SFF-TA-1027

Specification for

QSFP2 Cage, Connector, & Module Mechanical Specification

Rev 2.0 September 9, 2025

SECRETARIAT: SFF TWG
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ABSTRACT: This specification defines the mechanical requirements of the "QSFP112" and "QSFP224" pluggable solutions which include the QSFP2 cages, connectors, and modules that enable QSFP+ operation at greater signaling rates. This specification defines both 1x1 and 2x1 stacked cage/connector configurations. All combinations of cages and connectors defined in this specification are mechanically backwards compatible to accept legacy QSFP+ modules. In addition, the module mechanical requirements defined in this specification can be used in "QSFP28" or "QSFP56" pluggable solutions, with their corresponding cage/connector combinations. Such modules would be capable of performing at 28 Gbps or 56 Gbps per lane signaling rates with potentially improved thermal performance.

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FOREWORD

Much of the development work on this specification was done by the QSFP-DD MSA and given to the SFF TWG, a SNIA Technical Working Group, for continued development. Since its formation of the SFF Committee in August 1990, as well as since SFF's transition to SNIA in 2016, the membership has included a mix of companies that 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 https://www.snia.org/join.

REVISION HISTORY

Rev 1.0 *May 30, 2023:*

- First Publication

Rev 2.0 *September 9, 2025:*

- Updated the boilerplate information per the latest document template, including the logo, POINTS OF CONTACT, and EDITORS.
- Updated the title to include "Mechanical Specification".
- Updated the ABSTRACT.
- Added the PREFACE section.
- Updated the Scope (Section 1) to identify QSFP112 components and add QSFP224 components.
- Updated Industry Documents (Section 2.1), including the QSFP-DD Hardware specification title and description and added SFF-8662.
- Added NAMING CONVENTIONS in Conventions (Section 2.3).
- Updated Keywords (Section 3.1).
- Added SMT to Acronyms and Abbreviations (Section 3.2).
- Updated the definition of Datum in Definitions (Section 3.3).
- Updated Configuration Overview/Descriptions (Section 4.1) to indicate QSFP112 components and added QSFP224 components. Throughout the document, most instances of the QSFP2 term was replaced with either QSFP112 or QSFP224, unless the term applied to both QSFP112 and QSFP224.
- Updated Table 4-1 QSFP112 1x1 Connector, Cage, and Module Implementations, inserted a new Figure 4-2 QSFP224 1x1 Cage and Connector, inserted new Table 4-2 QSFP224 1x1 Connector, Cage, and Module Implementations, renumbered remaining Section 4 figures and tables, updated figure and table captions to identify QSFP112 or QSFP224 as appropriate, and updated Table 4-3 QSFP112 2x1 Connector, Cage, and Module Implementations.
- Inserted a new Section 4.1.1, including new Table 4-4.
- Inserted a new Section 4.1.2, including new Table 4-5.
- In Section 4.2, updated list of footprint pad numbering figures, inserted new figure for QSFP224 1x1 connector footprint pad numbering, added new text following Figure 4-6, Figure 4-7, and Figure 4-8 to clarify footprint pad numbering, and renumbered subsequent Section 4 figures.
- In Section 4.3, updated the figures for QSFP112 and QSFP224 and updated the datum descriptions. In Figure 4-9, changed dimension "29.6 REF" to "29.6 REF FOR QSFP112 29.7 REF FOR QSFP224". In Figure 4-10, changed dimension "29.6 REF" to "29.6 REF FOR QSFP112" and in the figure caption changed "QSFP2" to "QSFP112".
- Created a new Section 5 to focus on QSFP112 and moved all of the previous Section 5 to a new Section 5.1, moved all the previous Section 6 to a new Section 5.2, moved all the previous Section 7 to a new Section 5.3, and moved all the previous Section 8 to a new Section 5.4. Inserted a new Section 6 to focus on QSFP224. The previous Section 9 was renumbered as the new Section 7.
- Updated Section 5 headings, figures, captions, and text (including the Overview in each subsection).
- Updated the card slot depth dimension in Figure 5-3 and Figure 5-4 (was 3.05 MIN).

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- Updated the QSFP112 2x1 stacked connector figure, Figure 5-4, to show tolerance for the 16.60 slot width and to clarify that the 0±0.1 dimension applies to both the upper and lower ports.
- In the NOTES for Figure 5-6 QSFP112 1x1 Cage Dimensions (2 of 2), fixed typo in NOTE 1, deleted NOTE 12, and renumbered NOTE 13 as NOTE 12.
- Added some new text regarding cage optional heat sink openings to Section 5.2.1 (part of that text was moved from Section 5.2.2.1).
- In Section 5.2.2.1, clarified the backwards compatibility as mechanically, and added a reference to SFF-8665.
- In Figure 5-8, added missing NOTE 11 indicator to the 73.7 MAX dimension, fixed a typo in NOTE 1, updated NOTE 11, deleted NOTE 12, renumbered remaining NOTES, and updated the new NOTE 12.
- Modified text of Section 5.2.3 and added recommended riding heat sink normal force.
- In Figure 5-10, changed name of Detail View F to Detail View Y and Section E-E to Section Z-Z, updated the Datum D to Datum H dimension in Detail Y, changed "PULL TAB" to "LATCH RELEASE" in Section Z-Z, added Latch Stop View for added clarity, added additional height dimension values for Type 2B modules. Also correctly identified the NOTES as part of Figure 5-10 instead of as a separate figure. In the NOTES,
- In Section 5.3.1, removed the reference to SFF-8661, added a reference to the new Table 4-5, clarified the QSFP112 module support for up to 112 Gbps, and added a reference to SFF-8665 for implementation requirements.
- In Section 5.3.2.3, rewrote the paragraph to clarify the QSFP112 module paddle card support for up to 112 Gbps per lane signaling and added a reference to SFF-8665 for implementation requirements. Also updated Figure 5-12 to add a few NOTES to identify the mating pad types.
- In Section 5.4, clarified the QSFP112 footprints support for up to 112 Gbps per lane signaling.
- In Section 5.4.1, deleted the first and third sentences in the paragraph after Table 5-3, changed the wording for QSFP112 connector compatibility with SFF-8663 cages, referenced Figure 5-15 as showing an informative implementation, and added the recommendation to use the QSFP112 connectors with QSFP112 cages, and updated Figure 5-13 to modernize the representation of Datum L to comply with ASME Y14.5-2009.
- In Section 5.4.2, deleted the first sentence after Table 5-4.
- In Section 7.1, updated the Performance Tables title to include QSFP2 (since it applies to both QSFP112 and QSFP224).
- In the Performance Tables (Table 7-1 and Table 7-3), changed the Mating Force and Unmating Force requirements to apply with or without the presence of a riding heat sink and increased the Unmating Force value limit to 40N MAX,
- In Table 7-1, for the Field Temperature Performance Parameter, changed "65°C" to "0°C —65°C" in the Requirement, and for the Current Performance Parameter, changed "1.5 A per power contact MAX" to "2.2 A per power contact MAX" in the Requirement.
- In Table 7-3, for the Current Test, changed "30-degree temperature rise" to "30-degree C temperature rise" in the Test Descriptions and Details.
- In Appendix A, changed "QSFP2 1x1 cage" to "QSFP2 (QSFP112 or QSFP224) 1x1 cage".
- Added Appendix B for recommended footprint pad assignments.
- Added a new Appendix C.

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FIGURES

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TABLES

PREFACE

The family of QSFP products have been around for many years. The first QSFP specification (for 4 x 1 Gbps per lane data rates) was created by the QSFP MSA (multi-source agreement) and was eventually brought into the SFF Committee as the INF-8438 specification. The SFF Committee created a derivative specification, SFF-8436, for QSFP+ which was improved in many areas and later updated to operate at up to 4 x 10 Gbps per lane data rates. In an attempt to accelerate the further advancement of the QSFP family, the bulk of the content within the SFF-8436 QSFP+ specification was divided into separate specifications for the modules, connectors, cages, low speed & general electrical, and the management interface. These specifications, together, make up what became known as "QSFP10" (a marketing term for QSFP+ products capable of 4 x 10 Gbps per lane for a total of 40 Gbps) and later as "QSFP14" (a marketing term for QSFP+ products capable of 4 x 14 Gbps per lane for a total of 56 Gbps). The next generation of QSFP+ products, referred to "QSFP28" (a marketing term for QSFP+ products capable of 4 x 25 Gbps per lane for a total of 100 Gbps or capable of 4 x 28 Gbps per lane for a total of 112 Gbps). The same "QSFP28" specifications also were used in the "QSFP56" variants (a marketing term for QSFP+ products capable of up to a total of 200 Gbps). Although some early versions of "QSFP112" products may have been built using components based on the older "QSFP28" specifications, the SFF-TA-1027 specification is the mechanical specification for the cages, connectors, and modules for 400G QSFP or 800G QSFP products with data rates of up to 112 Gbps ("QSFP112") or 224 Gbps ("QSFP224"). Refer to reference document REF-TA-1011 and the QSFP+ 4X Pluggable Transceiver Solutions specification, SFF-8665, for additional information.

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1. Scope

This specification defines the mechanical requirements of the "QSFP112" and "QSFP224" pluggable solutions. These QSFP2 cages, connectors, and modules enable QSFP+ operation up to signaling rates of 112 Gbps for "QSFP112" or 224 Gbps for "QSFP224". This specification defines:

- Connector
  - QSFP112 1x1 (Footprint Styles A & B)
  - QSFP112 2x1 (Footprint Styles A, B, C, & D)
  - QSFP224 1x1 (QSFP224 1x1 Footprint)
- Cage (with or without an opening for a riding heat sink option)
  - QSFP112 1x1 & 2x1
  - QSFP224 1x1
- Module (Types 1, 2, 2A, & 2B)
  - QSFP112
  - QSFP224

The cages and connectors defined in this specification are mechanically backwards compatible with QSFP+ modules. The module mechanical requirements defined in this specification can be used in "QSFP28" or "QSFP56" pluggable solutions, with their corresponding cage/connector combinations. Such modules would be capable of performing at 28 Gbps or 56 Gbps per lane with potentially improved thermal performance. Refer to SFF-8665 for full details regarding the physical interface, low speed electrical, and management interface requirements of QSFP+ 4X pluggable solutions including "QSFP10", "QSFP14", "QSFP28", "QSFP56", "QSFP112", and "QSFP224".

2. References and Conventions

2.1 Industry Documents

The following documents are relevant to this specification:

- ASME Y14.5 Dimensioning and Tolerancing
- EIA-364-1000 Environmental Test Methodology for Assessing the Performance of Electrical Connectors and Sockets Used in Controlled Environment Applications
- QSFP-DD/QSFP-DD800/QSFP-DD1600 HW QSFP-DD/QSFP-DD800/QSFP-DD1600 Hardware Specification for QSFP DOUBLE DENSITY 8X
- REF-TA-1011 Cross Reference to Select SFF Connectors
- SFF-8661 QSFP+ 4X Module
- SFF-8662 QSFP+ 4X 28 Gb/s Connector (Style A)
- SFF-8663 QSFP+ 28 Gb/s Cage (Style A)
- SFF-8665 QSFP+ 4X Pluggable Transceiver Solutions
- SFF-8679 QSFP+ 4X Hardware and Electrical Specification

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.

Other standards may be obtained from the organizations listed below:

Standard	Organization	Website
ASME	American Society of Mechanical Engineers (ASME)	https://www.asme.org
Electronic Industries Alliance (EIA)	Electronic Components Industry Association (ECIA)	https://www.ecianow.org
IEEE	Institute of Electrical and Electronics Engineers (IEEE)	https://www.ieee.org
OIF	Optical Internetworking Forum (OIF)	https://www.oiforum.com
QSFP-DD	QSFP-DD MSA	http://www.qsfp-dd.com

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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

NAMING CONVENTIONS: Quotes are used when expressing a marketing term for a pluggable solution (e.g., "QSFP112").

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3. Keywords, Acronyms, and Definitions

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

3.1 Keywords

May: Indicates flexibility of choice with no implied preference.

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 that 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: Where the term is used for a signal on a connector contact, the 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 to the restricted designation, then the restricted bit, byte, word, or field shall be treated as a value whose definition is not in scope of this document, and is not interpreted by this specification.

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
Ra: The profile surface roughness parameter representing the arithmetic average of the surface roughness
SMT: Surface Mount Technology

3.3 Definitions

Basic (dimension): The theoretical exact size, profile, orientation, or location of a feature. It is used as the basis from which permissible variations are established by tolerances in notes or in feature control frames (GD&T).

Connector: Each half of an interface that, when joined together, establish electrical contact and mechanical retention between two components. In this specification, the term connector does not apply to any specific gender; it is used to describe the receptacle, the plug or the card edge, or the union of receptacle to plug or card edge. Other common terms include: connector interface, mating interface, and separable interface.

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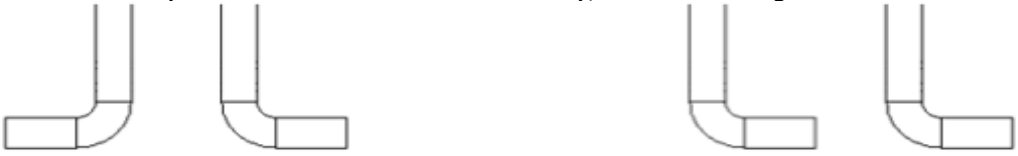
Contacts: A term used to describe connector terminals that make electrical connections across a separable interface.

Datum: A point, line, plane, etc. assumed to be exact for the purposes of computation or reference, as established from actual features, and from which the location or geometric relationship of another feature is established.

JL: A connector contact configuration that describes the tail direction; connector contact tails in different rows point in opposite same directions ("J" towards front of connector, "L" towards back of connector) as shown in Figure 3-1a.

LL: A connector contact configuration that describes the tail direction; connector contact tails in different rows point in the same direction (towards the back of the connector), as shown in Figure 3-1b.



a. "JL" Tail Configuration **b. "LL" Tail Configuration**

Figure 3-1 Connector Contact Configurations

Module: In this specification, module may refer to a plug assembly at the end of a copper (electrical) cable (passive or active), an active optical cable assembly, an optical transceiver, or a loopback.

Power class: A classification that dictates the maximum power a module is permitted to consume.

Reference (dimension): A dimension provided for information or convenience. It has no tolerance and is not to be used for inspection or conformance. It can be calculated from other tolerance dimensions or can be found elsewhere on the drawing with a tolerance. If removed, it would have no impact on the defined object or the ability to reproduce it.

Right Angle: A term used to describe either a connector design where the mating direction is parallel to the plane of the printed circuit board upon which the connector is mounted or a cable assembly design where the mating direction is perpendicular to the bulk cable.

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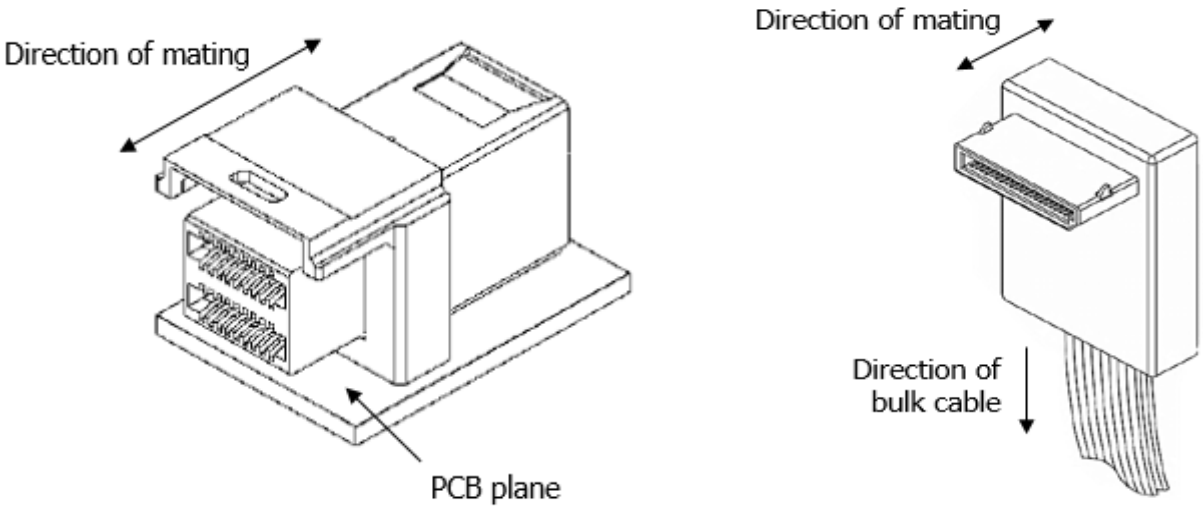

a) Right angle connector b) Right angle cable assembly

Figure 3-2 Right Angle Connector and Cable Assembly

Surface mount: A term used to describe a termination style in which solder tails sit on pads on the surface of a PCB and are then soldered to keep the connector or cage in place. Other common terms are surface mount technology or SMT.

Wipe: The distance a contact travels on the surface of its mating contact during the mating cycle as shown in Figure 3-3.

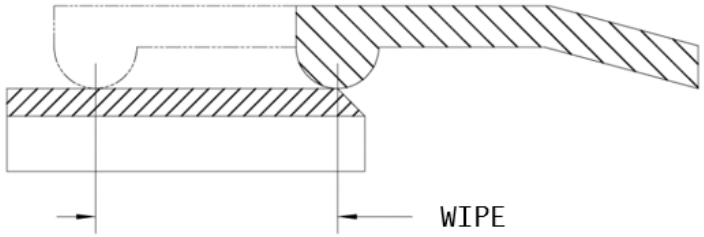

Figure 3-3 Wipe for a Continuous Contact

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4. General Description

4.1 Configuration Overview/Descriptions

The QSFP112 and QSFP224 connector, cage, and module system have multiple components:

a. Connector
   A. QSFP112 1x1 (Footprint Styles A & B)
   B. QSFP112 2x1 (Footprint Styles A, B, C, & D)
   C. QSFP224 1x1 (QSFP224 1x1 Footprint)
b. Cage (with or without an opening for a riding heat sink option)
   A. QSFP112 1x1 & 2x1
   B. QSFP224 1x1
c. Module (Types 1, 2, 2A, & 2B)
   A. QSFP112
   B. QSFP224

Each of the above listed components are detailed in the following sections. For reference, the QSFP112 1x1 cage and connector are shown in Figure 4-1 and the QSFP112 2x1 stacked cage and connector are shown in Figure 4-3. Connectivity for the 1x1 and 2x1 configurations are shown in Table 4-1 and Table 4-3, respectively.

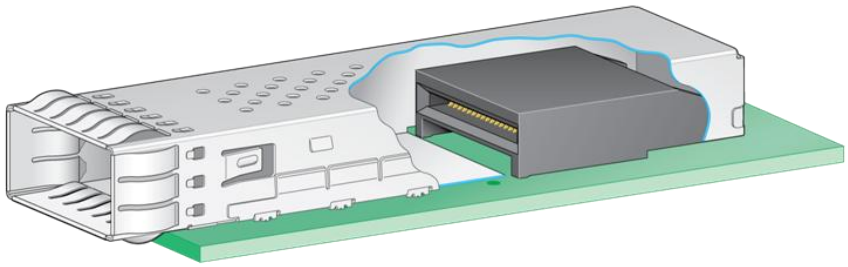

Figure 4-1 QSFP112 1x1 Cage and Connector

Table 4-1 QSFP112 1x1 Connector, Cage, and Module Implementations

1x1 Footprint Style	1x1 Connector Footprint Description	1x1 Cage	Module
Style A	0.8 pitch "LL" connector footprint	QSFP112 1x1 Cage (see Note 1), OR SFF-8663 Cage (see Note 2)	QSFP112 Module Type 1, 2, 2A, or 2B (see Note 3)
Style B	0.8 pitch "JL" connector footprint		

NOTES:
1. Refer to Section 5.2.2.1 for more information.
2. Use of an SFF-8663 cage is informative only. See also Figure 5-15 for modified PCB Layout.
3. Refer to Section 5.3.2.1 for more information.

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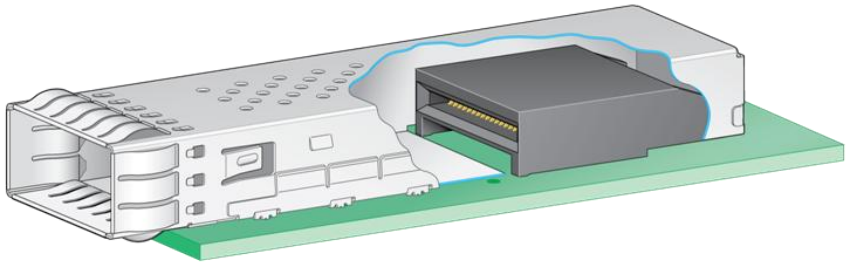

Figure 4-2 QSFP224 1x1 Cage and Connector

Table 4-2 QSFP224 1x1 Connector, Cage, and Module Implementations

QSFP224 1x1 Footprint Description	1x1 Cage	Module
0.6 pitch "LL" connector footprint	QSFP224 1x1 Cage (see Note 1)	QSFP224 Module Type 1, 2, 2A, or 2B (see Note 2)
NOTES: 1. Refer to Section 6.2.2.1 for more information. 2. Refer to Section 6.3.2.1 for more information.		

