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TITLE SheerPwr® Circular Connector System		PAGE 1 of 13	REVISION A
		AUTHORIZED BY Sam Wu	DATE Dec 17,2021
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1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the SheerPwr® Circular product.

2.0 Scope

This specification is applicable to the termination characteristics of the SheerPwr® Circular family of products which provides separable vertical receptacles mounted to printed circuit boards that mate to pins of varying diameters mounted to printed circuit boards/Bus Bar.

3.0 Ratings

- 3.1 Operating Voltage Rating: Not Applicable
- 3.2 Operating Current Rating: Refer to Tables 2
- 3.3 Operating Temperature Range =-40 ~ 105 °C¹

Operating temperature is tested in accordance with EIA-364-17 Method A for 1008 hours at 105°C per EIA-364-1000 Table 8 to meet field temperature of 75°C for 10 years field life.

Note 1: includes the terminal temperature rise when powered

4.0 Applicable Documents

4.1 AICC Specifications

4.1.1 Engineering drawings:

Receptacle: 10132381-2036E/2060E/2080E for enhanced version

10132381-20360/20600/20800 for legacy version

Plug: 10140847

10147654 for 5.7mm mating pin

4.1.2 Application specifications: GS-20-0597 for enhanced version/GS-20-0467 for legacy version

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-2019-03-024-CR for enhanced version of SheerPwr® 3.6mm

DL-2019-03-024A-CR for enhanced version of SheerPwr® 6.0mm

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DL-2019-03-024B-CR for enhanced version of SheerPwr® 8.0mm
DL-2017-08-001-CR for legacy version of SheerPwr® 3.6mm
DL-2017-01-010D-CR for legacy version of SheerPwr® 6.0mm & 8.0mm
DL-2018-12-016-CR for 5.7mm plug mating with Radsok®

- 4.4 Safety Agency Approvals
UL/CSA File #: E66906 Vol. 1 Sec. 169

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.

5.2.1 Receptacle:

Power Contacts – High Conductivity Copper Alloy
Housing Resin – High temperature thermoplastic, UL 94V-0 compliant

5.2.2 Plug:

Mating Pin - Zinc Alloy
EON - Copper Alloy

5.3 Finish

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

5.3.1 Receptacle:

Contact area: AGT® for power contacts
Tails: Tin plated over Nickel

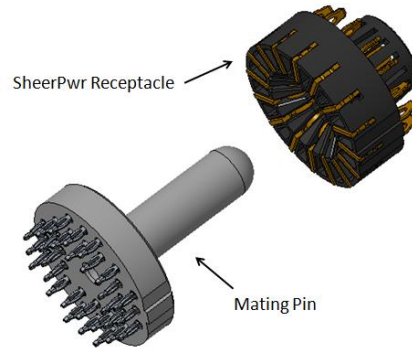
5.3.2 Plug:

Mating Pin - Ag plating
EON - 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.

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6.0 Electrical Characteristics

6.1 Contact Resistance, Low Level (LLCR)

The low level contact resistance shall not exceed 2 milliohms initially and after any treatment and/or 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

The contact resistance at a specified current shall not exceed specified milliohms (refer to Table 1) initially and after any treatment and/or environmental exposure.

Measurements shall be in accordance with EIA 364-06.

The following details shall apply:

Test Current – refer to Section 6.3.

Table 1 Maximum Contact Resistance

Mating Pin Ø	Contact Resistance (milliohms)
3.60mm	0.6
5.70mm	0.5
6.00mm	0.4
8.00mm	0.3

Notes: the mated part of 5.7mm Mating pin is Amphenol Radsok® series.

6.3 Current Rating

The temperature rise above ambient shall not exceed 30 deg C at any point in the system when the connector is powered at specified amperes (refer to Table 2).

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The following details shall apply:

- A. Ambient Conditions – still air at lab room ambient.
- B. Reference - EIA 364-70.

