SFF-8639

Specification for

Multifunction 6X Unshielded Connector

Rev 2.2 May 6, 2024

Secretariat: SFF TA TWG

Abstract: This specification defines the mechanical specifications and general requirements of a six lane, high speed multifunction plug and receptacle connector that is designed for use as a multi-application solution.

Systems utilizing this connector may support single port SATA, dual port SATA Express, dual port SAS, MultiLink SAS, or up to four (4) port PCIe device configurations in an isolated manner. Systems utilizing the six lane receptacle in a backplane application will accept devices with plugs developed in accordance with SFF-8482 and SFF-8630.

This specification provides a common reference for systems manufacturers, system integrators, and suppliers.

This specification is made available for public review at https://www.snia.org/sff/specifications. Comments may be submitted at https://www.snia.org/feedback. 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.

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FOREWORD

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

For those who wish to participate in the activities of the SFF TA TWG, the signup for membership can be found at https://www.snia.org/sff/join.

Change History

Revision 1.0
- Put PCB footprints in Informative Appendix as an example.

Revision 1.1
- Adopted common representation for SFF-8629/SFF-8639/SFF-8482
  - o Table 8-x Performance Requirements
  - o Appendix C introductory paragraphs

Revision 1.2
- Added explanatory text to Section 5.4 re datums.

Revision 1.3
- Removed lingering reference to SFF-8699 in Section 5.2

Revision 1.4
- Added paragraph to Appendix A that using interfaces are the definitive references

Revision 1.5
- Extracted Informative Annex A to become the basis for SFF-9639

Revision 1.6
- Added EIA reference for Temperature Rise in Table of Electrical Requirements.

Revision 1.7
- Deleted Section 6.2 which had obsolete pinout content.

Revision 1.8
- Restored Contact Mating Scheme in Section 6.2

Revision 1.9
- Pin ID numbers updated in Figure 5-3 and replaced 'PCIe-SSD' with 'SFF-8639'
- Added reference to Figure 5-3in Section 5.4

Revision 2.0
- The speed characteristics and electrical considerations were removed in order to create SFF-8637.

Revision 2.0.2
- Revised all references to SFF-8629 and made them SFF-8630
- Deleted all references to the following:
  - 12 Gb/s SFF-8637
  - 24 Gb/s SFF-8638
- Changed the Un-Mate Force from 12N to 6N in Table 9-2 Mechanical Requirements

Revision 2.0.3
- Small editorial changes to increase clarity

Revision 2.0.4
- Corrected a typo in Section 2.1
- Deleted sentence regarding Tin-Tin interface in Section 3.3
- Corrected a typo in the last line on Page 25.

Revision 2.1

Revision 2.2
- Revised Figure 5-4to be consistent with SFF-8482 and manufactured parts.
- Changed to SFF template Rev 1.1.1

TABLE OF CONTENTS

FIGURES

TABLES

1. Scope

This specification defines the terminology and mechanical requirements for a six lane, high speed plug and receptacle that is designed for use as a common connector system supporting SATA, SAS and PCIe based devices.

The mechanical dimensioning and signal assignments for the six lane common connector receptacle allows intermateability with the unshielded dual port serial attachment plug connectors that have been developed in accordance with SFF-8482, and unshielded multiport serial attachment connectors that have been developed in accordance with SFF-8630.

2. References

2.1 Industry Documents

The following documentation is relevant to this Specification.

ASME Y14.5M Dimensioning and Tolerancing

EIA-364-D Electrical Connector/Socket Test Procedures Including Environmental Classifications

IPC-A-610 Acceptability of Electronic Assemblies

SFF Committee specifications are available from https://www.snia.org/sff/specifications

- SFF-8223 2.5" Drive Form Factor with Serial Attached Connector
  Commonly known as the "2.5 inch drive" specification.
  Note: SFF-8223 has been standardized in EIA-720
- SFF-8323 3.5" Drive Form Factor with Serial Attached Connector
  Commonly known as the "3.5 inch drive" specification.
  Note: SFF-8323 has been standardized in EIA-740
- SFF-8482 Serial Attachment 2X Unshielded Connector
  Commonly known as the "SAS connector" specification
  Note: SFF-8482 has been standardized as EIA-966
- SFF-8630 Serial Attachment 4X Unshielded Connector
  Commonly known as SAS MultiLink

- SFF-9639 Multifunction 6X Unshielded Connector Pinouts

2.2 Sources

The complete list of SFF documents which have been published, are currently being worked on, or that have been expired by the SFF Committee can be found at https://www.snia.org/sff/specifications. Suggestions for improvement of this specification are welcome and should be submitted to https://www.snia.org/feedback.

Copies of ANSI standards may be purchased from the International Committee for Information Technology Standards (https://www.techstreet.com/incitsgate.tmpl).

2.3 Conventions

The following conventions are used throughout this document:

DEFINITIONS: Certain words and terms used in this standard have a specific meaning beyond the normal English meaning. These words and terms are defined either in the definitions or in the text where they first appear.

ORDER OF PRECEDENCE: If a conflict arises between text, tables, or figures, the order of precedence to resolve the conflicts is text; then tables; and finally figures. Not all tables or figures are fully described in the text. Tables show data format and values.

LISTS: Lists sequenced by lowercase or uppercase letters show no ordering relationship between the listed items.

EXAMPLE 1 - The following list shows no relationship between the named items:

a. red (i.e., one of the following colors):
    A. crimson; or
    B. pink;
b. blue; or
c. green.

Lists sequenced by numbers show an ordering relationship between the listed items.

EXAMPLE 2 -The following list shows an ordered relationship between the named items:

1. top;
2. middle; and
3. bottom.

Lists are associated with an introductory paragraph or phrase and are numbered relative to that paragraph or phrase (i.e., all lists begin with an a. or 1. entry).

DIMENSIONING CONVENTIONS: The dimensioning conventions are described in ASME-Y14.5, Geometric Dimensioning and Tolerancing. All dimensions are in millimeters, which are the controlling dimensional units (if inches are supplied, they are for guidance only).

NUMBERING 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

3. Keywords, Acronyms, and Definitions

For the purposes of this document, the following keywords, acronyms, and definitions apply.

3.1 Keywords

May or may not: Indicates flexibility of choice with no implied preference.

Obsolete: Indicates that an item was defined in prior specifications but has been removed from this specification.

Optional: 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.

Prohibited: Describes a feature, function, or coded value that is defined in a referenced specification to which this SFF specification makes a reference, where the use of said feature, function, or coded value is not allowed for implementations of this specification.

Reserved: Defines the signal on a connector contact. 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.

Restricted: Refers to features, bits, bytes, words, and fields that are set aside for other standardization purposes. If the context of the specification applies the restricted designation, then the restricted bit, byte, word, or field shall be treated as a reserved bit, byte, word, or field (e.g., a restricted byte uses the same value as defined for a reserved byte).

Shall: Indicates a mandatory requirement. Designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this specification.

Should: Indicates flexibility of choice with a strongly preferred alternative.

Vendor specific: Indicates something (e.g., a bit, field, code value) that is not defined by this specification. Specification of the referenced item is determined by the manufacturer and may be used differently in various implementations.

3.2 Acronyms and Abbreviations

PCB: Printed Circuit Board

3.3 Definitions

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

Advanced grounding contacts: Connector contacts that mate 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, pressfit.

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 specification "fixed" is specifically used to describe the mating side gender illustrated in Figure 2-1, and shown in Figure 3-1.

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.

Fixed Cable: A connector that uses a fixed gender mating side as shown in the Informative Appendix.

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 2-1, and shown in Figure 3-2.

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

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.

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.

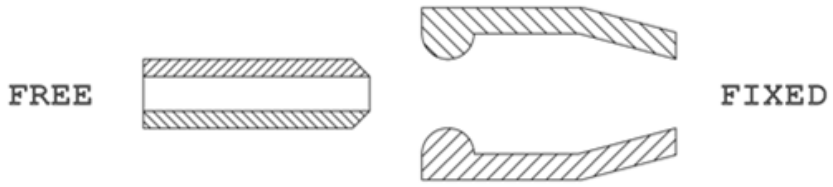


FIGURE 3-1 MATING SIDE GENDER DEFINITION

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.

Wipe (Contact Location): The contact location has two components: direction of mating and direction of contact pitch. In the direction of mating, the Free contact location must be a minimum of 0.05 mm from either end of the Fixed contact mating interface after mating and latching.

