SFF-TA-1006

Specification for

Enterprise and Datacenter 1U Short Device Form Factor (E1.S)

Rev 1.6.4 ~~September 2~~December 5, 2025

SECRETARIAT: SFF TWG

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

ABSTRACT: This specification defines the mechanical attributes of a 1U short form factor for a device with multiple thicknesses that will fit in vertically in standard 1U rack mounted host systems.

This specification provides a common reference for host systems manufacturers, host system integrators, and device suppliers. This specification originates from Enterprise and Datacenter SSD Form Factor Working Group (EDSFF). Based on non-SSD devices also using EDSFF and agreement from the EDSFF Working Group, the SFF TWG agreed changing EDSFF to Enterprise and Datacenter Standard Form Factor.

POINTS OF CONTACT:
SNIA Technical Council Administrator
Email: TCAdmin@snia.org

Chairman SFF TWG
Email: SFF-Chair@snia.org

EDITORS:
Anthony Constantine, Micron Technology
Wayne Gregory, Solidigm

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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, as well as since SFF's transition to SNIA in 2016, 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/join.

Revision History

Rev 1.0 *January 16, 2018:*

- Initial release with editorial fixes to TOC and Fig 4-1 diagram

Rev 1.1 *June 1, 2018*:

-Updated IP section and foreword per current policy.
-Corrected ASME reference in 2.3 for consistency.
-Corrected dimension F1 in Table 4-1.
-Corrected Figure 4-2 to remove E dimension and changed the radius of the notches in Detail and B.
-Further updates to TOC

Rev 1.2 *April 12, 2019*

-Converted to the new SFF document template
-Added new name (E1.S).
-Clarified abstract.
-Section 3.3: Added definition for enclosure and modified definition of 1U.
-Section 5: Clarified power is a recommendation and added recommended power for optional heat spreader and optional enclosures.
-Section 5.1: Added clarification to bounding volume, surface dimensions, and rounding.
-Table 5-1: Modified Measurement C2 to align with SFF-TA-1002.
-Table 5-1: Modified Measurements D3 and D4.
-Table 5-1: Fixed the comment for Measurement F6.
-Section 5.4, 5.5: Added. This adds optional symmetric and asymmetric enclosure dimensions.
-Section 7: Added. This is an informative section on system thermal design guidelines.

Rev 1.3 *July 17, 2019*

-Section 5.1: Added statement to clarify that PCB dimensions are not required but highly recommended for enclosures specified in sections 5.4 and 5.5.
-Section 5.1 changed added wording for PCB in enclosures
-Figure 5.1: Added new dimension D5
-Figure 5.1: Added label for LED facing side
-Table 5.1: Clarified measurement for D1, D2 is to LED center position
-Table 5-1: Made E1-E7 BASIC to match the drawing
-Table 5.1: Added comment to drawing on mounting hole dependency to C2
-Section 5.4, 5.5, 6: Added x8 Card Edge along with Dimension B10 (Enclosure to x8 Datum F)
-Section 5.4, 5.5: Added Measurement C8 (Datum Y to Datum T), B11 (Datum W to LED center)
-Section 5.5: Added note to clarify Section 5.5 dimensions are equivalent to section 5.4
-Figure 5-3, 5-4: Add label to primary and secondary side
-Figure 5-3, 5-4: Change drawing ordering
-Figure 5-3, 5-4, Table 5-3: Added dimensions D6, D7, D8, E16
-Table 5-3: Fixed an error in value of B8.
-Table 5-4: Deleted dimensions B8 and B9. Redundant

Rev 1.4 *March 27, 2020*

- Added 15mm asymmetric thickness to section 5.5, corresponding thermal entry in Table 7.1 and descriptions in sections 5.1 and 7.1.

Rev 1.5 *August 6, 2021*
-Changed SSD to device and abstract edit to reflect EDSFF name change.
-Section 3.1: Change to definition of Restricted
-Section 5: Clarification on power and only PCB card edge is exposed outside the enclosure area.
-Section 5: Removal of default tolerance and added tolerances to Table 5-2.
-Section 5: Datum name change from "Y" to "G" to align with SFF-TA-1002 Datum.
-Section 5: Removal of Power references apart from section 5.1 recommendations.
-Section 5: Moved the power references in section 5.1 to an informative table.
-Section 5.1: Moved statements on mounting holes, defined hatch, and labels to Section 5.2
-Section 5.1: Added statement allowing security labels to be placed anywhere on the enclosure.
-Table 5-1: Changed C2 note to cover 7.5 mm instead of 7 mm.
-Table 5-1: Removed x, y references to mounting hole measurements.
-Table 5-1: Removed dimensions in comments for the cutouts.
-Table 5-2: Removed heat spreader option and x, y references in the comments.
-Figure 5-4: Added Phi to E14
-Section 5.4, 5.5: Changed note 1 wording.
-Section 5.4, 5.5: Added note on security label being allowed in label keep out region.
-Section 5.4, 5.5: Changed PCB expose from shall to should. Intent to make shall in future revision.
-Section 5.4, 5.5: Clarification that both 1C and 2C card edges are allowed.
-Section 5.4, 5.5: Removed measurement E16 (REF dimension) and moved C8 to a different view.
-Section 5.4, 5.5: Note added for recommended ground contact.
-Section 7: Deleted informative thermal guidance. Replaced with power and thermal requirements.
-Table 7-1: Added an entry for bare PCB vs. enclosure-based device.

Rev 1.6 *September 2, 2025*
-Changes to align with boiler plate.
-Table 5-1, 5-2: Changed any reference value tolerance to REF for consistency with Table 5-3.
-Table 5-3: Corrected B5 comment from Datum X to Datum W.
-Section 7: Added additional description and context to Table 7-1 and removed Table 7-2.
-Editorial throughout

Rev 1.6.1 *September 23, 2025*
-Figure 5-3: Added direct cold plate contact area, roughness, flatness, and lead in measurements.
-Table 5-3: Added values to match Figure 5-3. Minor editorial.

