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SFF Committee

SFF-8639

Specification for

Multifunction 6X Unshielded Connector

Rev 2.1   May 26, 2017

Secretariat:  SFF TA TWG

Abstract:  This specification defines the mechanical specifications and general requirements of a six lane, high speed multifunction plug and receptacle connector that is designed for use as a multi-application solution.

Systems utilizing this connector may support single port SATA, dual port SATA Express, dual port SAS, MultiLink SAS, or up to four (4) port PCIe device configurations in an isolated manner. Systems utilizing the six lane receptacle in a backplane application will accept devices with plugs developed in accordance with SFF-8482 and SFF-8630.

This specification provides a common reference for systems manufacturers, system integrators, and suppliers.

This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this specification.

The description of a connector in this specification does not assure that the specific component is actually available from connector suppliers. If such a connector is supplied it must comply with this specification to achieve interoperability between suppliers.

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The user's attention is called to the possibility that implementation to this Specification may require use of an invention covered by patent rights. By distribution of this specification, no position is taken with respect to the validity of a claim or claims or of any patent rights in connection therewith. SNIA SFF TWG members which advise that a patent exists are required to grant a license on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

Change History

Revision 1.0
- Put PCB footprints in Informative Appendix as an example.

Revision 1.1
- Adopted common representation for SFF-8629/SFF-8639/SFF-8482
  - Table 8-x Performance Requirements
  - Appendix C introductory paragraphs

Revision 1.2
- Added explanatory text to Section 4.4 re datums.

Revision 1.3
- Removed lingering reference to SFF-8699 in Section 4.2

Revision 1.4
- Added paragraph to Appendix A that using interfaces are the definitive references

Revision 1.5
- Extracted Informative Annex A to become the basis for SFF-9639

Revision 1.6
- Added EIA reference for Temperature Rise in Table of Electrical Requirements.

Revision 1.7
- Deleted Section 5.2 which had obsolete pinout content.

Revision 1.8
- Restored Contact Mating Scheme in Section 5.2

Revision 1.9
- Pin ID numbers updated in Figure 4-3 and replaced 'PCIe-SSD' with 'SFF-8639'
- Added reference to Figure 4-3 in Section 4.4

Revision 2.0
- The speed characteristics and electrical considerations were removed in order to create SFF-8637.

Revision 2.0.2
- Revised all references to SFF-8629 and made them SFF-8630
- Deleted all references to the following:
  - 12 Gb/s SFF-8637
  - 24 Gb/s SFF-8638

Revision 2.0.3
- Changed the Un-Mate Force from 12N to 6N in Table 8-2 Mechanical Requirements

Revision 2.0.4
- Small editorial changes to increase clarity

Revision 2.0.5
- Corrected a typo in Section 2.1
- Deleted sentence regarding Tin-Tin interface in Section 2.5
- Corrected a typo in the last line on Page 25.

Revision 2.1
- Corrected a few small editorial issues: replaced “Development” with “Published” in header. Corrected document number by deleting the “-TA-” which was in the previous revision.
- Resized several figures to better utilize space and reduce number of pages.
Foreword

The development work on this specification was done by the SNIA SFF TWG, an industry group. Since its formation as the SFF Committee in August 1990, the membership has included a mix of companies which are leaders across the industry.

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type or connector location, between vendors. The SFF Committee provided a forum for system integrators and vendors to define the form factor of disk drives.

During their definition, other activities were suggested because participants in SFF faced more challenges than the form factors. In November 1992, the charter was expanded to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

In July 2016, the SFF Committee transitioned to SNIA (Storage Networking Industry Association), as a TA (Technology Affiliate) TWG (Technical Work Group).

Industry consensus is not a requirement to publish a specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

SFF meets during the T10 (see www.t10.org) and T11 (see www.t11.org) weeks, and SSWGs (Specific Subject Working Groups) are held at the convenience of the participants. Material presented to SFF becomes public domain, and there are no restrictions on the open mailing of the presented material by Members.

Many of the specifications developed by SFF have either been incorporated into standards or adopted as standards by ANSI, EIA, JEDEC and SAE.

