This document was developed by the SFF Committee prior to it becoming the SFF TA (Technology Affiliate) TWG (Technical Working Group) of the SNIA (Storage Networking Industry Association) in 2016.

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

POINTS OF CONTACT: SFF TA TWG Chair Email: sff-chair@snia.org.
LOCATION OF SFF DOCUMENTS: http://www.snia.org/sff/specifications.

Suggestions for improvement of this specification are welcome and should be submitted to http://www.snia.org/feedback.

If you are interested in participating in the activities of the SFF TA TWG, additional information and the membership application can be found at: http://www.snia.org/sff.

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

SFF Committee

SFF-8482

Specification for

Serial Attachment 2X Unshielded Connector

Rev 2.5 August 31, 2018

Secretariat: SFF Committee

Abstract: This specification defines an Unshielded dual lane Input/Output connector for serial interface unshielded devices, backplanes and cables.

There are multiple using generations based on performance.

3 Gb/s	SFF-8678
12 Gb/s	SFF-8680
24 Gb/s	SFF-8681

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

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

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

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

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EXPRESSION OF SUPPORT BY MANUFACTURERS

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

Adaptec	IBM
Amphenol	Intel
Comax	LSI
Dell	MGE
Dell Computer	Molex
EMC	NetApp
ENDL	Sandisk
FCI	Seagate
Foxconn	Sun Microsystems
Fujitsu CPA	TE Connectivity
Hewlett Packard	Unisys
HGST	Volex
Hitachi Cable	Western Digital
Hitachi GST	

The following SFF member companies voted no on the technical content of this industry specification.

All Best Technique

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

Amphenol	Maxtor
Avago	Micrel
Brocade	Nexans
Emulex	Oclaro
FCI	Panduit
Fiberxon	Picolight
Finisar	Pioneer
Foxconn	Sumitomo
Fujitsu Components	Toshiba
Infineon	Toshiba America
LSI	TriQuint
Luxshare-ICT	Vitesse Semiconductor
Madison Cable	Xyratex

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

Change History

Revision 2.3
- Edited out symbols because of reports that a few were not being displayed on screen correctly by some PDF readers.
- Clarified first and second stage content in 5.1 per request.

Revision 2.4
- p2 reflects support of SFF-8482 and SFF-8680
- Body replaced by SFF-8680 mechanical content which had enhanced host board solder pads and attachment specifications.
  Previous history of SFF-8680:
  - Footprints of SFF-8482 and SFF-8680 defined as Appendixes
  - SFF-8680 1.5
    - Adopted common representation for SFF-8630/SFF-8639/SFF-8680
      Table 6-x Performance Requirements
      Appendix A introductory paragraphs
  - SFF-8680 1.6
    - Corrected Abstract EIA-966 reference to be formerly SFF-8482
  - SFF-8680 1.7
    - Editorial update to auto-generate Appendix in headings and TOC.
  - SFF-8680 1.8
    - Added EIA reference for Temperature Rise in Electrical Requirements Table
  - SFF-8680 1.9
    - Added additional footprints to Appendix A
      1. Through-hole (Figure A-3)
      2. Hybrid (Figure A-4)

Rev 2.5 (August 31, 2018)
- Document to be withdrawn from EIA; other than the changes to the header and cover page, no content or formatting changes have been made since Rev 2.4 of this document.

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, and 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.

CONTENTS

FIGURES

TABLES

SFF Committee --

Serial Attachment 2X Unshielded Connector

1. Scope

This specification defines the mechanical and connector contact performance requirements for a composite connector system. This composite system is designed to support high speed serial signals and power on different contacts within the same housing.

1.1 Application Specific Criteria

Intended applications for this connector system include Serial Attached SCSI (SAS) as specified by the T10 standards and for other applications requiring such a connector system.

2. References

2.1 Industry Documents

The following interface standards are relevant to this SFF Specification.

- ASME Y14.5M Dimensioning and Tolerancing
- EIA-364-D Electrical Connector/Socket Test Procedures Including Environmental Classifications (see Section 7 for relevant test procedures)
- INCITS 478 Serial Attached SCSI 2.1 (SAS-2.1)
- INCITS 519 Serial Attached SCSI - 3 (SAS-3)
- INCITS 534 Serial Attached SCSI - 4 (SAS-4)
- SFF-8223 2.5 inch Form Factor Drive w/Serial Attached Connector (EIA-720)
- SFF-8323 3.5 inch Form Factor Drive w/Serial Attached Connector (EIA-740)
- SFF-8678 Serial Attachment 2X 3 Gb/s Unshielded Connector
- SFF-8680 Serial Attachment 2X 12 Gb/s Unshielded Connector
- SFF-8681 Serial Attachment 2X 24 Gb/s Unshielded Connector

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.tmpl).

2.4 Conventions

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

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

2.5 Definitions

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

Fixed: Used to describe the gender of the mating side of the connector that accepts

its mate upon mating. This gender is frequently, but not always, associated with the common terminology "receptacle". Other terms commonly used are "female" and "socket connector". The term "fixed" is adopted from EIA standard terminology as the gender that most commonly exists on the fixed end of a connection, for example, on the board or bulkhead side.

In this specification "fixed" is specifically used to describe the mating side gender illustrated in Figure 3-1 as Backplane "Fixed" (receptacle)and Cable "Fixed" (receptacle).

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

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

In this specification "free" is specifically used to describe the mating side gender illustrated in Figure 3-1 as Device "Free" (plug).

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

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.

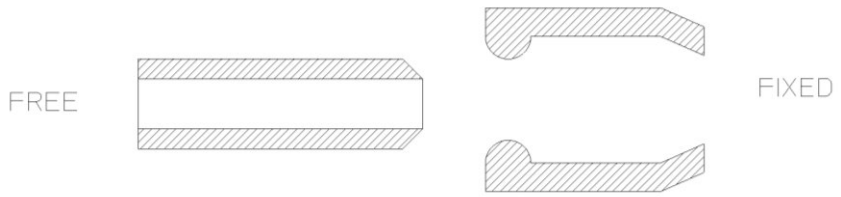


FIGURE 2-1 MATING SIDE GENDER

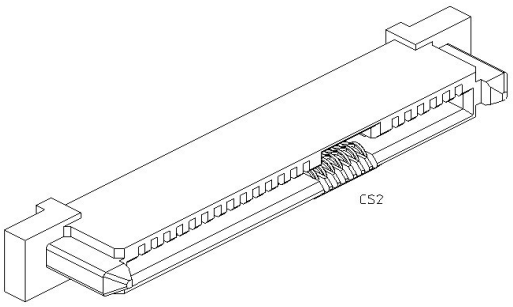
3. General Description

This connector system is designed to allow devices to connect to cable assemblies or to PCB's with the same device connector interface.

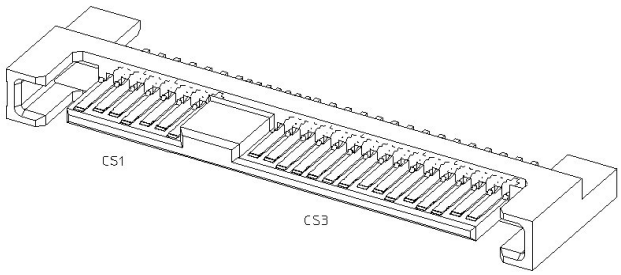
The device free (plug) interface incorporates three different contact sets (CS). Two of these sets (CS1 and CS2) contain 7 contacts each and typically are used for high speed serial signals. The high speed signals are grouped into differential pairs flanked with Grounds (G-S-S-G-S-S-G). The third set (CS3) contains 15 contacts and typically would be used for low frequency purposes such as power and control.

