

SFF specifications are available at <http://www.snia.org/sff/specifications>  
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.

POINTS OF CONTACT:

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Email: [SFF-Chair@snia.org](mailto:SFF-Chair@snia.org)

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>

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

SFF Committee

**SFF-8665**

Specification for

**QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)**

Rev 1.9      June 29, 2015

Secretariat: SFF Committee

**Abstract:** This specification defines a 28 Gb/s QSFP+ pluggable transceiver solution popularly known as QSFP28. It gathers the appropriate/unique Base Electrical, Optical, Common Management, Module/Plug Formfactor, Host connector and cage specifications into a clearly delineated solution for users.

There are multiple generations of QSFP+

Forwarded to Standardization

10 Gb/s    QSFP10    EIA-964/SFF-8436

Continuing Projects

10 Gb/s    QSFP10    SFF-8635

14 Gb/s    QSFP14    SFF-8685

28 Gb/s    QSFP28    SFF-8665

Connectors compliant to SFF-8665 are also compliant to SFF-8685, and SFF-8635, but the reverse is not necessarily true.

This document provides a common specification for systems manufacturers, system integrators, and suppliers. This is an internal working document 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.

**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  
Foxconn  
Hewlett Packard  
HGST  
JDS Uniphase  
Molex  
NetApp  
Oclaro  
Panduit  
TE Connectivity  
Volex

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

Amphenol  
Dell Computer  
EMC  
IBM  
LSI  
Luxshare-ICT  
MGE  
Pioneer  
Sandisk  
Seagate  
Toshiba

**Change History**

**Rev 1.6:**

- Moved referenced SFF specs to 2.1 Industry Documents and expanded the list
- Added SFF-8672 and SFF-8683 to Figure 3-1 plus complementary sections
- Added using interfaces to Application Specific Criteria

**Rev 1.7**

- Clarified introductory paragraph of SFF-8662 and SFF-8672

**Rev 1.8**

- Add multiple generations table to Abstract.

**Rev 1.9**

- Modified Figure 3-1 to include explanatory details.

## Published

### 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.

**Published****CONTENTS**

|     |                                       |    |
|-----|---------------------------------------|----|
| 1   | Scope                                 | 5  |
| 1.1 | Application Specific Criteria         | 5  |
| 2   | References                            | 5  |
| 2.1 | Industry Documents                    | 5  |
| 2.2 | SFF Specifications                    | 5  |
| 2.3 | Sources                               | 5  |
| 2.4 | Conventions                           | 6  |
| 3   | Introduction                          | 7  |
| 4   | Overview of Referenced Specifications | 8  |
| 4.1 | SFF-8636                              | 8  |
| 4.2 | SFF-8661                              | 9  |
| 4.3 | SFF-8662                              | 10 |
| 4.4 | SFF-8663 and SFF-8683                 | 11 |
| 4.5 | SFF-8672                              | 12 |
| 4.6 | SFF-8679                              | 13 |

**FIGURES**

|            |  |    |
|------------|--|----|
| Figure 3-1 | Specifications Needed to Implement a 28 Gb/s Pluggable Transceiver | 7  |
| Figure 4-1 | Management Interface   | 8  |
| Figure 4-2 | Typical Cable Plug and Pluggable Module                            | 9  |
| Figure 4-3 | SFF-8662 Host Connector Fixed Receptacle                           | 10 |
| Figure 4-4 | SFF-8663 and SFF-8683 Pluggable Module Cages                       | 11 |
| Figure 4-5 | SFF-8672 Host Connector Fixed Receptacle                           | 12 |
| Figure 4-6 | Application Reference Model  | 13 |

## Published

SFF Committee --

### QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)

## 1 Scope

In an effort to broaden the applications for storage devices, an ad hoc industry group of companies representing system integrators, peripheral suppliers, and component suppliers decided to address the issues involved.

The SFF Committee was formed in August, 1990 and the first working document was introduced in January, 1991.

### 1.1 Application Specific Criteria

This solution is capable of meeting the interface requirements for the operation of:

- InfiniBand IBTA EDR
- IEEE 802.3bj 100 GbE

## 2 References

### 2.1 Industry Documents

The following interface standards and specifications are relevant to this Specification.

