


NUMBER GS-12-1342	TYPE PRODUCT SPECIFICATION		
PwrMAX[®] Orthogonal Power Connector System (Preliminary)		PAGE 1 of 11	REVISION 8
		AUTHORIZED BY Chris Gieski	DATE 23-FEB-16
		CLASSIFICATION UNRESTRICTED	

1.0 OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of the PwrMAX[®] Orthogonal PCB/Busbar connector system.


2.0 SCOPE

This specification is applicable to the termination characteristics of the PwrMAX[®] Orthogonal family of products which provides a separable interface for power board to board and board to busbar applications.

3.0 GENERAL

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4.0 APPLICABLE DOCUMENTS


4.1 FCI Specifications:

Applicable FCI product drawings: 10132640c, 10132644c and 10133407c
GS-20-0447: Application Specification, PwrMax[®] Power Connector System.

4.2 Other Standards and Specifications

EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
IEC 60664-1: Insulation Coordination for Equipment with Low-Voltage Systems (Up to 50V products)
IEC 60950-1*: Information Technology Equipment – Safety, Part 1: General Requirements
IEC 61984: Connectors - Safety Requirements and Tests; (50V and above up to 1000V products)
UL 94-V0: Tests for Flammability of Plastic Materials in Devices and Appliances
UL 1977: Standard for Safety for Component Connectors for use in Data, Signal, Control and Power
UL 60950 (supersedes UL 1950): Safety of Information Technology Equipment
GR-1217-CORE: Telcordia Specification “Generic Requirements for Separable Electrical Connectors”

* IEC 60950-1 contains the same information as UL 60950

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4.3 FCI Lab Reports - Supporting Data

Cross-section, Crimp Lab Reports
GS-29-XXX PwrMax[®] Orthogonal Qualification Summary

4.4 UL/CSA/TUV Certification

UL/CSA file # EXXXXX
TUV certification # XXXX XXXXXXXX

5.0 REQUIREMENTS

5.1 Current Rating

Maximum operating temperature: 125C Max. (105C maximum continuous operating temp for 10 years)

Maximum operating voltage: (Ref. GS-20-0452)

Following are the current rating of the PwrMAX[®] Orthogonal/Backplane Connector system.

Application	Power Contact	Number of adjacent contacts (fully powered)	Test Board (Copper Pad)	Air Starting Temp.	Still Air	T-Rise (°C)	Current Rating per power contact (Amp)
PwrMAX [®] Orthogonal (Board To Board)	Power (10.00mm CL)	2	6 layer (2 oz. copper)	Ambient (xx)	Yes	30	100
PwrMAX [®] Orthogonal (Board to Busbar)	Power (10.00mm CL)	2	6 layer (2 oz. copper)				100
PwrMAX [®] Backplane (Board to Board)	Power (10.00mm CL)	2	6 layer (2 oz. copper)				100
PwrMAX [®] Backplane (Board to Busbar)	Power (10.00mm CL)	2	6 layer (2 oz. copper)				100


5.2 Materials

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

Power Contacts: High conductivity copper alloy
 Plug and Receptacle Housings: High temperature thermoplastic, UL 94V-0 compliant.
 Retention clip: Phosphor Bronze

Finish:

- Contact Area (Power):
Performance-base plating, qualified to meet the requirements of this specification
- Tails (Power)
Sn - Tin plated over Nickel

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5.3 Qualification

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

5.4 Design and Construction

Connectors shall be of the design, construction and physical dimensions specified on the applicable product drawings.

5.5 Visual

Visual examinations shall be performed using 10X magnification. Parts should be free from blistering, cracks, discoloration, etc.

6.0 ELECTRICAL CHARACTERISTICS

6.1 Power contacts Resistance tested at specified Current

a) High power contact (100A)

The High power contact resistance at a specified current shall not exceed 0.3 mΩ (milliohms) initially or after mating cycles and environmental exposure when measured in accordance with EIA 364-06.