The backplane fixed (receptacle) interface supports device free (plug) interfaces which have CS1 and CS3 only or has all CS1, CS2 and CS3 contacts. Blind mating is supported by the guides built into the mating interface and a provision for hot plugging is supported by the contact sequencing that is possible by using the offset contact positions.

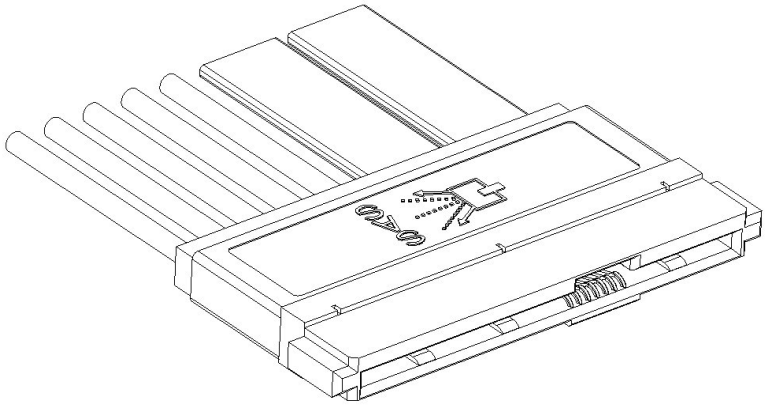
There is no provision for positive mating interface retention latching in the backplane fixed version.



BACKPLANE FIXED (RECEPTACLE) CONNECTOR



DEVICE FREE (PLUG) CONNECTOR



CABLE FIXED (RECEPTACLE) CONNECTOR

FIGURE 3-1 GENERAL VIEWS

The cable fixed (receptacle) supports device free (plug) interfaces which have CS1 and CS3 only or has all CS1, CS2 and CS3 contacts. The cable fixed (receptacle) interface incorporates a passive latching retention system to prevent accidental disconnection of the interface.

For cabled backplane implementation, the cable connector shall provide all feature requirements of the backplane fixed (receptacle)in addition to the passive cable retention defined.

4. Dimensioning Requirements

4.1 Connector Interface

All dimensional requirements for the connector within this specification must be met in order to provide intermateability between plug and receptacle and to fit within the physical boundaries required by the media and backplane.

4.2 General Tolerances

Unless otherwise shown, the following tolerances apply to the figures:

2 Place dimension = +/-0.20mm
Angular dimension = +/-3 degrees

The range of characteristics supported is indicative of the environment of use.

