

NUMBER GS-12-1682	TYPE PRODUCT SPECIFICATION	Amphenol ICC	
TITLE PwrBlade® Mini Mezzanine Connector System		PAGE 1 of 10	REVISION B
		AUTHORIZED BY Zhijun.He	DATE 2023-01-11
		CLASSIFICATION UNRESTRICTED	

1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the PwrBlade® Mini Mezzanine connector system.

2.0 Scope

This specification is applicable to the termination characteristics of the PwrBlade® Mini Mezzanine connector system which provides a separable interface which provides separable vertical headers that mate to vertical receptacles.

Tail Type	Vertical receptacles	Vertical headers	Remark
Solder type	10159578	10159583	General series
	10168793	10168795	Special
Press fit type	10164793	10164795	General series

3.0 Ratings

- 3.1 Operating Voltage Rating: 32 V_{AC} RMS.
- 3.2 Operating Current Rating: refer to values in the table in section 6.5.
- 3.3 Operating Temperature Range = -55°C ~ +125°C¹

Operating temperature is tested in accordance with EIA-364-17 Method A for 1000 hours at 125°C per EIA-364-1000 Table 8 to meet field temperature of 95°C for 10 years field life (95°C field temperature are based on the assumption that the contact spends 1/3 of its field life at that temperature and its remaining life at 40°C or less).

Note 1: includes the terminal temperature rise when powered

4.0 Applicable Documents

4.1 Specifications

- 4.1.1 Engineering drawings: 10159578, 10159583, 10164793, 10164795, 10168793, 10168795 etc.
- 4.1.2 Application specification: GS-20-0686

4.2 National or International Standards

- 4.2.1 Flammability: UL94V-0.
- 4.2.2 EIA 364: Electrical connector/Socket test procedures include environmental classification.
- 4.2.3 EIA 364-1000: Environmental test methodology for assessing the performance of electrical connectors and sockets used in business office applications.
- 4.2.4 EIA 364-1004: Environmental test methodology for verifying the current rating of freestanding power contacts or electrical connectors and sockets.

4.3 Laboratory Reports - Supporting Data

DL-2021-07-049-CR&DL-2022-08-007-CR

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- 4.4 Safety Agency Approvals
UL/CSA File #: E66906 Vol. 1 Sec. 201

5.0 Requirements

5.1 Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein.

5.2 Material

The material for each component shall be as specified herein or equivalent

High Power Contacts:	Copper alloy
Low Power Contacts:	Copper alloy
Signal Contacts:	Copper alloy
Header and Receptacle Housings:	High temperature thermoplastic, UL 94V-0 compliant.
Hold down:	Copper alloy

5.3 Finish

The finish for applicable components shall be as specified herein or equivalent

Contact Area (power & signal):

GCS® for Power contacts, GXT® for Signal contacts

Tails (power & signal):

Tin plated over Nickel

5.4 Design and Construction

Connectors shall be of the design, construction, and physical dimensions specified on the applicable product drawing. There shall be no cracks, burrs, or other physical defects that may impair performance.

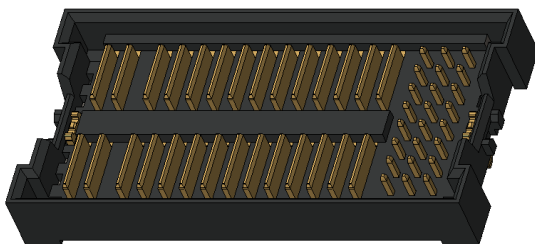


Figure 1: Header connector
Configuration shown: 4LP+12HP+24S

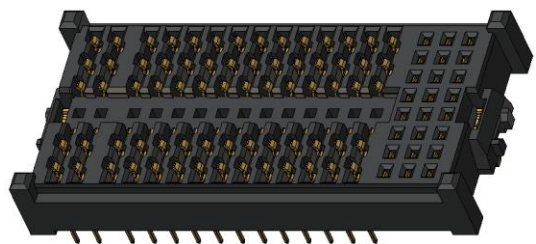


Figure 2: Receptacle connector
Configuration shown: 4LP+12HP+24S

6.0 Electrical Characteristics

6.1 Contact Resistance, Low Level

The Low level contact resistance of Signal contact shall not exceed 30 mΩ (milliohms) initially and Δ 10 mΩ (milliohms) after mating cycles and environmental exposure.

