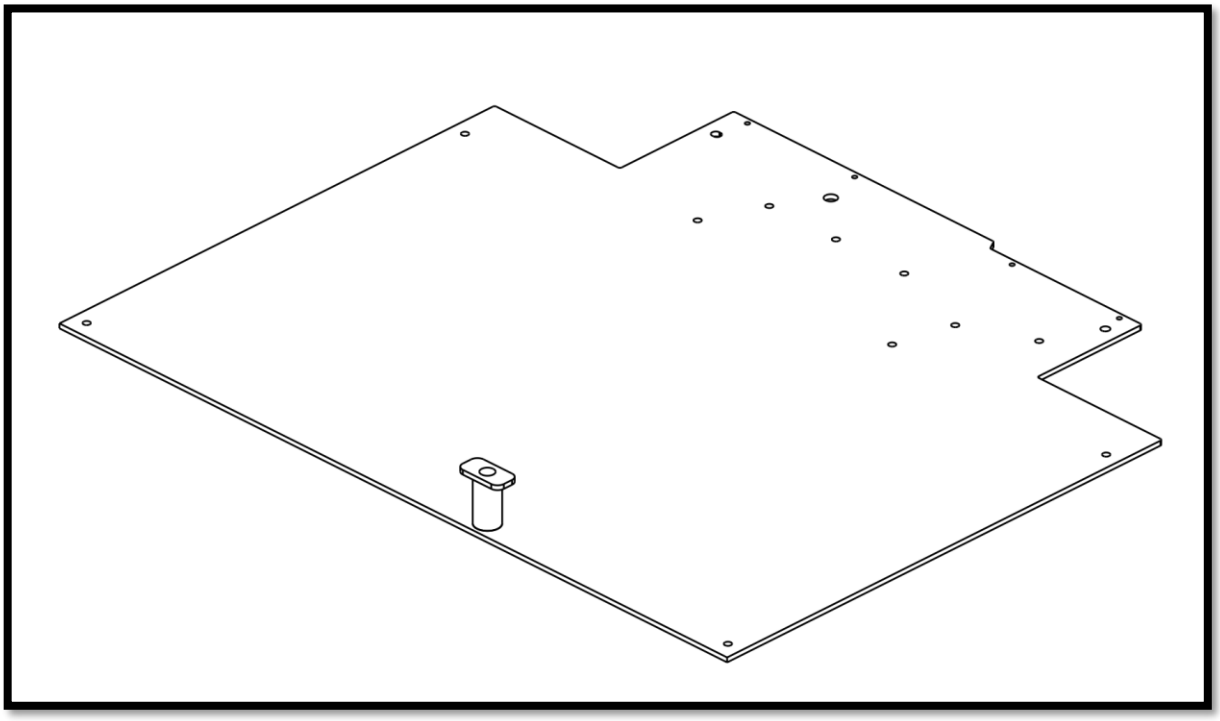
A keepout zone shall be implemented on both topside and bottom side around the Retention Hardware hole.

The Primary (or Topside) KOZ is defined in **Section 10.14**, **Figure 20. Zones for Primary**
480 **Side Component Height Restrictions**. For Secondary side KOZ, refer to **Section 10.15, Figure 22. HPM Secondary Side HPM Zero-Height Keepout Zones**

10.5. HPM Handle Hole

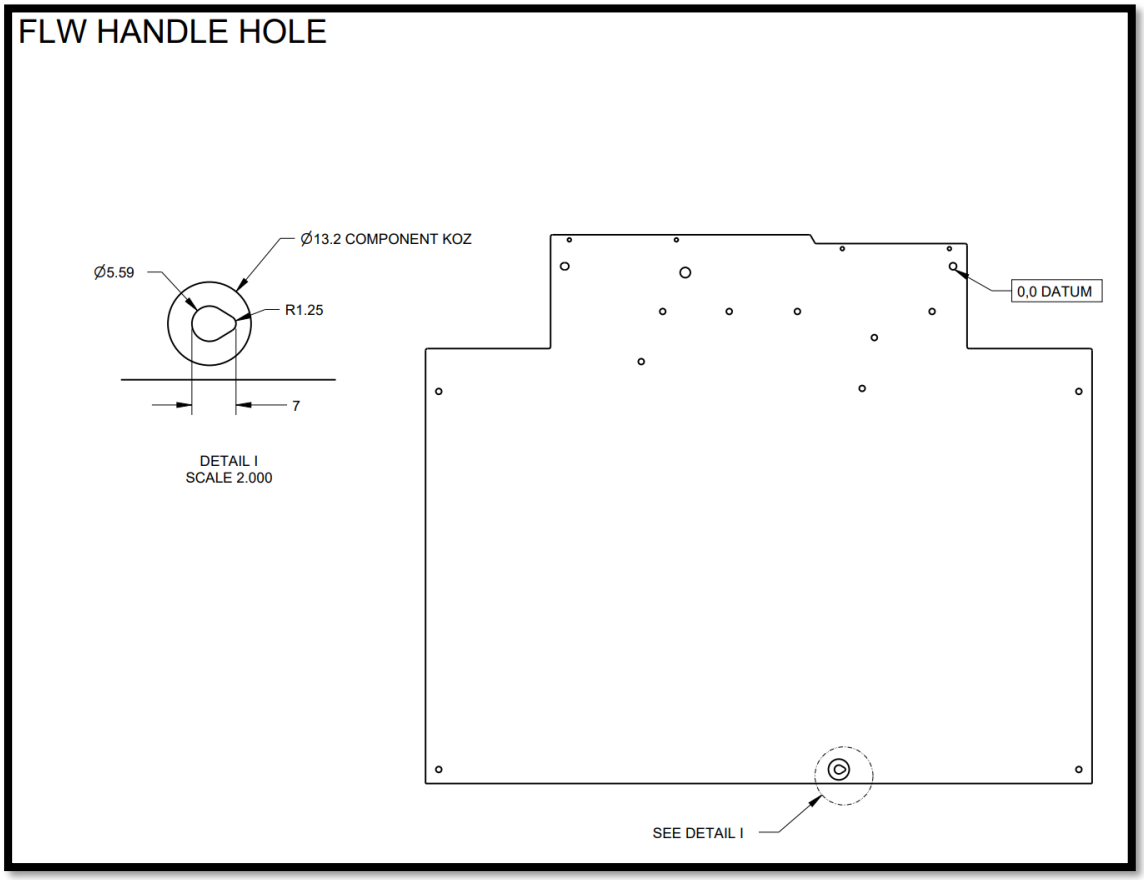
The FLW HPM shall require a hole interface to a mechanical handle near the Far Side Edge.
485 This handle solution may be implemented with but not limited to a plastic handle. Example is shown in **Figure 8**.

Figure 8. HPM Handling Feature



490 The HPM Handle Hole is shown in **Figure 9**. The location of the hole on the Far side is not specified but should be placed considering Compute Core details, such as Far High-Speed IO cabling, and Thermal solution keepout. To balance handling of board with chassis retention feature (near DC-SCM R2.0), it is preferred to place the handle feature to right half of the HPM. *The hole geometry for board handle shall follow the required dimensions and KOZ in **Figure 9**.*

Figure 9. HPM Handling Feature Detail



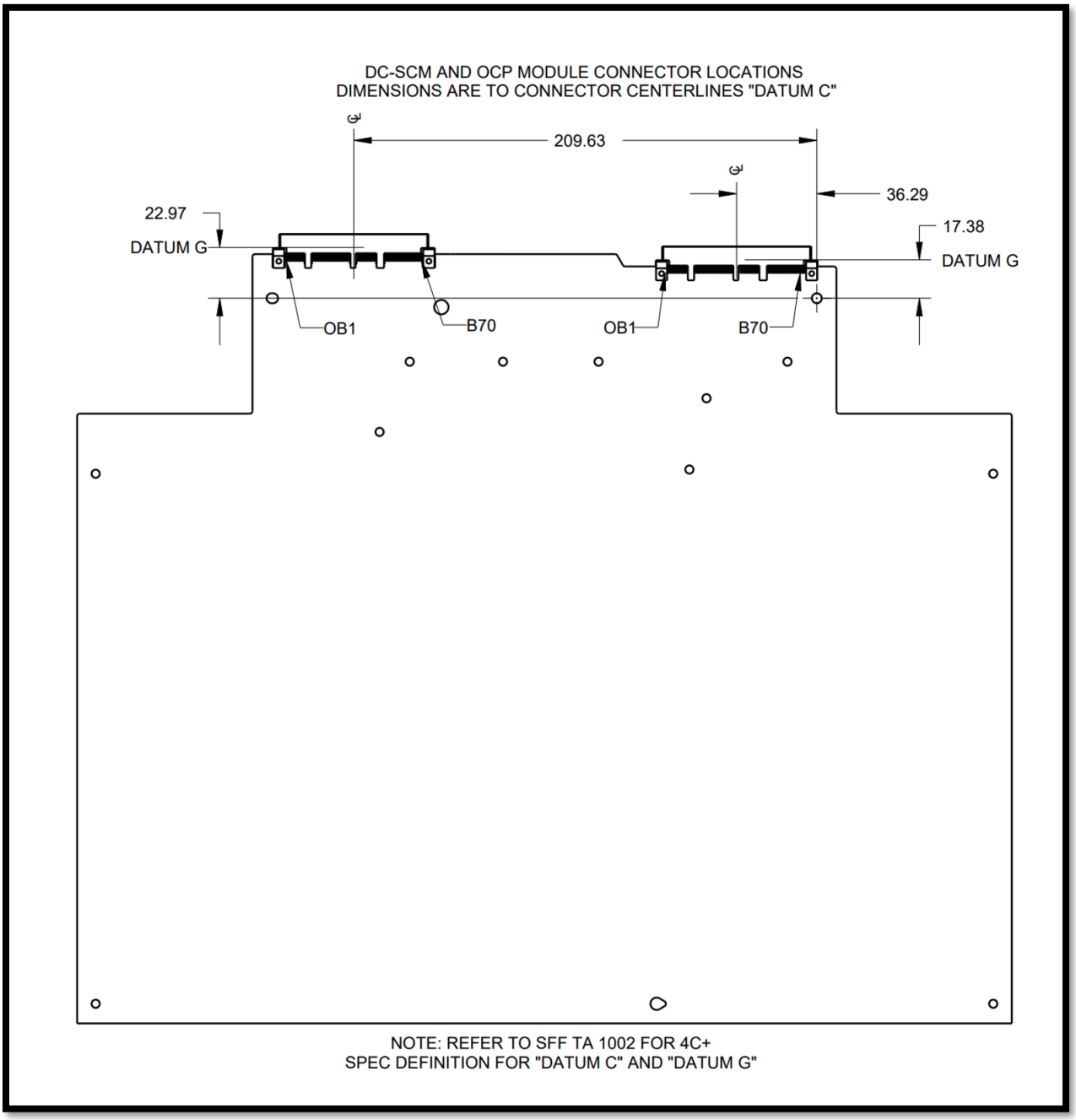
Implementors Note:

The HPM Handle Hole may also be considered a mounting hole for structural purposes. Platform designers should ensure their handle design supports the HPM. For example, a designer does NOT need to place a board mounting hole near the HPM Handle Hole.

10.6. OCP NIC R3 and DC-SCM R2 at Near Edge Locations

The HPM Shall place the OCP NIC R3 and DC-SCM R2 at the locations defined by the centerline location of each of the connector subsystems in ***Figure 10.*** For further details of how the connector centerlines are defined, refer to SFF-TA-1002 specification.

Figure 10. Centerline Locations of OCP NIC R3.0 and DC-SCM R2.0



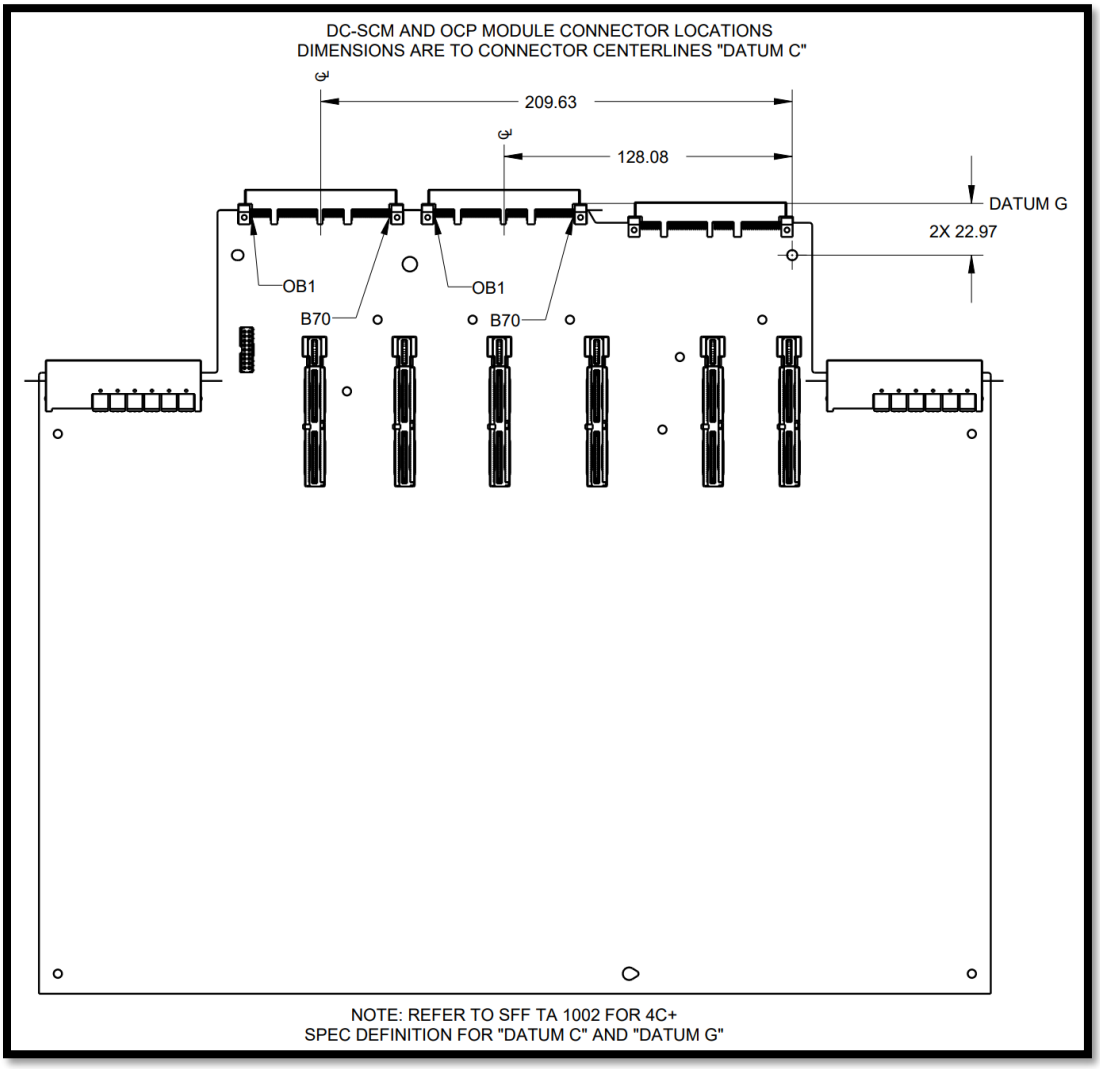
10.7. Platform Custom Zone

The Platform Custom Zone is defined as the Near Edge between the OCP NIC R3 and DC-SCM R2. This area is intentionally undefined, so that System Designers may provide their desired features for the target platform. The specification will define some options that are considered common use cases, to promote greater compatibility between future HPMs.

10.7.1. Second OCP NIC R3

An HPM design may want to support a second OCP NIC R3. These HPM designs should follow the placement guidance **Figure 11** for the second connector.

