


NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>1 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

## 1.0 OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of the eHPCE connector system which includes the Vertical and Right Angle configurations.


## 2.0 SCOPE

This specification is applicable to the termination characteristics of the eHPCE Connector System which provides a separable interface for power to Edge card applications.


## 3.0 GENERAL

This document is composed of the following sections:

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
<b>1.0</b>	<b>OBJECTIVE</b>	<b>1</b>
<b>2.0</b>	<b>SCOPE</b>	<b>1</b>
<b>3.0</b>	<b>GENERAL</b>	<b>1</b>
<b>4.0</b>	<b>APPLICABLE DOCUMENTS</b>	<b>3</b>
	4.1 APCI Specification	
	4.2 Others Standards and Specification	
	4.3 APCI Lab Reports – Supporting Data	
	4.4 UL/CSA/TUV Certification	
<b>5.0</b>	<b>REQUIREMENTS</b>	<b>3</b>
	5.1 Current Rating	
	5.2 Materials	
	5.3 Qualification	
	5.4 Design and construction	
	5.5 Visual	
<b>6.0</b>	<b>ELECTRICAL CHARACTERISTICS</b>	<b>4</b>
	6.1 Signal Pin LLCR	
	6.2 Power Pin LLCR	
	6.3 Insulation Resistance	
	6.4 Dielectric Withstanding Voltage	
	6.5 Current Rating:	
<b>7.0</b>	<b>MECHANICAL CHARACTERISTICS</b>	<b>6</b>
	7.1 Mating/Un-mating Force	
	7.2 Contact Retention	
	7.3 Reseating	
	7.4 Compliant Pin Insertion Force	
	7.5 Compliant Pin / Retention Force	
	7.6 PCB Hole Deformation Radius	
	7.7 PCB Hole Wall Damage	

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>2 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

<b>8.0</b>	<b>ENVIRONMENTAL CONDITIONS</b>	<b>8</b>
8.1	Thermal Shock	
8.2	Humidity and Temperature	
8.3	High Temperature Life	
8.4	High Temperature Life (Preconditioning)	
8.5	Industrial Mixed Flowing Gas	
8.6	Random Vibration	
8.7	Mechanical Shock	
8.8	Durability	
8.9	Durability (preconditioning)	
8.10	Solderability	
8.11	Thermal Disturbance	
8.12	Dust Contamination	
<b>9.0</b>	<b>QUALITY ASSURANCE PROVISIONS</b>	<b>9</b>
9.1	Equipment Calibration	
9.2	Inspection Conditions	
9.3	Sample Quantity and Description	
9.4	Acceptance	
9.5	Qualification Testing	
9.6	Re-qualification Testing	
<b>10.0</b>	<b>TABLE 1: QUALIFICATION TEST MATRIX</b>	<b>11</b>
<b>11.0</b>	<b>REVISION RECORD</b>	<b>12</b>

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>3 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

#### 4.0 APPLICABLE DOCUMENTS

##### 4.1 AFCI Specifications:

Applicable AFCI product drawings  
GS-20-0488: Application Specification, eHPCE Connector System.

##### 4.2 Other Standards and Specifications

- UL94-V0: Tests for Flammability of Plastic Materials in Devices and Appliances
- EIA 364: Electrical connector/Socket test procedures include environmental classification.
- EIA 364-1000: Environmental test methodology for assessing the performance of electrical connectors and sockets used in business office applications.
- EIA 364-1004: Environmental test methodology for verifying the current rating of freestanding power contacts or electrical connectors and sockets.
- GR-1217-CORE: Telcordia Specification "Generic Requirements for Separable Electrical Connectors"

##### 4.3 AFCI Lab Reports - Supporting Data

GS-29-\*\*\* (Customer Test Report)

##### 4.4 UL/CSA Certifications

- UL/CSA File # \*\*\*\*\*
- TUV certification # B \*\*\*\*\*

#### 5.0 REQUIREMENTS

##### 5.1 Current Rating


Operating temperature: -55 °C ~ +105 °C

- Per EIA 364-1000A (Table 8), the field temperature/field life values based on successful 105 °C, 228 hours temperature life test are 65 °C for 10 years.

