Battery Terminals: Direct to PCB

1. SCOPE

1.1. Content

This specification covers performance, tests, and quality requirements for Battery Terminals that are intended for Direct to PCB use.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed. The Qualification Test Report number for this testing is 501-134145.

1.4. Revision Summary

Revisions to this specification include:

- Updated Mating and Unmating force, Temperature Rating, Temperature Life, and Solderability tests. Updated Test Group 2 and Test Group 3, added Notes (e) and (f) to Figure 2. Updated Figure 3 and Figure 4.
- Updated Solderability Dip Test with additional details, immersion time added
- Changes to Test Groups (including new Test Group), comment added for PCB in Section 3.2.
- Vibration test in Test Group 2 updated (Note g)
- Correction to Temperature Rise vs. Current description (reference to Section 3.3A)
- Update to Temperature Rise vs. Current description and clarification added to Section 3.3A about thermal requirements. Update to Test Group 1, 2, and 3 sequences. Update to Figure 3. Clarification to Examination of Product. Qualification Test Report number added.

2. APPLICABLE DOCUMENTS AND FORMS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Connectivity Specifications

114-160168	Application Specification
501-134145	Qualification Test Report

2.2. Commercial Standards and Specifications

EIA-364	Electrical Connector/Socket Test Procedures Including Environmental Classifications
IEC 60068	International Standard – Environmental Testing

2.3. Reference Documents

109-1	General Requirements for Testing
102-950	Qualification of Separable Interface Connectors

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable TE drawing.

A. Contacts:
   1. Material: Copper alloy
   2. Finish: Nickel plating, selective Tin plating

B. Printed Circuit Board (PCB): With Traces Sized at least for the Intended Rated Current

3.3. Ratings

A. Current Rating:
   1. Power terminal: 20 A max per contact
   2. Signal terminal: 5 A max per contact

NOTE
Thermal requirements should be reviewed for each application based on number of terminals, terminal spacing, and other factors which are specific to an application.

B. Temperature Rating: –10°C to +110°C (includes temperature-rise of terminals)

3.4. Performance Requirements and Test Description

The product should meet the electrical, mechanical and environmental performance requirements specified in Figure 1. All tests shall be performed at ambient environmental conditions otherwise specified.

3.5. Test Requirements and Procedure Summary

Test Description	Requirement	Procedure
Examination of product	Meets requirements of product drawing and TE application specification. Parts show no physical damage that would impair product performance.	EIA-364-18, Method B Visual, dimensional and functional as per applicable inspection plan.
Electrical		
Low Level Contact Resistance	Initial (Power): 2.4 mΩ maximum Final (Power): 4.5 mΩ maximum Initial (Signal): 2.4 mΩ maximum Final (Signal): 9.5 mΩ maximum	EIA-364-23 Mating Conditions: Mated Test Current: <100 mA Test Voltage: <20 mV Resistance between plated through holes/slots. See Figure 3

Contact Resistance at Rated Current	Power Terminals: 4.1 mΩ average 4.5 mΩ maximum Signal Terminals: 9.0 mΩ average 9.5 mΩ maximum	EIA-364-06C The contact resistance shall be measured with the current of 20 A for the power terminal and 5 A for the signal terminal. The lowest voltage shall be used that allows the current to be achieved. Resistance between plated through holes/slots. See Figure 3
	Mechanical	
Temperature Rise vs. Current	Temperature rise of any individual termination shall not exceed 30°C when subjected to the specified maximum current indicated in Section 3.3A.	EIA-364-70 Test Current: Please see Section 3.3A. Power terminals and signal terminals are to be energized separately, with signal terminals being energized individually and power terminals representative of being energized individually. Measure temperature rise above ambient created by the energizing current. Measurement must be taken in a place where there is no influence from air convection. Temperature rise = Temperature of contact – Ambient temperature See Figure 3
Vibration	No Discontinuities of 1 microsecond or greater.	EIA-364-28, Condition VII, Level E Frequency Range: 20-500 Hz (Random) Amplitude: .05 g²/Hz (4.90 grms) Duration Each Axis: 15 minutes See Figure 3
Mechanical Shock	No Discontinuities of 1 microsecond or greater.	EIA-364-27, Condition A Pulse Type: Half-sine Pulse Amplitude: 50 g Pulse Duration: 11 ms See Figure 3
Durability	No physical damage that would impair product performance.	EIA-364-9: Mate and unmate specimen at a maximum rate of 500 cycles per hour. See Figure 3
Mating Force	Max Force per Power Terminal: 8 N Max Force per Signal Terminal: 6 N	EIA-364-13 Measure force necessary to mate a connector that consists of the number of power terminal(s) and signal terminal(s) specified in Figure 2. The overall mating force shall not exceed the cumulative value calculated from the individual values provided. Rate: 25.4 mm/min See Figure 3
Unmating Force (Continued on Next Page)	Min Force per Power Terminal: 0.8 N Min Force per Signal Terminal: 0.5 N	EIA-364-13 Measure force necessary to unmate a connector that consists of the number of power terminal(s) and signal terminal(s) specified in Figure 2. The overall unmating force shall be greater than the