- GR-253-CORE
- IEEE Std 802.3bj 100 GbE
- InfiniBand Architecture Specifications FDR and EDR
- FC-PI-5, FC-PI-6
- SAS-3
- ESD specifications EN61000-4-2, JEDEC JESD22-A114-B
- Optical Connectors: MPO:IEC 61754-7, Dual LC: IEC 61754-20
- Aligned key (Type B) MPO patch cords: TIA-568
- Dual LC optical patch cord: TIA/EIA-604-10A
- Thermal specifications: NEBS GR-63
- SFF-8636 Shielded Cables Common Management Interface
- SFF-8661 QSFP+ 28 Gb/s 4X Pluggable Module
- SFF-8662 QSFP+ 28 Gb/s 4X Connector (Style A)
- SFF-8663 QSFP+ 28 Gb/s Cage (Style A)
- SFF-8672 QSFP+ 28 Gb/s 4X Connector (Style B)
- SFF-8679 QSFP+ 4X Base Specification
- SFF-8683 QSFP+ 14 Gb/s Cage

### 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://www.techstreet.com/incitsgate.tmp1>).

**Published****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.

| <b>American</b> | <b>French</b> | <b>ISO</b>  |
|-----------------|---------------|-------------|
| 0.6             | 0,6           | 0.6         |
| 1,000           | 1 000         | 1 000       |
| 1,323,462.9     | 1 323 462,9   | 1 323 462.9 |

## Published

### 3 Introduction

This specification provides the required SFF specifications necessary to implement a 28 Gb/s pluggable 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 specifications provide a common solution for combined four-channel ports that support Ethernet and/or Fibre Channel and/or Infiniband and/or SAS and/or SONET/SDH specifications. This specification encompasses design(s) capable of supporting multimode and single mode modules, passive copper, active copper and active optical cables.

The Ethernet, Fibre Channel, InfiniBand, SAS, SONET/SDH, and other standards define performance requirements on the characteristic impedance and ability to transmit multi-gigabit signals for cable assemblies and backplanes. The connectors used in such applications are subject to the requirements of the appropriate standard.

A flow chart of the required SFF specifications is shown in Figure 3-1.

