1.0 OBJECTIVE

This specification provides information and requirements regarding customer application of PwrBlade® ULTRA HD+ connector system. 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, ACS cannot guarantee results.

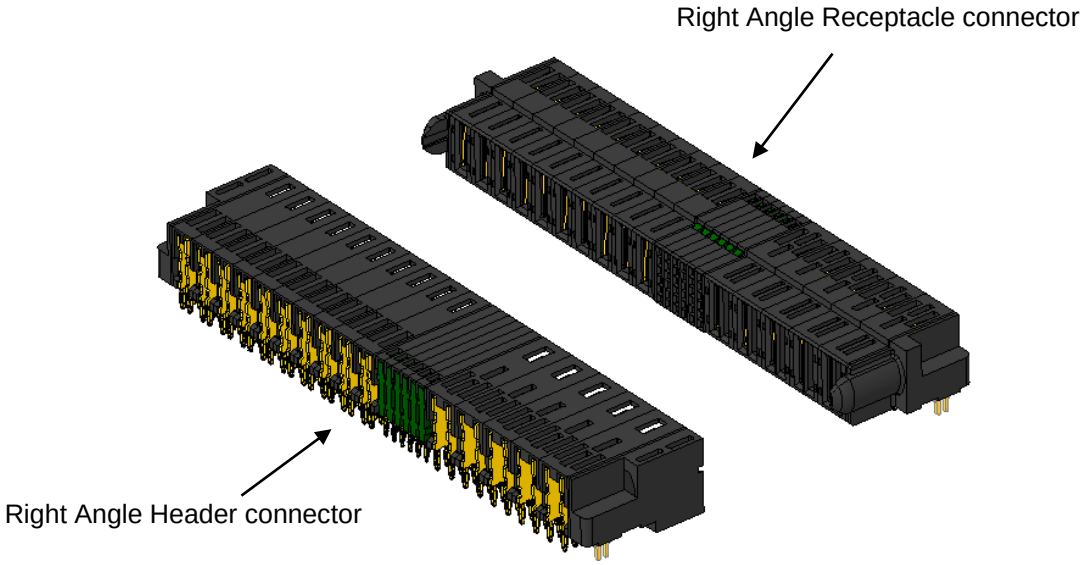
2.0 SCOPE

This specification provides information and requirements regarding customer application of PwrBlade® ULTRA HD+ connector system.

- Right Angle Receptacles, Solder-to-board and Press-fit
- Right Angle Headers, Solder-to-Board and Press-fit

3.0 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.



PwrBlade® ULTRA HD+ product
Configuration with 10LP+36HDS+10HP

4.0 DRAWINGS AND APPLICABLE DOCUMENTS

- AFCI PRODUCT SPECIFICATION: GS-12-1895
- AFCI PRODUCT DRAWINGS: 10169891 & 10169892

Product drawings and **AFCI's GS-12-1895** Product Specification are available at https://www.amphenol-cs.com/. 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 AFCI product drawings for appropriate details.

5.0 APPLICATION REQUIREMENTS

5.1 Safety

The connectors are designed to operate in a temperature range of -40°C to 125°C.

The voltage ratings are based on the Minimum Creepage Distances when the connector is installed in the PC board. It's related to the real application.

Table 1 — Voltage Rating

Table 2	PwrBlade ULTRA® HD+ Maximum Working Voltage Vs. Minimum Creep Distance (Reference UL 60950-1 Second Edition Table 2N)					
Type	Contact Pitch (mm / inch)	Pollution Degree (office Environment)	Material Group (Base on UL Rating)	MCD Of PCB (mm)	Maximum Working Voltage (AC RMS)	Maximum Working Voltage (DC/AC Peak)
Signal	2.00 [.079"]	2	II	0.75	38	54
High Power	5.00 [.197"]			1.74	242	342
	7.00 [.276"]			1.92	271	383
Low Power	3.50 [.138"]			1.92	271	383
Signal	2.00 [.079"]	2	IIIb	0.75	35	49
High Power	5.00 [.197"]			1.74	174	246
	7.00 [.276"]			1.92	192	271
Low Power	3.50 [.138"]			1.92	192	271

Note: Table 1 for Press-fit or Wave Soldering application, MCD for power contacts determined using Ø1.02mm finished hole with 0.24mm annular ring (nominal). Resulting in a Ø1.50mm Pad (nominal). MCD for signal contacts determined using Ø0.75mm finished hole with 0.25mm annular ring (nominal). Resulting in a Ø1.25mm Pad (nominal).

Table 2: Voltage rating table

Table 2	PwrBlade ULTRA® HD+ Maximum Working Voltage Vs. Minimum Creep Distance (Reference UL 60950-1 Second Edition Table 2N)					
Type	Contact Pitch (mm / inch)	Pollution Degree (office Environment)	Material Group (Base on UL Rating)	MCD Of PCB (mm)	Maximum Working Voltage (AC RMS)	Maximum Working Voltage (DC/AC Peak)
Signal	2.00 [.079"]	2	II	0.50	25	35
High Power	5.00 [.197"]			1.59	223	315
	7.00 [.276"]			1.77	246	347
Low Power	3.50 [.138"]			1.77	246	347
Signal	2.00 [.079"]	2	IIIb	0.50	25	35
High Power	5.00 [.197"]			1.59	156	220
	7.00 [.276"]			1.77	177	250
Low Power	3.50 [.138"]			1.77	177	250

Note: Table 2 for Reflow Soldering (PIP) application, MCD for power contacts determined using Ø1.15mm finished hole with 0.25mm annular ring (nominal). Resulting in a Ø1.65mm Pad (nominal). MCD for signal contacts determined using Ø1.0mm finished hole with 0.25mm annular ring (nominal). Resulting in a Ø1.50mm Pad (nominal).