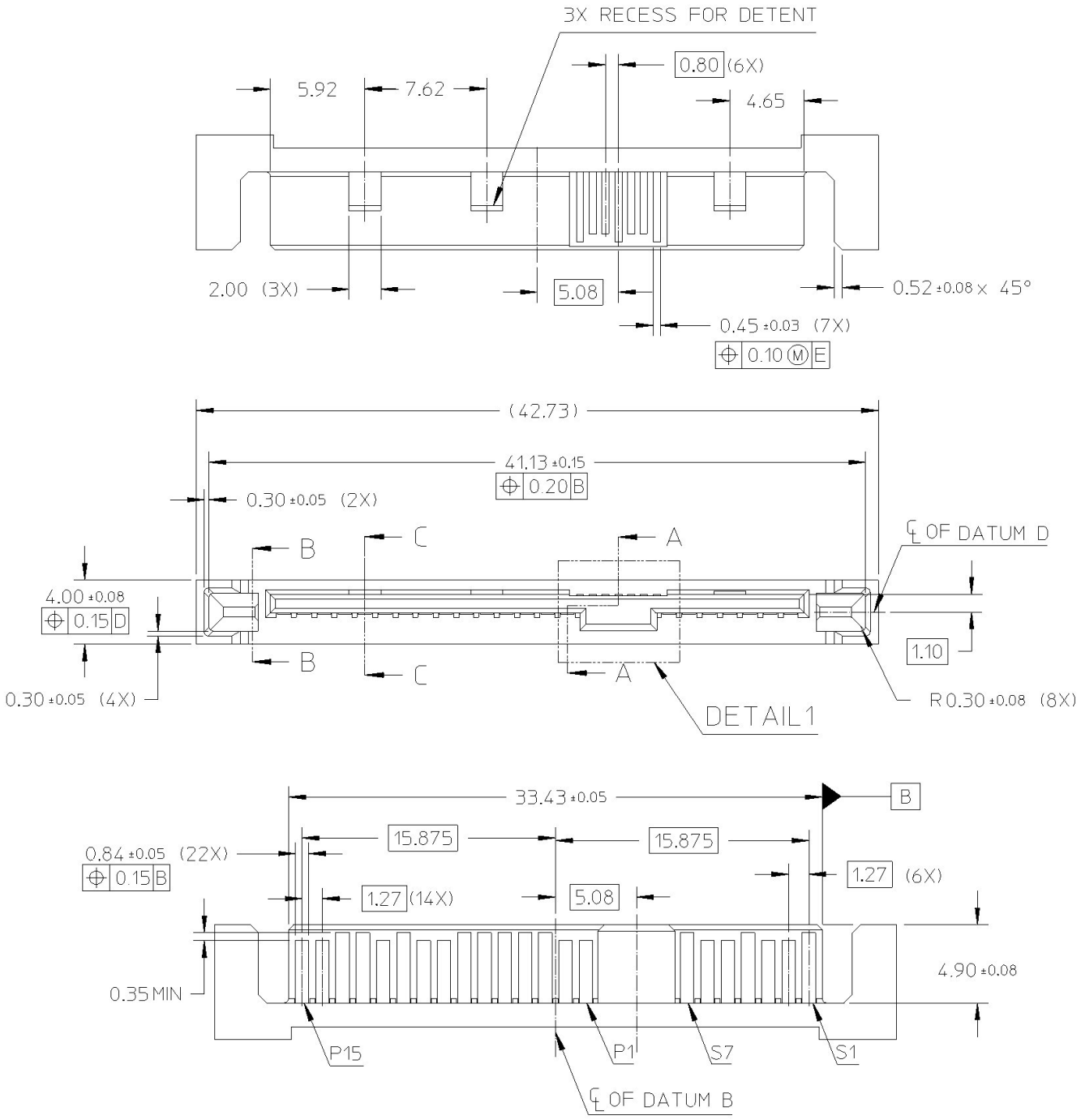


FIGURE 4-1 DEVICE FREE (PLUG) CONNECTOR

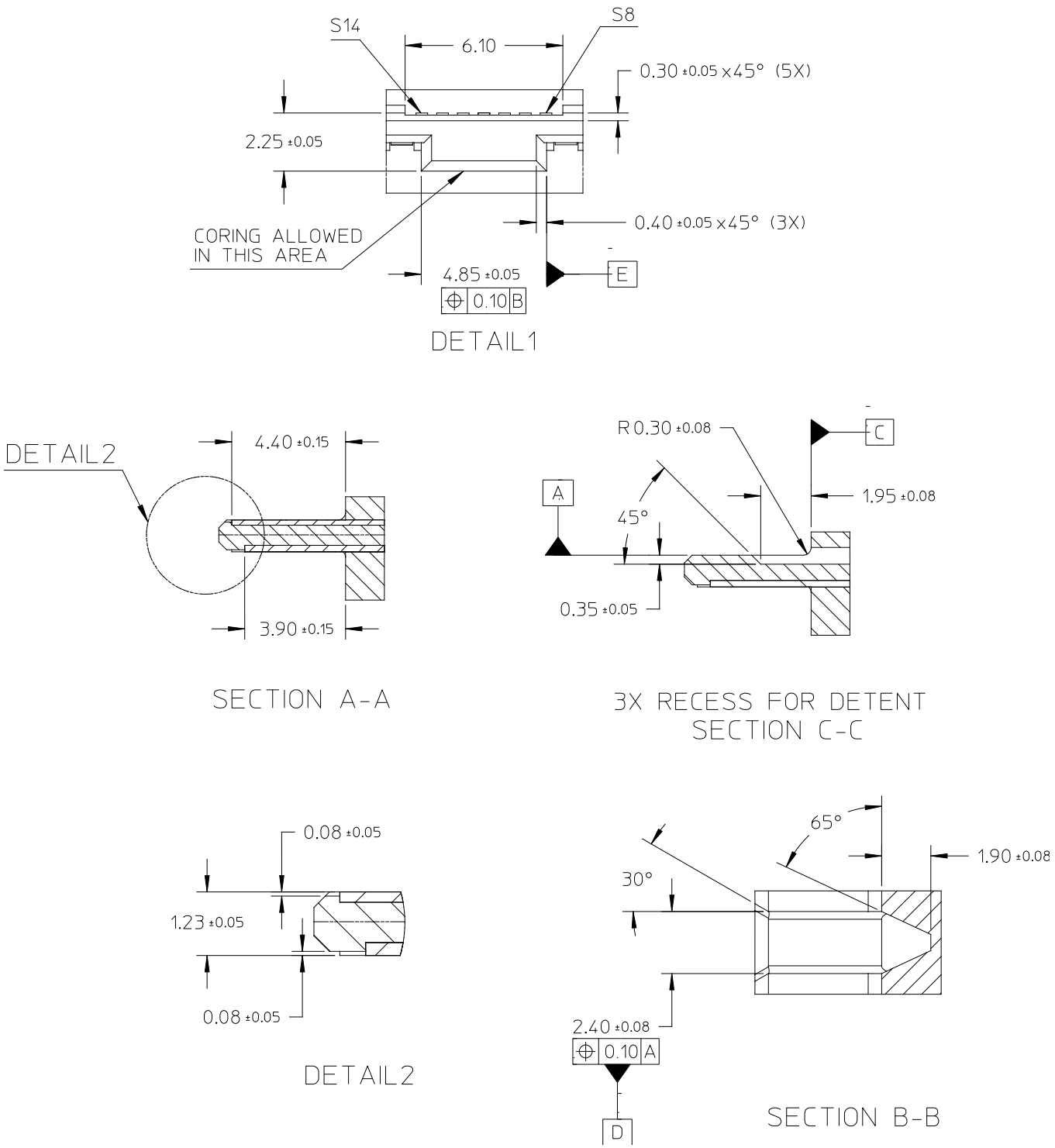


FIGURE 4-2 DEVICE FREE (PLUG) CONNECTOR DETAIL AND SECTION VIEW

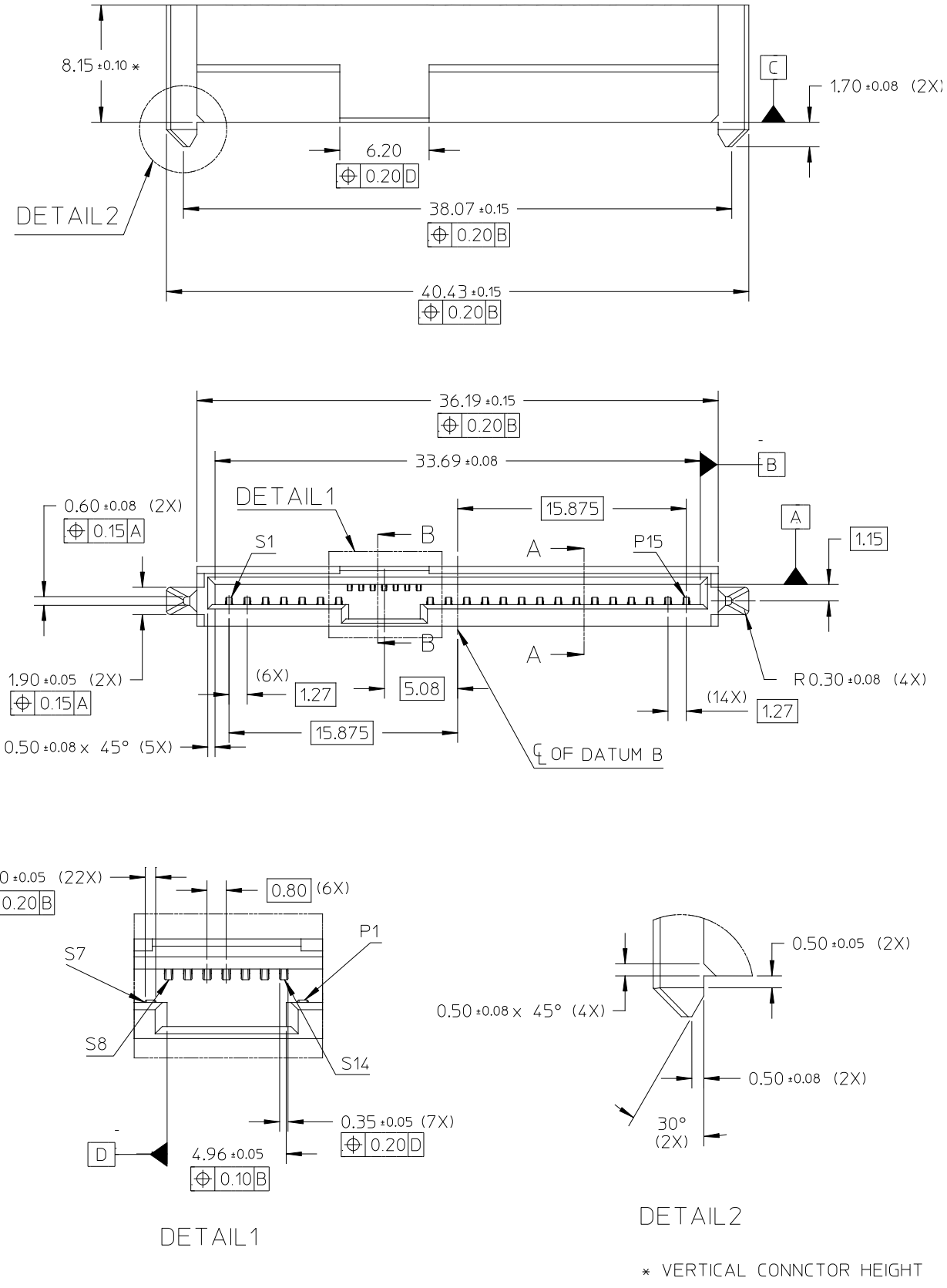
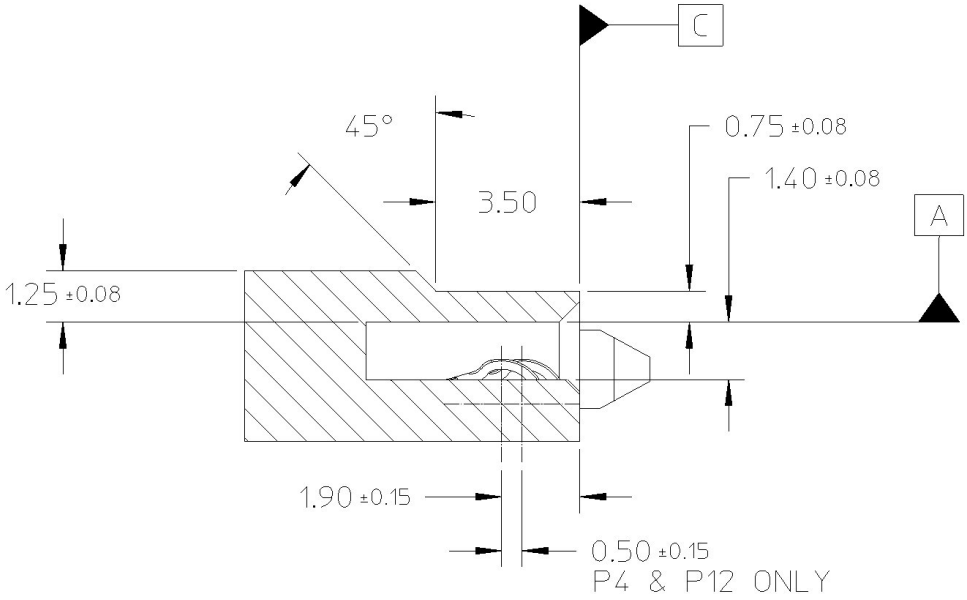
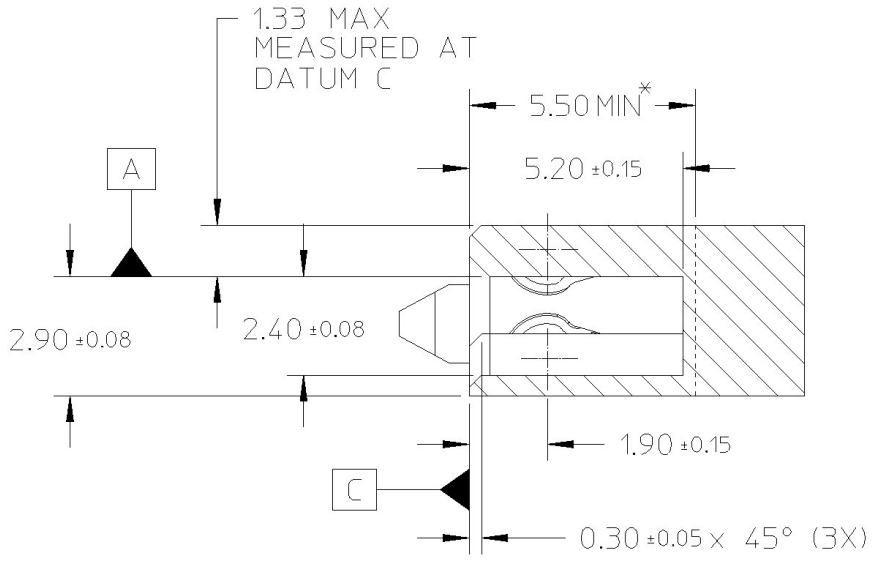


