SI | TechnoSystem

SI 3U PCB ELECTROMECHANICAL GUIDELINES

ELECTROMECHANICAL DESIGN GUIDELINES FOR 3U STANDARD BOARDS

Published: 17.11.2025

Authors: Marcin Magdziak

Version	Changelog	Date	Made by
v0	Initial draft	20.10.2025	Marcin Magdziak
v0.1	Updated PCB shape; added units, SFP, Ethernet&MicroUSB, DF Switch.	12.11.2025	Marcin Magdziak
v1.0	First release prepared for publication.	17.11.2025	Marcin Magdziak
v1.1	Changed enclosure mounting holes; corrected Mezzanine guidelines; added microSD card header.	07.01.2026	Marcin Magdziak

Table 1: Changelog Table

1. Introduction

The purpose of this document is to propose electromechanical standards within Sinara and DIOT modules. These standards are intended to ensure consistency between different modules, regardless of who will be revising or creating a new module. In addition, they are meant to facilitate collaboration between electronics and mechanics teams and to help avoid collisions or other issues that have frequently appeared in past revisions. The proposed standards aim to improve the overall quality of the modules and enhance the user experience.

SI | TechnoSystem

Contents

2. PCB Shape and general guidelines

2.1. Use bottom mounting hole as PCB origin

Using a common origin simplifies the workflow between ECAD and MCAD designers. When an MCAD designer imports a PCB into MCAD, they can easily align it to the origin. Similarly, when an ECAD designer imports a front panel, it can be placed at the origin without effort. Repetitive component placement across different projects becomes simpler, and everyone speaks the same language when discussing component locations.

2.2. Units and Dimensions

Unless otherwise specified, all dimensions in this document are in millimeters (mm).

When working on electromechanical aspects like:

- PCB outline
- Placement of key components (e.g., those requiring heat dissipation)
- Position of holes
- Placement of connectors on the front panel

Use meaningful units. Set the grid with a precision of up to one hundredth of a millimeter (dimensions like 55,45 mm).

2.3. DIOT System Board and Peripheral Boards

The following guidelines are based on the **CompactPCI® Serial Specification** with slight modifications for our application. The guidelines assume the use of enclosures for the modules. A DXF file accompanies these DIOT guidelines, capturing the board outline, hole locations, keepouts, and related mechanical data.

2.3.1. PCB outline

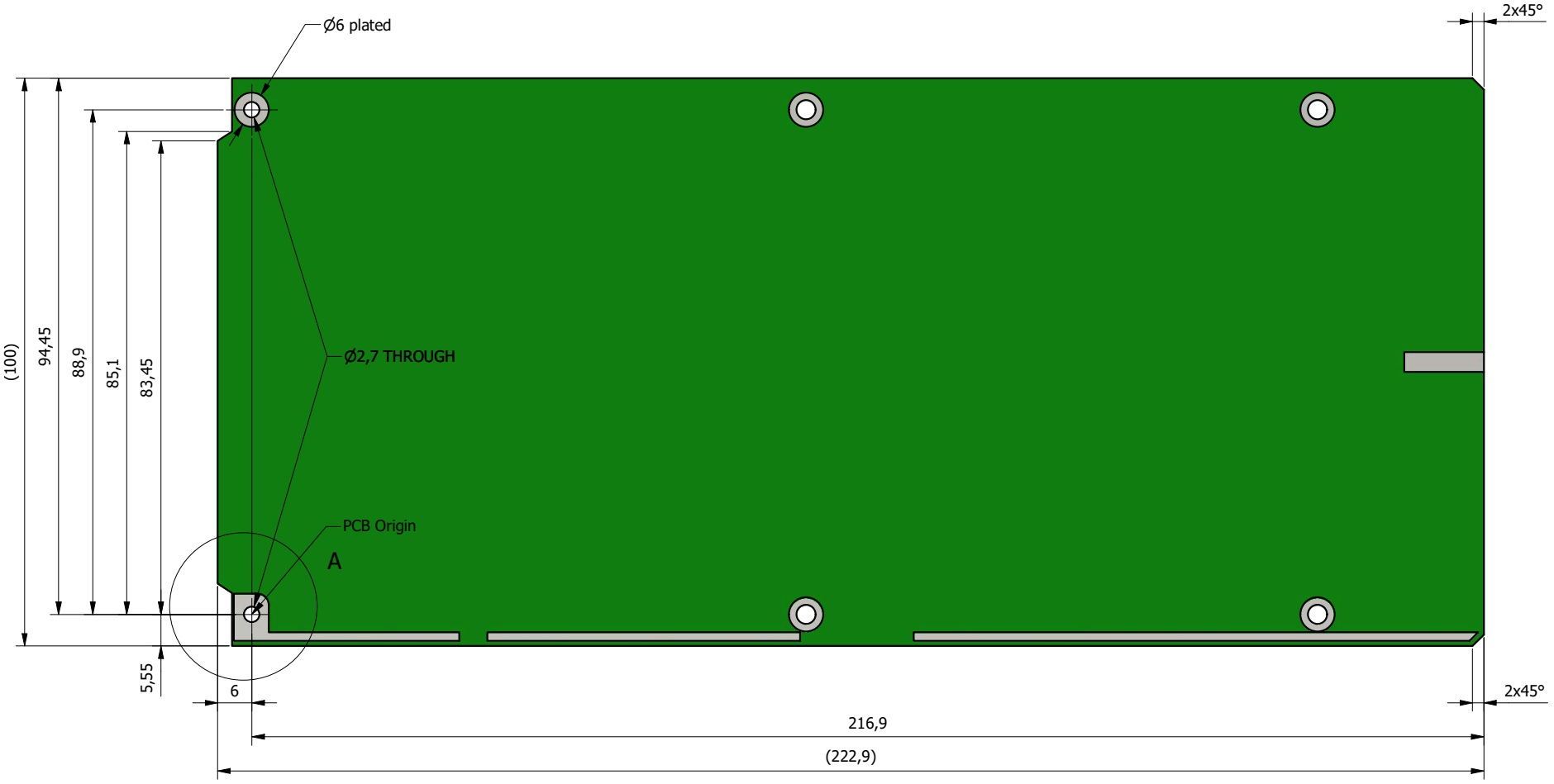

Figure 1: DIOT System Board and Peripheral Board outline

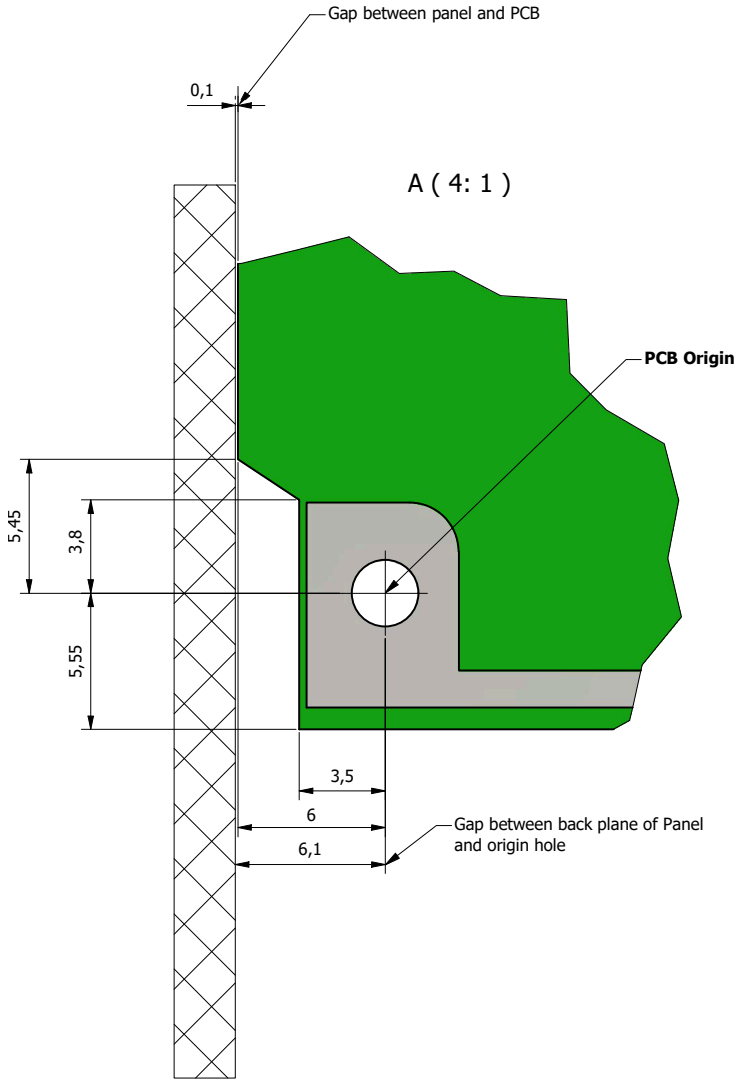

Figure 2: DIOT System Board and Peripheral Board outline

The PCB outline for DIOT System Boards and Peripheral Boards is defined in Figure 1 and Figure 2.
The front edge of the PCB ensures compatibility with standard Sinara front panels as well as panels using extractors in DIOT modules.
The extended front edge also helps prevent light leakage between the SMD LEDs on the top and bottom sides of the PCB (Light Leakage on LED L0, L1).

This design rule also applies to legacy Sinara modules, ensuring full mechanical compatibility across generations.
In the case of Sinara legacy modules, the overall PCB length may differ from that shown in Figure 1.

