

TB-2371

Paladin HD / HD2 Connector Design Guidelines

Revision “A”

**Specification Revision Status**

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## **Introduction**

### **Scope**

This document contains a description of the design rules for the Paladin® HD / HD2 connector system.

This document is intended to serve as an application guide for designing the Paladin HD / HD2 connector system into various customer system configurations.

### **Reference Documents:**

TB-2357 Paladin HD / HD2 Direct Orthogonal Guidelines

TB-2360 Paladin HD / HD2 Routing Guidelines

TB-2362 Paladin HD / HD2 Daughtercard Connector Installation

TB-2363 Paladin HD / HD2 General Product Specifications

TB-2364 Paladin HD / HD2 Daughtercard Module Removal and Replacement

TB-2366 Paladin HD / HD2 PCB Attach Feature Guidelines

TB-2374 Paladin HD / HD2 Backplane Connector Press-Fit Installation Process

### **Document Confidentiality**

This document is company confidential and may be used only by customers for their internal use. This document contains proprietary information, which is not to be used in any way not previously approved by Amphenol.

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### **Paladin HD / HD2 General Product Descriptions**

The standard Paladin HD / HD2 differential interconnect platform consists of connectors featuring 2 Pair, 3 Pair, 4 Pair, 5 Pair, 6 Pair, 7 Pair, 8 Pair, 9 Pair, 10 Pair 11 Pair & 12 Pair variations. For larger form factor applications, contact Amphenol Application Engineering. The interconnect system features solderless, eye-of-the-needle, press-fit terminations (with Pb free plating) to the printed circuit board for the ground system and compression spring contacts for the signal system. Paladin HD / HD2 incorporates a unique 3-D resonance damping shield that enables low crosstalk across a wide frequency spectrum. The interconnect system can also be used in direct orthogonal layouts, and "mid-plane" configurations where daughtercards plug into the backplane from both sides. The daughtercard or right angle female (RAF) connector building blocks include signal modules and guidance modules and end-caps that are all assembled to metal stiffeners. There are also male & female cables incorporating various cable gages available.

The backplane connectors can be arranged in 4, 5, 6, and 8 column modules. For the availability of non-standard sizes please contact Amphenol Application Engineering.

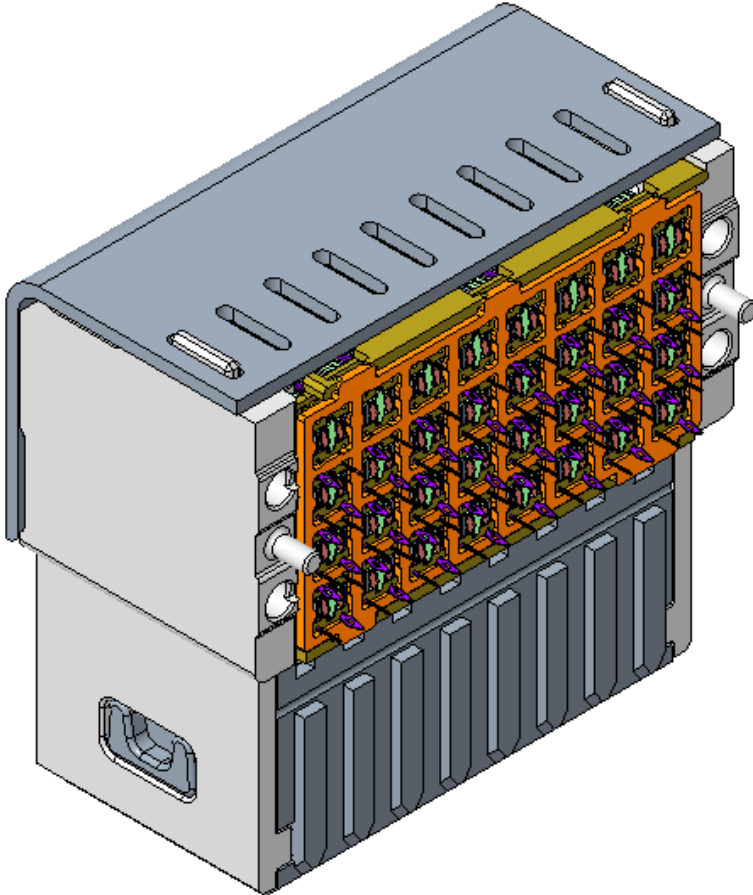
### **Design Guidelines for Daughtercard (RAF) Connectors**

#### **Scope**

This section describes the preferred daughtercard connector design guidelines. Stiffeners -The daughtercard connectors are configured to fit on mechanical stiffeners. The signal modules, guide modules and end-caps are placed onto the stiffeners in the specific configuration required by the customer. This stiffener keeps the daughtercard components on the 2.40/2.80 mm pitch. The Paladin HD / HD2 daughter card configuration may also be determined by the Paladin HD / HD2 RAM Connector (Right Angle Male) for coplanar applications to which it will mate. The stiffener can help to straighten the board edge but does not necessarily preclude the need for additional board stiffening.

