SFF specifications are available at http://www.snia.org/sff/specifications

SFF-TA-1002

Specification for

Protocol Agnostic Multi-Lane High Speed Connector

Rev 1.2 April 03, 2019

Secretariat: SFF TA TWG

Abstract: This specification defines an unshielded, Input/Output, card edge connector and mating card interface capable of operation up to 112GT/s PAM-4. The connector has 56, 84, or 140 contacts based on bandwidth needs and is configurable for straight, right angle, straddle mount, and orthogonal applications.

There are multiple using generations based on electrical performance.

2.5 GT/s NRZ to 112 GT/s PAM-4.
2.5 GT/s NRZ to 16 GT/s NRZ for orthogonal connectors only.

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

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.

POINTS OF CONTACT:

John Norton
Distinguished Technologist
Hewlett-Packard Enterprise
11445 Compaq Center Drive W
Houston, TX 77070-1433
Email: john.norton@hpe.com

Chairman SFF TA TWG
Email: sff-chair@snia.org
**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.

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

**Foreword**

The development work on this specification was done by the SNIA SFF 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 TWG, the signup for membership can be found at [http://www.snia.org/sff/join](http://www.snia.org/sff/join).
Change History

Rev 1.0 (December 2017)
- Initial release

Rev 1.0a (June 14, 2018)
- Corrected header error

Rev 1.0b (June 19, 2018)
- Corrected date error on title page
- Updated Intellectual Property Statement and Foreword to match new template

Rev 1.1 (January 2018)
- Intermediate draft revision

Rev 1.2 (April 3, 2019)
- Added the following connector variations
  o Straight 4C+ variation
  o Right angle height variation of 4.05mm and 4C+ variations
  o Straddle mount connector variations for 1C, 2C, 4C, 4C+ variations and respective SI requirements
  o Press fit and SMT orthogonal 1C & 2C variations
- Added clarification on differential pair counts in Section 3
- Clarified impedance requirements in Section 5.3
- Added Section 5.5 for manufacturability common requirements
- Relaxed insertion and un-mating force requirements.
- Added Section 6 to define pin geometry placement requirements
- Corrected minor drawing errors and editorials
## CONTENTS

1. Scope 7  
   1.1 Application Specific Criteria 7  
   1.2 Copyright 7  
   1.3 Disclaimer 7  

2. References 8  
   2.1 Industry Documents 8  
   2.2 Sources 9  
   2.3 Conventions 9  
   2.4 Definitions 10  

3. General Description 14  

4. Connector Interface Dimensions 18  
   4.1 General Requirements 18  
   4.2 General Tolerances 18  
   4.3 Unshielded Fixed (Receptacle) Connectors 19  
      4.3.1 Unshielded Fixed (Receptacle) Straight Connectors 19  
      4.3.2 Unshielded Fixed (Receptacle) Right Angle Connectors 25  
      4.3.3 Unshielded Fixed (Receptacle) Straddle Mount Connectors 32  
      4.3.4 Unshielded Fixed (Receptacle) Pressfit Orthogonal Connectors 40  
      4.3.5 Unshielded Fixed (Receptacle) Surface Mount Orthogonal Connectors 41  
   4.4 Add-In Card Free (Plug) Mechanical Drawings 44  
   4.5 Outer Locus of the Connector Mating Contacts 47  
   4.6 Outer Locus of SMT Leads 48  
   4.7 Outer Locus of Pressfit Leads 53  

5. Performance Requirements 55  
   5.1 Mechanical Testing and Performance 55  
   5.2 Electrical Testing and Performance 56  
   5.3 Signal Integrity Testing and Requirements 56  
   5.4 Reliability Testing and Requirements 57  
   5.5 Manufacturability Testing and Requirements 59  

6. Pin Geometry Pattern 61  

Appendix A. Mating Sequence 63  
Appendix B. Gatherability 65  
Appendix C. Printed Circuit Board Footprints 67  
Appendix D. Connector Solder Lead Geometry 75  

## FIGURES

**FIGURE 2-1 MATING SIDE GENDER DEFINITION** 11  
**FIGURE 2-2 DIRECTION OF MATING** 12  
**FIGURE 2-3 DIRECTION OF CONTACT** 12  
**FIGURE 2-4 CONTINUOUS CONTACT** 12  
**FIGURE 2-5 SPLIT CONTACT** 13  
**FIGURE 3-1. TYPICAL MATING CONFIGURATION FOR STRAIGHT AND RIGHT ANGLE CONNECTORS** 14  
**FIGURE 3-2. TYPICAL MATING CONFIGURATION FOR ORTHOGONAL CONNECTORS** 15  
**FIGURE 3-3. CONNECTOR SIZES** 15  
**FIGURE 3-4. STRAIGHT CONNECTOR AND AIC INTEROPERABILITY** 16  
**FIGURE 3-5. RIGHT ANGLE CONNECTOR AND CARD INTEROPERABILITY** 16  
**FIGURE 3-6. STRADDLE MOUNT CONNECTOR AND CARD INTEROPERABILITY** 17  
**FIGURE 3-7. ORTHOGONAL CONNECTOR AND CARD INTEROPERABILITY** 17  
**FIGURE 4-1. 1C, 2C, AND 4C+ STRAIGHT CONNECTOR DIMENSIONS OVERVIEW** 19
FIGURE 4-2. 1C, 2C, 4C AND 4C+ STRAIGHT CONNECTOR PROFILE DIMENSIONS

FIGURE 4-3. 1C STRAIGHT CONNECTOR DIMENSIONS

FIGURE 4-4. 2C STRAIGHT CONNECTOR DIMENSIONS

FIGURE 4-5. 4C STRAIGHT CONNECTOR DIMENSIONS

FIGURE 4-6. 4C+ STRAIGHT CONNECTOR DIMENSIONS

FIGURE 4-7. SECTION A: 1C, 2C, 4C AND 4C+ STRAIGHT CONNECTOR SEATING PLANE

FIGURE 4-8. DETAIL A: STRAIGHT CONNECTOR SMT LEAD CO-PLANARITY

FIGURE 4-9. 1C, 2C, 4C AND 4C+ RIGHT ANGLE CONNECTOR DIMENSIONS OVERVIEW

FIGURE 4-10. 1C, 2C, 4C AND 4C+ RIGHT ANGLE CONNECTOR PROFILE DIMENSIONS

FIGURE 4-11. 1C RIGHT ANGLE CONNECTOR DIMENSIONS

FIGURE 4-12. 2C RIGHT ANGLE CONNECTOR DIMENSIONS

FIGURE 4-13. 4C RIGHT ANGLE CONNECTOR DIMENSIONS

FIGURE 4-14. 4C+ RIGHT ANGLE CONNECTOR DIMENSIONS

FIGURE 4-15. SECTION A: 1C, 2C, 4C AND 4C+ RIGHT ANGLE CONNECTOR SEATING PLANE

FIGURE 4-16. DETAIL B: RIGHT ANGLE CONNECTOR SMT LEAD CO-PLANARITY

FIGURE 4-17. 1C, 2C, 4C AND 4C+ STRADDLE MOUNT CONNECTOR DIMENSIONS OVERVIEW

FIGURE 4-18. 1C, 2C, 4C AND 4C+ STRADDLE MOUNT CONNECTOR PROFILE DIMENSIONS (MM)

