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TITLE Mini-SAS HD Internal Application Specification		PAGE 1 of 17	REVISION E
		AUTHORIZED BY Jackbin Zou	DATE 2015-12-22
		CLASSIFICATION UNRESTRICTED	

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1.0 OBJECTIVE

This specification provides information and requirements regarding customer application of Mini-SAS HD board connector for internal applications. This specification is intended to provide general guidance for application process development. It is recognized that no single application process will work under all customer scenarios and that customers will develop their own application processes to meet their needs. However, if these application processes differ greatly from the one recommended, FCI cannot guarantee results.

2.0 SCOPE

This specification provides information and requirements regarding customer application of the internal Mini-SAS HD board connector with press-fit termination.

3.0 DRAWINGS AND APPLICABLE DOCUMENTS

- FCI PRODUCT SPECIFICATION GS-12-650
- FCI PRODUCT CUSTOMER DRAWINGS: 10112632, 10112633, 10112634, 10120666, 10120667
- INDUSTRY SPECIFICATION SFF-8643
- FCI REMOVAL TOOLING MANUAL: 10121023-9090


FCI product drawings and specifications can be obtained by accessing the FCI website www.fci.com or contacting FCI Technical Service. In the event of a conflict between this application specification and the drawing, the drawing will take precedence. Customers are advised to refer to the latest revision level of the applicable documents for appropriate details.

4.0 GENERAL

This document is meant to be an application guide. If there is a conflict between the product drawings and specifications, the drawings take precedence.

4.1 PRODUCT DESCRIPTION

The Mini-SAS HD internal board connector is a high density, high speed board connector designed to mate with a corresponding Mini-SAS HD internal cable assembly. The connector is offered in right angle or vertical orientation and features compliant press-fit tails for a reliable electrical interconnection between the connector and the printed circuit board (PCB). The connector is threaded for screw attachment to the PCB. This provides strain relief and additional retention to the board. The connector is keyed to ensure proper orientation for the mating cable connector. Each connector contains two rows of eighteen contacts for a total of thirty six contact positions. Twelve of the thirty six contacts are dedicated as ground terminals and the remaining twenty four contacts can be used for signal contacts. Connectors can be ganged together within a single assembly if more contact positions are needed. See section 4.2 for a listing of the available product sizes.

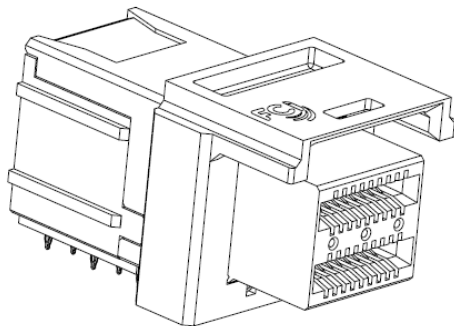
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4.2 PRODUCT CONFIGURATIONS

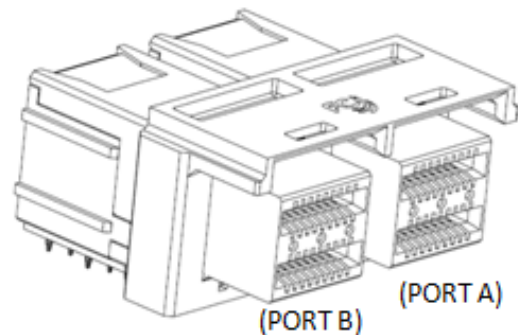
See Table 1 and Figure 1 for the listing and views of the available product configurations.

Product Configuration	Product Orientation	Number of contacts Per Assembly		
		Total	Signal	Ground
1 X 1	Right Angle	36	24	12
1 X 2	Right Angle	72	48	24
1 X 4	Right Angle	144	96	48
1 X 1	Vertical	36	24	12
1 X 2	Vertical	72	48	24

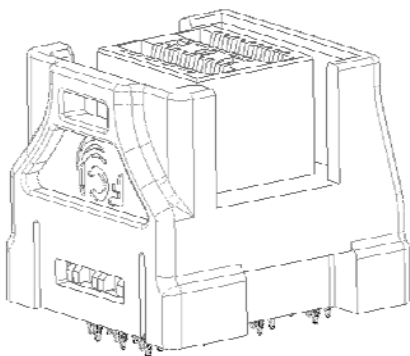
Table 1: Available Product configurations



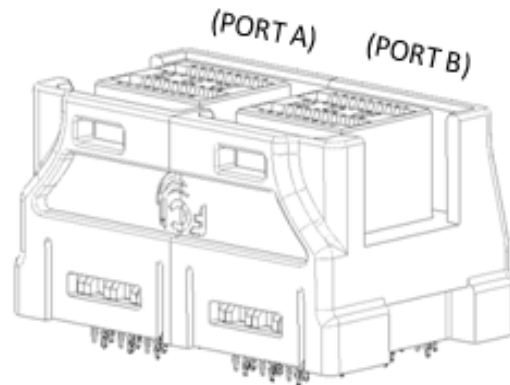
1X1 Configuration RA type



1X2 Configuration RA type




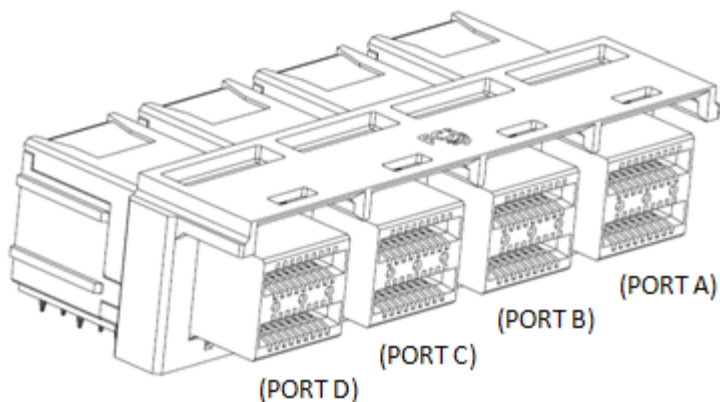
1X1 Configuration vertical type



1X2 Configuration vertical type

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1X4 Configuration RA type

Figure 1: Views of Product Configurations

4.3 KEYING FEATURE

The Mini-SAS HD board connector has an orientation key built into the housing assembly to ensure proper orientation of the cable connector during mating. See Figure 2 for a view of the keying feature.