Table 2 Current rating (Amperes)

Mating Pin Ø (mm)	Number of Contacts for Receptacle connector	Number of EON for Plug	Rated Current (A)
3.60	12	16	70
5.70	N/A	20	100
6.00	16	28	180
8.00	18	36	200

Notes:

- 1. The mated part of 5.7mm Mating pin is Amphenol Radsok® series.
- 2. Test boards have 6 layers and 2oz copper for each layer. 4 layers including (top and bottom layers) are for current carrying of power, and the rest 2 layers are for heat dissipation.

7.0 Mechanical Characteristics

7.1 Mating/Unmating Force

The force to mate a receptacle connector and compatible pin shall not exceed specified Newtons (refer to Table 3). The unmating force shall not be less than specified Newtons (refer to Table 3).

The following details shall apply:

- a. Cross Head Speed – 12.7mm per minute.
- b. Lubrication - No additional lubricant shall be added to production test samples.
- c. Utilize free floating fixtures.
- d. Reference – EIA 364-13.

Table 3 The values for Mating/Unmating force (Newtons)

Mating Pin Ø (mm)	Engagement Force (min)	Mating Force (max)	Unmating Force (min)
3.60	N/A	45N	4N
5.70	8.9N	66.8N	20N
6.00	N/A	60N	4N
8.00	N/A	70N	4N

Notes: the mated part of 5.7mm Mating pin is Amphenol Radsok® series.

7.2 Contact retention force

Power Contact of the Receptacle:

During mating, individual power contact shall withstand an axial retention load of 6 N.

EON Contact of Plug:

During mating, individual EON contact shall withstand an axial retention load of 6 N.

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Test condition – EIA-364-29C, method C.

7.3 Compliant Pin Insertion

The maximum insertion force (refer to Table 4) is required to insert an individual compliant pin into a plated through hole in a printed circuit board at a maximum rate of 12.7mm per minute.

Test condition – EIA-364-5

Table 4 Insertion force for compliant pin

Receptacle			
Mating Pin Ø (mm)	Number of Contacts	Insertion Force per EON (max.)	Insertion Force (max.)
3.60	12	140N	1680N
6.00	16	140N	2240N
8.00	18	140N	2520N

Plug			
Mating Pin Ø (mm)	Number of Contacts	Insertion Force per EON (max.)	Insertion Force (max.)
3.60	16	58N	928N
5.70	20	58N	1160N
6.00	28	58N	1624N
8.00	36	58N	2088N

Notes: the mated part of 5.7mm Mating pin is Amphenol Radsok® series.

7.4 Radial Hole Distortion and PTH Wall Damage

Radial distortion is 0.070mm [0.00276in] maximum.

Remaining Cu plating thickness is 0.008mm [0.00032in] minimum.

There shall be no copper cracks, separation between conductive interfaces, or separation between laminate and copper.

The following details shall apply:

- a. Measure at 0.2 to 0.5mm [0.008 to 0.020in] depth.
- b. Reference – EIA 364-96.

7.5 Compliant Pin retention

The minimum retention force (refer to Table 5) is required to remove an individual compliant pin into a plated through hole in a printed circuit board at a maximum rate of 12.7mm per minute.

Test condition – EIA-364-5

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Table 5 Retention force for compliant pin

Receptacle			
Mating Pin Ø (mm)	Number of Contacts	Retention Force per EON(min.)	Retention Force (min.)
3.60	12	20N	240N
6.00	16	20N	320N
8.00	18	20N	360N

Plug			
Mating Pin Ø (mm)	Number of Contacts	Insertion Force per EON(min.)	Retention Force (min.)
3.60	16	24N	384N
5.70	20	24N	480N
6.00	20	24N	672N
8.00	18	24N	864N

Notes: the mated part of 5.7mm Mating pin is Amphenol Radsok® series.

7.6 Reseating

Test condition: Manual plug/unplug the connector.

Requirement: Perform 3 such cycles.

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 qualification table. Unless specified otherwise, assemblies shall be mated during exposure.

