



SFF-TA-1006

Specification for

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

Rev 1.1.1

February 4, 2019

SECRETARIAT: SFF TA TWG

This specification is made available for public review at <http://www.snia.org/sff/specifications>. Comments may be submitted at <http://www.snia.org/feedback>. Comments received will be considered for inclusion in future revisions of this specification.

The description of the form factor in this specification does not assure that the specific component is available from suppliers. If such a form factor 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 solid state drive that ~~will fit in vertically in host systems designed to fit in one or multiple units of the standard 1U rack mount height. mounted host systems designed to support this new form factor.~~

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).

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

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

1 Foreword

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

5
6 For those who wish to participate in the activities of the SFF TWG, the signup for membership can be found at
7 <http://www.snia.org/sff/join>.

10 Revision History

11
12 **Rev 1.0.0** *January 16, 2018:*

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

14 **Rev 1.1** *October 24, 2018:*

15 -Updated IP section and foreword per current policy.

16 -Corrected ASME reference in 2.3 for consistency.

17 -Corrected dimension F1 in Table 4-1.

18 -Corrected Figure 4-2 to remove E dimension and changed the radius of the notches in Detail A

19 and B.

20 -Further updates to TOC

21 **Rev 1.1.1** *<new date>:*

22 -Converted to the new SFF document template

23 -Added new name (E1.S).

24 -Clarified abstract.

25 -Section 3.3: Added definition for enclosure and modified definition of 1U.

26 -Section 5: Clarified power is a recommendation and added recommended power for optional heat
27 spreader and optional enclosures.

28 -Table 5-1: Modified Measurement C2 to align with SFF-TA-1002.

29 -Table 5-1: Modified Measurements D3 and D4.

30 -Table 5-1: Fixed the comment for Measurement F6.

31 -Section 5.4, 5.5: Added. This adds optional symmetric and asymmetric enclosure dimensions.

32 -Section 7: Added. This is an informative section on system thermal design guidelines.

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1 **1. Scope**

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

4 **1.1 Application Specific Criteria**

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

7
8 The environment for the 1U short form factor is an enclosure connecting one or more drives in a restricted packaging
9 environment.
10

11 **2. References and Conventions**

12 **2.1 Industry Documents**

13 The following documents are relevant to this specification:

- 14 - ASME Y14.5-2009 Published by ASME
- 15 - SNIA SFF-TA-1002 Protocol Agnostic Multi-Lane High Speed Connector specification available at
16 <http://www.snia.org>
17

18 **2.2 Sources**

19 The complete list of SFF documents which have been published, are currently being worked on, or that have been
20 expired by the SFF Committee can be found at <http://www.snia.org/sff/specifications>. Suggestions for improvement
21 of this specification will be welcome, they should be submitted to <http://www.snia.org/feedback>.

22
23 Copies of ASME standards may be obtained from the American Society of Mechanical Engineers
24 (<https://www.asme.org>).

1 **2.3 Conventions**

2 The following conventions are used throughout this document:

3
4 **DEFINITIONS**

5 Certain words and terms used in this standard have a specific meaning beyond the normal English meaning. These
6 words and terms are defined either in the definitions or in the text where they first appear.

7
8 **ORDER OF PRECEDENCE**

9 If a conflict arises between text, tables, or figures, the order of precedence to resolve the conflicts is text; then
10 tables; and finally figures. Not all tables or figures are fully described in the text. Tables show data format and
11 values.

12
13 **DIMENSIONING CONVENTIONS**

14 The dimensioning conventions are described in ASME-Y14.5, Geometric Dimensioning and Tolerancing. All
15 dimensions are in millimeters, which are the controlling dimensional units (if inches are supplied, they are for
16 guidance only).

17
18 **NUMBERING CONVENTIONS**

19 The ISO convention of numbering is used (i.e., the thousands and higher multiples are separated by a space and
20 a period is used as the decimal point). This is equivalent to the English/American convention of a comma and a
21 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

23

24

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.

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 done in the same way as defined by the specification. Describing a feature as optional in the text is done to assist the reader.

Prohibited: Describes a feature, function, or coded value that is defined in a referenced specification to which this SFF specification makes a reference, where the use of said feature, function, or coded value is not allowed for implementations of this specification.

Reserved: Defines the signal on a connector contact [when] its actual 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 the restricted designation, then the restricted bit, byte, word, or field shall be treated as a reserved bit, byte, word, or field (e.g., a restricted byte uses the same value as defined for a reserved byte).

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

[NVM: Acronym for Non-Volatile Memory](#)

[SSD: Acronym for Solid State Drive](#)

1 **3.3 Definitions**

2 **1U:** 1 Standard Unit or Rack Unit 44.~~4550~~ mm (1.75~~2~~ inches).