For those who wish to participate in the activities of the SFF TWG, the signup for membership can be found at:

http://www.snia.org/sff/join

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:

http://www.snia.org/sff/specifications/SFF-8000.xls

If you wish to know more about the SFF TWG, the principles which guide the activities can be found at:

http://www.snia.org/sff/specifications/SFF-8032.PDF

Suggestions for improvement of this specification will be welcome, they should be submitted to:

http://www.snia.org/feedback
Figure A-5 Cable Retention: Cable Retention w/"L" Shaped Key 25
Figure A-6 Cable Retention: Cable Release Clearance top view 25
Figure A-7 Cable Retention: Cable Release Clearance side view 25
Figure B-1 Receptacle PCB Footprint Example 26

TABLES
Table 5-1  Contact Mating Scheme 17
Table 8-1  Electrical Requirements 21
Table 8-2  Mechanical Requirements 22
Table 8-3  Environmental Requirements 22
1. **Scope**
This specification defines the terminology and mechanical requirements for a six lane, high speed plug and receptacle that is designed for use as a common connector system supporting SATA, SAS and PCIe based devices.

The mechanical dimensioning and signal assignments for the six lane common connector receptacle allows intermateability with the unshielded dual port serial attachment plug connectors that have been developed in accordance with SFF-8482, and unshielded multiport serial attachment connectors that have been developed in accordance with SFF-8630.

1.1 **Application Specific Criteria**
This connector shall meet the electrical performance requirements defined by the using interfaces and intermate with previous generations of lower speed SAS connectors.

SAS, SATA and PCIe define respective requirements for the transmission of multi-gigabit signals on a backplane. When this connector is used in any of these applications, its performance shall meet the requirements of the appropriate standard.

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The information contained in this publication is subject to change without notice. The SNIA makes no warranty of any kind with regard to this specification, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The SNIA shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this specification.
Suggestions for revisions should be directed to http://www.snia.org/feedback/

2. References

2.1 Industry Documents
The following documentation is relevant to this Specification.

ASME Y14.5M Dimensioning and Tolerancing

EIA-364-D Electrical Connector/Socket Test Procedures Including Environmental Classifications

IPC-A-610 Acceptability of Electronic Assemblies

SFF Committee specifications are available from http://www.snia.org/sff/specifications
- SFF-8223 2.5" Drive Form Factor with Serial Attached Connector Commonly known as the "2.5 inch drive" specification.
  Note: SFF-8223 has been standardized in EIA-720
- SFF-8323 3.5" Drive Form Factor with Serial Attached Connector. Commonly known as the "3.5 inch drive" specification.
  Note: SFF-8323 has been standardized in EIA-740
- SFF-8482 Serial Attachment 2X Unshielded Connector Commonly known as the "SAS connector" specification
  Note: SFF-8482 has been standardized as EIA-966
- SFF-8630 Serial Attachment 4X Unshielded Connector Commonly known as SAS MultiLink
- SFF-9639 Multifunction 6X Unshielded Connector Pinouts

2.2 SFF Specifications
There are several projects active within the SFF Committee. The complete list of specifications which have been completed or are still being worked on are listed in the specification at http://www.snia.org/sff/specifications/SFF-8000.xls

2.3 Sources
Those who join the SFF Committee as an Observer or Member receive electronic copies of the minutes and SFF specifications (http://www.sffcommittee.com/ie/join.html).

Copies of ANSI standards may be purchased from the International Committee for Information Technology Standards (http://www.techstreet.com/incitsgate.tmpl).

2.4 Conventions
The ISO convention of numbering is used i.e., the thousands and higher multiples are separated by a space and a period is used as the decimal point. This is equivalent to the English/American convention of a comma and a period.

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2.5 Definitions

For the purpose of SFF Specifications, the following definitions apply:

**Advanced grounding contacts:** Connector contacts that mate first and break last and are capable of carrying power ground return currents and performing electrostatic discharge. Other terms sometimes used to describe these features are: grounding pins, ESD contacts, grounding contacts, static drain, and pre-grounding contacts.

**Alignment guides:** Connector features that preposition insulators prior to electrical contact. Other terms sometimes used to describe these features are: guide pins, guide posts, blind mating features, mating features, alignment features, and mating guides.

