SFF-8614

Specification for

Mini Multilane 4/8X Shielded Cage/ Connector (HDsh)

Rev 3.5 July 10, 2023

SECRETARIAT: SFF TA TWG
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The description of the connector in this specification does not assure that the specific component is available from connector suppliers. If such a connector is supplied, it should comply with this specification to achieve interoperability between suppliers.

ABSTRACT: This specification defines the physical interface and general performance requirements for the Mini Multilane connector, which is designed for use in high speed serial, interconnect applications at multi-gigabit speeds. This connector is popularly referred to as the Mini-SAS HD (High Density) Connector system.

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Foreword

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

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

Revision History

Note: Document revision numbers were not included in the revision history for all earlier versions of this document. In these instances, only the revision date is included in the history. Revision history for versions published before November 5, 2010 is not available.

November 5, 2010:

- Sorted dimension designators to alphabetic order for all figures
- Changed Figure 5.1: from 18.01 to 18.00 and from 0.86 to 0.88
- Changed TR01 from 15.61 to 15.46
- Changed R03 from 10.50 to 10.43
- Changed R04 from 1.25 to 1.18
- Changed R07 from 1.95 to 1.80
- Changed R08 from 22.25 Min to 22.10 +/- 0.15
- Changed P01 from 3.75 to 3.00
- Changed P02 from 5.50 to 4.75
- Changed P03 from 14.25 to 13.50
- Changed P04 from 16.00 to 15.25
- Changed P05 from 24.75 to 24.00
- Changed P06 from 26.50 to 25.75
- Changed P15 from 14.22 to 13.24
- Changed P16 from 12.59 to 11.62
- Changed P17 from 2.80 to 2.05
- Changed P18 from 1.17 to 0.42

November 19, 2010:

- Dimension values replaced with dimension designators on Datums figure
- Changed P06 from 25.25 to 25.75
- Added P10 as 'application specific'

December 7, 2010:

- Changed title to 'Shielded 8/4 Channel for 6 Gbs Applications'

Rev 2.5 *January 11, 2011*:

- Changed R07 from 1.80 to 1.70
- Changed N03 from 2.15 to 2.25
- Changed A11 from 0.105 +/- 0.025 to 0.10 +/- 0.05
- Added note to G11 to clarify contact zone
- Title added for Section 8.1

Rev 2.8 *May 5, 2011:*

- Changed title to 'Mini Multilane 12 Gbs 4/8X Shielded Connector'
- Expanded notes on Plug Latch figure
- Added Datum E, hard stop text and updated description on Plug EMI figure
- Added notes to 8X Plug figure

Rev 2.9 *August 9, 2012:*

- Editorial revision to adopt latest template
- Removed electrical performance requirements specified by the using interface
- Simplified titling of sections, figures, and tables
- Replaced double drawings of Figure 2-1
- Sections made consistent between SFF-8643 and SFF-8644

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Rev 3.0 *April 22, 2013:*
- Adopt editorial convention of Gb/s
- Title change for commonality in style with QSFP

Rev 3.1 *May 29, 2014:*
- Added plug versions to Table 3-1
- Renamed B20 as 'Snout Groove Lead-in Width'
- Corrected the descriptions of G17-G24
- Renamed H01 as 'Cage Attachment Hole Diameter'
- Changed use of 'nut' to 'fastener' throughout Section 6.3
- Removed the M2 location notes from Figures 6-7, 6-8, 6-9
- Table 8-3 revised
    - Expanded plug only Mating/Un-mating descriptions
    - Changed mating force requirement from 150 to 60N maximum
    - Added Latched Plug Pullout Force of 75N minimum
    - Added Primary Key Withstand Force Strength of 70N minimum
    - Added test criteria notes

Rev 3.2 *June 11, 2014:*
- G20 changed to 1.12 MIN

Rev 3.3 *August 4, 2014:*
- Completed revisions agreed to in the SSWG
    - Deleted test criteria notes
    - Blocking key withstand force removed
    - Added cautionary note to Figures 6-7, 6-8, 6-9 regarding choice of attachment screw length
    - Changed Mating Force from 60N to 62N in Table 8-3

Rev 3.4 *September 22, 2014:*
- This specification created with the connector content removed from SFF-8644

Rev 3.5 *July 10, 2023:*
- Converted to new document template
- Added several missing document references to Section 2.1
- Added SMT footprint option in Section 5.4
- Added drawings for the SMT footprint in Section 5.4.2
- Added dimension values to Table 5-6
- Added tolerances for the following dimensions: V11, V12, V30, V31, V38, V62, and V63
- Filled in missing reliability information in Section 8.1
- Added "Manufacturer to specify" to vibration & mechanical shock tests in Table 8-2 and Table 8-3

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1. Scope

This specification defines the Mini Multilane shielded cable plug, the shielded host board receptacle, and the latching requirements for them based upon the mating interface defined herein.

2. References and Conventions

2.1 Industry Documents

The following documents are relevant to this specification:

- ASME Y14.5 Dimensioning and Tolerancing
- EIA-364-09 Durability Test Procedure for Electrical Connectors and Contacts
- EIA-364-13 Mating and Unmating Force Test Procedure for Electrical Connectors and Sockets
- EIA-364-20 Dielectric Withstanding Voltage Test Procedure for Electrical Connectors, Sockets and Coaxial Contacts
- EIA-364-23 Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets
- EIA-364-27 Mechanical Shock (Specified Pulse) Test Procedure for Electrical Connectors and Sockets
- EIA-364-28 Vibration Test Procedure for Electrical Connectors and Sockets
- EIA-364-31 Humidity Test Procedure for Electrical Connectors and Sockets
- EIA-364-32 Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets
- EIA-364-65 Mixed Flowing Gas Test Procedure for Electrical Connectors and Sockets
- EIA-364-70 Temperature Rise Versus Current Test Procedure for Electrical Connectors and Sockets
- EIA-364-1000 Environmental Test Methodology for Assessing the Performance of Electrical Connectors and Sockets Used in Controlled Environment Applications
- INCITS 519 SAS-3 (Serial Attached SCSI 3)
- INCITS 534 SAS-4 (Serial Attached SCSI 4)
- SFF-8410 High Speed Serial Testing for Copper Links
- SFF-8643 Mini Multilane 4/8X 12 Gb/s Unshielded Connector (HD12un)
- SFF-8644 Mini Multilane 4/8X 12 Gb/s Shielded Connector (HD12sh)
- SFF-8673 Mini Multilane 4/8X 24 Gb/s Unshielded Connector (HD24un)
- SFF-8674 Mini Multilane 4/8X 24 Gb/s Shielded Connector (HD24sh)

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 will be welcome, they should be submitted to https://www.snia.org/feedback.

Copies of SAS standards may be obtained from the International Committee for Information Technology Standards (INCITS) (https://www.incits.org).

Copies of ASME standards may be obtained from the American Society of Mechanical Engineers (https://www.asme.org).

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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.

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

3. Keywords, Acronyms, and Definitions

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

3.1 Keywords

May/ may not: Indicates flexibility of choice with no implied preference.

Optional: 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.

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.

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.

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3.2 Acronyms and Abbreviations

HDsh: Mini Multilane x/8X Shielded Cage/ Connector
PCB: Printed Circuit Board
PF: Press Fit
PTH: Plated Through Hole
NPTH: Non-plated Through Hole
SMT: Surface Mount Technology

3.3 Definitions

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.

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

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 (AOC), an optical transceiver, or a loopback.
Plug: A term used to describe the connector that contains the penetrating contacts of the connector interface as shown in Figure 3-1. Plugs typically contain stationary contacts. Other common terms include male, pin connector, and card edge.

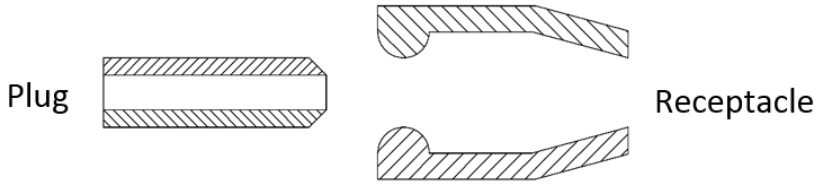

Figure 3-1 Plug and Receptacle Definition

Plated through hole termination: A term used to describe a termination style in which rigid pins extend into or through the PCB. Pins are soldered to keep the connector or cage in place. Other common terms are through hole or PTH.

Press fit: A term used to describe a termination style in which collapsible pins penetrate the surface of a PCB. Upon insertion, the pins collapse to fit inside the PCB's plated through holes. The connector or cage is held in place by the interference fit between the collapsed pins and the PCB.

Receptacle: A term used to describe the connector that contains the contacts that accept the plug contacts as shown in Figure 3-1. Receptacles typically contain spring contacts. Other common terms include female and socket connector.

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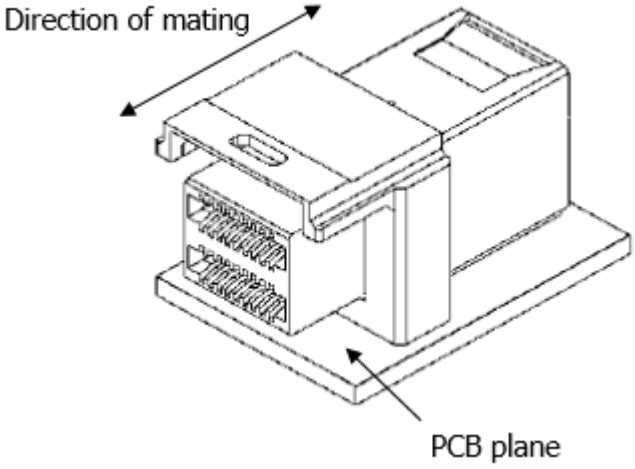
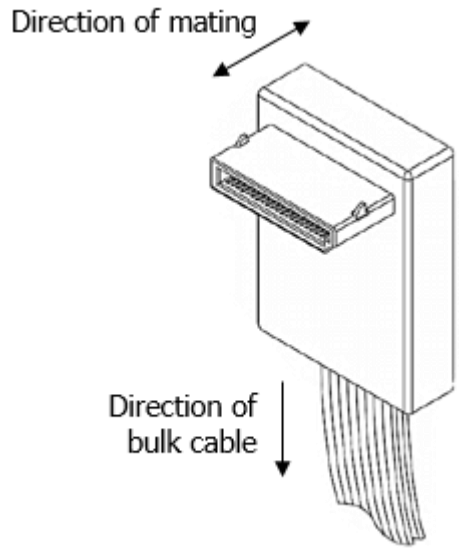
Right Angle: A term used to describe either a connector design where the mating direction is parallel to the plane of the printed circuit board upon which the connector is mounted or a cable assembly design where the mating direction is perpendicular to the bulk cable.



a) Right angle connector



a) Right angle cable assembly

Figure 3-2 Right Angle Connector and Cable Assembly

Straight: A term used to describe a connector design where the mating direction is parallel to the bulk cable.

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.

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4. General Description

4.1 Configuration Overview/Descriptions

The connector system is based upon an integrated right-angle receptacle (fixed) connector and guide shell. The host board footprint positioning holes contain the critical dimensions for locating the integrated receptacle/guide shell. The receptacle guide shell functions as the guide and strain relief for the free (plug) connector interface and provides the latching points for the plug connector. This connector system provides positive retention along with ease of insertion and removal.

This specification provides for a 1x1, 1x2 and 1x4 integrated receptacle/cage (fixed side) as well as a 1x1 (4X) and a 1x2 (8X) mating cable plug (free side).

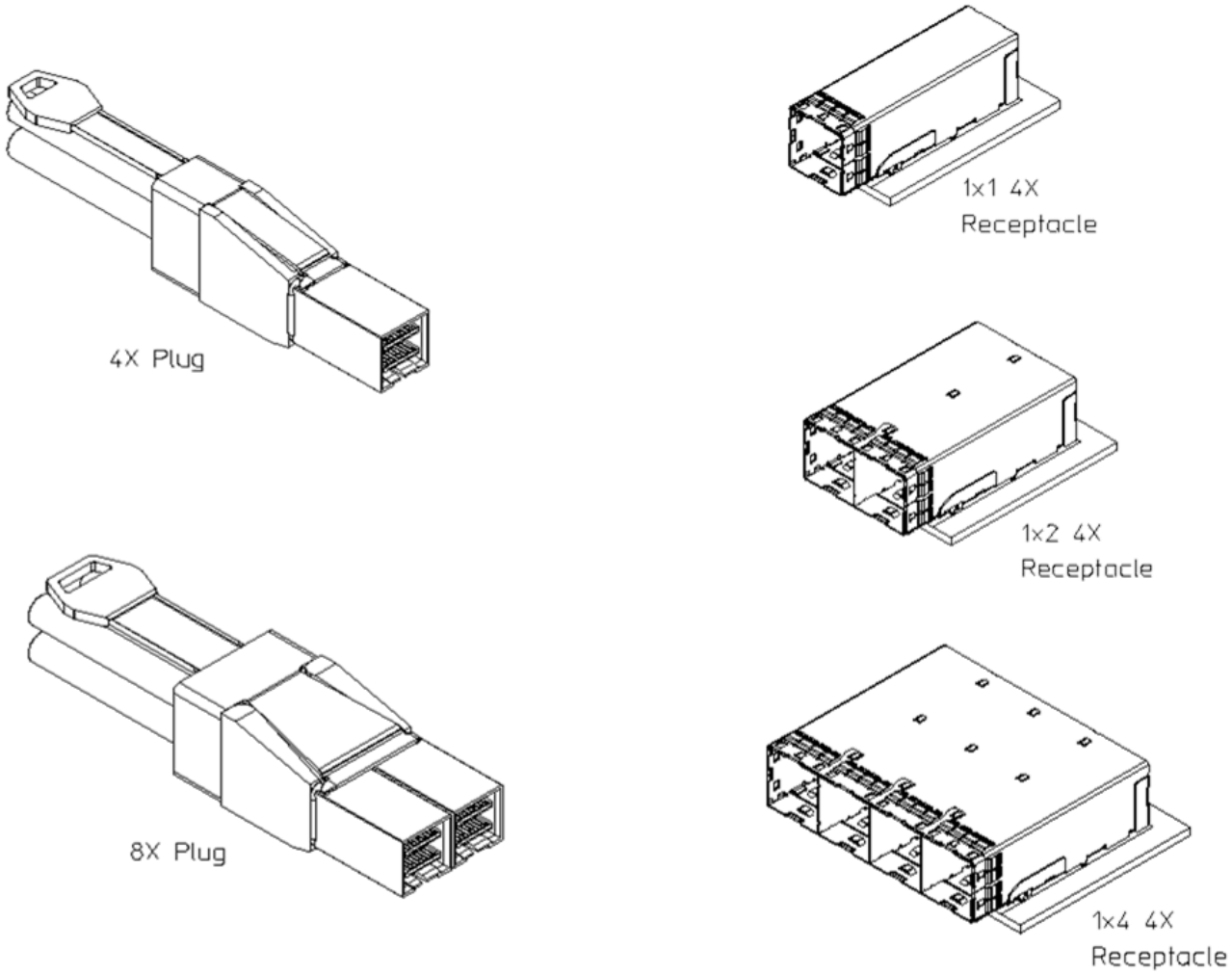

Figure 4-1 General View of Configurations

Table 4-1 Configurations Supported

Port	Positions	Host Connector Orientation	Plug
1x1	36	Right-angle	1x1
1x2	72	Right-angle	1x2
1x4	144	Right-angle	NA

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4.2 Contact Numbering

The pins or electrical contacts in this connector are numbered as shown in Figure 4-2. NOTE: Through hole pins are shown for illustrative purposes only. Receptacle tails implemented are dependent on the footprint type used. Refer to 5.3.2.1 for footprint information.

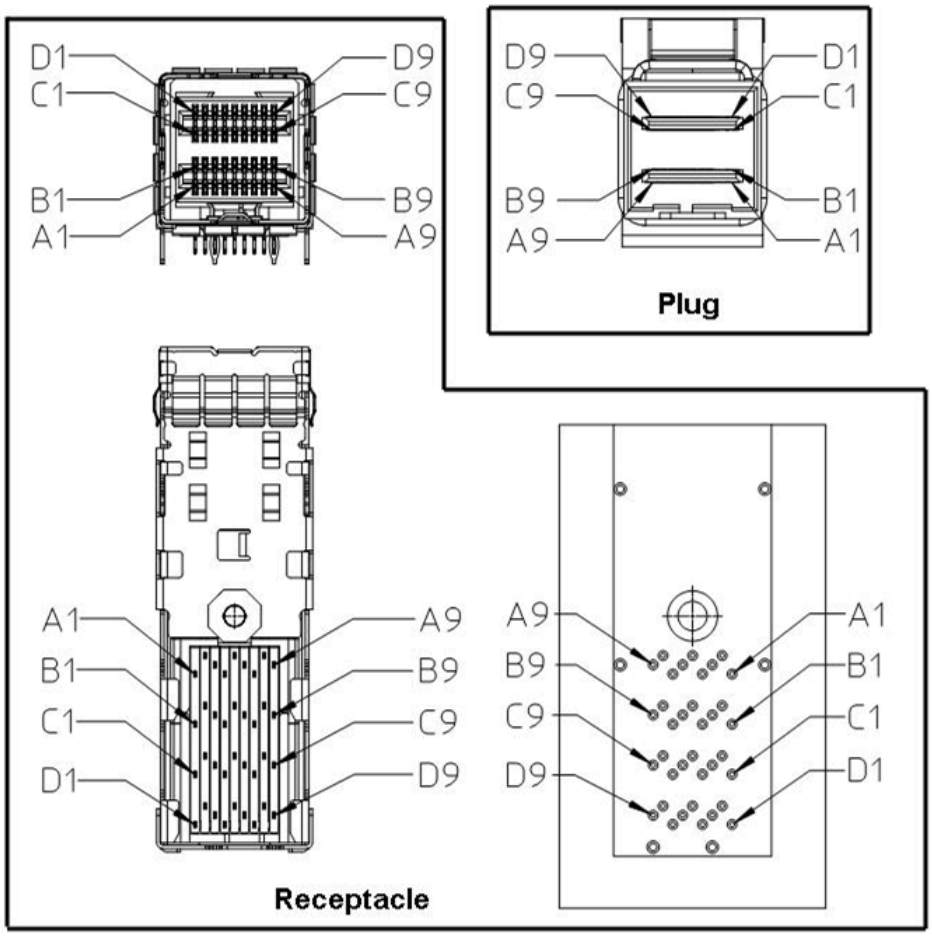

Figure 4-2 Contact Numbering

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5. Connector/ Cage Mechanical Specification

5.1 Datums

The datums defined in Figure 5-1 and Table 5-1 are used throughout the rest of the document to describe the dimensional requirements of this connector.