FIGURE 4-19. 1C STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)

FIGURE 4-20. 1C STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)

FIGURE 4-21. 2C STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)

FIGURE 4-22. 2C STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)

FIGURE 4-23. 4C STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)

FIGURE 4-24. 4C STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)

FIGURE 4-25. 4C+ STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)

FIGURE 4-26. 4C+ STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)

FIGURE 4-27. SECTION A: STRADDLE MOUNT CONNECTOR SEATING PLANE DIMENSIONS (MM)

FIGURE 4-28. SECTION A: STRADDLE MOUNT CONNECTOR SEATING PLANE WITH ZERO OFFSET (MM)

FIGURE 4-29. FIXED SIDE BOARD EDGE PROFILE DIMENSIONS (MM)

FIGURE 4-30. 1C RIGHT ANGLE ORTHOGONAL CONNECTOR DIMENSIONS (MM)

FIGURE 4-31. 2C RIGHT ANGLE ORTHOGONAL CONNECTOR DIMENSIONS (MM)

FIGURE 4-32. 1C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR DIMENSIONS (MM)

FIGURE 4-33. 2C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR DIMENSIONS (MM)

FIGURE 4-34. DETAIL B: RIGHT ANGLE ORTHOGONAL CONNECTOR SEATING PLANE DIMENSIONS

FIGURE 4-35. AIC MATING CARD PROFILE DIMENSIONS

FIGURE 4-36. AIC 1C MATING CARD DIMENSIONS

FIGURE 4-37. AIC 2C MATING CARD DIMENSIONS

FIGURE 4-38. AIC 4C MATING CARD DIMENSIONS

FIGURE 4-39. AIC 4C+ MATING CARD DIMENSIONS (MM)

FIGURE 4-40. DETAIL C: 1C AIC PAD DIMENSIONS (OPTIONAL SPLIT PAD SHOWN)

FIGURE 4-41. DETAIL D: 2C, 4C AND 4C+ AIC PAD DIMENSIONS (OPTIONAL SPLIT PAD SHOWN)

FIGURE 4-42. 1C OUTER LOCUS OF CONNECTOR CONTACT PIN

FIGURE 4-43. 2C OUTER LOCUS OF CONNECTOR CONTACT PIN

FIGURE 4-44. 4C OUTER LOCUS OF CONNECTOR CONTACT PIN

FIGURE 4-45. 4C+ OUTER LOCUS OF CONNECTOR CONTACT PIN

FIGURE 4-46. 1C STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-47. 1C RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-48. 1C STRADDLE MOUNT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-49. 1C SMT ORTHOGONAL OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-50. 2C STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-51. 2C RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-52. 2C STRADDLE MOUNT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-53. 2C SMT ORTHOGONAL OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-54. 4C STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-55. 4C RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-56. 4C STRADDLE MOUNT OUTER LOCUS OF CONNECTOR SMT LEADS
FIGURE 4-57. 4C+ STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS
FIGURE 4-58. 4C+ RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS
FIGURE 4-59. 4C+ STRADDLE MOUNT OUTER LOCUS OF CONNECTOR SMT LEADS
FIGURE 4-60. 1C PRESS FIT ORTHOGONAL OUTER LOCUS OF CONNECTOR LEADS
FIGURE 4-61. 2C PRESS FIT ORTHOGONAL OUTER LOCUS OF CONNECTOR LEADS
FIGURE B-1. LINEAR GATHERABILITY.
FIGURE B-2. ANGULAR GATHERABILITY.
FIGURE B-3. MECHANICAL KEYING.
FIGURE C-1. 1C STRAIGHT CONNECTOR FOOTPRINT
FIGURE C-2. 1C RIGHT ANGLE CONNECTOR FOOTPRINT
FIGURE C-3. 1C STRADDLE MOUNT CONNECTOR FOOTPRINT
FIGURE C-4. 2C STRAIGHT CONNECTOR FOOTPRINT
FIGURE C-5. 2C RIGHT ANGLE CONNECTOR FOOTPRINT
FIGURE C-6. 2C STRADDLE MOUNT CONNECTOR FOOTPRINT
FIGURE C-7. 4C STRAIGHT CONNECTOR FOOTPRINT
FIGURE C-8. 4C RIGHT ANGLE CONNECTOR FOOTPRINT
FIGURE C-9. 4C STRADDLE MOUNT CONNECTOR FOOTPRINT (MM)
FIGURE C-10. 4C+ STRAIGHT CONNECTOR FOOTPRINT
FIGURE C-11. 4C+ RIGHT ANGLE CONNECTOR FOOTPRINT (MM)
FIGURE C-12. 4C+ STRADDLE MOUNT CONNECTOR FOOTPRINT (MM)
FIGURE C-13. 1C PRESS FIT ORTHOGONAL CONNECTOR FOOTPRINT (MM)
FIGURE C-14. 2C PRESS FIT ORTHOGONAL CONNECTOR FOOTPRINT (MM)
FIGURE C-15. 1C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR FOOTPRINT
FIGURE C-16. 2C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR FOOTPRINT
FIGURE D-1 SMT LEAD GEOMETRY

TABLES
TABLE 3-1 INTEROPERABILITY MATRIX REQUIREMENTS
TABLE 4-1. RIGHT ANGLE HEIGHT VARIATIONS
TABLE 4-2. STRADDLE MOUNT HOST BOARD THICKNESS AND OFFSET VARIANTS (MM)
TABLE 4-3. WIPE VALUES FOR LEVEL 1 AND LEVEL 2 SEQUENCING
TABLE 5-1. MECHANICAL TESTING REQUIREMENTS
TABLE 5-2. MATING CYCLES BY CONNECTOR GRADE
TABLE 5-3. CONNECTOR ELECTRICAL AND OPERATING TEMPERATURE RATINGS.
TABLE 5-4. ELECTRICAL TEST REQUIREMENTS AND PROCEDURES
TABLE 5-5. VERTICAL, RIGHT ANGLE AND STRADDLE MOUNT CONNECTOR SIGNAL INTEGRITY REQUIREMENTS
TABLE 5-6. ORTHOGONAL (SMT AND PRESS-FIT) CONNECTOR SIGNAL INTEGRITY REQUIREMENTS ONLY
TABLE 5-7. RELIABILITY TEST SEQUENCE
TABLE 5-8. RELIABILITY TEST CONDITIONS
TABLE 5-9. RELIABILITY TEST CONDITIONS
TABLE 6-1. PIN GEOMETRY PATTERN FOR 1C, 2C, 4C, AND 4C+ CONNECTORS
TABLE A-1. CONTACT MATING POSITIONS FOR 1C, 2C, 4C AND 4C+ CONNECTORS
TABLE D-1. SMT LEAD GEOMETRY DIMENSIONS
1. Scope

This specification defines the mechanical and connector performance requirements for a card edge connector system. This connector system is designed to support high speed signals, power, and side bands on different contacts within the same housing.