#### **Daughtercard (RAF) Connector Configurations**

Daughtercard connector configurations are determined by the customer's system application. Amphenol recommends (but does not require) that for the optimal connector configuration design the connectors be grouped in increments of 4, 5, 6, and 8 column (also referred to as position). This matches the 4, 5, 6, and 8 column groupings of the backplane modules. Guide modules or end-caps are typically placed on the ends of the connector to protect Daughtercard connector from handling damage. See Figure 1 for a typical Paladin HD / HD2 connector configuration.



**Figure 1: Typical daughtercard connector configuration**

**Daughtercard Connector Lengths**

The maximum length of a daughtercard connector is determined by the length of a single signal module. Longer than specified modules will require an additional hold down in the middle of the connector pin-field. All Paladin HD / HD2 modules use screws as an ancillary connector hold down methods. The maximum daughtercard length is dependent on the number of signal modules. Refer to Table 1 for maximum lengths.

**Table 1: Maximum Daughtercard Connector Length**

Product Family	Maximum DC Length, mm (# of wafers)
2 Pair	24
3 Pair	24
4 Pair	24
5 Pair	24
6 Pair	18
8 Pair	18
9 Pair	18
10 Pair	16
11 Pair	12
12 Pair	12

**Guidance**

A robust guidance system is a must with today's higher density and higher pin count connectors. The Paladin HD / HD2 connector system relies on sequential funneling to ensure proper mating. The first phase is the gross alignment, which is provided by the card cage card guides as the card approaches the backplane. The Paladin HD / HD2 guide pins and receptacles provide the next alignment phase. The last and final phase is the alignment provided by the alignment ribs on the signal module front housing and the alignment slots on the backplane modules. Many design considerations must be considered when determining the guidance requirements such as:

- Length of connector
- Weight of daughtercard
- Gathering ability of the guide pins

- How the connector is used (i.e. Vertical or Horizontal)
- Amount of clearance in the card guides
- Multiple “separate / different” connectors of the same card edge.
- Cabled backplane applications

The length of the connector, length of card, and card weight will help to determine the number of guide pins required.

**Table 2: Guide Pin Recommendations**

<b>DC Connector Length</b>	<b>Recommended Minimum Number of Guide Pins</b>
150mm or less	One guide pin (minimum)
150mm – 360mm	Two guide pins at the ends of connector

It is not generally recommended to over-use pins due to probability of ‘binding’. In this scenario, the guide pins could work against each other due to tolerance stack up of the chassis and connector system. However, there have been rare applications where a very heavy daughter card (over 30 pounds) have used redundant guide pins in the application. Please consult your Amphenol ICC Application Engineer if your application has unique requirements using more than 1 guide pin.

The weight of the daughtercard assembly will also help to determine the type of guide pin / module used. There are two main guidance systems available when using the Paladin HD / HD2 system for the daughtercard.

1. The “standard” guide
2. The “wide” guide

For the guide pin daughtercard weight recommendations and guide pin force deflection, please refer to Table 3 and Figure 2.

**Table 3: Paladin HD / HD2 and Paladin Plus Guide Pin Daughtercard Weight Capacity Recommendations**

<b>Weight of Daughter card Assembly</b>	<b>Guidance System Recommendations</b>
-----------------------------------------	----------------------------------------

5 lbs or less	Use standard, plastic mounted guide pin and standard receptacle. Minimum one guide pin.
5 lbs – 10 lbs	Use two standard, plastic mounted guides pins and standard receptacles  Or One free standing, board mounted guide pin with standard guide receptacle.
10 lbs – 15 lbs	Use two free standing, board mounted guide pins with standard guide receptacles.
15 lbs or greater	Use wide guide, board mounted pin.