2.3.2. ESD strip

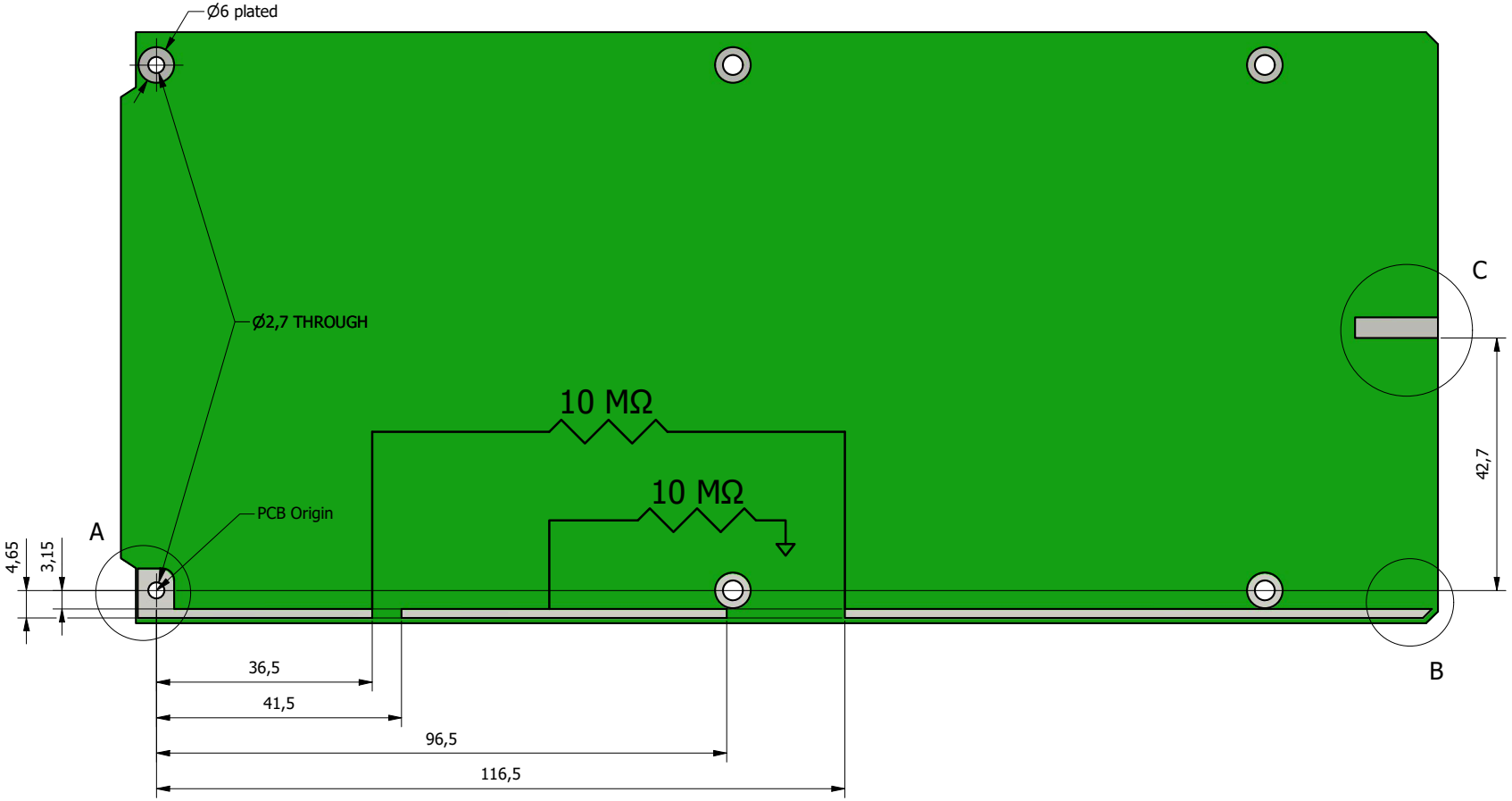

Figure 3: DIOT ESD Strip and metal plated area for Guide element

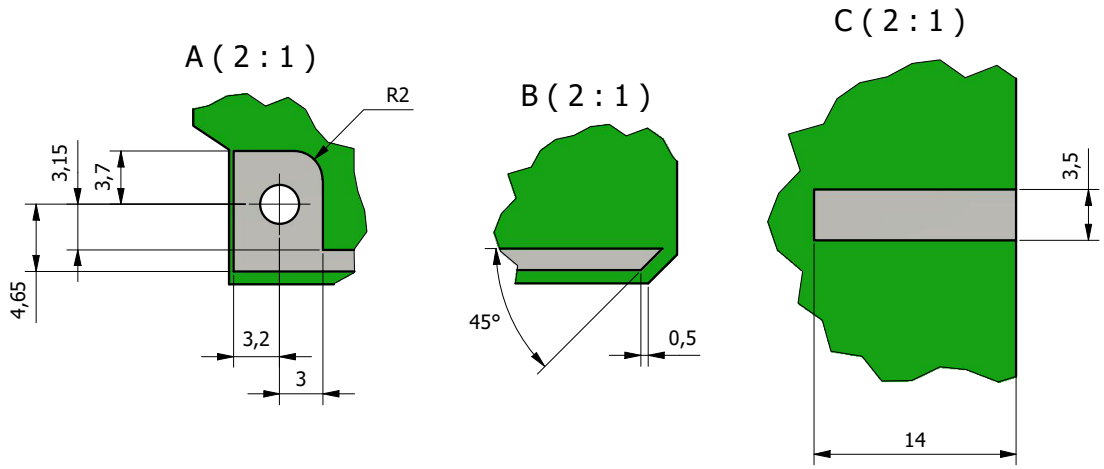

Figure 4: Details of DIOT ESD Strip and metal plated area for Guide element

The ESD strip shall be located on both sides of the PCB (TOP and BOTTOM), as shown in Figure 3 and Figure 4.

2.3.3. DIOT module Enclosure

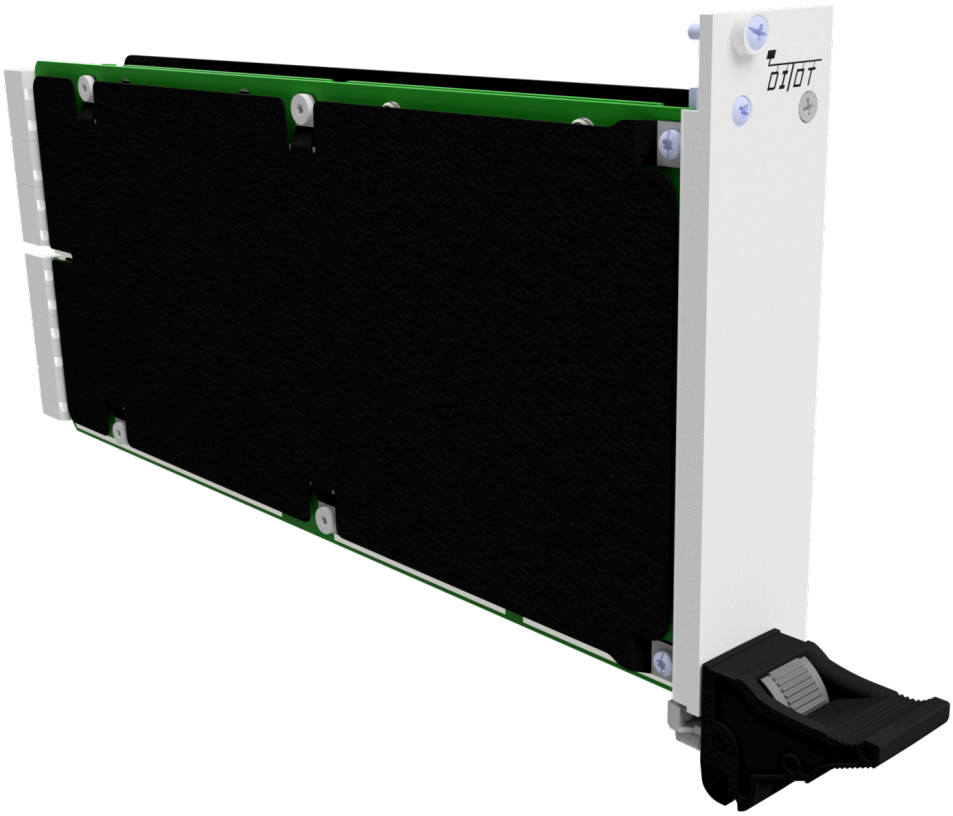

Figure 5: DIOT module Enclosure render

The DIOT module enclosure is designed to accommodate both System Boards and Peripheral Boards. The enclosure was created to protect the modules from user damage. It covers both the top and bottom of the PCB and has been designed so as not to interfere with the airflow around the board.

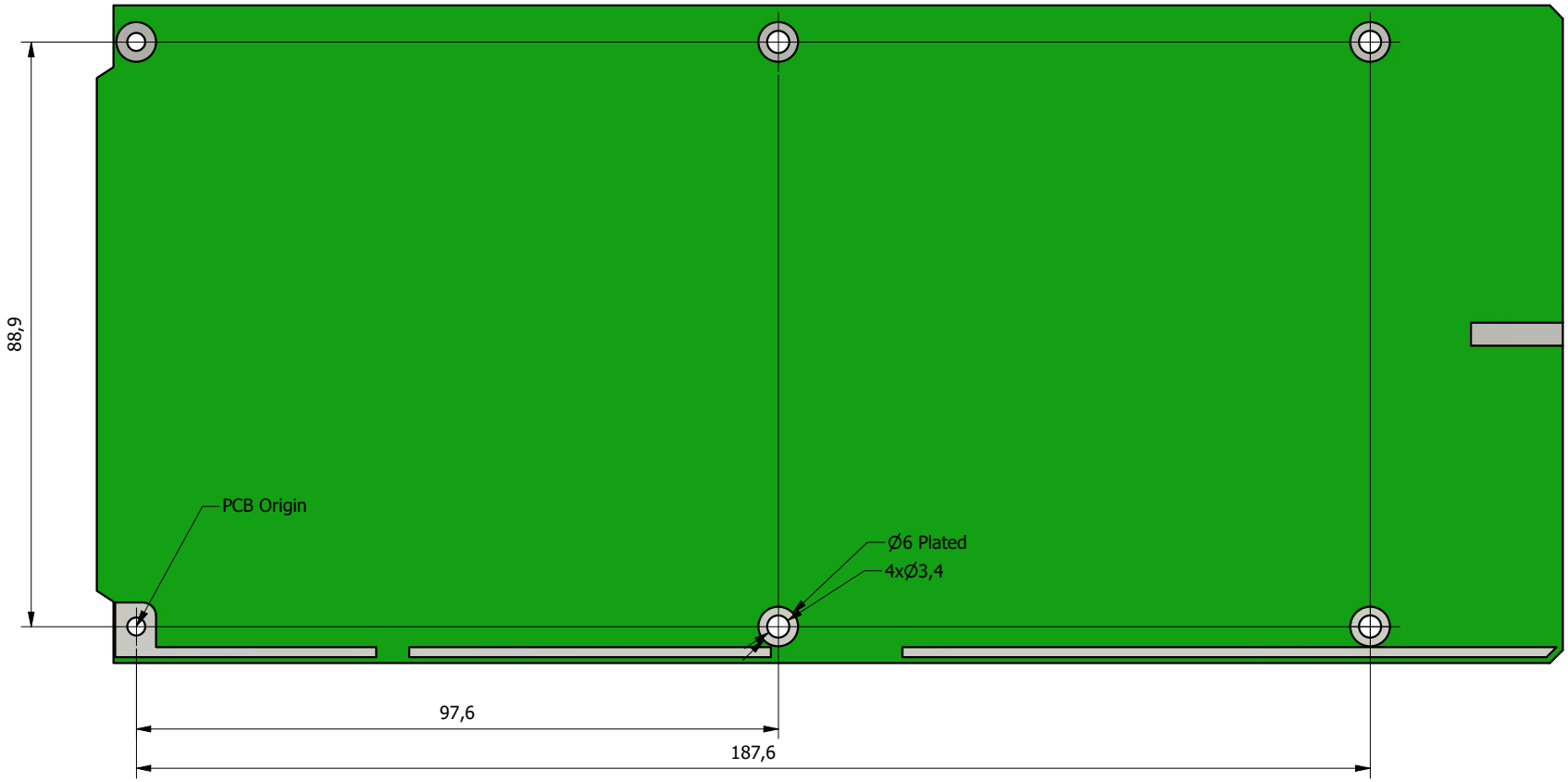

Figure 6: DIOT module Enclosure mounting holes

Enclosure mounting holes shall be plated through (top and bottom) and connected to the front panel potential (chassis ground).

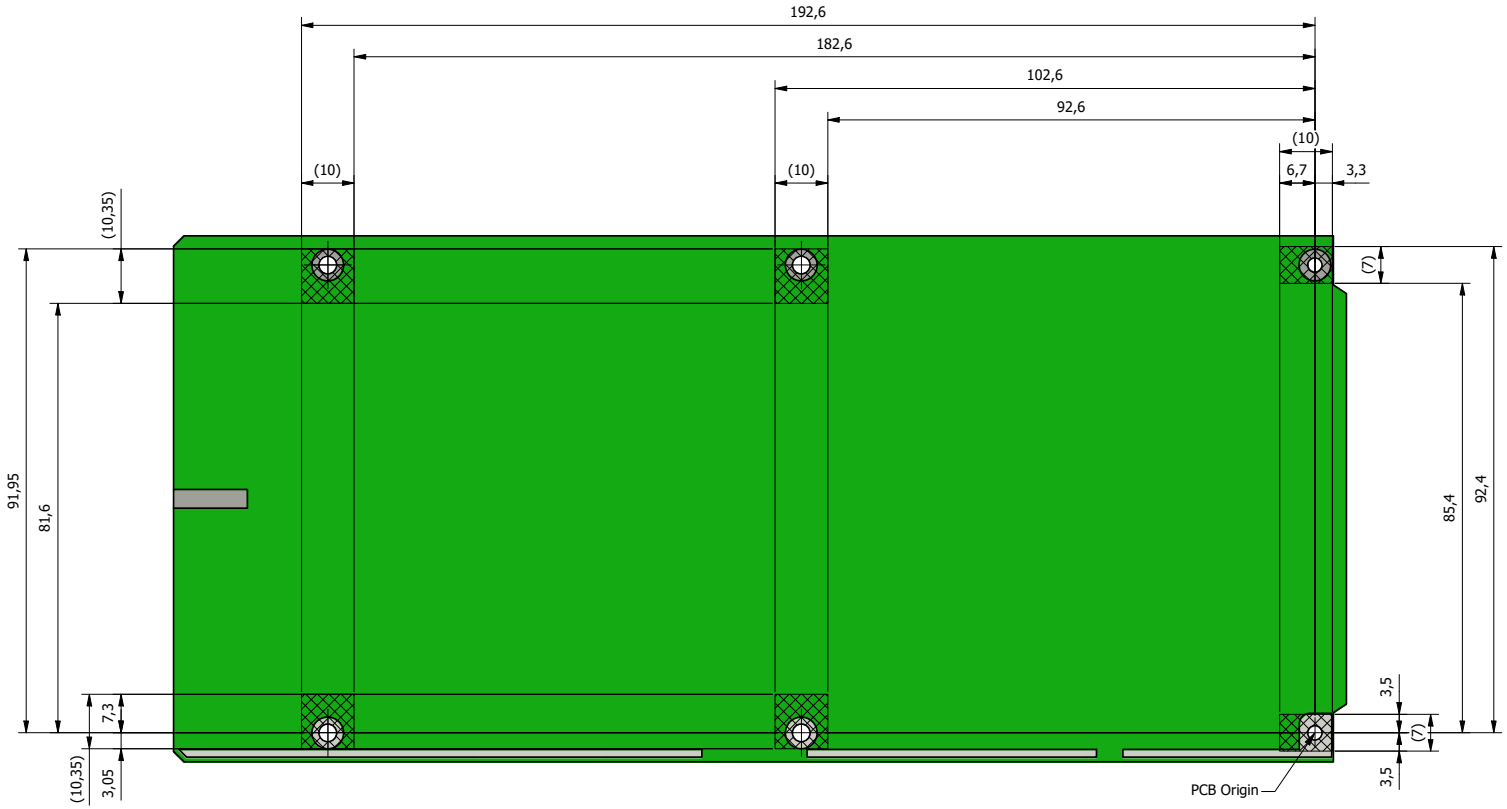

Figure 7: DIOT module Enclosure keepout areas

Hatched areas in Figure 7 indicate the keepout zones where no components should be placed. These areas are reserved for mounting holes and mechanical features of the enclosure.

