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SFF-8661

Specification for

QSFP+ 4X Module

Rev 2.5 June 22, 2018

Secretariat: SFF TA TWG

Abstract: This specification defines the mechanical specifications for the QSFP+ 4x Module Formfactor.

The mechanical dimensioning allows backwards mechanical compatibility between QSFP+ 4X modules plugged into most QSFP+ cages which have been implemented to SFF-8436. The EMI leakage is expected to be similar to that when QSFP+ modules and cages are mated.

Superior EMI performance can only be expected with mated combinations of modules compliant with this specification and cages compliant with SFF-8663 or SFF-8683.

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.

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Change History

December 28, 2010:
- Section 3:
  - Divided Figure 3-1 into two figures (3-1 and 3-2) and updated titles accordingly
- Section 4:
  - Added "Datum Definitions" table
  - Updated Figure 4-1 with the following changes:
    - Added "Module/Plug" description to top view
    - Added appropriate SFF document reference to each view
    - Extended datum line through all 3 views
    - Replaced "SEE FIGURES 12A AND 12B" WITH "EMI SOLUTION DEPENDENT"
- Section 5:
  - Updated Figure 5-1 with the following changes:
    - Added note triangle 2 to 32 MIN. dimension
    - Added 19 MAX., 13.5 REF., 3.4 MAX. and 1.6 MAX. dimensions
  - Updated Figure 5-2 with the following changes:
    - Added "MAX." and "MIN." to 1.10 / 0.55 dimension (View K-K)
  - Updated Figure 5-3 with the following changes:
    - Replaced SFP+ PCB with QSFP+ PCB
  - Updated description of Figure 5-3
- Section 6:
  - Updated title (previously was Section 7)
  - Replaced Table 7-1 AND 7-2 (SFP+ requirements) with Table 6-1
    - Added text to clarify that connector is included in module insertion/extraction

June 12, 2011:
- Global
  - Removed redundant use of 25G throughout body
  - All references to 25G were replaced by 32 Gb/s
  - Specification Titles updated to current usage
  - Added Table of Contents

January 30, 2012:
- All references to 32 Gb/s were replaced by 28 Gb/s

May 21, 2012:
- Expanded list of Industry Documents

July 7, 2012:
- Figure 5-1 was redrawn
  - Note 4 was clarified
  - Note 9 re higher wattage models added
  - Length of transceiver outside of cage restored to the 20 Max of the MSA

Rev 1.7 (May 22, 2013):
- Corrected title (removed 'Style')

Rev 1.8 (July 29, 2013):
- Identified Datums to be corrected on Figure 4-1, Figure 5-1 and Figure 5-2

Continued on next page

Rev 1.9 (October 16, 2013):
- Replaced Figure 4-1
  - Sidebar shows how Style A and B create a common figure
- Updated Figure 5-1
- Updated Figure 5-2
  - Added Datums D and H to Detail 1
- Revised Table 5-1 (was 6-1) cage retention force from 180N to 125N

Rev 2.0 (February 21, 2014):
- Replaced reference to SFF-8436 with EIA 964 in 2-1
- Replaced figures 4-1, 5-1, 5-2 to improve quality
- Deleted two rows in Table 6-1 that did not apply to the Plug/Module

Rev 2.1 (May 25, 2014):
- Restored two rows in Table 6-1 that should not have been deleted

Rev 2.2 (August 7, 2014):
- Replaced Figure 5-2 (the view of section J-J had the radius 0.05 MIN and the dimension 29.60 REF pointing to the wrong location).

Rev 2.3 (September 13, 2014):
- Removed references to 28 Gb/s

Rev 2.4 (October 3, 2017)
- Updated to SNIA format
- Revised abstract
- Reformatted Change History
- Fixed broken links in Foreword
- Updated applications (Section 1.1)
- Added EIA document references
- Clarified “fixed” and “free” definitions
- All references to “pluggable modules,” “plugs,” or “modules” changed to “module;” added definition for “module”
- Minor editorial issues resolved
- Renamed Figure 3-2
- Corrected table in Figure 4-1
- Clarified chamfer/radius callout in Figure 5-2
- Updated Section 5.3 (Insertion, Extraction, and Retention Forces) to agree with other SFF documents for QSFP

Rev 2.5 (June 22, 2018)
- Minor document number was increased to correct an error in the document numbering history. No other changes were made to this document’s content.