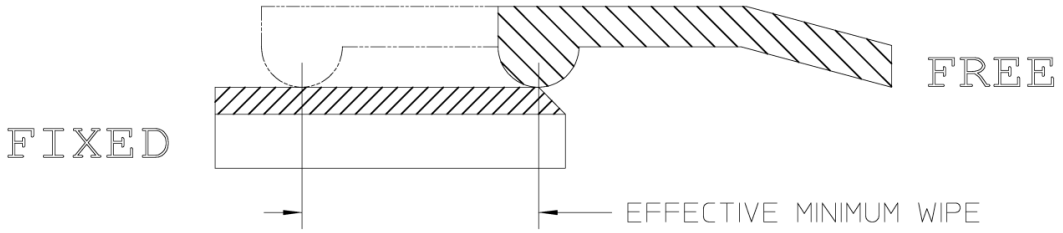


FIGURE 3-2 DIRECTION OF MATING

In the direction of contact pitch, the Free contact shall have no less than 50% of the available mating width in contact with the Fixed contact and there shall be a minimum clearance to the adjacent Fixed contact. The minimum clearance to the adjacent Fixed contact shall be 0.075 mm for interfaces with a pitch of at least 0.70 mm. For pitches less than 0.70 mm, the minimum clearance should be reviewed on a case by case basis to insure that a shorting condition does not exist.

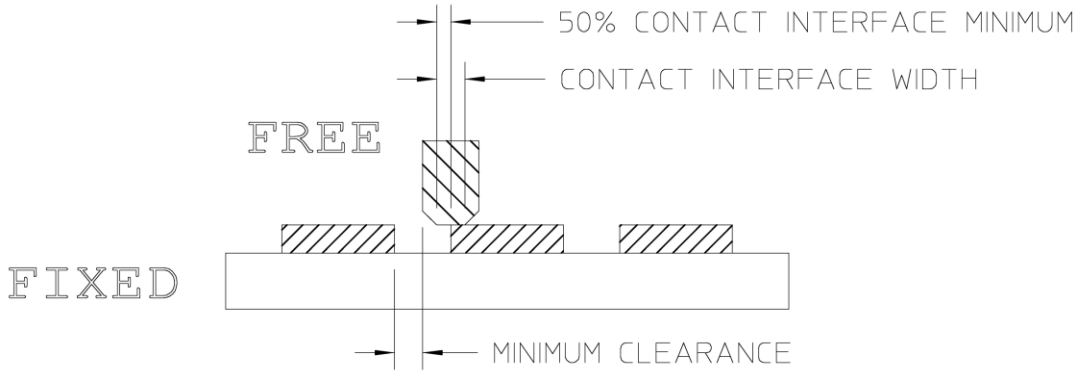


FIGURE 3-3 DIRECTION OF CONTACT

Wipe (Minimum Effective Contact): The distance that the Free contact moves along the Fixed contact without losing electrical connection.

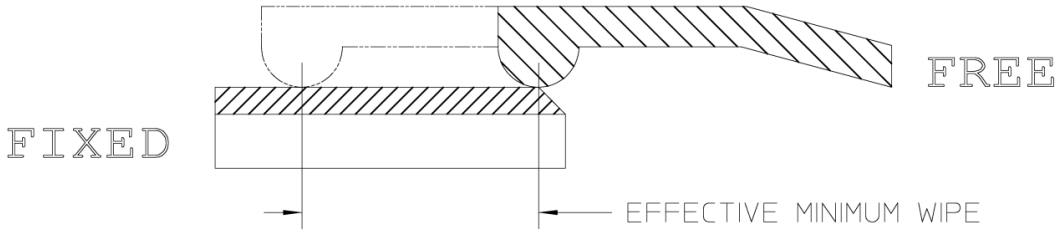


FIGURE 3-4 CONTINUOUS CONTACT

The minimum effective wipe is dependent on the finish of the contact interface. Tin-Tin interfaces shall have a minimum effective wipe of 2.00 mm. Gold-Gold interfaces shall have a minimum effective wipe of 0.40 mm.

4. General Description

This connector system is designed to allow devices that support single port SATA, dual port SATA Express, dual port SAS, MultiLink SAS, or up to four (4) port PCIe port plugs to mate to a common fixed receptacle that is mechanically compatible to the connector receptacles designed in accordance with SFF-8482 or SFF-8630. **Note: Legacy SAS and SATA Drive Plug Connectors will not mate with the cable variant version outlined in the Informative Appendix.**

The interface supports all of the contact sets defined by a dual port SAS implementation plus an additional 39 signals. The additional 39 signals are used to support 4 lanes of PCIe plus 10 sideband signals. In a MultiLink SAS implementation 14 of the 39 signals are used to support the two additional SAS ports.

