SFF specifications are available at http://www.snia.org/sff/specifications
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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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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:
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SFF Committee documentation may be purchased (see 2.3).
SFF Specifications available at ftp://ftp.seagate.com/sff

SFF Committee

SFF-8421 Specification for

HSSDC-2 Shielded Connections

Rev 2.7 January 24, 2006

Secretariat: SFF Committee

Abstract: This specification defines the physical interfaces and performance requirements for HSSDC-2 (High Speed Serial Data Connector -2) connectors and retention schemes to be used for Fibre Channel, Infiniband, SSA, and other duplex serial copper applications. Other uses of this general purpose connection system are also possible. These 7 position HSSDC-2 connectors are based on 1.25mm (0.05") ribbon style technology.

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

This document 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 document.

The description of a connector in this document 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 document is supported by the identified member companies of the SFF Committee.

Revision History: See 5.3

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EXPRESSION OF SUPPORT BY MANUFACTURERS

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

Broadcom
EMC
ENDL
Hewlett Packard
Hitachi Cable
Madison Cable
Sun Microsystems
Toshiba America
Tyco AMP

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

Amphenol

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

Agilent
Comax
FCI
Foxconn
Fujitsu Compnts
Fujitsu CPA
Hitachi GST
IBM
Intel
LSI Logic
Maxtor
Micrel
Molex
Picolight
Seagate
Unisys
Vitesse Semi
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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 this claim or of any patent rights in connection therewith. The patent holder has filed 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.

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), 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

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.

SFF Committee --

HSSDC-2 Shielded Connections

1. Scope

This specification defines the terminology and physical requirements for shielded HSSDC-2 (High Speed Serial Data Connector) connections, complete connectors, and the immediate electrical neighborhood of the connector proper that also influences the behavior of the connector. There is a single mating interface for all versions.

The HSSDC-2 connector style is specified in Fibre Channel and Infiniband and may be suitable for use with other high speed serial interface standards. These are all external shielded systems that require inter enclosure connections. These standards only specify the mating interface and have no specific performance requirements. This specification defines such requirements.

The Fibre Channel and Infiniband standards call out the contact position numbering for the respective application uses and are the normative sources.

The mating sides (including retention) are compatible for all versions of complete connector and the termination side is specified for a variety of practically important schemes.

The HSSDC-2 system was designed to satisfy the needs for gigabit serial data transmissions in a nominal 150 ohm differential balanced copper link. The shield connector mating interface provides an EMI-tight (Electro Magnetic Interference) seal. Design goals were minimization of crosstalk, minimum transmission line impedance discontinuity across the connector, and management of EMI (caused by the connector or its mating interfaces).

The transmission line impedance of the connector itself (not including the termination interface to the wire or board) matches the electrical media within the tolerances allowed for the media. This connection scheme may be used in multiple places within a cabling environment. Though optimized for a 150 ohm environment this connector will function acceptably at other impedance levels (to be optimized on a case by case basis).

The retention scheme consists of a single press-to-release catch. The look and feel of the HSSDC-2 family is suited to advanced high speed transmission applications (e.g. panel space requirements are less than many alternative connectors).

The physically robust design (e.g. no pins to bend) and relatively small size enable the HSSDC-2 to be usable in all applications from notebooks to data centers. The connector is of a straightforward construction which does not rely on advanced materials or processes.

This specification defines the requirements on the mating and termination sides of the connectors to enable functional multiple sourcing of the complete connectors. The construction of the connectors between the mating and termination sides are not defined by this specification.

The connectors specified are fully shielded at the mating interface with provision for connecting shields together and for terminating shields, therefore specifications are included for the backshell-to-connector interfaces. Fibre Channel and Infiniband standards presently incorporate requirements on the characteristic

impedance and ability to transmit Gigabaud signals for cable assemblies and backplanes. As the HSSDC-2 connector system may form part of this interconnect it is also subject to these requirements.

The high speed electrical performance requirements for the connector and its electrical neighborhood are specified in SFF-8410 which is hereby incorporated by reference into this document. These requirements include operation at 1 Gigabit/s and higher rates.

1.1 Description of Clauses

Clause 1 contains the Scope and Purpose.

Clause 2 contains Referenced and Related Standards and SFF Specifications.

Clause 3 contains the list of Figures and Tables

Clause 4 contains the General Description

Clause 5 contains the Definitions and Conventions

Clause 6 defines the Connector Descriptions and Dimensions.

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 interface standards are relevant to this Specification.

- X3.230-1994 FC-PH Fibre Channel Physical Interface
- X3.297-199x FC-PH-2 Fibre Channel Physical Interface -2
- X3.303-199x FC-PH-3 Fibre Channel Physical Interface -3
- INCITS 1306 Fibre Channel Physical Interface
- IEEE 802.3z Gigabit Task Force

2.2 SFF Specifications

The 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

2.3 Sources

Copies of SFF Specifications are available by joining the SFF Committee as an Observer or Member.

14426 Black Walnut Ct	408-867-6630x303
Saratoga	408-867-2115Fx
CA 95070	FaxAccess: 408-741-1600

Electronic copies of documents are also made available via CD_Access, a service which provides copies of all the specifications plus SFF reflector traffic. To sign up to receive electronic copies of specifications via the CD_Access service visit http://tinyurl.com/85fts.

