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**SFF-8663**

Specification for

**QSFP+ 28 Gb/s Cage (Style A)**

Rev 1.7

October 19, 2017

Secretariat: SFF TA TWG

**Abstract:** This specification defines the mechanical compatibility between this new Cage Formfactor and QSFP+ modules which have been implemented to SFF-8436. The EMI leakage for them 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 cages compliant with this specification or SFF-8683 and modules compliant with SFF-8661.

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

June 11, 2011:

- Global
  - o Removed redundant use of 25G throughout body
  - o All references to 25G were replaced by 32 Gb/s
  - o Specification Titles updated to current usage
- Section 4:
  - o Added "Datum Definitions" table
  - o 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:
  - o Updated Figure 5-1 with the following changes:
    - Rotated entire figure 90 degrees to show views that were cut off the page
    - 18.65 +/- 0.1 dimension was 18.75 +/- 0.1
  - o Updated Figure 5-2 with the following changes:
    - Rotated entire figure 90 degrees to show Detail 1 that was cut off the page
    - Added Note 5 referencing SFF-8662 spec
    - Added reference to SFF-8662 in figure title
  - o Updated Figure 5-3 with the following changes:
    - Rotated entire figure 90 degrees
    - Extended datum line through all 3 views
- Section 6:
  - o Updated title (previously was Section 7)
  - o 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 29, 2011:

- Added Table of Contents
- Added references to figures in Table 4-1

January 30, 2012:

- All references to 32 Gb/s were replaced by 28 Gb/s

Rev 1.0 (May 21, 2012):

- Expanded list of Industry Documents

Rev 1.1 (July 7, 2012):

- Figure 5-1 redrawn
  - o Note 9 re higher wattage models added
- Figure 5-4 redrawn
  - o Re-dimensioned thermal contact area to coincide with opening in top of cage

Rev 1.2 (July 27, 2013):

- Harmonized values of B20/B21 and C02/C03 with SFF-8662
- Identified dimension 10.6 on Figure 5-1 as should be 12.79

## Rev 1.3 (November 18, 2013):

- Replaced Figure 5-1
- Replaced Figure 5-2 and renamed dimension 3
- Deleted Figure 5-3 and associated dimensions
- Changed Table 6-1 Cage retention (Latch strength) to 125N

## Rev 1.4 (February 27, 2014):

- Replaced Figures 4-1, 5-1, 5-2, to improve legibility (highlighted in markup)
- Figure 5-1: revised the original 2 pin rear view, added new 1 pin rear view and a new zero pin rear view to show the pin locations of the pins
- Added dimensions for the rear wall pin locations to figure 5-2 cage footprint with table of dimensions.
- Table 5-1: Added dimension for the single pin version and revised the way the two pin version was dimensioned (the pins were not relocated)
- Removed Fibre Channel PI-5 from section 2-1; QSFP added in PI-6

## Rev 1.5 (April 3, 2014):

- Changed Dimension 21 in Figure 5-1 to include 10X and 11X as well as 12X

## Rev 1.6 (May 23, 2014):

- Added Detail to clarify the tip of latch to Figure 5-1
- Replaced Figure 5-5 with better quality copy - no changes to the figure itself
- Revised Table 6-1 to clarify the test requirements by removing the connector from the cage test as it should not be included in the test.

## Rev 1.7 (October 19, 2017)

- Updated to SNIA format
- Revised abstract
- Reformatted Change History
- Fixed broken links in Foreword
- Added EIA document references
- All references to “pluggable modules,” “plugs,” or “modules” changed to “module”; added definition for “module”
- Updated Section 6 (Insertion, Extraction, and Retention Forces) to agree with other SFF documents for QSFP

## 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](http://www.t10.org)) and T11 (see [www.t11.org](http://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/1211/SFF-8000.xlsx/latest>

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](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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## 1. Scope

This specification defines the terminology and mechanical requirements for a 28 Gb/s cage. This specification is also intended to facilitate the implementation of 1 x "n" ganged cages and the 2 x "n" stacked cage configurations.

The need for this specification became evident when it was realized that QSFP+ cage designs do not meet the needs for the higher data rates. The 28 Gb/s QSFP+ is an improved transceiver style which has tight mechanical tolerances on the module and enhanced EMI characteristics when mated with a cage designed for the 28 Gb/s module. Please note that there are new cage dimensional requirements specified in this document to enable assembly with the 28 Gb/s Mini Multilane connector specified in SFF-8662. These new requirements do not affect the mating compatibility of QSFP+ modules with the new 28 Gb/s cage.