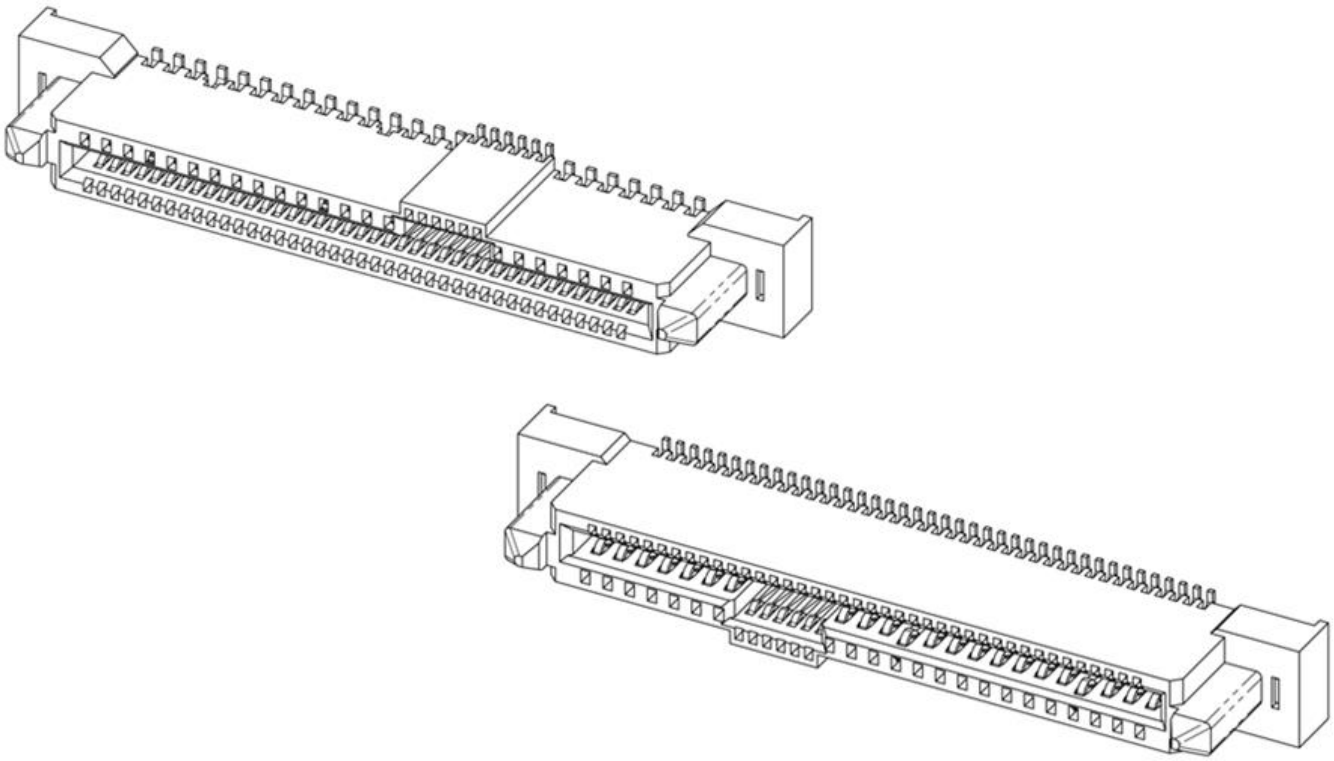


FIGURE 4-1 RECEPTACLE VIEW

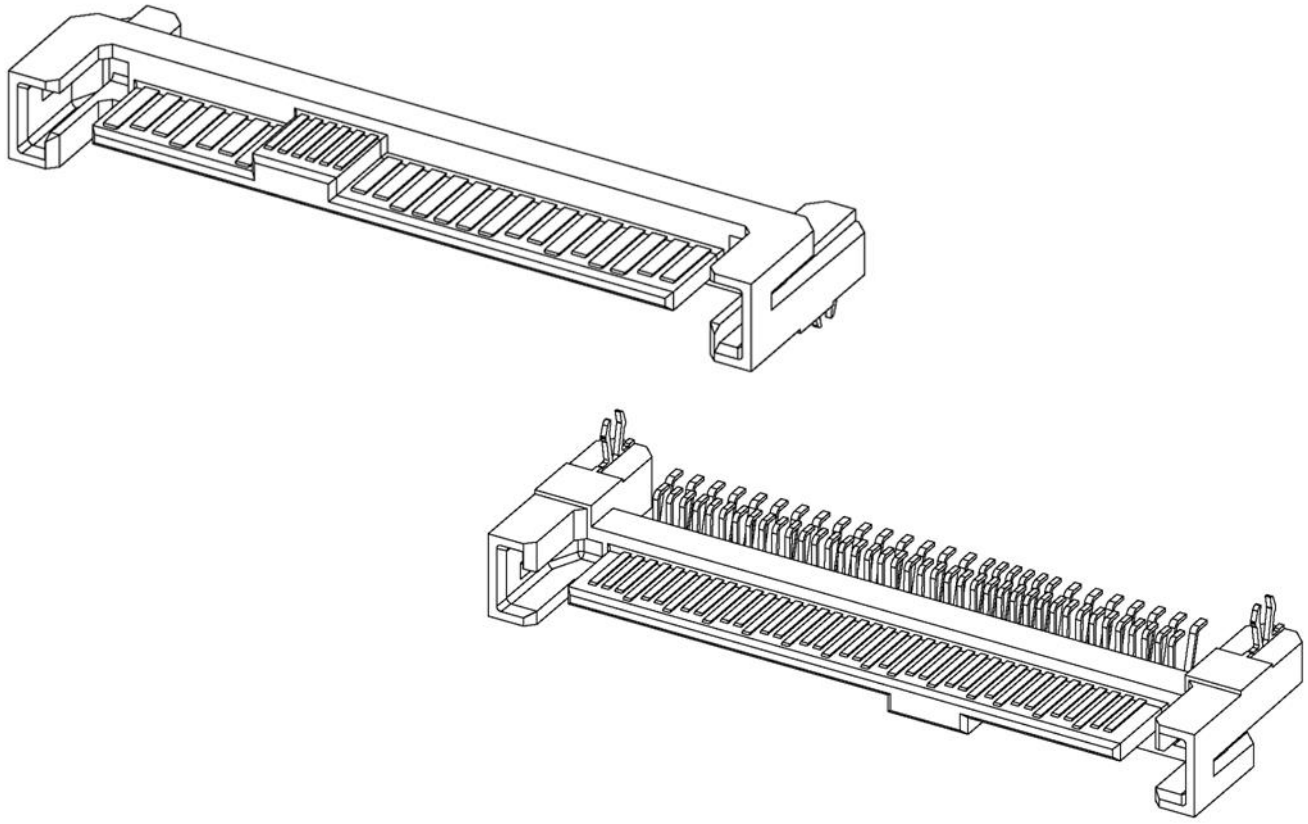


FIGURE 4-2 PLUG VIEW

4.1 Usage Models

The connector system defined in this specification is considered to be an extension of the connector systems defined in SFF-8482 and SFF-8630. This connector system may be used to implement five specific storage device use cases. These use cases are as follows:

- Single port SATA (as defined by Serial ATA revision 3.1)
- Two port SATA Express (as defined in Serial ATA Technical Proposal #TPR_C109, currently under development)
- Dual port SAS (as defined by SFF-8482)
- MultiLink SAS (as defined by SFF-8630)
- Up to 4 lanes of PCIe (as defined in this specification)

This connector system defines a total of 68 contacts. Not all contacts may be utilized on a particular connector implementation depending on the use case being supported. The connector system may be used for other use cases not defined in this specification.

5. Dimensioning Requirements

5.1 Connector Interface

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

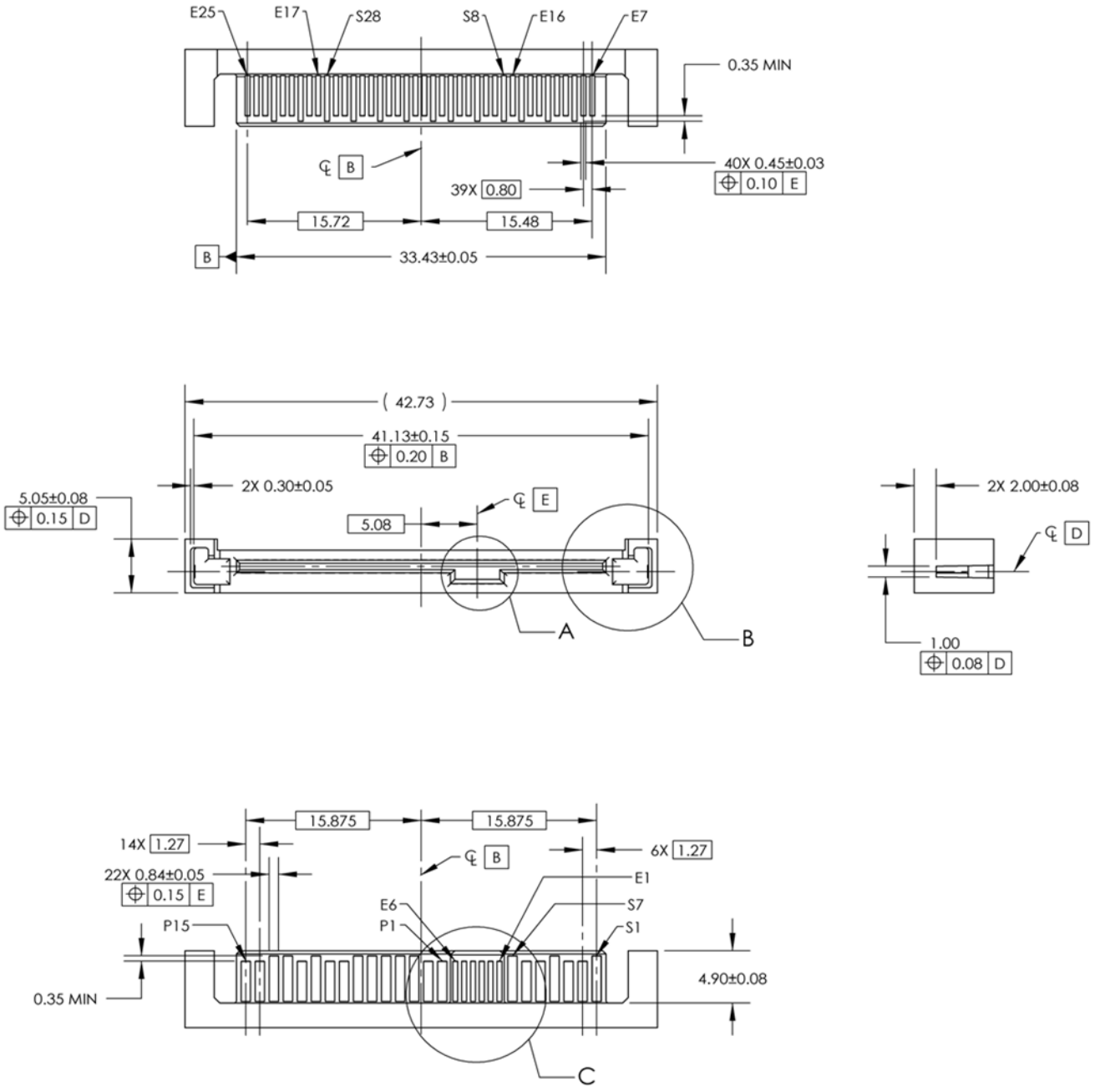
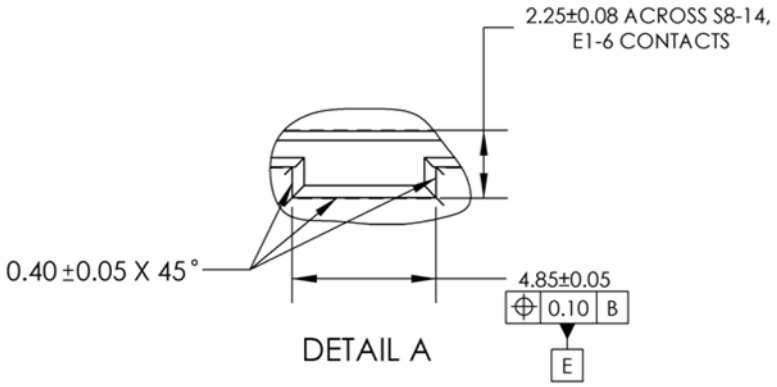


