SFF specifications are available at http://www.snia.org/sff/specifications
or ftp://ftp.seagate.com/sff

This specification was developed by the SFF Committee prior to it becoming the SFF TA (Technology Affiliate) TWG (Technical Working Group) of SNIA (Storage Networking Industry Association).

The information below should be used instead of the equivalent herein.

POINTS OF CONTACT:

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

If you are interested in participating in the activities of the SFF TWG, the membership application can be found at:
http://www.snia.org/sff/join

The complete list of SFF Specifications which have been completed or are currently being worked on can be found at:
http://www.snia.org/sff/specifications/SFF-8000.TXT

The operations which complement the SNIA's TWG Policies & Procedures to guide the SFF TWG can be found at:
http://www.snia.org/sff/specifications/SFF-8032.PDF

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

SFF Committee documentation may be purchased in hard copy or electronic form.
SFF specifications are available at ftp://ftp.seagate.com/sff

SFF Committee

INF-8280

Specification for

SATA Universal Storage Module

Rev 1.0 November 1, 2012

Secretariat: SFF Committee

Abstract: This specification defines the dimensions and connector locations of a rugged and reliable data storage module incorporating a SATA interface to be used in applications that require portable storage and that may include features specifically tailored for AV streaming and the CE environment. The SATA Universal Storage Module robustness includes surviving, without damage to data, a 0.75 meter drop to a carpeted surface and an interface connector capable of a minimum of 1,500 insertion/withdrawal cycles.

This specification provides requirements for external universal storage module dimensions; connector description, durability, and placement; power supply requirements; host system recommendations; environmental requirements; and EMC recommendations to assist manufacturers in designing SATA Universal Storage Modules and receptor products that provide interchangeability between multiple vendors.

This is an internal working specification of the SFF Committee, an industry ad hoc group.

This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this specification.

The user's attention is called to the possibility that implementation to this Specification may require use of an invention covered by patent rights. By distribution of this Specification, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has filed a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

POINTS OF CONTACT:

Alvin Cox
Technical Editor
Seagate Technology, LLC
10323 West Reno Avenue
Oklahoma City, OK 73127

Ph: 405-206-4809
Email: alvin.cox@seagate.com

Dal Allan
Chairman SFF Committee
14426 Black Walnut Court
Saratoga CA 95070

Ph: 408-867-6630 Fx: 408-867-2115
Email: endlcom@acm.org

EXPRESSION OF SUPPORT BY MANUFACTURERS

The following member companies of the SFF Committee voted in favor of this industry specification.

Cinch
FCI
Foxconn
Hewlett Packard
HGST
ICT-Lanto
Molex
Seagate
TE Connectivity

The following member companies of the SFF Committee voted to abstain on this industry specification.

EMC
NetApp
Sumitomo

Revision 1.0: Updated Table 2 and Figure 5 to change A3 dimension (length) of the 14.5 mm version tolerance to +/- 0.50 mm (0.020").

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

SFF Committee –

SATA Universal Storage Module

1 Scope

This specification defines the external characteristics of the SATA Universal Storage Module. The purpose of this specification is to provide information that will assist manufacturers in designing SATA Universal Storage Modules and receptor products that provide interchangeability between multiple vendors.

The SATA Universal Storage Module incorporates a standard SATA interface. Methods of encryption, password protection, vendor-specific system architecture, and features specifically tailored for AV streaming or the CE environment may be optionally used in the SATA Universal Storage Module. Such features are beyond the scope of this specification.

The SFF Committee was formed in August, 1990 to broaden the applications for storage devices, and is an ad hoc industry group of companies representing system integrators, peripheral suppliers, and component suppliers.

1.1 Description of Clauses

Clause 1 contains the Scope and Purpose.
Clause 2 contains Referenced and Related Standards and SFF Specifications.
Clause 3 contains the interface requirements including power, grounding, and the universal storage module and host system connectors.
Clause 4 contains the physical characteristics and mounting recommendations.
Clause 5 contains the shock requirements.
Clause 6 contains the vibration requirements.
Clause 7 contains the environmental requirements.
Clause 8 contains the EMC recommendations.

2 References

The SFF Committee activities support the requirements of the storage industry, and it is involved with several standards.