6.1.1 Group P power contacts tested at Low level: The Low level contact resistance shall not exceed 20 milliohms initially or after environmental expose when measured in accordance with EIA 364-TP-23. The following details shall apply:

- a) Test voltage – 20 millivolts DC max open circuit
- b) Test Current – not to exceed 100 milliamps

6.2 Insulation Resistance: (20 readings between adjacent contacts) Signal or LP/HP Power Contact


The insulation resistance of mated connectors shall not be less than 10,000 MΩ (megohms) for the High Power contact initially and after environmental exposure when measured in accordance with EIA 364-TP-21. The following details apply:

- a) Test voltage - 500 volts DC
- b) Electrification time - 2 minutes
- c) Points of measurement - between adjacent contacts

6.3 Dielectric Withstanding: (20 readings between adjacent contacts) Signal or Power Contacts

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (>1 milliampere) when mated connectors are tested in accordance with EIA 364-TP-20. The following details apply:

- a) Test voltage - 2500 volts DC (DC and AC power)
- b) Test duration - 60 seconds
- c) Test condition - 1 atm
- d) Points of measurement - between adjacent contacts

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6.4 Current Rating:

The following details shall apply:

- a) Ambient conditions - still air at Lab ambient
- b) Reference - EIA 364-70 specification
- c) Thermocouple must be attached to the contact near the base of the mating beams plug or receptacle.
- d) Copper trace weight – multi-layer PCB, made with 1oz and 2oz copper layers

Power Contacts (2 Circuits powered):

Develop temperature rise versus current curves for two adjacent contacts, placing thermocouples on the 2 center most contacts of each connector. Increase current level until all contacts have exceeded 30°C temperature rise. The current rating is to be determined by the current level at which the first contact exceeds 30°C temperature rise.

Power current rating on multi-layer test boards: = 100A

7.0 MECHANICAL CHARACTERISTICS

7.1 Mating/Un-mating forces per power/Signal contact

Contact Type	Mating Force (N) Max. Allowance	Un-mating Force (N) Min. Allowance
Power Contact	25	6.5

The following details shall apply:

- a) Cross head speed: 25.4 mm (1 inch) per minute
- b) Lubrication: None
- c) Utilize free-floating fixtures
- d) Reference EIA-364-TP-13

7.2 Contact Retention

Power Contact


During mating, the individual Header and Receptacle contacts shall withstand an axial retention load of 50 N.

7.3 Compliant Pin Insertion Force:

Power Individual compliant Pin:

Receptacle: The force required to insert an individual compliant pin into a plated through hole in a printed circuit board at a rate of 0.2 inches/minute shall not exceed 67 N (15 lbs).

RA Plug (PCB): The force required to insert an individual compliant pin into a plated through hole in a printed circuit board at a rate of 0.2 inches/minute shall not exceed 107N (24lbs).

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RA Plug (Busbar): The force required to insert an individual compliant pin into a Busbar at a rate of 0.2 inches/minute shall not exceed 125N (28lbs).

Insertion #1: 15 contacts; Record insertion forces based on average of nine tails.

Insertion #2: 15 virgin contacts, same PCB holes.

Insertion #3: 15 virgin contacts; same PCB holes; Record forces based on the average of nine tails.

7.4 Compliant Pin Retention Force :

Power Individual compliant Pin:

V/RA Receptacle: The retention force in the axial direction opposite that of insertion shall not be less than 15 N (3.4 lb) per press-fit tail.

RA Plug (PCB & Busbar): The retention force in the axial direction opposite that of the insertion shall not be less than 29N (6.5lbs) per press-fit tail.

Extraction #1: 15 contacts; Record insertion forces based on average of nine tails.

Extraction #2: 15 virgin contacts, same PCB holes.

Extraction #3: 15 virgin contacts, same PCB holes; Record forces based on the average of nine tails.


7.5 PCB Hole Deformation Radius:

Cross-section is parallel to board surface. Photograph and measure the hole deformation (deformation on board material) radius at a point .010" from the surface, and the center of the compliant pin section. Include 10 holes. The average (of 10 holes) hole deformation radius shall be no greater than 0.0015" when measured from the drilled hole. The absolute maximum deformation radius shall not exceed 0.002".

7.6 PCB Hole Wall Damage:

Cross-section perpendicular to the board surface, and through the compliant section wear track. Photograph and measure the copper thickness remaining between the compliant section and the printed wiring board laminate. Include 10 holes. The minimum average (of 10 holes) copper thickness remaining between the compliant pin and the printed wiring board laminate shall not be less than 0.0003". In addition there shall be no copper cracks, separations between conductive interfaces, or laminate-to-copper separations. Reference GR-1217-CORE, November 1995, Section 5.1.7.

8.0 ENVIRONMENTAL CONDITIONS

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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 applicable electrical and mechanical requirements of sections 6.0 and 7.0 as detailed in Table 1. Unless otherwise specified, assemblies shall be mated during exposure.