FIGURE 5-1 DEVICE FREE (PLUG) CONNECTOR



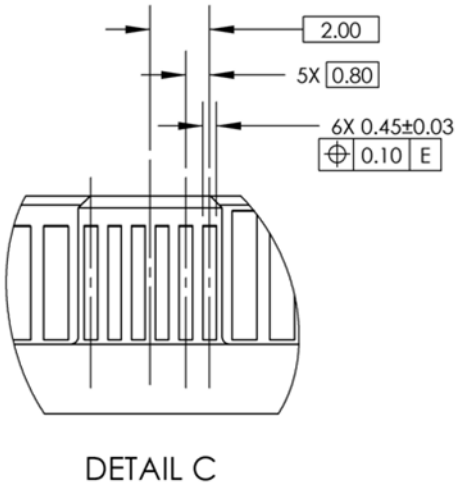


FIGURE 5-2 DETAIL A AND C, DEVICE FREE (PLUG) CONNECTOR

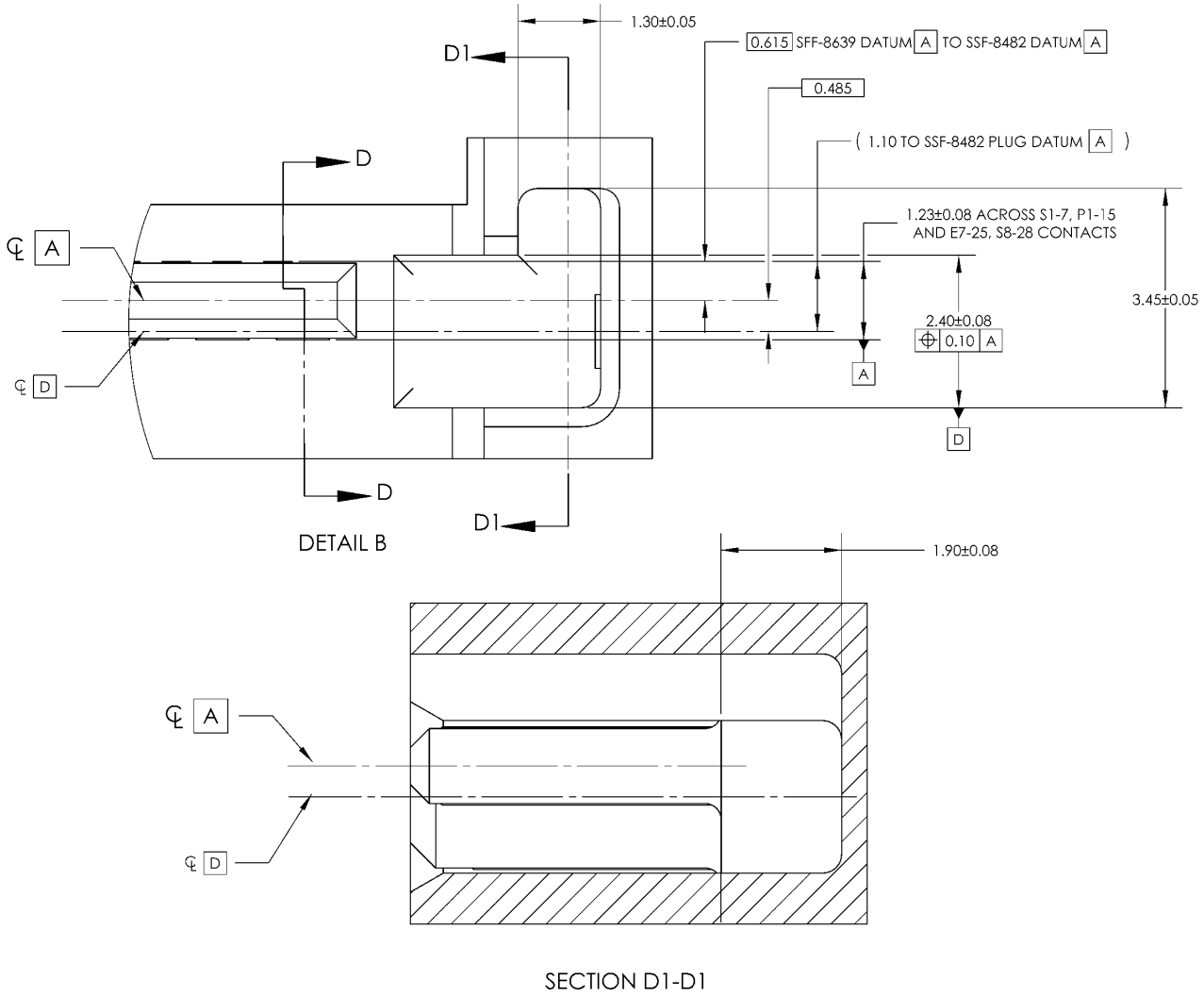


FIGURE 5-3 DETAIL B AND SECTION D1-D1, DEVICE FREE (PLUG) CONNECTOR

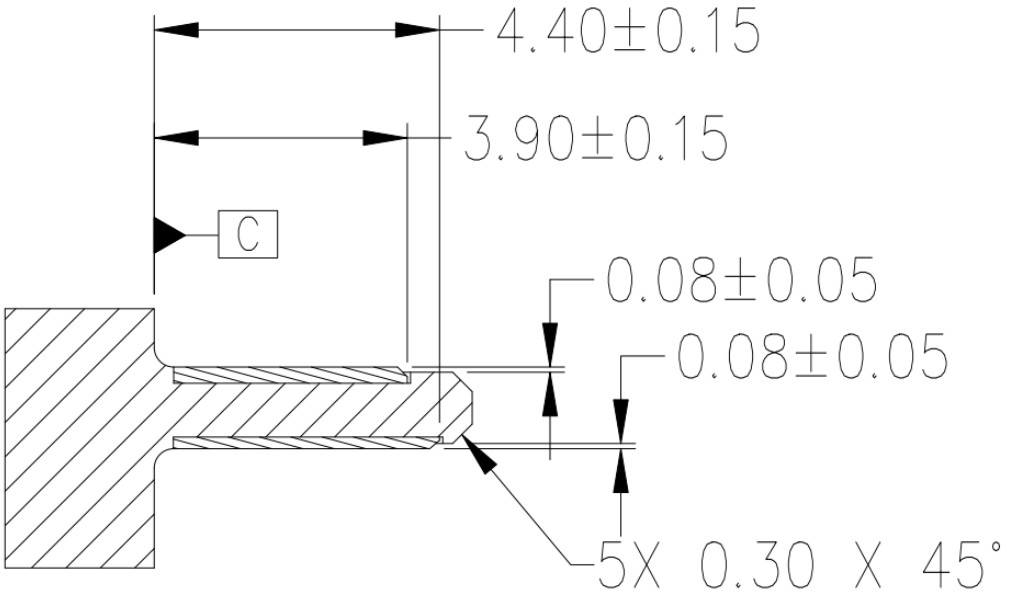


FIGURE 5-4 SECTION D-D, DEVICE FREE (PLUG) CONNECTOR

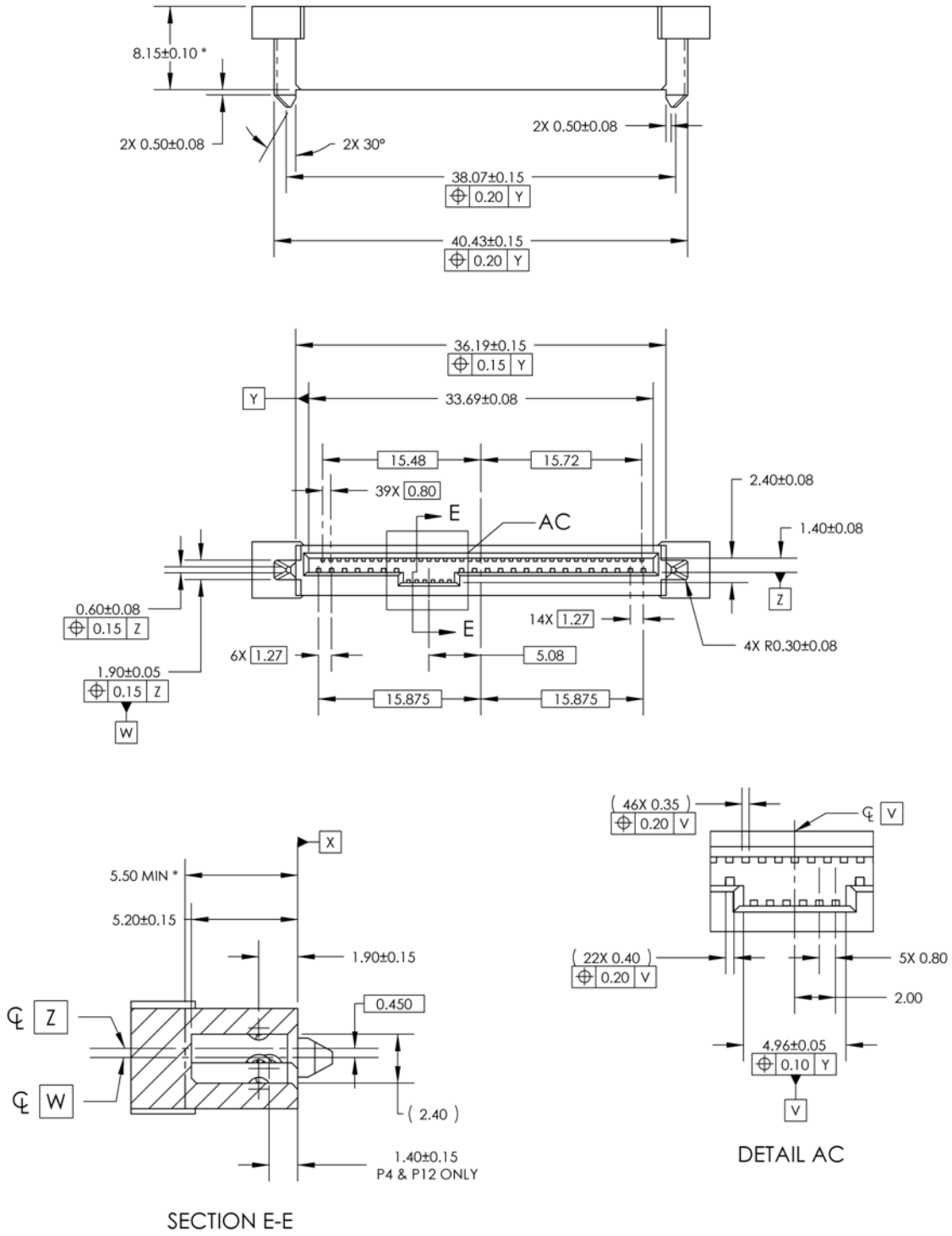


FIGURE 5-5 BACKPLANE FIXED (RECEPTACLE) CONNECTOR

5.2 Printed Circuit Board Layouts

This specification is not intended to 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.

Due to the construction of SFF-8639 and the inclusion of contacts opposite of the keying area the PCB footprint of SFF-8639 may restrict the mechanical placement of the connector. SFF-8639 is not intended to be a general replacement for either SFF-8482 or SFF-8630 and may not mechanically fit in all potential implementations.

5.3 General Tolerances

Unless otherwise stated, the following tolerances shall apply;
- 2 Place dimension = +/-0.20mm
- Angular dimension = +/-3 degrees

5.4 Intermateability

In this specification the location of Datum A of the plug is defined as the center of the plug tongue. The figure defines an offset between the Datum A definition of this specification and the Datum A definition in SFF-8482, see also Figure 5-3 for dimension between datums.