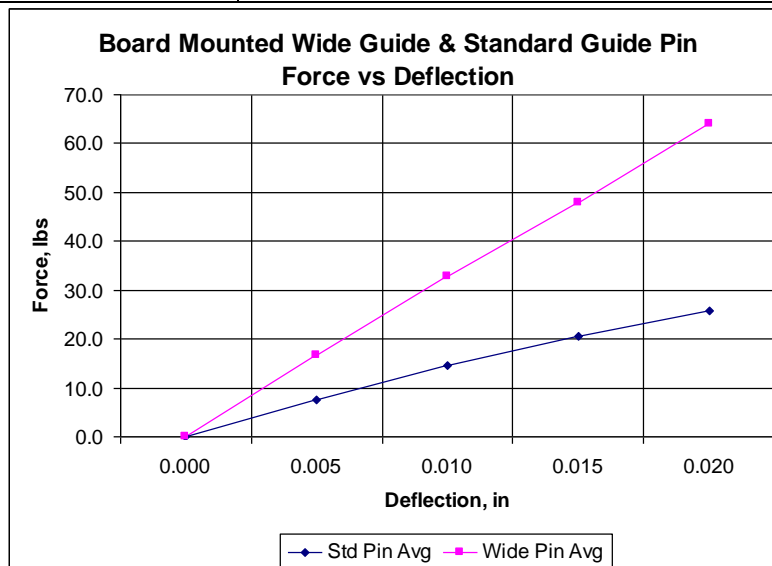
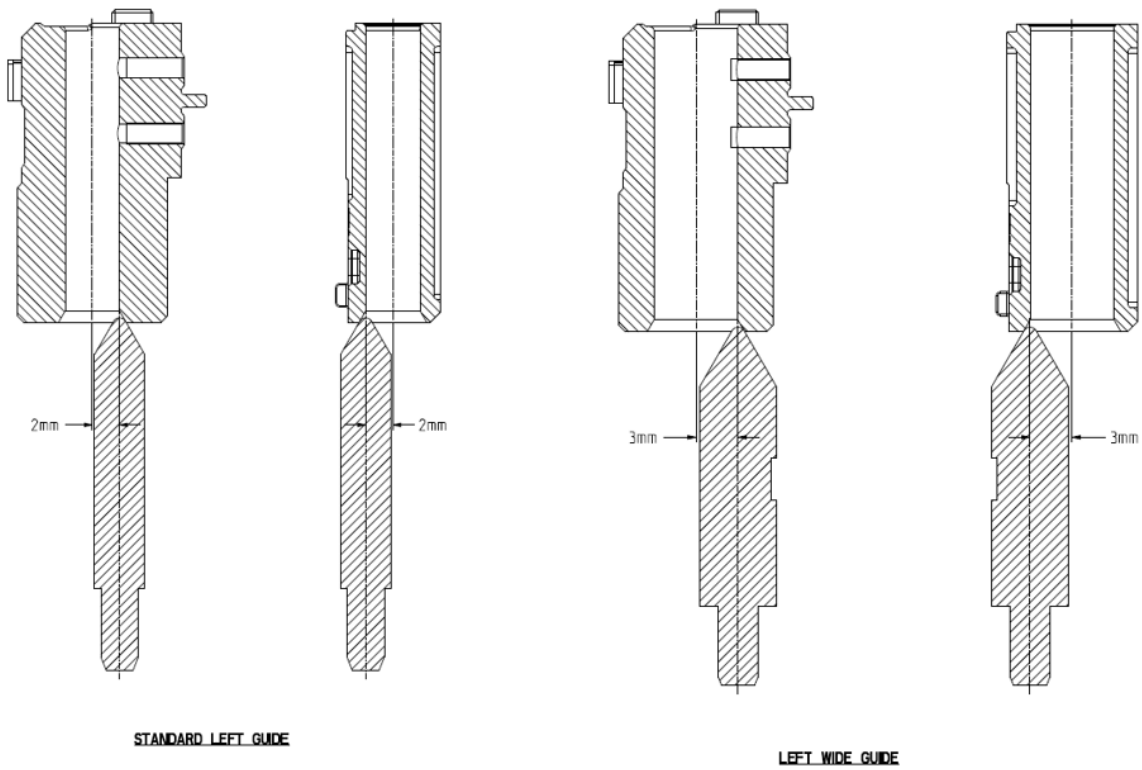


Figure 2: Guide Pin Force Vs Deflection Plot



The Paladin HD / HD2 guidance system is capable of gathering up to 2mm radial for the standard guide pin and 3 mm radial for the wide guide pin, see Figure 3.