2.1 Industry Documents

The following interface and industry standards are relevant to this specification:

- ANSI INCITS 452-2009, AT Attachment-8 ATA/ATAPI (ATA8-ACS)
- Serial ATA Revision 3.0 (SATA), 2 June 2009
- ASME Y14.5M Dimensioning and Tolerancing

3 Interface requirements

3.1 Power and grounding

3.1.1 Power

The SATA Universal Storage Module receives DC power through the same connector that contains the signal lines. The universal storage module shall operate with only +5V supplied. See SATA connector signal assignments for location of +5V power. The voltage supplied at the SATA Universal Storage Module connector following characteristics:

+5V +/- 5%

3.1.2 Grounding

Provision for tying the DC logic ground and the chassis ground together or for separating these two grounds is vendor specific. See Serial ATA specifications for additional grounding information.

3.2 I/O connector

3.2.1 Receptacle I/O connector

The SATA Universal Storage Module receiver uses a custom SATA receptacle connector to properly attach to the module. This SATA receptacle connector is available in vertical and horizontal PCB mounting configurations as shown in figure 1 and figure 2, respectively. This connector is equivalent to a standard SATA receptacle connector with the following four exceptions:

a) side mounted retention springs to improve the connector retention (optional);
b) anti-wiggle bumps to reduce cable deflection (optional);
c) two alignment ribs on each of the long outside surfaces (required); and
d) extended reach/length to properly attach the SATA universal storage module (required).

For hot plug implementation, pre-charge of the +5v line at the SATA connector, as described in the SATA specification, is recommended.

Suggested Supplier

The SATA Universal Storage Module custom SATA receptacle connector may be procured from:

Foxlink International
18, Chung Shan Road
Tu Chen City
Taipei, Taiwan

Horizontal Mount P/N: SATA7+15P HZ SMT
Vertical Mount P/N: SATA7+15P VT SMT

Connector drawings

All dimensions are in mm.
Tolerances, unless otherwise specified:
2 place +/-0.20
3 place +/-0.15

