SFF Committee documentation may be purchased in hard copy or electronic form.
SFF Specifications are available at fission.dt.wdc.com/pub/standards/sff/spec

SFF Committee

SFF-8430 Specification for

MT-RJ Duplex Optical Connections

Rev 4.1 November 21, 1999

Secretariat: SFF Committee

Abstract: This specification defines the physical interfaces and performance requirements for MT-RJ duplex optical connectors, mechanical retention schemes, and transceiver dimensions to be used for FC and other duplex serial optical applications. Other uses of this general purpose connection system are also possible. This system is approximately one third the physical size of the present dual SC connection system and is designed to be significantly less expensive in comparable volumes.

The controlling document for the dimensional values is TIA PN-4172 (to be EIA/TIA-604-12), an Electronic Industries Association Standard. The relevant parts of this EIA document are included in this specification for easy reference. The specific versions of complete connectors that are specified for use with FC and other related applications is controlled by this SFF document as not all possible combinations of mating side and termination side are supported.

This document provides a common specification for systems manufacturers, system integrators, and suppliers of storage devices. 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 imply that the specific connector is actually available from suppliers in the industry. If such a connector were to be supplied it must comply with the requirements in this document to achieve interoperability between different suppliers.

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

Documentation: This document has been prepared in a similar style to that of the ISO (International Organization of Standards).

POINTS OF CONTACT:

Bill Ham
Digital Equipment
334 South St
Shrewsbury, MA 01545

Ph: 508-841-2629 Fx: 508-841-5266
Email: ham@subsys.enet.dec.com

I. Dal Allan
Chairman SFF Committee
ENDL
14426 Black Walnut Court
Saratoga CA 95070
Ph: 408-867-6630 Fx: 408-867-2115
250-1752@mcimail.com

EXPRESSION OF SUPPORT BY MANUFACTURERS

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

AMP
Amphenol
Compaq
ENDL
Hitachi Cable
Molex
TI Japan
Unisys

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

Adaptec
DDK Electronics
FCI/Berg
Foxconn Int'l
Fujitsu CPA
Honda Connector
IBM
Matsushita
Maxtor
Montrose/CDT
Pioneer NewMedia
Quantum
Seagate
Sun Microsystems
Toshiba America
Yamagata Fujitsu
YC Cable

If you are not a member of the SFF Committee, but you are interested in participating, the following principles have been reprinted here for your information.

PRINCIPLES OF THE SFF COMMITTEE

The SFF Committee is an ad hoc group formed to address storage industry needs in a prompt manner. When formed in 1990, the original goals were limited to defining de facto mechanical envelopes within which disk drives can be developed to fit compact computer and other small products.

Adopting a common industry size simplifies the integration of small drives (2 1/2" or less) into such systems. Board-board connectors carrying power and signals, and their position relative to the envelope are critical parameters in a product that has no cables to provide packaging leeway for the integrator.

In November 1992, the SFF Committee objectives were broadened to encompass other areas which needed similar attention, such as pinouts for interface applications, and form factor issues on larger disk drives. SFF is a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

Documents created by the SFF Committee are expected to be submitted to bodies such as EIA (Electronic Industries Association) or an ASC (Accredited Standards Committee). They may be accepted for separate standards, or incorporated into other standards activities.

The principles of operation for the SFF Committee are not unlike those of an accredited standards committee. There are 3 levels of participation:

- Attending the meetings is open to all, but taking part in discussions is limited to member companies, or those invited by member companies
- The minutes and copies of material which are discussed during meetings are distributed only to those who sign up to receive documentation.
- The individuals who represent member companies of the SFF Committee receive documentation and vote on issues that arise. Votes are not taken during meetings, only guidance on directions. All voting is by letter ballot, which ensures all members an equal opportunity to be heard.

Material presented at SFF Committee meetings becomes public domain. There are no restrictions on the open mailing of material presented at committee meetings. In order to reduce disagreements and misunderstandings, copies must be provided for all agenda items that are discussed. Copies of the material presented, or revisions if completed in time, are included in the documentation mailings.

The sites for SFF Committee meetings rotate based on which member companies volunteer to host the meetings. Meetings have typically been held during the ASC T10 weeks.

The funds received from the annual membership fees are placed in escrow, and are used to reimburse ENDL for the services to manage the SFF Committee.

If you are not receiving the documentation of SFF Committee activities or are interested in becoming a member, the following signup information is reprinted here for your information.

Annual SFF Committee Membership Fee	$ 1,800.00
Annual SFF Committee Paper Documentation Fee	$ 300.00
Annual Surcharge for AIR MAIL to Overseas	$ 100.00
Annual Surcharge for Electronic Documentation	$ 360.00

Name: ________________________________

Title: ________________________________

Company: ________________________________

Address: ________________________________

____

____

Phone: ____________________

Fax: ____________________

Email: ________________________________

Please register me as a Member of the SFF Committee for one year.

Paper documentation	$ 1,800
Electronic documentation	$ 2,160

Check Payable to SFF Committee for $_______ is Enclosed

Please invoice me $_______ on PO #: ___________________

MC/Visa/AmX_____________________________ Expires______

Please register me as an Observer on the SFF Committee for one year.

Paper documentation	$ 300 U.S.	$ 400 Overseas
Electronic documentation	$ 660 U.S.	$ 760 Overseas

Check Payable to SFF Committee for $_______ (POs Not Accepted)

MC/Visa/AmX_____________________________ Expires______

SFF Committee
14426 Black Walnut Ct
Saratoga CA 95070

408-867-6630
408-867-2115Fx
250-1752@mcimail.com

Foreword

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 in which space was at a premium and time to market with the latest machine was an important factor. System integrators worked individually with vendors to develop the packaging. The result was wide diversity, and with space being such a major consideration in packaging, it was not possible to replace one vendor's drive with a competitive product.

The desire to reduce disk drive sizes to even smaller dimensions such as 1.8" and 1.3" made it likely that devices would become even more constrained in dimensions because of a possibility that such small devices could be inserted into a socket, not unlike the method of retaining semiconductor devices.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology in disk drives. After two informal gatherings on the subject in the summer of 1990, the SFF Committee held its first meeting in August.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced problems other than the physical form factors of disk drives. In November 1992, the members approved an expansion in charter 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.

At the same time, the principle was adopted of restricting the scope of an SFF project to a narrow area, so that the majority of documents would be small and the projects could be completed in a rapid timeframe. If proposals are made by a number of contributors, the participating members select the best concepts and uses them to develop specifications which address specific issues in emerging storage markets.

Those companies which have agreed to support a documented 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.

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

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

SFF Committee --

MT-RJ Duplex Optical Connections

1. Scope

This specification defines the terminology and physical requirements for duplex MT-RJ optical connections and complete connectors. There is a single mating interface for all versions.

The MT-RJ system offers the following features:

(1) duplex ferrule based technology
(2) fiber routing on both sides of the mating interface is parallel to the mating axis
(3) field termination for both connector genders
(4) usable with all types of optical transceivers
(5) one-touch positive retention.

This specification allows applications that need these features to do so interoperably.

Miniature duplex optical connections are desirable in FC and other external (to the system enclosure) shielded systems where intra cabinet connections are needed. The Fibre Channel, SSA, and Gigabit Ethernet standards specify the mating interface and have no specific performance requirements. This document along with the TIA-PN-4172 are the public specifications for the complete connector system.

The transmit and receive fibers and the transceiver pin assignments to the mounting circuit board are contained within this document.

The MT-RJ system is a derivative of the MT connector, which has been available for a number of years. The mechanical retention scheme between the mating connector halves has been modified and excess material in the housing and ferrule has been removed to produce a more compact and easier to use connection than the MT.

The retention scheme consists of a single press-to-release catch similar to those found on the common RJ style network and telephone unshielded copper connectors. The look and feel of the MT-RJ is suited for advanced high speed transmission applications and the panel space required is significantly less than many other alternatives.

The design is physically robust and small which allows it to be used in a varieety of applications from notebooks to data centers.

This document specifies 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 controlled by this document other than that implied by the performance requirements.

Duplex serial interfaces standards such as Fibre Channel and Gigabit Ethernet presently incorporate requirements on the optical interconnect used to transmit Gigabaud signals. If the MT-RJ connector system is used as part of such an interconnect, it is also subject to these requirements.

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 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-xxxx FC-PH-2 (Fibre Channel Physical Interface -2)
- X3.303-xxxx FC-PH-3 (Fibre Channel Physical Interface -3)
- EIA PN-xxxx

2.2 SFF Specifications

There are several projects active within the SFF Committee. At the date of printing document numbers had been assigned to the following projects. The status of Specifications is dependent on committee activities.

F = Forwarded	The document has been approved by the members for forwarding to a formal standards body.
P = Published	The document has been balloted by members and is available as a published SFF Specification.
A = Approved	The document has been approved by ballot of the members and is in preparation as an SFF Specification.
C = Canceled	The project was canceled, and no Specification was Published.
D = Development	The document is under development at SFF.
E = Expired	The document has been published as an SFF Specification, and the members voted against re-publishing it when it came up for annual review.
e = electronic	Used as a suffix to indicate an SFF Specification which has Expired but is still available in electronic form from SFF e.g. a specification has been incorporated into a draft or published standard which is only available in hard copy.
i = Information	The document has no SFF project activity in progress, but it defines features in developing industry standards. The document was provided by a company, editor of an accredited standard in development, or an individual. It is provided for broad review (comments to the author are encouraged).
s = submitted	The document is a proposal to the members for consideration to become an SFF Specification.

