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or <ftp://ftp.seagate.com/sff>

**This specification was developed by the SFF Committee prior to it becoming the SFF TA (Technology Affiliate) TWG (Technical Working Group) of SNIA (Storage Networking Industry Association).**

The information below should be used instead of the equivalent herein.

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If you are interested in participating in the activities of the SFF TWG, the membership application 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 can be found at:

<http://www.snia.org/sff/specifications/SFF-8000.TXT>

The operations which complement the SNIA's TWG Policies & Procedures to guide the SFF TWG 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>

SFF Committee documentation may be purchased in hard copy or electronic form. SFF specifications are available at ftp://ftp.seagate.com/sff

SFF Committee

SFF-8402

Specification for

SFP+ 1X 28 Gb/s Pluggable Transceiver Solution (SFP28)

Rev 1.1 September 13, 2014

Secretariat: SFF Committee

Abstract: This specification defines the physical interface and general performance requirements of the mating interface for a 0.8mm card edge connector for use in multigigabit applications using the upper row of contacts. One such use is as the receptacle connector for Fibre Channel.

There are multiple generations of the Pluggable Transceiver Solution based on performance.

4 Gb/s	SFP+	SFF-8084
10 Gb/s	SFP10	SFF-8083
16 Gb/s	SFP16	SFF-8081
28 Gb/s	SFP28	SFF-8402

Connectors compliant to SFF-8402 are also compliant to SFF-8081, SFF-8083 and SFF-8084, but the reverse is not necessarily true.

This specification provides a common reference for systems manufacturers, system integrators, and suppliers. This is an internal working specification of the SFF Committee, an industry ad hoc group.

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.

Support: This specification is supported by the identified member companies of the SFF Committee.

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**EXPRESSION OF SUPPORT BY MANUFACTURERS**

The following member companies of the SFF Committee voted in favor of this industry specification.

Avago  
Emulex  
FCI  
Finisar  
Hewlett Packard  
IBM  
JDS Uniphase  
LSI  
Luxshare-ICT  
Molex  
QLogic  
Shenzhen  
Sumitomo  
TE Connectivity  
Volex

The following member companies of the SFF Committee voted to abstain on this industry specification.

Amphenol  
Dell Computer  
EMC  
Foxconn  
HGST  
MGE  
NetApp  
Oclaro  
Panduit  
Pioneer  
Sandisk  
Seagate  
Toshiba  
Western Digital

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 this claim or of any patent rights in connection therewith. Members of the SFF Committee, which advise that a patent exists, are required to provide a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

**Change History**

Rev 0.5 - Restructured to reduce content which duplicates other speed variations.  
Rev 0.6 - Clarified meaning of last paragraph in Section 3.1  
Rev 0.7 - Added multiple generations table to Abstract.  
Rev 0.9 - Changed title to correlate with QSFP+ family of specifications  
- Expanded Figure 3-1  
Rev 1.0 - Title change for commonality in style with QSFP  
Rev 1.1 - Updates to reflect creation of SFF-8071 and SFF-8419 specifications

## Foreword

The development work on this specification was done by the SFF Committee, an industry group. The membership of the committee since its formation in August 1990 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, connector location, between vendors.

The first use of these disk drives was in specific applications such as laptop portable computers and system integrators worked individually with vendors to develop the packaging. The result was wide diversity, and incompatibility.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of the SFF Committee as an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced more problems than the physical form factors of disk drives. 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.

Those companies which have agreed to support a specification are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF 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 Committee meetings are held during T10 weeks (see [www.t10.org](http://www.t10.org)), and Specific Subject Working Groups are held at the convenience of the participants. Material presented at SFF Committee meetings becomes public domain, and there are no restrictions on the open mailing of material presented at committee meetings.

Most of the specifications developed by the SFF Committee have either been incorporated into standards or adopted as standards by EIA (Electronic Industries Association), ANSI (American National Standards Institute) and IEC (International Electrotechnical Commission).

If you are interested in participating or wish to follow the activities of the SFF Committee, the signup for membership and/or documentation can be found at:  
[www.sffcommittee.com/ie/join.html](http://www.sffcommittee.com/ie/join.html)

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:  
<ftp://ftp.seagate.com/sff/SFF-8000.TXT>

If you wish to know more about the SFF Committee, the principles which guide the activities can be found at:  
<ftp://ftp.seagate.com/sff/SFF-8032.TXT>

Suggestions for improvement of this specification will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

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## 1 Scope

This specification defines the terminology and physical requirements for the mating interface and physical characteristics of the 0.8 mm card edge connector to support multi gigabit applications.

The using interfaces define requirements on the characteristic impedance and ability to transmit multi-gigabit signals to and from optical pluggable modules, and in some cases via cable assemblies. When this connector is used in such an application, it is subject to the requirements of those documents.

### 1.1 Application Specific Criteria

This connector is capable of meeting the interface requirements for the operation of T11 FC-PI-6 (Fibre Channel Physical Interface - 6).

## 2 References

The SFF Committee activities support the requirements of the storage industry, and it is involved with several standards.