1.1 Application Specific Criteria

This connector is capable of supporting a range of protocols. This specification does not list specific supported protocols, but instead details the supported signaling rates and the signal integrity requirements met by the connector. The connector supports signaling rates from 2.5 GT/s NRZ to 112 GT/s PAM-4. This includes but is not limited to 16, 28, 32, and 56 GT/s NRZ, and 56 and 112 GT/s PAM-4. Only the pressfit orthogonal version of the connector is limited to signaling rates from 2.5 GT/s NRZ to 16 GT/s NRZ.

1.2 Copyright

The SNIA hereby grants permission for individuals to use this document for personal use only, and for corporations and other business entities to use this document for internal use only (including internal copying, distribution, and display) provided that:

1. Any text, diagram, chart, table or definition reproduced shall be reproduced in its entirety with no alteration, and,
2. Any document, printed or electronic, in which material from this document (or any portion hereof) is reproduced shall acknowledge the SNIA copyright on that material, and shall credit the SNIA for granting permission for its reuse.

Other than as explicitly provided above, there may be no commercial use of this document, or sale of any part, or this entire document, or distribution of this document to third parties. All rights not explicitly granted are expressly reserved to SNIA.

Permission to use this document for purposes other than those enumerated (Exception) above may be requested by e-mailing copyright_request@snia.org. Please include the identity of the requesting individual and/or company and a brief description of the purpose, nature, and scope of the requested use. Permission for the Exception shall not be unreasonably withheld. It can be assumed permission is granted if the Exception request is not acknowledged within ten (10) business days of SNIA's receipt. Any denial of permission for the Exception shall include an explanation of such refusal.

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/
2. References

2.1 Industry Documents

- ASME Y14.5-2009 published by ASME
- EIA-364-1000: Environmental Test Methodology for Assessing the Performance of Electrical Connectors and Sockets used in Controlled Environment published the Electronic Industries Alliance
- EIA-364-05: Contact Insertion, Release and Removal Force Test Procedure for Electrical Connectors published by the Electronic Industries Alliance
- EIA-364-13: Mating and Un-mating Force Test Procedure for Electrical Connectors and Sockets published by the Electronic Industries Alliance
- EIA 364-23: Low Level Contact Resistance Test Procedures for Electrical Connectors and Sockets published by the Electronic Industries Alliance
- EIA-364-27: Shock Test Procedure for Electrical Connectors published by the Electronic Industries Alliance
- EIA-364-28: Vibration Test Procedure for Electrical Connectors and Sockets published by the Electronic Industries Alliance
- EIA-364-29: Contact Retention Test Procedure for Electrical Connectors published by the Electronic Industries Alliance
- EIA-364-31: Humidity Test Procedure for Electrical Connectors and Sockets published by the Electronic Industries Alliance
- EIA-364-32: Thermal Shock Test Procedure for Electrical Connectors and Sockets published by the Electronic Industries Alliance
- EIA 364-70: Temperature Rise Versus Current Test Procedure for Electrical Connectors and Sockets published by the Electronic Industries Alliance
- JEDEC J-STD-002D: Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires
- JEDEC J-STD-001: Requirements for Soldered Electrical and Electronic Assemblies
- JEDEC JS709A: Defining “Low-Halogen” Electronic Products jointly published by ECIA and JEDEC
- JEDEC PS-002A: DDR4 288 Pin U/R/LR DIMM Connector Performance Standard published by ECIA and JEDEC
- IEEE 802.3 Standard for Ethernet (Clause 92.11.3.2) published by IEEE Standards Association
- IPC-7711/7721: Rework, Repair and Modification of Electronic Assemblies
- OIF Common Electrical I/O (CEI): Electrical and Jitter Interoperability Agreements for 6G+ bps, 11G+ bps and 25G+ bps I/O (OIF-CEI-03.1) published by the Optical Internetworking Forum
- SNIA REF-TA-1012: Pin Assignment Reference for SFF-TA-1002 Connectors
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 listed in 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).

ASME documents are available at https://www.asme.org

Gen-Z documents are available at https://genzconsortium.org/specifications/

The Electronic Components Industry Association (ECIA) manages Electronic Industries Alliance (EIA) standards—see https://www.ecianow.org

IEEE documents are available at https://standards.ieee.org


The Optical Internetworking Forum manages OIF documents—see http://www.oiforum.com

SNIA SFF documents are available at https://www.snia.org/technology-communities/sff/specifications

2.3 Conventions

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

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.

<table>
<thead>
<tr>
<th>American</th>
<th>French</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>1,000</td>
<td>1 000</td>
<td>1 000</td>
</tr>
<tr>
<td>1,323,462.9</td>
<td>1 323 462,9</td>
<td>1 323 462.9</td>
</tr>
</tbody>
</table>
2.4 Definitions

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

Advanced grounding contacts: Connector contacts that make first and break last and are capable of carrying power ground return currents and performing electrostatic discharge. Other terms sometimes used to describe these features are: grounding pins, ESD contacts, grounding contacts, static drain, and pre-grounding contacts.

Add in card (AIC): The free half of the connector mating interface defined by this specification. The AIC typically includes more functionality than the physical mechanical interface.

Asymmetric (transmission): Bi-directional interface where the maximum rate of transfer for each direction may be independently specified.

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.

Chiclet: A building block for use in naming convention defined as 8 differential pairs of data signals.

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.

Discrete pin connector: Connector where no pins are bussed together.

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.

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.

![Diagram of mating side](image)

**Figure 2-1 Mating Side Gender Definition**

**nC:** Connector naming (1C, 2C, 4C) convention that indicates the number of Chiclets. This convention is used because common naming such as “x4, x8” etc... implies symmetrical data transfer in each direction.

**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.

**Orthogonal:** 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 while the drive is perpendicular to it.

**Reserved:** Where this term is used for defining 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.

**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

**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.

**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 shall be a minimum of 0.05 mm from either end of the Fixed contact mating interface after mating and latching.