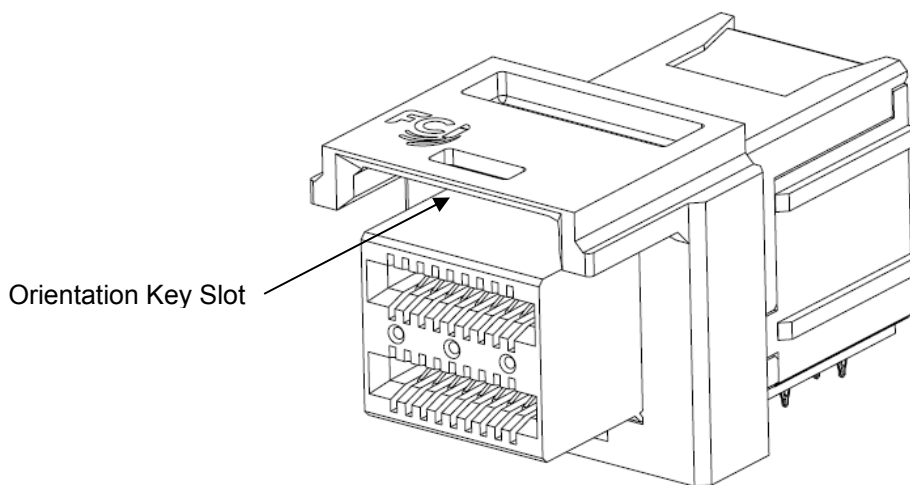



Figure 2: View of Orientation Key (1x1 configuration shown)

4.4 PIN DESIGNATIONS AND USAGE

The Mini-SAS HD board connector utilizes a ground bussing system. All contacts in columns 3, 6, and 9 (Positions A3, B3, C3, D3, A6, B6, C6, D6, A9, B9, C9, & D9) must be designated as ground terminals. All other contact positions may be used for signals. See figure 3 for a view of the pin designations.

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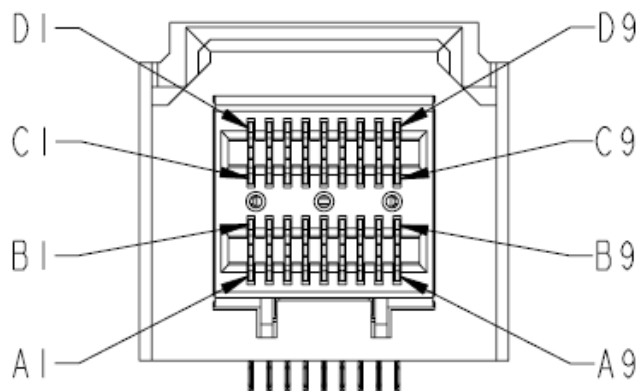


Figure 3: View of Pin Designations

5.0 PCB REQUIREMENTS

5.1 BOARD LAYOUT

Refer to the applicable FCI product customer drawing for the connector footprint layout.

5.2 BOARD THICKNESS

A minimum board thickness of 1.57 millimeters is required for the press-fit termination. There is no maximum board thickness requirement.

5.3 BACK DRILLING

Back drilling is a method used by system designers to improve high speed signal integrity performance by reducing the stub length of a conductive via. When back drilling is performed, it is important to avoid damaging the portion of the via that contacts the press-fit tail. After the back drilling operation the remaining via barrel length for the press fit tails on the connector must be at least 1.0mm minimum in order to ensure a reliable connection between the press-fit section and the PCB. See figure 5 below for more recommendations on proper back drilling.

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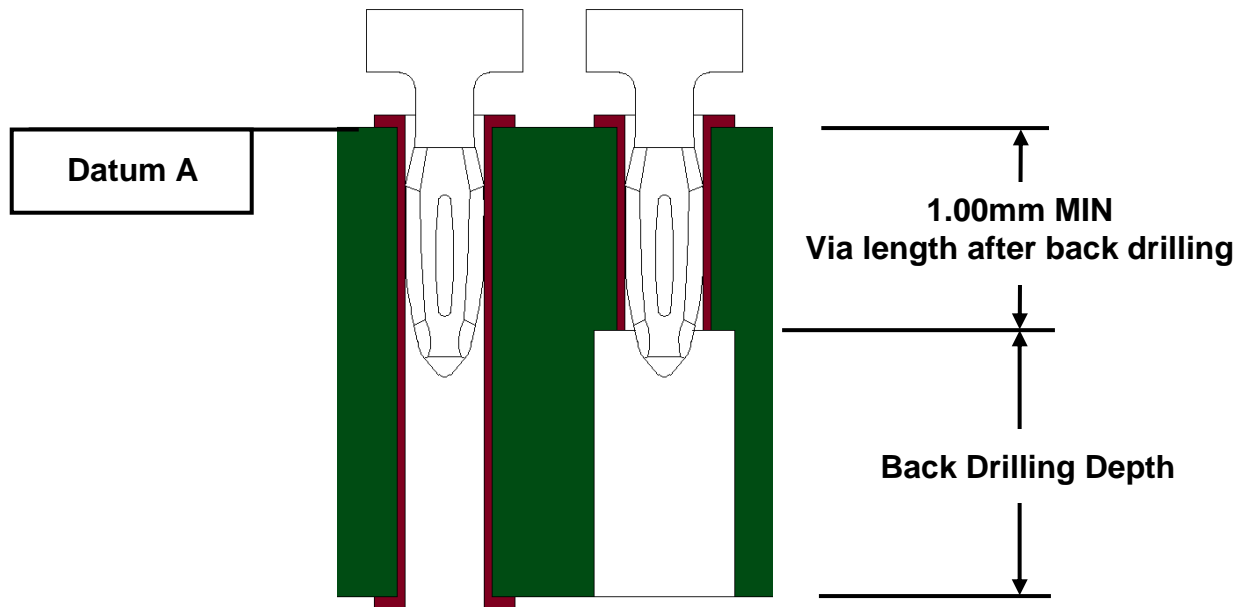


Figure 5: View of Back Drilling

5.4 KEEP-OUT ZONES FOR APPLICATION AND REMOVAL TOOLING

Keep out zones outside the envelope of the connector are required for both the insertion and removal tools. Refer to the applicable FCI product customer drawing for the details pertaining to the keep out zone requirements.