**Board Termination Technologies:** Surface mount single row, surface mount dual row, through hole, hybrid, straddle mount, pressfit.

**Cable Termination:** The attachment of wires to the termination side of a connector. Schemes commonly used in the industry are IDC (Insulation Displacement Contact), IDT (Insulation Displacement Termination), wire slots, solder, weld, crimp, braise, etc.

**Contact mating sequence:** Order of electrical contact during mating/unmating process. Other terms sometimes used to describe this feature are: contact sequencing, contact positioning, make first/break last, EMLB (early make late break) staggered contacts, and long pin / short pin.

**Fixed:** Used to describe the gender of the mating side of the connector that accepts its mate upon mating. This gender is frequently, but not always, associated with the common terminology "receptacle". Other terms commonly used are "female" and "socket connector". The term "fixed" is adopted from EIA standard terminology as the gender that most commonly exists on the fixed end of a connection, for example, on the board or bulkhead side. In this specification "fixed" is specifically used to describe the mating side gender illustrated in Figure 2-1, and shown in Figure 3-1.

**Fixed Board:** A connector that uses a fixed gender mating side and a termination side suitable for any of the printed circuit board termination technologies.

**Fixed Cable:** A connector that uses a fixed gender mating side as shown in the Informative Appendix.

**Free:** Used to describe the gender of the mating side of the connector that penetrates its mate upon mating. This gender is frequently, but not always, associated with the common terminology "plug". Other terms commonly used are "male" and "pin connector". The term "free" is adopted from EIA standard terminology as the gender that most commonly exists on the free end of a connection, for example, on the cable side. In this specification "free" is specifically used to describe the mating side gender illustrated in Figure 2-1, and shown in Figure 3-2.

**Free Board:** A connector that uses a free gender mating side and a termination side suitable for any of the printed circuit board termination technologies.

**Frontshell:** That metallic part of a connector body that directly contacts the backshell or other shielding material that provides mechanical and shielding continuity between the connector and the cable media. Other terms sometimes used to describe this part of a cable assembly are: housing, nosepiece, cowling, and metal shroud.

**Height:** Distance from board surface to farthest overall connector feature.
Mating side: The side of the connector that joins and separates from the mating side of a connector of opposite gender. Other terms commonly used in the industry are mating interface, separable interface and mating face.

Offset: An alignment shift from the center line of the connector.

Optional: This term describes features which are not required by the SFF Specification. However, if any feature defined by the SFF Specification is implemented, it shall be done in the same way as defined by the Specification. Describing a feature as optional in the text is done to assist the reader. If there is a conflict between text and tables on a feature described as optional, the table shall be accepted as being correct.

Reserved: Where this term is used for defining the signal on a connector pin its actual function is set aside for future standardization. It is not available for vendor specific use. Where this term is used for bits, bytes, fields and code values; the bits, bytes, fields and code values are set aside for future standardization. The default value shall be zero. The originator is required to define a Reserved field or bit as zero, but the receiver should not check Reserved fields or bits for zero.

Right Angle: A connector design for use with printed circuit board assembly technology where the mating direction is parallel to the plane of the printed circuit board.

Single row: A connector design for use with surface mount printed circuit board assembly technology where the termination side points are arranged in one line.

Single sided termination: A cable termination assembly style and a connector design style where only one side of the connector is accessible when attaching wires. This style frequently has IDC termination points that point in the same direction.

Straddle mount: A connector design style and a printed circuit board design style that uses surface mount termination points on both sides of the board. The connector is frequently centered between the top and bottom surfaces of the board.

Straight: A connector design for use with printed circuit board assembly technology where the mating direction is perpendicular to the plane of the printed circuit board.

Surface mount: A connector design and a printed circuit board design style where the connector termination points do not penetrate the printed circuit board and are subsequently soldered to the printed circuit board.

Termination side: The side of the connector opposite the mating side that is used for permanently attaching conductors to the connector. Due to pin numbering differences between mating side genders the termination side shall always be specified in conjunction with a mating side of a specific gender. Other terms...
commonly used in the industry are: back end, non-mating side, footprint, pc board side, and post side

**Through hole:** A connector design and a printed circuit board design style where the connector termination points penetrates the printed circuit board and are subsequently soldered to the printed circuit board.