3
4 **Card:** Refers to the device plugged into a connector

5
6 **Device:** Refers to the interface slave

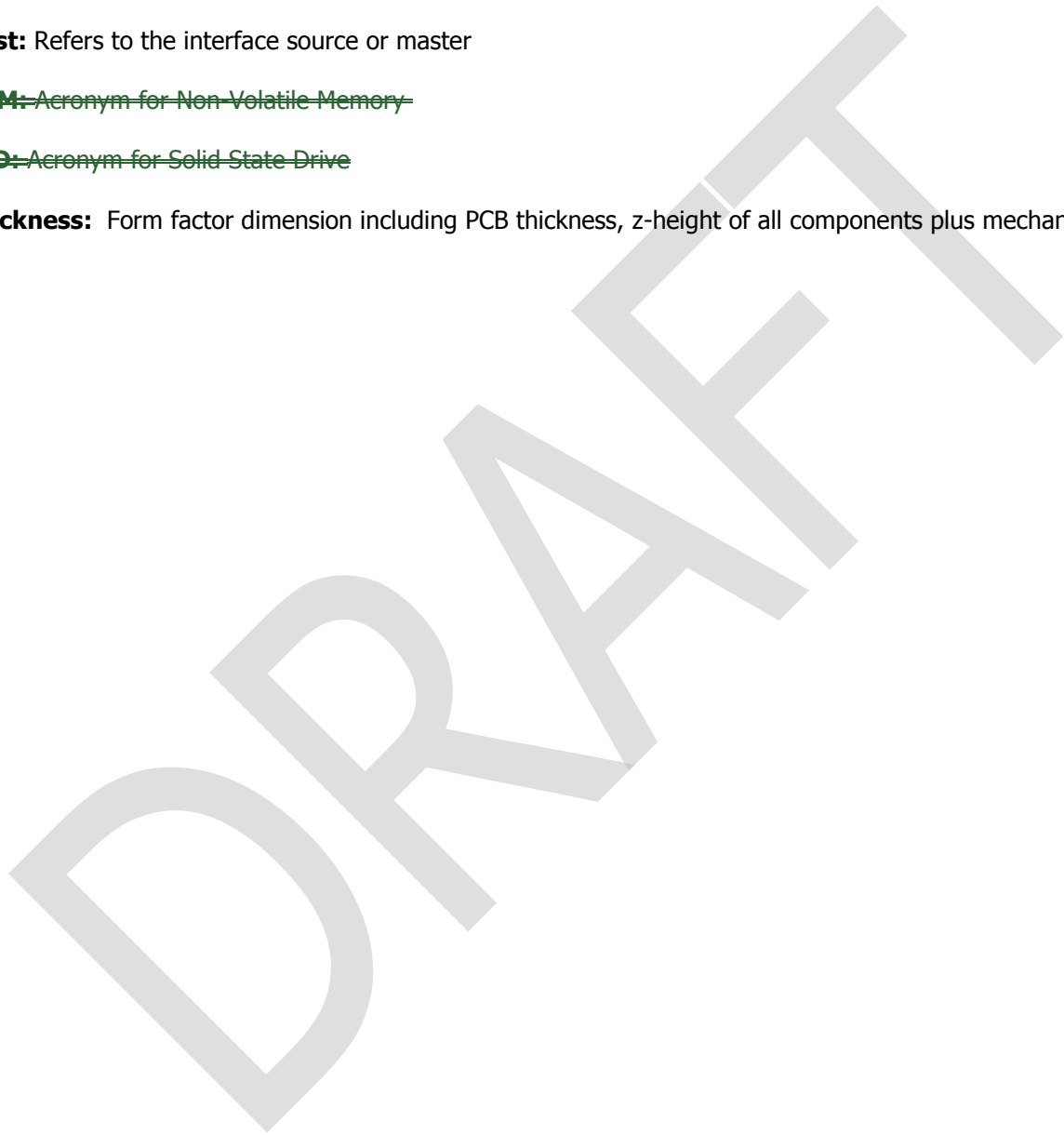
7
8 **Enclosure:** The housing that protects the internal components and acts as a heat sink.

9
10 **Host:** Refers to the interface source or master

11
12 ~~**NVM:** Acronym for Non-Volatile Memory~~

13
14 ~~**SSD:** Acronym for Solid State Drive~~

15
16 **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 SSD 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 ~~some high-level system implementations and usage model examples for the form factor~~ an example of a system implementation using the 1U short form factor.

