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SFF-8630

Specification for

Serial Attachment 4X Unshielded Connector

Rev 1.5 February 28, 2017

Secretariat: SFF TA TWG

Abstract: This specification defines an Unshielded Input/Output connector for serial interface unshielded devices, backplanes and cables. There are multiple generations based on electrical performance.

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.

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Change History

Revision 0.5
- Added last sentence in General Description about the 2 passive latches.
- Added C1, C2, and C3 callouts to Figure 3.1.
- Changed 5.45 to 4.85 in Figure 5.1
- Added datums B and Z and associated reference dimensions to Figure 5.2
- Added Figure 5.3
- Added Sections 5.3, 5.4, 5.5, and 5.6
- Added Table 1
- Added Revision history
- Updated Table of Contents, Table of Figures, and Table of Tables.
Revision 0.51
- Changed the footer from 24 Gb/s to 12 Gb/s
- Changed the revision history first entry from 4.1 to 0.5.
Revision 0.6
- Adopted latest template
Revision 0.7
- Changed all Gbs and Gbps to Gb/s
- Changed C1 ,C2 ,and C3 to CS1, CS2, and CS3 respectively in Fig. 3-1
- Took repeated words out of the abstract
- Added performance requirements clause
- Removed all "contains the"'s from Description of Clause
- Change 8200 to 8223 in the Section 2-1
- Added Section 5-4 Contact Numbering
Revision 0.8
- Removed PCB footprint
Revision 0.9
- Reinstated PCB footprint to Informative Appendix
Revision 1.0
- Editorial improvements to wording and flow of content
- Updated PCB footprint figure
Revision 1.1
- Adopted common representation for SFF-8630/SFF-8639/SFF-8680
  o Table 7-1 Performance Requirements
  o Appendix A introductory paragraphs
Revision 1.2
- Added EIA reference for Temperature Rise in Table of Electrical Requirements.
Revision 1.3
- The speed characteristics and electrical considerations were removed in order to create SFF-8629.
Revision 1.4
- Rev 1.3 contradicted policy to derive mechanical content as a new specification
- The connector content and prior history of this specification was used to create SFF-8629.
Revision 1.5
- Re-incorporated mechanical content due to planned cancellation of SFF-8629
- Editorial update to SNIA template

Foreword

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

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors. The SFF Committee provided a forum for system integrators and vendors to define the form factor of disk drives.

During their definition, other activities were suggested because participants in SFF faced more challenges than the form factors. 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.

In July 2016, the SFF Committee transitioned to SNIA (Storage Networking Industry Association), as a TA (Technology Affiliate) TWG (Technical Work Group).

Industry consensus is not a requirement to publish a 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 meets during the T10 (see www.t10.org) and T11 (see www.t11.org) weeks, and SSWGs (Specific Subject Working Groups) are held at the convenience of the participants. Material presented to SFF becomes public domain, and there are no restrictions on the open mailing of the presented material by Members.

Many of the specifications developed by SFF have either been incorporated into standards or adopted as standards by ANSI, EIA, JEDEC and SAE.

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

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:
http://www.snia.org/sff/specifications

Suggestions for improvement of this specification will be welcome, they should be submitted to:
http://www.snia.org/feedback

TABLE OF CONTENTS

FIGURES

TABLES

1 Scope

This specification defines the mechanical requirements for a composite connector system which is based on SFF-8680. For information not shown here refer to SFF-8680 document. 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.

This connector shall meet the electrical performance requirements defined by Serial Attached SCSI (SAS). SAS defines the requirements for the transmission of multi-gigabit signals on a backplane. When this connector is used, its performance shall meet the requirements of the appropriate standard.

1.2 Copyright

1.3 Disclaimer

The information contained in this publication is subject to change without notice. The SNIA makes no warranty of any kind with regard to this specification, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The SNIA shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this specification.