Spec #	Rev	List of Specifications as of November 21, 1999
SFF-8000		SFF Committee Information
SFF-8001i	E	44-pin ATA (AT Attachment) Pinouts for SFF Drives
SFF-8002i	E	68-pin ATA (AT Attachment) for SFF Drives
SFF-8003	E	SCSI Pinouts for SFF Drives
SFF-8004	E	Small Form Factor 2.5" Drives
SFF-8005	E	Small Form Factor 1.8" Drives
SFF-8006	E	Small Form Factor 1.3" Drives
SFF-8007	E	2mm Connector Alternatives
SFF-8008	E	68-pin Embedded Interface for SFF Drives
SFF-8009	4.1	Unitized Connector for Cabled Drives
SFF-8010	E	Small Form Factor 15mm 1.8" Drives
SFF-8011i	E	ATA Timing Extensions for Local Bus
SFF-8012	2.3	4-Pin Power Connector Dimensions
SFF-8013	E	ATA Download Microcode Command
SFF-8014	C	Unitized Connector for Rack Mounted Drives
SFF-8015	E	SCA Connector for Rack Mounted SFF SCSI Drives
SFF-8016	C	Small Form Factor 10mm 2.5" Drives
SFF-8017	E	SCSI Wiring Rules for Mixed Cable Plants
SFF-8018	E	ATA Low Power Modes
SFF-8019	E	Identify Drive Data for ATA Disks up to 8 GB
INF-8020i	E	ATA Packet Interface for CD-ROMs
SFF-8028i	E	- Errata to SFF-8020 Rev 2.5
SFF-8029	E	- Errata to SFF-8020 Rev 1.2
SFF-8030	1.8	SFF Committee Charter
SFF-8031		Named Representatives of SFF Committee Members
SFF-8032	1.4	SFF Committee Principles of Operation
SFF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs
SFF-8034i	E	High Speed Local Bus ATA Line Termination Issues
SFF-8035i	E	Self-Monitoring, Analysis and Reporting Technology
SFF-8036i	E	ATA Signal Integrity Issues
INF-8037i	E	Intel Small PCI SIG
INF-8038i	E	Intel Bus Master IDE ATA Specification
SFF-8039i	E	Phoenix EDD (Enhanced Disk Drive) Specification
SFF-8040	1.2	25-pin Asynchronous SCSI Pinout
SFF-8041	C	SCA-2 Connector Backend Configurations
SFF-8042	C	VHDCI Connector Backend Configurations
SFF-8043	E	40-pin MicroSCSI Pinout
SFF-8045	4.2	40-pin SCA-2 Connector w/Parallel Selection
SFF-8046	E	80-pin SCA-2 Connector for SCSI Disk Drives
SFF-8047	C	40-pin SCA-2 Connector w/Serial Selection
SFF-8048	C	80-pin SCA-2 Connector w/Parallel ESI
SFF-8049	E	80-conductor ATA Cable Assembly
INF-8050i	1.0	Bootable CD-ROM
INF-8051i	E	Small Form Factor 3" Drives
INF-8052i	E	ATA Interface for 3" Removable Devices
SFF-8053	5.4	GBIC (Gigabit Interface Converter)
INF-8055i	E	SMART Application Guide for ATA Interface
SFF-8056	C	50-pin 2mm Connector
SFF-8057	E	Unitized ATA 2-plus Connector
SFF-8058	E	Unitized ATA 3-in-1 Connector
SFF-8059	E	40-pin ATA Connector
SFF-8060	1.1	SFF Committee Patent Policy
SFF-8061	1.1	Emailing drawings over the SFF Reflector
SFF-8065	C	40-pin SCA-2 Connector w/High Voltage

SFF-8066	C	80-pin SCA-2 Connector w/High Voltage
SFF-8067	2.6	40-pin SCA-2 Connector w/Bidirectional ESI
INF-8068i	1.0	Guidelines to Import Drawings into SFF Specs
SFF-8069	E	Fax-Access Instructions
INF-8070i	1.2	ATAPI for Rewritable Removable Media
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications
SFF-8073	-	20-pin SCA-2 for GBIC Applications
SFF-8080	E	ATAPI for CD-Recordable Media
SFF-8090	3.6	ATAPI for DVD (Digital Video Data)
SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)
SFF-8201e	1.3	2 1/2" drive form factor dimensions
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector
SFF-8300e	1.1	3 1/2" drive form factors (all of 83xx family)
SFF-8301e	1.2	3 1/2" drive form factor dimensions
SFF-8302e	1.1	3 1/2" Cabled Connector locations
SFF-8332e	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector
SFF-8337e	1.2	3 1/2" drive w/SCA-2 Connector
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector
SFF-8400	C	Very High Density Cable Interconnect
SFF-8410	12.1	High Speed Serial Testing for Copper Links
SFF-8411	-	High Speed Serial Testing for Backplanes
SFF-8412	-	HSS Requirements for Duplex Optical Links
SFF-8420	10.1	HSSDC-1 Shielded Connections
SFF-8430	4.1	MT-RJ Duplex Optical Connections
SFF-8441	14.1	VHDCI Shielded Configurations
SFF-8451	10.1	HSS (High Speed Serial) SCA-2 Connections
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections
SFF-8500e	1.1	5 1/4" drive form factors (all of 85xx family)
SFF-8501e	1.1	5 1/4" drive form factor dimensions
SFF-8508e	1.1	5 1/4" ATAPI CD-ROM w/audio connectors
SFF-8551	2.0	5 1/4" CD-ROM 1" High form factor
SFF-8572	-	5 1/4" Tape form factor
SFF-8610	C	SDX (Storage Device Architecture)

2.3 Sources

Copies of ANSI standards or proposed ANSI standards may be purchased from Global Engineering.

15 Inverness Way East	800-854-7179 or 303-792-2181
Englewood	303-792-2192Fx
CO 80112-5704	

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

The increasing size of SFF Specifications has made FaxAccess impractical to obtain large documents. Document subscribers and members are automatically updated every two months with the latest specifications. Specifications are available by FTP at fission.dt.wdc.com/pub/standards/sff/spec

Electronic copies of documents are also made available via CD_Access, a service which provides copies of all the specifications plus SFF reflector traffic. CDs are mailed every 2 months as part of the document service, and provide the letter ballot and paper copies of what was distributed at the meeting as well as the meeting minutes.

Editor’s notes:

After extensive review between the Editor and AMP optical personnel this revision is presently considered to be complete per the original project description. Charts are provided that demonstrate the impact of fiber misalignment on performance in single mode and 62.5 micron multimode applications.

All the options for connector variations that presently exist are described.

This specification contains mechanical requirements substantially identical to that in its companion document in TIA, however the TIA document is the controlling document for all dimensions. The user of this document should check the latest TIA document before committing to any dimensions specified in this document.

Significant material is contained herein that is not available in any other document describing this connector.

1. Tables of Figures and Tables

1.1 TABLE OF FIGURES

1.2 TABLE OF TABLES

2. General Description

The MT-RJ consists of (1) a duplex ferrule that holds the fibers and guide pins or guide holes to ensure adequate alignment of the fibers when the connectors are fully mated, (2) housing features that support the ferrules and deliver pre alignment, and (3) retention features that prevent accidental demating and allow easy purposeful mating and demating.

The MT-RJ is capable of using duplex fibers within the same external jacket, of being used in connector to connector, connector to transceiver, or connector to patch panel applications. For cable connector to cable connector applications a connector to connector adapter is provided and the guide pin / guide hole polarity must be observed. The gender conventions are described in detail in 3.2.

The MT-RJ can be field terminated using simple techniques. Optical gender is configured after polishing, when the plug housing is assembled. As with any optical connector, cleanliness is important to maintain the optical performance in the mated connector. Particles on the fiber, on the guide pins / holes, or on the ferrule surface can affect the final position of the fibers with respect to each other when fully mated. Contamination on the fiber surface can absorb or reflect the light and affect performance. Both mechanical and chemical cleanliness must be observed.

The relationship of the guide pins, ferrules, fiber, and guide holes all determine the tolerance for the final fiber to fiber position in service. The tolerance build up for this connector system in the fully mated condition consists of the following: guide pin diameter, guide hole diameter, , fiber diameter for each fiber, ferrule fiber hole diameter for each fiber, ferrule fiber hole position for each fiber, guide pin axial angular tolerance for each pin, and guide hole angular axial tolerance for each pin. With modern manufacturing and assembly tolerance and inexpensive ferrule and guide pin materials this tolerance build up is manageable for both single mode and multimode fibers. The guide pin center position and guide hole center position are not part of the tolerance build up because the true position of the fiber hole is defined with respect to the guide holes.

However, the real test is in the optical losses produced when the connector is mated. This is a strong function of the offset achieved between the fibers and the offset goal is determined by the optical performance specification for which the parts are procured, AND on where the specific parts happen to be within the manufacturing distribution.

Optical loss can be converted to physical offset, and vice versa. The typical loss specification is the industry requirement for premise/networking is that specified by the TIA 568 building wiring standard - 0.75 dB per connection for both SM and MM.

Figure 1 and Figure 2 show the optical power insertion loss in a single mated connector for various mechanical offsets between the centers of the fiber cores on each side of the connector. These figures assume that the only loss mechanism is due to the offset and that the cores are stepped index (abrupt change in optical index of refraction from the core to the cladding). Since the single mode core is much smaller than the multimode core the loss is much greater for a given offset

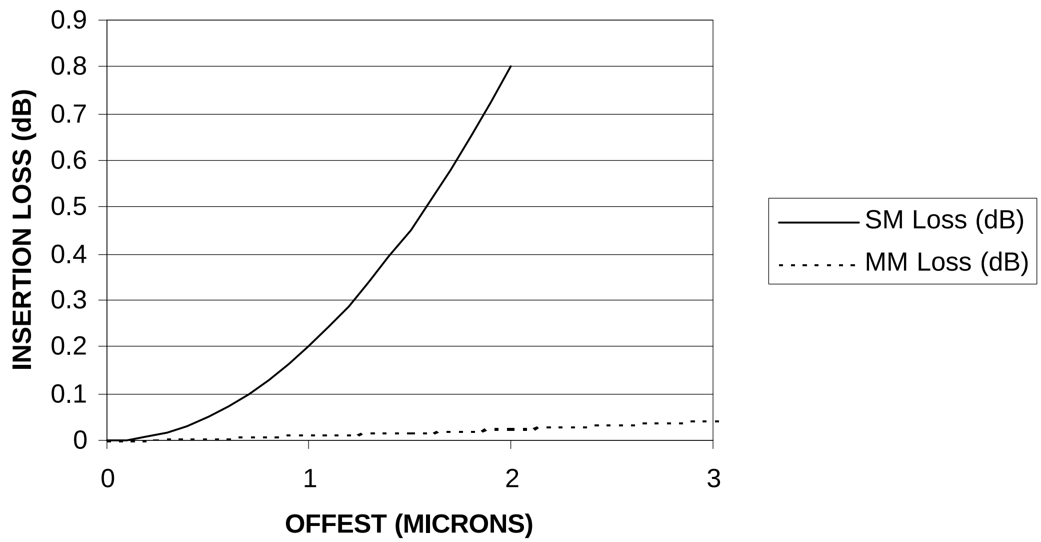


Figure 1 Insertion loss caused by fiber offset (small offsets)

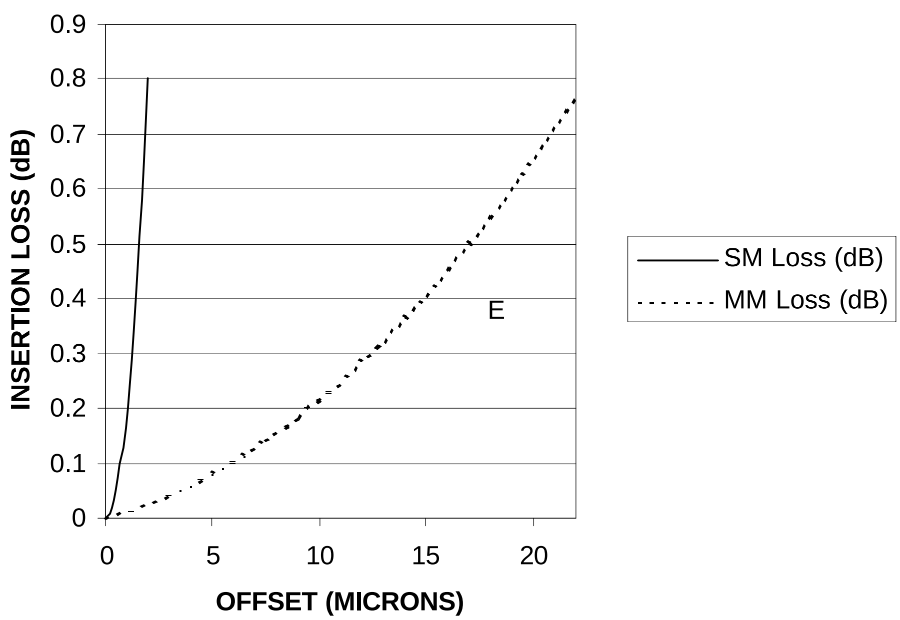


Figure 2 - Insertion loss caused by fiber offset (large offsets)

The MT-RJ system uses a spring loaded mechanism to ensure a minimum axial force on the ferrules after mating is complete. This force is also applied by the springs to the retention mechanism after mating is completed. When the retention is released the connector will “pop” out of the mating housing a small amount. Conversely, when mating, the retention engagement has the feel of a detent and there is excellent ergonomic feedback indicating that the mating process is complete.