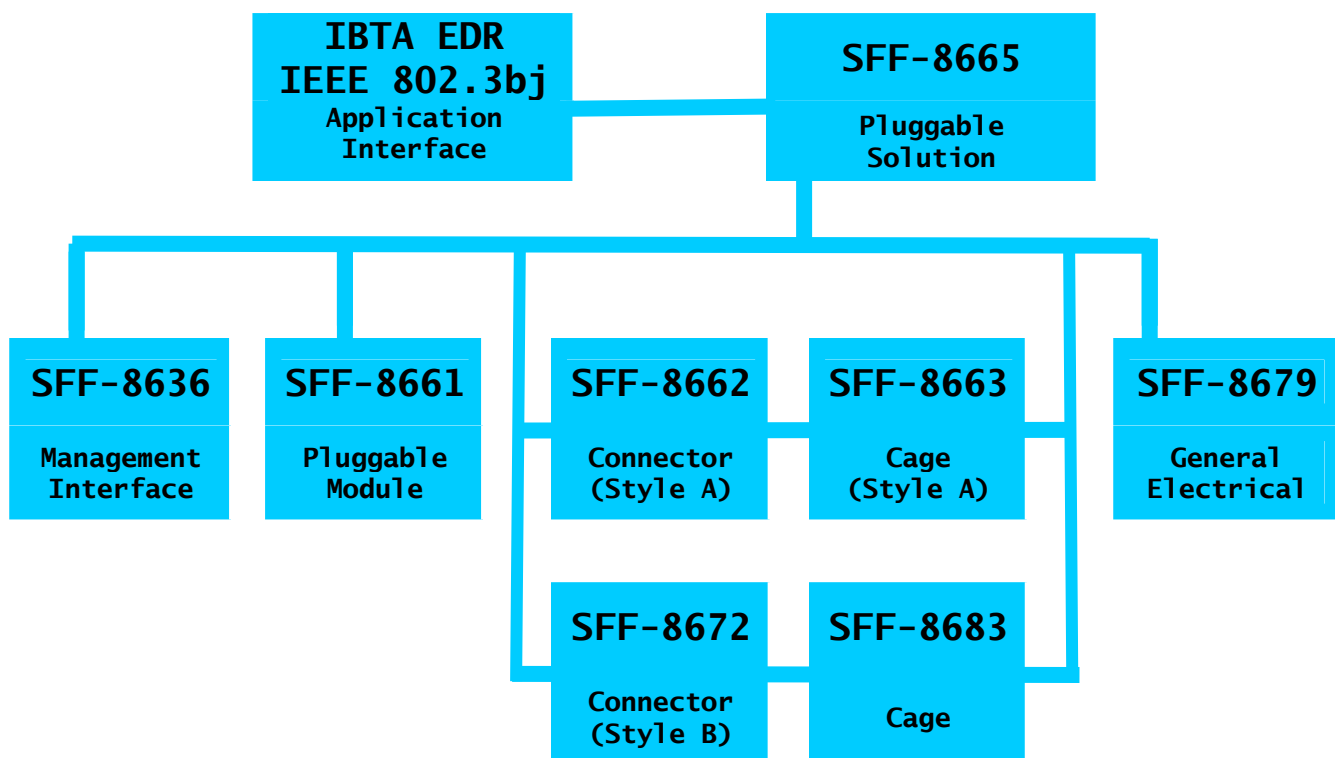


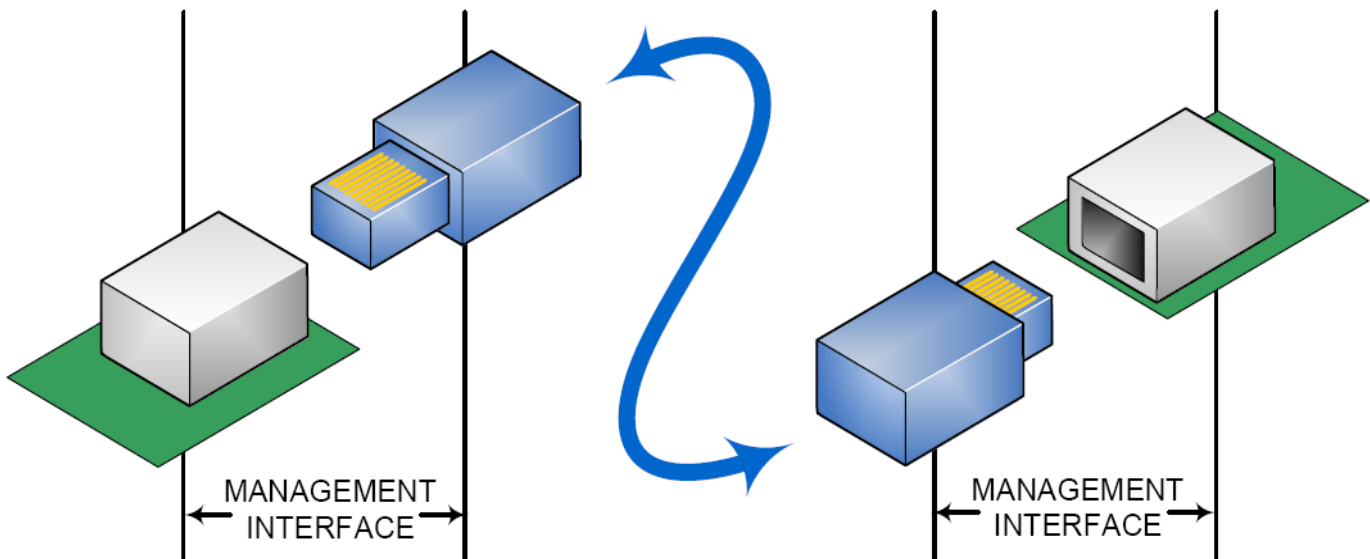
FIGURE 3-1 SPECIFICATIONS NEEDED TO IMPLEMENT A 28 GB/S PLUGGABLE TRANSCEIVER



**Published****4 Overview of Referenced Specifications****4.1 SFF-8636**

The Shielded Cables Common Management Interface specification defines a common management interface for 4-lane cable assemblies. It defines a common non-volatile memory map and protocol utilized for managed external cable interface implementations.