Suggestions for revisions should be directed to http://www.snia.org/feedback/

1.4 Intellectual Property

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 TWG which advise that a patent exists are required to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

2 References

2.1 Industry Documents

- *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 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-8482 Serial Attachment 2x Unshielded Connector (EIA-966)*
- *SFF-8639 Multifunction 6X Unshielded Connector*
- *SFF-8680 Serial Attachment 2x Unshielded Connector*

2.2 Sources

There are several projects active within the SFF TWG. The complete list of specifications which have been completed or are still being worked on are at http://www.snia.org/sff/specifications/

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

2.3 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

2.4 Definitions

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 2-1.*

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.*

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.*

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.*

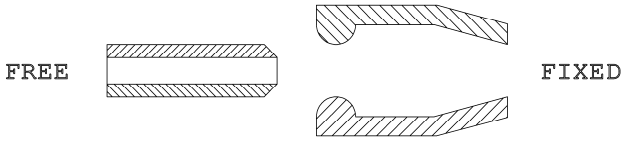


FIGURE 2-1 MATING SIDE GENDER DEFINITION

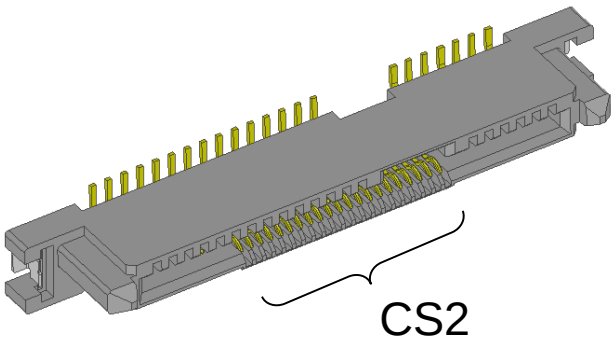
3 General Description

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

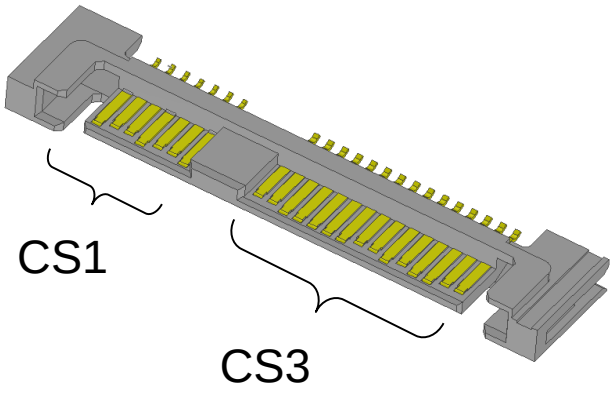
The device free (plug) interface incorporates three different contact sets (CS). Two of these sets (CS1 and CS2) contain 7 contacts for each physical link and typically are used for high speed serial signals. The high speed signals are grouped into differential pairs flanked with Grounds (G-S-S-G-S-S-G). In CS2, an adjacent Ground is shared between the pair of physical links that was not included in the SFF-8680 configuration. 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.

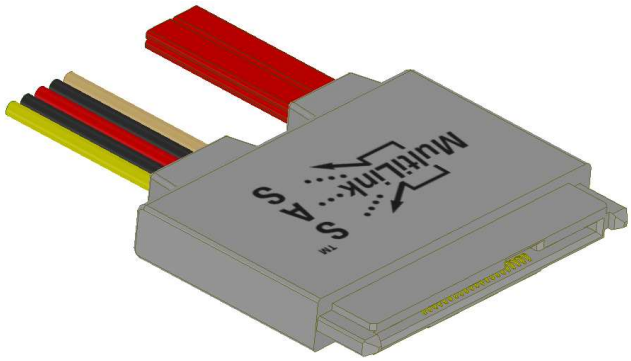
There is no provision for positive mating interface retention latching in the backplane fixed version, However, it does provide for two passive latches the same as found in SFF-8680 for the cabled version.



Backplane Fixed (Receptacle) Connector



Device Free (Plug) Connector



Cable Fixed (Receptacle) Connector

FIGURE 3-1 GENERAL VIEW CONNECTORS AND DESCRIPTIONS

4 Dimensional 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 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., are all major contributors to the final electrical characteristics of each unique application of the connector.

PCB thickness of greater than 2.54 mm (0.100") with FR-4 material may result in a differential impedance of less than 85 ohms when the thru-hole patterns are used.