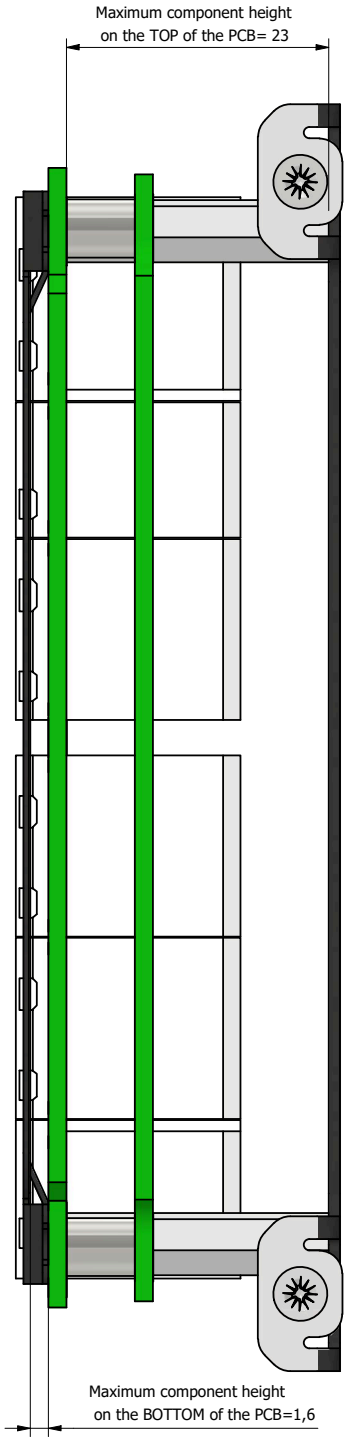

Figure 8: Maximum component height on the PCB

The maximum heights shown in Figure 8 apply to modules with the standard enclosure. When absolutely necessary (e.g., Kasli DIOT), a custom enclosure with cutouts may be used.

2.3.4. Keep-outs for guiderails

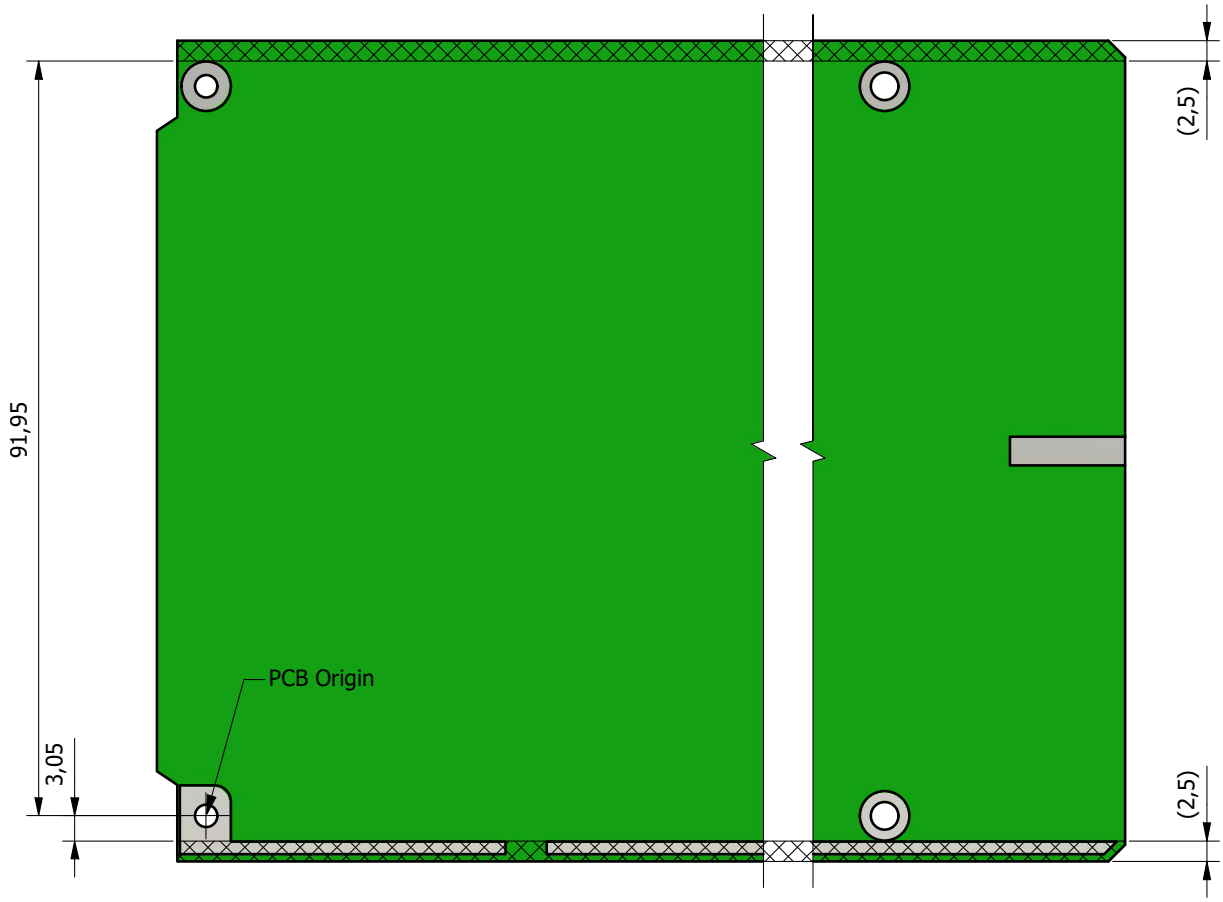

Figure 9: Keepout dimensions for guiderails on both sides of the PCB

The keep-out areas for guiderails are defined in Figure 9. These areas should remain free of components to avoid interference with the guiderails during module installation in the chassis. Keepouts apply to both sides of the PCB (TOP and BOTTOM).

2.3.5. DIOT backplane connectos

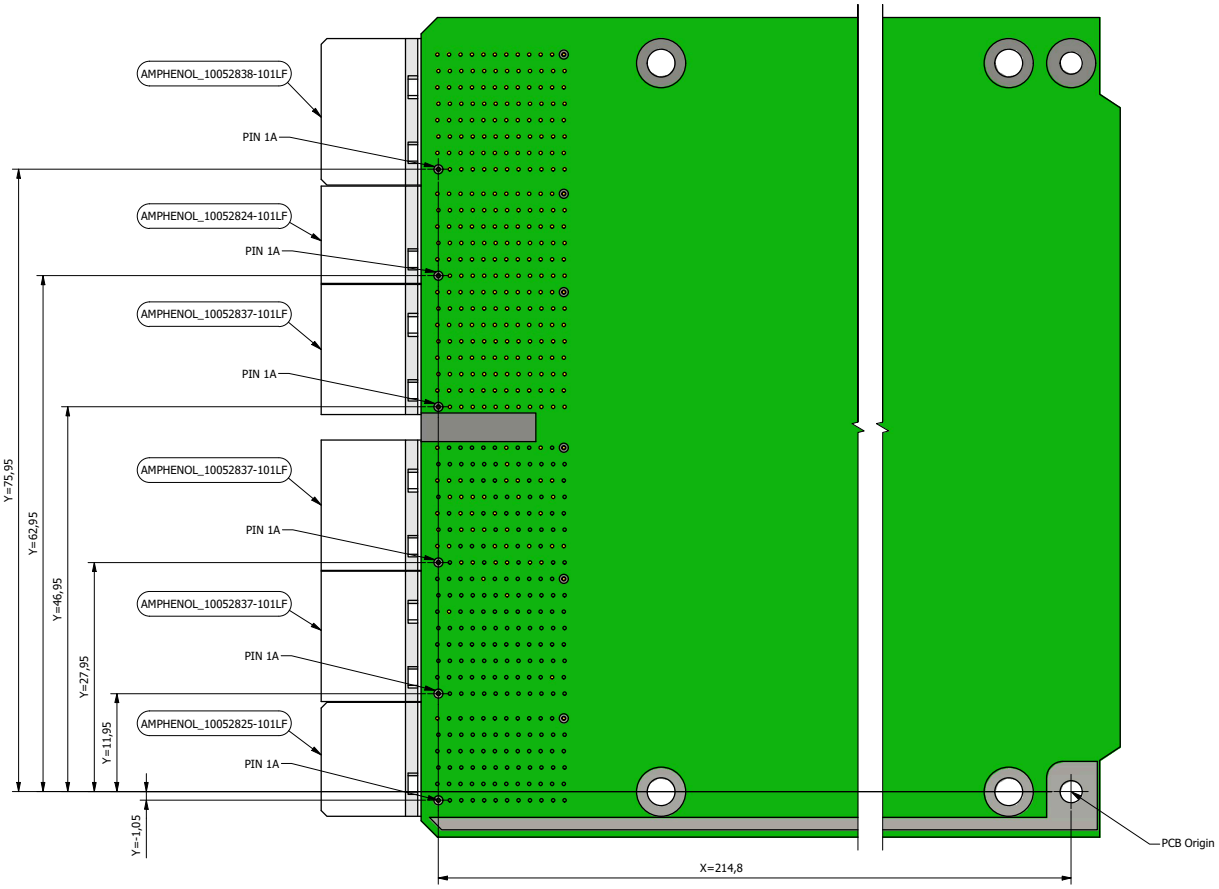

Figure 10: Placement of DIOT connectors, viewed from the bottom side

The connector placement shown in Figure 10 conforms to the CompactPCI® Serial Specification and the Amphenol AirMax VS® Connector System Application Specification.

2.3.6. DXF Reference

A single DXF file has been created, containing all the guidelines from the **DIOT System Board** and **Peripheral Boards** section.

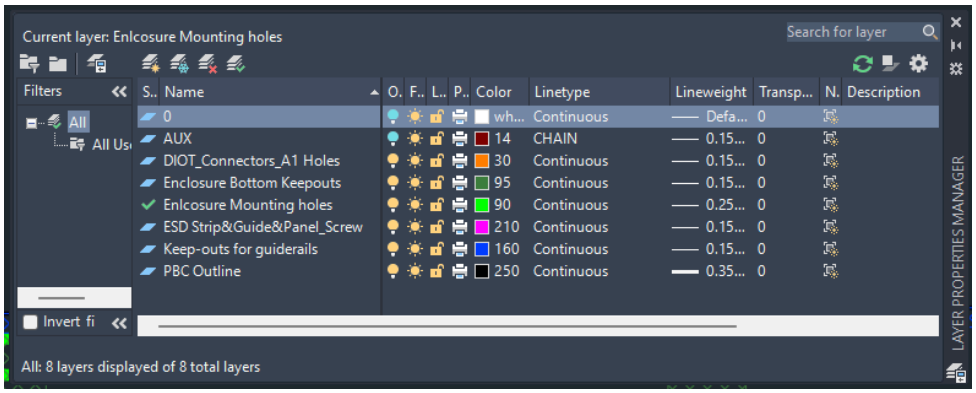

Figure 11: List of layers in the DXF file

The file includes separate layers corresponding to each subsection, as shown in Figure 11 . The DXF file will be included with the instructions.

2.4. Mezzanine Boards

2.4.1. Mezzanine origin

The origin of the mezzanine board should be set at the same location as the origin of the carrier board onto which it is mounted (see Section 2.1).
This alignment simplifies component placement, especially for board-to-board connectors interfacing between the mezzanine and the carrier board.
It also facilitates locating and designing cutouts in the mezzanine for components placed on the main board.