**Figure 3: Standard and Wide Guide Gathering Ability**

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### **Hold-Down**

Applications of connectors in chassis systems today are more complex than past generations of systems. Many applications are now direct mate orthogonal systems without the integration of a traditional midplane. This added complexity further highlights the need for proper alignment and card weight management. The elimination of a midplane requires the direct mating connectors to account for card bow in each system card mating that is compounding normal X, Y, and angle mating. Additionally, the higher the data rates and connector density correlates to heavier system cards, also straining traditional connector alignment features. The Paladin HD / HD2 interconnect system required either end caps or guide modules screwed down on both ends of the connector system. In larger chassis with larger / heavier cards, proper connector application design would incorporate supplemental hold down support to the PCB to overcome the mating and lateral forces and the significant card weight associated with these chassis systems. It is critical to ensure connectors remain secured to the PCB surface per the prescribed seating requirements in TB-2362, and supplemental connector hold down features should be incorporated into the overall system design.

### **Pick and Place**

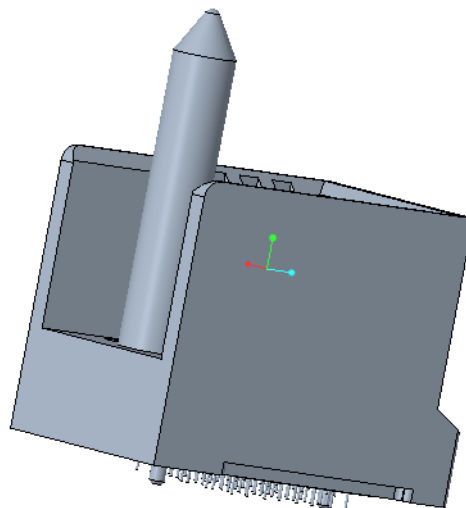
Pick and place operations may be necessary to process connectors in a manufacturing environment. Additional systems such as integrated AOI will require efforts between pick and place vendors, contract manufacturers, and Amphenol.

### **Design Guidelines for Backplane Connectors**

Scope: This section describes the preferred backplane connector design guidelines.

All backplane modules are available in left, right, and double guide/polarizing options, as well as double wall configurations.

Left, right, and double guide/polarizing modules have integrated, plastic mounted, standard guide pins available, see Figure 4.



**Figure 4: Paladin HD / HD2 4x4 with integrated guide. The integrated guide pins can be used with, or without, board mounted screws.**

### **Backplane signal blade lengths**

There are two different signal blade lengths available for the Paladin HD backplane connectors. Each different blade length provides a specific mechanical wipe length achieving 1.50mm or 2.00mm of wipe. Refer to the *Connector Mating Sequence Chart* which is available in section 0. Paladin HD2 only offers the 1.5mm signal wipe option for optimum electrical performance. The minimum mechanical wipe is defined as a fully mated connector and is based on the connector tolerance loop analysis.