5.2 PC Board

5.2.1 Material and Thickness

The PC board material shall be glass epoxy (FR-4 or G-10). The pc board thickness shall be as stated in Table 3.

Table 3 – Recommended Thickness of PC Board

Tail type	Tail length (mm)	PCB thickness (mm)
Solder To Board	2.25 ± 0.40	1.45~1.75. [.057~.069]
Solder To Board	3.05 ± 0.40	2.20~2.60. [.087~.102]
Press Fit	3.05 ± 0.40	1.60 Min [.063 Min]

5.2.2 Hole Dimensions

The PCB holes must be drilled and plated through to specific dimensions to prevent stubbing during placement of the connector on the pc board and to ensure optimum continuity for circuits after soldering. If applicable, holes for the retention clips or mounting hardware may be used with or without plated through holes. The drilled hole size, plating types, plating thickness, and finished hole size must be as stated to provide unrestricted insertion. See Table 4.

5.2.3 Land/pad size and layout

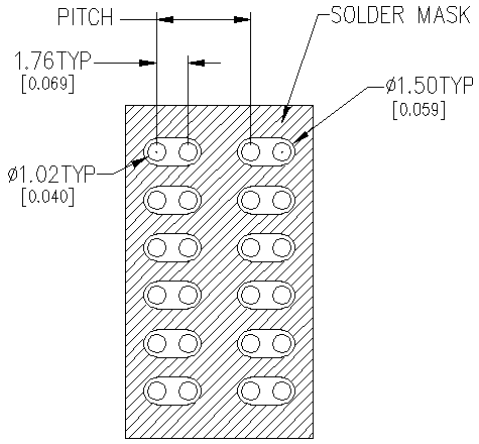
The pc board land/pad size is given in Table 4.

Table 4 – Recommended Land/Pad size

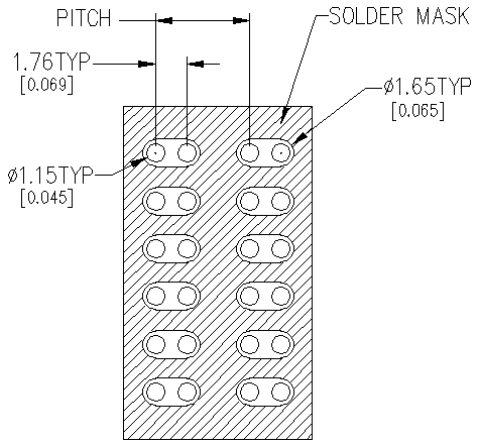
	Items	mm	inch
Wave soldering /Press-fit	Drilled hole diameter	1.150 +/- 0.025 (power) 0.850 +/- 0.025 (signal)	0.0453 +/- 0.001(power) 0.0335 +/- 0.025 (signal)
	Copper plating	0.051 +/- 0.025	0.002 +/- 0.001
	Tin plating	0.007	0.0003
	Plated hole diameter	1.02 +/- 0.07(power) 0.75 +/- 0.05(signal)	0.040 +/- 0.003(power) 0.0295 +/- 0.002(signal)
	Signal Land/Pad size	1.25 +/- 0.064	0.0492 +/- 0.0025
	Power Land/Pad size	1.500 +/- 0.064	0.060 +/- 0.0025
Reflow soldering（PIP）	Drilled hole diameter	1.250 +/- 0.025 (power) 1.10 +/- 0.025 (Header signal) 1.00 +/- 0.025 (Rec signal)	0.0492 +/- 0.001(power) 0.0433 +/- 0.025 (Header signal) 0.0393 +/- 0.025 (Rec signal)
	Copper plating	0.051 +/- 0.025	0.002 +/- 0.001
	Tin plating	0.007	0.0003
	Plated hole diameter	1.15 +/- 0.05(power) 1.00 +/- 0.05(Header signal) 0.90 +/- 0.05(Rec signal)	0.0453 +/- 0.002(power) 0.0393 +/- 0.002(Header signal) 0.0354 +/- 0.002(Rec signal)
	Signal Land/Pad size	1.50 +/- 0.064(Header signal) 1.40 +/- 0.064(Rec signal)	0.0590 +/- 0.0025(Header signal) 0.0511 +/- 0.0025(Rec signal)
	Power Land/Pad size	1.650 +/- 0.064	0.065 +/- 0.0025

Typical PC Board Land/Pad Lay-out For Reference Only

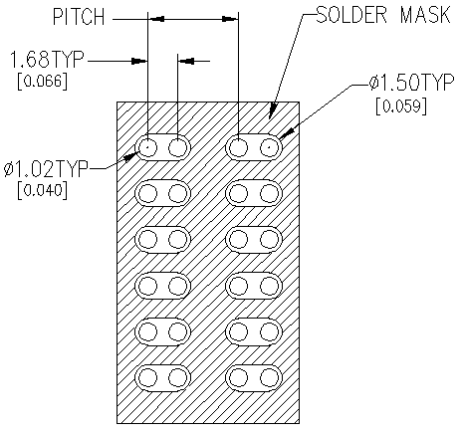
Dimensions are in mm[inch]