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.

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

During their definition, other activities were suggested because participants in SFF faced more challenges than the form factors. In November 1992, the charter was expanded to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

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

Industry consensus is not a requirement to publish a specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

SFF meets during the T10 (see www.t10.org) and T11 (see www.t11.org) weeks, and SSWGs (Specific Subject Working Groups) are held at the convenience of the participants. Material presented to SFF becomes public domain, and there are no restrictions on the open mailing of the presented material by Members.

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

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

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:
https://ta.snia.org/higherlogic/ws/public/download/47/SFF-8000.TXT

If you wish to know more about the SFF TWG, the principles which guide the activities can be found at:

https://ta.snia.org/higherlogic/ws/public/download/144/8032_028.PDF

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

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FIGURES

TABLES

1. Scope

This specification defines the terminology and mechanical requirements for a QSFP+ 4x module. This specification is also intended to facilitate the implementation of the 1 x "n" ganged and the 2 x "n" stacked cage configurations based on the mechanical form factor defined in this specification.

The need for this specification became evident when it was realized that some QSFP+ modules and cage designs do not meet the needs for the higher data rates. The QSFP+ is an improved transceiver style which has enhanced EMI characteristics when mated with a cage designed for the module. Please note that there are additional cage requirements specified in this document to allow proper function of the modules in application. These improvements make this module suitable for current QSFP+ applications as well as those at higher transfer rates.

1.1 Application Specific Criteria

SAS, InfiniBand, IEEE, and Fibre Channel define respective electrical performance requirements for the transmission of multi-gigabit signals through this interface. When this connector is used for any of these applications, its performance shall meet the requirements of the appropriate standard. This connector shall intermate with previous generations of lower speed QSFP connectors.

1.2 Copyright

1.3 Disclaimer

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

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

2. References

2.1 Industry Documents

- Ethernet IEEE 802.3ba 40G
- Ethernet IEEE 802.3bj 100G
- InfiniBand IBTA QDR/FDR/EDR
- T10 SAS-2.1 (Serial Attached SCSI)
- T10 SAS-3
- T11 FC-PI-5 (Fibre Channel Physical Interface)
- T11 FC-PI-6
- EIA-964 QSFP+ 10 Gb/s 4X Pluggable Transceiver
- SFF-8024 SFF Committee Cross Reference to Industry Product Names
- SFF-8410 High Speed Serial Testing for Copper Links
- SFF-8635 QSFP+ 10 Gb/s 4X Pluggable Transceiver Solution (QSFP10)
- SFF-8662 QSFP+ 28 Gb/s 4X Connector (Style A)
- SFF-8665 QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)
- SFF-8672 QSFP+ 28 Gb/s 4X Connector (Style B)
- SFF-8682 QSFP+ 4X Connector
- SFF-8683 QSFP+ Cage
- SFF-8685 QSFP+ 14 Gb/s 4X Pluggable Transceiver Solution (QSFP14)
- EIA-364-1000 Environmental Test Methodology for Assessing the Performance of Electrical Connectors and Sockets Used in Controlled Environment Applications
- EIA-364-13 Mating and Unmating Forces Test Procedure for Electrical 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 https://ta.snia.org/higherlogic/ws/public/download/47/SFF-8000.TXT

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

2.3 Conventions

The dimensioning conventions are described in ANSI-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.

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

2.4 Definitions

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

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

Alignment guides: Connector features that preposition insulators prior to electrical contact. Other terms sometimes used to describe these features are: guide pins, guide posts, blind mating features, mating features, alignment features, and mating guides

Contact mating sequence: Order of electrical contact during mating/unmating process. Other terms sometimes used to describe this feature are: contact sequencing, contact positioning, make first/break last, EMLB (early make late break) staggered contacts, and long pin / short pin.