**Wipe (Contact Location):** The contact location has two components: direction of mating and direction of contact pitch. In the direction of mating, the Free contact location must be a minimum of 0.05 mm from either end of the Fixed contact mating interface after mating and latching.

![FIGURE 2-2 DIRECTION OF MATING](image1)

In the direction of contact pitch, the Free contact shall have no less than 50% of the available mating width in contact with the Fixed contact and there shall be a minimum clearance to the adjacent Fixed contact. The minimum clearance to the adjacent Fixed contact shall be 0.075 mm for interfaces with a pitch of at least 0.70 mm. For pitches less than 0.70 mm, the minimum clearance should be reviewed on a case by case basis to insure that a shorting condition does not exist.

![FIGURE 2-3 DIRECTION OF CONTACT](image2)

**Wipe (Minimum Effective Contact):** The distance that the Free contact moves along the Fixed contact without losing electrical connection.

![FIGURE 2-4 CONTINUOUS CONTACT](image3)

The minimum effective wipe is dependent on the finish of the contact interface. Tin-Tin interfaces shall have a minimum effective wipe of 2.00 mm. Gold-Gold interfaces shall have a minimum effective wipe of 0.40 mm.
3. General Description

This connector system is designed to allow devices that support single port SATA, dual port SATA Express, dual port SAS, MultiLink SAS, or up to four (4) port PCIe port plugs to mate to a common fixed receptacle that is mechanically compatible to the connector receptacles designed in accordance with SFF-8482 or SFF-8630. **Note:** Legacy SAS and SATA Drive Plug Connectors will not mate with the cable variant version outlined in the Informative Appendix.

The interface supports all of the contact sets defined by a dual port SAS implementation plus an additional 39 signals. The additional 39 signals are used to support 4 lanes of PCIe plus 10 sideband signals. In a MultiLink SAS implementation 14 of the 39 signals are used to support the two additional SAS ports.
3.1 Usage Models

The connector system defined in this specification is considered to be an extension of the connector systems defined in SFF-8482 and SFF-8630. This connector system may be used to implement five specific storage device use cases. These use cases are as follows:

- Single port SATA (as defined by Serial ATA revision 3.1)
- Two port SATA Express (as defined in Serial ATA Technical Proposal #TPR_C109, currently under development)
- Dual port SAS (as defined by SFF-8482)
- MultiLink SAS (as defined by SFF-8630)
- Up to 4 lanes of PCIe (as defined in this specification)

This connector system defines a total of 68 contacts. Not all contacts may be utilized on a particular connector implementation depending on the use case being supported. The connector system may be used for other use cases not defined in this specification.

4. Dimensioning Requirements

4.1 Connector Interface

All dimensional requirements for the connector within this specification shall be met in order to provide intermateability between plug and receptacle and to fit within the physical boundaries defined for the media and backplane.
FIGURE 4-2 DETAIL A AND C, DEVICE FREE (PLUG) CONNECTOR

FIGURE 4-3 DETAIL B AND SECTION D1-D1, DEVICE FREE (PLUG) CONNECTOR
4.2 Printed Circuit Board Layouts

This specification is not intended to address the electrical performance characteristics of the host Printed Circuit Board (PCB) material and construction used in these applications. The PCB thickness, number of layers, layer stack up,
trace layer location(s), copper plane anti-pads, etc., as all are major contributors to the final electrical characteristics of each unique application of the connector.

Due to the construction of SFF-8639 and the inclusion of contacts opposite of the keying area the PCB footprint of SFF-8639 may restrict the mechanical placement of the connector. SFF-8639 is not intended to be a general replacement for either SFF-8482 or SFF-8630 and may not mechanically fit in all potential implementations.

### 4.3 General Tolerances

Unless otherwise stated, the following tolerances shall apply:
- Place dimension = +/-0.20mm
- Angular dimension = +/-3 degrees

### 4.4 Intermateability

In this specification the location of Datum A of the plug is defined as the center of the plug tongue. The figure defines an offset between the Datum A definition of this specification and the Datum A definition in SFF-8482, see also Figure 4-3 for dimension between datums.