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3. Tables of Figures and Tables

3.1 TABLE OF FIGURES

3.2 TABLE OF TABLES

4. General Description

The HSSDC-2 connection system is based on ribbon or leaf style contacts while other alternatives use round pins. This ribbon style offers single wipe and is based on proven connector technology using the mechanically robust ribbon or leaf contact style. It is very difficult to damage the contacts.

HSSDC-2 connectors find their most important application where signals have rise times typically in the range of 250 ps and where positive retention is needed but ease of insertion and removal is also desired. This covers virtually all of the external inter-enclosure applications for gigabit serial applications that use balanced copper media for transmission.

The shield contact is required to make contact before any of the signal contacts upon insertion and to break contact only after all contacts are separated upon removal. This ensures that any ground potential differences between enclosures are first exposed to the shield and thereby minimizes the risk of damaging the sensitive input and output stages of the transceivers when the signal contacts are mated.

Figure 1 shows the required sequencing of the shield and signal grounds.

The dimension shown in Figure 1 is for reference only. The detail dimensions are shown in Figure 6 and Figure 7.

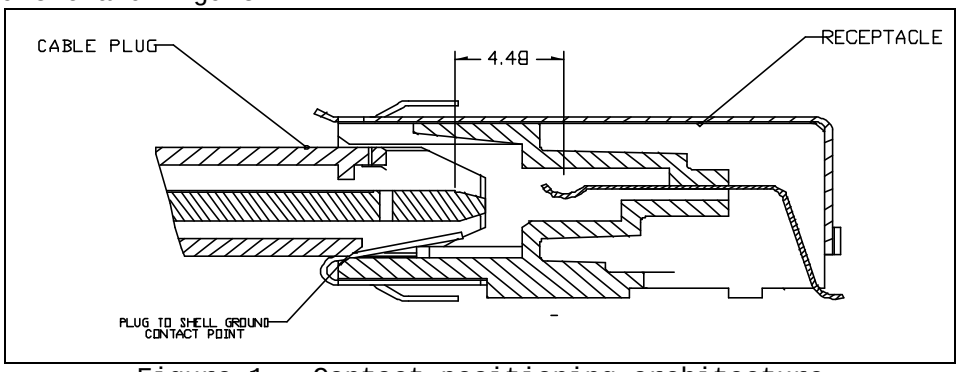


Figure 1 – Contact positioning architecture

5. Definitions and Conventions

5.1 Definitions

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

Advanced grounding contacts: Connector contacts that make 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

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 document “fixed” is specifically used to describe the mating side gender illustrated in Figure 2.

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 document “free” is specifically used to describe the mating side gender illustrated in Figure 2.

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.

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

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

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.

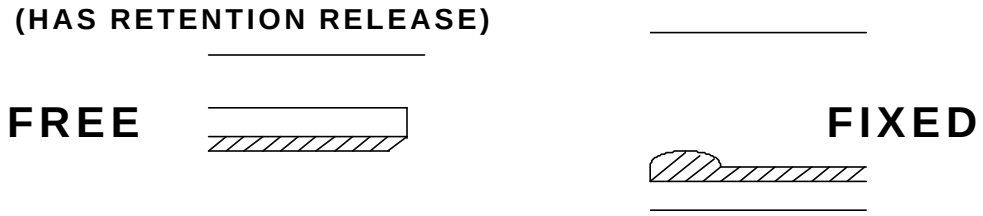
Straddle mount: A connector design style and a printed circuit board design style that uses surface mount termination points on both sides of the board. The connector is frequently centered between the top and bottom surfaces of the board.

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.



THE FIXED GENDER IS USED ON THE DEVICE SIDE EXCEPT WHEN USED WITH WIRE TERMINATION

Figure 2 – Mating side gender definition

5.2 Conventions

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

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

5.3 Revision History

The following changes have been made to the Published Rev 2.4 dated June 20, 2002.

Figure 4. Remove 14.10 +/- 0.13

Figure 5. Remove 32.65 and 64.65 dimensions
Change 13.80 +/- 0.10 and 13.80 +/- 0.20 to 15.3 Max

Figure 6. Change 9.00 +/- 0.13 to 8.87 Min
Add 2.80 Max dimension for lead-in chamfer depth
Change tolerance on 1.00 +/- 0.13 to +/- 0.25 in detail G
Add +/- 3 degree tolerance in detail G
Change tolerance on 1.00 +/- 0.13 to +/- 0.25 on bottom chamfer in section X-X.
Change tolerance on 1.00 +/- 0.13 to +0.25/-0.13 on top chamfer in section X-X.
Remove 20 degrees, add 0.38 +0.20/-0.07 for chamfer depth in section X-X.
Add requirement for printed circuit board to meet IPC-A-600, class 2.

Figure 7. Add +/-0.13 tolerance to 5.75 dimension
Add 1.80 +/- 0.08 slot dimension, remove 1.87 dimension
Change 4.00 REF to 3.95 Min.
Add contact location of 2.00 max.

6. Connector descriptions:

6.1 Complete connector options

The complete connectors listed in this section are supported in this document. The overall view of the mating sides are shown in Figure 3.

FREE MATING SIDE CONNECTORS (used on the side that has the retention release) Refer to figures (5) and (6) for mating side specifications.