3. Definitions and Conventions

3.1 Definitions

For the purpose of SFF Specifications, the following definitions apply. Not all those listed are used in this document.

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 or fibers 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.

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 3.

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 3.

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

3.2 Gender definitions for MT-RJ

Whether a connector has guide pins or guide holes associated with the ferrule determines the gender of the connector optical interface. In addition to this gender difference relating to the optical interface there is a secondary “gender” difference relating to the housing application. The housing mating interface is different depending on whether a cable ,transceiver, adapter, or patch panel application is used. The cable-to-cable application uses a housing that is identical for both optical interface genders and will use a plug-to-plug adapter (a third component similar to that used for the SC system in patch panels) to connect two different optical interface gender cable connectors. Housing interfaces similar to that provided by the plug-to-plug adapter are used for transceiver and patch panel applications. Plug to plug adapters have the ribs. Ribs are optional in transceivers. The housing gender associated with cable applications is termed a plug. The housing gender associated with cable adapters, transceivers, and patch panels is termed a receptacle. The plug always contains the retention release mechanism. This connection system has a matrix that describes the gender content as shown in Table 1.

Table 1 - Gender matrix for the MT-RJ system

Component	Optical interface gender		Physical interface gender	
	Male	Female	Plug	Receptacle
Cable	no	yes	yes	no
Hybrid Extension cable assembly	yes (one end only)	yes (one end only	yes (both ends)	no
Pure extension cable assembly	yes (both ends)	no	yes (both ends)	no
Transceiver	yes	no	no	yes
Plug to plug adapter	NA - no optical interface	NA - no optical interface	no	yes
Patch panel front	yes	no	no	yes
Note: the most common usage is a cable assembly to connect transceivers or to connect a transceiver to a patch panel. When two cables assemblies are concatenated using one or more extension cables assemblies at least one plug on the extension cable assembly must have a male optical gender (i.e. have guide pins). Plug to plug adapters are required for all extension cable assembly connections to other cable assemblies.				

Figure 3 shows the definition of the optical interface genders.

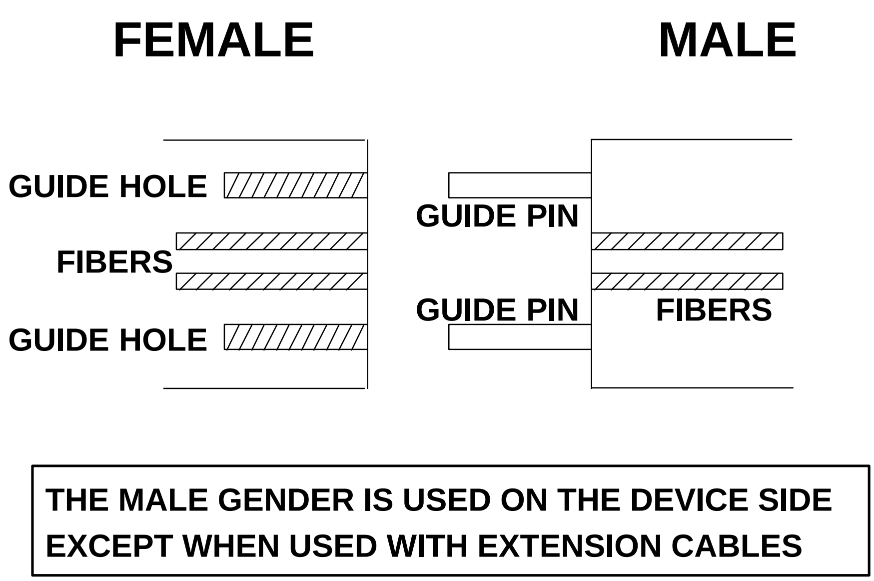


Figure 3 - Mating side optical interface gender definition

Note: the male gender is also used on the patch panel side (i. e. the building wiring side).

Figure 4 shows the gender definitions for the housing interface.

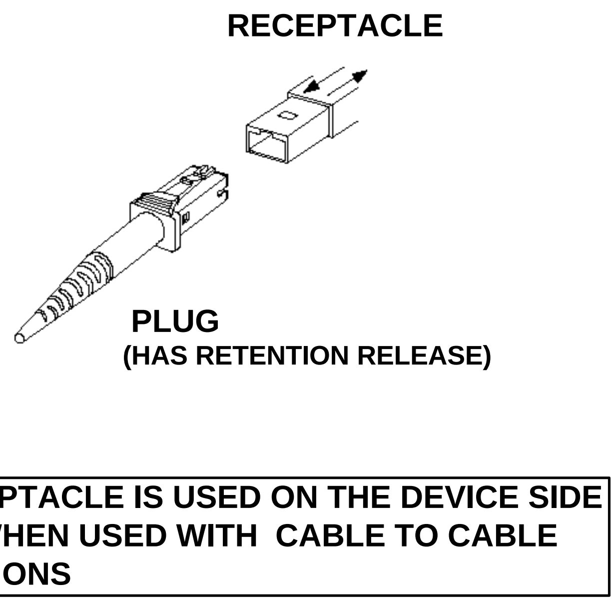


Figure 4 - Mating side housing gender definitions

3.3 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

4. Component descriptions:

4.1 Complete connector/component options

The complete components listed in this section are supported in this document. The overall view of the connection system is shown in Figure 5.

MALE OPTICAL INTERFACE COMPONENTS (has the guide pins in the ferrule)(refer to 4.4 and 4.5 for mating side specifications):

COMPONENT NAME	OVERVIEW	OUTLINE	TERMINATION SIDE
MALE CABLE PLUG	Figure 6	Figure 7	NA
MALE RECEPTACLE TRANSCEIVER BOARD RIGHT ANGLE SURFACE MOUNT 10 POSITION	Figure 8	Figure 9	Figure 25
MALE RECEPTACLE TRANSCEIVER BOARD RIGHT ANGLE SURFACE MOUNT 20 POSITION	Figure 8	Figure 9	Figure 25

FEMALE OPTICAL INTERFACE COMPONENTS (has guide holes in the ferrule) (Refer to 4.4 and 4.5 for mating side specifications):

COMPONENT NAME	OVERVIEW	OUTLINE	TERMINATION SIDE
FEMALE CABLE PLUG	Figure 6	Figure 7	NA

HOUSING COMPONENTS WITH NO OPTICAL INTERFACE (has only capability to deliver housing prealignment and accept retention mechanism)

COMPONENT NAME	OVERVIEW	OUTLINE	TERMINATION SIDE
CABLE TO CABLE RECEPTACLE FREE ADAPTER	Figure 10	Figure 11	NA
CABLE TO CABLE RECEPTACLE PATCH PANEL ADAPTER	Figure 12	Figure 13	NA
6 position cable to cable receptacle patch panel adapter	Figure 14	Figure 15	

The relevant figures from TIA PN-4172 are duplicated for reference below: Only the physical dimensions and a table of the most important performance requirements are included. Other requirements are also described. Where the TIA/EIA document does not specify requirements and this document does, then requirements in this document apply.

4.2 Performance and compatibility requirements

MT-RJ shielded connectors shall meet the performance requirements specified in EIA/TIA 568. Some of these are summarized in Table 2.

Table 2 - Some performance requirements for MT-RJ connectors

Parameter	Requirements
Insertion loss per mated connector	0.75 dB max
Return loss	20 dB min MM 26 dB min SM
Ambient Temperature	-55°C - +85°C
Mating Cycles	500

Note: an SFF project to specify detailed test methods for these and other performance requirements for optical cable assemblies is underway.

The physical compatibility requirements for use with printed circuit boards are given in Table 3. Board thicknesses and/or assembly processes that require tail lengths other than that given in Table 3 are not compatible with the connectors defined in this document.

Table 3 - Printed circuit board compatibility requirements

TERMINATION SIDE STYLE	PRINTED CIRCUIT BOARD THICKNESS	
	MIN (MM / INCHES)	MAX (MM /INCHES)
SURFACE MOUNT *	1.01 / 0.040	1.27 / 0.050
THROUGH HOLE A (0.070 TAILS)	0.87 / 0.034	1.13 / 0.044

THROUGH HOLE B (0.110 TAILS)	1.45 / 0.057	1.75 / 0.069
THROUGH HOLE C (0.125 TAILS)	2.21 / 0.087	2.51 / 0.099
THORUGH HOLE D (0.160 TAILS)	3.03 / 0.119	3.33 / 0.125
THROUGH HOLE E (0.180 TAILS)	3.44 / 0.135	4.20 / 0.165
THROUGH HOLE SOLDERLESS **	**	**
STRADDLE MOUNT	0.96 / 0.038	1.32 / 0.052?
* This dimension is required to accommodate board retention features that penetrate the board		
** The transceiver pin properties shall be designed to work with these board specifications and are not otherwise specified Finished hole size: 0.72 / 0.028 min 0.88 / 0.035 max (same as Thru hole size) Board Thickness: 1.57 / 0.062 min 3.17 / 0.125 max Solder thickness: per IPC hole plating specification Copper thickness: per IPC hole plating specification		

4.3 Dimensional requirements

The drawings in this section use the dimensioning conventions described in ANSI-Y14.5M, Dimensioning and tolerancing. All dimensions are in millimeters. In addition the following apply (MMC is maximum material condition):

1. Where a tolerance of form is not specified, the limits of the dimensions for a feature control the form as well as the size. The combined effects of size and form variations may not exceed the envelope of perfect form at the MMC (maximum material condition).

2. Where interrelated features of size (features shown with a common axis or center plane) have no geometric tolerance of location or runout specified, the limits of the dimensions for a feature control the location tolerance as well as the size. When the interrelated features are at the MMC, they shall be perfectly located to each other as indicated by the drawing.