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5.5 BREAKOUT RECOMMENDATION:

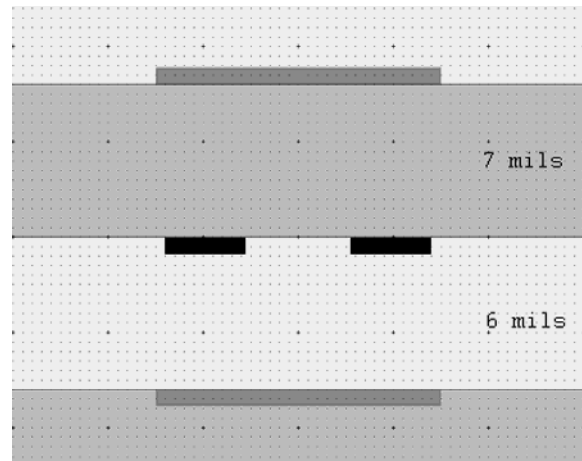
TRACE GEOMETRY

- Differential Trace Dimensions: 3/4/3
- Relative Dielectric Range: 3.6 to 4.4
- Copper weight: 0.5 oz

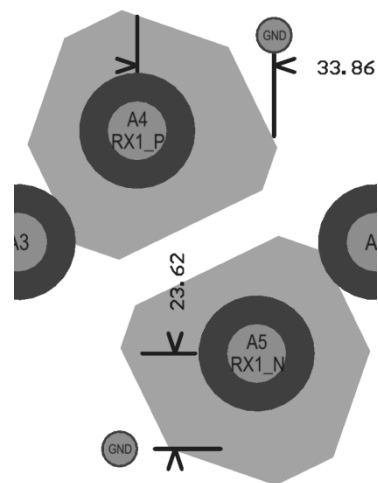
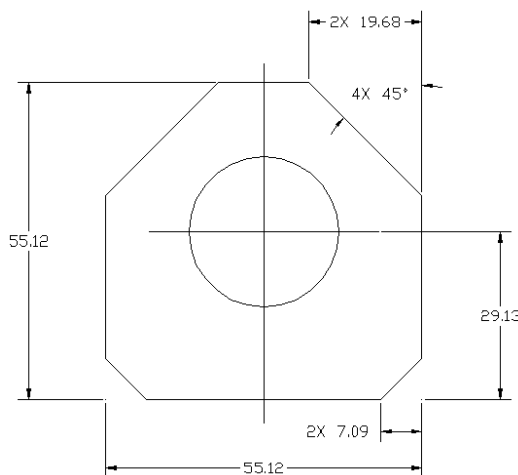
Using the recommended anti-pad geometry shown below, ground will be above and below the signal traces, providing an adequate return path for high speed signaling.

SIGNAL LAYER STACK-UP

- Above trace: 7mil core
- Below trace: 6mil pre-preg




ANTI PAD GEOMETRY (Dimensions in mils)



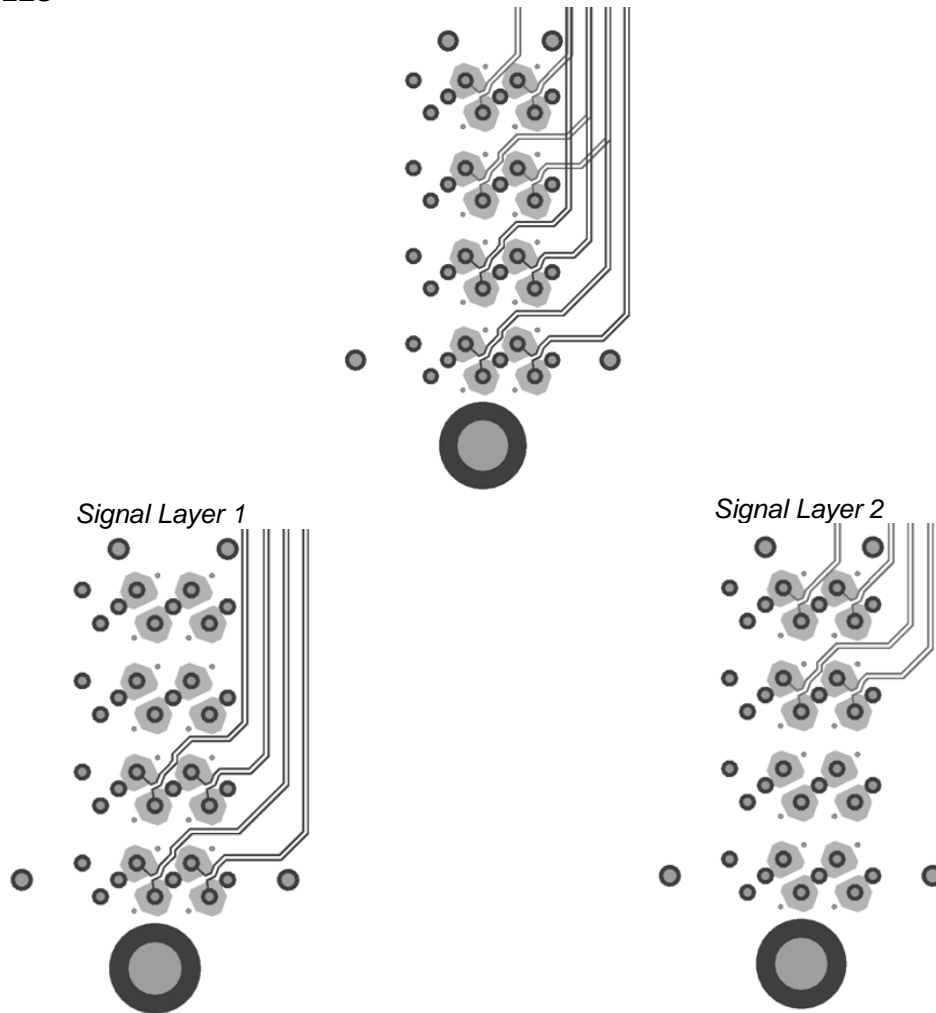
ANTIPAD GEOMETRY CONT.