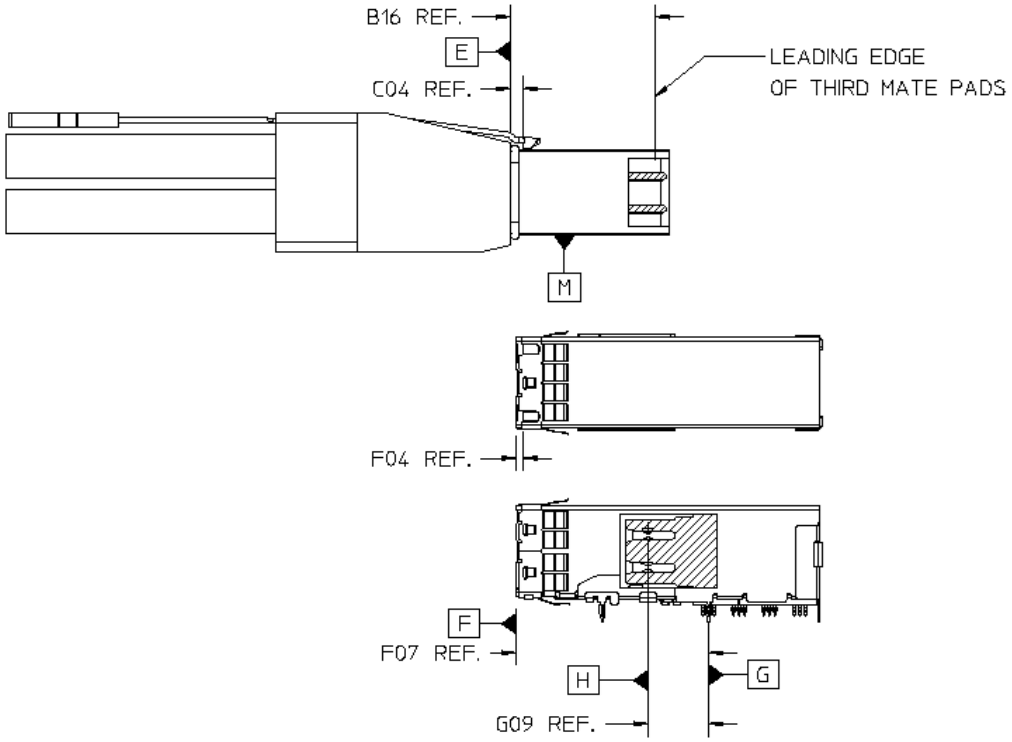

Figure 5-1 Datums (Not All Shown)

Table 5-1 Datum Descriptions

Datum	Description
A	Width of paddle card
B	Top surface of paddle card
C	Leading edge of third mate signal pad on paddle card
D	Width of plug snout
E	Leading edge of plug body
F	Front edge of receptacle snout
G	Centerline of second row of first group of complaint tails
H	Centerline of receptacle contacts- lower row
J	Centerline of outer holes
K	Centerline of second row of first group of PCB holes
L	Surface of PCB
M	Bottom of plug body
P	Width of receptacle snout
R	Bottom of receptacle (PCB interface)
X, Y	Reference 0, 0 on host board

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5.2 Mechanical Description: Press Fit Connector and Cage

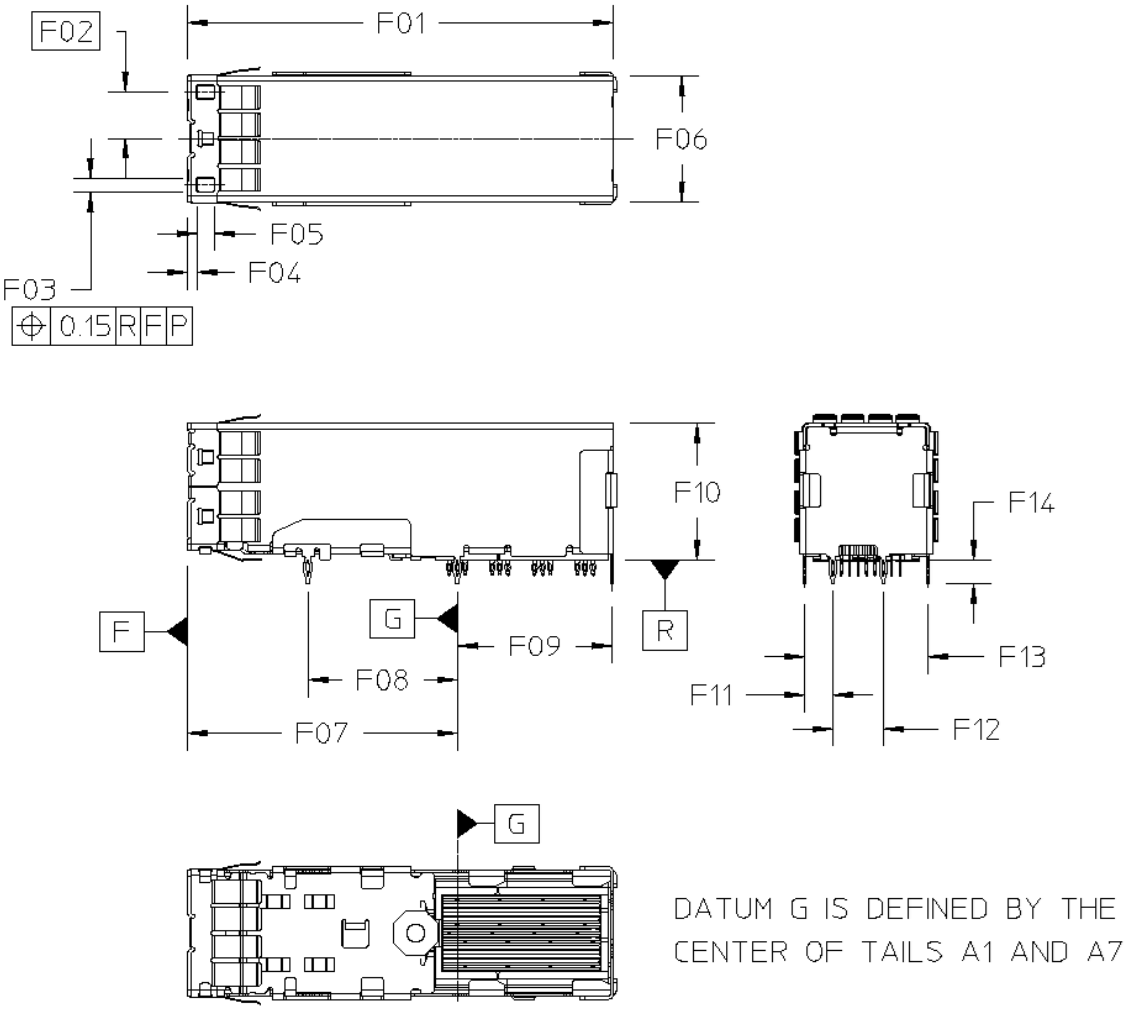

Figure 5-2 Receptacle

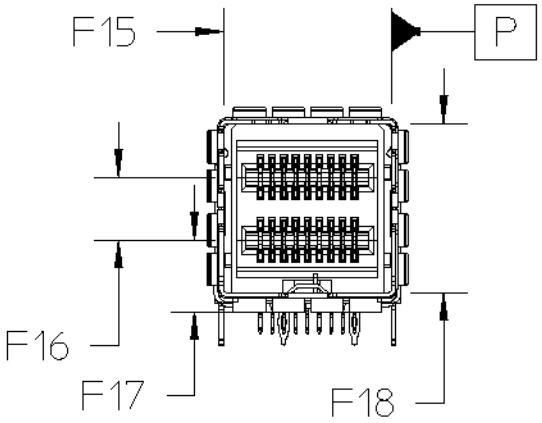

Figure 5-3 Front View of Receptacle

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Table 5-2 Receptacle Dimensions

Designator	Description	Dimension	Tolerance +/-
F01	Cage length	38.00	0.15
F02	Cage center to latch hole center	4.15	Basic
F03	Latch hole width	1.20	0.10
F04	Cage front to latch hole front	0.88	0.05
F05	Latch hole length	1.40	MIN
F06	Cage width	11.25	0.10
F07	Datum G to front face	24.06	0.10
F08	Datum G to cage tail	13.31	0.05
F09	Datum G to cage tail	13.81	0.05
F10	Cage height	12.24	0.13
F11	Cage tail-to-tail	2.51	0.10
F12	Cage tail-to-tail	4.50	0.05
F13	Cage tail-to-tail	11.00	0.10
F14	Cage tail length	2.50	MAX
F15	Cage opening width	10.75	0.08
F16	Lower card slot to upper card slot	4.00	0.05
F17	Datum R to lower card slot	4.55	0.10
F18	Cage opening height	10.76	0.08

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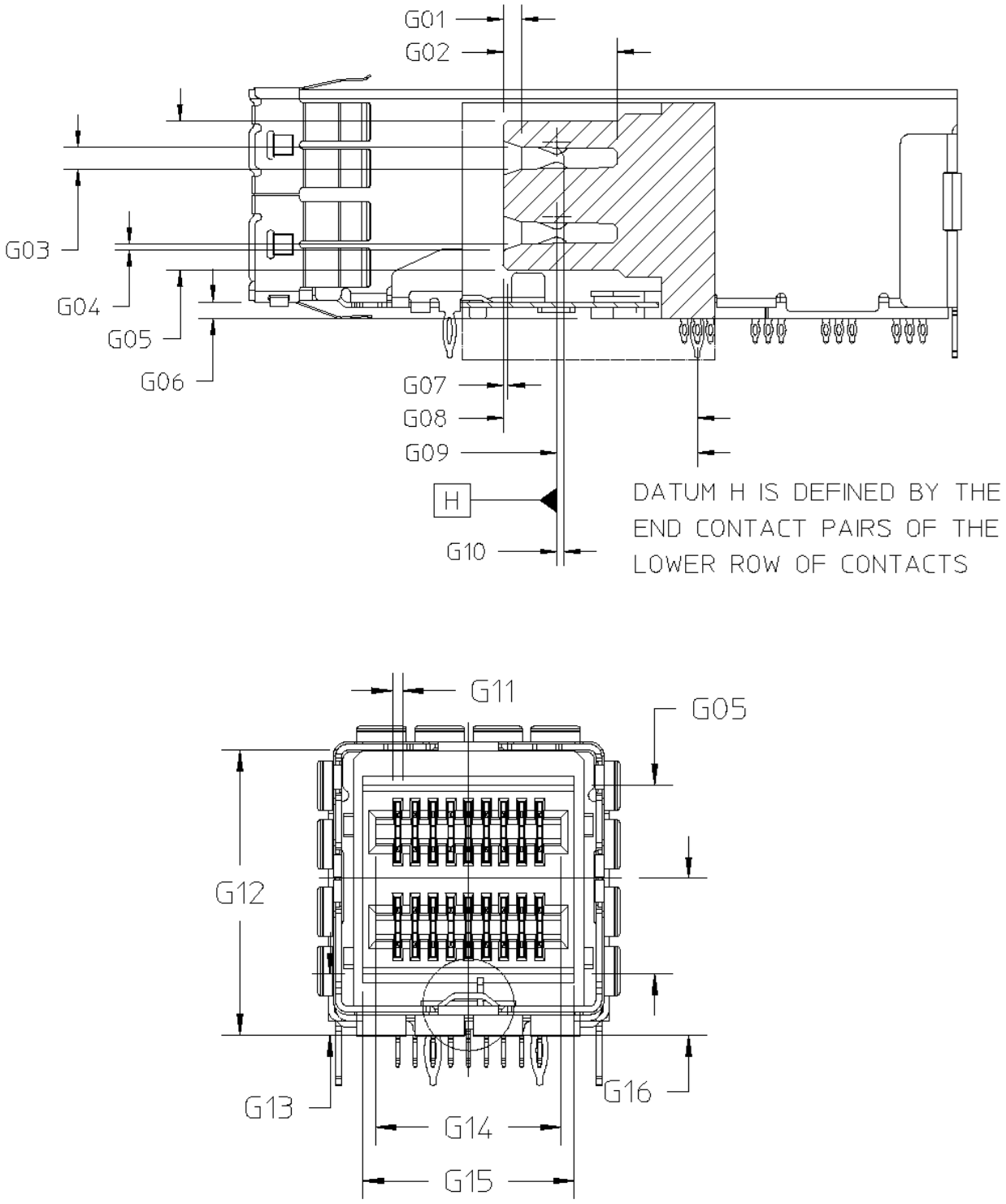

Figure 5-4 Receptacle Contact Locations

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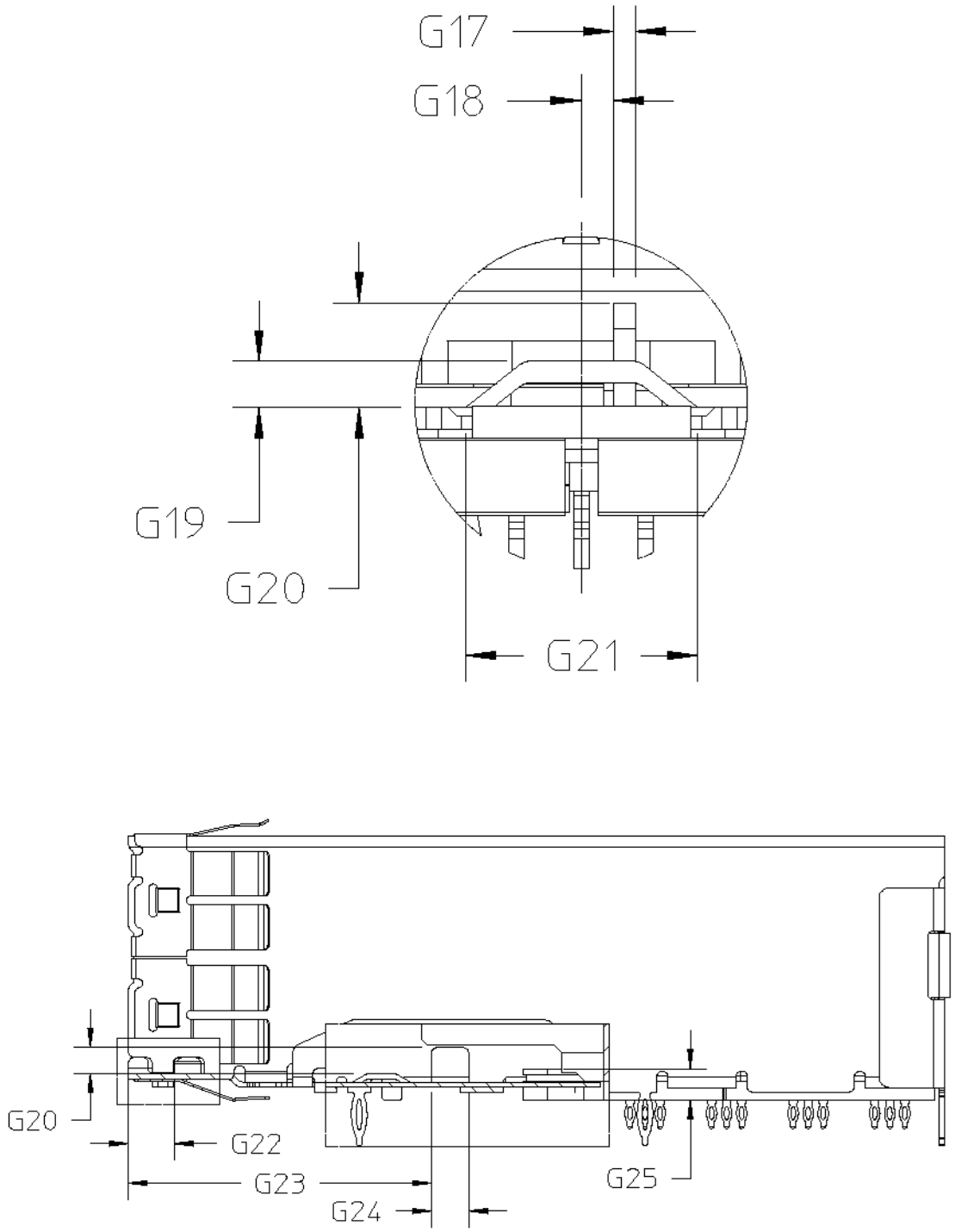

Figure 5-5 Receptacle Blocking Key

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Table 5-3 Receptacle Contact Location and Blocking Key Dimensions

Designator	Description	Dimension	Tolerance +/-
G01	Receptacle card slot lead-in	1.00	0.25
G02	Receptacle snout length	6.13	0.08
G03	Receptacle card slot height	1.20	0.08
G04	Receptacle card slot lead-in	0.30	0.10
G05	Receptacle snout height	7.94	0.10
G06	Cage snout offset	0.86	0.15
G07	Housing chamfer x 45°	0.25	0.10
G08	Datum G to receptacle front	10.43	0.10
G09	Datum G to lower contact interface	7.56	0.10
G10	Lower contact to upper contact	0.00	0.05
G11 (*)	Contact zone (0.18 wide terminal)	0.30	MAX
	Contact zone (0.20 wide terminal)	0.32	MAX
	Contact zone (0.22 wide terminal)	0.34	MAX
G12	Cage opening to cage bottom	11.98	0.10
G13	Datum R to receptacle snout	2.58	0.08
G14	Receptacle card slot width	7.85	0.05
G15	Receptacle body width	8.95	0.10
G16	Datum R to centerline of cage snout opening	6.60	0.10
G17	Primary blocking key width	0.25	0.05
G18	Primary blocking key location 1	0.37	0.10
G19	Preliminary blocking key height	0.54	0.10
G20	Primary blocking key height	1.12	MIN
G21	Preliminary blocking key width	3.00	MAX
G22	Preliminary blocking key location	2.10	0.13
G23	Primary blocking key location 2	14.10	0.13
G24	Primary blocking key length	1.75	MIN
G25	M2 threaded height to cage bottom	1.45	MAX
(*) NOTE: Contact zone is defined as a zone with its centerline located at the theoretical contact centerline and the contact must always be completely located within it.			