Rev 1.6.2 *October 24, 2025*
-Added spec for maximum pressure.
-Figure 5-3: Made additional changes to clarify cooling interface area and primary side supports.
-Figure 5-3: Added notes 2-5

Rev 1.6.3 *October 27, 2025*
-Figure 5-3: Added new dimension C11 for Cooling Interface Area length.

Rev 1.6.4 *December 5, 2025*
-Addressed comments during comment resolution.

Rev 2.0 *tbd, 2025*
-Section 5.4: Updated drawings, notes, and measurements for Direct Liquid Cooling support of the 1U Short Form Factor with Optional Symmetric Enclosure (E1.S 9.5mm). Symmetric enclosures based on Revision 1.6 and older are not compatible, starting with Revision 2.0 specification.

Contents

Figures

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1. Scope

This specification defines the mechanical attributes of a new form factor for a device that will fit in 1U rack mounted host systems designed to support this form factor.

1.1 Application Specific Criteria

This 1U short form factor provides external dimensions, card edge placement, grounded mechanical mounting hole locations and LED placement to assist host system manufacturers in integration of this form factor.

The environment for the 1U short form factor is an enclosure connecting one or more devices in a dedicated packaging environment.

2. References and Conventions

2.1 Industry Documents

The following documents are relevant to this specification:

- ASME Y14.5-2009 Dimensioning and Tolerancing published by ASME, available at https://www.asme.org
- SFF-TA-1002 Protocol Agnostic Multi-Lane High Speed Connector specification
- SFF-TA-1009 Enterprise and Datacenter Standard Form Factor Pin and Signal Specification
- SFF-TA-1023 Thermal Characterization Specification for EDSFF Devices

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

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

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 which are not required by the SFF specification. However, if any feature defined by the SFF specification is implemented, it shall be implemented 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

EDSFF: Enterprise and Datacenter Standard Form Factor
NVM: Non-Volatile Memory
SSD: Solid State Drive

3.3 Definitions

1U: 1 Standard Unit or Rack Unit 44.45 mm (1.75 inches).

Card: Refers to the device plugged into a connector

Device: Refers to the interface target

Enclosure: The housing that protects the internal components and acts as a heat sink.

Host: Refers to the interface source or initiator

Thickness: Form factor dimension including PCB thickness, z-height of all components plus mechanicals.

4. General Description

4.1 Configuration Overview/Descriptions

The application environment for the 1U short form factor is a cabinet or enclosure connecting to one or more add-in cards. 1U refers to 1 standard unit of an IT equipment rack and the IT enclosures that fit in this space. The device form factor is intended for use in enclosures that fit within that given space. The primary usage is for datacenter server and storage systems that require high capacity and performance highly scalable in 1U. The device connects electrically to the system through a card edge connector as defined in SFF-TA-1002. There are multiple thicknesses of the 1U short form factor depending on the max power rating. The definition of mounting holes and component placement area allows for attachment of mechanicals to adapt among different enclosure chassis, such as rails and latching. The form factor is designed not to require a fully enclosed case, but outer dimensions of a case version are included for compatibility if one is desired. Figure 4-1 represents an example of a system implementation using the 1U short form factor.

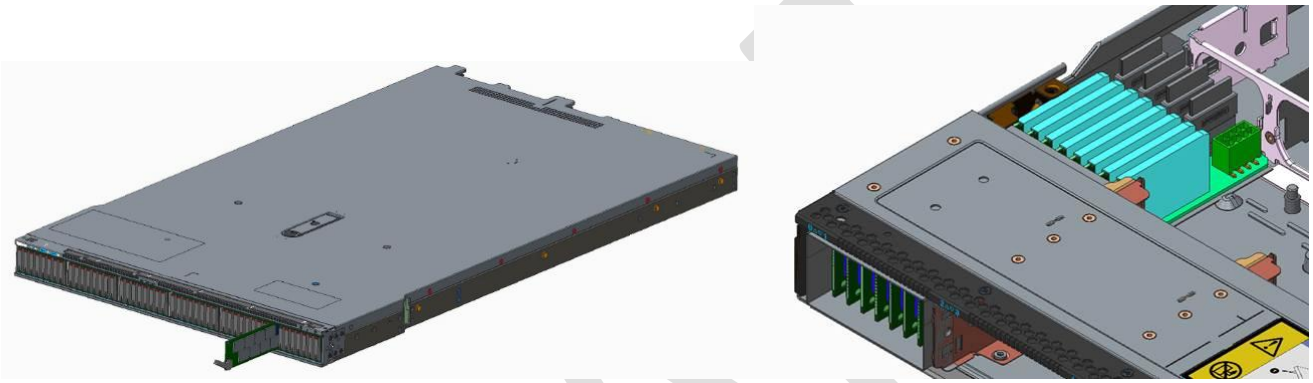


Figure 4-1. Example systems showing implementations of 1U short form factor.

5. Mechanical Specification

5.1 Overview

This section specifies the dimensions for the 1U short form factor. There are multiple thicknesses specified:

- A 5.9 mm thick form factor
- An 8.01 mm thick form factor with an optional heat spreader
- A 9.5 mm thick form factor with an optional symmetrical enclosure
- A 15 mm thick form factor with an optional asymmetric enclosure
- A 25 mm thick form factor with an optional asymmetric enclosure

No part of the host chassis/guide rails of a host enclosure or parts connected to the mounting holes (e.g., a latch) should encroach into any part of the bounding volume of the device form factor dimensions and tolerances as specified in this standard when the device is inserted into the host enclosure.

Unless specified, the default tolerance is +/- 0.15 mm. All dimensions provided in mm.