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- Recommended Anti-Pad angle: 30°
 - The angle of the anti-pad adjusts the trace angle departure.
- Recommended Pinning Hole size: ≤ 8mils
 - The pinning via can be any size that does not interfere with the differential traces.

BREAK OUT EXAMPLES



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6.0 APPLICATION TOOLING

6.1 CONNECTOR INSERTION TOOLING

The application tools recommended for the Mini-SAS HD External board connectors are shown in Table 2. A special bottom support tool will be necessary if the connector's tails are longer than the thickness of the PCB that the connector is being applied to (the tail length specification for the cage is 2.10mm \pm 0.13mm). The bottom support tool could be a PCB with oversized holes or a custom tool designed by the user.

Insertion Tool P/N	Description
10118559	Insertion tool for 1X1 Internal (R/A type) Assembly (Connector series 10112632)
10118560	Insertion tool for 1X2 Internal (R/A type) Assembly (Connector series 10112633)
10118561	Insertion tool for 1X4 Internal (R/A type) Assembly (Connector series 10112634)
Flat Block	Insertion tool for 1X1 Internal (Vertical type) Assembly (Connector series 10120666)
Flat Block	Insertion tool for 1X2 Internal (Vertical type) Assembly (Connector series 10120667)

Table 2: Insertion Tooling Part Numbers

6.2 INSERTION PRESSES

Several important items to consider when selecting an insertion press include:


- The press must have sufficient force capabilities to insert the specific receptacle configuration.
- The press ram should be sufficiently long to cover the Press Block tooling to prevent tooling flex.
- The press table should be large enough to properly accommodate the PCB size.

Typical press types include:

- Manual arbor press
- Pneumatic press
- Hydraulic press
- Servo driven electronic press

Although the connector can be applied using any of the press types mentioned above the preferred press type is the servo driven electronic press. This press gives the best control during the insertion process and offers the most flexibility.

7.0 RECOMMENDED INSERTION FORCES

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The recommended maximum insertion force is 18 Newton per press-fit pin. The maximum insertion force per connector is found by taking the total number of contacts in the connector assembly and multiplying it times the 18 N maximum requirement. Refer to the example below.

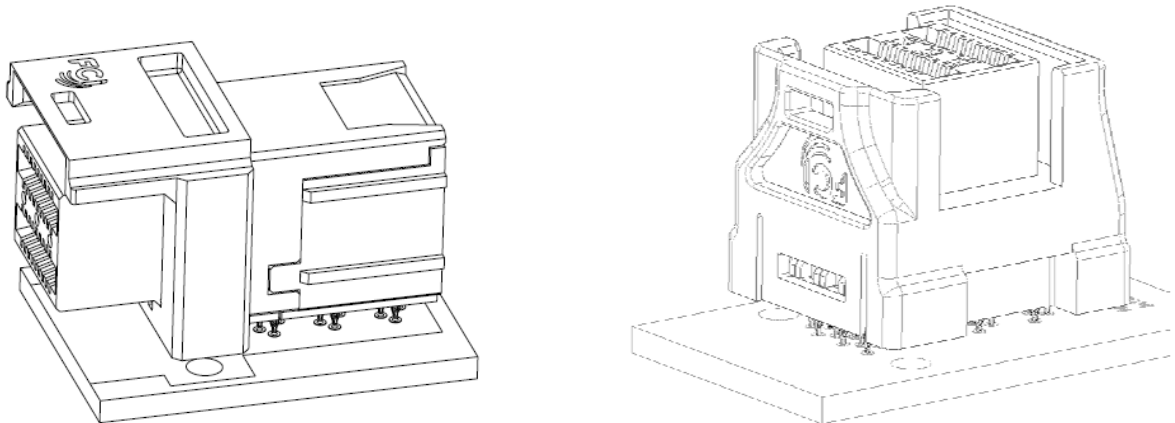
EXAMPLE: For a 1X1 receptacle assembly there are 36 press-fit tails being inserted into the PC board. Therefore, the maximum recommended press setting would be 648 N (36 press-fit tails x 18 N).

This maximum force recommendation has been determined to yield acceptable insertion results for PCB holes within FCI's recommended guidelines. While it is acceptable to use a lower insertion force per press-fit pin, steps should be taken to guarantee that the connector is seated properly (see Section 9). Force settings may vary with different types of PTH finishes. Customers should develop parameters that best suit individual application requirements.