Maximum operating voltage: (Ref. GS-20-0488, Table 5, 6)

Following are the current rating values for the eHPCE connector system:

Contact current rating( Δ 30 °C )	
Contact type	Current AMPS
AMPS per MP(total MPs is less than 20MPs)	24
AMPS per MP(total MPs is more than 20MPs)	21
AMPS per Signal	1.0
NOTES:	
1. Copper trace weight: 8 layers test board, 2oz each layer.	
2. Ambient condition: still air at lab ambient.	
3. Temperature rise 30 °C Max.	
4. Signal contact current rating: 1.0A	
5. "MP"= middle power	

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>4 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

## 5.2 Materials

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

Power Receptacle Contacts: Copper alloy

Signal Receptacle contacts: Copper alloy

Housings: High temperature thermoplastic, UL 94V-0 compliant

### Finish:

- Contact Area (Power & Signal):

GCS for Power, GXT for Signal, qualified to meet the requirements of this specification

- Tails (Power & Signal):

Tin plated over Nickel

## 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 Signal Pin LLCR

- Test condition: per EIA 364-23.
- Requirement: the contact resistance shall not exceed 25mΩ per pin, initially; and less than 10mΩ changes after test

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>5 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

6.2 Power contacts tested at specified Current (24A DC / middle power contact):

The contact resistance at a specified current shall not exceed 1.0 mΩ (milliohms) initially or after mating cycles and environmental exposure when measured in accordance with EIA 364-06.

6.3. Insulation Resistance:

- Test condition: per EIA 364-21. Apply with a test voltage 500 VDC between the closest adjacent contacts.
- Requirement: the insulation resistance shall be exceed 5,000MΩ (mega ohms) minimum for power contact and 500MΩ minimum for signal contact.


6.4. Dielectric Withstanding Voltage:

- Test condition: per EIA 364-20. Apply with test voltage 1800 VDC for power contact and 500 VDC for signal contact.
- Requirement: there shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (>1 mA).

6.5 Current Rating:

- Test condition: Energize the series of the power contacts of both upper and lower row, including signal contacts.
  - a) Ambient conditions: still air at Lab ambient
  - b) Reference: EIA 364-70 specification
  - c) Copper trace weight: 8 layers test board, 2oz each layer.
  - d) Feed wire size: (Ref. EIA 364-70 specification)
  - e) Maximum 30 °C temperature rise
- Requirement:

Develop temperature rise versus current curves for 20 MP contacts on upper and lower line and 24 Signal pins. Increase current level to 24A for each MP contact and 1.0A for each signal pin 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.

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>6 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

## 7.0 MECHANICAL CHARACTERISTICS

### 7.1 Mating/Un-mating forces:

- Test condition:
  - a) Cross head speed: 25.4mm (1 inch) per minute
  - b) Lubrication: None
  - c) Utilize Fixed fixtures
  - d) Reference EIA 364-13
  - e) Test with 1.57 mm thickness of Edge card.

Configuration	Mating Force (N) (Max. Allowance)	Un-Mating Force (N) (Min. Allowance)
Single Middle Power Contact	3.00	0.36
Single Signal Contact	0.22	0.06

### 7.2 Contact Retention:

- Test condition: Per EIA 364-29; no movement > 0.38mm.
- Requirement:

#### Signal Pin

During mating, Individual Receptacle Signal Pin shall withstand an axial retention load of 8 N.

#### Power Contact

During mating, the individual Receptacle Power Pin shall withstand an axial retention load of 8 N.

### 7.3 Reseating:

- Test condition: Manual plug/unplug the connector with module board.
- Requirement: Perform 3 such cycles.

### 7.4 Compliant Pin Insertion Force:


#### Power - Individual compliant Pin

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 120 N.

Insertion #1: 14 contacts; Record forces based on average of 2 tails.

Insertion #2: 14 virgin contacts, same PCB holes; No data.