- SFF-8482 Datum A is the same for both the Plug and the Receptacle. The Plug Connector Datum A is the surface opposite the key plug tongue and the surface opposite the key in the receptacle.

- SFF-8639 Datum A is centered in the plug tongue.
- SFF-8639 Datum Z is centered in the receptacle slot.

SFF-8639 has many contacts on the opposite side of the connector at the 0.80mm pitch and these would have more of a centering effect than those in SFF-8482.

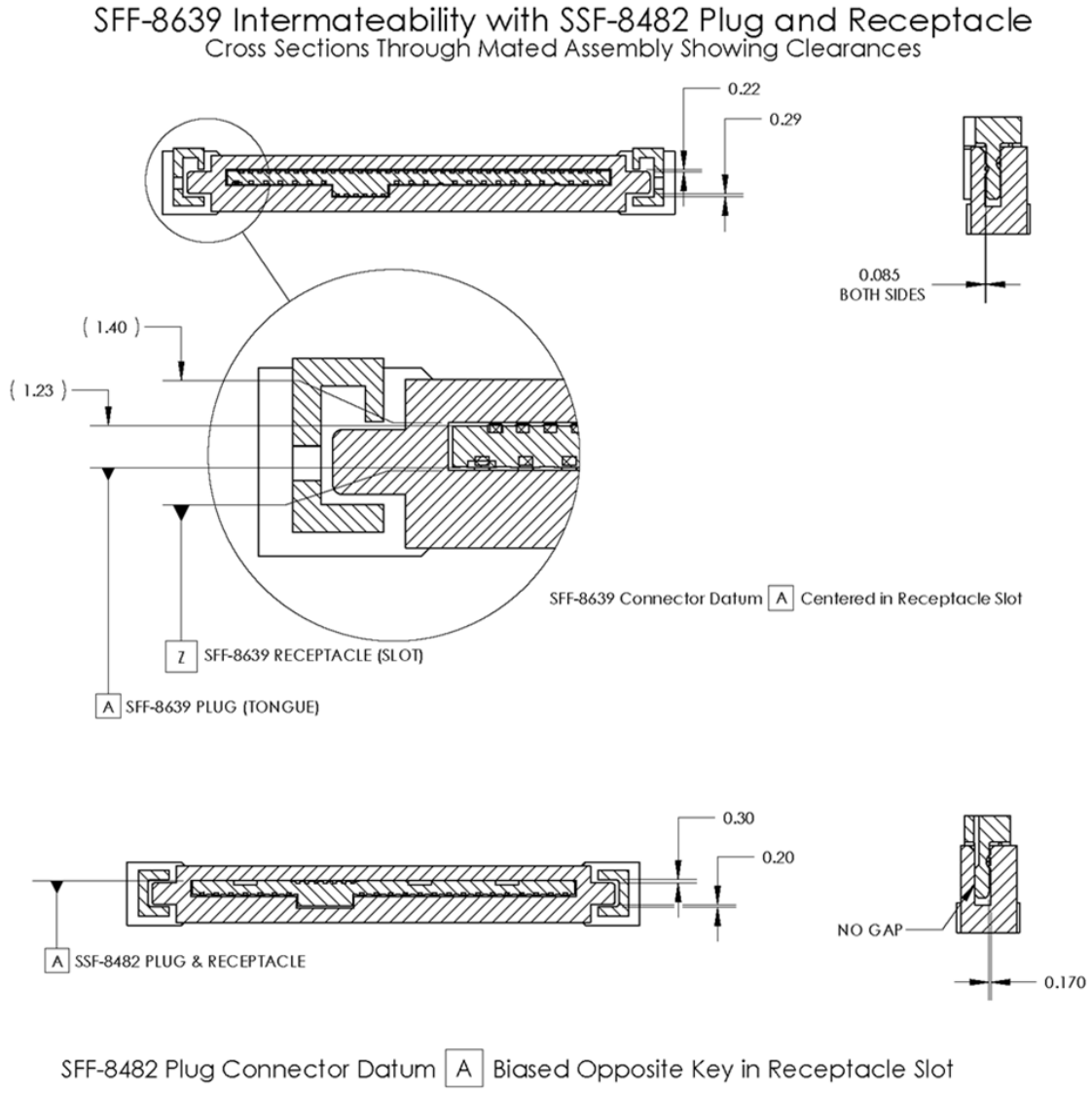


FIGURE 5-6 OFFSET TO DATUM A OF SFF-8482

6. Signal Assignments

6.1 Contact Numbering Scheme

The contact numbering scheme is an extension of the contact numbering schemes defined in SFF-8482 and SFF-8630. Figure 5-1 shows the contact numbering for a fully populated version of an SFF-8639 connector. The contact numbering started with the contacts defined in SFF-8482 (P1 - P15 and S1 - S14). The numbering scheme was extended to cover the use case of a SAS MultiLink connector (S15 - S28) as defined in SFF-8630. Additional contacts (E1 - E25) were added to cover the use case of a 4-lane PCIe connector. SFF-9639 provides a comprehensive list of pinout use cases.