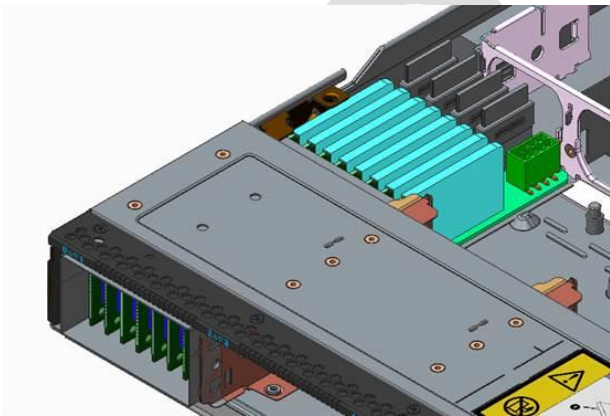
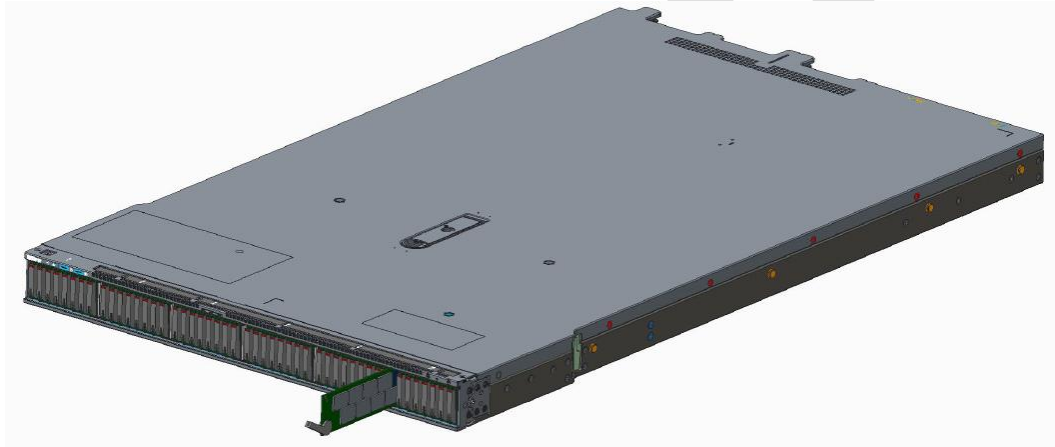


Figure 4-1. Example system implementations of 1U short form factor.

5. Mechanical Specification

5.1 Overview

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

- A PCB form factor with a recommended power rating of 12W
- The form factor with an optional heat spreader and a recommended power rating of 16W
- The form factor with an optional 9.5mm symmetrical enclosure and a recommended power rating of 25W
- The form factor with an optional 25mm asymmetric enclosure and a recommended power rating of 25W

~~including the caseless board with a max sustained power rating of 12W and an optional heat spreader.~~ 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. Any labels must be in component placement or optional heat spreader area. Default tolerance is +/- 0.15mm. All dimensions provided in mm.