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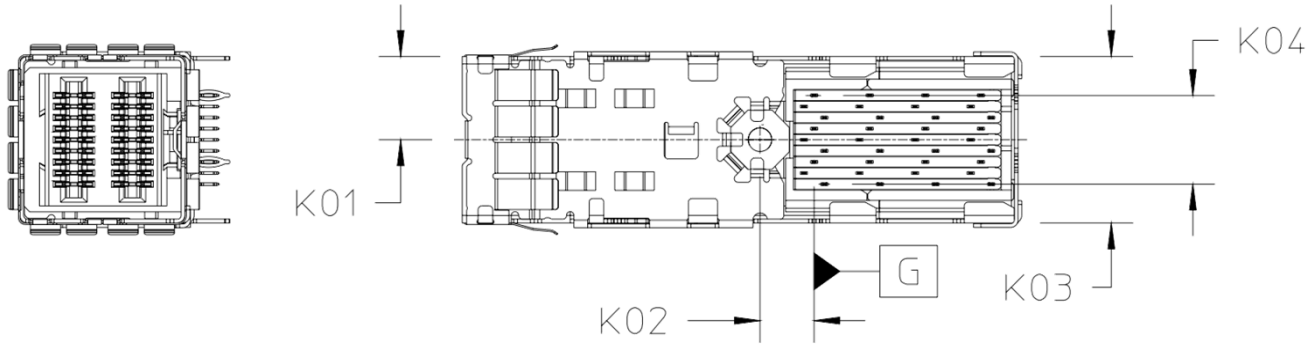
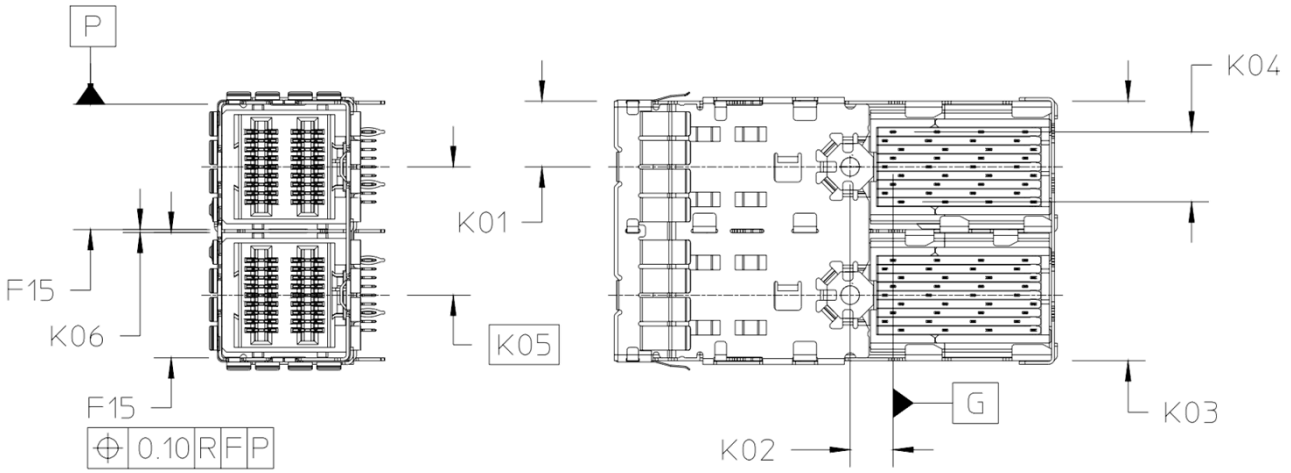
5.2.1 1x1 Press Fit Cage Retention Feature



CAUTION: Special attention is required when choosing the length of the requires M2 connector to PCB attachment screw. The end of the screw must not interfere with full insertion of the mating plug. The appropriate length is determined by the thickness of the PCB and its associated tolerances.

Figure 5-6 1x1 Press Fit Cage Retention Feature

5.2.2 1x2 Press Fit Cage Retention Feature



CAUTION: Special attention is required when choosing the length of the requires M2 connector to PCB attachment screw. The end of the screw must not interfere with full insertion of the mating plug. The appropriate length is determined by the thickness of the PCB and its associated tolerances.

Figure 5-7 1x2 Press Fit Cage Retention Feature

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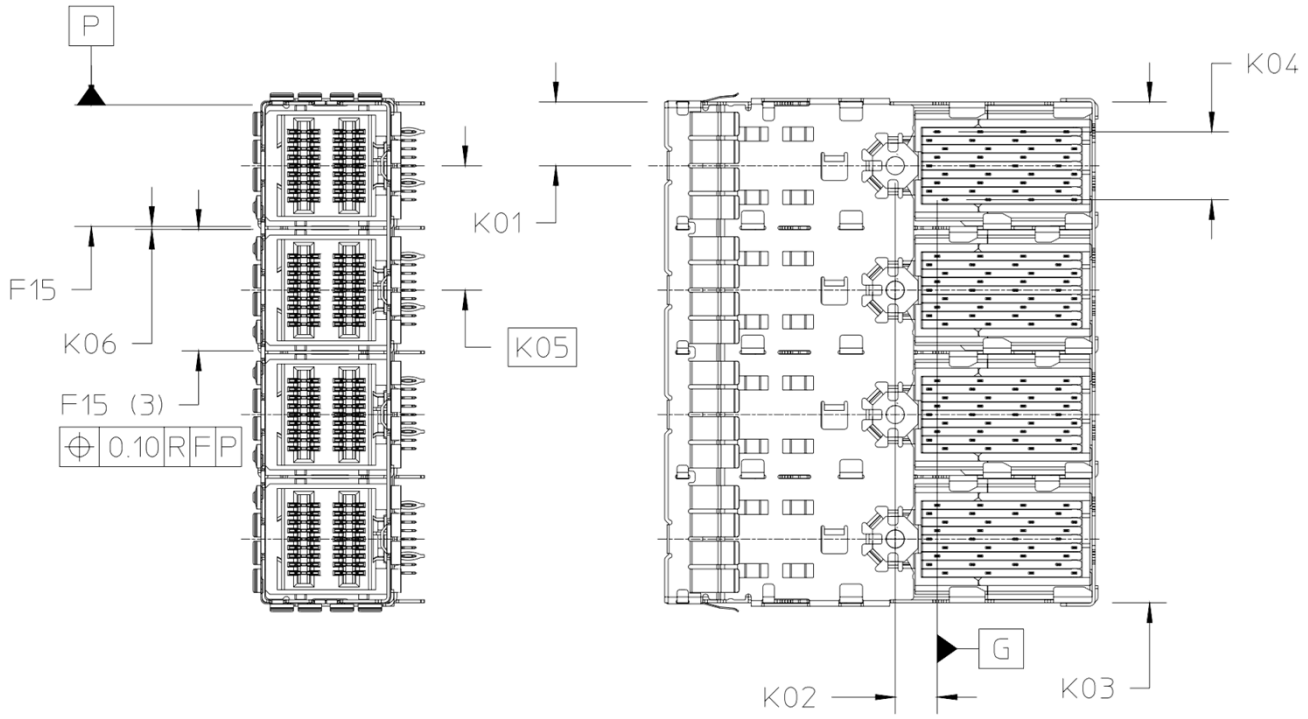
5.2.3 1x4 Press Fit Cage Retention Feature



CAUTION: Special attention is required when choosing the length of the requires M2 connector to PCB attachment screw. The end of the screw must not interfere with full insertion of the mating plug. The appropriate length is determined by the thickness of the PCB and its associated tolerances.

Figure 5-8 1x4 Press Fit Cage Retention Feature

Table 5-4 Receptacle Attachment Fastener Dimensions

Designator	Description	Dimension	Tolerance +/-
K01	Outside of cage to M2 fastener centerline	5.625	REF
K02	Datum G to shield M2 fastener thread	3.70	REF
K03	1x1 connector	11.25	0.10
	1x2 connector	22.25	0.10
	1x4 connector	44.25	0.10
K04	Receptacle tail-to-receptacle tail	6.00	REF
K05	Port-to-port spacing	11.00	Basic
K06	Cage internal wall thickness	0.25	0.03

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5.3 Mechanical Description: SMT Connector & Cage

5.3.1 SMT Connector

The SMT connector variants must fit within the cages defined in Sections 5.3.2.1 for 1x1, 5.3.2.2 for 1x2, and 5.3.2.3 for 1x4. Additionally, SMT connectors must accept the plugs defined in Section 7, and must fit with the appropriate SMT footprints defined in Section 5.4.2.

5.3.2 Cage for SMT Connector

Cages for the SMT connector come in 1x1, 1x2, and 1x4 configurations as defined in the following subsections.

5.3.2.1 1x1 Cage for SMT Connector

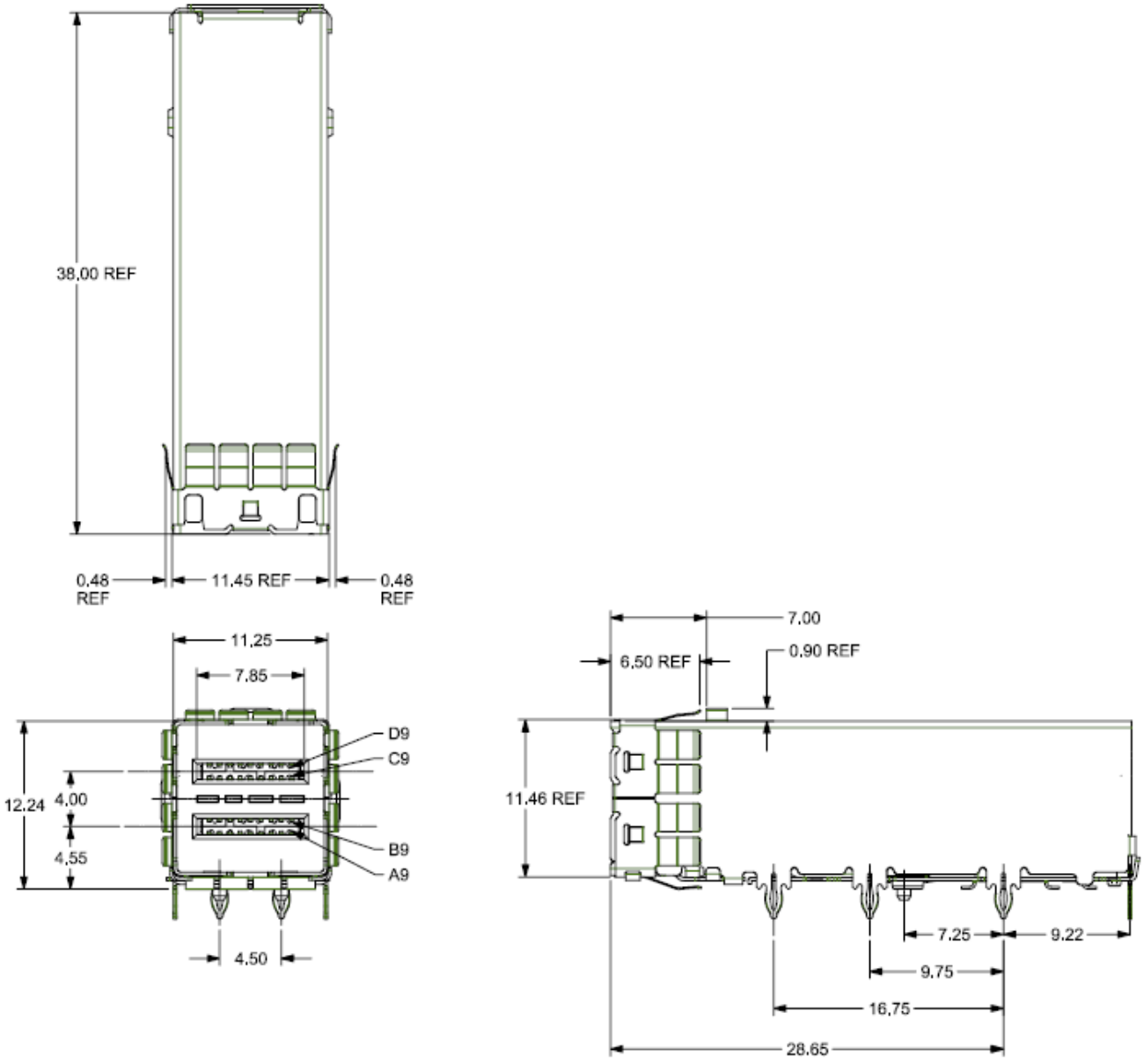

Figure 5-9 Cage for 1x1 SMT Connector

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5.3.2.2 **1x2 Cage for SMT Connector**

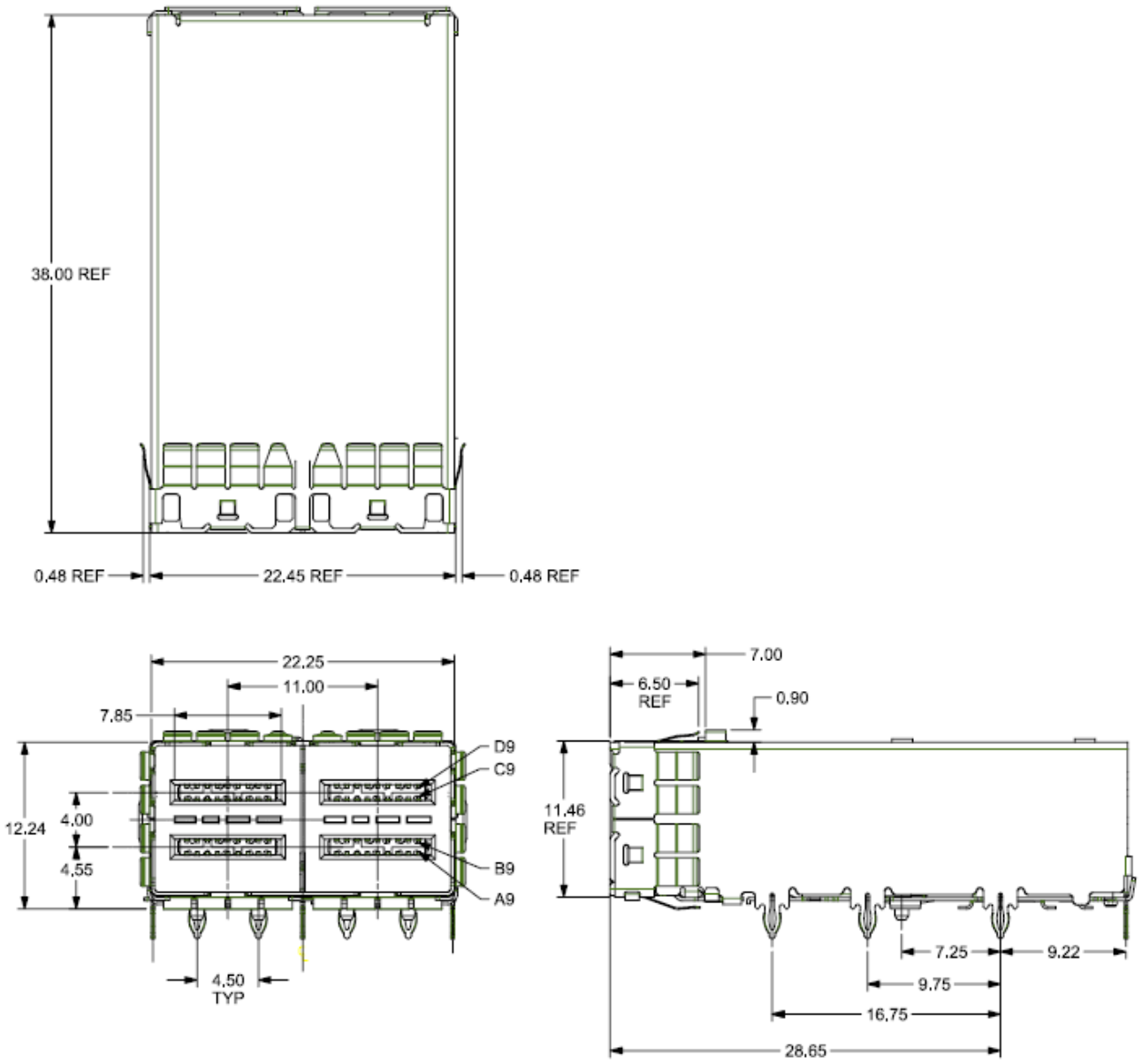

Figure 5-10 Cage for 1x2 SMT Connector

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5.3.2.3 **1x4 Cage for SMT Connector**

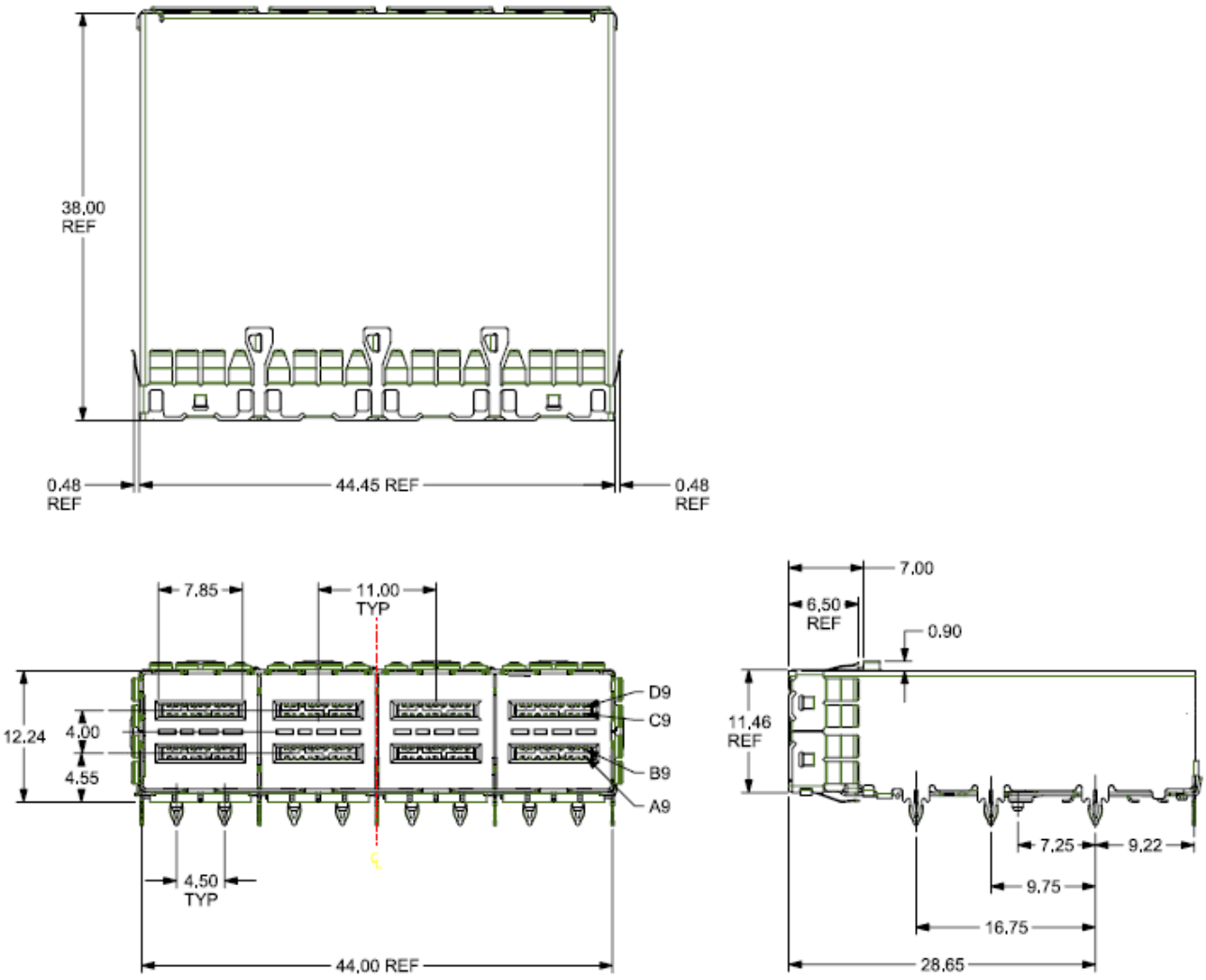

Figure 5-11 Cage for 1x4 SMT Connector

5.4 Receptacle Footprints

Two footprint options are specified: through hole and SMT.