3. Where perpendicular features (features shown at right angles) have no geometric tolerance or orientation or runout specified, the limits of the dimensions for a feature control the orientation tolerance as well as the size. When perpendicular features are at the MMC, they shall be perfectly oriented to each other as indicated by the drawing.

4. As the size of a feature departs from the MMC, variations in form, location and orientation are permissible.

Figure 5 shows the general view of the cable plugs, the cable free adapter receptacle, and the transceiver receptacle.

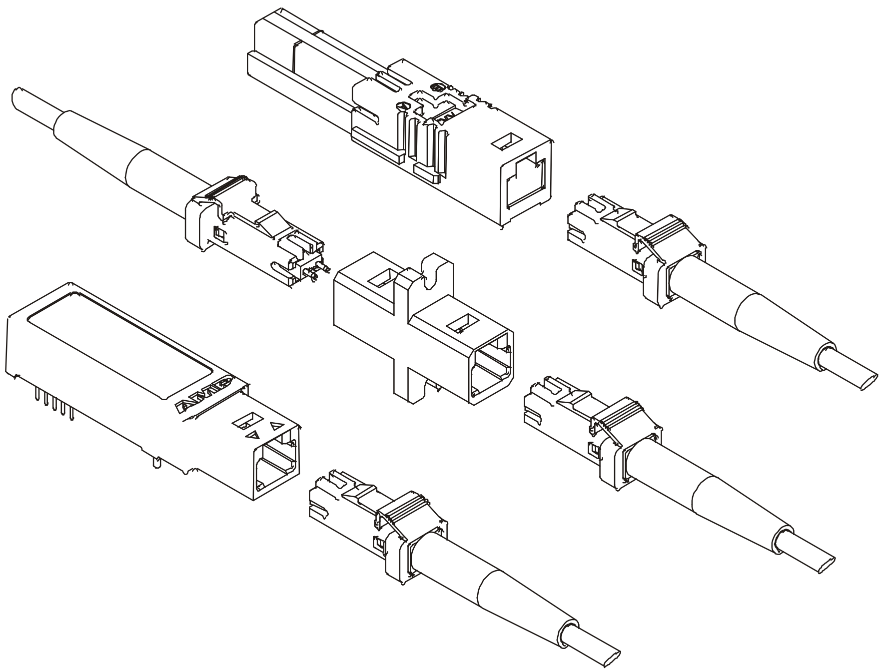


Figure 5 - General view of components

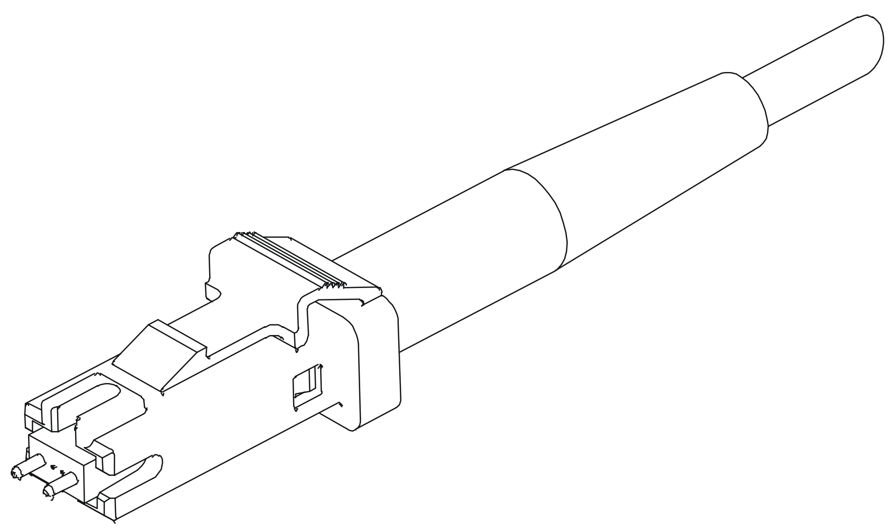
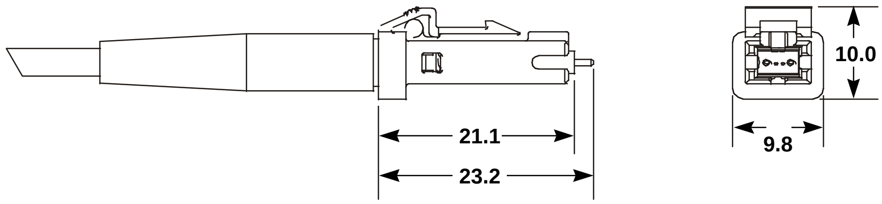


Figure 6 - Overview of plug (guide pins only used for male optical types)



GUIDE PINS REQUIRED ON MALE PLUGS ONLY

Figure 7 - Outline dimensions for plugs (with and without guide pins)

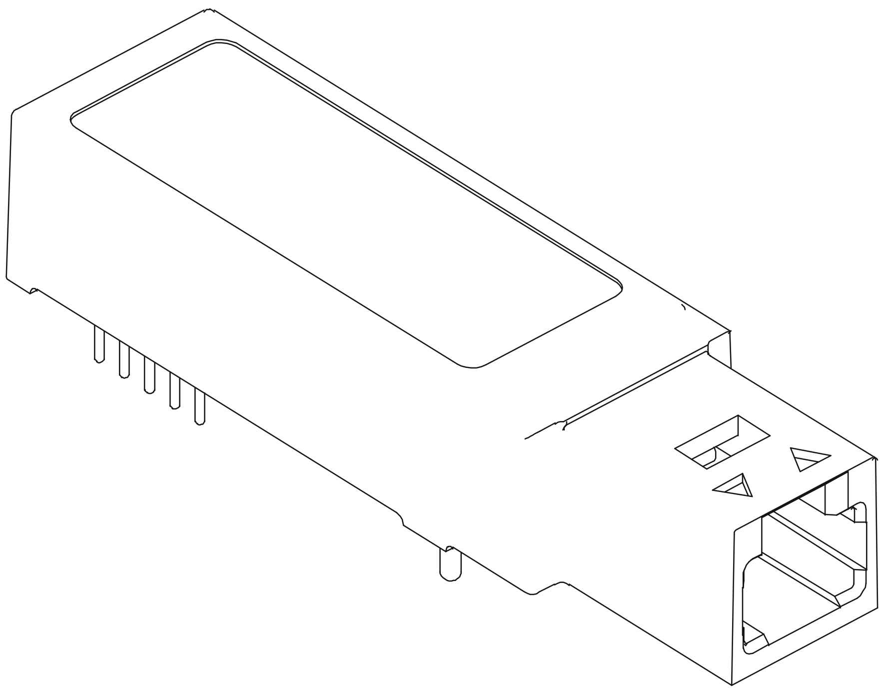


Figure 8 - Overview of right angle thru hole board receptacle transceiver

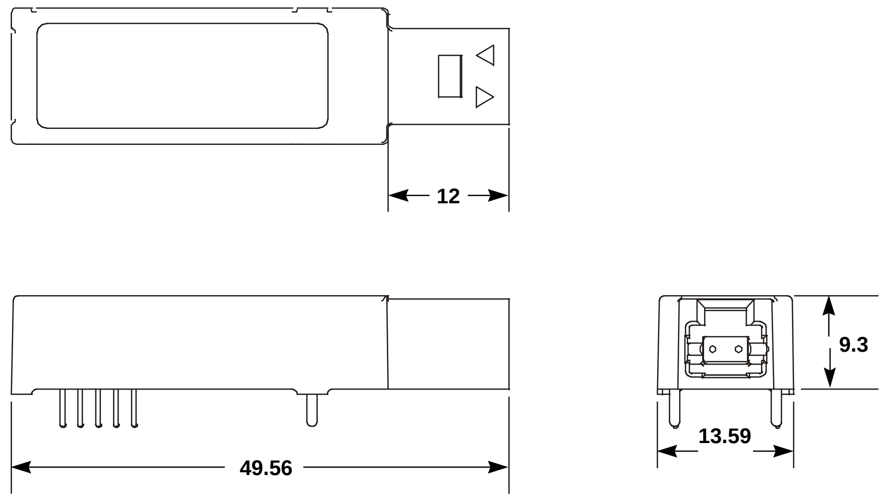


Figure 9 - Outline dimensions for right angle thru hole board receptacle transceiver

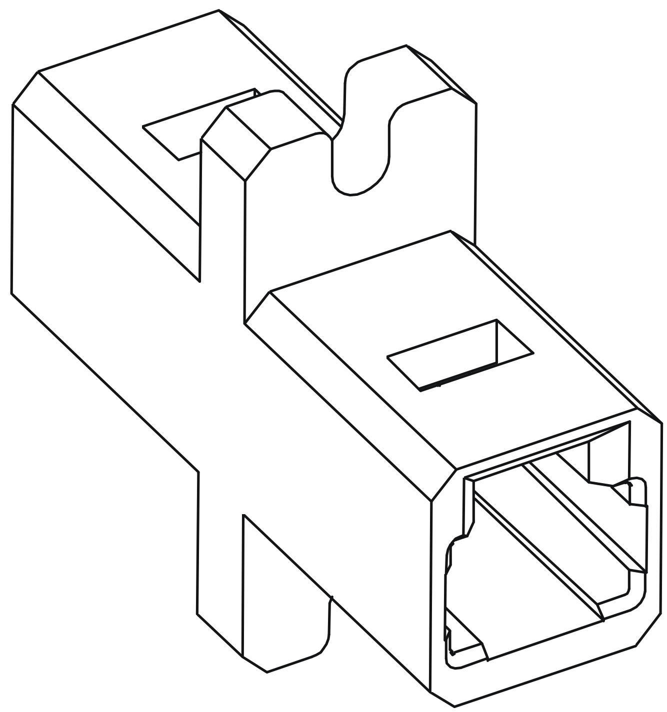


Figure 10 - Overview of free cable adapter (receptacle)