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The Low level contact resistance of High power contact shall not exceed 1.0 mΩ (milliohms) initially or after mating cycles and environmental exposure.

The Low level contact resistance of Low power contact shall not exceed 2.0 mΩ (milliohms) initially or after mating cycles and environmental exposure.

Measurements shall be in accordance with EIA 364-23.

The following details shall apply:

- a. Test Voltage - 20 milli-volts DC max open circuit.
- b. Test Current - Not to exceed 100 milli-amperes

6.2 Contact Resistance, Specified Current (Power contact)

a. High power contact

The High power contact resistance at a specified current shall not exceed 1.0 mΩ (milliohms) initially or after mating cycles and environmental exposure.

Measurements shall be in accordance with EIA 364-06.

The following details shall apply: Test Current – Shown in the table in section 6.5.

b. Low power contact

The Low power contact resistance at a specified current shall not exceed 2.0 mΩ (milliohms) initially or after mating cycles and environmental exposure.

Measurements shall be in accordance with EIA 364-06.

The following details shall apply: Test Current – Shown in the table in section 6.5.

6.3 Insulation Resistance

The insulation resistance of mated connectors shall not be less than 1,000 MΩ (megohms) for the Low Power and High Power contact, and 500 MΩ for Signal initially and after environmental exposure.

Measurements shall be in accordance with EIA 364-21

The following details shall apply:

- a. Test Voltage - 500 volts DC.
- b. Electrification Time - 2 minutes, unless otherwise specified.
- c. Points of Measurement - Between adjacent contacts.

6.4 Dielectric Withstanding Voltage

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current > 1 mA when mated connectors.

Measurements shall be in accordance with EIA 364-20

The following details shall apply:

- a. Test Voltage - 1000 volts DC (High Power & Low Power & Signal)
- b. Test Duration - 60 seconds.
- c. Test Condition - 1 (760 Torr - sea level).

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d. Points of Measurement - Between adjacent contacts.

6.5 Current Rating

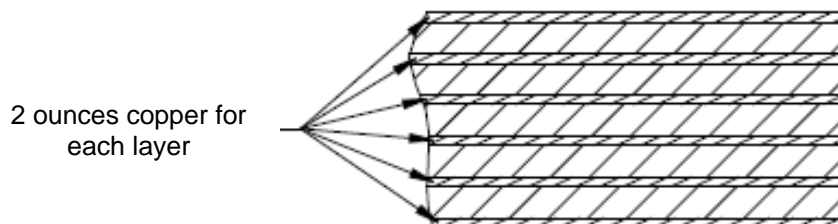
The temperature rise above ambient shall not exceed 30°C at any point in the system when all contacts are powered at specified current as below.

The following details shall apply:

- a. Ambient Conditions – still air at lab room ambient (25°C).
- b. Test configuration refer to the table.
- c. Reference - EIA 364-70.

Application	Contact type	Number of adjacent contacts (fully powered)	Test board (Copper Pad)	Still Air	T-Rise (°C)	Current rating per contact (Amp)
PwrBlade® Mini Mezzanine (Board To Board)	High Power (2.0mm pitch)	1	2 ounces X 6 layers (refer to figure 1)	Yes	30	70
		2				50
		4				45
		6				40
		8				40
		10				40
	Signal (2.0mm pitch)	1				38
		/2				1
	Low Power (2.00mm pitch)	2				25
		4				20

FIGURE 3 Test PCB with 6 layers



Note: Connectors are applied to test boards with 6 layers x 2 ounces copper for power contact and 2 layers x 2 ounces copper for signal contact.

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7.0 Mechanical Characteristics

7.1 Mating/Unmating Force

The following details shall apply:

- a. Cross Head Speed - 25.4mm per minute.
- b. Lubrication: Yes
- c. Utilize free floating fixtures.
- d. Reference – EIA 364-13.

Contact type	Mating force (N) Max. Allowance	Un-mating force (N) Min. Allowance
One pair of HP contact	20	3.0
One pair of LP contact	10	1.5
One pair of Signal contact	1.0	0.1

7.2 Contact retention

Test condition: Per EIA-364-29C, method C, a maximum rate of 25.4mm per minute

- a. Signal Pin: individual Signal pin shall withstand an axial retention load of 5 N minimum.
- b. High Power Contact: individual power pin shall withstand an axial retention load of 20 N minimum.
- c. Low Power Contact: individual power pin shall withstand an axial retention load of 10 N minimum.