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5.4.1 Press Fit Option

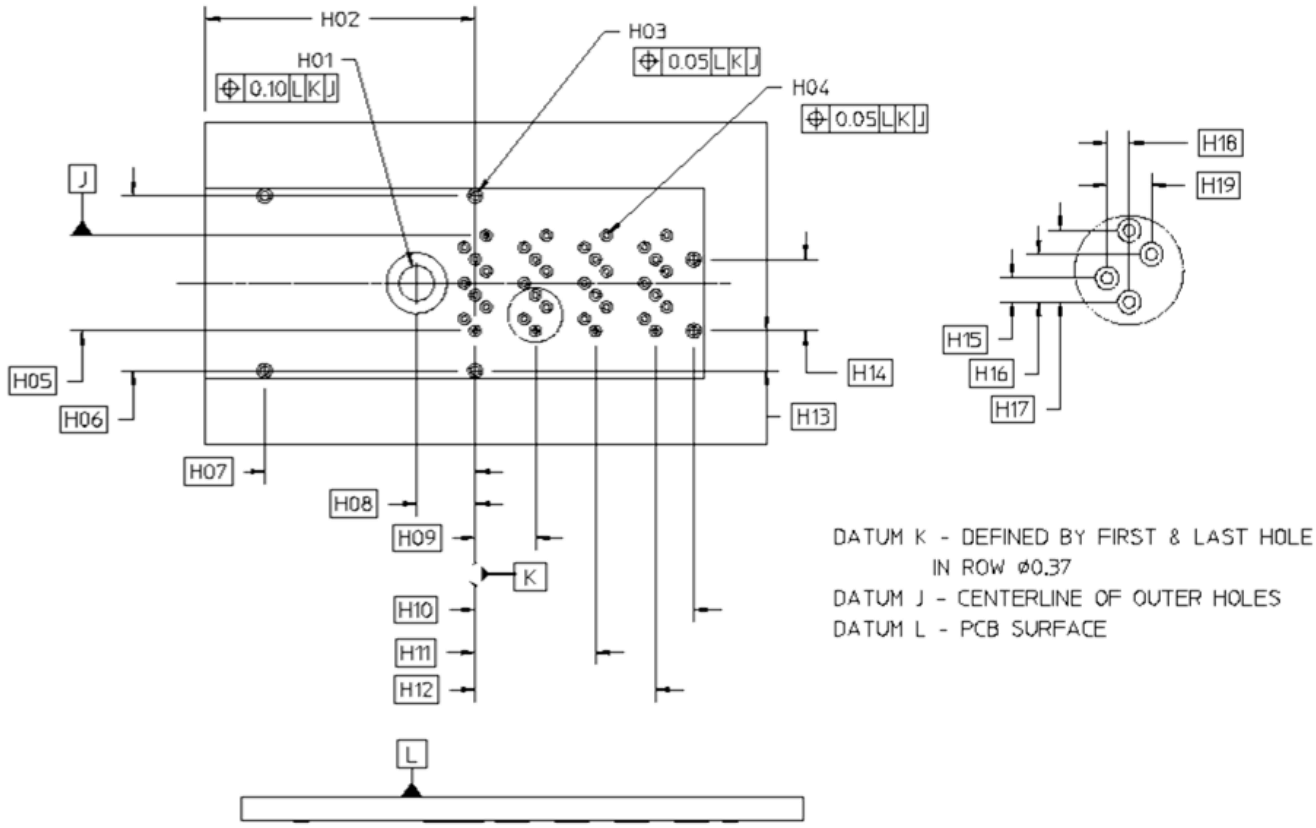

Figure 5-12 1x1 Receptacle Press Fit Footprint Option

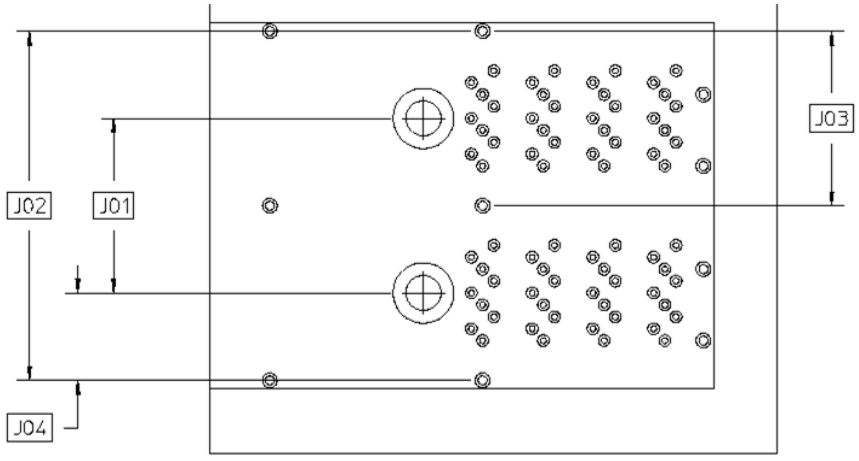

Figure 5-13 1x2 Receptacle Press Fit Footprint Option

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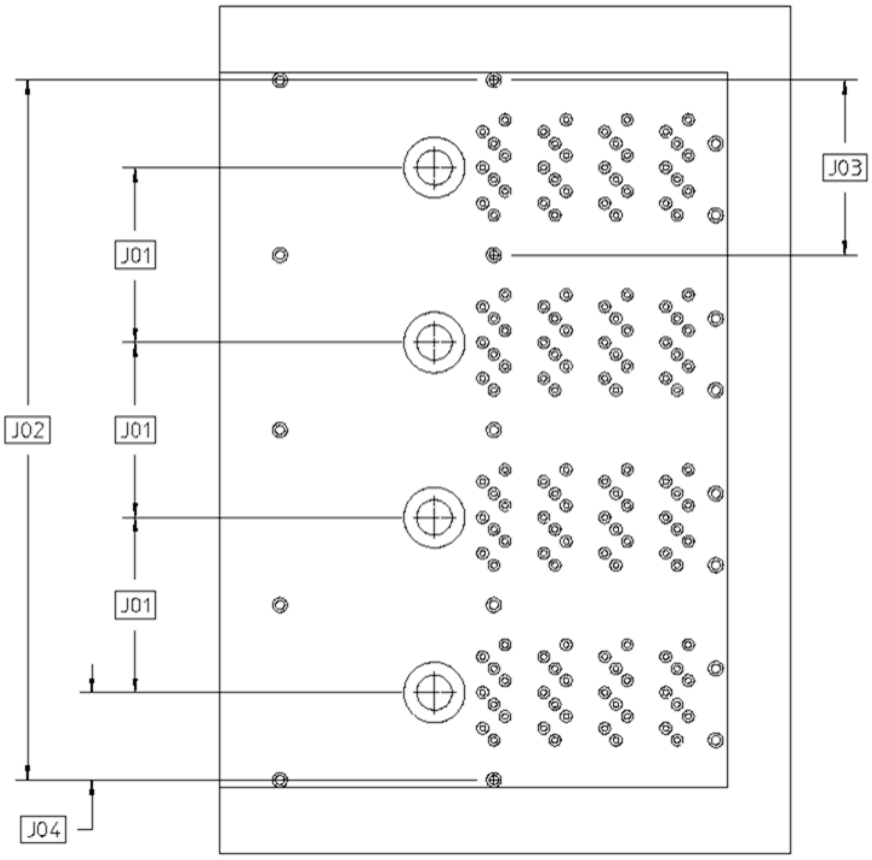

Figure 5-14 1x4 Receptacle Press Fit Footprint Option

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Table 5-5 Receptacle Press Fit Footprint Option Dimensions

Designator	Description	Dimension	Tolerance +/-
H01	Cage attachment hole diameter	2.20	0.10
H02	Datum to front edge of PCB (PCI add-in card applications)	17.10	0.15
H02	Datum to front edge of PCB (all other M/B) applications	18.19	0.15
H03	EMI cage hole diameter	0.57	0.05
H04	Receptacle hole diameter	0.37	0.05
H05	Receptacle pin, center-to-center	6.00	Basic
H06	EMI cage, hole-to-hole	11.00	Basic
H07	Datum K to front holes	13.31	Basic
H08	Datum K to mounting hole	3.70	Basic
H09	Datum K to second group	3.80	Basic
H10	Datum K to back holes	13.81	Basic
H11	Datum K to third group	7.60	Basic
H12	Datum K to fourth group	11.40	Basic
H13	EMI cage, hole-to-hole	2.50	Basic
H14	EMI cage, hole-to-hole	4.50	Basic
H15	Receptacle, hole-to-hole	0.75	Basic
H16	Receptacle, hole-to-hole	1.50	Basic
H17	Receptacle, hole-to-hole	2.25	Basic
H18	Receptacle, hole-to-hole	0.70	Basic
H19	Receptacle, hole-to-hole	1.40	Basic
J01	Port-to-port spacing	11.00	Basic
J02	1x2 shield, hole-to-hole	22.00	Basic
J02	1x4 shield, hole-to-hole	44.00	Basic
J03	Shield, hole-to-hole	11.00	Basic
J04	Shield, hole-to-mounting hole	5.50	Basic

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5.4.2 **SMT Option**

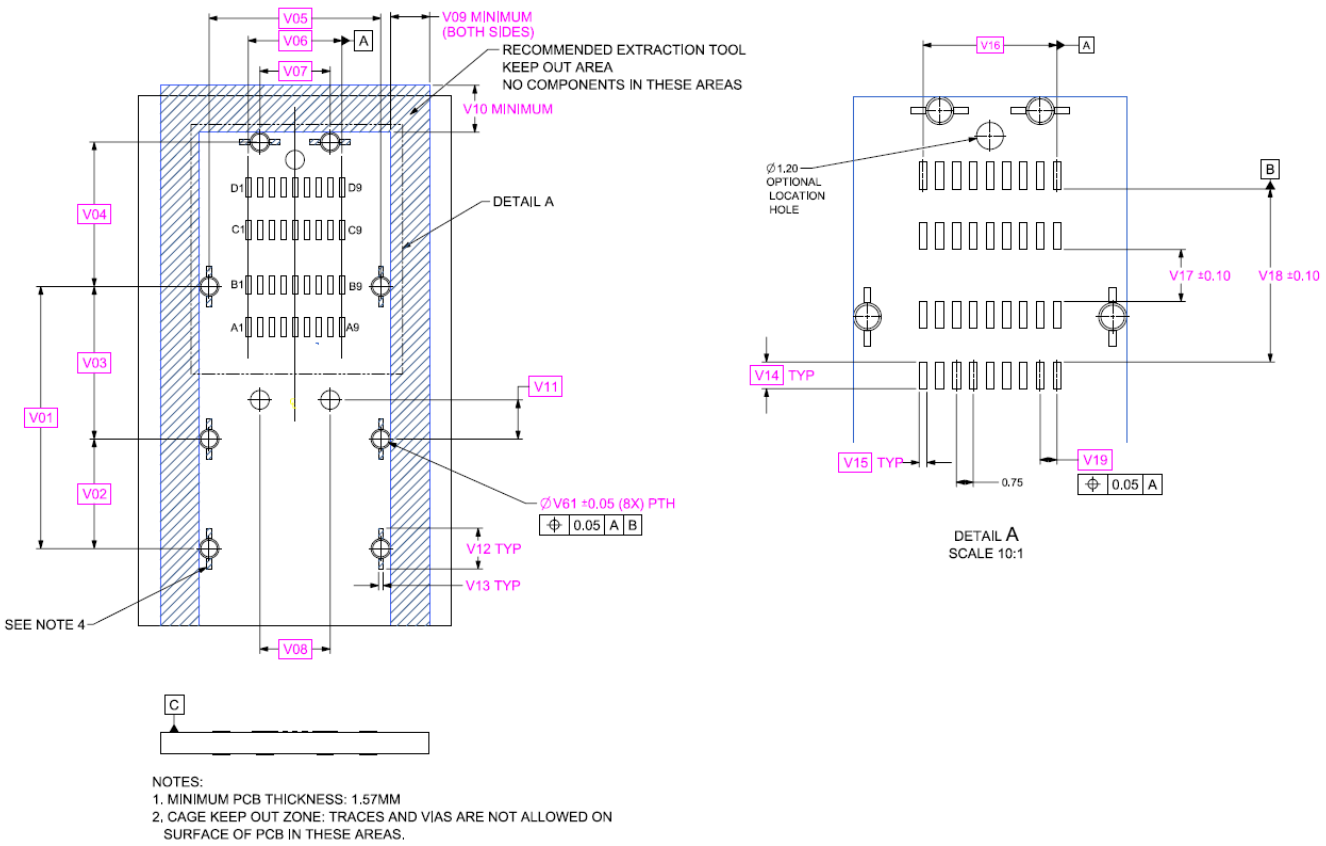

Figure 5-15 1x1 Receptacle SMT Footprint Option

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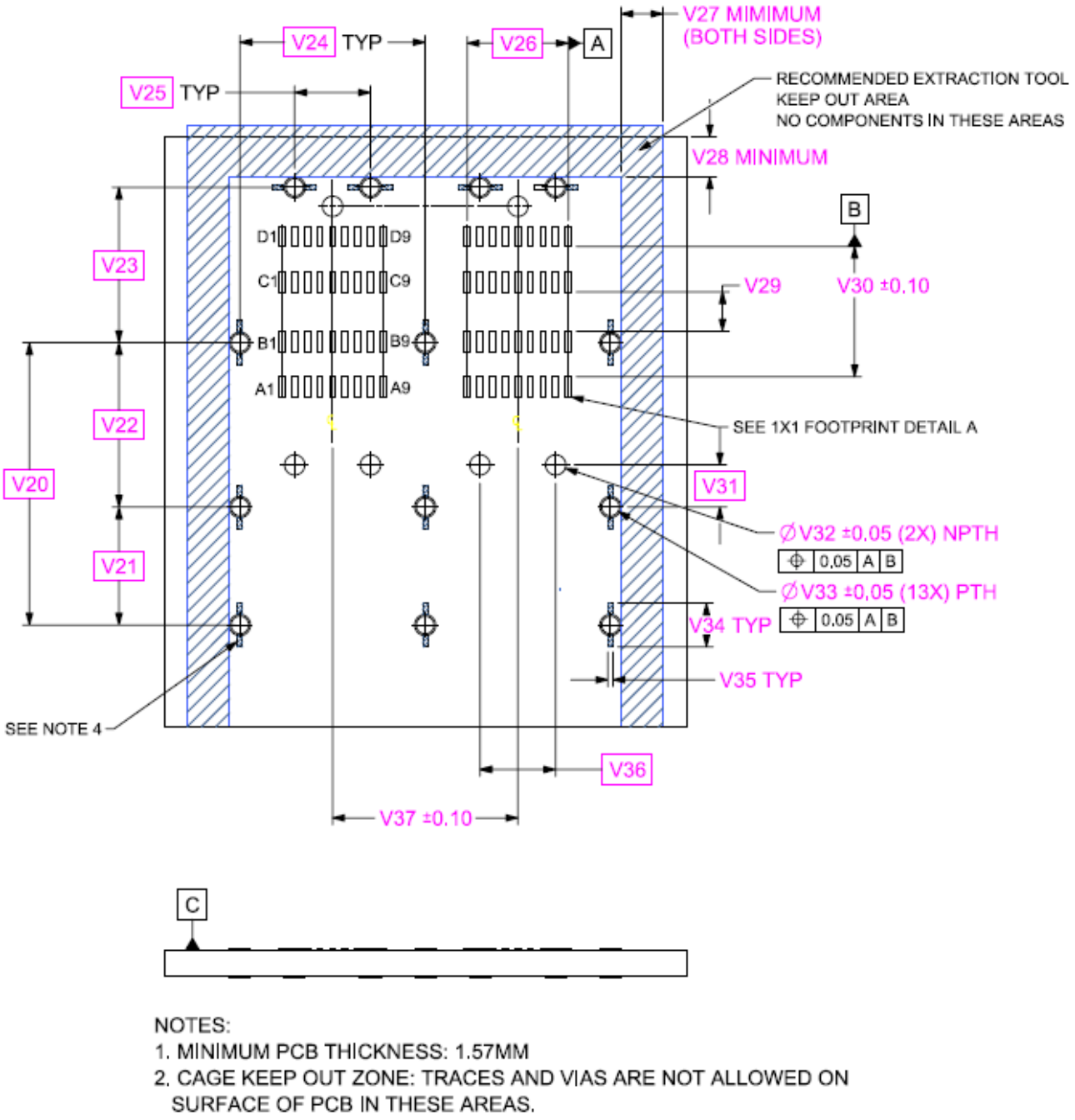

NOTES:
1. MINIMUM PCB THICKNESS: 1.57MM
2. CAGE KEEP OUT ZONE: TRACES AND VIAS ARE NOT ALLOWED ON SURFACE OF PCB IN THESE AREAS.