FIGURE 4-3 BACKPLANE FIXED (RECEPTACLE) CONNECTOR



SECTION A-A



SECTION B-B

*ALL FEATURES TO BE MAINTAINED WITHIN THEIR RESPECTIVE TOLERANCES OVER THIS DEPTH FROM DATUM C BACK.

FIGURE 4-4 BACKPLANE FIXED (RECEPTACLE) CONNECTOR SECTION VIEW

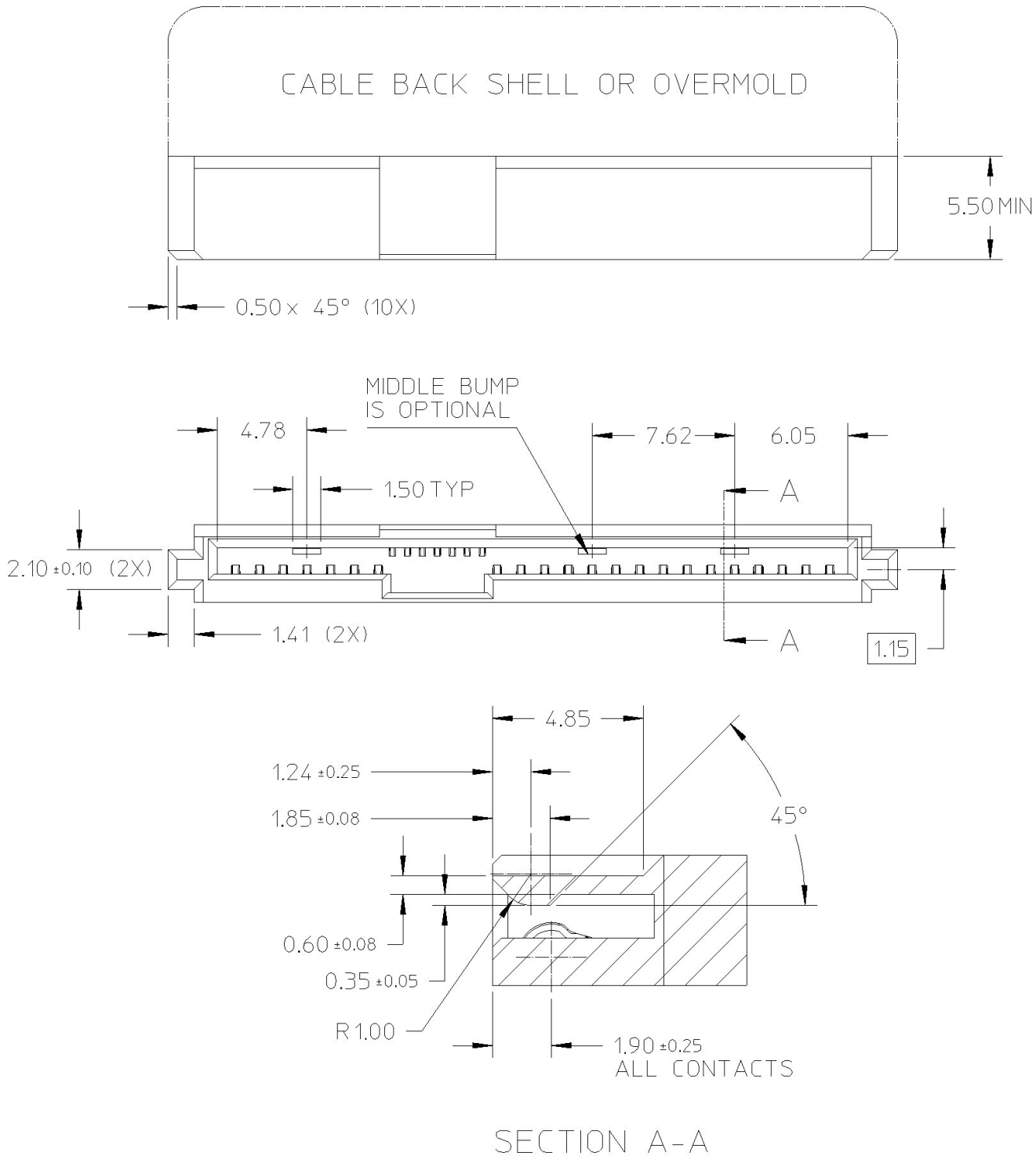


FIGURE 4-5 CABLE FIXED (RECEPTACLE) CONNECTOR

5. Backplane Fixed (Receptacle) Interface Features

5.1 Blind Mating

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

The mating interface specifications require a two stage process to arrive at the Final mated contact:

- The first stage must be delivered by the device enclosure system to achieve center to center alignment of less than 1.5 mm in the longitudinal axis and less than 1.0 mm in the horizontal axis prior to any part of the connector pair engaging. This is the blind mate tolerance zone depicted in Figure 5-1.