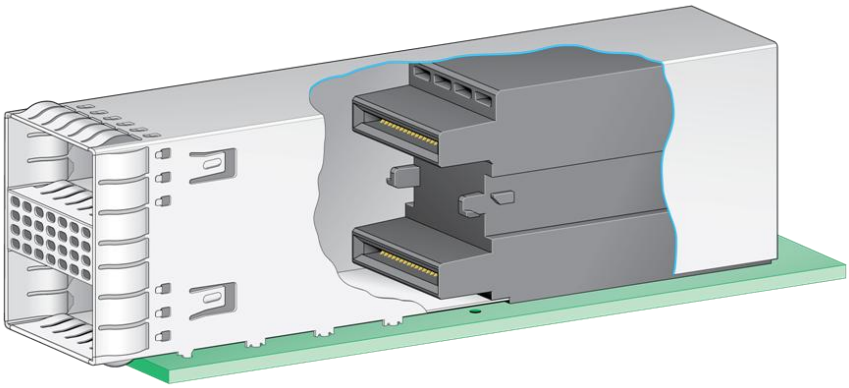

Figure 4-3 QSFP112 2x1 Stacked Cage and Connector

Table 4-3 QSFP112 2x1 Stacked Connector, Cage, and Module Implementations

2x1 Stacked Footprint Style	2x1 Stacked Connector Description	Cage	Module
Style A	"LL" connector footprint with retention pin	QSFP112 2x1 Stacked Cage (see Note 1)	QSFP112 Module Type 1, 2, 2A, or 2B (see Note 2)
Style B	"JL" connector footprint with retention pin		
Style C	"LL" connector footprint with glue pad		
Style D	"JL" connector footprint with glue pad		
NOTES: 1. Refer to Section 5.2.2.2 for more information. 2. Refer to Section 5.3.2.1 for more information.			

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4.1.1 Enhanced Options to Use for "QSFP224" vs. "QSFP112"

The QSFP2 component enhancements will enable QSFP+ operation at signaling rates up to at least 112 Gbps per lane and are suitable for "QSFP112" applications. The QSFP224 component definitions enable signaling rates up to 224 Gbps per lane and are suitable for "QSFP224" applications. The following table, Table 4-4, highlights the combination of enhanced components that are needed to obtain the faster signaling rates and thermal enhancements for higher power dissipation.

Table 4-4 Enhancements for "QSFP112" and "QSFP224" Applications

Enhancement	Used for QSFP112 Components	Used for QSFP224 Components
Thermal Enhancements		
Cage contains optional heat sink opening to enable the use of a riding heat sink	Yes (See Section 5.2)	Yes (See Section 6.2)
Modules with enhanced flatness and surface roughness are recommended. Type 2, 2A, or 2B modules may also provide better heat dissipation	Yes (See Section 5.3)	Yes (See Section 6.3)
Enhancements Needed for Signaling Rates		
Strict requirements for the Cage Latch Tab (Cage Flap) to accommodate the Angled-Latch Design	No (See Section 5.2)	Yes (See Section 6.2)
QSFP224 1x1 Connectors with QSFP224 1x1 Footprint and reduced Card Slot Width Tolerance and adjustments to the 2 Locating Peg Diameters and the Tolerance for the distance of the Locating Pegs to the mating interface Contact Point	No (See Section 5.1)	Yes (See Section 6.1)
Angled-Latch Design Modules and QSFP224 Paddle Card with reduced Pad Sizes and reduced distance from Datum D (hard stop on module) to Datum H (leading edge of signal contact pads on module paddle card) for Improved SI Performance	No (See Section 5.3)	Yes (See Section 6.3)

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4.1.2 Compatibility Matrix for QSFP112 and QSFP224 Components

Table 4-5 shows the mechanical cross-compatibility between cages, connectors, and modules. Besides the speed and throughput differences, there are subtle differences in mechanical and tolerance specifications between QSFP112 and QSFP224 components and with prior generations of QSFP+ components (such as SFF-8661 modules, SFF-8662 connectors, and SFF-8663 cages). QSFP112 modules can be plugged into prior generation ports. However, the operation of the pluggable solution will be limited by the full combination of physical interface, low-speed electrical, and management interface. See SFF-8665 for those requirements.

Table 4-4 showed the signaling rate enhancements needed for QSFP224 modules. These enhancements could cause some compatibility issues with non-QSFP224 cages or connectors, including the potential for a failure to latch properly or for the latch to get stuck, which may require special care to remove it without causing damage to the cage. Therefore, QSFP224 modules should only be plugged into QSFP224 cages. QSFP224 connectors and cages can be used to create any QSFP+ pluggable solution, however, the operation of the pluggable solution will be limited by the full combination of physical interface, low-speed electrical, and management interface. See SFF-8665 for those requirements.

Table 4-5 Mechanical Cross-Compatibility Between Cages, Connectors, and Modules

<table>
<tr><th></th><th>SFF-8661 Modules[2]</th><th>QSFP112 Modules</th><th>QSFP224 Modules</th></tr>
<tr><td>SFF-8662 Connectors[2] & SFF-8663 Cages[2]</td><td colspan="2">Supported Use Case</td><td>Modules can be plugged in and powered but may have potential latching issues. Use Case Not Advisable.</td></tr>
<tr><td>QSFP112 Connectors & Cages</td><td colspan="2">Supported Use Case</td><td>Modules can be plugged in and powered but may have potential latching issues. Use Case Not Advisable.</td></tr>
<tr><td>QSFP224 Connectors & Cages</td><td colspan="3">Supported Use Case</td></tr>
</table>

NOTES:
1. Mechanical compatibility does not guarantee electrical performance. System data rates are limited by the slowest components. See SFF-8665.
2. Commonly known as QSFP+ or "QSFP28". See SFF-8665.

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4.2 Contact Numbering

The electrical contacts for the 1x1 connector are numbered as shown in Figure 4-4. The electrical contacts for the 2x1 stacked connector are numbered as shown in Figure 4-5. Additionally, the footprint pad numbering for the 1x1 and 2x1 connectors are shown in Figure 4-6, Figure 4-7, and Figure 4-8, respectively. Contact numbering on the module paddle card is shown in Figure 5-12.

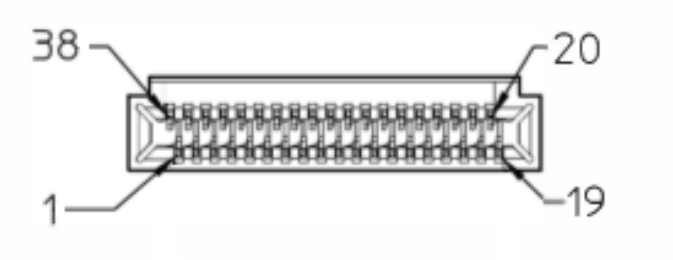

Figure 4-4 QSFP2 1x1 Connector Contact Numbering

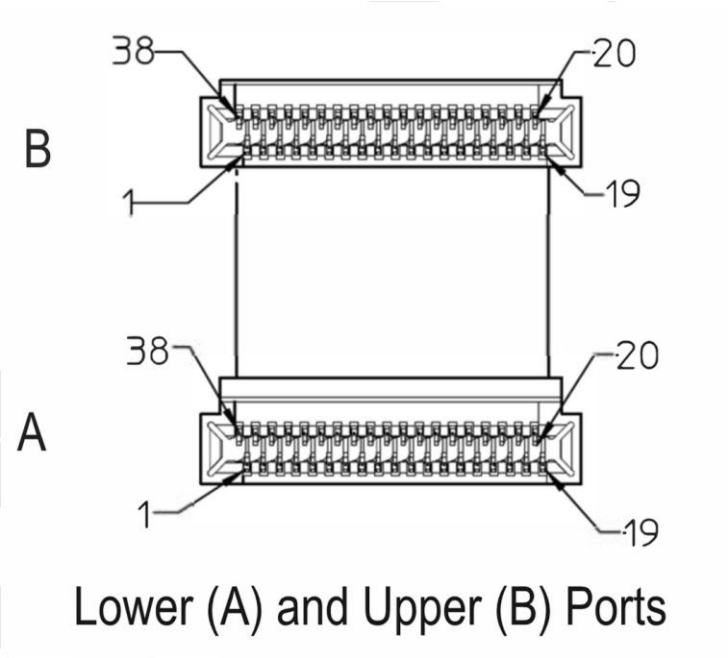

Figure 4-5 QSFP112 2x1 Stacked Connector Contact Numbering

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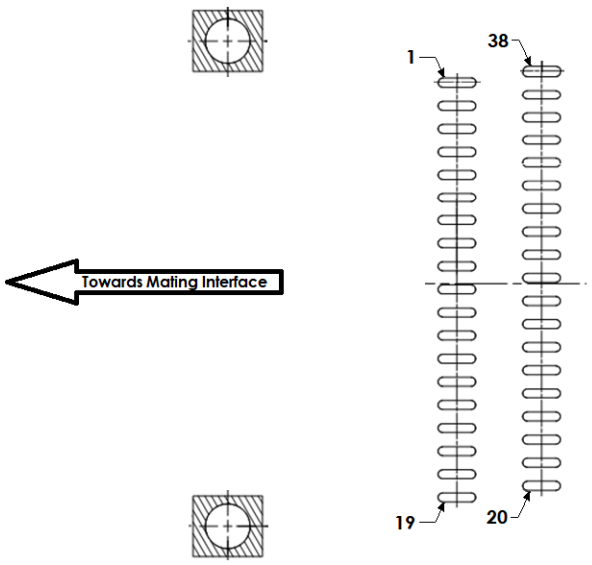

Figure 4-6 QSFP112 1x1 Connector Style A & Style B Footprint Pad Numbering

Refer to Section 5.4 for details regarding the QSFP112 1x1 connector footprints. See Appendix B for additional information regarding the differences in pad assignments for the QSFP112 1x1 footprint Style A and the QSFP112 1x1 footprint Style B versus the QSFP224 1x1 footprint.

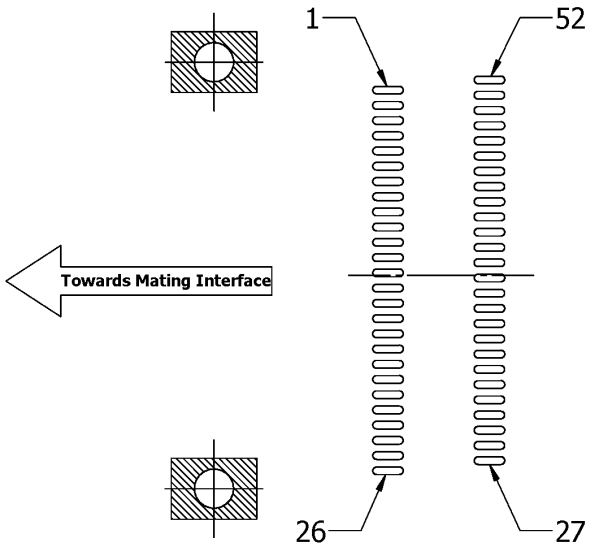

Figure 4-7 QSFP224 1x1 Connector Footprint Pad Numbering

Refer to Section 6.4 for details regarding the QSFP224 1x1 connector footprints. See Appendix B for additional information regarding the differences in pad assignments for the QSFP112 1x1 footprint Style A and the QSFP112 1x1 footprint Style B versus the QSFP224 1x1 footprint.

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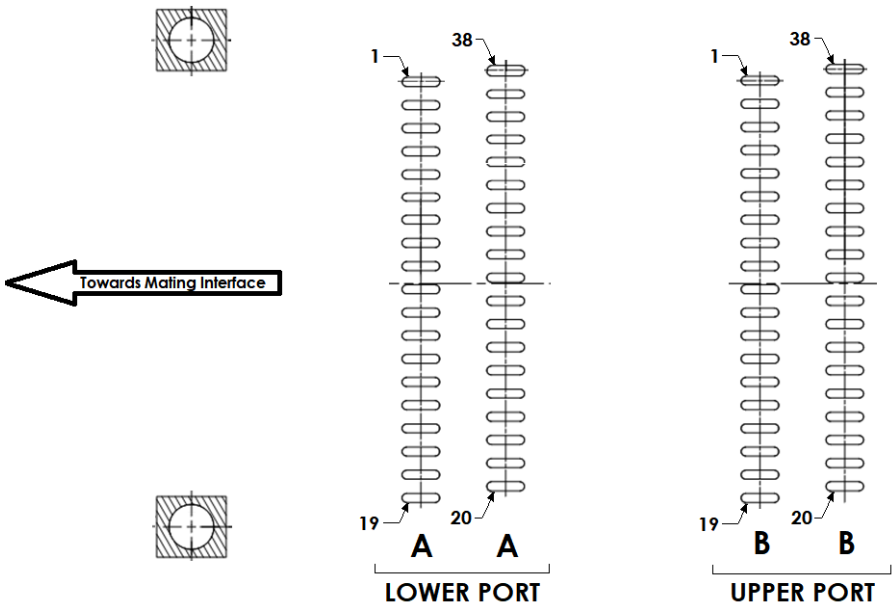

Figure 4-8 QSFP112 2x1 Stacked Connector Footprint Pad Numbering

Refer to Section 5.4.2 for details regarding the QSFP112 2x1 stacked connector footprints.

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4.3 Datums

Datum definitions for the 1x1 and 2x1 stacked QSFP2 cages, connectors, and modules are shown in Figure 4-9 and Figure 4-10, respectively. Datum descriptions are provided in Table 4-6. The alignments of some of the datums are noted. To reduce the complexity of the drawings, all dimensions are considered centered unless otherwise specified. Dimensions and tolerancing conform to ASME Y14.5-2009. All dimensions are in millimeters.

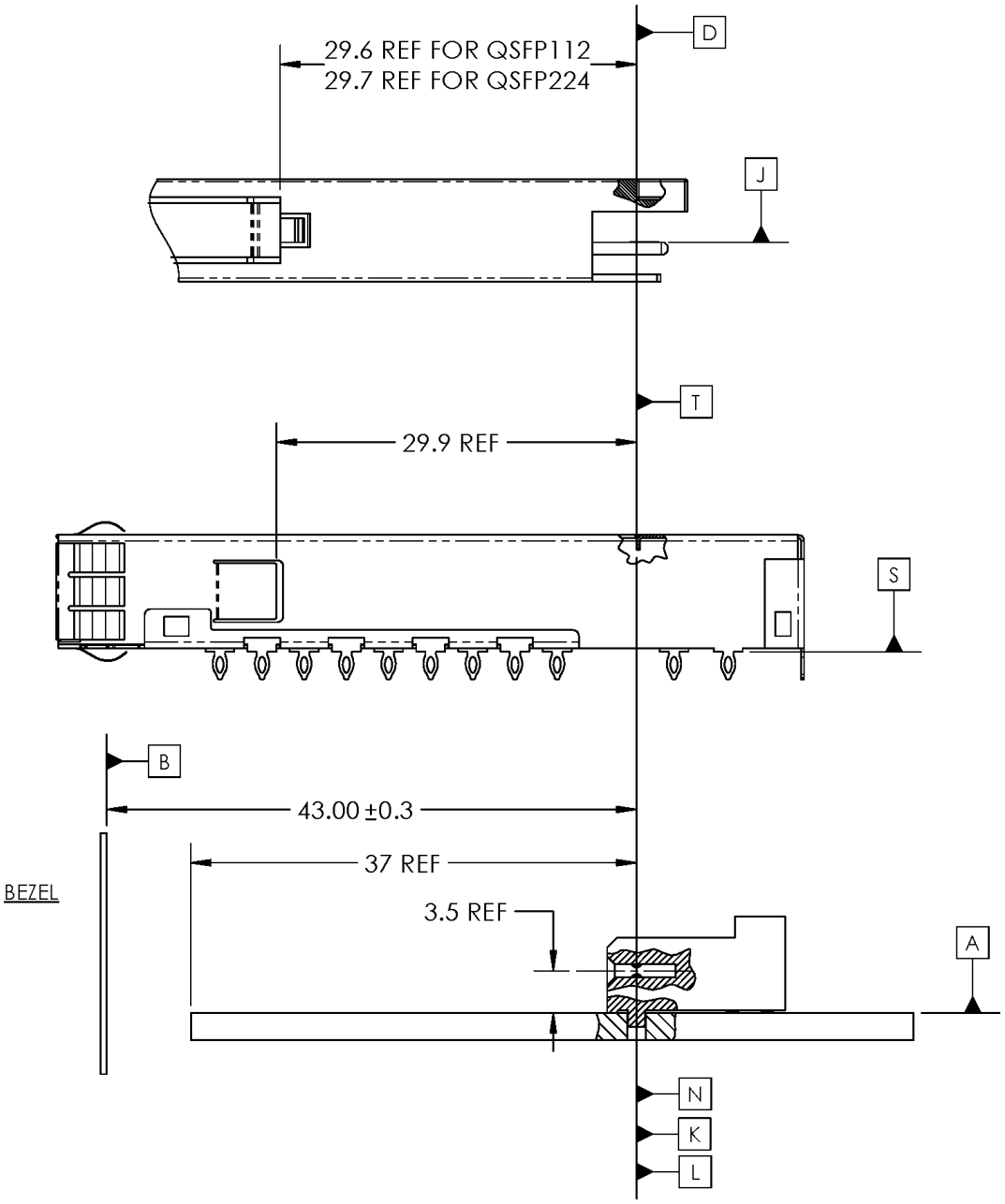

Figure 4-9 QSFP2 Module, 1x1 Connector, and 1x1 Cage Datums

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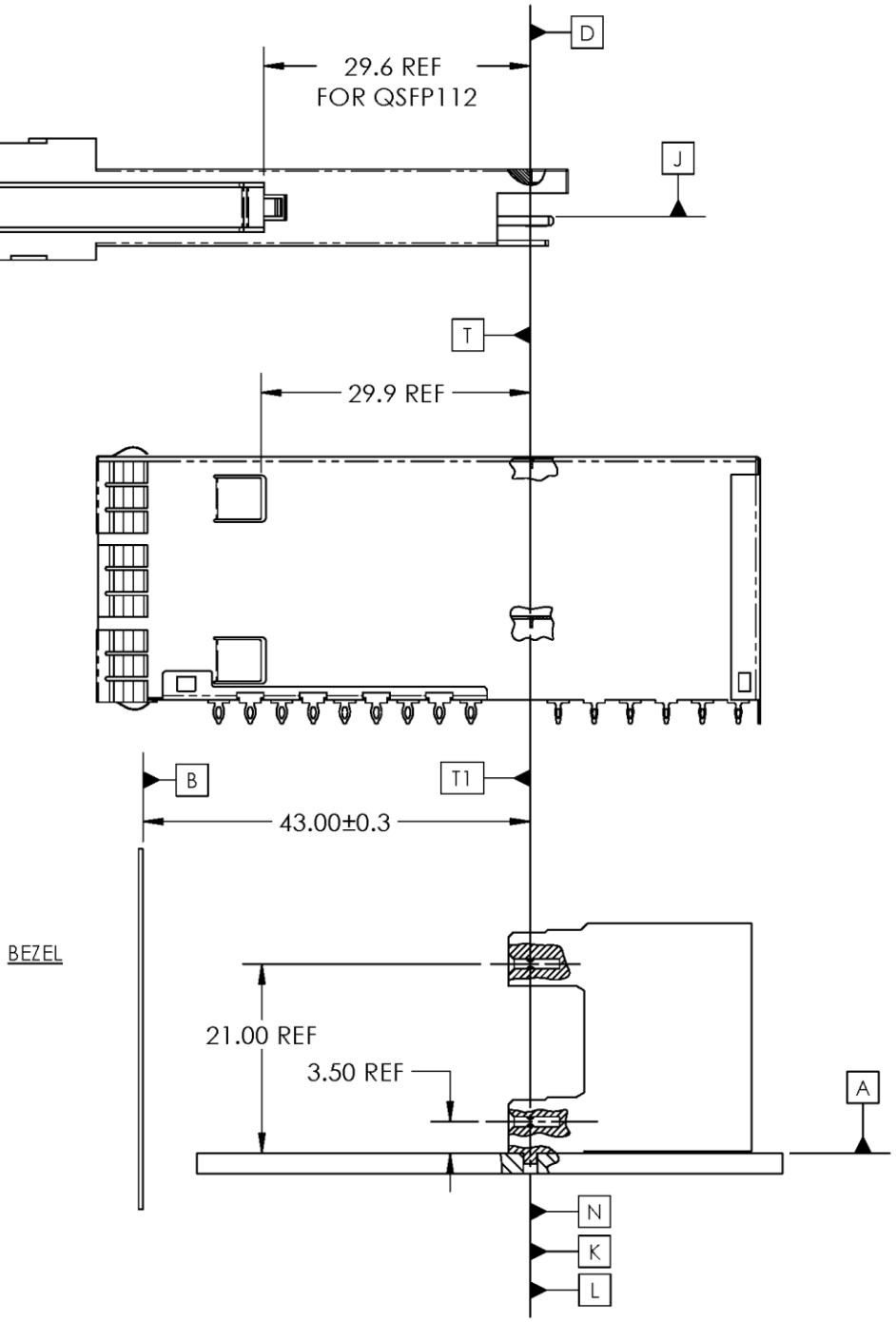

Figure 4-10 QSFP112 Module, 2x1 Stacked Connector, and 2x1 Stacked Cage Datums

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Table 4-6 Datum Descriptions

Datum[1]	Description
A	Host board top surface
B	Inside surface of bezel
C	Distance between connector alignment holes on host board[3]
D	Hard stop on module[2]
E	Width of module[3]
F	Height of module housing
G	Width of module paddle card[3]
H	Leading edge of signal contact pads on module paddle card
J	Top surface of module paddle card
K	Host board through hole #1 to accept connector guidepost[2]
L	Host board through hole #2 to accept connector guidepost[2]
M	Width of bezel cut out[3]
N	Connector alignment post
P	Vertical centerline of internal surface of cage
S	Seating plane of cage on host board
T	Hard stop on cage[2]
AA	Connector slot width[3]
BB	Seating plane of connector on host board
DD	Top surface of module housing
FF	Centerline of upper port cage height
GG	Centerline of lower port cage height

Notes:
1. All dimensions are in mm.
2. Datums D, K, L, N and T are aligned when assembled (see Figure 4-9 and Figure 4-10).
3. Centerlines of datums C, E, G, M, and AA are aligned on the same vertical plane.