Figure 5-16 1x2 Receptacle SMT Footprint Option

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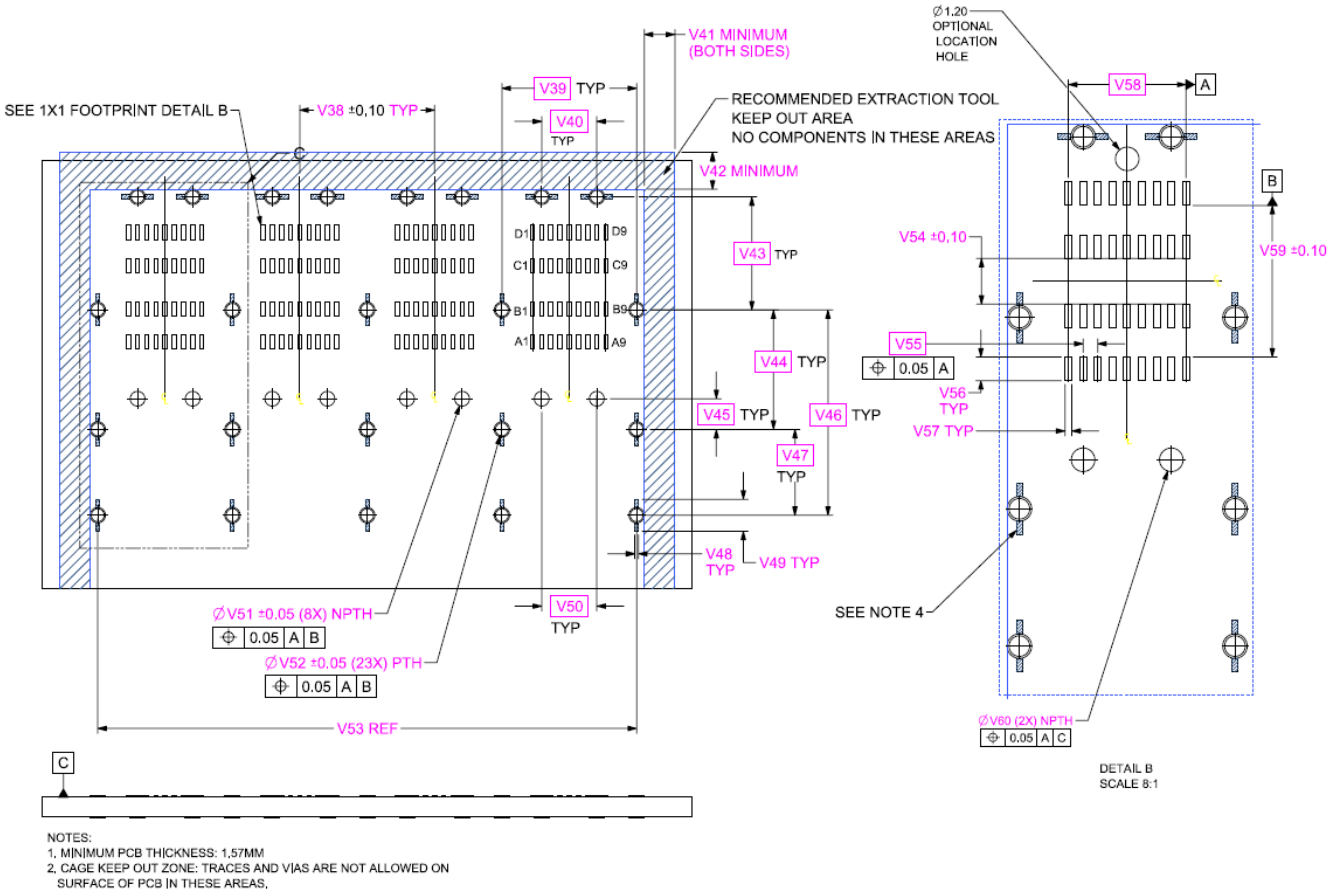

Figure 5-17 1x4 Receptacle SMT Footprint Option

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Table 5-6 Receptacle SMT Footprint Option Dimensions

Designator	Description	Dimension	Tolerance +/-
V01	Horizontal distance between center of left first row hold-down to center of third left hold-down	16.75	Basic
V02	Horizontal distance between center of first row hold-down to center of second left hold-down	7.00	Basic
V03	Horizontal distance between center of second row left hold-down to center of third left hold-down	9.75	Basic
V04	Horizontal distance between center of fourth row right hold-down to center of third left hold-down	9.22	Basic
V05	Horizontal distance between center of left first row hold-down to the center of right first row hold-down	11.00	Basic
V06	Center-to-center distance between first and ninth receptacle contacts	6.00	Basic
V07	Center-to-center distance between back hold-downs	4.50	Basic
V08	Horizontal distance between locating pegs	4.50	Basic
V09	Connector keep-out zone width	2.50	MIN
V10	Connector keep-out zone height	3.00	MIN
V11	Vertical distance between center of first row locating pegs to right first row hold-down	2.50	Basic
V12	Height of hold-down slot	2.60	TYP
V13	Width of hold-down slot	0.30	TYP
V14	Receptacle contact length	1.20	Basic TYP
V15	Receptacle contact width	0.35	Basic TYP
V16	Center-to-center distance between first and ninth receptacle contacts	6.00	Basic
V17	Distance between Row B and Row C receptacle contacts	2.33	0.10
V18	Distance between Row A and Row D receptacle contacts	7.73	0.10
V19	Distance between adjacent receptacle contacts	0.75	Basic
V20	Horizontal distance between center of left first row hold-down to center of third left hold-down	16.75	Basic
V21	Horizontal distance between center of first row hold-down to center of third left hold-down	7.00	Basic
V22	Horizontal distance between center of second row left hold-down to center of third left hold-down	9.75	Basic
V23	Horizontal distance between center of fourth row right hold-down to center of third left hold-down	9.22	Basic
V24	Horizontal distance between center of left first row hold-down to right first row hold-down	11.00	Basic TYP
V25	Center-to-center distance between back hold-downs	4.50	Basic TYP
V26	Center-to-center distance	6.00	Basic
V27	Connector keep-out zone width	2.50	MIN
V28	Connector keep-out zone height	3.00	MIN
V29	Distance between Row B and Row C receptacle contacts	2.33	0.10
V30	Distance between Row A and Row D receptacle contacts	7.73	0.10
V31	Vertical distance between center of first row locating pegs to first row hold-down center	2.50	Basic

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V32	1.20 diameter NPTH (2X)	1.20	0.05
V33	1.05 diameter PTH (13X)	1.05	0.05
V34	Width of hold-down slot	2.60	TYP
V35	Width of hold-down slot	0.30	TYP
V36	Distance between locating holes within a port	4.50	BASIC
V37	Port-to-port spacing	11.00	0.10
V38	Port-to-port spacing	11.00	0.1 TYP
V39	Horizontal distance between center of left first row hold-down to the center of right first row hold-down	11.00	Basic TYP
V40	Center-to-center distance between back hold-downs	4.50	Basic TYP
V41	Connector keep-out area	2.50	MIN
V42	Connector keep-out area	3.00	MIN
V43	Horizontal distance between center of fourth row right hold-down to center of third left hold-down	9.22	Basic TYP
V44	Right second row hold-down to right third row hold-down	9.75	Basic TYP
V45	Vertical distance between center of first row locating pegs to first row hold-down center	2.50	Basic TYP
V46	Right second row hold-down to right third row hold-down	16.75	Basic TYP
V47	Right first row hold-down to right second row hold-down	7.00	Basic TYP
V48	Width of hold-down slot	0.30	TYP
V49	Length of hold-down slot	2.60	TYP
V50	Horizontal distance between locating pegs within port	4.50	Basic TYP
V51	(8X) NPTH diameter	1.20	0.05
V52	(23X) PTH diameter	1.05	0.05
V53	Horizontal spacing between outer most hold-downs	44.00	REF
V54	Distance between Row B and Row C receptacle contacts	2.33	0.10
V55	Distance between adjacent receptacle contacts	0.75	Basic 0.05
V56	Receptacle contact length	1.20	TYP
V57	Receptacle contact width	0.35	TYP
V58	Center-to-center distance between first and ninth receptacle contacts	6.00	BASIC
V59	Distance between Row A and Row D receptacle contacts	7.73	0.10
V60	1.20 diameter NPTH (2X)	1.20	0.05
V61	1.05 diameter PTH (8X)	1.05	0.05

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5.5 Receptacle-to-Bezel

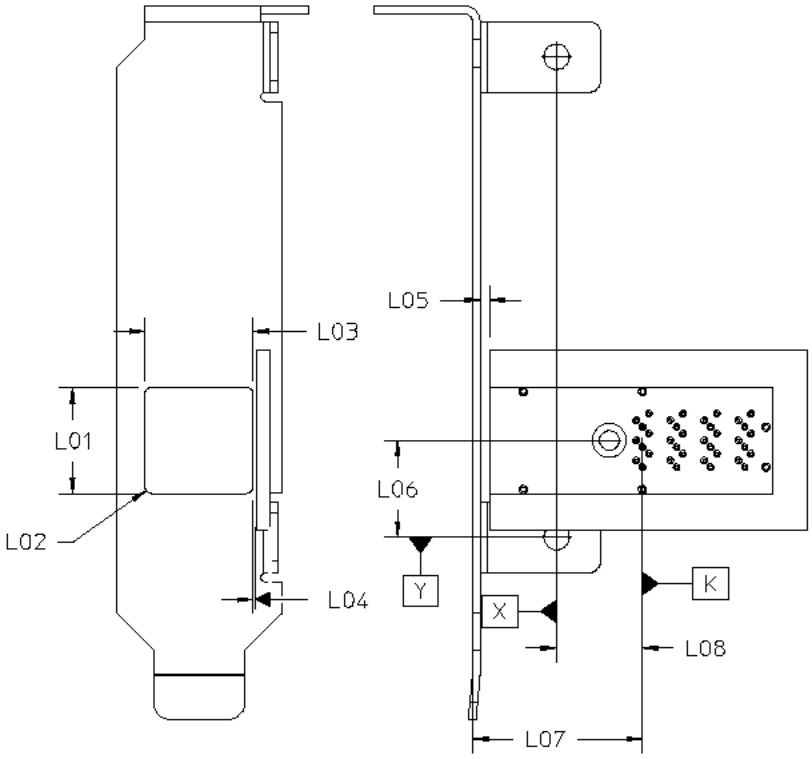

Figure 5-18 1x1 Receptacle to Bezel

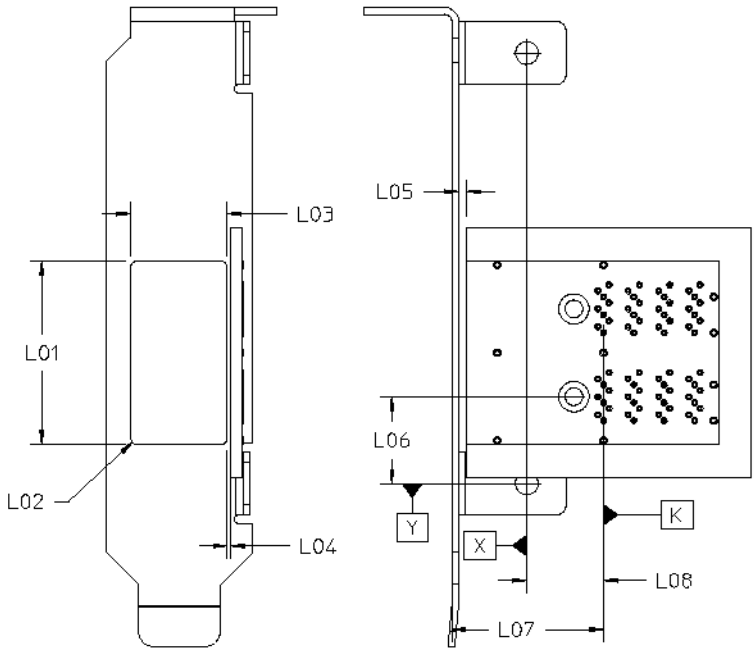

Figure 5-19 1x2 Receptacle to Bezel

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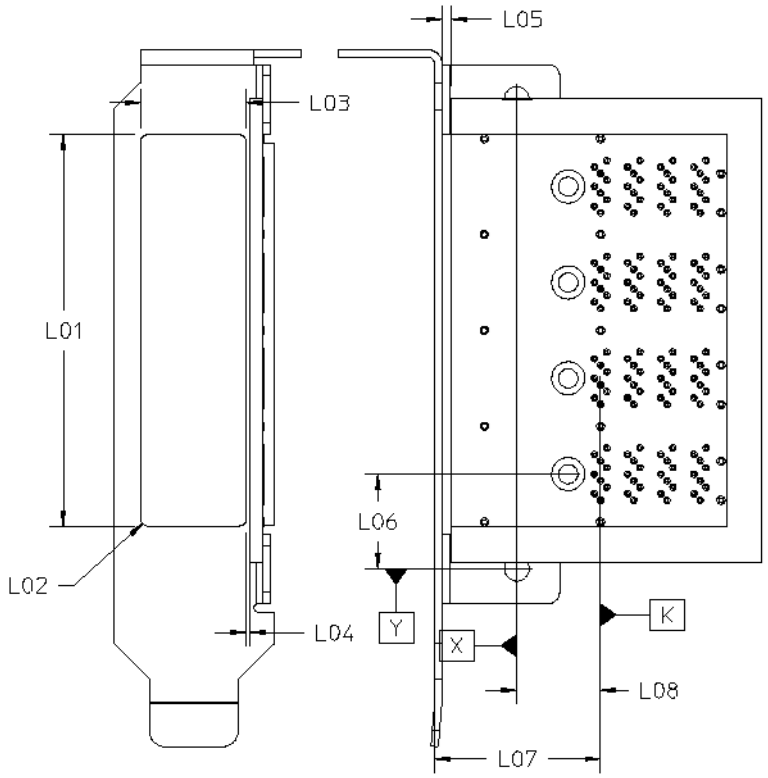

Figure 5-20 1x4 Receptacle to Bezel

Table 5-7 Receptacle to Bezel Dimensions

Designator	Description	Dimension	Tolerance +/-
L01	1x1 bracket cut-out width	11.90	0.10
	1x2 bracket cut-out width	22.90	0.10
	1x4 bracket cut-out width	44.90	0.10
L02	Bracket cut-out radius	0.75	MAX
L03	Bracket cut-out height	12.07	0.10
L04	PCB surface to bracket cut-out	0.38	0.10
L05	Bracket back to PCB front edge	1.03	REF
L06	Mounting hole to manufacturer fiducial	Basic	N/A
L07	Bracket front to Datum K (PCI add-in card applications)	19.00	0.15
	Bracket front to Datum K (all other (M/B) applications)	20.08	0.15
L08	Mounting hole to manufacturer fiducial	Basic	N/A

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5.6 Minimum Receptacle Pitch

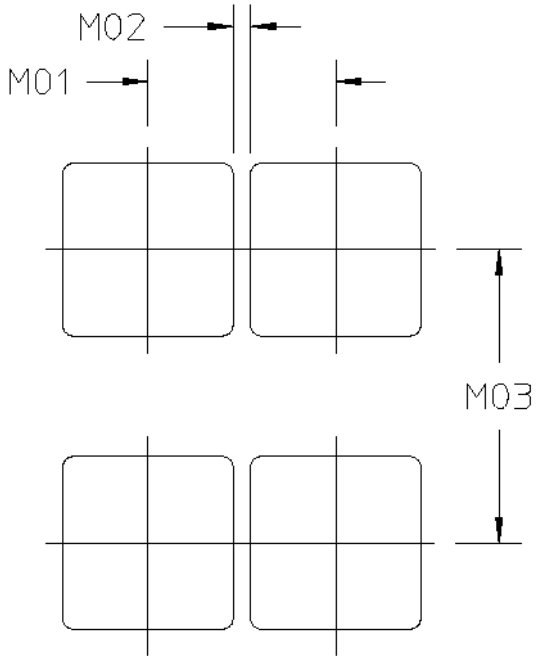

Figure 5-21 Minimum Receptacle Pitch

Table 5-8 Minimum Receptacle Pitch Dimensions

Designator	Description	Dimension	Tolerance +/-
M01	Port-to- port, horizontal	13.25	MIN
M02	Bracket web	1.00	MIN
M03	Port-to-port, vertical	20.50	0.10

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5.7 Receptacle Dust Cover

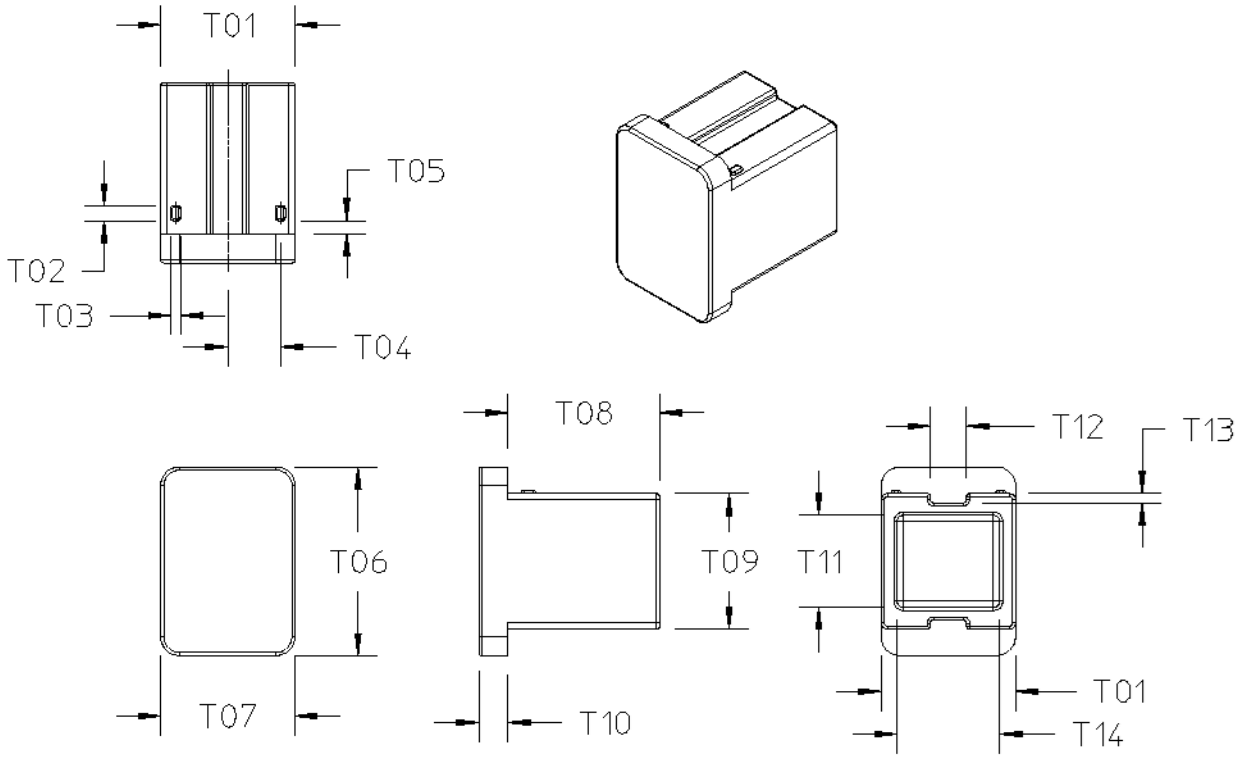

Figure 5-22 Receptacle Dust Cover

Table 5-9 Receptacle Dust Cover Dimensions

Designator	Description	Dimension	Tolerance +/-
T01	Plug body width	10.65	0.10
T02	Dimple length	1.20	0.10
T03	Dimple width	0.80	0.10
T04	Dimple location	4.15	0.10
T05	Dimple location	1.03	0.10
T06	Plug front width	10.65	MAX
T07	Plug front height	14.95	0.25
T08	Plug body length	12.00	MAX
T09	Plug body height	10.76	0.10
T10	Plug front thickness	2.00	MIN
T11	Plug body height, inside	7.30	0.25
T12	Groove width	2.85	0.25
T13	Groove depth	0.73	0.25
T14	Plug body width, inside	8.15	0.25