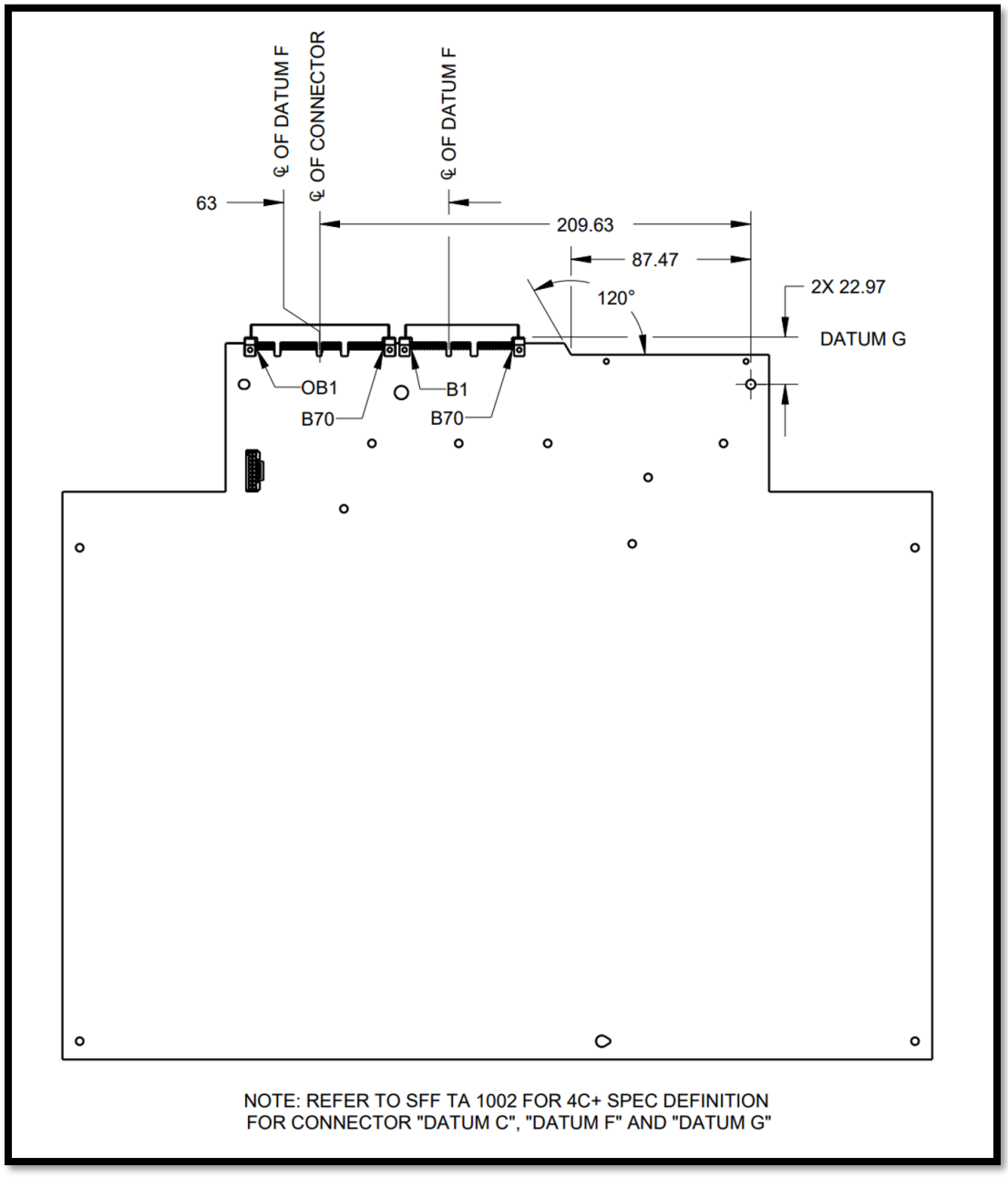
Figure 11. Location for Second OCP NIC R3 in Platform Custom zone



10.7.2. OCP NIC R3 LFF

An HPM design may want to support an OCP NIC R3 LFF, instead of a single SFF. These HPM designs should follow the following placement guidance for the LFF connectors.

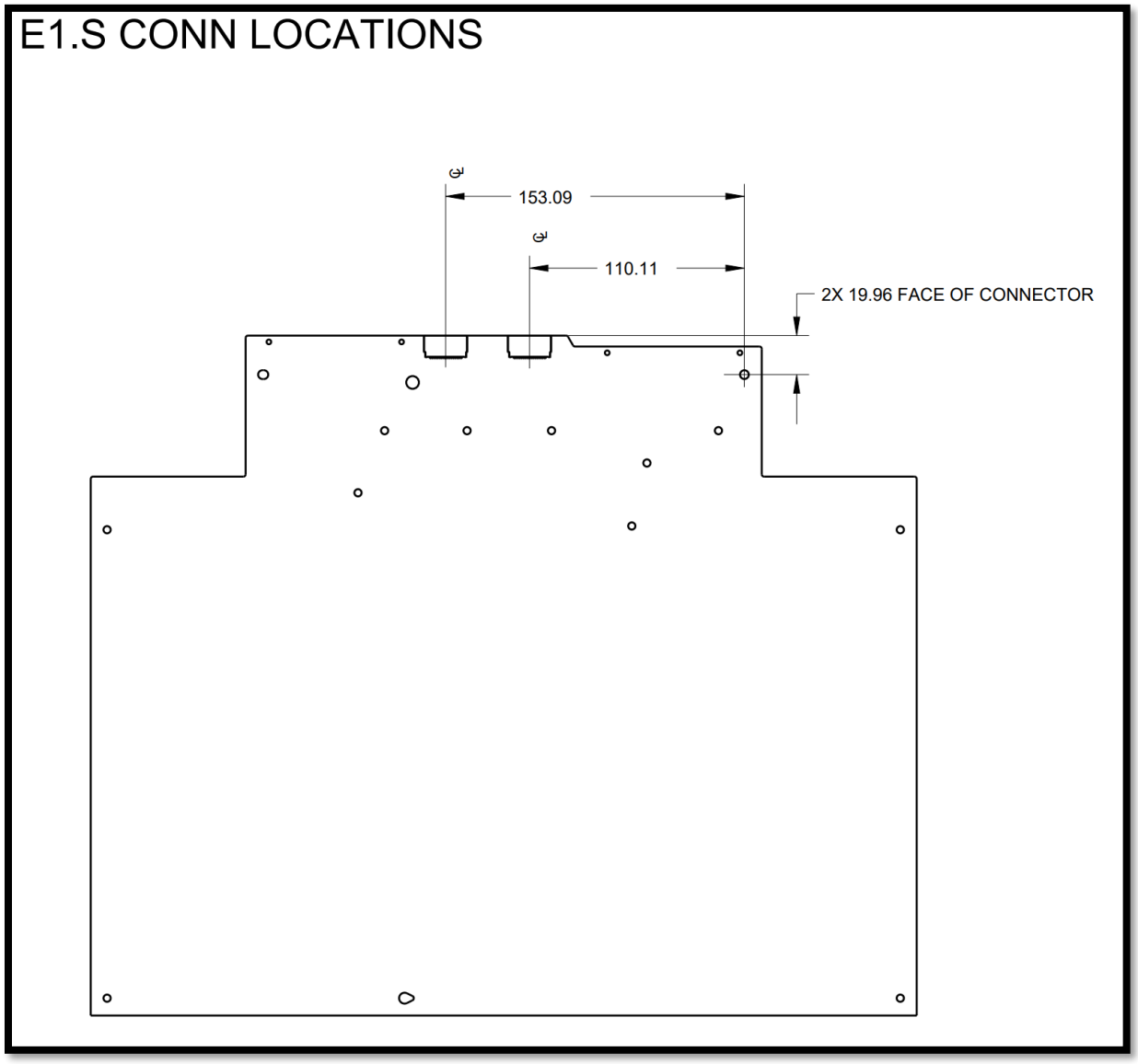
Figure 12. OCP NIC R3 LFF support



10.7.3. Direct Dock E1.S

An HPM design may want to support direct docking E1.S (EDSFF) in the Platform Custom zone. These HPM designs should follow the following placement guidance for SFF-TA-1002, 1C connectors. See **Figure 13**. See M-PIC specification, chapter “E1.S Direct Attach Boot Storage” for complete connector and pinout guidance.

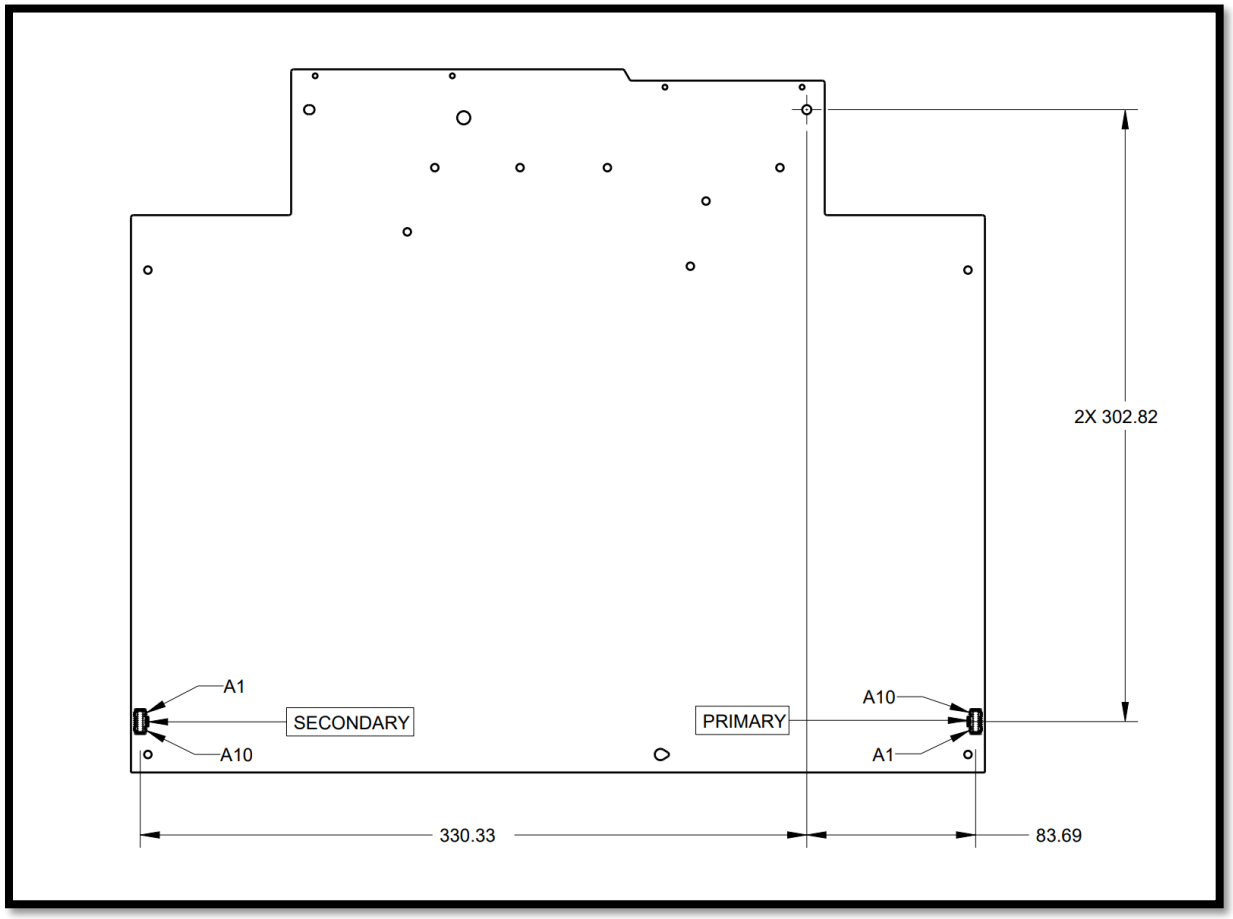
Figure 13. Direct Dock E1.S connector Enablement



10.8. Control Panel Connector Locations

The HPM shall implement two instances of the M-PIC defined Control Panel connections as shown in ***Figure 14.*** The Control Panel Connector details are further defined in M-PIC Section Reference: “Control Panel Interfacing”.

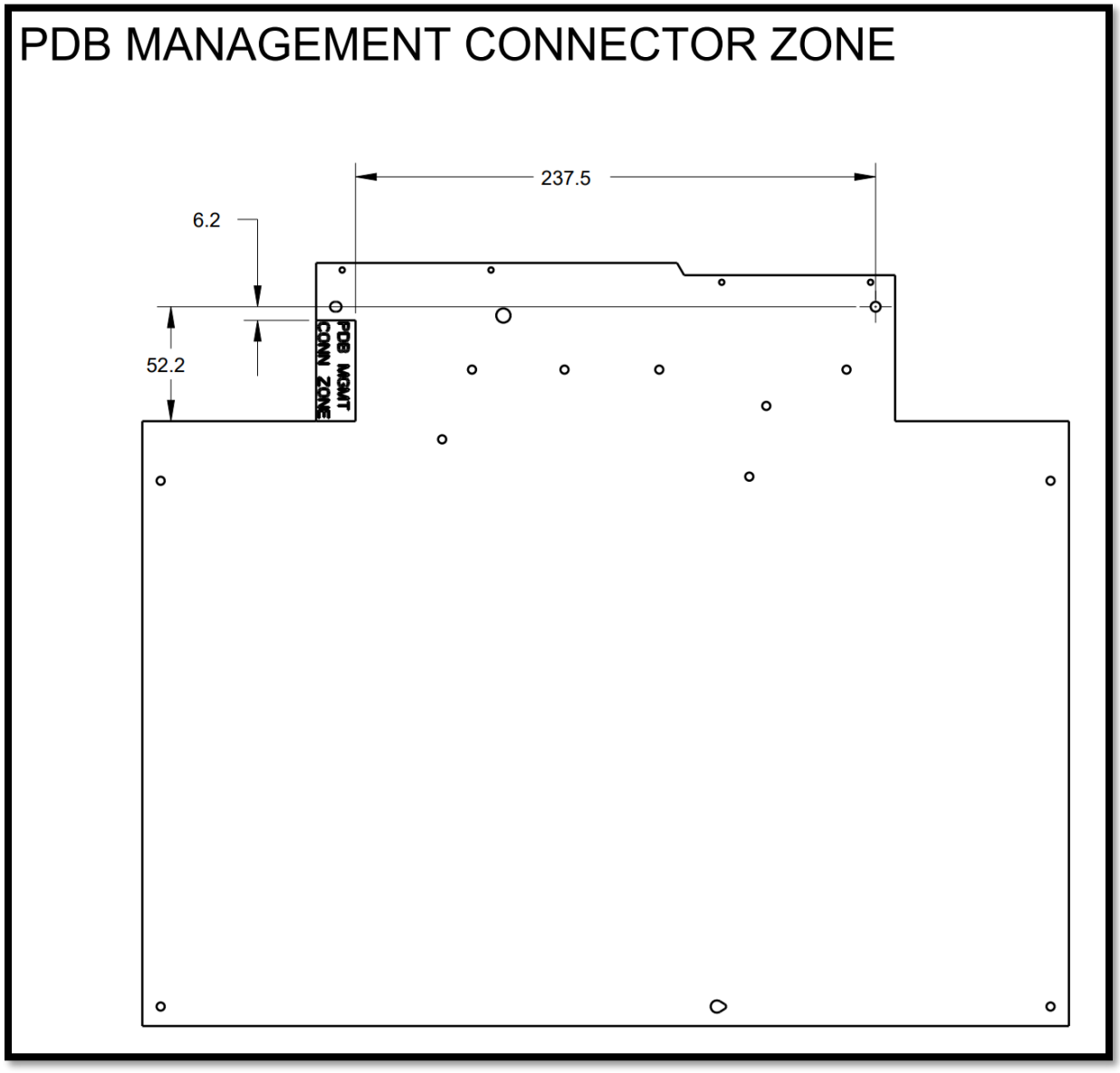
Figure 14. Control Panel Connection Locations



10.9. Zone for PDB Management Connector Header

555 *The HPM shall implement a PDB Management Connector Header. The connector must be placed in the HPM within the zone defined by* ***Figure 15*** *(but can be depopulated in assembly BOM at a Design Specification level guidance).* The PDB Management Connector details are further defined in M-PIC Section Reference: “PDB Management Connector Header”.

560 Figure 15. PDB Management Connector Header Location

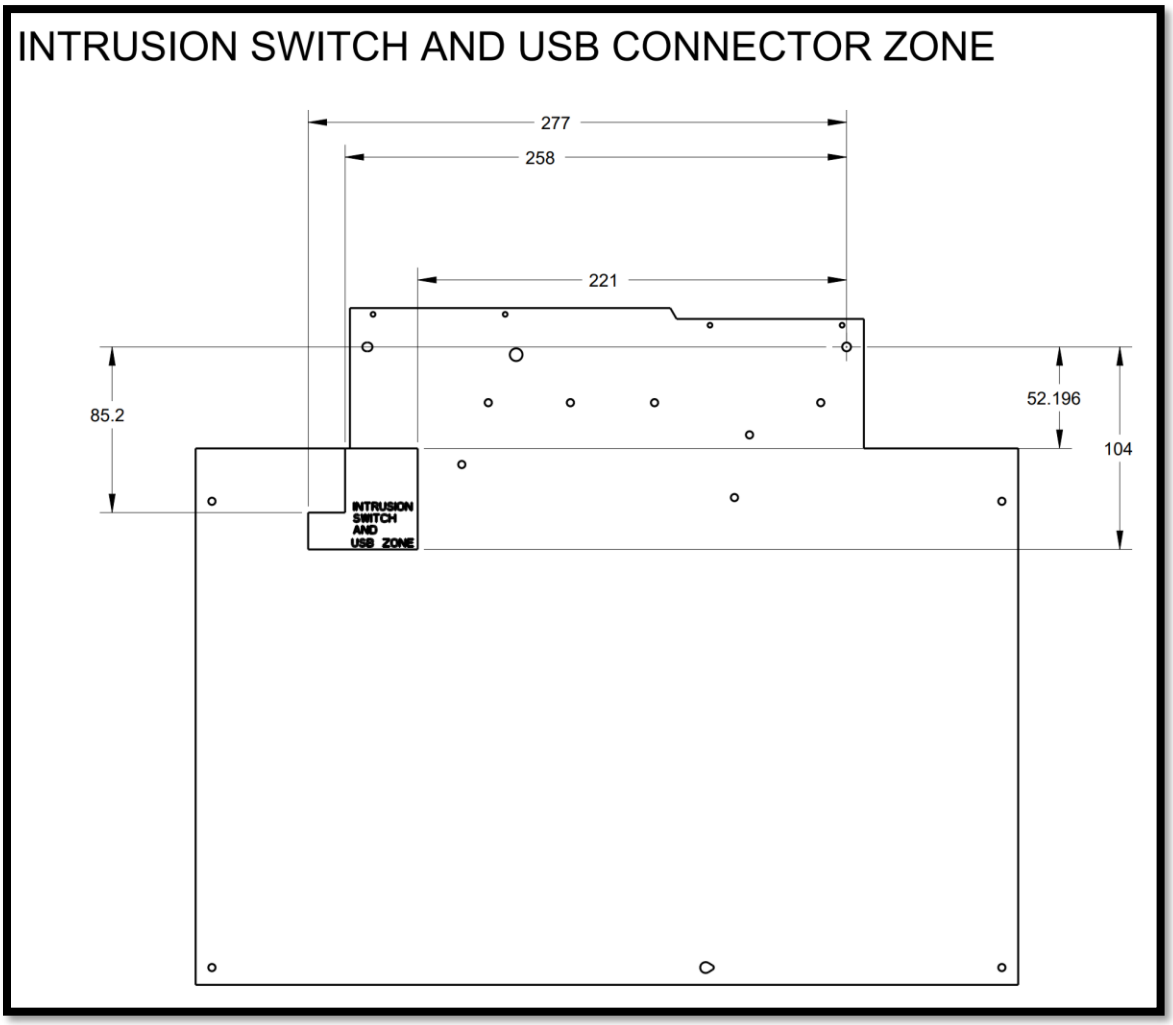


10.10. Zone for Intrusion Switch and Internal Host USB3 Connection

*The HPM shall implement an internal USB3 connector. The connector must be placed on the HPM within the zone defined by **Figure 16**.* The USB Connector details are further defined in M-PIC Section Reference: “Internal Host USB3 Connector”.