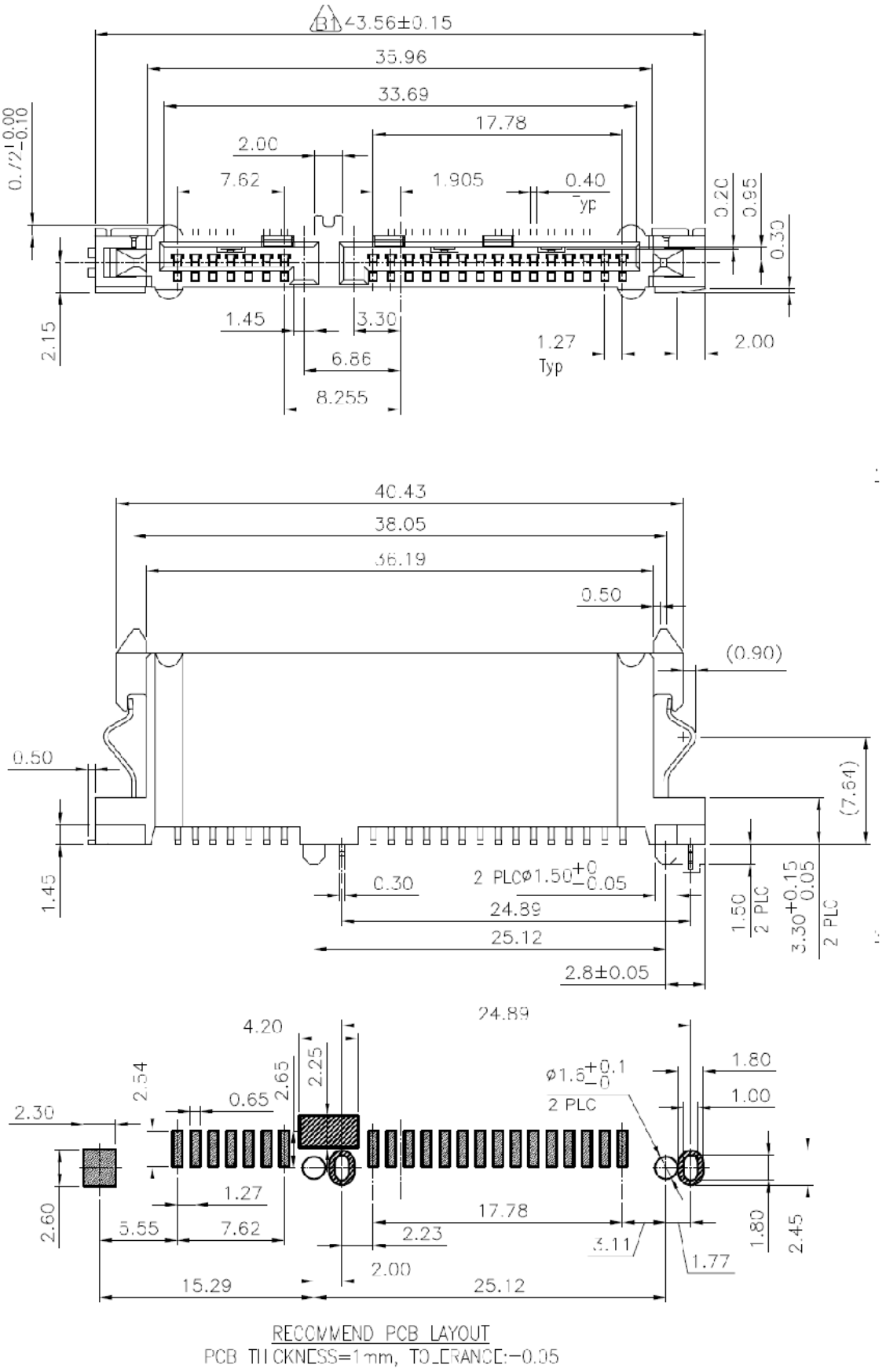

Figure 1 SATA Connector - Vertical Mount

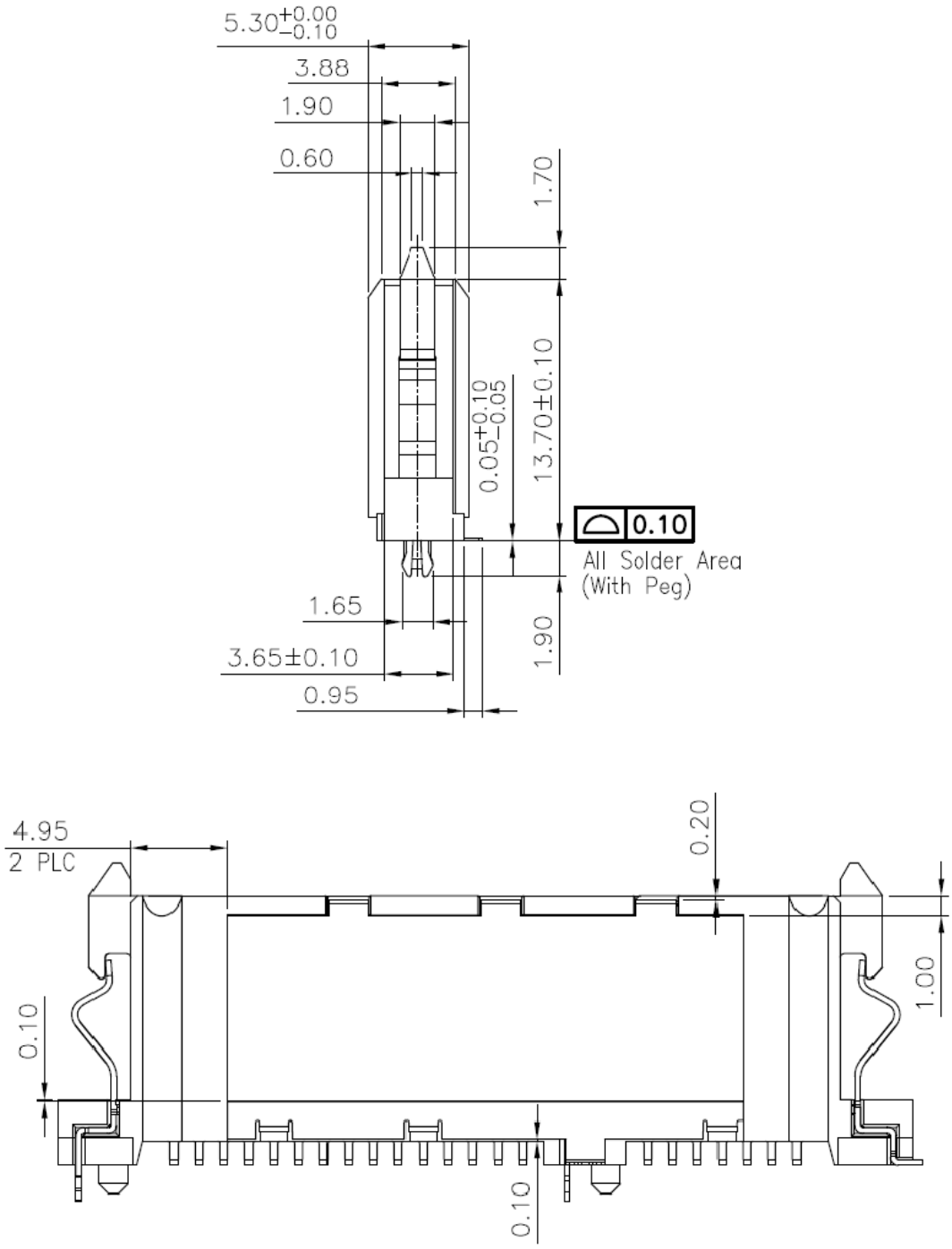