- SFF-8482 Datum A is the same for both the Plug and the Receptacle. The Plug Connector Datum A is the surface opposite the key plug tongue and the surface opposite the key in the receptacle.
- SFF-8639 Datum A is centered in the plug tongue.
- SFF-8639 Datum Z is centered in the receptacle slot.

SFF-8639 has many contacts on the opposite side of the connector at the 0.80mm pitch and these would have more of a centering effect than those in SFF-8482.

---

**FIGURE 4-6 OFFSET TO DATUM A OF SFF-8482**
5. Signal Assignments

5.1 Contact Numbering Scheme

The contact numbering scheme is an extension of the contact numbering schemes defined in SFF-8482 and SFF-8630. Figure 5-1 shows the contact numbering for a fully populated version of an SFF-8639 connector. The contact numbering started with the contacts defined in SFF-8482 (P1 - P15 and S1 - S14). The numbering scheme was extended to cover the use case of a SAS MultiLink connector (S15 - S28) as defined in SFF-8630. Additional contacts (E1 - E25) were added to cover the use case of a 4-lane PCIe connector. SFF-9639 provides a comprehensive list of pinout use cases.

FIGURE 5-1 CONTACT NUMBERING SCHEME
### 5.2 Contact Mating Scheme

#### TABLE 5-1 CONTACT MATING SCHEME

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<th>Backplane Interface</th>
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continued....
| Signal Side (0.80 mm) | | | | |
|----------------------|----------------------|----------------------|----------------------|
| E7                   | E7                   | E7                   | E7                   |
| E8                   | E8                   | E8                   | E8                   |
| E9                   | E9                   | E9                   | E9                   |
| E10                  | E10                  | E10                  | E10                  |
| E11                  | E11                  | E11                  | E11                  |
| E12                  | E12                  | E12                  | E12                  |
| E13                  | E13                  | E13                  | E13                  |
| E14                  | E14                  | E14                  | E14                  |
| E15                  | E15                  | E15                  | E15                  |
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<td>E22</td>
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<tr>
<td>E23</td>
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</tr>
<tr>
<td>E24</td>
<td>E24</td>
<td>E24</td>
<td>E24</td>
</tr>
</tbody>
</table>

<-0.5 mm> <-0.50 mm>
6. Backplane Fixed (receptacle) Interface Features

6.1 Blind Mating

The process of mating an unshielded serial attachment connector pair should be accomplished in a "free fit" manner where no excessive mechanical stresses are placed on the connectors during or after the mating process. The mating process should be considered in the context of the packaging surrounding the device with the connectors. Stresses considered include those transmitted to the mated connector through the device: for example, the weight of the drive, that resulting from resilient device guide members in the enclosure, the device retention mechanism, acceleration stresses (mechanical shock testing), and interference with enclosure parts. Mechanical interference between the device with the mated connectors and fixed or solid parts of the packaging will generally not be tolerated by the unshielded serial attachment system.

The mating interface specification requires a two stage process to arrive at the final mated contact:

- The first stage must be delivered by the device enclosure system to achieve center to center alignment of less than 1.5mm in the longitudinal axis and less than 1.0mm in the horizontal axis prior to any part of the connector pair engaging. This is known as the blind mate tolerance zone.

- The second stage (connector blind mate pre-alignment features) positions the connectors from +/- 1.5mm / +/- 1.0mm at initial engagement through to a point where the main connector chamfers engage (normal connector engagement).

Connector designers should recognize that certain lateral movement between free gender contacts and fixed gender contacts may occur between the time the pre-alignment features engage and the contacts reach final mated position.

Connector pre-alignment and alignment features are different than what is specified in SFF-8482. SFF-8639 utilizes an "L" Shaped Key in the Fixed Cable (Receptacle) (Cable Variant) of the SFF-8639 Receptacle. A corresponding "L" shaped pocket is incorporated into the Free / mating Plug side of the SFF-8639 connector. This "L" Shaped Key in the Fixed Cable (Receptacle) blocks legacy SAS and SATA devices from being plugged into the Fixed Cable (Receptacle) (Cable Variant). For Fixed (Backplane) application this is not an issue. The Fixed (Backplane) alignment features are consistent with what is specified in SFF-8482 section 5.1.

