TB-2331

Paladin® Connector Design Guidelines

Revision “B”

Specification Revision Status

Revision	SCR No.	Description	Initial	Date
A	S5664	New Release	J. Dunham	4/4/17
B	S10415	Added TB-2367 to Section 1.2 Added Section 2.6 for recommendation of hold-down feature	T. Nierendorf	3/7/23

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Table of Contents

1 Introduction

1.1 Scope

1.1.1 This document contains a description of the design rules for the Paladin® connector system. This document is intended to serve as an application guide for designing the Paladin connector system into various customer system configurations.

1.2 Reference Documents:

TB-2324 Paladin General Product Specifications
TB-2322 Paladin Routing Guidelines
TB-2332 Paladin Backplane Connector Press-Fit Installation Process
TB-2326 Paladin Daughtercard Connector Installation
TB-2320 Paladin Direct Orthogonal Guidelines
TB-2327 Paladin Daughtercard Module Removal and Replacement
TB-2367 Paladin Plus Daughtercard Connectors Press-Fit Installation Process

1.3 Document Confidentiality

1.3.1 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.

1.4 Paladin General Product Descriptions

1.4.1 The standard Paladin differential interconnect platform consists of connectors featuring 2 Pair, 3 Pair, 4 Pair, 5 Pair, 6 Pair, 7 Pair, & 8 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. Paladin 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, power modules, guidance/polarizing modules, and grounded guidance modules that are all assembled to metal stiffeners.

1.4.2 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.

2 Design Guidelines for Daughtercard (RAF) Connectors

2.1 Scope

2.1.1 This section describes the preferred daughtercard connector design guidelines.

2.2 Stiffeners

2.2.1 The daughtercard connectors are configured to fit on mechanical stiffeners. The signal modules, guide modules, power modules and other components are placed onto the stiffeners in the specific configuration required by the customer. This is

usually determined by the design of their backplane slot. This stiffener keeps the daughtercard components on the 2.40 mm pitch.

2.2.2 The standard Paladin daughter card configuration may also be determined by the Paladin RAM Connector (Right Angle Male) for coplanar applications to which it will mate.

2.2.3 The stiffener can help to straighten the board edge but does not necessarily preclude the need for additional board stiffening.

2.3 Daughtercard (RAF) Connector Configurations

2.3.1 Daughtercard connector configurations are determined by the customer’s system application. Amphenol recommends 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 and power modules are typically placed on the ends of the connector to protect Daughtercard connector from handling damage. If both guides and powers are used on the same connector, Amphenol recommends placing them on opposite ends of the signal connector. See Figure 1 for a typical Paladin connector configuration.