Insertion #3: 14 virgin contacts; same PCB holes; Record forces based on the average of 2 tails.

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>7 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

#### Signal - Individual compliant Pin

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 30 N.

Insertion #1: 12 contacts; Record forces.

Insertion #2: 12 virgin contacts, same PCB holes; No data.

Insertion #3: 12 virgin contacts; same PCB holes; Record forces.

#### 7.5 Compliant Pin / Retention Force:

##### Power Individual compliant Pin

The retention force in the axial direction opposite that of insertion shall not be less than 10 N per press-fit tail.

Extraction #1: 14 contacts; Record forces based on average of 2 tails.

Extraction #2: 14 contacts, same PCB holes; No data.

Extraction #3: 14 contacts, same PCB holes; Record forces based on the average of 2 tails.

##### Signal Individual compliant Pin

The retention force in an axial direction opposite that of insertion shall not be less than 8 N.

Extraction #1: 12 contacts; Record forces.

Extraction #2: 12 contacts, same PCB holes; No data.


Extraction #3: 12 contacts, same PCB holes; Record forces.

#### 7.6 PCB Whole Deformation Radius:

Use boards with minimum diameter holes. Cross-section 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". Photograph and measure the copper thickness remaining between the compliant section and the printed wiring board laminate. The minimum average (of 10 holes) copper thickness remaining shall not be less than 0.0003". Reference GR-1217-CORE, November 1995, Section 5.1.7.

#### 7.7 PCB Hole Wall Damage:

Cross-section perpendicular to the board surface, and through the compliant section wear track. 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.

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>8 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

## 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 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:

- Test condition: Per EIA 364-32, Test condition 1. Cycle the connector -55 °C to +85 °C. Dwell time of 30 minutes at extreme temperature. Transfer time 5 minutes max.
- Requirement: No physical damages and meets sequenced tests.
  - Test duration : 5 cycles

### 8.2 Humidity and Temperature:

- Test condition: Per EIA 364-31, method II. Exposes the connector to 40 °C±2 °C at humidity of 90% to 95%. The test condition A will be used and the test duration is 96 hours.
- Requirement: No physical damages and meets sequenced tests

### 8.3 High Temperature Life:

- Test condition: Per EIA 364-17, Test method A, 228 hours at temperature 105± 2 °C, pertaining to 65 °C for 10 years.
- Requirement: No physical damages and meets sequenced tests.

### 8.4 High Temperature Life (preconditioning)

- Test condition: Per EIA 364-17, Test method A, 132 hours at temperature 105± 2 °C, pertaining to 65 °C for 10 years.
- Requirement: No physical damages and meets sequenced tests.


### 8.5 Industrial Mixed Flowing Gas:

- Test condition: Per EIA 364-65, Class IIA. Perform 10 days mated.
- Requirement: No physical damages and meets sequenced tests.

### 8.6 Random Vibration:

- Test condition: Per EIA 364-28. Test condition VII, Condition E with overall 4.90 rms g between 10-500 Hz. This test shall be performed for a total of 1 ½ hours in each axis.
- Requirement: No physical damages and no electrical discontinuity more than 1µ second.



NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>9 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

#### 8.7 Mechanical Shock:

- Test condition: per EIA 364-27, Test condition A. Half-Sine pulse, 50G, 11ms, 3 shocks, 6 directions (18 shocks totally)
- Requirement: No physical damages and no electrical discontinuity more than 1μ second.

#### 8.8 Durability:

- Test condition: per EIA 364-09
  - a) Number of cycles: 200
  - b) Cycling rate: 127 mm/minute (5 inches/minute)
  - c) Mating and unmating force to be measured on the first and last cycle
- Requirement: There shall be no damage to the housing or contacts after 200 cycles.

#### 8.9 Durability (preconditioning)

- Test condition: per EIA 364-09
  - a) Number of cycles: 20
  - b) Cycling rate: 127 mm/minute (5 inches/minute)
  - c) Mating and un-mating force to be measured on the first and last cycle
- Requirement: There shall be no damage to the housing or contacts after 20 cycles.