*The HPM shall implement an intrusion switch connector. The connector must be placed on the HPM within the zone defined by **Figure 16**.* The Intrusion Switch details are further defined in M-PIC Section Reference: “Intrusion Switch”.

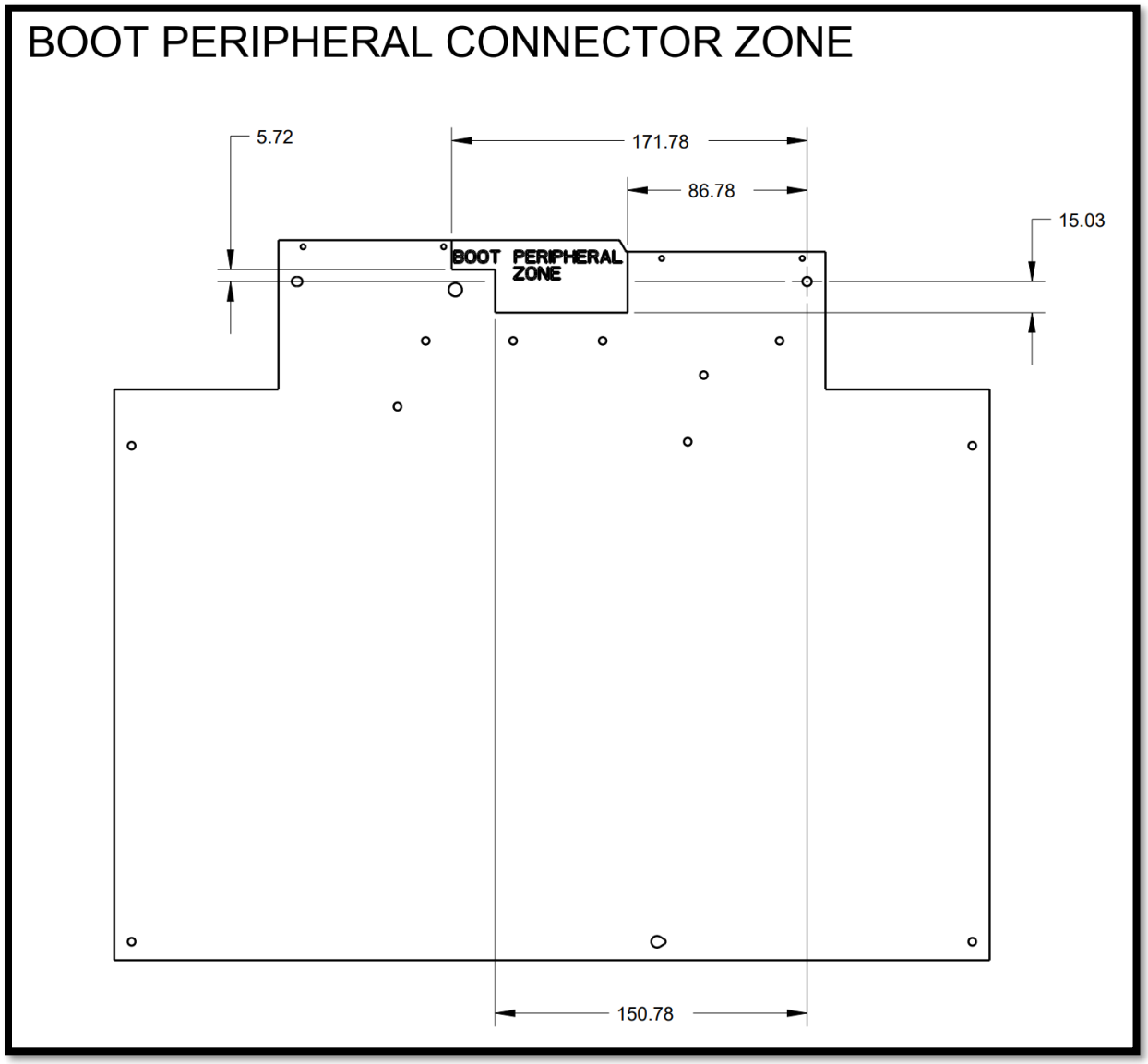
Figure 16. Intrusion and USB Connection Placement Zone



10.11. Boot Storage Peripheral Connection

The HPM is recommended to implement a Boot Storage Peripheral connector. The connector should be placed on the HPM within the zone defined by **Figure 17**. The Boot Storage Connector options and details are defined in M-PIC Section Reference: “Boot Storage”.

Figure 17. Placement Zone for Boot Peripheral Connector



10.12. Near Side IO Connectors

10.12.1. Location of Near Side M-XIO Connectors

Note, that Near IO Requirements are mechanically focused to enable reuse of chassis and IO subsystems.

1) *The required connector for Near IO Riser positions shall be SFF-TA-1033.*
- ***a)*** This Near IO connector can support either rigid or cabled riser connections.

2) An HPM might not use all 6x Near IO positions, but designers are recommended to use maximum number of possible positions. *For Near IO implemented positions, the Near IO Connector shall be placed at locations defined in* ***Figure 18.***

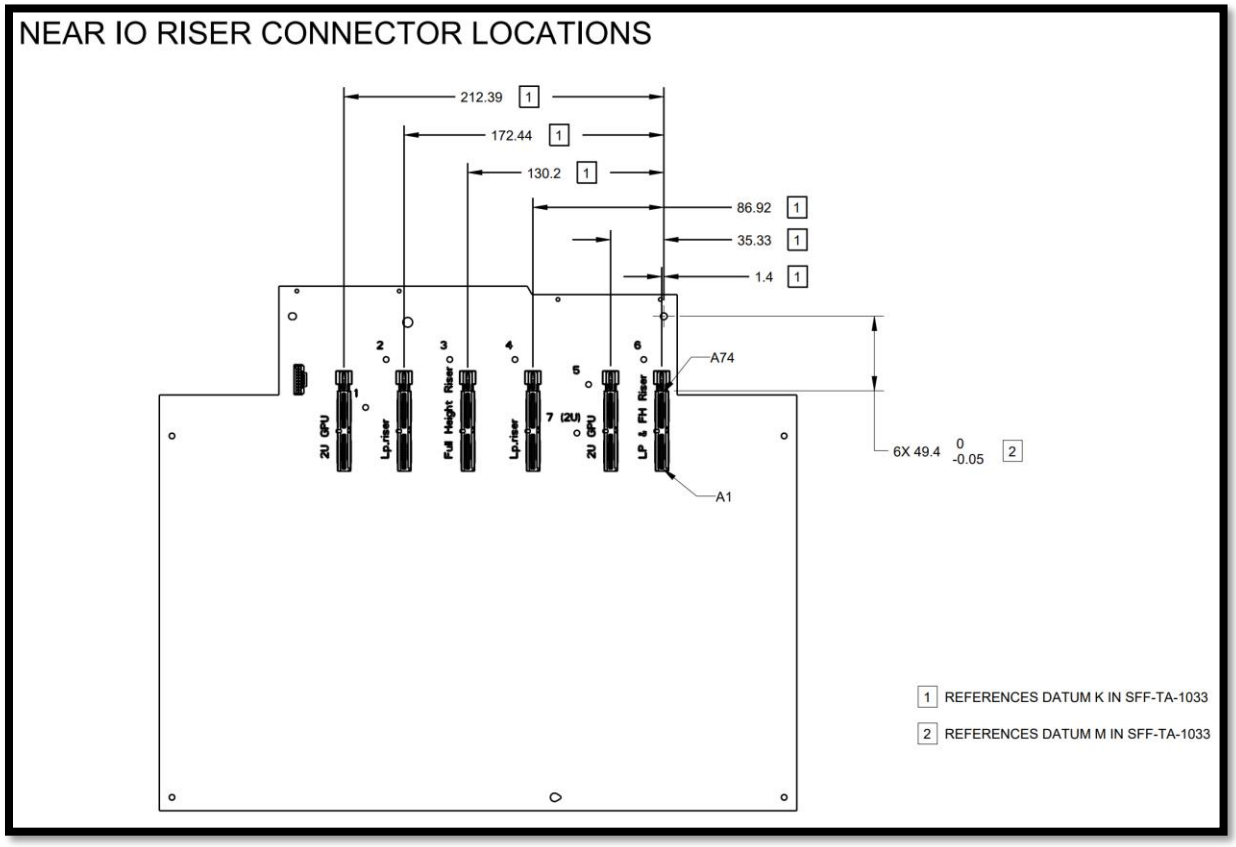
3) Additional and/or Alternate connectors used within the Near IO zone are allowed.
- Alternate connector types, location and use cases are outside the scope of this specification.

4) Adoption of the following allocation priority in is recommended. Following this recommendation may result in increased applicability and interoperability of the HPM.

Table 3. Table of IO allocation and connector priorities for Near IO connector SFF-TA-1033

Recommended Priority	High speed connector housing	High speed routing	Power bay
1	X16	X16	power
2	X16	X8	power
3	X8	X8	Power
4	None	None	Power
5	Depopulate all connectors		

Figure 18. Near IO Connector Locations



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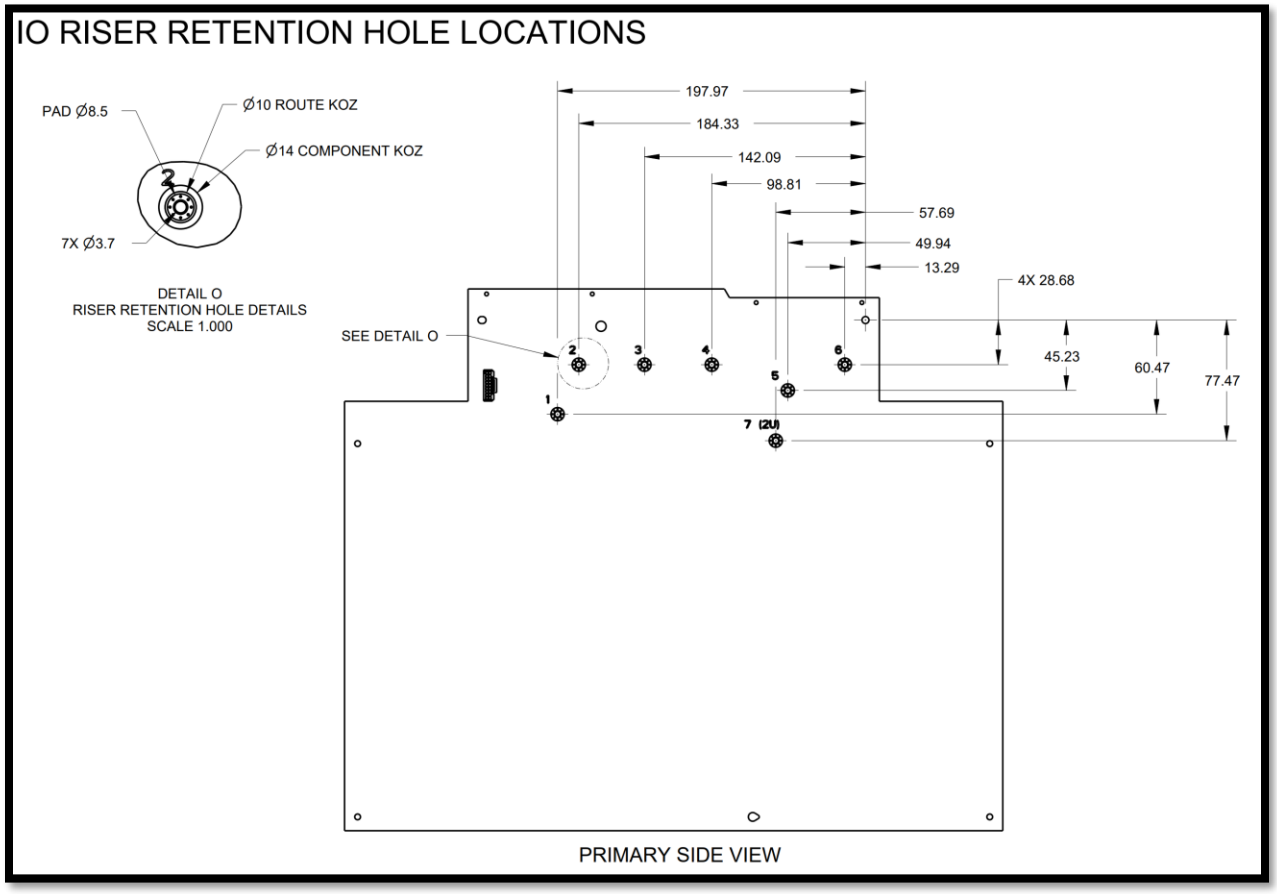
10.12.2. Mounting Hole Requirements for Near Side Riser Retention

*The HPM shall implement all mounting holes associated with each Near Side Riser location, as defined in **Figure 19.*** These are intended to be used for mechanical module retention (such as PCIe Risers, or other modules that require mechanical retention in the HPM area). There is a total of 7x holes associated with the 6x IO connectors. These mounting holes are associated with both 1U and 2U PCIe Riser configurations. The riser retention holes are defined as a 3.7mm diameter hole, as shown in **Figure 19**, along with associated pads and component KOZ. Chassis Designers may choose the hardware and utilization method for riser retention.

Figure 19. 1U and 2U Near Side Riser Retention Enablement Holes



For further explanation on which mounting holes are associated with its Near IO connectors, see **Figure 42. Riser Retention Holes and Associated Near XIO Locations** in the Supplemental Information section.

10.13. Far Side IO Connector Choice and Placement

The Far Side IO connector locations referenced in **Figure 1. Full Width HPM Layout Diagram** are not specified because they are all assumed to be cable-only connections and will not have major dependencies to chassis or subsystem reuse compatibility.

High Speed IO connector choices for the Far Side shall meet the Height Restriction requirements. The recommended connectors for use in the Far side are in **Table 4**

Table 4. Far Side HSIO Recommended Connectors

Recommended Connector	Note
SFF-TA-1016	Must choose low profile variant
SFF-TA-1026	Appropriate due to low profile and ability to fit under thermal solutions

Implementors Note on SFF-TA -1016 Connectors

SFF-TA-1016 Connectors have mated height options above and below 12mm. System Designers should take these options into account with respect to the height restriction zones, if selecting SFF-TA-1016 connectors for an HPM.

10.14. Primary Side Component Height Restriction Zones

*A Component Height Restriction Zone shall be required, per **Figure 20. Zones for Primary Side Component Height Restrictions**; which applies to all soldered components.* The exceptions are: DIMM sockets, special exceptions specified per zone, or zones that are Recommended.