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

System/Application designers should recognize that certain lateral movement between free gender contacts and fixed gender contacts may occur between the time the pre-alignment features engage and the contacts reach the final mated position. The positional requirements in Figure 5-2 define the fully mated condition.

CAUTION: When mating unshielded serial attachment connectors without the aid of guide rails (or other pre-mating guiding systems not part of the connector) there is a risk of shorting signals to power. This event may damage the devices on either side of the connector.

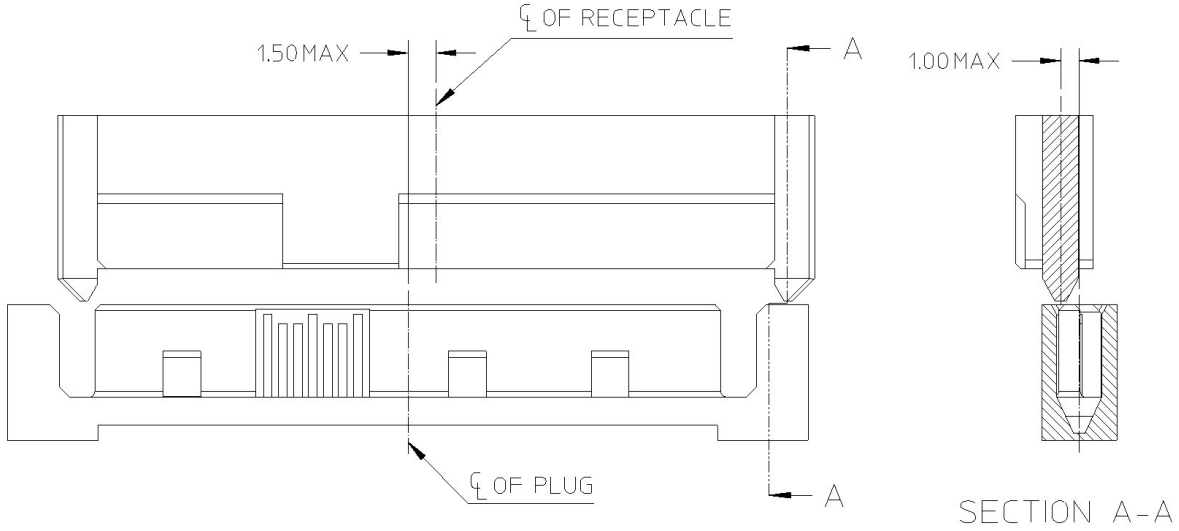


FIGURE 5-1 BLIND MATE TOLERANCE ZONES

5.2 Device to Backplane Location

In order to guarantee minimum contact engagement is provided in a backplane system, the position of the device connector interface must be controlled relative to the Backplane surface as shown in Figure 5-2.
Device clearances vary by Form Factor, see the appropriate Form Factor Specifications for connector location with respect to each Form Factor.

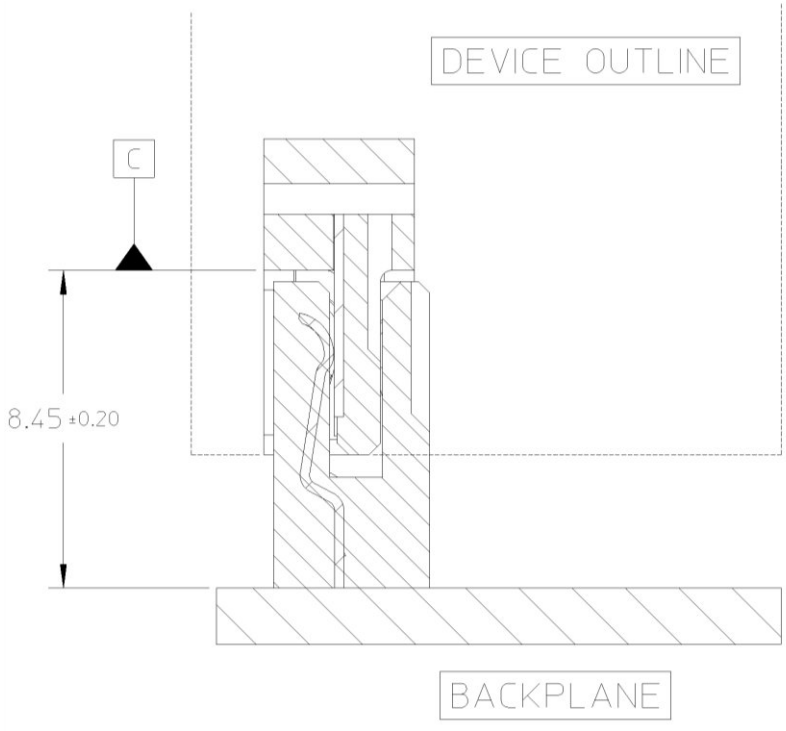


FIGURE 5-2 DEVICE TO BACKPLANE LOCATION

5.3 Hot Plugging

In order to facilitate hot plugging of a device into a powered backplane, the Backplane fixed (Receptacle) & Device free (plug) interface is designed to provide a 3 level contact engagement sequence. By specifying an offset between key contacts on each side of the mating interface, the mating sequence of these contacts is timed to occur in the proper order. There are 2 pins located in CS3 of the Backplane fixed (receptacle) interface that are advanced 0.50mm nominal from all other contact pins on this side of the interface. These pin locations represent the 1st level of mating upon insertion of the Device. The 2nd level of mating is established when the forward group of contacts located in the CSs of the Device free (plug) interface penetrate 0.50mm nominal into the Backplane fixed (receptacle) interface. The remaining contacts of the Device free (plug) interface are set back 0.50mm nominal and will be the last contacts to mate. In order to maintain this sequence, sufficient tolerance has been designed into the interface to allow for manufacturing and alignment of the device to the enclosure – see section 5.1.
The pin locations for the long & short contacts on both sides of the interface are defined in Table 5-1.

Hot plugging of cables **is not** supported by this interface.

TABLE 5-1 HOT PLUG CONTACT SEQUENCING

Device Free (Plug) Interface			Backplane Fixed (Receptacle) Interface		
S1					S1
S2					S2
S3					S3
S4					S4
S5					S5
S6					S6
S7					S7
S8					S8
S9					S9
S10					S10
S11					S11
S12					S12
S13					S13
S14					S14
P1					P1
P2					P2
P3					P3
P4					P4
P5					P5
P6					P6
P7					P7
P8					P8
P9					P9
P10					P10
P11					P11
P12					P12
P13					P13
P14					P14
P15					P15
	<-0.50mm->		<-0.50mm->		

6. Ratings

6.1 Current

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

Signal section (per pin)
- Continuous Current 500 mA

6.2 Temperature

Operating 0° C to 55° C
Non-operating -40° C to 85° C

7. General Connector Performance Requirements

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

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

TABLE 7-1 ELECTRICAL REQUIREMENTS

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

TABLE 7-2 MECHANICAL REQUIREMENTS

Description	Requirement	Procedure
Mechanical Shock	Discontinuity <1 microsecond 15 milliohm maximum change from initial Contact Resistance	EIA-364-27 Subject mated connectors to 50G's half-sine shock pulses of 11 milliseconds duration in each X,Y and Z axis (18 shocks total)
Random Vibration	Discontinuity <1 microsecond 15 milliohm maximum change from initial Contact Resistance	EIA-364-28, Test Condition VII Subject mated connectors to 3.10G's RMS between 20-500 Hz for 15 minutes in each of 3 mutually perpendicular planes
Durability	No damage 15 milliohm maximum change from initial Contact Resistance	EIA 364-09: Mate and unmate connectors at a maximum rate of 200 cycles per hour Backplane - 500 Cycles Cable - 25 Cycles
Connector Mate and Unmate Forces	Backplane Mate - 25N max Unmate - 5N min Cable Mate - 50N max Unmate - 20N min Initial and after durability	EIA 364-13: Mate and unmate connectors at a rate of 25mm per minute