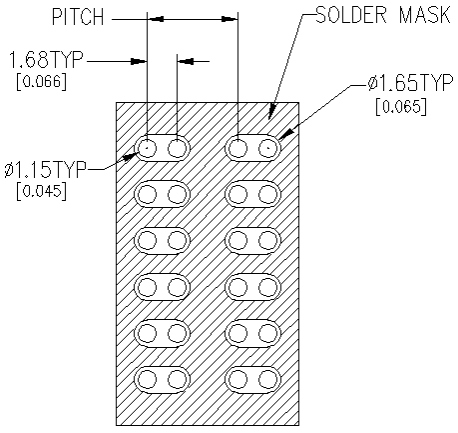
Recommended Land/Pad layout
For RAH High Power Modules
Press-fit or Wave soldering



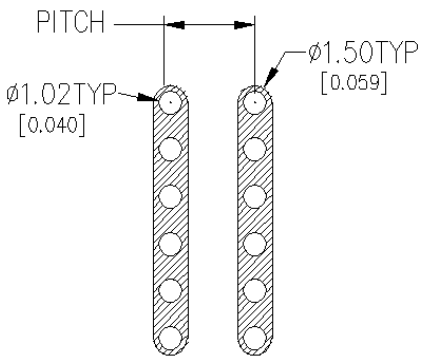
Recommended Land/Pad layout
For RAH High Power Modules
Reflow soldering (PIP)



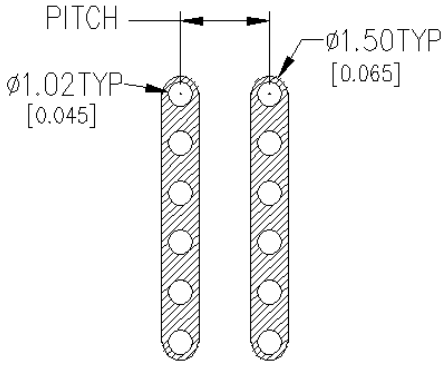
Recommended Land/Pad layout
For RAR High Power Modules
Press-fit or Wave soldering



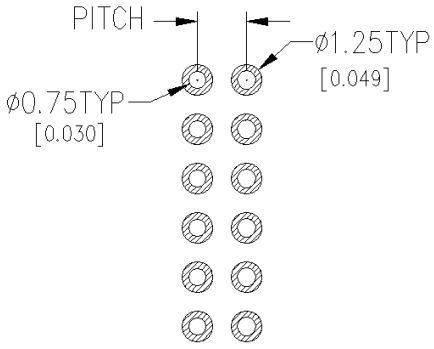
Recommended Land/Pad layout
For RAR High Power Modules
Reflow soldering (PIP)



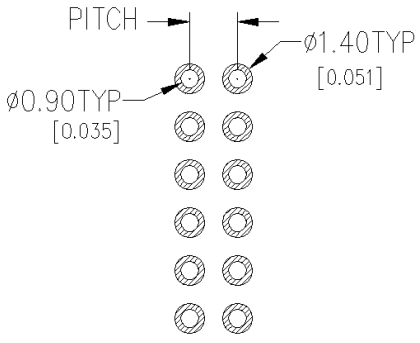
Recommended Land/Pad lay out
For Low Power Modules
Press-fit or Wave soldering



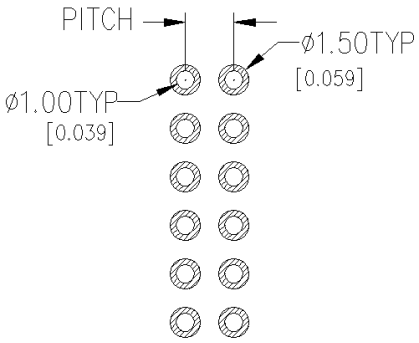
Recommended Land/Pad lay out
For Low Power Modules
Reflow soldering (PIP)



Recommended Land/Pad layout
For all signal modules
Press-fit or Wave soldering



Recommended Land/Pad layout
For RAR signal modules
Reflow soldering (PIP)