Figure 1 (continued) SATA Connector - Vertical Mount

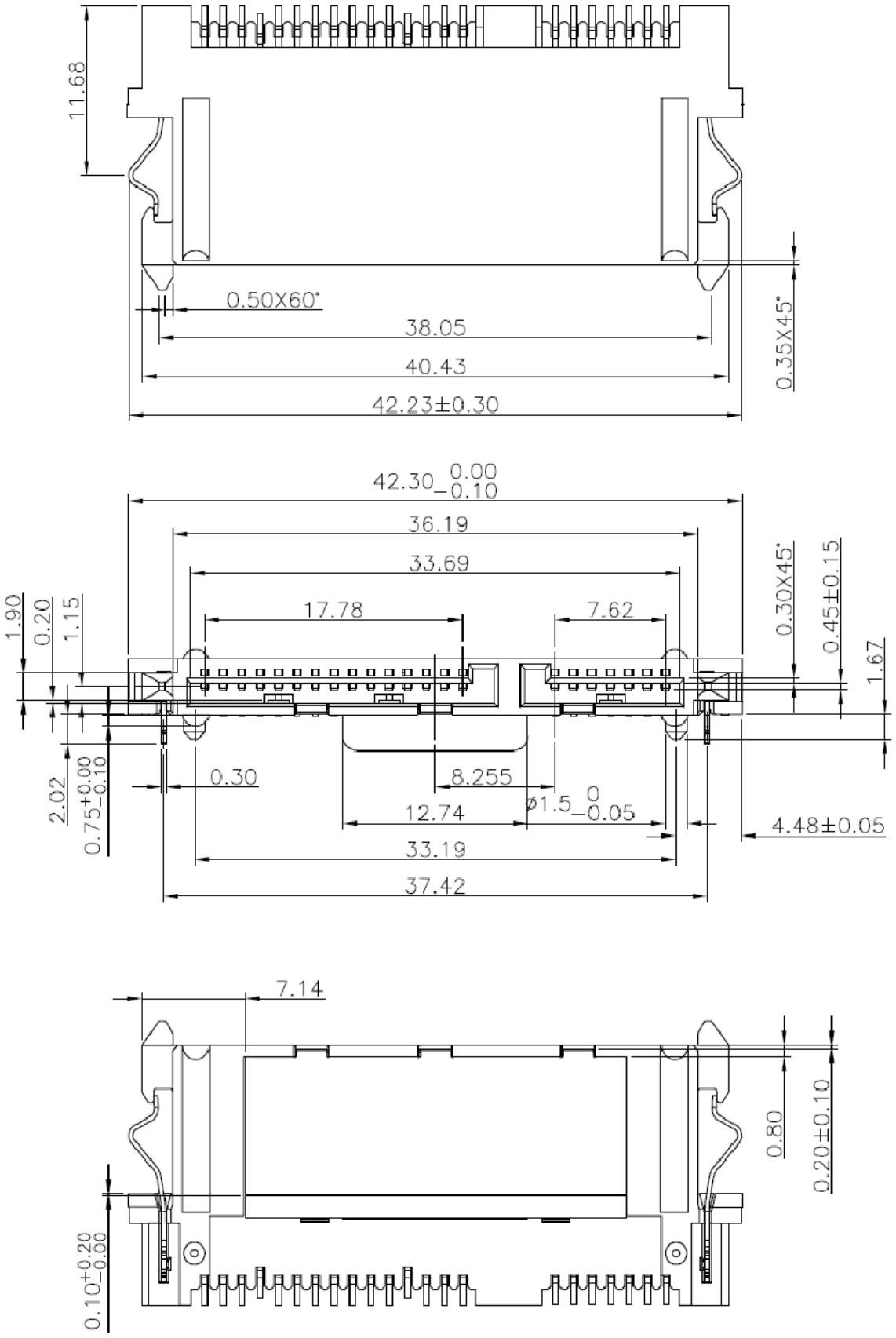

Figure 2 SATA Connector - Horizontal Mount (1 of 2)