8.1 Thermal Shock, (Ref. EIA 364-32, test condition II and Telcordia GR-1217-CORE).

The following details shall apply:

- a) Number of cycles: 5
- b) Temperature range: -65°C to +125°C
- c) Time at each temperature: 30 minutes minimum
- d) Transfer time: 5 minutes maximum

8.2 Cyclical Humidity and Temperature: (ref. EIA 364-31 and Telcordia GR-1217-CORE)

Mated samples are to be exposed to cyclical humidity and temperature in accordance with EIA 364-31, Method IV, with the following exceptions. Samples are to be subjected to 50 cycles of 10-hour durations for a total of 500 hours. A cycle consists of the following steps:

- a) Ramp from 25±2°C at 80%-98% RH to 65±2°C at 94±4% RH in 2 hours.
- b) Dwell at 65±2°C at 94±4% RH for 4 hours.
- c) Ramp down to 25±2°C at 80%-98% RH in 2 hours.
- d) Dwell at 25±2°C at 80%-98% RH for 2 hours.

8.3 Temperature Life: (Ref EIA-364-17 and Telcordia GR-1217-CORE)

EIA 364-17, Method A, Test Condition 4. Headers and receptacles shall remain mated w/o any electrical load. The following details shall apply:

- a) Test duration: 1827 hours
- b) Temperature: 125° +/- 2°C

8.4 Industrial Mixed Flowing Gas (4-gas MFG): (ref. EIA 364-65 and Telcordia GR-1217-CORE)

Test Samples are to be exposed to a central office of industrial gas mixture "Class II a" for a total duration of 20 days. The test chamber is to be maintained at a temperature of 30±1°C with a relative humidity of 70 ±2%.

- For Backplane/Orthogonal configuration, vertical & RA receptacle connector are exposed in the Un-mated condition for 10 days and followed by exposure of mated connectors for the remaining 10 days (See table 1B)


8.5 Vibration (Random):

Perform in accordance with EIA-364-28 and Telcordia GR-1217-CORE, November 1995. The following details shall apply:

- a) Test condition – VII, test condition E.
- b) Frequency range: Subject mated specimens to 4.90G's rms between 20~500 Hz
- c) Duration: 15 minutes in each of 3 mutually perpendicular planes.
- d) Mounting: Rigidly mount assemblies
- e) Requirement: No discontinuities greater than 10 micro-seconds

8.6 Mechanical Shock:

Perform in accordance with EIA-364-27 and Telcordia GR-1217-CORE, November 1995.

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The following details shall apply:

- a) Condition: A (50G, 11 millisecond, half-sine wave)
- b) Shocks: 3 shocks in both directions along each of three orthogonal axis (18 shocks total)
- c) Mounting: rigidly mounted assemblies
- d) Measure resistance after shock in each axis
- e) Requirement: No discontinuities greater than 1.0 micro-seconds.

8.7 Durability:

Perform in accordance with EIA-364-09

Use standard laboratory procedure as applicable to the specific product.

- a) Number of cycles: see Table 1 (200 mating cycles minimum)
- b) Cycling rate: 127 mm/minute (5 inches/minute)
- c) Mating and un-mating force to be measured per Section 7.1 on the first and last cycle

8.8 Solder ability – ANSI-J-002, Test Condition A

- a) Steam aging – 4 hours
- b) PCB termination are was evaluated and meets the requirements of ANSI-J-002

8.9 Resistance to Solder Heat – EIA 364-56

- a) Test Condition – E
- b) There shall be no evidence of physical or mechanical damage.

8.10 Dust – EIA 364-91

- a) Samples to be exposed to one-hour dust exposure.
- b) Using a benign dust composition number 1
- c) Only un-mated connectors shall be exposed to dust and then mated to unexposed connectors.

8.11 Disturb: (ref. GR-1217-CORE)

Back the fully seated header from the receptacle approximately 0.10 mm (0.004 in) and reseal fully.

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 ISO 9000.


9.2 Inspection conditions:

Unless otherwise specified, all inspections shall be performed under the following 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 is listed for each test in the appropriate section of this document.

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9.4 Acceptance:

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

Failures attributed to equipment, test set-up 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 with equipment and procedures normally used in production. Test sequence is as shown in Table 1.

9.6 Re-qualification Testing

If any of the following conditions occur, the responsible product engineer shall initiate re-qualification testing consisting of the applicable parts of the test matrix, Table 1.