5.2 Physical Definition: 1U Short Form Factor

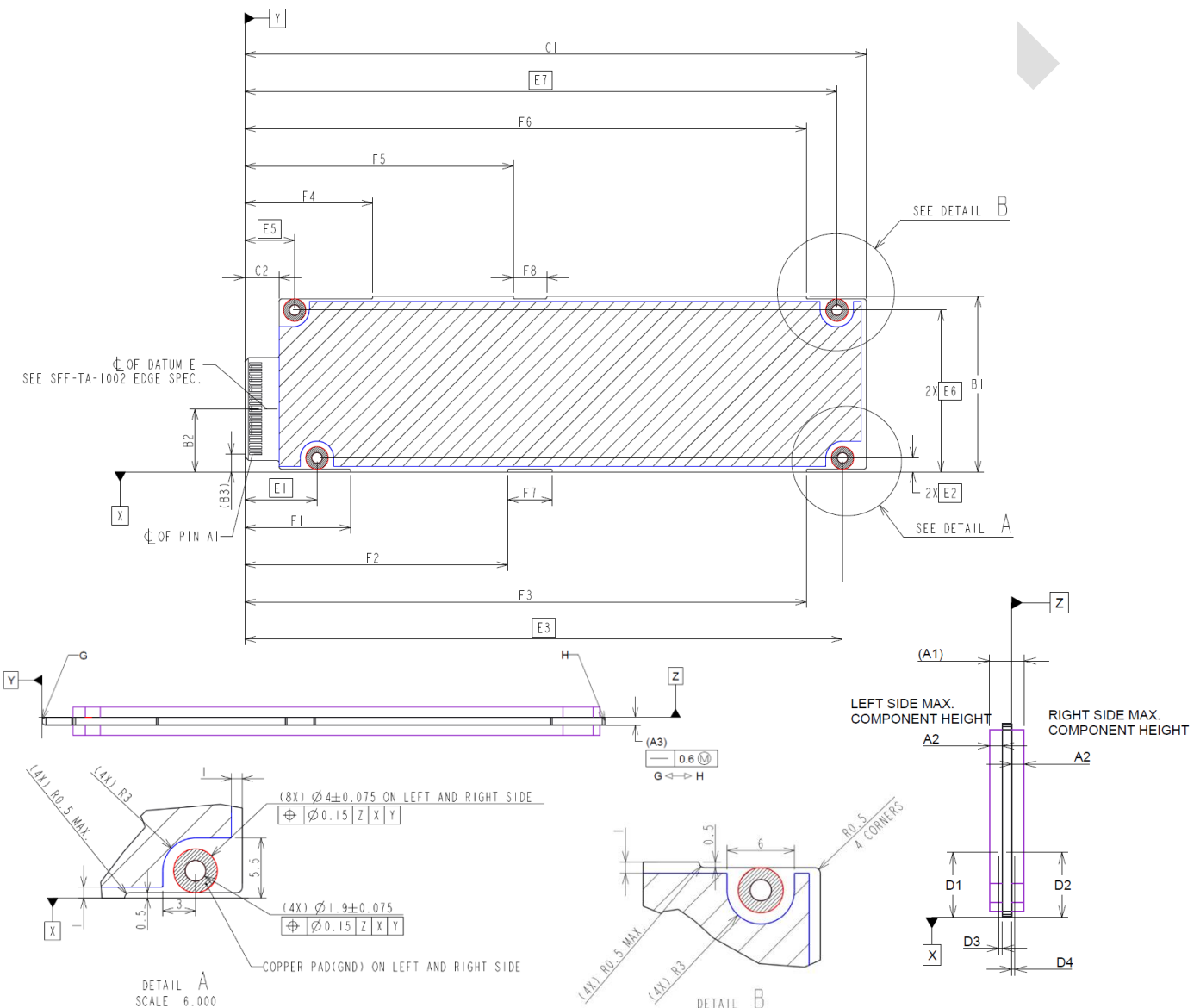


Figure 5-1. 5.9mm Thick 1U Short Form Factor drawing (12W)

1 **5.2.1 1U Short Form Factor**

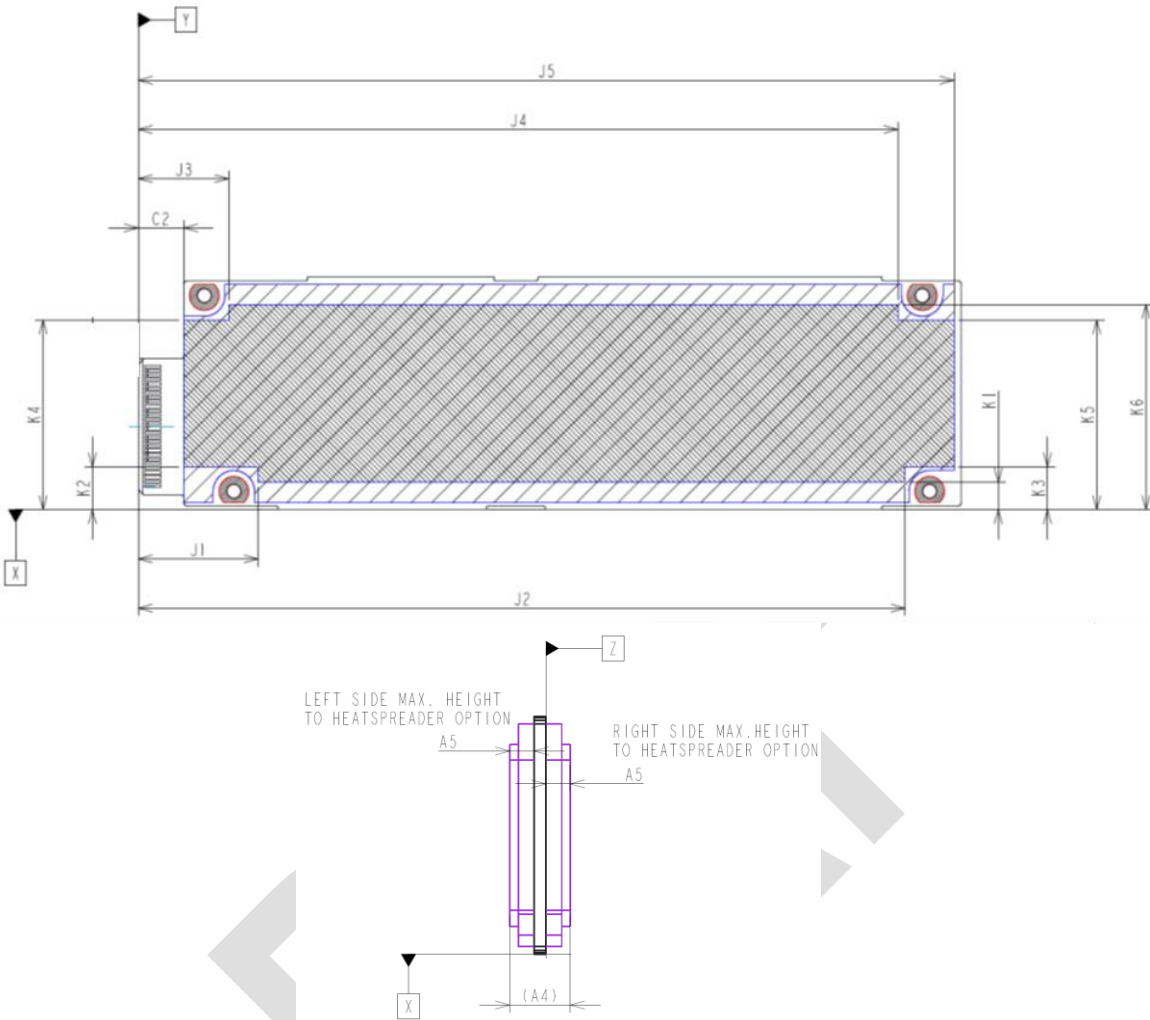
2 **Table 5-1. 1U Short Form Factor Dimensions**