![Figure 2-2 Direction of Mating](image)

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 2-3 Direction of Contact](image)

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

![Figure 2-4 Continuous Contact](image)

A split or interrupted contact surface (i.e. a contact interface with a pre-pad) is
allowable so long as the gap does not allow for the Free contact to make contact with a non-conductive surface.

FIGURE 2-5 SPLIT 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.
3. General Description

This specification defines a card edge connector and add in card interface. Refer to the Gen-Z Scalable Connector Specification 1.1 for cable application details. This connector is deployable in a variety of applications and maintains interoperability between cards of different sizes. The connector supports signaling rates from 2.5 GT/s NRZ to 112 GT/s PAM-4. This includes but is not limited to 16, 28, 32, and 56 GT/s NRZ, and 56 and 112 GT/s PAM-4. Only the orthogonal version of the connector is limited to signaling rates from 2.5 GT/s NRZ to 16 GT/s NRZ. This connector uses a discrete pin interface that allows repurposing for other applications and supports asymmetric transmission. This specification describes four different connector orientations, straight, right angle, orthogonal and straddle mount, and four connector sizes as follows.

a. 1C Connector: A connector with 56 contacts with up to 18 differential pairs of data signals in a GSSGSSG configuration as defined in Table 6-1.

b. 2C Connector: A connector with 84 contacts with up to 26 differential pairs of data signals in a GSSGSSG configuration as defined in Table 6-1.

c. 4C Connector: A connector with 140 contacts with up to 44 differential pairs of data signals in a GSSGSSG configuration as defined in Table 6-1.

d. 4C+ Connector: A connector with 168 contacts with up to 52 differential pairs of data signals in a GSSGSSG configuration as defined in Table 6-1.

In addition to differential pairs of data signals, each connector provides a number of contacts to supply power and management signals. The connector supports repurposing of power and management pins for high speed differential pairs in a GSSGSSG configuration and vice versa. 2C, 4C, and 4C+ connectors provide keys to provide fine alignment and prevent 180 degree insertion. 1C connectors use the internal side walls of the connector for fine alignment and are keyed by the form factor and host. Refer to specific application specifications for pin functions and assignments. For a reference list of applications and pin assignments in the industry refer to REF-TA-1012: Pin Assignment Reference for SFF-TA-1002 Connectors.

Figure 3-1 represents a typical mating configuration of this connector. Figure 3-3 show the three connector sizes.
The connector allows complete upward and downward interoperability as follows and as indicated in Table 3-1 and shown in Figure 3-4 and Figure 3-5:

**TABLE 3-1 INTEROPERABILITY MATRIX REQUIREMENTS**

<table>
<thead>
<tr>
<th>Connectors</th>
<th>Add-in Cards (AICs)</th>
<th>1C</th>
<th>2C</th>
<th>4C</th>
<th>4C+*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1C</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2C</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4C</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4C+*</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Note: 1C, 2C, and 4C connectors/AICs must be aligned through the mating form factor and host with the 4C+ connector/AICs to ensure interoperability as shown in Figure 3-4.
FIGURE 3-4. STRAIGHT CONNECTOR AND AIC INTEROPERABILITY

FIGURE 3-5. RIGHT ANGLE CONNECTOR AND CARD INTEROPERABILITY
FIGURE 3-6. STRADDLE MOUNT CONNECTOR AND CARD INTEROPERABILITY

FIGURE 3-7. ORTHOGONAL CONNECTOR AND CARD INTEROPERABILITY

This specification defines the contact range that the retention scheme must provide to assure acceptable connector performance.
4. Connector Interface Dimensions

4.1 General Requirements

All dimensional requirements for the connector and mating card within this specification shall be met in order to provide interoperability between connector and add in card and to fit within the physical boundaries required by the host.

4.2 General Tolerances

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

a. Two-Place dimension = +/- 0.20mm
b. Angular dimension = +/- 3 degrees
4.3 Unshielded Fixed (Receptacle) Connectors

4.3.1 Unshielded Fixed (Receptacle) Straight Connectors

![Diagram of 1C, 2C, and 4C+ Straight Connectors]

**FIGURE 4-1. 1C, 2C, AND 4C+ STRAIGHT CONNECTOR DIMENSIONS OVERVIEW**
FIGURE 4-2. 1C, 2C, 4C AND 4C+ STRAIGHT CONNECTOR PROFILE DIMENSIONS
FIGURE 4-3. 1C STRAIGHT CONNECTOR DIMENSIONS
FIGURE 4-4. 2C STRAIGHT CONNECTOR DIMENSIONS
FIGURE 4-5. 4C STRAIGHT CONNECTOR DIMENSIONS
FIGURE 4-6. 4C+ STRAIGHT CONNECTOR DIMENSIONS

FIGURE 4-7. SECTION A: 1C, 2C, 4C AND 4C+ STRAIGHT CONNECTOR SEATING PLANE
FIGURE 4-8. DETAIL A: STRAIGHT CONNECTOR SMT LEAD CO-PLANARITY

4.3.2 Unshielded Fixed (Receptacle) Right Angle Connectors

FIGURE 4-9. 1C, 2C, 4C AND 4C+ RIGHT ANGLE CONNECTOR DIMENSIONS OVERVIEW
FIGURE 4-10. 1C, 2C, 4C AND 4C+ RIGHT ANGLE CONNECTOR PROFILE DIMENSIONS
FIGURE 4-11. 1C RIGHT ANGLE CONNECTOR DIMENSIONS
FIGURE 4-12. 2C RIGHT ANGLE CONNECTOR DIMENSIONS
FIGURE 4-13. 4C RIGHT ANGLE CONNECTOR DIMENSIONS
FIGURE 4-14. 4C+ RIGHT ANGLE CONNECTOR DIMENSIONS
FIGURE 4-15. SECTION A: 1C, 2C, 4C AND 4C+ RIGHT ANGLE CONNECTOR SEATING PLANE

FIGURE 4-16. DETAIL B: RIGHT ANGLE CONNECTOR SMT LEAD CO-PLANARITY

TABLE 4-1. RIGHT ANGLE HEIGHT VARIATIONS

<table>
<thead>
<tr>
<th>DIM H (mm)</th>
<th>DIM G (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.55 MAX</td>
<td>4.05</td>
</tr>
<tr>
<td>5.55 MAX</td>
<td>3.05</td>
</tr>
</tbody>
</table>
4.3.3 Unshielded Fixed (Receptacle) Straddle Mount Connectors

**FIGURE 4-17. 1C, 2C, 4C AND 4C+ STRADDLE MOUNT CONNECTOR DIMENSIONS OVERVIEW**

**FIGURE 4-18. 1C, 2C, 4C AND 4C+ STRADDLE MOUNT CONNECTOR PROFILE DIMENSIONS (MM)**
FIGURE 4-19. 1C STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)
FIGURE 4-20. IC STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)
FIGURE 4-21. 2C STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)
FIGURE 4-22. 2C STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)
FIGURE 4-23. 4C STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)

FIGURE 4-24. 4C STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)
FIGURE 4-25. 4C+ STRADDLE MOUNT CONNECTOR DIMENSIONS – FRONT VIEW (MM)

FIGURE 4-26. 4C+ STRADDLE MOUNT CONNECTOR DIMENSIONS – REAR VIEW (MM)
FIGURE 4-27. SECTION A: STRADDLE MOUNT CONNECTOR SEATING PLANE DIMENSIONS (MM)

FIGURE 4-28. SECTION A: STRADDLE MOUNT CONNECTOR SEATING PLANE WITH ZERO OFFSET (MM)

Note: Refer to TABLE 4-2 for DIM T values.