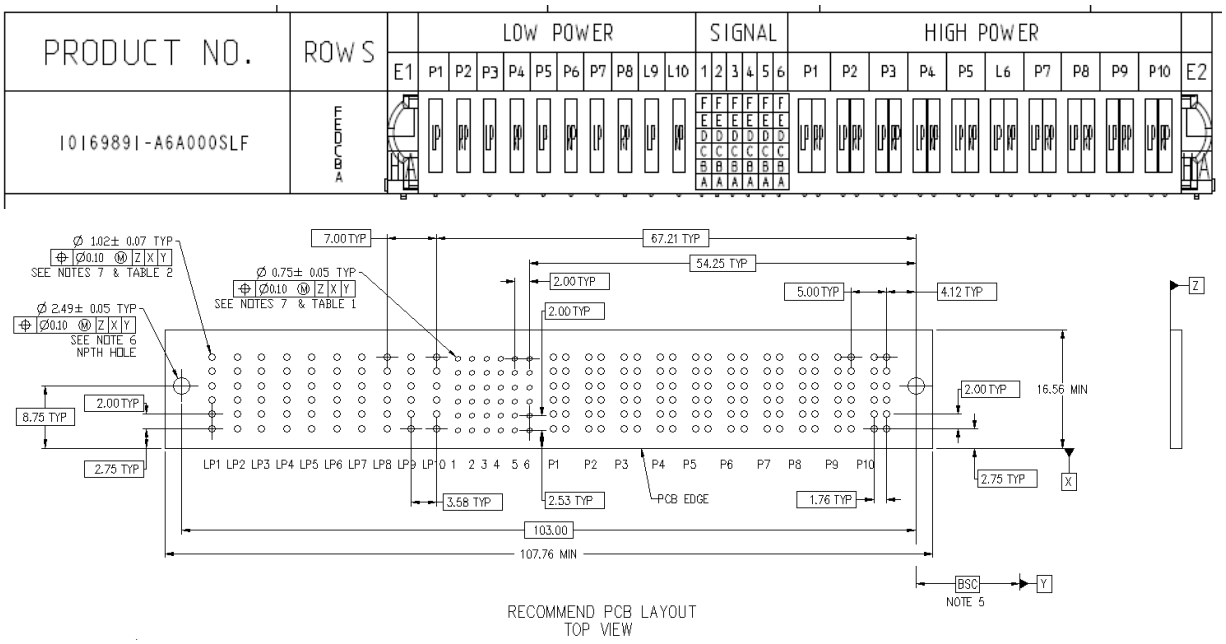
Recommended Land/Pad layout
For RAH signal modules
Reflow soldering (PIP)

5.2.4 PC Board Layout

The holes in the pc board must be precisely located to ensure proper placement and optimum performance of the connector. The pc board layout must be designed per the dimensions provided on the customer drawing for the specific connector. The following figures show the recommended PC board layout.

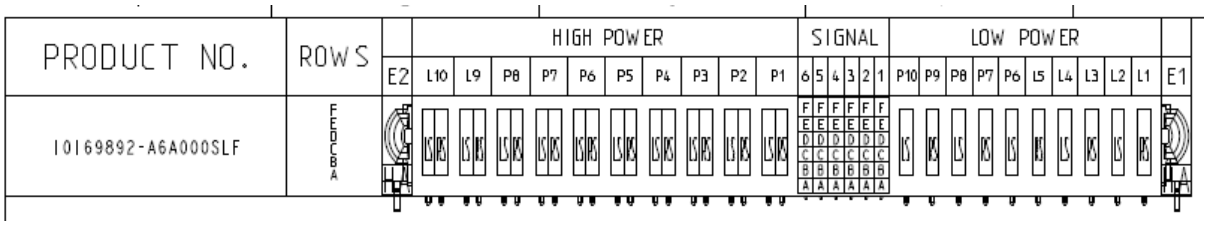
Sample of Recommended PC Board Layout

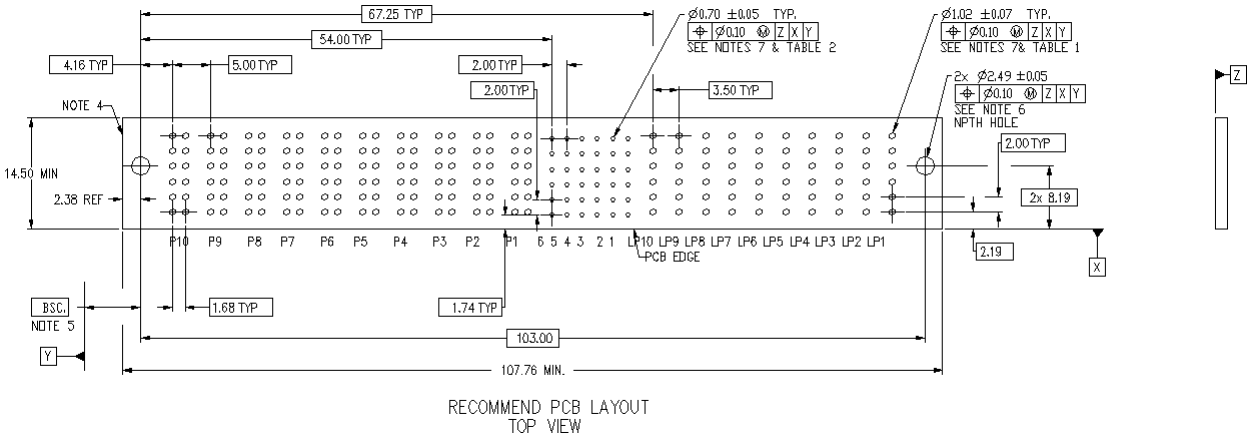
Right Angle Header



Sample of Recommended PC Board Layout

Right angle Receptacle



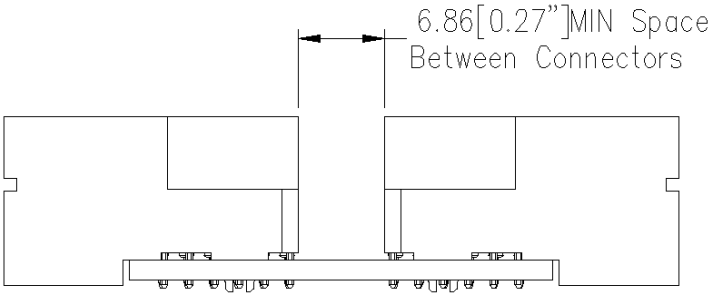


Remark:
Power and Signal traces inside the connector zone need to be coated or under solder mask to protect against oxidation and minimize wear or damage during assembly and handling.