CONNECTOR NAME	OVERVIEW	OUTLINE	TERMINATION SIDE
Free Cable	Figure 3	Figure 5	NA

FIXED MATING SIDE CONNECTORS (used on the device side except when used with cable terminations) Refer to figures (4) and (7) for mating side specifications.

CONNECTOR NAME	OVERVIEW	OUTLINE	TERMINATION SIDE
Fixed Board Right Angle Surface Mount	Figure 3	Figure 4	Figure 8

Only the physical dimensions and a table of the most important performance requirements are listed below.

6.2 Performance and compatibility requirements

6.2.1 Low frequency performance requirements

HSSDC-2 shielded connectors shall meet the performance requirements specified in table (2). These requirements are all for the connector proper and do not include the high speed requirements that ensure adequate operation at gigabit/s and above rates.

Table 1 – Connector ratings

Items	Specifications
1) Current	0.5 ampere maximum
2) Voltage	30 volts DC
3) Temperature	-10 to 60°C

Table 2 – Low frequency performance requirements

Parameter	Requirements
Insulation Resistance	1000 Megohms minimum
Dielectric withstanding voltage	350 VAC at sea level. 1 minute hold with no breakdown or flashover
Contact Resistance Non-Shield Contacts	70 milliohms maximum initial; 20 milliohms maximum change

Table 3 – Mechanical Requirements

Items	Conditions	Specifications
1) Durability	Mating speed: 500 cycles per hour maximum	250 cycles
2) Insertion Force	Measurement speed: 12.7mm per minute maximum	See Table 4
3) Withdrawal Force	Measurement speed: 12.7mm per minute maximum with retention latch disengaged	See Table 4

Table 4 – Insertion and Withdrawal Force

Items	
Insertion Force (N Maximum)	30
Withdrawal Force (N Maximum)	30

Table 5 – Environmental Requirements

Test Items	Test Conditions	Specifications
1) Durability	Mating speed should be 500 cycles per hour maximum	250 cycles
2) Vibration, random	EIA-364-28, Test Condition VII, Condition D.	Subject mated specimens to 3.10 G's rms between 20-500 Hz for 15 minutes in each of 3 mutually perpendicular planes
3) Physical shock	EIA-364-27, Method H.	Subject mated specimens to 30 G's half-sine shock pulses of 11 milliseconds duration. 3 shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks.
4) Thermal shock	EIA-364-32	Subject unmated specimens to 5 cycles between –10 and 70°C
5) Temperature Life	EIA-364-17, Method A, Test Condition 2, Test Time Condition C	Subject mated specimens to 70°C for 500 hours
6) Humidity-temperature cycling	EIA-364-31 Method III.	Subject unmated specimens to 10 cycles (10 days) between 25 and 65°C at 80 to 100% RH
7) Mixed flowing gas	EIA-364-65, Class IIA	Subject specimens to environmental Class IIA for 7 days unmated, and 7 days mated.

6.2.2 Connector performance (After test)

The connector should satisfy the minimum performance indicated in Table 6

Note – On Table 6, items with a "Y" should be measured/observed. Items with "N" should not be required measurement or observation.

Table 6 – Connector performance (After test)

Items	Insertion withdrawal force	Contact resistance	Insulation resistance	Dielectric withstanding voltage	Appearance check
Condition	Satisfy Table 4	Resistance change should be 20 milliohms maximum	1000 Megohms minimum	Satisfy Table 2	There should be no defect
Durability	Y	Y	N	N	Y
Vibration	Y	Y	N	N	Y
Physical shock	Y	Y	N	N	Y
Thermal shock	N	N	Y	Y	Y
Temperature Life	N	Y	N	N	Y
Humidity-temperature cycling	N	N	Y	Y	Y
Mixed flowing gas	N	Y	N	N	y

6.2.3 High frequency performance requirements

The requirements for the high speed performance are enabled by reference to SFF-8410, a separate SFF document that defines testing methodology and some performance requirements. These high speed performance requirements are incorporated into the HSSDC-2 specification by reference and constitute an essential part of the HSSDC-2 specification. For convenience these requirements are not duplicated here.

6.2.4 PCB compatibility requirements

The physical compatibility requirements for use with printed circuit boards are given in table (2). Board thicknesses and/or assembly processes that require tail lengths other than that given in table (2) are not compatible with the connectors defined in this document.

Table 7 – Printed circuit board compatibility requirements

Termination Side Style	Printed Circuit Board Thickness	
	MIN (MM / INCHES)	MAX (MM / INCHES)
Fixed Board Right Angle Surface Mount*	1.57 / 0.062	2.36 / 0.093
* This dimension necessary to accommodate board retention feature that penetrates the board.		

6.3 Dimensional requirements

The drawings in this section use the dimensioning conventions described in ANSI-Y14.5M, Dimensioning and tolerancing. All dimensions are in millimeters.