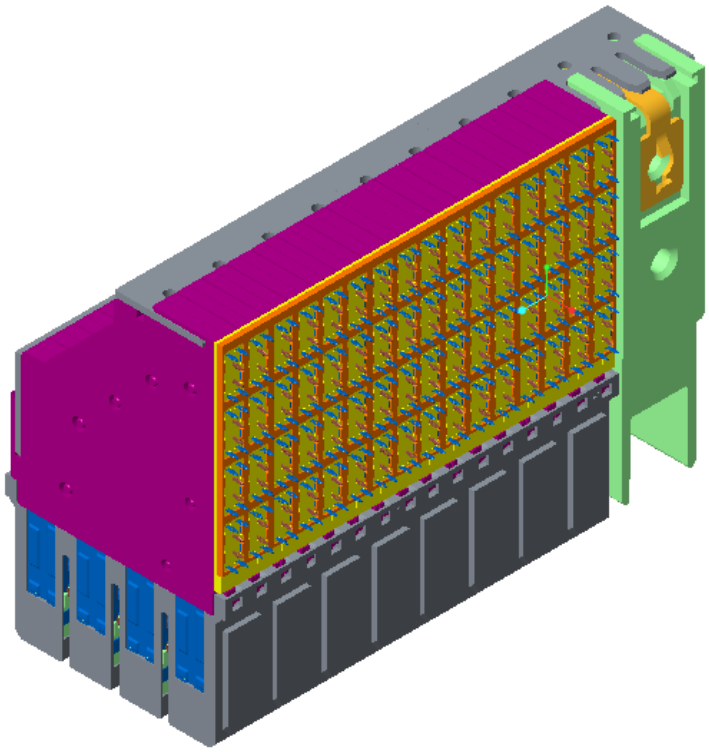

Figure 1: Typical daughtercard connector configuration

2.4 Daughtercard Connector Lengths

2.4.1 The minimum length of a daughtercard connector is determined by the minimum required number of signal modules and other components. For smaller form factor interconnects, contact Amphenol Application Engineering for recommendations on 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 modules)
2 Pair	153.6 (8)
3 Pair	153.6 (8)
4 Pair	153.6 (8)
5 Pair	115.2 (6)
6 Pair	115.2 (6)
8 Pair	115.2 (6)

2.5 Guidance and Keying

2.5.1 A robust guidance system is a must with today’s higher density and higher pin count connectors. The Paladin 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 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.

2.5.2 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

DC Connector Length	Recommended Minimum Number of Guide Pins
150mm or less	One guide pin (minimum)
150mm – 360mm	Two guide pins at the ends of connector
360mm or greater	Contact Amphenol ICC application engineer

2.5.3 It is not recommended to use over 3 guide 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) has had three guide pins used in the application. Please consult your Amphenol ICC Application Engineer if your application has unique requirements using more than 3 guide pins.

2.5.4 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 system for the daughtercard.

1. The "standard" guide
2. The "wide" guide

2.5.5 For the guide pin daughtercard weight recommendations and guide pin force deflection, please refer to Table 3 and Figure 2. In addition, there is also an ESD (electro-static discharge) guide module option for all Paladin connectors.

Table 3: Paladin and Paladin Plus Guide Pin Daughtercard Weight Capacity Recommendations

Weight of Daughter card Assembly	Guidance System Recommendations
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.