### 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

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### 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-6 (Fibre Channel Physical Interface)
- SFF-8024 SFF Committee Cross Reference Nto Industry Product Names
- SFF-8410 High Speed Serial Testing for Copper Links
- SFF-8661 QSFP+ 28 Gb/s 4X Module (Style A)
- SFF-8662 QSFP+ 28 Gb/s 4X Connector (Style A)
- SFF-8665 QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)
- 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/1211/SFF-8000.xlsx/latest>.

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

### 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:

**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

**Frontshell:** That metallic part of a connector body that directly contacts the backshell or other shielding material that provides mechanical and shielding continuity between the connector and the cable media. Other terms sometimes used to describe this part of a cable assembly are: housing, nosepiece, cowling, and metal shroud.

**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.

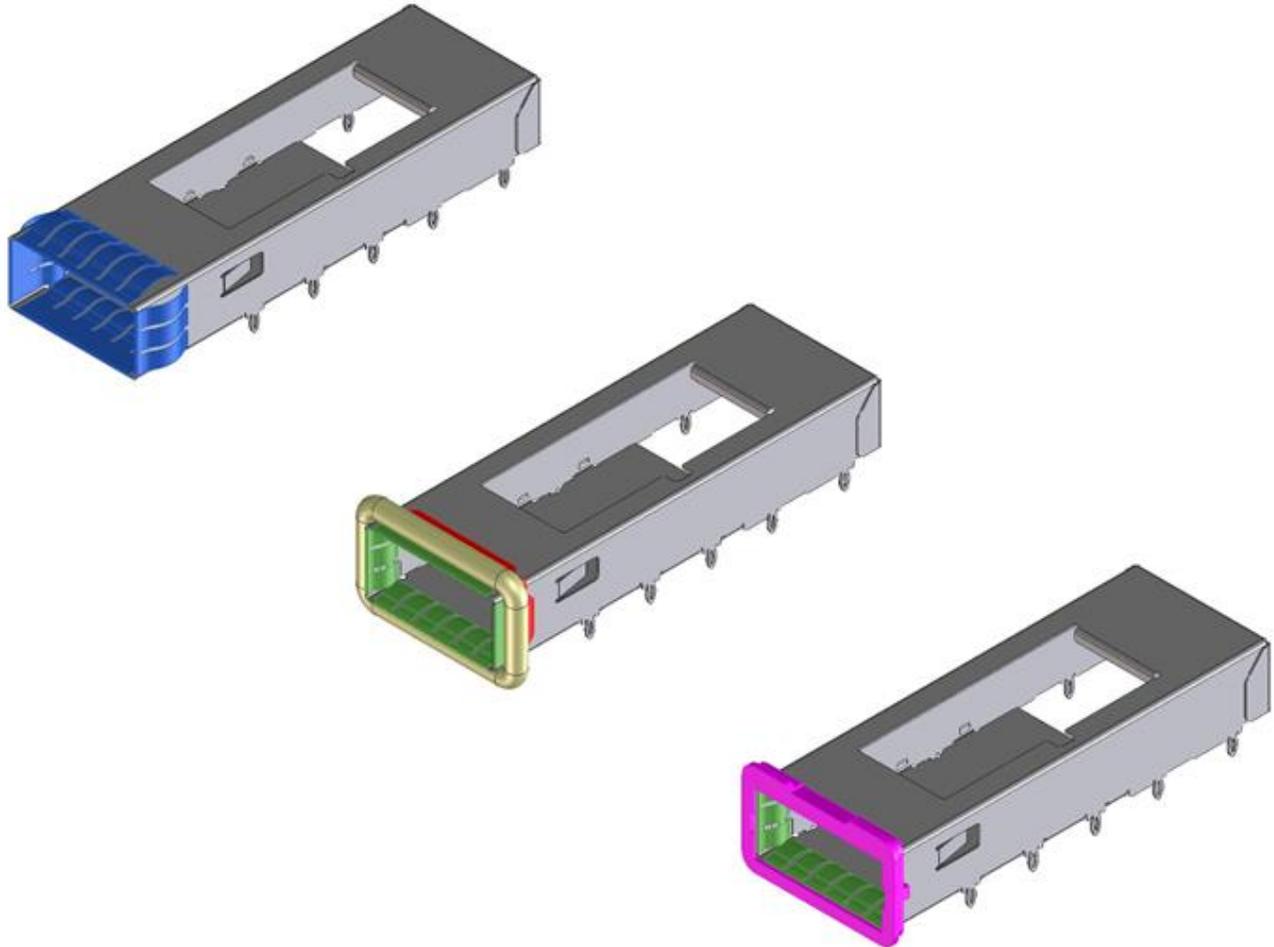
**Surface mount:** A connector design and a printed circuit board design style where the connector termination points do not penetrate the printed circuit board and are subsequently soldered to the printed circuit board

**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.

### 3. General Description

This specification defines the complete mechanical dimensions of the 28 Gb/s QSFP+ cage. This cage system provides several implementation alternatives in terms of interoperability and EMI control that provide the increased data rate capability required for 28 Gb/s applications.