Fixed: 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. It is typically used to describe the gender of the mating side of the connector that accepts its mate upon mating. Other common terms are “receptacle,” “female,” and “socket connector.”

Free: 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. It is typically used to describe the gender of the mating side of the connector that penetrates its mate upon mating. Other common terms are "plug” or “module," "male," and "pin connector.”

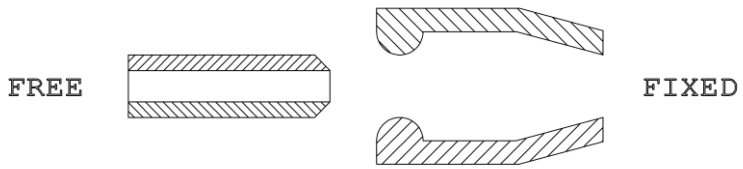


FIGURE 2-1 FIXED AND FREE DEFINITION

Module: In this specification, refers to direct attach copper (DAC), direct attach optics, and pluggable optics.

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.

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. Other common terms are “surface mount technology” or “SMT.”

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. Other common terms are “plated through hole” or “PTH.”

3. General Description

This specification defines the complete mechanical dimensions of the QSFP+ 4x module. This module provides interoperability and EMI control for the QSFP system.

The dimensions for the module are normative.

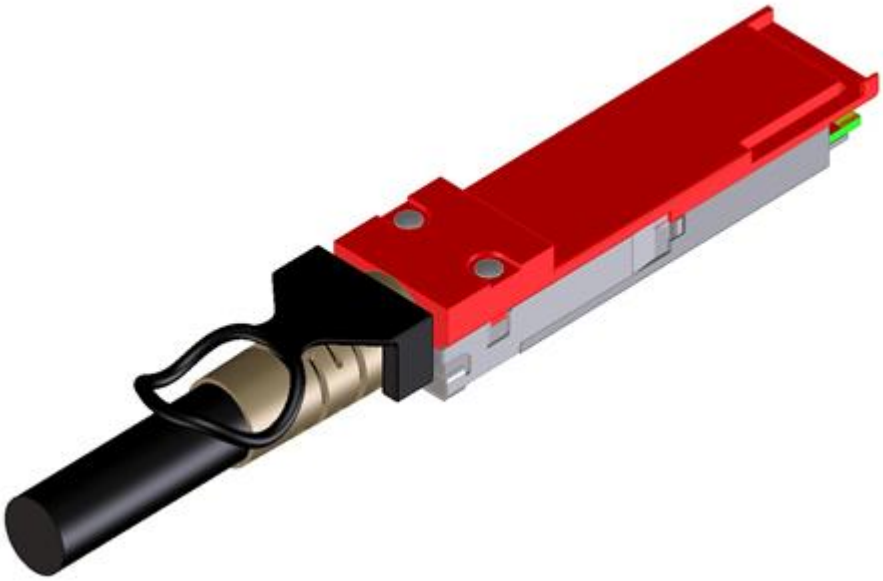


FIGURE 3-1 TYPICAL MODULE WITH COPPER CABLE

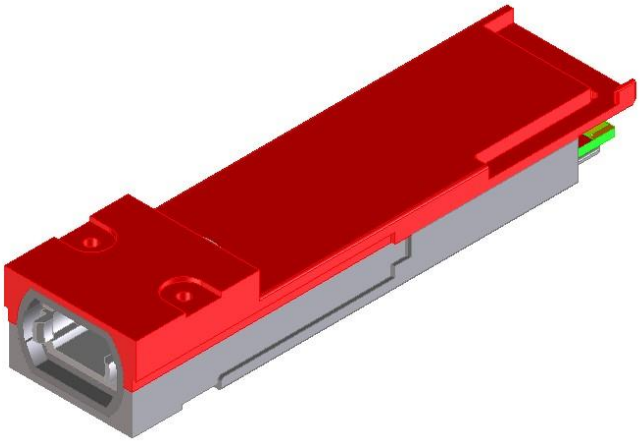
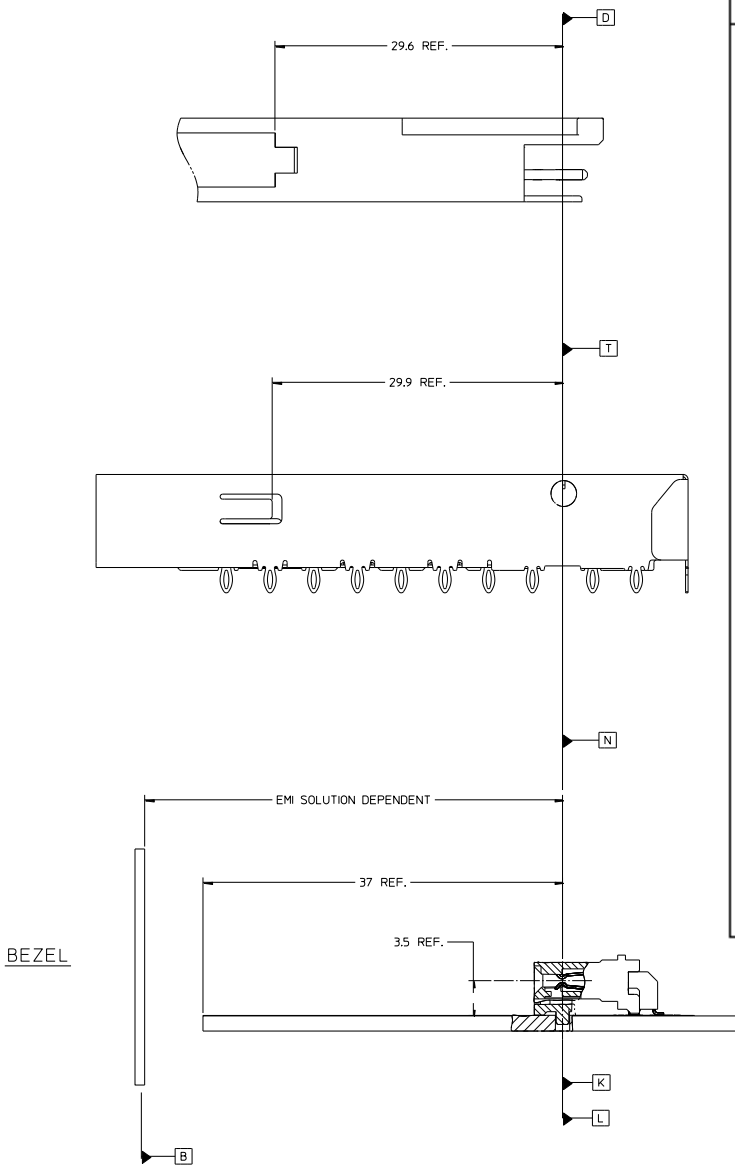


FIGURE 3-2 TYPICAL MODULE (WITHOUT CABLE)

4. Datums



	QSFP10 & QSFP14	QSFP28 (Style A)	QSFP28 (Style B)
MODULE	SFF-8661	SFF-8661	SFF-8661
CAGE	SFF-8683	SFF-8663	SFF-8683
CONNECTOR	SFF-8682	SFF-8662	SFF-8672