### 2.1 Industry Documents

The following standards and specifications are relevant to this Specification.

T11/2221D	FC-PI-6 (Fibre Channel Physical Interface - 6
SFF-8071	SFP+ 1X 0.8mm Card Edge Connector
SFF-8418	SFP+ High Speed Electrical Interface
SFF-8419	SFP+ Low Speed Electrical Interface
SFF-8432	SFP+ Module and Cage
SFF-8433	SFP+ Ganged Cage Footprints and Bezel Openings
SFF-8472	SFP+ Management Interface

### 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 <ftp://ftp.seagate.com/sff/SFF-8000.TXT>

### 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://tinyurl.com/c4psg>).

EIA documents are available at <http://global.ihs.com>

### 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.

American	French	ISO
0.6	0,6	0.6
1,000	1 000	1 000
1,323,462.9	1 323 462,9	1 323 462.9

### General Description

This specification provides the required SFF specifications necessary to implement a 28 Gb/s transceiver module. It includes mechanical specifications required by the host i.e. the host connector, the host card cage and mechanical specifications of the pluggable module. In addition, the SFF specifications necessary to implement the module management interface and the common electrical/optical base specifications are referenced.

The mechanical form factor defined in SFF-8071 applies to all of the generations. However, as the performance requirements have increased over time, the performance compliance has also changed for the connector.

This specification identifies the documentation required to implement a Pluggable Transceiver Solution using an 0.8mm card edge connector for speeds suitable to the using applications, as illustrated in the following pictorial representation.

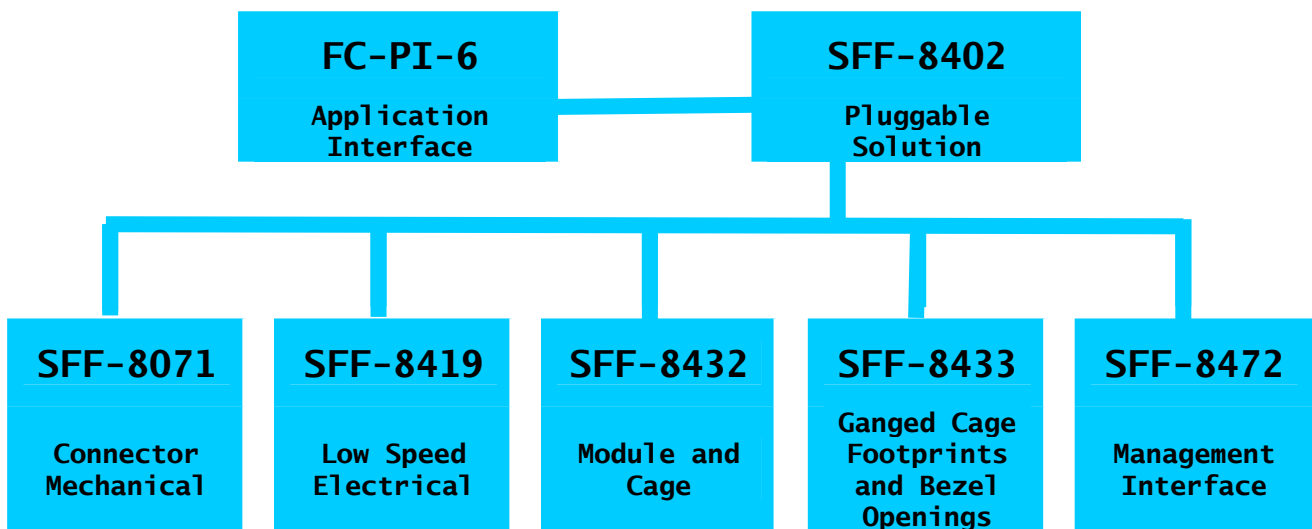
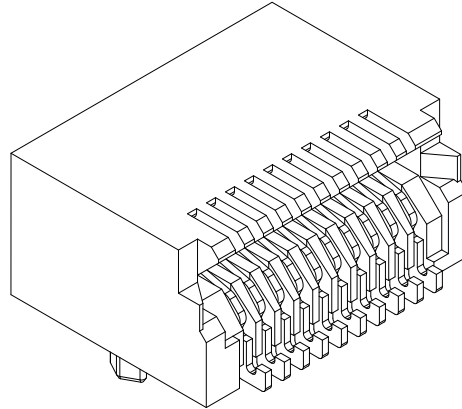


FIGURE 0-1 SPECIFICATIONS NEEDED TO IMPLEMENT A 28 GB/S PLUGGABLE TRANSCEIVER

## 2.5 Connector Configuration

The mechanical dimensioning of this specification provides backwards mechanical compatibility between generations of various speeds. Figure 3-2 illustrates one style of receiving body.



**FIGURE 0-2 GENERAL VIEW OF RIGHT-ANGLED BODY RECEPTACLE**

The mechanical representation of this connector looks the same as previous generations, however, there may have been changes to the internal design which enable it to perform at the characteristics required of this specification.

Connectors manufactured to meet this specification can be expected to perform satisfactorily in systems designed for lower data rates, but they may not meet the needs of systems that require higher data rates.