TABLE 7-3 ENVIRONMENTAL REQUIREMENTS

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

A. Appendix (Informative): Receptacle PCB Footprints (High Performance)

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

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

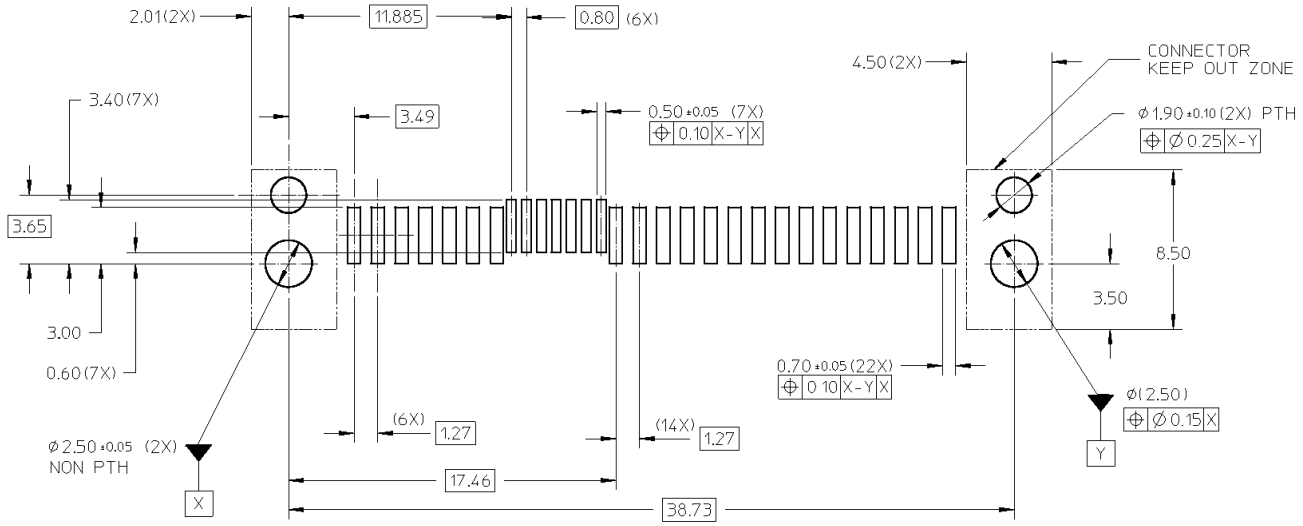


FIGURE_ A-1 PRINTED CIRCUIT BOARD DETAIL SURFACE MOUNT

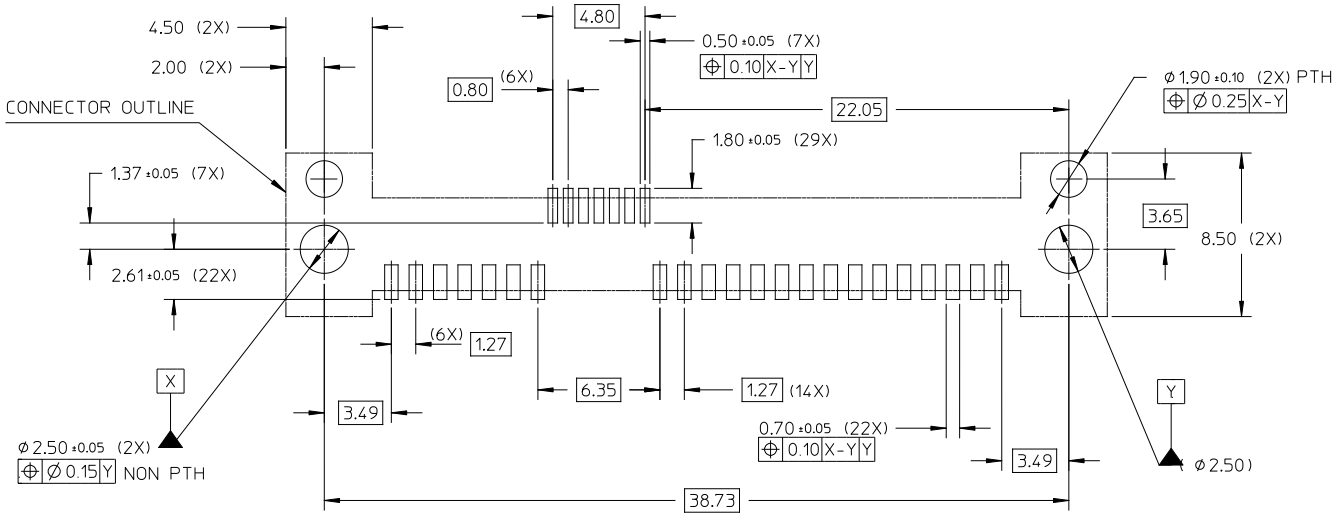


FIGURE_ A-2 PRINTED CIRCUIT BOARD DETAIL ALTERNATE SURFACE MOUNT

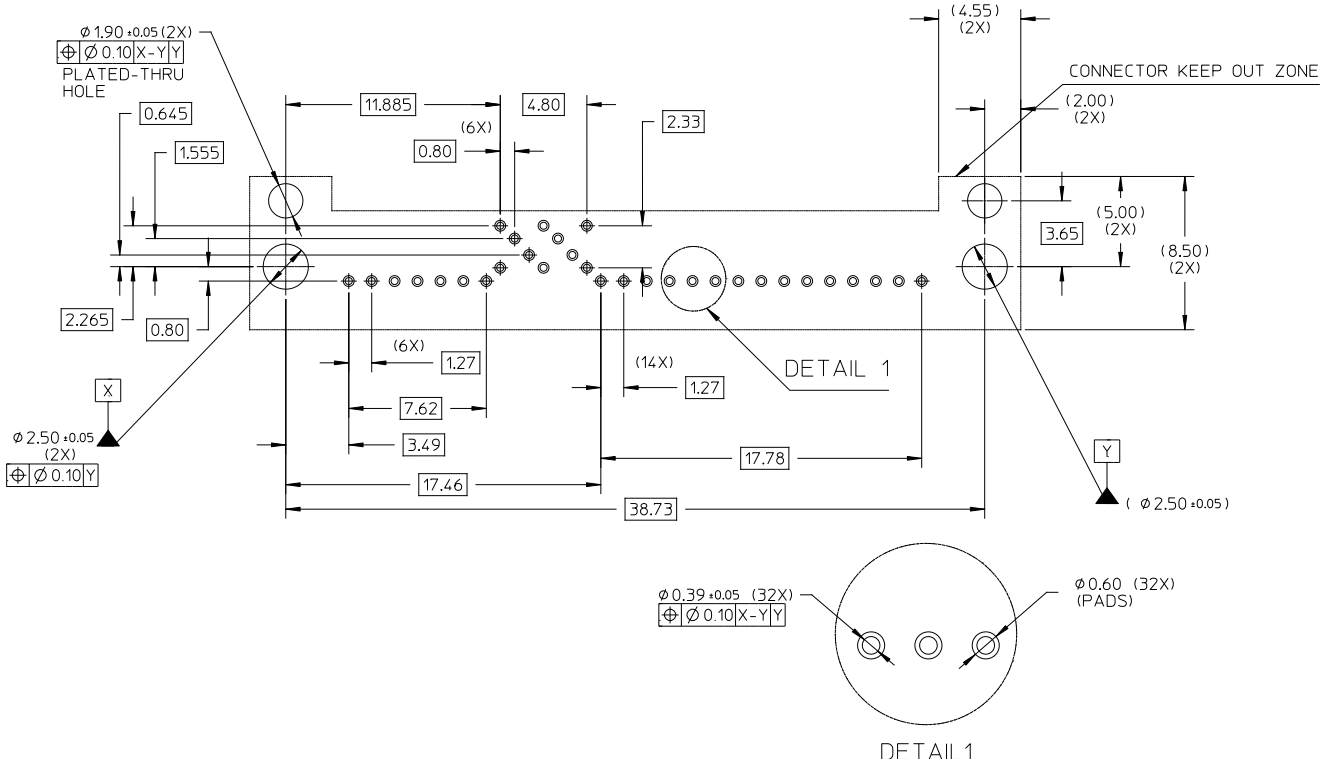


FIGURE_ A-3 PRINTED CIRCUIT BOARD DETAIL THROUGH HOLE (Press Fit & Solder Pin)

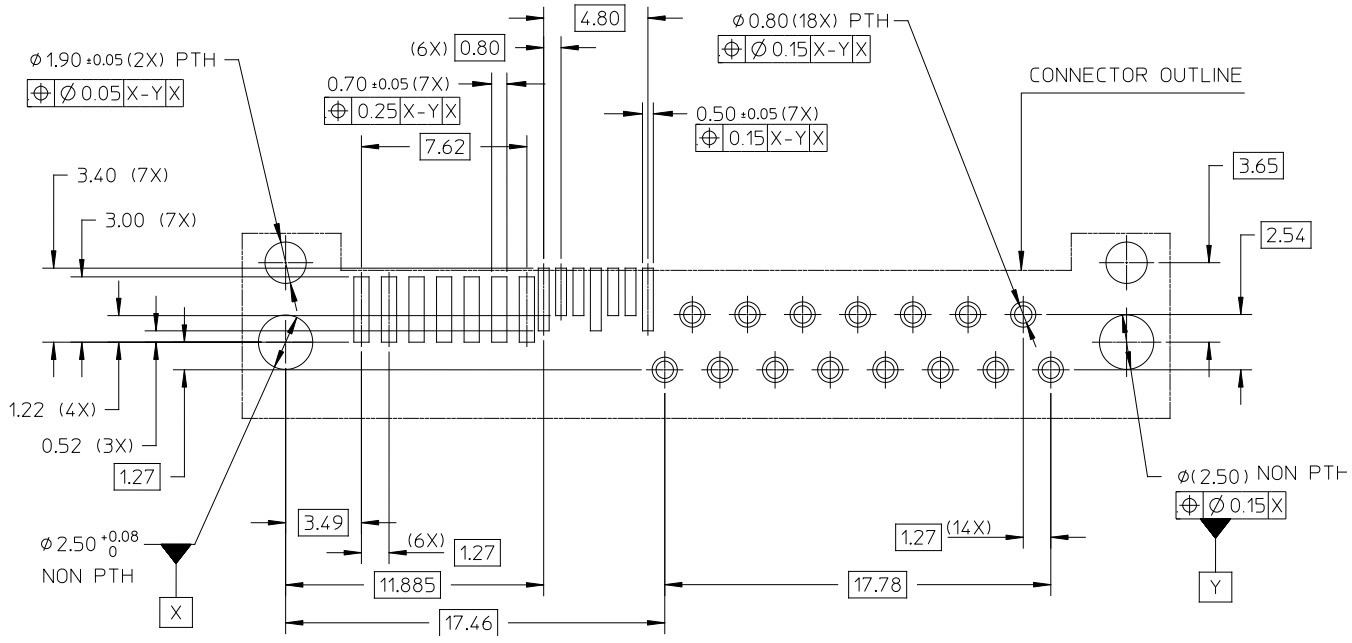


FIGURE_ A-4 PRINTED CIRCUIT BOARD DETAIL HYBRID

B. Appendix (Informative): Receptacle PCB Footprints

These footprint examples suit the performance defined by SFF-8678.

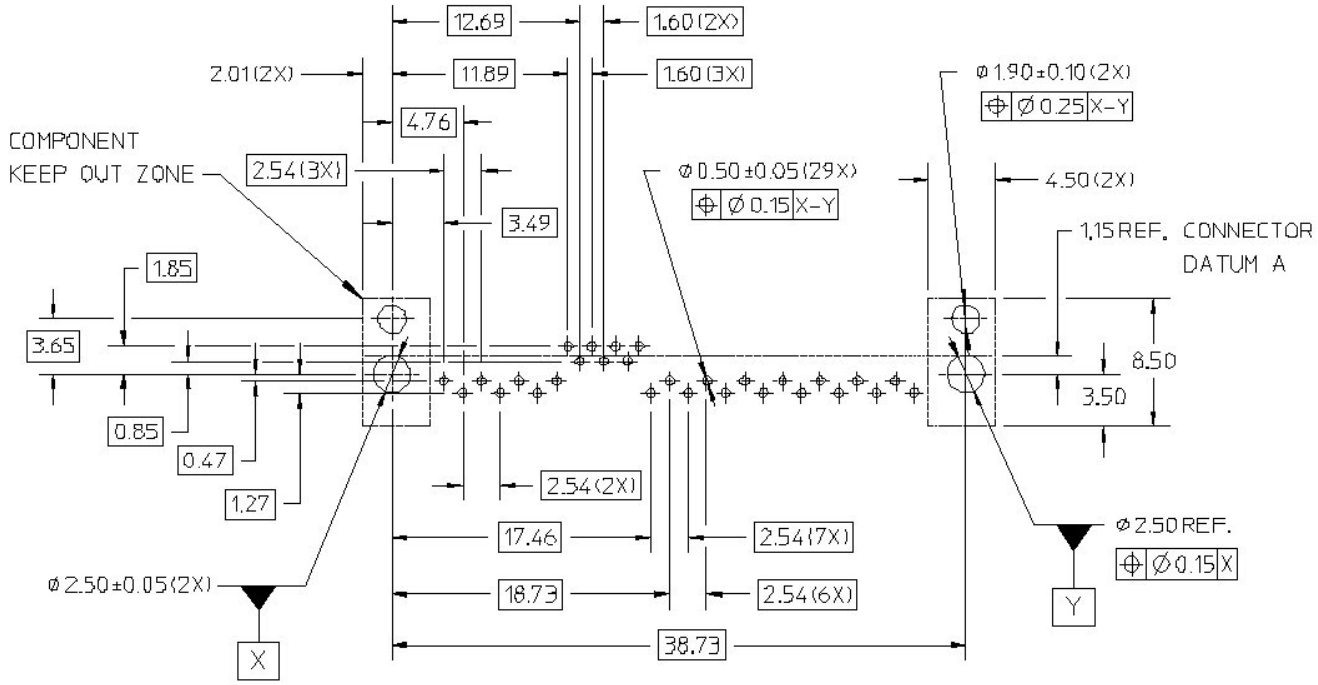


FIGURE_ B-1 THROUGH HOLE PRINTED CIRCUIT BOARD DETAIL (PRESS FIT & SOLDER PIN)