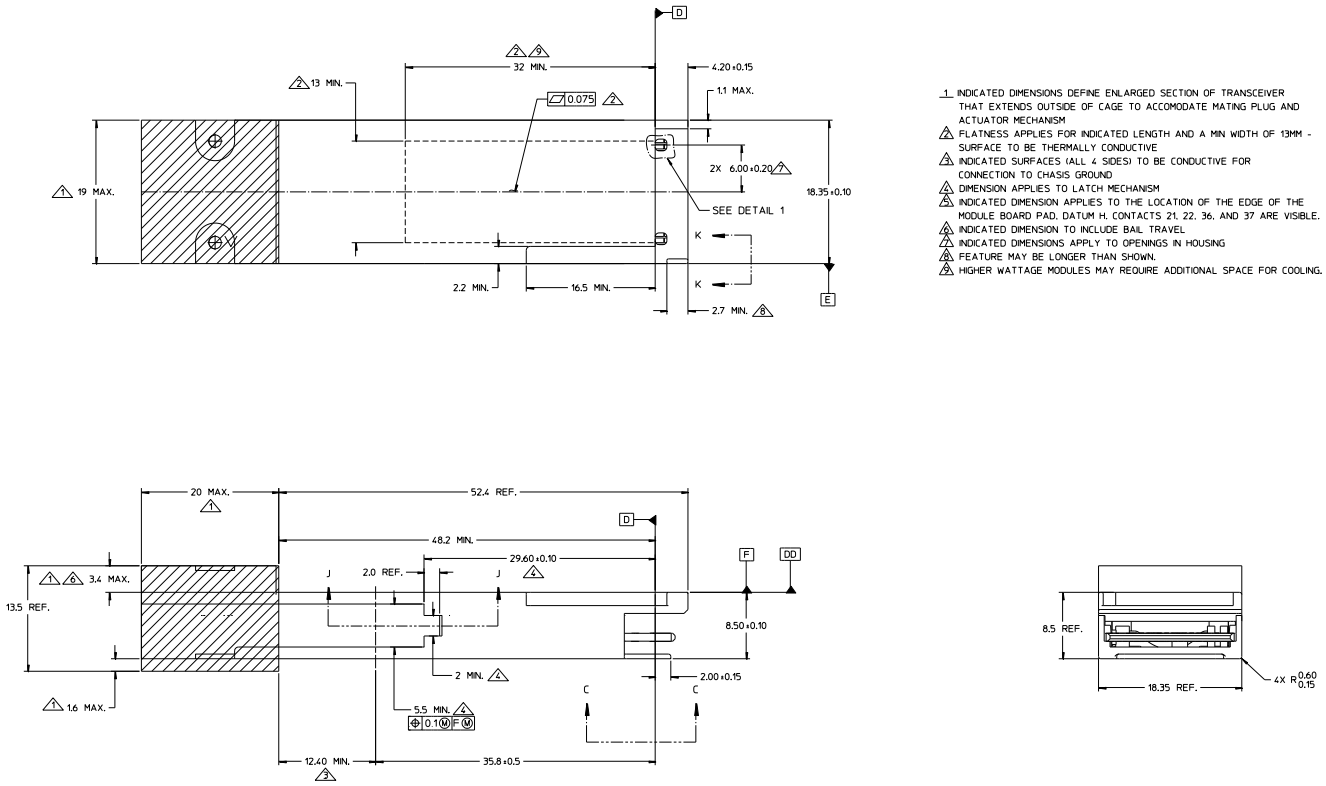
FIGURE 4-1 DATUM DEFINITIONS

TABLE 4-1 DATUM DEFINITIONS

Datum	Description
A	Host board top surface
B	Centerline of bezel
D	*Hard stop on module
E	**Width of module
F	Height of module housing
H	Leading edge of signal contact pads on module PCB
J	Top surface of module PCB
K	*Host board thru hole #1 to accept connector guide post
L	*Host board thru hole #2 to accept connector guide post
N	*Connector alignment pin
T	*Hard stop on cage
AA	**Connector slot width
DD	Top surface of connector backshell
*Datums D, K, L, N and T are aligned when assembled.	
**Centerlines of Datums AA, E and Z are aligned on the same vertical axis.	
***All dimensions shown are in millimeters.	

5. Module Description

5.1 Dimensions



1. INDICATED DIMENSIONS DEFINE ENLARGED SECTION OF TRANSCEIVER THAT EXTENDS OUTSIDE OF CAGE TO ACCOMODATE MATING PLUG AND ACTUATOR MECHANISM
2. FLATNESS APPLIES FOR INDICATED LENGTH AND A MIN WIDTH OF 13MM - SURFACE TO BE THERMALLY CONDUCTIVE
3. INDICATED SURFACES (ALL 4 SIDES) TO BE CONDUCTIVE FOR CONNECTION TO CHASIS GROUND
4. DIMENSION APPLIES TO LATCH MECHANISM
5. INDICATED DIMENSION APPLIES TO THE LOCATION OF THE EDGE OF THE MODULE BOARD PAD. DATUM H. CONTACTS 21, 22, 36, AND 37 ARE VISIBLE.
6. INDICATED DIMENSION TO INCLUDE BAIL TRAVEL
7. INDICATED DIMENSIONS APPLY TO OPENINGS IN HOUSING
8. FEATURE MAY BE LONGER THAN SHOWN.
9. HIGHER WATTAGE MODULES MAY REQUIRE ADDITIONAL SPACE FOR COOLING.