8.0 APPLICATION PROCEDURE

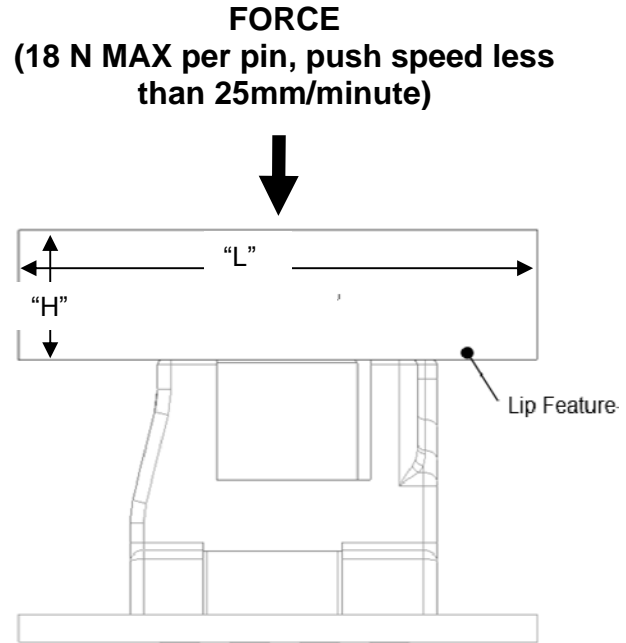
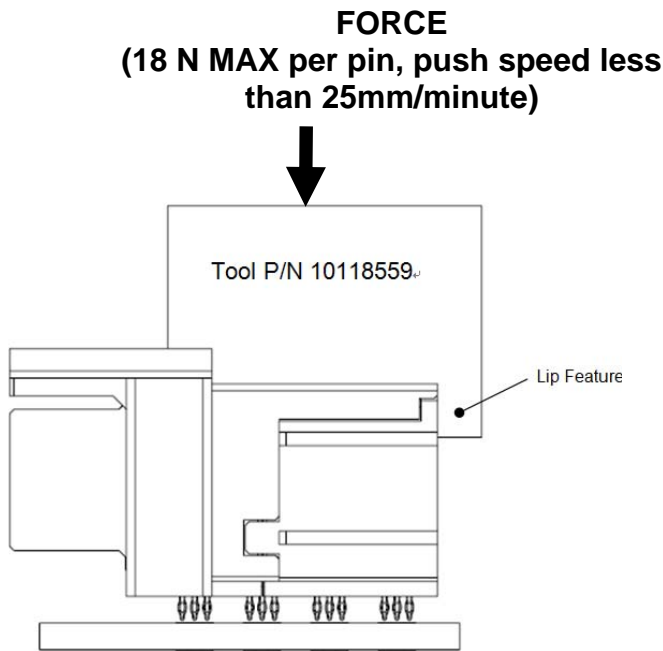
The application procedure for the Mini-SAS HD connector assembly is as follows:

- Place the connector assembly in the desired location on the daughter card taking care to assure that all press-fit tails line up with the proper holes.



- Place the proper insertion tool (refer to section 6.1) on top of the connector assembly as shown in the figure below. The tool should rest flat on the two surfaces of the housing and the lip of tool should be placed against the back of the connector. Apply force to the flat surface of the insertion tool. Actuation of the press should be slow and controlled, not fast like a punch press. Inserting to a specified force will yield more consistent results than inserting to a set distance. To ensure proper insertion, connectors must be centered beneath the press ram. An offset in the loading may result in improper seating of the connector.

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The vertical insertion tool recommended Dim as follows:
 Height: 7mm
 Length: 28mm
 Width: 37mm

- Remove the board assembly and inspect the connector for proper application (refer to section 9.0).

9.0 POST-APPLICATION INSPECTION PROCEDURES

The Post-application inspection should consist of several simple checks to assure that the connector is applied properly and is not damaged.

- Visually assure that all press-fit tails are seated in the proper PCB holes and that none have been crushed during application.
- Visually assure that the metal standoffs on the bottom of cage assembly are seated flush to no greater than 0.08 mm away from the top of the PCB surface. A larger gap beneath the standoffs may indicate that the connector is not fully seated or is not seated parallel to the board. This can lead to assembly issues with the panel opening, or even problems with mating.

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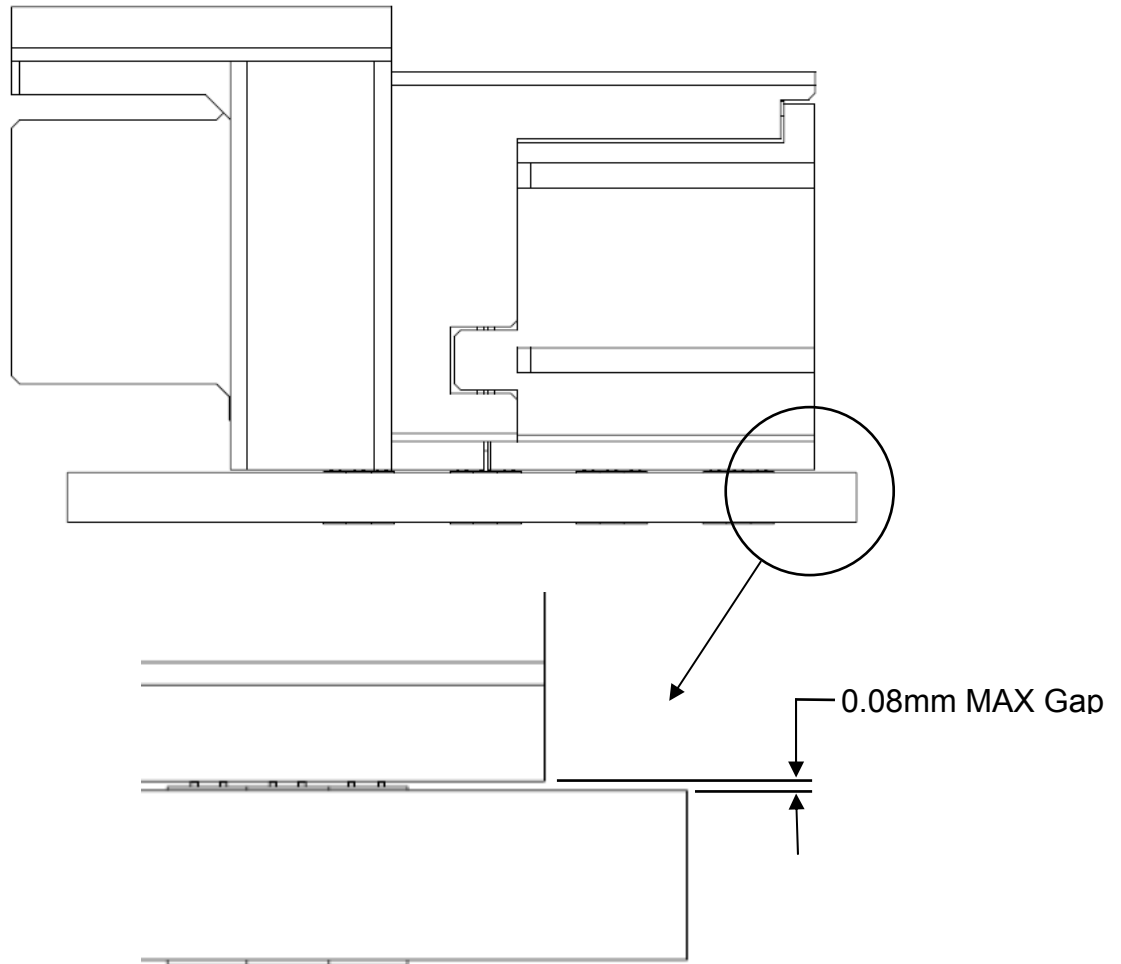