2.4.2. Mezzanine Height and Connector Clearance

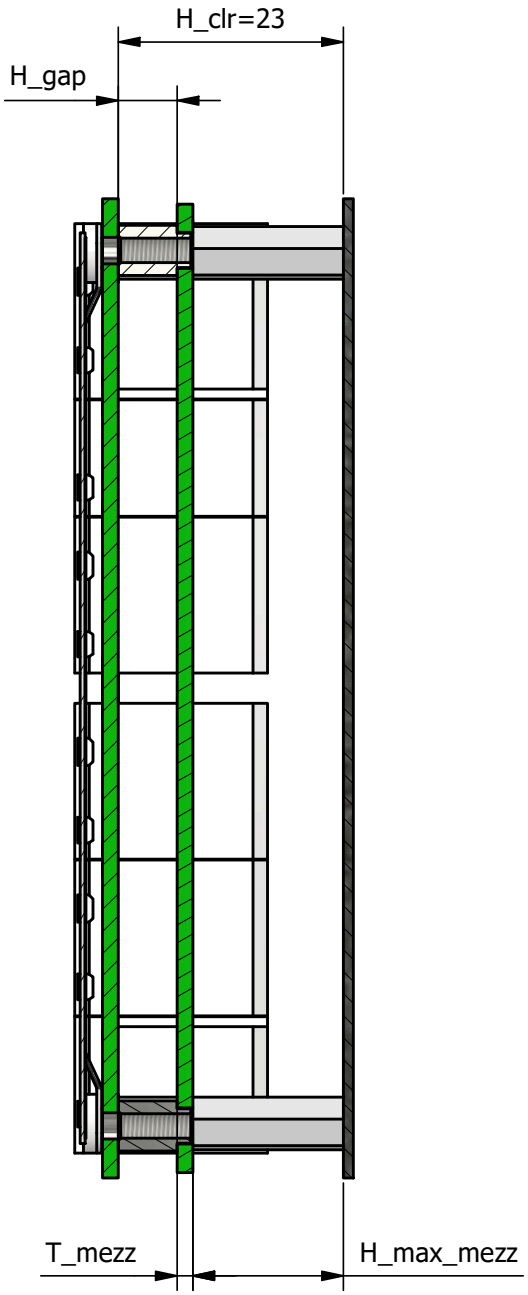

Figure 12: Reference diagram showing height constraints and related parameters

Parameter Definitions:

- H_{clr}- Clearance under the enclosure.
- H_{gap} - Vertical gap between the carrier board and the mezzanine board, defined by the board-to-board connector height.
- T_{mezz} - Thickness of the mezzanine PCB.
- $H_{\text{max\_mezz}}$ - Maximum allowable component height on the mezzanine board.

Height Constraints
For DIOT modules with a 6 HP front panel above the carrier board and a standard DIOT module enclosure, there is H_{clr}=23 mm of available space along the Z-axis for components.
When designing a mezzanine board, this clearance must be taken into account.

The design process of the mezzanine should start with defining which board-to-board connector will be used, as it determines H_{gap}.

$$H_{\mathrm{max\_mezz}} = H_{\mathrm{clr}} - H_{\mathrm{gap}} - T_{\mathrm{mezz}}$$

Figure 13: Equation defining the maximum mezzanine height

In order to calculate the maximum mezzanine component height, use Equation from Figure 13.

Due to the guide rails into which the module is assembled, the minimum H_{gap} is 2 mm.

Use SMT Threaded Spacers
Whenever possible, use SMT threaded spacers to mount mezzanine boards onto carrier boards. The **WA-SMSI SMT Steel Spacer with internal M2.5 thread series** is particularly recommended, as these spacers are available in **0,5 mm height increments**, allowing easy adjustment of the board-to-board distance.
The spacers should be placed on the **bottom side of the mezzanine board**. This approach eliminates the need to install spacers on the carrier board when the mezzanine is not used, reducing unnecessary cost and assembly effort.

2.4.3. PCB Outline for Mezzanine Boards

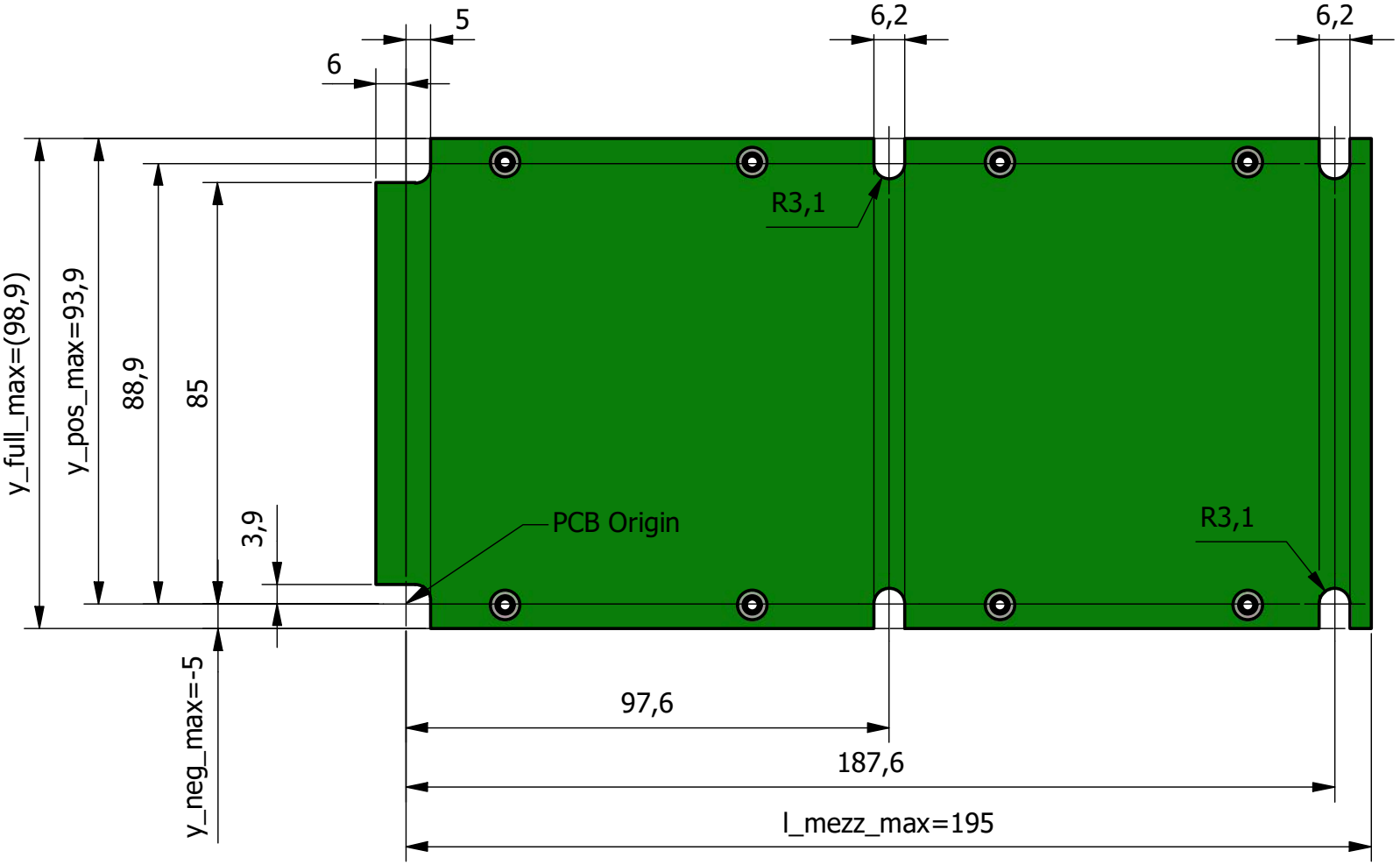

Figure 14: Reference mezzanine outline showing the maximum PCB size.

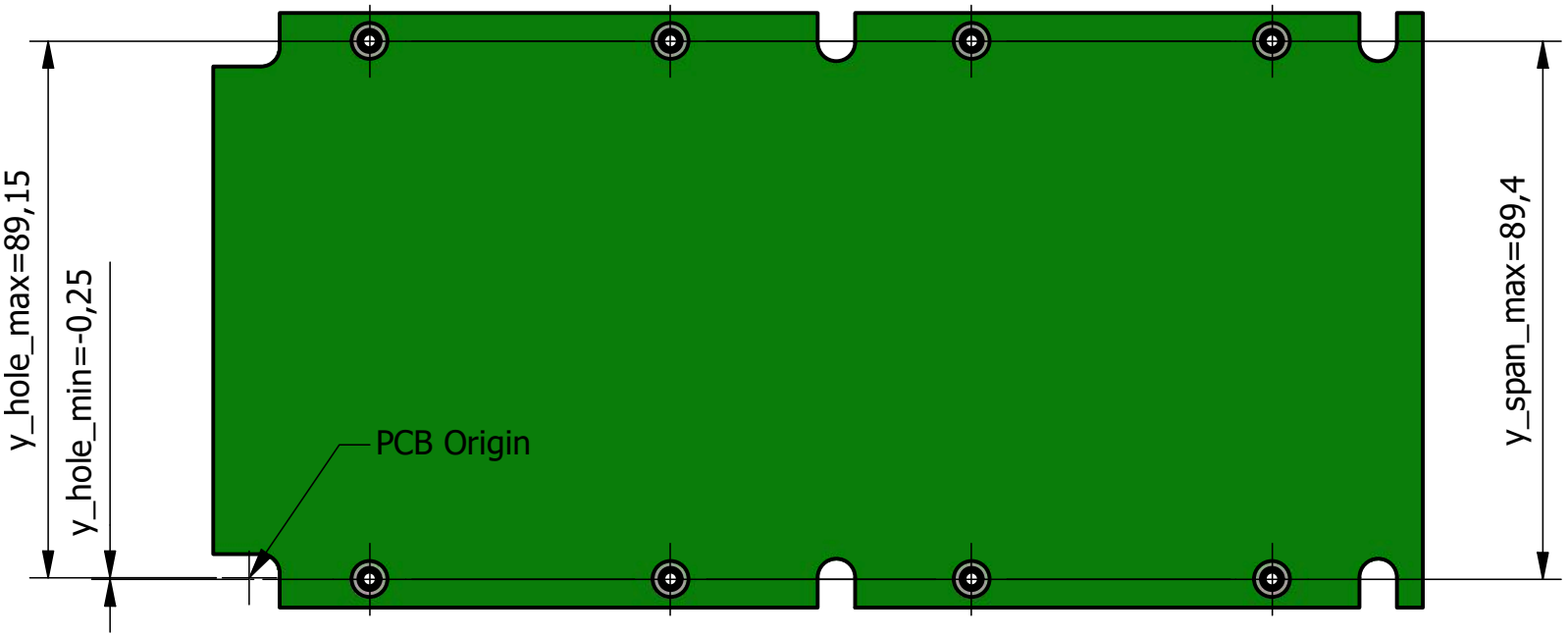

Figure 15: Reference locations of mezzanine mounting holes showing maximum spacing.

Parameter Definitions:

- $y_{\text{full\_max}}$ - Total maximum dimension of the mezzanine board along the Y-axis.
- $y_{\text{pos\_max}}$ - Maximum Y-axis position (positive direction) of the mezzanine outline or mounting features.
- $y_{\text{neg\_max}}$ - Maximum Y-axis position (negative direction) of the mezzanine outline or mounting features.
- $l_{\text{mezz\_max}}$ - Maximum overall length of the mezzanine PCB.
- $y_{\text{hole\_max}}$ - Maximum Y-axis position (positive direction) of the outermost mezzanine mounting holes.
- $y_{\text{hole\_min}}$ - Maximum Y-axis position (negative direction) of the outermost mezzanine mounting holes.

The outline for mezzanine boards is defined in Figure 14, and the mounting holes are defined in Figure 15.
The parameters shown in both figures above may be adjusted; the values presented represent the maximum dimensions that can be accommodated.

⚠️ **Warning:** Maximum dimensions of the Mezzanine may be increased; verify there are no collisions with other Module components. ⚠️

2.4.4. Component placement on Mezzanine Boards

The X-axis placement of front-panel connectors on the mezzanine should follow the same guidelines as for standard modules.
The Y-axis placement limits of components on the mezzanine differ from those on standard modules because the PCB outline may vary from the standard module design.

3. Component placement

Component placement is measured from characteristic reference points (e.g., center of holes, center of pins, etc.). This approach is used because identical components from different libraries may have their origins defined in different locations, which could lead to placement errors.

3.1. Standard SMA connectors

Assumptions:

- Default SMA connector: Delock 65848.
- Edge-mount SMA connector: Molex 73251-2121 (732512121_sd.pdf).
- Protrusion: Both SMA connectors shall extend 8.5 mm beyond the front panel, with at least 6.1 mm of usable thread.
- Isolation: Provision for electrical isolation of the connector from the panel (e.g., insulating bushings/washers).