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6. Thermal Solutions

6.1 Overview

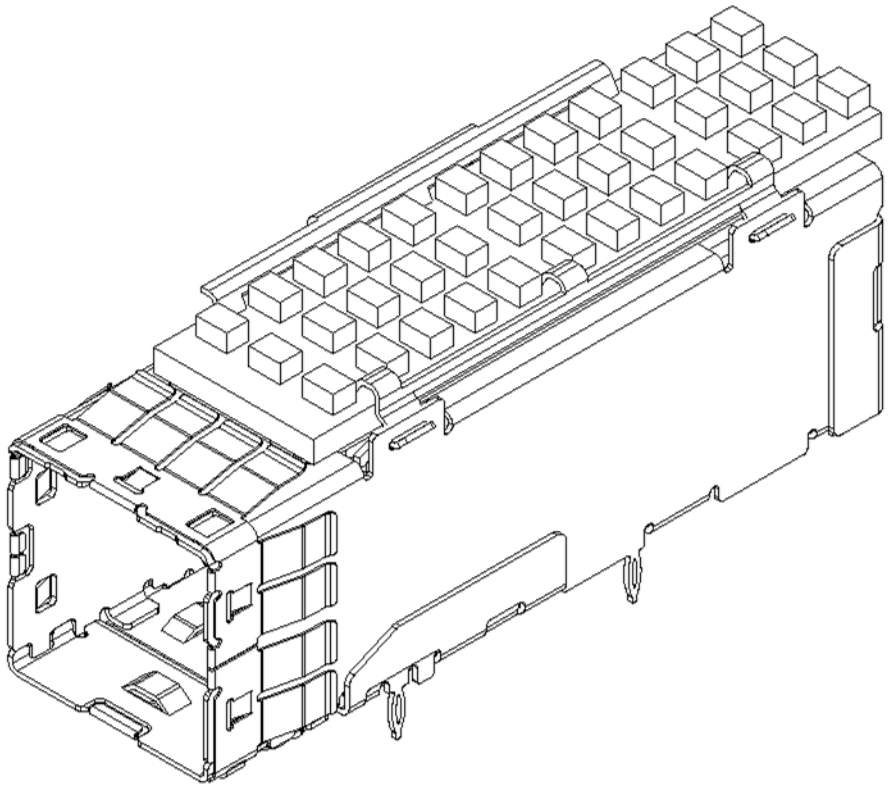

Figure 6-1 Cage with heat sink

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6.2 Cage Heat Sink

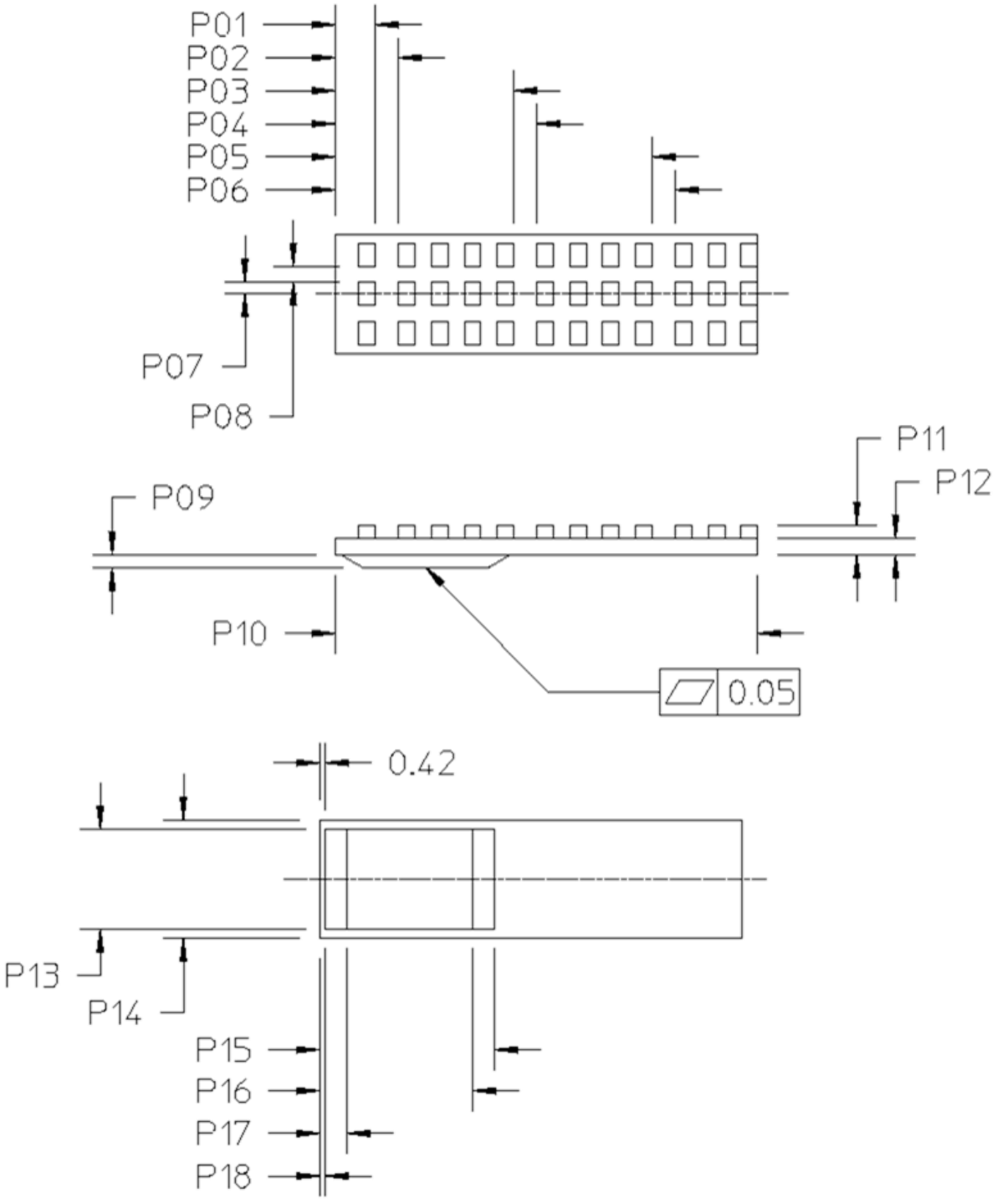

Figure 6-2 Cage Heat Sink

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Table 6-1 Cage Heat Sink Dimensions

Designator	Description	Dimension	Tolerance +/-
P01	Heat sink clip, groove start	3.00	0.10
P02	Heat sink clip, groove end	4.75	0.10
P03	Heat sink clip, groove start	13.50	0.10
P04	Heat sink clip, groove end	15.25	0.10
P05	Heat sink clip, groove start	24.00	0.10
P06	Heat sink clip, groove end	25.75	0.10
P07	Heat sink clip, groove end	0.88	0.10
P08	Heat sink clip, groove end	1.25	0.10
P09	Heat sink pad height	0.94	0.10
P10	Heat sink length (application specific)	32.75	REF
P11	Heat sink height (application specific)	2.27	REF
P12	Heat sink base thickness	1.25	0.15
P13	Heat sink pad width	7.50	0.15
P14	Heat sink width	9.00	0.25
P15	Heat sink front to chamfer end	13.24	0.15
P16	Heat sink front to chamfer start	11.62	0.15
P17	Heat sink front to chamfer end	2.05	0.15
P18	Heat sink front to chamfer start	0.42	0.15

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6.3 Cage Heat Sink Attachment

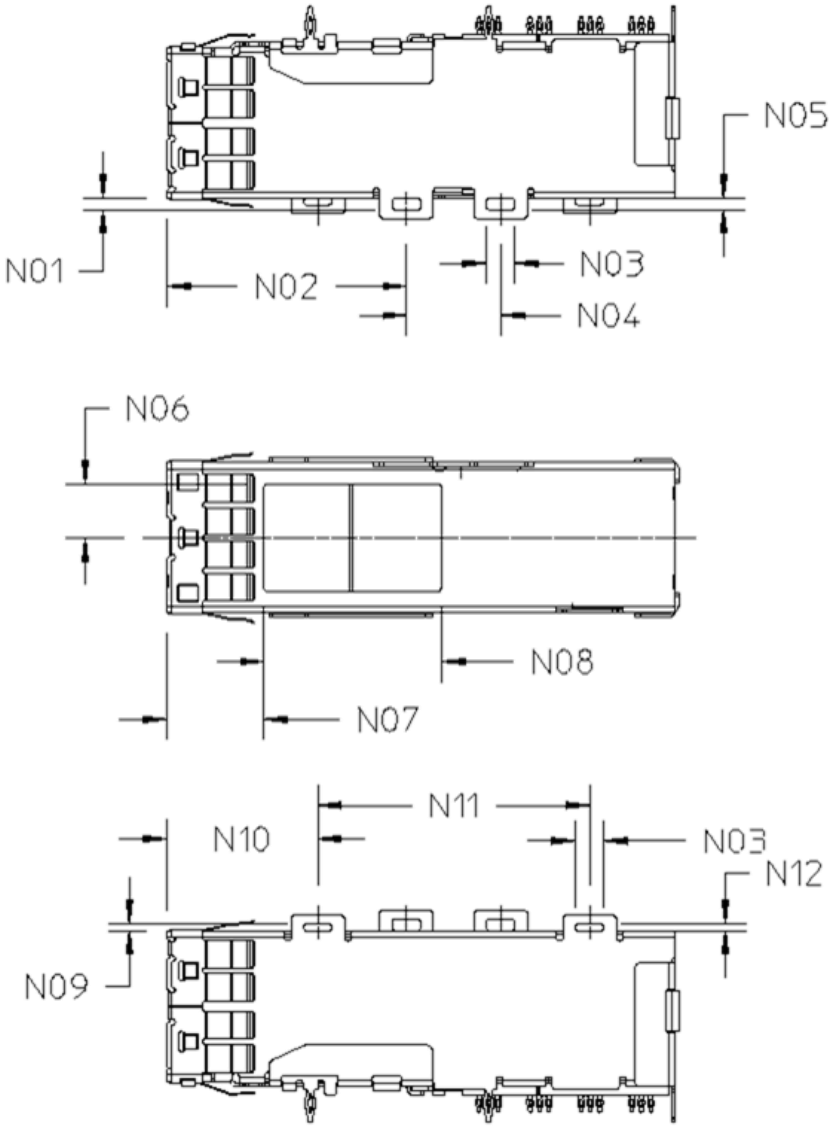

Figure 6-3 Cage Heat Sink Attachment

Table 6-2 Cage Heat Sink Attachment Dimensions

Designator	Description	Dimension	Tolerance +/-
N01	Top of cage to top of slot	0.86	0.10
N02	Front of cate to front slot centerline	17.93	0.10
N03	Slot width	2.25	0.10
N04	Front slot to back slot	7.03	0.10
N05	Slot height	0.85	MIN
N06	Heat sink cut-out width	4.00	0.10
N07	Shield front to heat sink cut-out	7.28	0.10
N08	Heat sink cut-out length	13.25	0.10
N09	Top of cage to top of slot	0.50	0.10
N10	Front of cage to front slot centerline	11.30	0.10
N11	Front slot to back slot	20.30	0.10
N12	Slot height	0.40	MIN

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6.4 Cage Heat Sink Attachment Clip Design

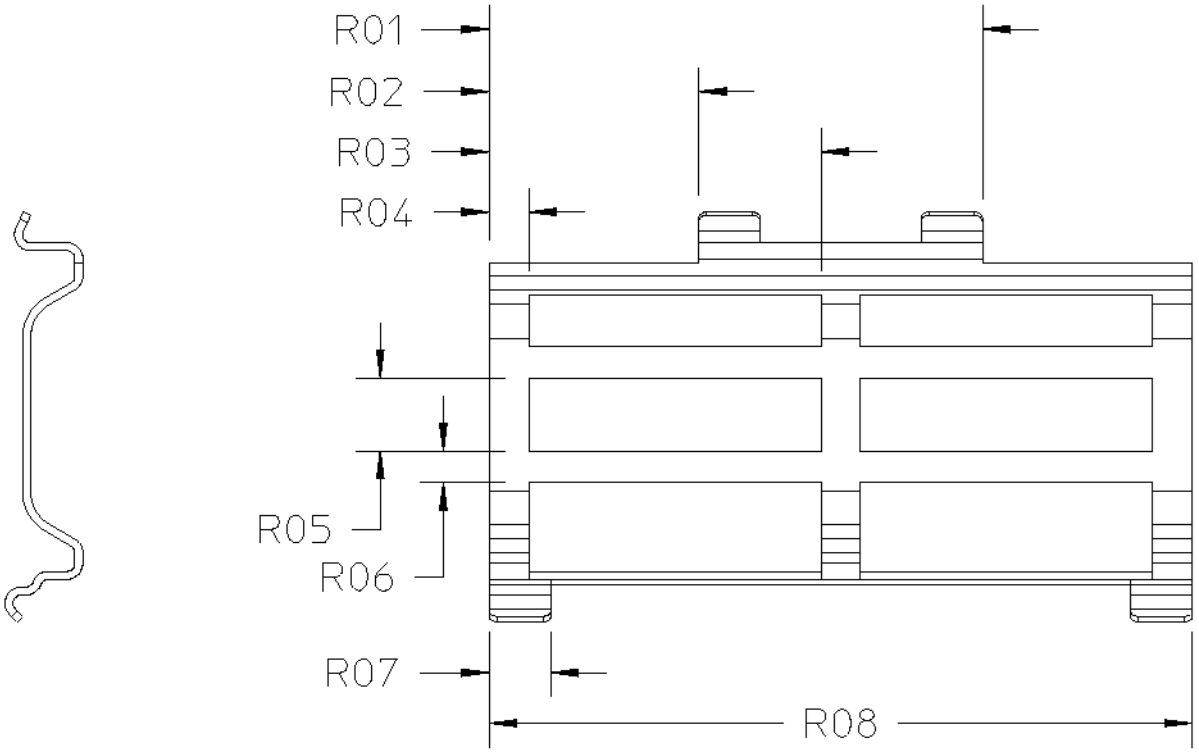

Figure 6-4 Cage Heat Sink Attachment Clip

Table 6-3 Cage Heat Sink Attachment Clip Dimensions

Designator	Description	Dimension	Tolerance +/-
R01	Tab location	15.46	0.10
R02	Tab location	6.63	0.10
R03	Strap location	10.43	0.10
R04	Strap width	1.18	0.10
R05	Window height	2.30	0.10
R06	Strap height	1.00	0.10
R07	Latch tab window	1.70	0.10
R08	Clip length	22.10	0.15

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7. Plug Mechanical Specification

7.1 Paddle Card

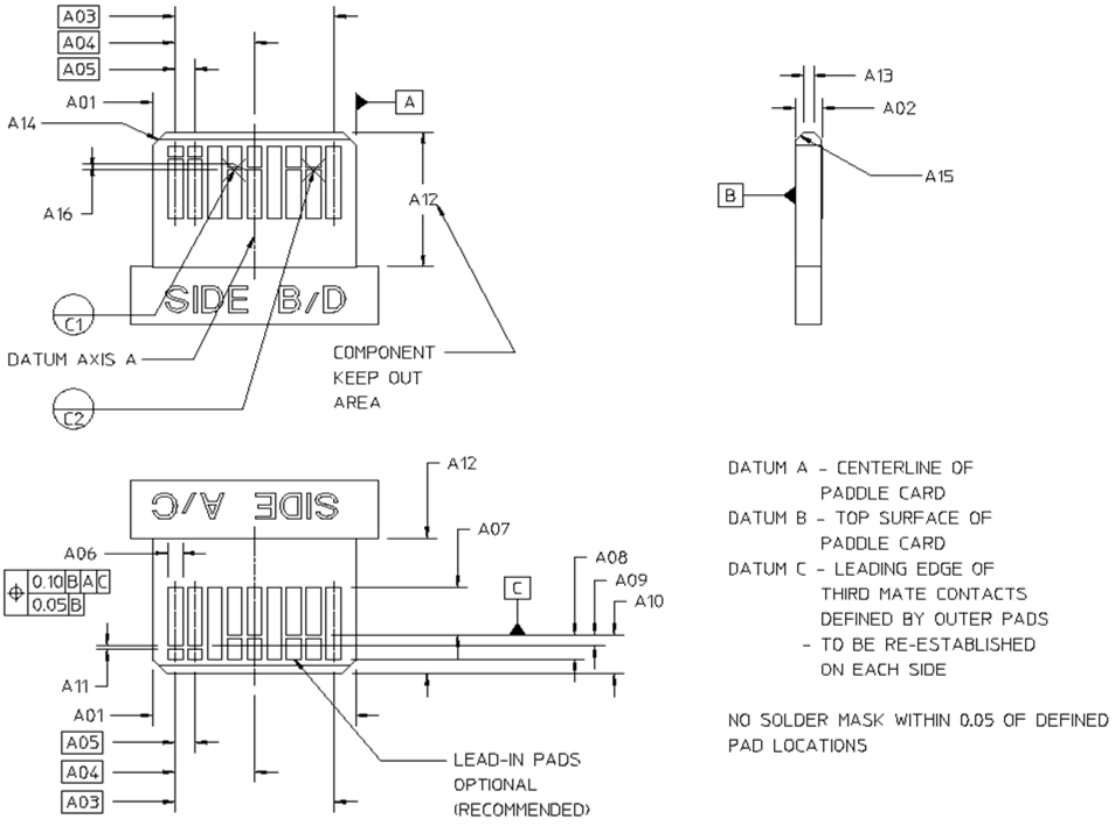

Figure 7-1 Plug Paddle Card

Table 7-1 Plug Paddle Card Dimensions

Designator	Description	Dimension	Tolerance +/-
A01	Paddle card width	7.65	0.10
A02	Paddle card thickness (across pads)	1.00	0.10
A03	First to last pad centers	6.00	Basic
A04	Card center to outer pad center	3.00	Basic
A05	Pad center-to-center (pitch)	0.75	Basic
A06	Pad width	0.57	0.03
A07	Pad length – Third mate	1.85	MIN
A08	Third mate to first mate	0.90	0.05
A09	Third mate to second mate	0.40	0.05
A10	Card edge to third mate pad	1.45	0.10
A11	Pad to pre-pad	0.10	0.05
A12	Component keep-out area	5.40	MIN
A13	Lead-in flat	0.40	REF
A14	Lead-in chamfer x 45 degrees	0.50	0.05
A15	Lead-in chamfer x 45 degrees	0.30	0.05
A16	Third mated pad to Datum C	0.00	0.03