4.3 General Tolerances

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

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

5 Dimensions

The dimensioning conventions are described in ANSI-Y14.5M, Dimensioning and Tolerancing. All dimensions are in millimeters.

Dimension related requirements for the connector system addressed in this document are specified in the figures in this clause and SFF-8680.

5.1 Device Free (Plug) Connector

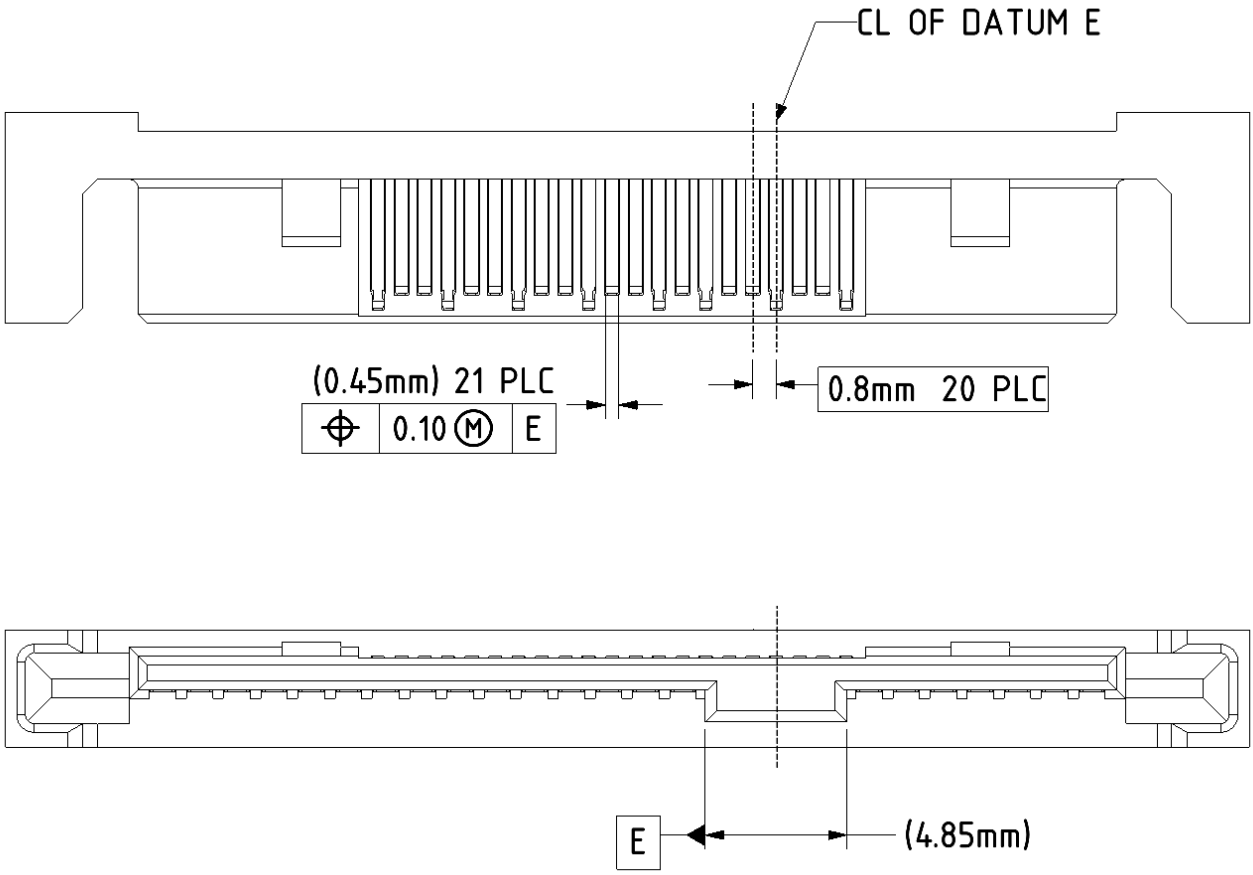


FIGURE 5-1 DEVICE FREE (PLUG) CONNECTOR

5.2 Backplane Fixed (Receptacle) Connector

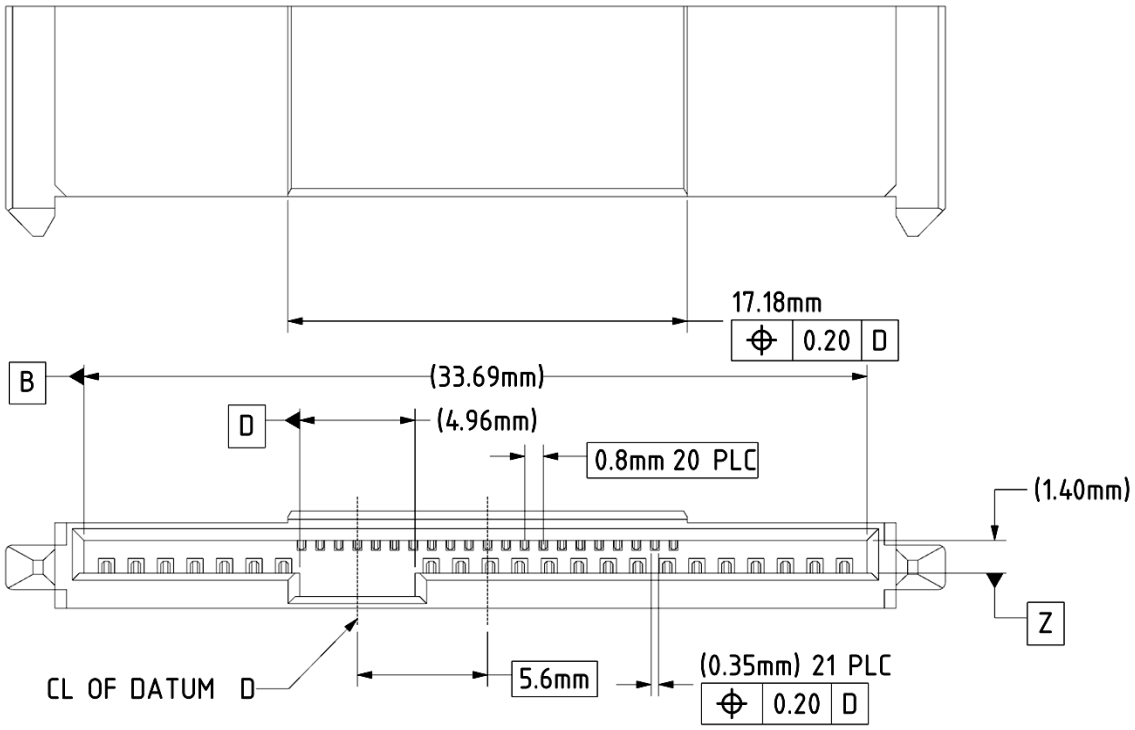
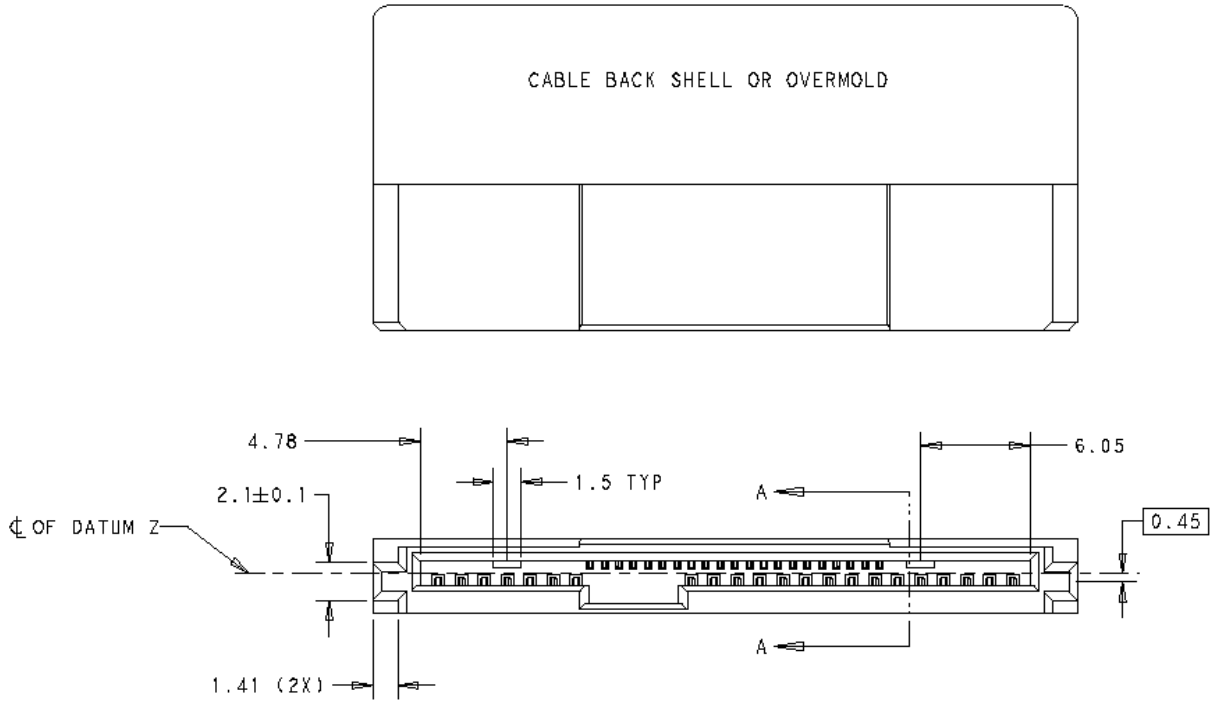
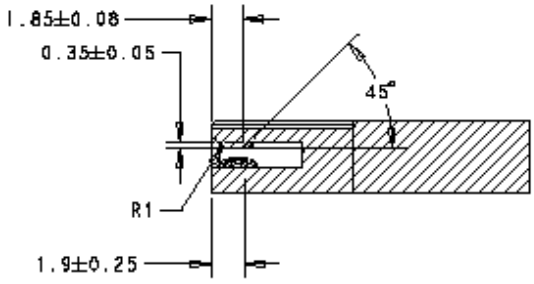