FIGURE 5-1 BASIC VIEWS

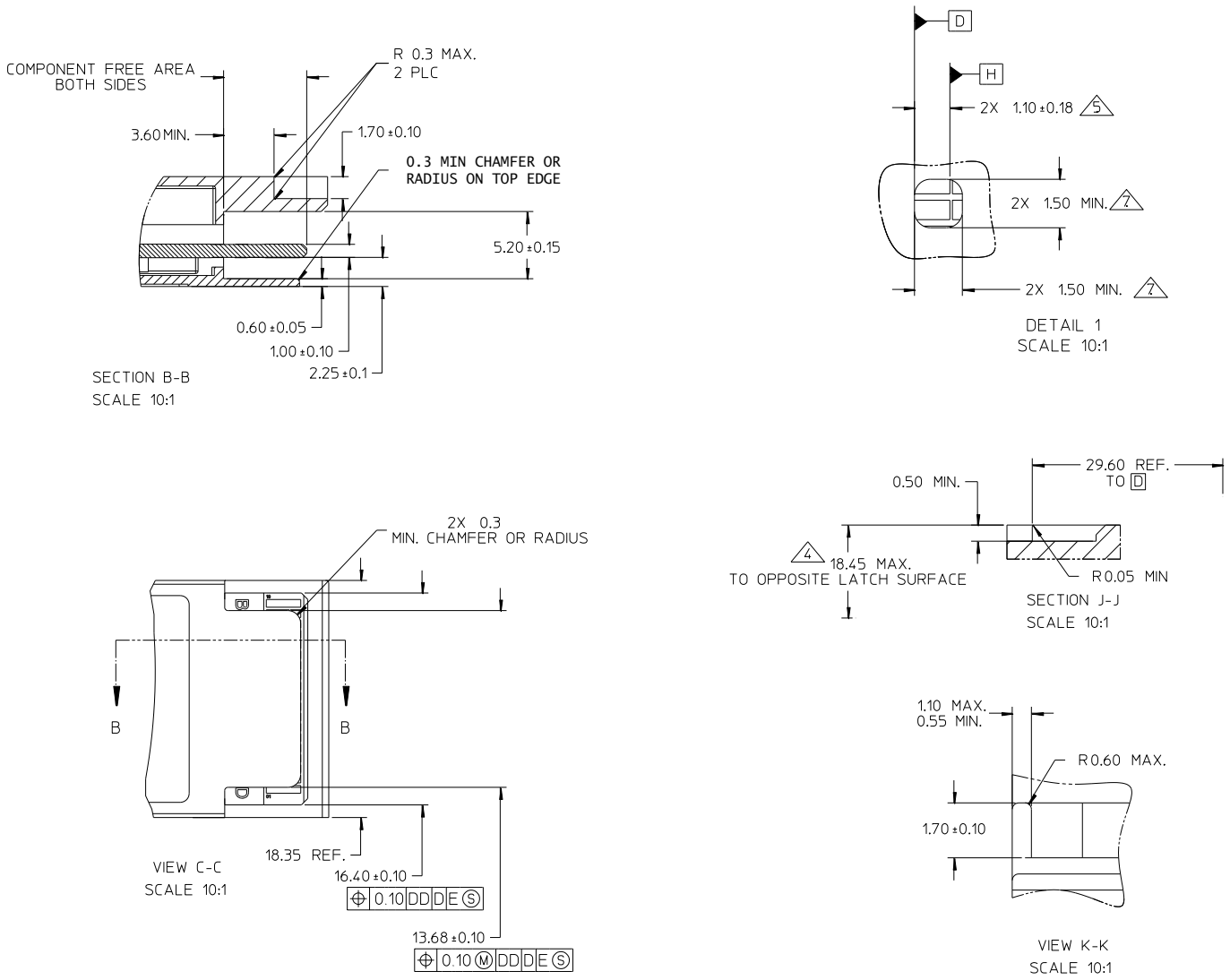


FIGURE 5-2 ENLARGED VIEW OF MODULE

5.2 Electrical Interface

The QSFP+ module contains a printed circuit board that mates with an appropriately designed connector. The pads are designed for a sequence mating:

- First mate: Ground contacts
- Second mate: Power contacts
- Third Mate: Signal contacts

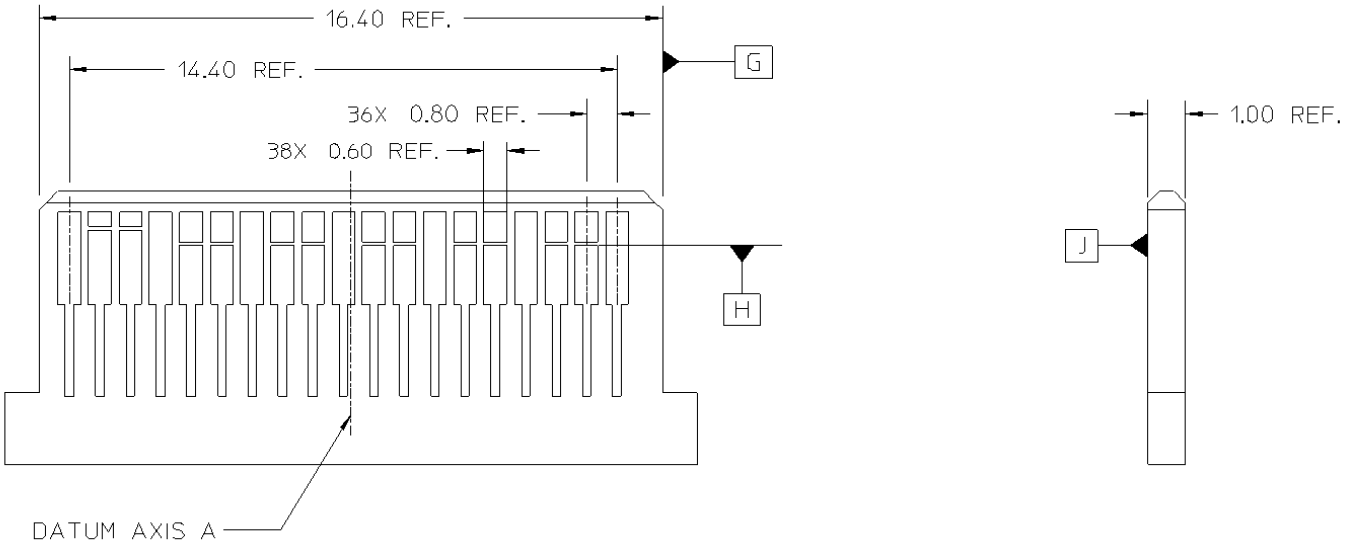


FIGURE 5-3 MODULE ELECTRICAL INTERFACE

Note: View is shown for reference only. See appropriate specfication for dimensional values. Seee the appropriate standard for the pad layout and definitions.

5.3 Insertion, Extraction, and Retention Forces

TABLE 5-1 INSERTION, EXTRACTION, AND RETENTION VALUES

Parameter	Procedure	Requirement[1]
Insertion force	EIA 364-13 Test with connector, cage & module (latch disengaged, without heatsink)	60N MAX
Extraction force	EIA 364-13 Test with connector, cage & module (latch disengaged, without heatsink)	30N MAX
Latch strength	Pull to separate module from cage Test with connector, cage & module (latch engaged)	125N MIN
Bulk cable retention in module[2]	Pull to separate bulk cable from module Test with cable assembly only	90N MIN
Module durability	Test with connector, cage & module as part of TS-1000[3]	50 cycles MIN

NOTES:
1. In addition to the requirements listed, all parts must be free of visible damage after testing.
2. Does not apply to pluggable optical modules.
3. Modules may be replaced every 50 cycles.