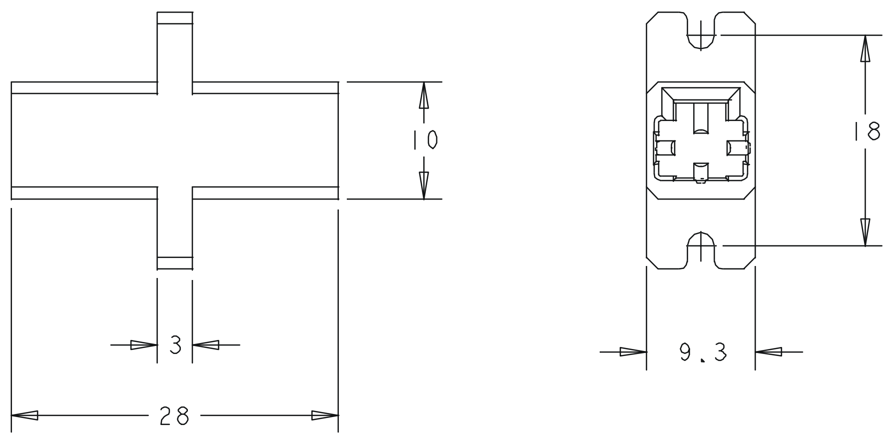


Figure 11 - Outline dimensions for free cable adapter

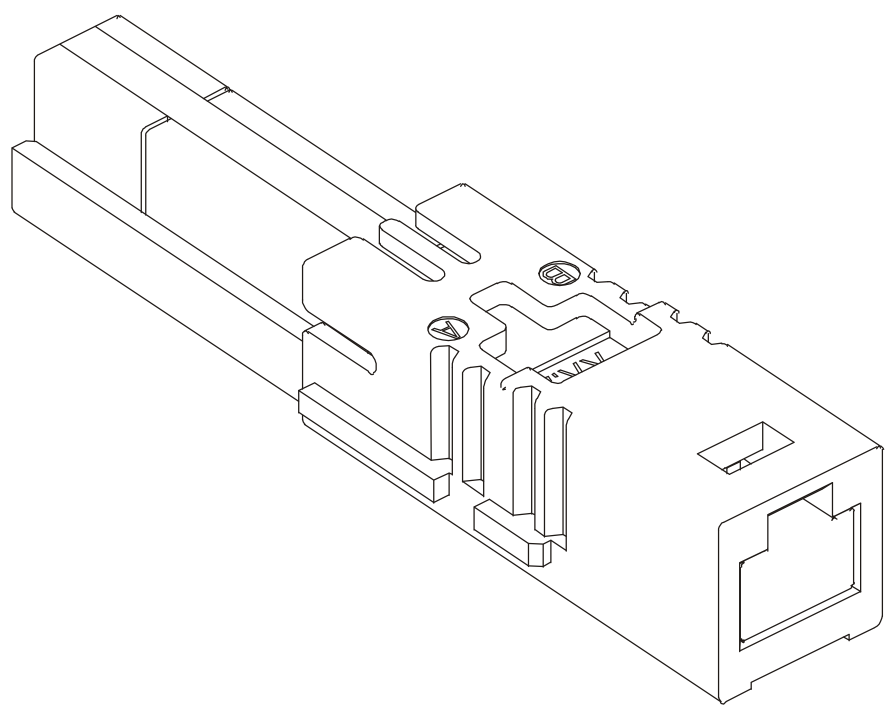


Figure 12 - Overview of patch panel receptacle

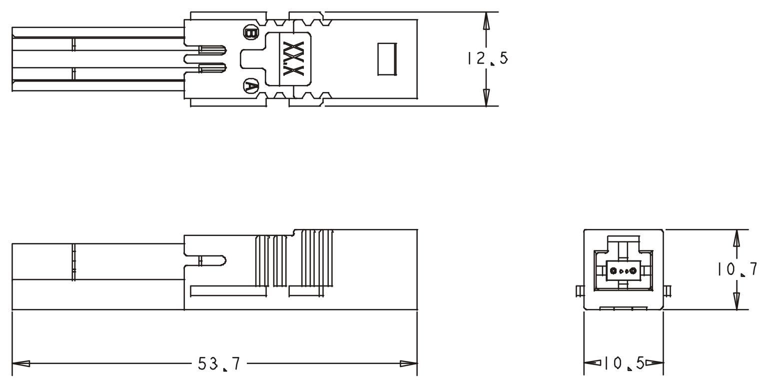


Figure 13 - Outline dimensions for patch panel receptacle

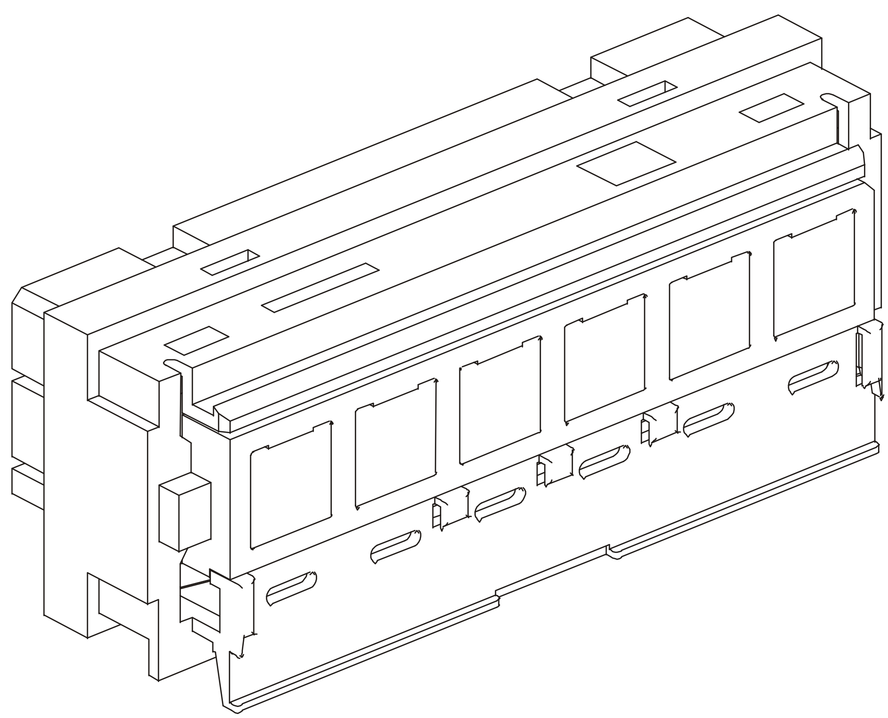


Figure 14 - Overview of 6 position patch panel receptacle

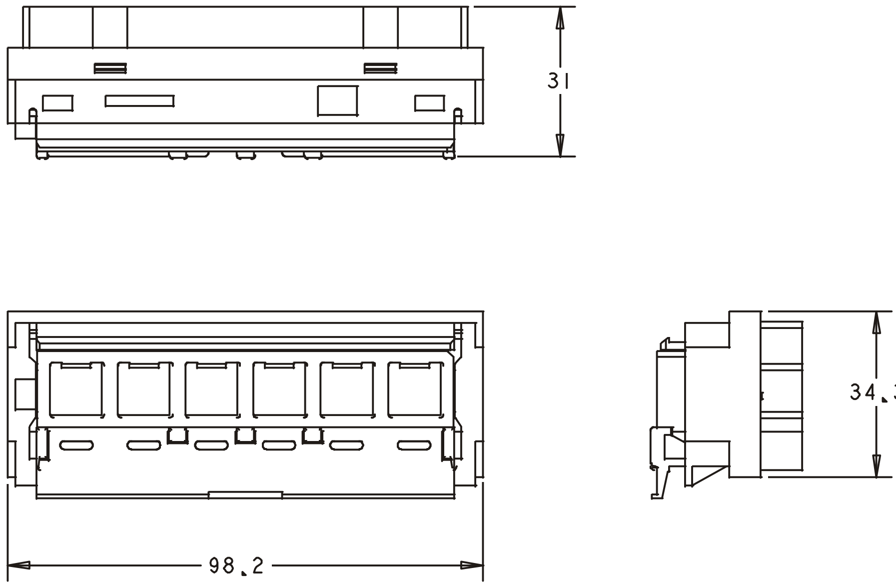


Figure 15 - Outline dimensions for 6 position patch panel receptacle

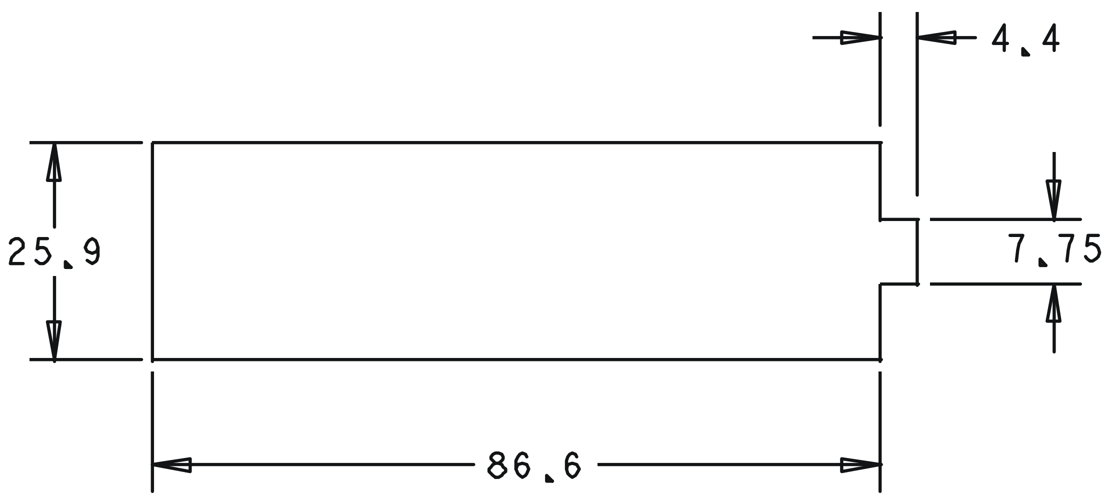


Figure 16 - Panel cut out for 6 position patch panel receptacle

4.4 Housing interfaces

The mechanical specifications for the housing interfaces (plugs and receptacles) are described in this section. The dimensions in this section may not be current and are provided for information only. Please refer to TIA FOCIS document SP-4172 (scheduled to become TIA/EIA 604-12).