The dimensions for the module are normative.



**FIGURE 3-1 TYPICAL SPRING FINGER, ELASTOMERIC GASKET & BEHIND THE BEZEL CAGES**

NOTE: Cages shown with optional opening in the top to accept a heat sink.

4. Datums

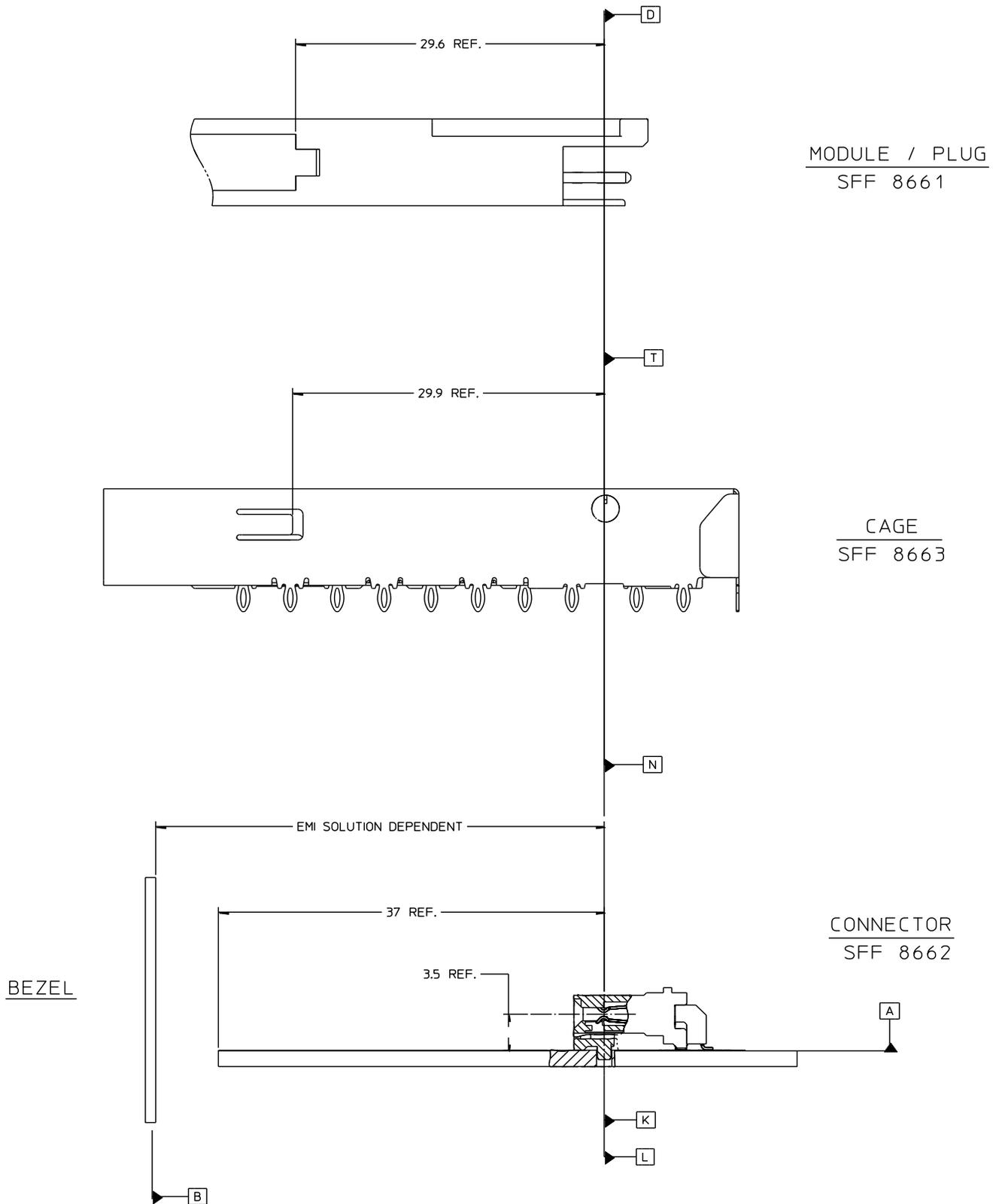


FIGURE 4-1 DATUM DEFINITIONS

NOTE: Shown in conjunction with SFF-8661 & SFF-8662.