For the label placement and fin area, dimensions for a surface apply to a single point minimum. If a surface is not flat, the dimension applies to the highest raised location on that surface. Except for the card edge connector, each defined edge may have rounding that should be as little as possible and as much as necessary.

The form factors specified in Section 5.2 and Section 5.3 may be used within the enclosures specified in Section 5.4 and 5.5, but is not required. The PCB with 2C (x8) card edge is not required to meet Section 5.2.

5.2 Physical Definition: 1U Short Form Factor

All specified mounting holes shall be grounded and mechanical attachment should not exceed radius of defined copper pads. The defined hatched area is component placement area. Unless specified, any labels must be in component placement or optional heat spreader area.

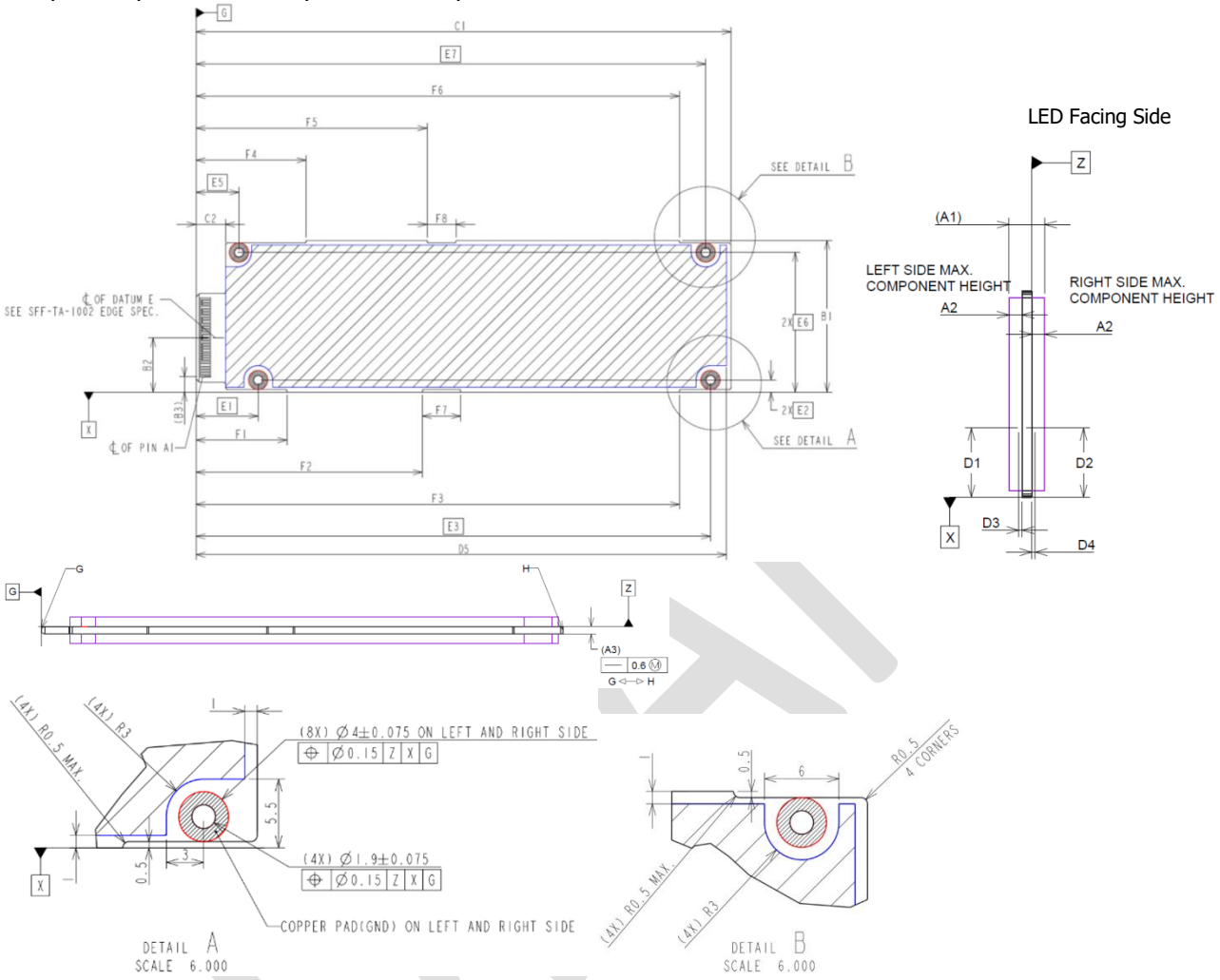


Figure 5-1. 5.9 mm Thick 1U Short Form Factor drawing

5.2.1 1U Short Form Factor

Table 5-1. 1U Short Form Factor Dimensions

Dimensions	Millimeters	Tolerance	Comment
A1	5.9	REF	Maximum device thickness (reference)
A2	2.10	MAX	Maximum component height
A3	1.57	REF	PCB Card Edge thickness (see SFF-TA-1002)
B1	31.5	0.2	Device height with defined cutouts
B2	11.23	0.15	Card Bottom Edge to centerline of Datum E
B3	3.21	REF	Center of Connector Pin A1 location from PCB (reference)
C1	111.49	0.15	Add in card Length
C2	6	MIN	Card edge length. Note if dimension is greater than 7.5 mm, mounting hole 3 is allowed to be a half-moon
D1	10.6	0.15	Power and activity (Green) LED lens mechanical center position from Datum X
D2	10.6	0.15	Attention or error (Amber) LED lens mechanical center position from Datum X
D3	0.5	0.2	Power and activity (Green) LED lens mechanical center position from PCB.
D4	0.5	0.2	Attention or error (Amber) LED lens mechanical center position from PCB.
D5	110.49	0.45	LED edge closest to latch area
E1	12.95	BASIC	Mounting hole 1
E2	2.5	BASIC	Mounting hole 1 and 2
E3	107.19	BASIC	Mounting hole 2
E5	8.95	BASIC	Mounting hole 3
E6	29	BASIC	Mounting hole 3 and 4
E7	106.19	BASIC	Mounting hole 4
F1	18.95	0.15	Cutout 1
F2	47.15	0.15	Cutout 2
F3	100.69	0.15	Cutout 3
F4	22.95	0.15	Cutout 4
F5	48.15	0.15	Cutout 5
F6	100.69	0.15	Cutout 6
F7	8	0.15	Width of cutout 2
F8	6	0.15	Width of cutout 5