FIGURE 5-2 BACKPLANE FIXED (RECEPTACLE) CONNECTOR

5.3 Cable Fixed (Receptacle) Connector





SECTION A-A

FIGURE 5-3 CABLE FIXED (RECEPTACLE) CONNECTOR

5.4 Contact Numbering Scheme

The contact numbering scheme is an extension of the contact numbering scheme defined in EIA-966 (formerly SFF-8482) and SFF-8680. Figure 5-4 shows the contact numbering for a fully populated SFF-8630 connector. The contact numbering started with the contacts defined in EIA-966 (P1 - P15 and S1 - S14). The contact numbering scheme was extended to cover this SAS MultiLink Connector (S15 - S28). Note that additional contacts are added to this connector to define the SFF-8639 (Multifunction 6X Unshielded Connector).

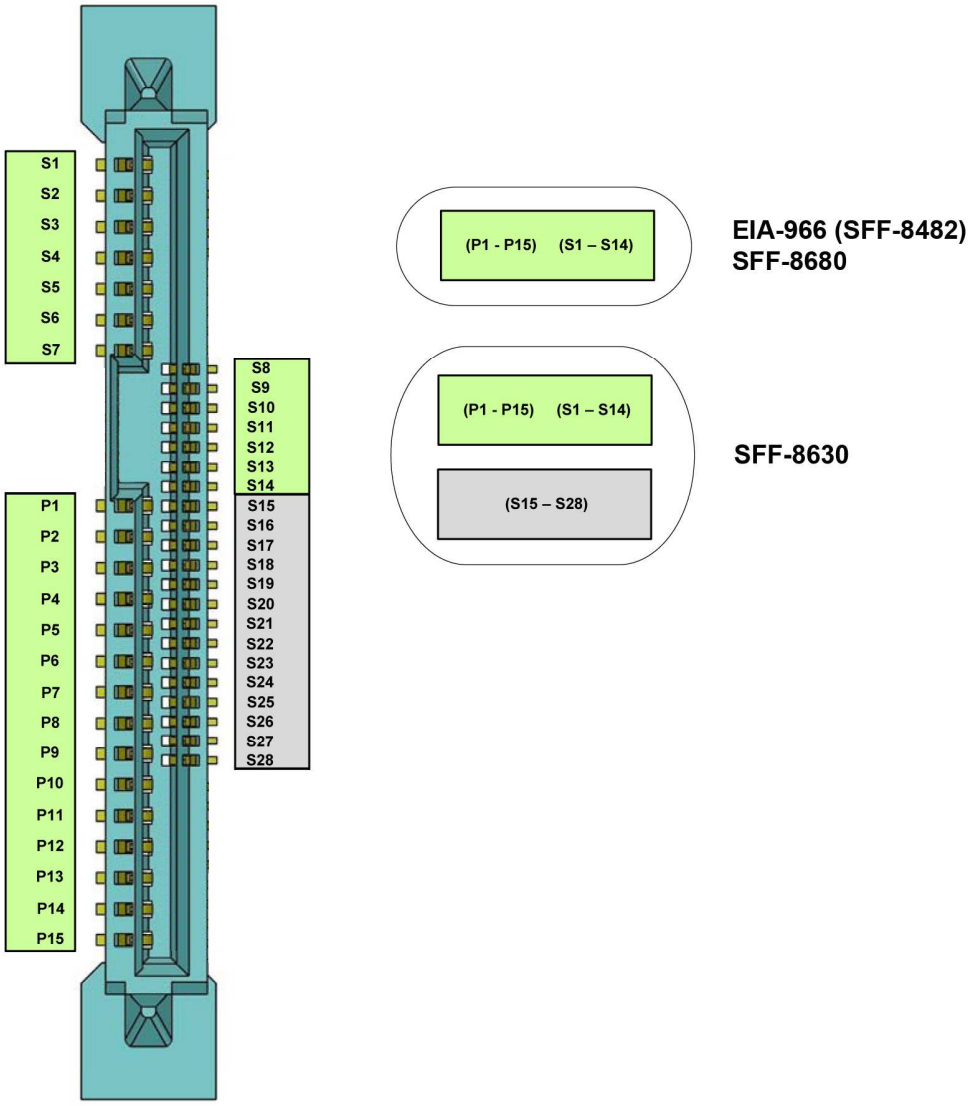


FIGURE 5-4 CONTACT NUMBERING SCHEME

TABLE 5-1 HOT PLUG SEQUENCING

Device Free (Plug) Interface				Backplane Fixed (Receptacle) Interface			
CS1	S1					S1	CS1
	S2					S2	
	S3					S3	
	S4					S4	
	S5					S5	
	S6					S6	
	S7					S7	
CS2	S8					S8	CS2
	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	
CS3	P1					P1	CS3
	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	
			<-0.5 mm->	<-0.50 mm>			

5.5 Blind Mating

See SFF-8680

5.6 Device To Backplane Location

See SFF-8680

5.7 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 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 0.50 mm nominal from all other contact pins on this side of the interface. These pin locations represent the first level of mating upon insertion of the device. The second level of mating is established when the forward group of contacts located in the CS's of the Device free (plug) interface penetrate 0.50 mm nominal into the Backplane fixed (receptacle) interface. The remaining contacts of the Device free (plug) interface are set back 0.50 mm nominal and will be the last contacts to mate. In order to maintain this sequence, sufficient tolerance had been designed into the interface to allow for manufacturing and alignment of the device to the enclosure. See Section 5.4.

The pin locations for the long and short contacts on both sides if the interface are defined in table 5-1.

Hot plugging of cables is not supported by this interface.