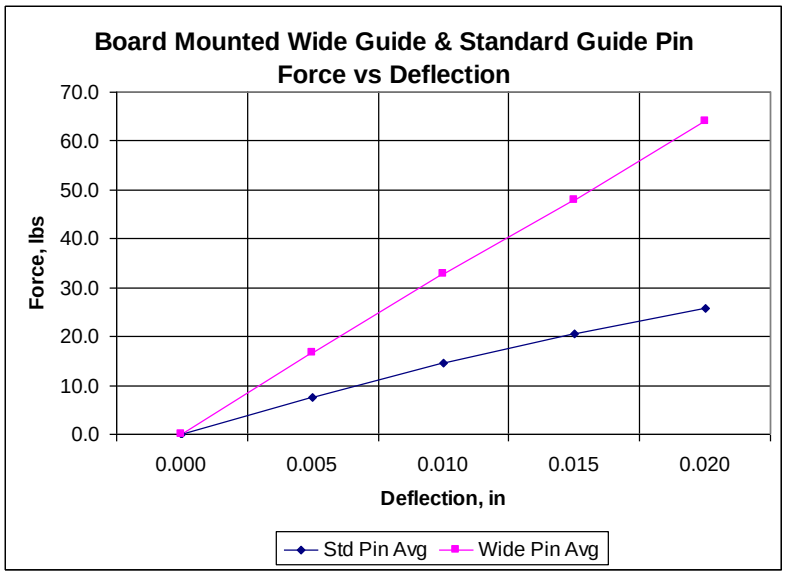

Figure 2: Guide Pin Force Vs Deflection Plot

2.5.6 The Paladin 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.

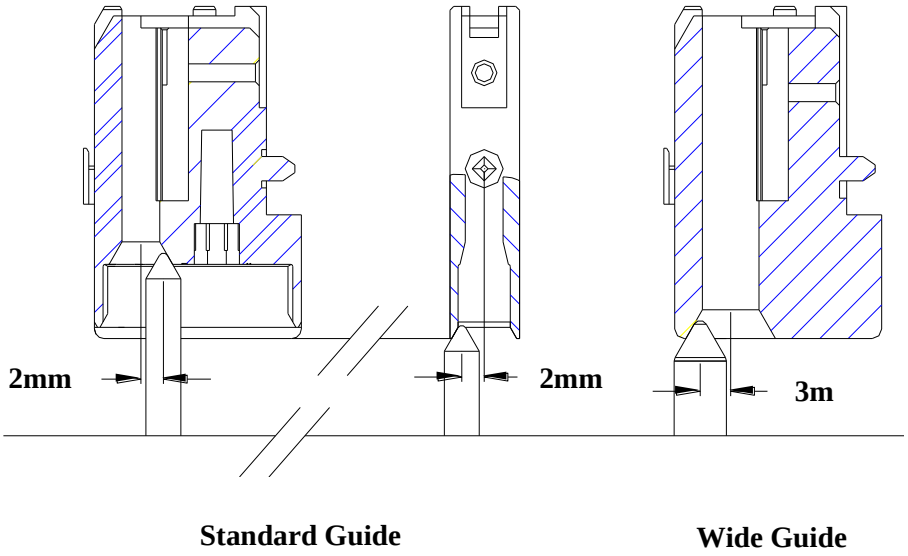

Figure 3: Standard and Wide Guide Gathering Ability

2.6 Hold-Down Fixturing

2.6.1 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. 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-2326, and supplemental connector hold down features should be incorporated into the overall system design.

2.6.2 Standard Paladin: hold-down fixturing is recommended for standard Paladin.

2.6.3 Paladin Plus: hold-down fixturing is required for Paladin Plus.

2.6.4 Feature Details: Hold-down fixturing should apply force on the connector against the PCB after it has been pressed in. Hold-down fixturing can be integrated into the chassis design or via a guide module and/or endcaps that attach to the connector stiffener and fasten to the PCB with screw. Please contact a Field Applications Engineer with questions about the hold-down fixturing, including design requirements for solutions that do not fasten to the PCB.

3 Design Guidelines for Backplane Connectors

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

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

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

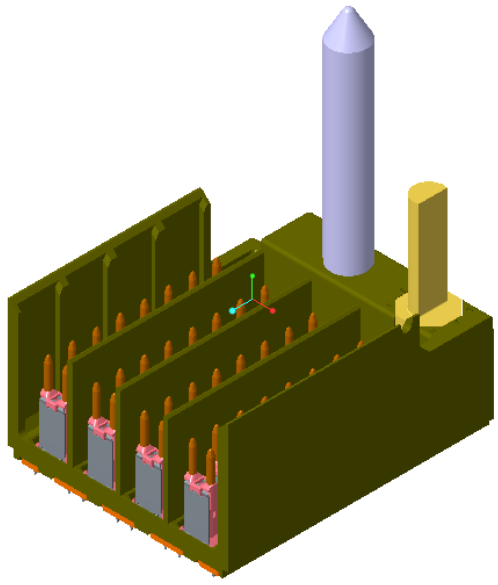

Figure 4: Paladin 4x8 with integrated guide and polarizer.

3.1.3 The integrated plastic mounted guide pins can be used with, or without, board mounted screws.

3.2 Backplane signal blade lengths

3.2.1 There are two different signal blade lengths available for the Paladin backplane connectors. Each different blade length provides a specific mechanical wipe length achieving 1.50mm or 2.25mm of wipe. Refer to the *Connector Mating Sequence Chart* which is available in section 5.1.

3.2.2 The minimum mechanical wipe is defined as a fully mated connector and is based on the connector tolerance loop analysis.

3.2.3 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.

3.3 Backplane shield blade length

3.3.1 The backplane shield is only available in one length, and has a minimum mechanical wipe of 3.00 mm. The Paladin connectors are designed to have the shield contacts mate prior to all of the signal contacts. Refer to the sequencing chart in section 5.1.