#### 8.10 Solderability:

- Test condition: per EIA 364-52, Class 1, and Category 3 (8 hours Steam Age).
- Requirement: There shall have a solder coverage of 95% minimum.

#### 8.11 Thermal Disturbance:

- Cycle the connector between 15°C ±3°C and 85°C ±3°C, as measured on the part. Ramps should be a minimum of 2°C per minute, and dwell times should insure that the contacts reach the temperature extremes (a minimum of 5 minutes) Humidity is not controlled. Perform 10 such cycles.
- Requirement: No physical damages and meets sequenced tests.


#### 8.12 Dust Contamination:

- Perform in accordance with EIA 364-91 Dust contamination 1 (benign), unmated receptacle connectors.

### **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.

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>10 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

## 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 80%
- 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.

## 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.

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>11 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

**10. Table 1: Qualification Test Matrix**

TEST GROUP ID:		1	2	3	4	5	6	7	8
TEST DESCRIPTION	SECTION	Mixed Flowing Gas	Temp Life	Dielectric	Thermal Shock & Humidity	Mech. Shock & Vibration	Initial Current Rating	Terminal	Repair
VISUAL EXAMINATION	5.5	1, 20	1,16	1,10	1,22	1,21	1,5	1	1, 10
MATE RECEPTACLE & EDGE CARD		2	2		2	2	2		
<b>ELECTRICAL:</b>									
CONTACT RESISTANCE AT LOW LEVEL (Signal)	6.1	3,9,12, 15,18	3,8,11, 14		3,8,11, 14,17,20	3,6,11, 13,16,19			
CONTACT RESISTANCE (Power)	6.2	4,10,13, 16,19	4,9,12, 15		4,9,12, 15,18,21	4,7,12, 14,17,20			
INSULATION RESISTANCE	6.3			2,5,8					
DIELECTRIC WITHSTANDING VOLTAGE	6.4			3,6,9					
CURRENT RATING (Power)	6.5						3		
CURRENT RATING (Signal)	6.5						4		
<b>MECHANICAL:</b>									
MATING / UNMATING FORCE	7.1	5,7	5,7		5,7	8,10			
CONTACT RETENTION (Power & Signal)	7.2							2	
RESEATING	7.3	17	13		19				
COMPLIANT PIN INSERTION FORCE (Power & Signal)	7.4								2,4,6
COMPLIANT PIN RETENTION FORCE (Power & Signal)	7.5								3,5,7
PCB HOLE DEFORMATION RADIUS	7.6								8
PCB HOLE WALL DAMAGE	7.7								9
<b>ENVIRONMENTAL:</b>									
THERMAL SHOCK	8.1			4	10				
HUMIDITY & TEMP.	8.2			7	16				
HIGH TEMPERATURE LIFE	8.3		10						
HIGH TEMPERATURE LIFE (Preconditioning)	8.4	8				5			
MFG - 10 days (EIA-364-65 Class IIA, table 4.1)	8.5	11							
RANDOM VIBRATION	8.6					15			
MECHANICAL SHOCK	8.7					18			
DURABILITY, 200 Cycles	8.8					9			
DURABILITY, 20 CYCLES (Preconditioning)	8.9	6	6		6				
SOLDERABILITY	8.10							3	
THERMAL DISTURBANCE	8.11	14							
DUST CONTAMINATION	8.12				13				
SAMPLES QUANTITY(PCS)		5	5	5	5	5	5	5	5

NUMBER <b>GS-12-1380</b>	TYPE <b>PRODUCT SPECIFICATION</b>		
TITLE <b>ENHANCED HIGH POWER CARD EDGE (eHPCE®) CONNECTOR</b>		PAGE <b>12 of 12</b>	REVISION <b>3</b>
		AUTHORIZED BY <b>Jackbin ZOU</b>	DATE <b>Nov 16, 2016</b>
		CLASSIFICATION <b>preliminary</b>	

# 11. REVISION RECORD

<u>REV</u>	<u>PAGE</u>	<u>DESCRIPTION</u>	<u>EC#</u>	<u>DATE</u>
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