5.3 Physical Definition: 1U Short Form Factor with Optional Heat Spreader

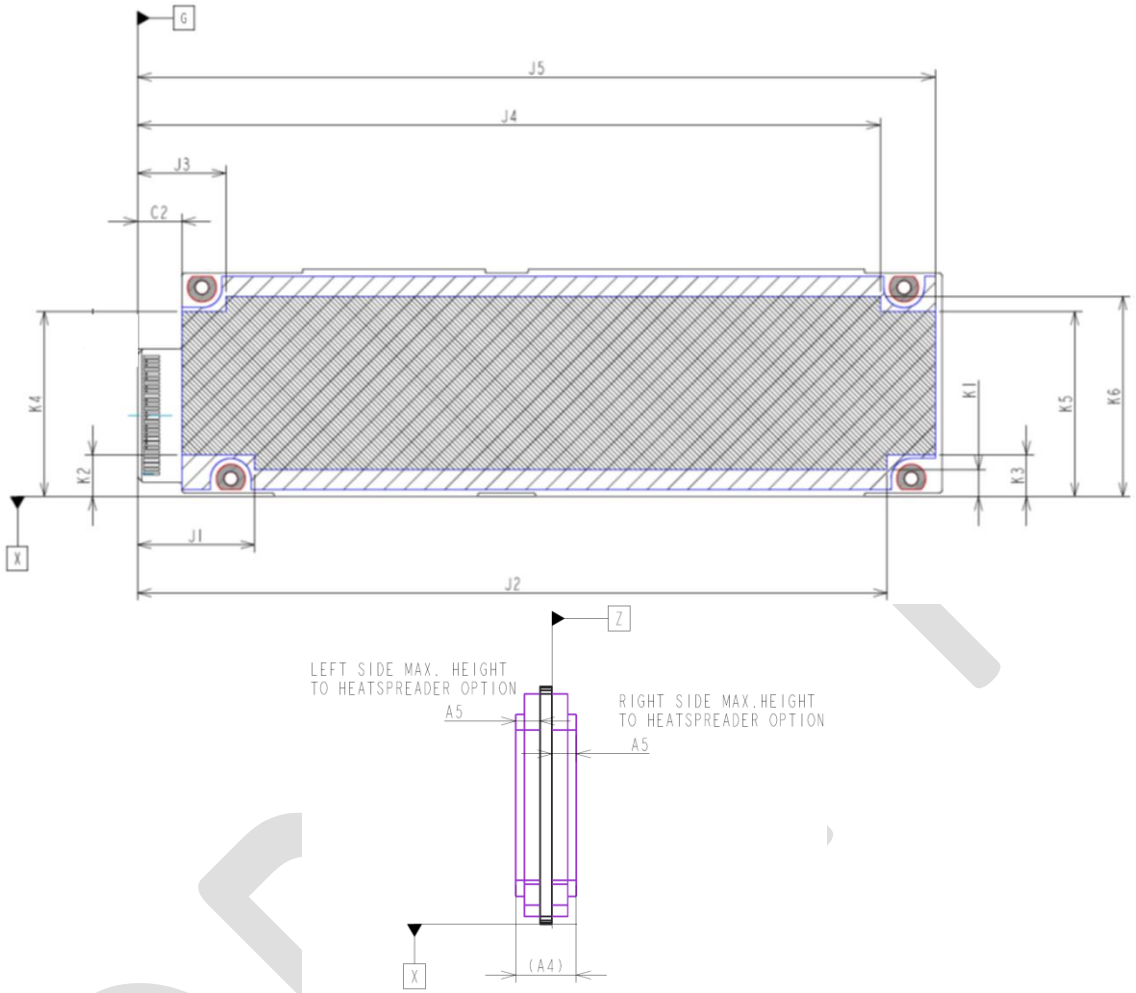


Figure 5-2. 1U Short Form Factor drawing with heat spreader option

5.3.1 1U Short Form Factor with Optional Heat Spreader

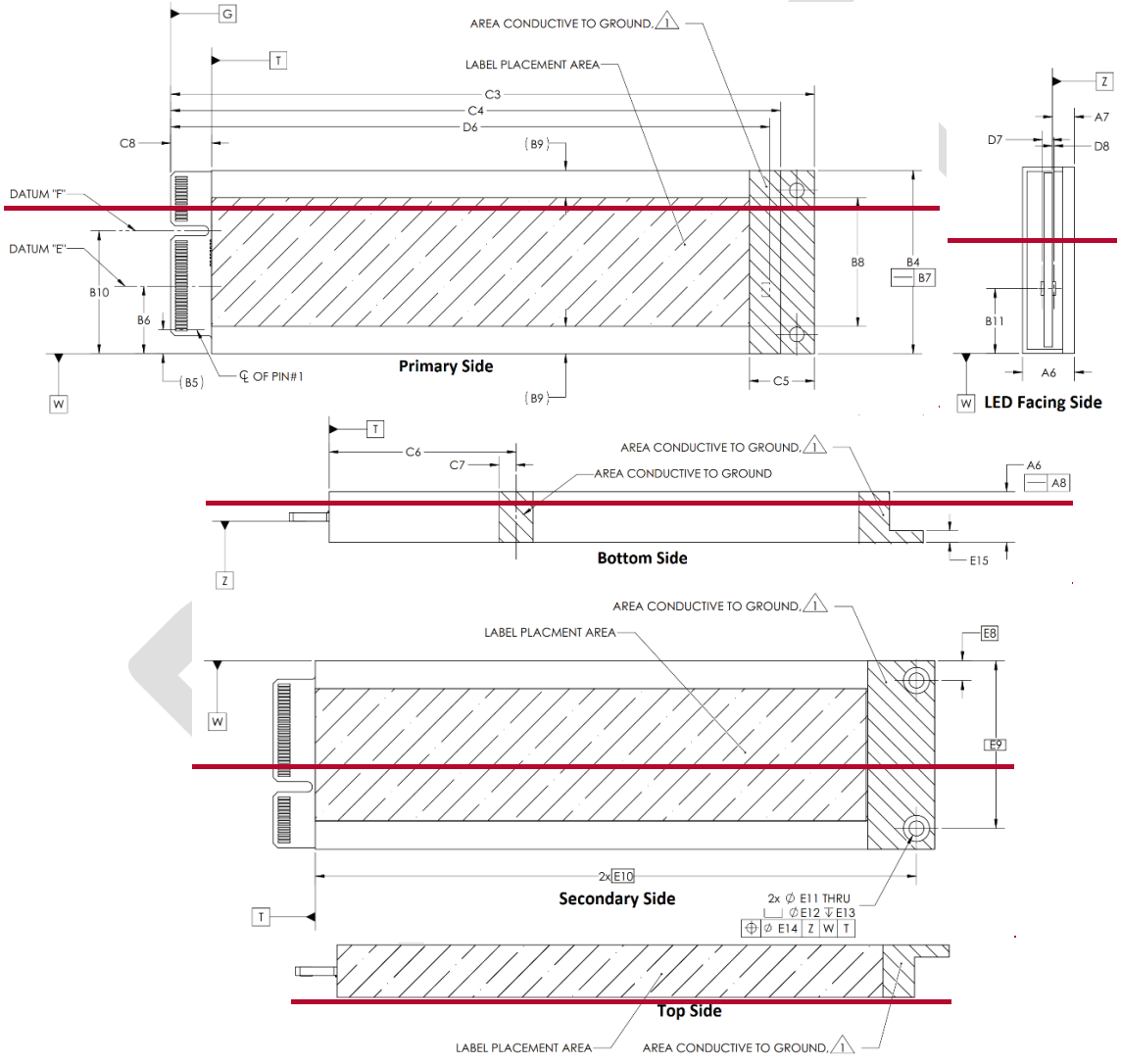
Table 5-2. 1U Short Form Factor – Optional Heat Spreader Dimensions

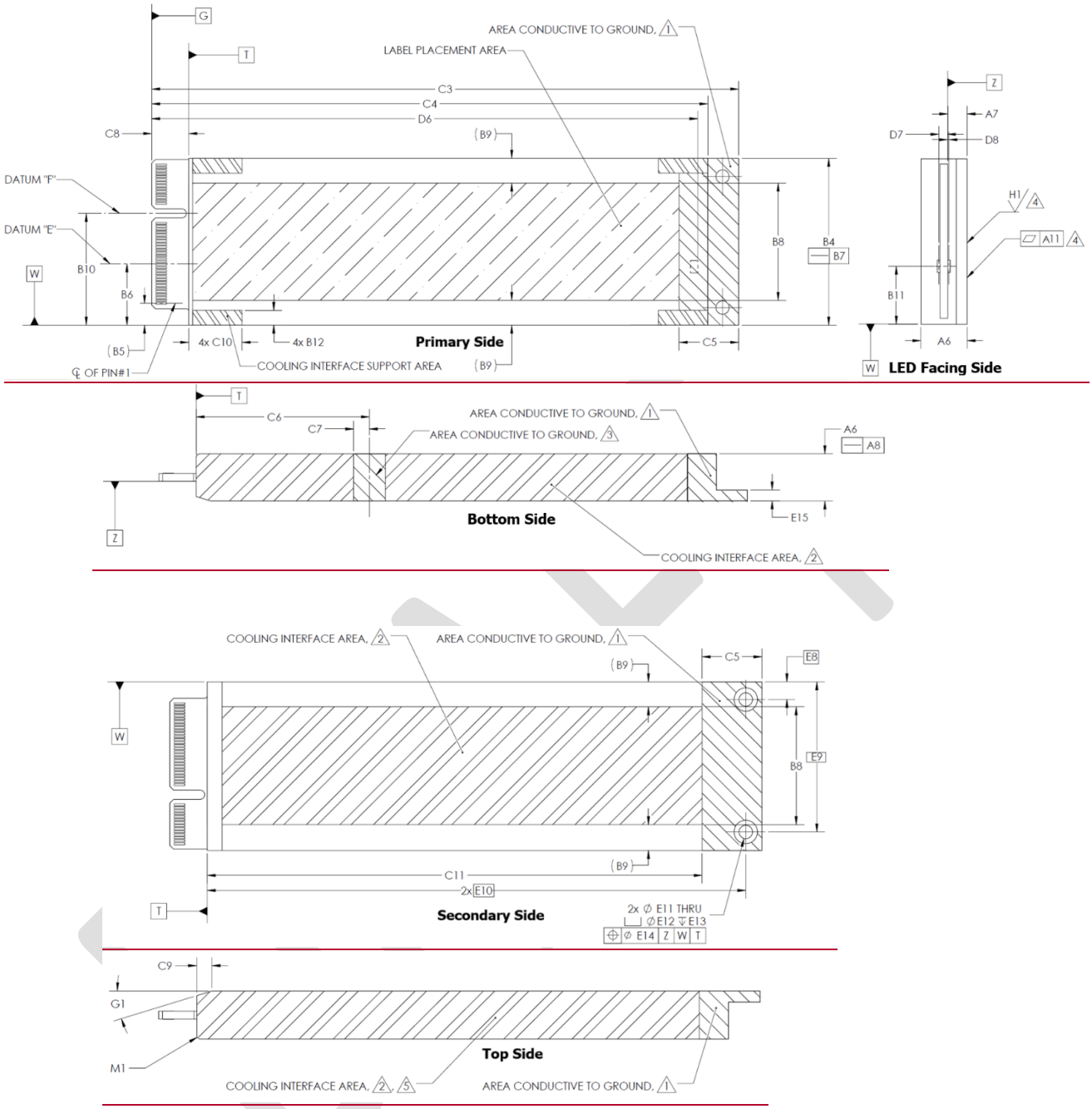
Dimensions	Millimeters	Tolerance	Comment
A4	8.01	REF	Device thickness including heat spreader (reference)
A5	3.22	0.25	PCB to outer thickness for heat spreader
J1	16.25	0.15	Heat spreader dimension
J2	103.89	0.15	Heat spreader dimension
J3	12.25	0.15	Heat spreader dimension
J4	102.89	0.15	Heat spreader dimension
J5	110.49	0.15	Heat spreader dimension
K1	3.7	0.15	Heat spreader dimension
K2	5.8	0.15	Heat spreader dimension
K3	5.8	0.15	Heat spreader dimension
K4	25.7	0.15	Heat spreader dimension
K5	25.7	0.15	Heat spreader dimension
K6	27.8	0.15	Heat spreader dimension