TABLE 4-1 DATUM DESCRIPTIONS

Datum	Description
A	Host Board Top Surface
B	Inside Surface of bezel
C	**Distance between Connector housing pegs on host board
D	*Hard stop on Module
K	*Host board thru hole #1 to accept connector guide post
L	*Host board thru hole #2 to accept connector guide post
M	**Width of bezel cut out
N	*Connector alignment pin
P	**Width of inside of cage at EMI gasket (when fully compressed)
R	Height of inside of cage at EMI gasket (when fully compressed)
S	Seating plane of cage on host board
T	*Hard stop on cage
W	Seating surface of the heat sink on the cage
X & Y	Host board horizontal and depth datums established by customer's fiducials
Z	**Width of heat sink surface that fits into clip
CC	Length of boss on heat sink that fits inside of the cage
<p>All dimensions shown are in millimeters.            *Datums D, K, L, N and T are aligned when assembled.            **Centerlines of datums C, M, P and Z are aligned on the same vertical axis.</p>	

5. Cage Dimensions

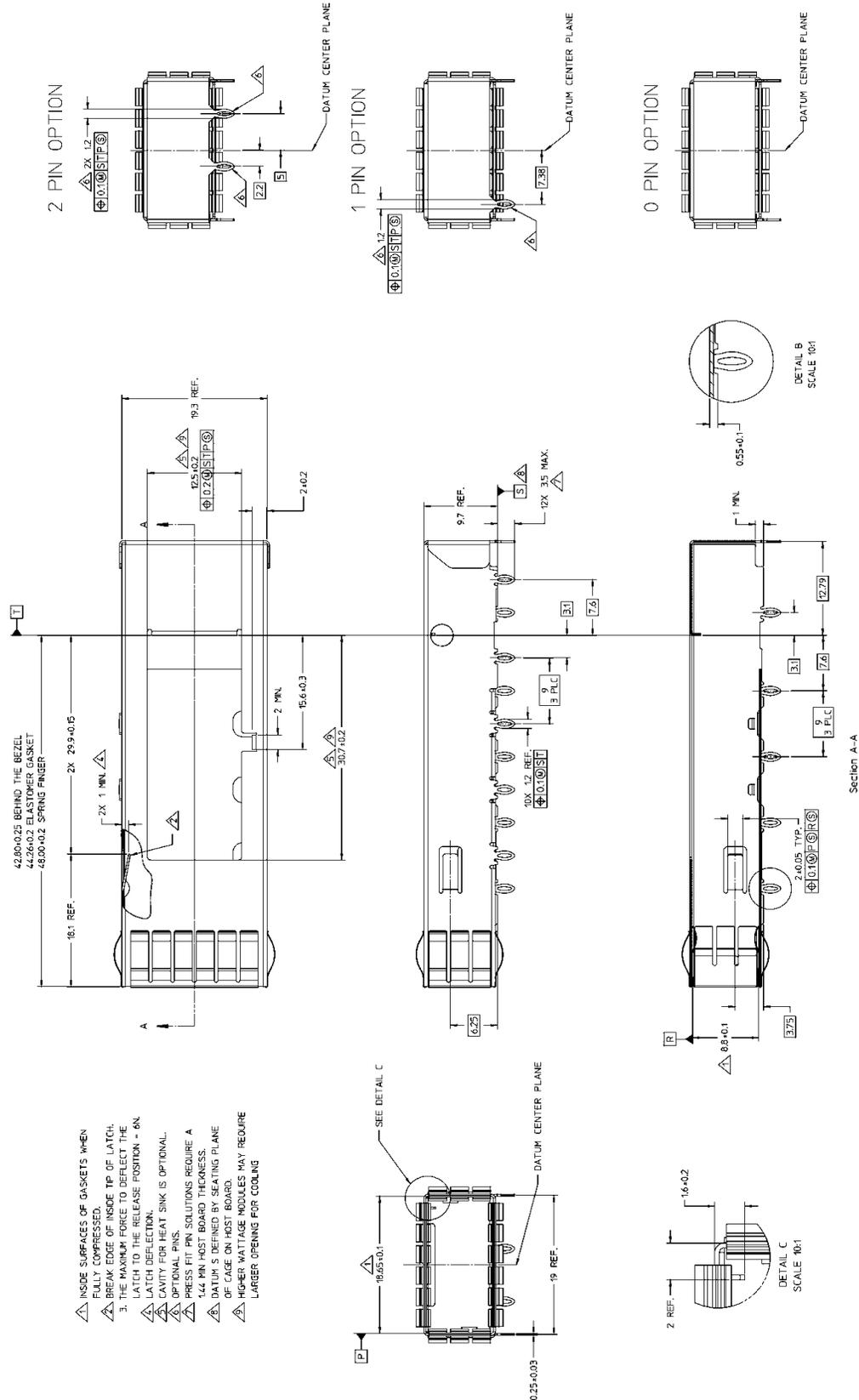


FIGURE 5-1 CAGE DIMENSIONS (1 OF 2)