- a) A significant design change is made to the existing product that 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 or contact surface geometry, insulator design, contact base material or contact lubrication requirements.
- b) A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.
- c) A significant change is made to the manufacturing process that impacts the product form, fit or function.

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10.0 Table 1: Qualification Test Matrix

TEST GROUP ID:			1A	1B	2	3A	3B	4	5	6
TEST DESCRIPTION	SECTION	Group P Testing (1)	Mixed Flowing Gas (Mated)	Mixed Flowing Gas (Un-Mated)	Temp Life	Thermal Shock & Humidity (Dielectric)	Thermal shock / Humidity	Vibration / Mech. Shock	Current Rating	Repair ability
VISUAL EXAMINATION	5.5	1	1, 12	1,14	1,6	1,10	1,14	1,15	1,6	1, 10,
MATE HEADER & RECEPTACLE		2	2	2,8	2	2	2,10	3,9	2	
UNMATE HEADER & RECEPTACLE				6	7		8	7	5	
ELECTRICAL:										
CONTACT RESISTANCE AT LOW LEVEL	6.1	3								
CONTACT RESISTANCE AT SPECIFIED CURRENT	6.1	6,8,10	3,5,7,9,11	3,5,9,11,13,	3,6		3,5,7,11, 13	4,6,10,12, 14	4	
INSULATION RESISTANCE	6.2					4,7				
DIELECTRIC WITHSTANDING VOLTAGE	6.3					5,8				
CURRENT RATING	6.4	5							3	
MECHANICAL:										
MATING / UNMATING FORCE	7.1							2		
CONTACT RETENTION	7.2					9				
COMPLIANT PIN INSERTION FORCE	7.3									2,4,6
COMPLIANT PIN 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					3	4			
CYCLICAL HUMIDITY & TEMP.	8.2					6	12			
TEMPERATURE LIFE	8.3				4					
MFG – UNMATED, 10 Days	8.4			7						
MFG - MATED, 10 days	8.4		6,8	10						
VIBRATION	8.5							13		
MECHANICAL SHOCK	8.6							11		
DURABILITY, 200 CYCLES	8.7									
DURABILITY, 100 CYCLES	8.7	9(3)					6	5		
DURABILITY, 25 CYCLES	8.7	4(2)	4	4						
DURABILITY, 75 CYCLES	8.7	7								
DUST CONT	8.10						9	8		
DISTURB	8.11		10	12						


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Table 2: Qualification Sample Requirements

TEST GROUP ID ►	P ⁽¹⁾	1A	1B	2	3	4	5	6	7
COMPONENT DESCRIPTION	Design Verification for Product Extension	Mixed Flowing Gas	Mixed Flowing Gas (Un-mated)	Temp Life	Thermal Shock & Humidity (Dielectric)	Thermal Shock & Humidity	Vibration & Mech. Shock	Current Rating	Reparability
Number of RA Plug (10132640)	3	4	4	4	4	4	4	3	9
Number of RA Receptacle (10132644)	3	4	4	4	4	4	4	3	9
Number of V Receptacle (10133407)	3	4	4	4	4	4	4	3	9
RA T-rise Board (10137024)	3	4	4	4	4	4	4	3	3
V T-rise Board (10137025)	3	4	4	4	4	4	4	3	3
RA Busbar (10137856)	3	4	4	4	4	4	4	3	3

NOTE:

1. Group P is not required for a full qualification. Group P is a preliminary design verification sequence.
2. Record mating and un-mating forces on first five cycles of durability.
3. Complete remaining 100 durability cycles. Record mating and un-mating force on last 5 cycles.

11.0 REVISION RECORD

Rev	Page	Description	EC#	Date
1	ALL	Initial release	N/A	10-20-2015
2	2	Modified Section 4.2 Other standards and specs	N/A	11-02-2015
3	3	Added the correct application specification # and title to section 5.1	N/A	11-03-2015
4	5	Updated verbiage in section 6.4	N/A	11-10-2015
5	ALL	Update PwrMAX [®] title and other minor clerical updates. Update max mating force sec. 7.1	N/A	12-11-2015
6	7	Updated section 8.5 and 8.6	N/A	01-15-2016
7	3,7	Changed temp life sequence to 125 for 1827. Changed max operating temp	N/A	02-08-2016
8	10	Modify durability cycles in groups 1A & 1B	N/A	02-23-2016