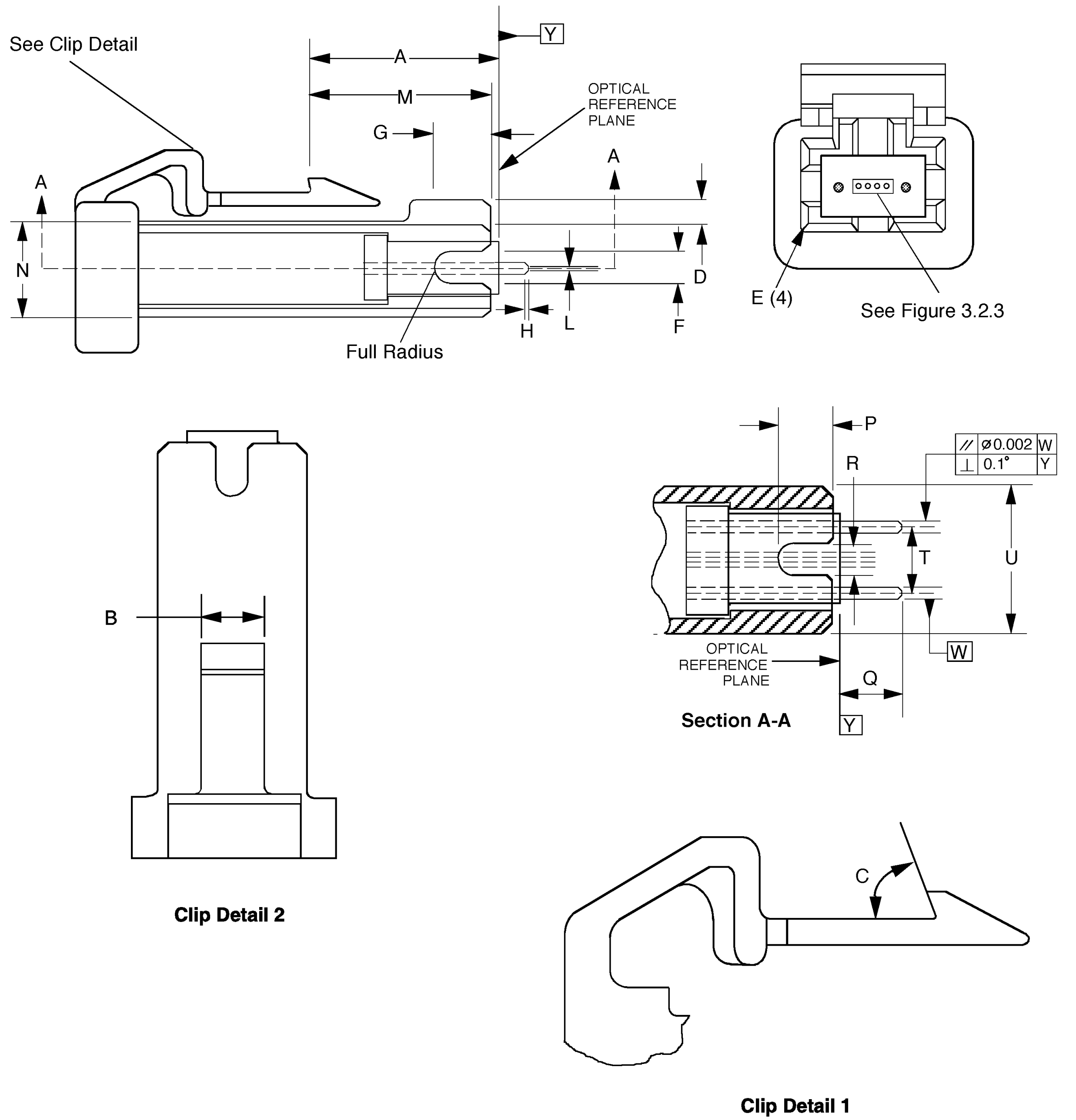


Figure 17 - Mating interface for cable plug

Table 4 - Dimensions for mating interface for cable plug

	Plug Dimensions (mm)		
Reference	Minimum	Maximum	Notes
A	9.7	10.2	1
B	3.8	4.0	
C	83°	87°	
D	0.9	1.1	
E	.25	---	
F	1.45	1.55	
G	3.95	4.05	
H	0.2	0.5	2
K	14.15	---	1
L	---	0.4	2
M	8.9	9.1	
N	4.61	4.69	
O	---	.8	
P	3.95	4.05	
Q	1.83	2.17	
R	1.45	1.55	
T	---	2.6	3, 4, 5
U	7.11	7.19	

1) Dimension is given for an unmated plug; see Figure 3.2.2.

2) Dimensions apply to an option c = 1 plug only.

3) The option c = 2 plug shall accept a gauge pin, as shown in Figure 3.2.1a, with a maximum insertion force of 1.7 N. It shall also accept the gauge shown in Figure 3.2.1b to a depth of 5.5 mm, with a maximum insertion force of 3.4 N.

4) The alignment pins of an option c = 1 plug shall be retained so as to remain within the plug during mating and unmating.

5) See Section 3.2.7 for alignment pin and hole diameter specifications.

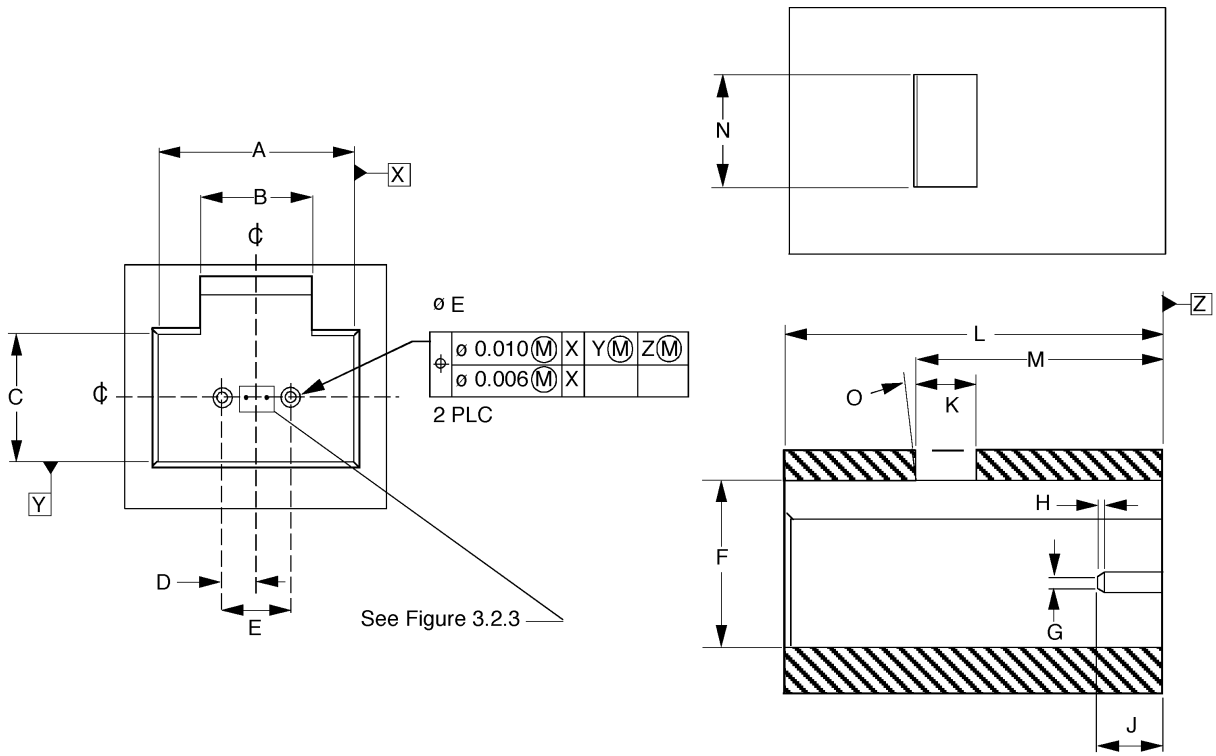


Figure 18 - Mating interface for receptacles

Table 5 - Dimensions for receptacle mating interface

	Receptacle Dimensions (mm)		
Reference	Minimum	Maximum	Notes
A	7.2	7.28	
B	4.0	4.15	
C	7.2 4.7	7.28 4.78	
D	1.3	1.3	1
E	2.6	2.6	1
F	6.08	6.36	
G	0.2	0.4	
H	0.2	0.5	
J	1.6	3.3	
K	2.1	2.25	
L	13.8	14.2	
M	9.1	9.2	
N	4.0	4.15	
O	2°	5°	
1) Target values. Tolerances are as listed in position tolerance in Figure 18			

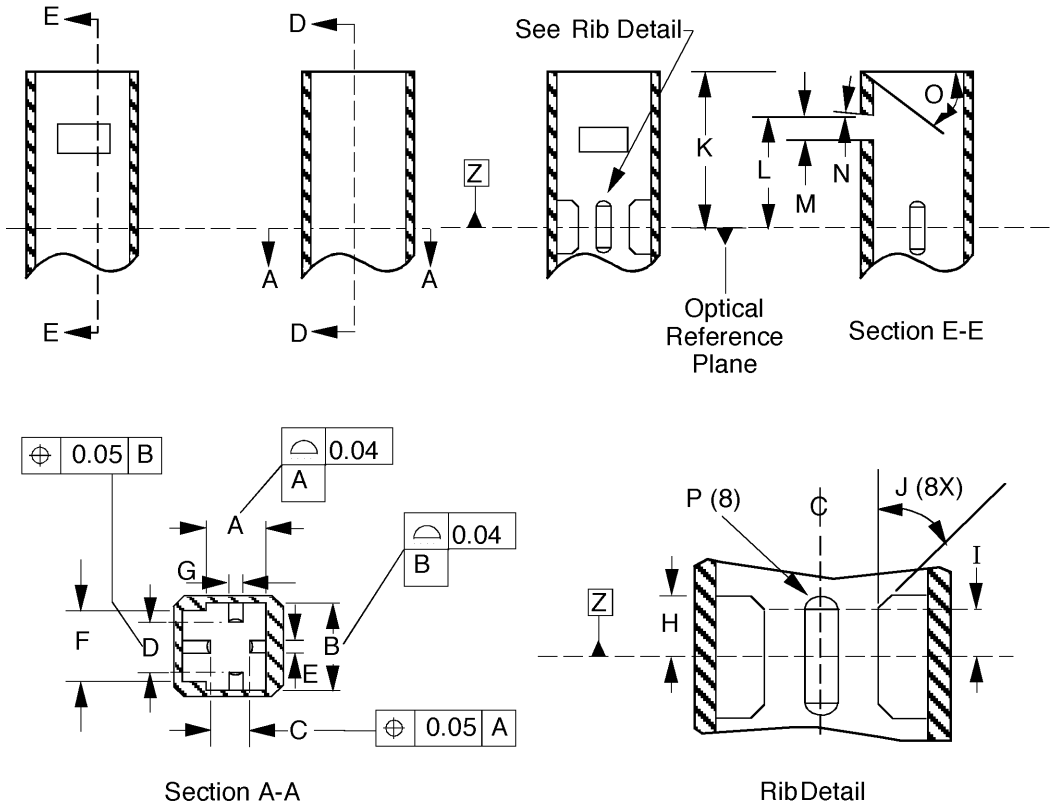


Figure 19 - Mating interface for cable free adapter receptacle

Table 6 - Dimensions for mating interface for cable free adapter receptacle

	Adapter Dimensions (mm)		
Reference	Minimum	Maximum	Notes
A	4.7	4.78	
B	7.2	7.28	
C	2.51	2.61	
D	4.46	4.56	
E	1.15	1.25	
G	1.15	1.25	
H	3.45	3.55	
I	2.95	3.05	
J	29°	31°	
K	13.95	14.05	
L	9.1	9.2	
M	2.1	2.3	
N	4°	5°	
O	30°	60°	
Q	---	.25	
R	.25	---	
S	0.8	1.2	

4.5 Optical interface

This section describes the mechanical requirements for the optical interfaces. These mechanical requirements alone may not be sufficient to guarantee 100 yield in a manufacturing process. The final determination for the success of the optical interface is the made by measuring the optical losses in the mated interfaces where one side is the interface under test and the other side is a known good interface used for testing purposes.

This document does not describe how to make or select the interface used for testing purposes. See TIA/EIA 455-171 (FOTP-171) Method D for details.

Alignment pin/hole diameter options for the optical interface are specified in Table 7.