8.1 Thermal Shock – EIA 364-32.

- a. Number of Cycles - 25
- b. Temperature Range - Between -65°C and +105°C
- c. Time at Each Temperature - 60 minutes
- d. Transfer Time - 5 minutes, maximum

8.2 Cyclic Temperature & Humidity – EIA 364-31 method III (cyclic temperature)

- a. Relative Humidity - 80% to 98%
- b. Temperature - 25°C~65°C
- c. Duration - 240 hours
- d. Omit step 7b (vibration) where applicable

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- 8.3 High Temperature Life – EIA 364-17.
 - a. Test Temperature - 105± 2°C
 - b. Test Duration - 1008 hours
- 8.4 High Temperature Life (preconditioning) – EIA 364-1000.
 - a. Test Temperature - 105± 2°C
 - b. Test Duration - 72 hours
- 8.5 Mixed Flowing Gas corrosion (MFG) – EIA 364-65
 - a. Class - IIA
 - b. Duration - 14 days
 - c. ½ of samples mated for 336 hours, ½ of samples unmated for 168 H, then mated for final 168 hours
- 8.6 Vibration (Random) – EIA 364-28
 - a. Test Condition - method V, letter C
 - b. Vibration Amplitude – 9.26 rms G
 - c. Duration – 2 hours along each of three orthogonal axes
 - d. Mounting - Rigidly mount assemblies
 - e. No discontinuities greater than 1 microsecond
- 8.7 Mechanical Shock – EIA 364-27
 - a. Condition - Test condition A (50G, 11 milliseconds, half-sine pulse type)
 - 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.
- 8.8 Durability - EIA 364-09
 - a. Number of Cycles - 50 cycles
 - b. Cycling Rate – 127 mm/min
 - c. Use free floating fixtures
- 8.9 Durability (preconditioning) - EIA 364-09
 - a. Number of Cycles - 20 cycles
 - b. Cycling Rate - 127 mm/min
 - c. Use free floating fixtures
- 8.10 Thermal Disturbance – EIA 364-110
 - a. Number of Cycles - 10

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- b. Temperature Range - Between 15 ±3°C and +85 ±3°C
- c. Dwell time for each extreme temperature – 5 minutes minimum
- d. Ramp rate – a minimum of 2°C per minute

8.11 Dust - EIA 364-91

- a. Dust Composition #1 (benign)
- b. Duration: 1.0 hour
- c. Unmated connector to be placed in the chamber

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 deg 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 6. 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.

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

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9.7 Qualification Test Table