The dimensions indicated in **Figure 20. Zones for Primary Side Component Height Restrictions** are maximum heights. *Component and assembly (solder) tolerances must be chosen to stay within the maximum height.*

The purpose for these height restrictions is to enable:

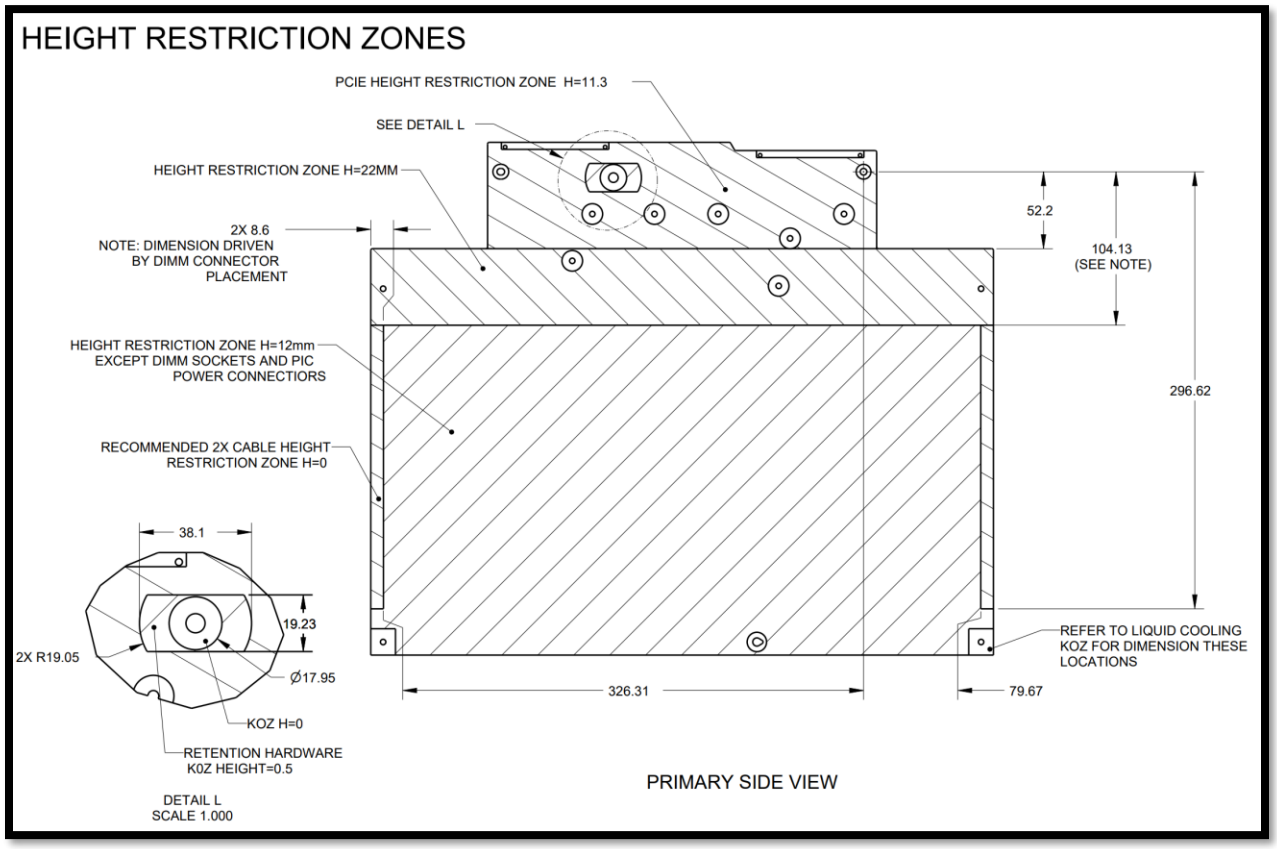
- Thermal solutions to interface to Compute Core items such as CPU and DIMMs (not shown). Thermal solutions in scope include extended air heatsinks and liquid cooling solutions.
- Cable routing channels along HPM edges
- PCIe CEM cards on 1U risers

For thermal solutions, one must consider the allowable variance in numbers, types, and location of Compute Core items. Thus, a fixed 12mm for component height restriction in the Compute Core area is intended to allow air cooling heatsinks or liquid cooling hardware of any variance. DIMM sockets are exempt from the 12mm component height restriction. All other soldered

board components must comply with exceptions noted in **Figure 20. Zones for Primary Side Component Height Restrictions**

If a cable connection (power, High speed IO, etc) is placed in the component height restriction zone, the max height restriction shall apply to the mated height of the plug and cable assembly, including component and assembly tolerances.

Figure 20. Zones for Primary Side Component Height Restrictions



Implementation Note:

The Height Restriction Zones defined in **Figure 20. Zones for Primary Side Component Height Restrictions** apply specifically to soldered circuit board components, mated connector heights or other mated assemblies of solder components. This does NOT apply to heatsinks of any kind, shrouds or other mechanical parts that are added to the board at a later integration stage.

It is assumed that items such as CPU heatsinks, VR heatsinks, and shrouds are all designed by System Designers. And thus, the height and location tradeoff between these items are assumed responsibilities of the System Designer and not the HPM designer. The HPM Designer should consider best practices when making component placement choices. This makes no assumptions on the compatibility of Chassis, Peripherals or Thermal solutions. For future chassis and HPM compatibility, a System Designer is advised NOT design elements that intersect with the Height Restriction zone (Fans, Heatsinks, Risers, etc).

Recommended Cable Zero Height Restriction Zone: It is strongly recommended to implement a keepout zone to left and right of outermost DIMM sockets with a minimum dimension to HPM edge of 8.6mm, shown as Cable Height Restriction Zone in **Figure 20. Zones for Primary Side Component Height Restrictions**.

This keepout is to enable HSIO cabling, power cabling and other platform infrastructure cabling to traverse from Near Side to Far Side zones, as needed by Platform Designers. (Designers should consider differences in DIMM socket widths from various vendors when determining DIMM placement.)

Implementation Note:

In some cases, a Compute Core design may only be able to deliver a desired capability by violating the cable keepout zone. By doing so, an HPM will cause issue with a platform's ability to cable High-Speed IO and Power delivery. In this case, a HPM Designer should make efforts to collaborate with Platform Designers on:

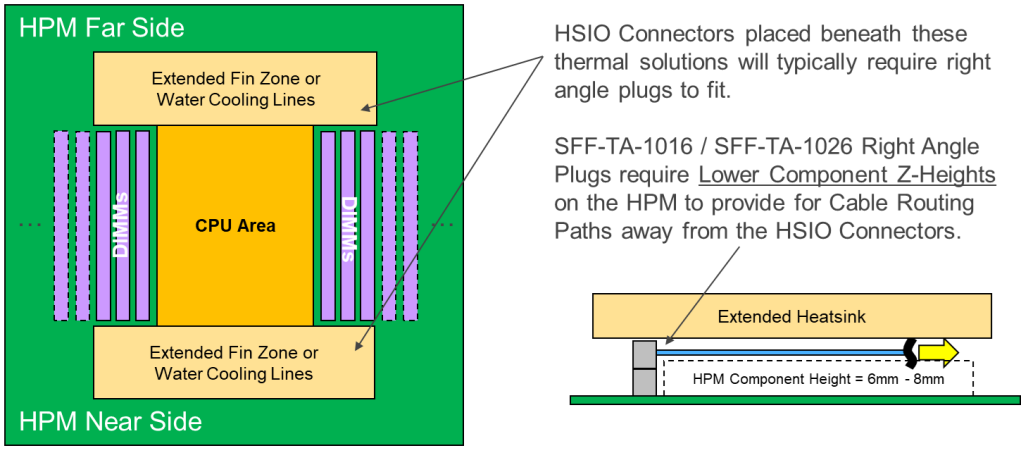
1. Increasing Near Side to Far Side power delivery and power egress capability to mitigate loss of power cabling

2. Identify available cabling space for High-Speed IO to meet a given platform configuration.

3. Adjusting DIMM pitch to enable cables should be considered.

Implementation Note:

HPM designers must take care with component placements relative to cabled HSIO Connectors. Placements should allow for cable routing strategies beneath the defined 12mm maximum component height. Failure to do so will limit potential system intercepts for the HPM.



10.15. Secondary Side KOZ and Height Restrictions

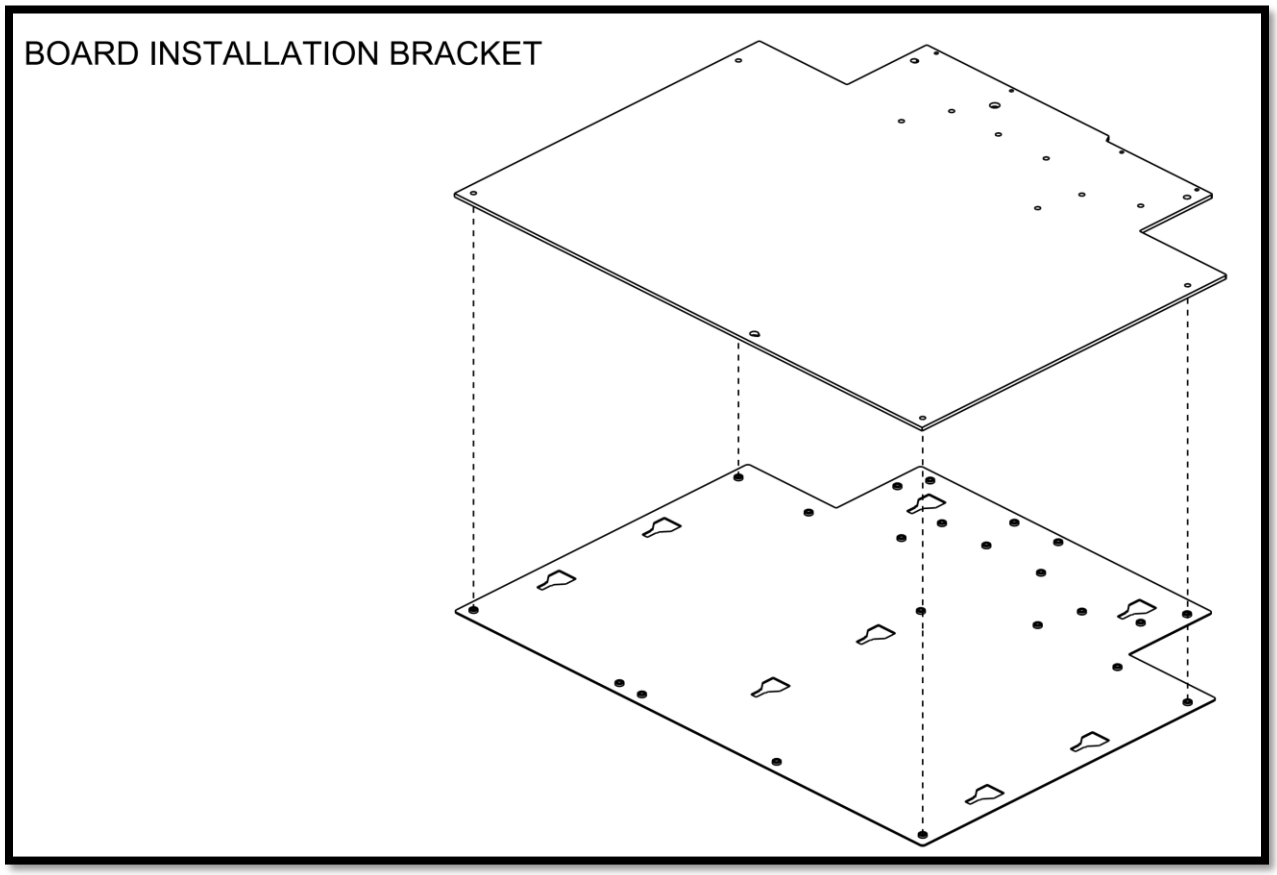
10.15.1. Overall Secondary side Keep-in-Zone Requirements

The back side or secondary side of the HPM shall have a universal height restriction of 1.6 mm, unless otherwise specified in the areas of 0 height zones. This is to ensure clearance to chassis componentry. This is especially important with a max allowable board thickness defined in **Section 10.3 HPM Board and Assembly Thickness.**

10.15.2. Chassis-to-HPM Bracket (Board Pan) Requirements, and KOZs.

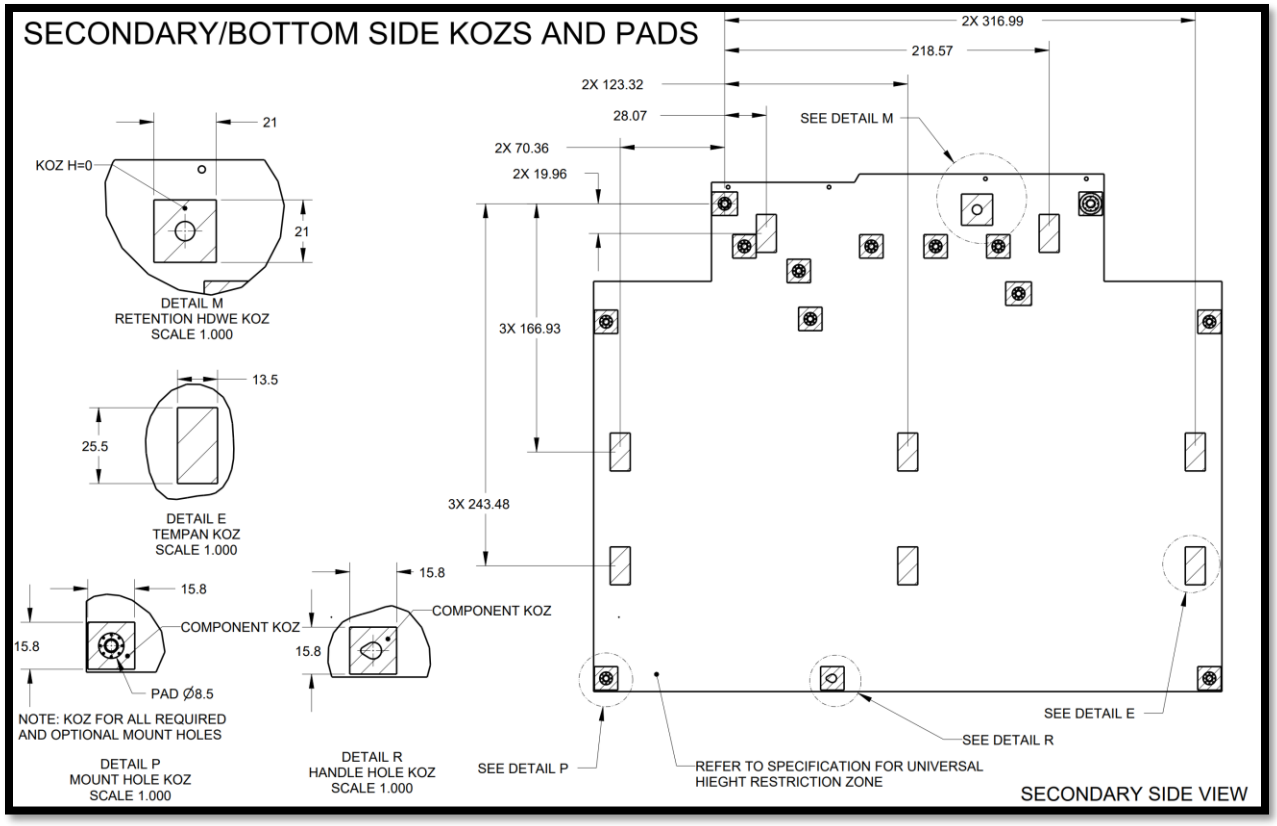
*The M-FLW HPM shall be designed to fit a Chassis-to-HPM Bracket (Board Pan) that enables different board layouts and mounting hole locations between different Compute Core designs while still maintaining compatibility to a common chassis design. See **Figure 21***

Figure 21. Example of Chassis-to-HPM Bracket (Board Pan)



On the HPM, there will be required locations for chassis hook features that interface between chassis base and the Chassis-to-HPM Bracket. These hook locations require HPM secondary side (bottom side) zero-height keepout zones, as specified in ***Figure 22***

Figure 22. HPM Secondary Side HPM Zero-Height Keepout Zones



The Keepout Zones defined in Detail E of Figure 22 are to allow chassis base hook geometry to interface the cutouts on the chassis to HPM bracket. See example in **Figure 44. Chassis Base Geometry to Interface Chassis-to-Board Bracketry**. The geometry of the HPM bracket is not specified and is a design choice for System Designer.

10.15.3. Secondary Side Tall Component Exceptions

In some instances, an HPM Designer or System Designer, may desire tall secondary side components (such as special capacitors) that exceed the secondary side height restriction. Although this should be avoided, a HPM Designer may implement local exceptions if the following conditions can be met:

- Exceptions are contained to small areas of the secondary side, not to exceed 400mm^2 area per instance.
- *No two instances of a secondary side exception shall be closer than 10mm, as to not drive excess cutouts in Chassis-to-HPM bracketry*
- The Chassis-to-HPM bracketry can be cutout to accommodate these exceptions.
- Refer to **Section 10.3 HPM Board and Assembly Thickness**, for maximum overall assembly thickness with regards to secondary side component selection.

10.16. HPM Secondary Support

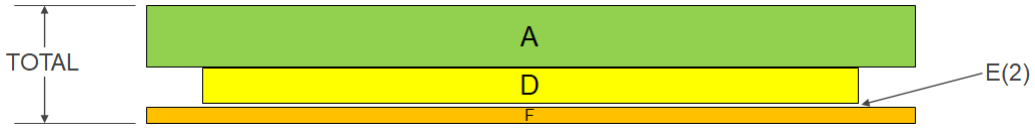
To ensure maximum flexibility of HPM primary side layouts, secondary supports need to be incorporated under the DIMM Sockets and / or any other area of the HPM needing extra vertical compression support. These supports help prevent the board from flexing during assembly, when downward forces are applied to the HPM from the primary side.

The HPM shall have zones and provide HPM Secondary Supports that are 1.78mm +/- 0.10mm thick. They are designed to be close to the board pan or chassis, and provide a vertical deflection stop for the HPM. The materials used and methods for support are the choice of the HPM Designer.

This support height creates a common reference surface that Chassis Designers can rely on that is taller than the Secondary Component Z-Height MAX of 1.6mm.

In **Figure 23,** The HPM is labeled A, Chassis or Board Pan is D, and Secondary supports are represented by area ‘D’.