6 Ratings

6.1 Current

Continuous Current (per pin): 1.5A
Peak Current: 2.5A for 1.5 s
Peak current Pre-Charge: 6A for 1ms

6.2 Temperature

Operating: -55C to 85C

7 Performance Requirements

The general Electrical, Mechanical, and Environmental requirements for mating connectors are listed in the table. 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 - 37.5N max* *Unmate - 8.0N 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*

8 Appendix A (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.

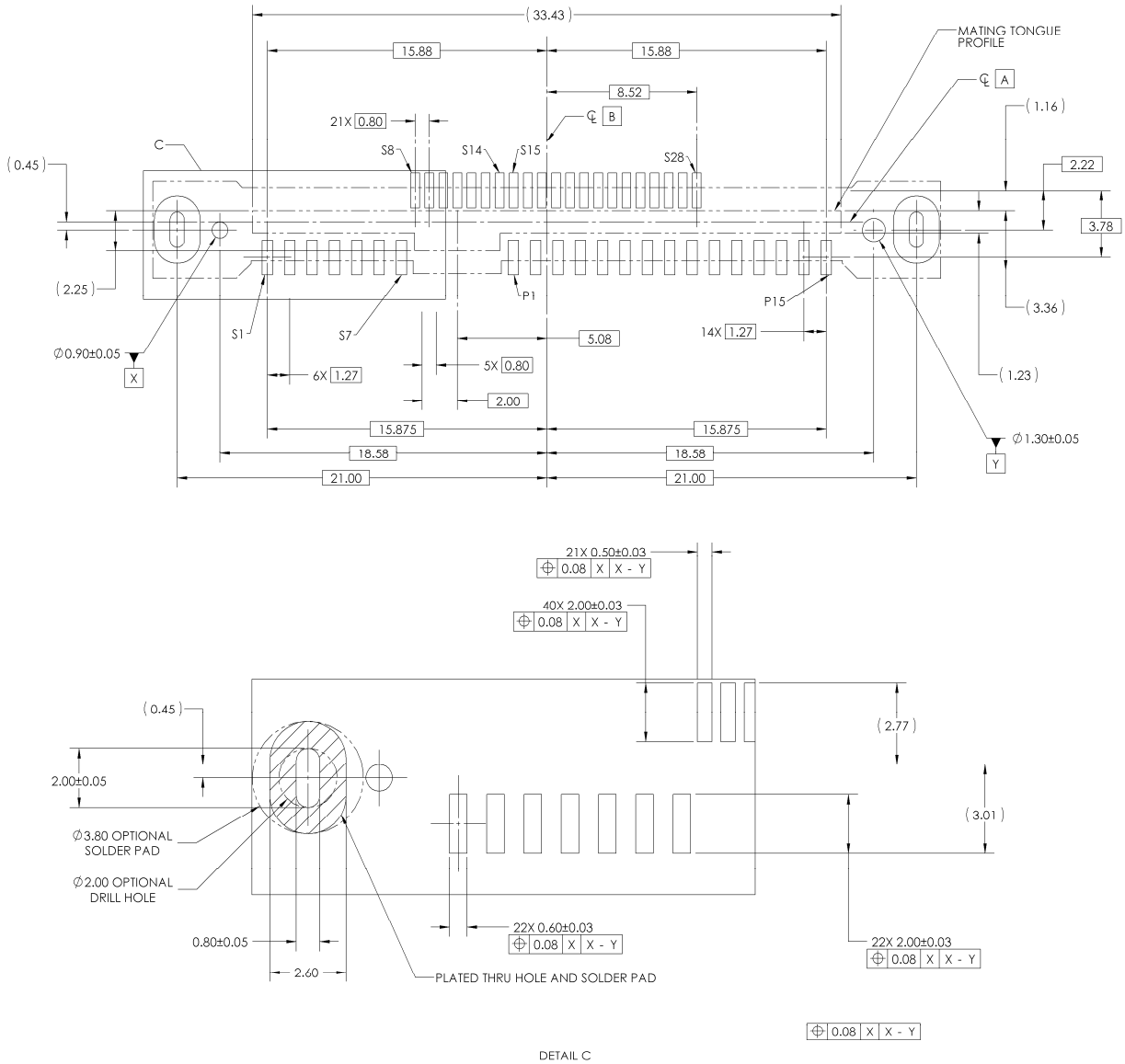


FIGURE 8-1 BACKPLANE FIXED (RECEPTACLE) SMT PCB LAYOUT