Memory map details and communication protocol used to transfer the information are described within this specification. This approach facilitates a common memory map and management interface for applications with different mechanical, physical layer and otherwise different implementations.

**FIGURE 4-1 MANAGEMENT INTERFACE**

**Published****4.2 SFF-8661**

This specification defines the terminology and mechanical requirements for a pluggable transceiver module/plug.

It is also intended to facilitate the implementation of 1 x "n" ganged and the 2 x "n" stacked cage configurations based on the mechanical form factor defined in this specification.

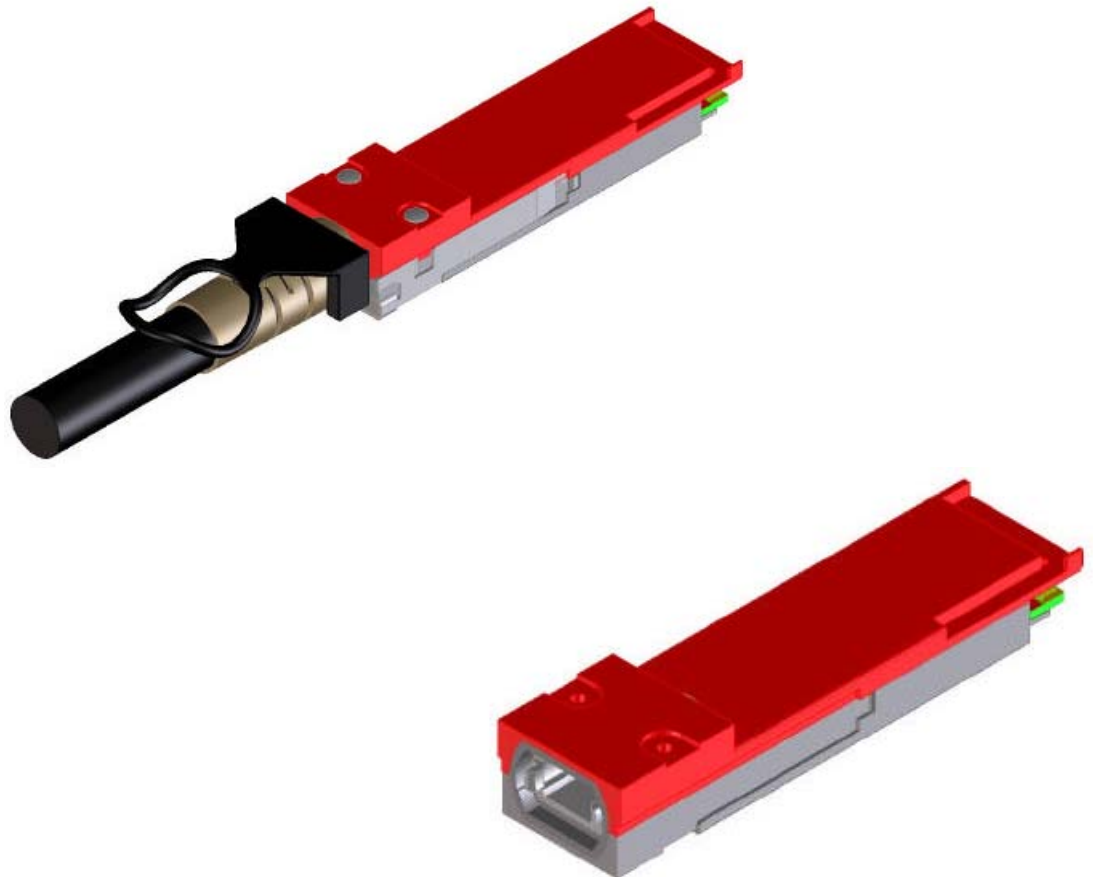
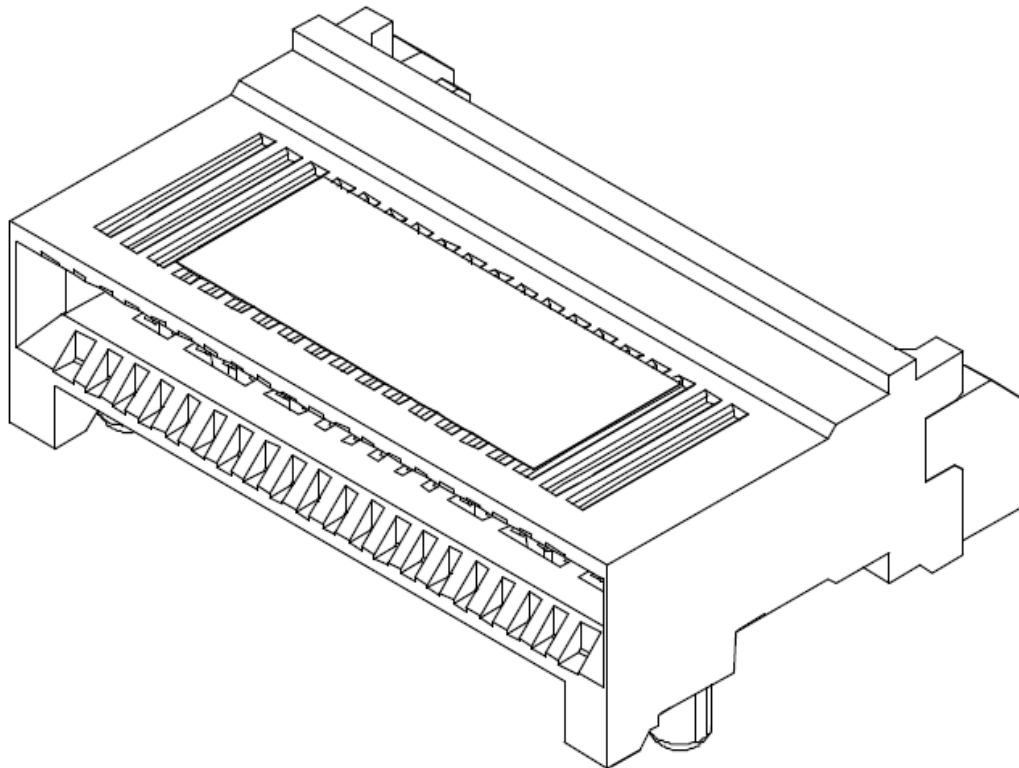