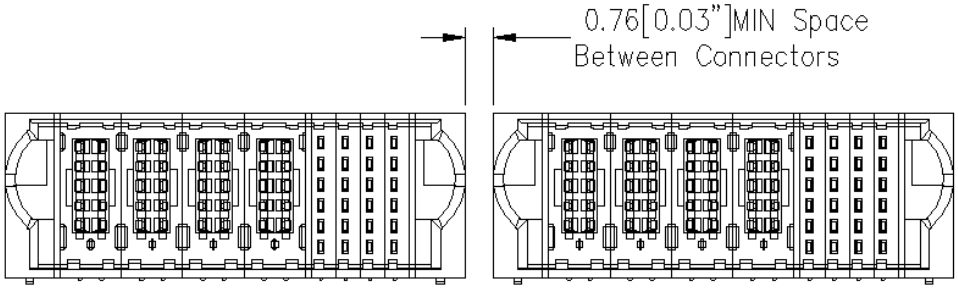
5.2.5 Spacing

Space must be considered to avoid interference between adjacent connectors and other components. In addition, space allowed between pc boards for mating of connectors must be considered when determining distance between pc boards. The minimum allowable distance needed between connectors to ensure full mating of connectors and the allowable distance between pc boards with connectors fully mated are provided in following figures.

Allowable Distance between Connectors

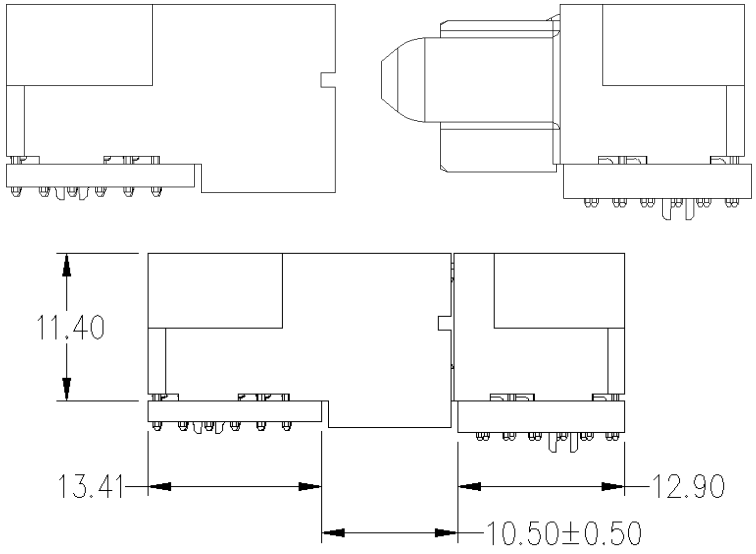


End View



Side View

Allowable Distance between PC Boards
When connectors are fully mated



Right Angle Receptacle mates with Right Angle Header

6.0 APPLICATION TOOLING

6.1 Connectors with Solder Type tails

No tooling is required for placement of the connectors with solder type tails onto the pc board.

6.2 Connectors with Press-fit tails

Use a flat rock tooling to press down the connectors with press-fit type tails onto the pc board.

7.0 APPLICATION PROCEDURE

7.1 Connector placement

7.1.1 Registration

When placing connectors on the pc board, contacts and retention clips or mounting holes, if applicable, must be aligned and started into the matching holes before seating the connector onto the board.

7.1.2 Insertion Force

The force required to seat the connector with press-fit contacts or retention clips onto the pc board can be calculated by:

Insertion force N [lbs.] = Number of connector press-fit EONs X maximum insertion force per EON

Insertion force N [lbs.] = Number of connector retention clips X maximum insertion force per retention clips

The maximum amount of insertion force per press-fit contact and retention clip are given in Table 5.

Table 5

Contact types	Insertion force per compliant EON
Plug/Receptacle Power Contacts	90N[20.2lbs] maximum
Plug Signal Contacts	67N[15.0lbs] maximum
Receptacle Signal Contacts	30N[6.7lbs] maximum
Retention clips	27N[6lbs] maximum

7.2 Soldering

Follow guidelines and procedures when soldering tails. Contact solder tail must be soldered, cleaned, and dried according to the following:

7.2.1 Flux Selection

Contact solder tines must be fluxed prior to soldering with a mildly active, rosin base flux. Selection of the flux will depend on the type of pc board and other components mounted on the board. Additionally, the flux must be compatible with the wave solder line, manufacturing, health, and safety requirements. Flux types that compatible with these connectors are provided in table 6.

Table 6 – Flux

Flux Type	Activity	Residue	Commercial Designation	
			Kester	Alpha
RMA	Mild	Noncorrosive	186	611

7.2.2 Process

The connectors can be soldered using wave soldering or equivalent soldering techniques. It is recommended using tin solder for these connectors. The temperatures and exposure time shall be as specified in table 7.