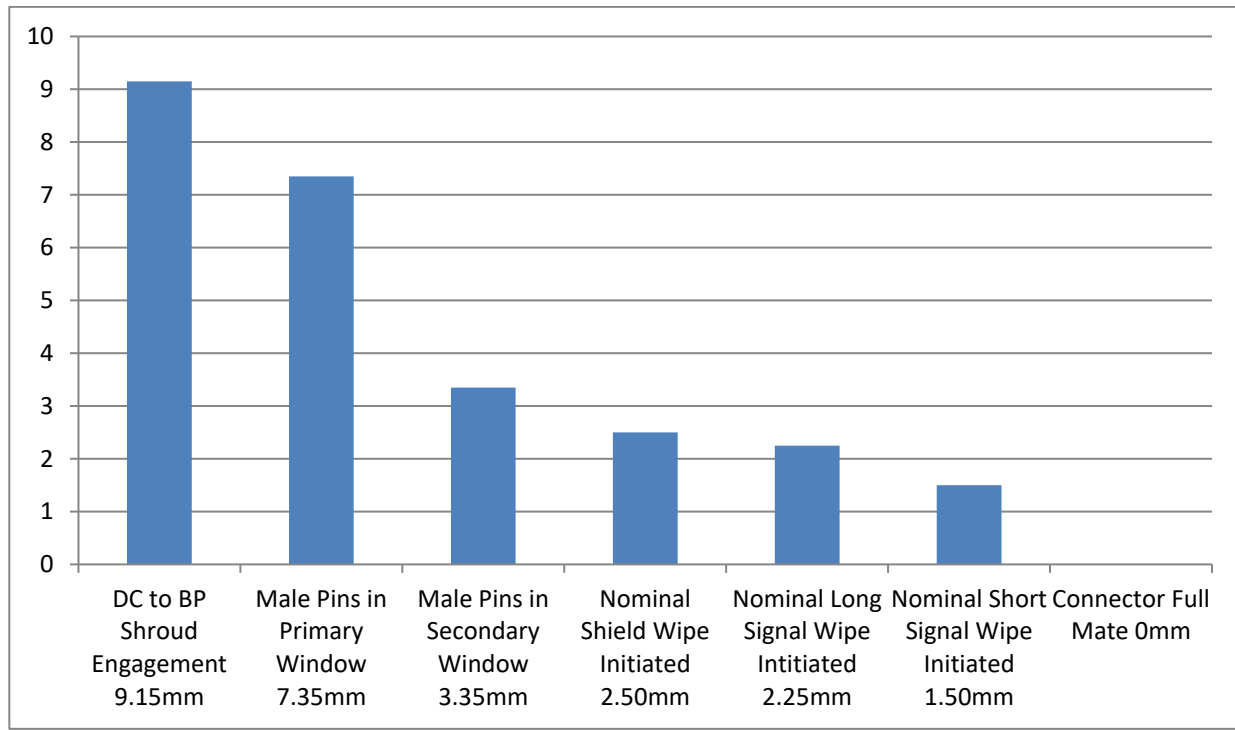
On Paladin HD, the backplane signal blades can be configured with multiple blade lengths within the same backplane module. The customer determines at which location the different blade lengths are to be stitched into the backplane module.

### **Backplane shield blade length**

The backplane shield is only available in one length and has a minimum mechanical wipe of 2.50mm. The Paladin HD / HD2 connectors are designed to have the shield contacts mate prior to all of the signal contacts. Refer to the sequencing chart in figure 7.

**Connector Mating Sequence**

**Paladin HD / HD2 Nominal Sequencing Chart**



**Figure 5: Paladin HD / HD2 sequencing chart.**

**Connector Density and Slot Pitch****Table 4: Connector Density and Slot Pitch**

	Connector Density	Slot Pitch
2 Pair	21 Pairs per inch	2.40mm
3 Pair	31 Pairs per inch	2.40mm
4 Pair	42 Pairs per inch	2.40mm
5 Pair	52 Pairs per inch	2.40mm
6 Pair	63 Pairs per inch	2.40mm
7 Pair	74 Pairs per inch	2.40mm
8 Pair	84 Pairs per inch	2.40mm
9 Pair	95 Pairs per inch	2.40mm
10 Pair	105 Pairs per inch	2.40mm
11 Pair	116 Pairs per inch	2.40mm
12 Pair	127 Pairs per inch	2.40mm
2 Pair	18 Pairs per inch	2.80mm
3 Pair	27 Pairs per inch	2.80mm
4 Pair	36 Pairs per inch	2.80mm
5 Pair	45 Pairs per inch	2.80mm
6 Pair	54 Pairs per inch	2.80mm
7 Pair	63 Pairs per inch	2.80mm
8 Pair	72 Pairs per inch	2.80mm
9 Pair	81 Pairs per inch	2.80mm
10 Pair	90 Pairs per inch	2.80mm
11 Pair	99 Pairs per inch	2.80mm
12 Pair	108 Pairs per inch	2.80mm

**Printed Circuit Board (PCB) Consideration**

Refer to TB-2360 Paladin HD / HD2 Routing Guidelines

**Mated Mechanical Lengths**

Refer to TB-2363 General Product Specification for Paladin HD / HD2 Backplane, Daughtercard and Direct Orthogonal Interconnect System

**Direct Orthogonal Applications**

Refer to TB-2357 Paladin HD / HD2 Direct Ortho General Guidelines

**Connector Pressing (Installation)**

**Daughtercard Pressing**

Refer to TB-2362 Paladin HD / HD2 Daughtercard Connector Press-Fit Installation Process

**Backplane Pressing**

Refer to TB-2374 Paladin HD / HD2 Backplane Connector Press-Fit Installation