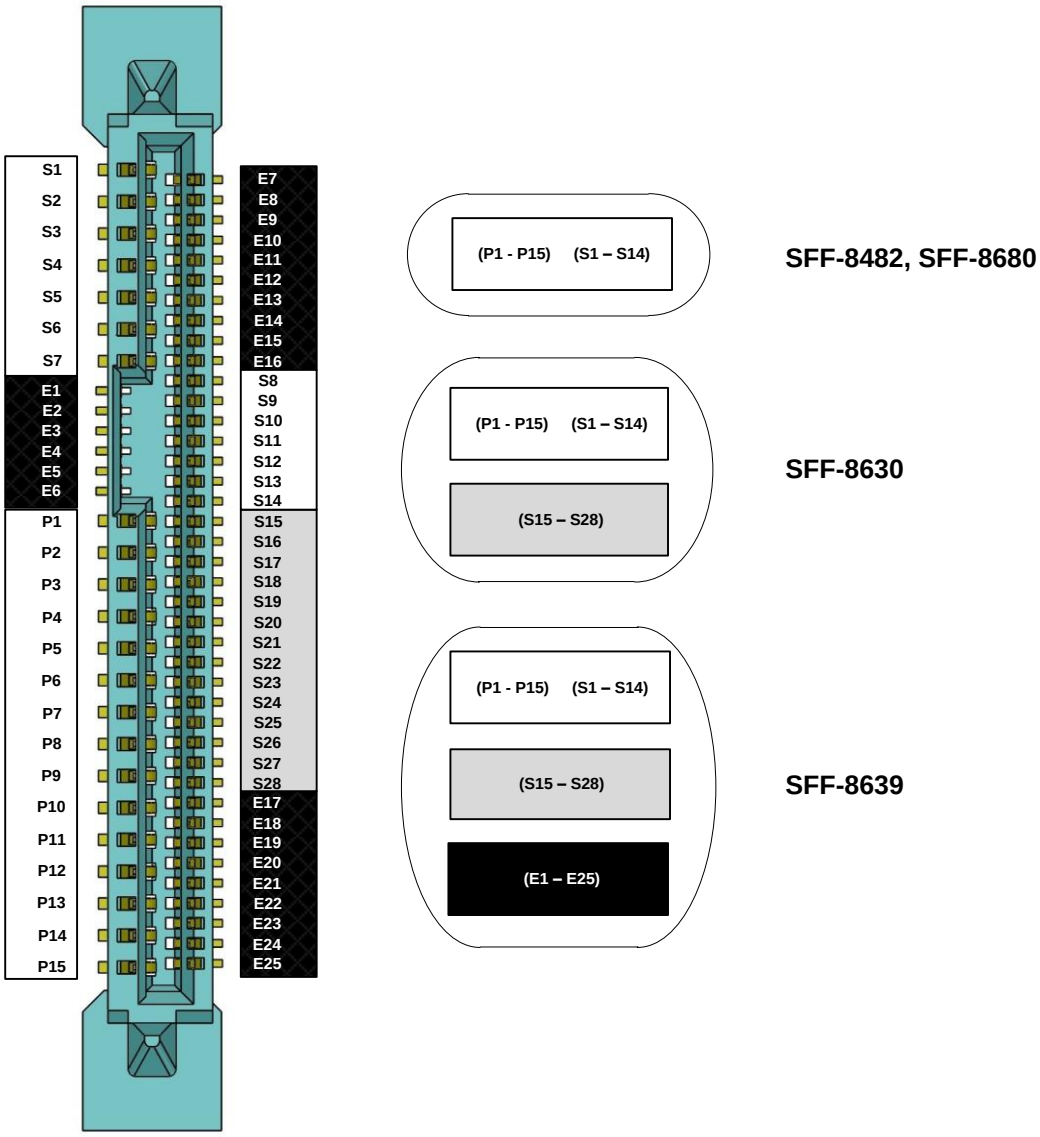


FIGURE 6-1 CONTACT NUMBERING SCHEME

6.2 Contact Mating Scheme

TABLE 6-1 CONTACT MATING SCHEME

Device Interface				Backplane Interface			
Power & Signal Side (1.27 & 0.80 mm)							
	S1					S1	
	S2					S2	
	S3					S3	
	S4					S4	
	S5					S5	
	S6					S6	
	S7					S7	
Keyed Area	E1					E1	Keyed Area
	E2					E2	
	E3					E3	
	E4					E4	
	E5					E5	
	E6					E6	
	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	

continued....

Signal Side (0.80 mm)						
	E7				E7	
	E8				E8	
	E9				E9	
	E10				E10	
	E11				E11	
	E12				E12	
	E13				E13	
	E14				E14	
	E15				E15	
	E16				E16	
Keyed Area	S8				S8	Keyed Area
	S9				S9	
	S10				S10	
	S11				S11	
	S12				S12	
	S13				S13	
	S14				S14	
	S15				S15	
	S16				S16	
	S17				S17	
	S18				S18	
	S19				S19	
	S20				S20	
	S21				S21	
	S22				S22	
	S23				S23	
	S24				S24	
	S25				S25	
	S26				S26	
	S27				S27	
	S28				S28	
	E17				E17	
	E18				E18	
	E19				E19	
	E20				E20	
	E21				E21	
	E22				E22	
	E23				E23	
	E24				E24	
	E25				E25	
<-0.5 mm-> <-0.50 mm>						

7. Backplane Fixed (receptacle) Interface Features

7.1 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 attachment system.

The mating interface specification requires 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 1.5mm in the longitudinal axis and less than 1.0mm in the horizontal axis prior to any part of the connector pair engaging. This is known as the blind mate tolerance zone.

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

Connector 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 final mated position.

Connector pre-alignment and alignment features are different than what is specified in SFF-8482. SFF-8639 utilizes an "L" Shaped Key in the Fixed Cable (Receptacle) (Cable Variant) of the SFF-8639 Receptacle. A corresponding "L" shaped pocket is incorporated into the Free / mating Plug side of the SFF-8639 connector. This "L" Shaped Key in the Fixed Cable (Receptacle) blocks legacy SAS and SATA devices from being plugged into the Fixed Cable (Receptacle) (Cable Variant). For Fixed (Backplane) application this is not an issue. The Fixed (Backplane) alignment features are consistent with what is specified in SFF-8482 section 5.1.

7.2 Mating Wipe and Device Clearances

In order to guarantee minimum contact engagement is provided in a backplane system, the position of the device connector interface shall be controlled relative to the backplane surface. The device connector datum C (as shown in figure 4-4) shall be 8.45 +/- 0.20mm from the backplane surface. Device clearances vary by form factor, see the appropriate form factor specification for connector location with respect to form factor.

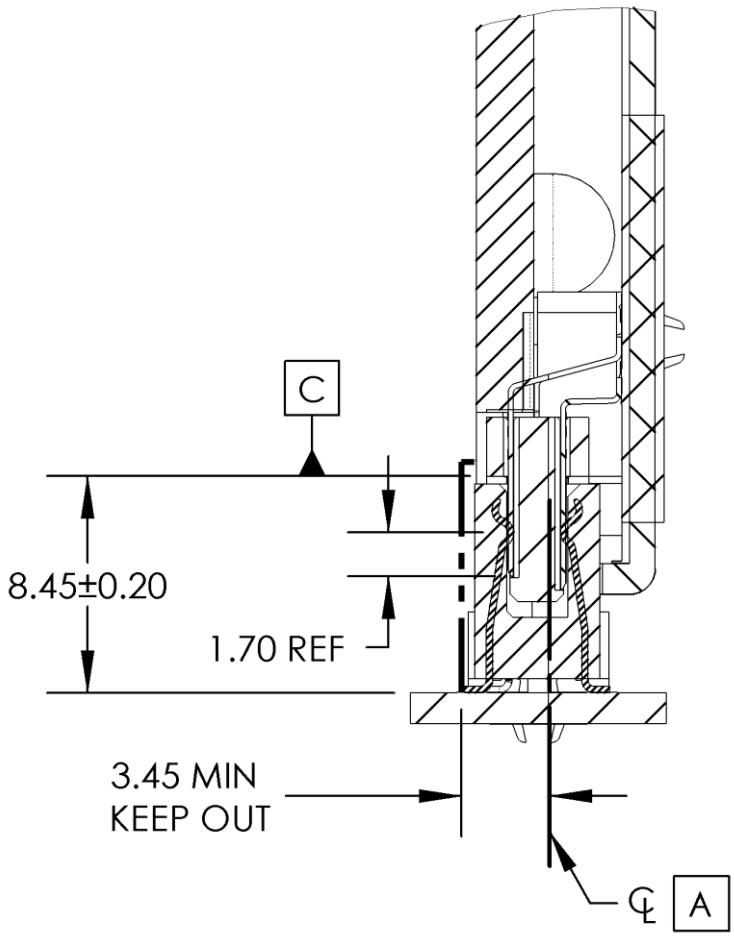


FIGURE 7-1 MATING WIPE

7.3 Hot Plugging

In order to facilitate hot plugging of a device into a powered backplane, the backplane fixed (receptacle) and 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 sequences of these contacts are timed to occur in the proper order.

There are a series of pins of the backplane fixed (receptacle) interface that are advanced 0.50mm nominal from all other contacts pins on this side of the interface. These pins 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 on the device free (plug) interface penetrates 0.50mm nominal into the backplane fixed (receptacle) interface.

The remaining contacts represent the 3rd level of mating and are set back 0.50mm nominal from the 2nd mating level contacts. These will be the last contacts to mate. Table 5-1, Table 5-2 and Table 5-3 show the mating level of each contact in this connector system. 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.

Note: In some installations, the Pluggable Storage Device must be in a tray with

hand lever insertion to meet associated enclosure requirements. However, this is outside the scope of this specification.

8. Ratings

8.1 Current

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

Signal Section (per pin):
- Continuous Current 500mA

8.2 Temperature

Operating	0.0C to 55.0C
Non-operating	-40.0C to 85.0C

9. 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 9-1 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 9-2 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	Mate - 59N max Unmate – 6N min Initial and after durability	EIA 364-13: Mate and unmate connectors at a rate of 25mm per minute

TABLE 9-3 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): Fixed Cable (Receptacle)

Development of the Fixed Cable (Receptacle) of SFF-8639 has been put on hold.

The Fixed Cable (Receptacle) interface incorporates an active latching retention system to prevent accidental disconnect of the interface. The cable retention is a finger actuated latch engaging at the ends. This is different than the existing SATA and SAS connectors which use a friction detent on the secondary side. A "L" Shaped Key has also been incorporated into the alignment post of the "Fixed Cable" (Receptacle) to block insertion of legacy SAS and SATA drive plug connectors that do not have the related cable retention "cut-outs".