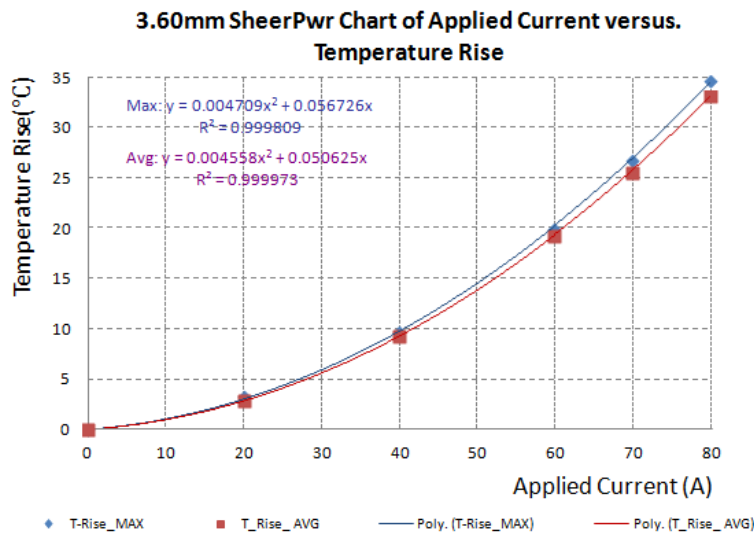
Table 6 Qualification Test Table

Test Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10
Visual Examination	1, 9	1, 11	1, 11	1, 9	1, 11	1, 6	1, 6	1, 4	1, 4	1, 8
LLCR	2, 5, 7	2, 5, 7, 9	2, 5, 7, 9	2, 5, 7	2, 5, 7, 9	2, 4	2, 4			
CR	8	10	10	8	10	5	5			
Durability(Precondition)	3	3	3	3	3			2		
Durability						3				
Temperature Life (precondition)			4	4						
Temperature Life	4									
Thermal Shock		4								
Cyclic Temperature & Humidity		6								
T-rise							3			
Mating/unmating								3		
Vibration			8							
Mechanical Shock			6							
MFG				6						
Dust					4					
Thermal Disturbance					6					
Compliant Pin Insertion									2	2, 4, 6
Radial hole distortion									3	
Compliant pin retention										3, 5, 7
Reseating	6	8			8					
Sample Quantity	10 sets	10 sets	10 sets	10+10 sets	10 sets	10 sets	3 sets	10 sets	10 sets	10 sets

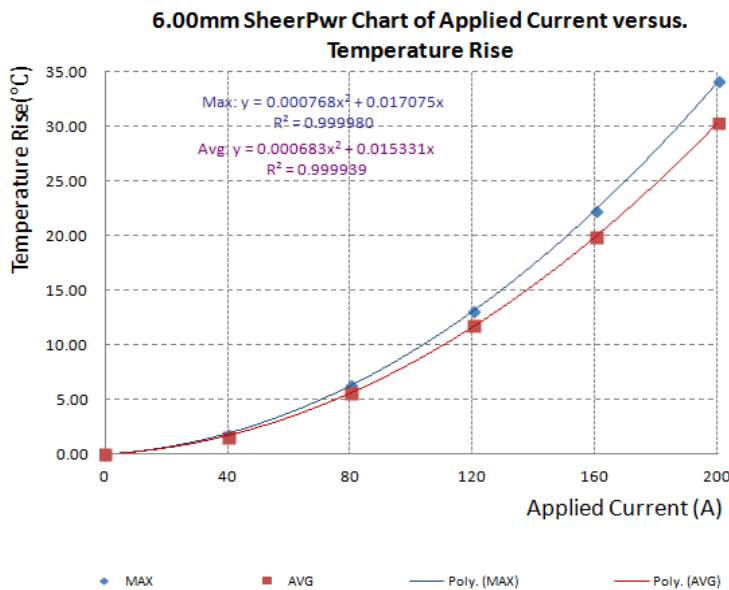
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10.0 Appendix

The T-rise curves for SheerPwr series are as follows.

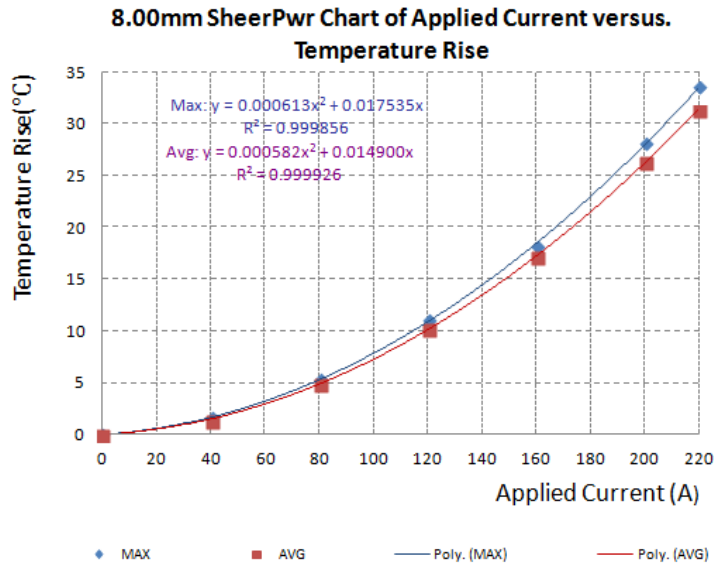


The maximum temperature rise reached to 30°C when 3.60mm SheerPwr was energized at 74A current.



The maximum temperature rise reached to 30°C when 6.00mm SheerPwr was energized at 186.9A current.

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The maximum temperature rise reached to 30°C when 8.00mm SheerPwr was energized at 207.4A current.

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REVISION RECORD

Rev	Page	Description	EC#	Date
A	All	Initial release	N/A	12/17/2021