Table 7 - Guide pin and guide hole dimensions

	Dimensions (mm)			
	Guide Pin Diameter		Guide Hole Diameter	
Option	Minimum	Maximum	Minimum	Maximum
SM/MM	0.698	0.699	0.699	0.700
MM only	0.697	0.699	0.699	0.701

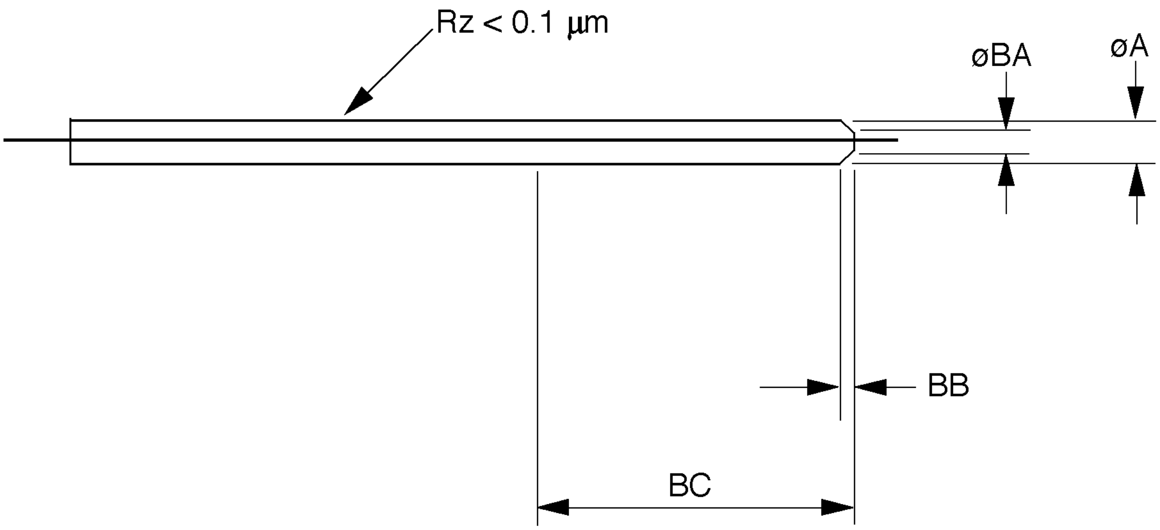


Figure 20 - Guide hole gauge pin

Table 8 - Guide hole gauge pin dimensions

	Dimensions (mm)		
Reference	Minimum	Maximum	Notes
A	0.6985	0.6990	
BA	0.2	0.4	
BB	0.2	0.5	
BC	1.83	2.17	1
1) Length over which surface texture shall be maintained.			

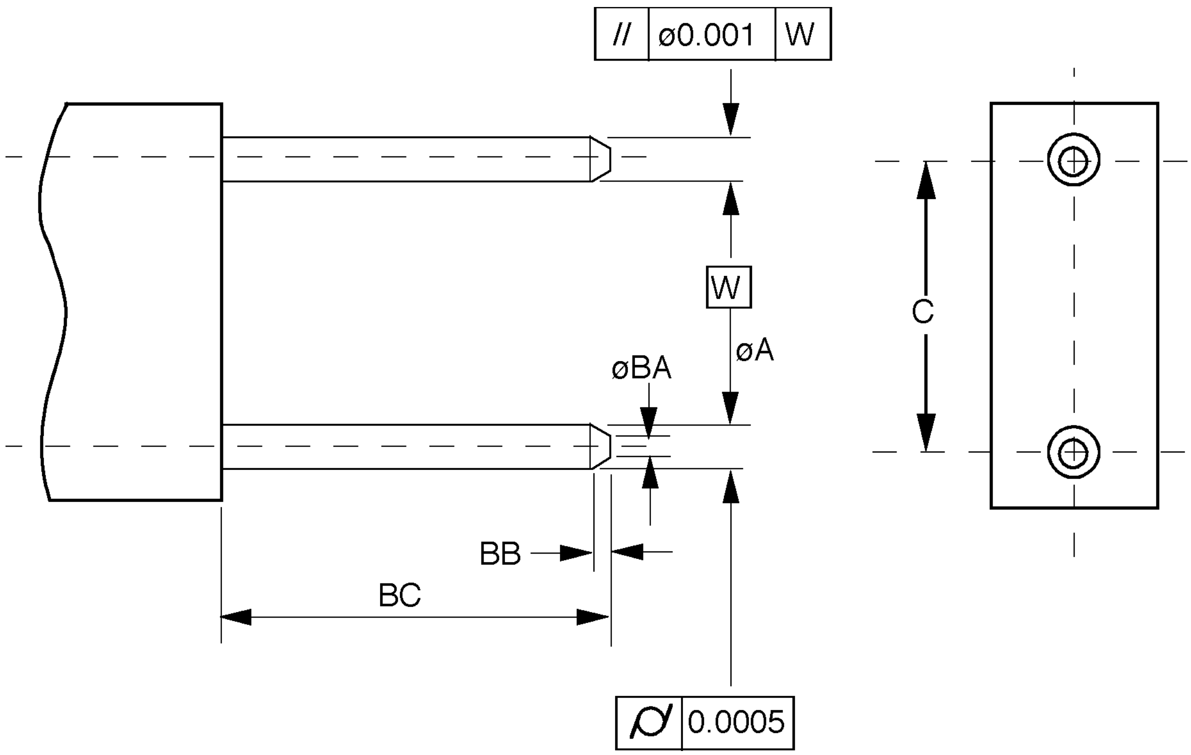


Figure 21 - Guide hole gauge assembly

Table 9 - Dimensions for guide hole gauge assembly

	Dimensions (mm)		
Reference	Minimum	Maximum	Notes
A	0.6985	0.6990	1
C	2.5995	2.6005	
BA	0.2	0.4	
BB	0.2	0.5	
BC	6.0	- - -	
1) Surface roughness < 0.1 microns.			

The optical interface may include fibers located in the positions defined in Figure 22 and Table 10.

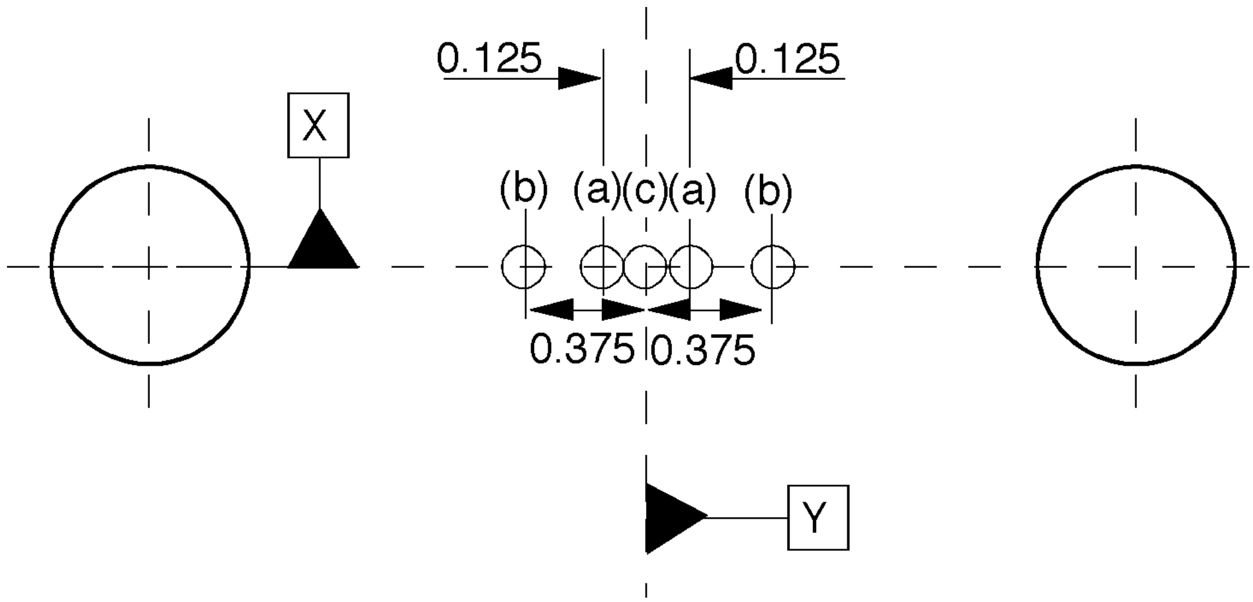


Figure 22 - Fiber positions relative to guide pins / holes

Table 10 - Fiber populations (n=2 for FC)

Number of fibers (n)	Allowed fiber population positions
1	c
2	b
3	b and c
4	a and b

Figure 23 and Table 11 contain the requirements on the relationship between the ferrule position (with respect to the retention clip) and the axial force required on the mating interface of the ferrule to produce that position.

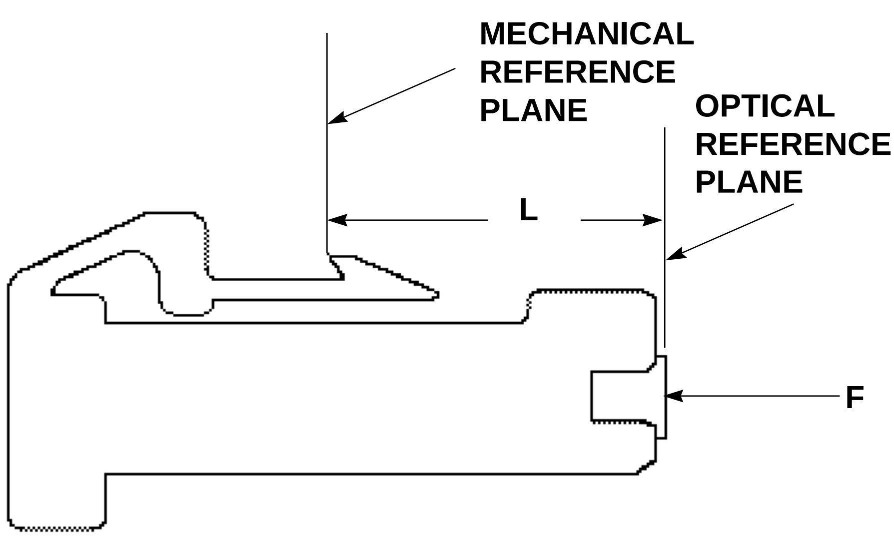


Figure 23 - Ferrule extension from housing and mating interface axial force

Table 11 - Requirements on ferrule positions and axial mating interface force

Requirement	**IF**	**THEN**
1	F = 0	9.7 mm £ A £ 10.2 mm
2	A £ 9.3 mm	F ³ 7.8 N
3	A ³ 9.1 mm	F £ 11.8 N

4.6 Termination side specifications

The cable termination side for plugs is not specified in this document. The requirements for the board side of the transceiver receptacle are shown in Figure 24 and Figure 25.