Figure 23. HPM Secondary Support Diagram



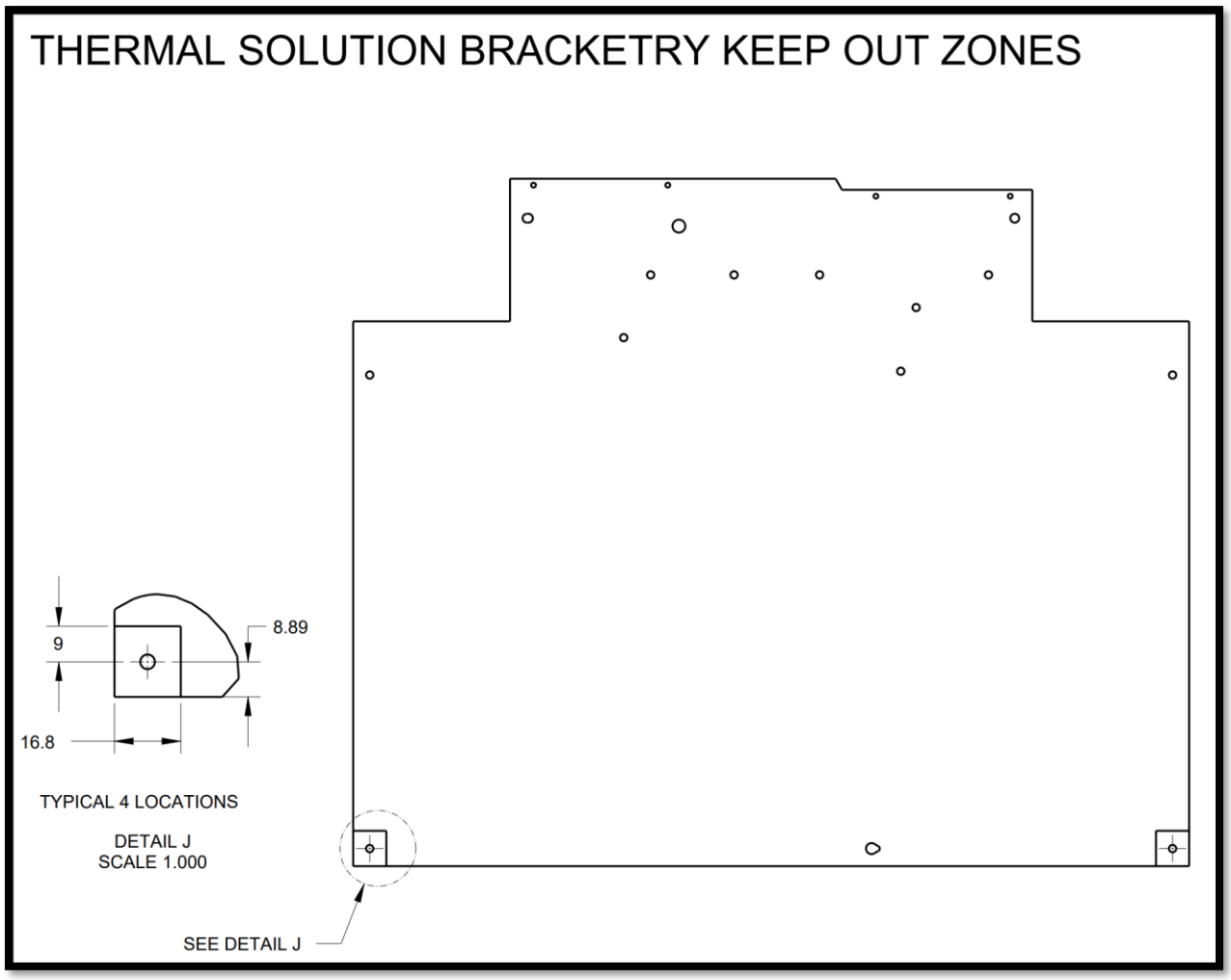
Implementors Note:

If an HPM Designer and a Chassis Designer agree to transfer this responsibility for HPM support, and the HPM Designer provides all the appropriate PCB keepouts and guidance necessary to relocate these supports into the chassis design, then it will be permissible to remove these supplemental supports from the finished HPM PCB assembly.

10.17. Thermal Solution Bracketry Keepout Zones

*There shall be keepouts around the Far Side HPM mounting holes to enable bracket mounting to the HPM, as detailed in **Figure 24**.* These brackets may be needed for systems that wish to mount liquid cooling components, such as DIMM liquid manifolds, or large radiator assemblies.

Figure 24. Thermal Solution Bracket Keepouts



11. Power Delivery

The M-FLW HPM is powered from a 12V DC source. This Base Specification does not cover alternate PSU voltage sources (e.g., 48V DC implementations).

11.1. HPM Power Zones

The HPM supports multiple power zones where significant power delivery and connectivity is expected. **Figure 25** illustrates locations of power zones on the HPM. Details of each zone are described below, some are ingress, some are egress from the HPM. Designers should use this guidance in design of HPM Power planes.

Figure 25. HPM Power Zone locations

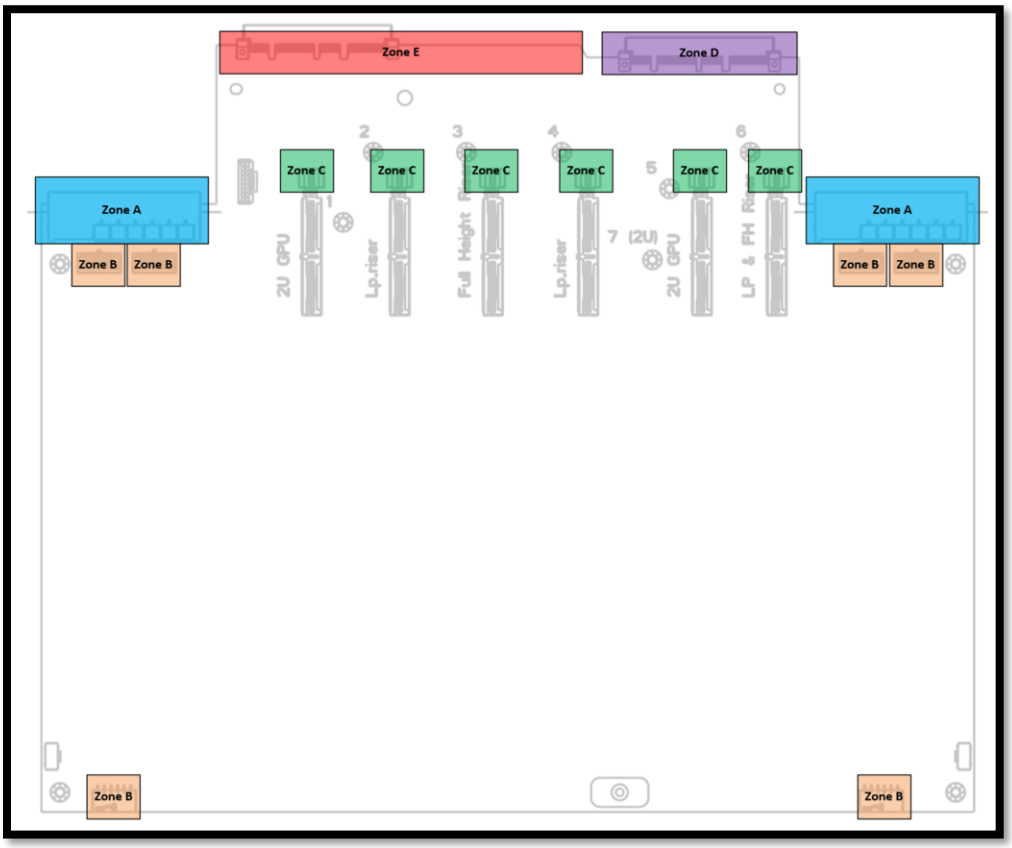


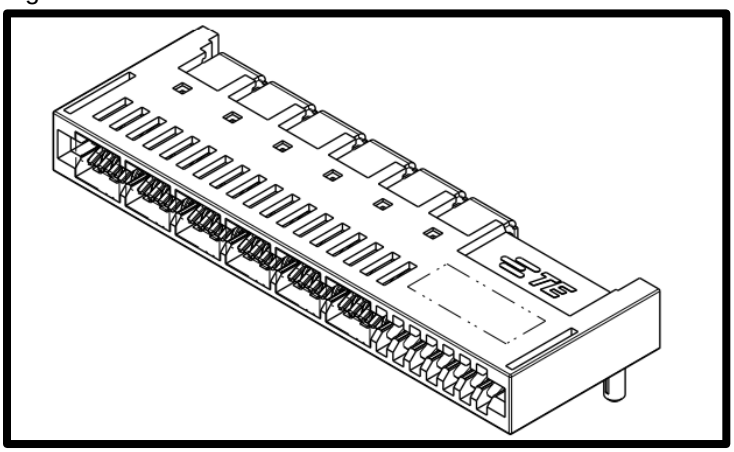
Table 5. Power Delivery Zones

Zone	Feature	Typical Usage	Zone Power Rating
Zone A	M-CRPS Connector	Ingress	up to 3200W
Zone B	2x6+12s PICPWR	Egress	up to 864W
Zone C	Near Side Riser PICPWR	Egress	up to 250W per Near IO Connector populated
Zone D	DC-SCM R2.0	Egress	up to 50W
Zone E	OCP NIC R3.0 + Platform Custom Zone	Egress	up to 160W

11.1.1. Zone A: M-CRPS Connector(s)

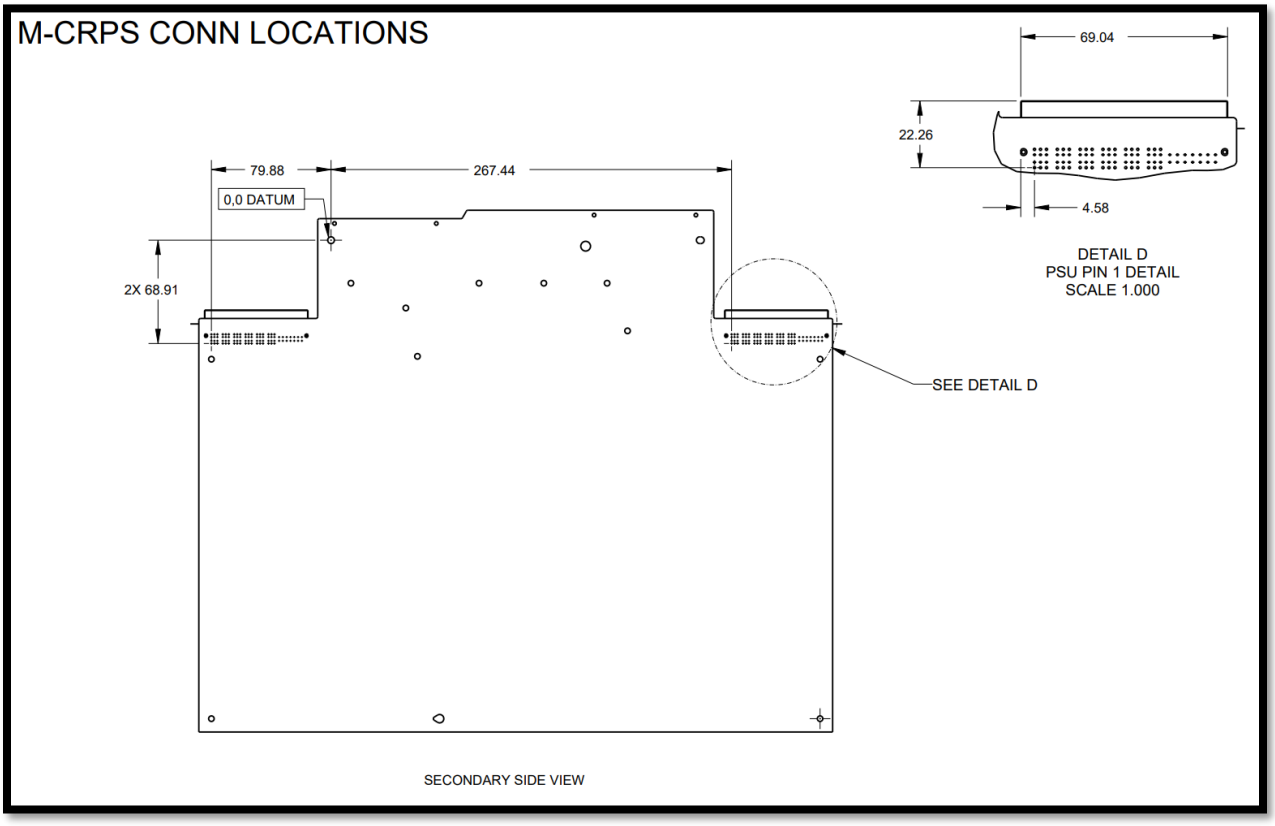
- Connector Power Rating: 3200W
- Typical usage: Power ingress
- Refer to M-PIC and M-CRPS Specification(s) for additional implementation details.

Figure 26. M-CRPS Power Connector



Locations of M-CRPS connectors shall be placed as defined in ***Figure 27***

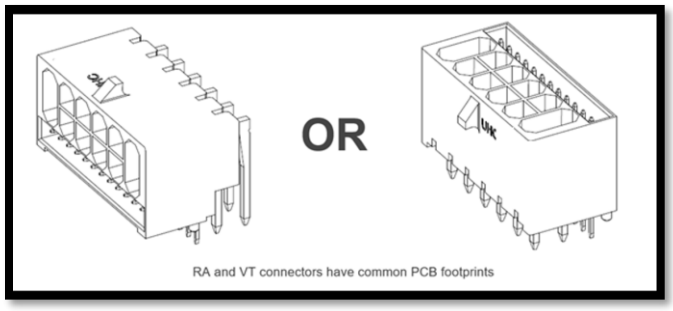
Figure 27. M-CRPS Connector Location Requirements



11.1.2. Zone B: PICPWR Connector(s)

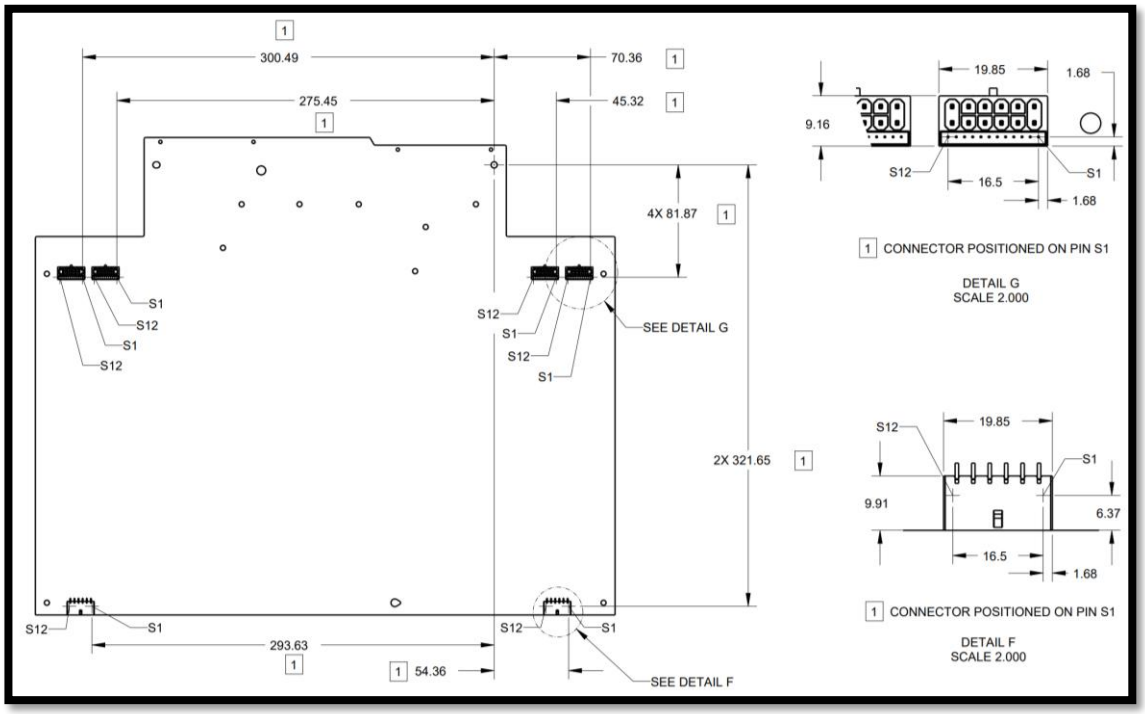
- Connector Power Rating: 864W
- Typical usage: Power egress to peripherals, Power Ingress from PDB
- Refer to M-PIC Specification for additional details
- Far Side PIC PWR may be either Vertical or Right Angle, the connector has common footprints.
- Note, Near Side PIC PWR should be vertical connector only

Figure 28. 2x6+12s PICPWR Power Connectors



The HPM shall implement 6x PICPWR connectors at locations defined in ***Figure 29****.* Note: HPM shall implement these connector footprints (but can be depopulated in assembly BOM at a Design Spec level guidance.)

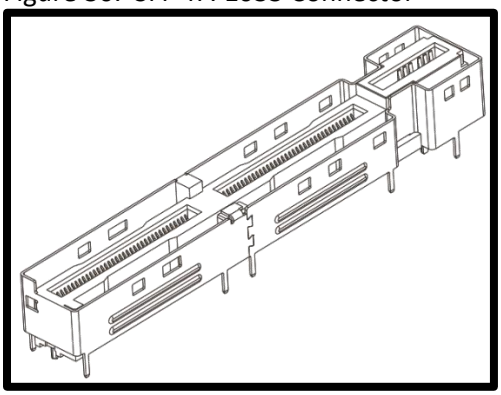
Figure 29 PICPWR connector (2x6+12s) Location Requirement (6 locations)



11.1.3. Zone C: SFF-TA-1033 Connectors w/ PICPWR

- Connector Power Rating: 250W
- Typical usage: Power egress for up to 3x 75W CEM PCIe devices
- Refer to M-PIC Specification for additional details.
- Refer to **Section 10.12 Near Side IO Connectors** for additional details on Near Side connector and location.