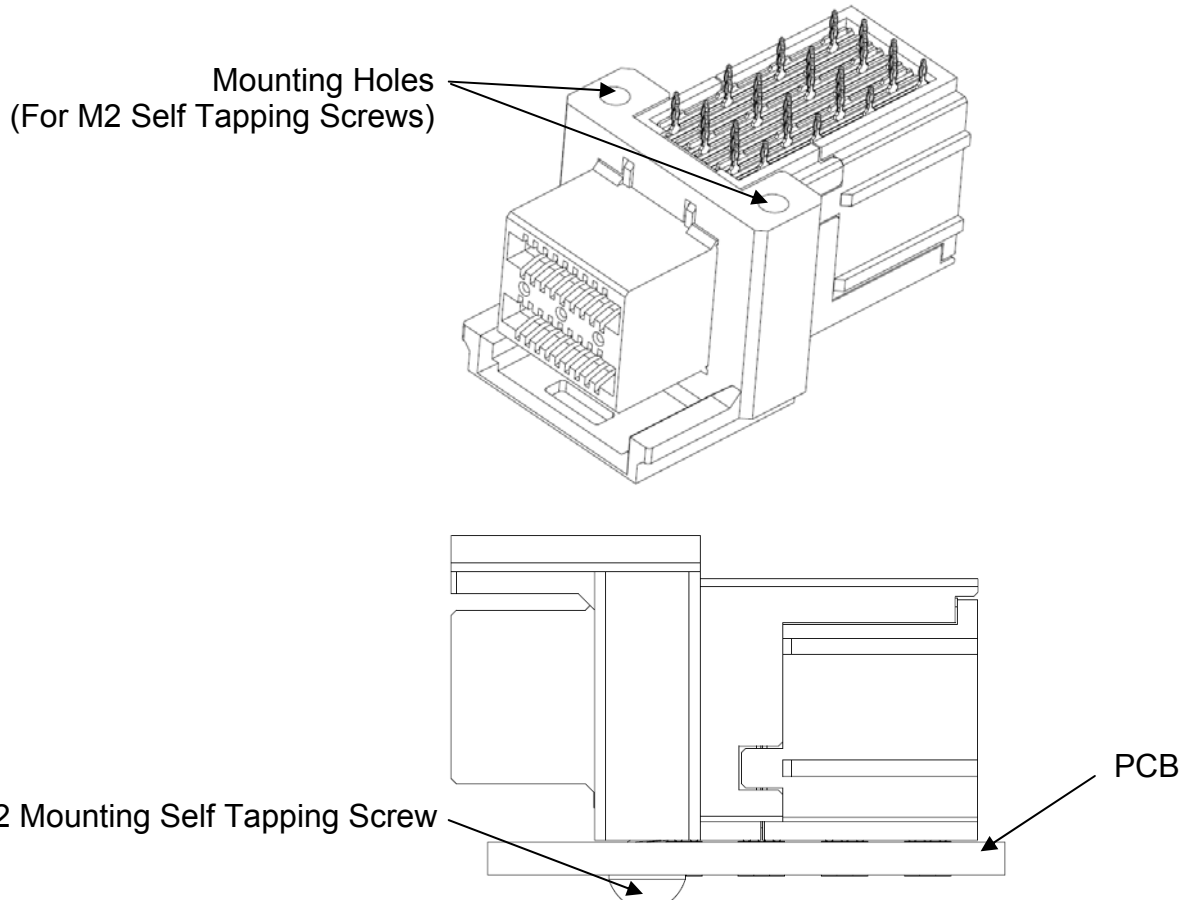


Figure 6: Proper Seating after Board Application

10.0 MOUNTING SCREWS

The connector assembly is equipped with blind mounting holes in the plastic housing that accepts M2 self tapping screws for attachment to the PCB. The screw mounts help retain the connector onto the PCB and also provides strain relief for the press-fit terminals. The proper screw length needed for an application shall be determined by adding the PCB thickness plus an additional length of up to 2.5 millimeters. Screws should be fastened refer to below torque specification. Do not over torque the screws as this could cause damage to the assembly.