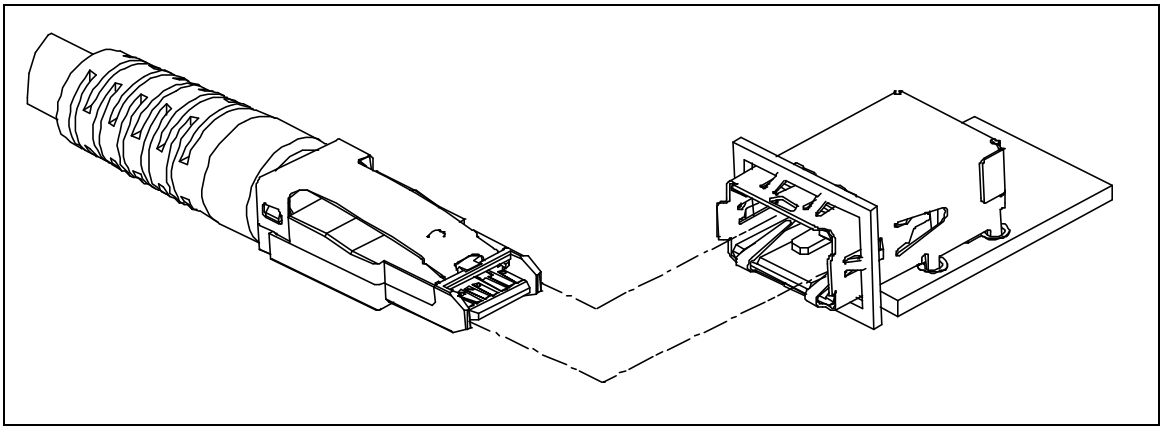


Figure 3 – General view of mating sides

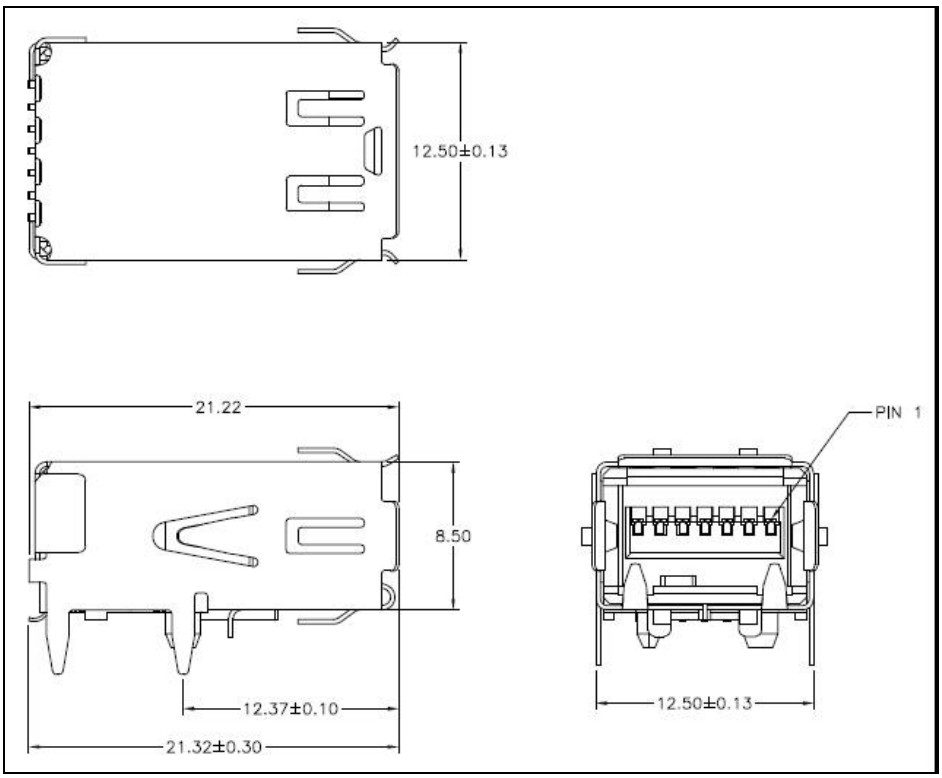