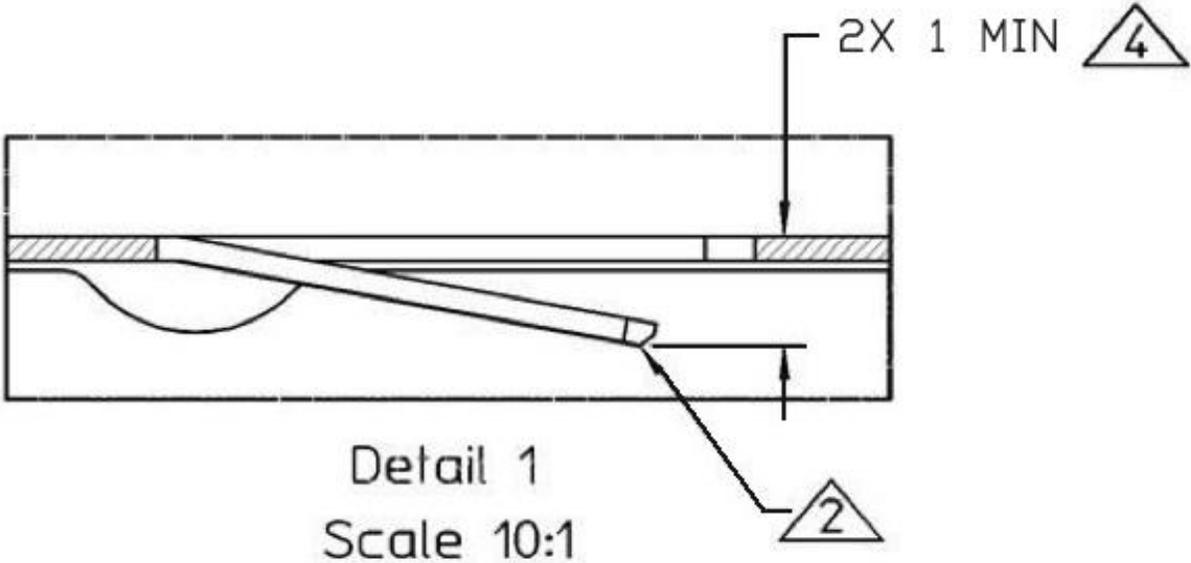
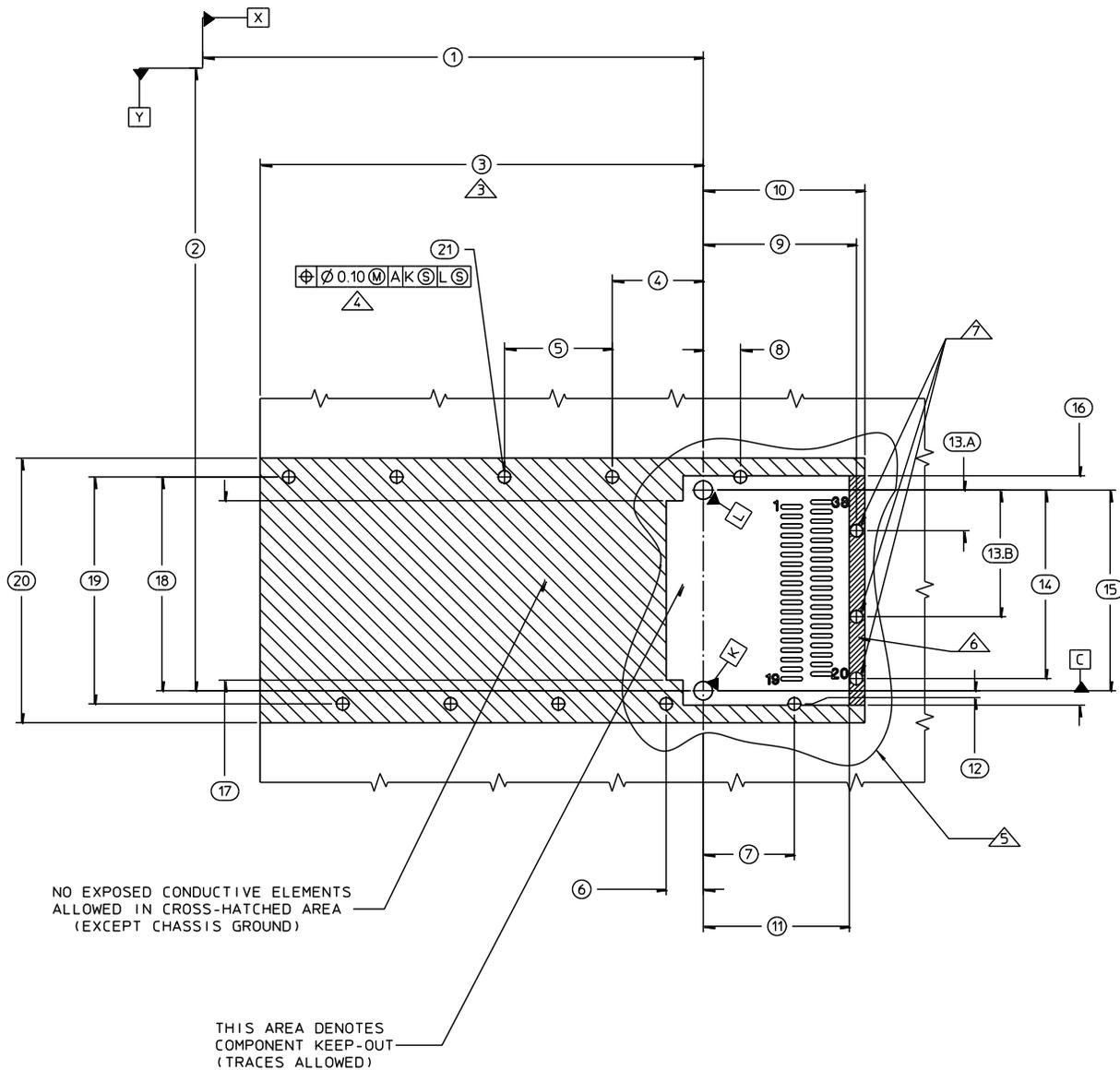