Table 7

Soldering Process	Temperature	Time (At Maximum Temperature)
Wave soldering	260°C [500˚F]	10 Seconds
Reflow soldering	260°C [500˚F]	10 Seconds

7.2.3 Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. Cleaners must be free of dissolved flux and other contaminants. Common cleaning solvents that will not the affect connectors for the time and temperature specified are list as below.

Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Refer to the manufacture's Material Safety Data Sheet (MSDS) for characteristics and handling of cleaners. Trichloroethylene and Methylene Chloride is not recommended because of harmful occupational and environmental effects. Both are carcinogenic (cancer-causing).

Even when using "no clean" solder paste, it is imperative that the contact interface be kept clean of flux and residue, since it acts as an insulator. Flux may migrate under certain conditions with elevated temperatures and therefore, cleaning is necessary

Table 8

Cleaner		Time (Minutes)	Temperature (Maximum)
Name	Type		132°C [270˚F]
ALPHA 2110	Aqueous	1	100°C [212˚F]
BIOACT EC-7	Solvent	5	100°C [212˚F]
BIOACT EC-7	Solvent	5	Ambient Room
Butyl CARBITOL	Solvent	1	100°C [212˚F]
Isopropyl Alcohol	Solvent	5	100°C [212˚F]
KESTER 5778	Aqueous	5	100°C [212˚F]
KESTER 5779	Aqueous	5	100°C [212˚F]
LONCOTERGE 520	Aqueous	5	100°C [212˚F]
LONCOTERGE 530	Aqueous	5	100°C [212˚F]
Terpene Solvent	Solvent	5	100°C [212˚F]

Remark:

ALPHA is a trademark of Cookson Group, Inc. CARBITOL and LONCOTERGE are trademarks of Union Carbide Corp.

BIOACT is a trademark of Petroferm, Inc. KESTER is a trademark of Kester, Inc.

7.2.4 Drying

When drying cleaned connectors and pc boards, make certain that temperature limitations are not exceeded: -40°C to 105°C [-40˚F to 221˚F]. Excessive temperatures may cause housing degradation.

8.0 REPAIR / REMOVAL PROCEDURE

8.1 These connectors are not repairable. Damaged or defective connectors must not be used.

8.2 Solder Type Tails

Connectors with solder type contacts must be removed from the pc board by standard de-soldering methods. After removal from the board, the connector MUST NOT be re-used.

8.3 Press-fit Tails

Connectors with press-fit tails must be removed from the pc board using a push bar (or flat rock) and pc board support. (If a push bar used, for repair ability, the tips of push bar must be extended into PCB Hole and keep a 0.8mm [.032”] maximum distance to PCB top surface; If not, the connector May NOT be removed from the pc board.)

8.4 Retention Force

The force retaining the connector with press-fit contacts or retention clips on the pc board can be calculated by.

Retention Force N [lb] = Number of connector press-fit contacts X minimum retention force per contact

Retention Force N [lb] = Number of connector retention clips X minimum retention force per retention clip

The minimum amount of retention force per press-fit contact and retention clip is given in table 9

Table 9

Contact types	Retention force per compliant EON
Plug/Receptacle Power Contacts	10N[2.25lbs] minimum
Plug Signal Contacts	6.7N[1.5lbs] minimum
Receptacle Signal Contacts	6.7N[1.5lbs] minimum
Retention clips	13.3N[3]minimum

9.0 OTHER

9.1 Storage Safety

Don't stack product shipping containers so high that the containers buckle or deform

9.2 Material

The housing is made of High temperature thermoplastic or other high performance resin rated flame retardant 94V-0 in accordance with UL-94. The contacts are made of high-conductivity copper alloy underplated with nickel and plated with GCS® or GXT®; solder tines are plated with tin over nickel. Retention clips are made of copper alloy plated with nickel.

9.3 Connector Mating

Connectors should be handled only by the housing to avoid deformation, contamination, or damage to the contacts.

9.3.1 Polarization

For connectors with guides, polarization is provided by matching the guides of mating connectors. For connectors with latch receivers or without guides, polarization is provided by matching the mating alignment keys with the key slots of mating connectors.

9.3.2 Connector Mating Force

The maximum amount of connector mating force per contact is given as below table 10.

Table 10 – Connector Mating Force

Contact types	Mating force (Maximum)	Un-mating Force (Minimum)
Per High Power Contacts	12N	2.2N
Per Low Power Contacts	6N	1.1N
Per Signal Contacts	1N	0.2N

9.3.3 Mating Sequence

Contact mating sequences available for the connectors are listed in table 11.

Table 11 – Mating Sequence

Connector	Contact Mating Sequence		
	High Power Contact	Low Power Contact	Signal Contact
Receptacle	MFBL(Pre-Mate) Standard	MFBL(Pre-Mate) Standard	Standard
Plug	Standard	Standard	Standard MLBF(Post-Mate)

9.3.4 Wipe Length

The wipe length at the level of mating for power and signal contacts is listed in table 12.