FIGURE 4-2 TYPICAL CABLE PLUG AND PLUGGABLE MODULE

**Published****4.3 SFF-8662**

This specification defines the physical interface and general performance requirements of the receptacle designed for use in high speed serial interconnect applications when paired with SFF-8663.

The receptacle is used as the mating interface of the cable plug and pluggable module.

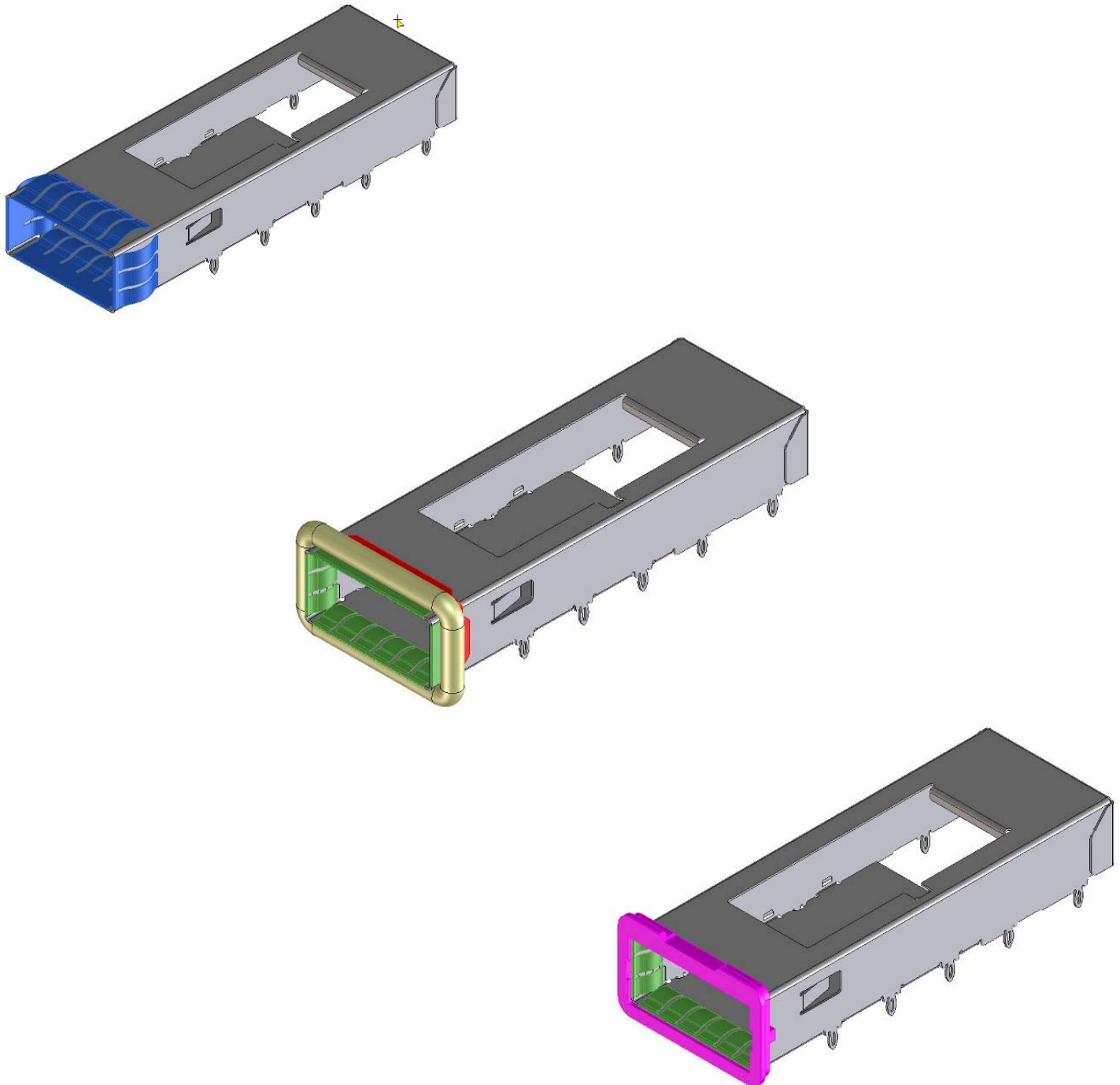


**FIGURE 4-3 SFF-8662 HOST CONNECTOR FIXED RECEPTACLE**

**Published****4.4 SFF-8663 and SFF-8683**

The mechanical dimensioning of the cages provides backwards mechanical compatibility between generations of cable plugs and pluggable modules.

SFF-8663 facilitates the implementation of 1 x "n" ganged cages and the 2 x "n" stacked cage configurations.



**FIGURE 4-4 SFF-8663 AND SFF-8683 PLUGGABLE MODULE CAGES**

**Published****4.5 SFF-8672**

This specifications defines the physical interface and general performance requirements of the receptacle designed for use in high speed serial interconnect applications when paired with SFF-8683.

The receptacle is used as the mating interface of the cable plug and pluggable module.