5.4 Physical Definition: 1U Short Form Factor with Optional Symmetric Enclosure for Air and Direct Liquid Cooling

The PCB excluding the card edge should not extend past the defined enclosure area. The device defined in the following section supports either the 1C or 2C card edge as defined in SFF-TA-1002 and has defined contact areas for direct liquid cooling. The area conductive to ground may be larger than what is documented. Labels shall be placed in the label placement area. Security labels and recessed mounting holes are permitted on any surface of the enclosure.

Warning: In a direct liquid cooling usage, the force applied to the secondary side should not be applied such that there is excessive shear force applied to the card edge and connector. This is a host responsibility and the card edge and/or connector could be damaged by excessive force. Host cold plates should not extend past the cooling interface area.





Notes:

1. Host should make grounding contact to at least 1 of these surfaces on the LED facing side.
2. Each area shall withstand up to 138 kPa normal to the surface. For the secondary side, this assumes the host supports at a minimum the full contact area of the indicated primary side Cooling Interface Support Areas. For top or bottom side, the opposite side cooling area is the Cooling Interface Support Area.
3. This surface may also be used as a cooling interface area.
4. A11 and H1 at minimum apply only to the cooling interface area.
5. ~~1.~~Surface may be used as label placement area if not being used as cooling interface area.

Figure 5-3. 1U Short Form Factor drawing with Optional Symmetric Enclosure

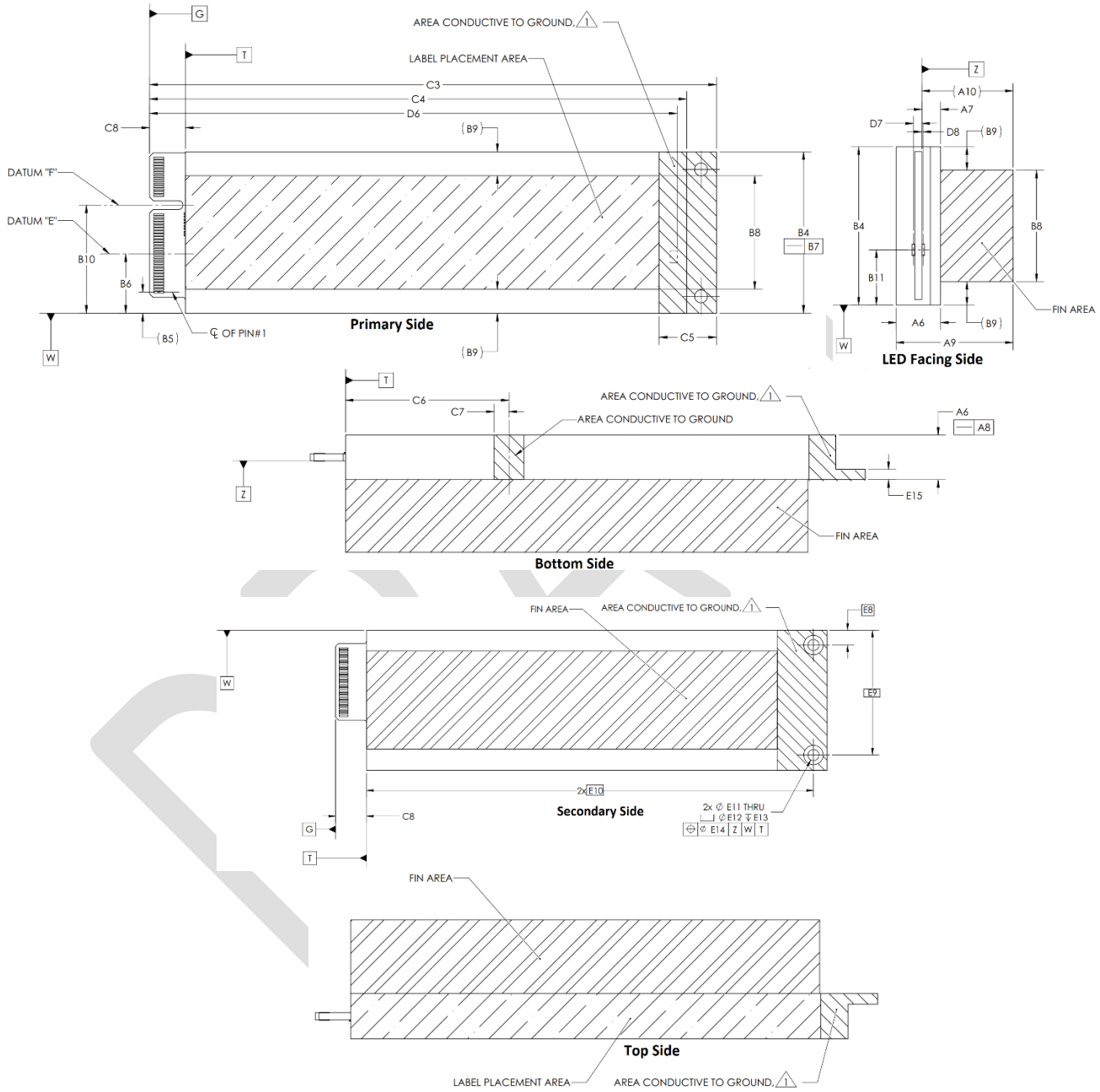
5.4.1 1U Short Form Factor with Optional Symmetric Enclosure