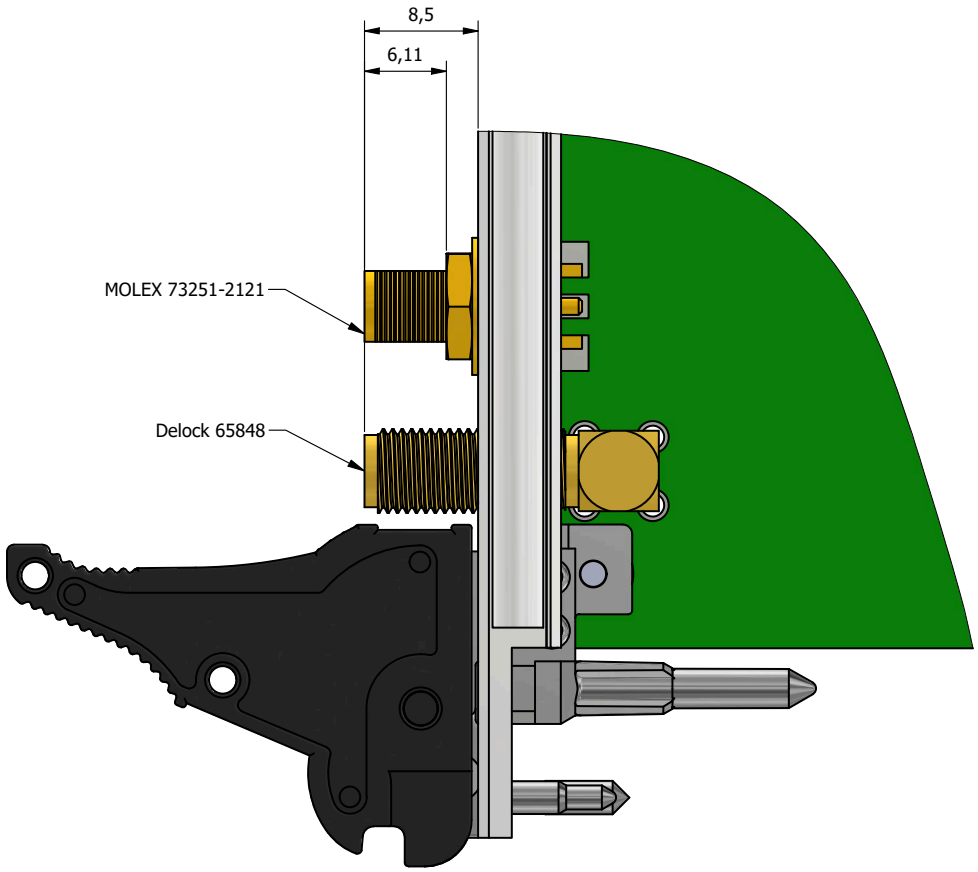

Figure 16: General view of SMA connectors placement

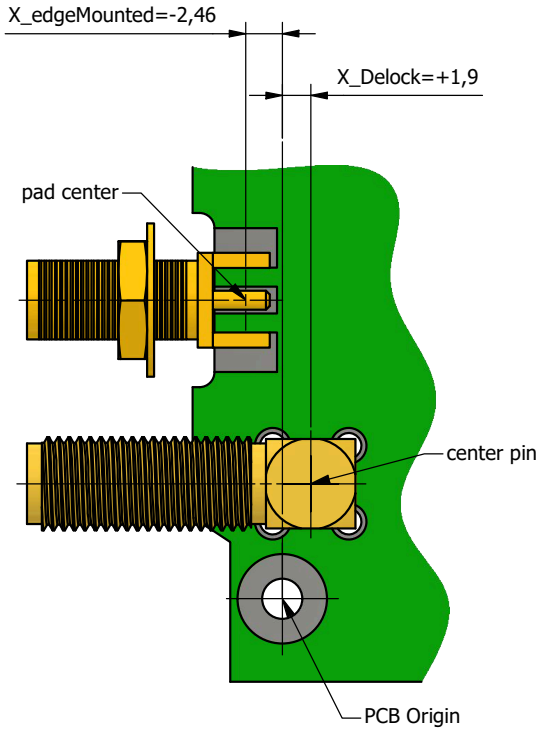

Figure 17: SMA connectors X-axis placement

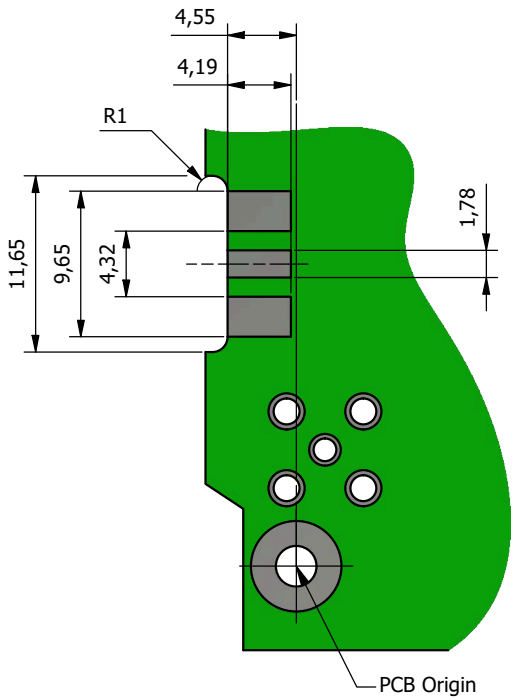

Figure 18: Footprint for Molex 73251-2121

The X-axis placement of SMA connectors is shown in Figure 17.

Y-axis placement range:

- **Delock SMA: 7,7÷82,45 mm**
- **Molex SMA (edge-mount): 8,8÷80,65 mm**

The Y-axis placement is referenced to the same point as the X-axis placement.
The suggested footprint for the Molex 73251-2121 is shown in Figure 18. It follows the Molex datasheet and includes the required undercut at the PCB's front edge.

3.2. MCX Amphenol 919-383J-51A

Assumption:

- Using Amphenol MCX Right Angle PCB Jack Through Hole 50 Ohm (PN: **919-383J-51A**)
- Ability to provide connector isolation (MCX connectors isolation from panel 2)

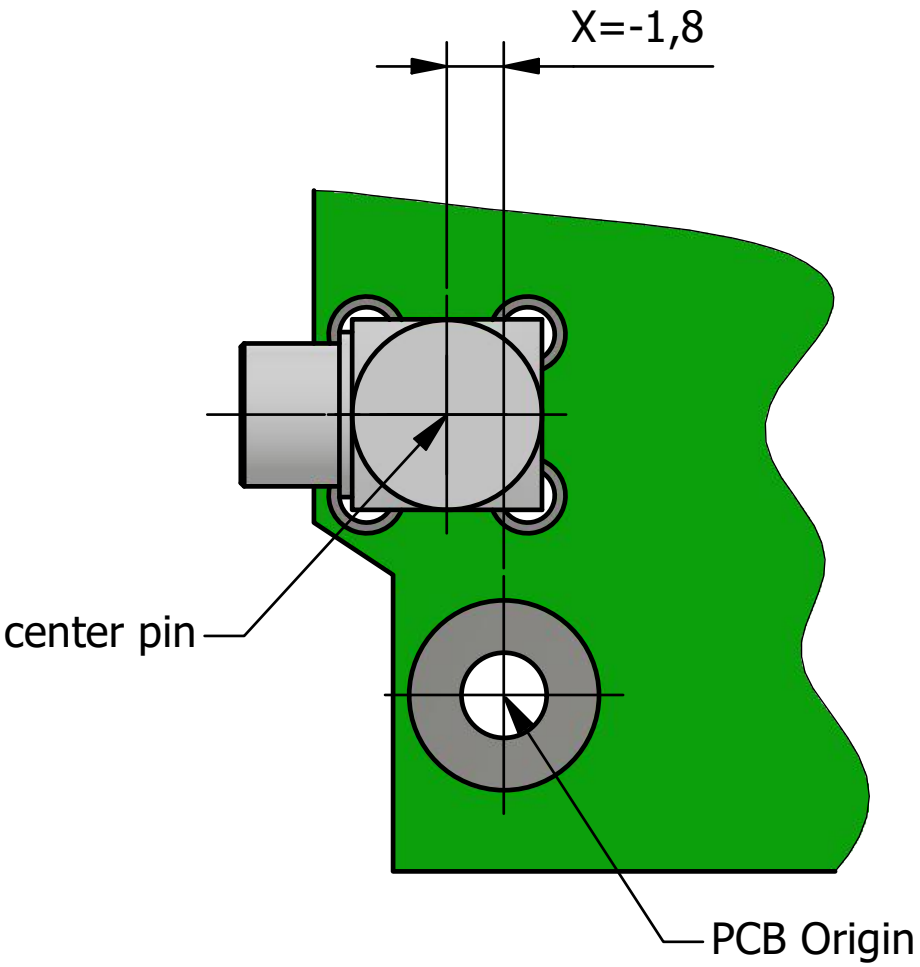

Figure 19: MCX connectors placement

The X-axis placement of MCX connector is shown in Figure 19.
The Y-axis placement range is 8,85÷80,75 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.3. Power connector Switchcraft 712RA

Assumption:

- Using **Switchcraft 712RA** connector
- Ability to provide connector isolation (Power supply connector - panel isolation · Issue 91 · sinara-hw/Kasli)
- Solving problem with connector shorting to panel (12V barrel connector shorts out filter to chassis · Issue 14 · sinara-hw/Clocker)

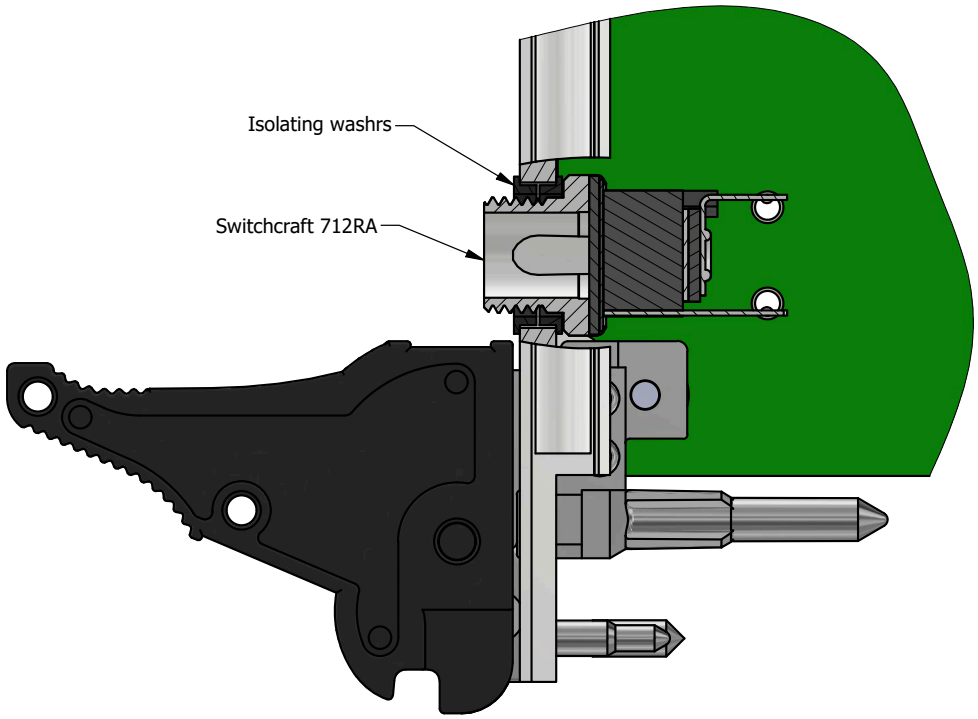

Figure 20: General view of Switchcraft 712RA connector placement

The placement shown in Figure 20 allows the connector to be isolated from the front panel using insulating washers. The guidelines below also prevent positioning the connector too close to the mounting brackets.