Figure 4 – Fixed board right angle surface mount outline dimensions

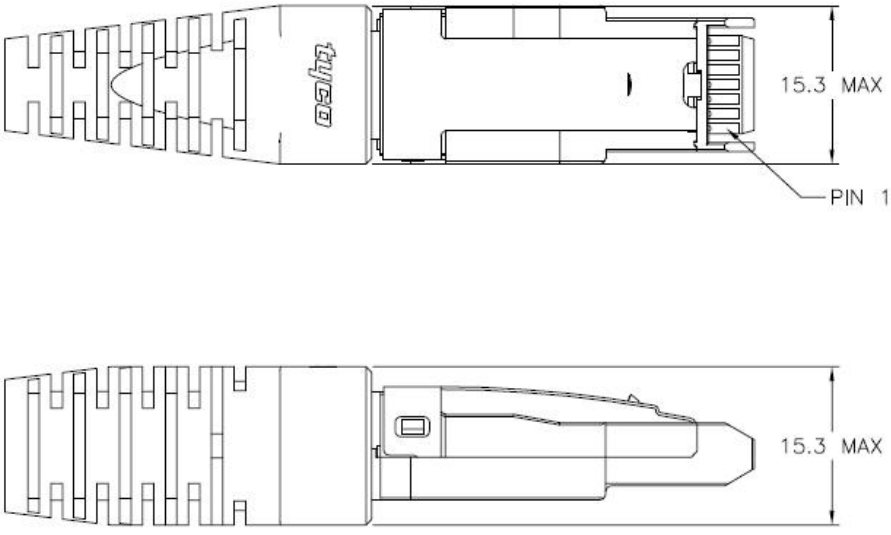
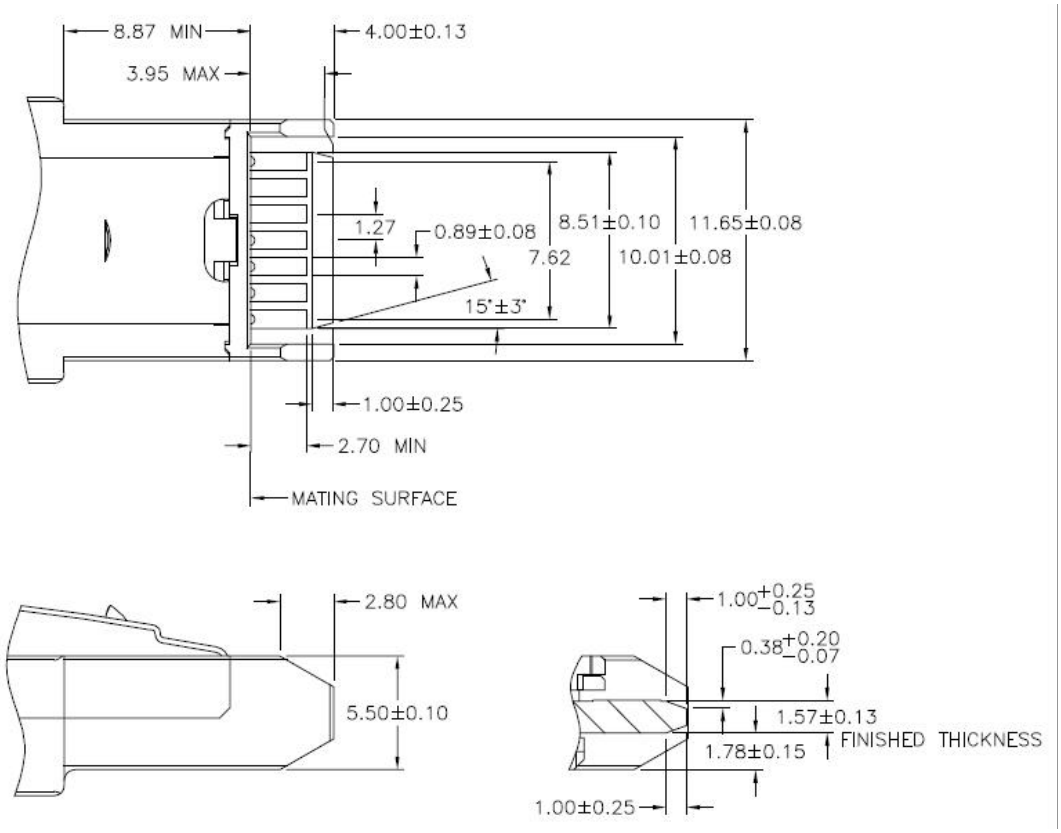