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Recommended screw torque specification				
product type & base number		screw specification		
		M2X0.91mm	M2X0.80mm	M2X0.40mm
right angle	10112632	120~150 N-mm	100~110 N-mm	100~110 N-mm
	10112633			
	10112634			
vertical	10120666	150~180 N-mm	150~180 N-mm	N/A
	10120667			

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11.0 REPAIR TOOLING

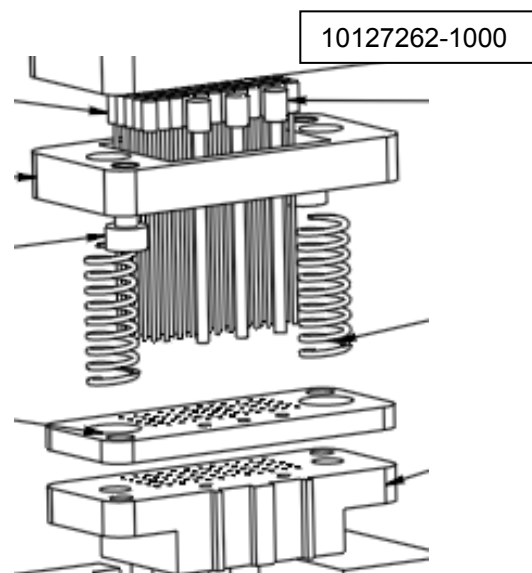
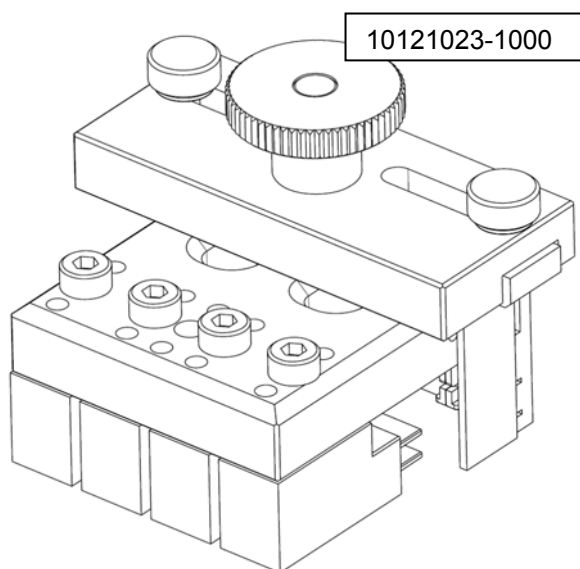
Tool PN	Tool Description	Connector PN	Connector Description
10121023-1000	Removal Tooling (FCI MANUAL P/N 10121023-9090)	10112632	1x1 Internal Mini-SAS HD
		10112633	1x2 Internal Mini-SAS HD
		10112634	1x4 Internal Mini-SAS HD
10127262-1000	Removal Tooling (FCI MANUAL P/N 10127262-9090)	10120666	1x1 Internal Mini-SAS HD vertical receptacle
		10120667	1x2 Internal Mini-SAS HD vertical receptacle
10118559	Insertion Tooling	10112632	1x1 Internal Mini-SAS HD
10118560		10112633	1x2 Internal Mini-SAS HD
10118561		10112634	1x4 Internal Mini-SAS HD


Refer to removal tool manual 10121023-9090 or 10127262-9090 for detailed instructions on how to properly remove a connector with this tool.

Refer to section 8.0 for details on installing a new connector.

Connectors must be replaced if removed from the PCB. Connectors may be removed from the PCB up to two times and the PCB may sustain a third connector application. This may vary with board and PTH construction. Plated holes should be inspected to ensure no detrimental degradation has occurred.

If repairs to the PCB require soldering while the connector is mounted to the PCB; after soldering, remove fluxes, residues, and activator. Follow the procedures and use solvents recommended by the solder and flux manufacture. Cleaners must be free of dissolved flux and other contaminants. When removing a “no clean” solder paste residue; it is critical that the connector contact interface be kept clean of flux and residue.



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12.0 Appendix A
Optional Common Footprint for Use with either Right Angle Connector or Vertical Connector

A common footprint that will accept either a Mini-SAS HD Internal Right Angle or Mini-SAS HD Internal Vertical connector is described below.

The option to use either a Mini-SAS HD Internal Right Angle or Mini-SAS HD Internal Vertical connector in a common footprint can be achieved with the addition of two mounting holes 11.40mm from datum K. To accommodate the third mounting screw used with the Mini-SAS HD Internal Vertical connector, a slot at location #1 will be needed.

See the product drawings for the recommended keep-out areas of each connector.