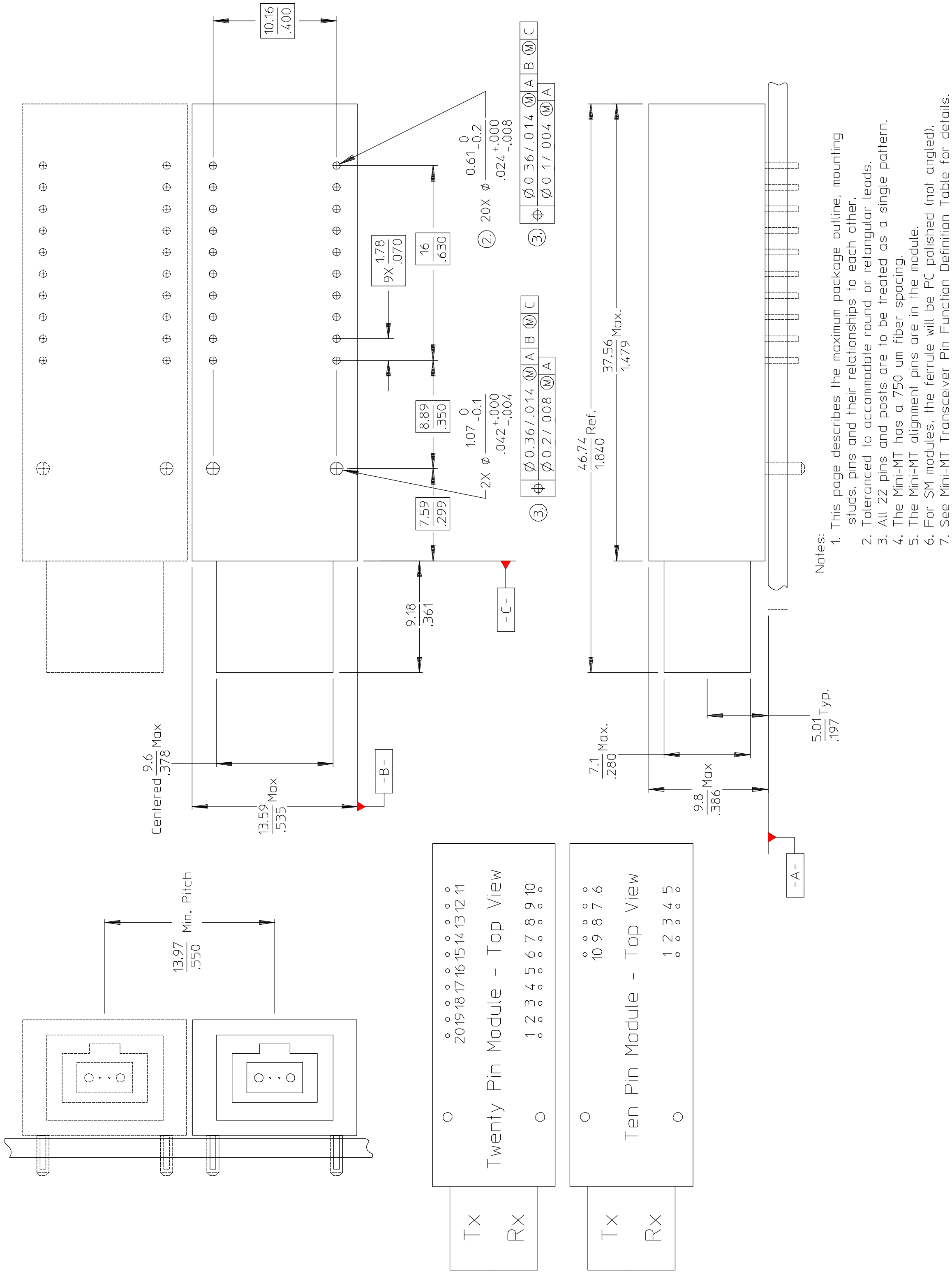


Figure 24 - Transceiver positioning

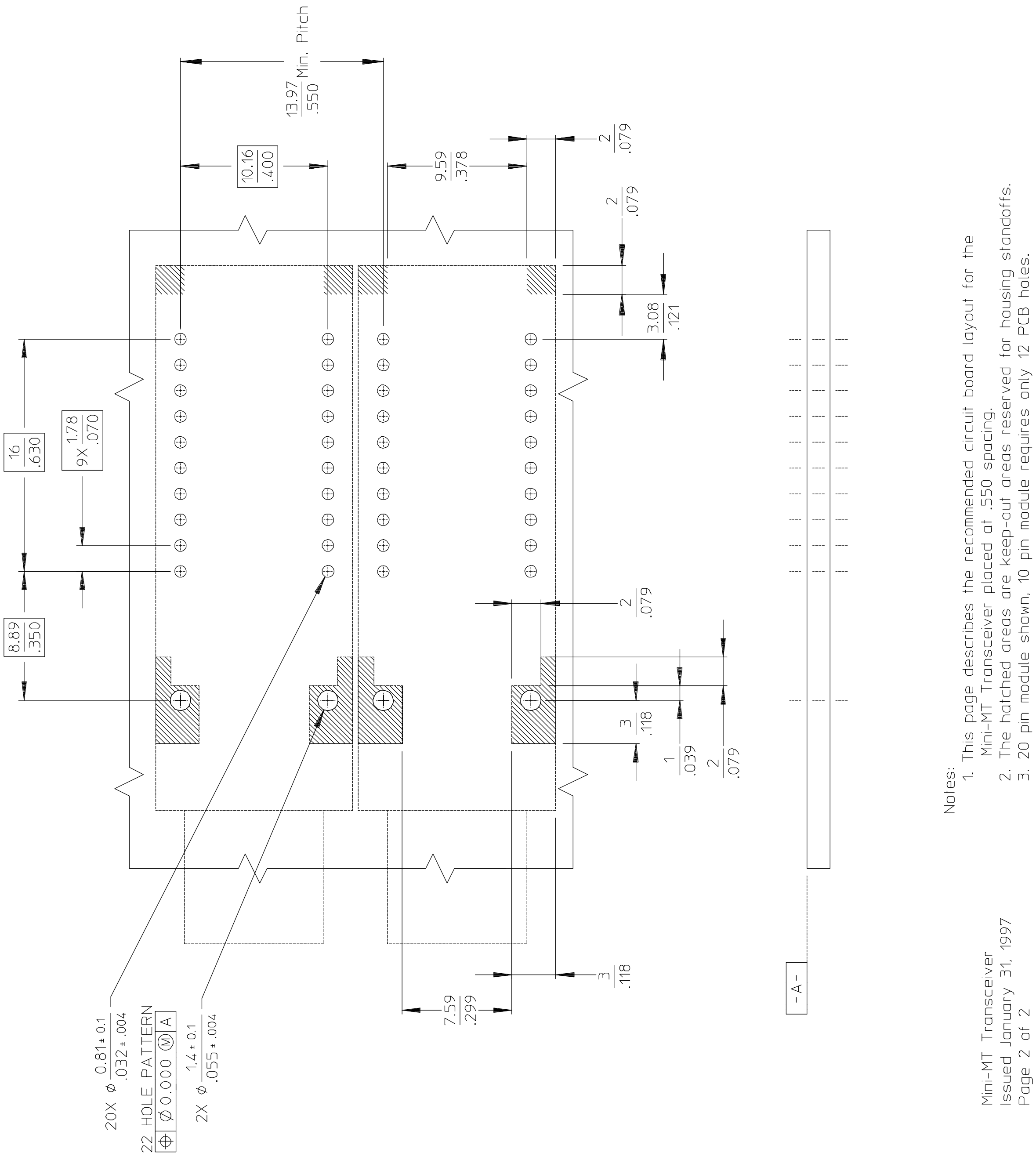


Figure 25 - Transceiver footprint

The requirements for the functions of the transceiver electrical contacts are contained in Table 12 and Table 13.

Table 12 - 10 position transceiver position function definitions

10 Position Transceiver Position Function Definitions			
10 and 20 Position Part Versions Two versions of this transceiver are intended. The 10 position version is intended for applications where the extra features of the 20 position version are not required. The 20 position version provides extra positions for features beyond data in and out such as recovered clock and laser transmitter monitors and alarms. See Package Outline Drawing for Position placement within the Package.			
Position Number	Symbol	Functional Description	Logic Family
MS	MS	Mounting Studs - The MS are provided for transceiver mechanical attachment to the circuit board. They must be connected to a floating pad on the circuit board which is not tied to signal or chassis ground.	N/A
1	RD-	Received Data Out Bar	PECL
2	RD+	Received Data Out	PECL
3	SD	Signal Detect	PECL
4	Vee_r	Receiver Signal Ground	N/A
5	Vcc_r	Receiver Power Supply	N/A
6	Vcc_t	Transmitter Power Supply	N/A
7	TD+	Transmitter Data In	PECL
8	TD-	Transmitter Data In Bar	PECL
9	Vee_t	Transmitter Signal Ground	N/A
10	TDis	Transmitter Disable: Optional Feature Do not connect if unused.	

Table 13 - 20 position transceiver position function definition

20 Position Transceiver Position Function Definitions			
10 and 20 Position Part Versions Two versions of this transceiver are intended. The 10 position version is intended for applications where the extra features of the 20 position version are not required. The 20 position version provides extra positions for features beyond data in and out such as recovered clock and laser transmitter monitors and alarms. See Package Outline Drawing for Position placement within the Package.			
Position Number	Symbol	Functional Description	Logic Family
MS	MS	Mounting Studs - The MS are provided for transceiver mechanical attachment to the circuit board. They must be connected to a floating pad on the circuit board which is not tied to signal or chassis ground.	N/A
1		Optional feature reserved for future use. Do not connect.	TBD
2	Ref Clk	Reference Clock: Optional Feature Do not connect if unused.	PECL
3	Lck Ref-	Lock to Reference Clock Bar: Optional Feature Do not connect if unused.	PECL
4	Clk+	Received Recovered Clock Out: Optional Feature Do not connect if unused.	PECL
5	Clk-	Received Recovered Clock Out Bar: Optional Feature Do not connect if unused.	PECL
6	RD-	Received Data Out Bar	PECL
7	RD+	Received Data Out	PECL
8	SD	Signal Detect	PECL
9	Vee_r	Receiver Signal Ground	N/A
10	Vcc_r	Receiver Power Supply	N/A
11	Vcc_t	Transmitter Power Supply	N/A
12	TD+	Transmitter Data In	PECL
13	TD-	Transmitter Data In Bar	PECL
14	Vee_t	Transmitter Signal Ground	N/A
15	TDis	Transmitter Disable: Optional Feature Do not connect if unused.	
16	Pmon	Laser Diode Optical Power Monitor: Optional Feature Do not connect if unused.	
17		Optional feature reserved for future use. Do not connect.	TBD
18	Lmon(+)	Laser Diode Bias Current Monitor (+): Optional Feature Do not connect if unused.	
19	Lmon(-)	Laser Diode Bias Current Monitor (-): Optional Feature Do not connect if unused.	
20		Optional feature reserved for future use. Do not connect.	TBD