Unmating Force (Continued)		cumulative value calculated from the individual values provided. Rate: 25.4 mm/min
Solderability Dip Test	Acceptance Criteria as per Method 1 of IEC 60068-2-20.	IEC 60068-2-20 Method 1 Immersion Time: 5 Seconds
Environmental		
Humidity-Temperature Cycling	No physical damage that would impair product performance.	EIA 364-31B, Method IV Subject mated terminals on printed circuit board to 10 humidity/temperature cycles between 25°C and 65°C at 95% RH. See Figure 3
Temperature Life	No physical damage that would impair product performance.	EIA 364-17B Subject mated terminals on printed circuit board to temperature life at 110°C for 240 hours. See Figure 3

Figure 1

NOTE
Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.

3.6. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)				
	1 Mechanical (e)	2 Current Rating (e)	3 Durability(e)	4 Mating and Unmating Force (f)	5 Solderability
	TEST SEQUENCE (b)				
Examination of Product	1,11	1,12	1,6	1,4	1,3
Low Level Contact Resistance	3,6,8	2,4,6,8,10	2,4		
Contact Resistance at Rated Current	9				
Temperature Rise vs. Current		11	5		
Vibration	5	9(g)			
Mechanical Shock	7				
Durability	4(c)	3(c)	3(d)		
Mating Force	2			2	
Unmating Force	10			3	
Solderability Dip Test					2
Humidity-Temperature Cycling		5			
Temperature Life		7			

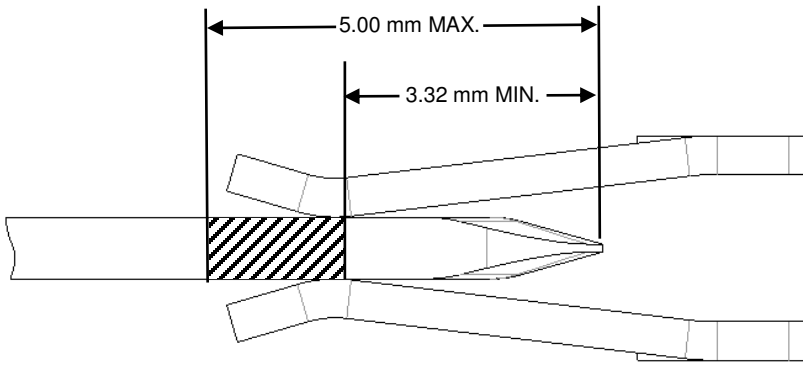
Figure 2

NOTE

(a) See paragraph 4.2.
(b) Numbers indicate sequence in which tests are performed.
(c) Perform 50 durability cycles.
(d) Perform 10,000 durability cycles.
(e) Connector consists of two power terminals and five signal terminals (signal terminals between the two power terminals).
(f) Connector consists of one terminal (power and signal terminals are tested individually and separately).
(g) Vibration is performed at an 18°C Temperature Rise, and discontinuities are not monitored.

3.7. Contact Insertion Depth

Power Terminals:



Signal Terminals:

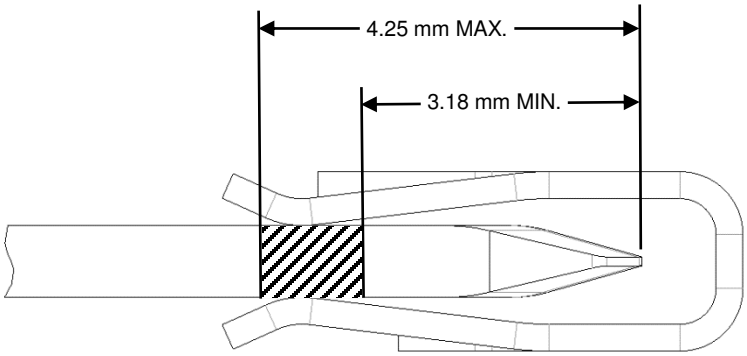


Figure 3

4. QUALITY ASSURANCE PROVISIONS

4.1. Test Conditions

Unless otherwise specified, all the tests shall be performed in any combination of the following test conditions shown in Figure 4.

Temperature	15°C – 35°C
Relative Humidity	20% – 80%
Atmospheric Pressure	86.6 – 106.6 kPa

Figure 4

4.2. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable instruction sheets and shall be selected at random from current production.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

4.3. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.4. Acceptance

Acceptance is based on verification that the product meets the requirements in Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.5. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.