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5. QSFP112 Component Mechanical Specification

5.1 QSFP112 Connector Mechanical Specification

5.1.1 Overview

QSFP112 connectors come in 1x1 and 2x1 stacked configurations. The QSFP112 1x1 connector, shown in Figure 5-1, is a right-angle connector with 38 contacts. The QSFP112 1x1 connector comes in two Footprint Styles: A and B; refer to Section 5.4.1 for details. The QSFP112 2x1 stacked connector, shown in Figure 5-2, is a right-angle connector with upper and lower ports, both of which contain 38 contacts. The QSFP112 2x1 connector comes in four Footprint Styles: A, B, C, and D; refer to Section 5.4.2 for details.

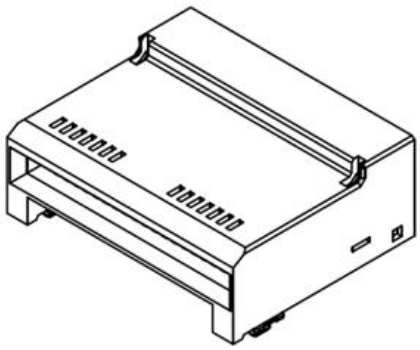

Figure 5-1 QSFP112 1x1 Connector

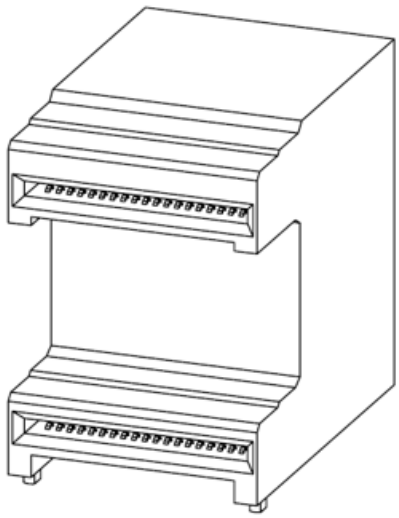

Figure 5-2 QSFP112 2x1 Stacked Connector

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5.1.2 Mechanical Description: QSFP112 Connector

5.1.2.1 QSFP112 1x1 Connector

QSFP112 1x1 connector front and side views are shown in Figure 5-3. Refer to Section 5.4.1 for footprint information.

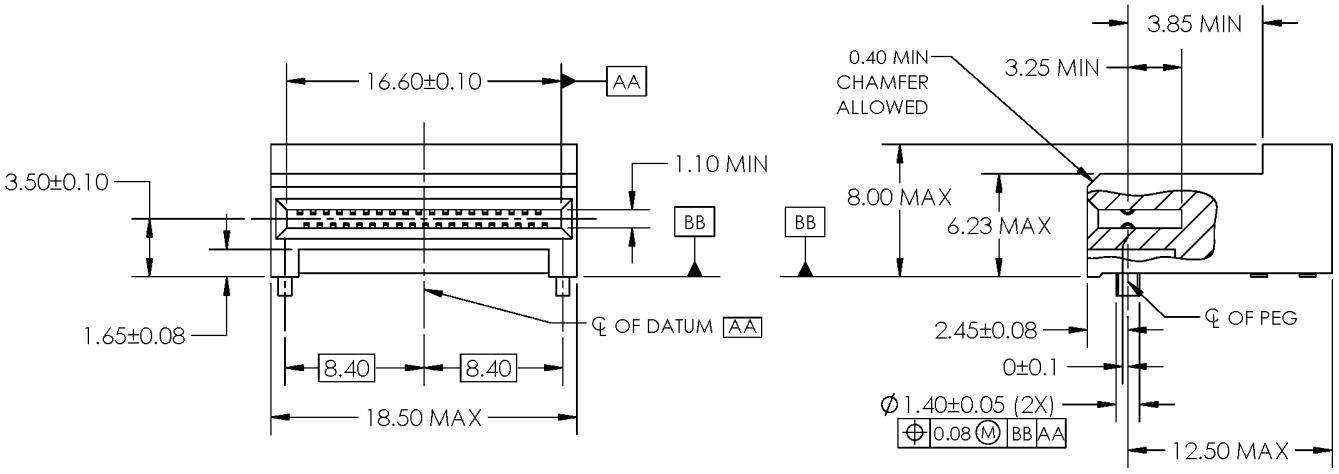

Figure 5-3 QSFP112 1x1 Connector Dimensions

5.1.3 QSFP112 2x1 Stacked Connector

QSFP112 2x1 stacked connector front and side views are shown in Figure 5-4. Refer to Section 5.4.2 for footprint information.

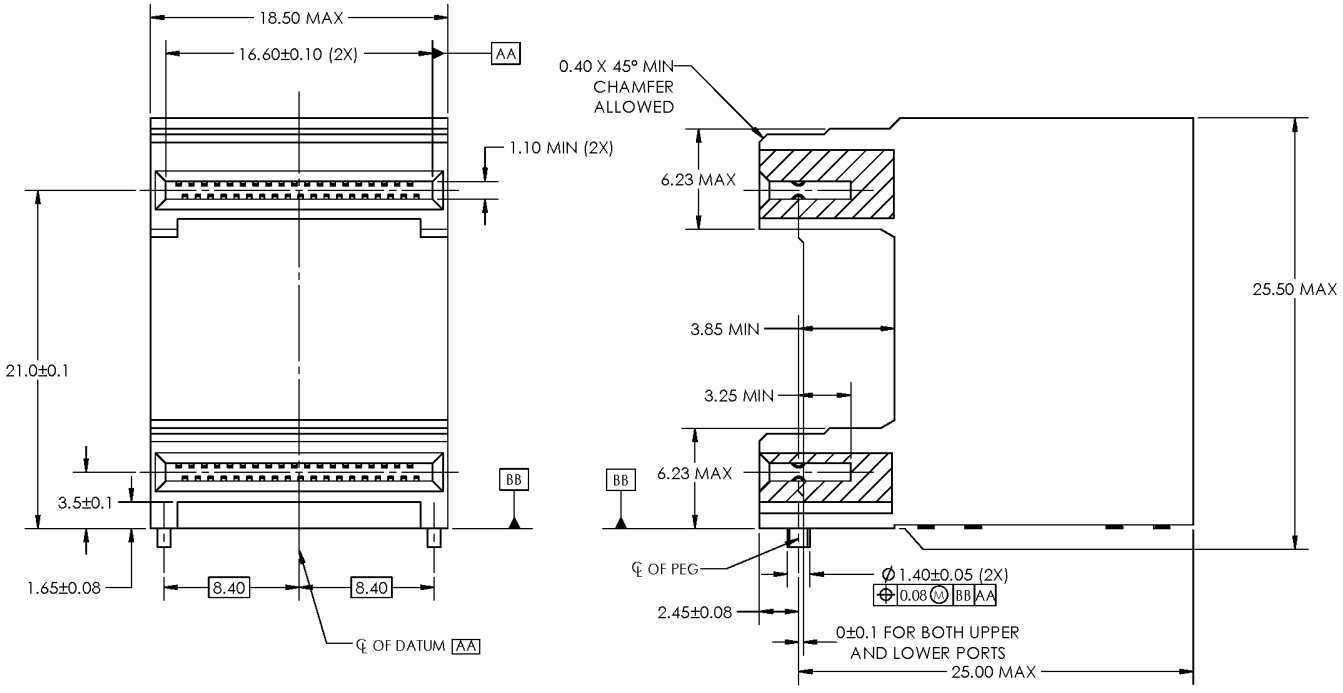

Figure 5-4 QSFP112 2x1 Stacked Connector Dimensions

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5.2 QSFP112 Cage Mechanical Specification

5.2.1 Overview

Detailed drawings for QSFP112 cages are provided in the following sections. Refer to Section 5.4 for footprint details and Appendix A for information about bezel openings. The cage may or may not include an opening on the top surface for a riding heat sink. If the thermal requirements for an application do not need the added heat sink, then the cage should not include the optional opening. The riding heat sink designs are not defined in this specification. However, if heat sinks are used, they should be designed to be compatible with the optional opening detailed in Figure 5-6 or Figure 5-8.

The legacy-latch modules (QSFP112) defined in this specification are mechanically compatible with all the cages defined in this specification. Refer to Table 4-5 for cross-compatibility details.

5.2.2 Mechanical Description: QSFP112 Cage

5.2.2.1 QSFP112 1x1 Cage

The QSFP112 1x1 cage is illustrated in Figure 5-5 and is mechanically compatible with QSFP+ modules as specified in SFF-8665. A detailed drawing is provided in Figure 5-6. The location of the footprint pattern on the host board is application specific. Refer to Section 5.4.1 for footprint information. Refer to Appendix A for information about bezel openings.

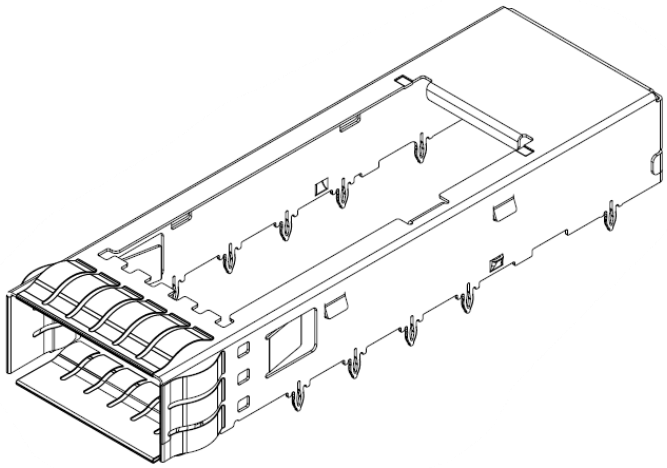

Figure 5-5 QSFP112 1x1 Cage

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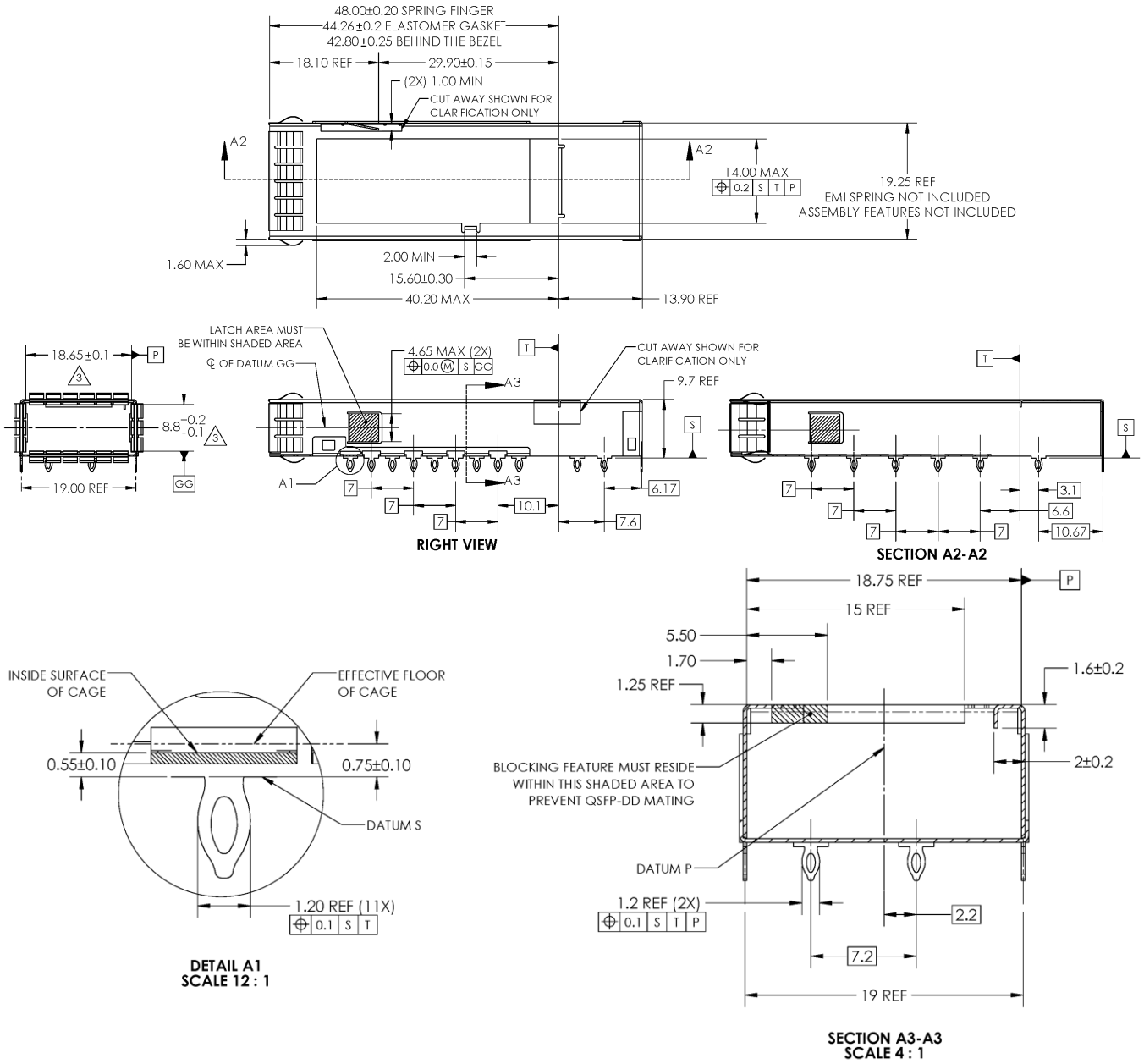

Figure 5-6 QSFP112 1x1 Cage Dimensions (1 of 2)

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NOTES: (for QSFP112 1x1 cage dimensions)

1. DIMENSIONS AND TOLERANCING CONFORM TO ASME Y14.5-2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS FROM INSIDE SURFACES OF SPRING FINGERS WHEN FULLY DEPRESSED.
4. CONNECTOR REMOVED FOR CLARITY.
5. APPLIES TO ALL SPRING FINGERS ON ALL SIDES.
6. EXTERNAL CAGE DIMENSIONS DO NOT INCLUDE FOLDED ASSEMBLY TABS.
7. LENGTH OF CAGE AND SIGNAL TAILS
8. PRESS FIT CAGE PINS APPLY TO RIGHT SIDE OF CAGE.
9. PRESS FIT CAGE PINS APPLY TO LEFT SIDE OF CAGE.
10. PRESS FIT OFFSET BETWEEN RIGHT AND LEFT SIDE OF CAGE.
11. DIMENSIONS INCLUDE BACK COVER.
12. OPENING FOR HEAT SINK IS OPTIONAL.

Figure 5-6 QSFP112 1x1 Cage Dimensions (2 of 2)

5.2.2.2 QSFP112 2x1 Stacked Cage

The QSFP112 2x1 stacked cage is shown in Figure 5-7. A detailed drawing is provided in Figure 5-8. The location of the pattern on the host board is application specific. Refer to Section 5.4.2 for footprint information. Refer to Appendix A for information about bezel openings.

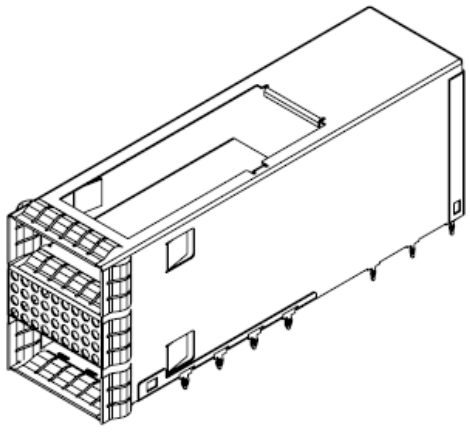

Figure 5-7 QSFP112 2x1 Stacked Cage

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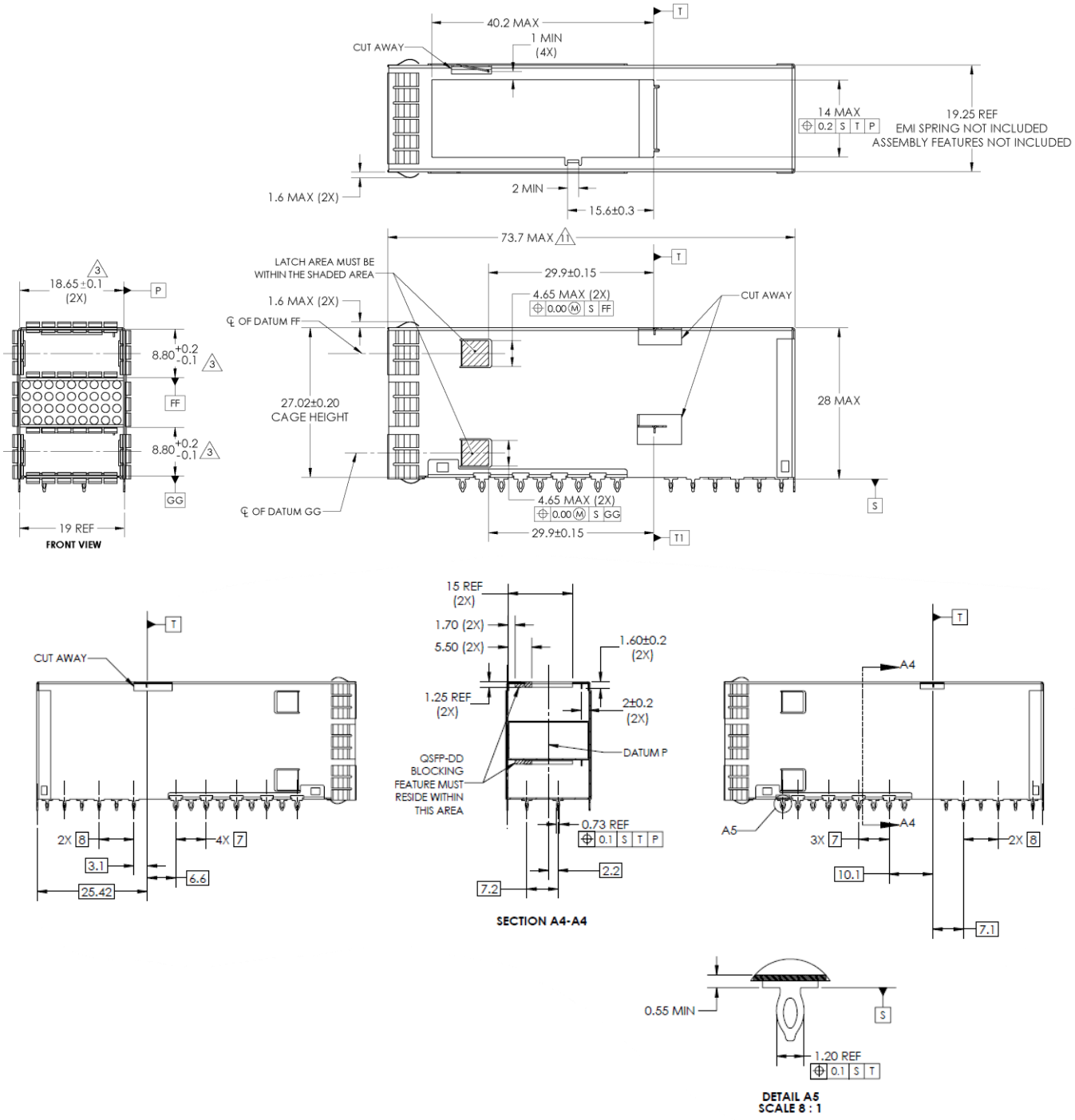

Figure 5-8 QSFP112 2x1 Stacked Cage Dimensions (1 of 2)

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NOTES: (for QSFP112 2x1 cage dimensions)

1. DIMENSIONS AND TOLERANCING CONFORM TO ASME Y14.5-2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS FROM INSIDE SURFACES OF SPRING FINGERS WHEN FULLY DEPRESSED.
4. CONNECTOR REMOVED FOR CLARITY.
5. APPLIES TO ALL SPRING FINGERS ON ALL SIDES.
6. EXTERNAL CAGE DIMENSIONS DO NOT INCLUDE FOLDED ASSEMBLY TABS.
7. LENGTH OF CAGE AND SIGNAL TAILS
8. PRESS FIT CAGE PINS APPLY TO RIGHT SIDE OF CAGE.
9. PRESS FIT CAGE PINS APPLY TO LEFT SIDE OF CAGE.
10. PRESS FIT OFFSET BETWEEN RIGHT AND LEFT SIDE OF CAGE.
11. DIMENSION INCLUDES BACK COVER.
12. OPENING FOR HEAT SINK IS OPTIONAL.
13. CONTACT PIN DIMENSION MEASURED FROM DATUM T.
14. CONTACT PIN DIMENSION MEASURED FROM DATUM T1.

Figure 5-8 QSFP112 2x1 Stacked Cage Dimensions (2 of 2)

5.2.3 Thermal Management for "QSFP112"

The thermal management of connectors systems and modules described in this document is the responsibility of the implementer. Each system is different and may require specialized solutions. This document outlines the physical characteristics of the module for interoperability with provisions to promote heat transfer. Type 2, Type 2A, and Type 2B modules offer the potential for better heat dissipation than the Type 1 modules but take up more space. The connectors/cages support external heat sinks, and in the case of the 2x1 stacked connector/cage, an internal heat sink between ports. The cages are not limited to specific heat sink or venting configurations. This document does not suggest any airflow requirements. The implementation of thermal components is not described.