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7.2 X4 Plug

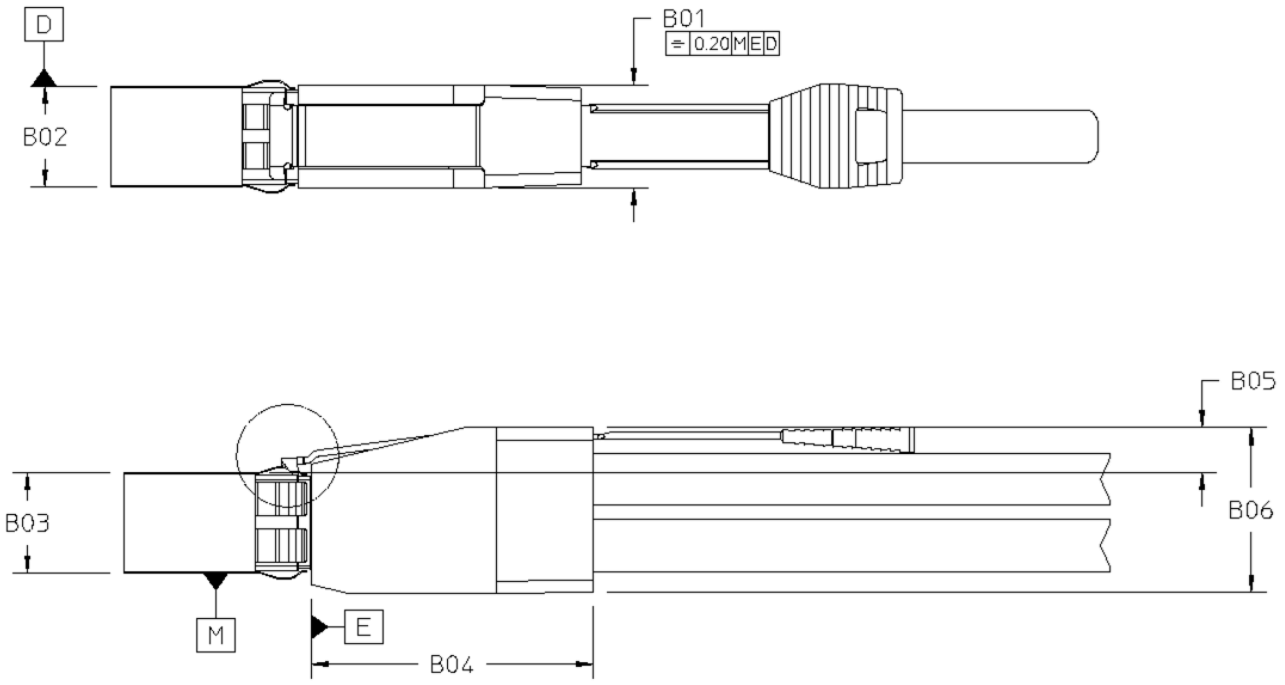

Figure 7-2 4X Plug

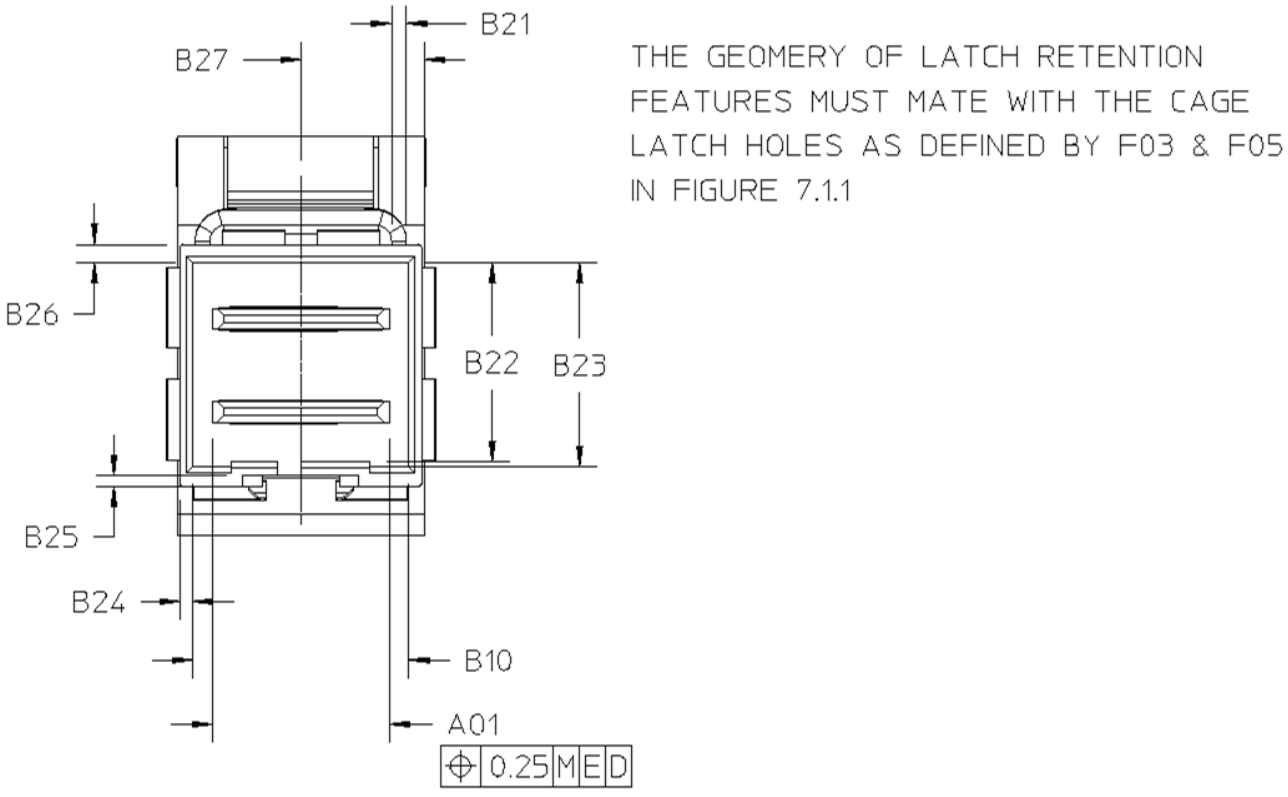

Figure 7-3 4X Plug Retention

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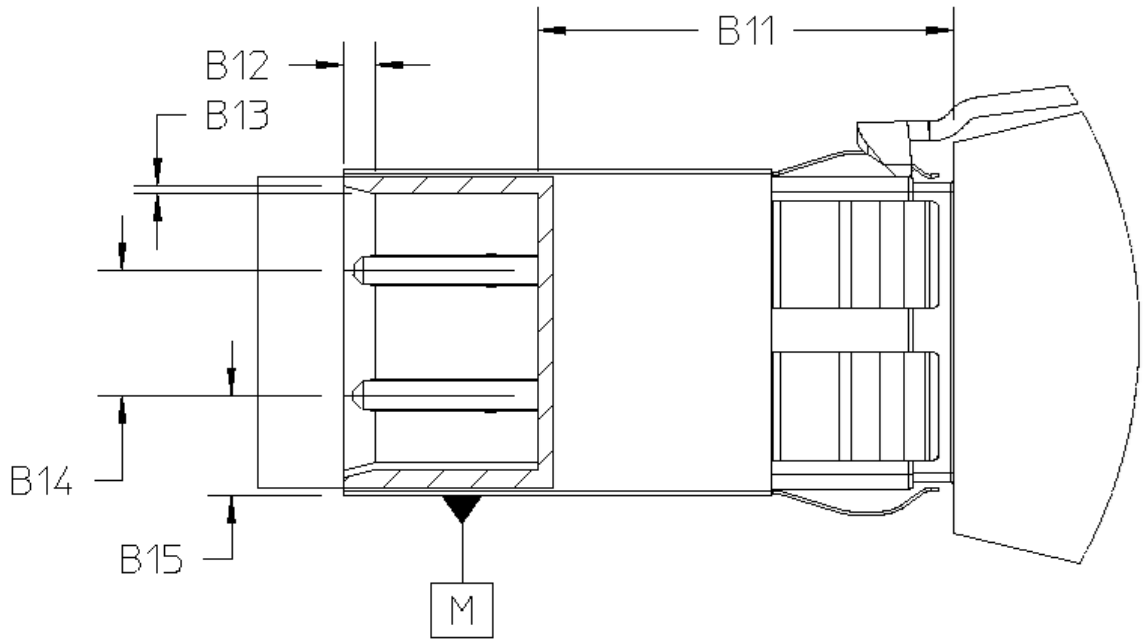

Figure 7-4 4X Plug Housing

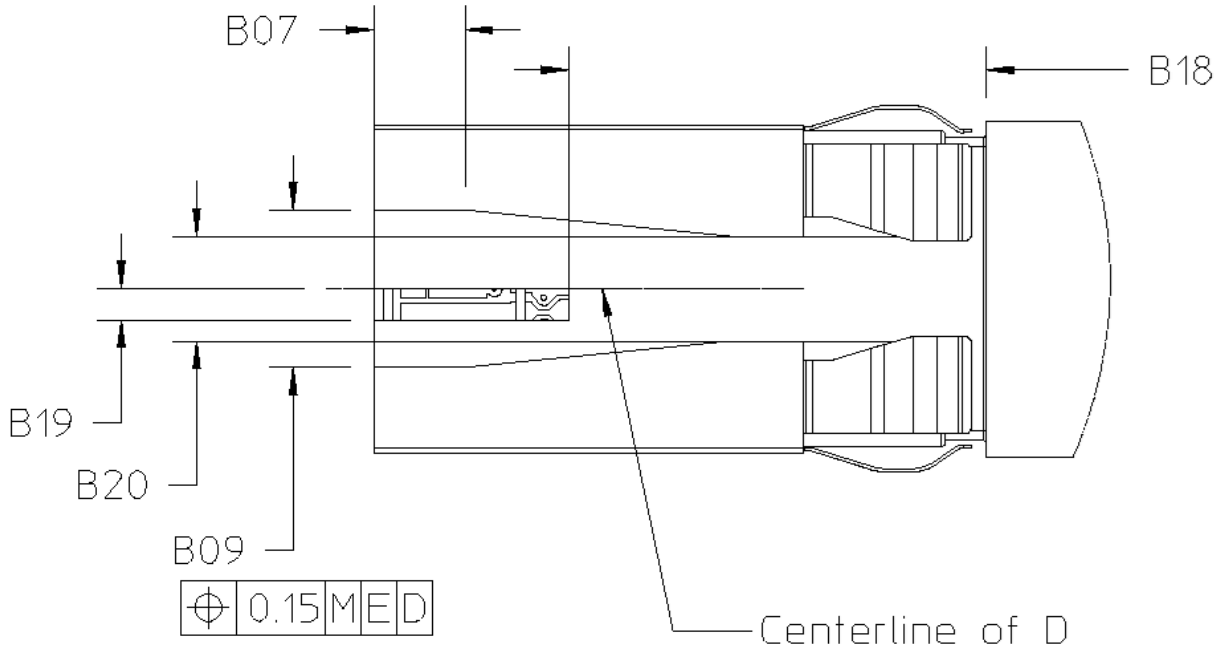

Figure 7-5 4X Plug Key Slot

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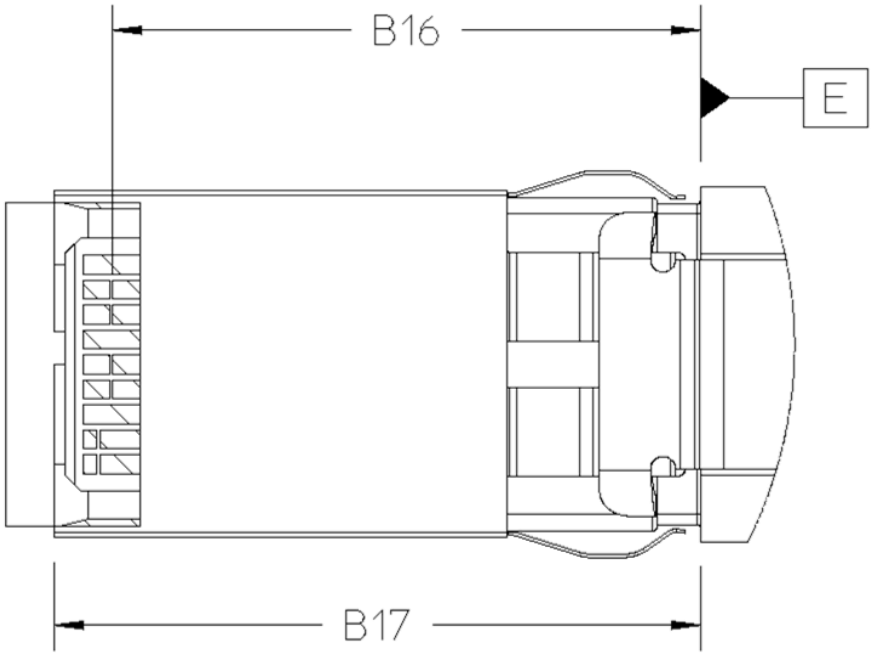

Figure 7-6 4X Plug Latch Stop to Contact

Table 7-2 4X Plug Dimensions

Designator	Description	Dimension	Tolerance +/-
B01	Plug body width	10.85	MAX
B02	Snout width	10.45	0.15
B03	Snout height	10.45	0.15
B04	Plug body length	32.00	MAX
B05	Snot top to plug body top	4.70	0.15
B06	Plug body height	20.30	MAX
B07	Snout groove lead-in length	2.92	0.25
B08	Datum E to snout groove end	1.50	0.10
B09	Snout groove lead-in width	5.00	0.15
B10	Snout inside width	9.35	REF
B11	Datum E to internal keep-out area	13.33	0.10
B12	Lead-in chamfer	1.00	0.15
B13	Lead-in chamfer	0.25	0.10
B14	PCB centerline to PCB centerline	4.00	0.10
B15	Snout bottom to lower PCB centerline	3.22	0.10
B16	Plug body to PCB datum	17.80	0.25
B17	Snout length	19.56	0.10
B18	Datum E to blocking key slot end	13.33	0.10
B19	Blocking key slot width	1.00	0.15
B20	Snout groove lead-in width	3.34	0.15
B21	Latch bard zone	0.70	REF
B22	Snout inside height	8.62	0.10
B23	Snout inside height	8.85	0.10
B24	Plug side wall thickness	0.55	0.08
B25	Snout groove height	0.45	0.10
B26	Snout top thickness	0.78	0.10
B27	Latch catch width	4.57	REF

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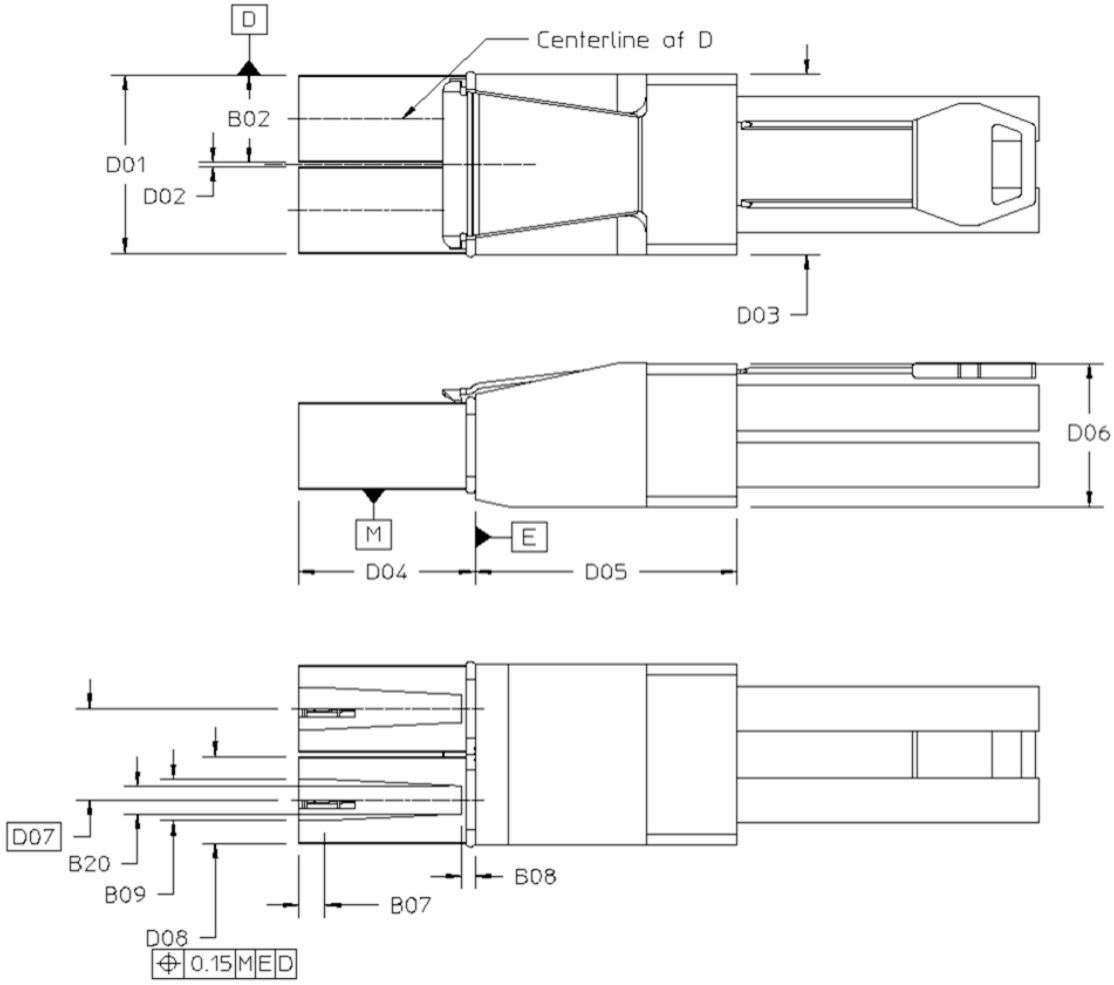
7.3 8X Plug



Note: This figure is shown with one possible elastomeric gasket solution and Datum E and the dimensions established from that datum have been adjusted accordingly for this solution's equivalent hard stop.