FIGURE 4-29. FIXED SIDE BOARD EDGE PROFILE DIMENSIONS (MM)
### TABLE 4-2. STRADDLE MOUNT HOST BOARD THICKNESS AND OFFSET VARIANTS (MM)

<table>
<thead>
<tr>
<th>DIM T</th>
<th>DIM U</th>
</tr>
</thead>
<tbody>
<tr>
<td>(HOST BOARD THICKNESS)</td>
<td>(OFFSET)</td>
</tr>
<tr>
<td>1.57±0.15 (.062&quot;)</td>
<td>0.00 (.0000&quot;)</td>
</tr>
<tr>
<td>1.93±0.19 (.076&quot;)</td>
<td>0.30 (.0118&quot;)</td>
</tr>
<tr>
<td>2.36±0.23 (.093&quot;)</td>
<td>0.00 (.0000&quot;)</td>
</tr>
</tbody>
</table>

#### 4.3.4 Unshielded Fixed (Receptacle) Pressfit Orthogonal Connectors

![Diagram of 1C Right Angle Orthogonal Connector Dimensions (MM)](image)

**FIGURE 4-30. 1C RIGHT ANGLE ORTHOGONAL CONNECTOR DIMENSIONS (MM)**
FIGURE 4-31. 2C RIGHT ANGLE ORTHOGONAL CONNECTOR DIMENSIONS (MM)

4.3.5 Unshielded Fixed (Receptacle) Surface Mount Orthogonal Connectors
FIGURE 4-32. 1C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR DIMENSIONS (MM)
FIGURE 4-33. 2C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR DIMENSIONS (MM)

AIC REFERENCE SEATING PLANE

SECTION B-B

FIGURE 4-34. DETAIL B: RIGHT ANGLE ORTHOGONAL CONNECTOR SEATING PLANE DIMENSIONS (MM)
4.4 Add-In Card Free (Plug) Mechanical Drawings

- The Add-In Card (AIC) card outline dimensions are shown in Figure 4-35 through Figure 4-41. If plating tie bars are used for plating purposes, all tie bars shall be removed on the mating AIC. All chamfered edges and edge of pads shall be free of burrs.

![Diagram](image)

**FIGURE 4-35. AIC MATING CARD PROFILE DIMENSIONS**

![Diagram](image)

**FIGURE 4-36. AIC 1C MATING CARD DIMENSIONS**

Notes: Position A1 on opposite side of card of B1. Dimensions for pad locations are to center of the pad.
Notes: Position A1 on opposite side of card of B1. Dimensions for pad locations are to center of the pad.

**FIGURE 4-37. AIC 2C MATING CARD DIMENSIONS**

Notes: Position A1 on opposite side of card of B1. Dimensions for pad locations are to center of the pad.

**FIGURE 4-38. AIC 4C MATING CARD DIMENSIONS**
Notes: Position A1 on opposite side of card of B1. Dimensions for pad locations are to center of the pad.

FIGURE 4-39. AIC 4C+ MATING CARD DIMENSIONS (MM)

TABLE 4-3. WIPE VALUES FOR LEVEL 1 AND LEVEL 2 SEQUENCING

<table>
<thead>
<tr>
<th></th>
<th>Wipe (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 sequence</td>
<td>1.7 REF</td>
</tr>
<tr>
<td>Level 2 sequence</td>
<td>1.3 REF</td>
</tr>
</tbody>
</table>

FIGURE 4-40. DETAIL C: 1C AIC PAD DIMENSIONS (OPTIONAL SPLIT PAD SHOWN)
4.5 Outer Locus of the Connector Mating Contacts

Figure 4-42 through Figure 4-44 show the outer locus of the connector contacts at the AIC mating interface.
4.6 Outer Locus of SMT Leads

Figure 4-46 through Figure 4-55 show the outer locus of the flat surfaces of the connector SMT leads.
FIGURE 4-46. 1C STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-47. 1C RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS
FIGURE 4-48. 1C STRADDLE MOUNT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-49. 1C SMT ORTHOGONAL OUTER LOCUS OF CONNECTOR SMT LEADS
FIGURE 4-50. 2C STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-51. 2C RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-52. 2C STRADDLE MOUNT OUTER LOCUS OF Connector SMT LEADS
FIGURE 4-53. 2C SMT ORTHOGONAL OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-54. 4C STRAIGHT OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-55. 4C RIGHT ANGLE OUTER LOCUS OF CONNECTOR SMT LEADS

FIGURE 4-56. 4C STRADDLE MOUNT OUTER LOCUS OF CONNECTOR SMT LEADS
4.7 Outer Locus of Pressfit Leads

**FIGURE 4-60** through **FIGURE 4-61** show the outer locus of the flat surfaces of the orthogonal pressfit leads.
FIGURE 4-60. 1C PRESS FIT ORTHOGONAL OUTER LOCUS OF CONNECTOR LEADS

FIGURE 4-61. 2C PRESS FIT ORTHOGONAL OUTER LOCUS OF CONNECTOR LEADS
5. Performance Requirements

5.1 Mechanical Testing and Performance

The connector shall meet the mechanical testing requirements shown in Table 5-1.