Cage-mounted riding heat sink and retention clip thermal designs are application specific and not specifically defined by this specification. However, the recommended riding heat sink normal force should be at least 25 N to help facilitate heat transfer.

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5.3 QSFP112 Module Mechanical Specification

5.3.1 Overview

The QSFP112 module mechanical definitions specified in this section are designed to support up to 112 Gbps per lane signaling, but can be applied to a broad range of QSFP+ pluggable solutions. See SFF-8665 for implementation requirements. For QSFP112 modules, the bottom surface of the module within the cage shall be flat without a pocket. The options for the position of the label could include the bottom surface of the module that protrudes outside the bezel of the cage or etched into the metal surface. Caution should be exercised so that any etchings do not affect thermal performance. Refer to Table 4-5 for cross-compatibility details.

5.3.2 Mechanical Description: QSFP112 Module

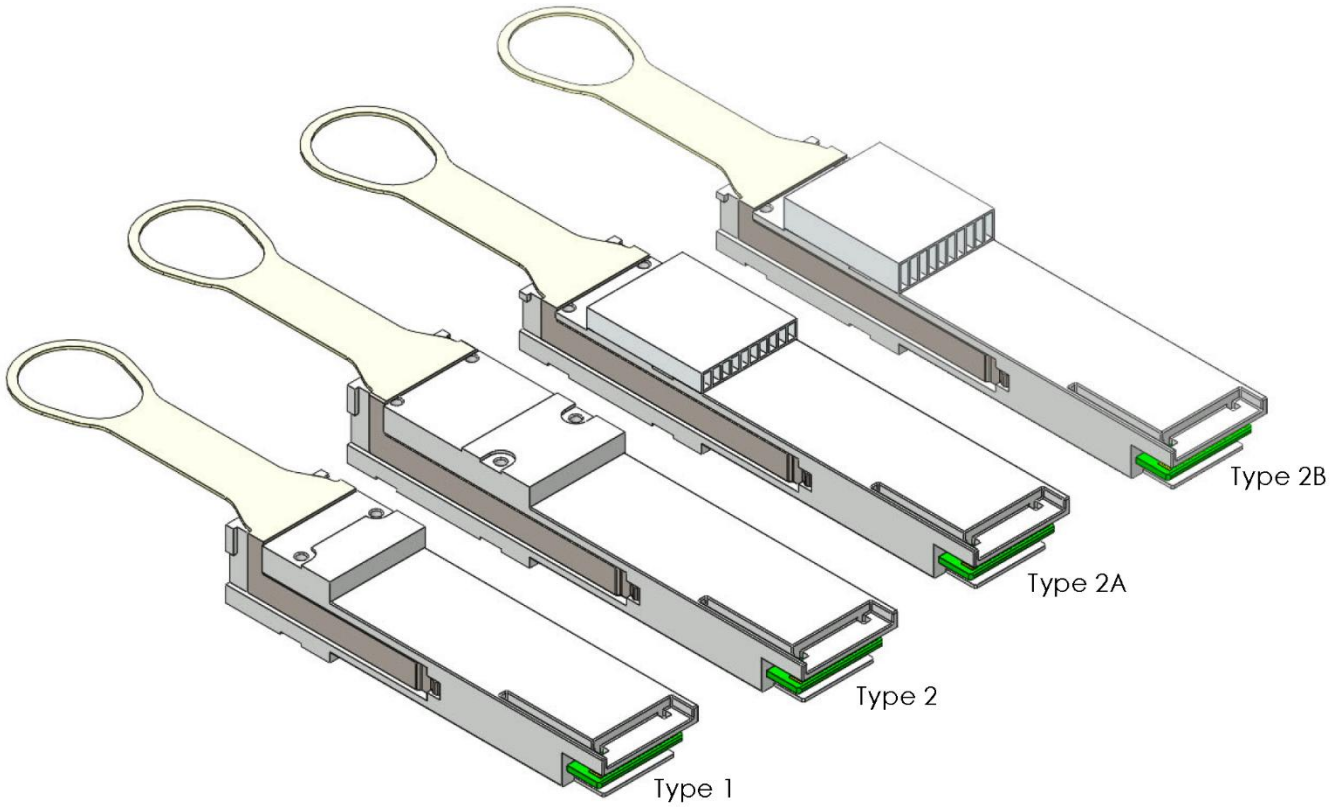

Figure 5-9 QSFP112 Module Types

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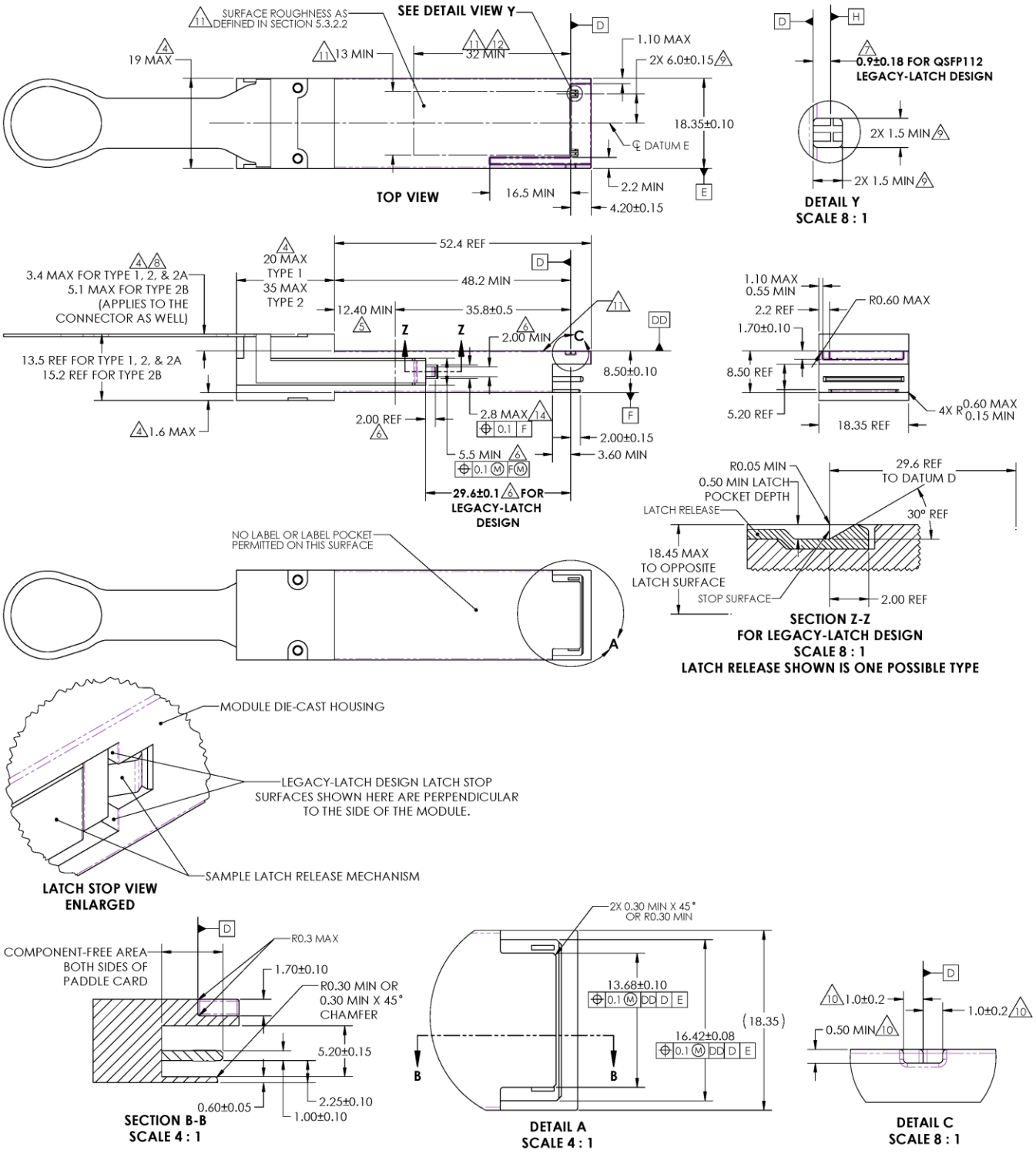
5.3.2.1 QSFP112 Module Mechanical Dimensions



NOTE: Heat sink definitions for QSFP112 2A & 2B module types are shown in Figure 5-11.

Figure 5-10 QSFP112 Module Dimensions (Type 1, 2, 2A, and 2B)

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NOTES: (for QSFP112 module dimensions)

1. DIMENSIONS AND TOLERANCING CONFORM TO ASME Y14.5-2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. UNLESS OTHERWISE SPECIFIED, SHARP CORNERS, EDGES, AND BURRS ARE NOT ALLOWED. ROUND OFF ALL EDGES AND CORNERS TO A MINIMUM RADIUS OF 0.20 MM.

4 DIMENSION DEFINES ENLARGED SECTION OF MODULE THAT EXTENDS OUTSIDE OF CAGE TO ACCOMMODATE MATING PLUG AND ACTUATOR MECHANISM.

5 SURFACES ON ALL 4 SIDES OF THE 12.4 MIN DIMENSION TO BE CONDUCTIVE FOR CONNECTION TO CHASSIS GROUND.

6 DIMENSION APPLIES TO THE LATCH MECHANISM.

7 DIMENSION APPLIES TO THE LOCATION OF THE EDGE OF THE MODULE PADDLE CARD PAD, DATUM H. CONTACTS 21, 22, 36, AND 37 ARE VISIBLE.

8 DIMENSION TO INCLUDE BAIL TRAVEL.

9 DIMENSIONS APPLY TO OPENINGS IN THE HOUSING.

10 OPTIONAL FEATURE TO AID INSPECTION OF DIMENSIONS FROM DATUM D.

11 FLATNESS AND SURFACE ROUGHNESS (Ra) APPLIES FOR INDICATED LENGTH AND MIN WIDTH OF 13 MM. SURFACE TO BE THERMALLY CONDUCTIVE. SEE SECTION 5.3.2.2, Table 5-1, FOR FLATNESS AND ROUGHNESS REQUIREMENTS.

12 HIGHER WATTAGE MODULES MAY REQUIRE ADDITIONAL SPACE FOR COOLING.

13 NO LABEL MATERIAL SHALL BE APPLIED IN THIS AREA. ETCHINGS ARE ALLOWED BUT MUST NOT AFFECT THERMAL PERFORMANCE.

14 DIMENSION APPLIES TO LATCH POCKET.

Figure 5-10 QSFP112 Module Dimensions (Type 1, 2, 2A, and 2B) Continued

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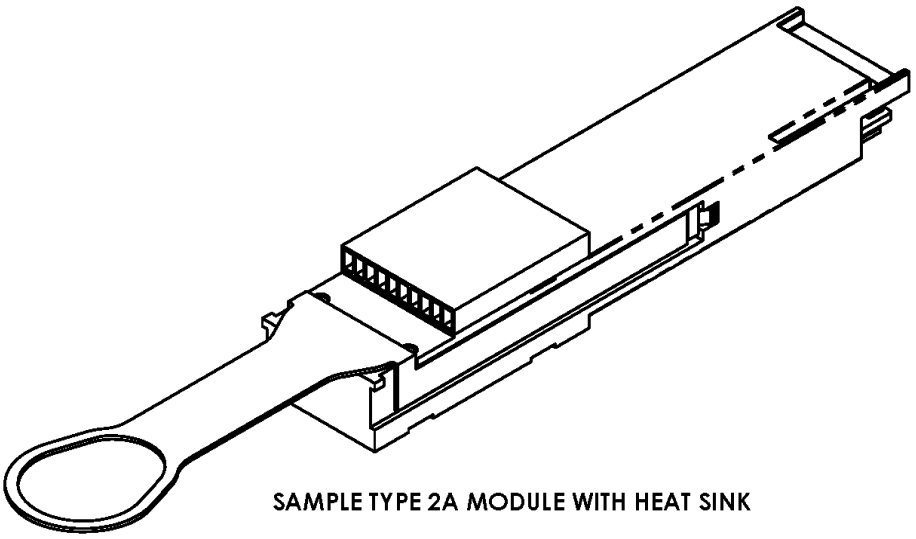
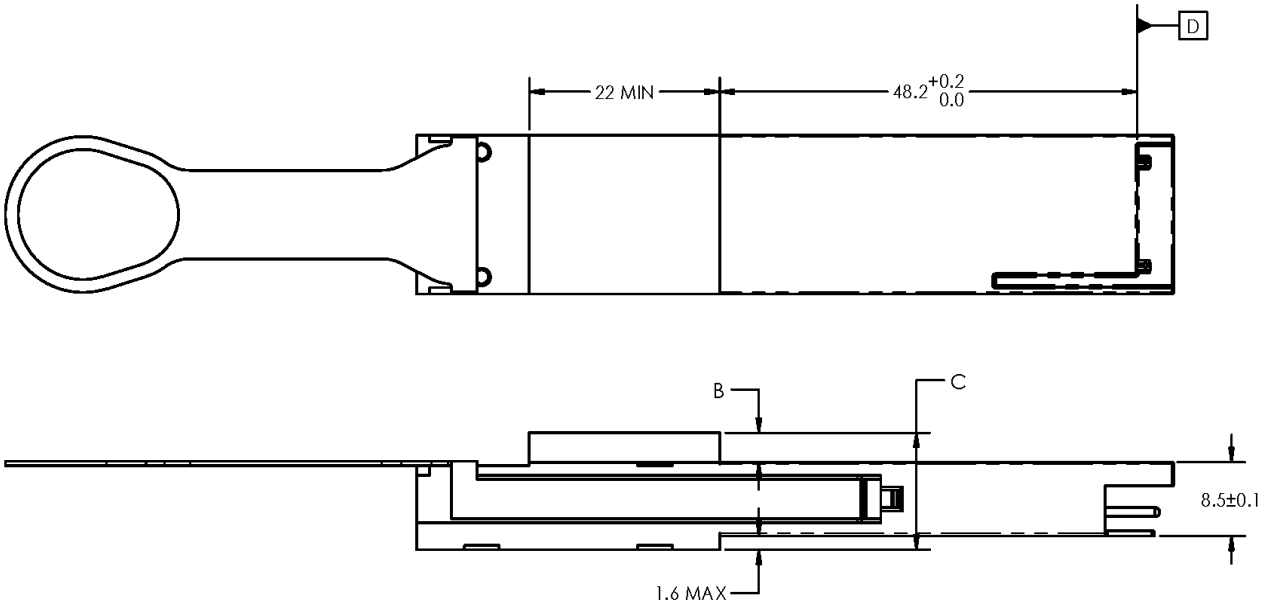


SAMPLE TYPE 2A MODULE WITH HEAT SINK



QSFP112 Module Type	Dim "B" (MAX)	Dim "C" (REF)
Type 2A	3.4	13.5
Type 2B	5.1	15.2

Figure 5-11 QSFP112 Module Type 2A, Type 2B Details

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5.3.2.2 Flatness and Surface Roughness for QSFP112 Modules

Module flatness and surface roughness are specified for QSFP112 modules to improve thermal characteristics when used with a riding heat sink. Relaxed specifications are used for lower power modules to potentially reduce cost. The flatness and surface roughness specifications are shown in Table 5-1 and apply to the specified heat sink contact area. Flatness and roughness specifications apply to both top and bottom surfaces of modules. Power Class 1Cu is dedicated to passive copper cables with a more relaxed flatness of 0.15 mm.

Table 5-1 QSFP112 Module Flatness And Surface Roughness Specifications

Power Class[1]	Module Flatness (mm) Tol Zone	Surface Roughness (Ra, µm) MAX
1Cu[2]	0.15	1.6
1	0.075	1.6
2	0.075	1.6
3	0.075	1.6
4	0.075	1.6
5	0.075	1.6
6	0.075	1.6
7	0.075	1.6
8	0.050	0.8
1. Power Classes are defined in SFF-8679. 2. Power Class 1Cu maximum power dissipation is the same as Power Class 1.		

To improve thermal performance, optional enhanced surface specifications are specified in Table 5-2. This is an optional specification and does not override the required specifications in Table 5-1.

Table 5-2 Optional Enhanced QSFP112 Module Flatness Specifications

Power Class	Module Flatness (mm) Tol Zone	Surface Roughness (Ra, µm) MAX
8	0.025	0.4

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5.3.2.3 QSFP112 Card Edge Description (Mechanical Interface)

The QSFP112 module paddle card combines with the rest of the QSFP112 module hardware to enable support for up to 112 Gbps per lane signaling. See Figure 5-12 for QSFP112 module paddle card dimensions. See SFF-8665 for implementation requirements and compatibility with other QSFP+ pluggable solutions.

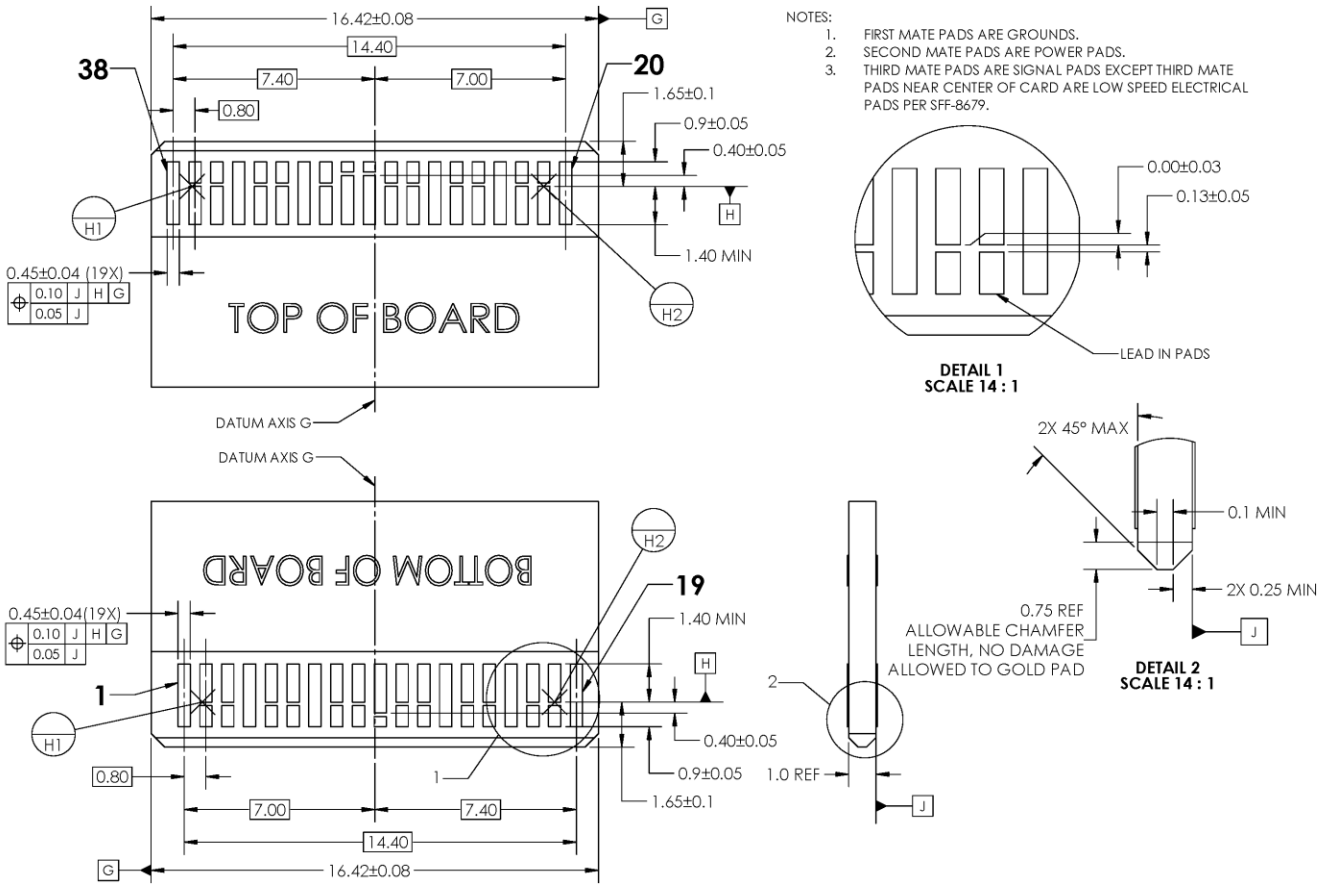

Figure 5-12 QSFP112 Paddle Card Dimensions

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5.4 QSFP112 Footprints

The QSFP112 footprints including pad dimensions and associated tolerances are designed to support up to 112 Gbps per lane signaling.