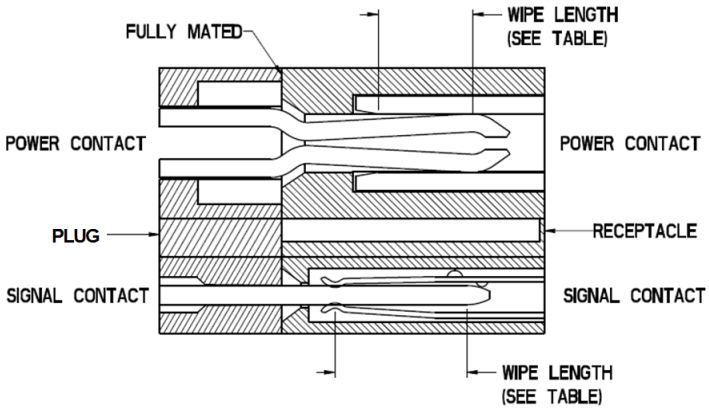


Table 12 – Wiping length

Contact	Mating Sequence	Mating Level	Wipe Length	Remark
High Power	MFBL (PRE-MATE)	1	4.50mm [.177”]	Normal
	STANDARD	2	3.23mm [.127”]	Normal
Low Power	MFBL (PRE-MATE)	1	4.50mm [.177”]	Normal
	STANDARD	2	3.23mm [.127”]	Normal
Signal	STANDARD	2	3.27mm [.129”]	Normal
	MLBF (POST-MATE)	3	2.00mm [.079”]	Normal

9.3.5 Sequencing

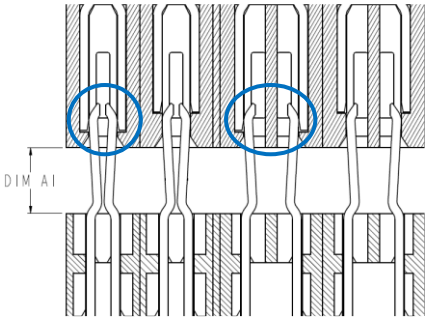
The connectors provide sequencing among contacts with 3 mating levels. The offset distance, measured from the receptacle mating face to the plug mating face at the point of electrical engagement, depends on the contact (power or signal) and mating length (standard, MFBL, or MLBF) of the mating connectors. The offset distance at the level of mating for power and signal contacts is listed in Table 13.

Table 13

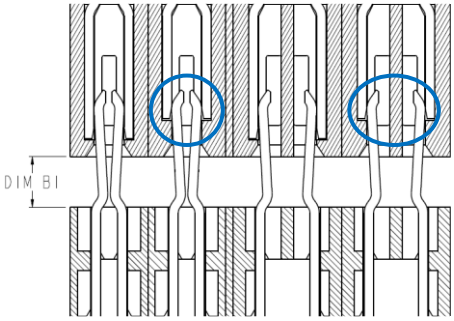
Contact	Mating Sequence	Mating Level	Offset Distance		Remark
			Dimension	Nominal	
High Power	MFBL (PRE-MATE)	1	A1	4.50mm [.177”]	Normal
	STANDARD	2	B1	3.23mm [.127”]	Normal
Low Power	MFBL (PRE-MATE)	1	A1	4.50mm [.177”]	Normal
	STANDARD	2	B1	3.23mm [.127”]	Normal
Signal	STANDARD	2	A2	3.27mm [.129”]	Normal
	MLBF (POST-MATE)	3	B2	2.00mm [.079”]	Normal

High Power/Low Power Contacts

Mating Level 1: MFBL

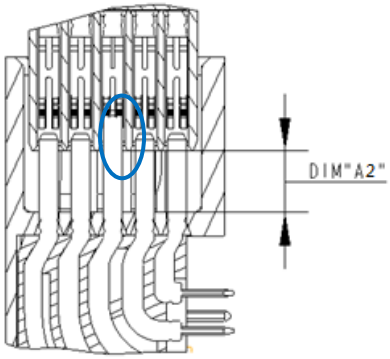


Mating Level 2: STD (Note 1)

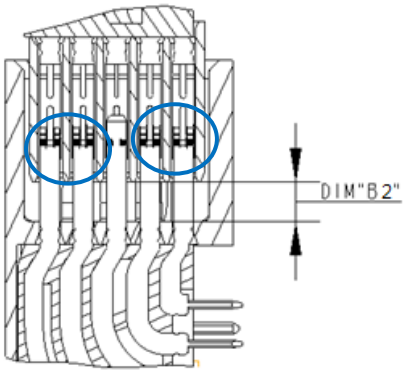


Signal Contacts

Mating Level 2: STD (Note 1)



Mating Level 3: MLBF (Note 2)



Note 1: The offset distance between “B1” and “A2” is not enough to consider these as separate levels.