Dimensions	Millimeters	Tolerance	Comment
A1	5.9	<u>0.15</u>	Maximum drive thickness (reference)
A2	2.10	<u>0.15</u>	Maximum component height
A3	1.57	0.13	PCB Card Edge thickness (ref: see SFF-TA-1002)
B1	31.5	0.2	Drive height with defined cutouts
B2	11.23	0.15	Card Bottom Edge to centerline of Datum E
B3	3.21	0.15	Center of Connector Pin A1 location from PCB (reference)
C1	111.49	0.15	Add in card Length
C2	6.15	<u>0.15Min</u>	Card edge length
D1	10.6	0.15	Power and activity (Green) LED position, edge of keep in
D2	10.6	0.15	Attention or error (Amber) LED position, edge of keep in
D3	0.5	<u>0.2</u>	Power and activity (Green) LED center position
D4	0.5	<u>0.2</u>	Attention or error (Amber) LED center position
E1	12.95	<u>0.15</u>	Mounting hole 1 x position
E2	2.5	<u>0.15</u>	Mounting hole 1 y and 2y positions
E3	107.19	<u>0.15</u>	Mounting hole 2 x position
E5	8.95	<u>0.15</u>	Mounting hole 3 x position
E6	29	<u>0.15</u>	Mounting hole 3 y and 4y positions
E7	106.19	<u>0.15</u>	Mounting hole 4 x position
F1	18.95	0.15	Cutout 1 - 12.8x0.5
F2	47.15	0.15	Cutout 2 – 8x0.5
F3	100.69	0.15	Cutout 3 – 10.8x0.5
F4	22.95	0.15	Cutout 4 – 16.8x0.5
F5	48.15	0.15	Cutout 5 – 6x0.5
F6	100.69	0.15	Cutout 6 – 2 10.8x0.5
F7	8	0.15	Width of cutout 2
F8	6	0.15	Width of cutout 5