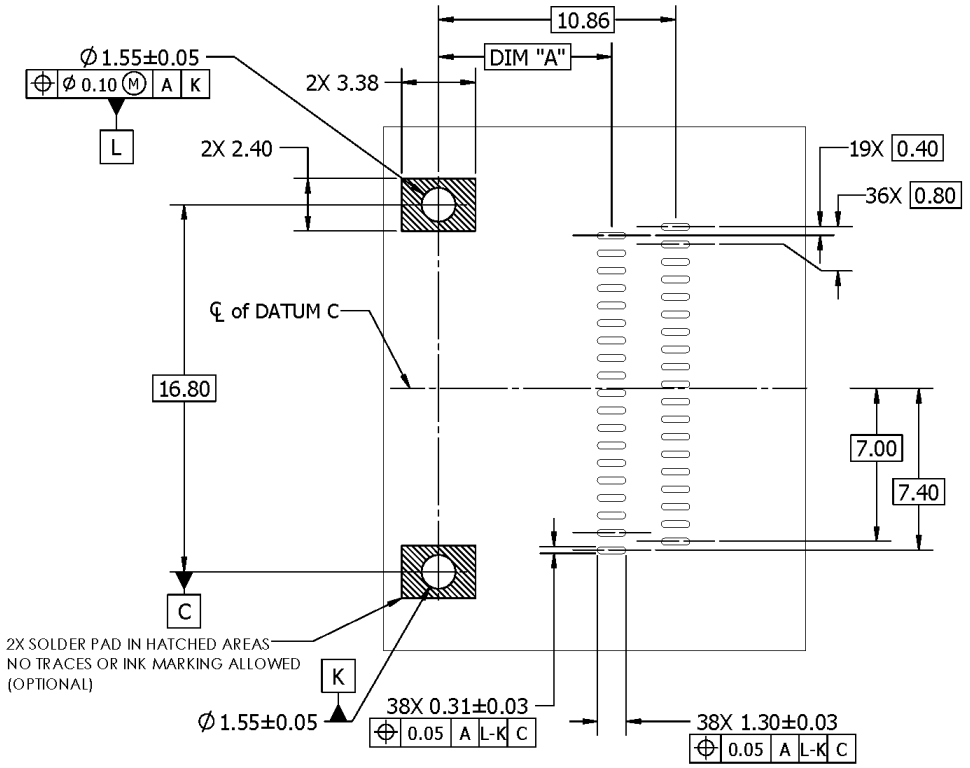
5.4.1 QSFP112 1x1 Connector Footprints

There are two QSFP112 1x1 footprint styles, summarized in Table 5-3, designed to aid in the implementation of different connector tail configurations:

Table 5-3 QSFP112 1x1 Connector Footprint Styles

Footprint Style	Description
Style A	"LL" 0.8mm pitch connector footprint
Style B	"JL" 0.8mm pitch connector footprint

The QSFP112 1x1 connector Style A and Style B footprints are shown in Figure 5-13. The mechanical layout for attaching the QSFP112 1x1 connector Style A or B and a cage to a host board is shown in Figure 5-14. It is recommended that QSFP112 connectors be used with QSFP112 cages. However, QSFP112 connectors are compatible with other cages. Figure 5-15 shows an informative implementation of a QSFP112 connector with an SFF-8663 cage.



QSFP112 1x1 Footprint Style	Dim "A"
Style A	7.93
Style B	7.05

Figure 5-13 PCB Layout for QSFP112 1x1 Connector (Footprint Styles A & B)

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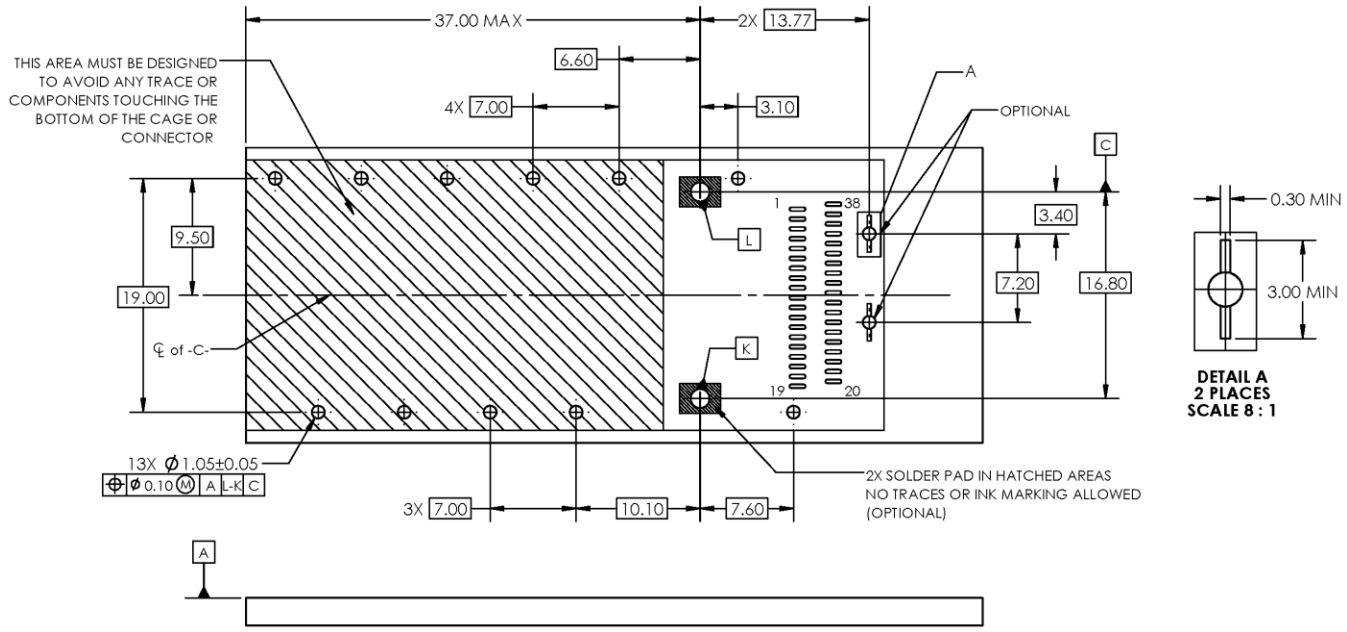

Figure 5-14 PCB Layout for QSFP112 1x1 Cage & Connector (Footprint Styles A & B)

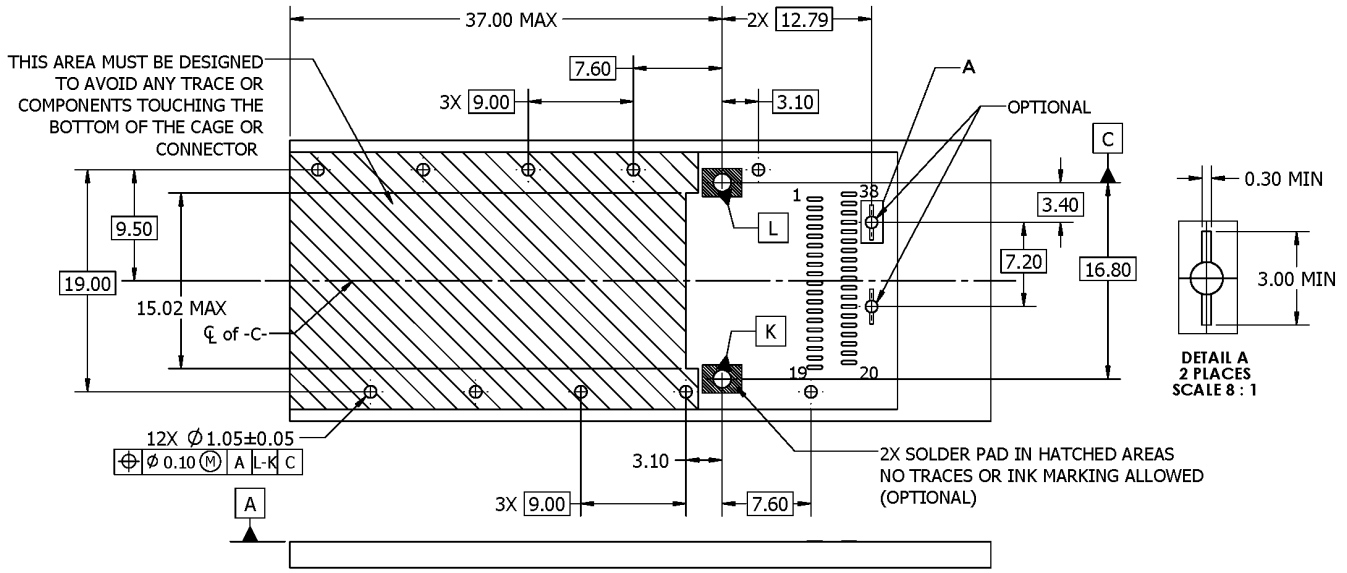

Figure 5-15 PCB Layout for 1x1 SFF-8663 Cage and QSFP112 Connector (Footprint Styles A & B)

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5.4.2 QSFP112 2x1 Stacked Connector Footprints

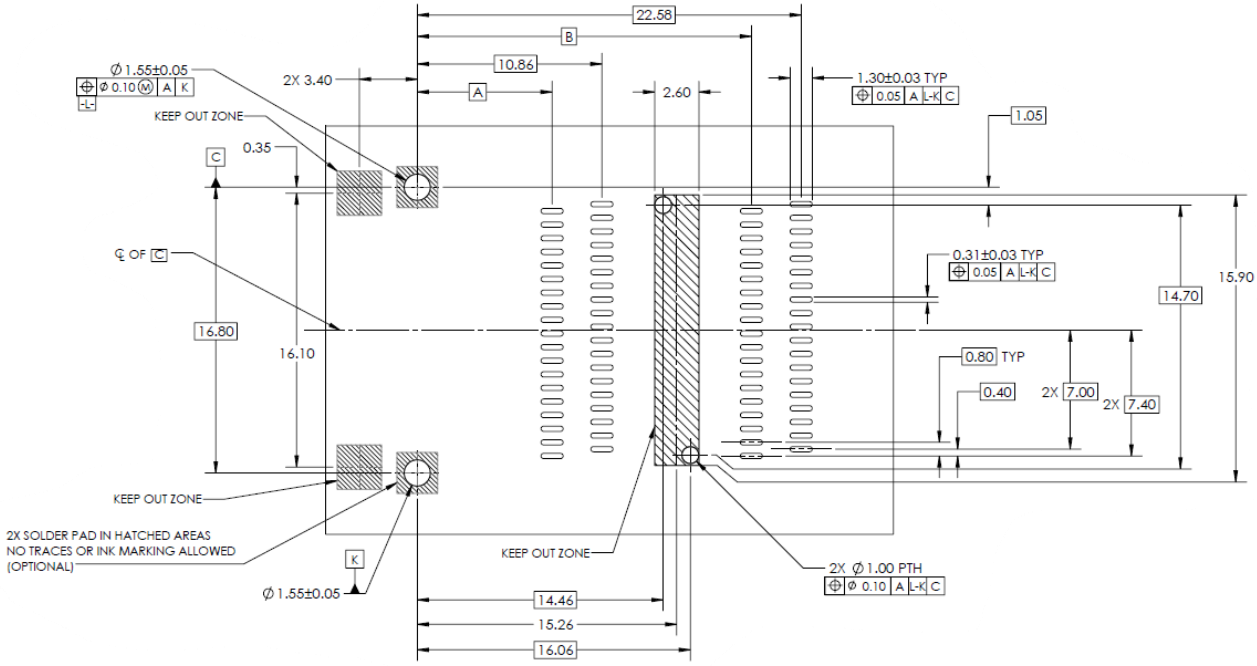
There are four QSFP112 2x1 stacked footprint styles, summarized in Table 5-4, designed to aid in the implementation of different connector tail configurations:

Table 5-4 QSFP112 2x1 Stacked Connector Footprint Styles

Style	Retention Method	Description
Style A	Retention Pin	"LL" 0.8mm pitch connector footprint with retention pin
Style B	Retention Pin	"JL" 0.8mm pitch connector footprint with retention pin
Style C	Glue	"LL" 0.8mm pitch connector footprint with glue pad
Style D	Glue	"JL" 0.8mm pitch connector footprint with glue pad

The QSFP112 2x1 stacked connector footprints are shown in Figure 5-16 and Figure 5-17.

The mechanical layout for attaching the QSFP112 2x1 stacked connector and cage to a host board is shown in Figure 5-18.



QSFP112 2x1 Stacked Footprint Style	Dim "A"	Dim "B"
Style A	7.93	19.65
Style B	7.05	18.77
Style C (see Note)	7.93	19.65
Style D (see Note)	7.05	18.77
NOTE: Styles C & D utilize glue pads instead of retention pins. Refer to Figure 5-17 for details.		

Figure 5-16 PCB Layout for QSFP112 2x1 Stacked Connector (Footprint Styles A, B, C, & D)

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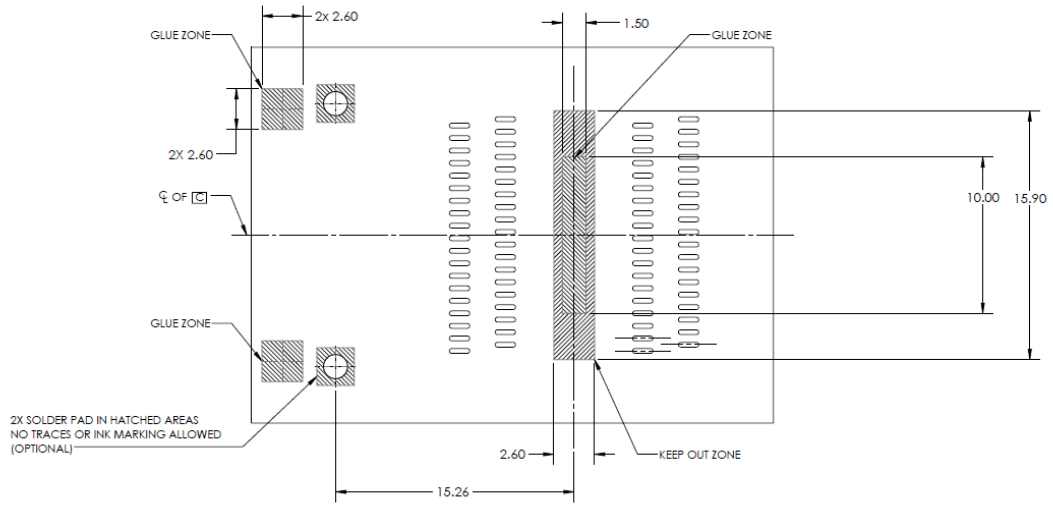

NOTE: For remaining dimensions, including values for Dim A & Dim B, refer to Figure 5-16.

Figure 5-17 PCB Layout for QSFP112 2x1 Stacked Connector (Footprint Styles C & D)

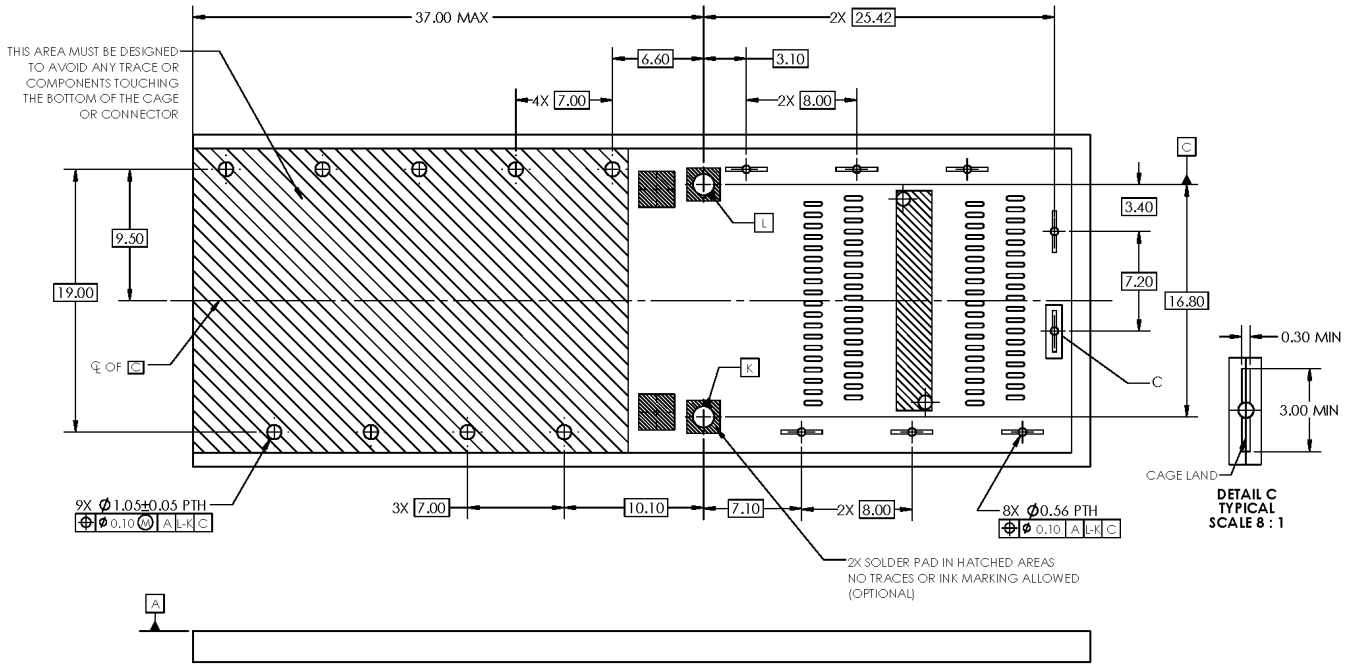

Figure 5-18 PCB Layout for QSFP112 2x1 Stacked Cage & Connector (Footprint Styles A, B, C, & D)

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6. QSFP224 Component Mechanical Specification

6.1 QSFP224 Connector Mechanical Specification

6.1.1 QSFP224 Connector Overview

QSFP224 connectors come in a 1x1 configuration. The QSFP224 1x1 connector, shown in Figure 5-1, is a right-angle connector with 38 mating contacts and 52 solder tails. The QSFP224 1x1 connector comes in one footprint for the 52 solder tails; refer to Section 6.4.1 for the footprint details. See also Appendix B for the recommended footprint pad assignments. The QSFP224 1x1 connector is defined to support up to 224 Gbps per lane signaling.

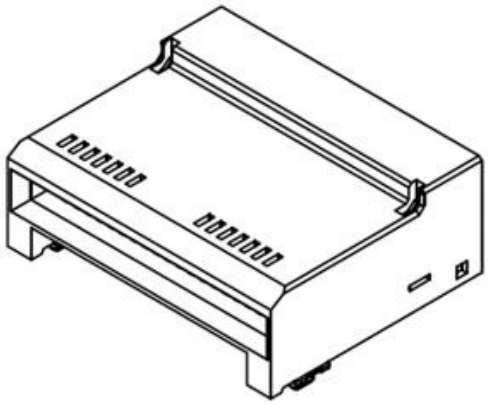
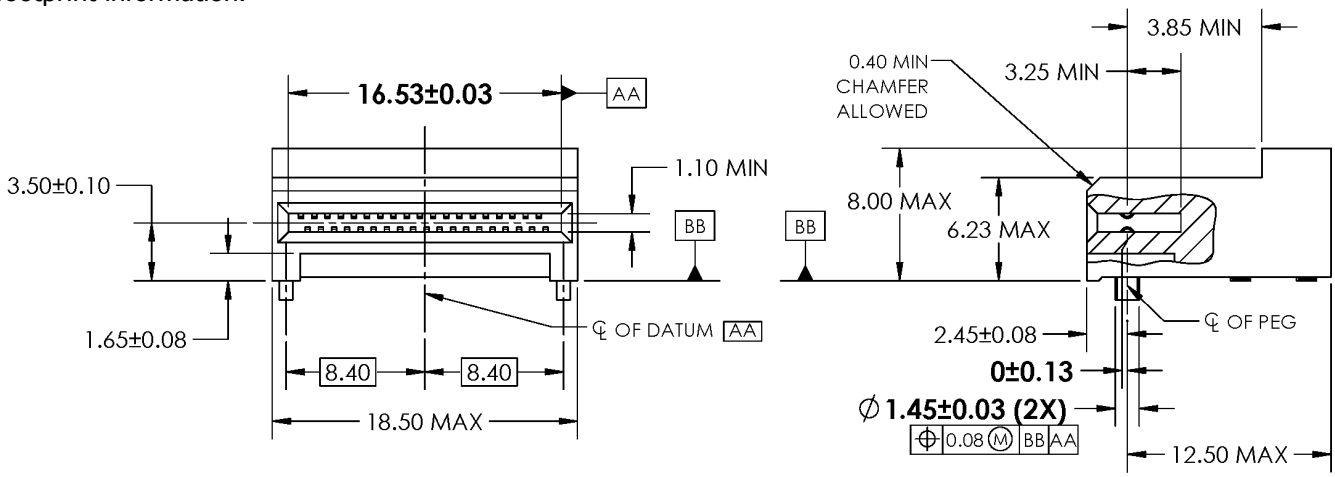


Figure 6-1 QSFP224 1x1 Connector

6.1.2 Mechanical Description: QSFP224 Connector

6.1.2.1 QSFP224 1x1 Connector

QSFP224 1x1 connector front and side views are shown in Figure 6-2. Refer to Section 6.4.1 for QSFP224 1x1 footprint information.



NOTE: BOLD DIMENSIONS INDICATE A DIFFERENCE FROM THE QSFP112 1X1 CONNECTOR

Figure 6-2 QSFP224 1x1 Connector Dimensions

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6.2 QSFP224 Cage Mechanical Specification

6.2.1 Overview

Detailed drawings for QSFP224 cages are provided in the following sections. Refer to Section 6.4 for footprint details and Appendix A for information about bezel openings. The cage may or may not include an opening on the top surface for a riding heat sink. If the thermal requirements for an application do not need the added heat sink, then the cage should not include the optional opening. The riding heat sink designs are not defined in this specification. However, if heat sinks are used, they should be designed to be compatible with the optional opening detailed in Figure 6-4.

6.2.2 Mechanical Description: QSFP224 Cage

6.2.2.1 QSFP224 1x1 Cage

The QSFP224 1x1 cage is illustrated in Figure 6-3 and is mechanically compatible with QSFP+ modules as specified in SFF-8665. A detailed drawing is provided in Figure 6-4. These cages are intended to be used with the angled-latch design type of module latches (see below for additional details). The location of the footprint pattern on the host board is application specific. Refer to Section 6.4.1 for footprint information. Refer to Appendix A for information about bezel openings.