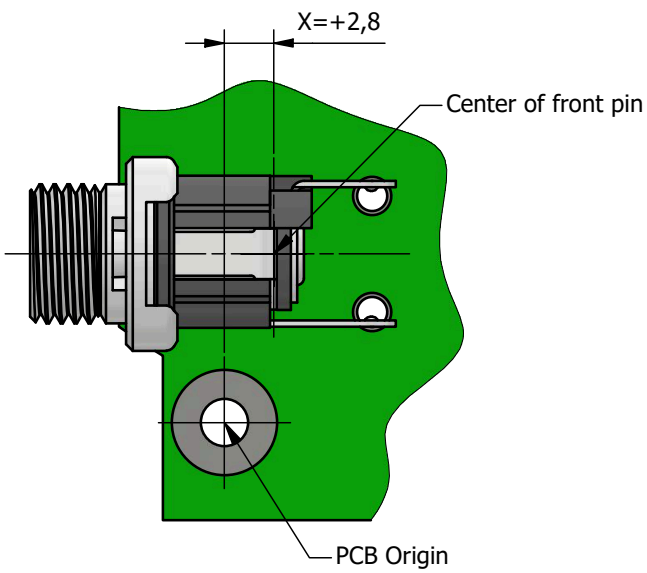

Figure 21: Switchcraft 712RA Placement

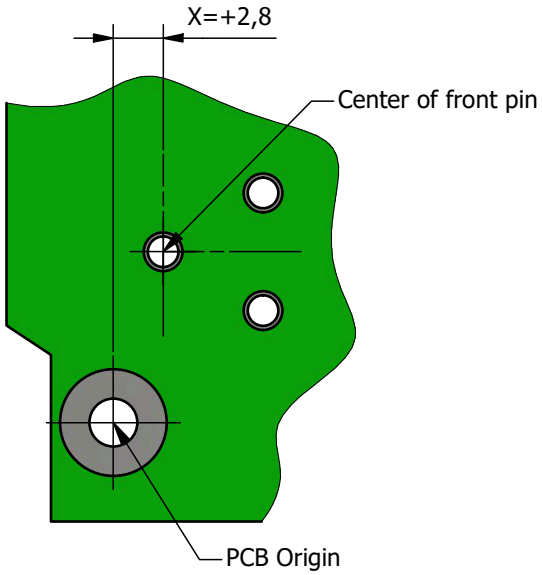

Figure 22: Switchcraft 712RA Footprint

The X-axis placement of the Switchcraft 712RA connector is shown in Figure 21. Figure 22 is provided solely to clarify the center of front pin location.

The Y-axis placement range is 9,6÷80,55 mm.

The Y-axis placement is referenced to the same point as the X-axis placement.

3.4. LED Bivar series H485 and Dialight series 571-01xxF

Assumption:

- Using 4x 2,54mm LED Bivar series H485 in various colors etc.
- Using 2x LED Dialight series 571-01xxF in various colors etc.

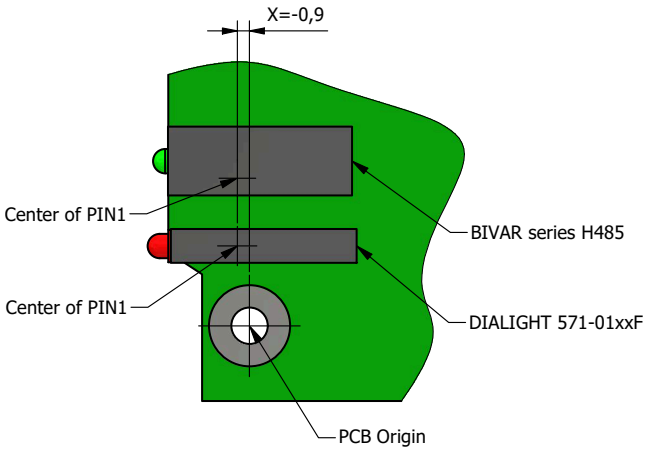

Figure 23: Bivar & Dialight Placement

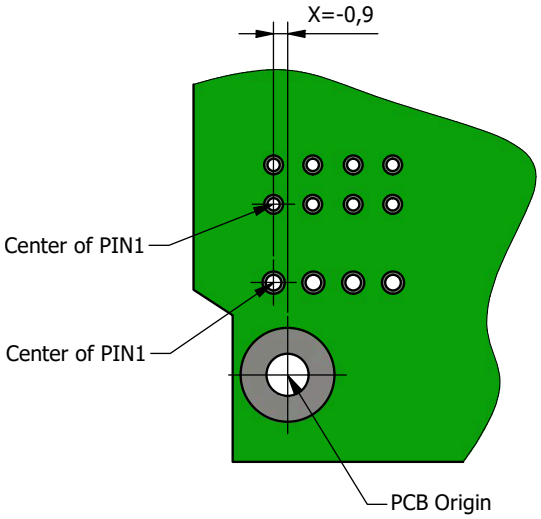

Figure 24: Bivar & Dialight Footprint

The X-axis placement of the Bivar series H485 and Dialight series 571-01xxF is shown in Figure 23.
Figure 24 is provided solely to clarify the location of the reference pin for measurements.

Y-axis placement range:

- **Bivar series H485: 5,9÷81,65 mm**
- **Dialight series 571-01xxF: 5,9÷84,25 mm**

The Y-axis placement is referenced to the same point as the X-axis placement.

3.5. LED SMD 0603 AVAGO HSME-C120

Assumption:

- Using 0603 LED, Tested on AVAGO HSME-C120 (AV02-0975EN DS HSMx-C120)
- Maintaining a 0,2 mm gap between the front panel and the LED's emitting surface minimizes light leakage between SMD LEDs on the top and bottom sides of the PCB. (Light Leakage on LED L0, L1 · Issue 49 · sinara-hw/EEM_FMC_Carrier)

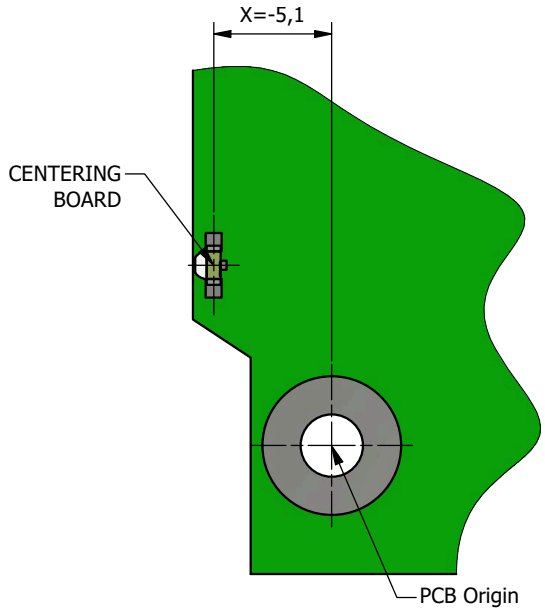

Figure 25: AVAGO HSME-C120 LED Placement

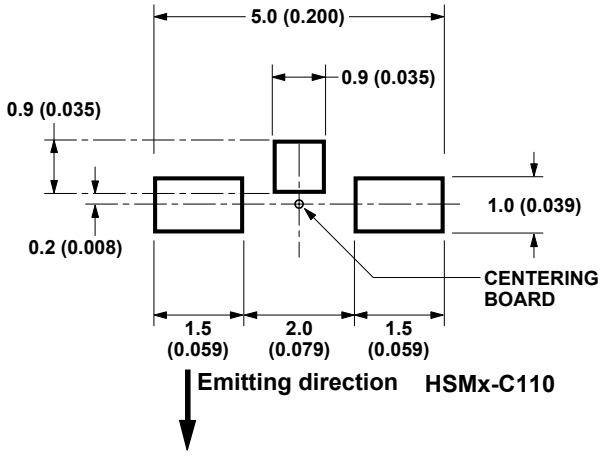

Figure 26: AVAGO HSME-C120 LED Footprint

The X-axis placement of the AVAGO HSME-C120 LED is shown in Figure 25.
Figure 26 is provided solely to clarify the location of the Cenetering Board used for measurements.
The Y-axis placement range is 7,2÷81,7 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.6. Default firmware switch (OMRON B3U-3000PM)

Assumption:

- Using **OMRON B3U-3000PM** Ultra-small Tactile Switch (SMT) (B3U-3000PM DS)

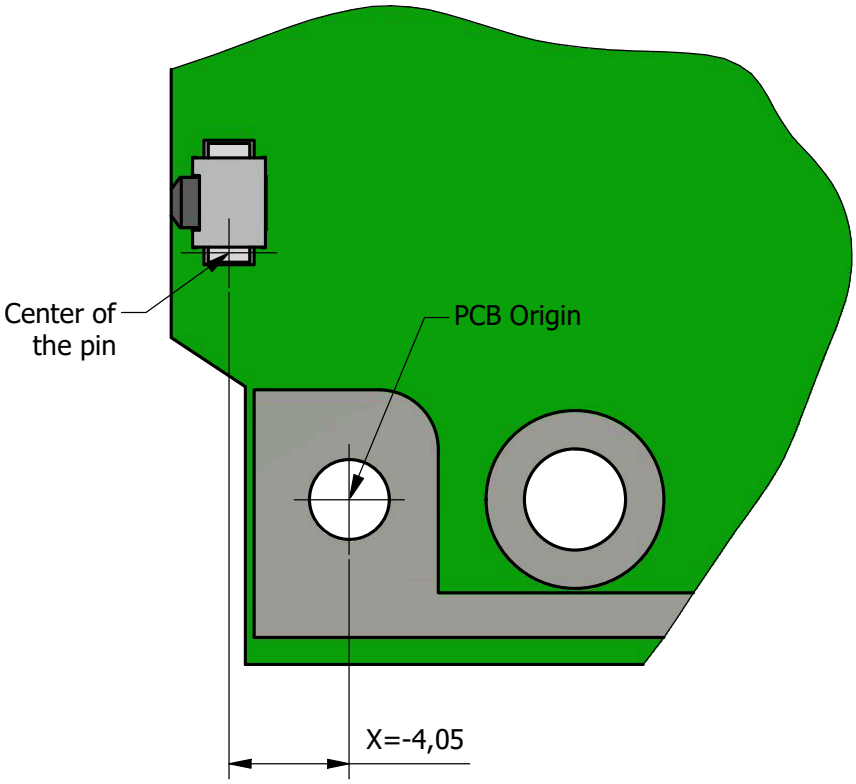

Figure 27: OMRON B3U-3000PM Placement

The X-axis placement of the OMRON B3U-3000PM switch is shown in Figure 27.
The Y-axis placement range is 7,1÷80,1 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.7. Micro USB Hirose ZX62RD-AB-5P8(30)

Assumption:

- Using USB **Hirose ZX62RD-AB-5P8(30)** (ZX62RD-AB-5P8(30) 2D Drawing)
- At least 0,3 mm clearance between USB cable and front panel, as shown in Figure 28