Figure 7-7 8X Plug

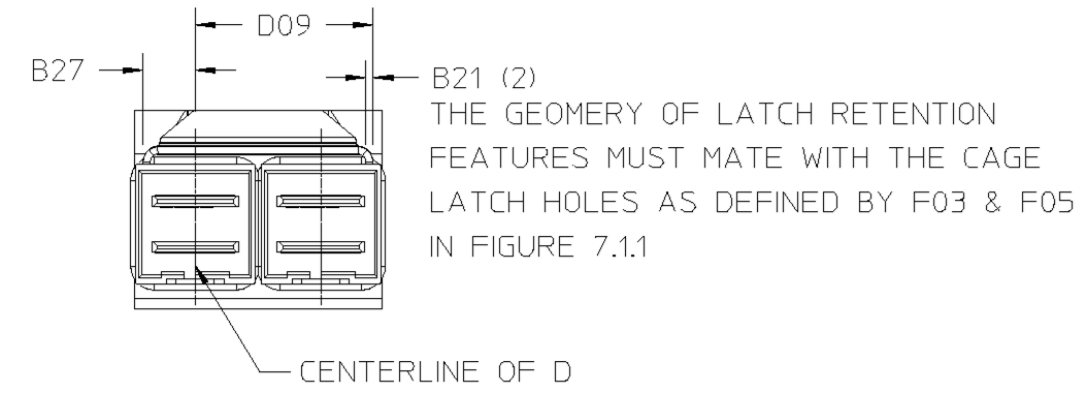


Figure 7-8 8X Plug Retention

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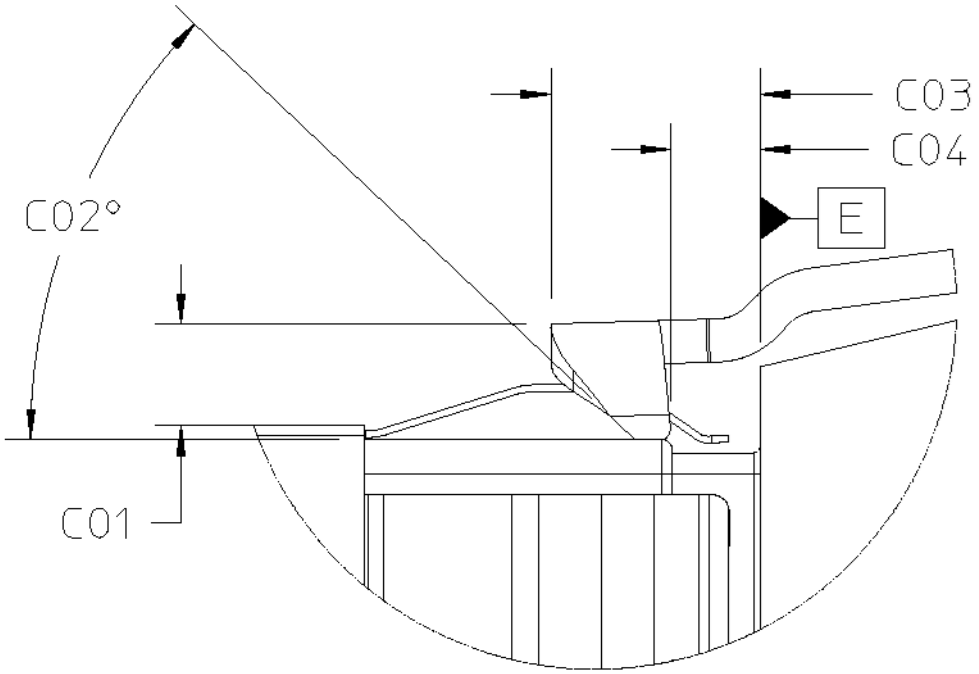
Table 7-3 8X Plug Dimensions

Designator	Description	Dimension	Tolerance +/-
D01	Snout width- overall	21.45	0.20
D02	Snout gap	0.55	REF
D03	Plug body width	21.90	MAX
D04	Snout length	19.76	0.10
D05	Plug body length	32.00	MAX
D06	Plug body height	20.30	MAX
D07	Snout-to-snout pitch	11.00	Basic
D08	Snout width	10.45	0.15
D09	Datum D to latch catch	15.57	REF

7.4 4X Plug Latch



NOTES:

1. Figure shown is one possible EMI solution/ latch configuration
2. Datum E is the leading edge of the plug body and in this configuration acts as the hard stop for the plug against the receptacle cage
3. For other configurations, dimension taken from Datum E (i.e., C03 and C04) must be adjusted to reflect the equivalent hard stop location from Datum E (i.e., using the compression of the elastomeric gasket to define the hard stop)

Figure 7-9 4X Plug Latch

Table 7-4 4X Plug Latch Dimensions

Designator	Description	Dimension	Tolerance +/-
C01	Latch height	1.51	REF
C02	Latch lead-in angle	43°	REF
C03	Latch length	3.70	MAX
C04	Latch barb location	1.32	0.15

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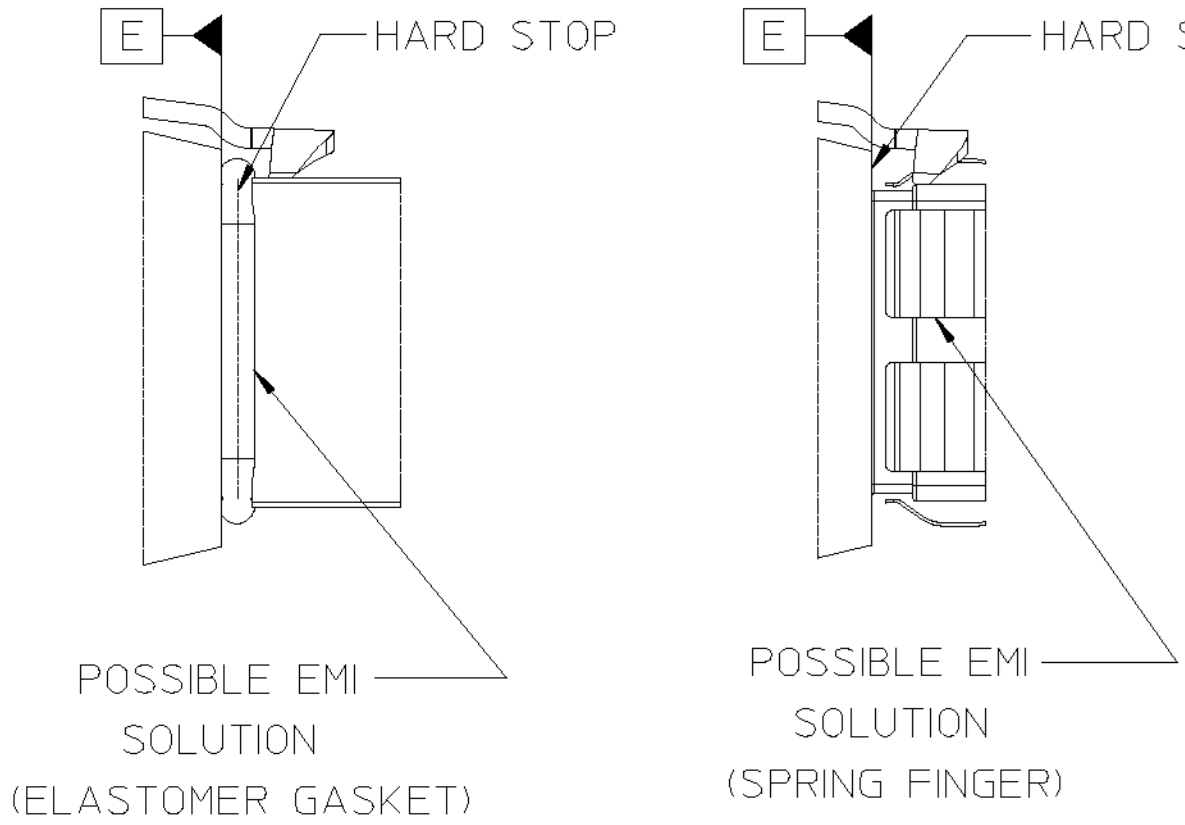

NOTES:
1. Figure shows two possible EMI solutions
2. Other EMI solutions or configurations are possible based on the application requirements

Figure 7-10 4X Plug EMI Options

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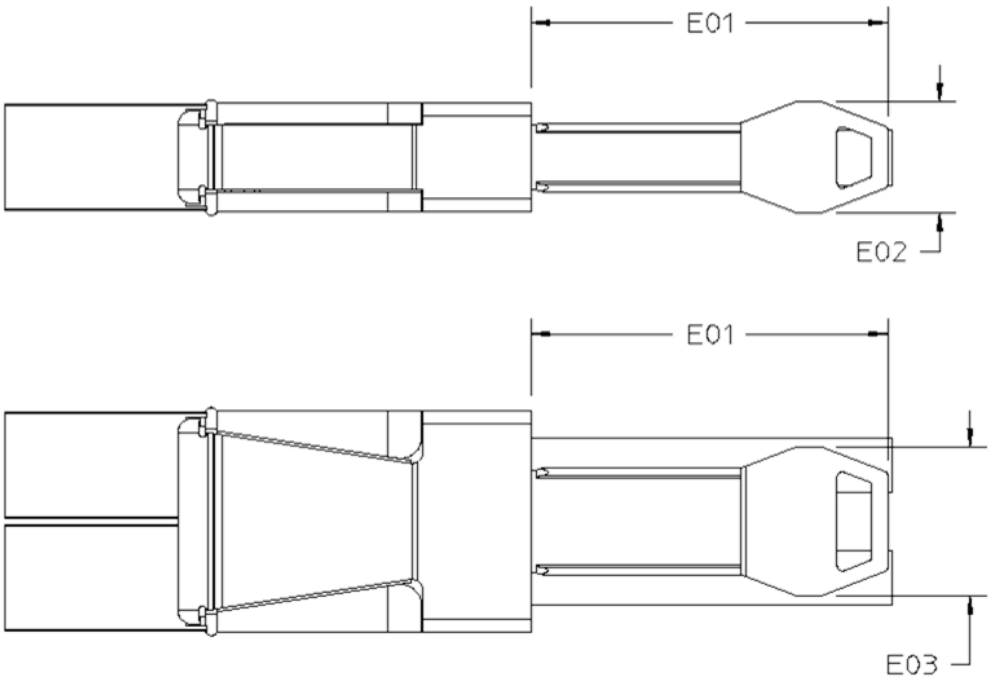
7.5 Plug Pull tab



NOTES:

1. Figure shown is one possible solution. Other configurations to remain with the E02 dimensions.
2. Specific standards may employ color coding for pull tabs.

Figure 7-11 Plug Pull tab

Table 7-5 Plug Pull Tab Dimensions

Designator	Description	Dimension	Tolerance +/-
E01	Latch pull length	40.00	REF
E02	4X latch pull width	10.90	MAX
E03	8X latch pull width	15.00	MAX

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7.6 Plug Thermal Interface

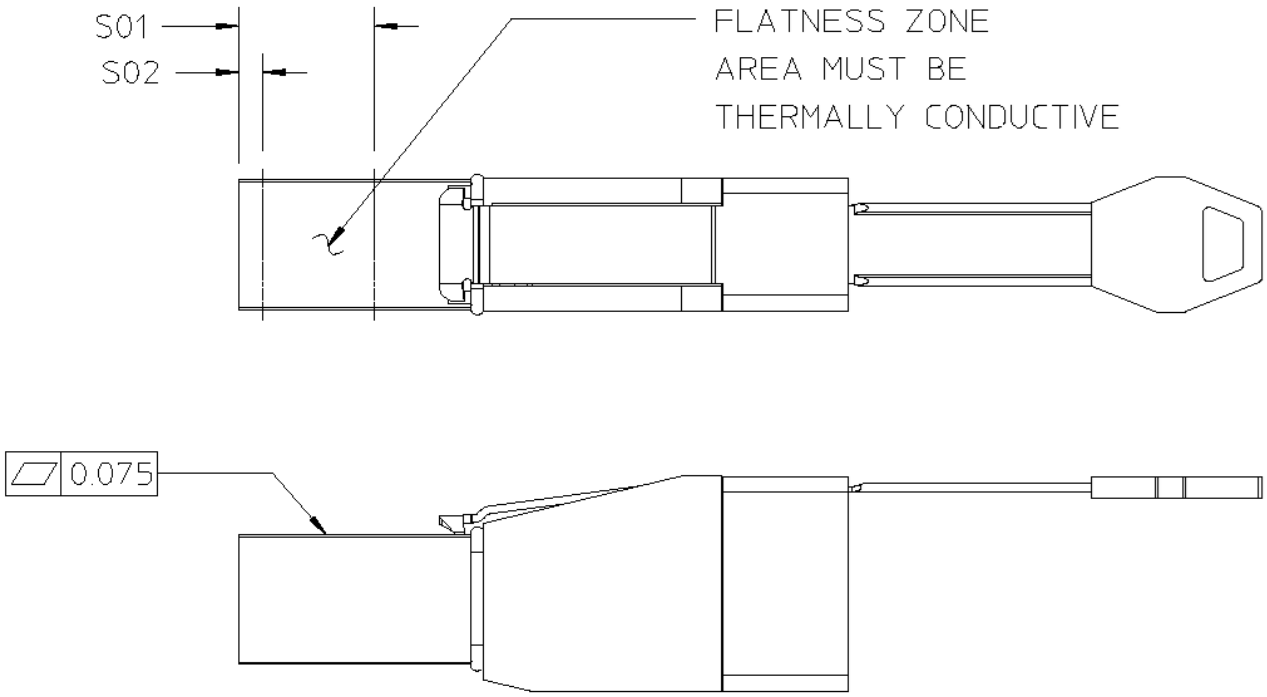

Figure 7-12 Plug Thermal Interface

Table 7-6 Plug Thermal Interface Dimensions

Designator	Description	Dimension	Tolerance +/-
S01	Heat sink engagement zone	11.00	MIN
S02	Heat sink engagement zone	2.00	MAX

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

8.1 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 shall 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.

Table 8-1 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 8-2. Finally, testing procedures used to validate any performance criteria not included in EIA-364-1000 are provided in Table 8-3.

Table 8-1 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; Test Group 6 required if surface treatment is applied	Manufacturer to specify
Wipe length	Designed distance a contact traverses over a mating contact surface during mating and resting at a final position; Test Group 6 is required if wipe length is less than 0.127mm	Manufacturer to specify
Rated Durability Cycles	The expected number of durability cycles a component is expected to encounter over the course of its life	250 cycles
Mating Force*	Amount of force needed to mate a module with a connector when latches are deactivated	62 N MAX
Unmating Force*	Amount of forced needed to separate a module from a connector when latches are deactivated	30 N MAX
Latch Retention*	Amount of force the latching mechanism can withstand	75 N MIN
Environmental Requirements		
Field Life	The expected service life for a component	10 years
Field Temperature	The expected service temperature for a component	65°C
Storage Temperature*	The expected storage temperature for a component when not in use	-20°C to +85°C
Storage Humidity*	The expected storage humidity for a component when not in use	80% Relative Humidity
Environmental Requirements		
Current*	Maximum current to which a contact is exposed in use	0.5A per contact MAX
Operating Rating Voltage	Maximum voltage to which a contact is exposed in use	30V DC per contact MAX
NOTE: Performance criteria denoted with starts (*) are not validated by EIA-364-1000 testing. Refer to **Table 8-3** for test procedures and pass/fail criteria.		

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Table 8-2 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 8-1 are met. Any information in this table supersedes EIA-364-1000.

Table 8-2 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 should be locked)	No evidence of physical damage
Durability	EIA-364-09 To be tested with connector, cage, and module (Latches should be locked out per EIA-364-1000)	No visual damage to mating interface or latching mechanism
Environmental Tests		
Mixed Flowing Gas (see Note 1)	EIA-364-65 Class II See Table 4.1 in EIA-364-1000 for exposure times Test option Per EIA-364-1000: 1B	No intermediate test criteria
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

NOTES:
1. Temperature and duration must be reported.
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 8-3 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 8-1 are met.

Table 8-3 Additional Test Procedures

Test	Test Descriptions and Details	Pass/ Fail Criteria
Mechanical/ Physical Tests		
Mating Force	EIA-364-13 To be tested with cage, connector, and module without heat sinks Latching mechanism deactivated (locked out)	Refer to Table 8-1 -AND- No physical damage to any components
Unmating Force	EIA-364-13 To be tested with cage, connector, and module without heat sinks 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)	
Vibration	EIA-364-28 Manufacturer to report test details	No physical damage -AND- No discontinuity longer than 1 microsecond -AND- 20 mΩ MAX change from baseline
Mechanical Shock	EIA-364-27 Manufacturer to report test details	No physical damage -AND- 20 mΩ MAX change from baseline
Environmental Tests		
Storage Temperature	EIA-364-32 Method A, Test Condition 1, Duration 4 Use min and max Field Temperatures listed in Table 8-1 for temperature range	Refer to Table 8-1
Storage Humidity	EIA-364-31	Refer to Table 8-1
Electrical Tests		
Current	EIA-364-70 Method 3, 30-degree temperature rise Contacts energized: Manufacturer to specify	Refer to Table 8-1 for current magnitude
Insulation Resistance	100 VDC	1000 Megaohms minimum between adjacent contacts

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