An angled-latch design for module and cage reduces the amount of forward and backward movement capable between the cage and module while fully mated. This reduced movement allows for more precise positioning of the mating interface signal pads of the module with respect to the mating interface contacts of the connector. When the angled-latch design is combined with a QSFP224 1x1 connector (which includes some tighter tolerances) and the QSFP224 1x1 footprint (which provides improved isolation between signal contacts at the footprint), improved signal integrity performance is possible. The angled-latch design requires greater definition of the cage flap length (as shown in Figure 6-4) and the module latch pocket depth (as shown in Figure 6-6 QSFP224 Module Dimensions (Type 1, 2, 2A, and 2B)). Refer to Table 4-5 for cross-compatibility details.

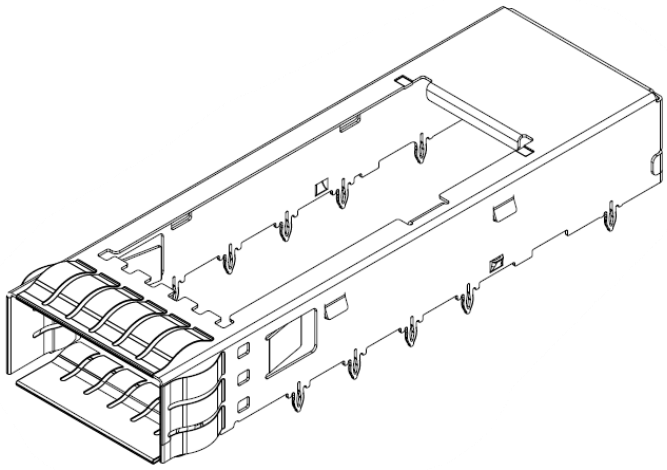

Figure 6-3 QSFP224 1x1 Cage

It is recommended that the 29.90±0.05 mm dimension (see Figure 6-4) from the tip of the cage flap (cage latch tab) to Datum T (the cage hard stop for the module) and the 7.00-9.00 mm cage flap length be measured in a mated condition, either with a mating module plugged in or a gauge plug inserted into the cage to simulate the size of a module. See Appendix C for a sample of a recommended cage gauge plug.

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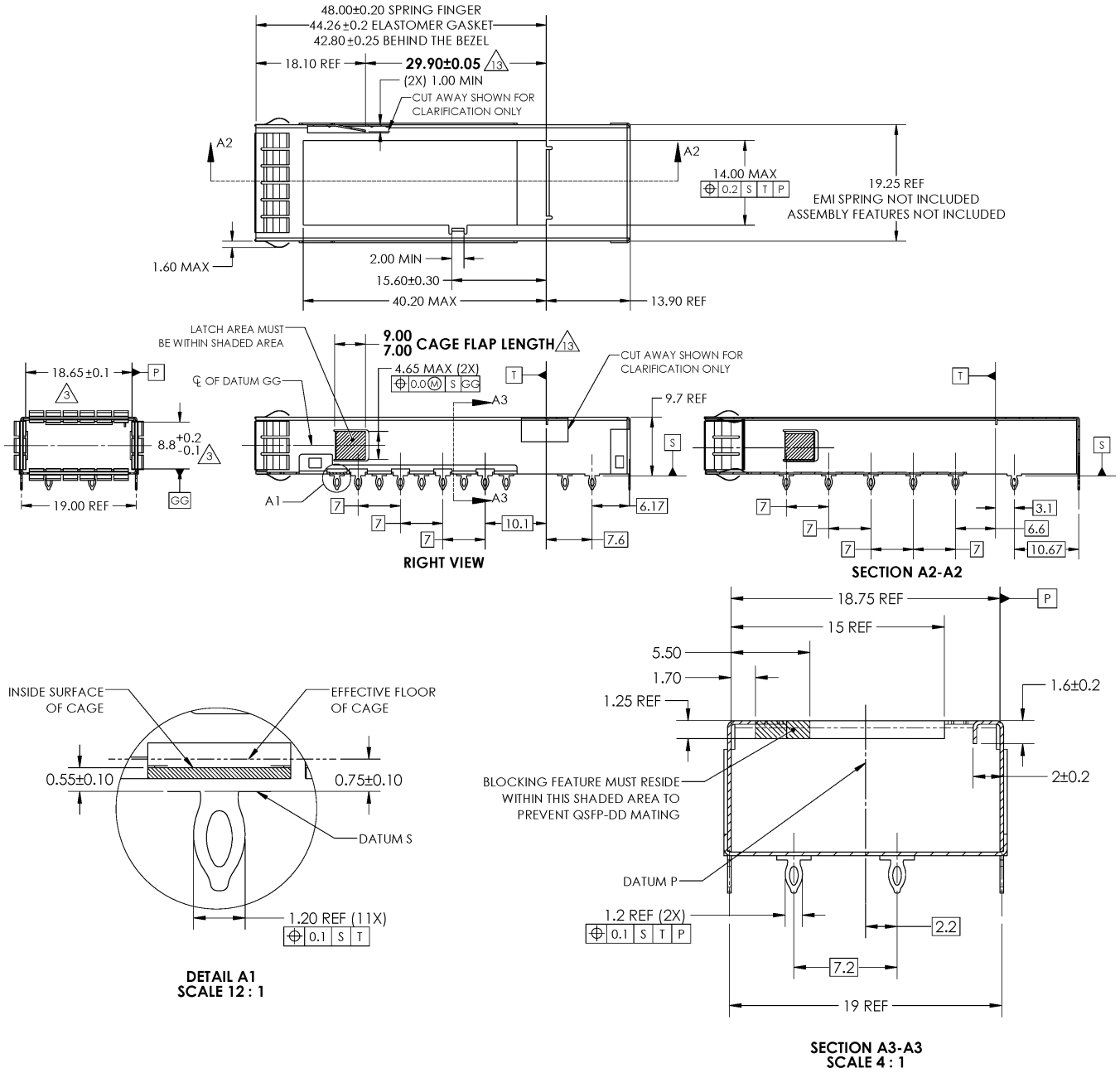

Figure 6-4 QSFP224 1x1 Cage Dimensions (1 of 2)

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NOTES: (for QSFP224 1x1 cage dimensions)

1. DIMENSIONS AND TOLERANCING CONFORM TO ASME Y14.5-2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS FROM INSIDE SURFACES OF SPRING FINGERS WHEN FULLY DEPRESSED.
4. CONNECTOR REMOVED FOR CLARITY.
5. APPLIES TO ALL SPRING FINGERS ON ALL SIDES.
6. EXTERNAL CAGE DIMENSIONS DO NOT INCLUDE FOLDED ASSEMBLY TABS.
7. LENGTH OF CAGE AND SIGNAL TAILS
8. PRESS FIT CAGE PINS APPLY TO RIGHT SIDE OF CAGE.
9. PRESS FIT CAGE PINS APPLY TO LEFT SIDE OF CAGE.
10. PRESS FIT OFFSET BETWEEN RIGHT AND LEFT SIDE OF CAGE.
11. DIMENSIONS INCLUDE BACK COVER.
12. OPENING FOR HEAT SINK IS OPTIONAL.
13. SEE THE PARAGRAPH BEFORE FIGURE 6-4 FOR THE RECOMMENDED WAY TO MEASURE THE INDICATED DIMENSIONS.
14. BOLD DIMENSIONS INDICATE A DIFFERENCE FROM THE QSFP112 1X1 CAGE DIMENSIONS.

Figure 6-4 **QSFP112 1x1 Cage Dimensions (2 of 2)**

6.2.3 Thermal Management for "QSFP224"

The thermal management of connectors systems and modules described in this document is the responsibility of the implementer. Each system is different and may require specialized solutions. This document outlines the physical characteristics of the module for interoperability with provisions to promote heat transfer. Type 2, Type 2A, and Type 2B modules offer the potential for better heat dissipation than the Type 1 modules but take up more space. The connectors/cages support external heat sinks. The cages are not limited to specific heat sink or venting configurations. This document does not suggest any airflow requirements. The implementation of thermal components is not described.

Cage-mounted riding heat sink and retention clip thermal designs are application specific and not specifically defined by this specification. However, the recommended riding heat sink normal force should be at least 25 N to help facilitate heat transfer.

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6.3 QSFP224 Module Mechanical Specification

6.3.1 Overview

The QSFP224 module mechanical definitions specified in this section are designed to support up to 224 Gbps per lane signaling but can be applied to a broad range of QSFP+ pluggable solutions if specific compatibility conditions are met. See SFF-8665 for implementation requirements . For QSFP224 modules, the bottom surface of the module within the cage shall be flat without a pocket. The options for the position of the label could include the bottom surface of the module that protrudes outside the bezel of the cage or etched into the metal surface. Caution should be exercised so that any etchings do not affect thermal performance.

Caution should be exercised as QSFP112 cages and prior generation cages (SFF-8663) were not optimized for the QSFP224 module's angled-latch design potentially leading to a failure to latch properly or for the latch to get stuck in extreme cases. Therefore, QSFP224 modules should only be used in hosts that have QSFP224 cages. Refer to Table 4-5 for cross-compatibility details.

6.3.2 Mechanical Description: QSFP224 Module

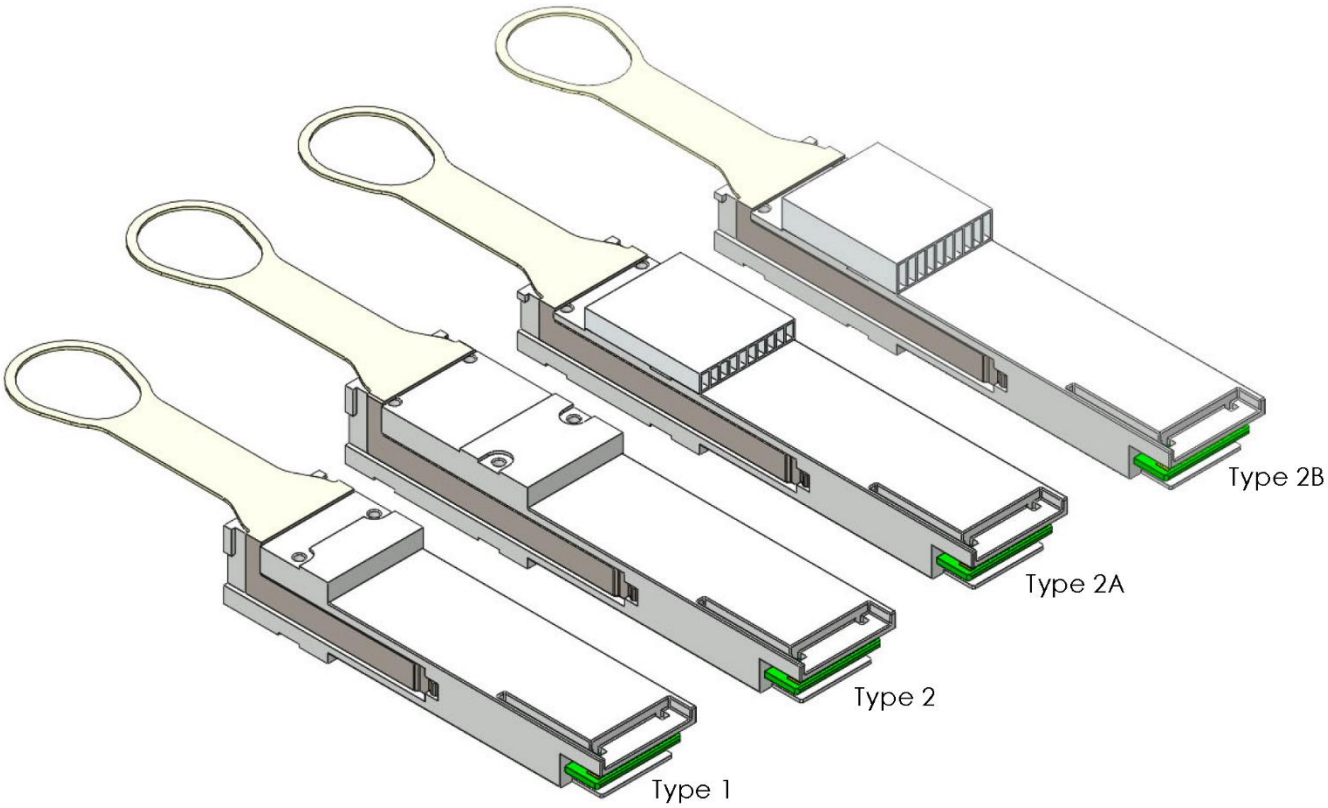

Figure 6-5 QSFP2 Module Types

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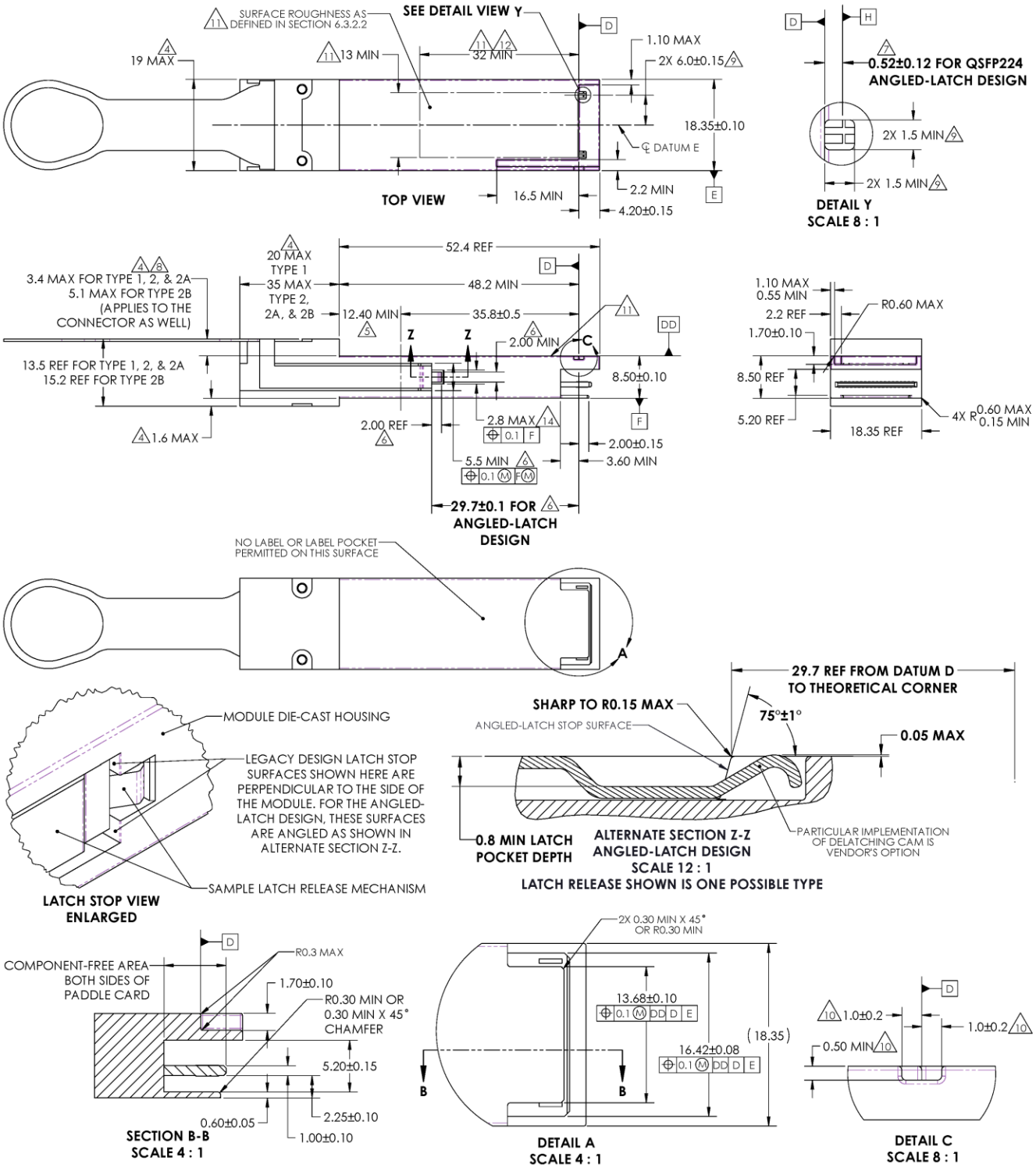
6.3.2.1 QSFP224 Module Mechanical Dimensions



NOTE: Heat sink definitions for QSFP2 2A & 2B module types are shown in Figure 6-7.

Figure 6-6 QSFP224 Module Dimensions (Type 1, 2, 2A, and 2B)

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NOTES: (for QSFP224 module dimensions)

1. DIMENSIONS AND TOLERANCING CONFORM TO ASME Y14.5-2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. UNLESS OTHERWISE SPECIFIED, SHARP CORNERS, EDGES, AND BURRS ARE NOT ALLOWED. ROUND OFF ALL EDGES AND CORNERS TO A MINIMUM RADIUS OF 0.20 MM.

4 DIMENSION DEFINES ENLARGED SECTION OF MODULE THAT EXTENDS OUTSIDE OF CAGE TO ACCOMMODATE MATING PLUG AND ACTUATOR MECHANISM.

5 SURFACES ON ALL 4 SIDES OF THE 12.4 MIN DIMENSION TO BE CONDUCTIVE FOR CONNECTION TO CHASSIS GROUND.

6 DIMENSION APPLIES TO THE LATCH MECHANISM.

7 DIMENSION APPLIES TO THE LOCATION OF THE EDGE OF THE MODULE PADDLE CARD PAD, DATUM H. CONTACTS 21, 22, 36, AND 37 ARE VISIBLE.

8 DIMENSION TO INCLUDE BAIL TRAVEL.

9 DIMENSIONS APPLY TO OPENINGS IN THE HOUSING.

10 OPTIONAL FEATURE TO AID INSPECTION OF DIMENSIONS FROM DATUM D.

11 FLATNESS AND SURFACE ROUGHNESS (Ra) APPLIES FOR INDICATED LENGTH AND MIN WIDTH OF 13 MM. SURFACE TO BE THERMALLY CONDUCTIVE. SEE SECTION 6.3.2.2, Table 6-1, FOR FLATNESS AND ROUGHNESS REQUIREMENTS.

12 HIGHER WATTAGE MODULES MAY REQUIRE ADDITIONAL SPACE FOR COOLING.

13 NO LABEL MATERIAL SHALL BE APPLIED IN THIS AREA. ETCHINGS ARE ALLOWED, BUT MUST NOT AFFECT THERMAL PERFORMANCE.

14 DIMENSION APPLIES TO LATCH POCKET.

15. BOLD DIMENSIONS INDICATE A DIFFERENCE FROM THE QSFP112 1X1 MODULE DIMENSIONS.

Figure 6-6 QSFP224 Module Dimensions (Type 1, 2, 2A, and 2B) Continued

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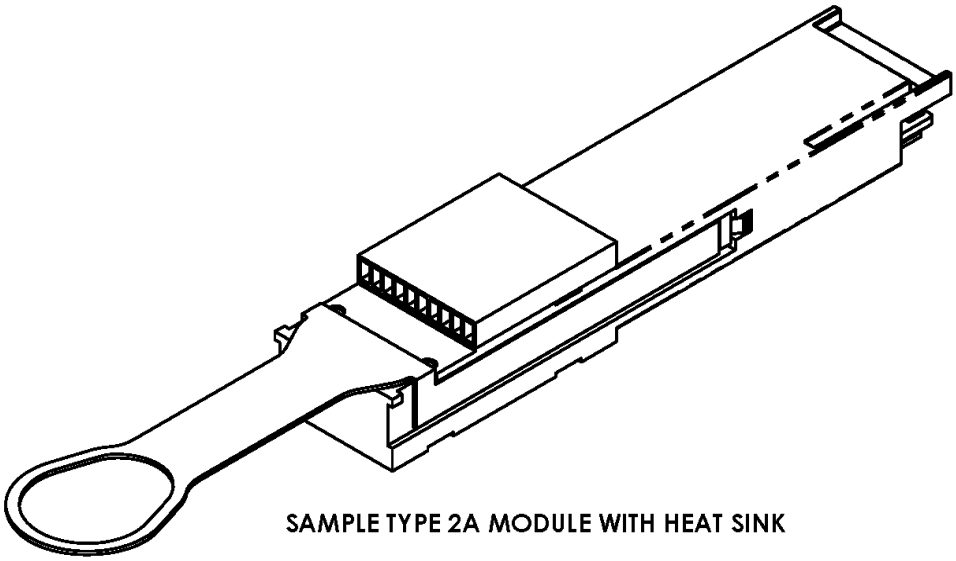
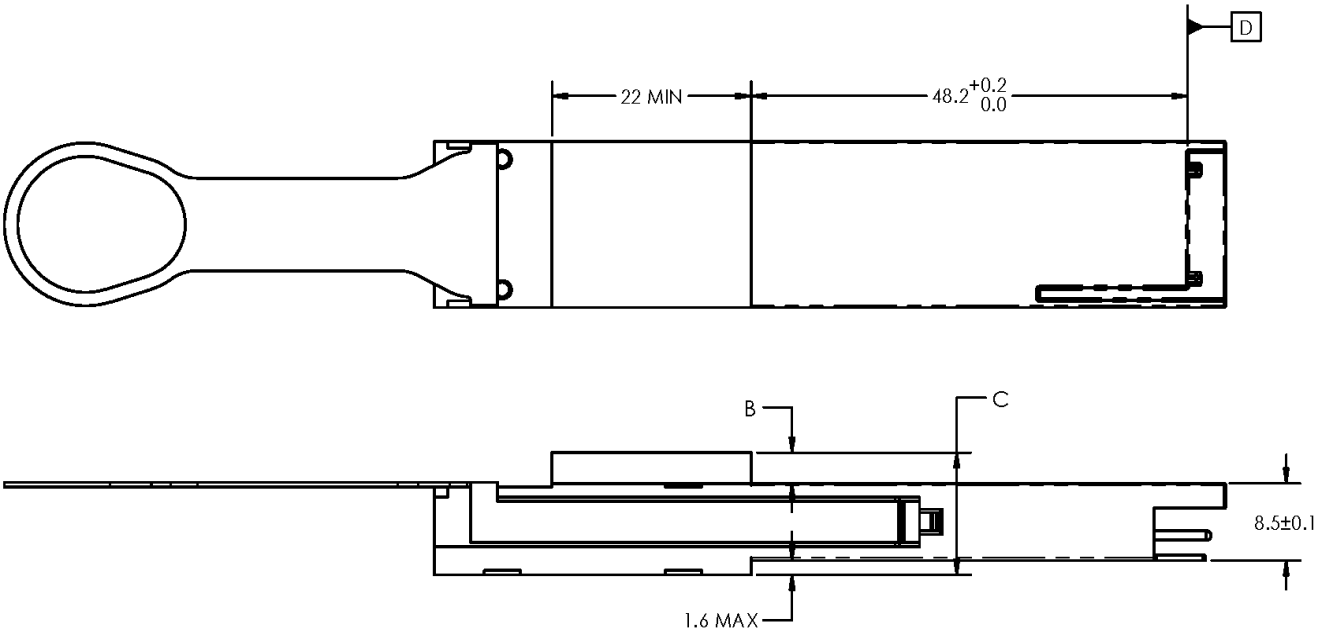


SAMPLE TYPE 2A MODULE WITH HEAT SINK



QSFP224 Module Type	Dim "B" (MAX)	Dim "C" (REF)
Type 2A	3.4	13.5
Type 2B	5.1	15.2

Figure 6-7 QSFP224 Module Type 2A, Type 2B Details

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6.3.2.2 Flatness and Surface Roughness for QSFP224 Modules

Module flatness and surface roughness are specified for QSFP224 modules to improve thermal characteristics when used with a riding heat sink. Relaxed specifications are used for lower power modules to potentially reduce cost. The flatness and surface roughness specifications are shown in Table 6-1 and apply to the specified heat sink contact area. Flatness and roughness specifications apply to both top and bottom surfaces of modules. Power Class 1Cu is dedicated to passive copper cables with a more relaxed flatness of 0.15 mm.