Table 5-3. 1U Short Form Factor – Optional Symmetric Enclosure Dimensions

Dimensions	Millimeters	Tolerance	Comment
A6	9.5	0.35	Device Thickness including enclosure
A7	3.96	0.15	PCB at LED and card edge connector to outer thickness
A8	0.4	MAX	Straightness
A11	0.12	MAX	Flatness for Cooling Interface Area on Secondary Side
B4	33.75	0.25	Device width
B5	4.4	REF	Center - Connector Pin A1 location from DATUM "W"
B6	12.415	0.35	Control dimension for x4 card edge; SFF-TA-1002 DATUM "E"
B7	0.4	MAX	Straightness
B8	23.75	0.25	Label~~/Fin~~ placement region (primary side), Cooling Interface Area for symmetric enclosure / Fin Area for asymmetric enclosures (secondary side)
B9	5	REF	Host alignment structure region (reference)
B10	22.605	0.35	Control dimension for x8 card edge; SFF-TA-1002 DATUM "F"
B11	11.79	0.35	Datum "W" to LED center position
B12	3	MIN	Cooling Interface Support Area Width
C3	118.75	0.55	Device length
C4	112.5	+0.15/-0.95	Datum "G" to latch area keep out zone
C5	12	MIN	Minimum Conductive area length. If this area overlaps with the Cooling Interface Support Area, then that overlapped area shall meet both sets of requirements.
C6	35	0.15	Datum "T" to ~~B~~bottom conductive area 1 ~~x~~ position
C7	3.2	MIN	Bottom conductive area length
C8	7.5	0.25	Datum "G" to Datum "T" (edge of enclosure)
C9	3.0	+0.5/-0	Lead-in chamfer length
C10	10	MIN	Cooling Interface Support Area length
C11	99.25	+0/-0.5	Cooling Interface Area length
D6	110.49	0.45	LED edge closest to latch area
D7	2.07	0.48	Green LED center position
D8	0.5	0.35	Amber LED center position
E8	3.55	BASIC	Datum "W" to ~~M~~mounting Hole 1 ~~g~~ position
E9	30.05	BASIC	Datum "W" to ~~M~~mounting Hole 2 ~~g~~ position
E10	108	BASIC	Datum "T" to ~~M~~mounting Hole 1 ~~x~~ and 2 ~~x~~ position
E11	2.7	0.15	Mounting Thru Hole Diameter
E12	4.7	0.15	Mounting Counterbore Diameter
E13	1.2	0.1	Mounting Counterbore Depth
E14	0.25	MAX	Position Tolerance
E15	2.2	0.15	Latch mounting area thickness
G1	17°	+3°/-0°	Lead-in chamfer angle
H1	0.0016	MAX	Roughness for Cooling Interface Area on Secondary Side
M1	0.8	+0.4/-0	Lead-in fillet radius

5.5 Physical Definition: 1U Short Form Factor with Optional Asymmetric Enclosure

Unless specified in Table 5-4, dimensions are the same as in Table 5-3. There are two thicknesses denoted in Table 5-4. The PCB excluding the card edge should not extend past the defined enclosure area. The device defined in the following section supports either the 1C or 2C card edge as defined in SFF-TA-1002. The area conductive to ground may be larger than what is documented. Labels shall be placed in the label placement area. Security labels are permitted on any surface of the enclosure.



Notes:

1. Host should make grounding contact to at least 1 of these surfaces on the LED facing side.

Figure 5-4. 1U Short Form Factor drawing with Optional Asymmetric Enclosure

5.5.1 1U Short Form Factor with Optional Asymmetric Enclosure

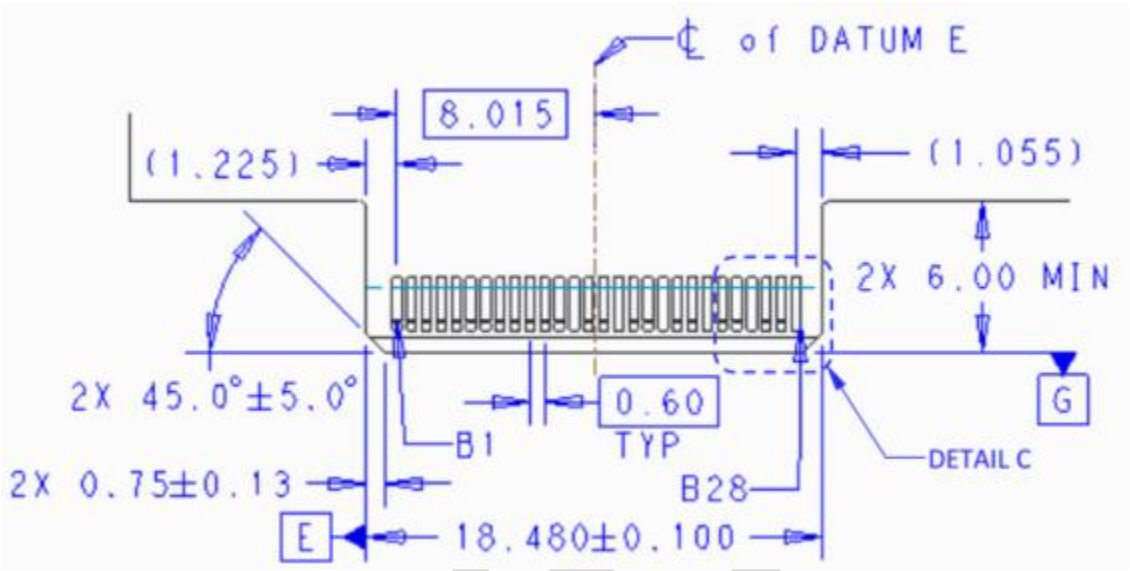
Table 5-4. 1U Short Form Factor – Optional Asymmetric Enclosure Dimensions

Dimensions	Millimeters	Tolerance	Comment
A9a	25	+0.35/-0.60	Device Thickness including thick enclosure (25 mm)
A10a	19.46	REF	PCB to outer thickness with Heatsink (25 mm)
A9b	15	+0.35/-0.60	Device Thickness including thick enclosure (15 mm)
A10b	9.46	REF	PCB to outer thickness with Heatsink (15 mm)

6. Informative: SFF-TA-1002 edge (plug) Mechanical drawing

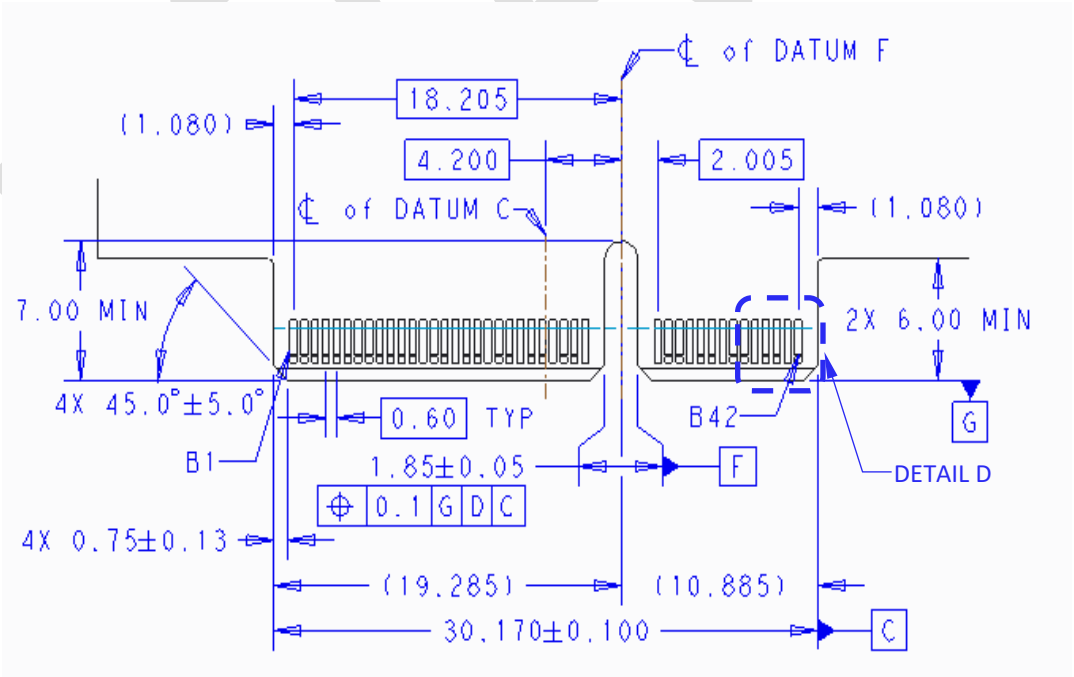
6.1 Overview

This section shows the card edge mechanical drawing for convenience only. See SFF-TA-1002 for normative and performance requirements.



Note: Position A1 on opposite side of card of B1

Figure 6-1. 1C (x4) Mating Card Dimensions



Note: Position A1 on opposite side of card of B1

Figure 6-2. 2C (x8) Mating Card Dimensions

7. E1.S Power/Thermal Requirements

The following section covers the power and thermal requirements of the device.

7.1 Power

Power constraints for this device form factor are summarized in Table 7-1. For more information, refer to SFF-TA-1009 *Enterprise and Datacenter Standard Form Factor Pin and Signal Specification*.

Table 7-1. Device Power Requirements for a 1U short (E1.S) system implementation

Parameter	E1.S (5.9/8.01 mm Thickness)	E1.S (9.5/15/25 mm Thickness)	Comment
Initial Slot Power Limit(12Vpinit)	12 W	25 W	Refer to SFF-TA-1009 for definitions and additional details.
Maximum device power capability	Up to 79.2 W at 12 V		Limited by the current capability of SFF-TA-1002

7.2 Thermals

For detailed device thermal requirements, refer to SFF-TA-1023 *Thermal Specification for EDSFF Devices*.

7.3 Informative: Maximum Sustained Device Power

There is no specified maximum sustained power for this device apart from the connector limits. The connector is defined to supply a maximum sustained current of 6.6 A which at 12 V nominal limits the form factor to 79.2 W of power. This value, however, is further limited by the operating environment of the host and device. The host manufacturer should provide their requirements and communicate this value as defined by the 12Vpsus definition in SFF-TA-1009 *Enterprise and Datacenter Standard Form Factor Pin and Signal Specification*.