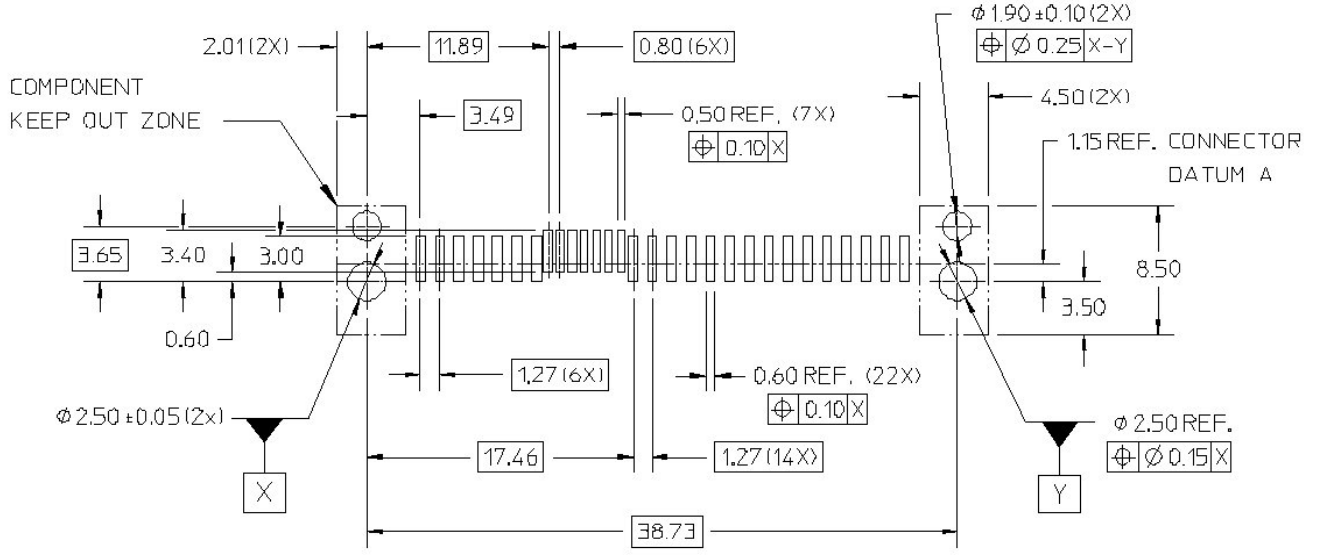


FIGURE_ B-2 SURFACE MOUNT PRINTED CIRCUIT BOARD DETAIL

Pad widths listed as reference dimensions are left open to the manufacturer to determine based on their internal design standards. In order to determine the pad widths for Surface Mount leads the following dimensions and tolerances apply:

Solder Leads on 1.27mm spacing = 0.40 +/- 0.08mm
Solder Leads on 0.80mm spacing = 0.30 +/- 0.05mm

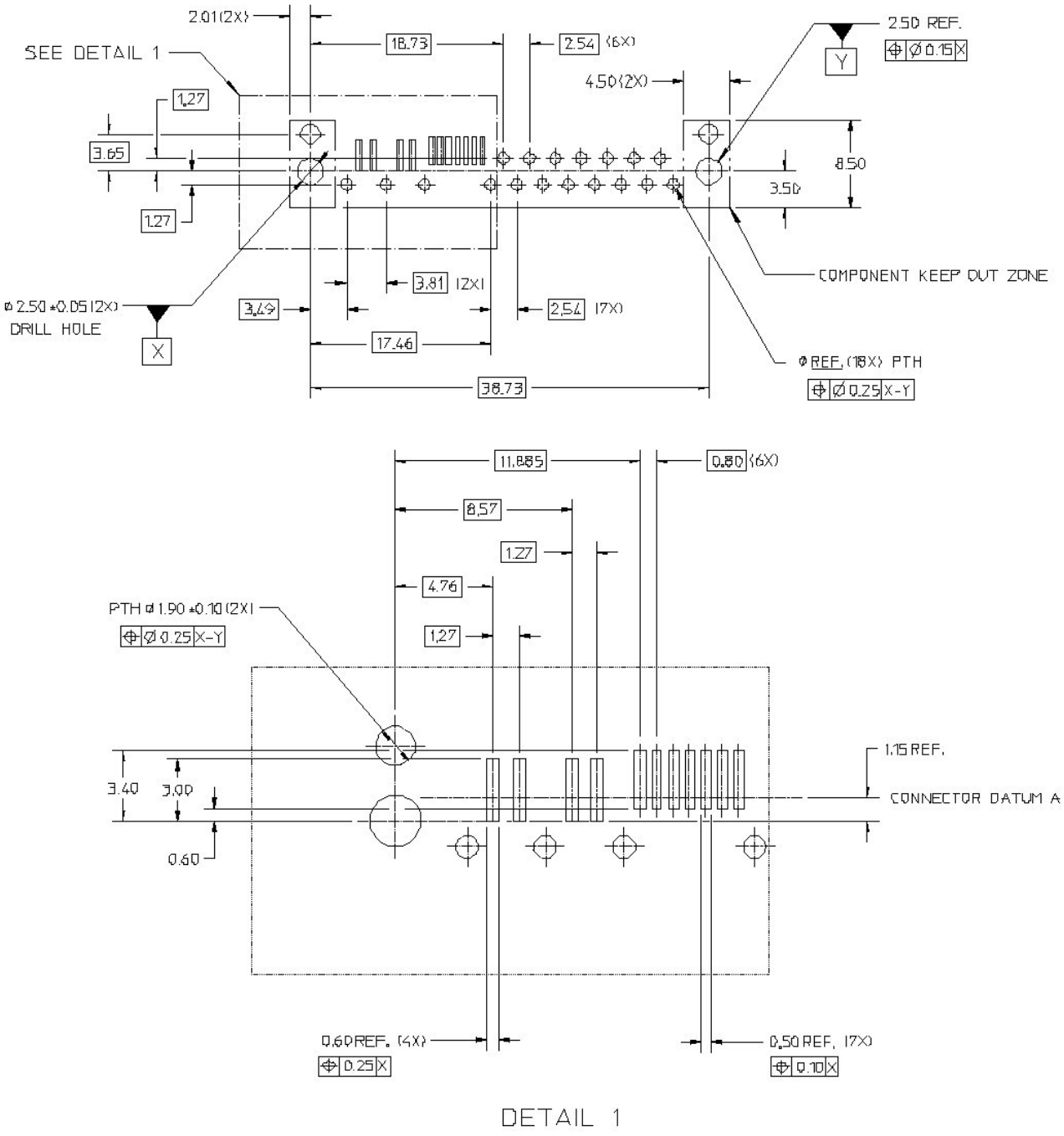


FIGURE_ B-3 HYBRID PRINTED CIRCUIT BOARD DETAIL

Hole sizes listed as reference dimensions are left open to the manufacturer to determine based on their internal design standards. In order to determine the hole diameter for Solder Pins the following pin width dimensions and tolerances apply:

Solder Pins on 1.27mm spacing = 0.40 +/- 0.08mm
Solder Pins on 0.80mm spacing = 0.40 +/- 0.08mm

Pad widths listed as reference dimensions are left open to the manufacturer to determine based on their internal design standards. In order to determine the pad widths for Surface Mount leads the following dimensions and tolerances apply:

Solder Leads on 1.27mm spacing = 0.40 +/- 0.08mm
Solder Leads on 0.80mm spacing = 0.30 +/- 0.05mm