Table 6-1 QSFP224 Module Flatness And Surface Roughness Specifications

Power Class[1]	Module Flatness (mm) Tol Zone	Surface Roughness (Ra, µm) MAX
1Cu[2]	0.15	1.6
1	0.075	1.6
2	0.075	1.6
3	0.075	1.6
4	0.075	1.6
5	0.075	1.6
6	0.075	1.6
7	0.075	1.6
8	0.050	0.8
1. Power Classes are defined in SFF-8679. 2. Power Class 1Cu maximum power dissipation is the same as Power Class 1.		

To improve thermal performance, optional enhanced surface specifications are specified in Table 6-2. This is an optional specification and does not override the required specifications in Table 6-1.

Table 6-2 Optional Enhanced QSFP224 Module Flatness Specifications

Power Class	Module Flatness (mm) Tol Zone	Surface Roughness (Ra, µm) MAX
8	0.025	0.4

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6.3.2.3 QSFP224 Card Edge Description (Mechanical Interface)

The QSFP224 module paddle card pad dimensions have been modified compared to QSFP112 module paddle cards to support up to 224 Gbps signaling rates. See Figure 6-8 for QSFP224 module paddle card dimensions.

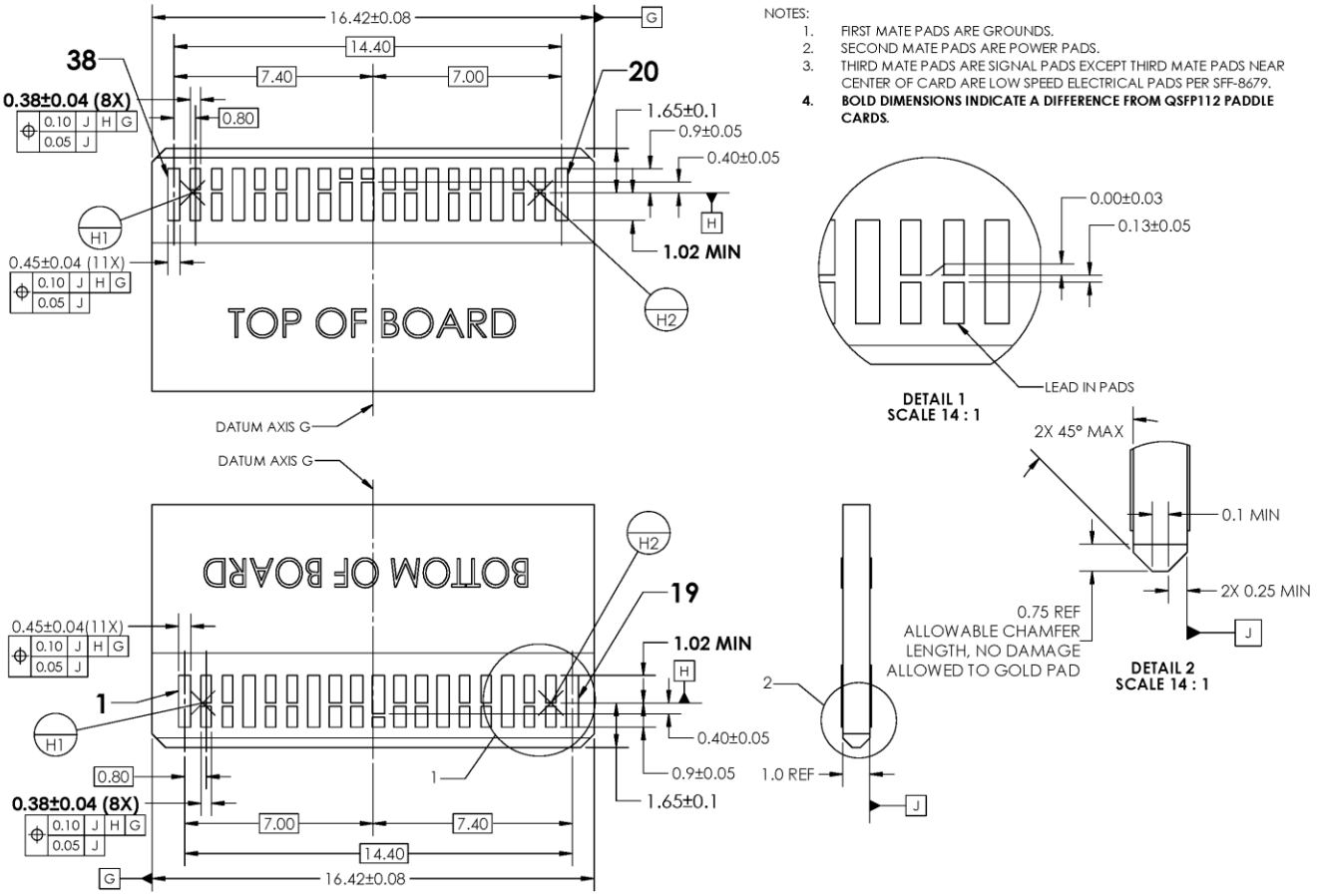

Figure 6-8 QSFP224 Paddle Card Dimensions

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6.4 QSFP224 Footprints

The QSFP224 footprint including pad dimensions and associated tolerances is designed to support up to 224 Gbps per lane signaling.

6.4.1 QSFP224 1x1 Connector Footprints

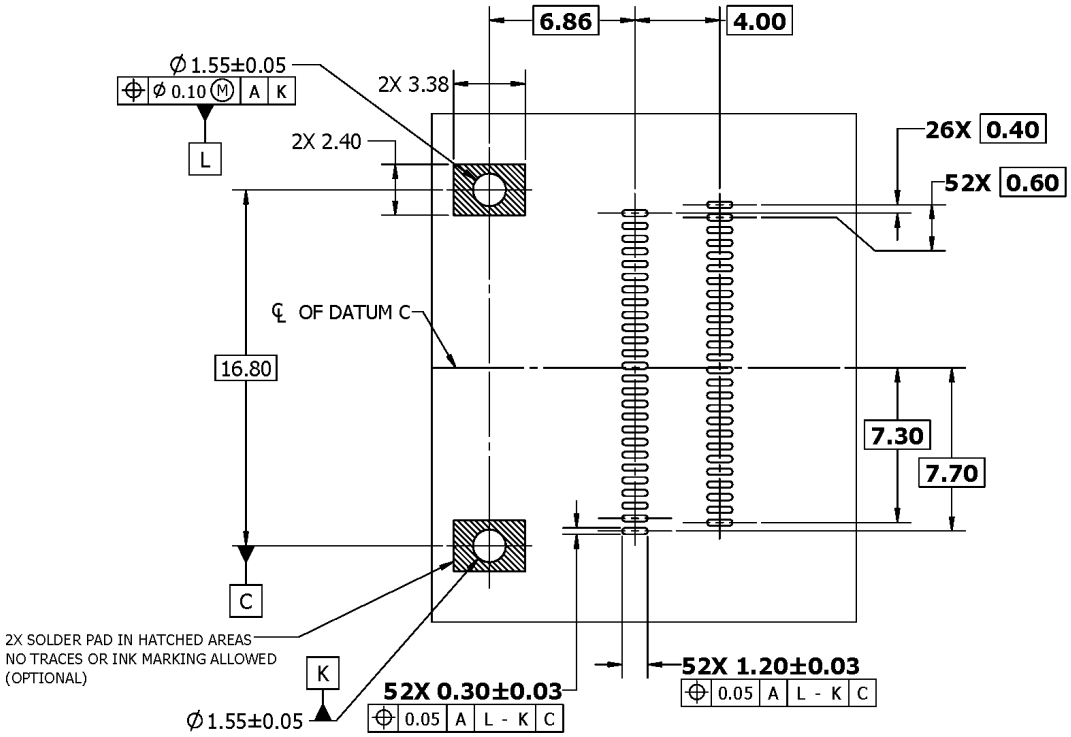
There is one QSFP224 1x1 footprint style summarized in Table 6-3:

Table 6-3 QSFP224 1x1 Connector Footprint

1x1 Footprint	Description
QSFP224 1x1	"LL" 0.6mm pitch connector footprint

The QSFP224 1x1 connector footprint is shown in Figure 6-9. The mechanical layout for attaching the QSFP224 1x1 connector with the QSFP224 1x1 footprint and cage to a host board is shown in Figure 6-10.

Within the QSFP224 1x1 connectors, some of the 38 contact positions at the mating interface are divided into two solder tails at the footprint interface resulting in a greater number of solder tails and requiring a greater number of footprint pads. The following mating interface contact positions are divided at the solder tail end: Contact Number 1, 4, 7, 10, 13, 16, 19, 20, 23, 26, 29, 32, 35, and 38. The result is 52 solder tails requiring 52 footprint pads as shown in Figure 6-9 (also see Appendix B).



NOTE: BOLD DIMENSIONS INDICATE A DIFFERENCE FROM THE QSFP112 1X1 FOOTPRINT DIMENSIONS

Figure 6-9 PCB Layout for QSFP224 1x1 Connector Footprint

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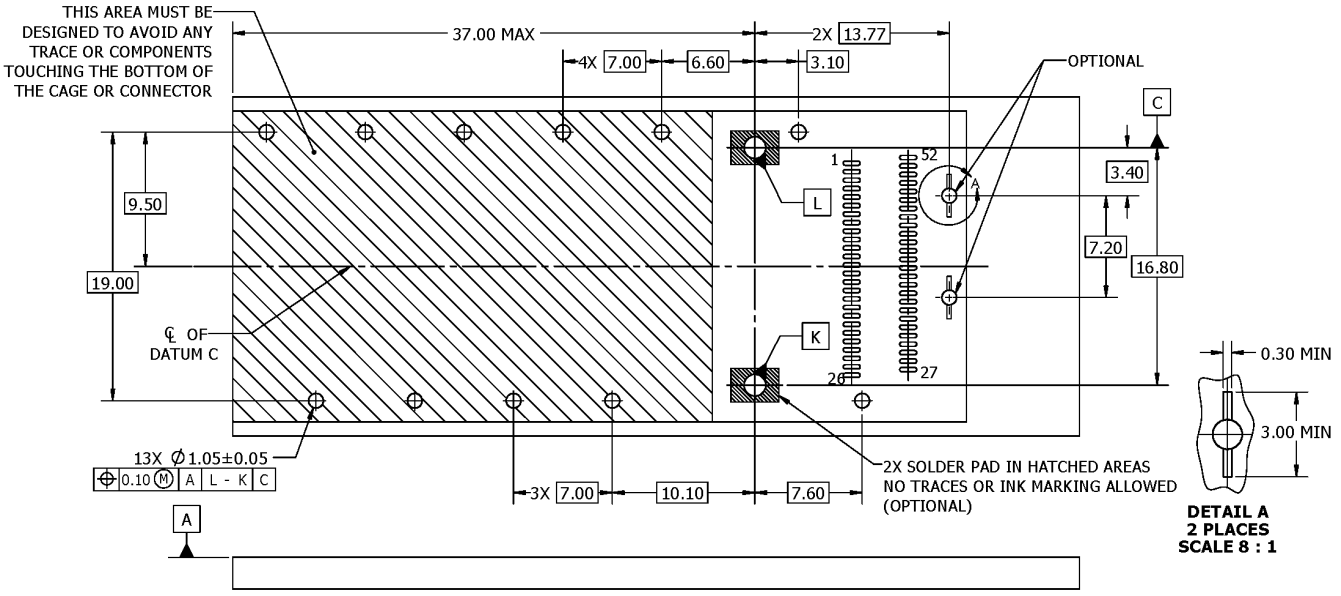

Figure 6-10 PCB Layout for QSFP224 1x1 Cage & QSFP224 1x1 Connector Footprint

7. Test Requirements and Methodologies (TS-1000, etc.)

7.1 QSFP2 Performance Tables

EIA-364-1000 (TS-1000) shall be used to define the test sequences and procedures for evaluating the connector system described in this document. Where multiple test options are available, the manufacturer shall select the appropriate option where not previously specified. The selected procedure should be noted when reporting data. If there are conflicting requirements or test procedures between EIA-364 procedures and those contained within this document, this document shall be considered the prevailing authority.

Unless otherwise specified, procedures for sample size, data, and collection to be followed as specified in EIA-364-1000. See EIA-364-1000 Annex B for objectives of tests and test groups.

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Table 7-1 summarizes the performance criteria that are to be satisfied by the connector described in this document. Most performance criteria are validated by EIA-364-1000 testing, but this test suite leaves some test details to be determined. To ensure that testing is repeatable, these details are identified in Table 7-2. Finally, testing procedures used to validate any performance criteria not included in EIA-364-1000 are provided in Table 7-3.

Table 7-1 Form Factor Performance Requirements

Performance Parameters	Description/ Details	Requirement
Mechanical/ Physical Requirements		
Plating Type	Plating type on connector contacts	Precious
Surface Treatment	Surface treatment on connector contacts, if surface treatment is applied, Test Group 6 is required.	Manufacturer to specify
Wipe length	Designed distance a contact traverses over a mating contact surface during mating and resting at a final position. If less than 0.127 mm, Test Group 6 is required	Manufacturer to specify
Rated Durability Cycles	The expected number of durability cycles a component is expected to encounter over the course of its life	Connector/ cage: 100 MIN cycles Module: 50 MIN cycles
Mating Force* (See Note 2)	Amount of force needed to mate a module with a connector (with or without the presence of a riding heat sink) when latches are deactivated	60 N MAX
Unmating Force* (See Note 2)	Amount of forced needed to separate a module from a connector (with or without the presence of a riding heat sink) when latches are deactivated	40 N MAX
Latch Retention* (See Note 2)	Amount of force the latching mechanism can withstand	90 N MIN
Cage Latch Strength*	The amount of force that the cage latches can hold without being damaged.	125 N MIN
Cage Retention to Host Board*	Amount of force a cage can withstand without separating from the host board	114 N MIN
Environmental Requirements		
Field Life	The expected service life for a component	10 years
Field Temperature	The expected service temperature for a component (ambient air temperature around the component)	0°C —65°C, applicable to the mated cage, connector, and module only
Electrical Requirements		
Current	Maximum current to which a contact is exposed in use	0.5 A per signal contact MAX 2.2 A per power contact MAX
Operating Rating Voltage	Maximum voltage to which a contact is exposed in use	29.9 V DC per contact MAX

NOTES:
1. Performance criteria denoted with stars (*) are not validated by EIA-364-1000 testing. Refer to Table 7-3 for test procedures and pass/fail criteria.
2. Refer to the QSFP-DD MSA for the interactions of QSFP modules with QSFP-DD connectors and cages.

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Table 7-2 describes the details necessary to perform the tests described in the EIA-364-1000 test sequences. Testing shall be done in accordance with EIA-364-1000 and the test procedures it identifies in such a way that the parameters/ requirements defined in Table 7-1 are met. Any information in this table supersedes EIA-364-1000.

Table 7-2 EIA-364-1000 Test Details

Test	Test Descriptions and Details	Pass/ Fail Criteria
Mechanical/ Physical Tests		
Durability (preconditioning)	EIA-364-09 To be tested with connector, cage, and module (Latches may be locked out to aid in automated cycling)	No evidence of physical damage
Durability (see Note 1)	EIA-364-09 To be tested with connector, cage, and module (Latches may be locked out to aid in automated cycling)	No visual damage to mating interface or latching mechanism
Environmental Tests		
Cyclic Temperature and Humidity	EIA-364-31 Method IV omitting step 7a. Test Duration B	No intermediate test criteria
Vibration	EIA-364-28 Test Condition VII Test Condition Letter D Test set-up: Connectors may be restrained by a plate that replicates the system panel opening as defined in this specification. External cables may be constrained to a non-vibrating fixture a minimum of 8 inches from the module. For cabled connector solutions: Wires may be attached to PCB or fixed to a non-vibrating fixture.	No evidence of physical damage -AND- No discontinuities longer than 1 µs allowed
Mixed Flowing Gas	EIA-364-65 Class II See Table 4.1 in EIA-364-1000 for exposure times. Test option per EIA-364-1000: Option 3	No intermediate test criteria during the EIA-364-65 portion of the EIA-364-1000 Group 4 testing
Electrical Tests		
Low Level Contact Resistance (see Note 2)	EIA-364-23 20 mV DC MAX, 100 mA MAX To include wire termination or connector-to-board termination	20 mΩ MAX change from baseline
Dielectric Withstanding Voltage	EIA-364-20 Method B 300 VDC minimum for 1 minute Applied voltage may be product / application specific	No defect or breakdown between adjacent contacts -AND- 5 mA Max Leakage Current

NOTES:
1. Since the durability requirement on the connector and cage is greater than that of the module, modules may be replaced after their specified durability rating.
2. The first low level contact resistance reading in each test sequence is used to determine a baseline measurement. Subsequent measurements in each sequence are measured against this baseline.

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Table 7-3 describes the testing procedures necessary to validate performance criteria not validated by EIA-364-1000 testing. The tests are to be performed in such a way that the parameters/ requirements defined in Table 7-1 are met.

Table 7-3 Additional Test Procedures

Test	Test Descriptions and Details	Pass/ Fail Criteria
Mechanical/ Physical Tests		
Mating Force (See Note 1)	EIA-364-13 To be tested with cage, connector, and module. Latching mechanism deactivated (locked out).	Refer to Table 7-1 -AND- No physical damage to any components
Unmating Force (See Note 1)	EIA-364-13 To be tested with cage, connector, and module. Latching mechanism deactivated (locked out).	
Latch Retention	EIA-364-13 To be tested with cage, connector, and module without heat sinks Latching mechanism engaged (not locked out)	
Latch Strength	An axial load applied using a static load or ramped loading to the specified load. To be tested with cage, connector, and module or module representative tool without heat sinks Latching mechanism engaged (not locked out).	
Cage Retention to Host Board	Tested with module, a module analog, or fixtures mated to cage. Pull cage in a direction perpendicular to the board at a rate of 25.4mm/min to the specified force.	No physical damage to any components -AND- Cage shall not separate from board
Electrical Tests		
Current	EIA-364-70 Method 3, 30-degree C temperature rise. Contacts energized: All signal and power contacts tested simultaneously.	Refer to Table 7-1 for current magnitude
NOTES: 1. Values listed in Table 7-1 for these tests apply with or without the presence of a riding heat sink.		

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Appendix A. Bezel Panel Cut-Out Recommendations (Informative)

A.1 1x1 Bezel Panel Cut-Out

The recommended bezel panel cut-out for a QSFP2 (QSFP112 or QSFP224) 1x1 cage is shown in Figure A-1. An example of a QSFP2 1x1 bezel design for use with Type 2A & 2B modules is shown in Figure A-2.