Figure 5 – Free cable outline dimensions



Plug printed circuit board to meet requirements of IPC-A-600, Class 2

Figure 6 – Free cable mating dimensions

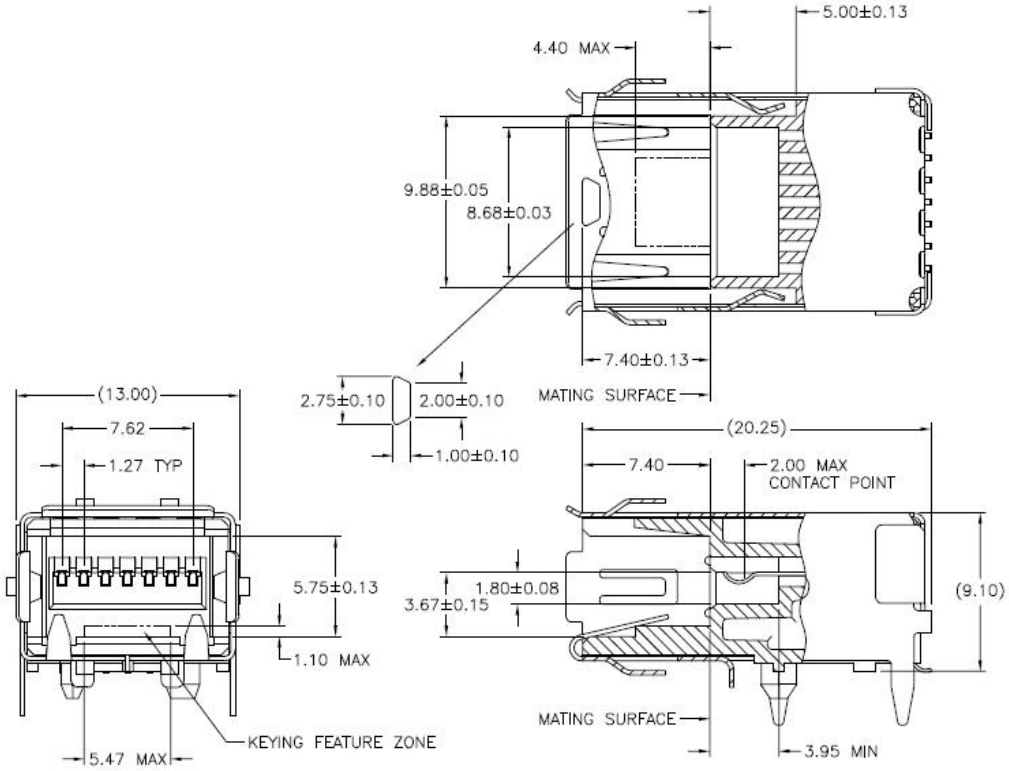


Figure 7 - Fixed mating side dimensions

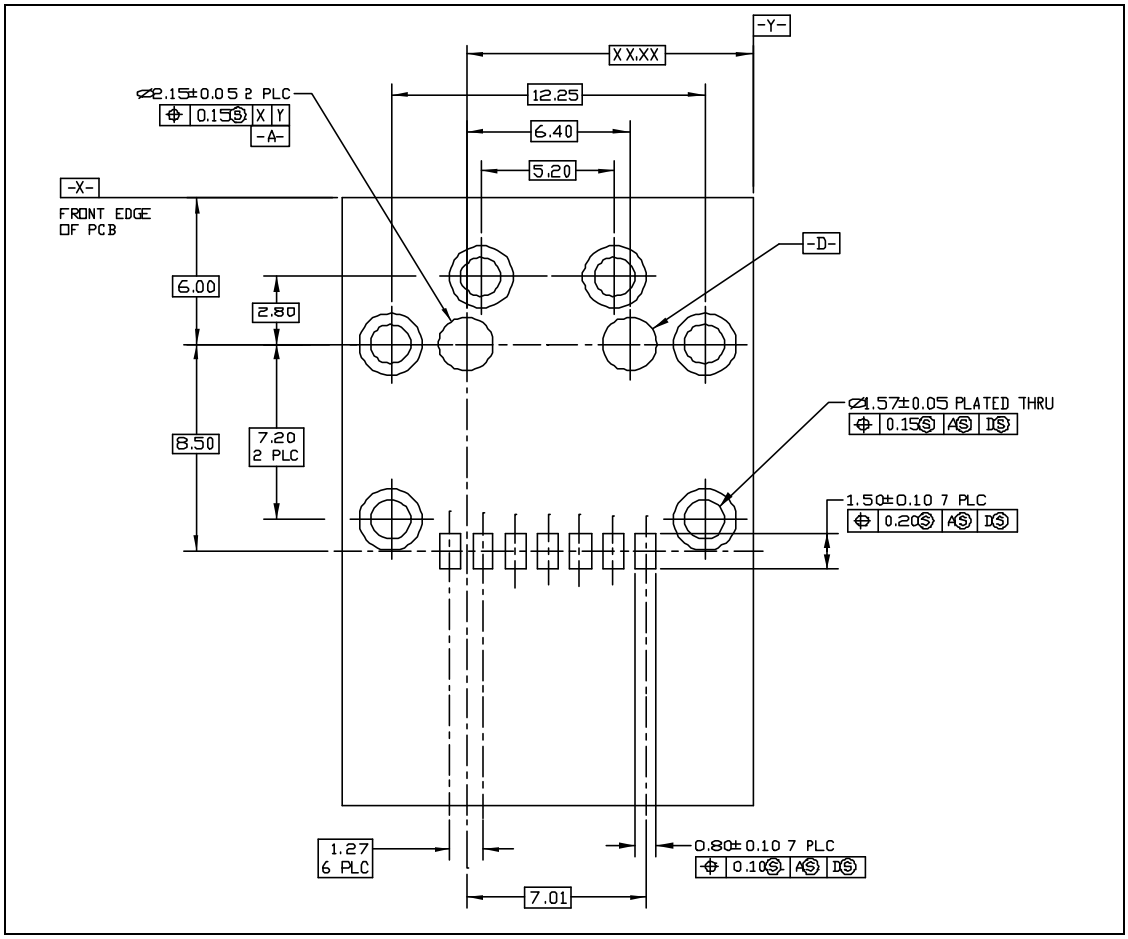


Figure 8 – Fixed board right angle surface mount footprint