**TABLE 5-1. MECHANICAL TESTING REQUIREMENTS**

<table>
<thead>
<tr>
<th>Mechanical Test Description</th>
<th>Procedure</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion Force</strong> (AIC to Connector)</td>
<td>EIA-364-13 Axial Tension/Compression machine such as an Instron Tensile Tester. Rate: 25.4 mm/min. A gauge or AIC manufactured to the maximum thickness shall be used for testing purposes.</td>
<td>1.1 N/pin pair Maximum</td>
</tr>
<tr>
<td><strong>Unmating Force</strong> (AIC to Connector)</td>
<td>EIA-364-13 Axial Tension/Compression machine such as an Instron Tensile Tester. Rate: 25.4 mm/min. A gauge or AIC manufactured to the minimum thickness shall be used for testing purposes.</td>
<td>0.10 N/pin pair Minimum</td>
</tr>
</tbody>
</table>
| **Insertion Force** (Connector to Board) | EIA-364-05 Axial Tension/Compression machine such as an Instron Tensile Tester. | SMT: 0-3 N maximum to enable pick and place  
Press fit: 27 N/pin maximum |
| **Retention Force** (Connector to Board, press fit only) | EIA-364-05 Axial Tension/Compression machine such as an Instron Tensile Tester. | 2 N/pin minimum to remove |
| **Durability** (mating/unmating) | EIA-364-09 Use appropriate AIC. Perform required cycles for connector grade required per the table below. Plug and unplug cycles at a rate of 25.4 mm/minute, replace mating card after 25 cycles | LLCR: Refer to TABLE 5-8. RELIABILITY TEST CONDITIONS for LLCR requirement. Note: This specification intentionally deviates from EIA-364-09 procedure |

**TABLE 5-2. MATING CYCLES BY CONNECTOR GRADE**

<table>
<thead>
<tr>
<th>Connector Grade</th>
<th>Total Cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>200</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
</tr>
<tr>
<td>C</td>
<td>50</td>
</tr>
</tbody>
</table>

Note: To enable high durability cycles, a metal alignment key may be implemented in the connector body.
5.2 Electrical Testing and Performance

Refer to Table 5-3 for connector electrical ratings and Table 5-4 for electrical test requirements and procedures.

| TABLE 5-3. CONNECTOR ELECTRICAL AND OPERATING TEMPERATURE RATINGS. |
|-----------------|-------|------|----------------|
| Parameter       | Value | Unit | Comment                                   |
| Voltage Rating per pin | 29    | V    | Refer to Table 5-4 for testing requirements |
| Current Rating per pin   | 1.1   | A    | Tested per EIA 364-70, up to a maximum of 6 adjacent pins per side, 12 pins total |
| Temperature Rating      | -40 to 85°C | T    |                                              |

| TABLE 5-4. ELECTRICAL TEST REQUIREMENTS AND PROCEDURES |
|-----------------|---------------|----------------|
| Test Description | Requirement | Procedure                 |
| Dielectric withstand voltage. | 1 minute hold with no breakdown or flashover | EIA 364-20 Method B Test between adjacent contacts of unmated connector assemblies. Voltage: 300 VAC, Current leakage: 0.5 mA max. Note: This specification intentionally deviates from EIA 364-20 standard procedure. |
| Insulation resistance | 1,000 MΩ minimum. | EIA 364-21 After 100 VDC for 1 minute, measure the insulation resistance between the adjacent contacts of unmated connector assemblies. |

5.3 Signal Integrity Testing and Requirements

The connector shall meet the Signal Integrity requirements for all line rates specified in Table 5-5 and Table 5-6. This specification does not restrict, require or define a specific impedance for the connector. The electrical requirements contained in Table 5-5 and Table 5-6 are normalized to an 85 Ohm differential simulated or measured environment. In addition to simulated results, the connector supplier shall provide correlation between simulation and measurement using the following method: Use TP1 and TP4 test points of Clause 13.3.1 & 13.4 of OIF-CEI-03.1 setup requirements for Host Compliant Board (HCB) and Module Compliance Board (MCB).
5.4 Reliability Testing and Requirements

Table 5-7 shows the testing required to validate the connectors developed with this specification per EIA 364-1000 test groups 1, 2, 3, and 4 for 3, 5, or 7-year life cycle requirements. Five samples shall be tested per subgroup.
### TABLE 5-7. RELIABILITY TEST SEQUENCE

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Low Level Contact Resistance</td>
<td>1,4,6</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Reseating</td>
<td>5</td>
</tr>
<tr>
<td>Vibration</td>
<td></td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5-8. RELIABILITY TEST CONDITIONS

<table>
<thead>
<tr>
<th>Reliability Test Description</th>
<th>Procedure</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durability (preconditioning)</td>
<td>Refer to EIA 364-1000 for requirements</td>
<td>No evidence of physical damage</td>
</tr>
<tr>
<td>Temperature Life</td>
<td>EIA-364-17, Method A (without electrical load)</td>
<td>Electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td>Temperature Life (preconditioning)</td>
<td>Test Temperature and Test Duration per EIA 364-1000 Table 8</td>
<td></td>
</tr>
<tr>
<td>Mixed Flowing Gas</td>
<td>EIA-364-23 (termination of connector to board carrier shall be included in the measurements)</td>
<td>Refer to EIA-364-23, Table 5.4.2. Delta: 15mΩ MAX</td>
</tr>
<tr>
<td>Low Level Contact Resistance (LLCR)</td>
<td>EIA-364-23, Table 5.4.2. Delta: 15mΩ MAX</td>
<td></td>
</tr>
</tbody>
</table>
### Reliability Test Description

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical Shock</strong>&lt;br&gt;EIA-364-27, Test Condition A&lt;br&gt;Trapezoidal shock 50 G, ± 10%&lt;br&gt;Duration 11 ms&lt;br&gt;Velocity change 170 inch/sec, ± 10%&lt;br&gt;Three drops in each of six directions are applied to each of the samples&lt;br&gt;Shock and Vibration board, Annex D</td>
<td>Electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td><strong>Vibration</strong>&lt;br&gt;EIA-364-28 Test Condition D&lt;br&gt;Random profile:&lt;br&gt;5 Hz @ 0.01 g2/Hz to 20 Hz @ 0.02 g2/Hz (slope up)&lt;br&gt;20 Hz to 500 Hz @ 0.02 g2/Hz (flat)&lt;br&gt;Input acceleration is 3.13 g RMS&lt;br&gt;10 minutes per axis for all 3 axes on all samples Random control limit tolerance is ± 3 dB</td>
<td>No discontinuities of ≥ 1 microsecond&lt;br&gt;electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td><strong>Cyclic Temperature and Humidity</strong>&lt;br&gt;EIA-364-31B, Method III without conditioning, initial measurements, cold shock and vibration. Ramp times should be 0.5 hour and dwell times should be 1.0 hour. Dwell times start when the temperature and humidity have stabilized within specified levels, perform 24 cycles in mated condition.</td>
<td>Electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td><strong>Thermal Shock</strong>&lt;br&gt;EIA-364-32, Method A, Table 2, Test Condition 1, −55 °C to 85 °C, perform 5 cycles in mated condition</td>
<td>Electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td><strong>Thermal Disturbance</strong>&lt;br&gt;EIA-364-1000 Cycle the connector between 15 ±3 °C and 85 ±3 °C, as measured on the part. Ramps should be a minimum of 2 °C/minute. Dwell times should ensure that the contacts reach the temperature extremes (a minimum of 5 minutes), humidity is not controlled; perform 10 cycles in mated condition.</td>
<td>Electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td><strong>Mixed Flowing Gas</strong>&lt;br&gt;EIA-364-65, class IIA, Option 4. Expose all specimens in the mated condition for the total mixed flowing gas exposure duration per Table 4.</td>
<td>Electrical, mechanical and environmental criteria</td>
</tr>
<tr>
<td><strong>Reseating</strong>&lt;br&gt;Manually unplug/plug the connector. Perform 3 cycles</td>
<td>No evidence of physical damage</td>
</tr>
</tbody>
</table>

### 5.5 Manufacturability Testing and Requirements

Table 5-7 shows the testing required to validate the connectors developed with this specification meet common manufacturing criteria in the electronics industry. The
test details shown here are for reference. It is recommended that the connector body be narrowed above the SMT leads to allow for visual inspection of solder joints.