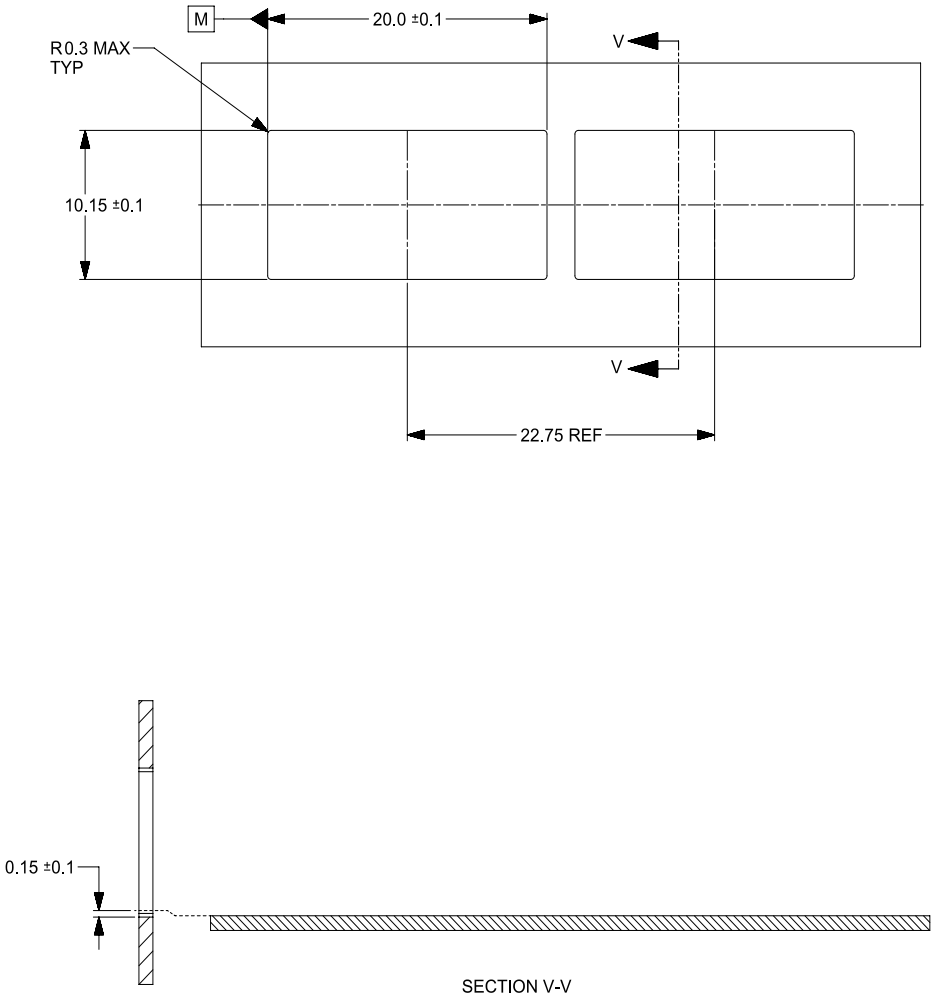

Figure A-1 Recommended QSFP2 1x1 Bezel Panel Cut-Out

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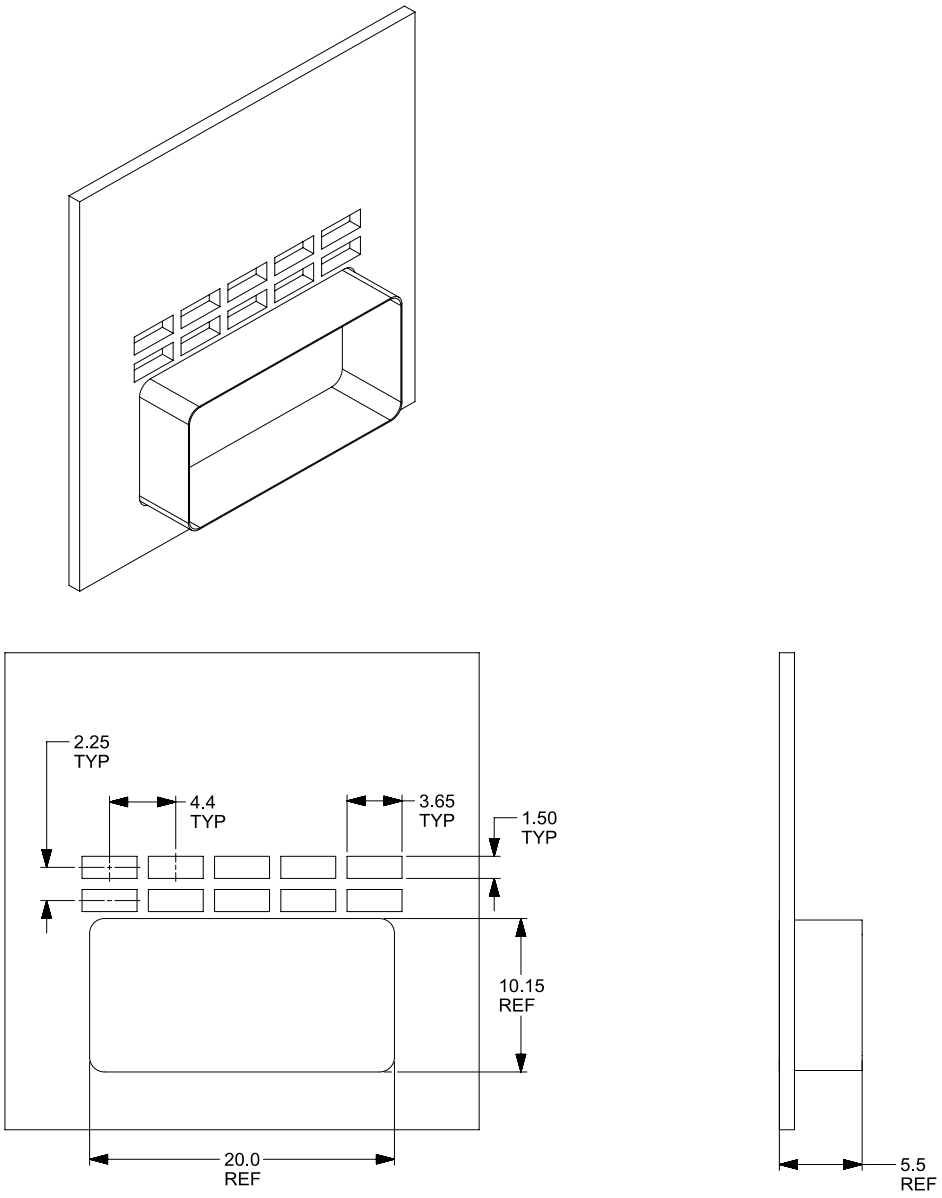

Figure A-2 Example of QSFP2 1x1 Bezel Design for Use with Type 2A & 2B Modules

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A.2 Stacked 2x1 Bezel Panel Cut-Out

The recommended bezel panel cut-out for a QSFP112 2x1 stacked cage is shown in Figure A-3. An example of a QSFP112 2x1 stacked bezel design for use with Type 2A & 2B modules is shown in Figure A-4.

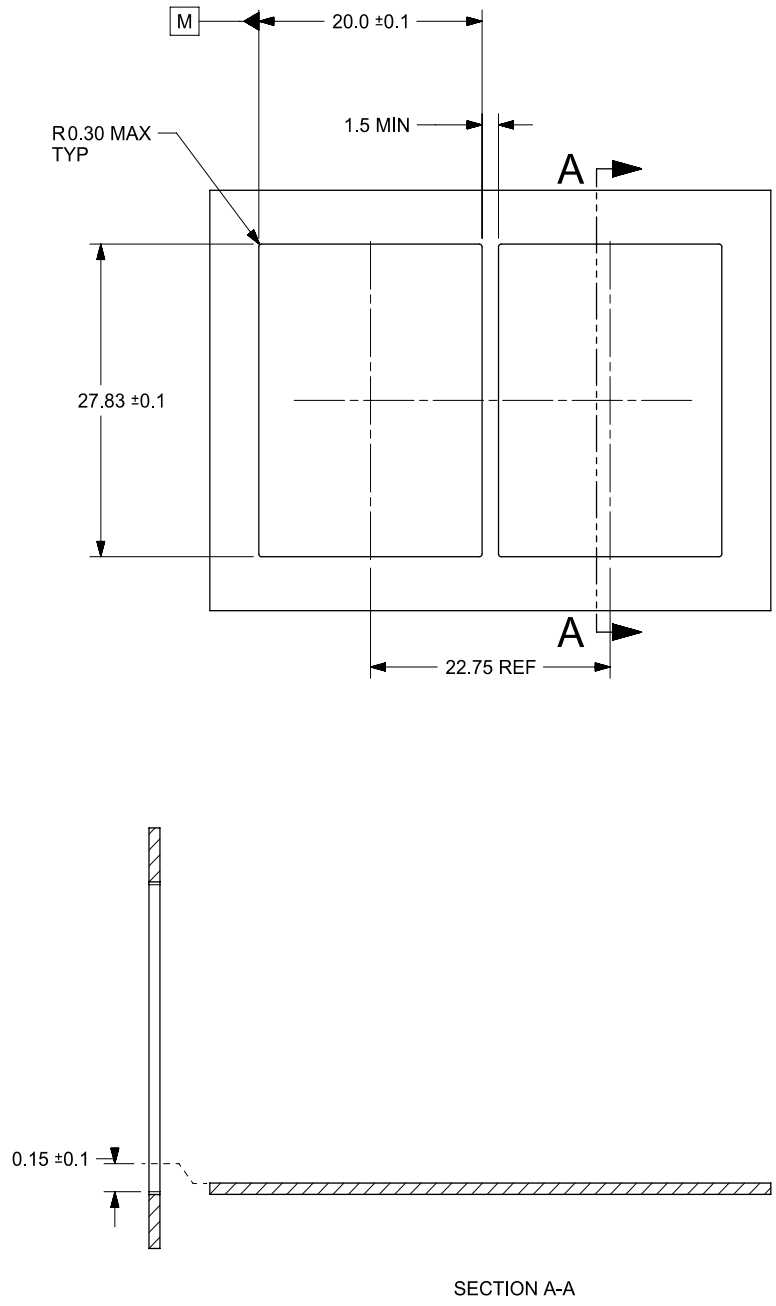

Figure A-3 Recommended QSFP112 2x1 Stacked Bezel Panel Cut-Out

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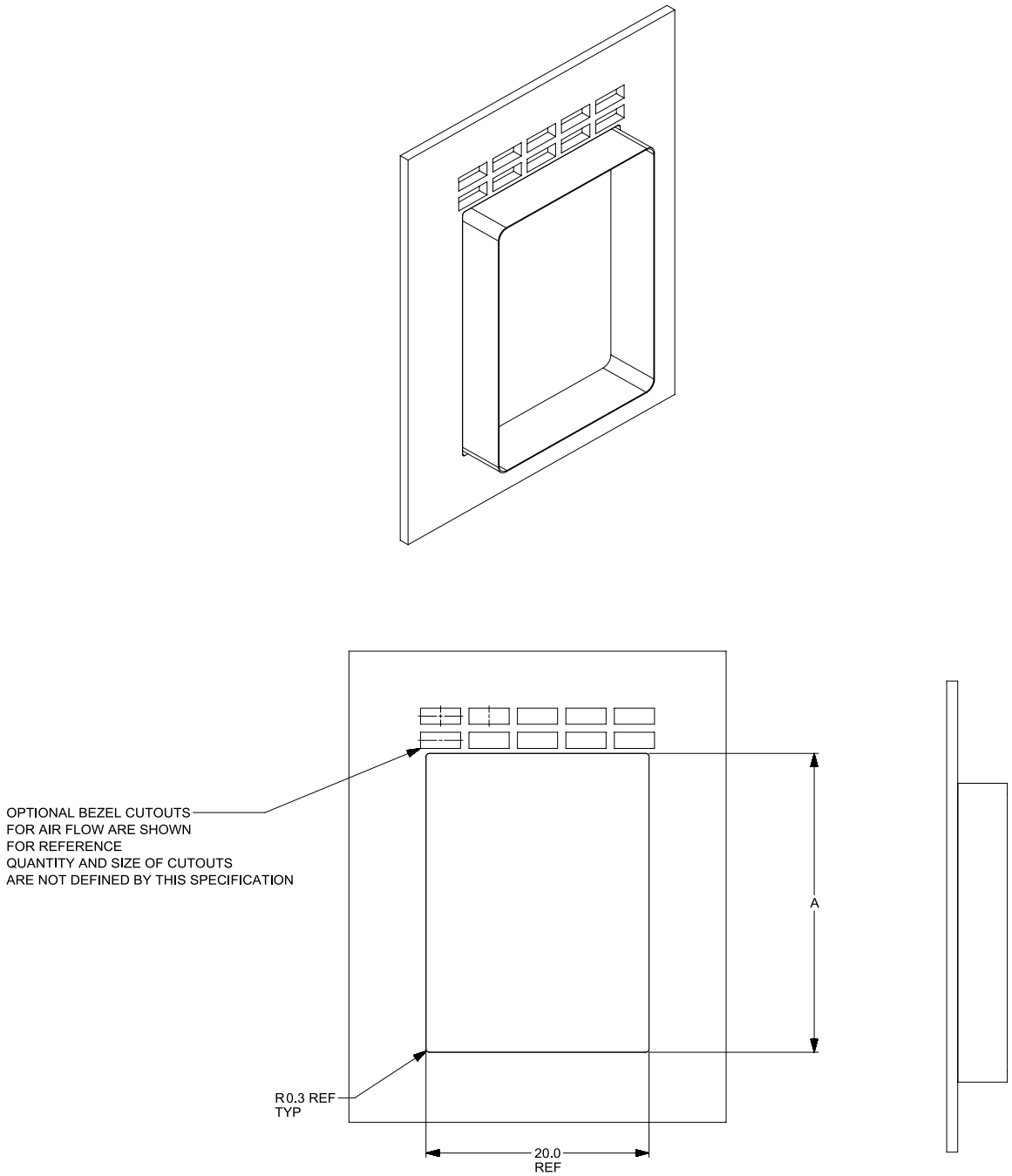

Figure A-4 Example of QSFP112 2x1 Stacked Bezel Design for Use with Type 2A & 2B Modules

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Appendix B. Footprint Pad Assignments

B.1 QSFP112 1x1 Style A & B versus QSFP224 1x1 Footprint Pad Assignments

The recommended pad assignments for QSFP112 1x1 footprint Style A and B versus QSFP224 1x1 footprint are shown in Figure B-1.

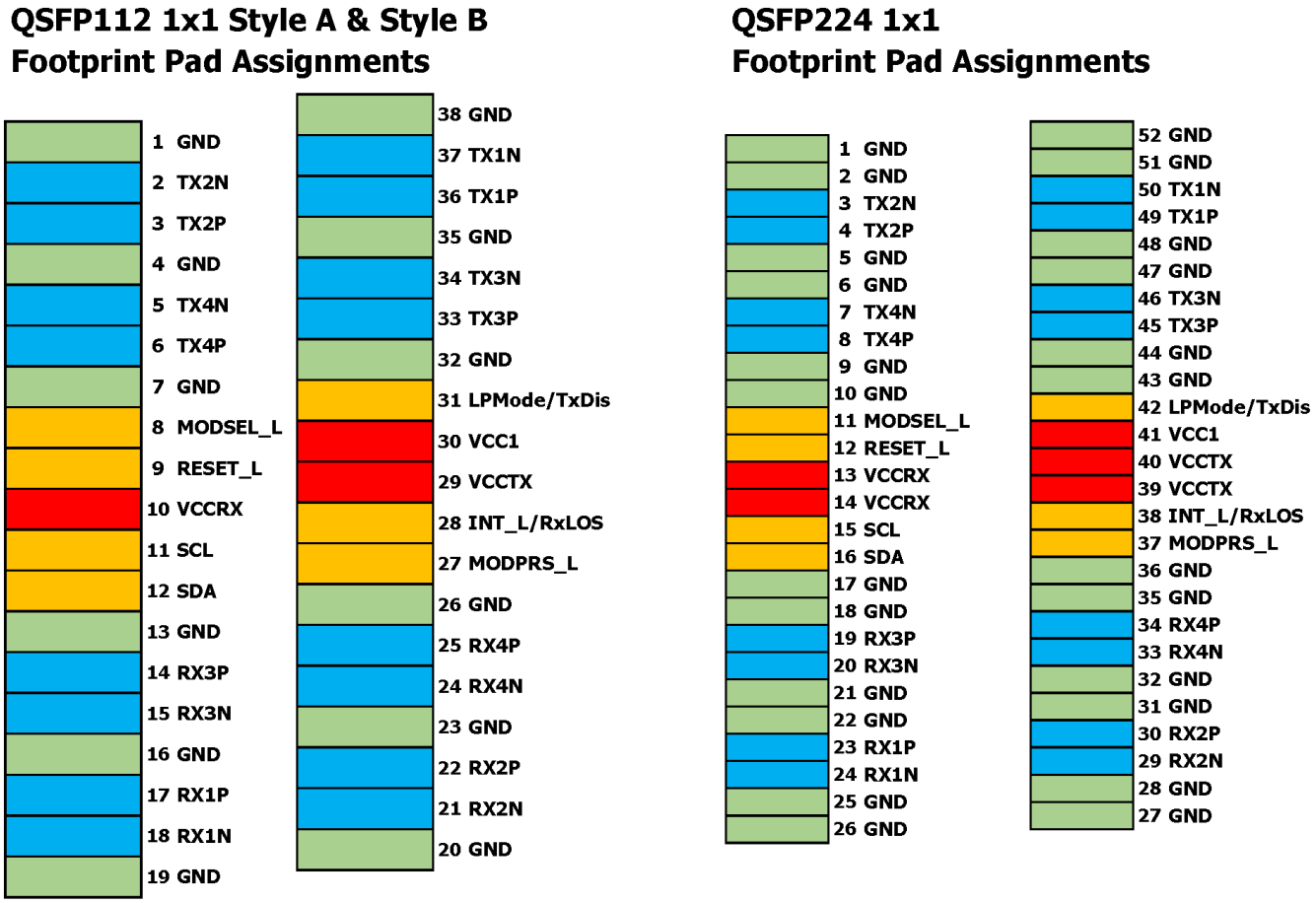

Figure B-1 QSFP112 1x1 Style A & B versus QSFP224 1x1 Footprint Pad Assignments

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Appendix C. Recommended Cage Gauge Plug

C.1 Recommended Cage Gauge Plug for QSFP224 Cages

Here is a sample of a recommended cage gauge plug to be used to position the cage latch tab (cage flap) as it would be in the mated condition in order to obtain a realistic and consistent measurement of the functional distance from the tip of the cage latch tab (cage flap) to Datum T (the cage hard stop for the module).

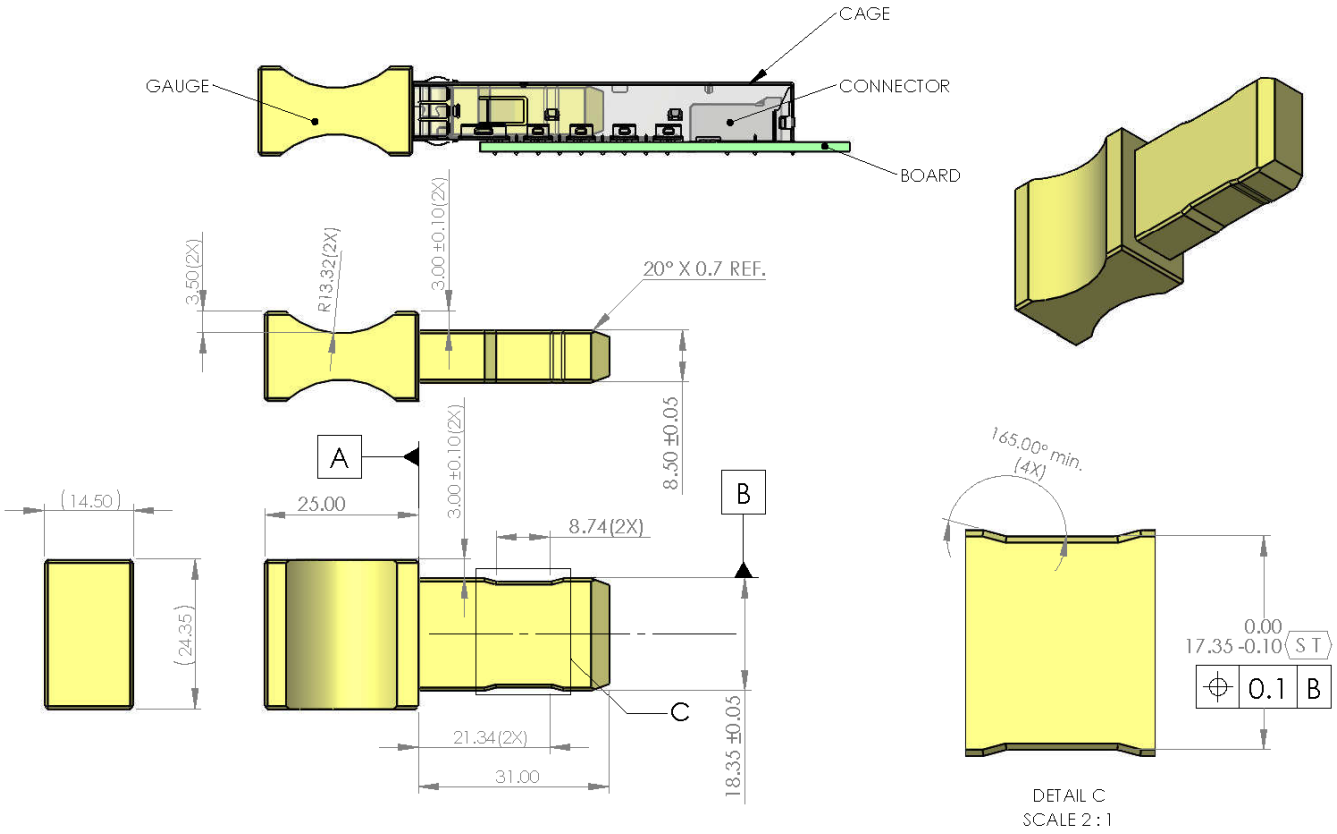

Figure C-1 Recommended Cage Gauge Plug

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