3

4

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



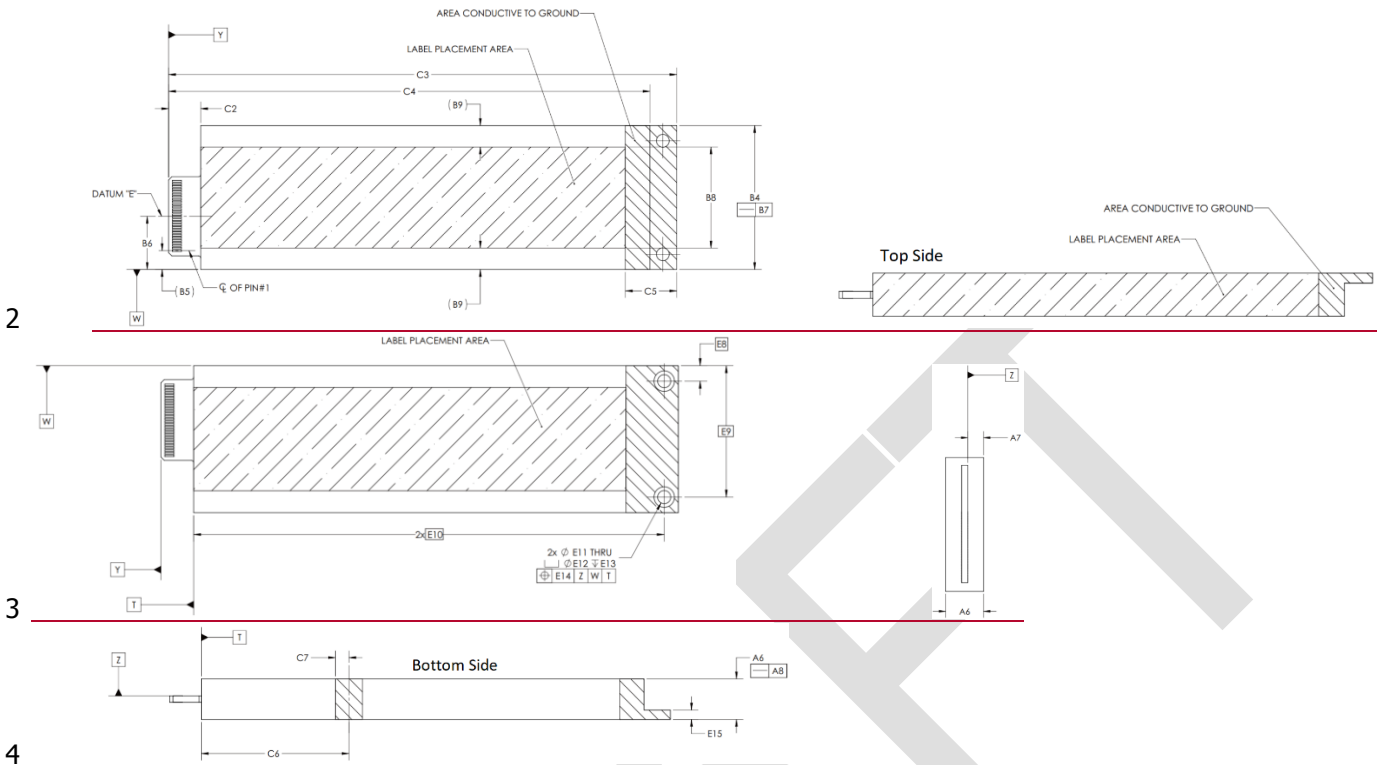
2
3
4
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6 **Figure 5-2. 1U Short Form Factor drawing with heatspreader option (16W)**

5.3.1 1U Short Form Factor with Optional Heat Spreader

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

Dimensions	Millimeters	Tolerance	Comment
A4	8.01		Drive thickness including heatspreader (reference)
A5	3.22	0.25	PCB to outer thickness for heatspreader option
J1	16.25		Heatspreader option 1x position
J2	103.89		Heatspreader option 2x position
J3	12.25		Heatspreader option 3x position
J4	102.89		Heatspreader option 4x position
J5	110.49		Heatspreader option 5x position
K1	3.7		Heatspreader option 1y position
K2	5.8		Heatspreader option 2y position
K3	5.8		Heatspreader option 3y position
K4	25.7		Heatspreader option 4y position
K5	25.7		Heatspreader option 5y position
K6	27.8		Heatspreader option 6y position

1 **5.4 Physical Definition: 1U Short Form Factor with Optional Symmetric Enclosure**



2
3
4
5 **Figure 5-3. 1U Short Form Factor drawing with Optional Symmetric Enclosure (25W)**

6
7 **5.4.1 1U Short Form Factor with Optional Symmetric Enclosure**

8 **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 to outer thickness (enclosure option)
A8	0.4	MAX	Straightness
B4	33.6	0.25	Device width
B5	4.4	REF	Center - Connector Pin A1 location from Datum X
B6	12.415	0.35	Control dimension for x4 card edge; TA-1002 DATUM "E"
B7	0.4	MAX	Straightness
B8	23.6	0.25	Label/Fin placement region
B9	5	REF	Host alignment structure region (reference)
C3	118.75	0.55	Device length
C4	112.5	+0.15/-0.95	Datum Y to latch area keep out zone
C5	12	MIN	Minimum Conductive area length
C6	35	0.15	Bottom conductive area 1 x position
C7	3.2	MIN	Bottom conductive area length
E8	3.55	BASIC	Mounting Hole 1 y position
E9	30.05	BASIC	Mounting Hole 2 y position
E10	108	BASIC	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