**TABLE 5-9. RELIABILITY TEST CONDITIONS**

<table>
<thead>
<tr>
<th>Manufacturing Test Description</th>
<th>Procedure</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solderability - Lead Free</td>
<td>J-STD-002D; Condition C, 8 hours ± 15 minutes steam precondition.</td>
<td>95% coverage minimum</td>
</tr>
<tr>
<td>Lead Free Processability</td>
<td>260 °C, 5 seconds.</td>
<td>No physical damage to connector per visual inspection at 24 inches. No magnification</td>
</tr>
<tr>
<td>Electronic Assembly Rework, Repair, and Modification Procedures</td>
<td>IPC-7711/7721: Rework, Repair and Modification of Electronic Assemblies</td>
<td>Meets Class 2, Highest Level of Conformance (section 1.5.1)</td>
</tr>
<tr>
<td>Electronic Assembly Materials, Methods, and Acceptance Criteria</td>
<td>IPC J-STD-001: Requirements for Soldered Electrical and Electronic Assemblies</td>
<td>Meets Class 2 Acceptance criteria, Dedicated Service Electronic Products (section 1.3)</td>
</tr>
</tbody>
</table>
6. Pin Geometry Pattern

As stated in section 3, the connector is discrete pin to enable repurposing for applications that require additional high speed differential pairs or more power pins or side band signals. If a connector implementation uses different pin geometry between ground pins and high speed signal pins, the connector shall follow the GS/GS/GS pattern defined in Table 6-1 below. This table only describes which pins use a “signal” geometry and which pins use a “GND” geometry, if and only if the geometry of those pins is different and does not define a functional pin out.

**TABLE 6-1. PIN GEOMETRY PATTERN FOR 1C, 2C, 4C, AND 4C+ CONNECTORS**
<table>
<thead>
<tr>
<th>Row</th>
<th>Side A</th>
<th>Side B</th>
<th>Connector Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>O2</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O3</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O4</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>O5</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O6</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O7</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>O8</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O9</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O10</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>O11</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O12</td>
<td>SIGNAL</td>
<td>SIGNAL</td>
<td></td>
</tr>
<tr>
<td>O13</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>O14</td>
<td>GND</td>
<td>GND</td>
<td></td>
</tr>
</tbody>
</table>

**KEY**

1 | GND | GND | 1C Connector
2 | SIGNAL | SIGNAL | 2C Connector
3 | SIGNAL | SIGNAL | 4C Connector
4 | GND | GND | 4C+ Connector

**Row Side A Side B**

- **1C Connector**
- **2C Connector**
- **4C Connector**
- **4C+ Connector**
Appendix A. Mating Sequence

The connector receptacle has one stage of mating. First mate last break functionality is achieved with the Level 1 and Level 2 Sequencing on the AIC mating pads as indicated in Table A-1. The AIC mating positions below are an example implementation.

TABLE A-1. CONTACT MATING POSITIONS FOR 1C, 2C, 4C AND 4C+ CONNECTORS

<table>
<thead>
<tr>
<th>Row</th>
<th>AIC Plug (Free)</th>
<th>Receptacle (Fixed)</th>
<th>Row</th>
<th>AIC Plug (Free)</th>
<th>Receptacle (Fixed)</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA1</td>
<td></td>
<td>OA1</td>
<td>OB1</td>
<td></td>
<td>OB1</td>
<td></td>
</tr>
<tr>
<td>OA2</td>
<td></td>
<td>OA2</td>
<td>OB2</td>
<td></td>
<td>OB2</td>
<td></td>
</tr>
<tr>
<td>OA3</td>
<td></td>
<td>OA3</td>
<td>OB3</td>
<td></td>
<td>OB3</td>
<td></td>
</tr>
<tr>
<td>OA4</td>
<td></td>
<td>OA4</td>
<td>OB4</td>
<td></td>
<td>OB4</td>
<td></td>
</tr>
<tr>
<td>OA5</td>
<td></td>
<td>OA5</td>
<td>OB5</td>
<td></td>
<td>OB5</td>
<td></td>
</tr>
<tr>
<td>OA6</td>
<td></td>
<td>OA6</td>
<td>OB6</td>
<td></td>
<td>OB6</td>
<td></td>
</tr>
<tr>
<td>OA7</td>
<td></td>
<td>OA7</td>
<td>OB7</td>
<td></td>
<td>OB7</td>
<td></td>
</tr>
<tr>
<td>OA8</td>
<td></td>
<td>OA8</td>
<td>OB8</td>
<td></td>
<td>OB8</td>
<td></td>
</tr>
<tr>
<td>OA9</td>
<td></td>
<td>OA9</td>
<td>OB9</td>
<td></td>
<td>OB9</td>
<td></td>
</tr>
<tr>
<td>OA10</td>
<td></td>
<td>OA10</td>
<td>OB10</td>
<td></td>
<td>OB10</td>
<td></td>
</tr>
<tr>
<td>OA11</td>
<td></td>
<td>OA11</td>
<td>OB11</td>
<td></td>
<td>OB11</td>
<td></td>
</tr>
<tr>
<td>OA12</td>
<td></td>
<td>OA12</td>
<td>OB12</td>
<td></td>
<td>OB12</td>
<td></td>
</tr>
<tr>
<td>OA13</td>
<td></td>
<td>OA13</td>
<td>OB13</td>
<td></td>
<td>OB13</td>
<td></td>
</tr>
<tr>
<td>OA14</td>
<td></td>
<td>OA14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KEY