FIGURE 5-2 CAGE DIMENSIONS (2 OF 2)



- NOTES
1. DATUM X & Y ARE ESTABLISHED BY THE CUSTOMER'S FIDUCIAL
  2. DATUM A IS THE TOP SURFACE OF THE HOST BOARD
- △ LOCATION OF THE EDGE OF PCB IS APPLICATION SPECIFIC
  - △ FINISHED HOLE SIZE
  - △ REFER TO SFF8662 FOR CONNECTOR FOOTPRINT DIMENSIONS
  - △ SURFACE TRACES PERMITTED WITHIN THIS SHADED AREA
  - △ INDICATED HOLES ARE OPTIONAL (SEE TABLE FOR COMPLIANT PIN CONFIGURATION)

	# OF REAR PINS			
OPTION 1	2	13.A	13.B	N/A
OPTION 2	1	N/A	N/A	14
OPTION 3	0	N/A	N/A	N/A

FIGURE 5-3 CAGE FOOTPRINT

TABLE 5-1 CAGE FOOTPRINT DIMENSIONS

Designator	Description	Dimension	Tolerance
1	Fiducial to Datum L/K	System	Basic
2	Fiducial to Datum C	System	Basic
3	Datum L/K to End of the Host PCB	37.00	Max
4	Datum L/K to Cage Pin PF Pin Hole Diameter	7.60	Basic
5	Datum L/K to Cage Pin PF Pin Hole Diameter	9.00(6x)	Basic
6	Datum L/K to Cage Pin PF Pin Hole Diameter	3.10	Basic
7	Datum L/K to Cage Pin PF Pin Hole Diameter	7.60	Basic
8	Datum L/K to Cage Pin PF Pin Hole Diameter	3.10	Basic
9	Datum L/K to Cage Pin PF Pin Hole Diameter	12.79	Basic
10	Datum L/K to Outside Edge of Shaded Area	13.49	Min
11	Datum L/K to Inside Edge of Shaded Area	12.49	Max
12	Datum C to Side of Component Free Area	1.10	Basic
13.A	Datum L to rear Cage PF Pin Hole (2 Pin Option)	3.40	Basic
13.B	Datum L to rear Cage PF Pin Hole (2 Pin Option)	10.60	Basic
14	Datum L to rear Cage PF Pin Hole (1 Pin Option)	15.78	Basic
15	Distance between Datum L and Datum K	16.80	Ref
16	Width of Component Free Area	19.20	Max
17	Width of Component Free Area	15.02	Max
18	Datum C to Row of Cage Pins	17.90	Ref
19	Side to Side between Cage Pin Holes	19.00	Basic
20	Cage Footprint Width	22.15	Min
21	Diameter of Cage PF Pin Holes (10X, 11X, 12X)	1.05	+/-0.05