6.2 Mating Wipe and Device Clearances

In order to guarantee minimum contact engagement is provided in a backplane system, the position of the device connector interface shall be controlled relative to the backplane surface. The device connector Datum C (as shown in figure 4-4) shall be 8.45 +/- 0.20mm from the backplane surface. Device clearances vary by form factor: see the appropriate form factor specification for connector location with respect to form factor.
6.3 Hot Plugging

In order to facilitate hot plugging of a device into a powered backplane, the backplane fixed (receptacle) and device free (plug) interface is designed to provide a 3 level contact engagement sequence. By specifying an offset between key contacts on each side of the mating interface, the mating sequences of these contacts are timed to occur in the proper order.

There are a series of pins of the backplane fixed (receptacle) interface that are advanced 0.50mm nominal from all other contacts pins on this side of the interface. These pins locations represent the 1st level of mating upon insertion of the device.

The 2nd level of mating is established when the forward group of contacts located on the device free (plug) interface penetrates 0.50mm nominal into the backplane fixed (receptacle) interface.

The remaining contacts represent the 3rd level of mating and are set back 0.50mm nominal from the 2nd mating level contacts. These will be the last contacts to mate. Table 5-1, Table 5-2 and Table 5-3 show the mating level of each contact in this connector system. In order to maintain this sequence sufficient tolerance has been designed into the interface to allow for manufacturing and alignment of the device to the enclosure.
Note: In some installations, the Pluggable Storage Device must be in a tray with hand lever insertion to meet associated enclosure requirements. However, this is outside the scope of this specification.

7. Ratings

7.1 Current

Power section (per pin):
- Continuous Current 1.5A
- Peak Current 2.5A for 1.5s
- Peak Current Pre-charge 6A for 1mS

Signal Section (per pin):
- Continuous Current 500mA

7.2 Temperature

Operating 0.0C to 55.0C
Non-operating -40.0C to 85.0C

8. Performance Requirements

The General Electrical, Mechanical and Environmental requirements for mating connectors are listed in the tables.

See section 1.2 for the Electrical Performance requirements for this connector solution.

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Level Contact Resistance</td>
<td>30 milliohms maximum for signal contacts (initial)</td>
<td>EIA-364-23: Mate connectors and apply a maximum voltage of 20 mV and a current of 100 mA</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>1000 Megaohms minimum</td>
<td>EIA 364-21: Apply a voltage of 500 VDC for 1 minute between adjacent terminals</td>
</tr>
<tr>
<td>Dielectric Withstanding Voltage</td>
<td>No breakdown or flashover</td>
<td>EIA 364-20, method B: Apply a voltage of 500 VAC for 1 minute between adjacent terminals</td>
</tr>
<tr>
<td>Temperature Rise (via current cycling) Power section only (P1 thru P15)</td>
<td>Temperature rise shall not exceed 30C degrees</td>
<td>EIA-364-70B: Wire contact pins P1, P2, P8 and P9 in parallel for power Wire contact pins P4, P5, P6, P10 and P12 in parallel for return Supply 6 Amp total DC current to the power pins in parallel, returning from the parallel ground pins Measure and record the temperature after 96 hours (45 minutes ON and 15 minutes OFF per hour) in ambient condition of 25C still air</td>
</tr>
</tbody>
</table>
### TABLE 8-2  MECHANICAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Shock</td>
<td>Discontinuity &lt;1 microsecond 15 milliohm maximum change from initial Contact Resistance</td>
<td>EIA-364-27: Subject mated connectors to 50G's half-sine shock pulses of 11 milliseconds duration in each X,Y and Z axis (18 shocks total)</td>
</tr>
<tr>
<td>Random Vibration</td>
<td>Discontinuity &lt;1 microsecond 15 milliohm maximum change from initial Contact Resistance</td>
<td>EIA-364-28, Test Condition VII: Subject mated connectors to 3.10G's RMS between 20-500 Hz for 15 minutes in each of 3 mutually perpendicular planes</td>
</tr>
</tbody>
</table>
| Durability                   | No damage 15 milliohm maximum change from initial Contact Resistance        | EIA 364-09: Mate and unmate connectors at a maximum rate of 200 cycles per hour  
Backplane - 500 Cycles  
Cable - 25 Cycles |
| Connector Mate and Unmate Forces | Mate - 59N max  
Unmate - 6N min  
Initial and after durability | EIA 364-13: Mate and unmate connectors at a rate of 25mm per minute |