Figure 30. SFF-TA-1033 Connector



The Egress Near Side Riser Power Zone provides power to PCIe devices on risers. This specification does not cover direct dock CEM implementation (non-riser approach). The HPM provides 12V_PRIMARY[1] to the Egress Near Riser Power Zone.

75W Slot power, detailed in **Table 6**, is provided for each PCIe CEM slot on all PCIe risers. The PCIe riser enables a +3.3Vaux and +3.3V (V_{cc3_3}) power sources derived from the 12V_PRIMARY source from the HPM

Table 6. Minimum HPM Power Supply Rail Requirements per PCIe CEM Slot

Power Rail	75 W Slot[2]
+3.3Vaux	Generated on PCIe riser. Derived from 12V_PRIMARY
+3.3V (V_{cc3_3})	Generated on PCIe riser. Derived from 12V_PRIMARY
12V_PRIMARY Voltage Current	 12V nominal 7.25A total: 5.5 A (CEM 5.0) + ~1.0A (VR conversion to V_{cc3_3}) + ~0.35A (VR conversion to +3.3Vaux) + ~0.40A (misc.)

Note 1: see M-PIC specification for definition of 12V_PRIMARY

Note 2: Additional power is provided to each CEM slot beyond PCIe CEM 5.0 specification to budget for miscellaneous logic on risers and VR conversion losses. Effective total power is 87W per slot.

11.1.4. Zone D: DC-SCM r2.0 Connector

- Connector Type: See OCP DC-SCM R2.0 specification
- Connector Power Rating: 50W

11.1.5. Zone E: NIC 3.0 and Platform Customization Zone Connector(s)

- Power Connector Type: See OCP NIC R3.0 specification and Platform Custom Zone
- Connector(s) Power Rating: 160W (combination OCP NIC R3 *and* Platform Custom Zone)
- This is a maximum number, the connectors OCP NIC R3 and Platform Custom Zone choice may not consume maximum power.

11.2. HPM Power Planes

Note: This section and Table 7 is subject to change for 1.0.

The HPM power planes (and supplementary power delivery mechanisms like cables) shall have the following features

1. At maximum load, the HPM power shapes temperatures have a maximum of 30°C T-rise and do not exceed 100°C absolute
2. At maximum load, the maximum HPM voltage drop (IR loss) between power sources and associated loads or connectors is less than or equal to 1%
3. Any load (operating up to its maximum power rating) in the platform can be powered with a single operational power source (e.g. PSU), where the total of all loads does not exceed the capacity of the power planes as defined in defined in **Table 7. Minimum Power Plane Capacity Requirements.**
4. It is not expected that all loads/connectors on the HPM will be operating at maximum power concurrently. However, it is recommended that, minimally, the power distribution be designed to allow any single load/connector to operate at max power rating.

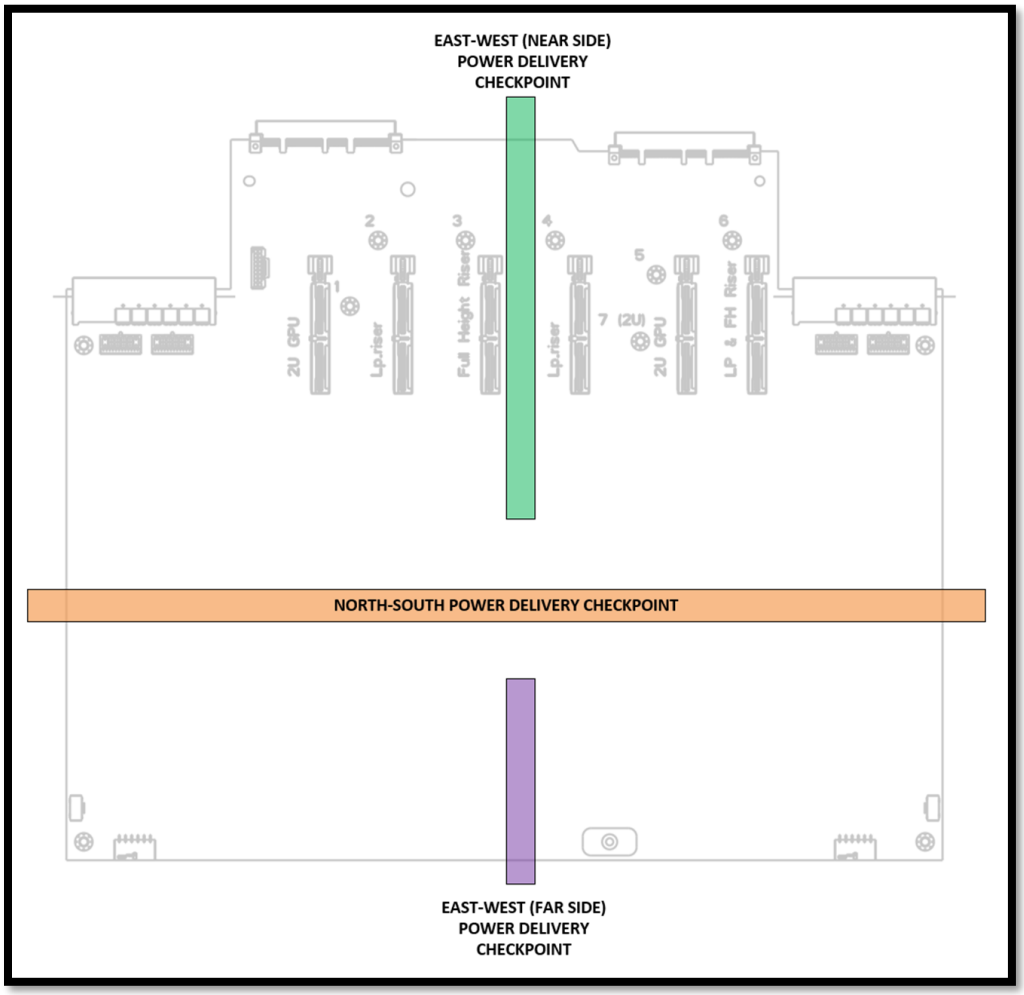
Implementation Note:

It is up to System Designers to understand use cases and loads in different system configurations to ensure that there is adequate power delivery within the HPM

Three checkpoint areas have been defined on the HPM, see **Figure 31**

1) NORTH-SOUTH power delivery checkpoint
2) EAST-WEST NEAR SIDE power delivery checkpoint
3) EAST-WEST FAR SIDE power delivery checkpoint

Figure 31 Power Plane (and Supplementary Power Delivery Mechanisms) Checkpoint Areas



*The sum of all 12V_PRIMARY[1] power planes (and supplementary power delivery mechanisms) INSIDE the cross-sectional areas of the HPM defined by the power delivery checkpoints must meet the minimum power delivery capacity requirements defined in **Table 7**.*

Table 7. Minimum Power Plane Capacity Requirements

Power Plane Checkpoint	Minimum Power Delivery Capacity
NORTH-SOUTH	2800W
EAST-WEST NEAR SIDE	2400W
EAST-WEST FAR SIDE	864W

Note 1: see M-PIC specification for definition of 12V_PRIMARY

12. Adapted M-FLW HPMs

This section shall define open and standardized adaptations of the M-FLW HPM specification.

- Any additions to interior of form factor, that doesn't impact requirements table, is considered a base M-FLW compliant HPM.

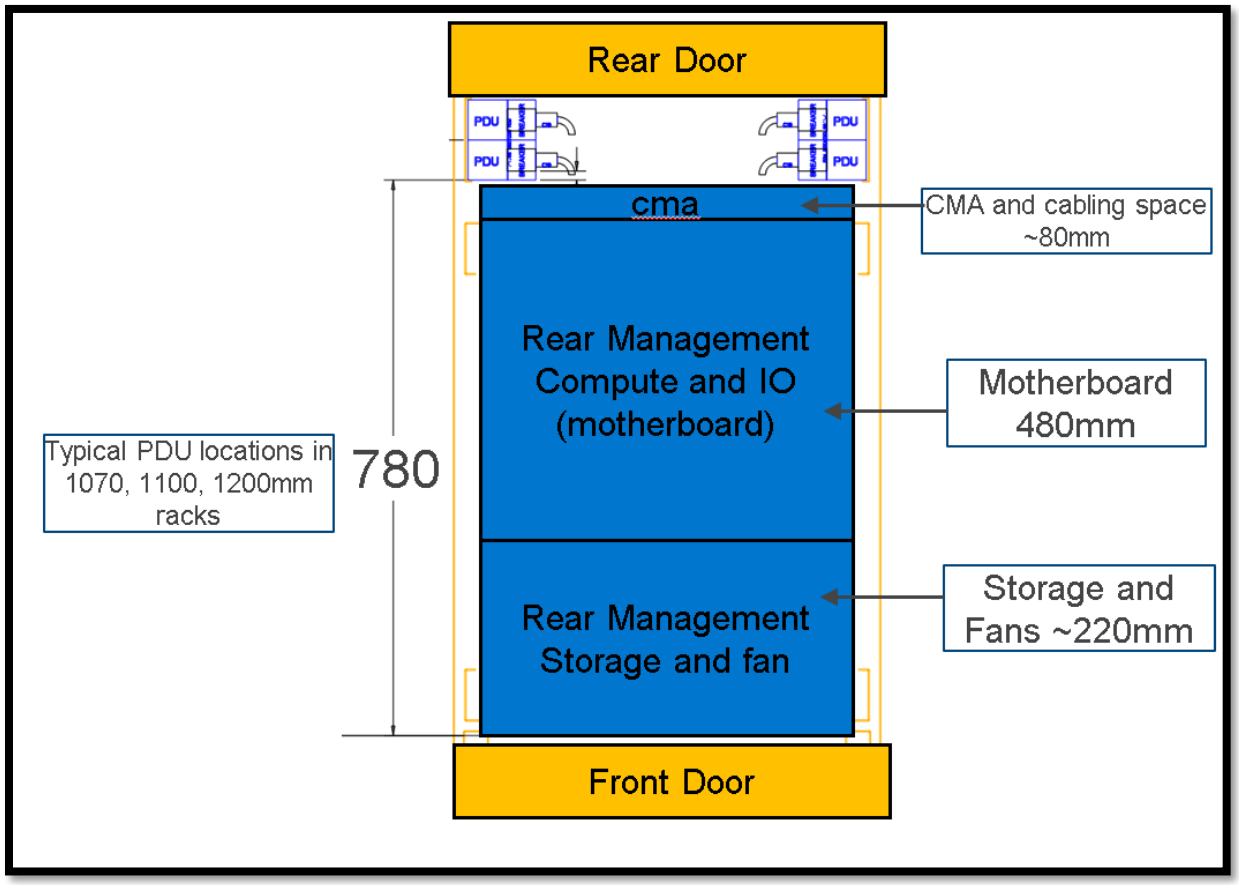
- If any design attributes of an HPM do not meet the items in **Section 4** Specification Compliance Table, this results in an Adapted HPM may not be specification compliant, and may not fit existing chassis built to compliant boards.

13. Supplemental Information

13.1. Rack and Chassis Depth Stackup Assumptions

The M-FLW HPM Base Specification is constructed under the considerations that the installation environment has a Power Distribution Unit approximately 780mm from the front EIA flange. Although platforms may vary in depth, the board size constraint is chosen to enable typical chassis storage systems using this M-FLW HPM spec to fit with a Cable Management arm in less than the 780mm PDU constraint.

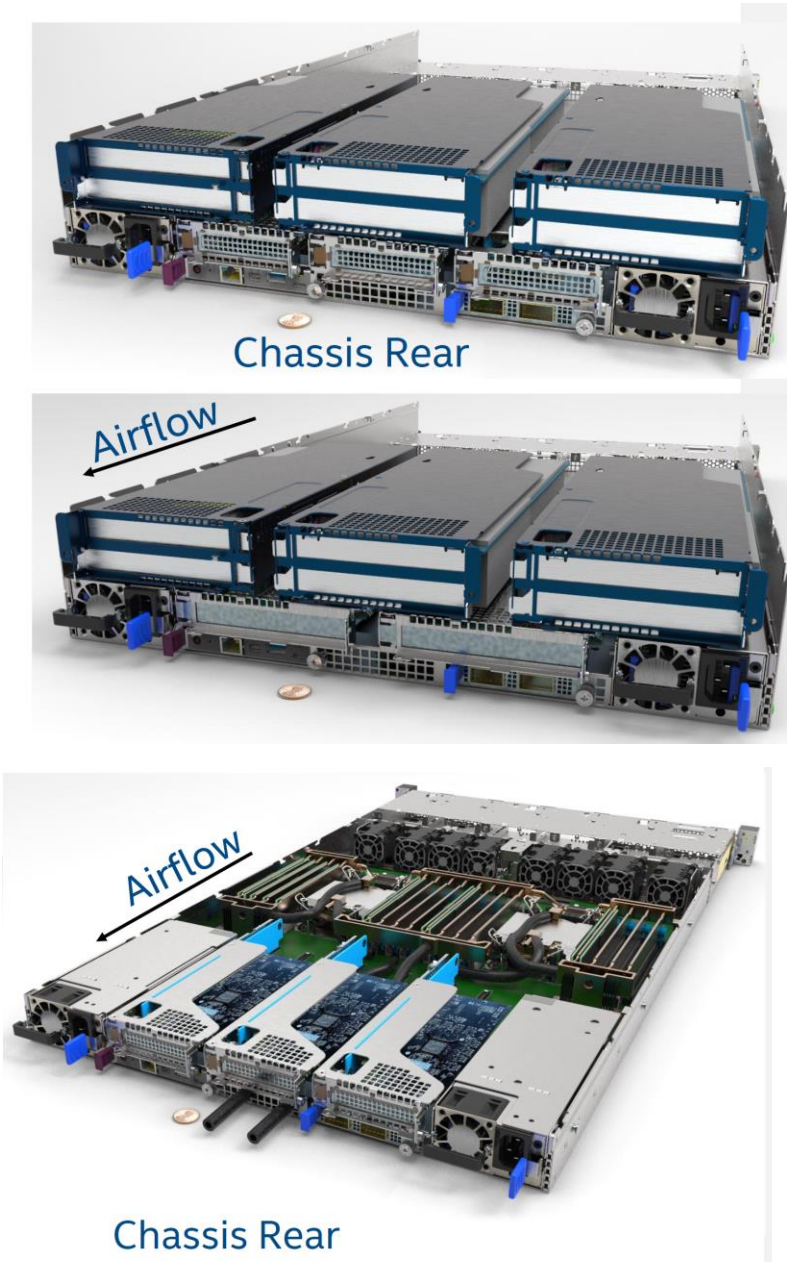
Figure 32. Rack Depth Constraints



13.2. 1U and 2U PCIe Slot Typical Configurations

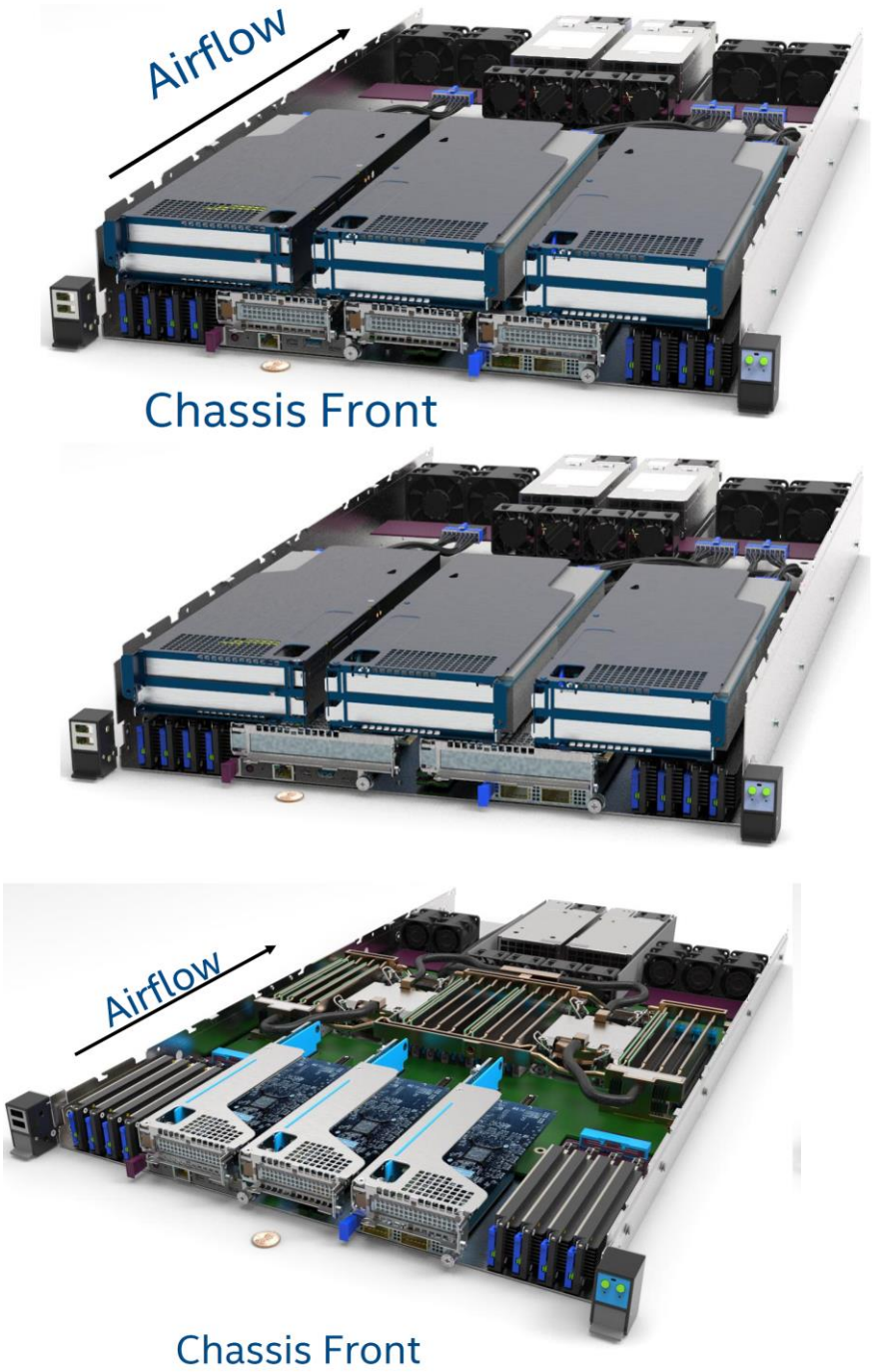
The following images in **Figure 33** are of typical Enterprise 1U and 2U PCIe Slot Configurations.