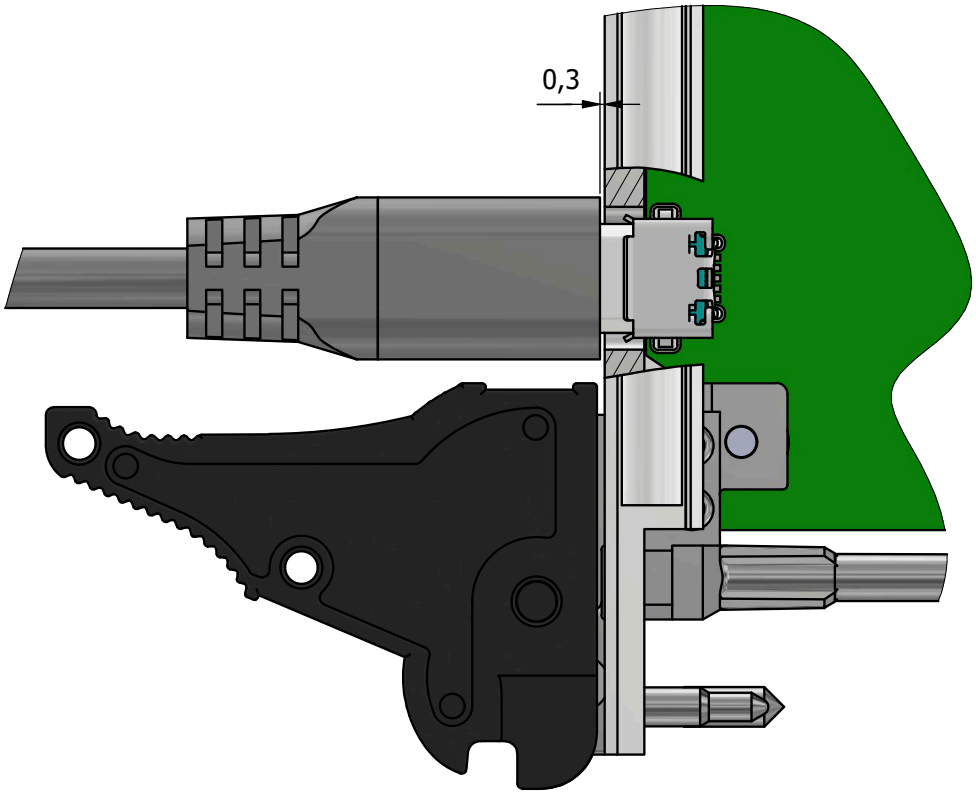

Figure 28: Hirose USB connector and cable assembly

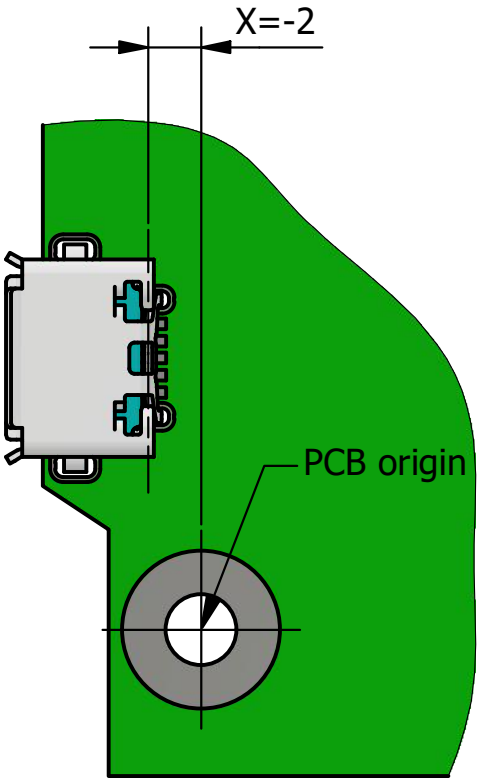

Figure 29: Hirose ZX62RD-AB-5P8(30) Placement

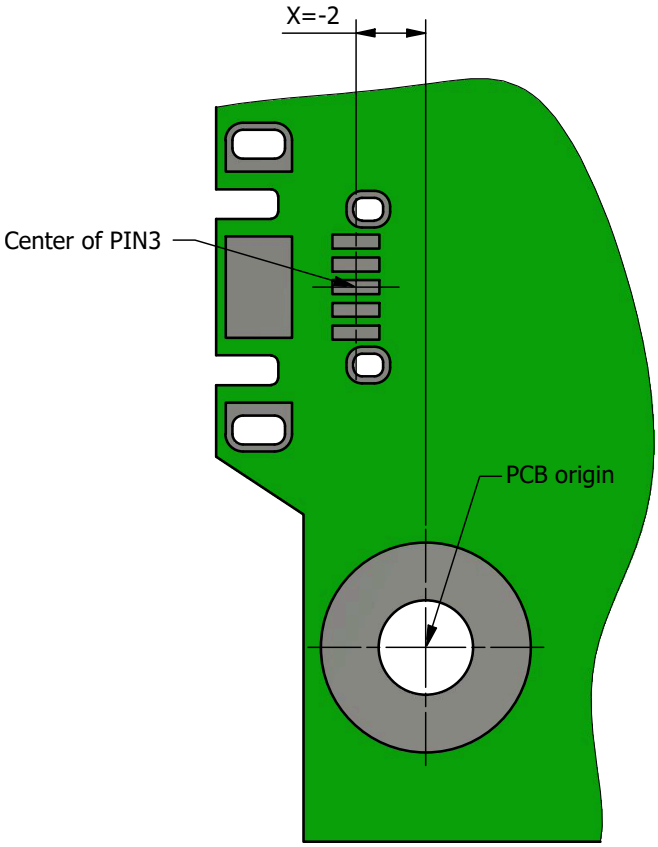

Figure 30: Hirose ZX62RD-AB-5P8(30) Footprint

The X-axis placement of the Hirose ZX62RD-AB-5P8(30) MicroUSB is shown in Figure 29. Figure 30 is provided solely to clarify the location of the reference pin for measurements.
The Y-axis placement range is 10,3÷78,6 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.8. Default Micro USB under Ethernet Connector combo

Assumption:

- Using Micro USB **Molex 47642-1001** (Molex 47642-1001 DS)
- Using RJ45 connector **BELFUSE 0826-1X1T-80-F** (BELFUSE 0826-1X1T-80-F)

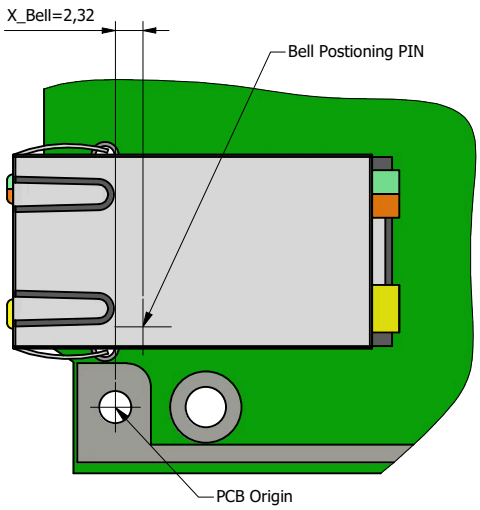

Figure 31: BELFUSE Ethernet Placement (TOP view)

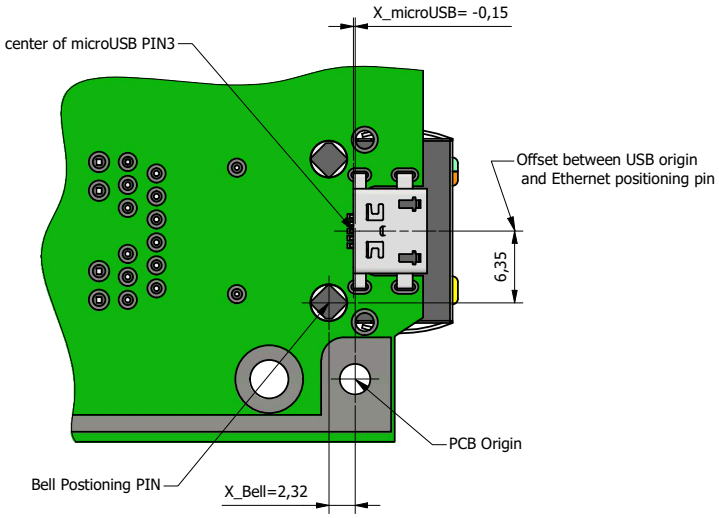

Figure 32: Molex microUSB Placement (BOTTOM view)

The X-axis placement of the BELFUSE 0826-1X1T-80-F Ethernet connector is shown in Figure 31.
The X-axis placement of the Molex 47642-1001 Micro USB connector is shown in Figure 32. Additionally, Figure 32 shows the offset along the Y-axis, which ensures that the symmetry axes of the USB and Ethernet connectors are aligned at the same Y position.
The Y-axis placement of Molex 47642-1001 range is 13,1÷76,6 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.
The Y-axis placement of BELFUSE 0826-1X1T-80-F can be calculated using the offset value shown in Figure 32.

3.9. microSD Card Header

Assumption:

- Using **Molex 473092651** microSD Card Header (Molex 473092651)
- Maintain the ability to replace the microSD card with the DIOT module enclosure installed.
- Ensure no interference with the guide rails.

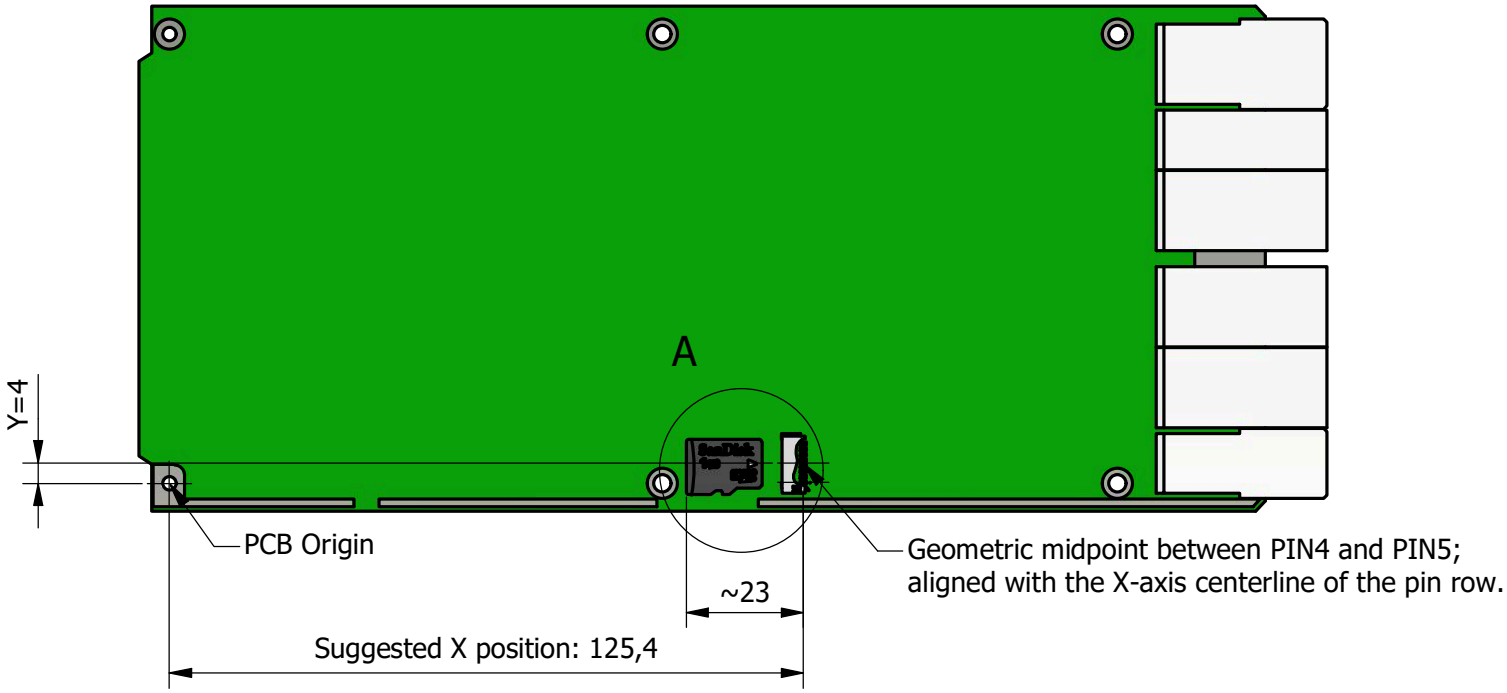

Figure 33: microSD Card Header Placement

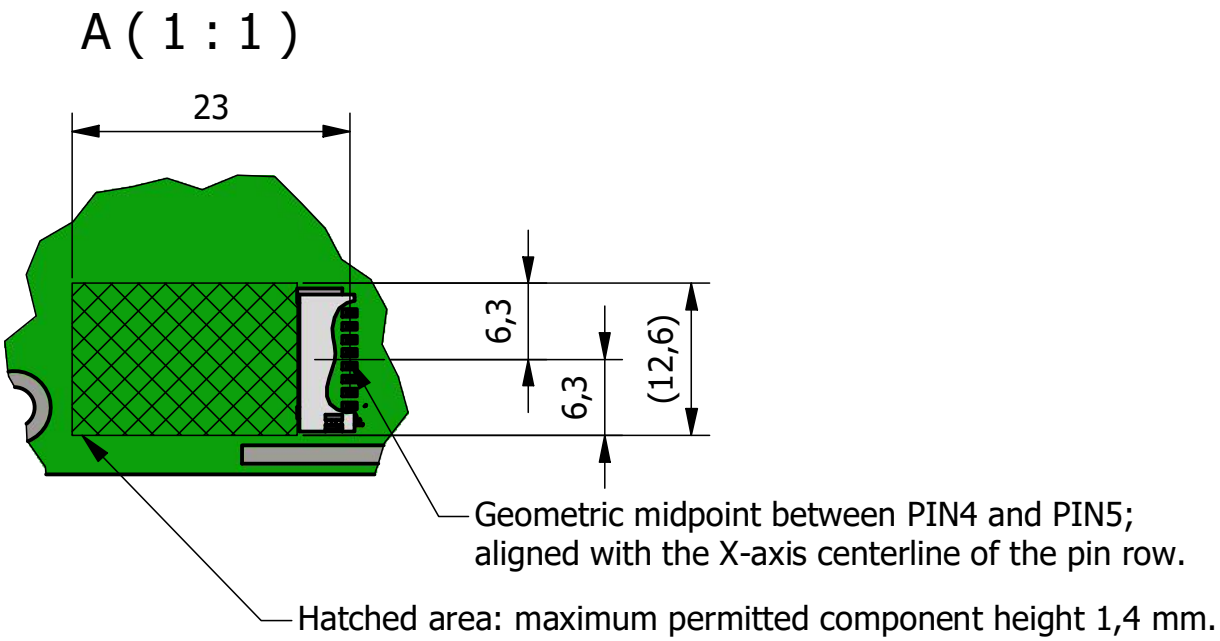

Figure 34: microSD Card Header Placement details

The Y-axis position of the Molex microSD card header shown in Figure 33 allows the card to be replaced with the DIOT enclosure installed and avoids interference with the crate guide rails. Card replacement can be done without removing the module from the crate, provided the crate's bottom cover is removed.