### TABLE 8-3  ENVIRONMENTAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Shock</td>
<td>No damage 15 milliohm maximum change from initial Contact Resistance</td>
<td>EIA 364-32, Test Condition I: Subject mated connectors to 10 cycles between minus 55C and plus 85C degrees</td>
</tr>
<tr>
<td>Temperature Life</td>
<td>No damage 15 milliohm maximum change from initial Contact Resistance</td>
<td>EIA 364-17, Test Condition III, Method A, Test Time Condition C: Subject mated connectors to 85C for 500 hours</td>
</tr>
<tr>
<td>Mixed Flowing Gas</td>
<td>No damage 15 milliohm maximum change from initial Contact Resistance</td>
<td>EIA 364-65, Class IIA: (4 Gas): Expose half of samples unmated for 7 days and then mated for 7 days. The other half are exposed mated for full 14 day test period.</td>
</tr>
<tr>
<td>Humidity</td>
<td>No damage 15 milliohm maximum change from initial Contact Resistance</td>
<td>EIA 364-31, Method II, Test Condition A: Subject mated connectors to 96 hours at 40C degrees with 90-95% relative humidity per</td>
</tr>
</tbody>
</table>

*Multifunction 6X Unshielded Connector*  
*Published SFF-8639 Rev 2.1*  
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A. Appendix (Informative): Fixed Cable (Receptacle)

Development of the Fixed Cable (Receptacle) of SFF-8639 has been put on hold.

The Fixed Cable (Receptacle) interface incorporates an active latching retention system to prevent accidental disconnect of the interface. The cable retention is a finger actuated latch engaging at the ends. This is different than the existing SATA and SAS connectors which use a friction detent on the secondary side. A "L" Shaped Key has also been incorporated into the alignment post of the "Fixed Cable" (Receptacle) to block insertion of legacy SAS and SATA drive plug connectors that do not have the related cable retention "cut-outs".

Please note: The Beam which corresponds to the "L" Shaped Key defined below is still defined in the figures above. This feature has been retained so that if a Cable Variant of the SFF-8639 is developed at a later date it can be used to block legacy SAS and SATA drives from being inserted into the Cable Variant of the SFF-8639 as defined in this informative section of this document.

A slot feature has also been incorporated into the plug which can be used for cable retention if a Cable Variant of the SFF-8639 is developed at a later date.
FIGURE A-3 CABLE RETENTION: CABLE MATED AND UNMATED

FIGURE A-4 CABLE RETENTION: REPRESENTATIVE CABLE HOUSING
FIGURE A-5 CABLE RETENTION: CABLE RETENTION W/"L" SHAPED KEY

FIGURE A-6 CABLE RETENTION: CABLE RELEASE CLEARANCE TOP VIEW

FIGURE A-7 CABLE RETENTION: CABLE RELEASE CLEARANCE SIDE VIEW
B. Appendix (Informative): Receptacle PCB Footprint

The following is one example of a potential PCB footprint that could be used with a receptacle. The PCB footprint has an impact on the Signal Integrity (SI) performance of the connector system and the actual geometry may vary between different vendor implementations. Being an example, the footprint may not meet the necessary SI performance for all vendor implementations, and it is not a requirement of this specification.

Note: This specification does not address the electrical performance characteristics of the host Printed Circuit Board (PCB) material and construction used in these applications. The PCB thickness, number of layers, layer stack up, trace layer location(s), copper plane anti-pads, etc., as all are major contributors to the final electrical characteristics of each unique application of the connector.

FIGURE B-1 RECEPTACLE PCB FOOTPRINT EXAMPLE