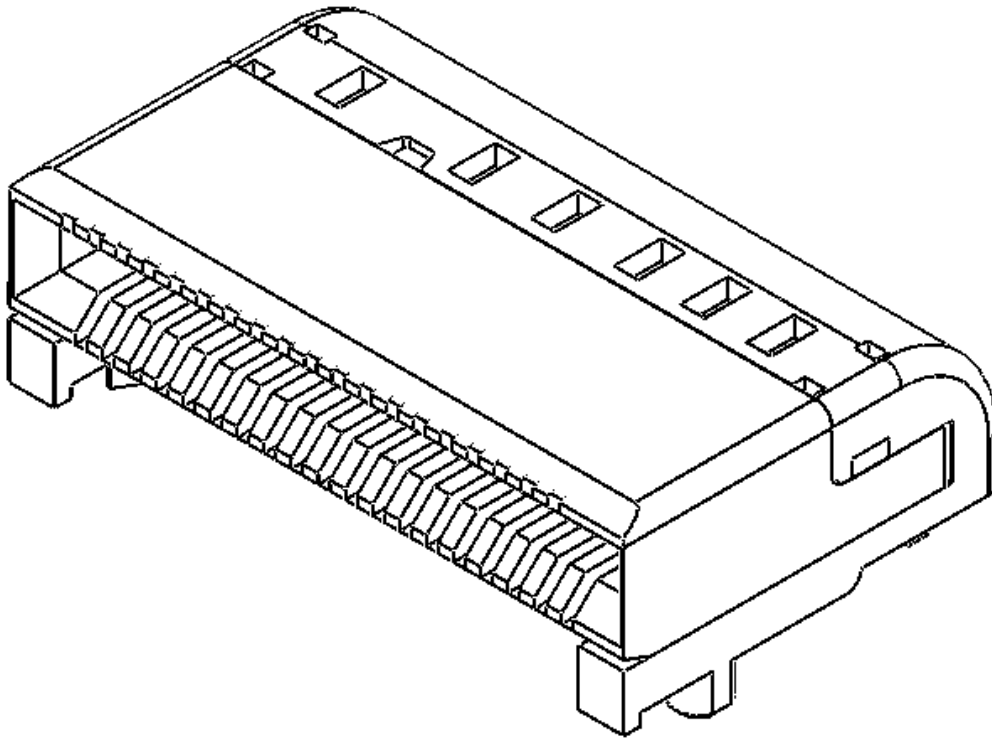
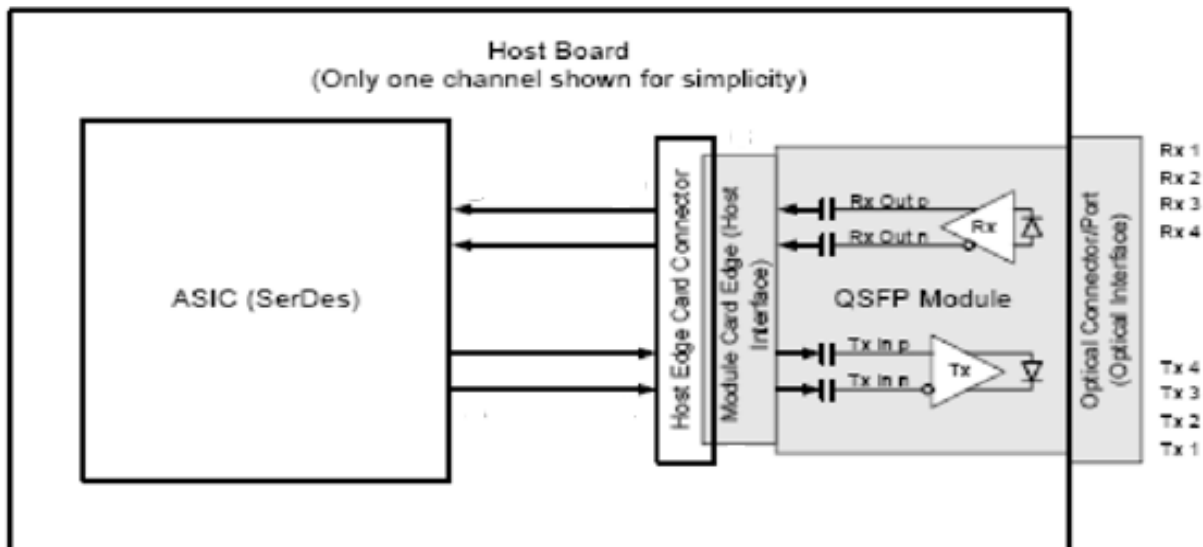


FIGURE 4-5 SFF-8672 HOST CONNECTOR FIXED RECEPTACLE

**Published**
**4.6 SFF-8679**

This specification defines the pin outs, the electrical, the optical, the power supply, the ESD and the thermal characteristics of the cable plugs and pluggable modules.



**FIGURE 4-6 APPLICATION REFERENCE MODEL**