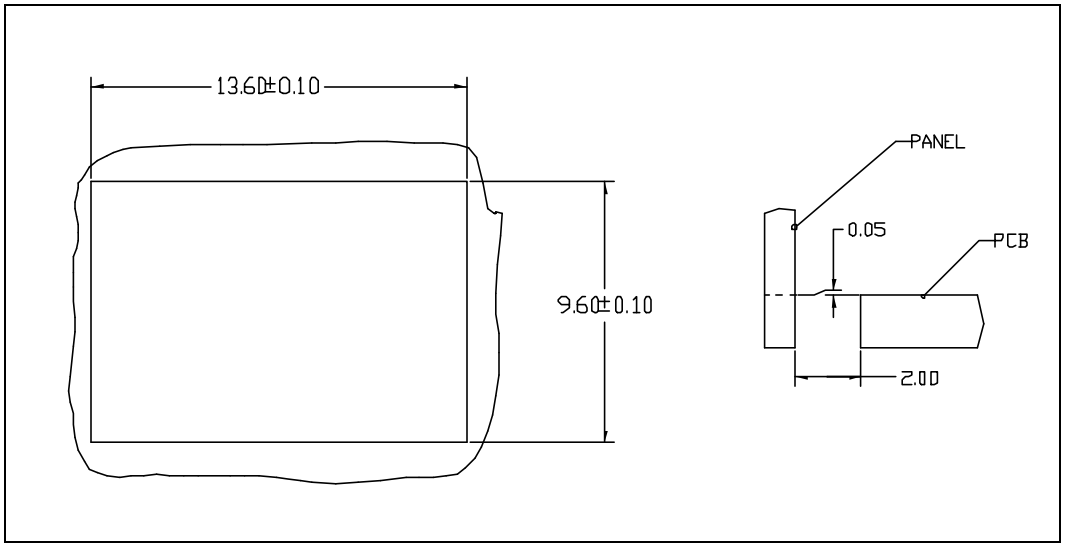


Figure 9 – Bulkhead cutout fixed board right angle

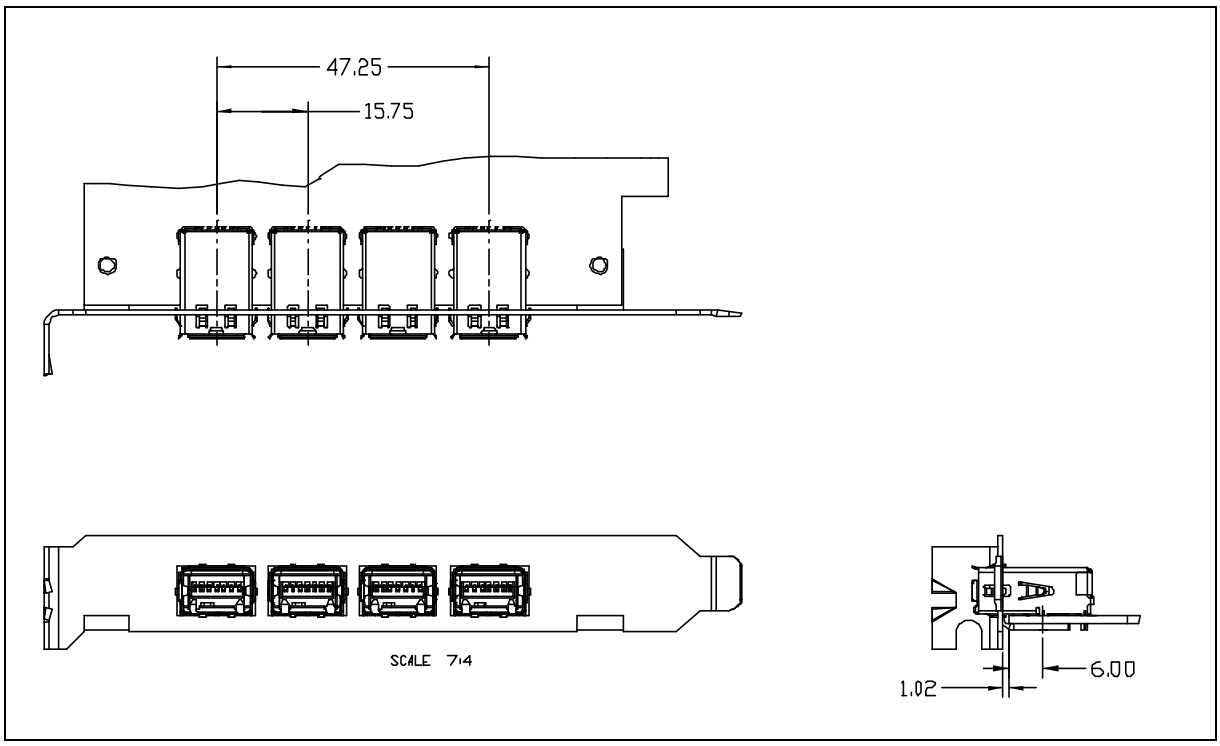


Figure 10– PCI bracket 4 bay dimensions fixed board right angle

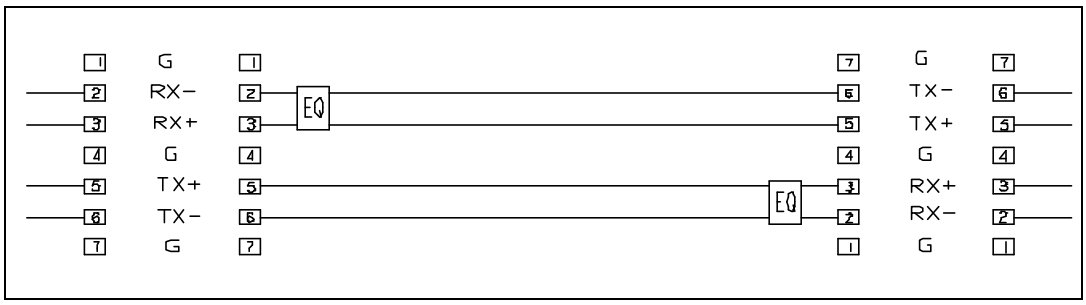


Figure 11 – Fibre Channel pin assignments
G = Ground, RX = Receive, TX = Transmit
EQ = Equalization (Optional)