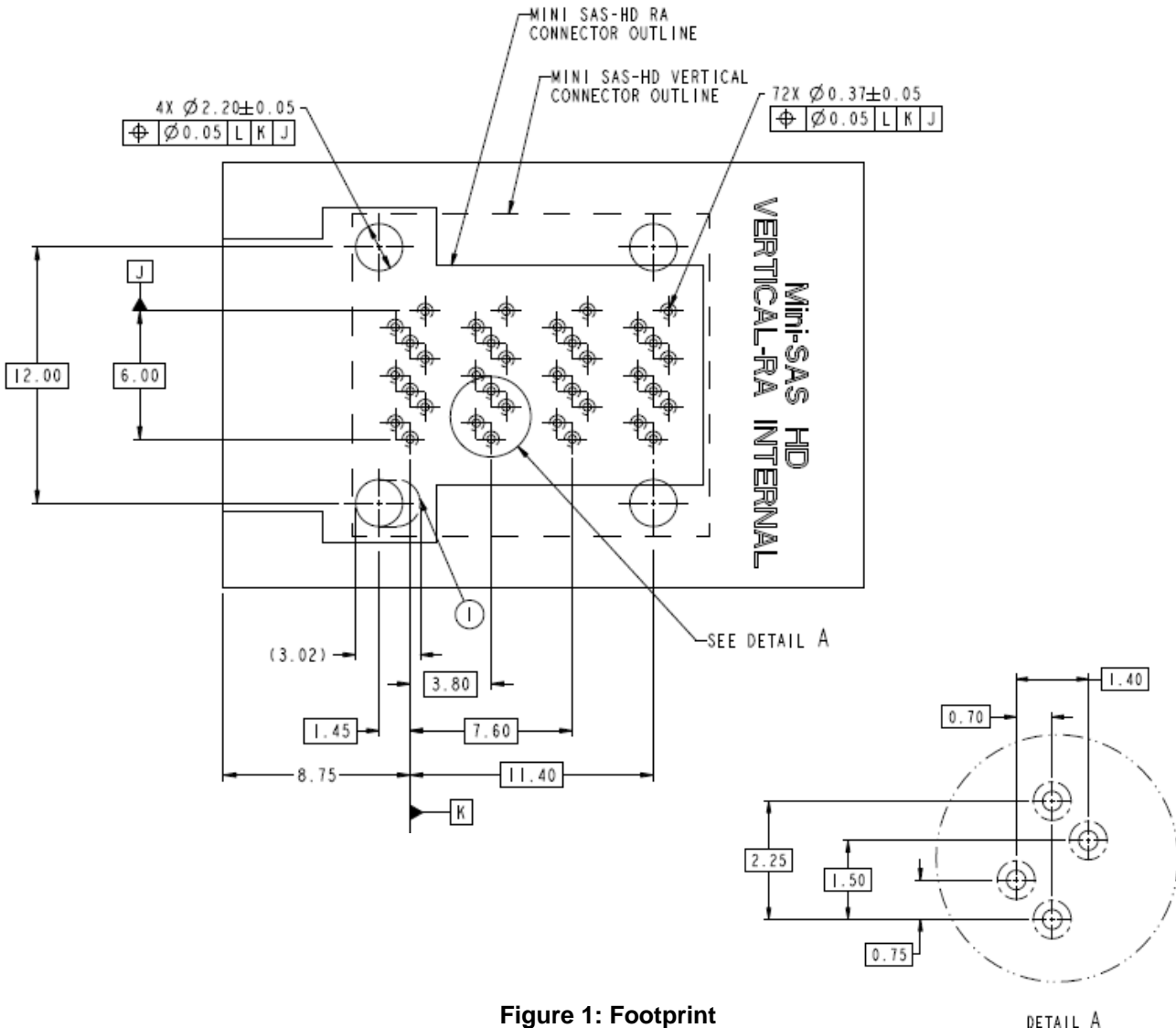


Figure 1: Footprint

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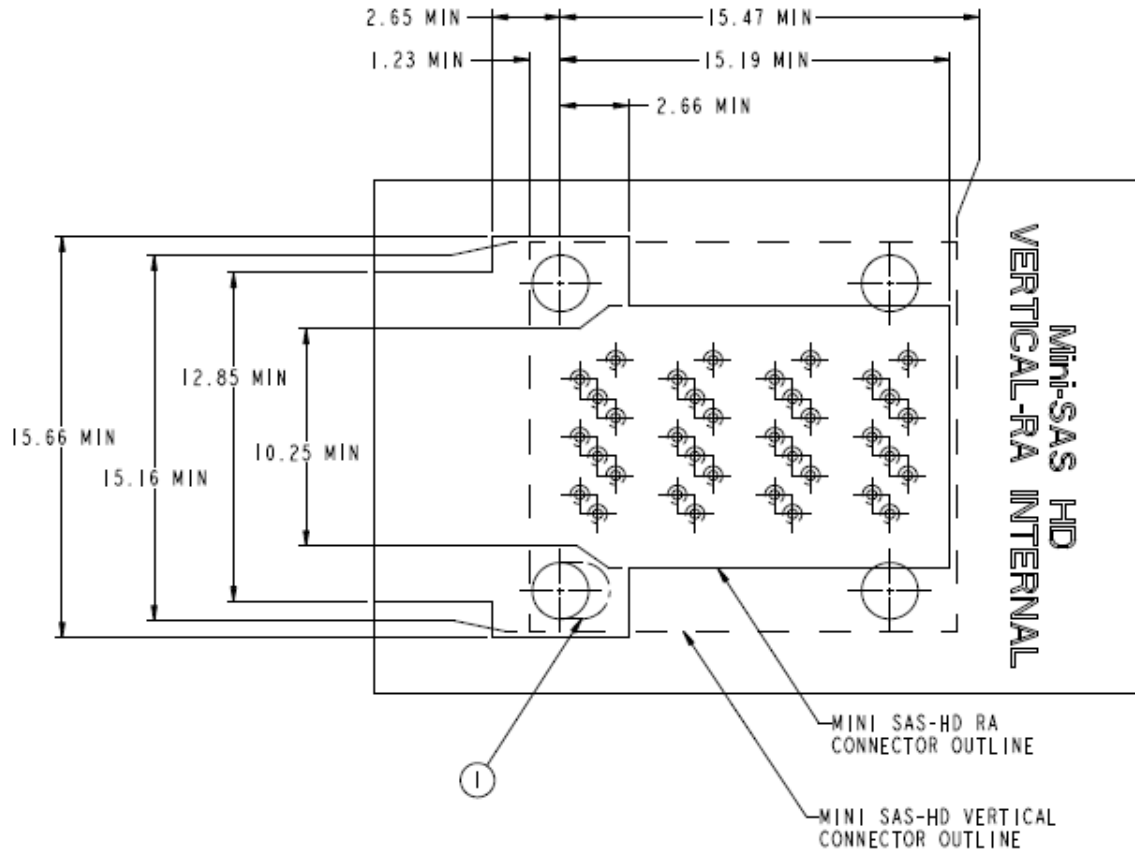



Figure 2: Connector Outline

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13.0 RECORD RETENTION

REV	PAGE	DESCRIPTION	EC #	DATE
A	All	Initial Release	-	2012-10-10
B	14-15	Add Optional Footprint	ELX-V-13895-1	2013-01-16
C	All	Add vertical related information	ELX-DG-15069-1	2013-05-28
D	14	Add vertical removal tooling related information	ECN-ELX-DG-16182-1	2013-09-11
E	12-13	Recommend additional options of screw and define torque specification for different screws	ECN-ELX-DG-22753-1	2015-12-22