Please note: The Beam which corresponds to the "L" Shaped Key defined below is still defined in the figures above. This feature has been retained so that if a Cable Variant of the SFF-8639 is developed at a later date it can be used to block legacy SAS and SATA drives from being inserted into the Cable Variant of the SFF-8639 as defined in this informative section of this document.

A slot feature has also been incorporated into the plug which can be used for cable retention if a Cable Variant of the SFF-8639 is developed at a later date.

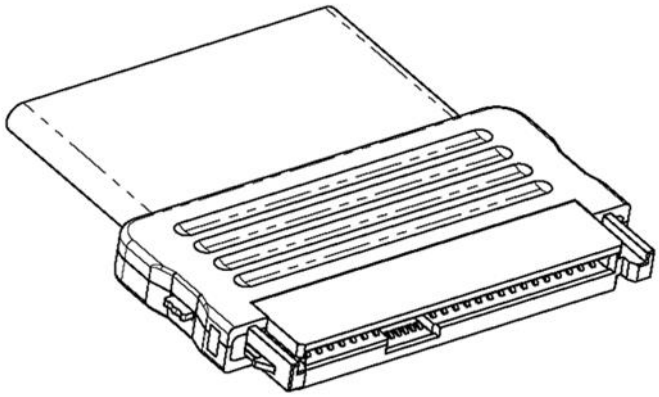


FIGURE A-1 FIXED CABLE (RECEPTACLE) CONNECTOR

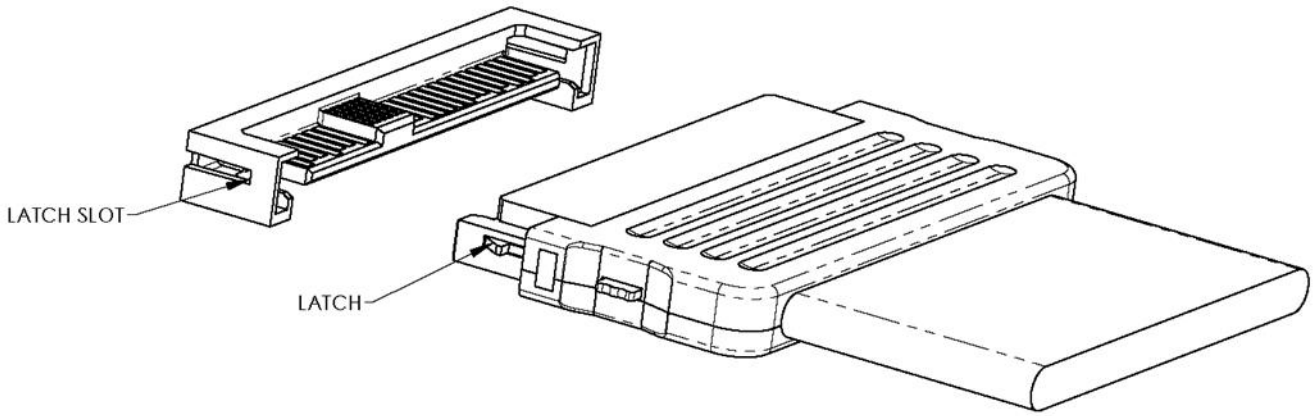


FIGURE A-2 FIXED CABLE (RECEPTACLE) CONNECTOR

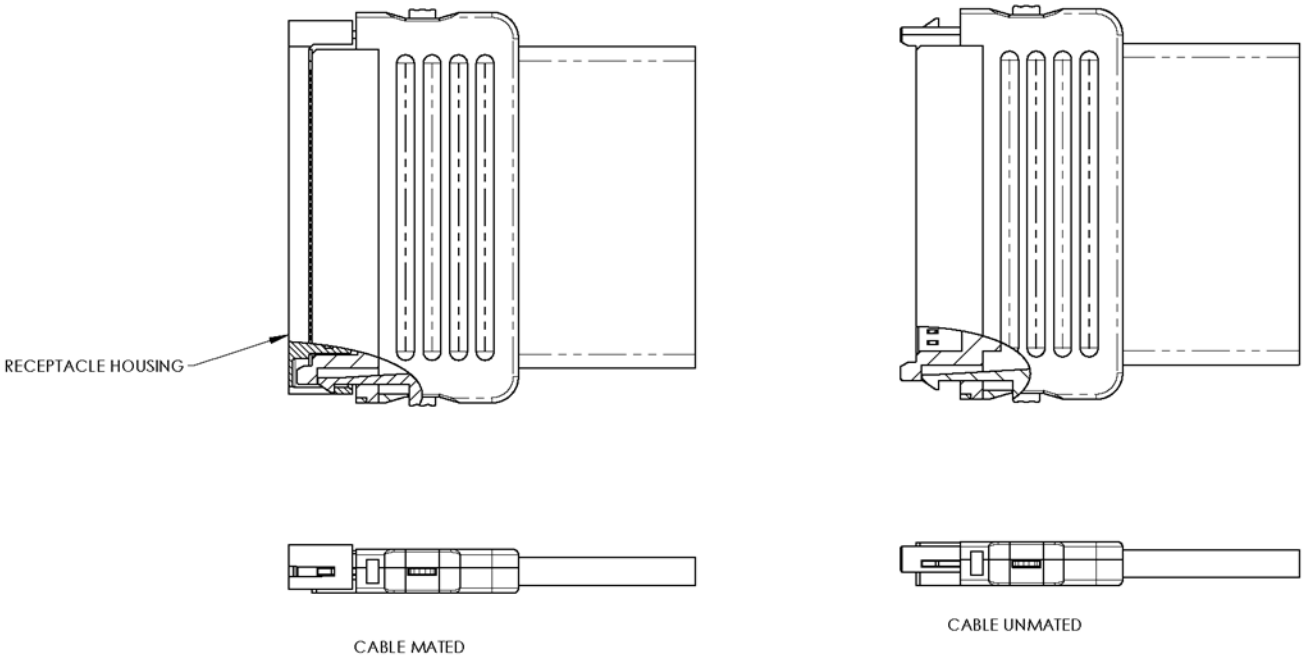