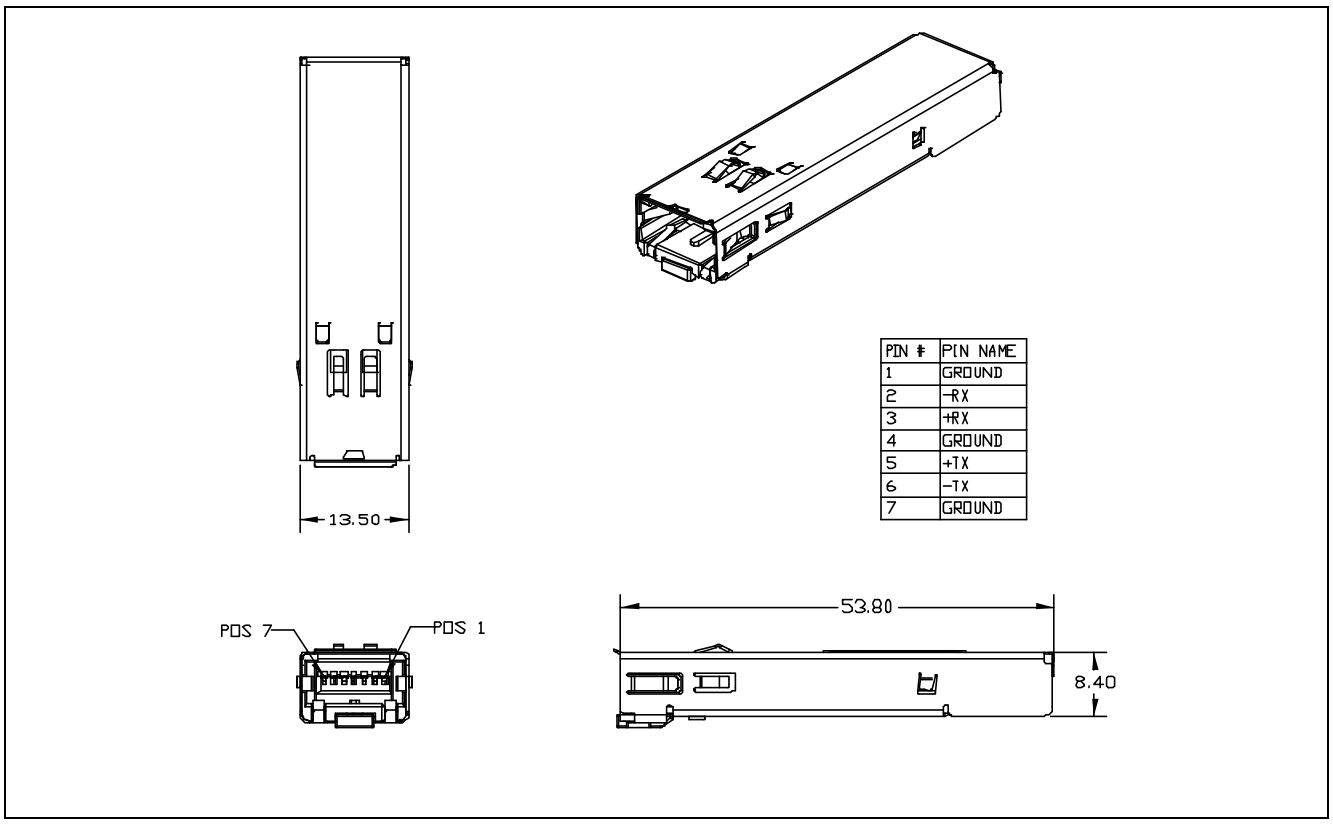
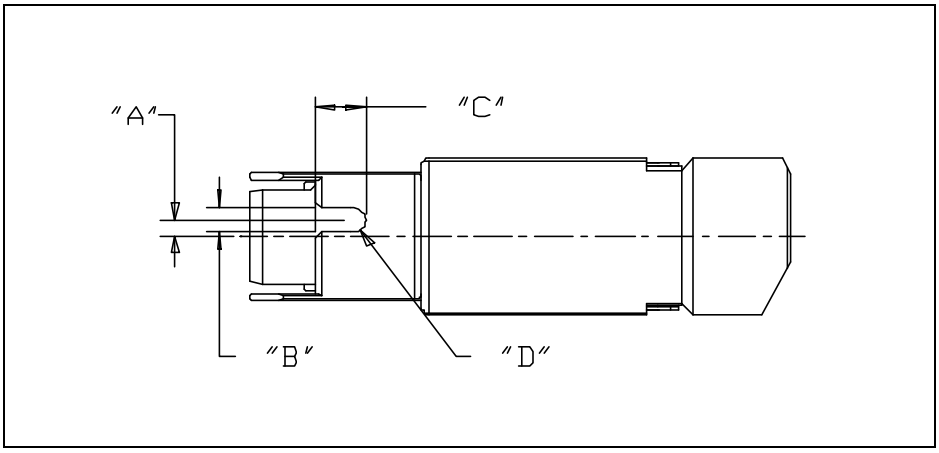


FIGURE 12 – SFP Copper Module



Description	"A"	"B"	"C"	"D" (radius)
Option 1	1.51±0.13	2.25±0.13	3.80±0.13	1.13±0.13
Option 2	0.00±0.13	1.25±0.13	3.80±0.13	0.63±0.13

Option 1 is typically associated with Fibre Channel applications
Option 2 is typically associated with Infiniband applications

FIGURE 13 – KEYING OPTIONS