7.3 Compliant Pin Insertion Force – EIA 364-05

- a. Speed: 5.08mm/minute.
- b. Test board: Tin/OSP printed circuit board.

Tail type	Insertion force (N) Max. Allowance	Remark
Per Power EON of Header	50	Per EON tested
Per Signal EON of Header	67	Per EON tested
Per Power EON of Receptacle	50	Per EON tested
Average force Per Signal EON of Receptacle	17	Per connector tested

7.4 Compliant Pin Retention Force – EIA 364-05

- a. Speed: 5.08mm/minute.
- b. Test board: Tin/OSP printed circuit board

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Tail type	Retention force (N) Min. Allowance	Remark
Per Power EON of Header	5	Per EON tested
Per Signal EON of Header	6.7	Per EON tested
Per Power EON of Receptacle	5	Per EON tested
Average force Per Signal EON of Receptacle	2.5	Per connector tested

7.5 PCB Hole Deformation Radius and Remaining Cu Plating Thickness (compliant pin)

Use PCB's with minimum diameter holes, tin/OSP plating, and 1.57mm overall thickness. Metallographic cross-sections shall be prepared parallel to the PCB surface (transverse section) to facilitate radial hole deformation measurement, photographs, and remaining Cu plating measurement. Prior to cross-section preparation, perform 3 compliant pin insertions and 3 compliant pin withdrawals. The measurements and photographs shall be performed at 0.3 mm, [+0.2 mm, -0.1 mm] (0.012", [+0.008", -0.004"]) from the connector side PCB laminate (not copper) surface and at the center of the compliant pin section on a minimum of 10 holes. The average (of 10 holes) hole deformation radius shall be no greater than 37.5 µm (0.0015") when measured from the drilled hole. The absolute maximum deformation radius shall not exceed 50 µm (0.002"). The minimum average (of 10 holes) copper thickness remaining between the compliant pin and the printed wiring board laminate shall not be less than 7.5 µm (300 µ"). Refer to EIA-364-96.

7.6 PCB Hole Wall Damage

Use PCB's with minimum diameter holes, tin/OSP plating, and 1.57mm overall thickness. Metallographic cross-sections shall be prepared perpendicular to the PCB surface (longitudinal section) and through the compliant section wear track to facilitate examination of the PTH. Prior to cross-section preparation, perform 3 compliant pin insertions and 3 compliant pin withdrawals. There shall be no copper cracks, separations between conductive interfaces, or laminate-to-copper separations. Test 10 pins/holes. Refer to EIA-364-96.

8.0 Environmental Conditions

After exposure to the following environmental conditions in accordance with the specified test procedure and/or details, the product shall show no physical damage and shall meet the electrical and mechanical requirements per paragraphs 6.0 and 7.0 as specified in the test sequences in the qualification test table. Unless specified otherwise, assemblies shall be mated during exposure.

8.1 Thermal Shock – EIA 364-32.

- a. Number of Cycles - 5
- b. Temperature Range - Between -65°C and +125°C
- c. Time at Each Temperature - 30 minutes
- d. Transfer Time - 5 minutes, maximum

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- 8.2 Cyclic Temperature & Humidity – EIA 364-31 method IV (cyclic temperature)
 - a. Relative Humidity - 80% to 98%
 - b. Temperature - 25°C~65°C
 - c. Duration - 10 cycles, 24h/cycle, 240 hours total
 - d. Omit step 7a (cold shock)
- 8.3 High Temperature Life – EIA 364-17.
 - a. Test Temperature - 125± 2°C
 - b. Test Duration - 1000 hours
- 8.4 Mixed Flowing Gas corrosion (MFG) – EIA 364-65
 - a. Class - IIA
 - b. Duration - 20 days
 - c. Un-mated condition for 10 days and followed by exposure of mated connectors for the remaining 10 days
- 8.5 Vibration (Random) – EIA 364-28
 - a. Test Condition - method VII, letter E
 - b. Vibration Amplitude - 4.90 rms G
 - c. Duration – 15 minutes along each of three orthogonal axes
 - d. Mounting - Rigidly mount assemblies
 - e. No discontinuities greater than 1 microsecond
- 8.6 Mechanical Shock – EIA 364-27
 - a. Condition - Test condition A
 - b. Shocks - 3 shocks in both directions along each of three orthogonal axes (18 shocks total)
 - c. Mounting - Rigidly mount assemblies
 - d. No discontinuities greater than 1 microsecond
- 8.7 Durability - EIA 364-09
 - a. Number Cycles - 200 cycles
 - b. Cycling Rate - 127 mm/minute
 - c. Use free floating fixtures
- 8.8 Solder ability – ANSI-J-STD-002, Test Condition S1
 - a. Preconditioning Category E
 - b. PCB termination area was evaluated and meets the requirements of ANSI-J-STD-002