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

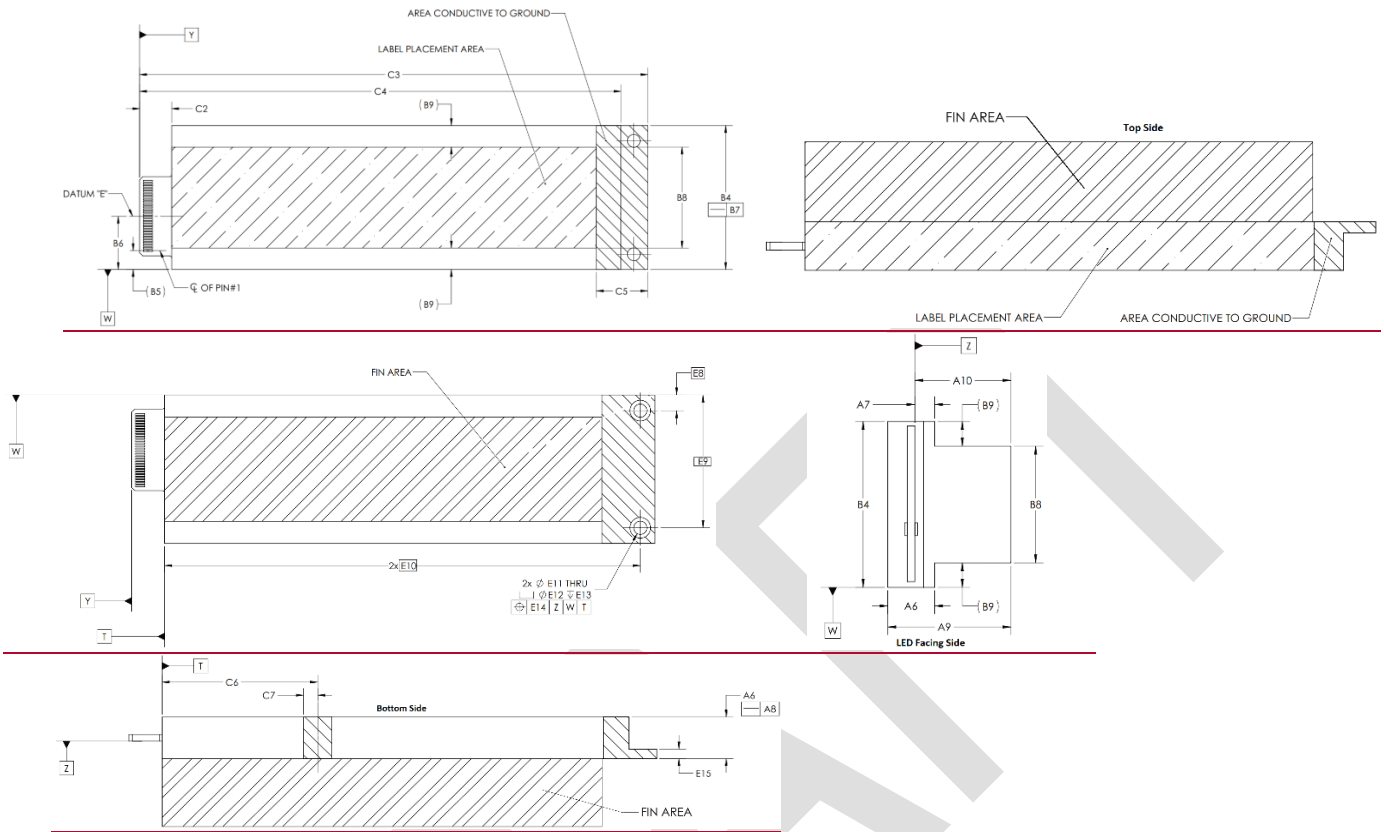


Figure 5-4. 1U Short Form Factor drawing with Optional Asymmetric Enclosure (25W)

5.5.1 1U Short Form Factor with Optional Asymmetric Enclosure

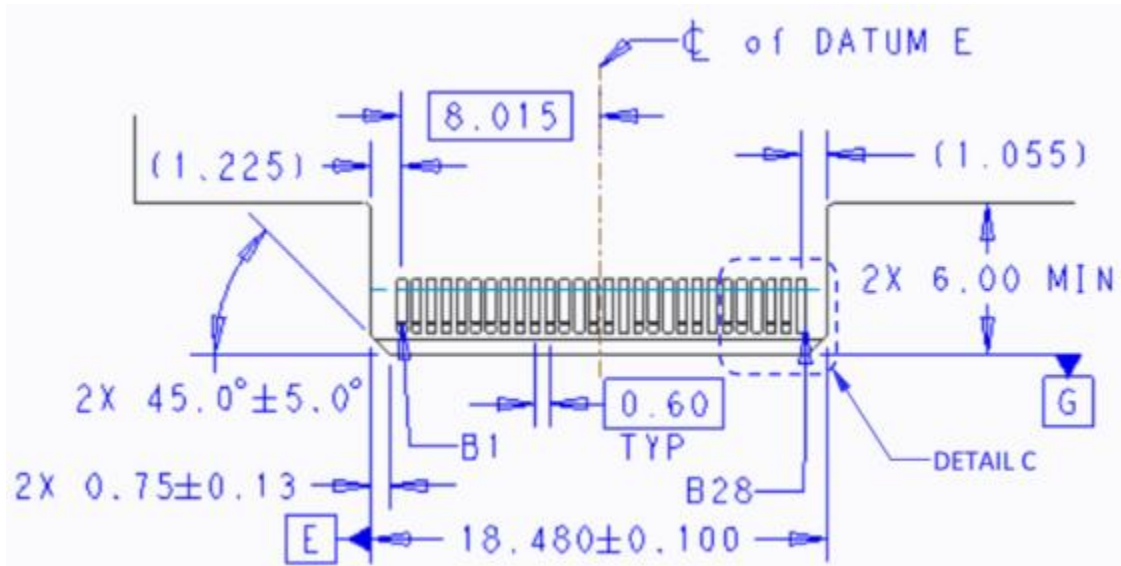
Table 5-4. 1U Short Form Factor – Optional Thick Enclosure Dimensions