<table>
<thead>
<tr>
<th>Row</th>
<th>AIC Plug (Free)</th>
<th>Receptacle (Fixed)</th>
<th>Row</th>
<th>AIC Plug (Free)</th>
<th>Receptacle (Fixed)</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td></td>
<td>A1</td>
<td>B1</td>
<td></td>
<td>B1</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td>A2</td>
<td>B2</td>
<td></td>
<td>B2</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td>A3</td>
<td>B3</td>
<td></td>
<td>B3</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td></td>
<td>A4</td>
<td>B4</td>
<td></td>
<td>B4</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td></td>
<td>A5</td>
<td>B5</td>
<td></td>
<td>B5</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td></td>
<td>A6</td>
<td>B6</td>
<td></td>
<td>B6</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td></td>
<td>A7</td>
<td>B7</td>
<td></td>
<td>B7</td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td></td>
<td>A8</td>
<td>B8</td>
<td></td>
<td>B8</td>
<td></td>
</tr>
<tr>
<td>A9</td>
<td></td>
<td>A9</td>
<td>B9</td>
<td></td>
<td>B9</td>
<td></td>
</tr>
<tr>
<td>A10</td>
<td></td>
<td>A10</td>
<td>B10</td>
<td></td>
<td>B10</td>
<td></td>
</tr>
<tr>
<td>A11</td>
<td></td>
<td>A11</td>
<td>B11</td>
<td></td>
<td>B11</td>
<td></td>
</tr>
<tr>
<td>A12</td>
<td></td>
<td>A12</td>
<td>B12</td>
<td></td>
<td>B12</td>
<td></td>
</tr>
<tr>
<td>A13</td>
<td></td>
<td>A13</td>
<td>B13</td>
<td></td>
<td>B13</td>
<td></td>
</tr>
<tr>
<td>A14</td>
<td></td>
<td>A14</td>
<td>B14</td>
<td></td>
<td>B14</td>
<td></td>
</tr>
<tr>
<td>A15</td>
<td></td>
<td>A15</td>
<td>B15</td>
<td></td>
<td>B15</td>
<td></td>
</tr>
<tr>
<td>A16</td>
<td></td>
<td>A16</td>
<td>B16</td>
<td></td>
<td>B16</td>
<td></td>
</tr>
<tr>
<td>A17</td>
<td></td>
<td>A17</td>
<td>B17</td>
<td></td>
<td>B17</td>
<td></td>
</tr>
<tr>
<td>A18</td>
<td></td>
<td>A18</td>
<td>B18</td>
<td></td>
<td>B18</td>
<td></td>
</tr>
<tr>
<td>A19</td>
<td></td>
<td>A19</td>
<td>B19</td>
<td></td>
<td>B19</td>
<td></td>
</tr>
<tr>
<td>A20</td>
<td></td>
<td>A20</td>
<td>B20</td>
<td></td>
<td>B20</td>
<td></td>
</tr>
<tr>
<td>A21</td>
<td></td>
<td>A21</td>
<td>B21</td>
<td></td>
<td>B21</td>
<td></td>
</tr>
<tr>
<td>A22</td>
<td></td>
<td>A22</td>
<td>B22</td>
<td></td>
<td>B22</td>
<td></td>
</tr>
<tr>
<td>A23</td>
<td></td>
<td>A23</td>
<td>B23</td>
<td></td>
<td>B23</td>
<td></td>
</tr>
<tr>
<td>A24</td>
<td></td>
<td>A24</td>
<td>B24</td>
<td></td>
<td>B24</td>
<td></td>
</tr>
<tr>
<td>A25</td>
<td></td>
<td>A25</td>
<td>B25</td>
<td></td>
<td>B25</td>
<td></td>
</tr>
<tr>
<td>A26</td>
<td></td>
<td>A26</td>
<td>B26</td>
<td></td>
<td>B26</td>
<td></td>
</tr>
<tr>
<td>A27</td>
<td></td>
<td>A27</td>
<td>B27</td>
<td></td>
<td>B27</td>
<td></td>
</tr>
<tr>
<td>A28</td>
<td></td>
<td>A28</td>
<td>B28</td>
<td></td>
<td>B28</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B. Gatherability

Figure B-1 and Figure B-2 show the linear and angular gatherability of the connector. Figure B-3 shows the mechanical keying for the 4C connector.

FIGURE B-1. LINEAR GATHERABILITY.

FIGURE B-2. ANGULAR GATHERABILITY.
 FIGURE B-3. MECHANICAL KEYING.
Appendix C. Printed Circuit Board Footprints

Included PCB layouts are informative to provide a common connector mounting interface to the host board to enable multi-sourcing of the connector while ensuring electrical performance. 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.

Figure C-1 through Figure C-16 show the recommended PCB footprints.
**FIGURE C-2. 1C RIGHT ANGLE CONNECTOR FOOTPRINT**

**FIGURE C-3. 1C STRADDLE MOUNT CONNECTOR FOOTPRINT**

**NOTE:** POSITION B1 ON THE OPPOSITE SIDE OF CARD OF A1
FIGURE C-4. 2C STRAIGHT CONNECTOR FOOTPRINT

FIGURE C-5. 2C RIGHT ANGLE CONNECTOR FOOTPRINT
FIGURE C-6. 2C STRADDLE MOUNT CONNECTOR FOOTPRINT

FIGURE C-7. 4C STRAIGHT CONNECTOR FOOTPRINT

FIGURE C-8. 4C RIGHT ANGLE CONNECTOR FOOTPRINT
FIGURE C-12. 4C+ STRADDLE MOUNT CONNECTOR FOOTPRINT (MM)

FIGURE C-13. 1C PRESS FIT ORTHOGONAL CONNECTOR FOOTPRINT (MM)
FIGURE C-14. 2C PRESS FIT ORTHOGONAL CONNECTOR FOOTPRINT (MM)
FIGURE C-15. 1C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR FOOTPRINT

FIGURE C-16. 2C RIGHT ANGLE ORTHOGONAL SMT CONNECTOR FOOTPRINT
Appendix D. Connector Solder Lead Geometry

Refer to Table D-1 and Figure D-1 for informative solder lead geometry for the connector.

**TABLE D-1. SMT LEAD GEOMETRY DIMENSIONS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Vertical</th>
<th>Right Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pad Width</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>B</td>
<td>Lead Thickness</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>C</td>
<td>Lead Length on Pad</td>
<td>0.76</td>
<td>1.12</td>
</tr>
<tr>
<td>D</td>
<td>Lead Tip to Footprint Centerline</td>
<td>2.75</td>
<td>1.79</td>
</tr>
<tr>
<td>E</td>
<td>Pad Length</td>
<td>1.20</td>
<td>1.40</td>
</tr>
<tr>
<td>F</td>
<td>Distance Between Inside Edges of Pads</td>
<td>3.40</td>
<td>1.56</td>
</tr>
<tr>
<td>W</td>
<td>Lead Width</td>
<td>0.24</td>
<td>0.24</td>
</tr>
</tbody>
</table>

**FIGURE D-1** SMT LEAD GEOMETRY