Figure 33. Typical 1U and 2U PCIe Slot Configurations for Rear Management System



The following images in **Figure 34** are of typical Hyperscale 1U and 2U PCIe Slot Configurations. Note, these are 19" FrontIO chassis like OCP Project Olympus. Also, the front can be shuffled around using an extra "adapter board" like **Figure 43** is not covered by the M-FLW HPM spec.

Figure 34. Typical 1U and 2U PCIe Slot Configurations for Front Management System



13.3. HPM with Far Side Panel Mount IO (FSPM) Requirements

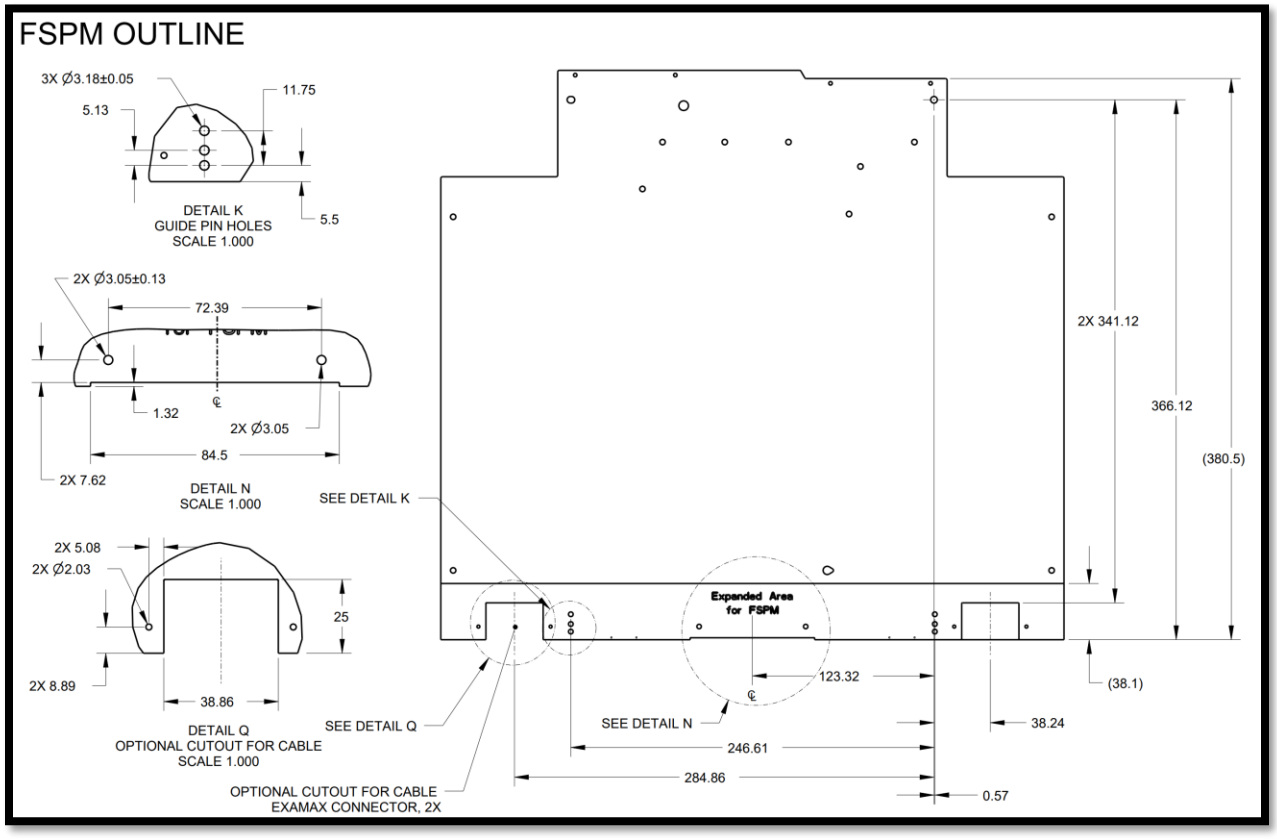
Readers Note: This Section represents a Future FLW Type or Adapted HPM. For this Version of FLW, we will abbreviate this HPM type as the FSPM (Far Side Panel Mount) HPM. This informative section will go into the normative section of the FLW specification once the FSPM target interfaces are released.

The FSPM HPM architecture leverages the base HPM specifications. FSPM Adaptation or Type has differences from the Type 1 base spec, which are focused on the Far Side area to optimize Power Delivery and IO connections that are part of a Front Panel IO or Blade implementation. *A FSPM implementation must implement blind-mate panel mountable connectors in the specified locations as described in* ***Figure 35. Full Width HPM Outline Modifications for Far Side Panel Mount***

13.3.1. FSPM HPM Outline

FSPM HPM Outline is an extension of the base outline listed in ***Section 10 Mechanical Requirements*** *and must match the specified dimensions.* The Far Side dimension of the base outline is extended by 38.11mm [1.5”] to accommodate blind mate IO connectors, power connector, and blind-mate guide pins to achieve reliable docking with panel-mount connections. This is shown in **Figure 35**

Figure 35. Full Width HPM Outline Modifications for Far Side Panel Mount



13.3.2. Blade High Speed IO connector

High Speed IO connector outlines shown in **Figure 35** are based on the Amphenol ExaMAX family (or equivalent) series. There are seven 4x8 ExaMAX shown from left to right. In addition, there is one 6x8 ExaMAX in the far-right position that is intended to include extra clock and management signals. *The position of these connectors must align to the indicated positions, but any of the connectors may be depopulated if not used. However, both guide pin receptacles **must** always be included for mechanical robustness during blind-mate insertion. The pin-out for the connectors must adhere to the definitions defined in the M-XIO specification.*

Table 8. Blade Far/South High-Speed IO Recommended Connectors

Connector family	Company	Configuration
ExaMAX / ExaMAX 2	Amphenol or Equivalent	4 pairs X 8 columns
ExaMAX / ExaMAX 2	Amphenol or Equivalent	6 pairs X 8 columns

Figure 36. ExaMAX 4x8 connector

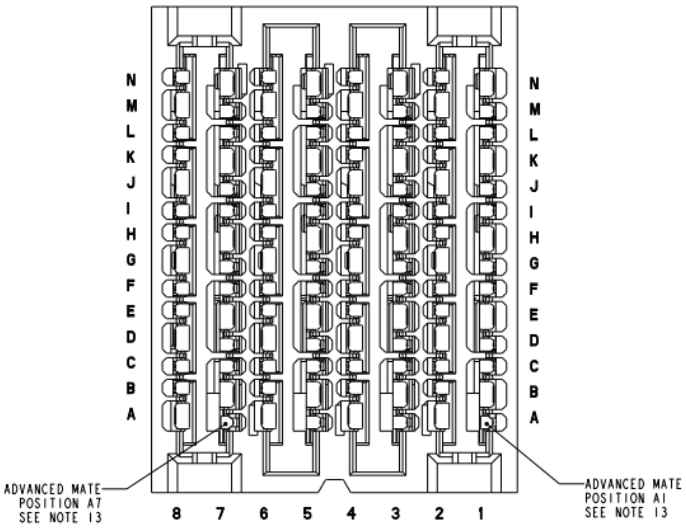
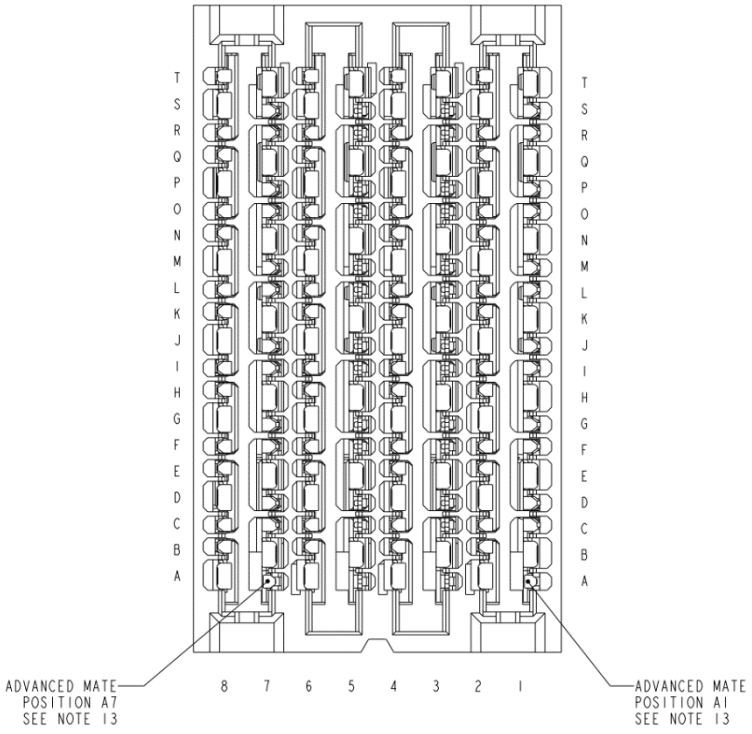


Figure 37. ExaMAX 6x8 connector



940

Refer to M-PIC Specification for additional details.

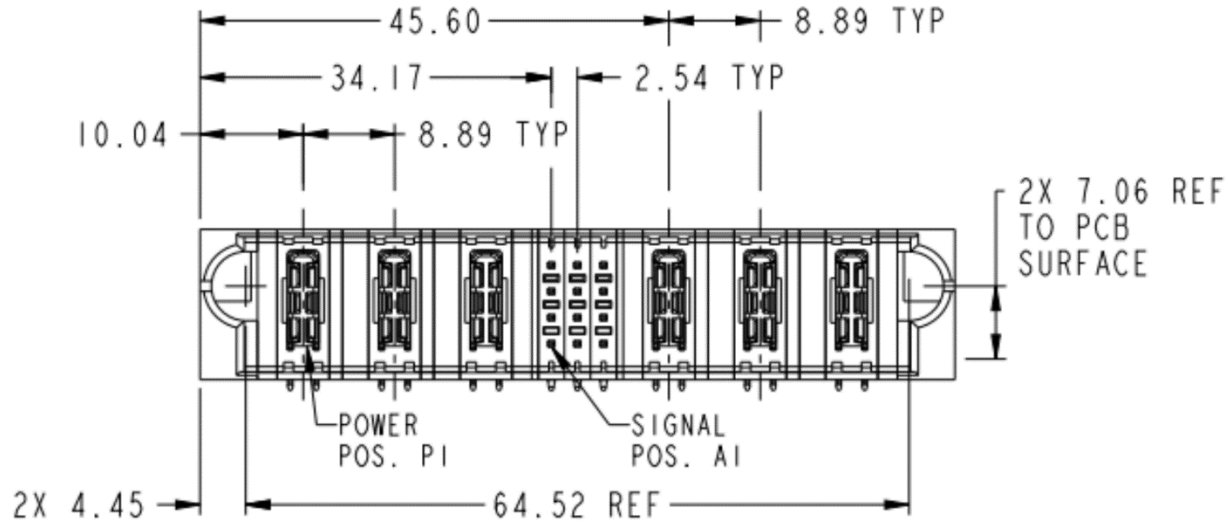
13.3.3. Ingress Power Connector

The Far Side power connector shown in **Figure 32.** *The connector must be based on Amphenol PowerBlade+ (or equivalent).* The configuration is 3 high-power contacts on each side with 16 signal contacts in the middle. *The pin-out and signal definitions must align with the definitions in the M-PIC and PICPWR specifications.*

Table 9. Blade Far/South Ingress Power Recommended Connector

Connector Family	Company	Configuration
PowerBlade+	Amphenol 10106263-6003003LF or equivalent	3 High Power + 16 Signals + 3 High Power

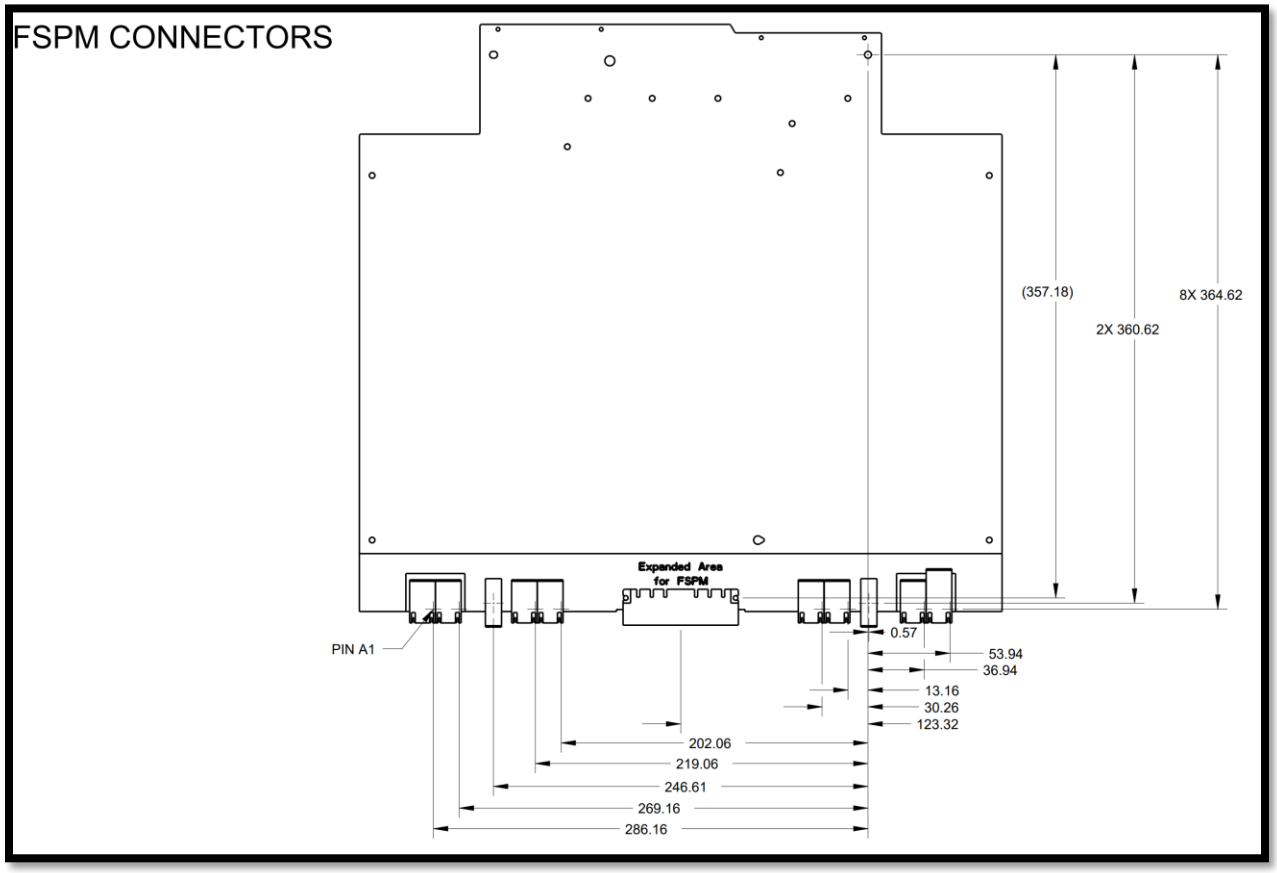
Figure 38. PowerBlade+ Ingress Power Connector



13.3.4. FSPM HPM Locations for Power and High-Speed IO

The connector locations for the FSPM HPM are specified in **Figure 39** . *The Adapted HPM must comply with these connector locations.*