<u>Dimensions</u>	<u>Millimeters</u>	<u>Tolerance</u>	<u>Comment</u>
<u>A7</u>	<u>3.96</u>	<u>0.15</u>	<u>PCB to outer thickness in host alignment structure region</u>
<u>A9</u>	<u>25</u>	<u>0.35</u>	<u>Device Thickness including thick enclosure</u>
<u>A10</u>	<u>19.46</u>	<u>0.15</u>	<u>PCB to outer thickness with Heatsink</u>
<u>B8</u>	<u>23.6</u>	<u>0.25</u>	<u>Label/Fin placement region</u>
<u>B9</u>	<u>5</u>	<u>REF</u>	<u>Host alignment structure region (reference)</u>

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

2 **6.1 Overview**

3 This section shows the card edge mechanical drawing for convenience only. See SFF-TA-1002 for normative and
4 performance requirements.
5



6 Note: Position A1 on opposite side of card of B1

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

8
9

7. Informative: System Thermal Design Guidelines

7.1 Overview

The following thermal guidelines are provided to assist in the storage subsystem implementation of the EDSFF 1U short form factor specification. An example implementation is shown in Figure 7-1. In this example, there are 24 add in cards with 2 different thicknesses connected to a midplane with fans pulling air across the add in cards. Each add in card plugs into a connector that is mounted onto the midplane.



Figure 7-1. Example implementation of 1U short add in cards in an enclosure (Top View)

There are 4 thickness considered for 1U short add in cards: bare PCB at 5.9mm thickness, bare PCB with optional heat spreader at 8.01mm thickness, a fully enclosed device at 9.5mm thickness, and a fully enclosed device at 25mm thickness. The heat spreader makes it easier for a system provider to have a common surface such that a heat sink can be attached for additional thermal dissipation. The fully enclosed drives are for a higher operating thermal envelope among other things. As a reference, the connector can support up to a 70W device. To prevent the add in cards from throttling or overheating, system guidelines for both with and without heat spreader add in cards are provided in Table 7-1.

<u>Enclosure Parameter</u>	<u>5.9mm Device</u>	<u>Device with Heat Spreader (8.01mm)</u>	<u>Device with Symmetric Enclosure (9.5mm)</u>	<u>Device with Asymmetric Enclosure (25mm)</u>
<u>Recommended sustained power (W)</u>	<u>12</u>	<u>16</u>	<u>25</u>	<u>25</u>
<u>Add in card Touch point Temperature limit (° C)</u>	<u>70</u>	<u>70</u>	<u>70</u>	<u>70</u>
<u>Enclosure Max Inlet air temperature, < 950 m (° C)</u>	<u>40</u>	<u>40</u>	<u>40</u>	<u>40</u>
<u>Enclosure Max Inlet air temperature, 950 m to 3050 m(° C)</u>	<u>40 - (1° C for every 175 m over 950 m)</u>	<u>40 - (1° C for every 175 m over 950 m)</u>	<u>40 - (1° C for every 175 m over 950 m)</u>	<u>40 - (1° C for every 175 m over 950 m)</u>
<u>Add in card to add in card pitch (mm)</u>	<u>8.5</u>	<u>11</u>	<u>13</u>	<u>26</u>
<u>Fan Pressure Deficit across device, Min (Pascal)</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
<u>Airflow, average min per device (CFM). 1 CFM = 1.7 m³/h)</u>	<u>xx – (0.xx CFM for every 1° C below 40° C inlet temp)</u>	<u>xx – (0.xx CFM for every 1° C below 40° C inlet temp)</u>	<u>xx - (0.xx CFM for every 1° C below 40° C inlet temp)</u>	<u>xx - (0.xx CFM for every 1° C below 40° C inlet temp)</u>

Table 7-1. Thermal guidelines for a 1U short system implementation

1
2
3
4
5