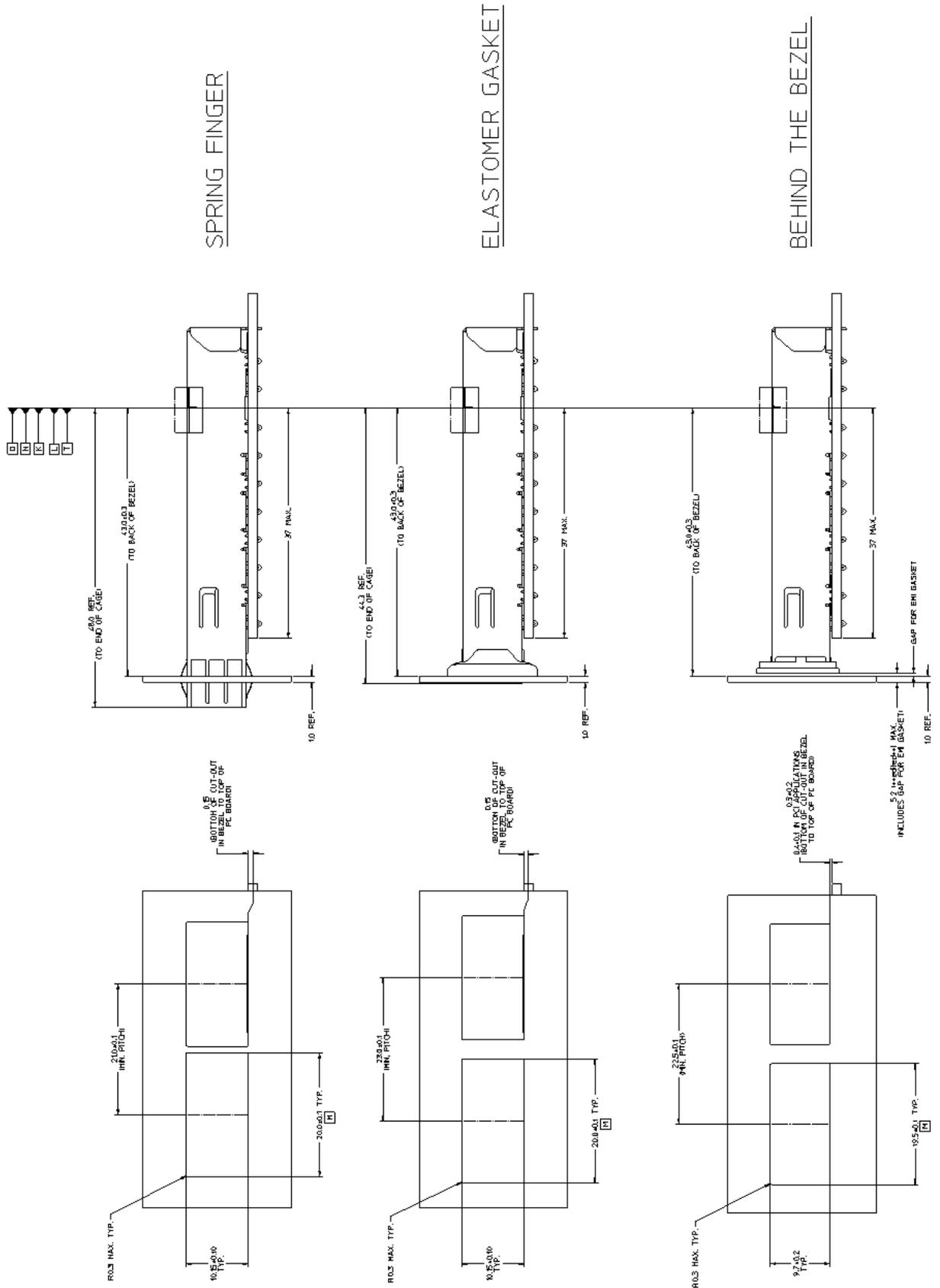
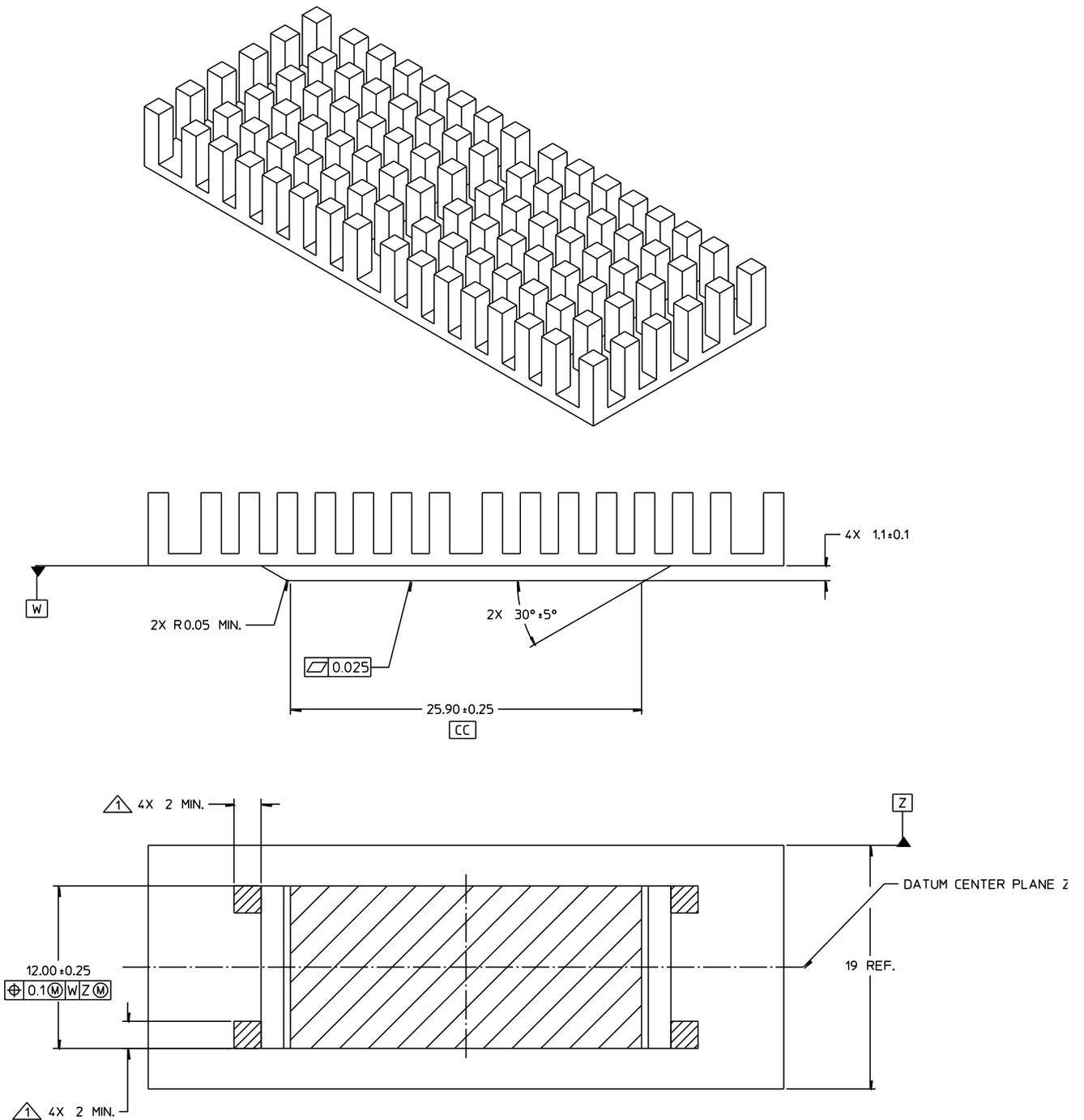


FIGURE 5-4 CAGE TO BEZEL DIMENSIONING AND BEZEL OPENINGS FOR SINGLE CAGE



- 1. PLANE FOR FLATNESS AND HEIGHT MEASUREMENTS ESTABLISHED AT FOUR INDICATED AREAS
- 2. ALL OTHER DIMENSIONS ARE PER MANUFACTURER DESIGN

**FIGURE 5-5 TYPICAL HEAT SINK CONFIGURATION**

## 6. Insertion, Extraction, and Retention Forces

**TABLE 6-1 INSERTION, EXTRACTION, AND RETENTION FORCES FOR CAGE**

Parameter	Procedure	Requirement <sup>1</sup>
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
Cage retention in host board	Manufacturer specified test to vertically pull cage off board	114N MIN
Cage durability	Test with connector, cage & module as part of TS-1000 <sup>2</sup>	100 cycles MIN
NOTES: 1. In addition to the requirements listed, all parts must be free of visible damage after testing. 2. Modules may be replaced every 50 cycles.		