Figure 39. FSPM HPM Required Connector Locations



13.3.5. Blade Minimum Power Plane Capacity Requirements

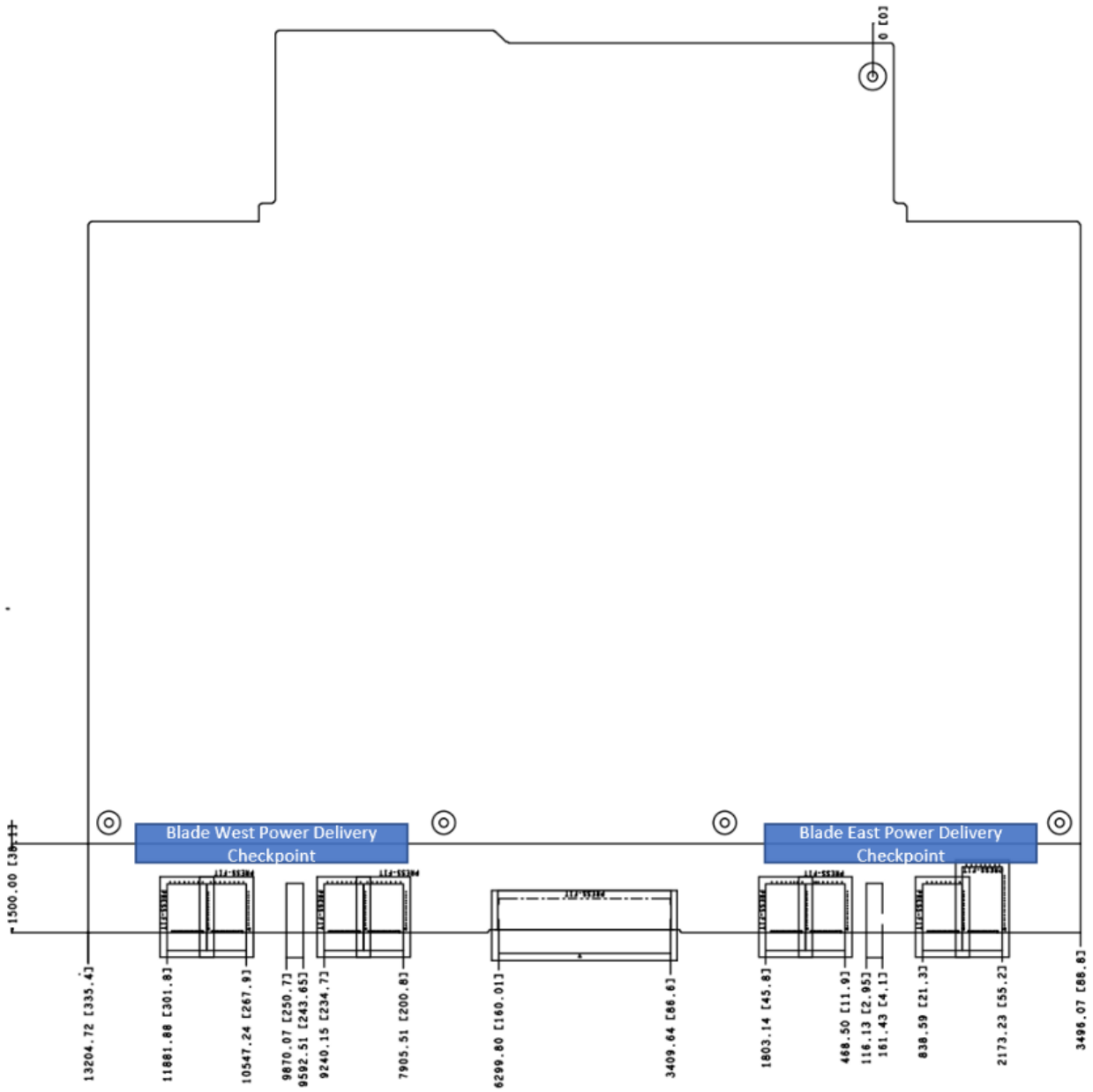
FSPM HPM Far Side power delivery ingress is intended to heavily leverage existing power delivery capacity in base HPM definition. *As such, the bulk of power delivery capacity requirements **must** follow the requirements defined in Far Side PICPWR connector (see **0**).*
The PICPWR connectors at the Far Side must be de-populated.

There are two power delivery checkpoint areas defined. *The requirements defined in **Figure 40** and Table 10. FSPM Minimum Power Plane Capacity Requirements must be implemented to ensure the UBB Blade Adaptation has sufficient power delivery capacity.*

975 Table 10. FSPM Minimum Power Plane Capacity Requirements

Power Plane Checkpoint	Minimum Power Delivery Capacity
Blade West	1100W
Blade East	1100W

Figure 40. FSPM Power Plane Checkpoint Areas



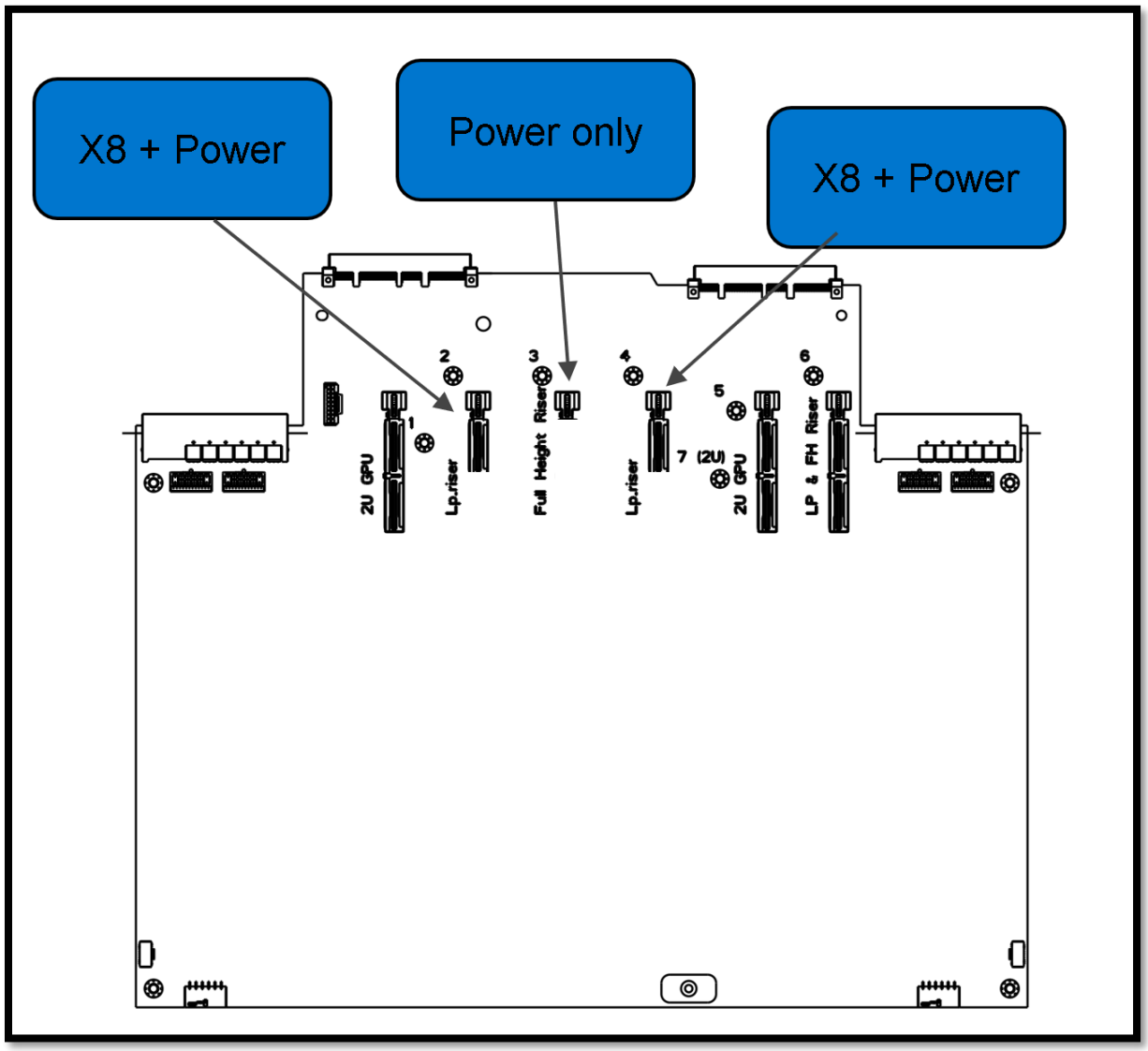
13.3.6. Blade Mechanical Guide Pin

The outline shown in **Figure 39. FSPM HPM Required Connector Locations** also includes a position identified for a mechanical guide pin for blind mate alignment. *The HPM must implement these features for safe blind mate implementation. The part number to use for the guide pin should be Amphenol 10037912-101LF (or equivalent).*

13.4. Example Scenario for Near IO Population with less than 6x16 ports

As shown in **Figure 41** the HPM Designer may elect to follow the rules shown in **Section 10.12.1** Location of Near Side M-XIO Connectors**,** and **.** An example of this is shown below. HSIO might be cabled into the riser, but the riser still has the PICPWR portion of the connector for PCB applications.

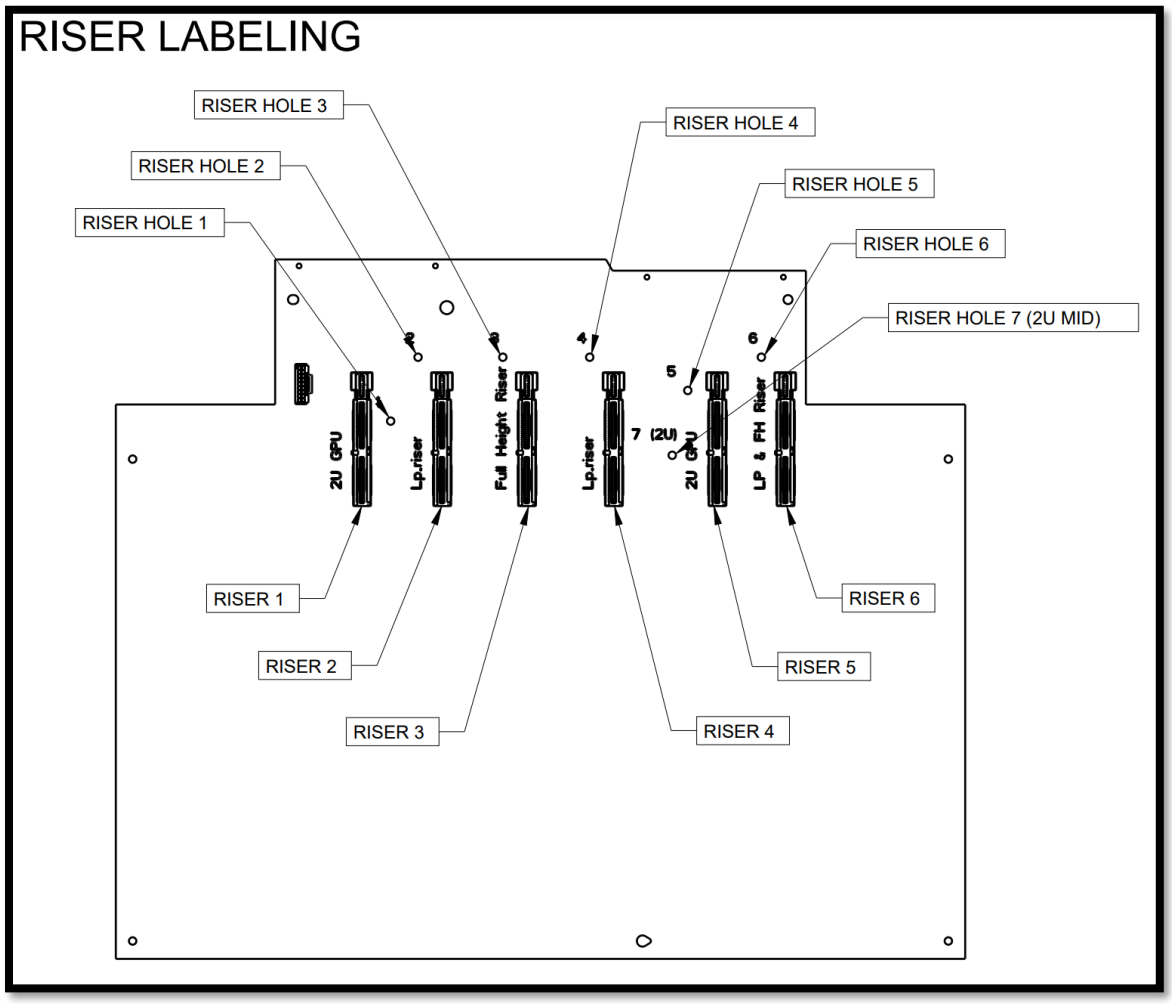
Figure 41. Example Near IO Connector Population Scenario



13.5. Additional Information on Near IO Riser Retention Holes

In a system configuration that uses riser cards in the Near IO, mechanical retention is enabled by holes in the HPM near each Near IO location. The following **Figure 42** demonstrates the riser retention holes and which Near IO position each hole is associated with.

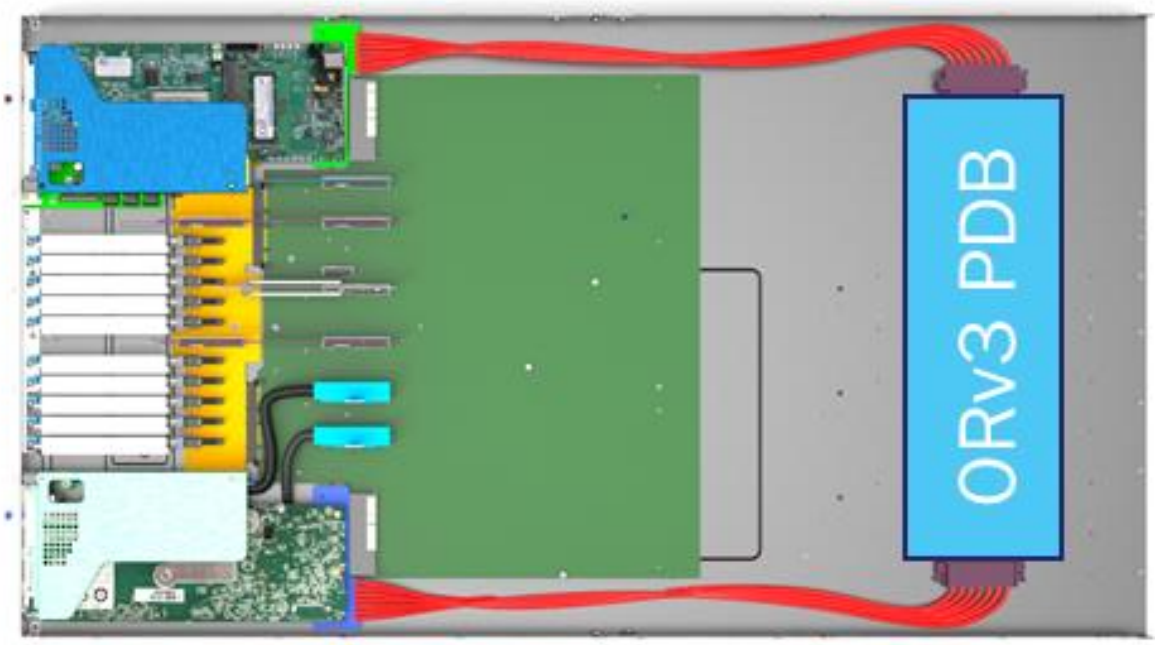
Figure 42. Riser Retention Holes and Associated Near XIO Locations



13.6. Reference System Architecture in 21” Chassis

Figure 43 shows how the Base Outline HPM can be utilized in a 21” chassis architecture, including if Power Supply Infrastructure is on the Far Side with cables to the near side power ingress.

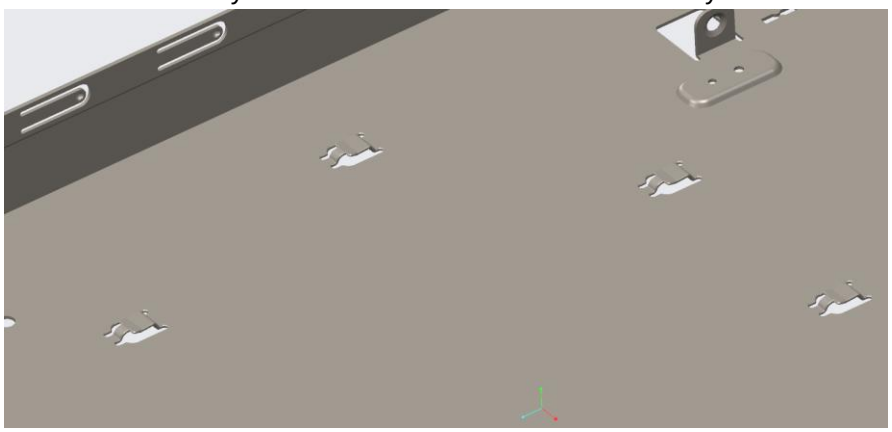
Figure 43. Base Outline HPM used in 21" Reference Chassis



13.7. Chassis Base Geometry for Chassis-to-Board Bracket interface

Figure 44 demonstrates example geometry required in the chassis base to interface to the Chassis-to-HPM bracketry in **Figure 21. Example of Chassis-to-HPM Bracket (Board Pan).** The exact geometry is not specified, but considerations must be made for maximum board thickness (see **Section 10.3** HPM Board and Assembly Thickness) and HPM Keepout Zone sizes (See **Section 10.4.1** Keepout Zone for Retention Hardware).

Figure 44. Chassis Base Geometry to Interface Chassis-to-Board Bracketry



13.8. CAD files

This will be filled out at version 1.0.

Link to CAD files
Link to full PDF files

14. Appendix A - Checklist for IC approval of this specification (to be completed by contributor(s) of this Spec)

Complete all the checklist items in the table with links to the section where it is described in this spec or an external document.

This will be filled out at version 1.0.

15. Appendix B - <supplier name> - OCP Supplier Information and Hardware Product Recognition Checklist

(to be provided by each supplier seeking OCP recognition for a Hardware Product based on this specification)

This will be filled out at version 1.0.