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- 8.9 Resistance to Solder Heat – EIA 364-56
 - a. Condition 6, Level 6
 - b. There shall be no evidence of physical or mechanical damage

9.0 QUALITY ASSURANCE PROVISIONS

9.1 Equipment Calibration

All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with ANSI Z-540 and ISO 9000.

9.2 Inspection Conditions

Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions:

- a. Temperature: 25 +/- 5°C
- b. Relative Humidity: 30% to 60%
- c. Barometric Pressure: Local ambient

9.3 Sample Quantity and Description

The sample size and description are listed for each test in the appropriate section of this document.

9.4 Acceptance

9.4.1 Electrical and mechanical requirements placed on test samples as indicated in paragraphs 6.0 and 7.0 shall be established from test data using appropriate statistical techniques or shall otherwise be customer specified, and all samples tested in accordance with this product specification shall meet the stated requirements.

9.4.2 Failures attributed to equipment, test setup, or operator error shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

9.5 Qualification Testing

Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequences shall be as shown in the qualification test table 1. Data shall be provided with the samples noting production history: production lot codes for components and assemblies, components and assemblies produced to print revision, verification of plating composition and thickness, etc.

9.6 Re-Qualification Testing

If any of the following conditions occur, the responsible product engineer shall initiate requalification testing consisting of all applicable parts of the qualification test matrix.

- a. A significant design change is made to the existing product which impacts the product form, fit or function. Examples of significant changes shall include, but not be limited to, changes in the plating material composition or thickness, contact force, contact surface geometry, insulator design, contact base material, or contact lubrication requirements.
- b. A significant change is made to the manufacturing process which impacts the product form, fit or function.

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c. A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.

9.7 Qualification Test Table

TEST GROUP ID:		P	1A	1B	2	3	4	5	6	7	8
Test Description	Section	Group P Testing	MFG	MFG	Temp Life	Thermal Shock & Humidity (Dielectric)	Thermal shock / Humidity	Vibration / Mech. Shock	Solder ability	Resistance to Solder Heat	Repair ability
Visual Examination		1,4	1, 7	1, 13	1,7	1,11	1,9	1,11	1,3	1,3	1, 10,
ELECTRICAL:											
Contact Resistance At Low Level	6.1		2,4,6	2,4,6,8, 10,12	2,4,6		2,4,6,8	2,6,8, 10			
Contact Resistance At Specified Current	6.2	2									
Insulation Resistance	6.3					2,5,8					
Dielectric Withstanding Voltage	6.4					3,6,9					
Current Rating	6.5	3									
MECHANICAL:											
Mating / Un-mating Force	7.1							3,5			
Contact Retention Force	7.2					10					
EON Insertion Force	7.3										2,4,6
EON Retention Force	7.4										3,5,7
PCB Hole Deformation Radius	7.5										8
PCB Hole Wall Damage	7.6										9
ENVIRONMENTAL:											
Thermal Shock	8.1					4	5				
Cyclical Humidity & TEMP.	8.2					7	7				
Temperature Life	8.3				5						
MFG - Receptacle Only, 5 Days	8.4			5,7							
MFG – Mated, 5 Days	8.4			9,11							
MFG – Mated, 20 Days	8.4		5								
Vibration	8.5							7			
Mechanical Shock	8.6							9			
Durability, 200 Cycles	8.7							4			
Durability, 20 Cycles	8.7		3	3	3		3				
Solder ability	8.8								2		
Resistance to Solder Heat	8.9									2	
SAMPLE SIZE:											
Mating Pairs		3	3	3	3	3	3	3	3	3	
Contact With Press-Fit Tails											120
ELEC. Test Boards (2 layers- 1 oz. Cu traces)			3	3	3	3	3	3	3		
ELEC. Test Boards (6 layers- 2 oz. Cu traces)		3									

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REVISION RECORD

Rev	Page	Description	EC#	Date
A	ALL	Initial release	N/A	2022-01-20
B	Page 5&6	Add press-fit type into this Spec	N/A	2023-01-11