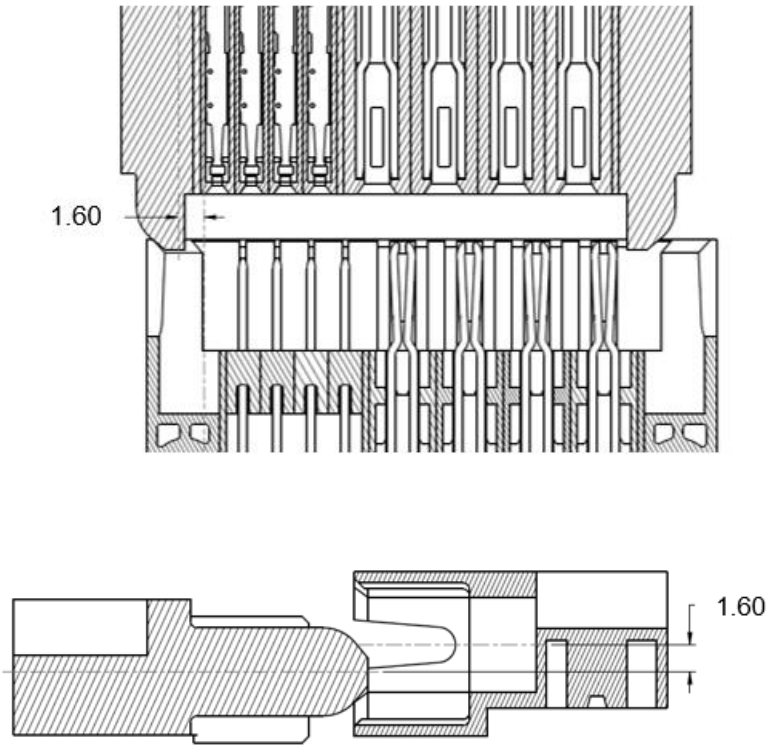
9.3.6 Misalignment

When mating connectors, the misalignment is allowed to the dimensions given in Figure.

Connectors with guides should be used in applications requiring blind mating. Connectors without guides should not be used in applications requiring blind mating.

Misalignment for Connectors With Guides

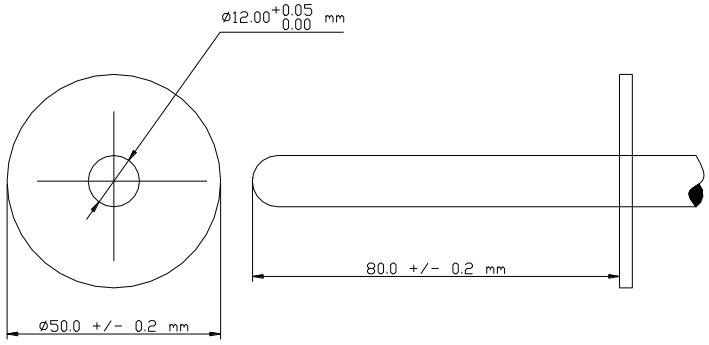
The connectors can be radially misaligned by a nominal value of 1.60mm [0.063”].



Figure

9.4 Circuit Testing

Unmated receptacles and mated plugs must be tested against hazardous voltages using the test probe specified in UL 60950. Specific area of the connector must be tested as indicated in Figure.



Dimensions of UL Probe

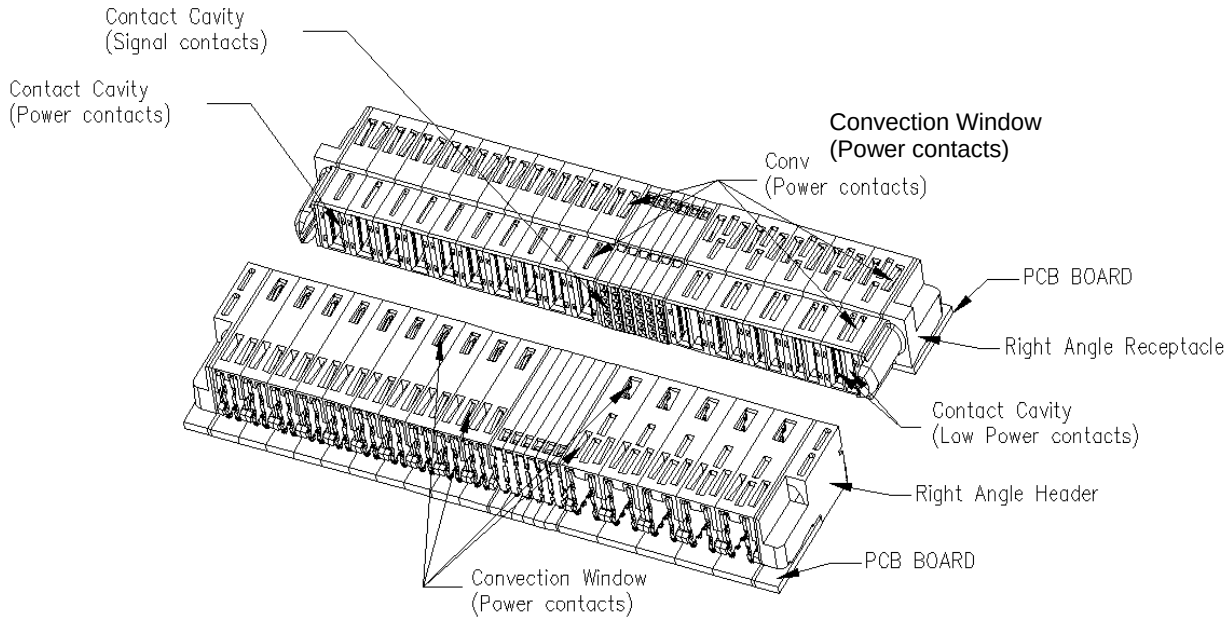


Figure – Area to be tested

Connector	Area To Be Tested			
	Unmated Connectors		Mated Connectors	
	Contact Cavities	Convection Windows	Contact Cavities	Convection Windows
Right Angle Receptacle	Yes	Yes	N/A	Yes
Right Angle Plug	N/A	Yes	N/A	Yes

10.0 RECORD RETENTION

REV	PAGE	DESCRIPTION	EC#	DATE
A	All	New release	NA	7/18/2024