FIGURE A-3 CABLE RETENTION: CABLE MATED AND UNMATED

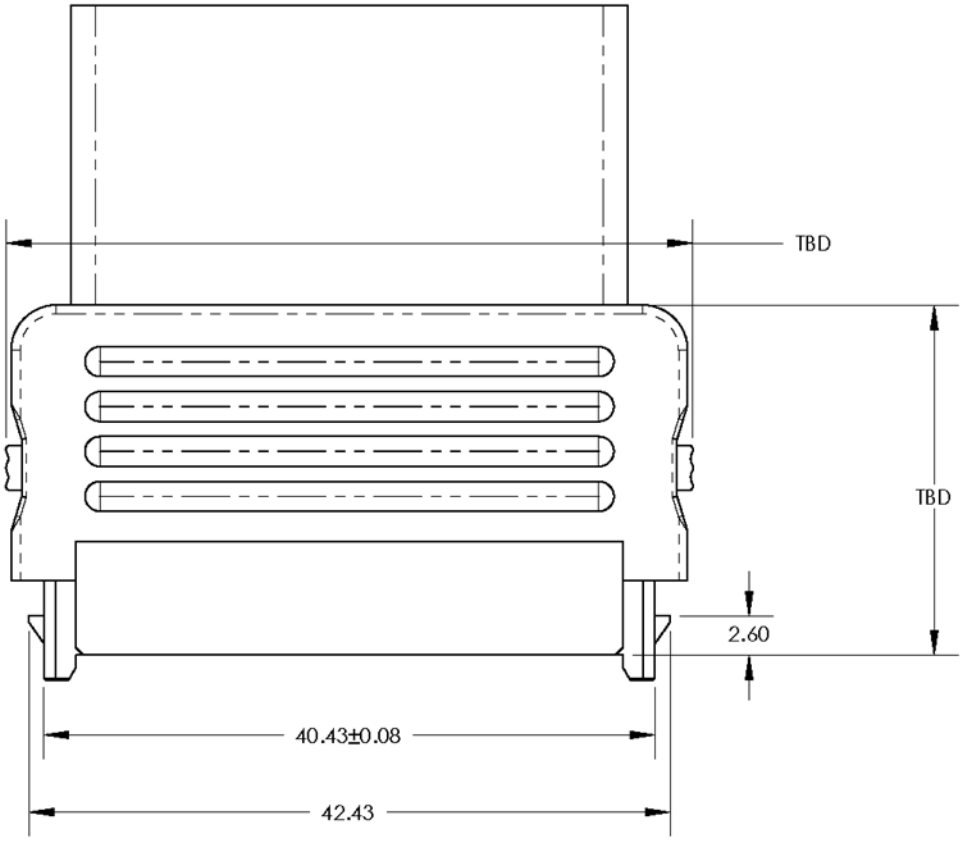


FIGURE A-4 CABLE RETENTION: REPRESENTATIVE CABLE HOUSING

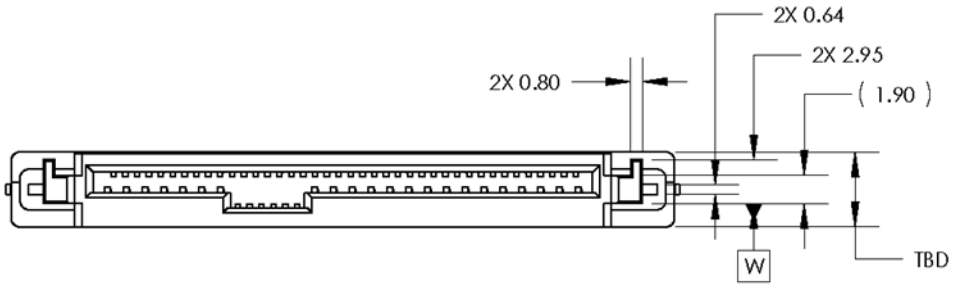


FIGURE A-5 CABLE RETENTION: CABLE RETENTION W/"L" SHASPED KEY

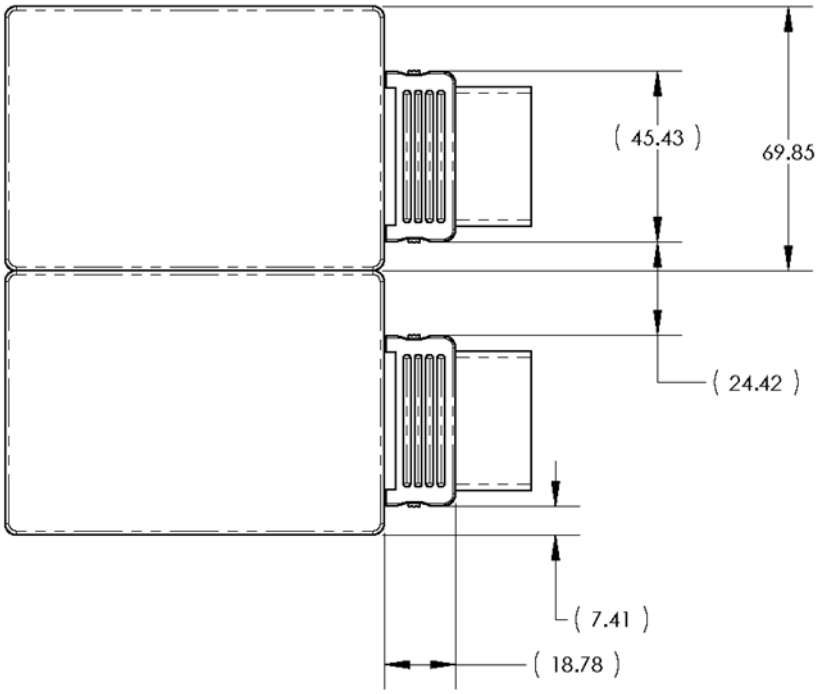


FIGURE A-6 CABLE RETENTION: CABLE RELEASE CLEARANCE TOP VIEW

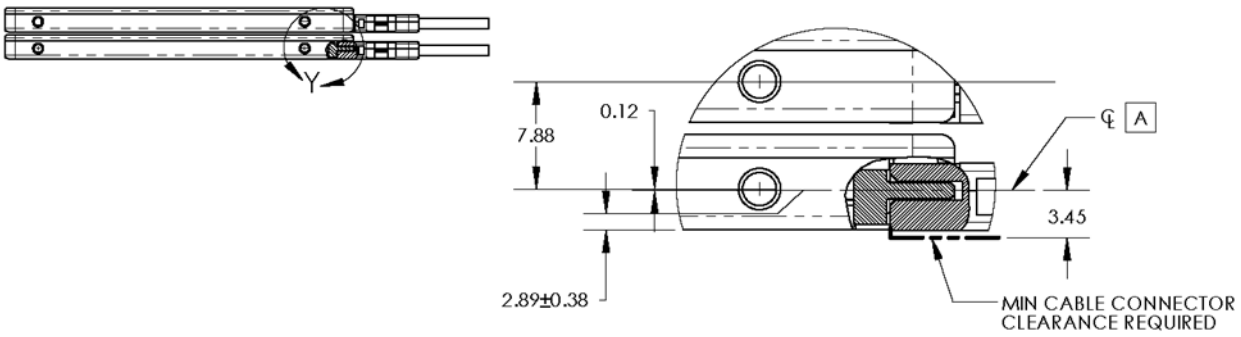


FIGURE A-7 CABLE RETENTION: CABLE RELEASE CLEARANCE SIDE VIEW

B. Appendix (Informative): Receptacle PCB Footprint

The following is one example of a potential PCB footprint that could be used with a receptacle. 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.

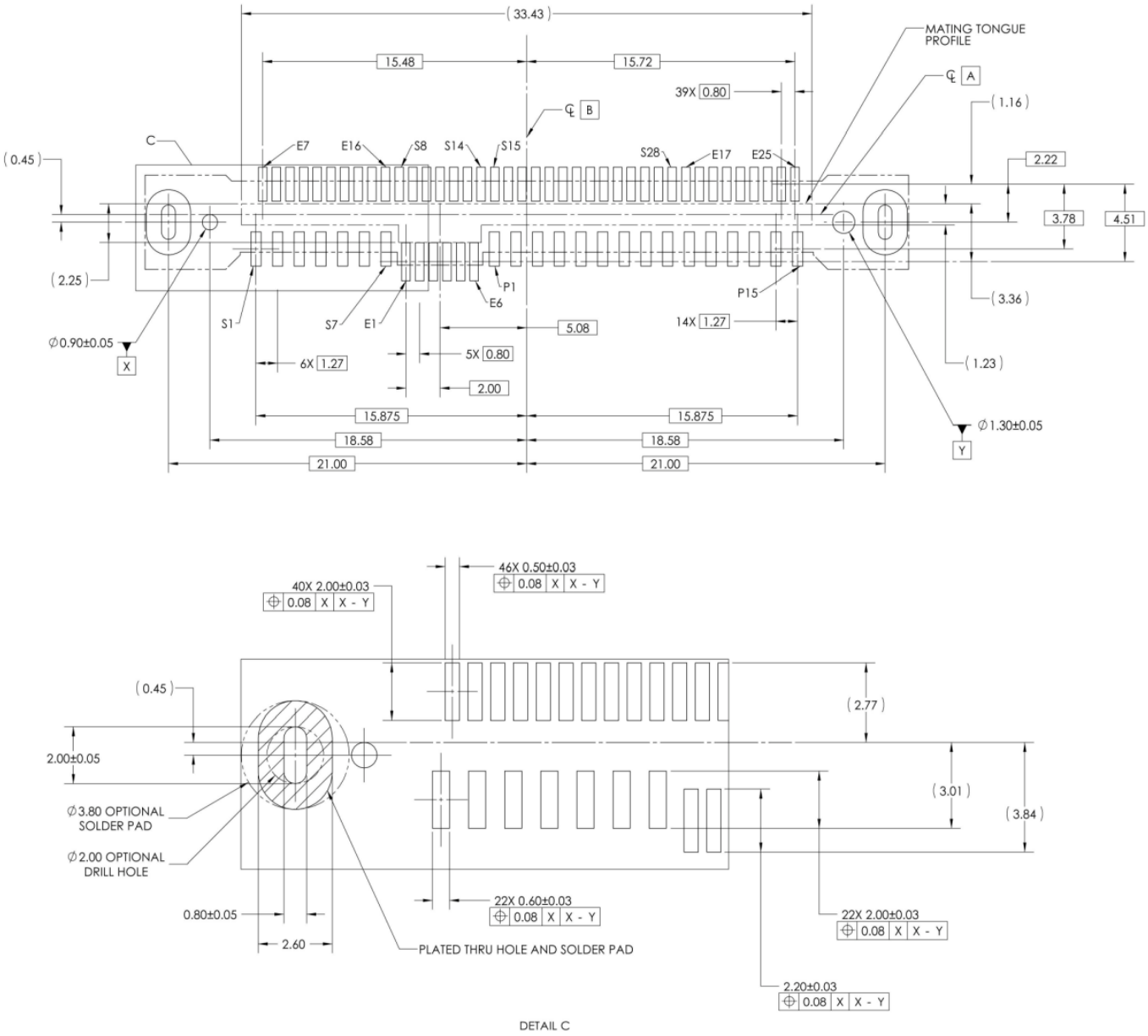


FIGURE B-1 RECEPTACLE PCB FOOTPRINT EXAMPLE