4 Power

4.1 Scope

4.1.1 This section describes the preferred power connector design guidelines.

4.2 Integrated power with RADSOK® Contact

4.2.1 The Paladin connector system utilizes the RADSOK® contact technology for its integrated power applications. The RADSOK® technology is based on a stamped and formed, flat grid, uniquely twisted into a hyperbolic geometry, to provide robust, high density contact to the mating male pin. It is a high reliability, low resistance contact technology that has been used in multiple industries for many years.

4.2.2 The Paladin connector system is able to integrate the power connector into traditional daughtercard and direct orthogonal connectors.

Figure 5: Example of Paladin direct orthogonal (left) and traditional daughtercard (right) with integrated power.

4.3 Electrical Ratings

4.3.1 The RADSOK® contacts used in the Paladin connector system have a current rating starting at 35amps, with larger options also available. For larger current requirements, contact an Amphenol application engineer.

4.3.2 Current rating and temperature rise curves:

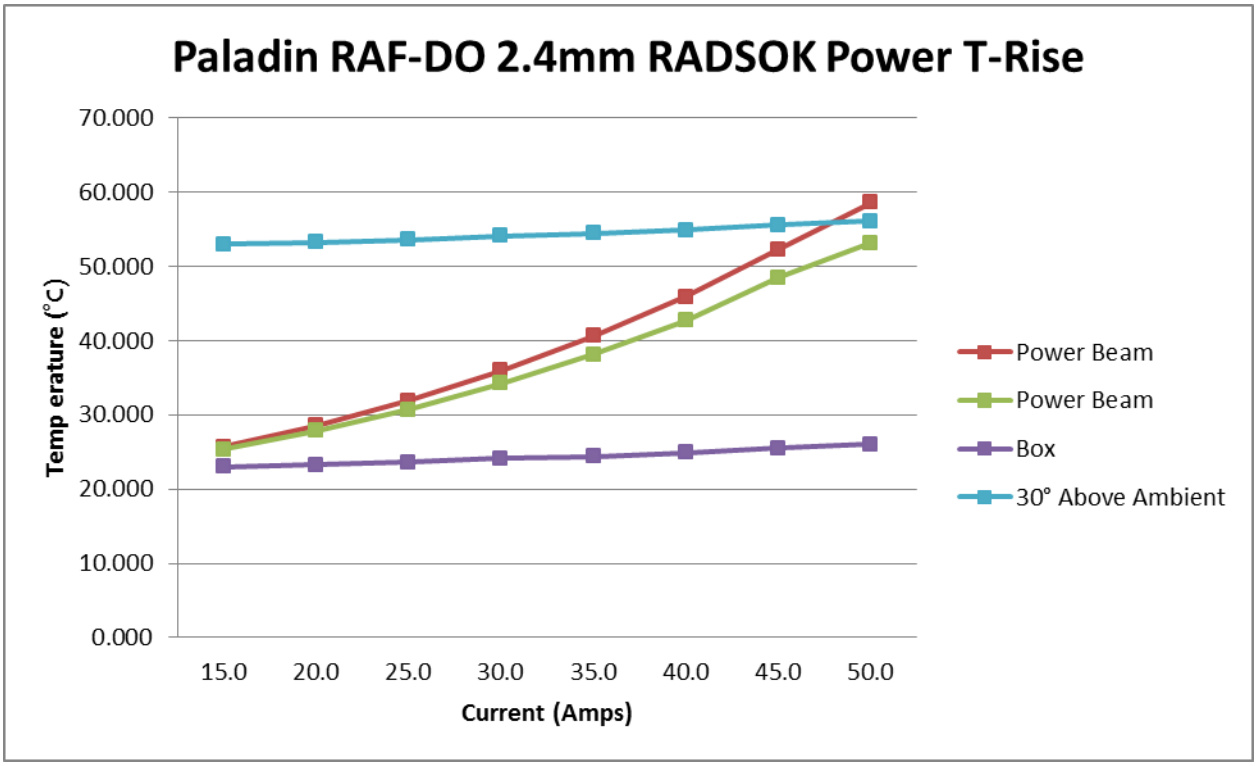

Figure 6: Paladin Power T-rise

5 Connector Mating Sequence

5.1 Paladin Nominal Sequencing Chart

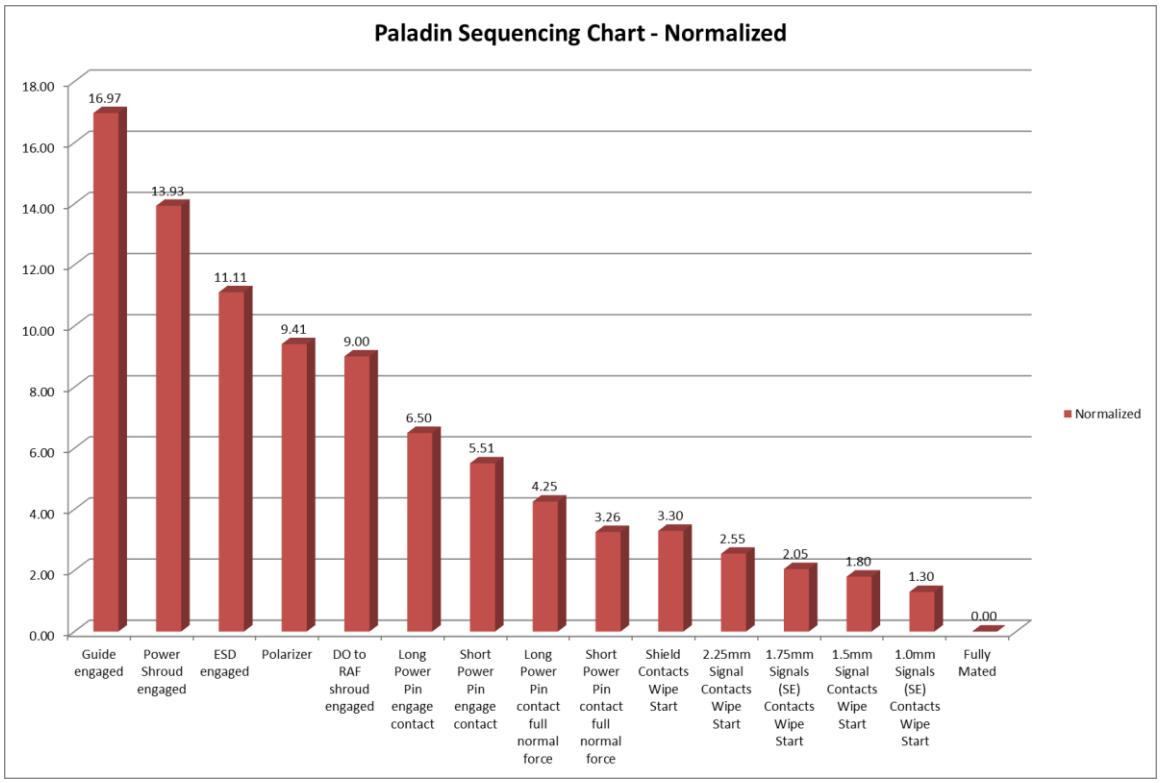

Figure 7: Paladin sequencing chart.

6 Printed Circuit Board (PCB) Consideration-
Refer to TB-2322 *Paladin Routing Guidelines*

7 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

8 Mated Mechanical Lengths

Refer to TB-2324 General Product Specification for Paladin Backplane, Daughtercard and Direct Orthogonal Interconnect System

9 Direct Orthogonal Applications

Refer to TB-2320 Paladin Direct Ortho General Guidelines

10 Connector Pressing (Installation)

10.1 Daughtercard Pressing

Refer to TB-2326 Paladin Daughtercard Connector Press-Fit Installation Process or TB-2367 Paladin Plus Daughtercard Connector Press-Fit Installation Process

10.2 Backplane Pressing

Refer to TB-2332 Paladin Backplane Connector Press-Fit Installation