For Figure 34, it is recommended to keep the hatched area free of components. However, placement is permitted if the components are no taller than 1.4 mm.
The hatched area also represents the sweep envelope of the microSD card during insertion and removal, so this clearance must be ensured in the final design.

3.10. Mini SAS Molex 75783 Series

Assumption:

- Using **Molex 75783 series** mSAS connectors (Molex 757830132 mSAS DS)

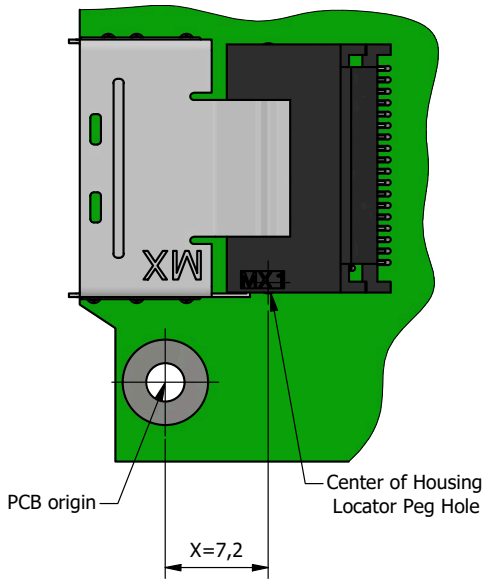

Figure 35: Molex 75783 mSAS Placement (TOP view)

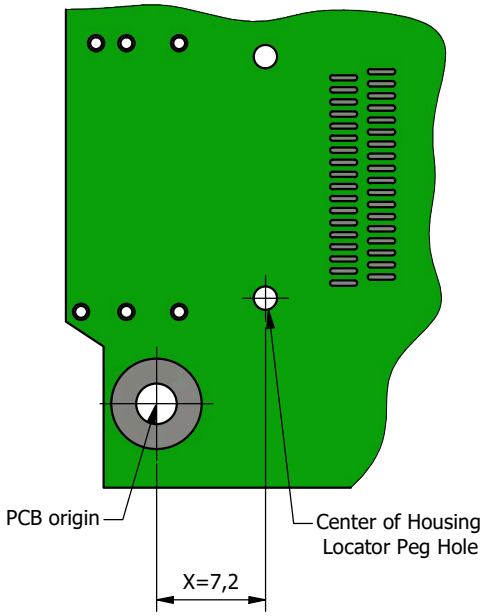

Figure 36: Molex 75783 mSAS Footprint

The X-axis placement of the Molex 75783 series is shown in Figure 35.
Figure 36 is provided solely to clarify the location of the housing locator peg hole.
The Y-axis placement range is 6,7÷66,9 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.11. Dual BNC Bomar 364A2595

Assumption:

- Using **Bomar 364A2595** 2xBNC connector (Bomar 364A2595 DS)
- 0,1 mm between FP back face and BNC resting face

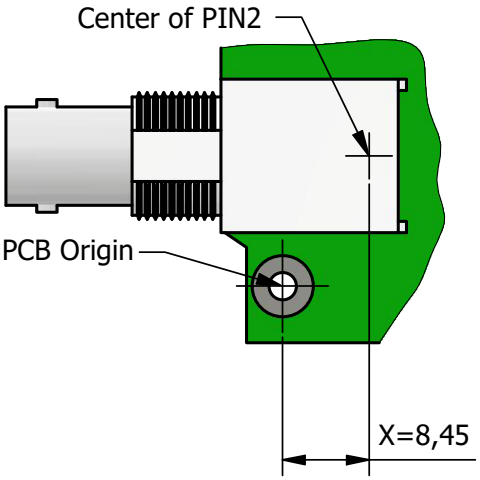

Figure 37: Bomar 364A2595 Placement (TOP view)

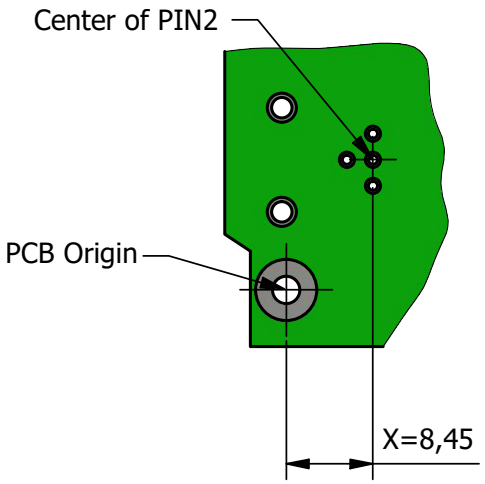

Figure 38: Bomar 364A2595 Footprint

The X-axis placement of the Bomar 364A2595 series is shown in Figure 37.
Figure 38 is provided solely to clarify the location of the center of PIN2.
The Y-axis placement range is 12,7÷77,4 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.12. 4x SFP Amphenol UE78B212700321

Assumption:

- Using **Amphenol UE78B212700321** 2X2 SFP COMBO connector (Amphenol UE78B212700321 DS)

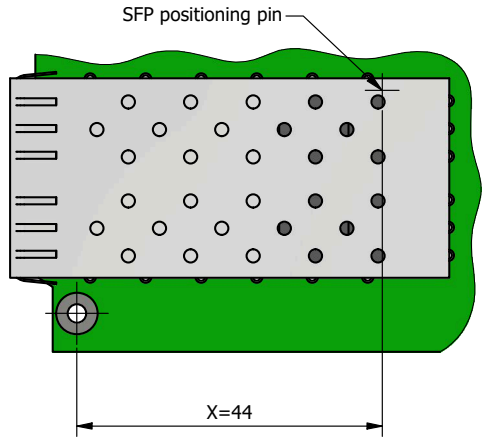

Figure 39: UE78B212700321 Placement (TOP view)

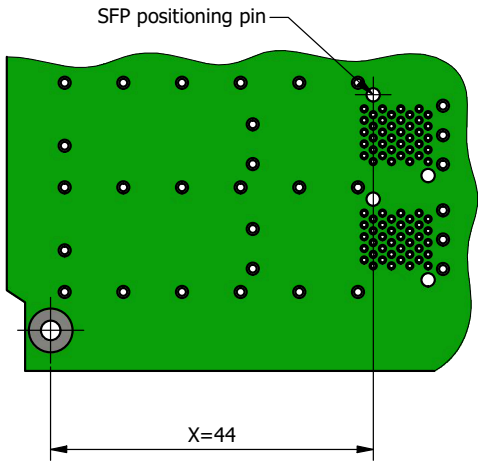

Figure 40: UE78B212700321 Footprint

The X-axis placement of the Amphenol UE78B212700321 series is shown in Figure 39. Figure 40 is provided solely to clarify the location of SFP positioning pin.
The Y-axis placement range is 32,12÷83,22 mm.
The Y-axis placement is referenced to the same point as the X-axis placement.

3.13. 1x SFP TE Connectivity 1888247-1 & 2007198-1

- Using **TE Connectivity 1888247-1** SFP connector (TE Connectivity 1888247-1 DS)
- Using **TE Connectivity 2007198-1** SFP CageAssembly (TE Connectivity 2007198-1 DS)
- Based on the TE Connectivity Application Specification (Application Specification 114-13120)

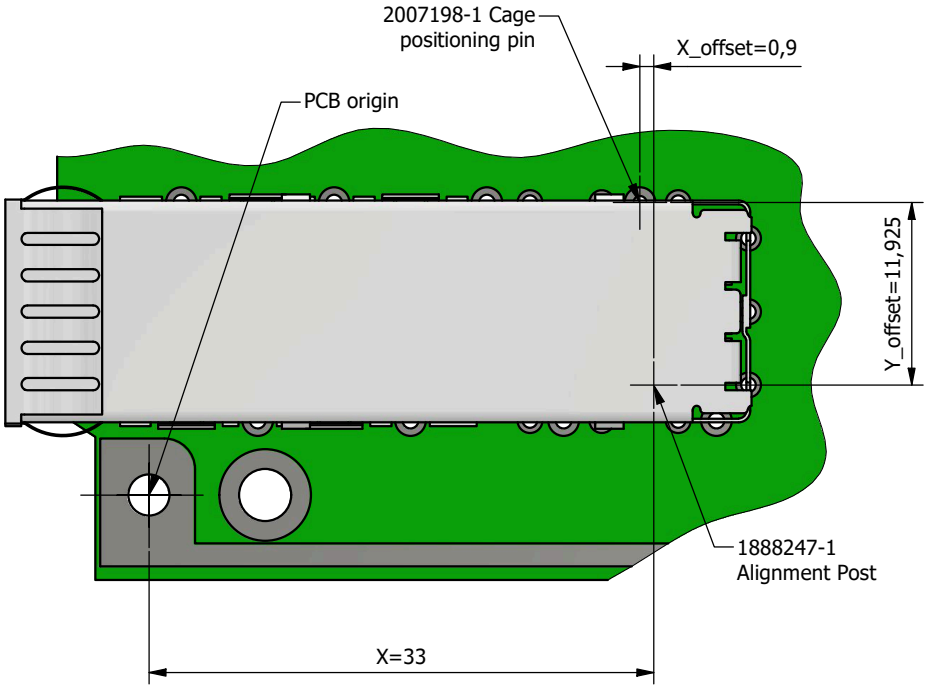

Figure 41: SFP cage location

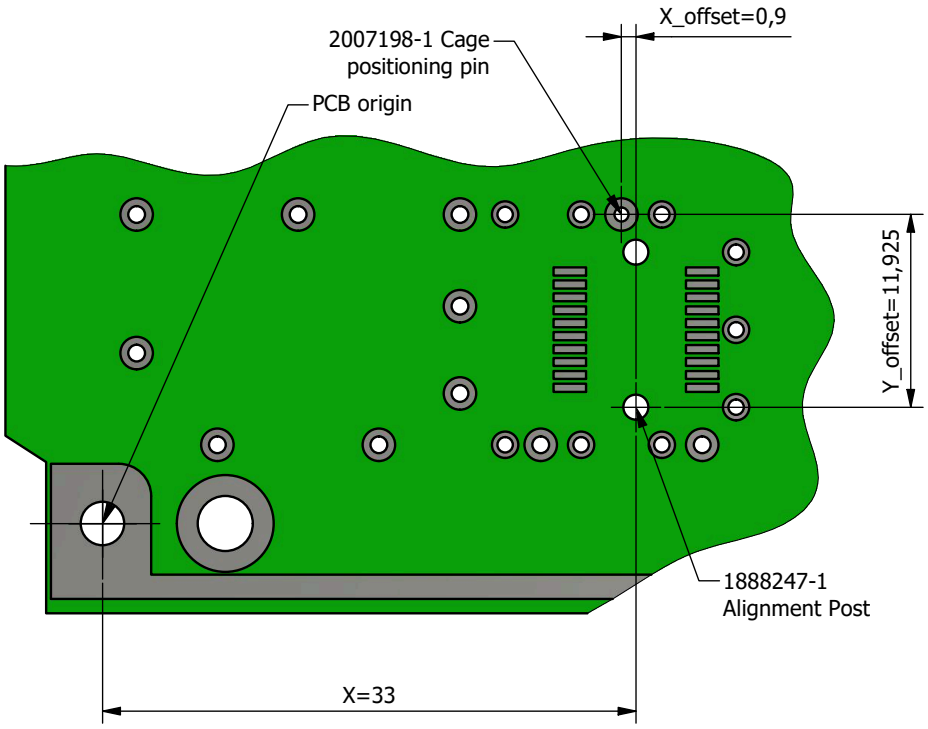

Figure 42: SFP cage location (footprint view)

The X-axis placement of the TE Connectivity 1888247-1 SFP connector together with the TE Connectivity 2007198-1 SFP Cage Assembly is shown in Figure 41.
Figure 42 illustrates the position of the 1888247-1 alignment post and the 2007198-1 cage positioning pin.
The X_offset and Y_offset between the 1888247-1 alignment post and the 2007198-1 cage positioning pin should be used to ensure proper alignment of the SFP connector.
The Y-axis placement range is 7,2÷72,1 mm (measured to the 1888247-1 alignment post).