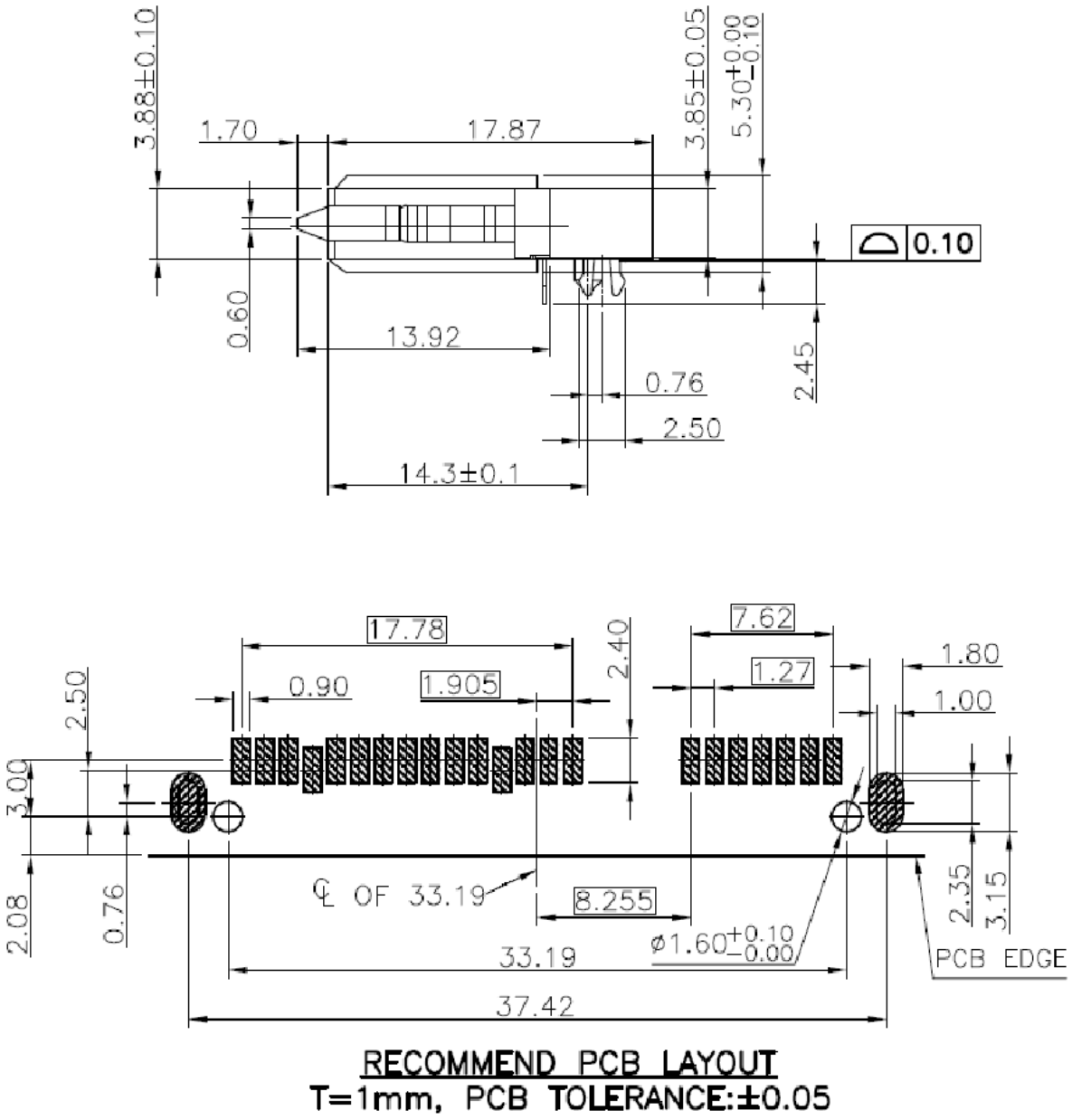

Figure 3 SATA Connector - Horizontal Mount (2 of 2)

3.2.2 Universal storage module I/O connector

3.2.2.1 Universal storage module I/O connector overview

The I/O connector defined in the mechanical configuration is the unitized serial connector for Serial ATA. The SATA Universal Storage Module connector shall conform to the requirements of Serial ATA specification with the exception of the durability requirement and the insertion/withdrawal requirements. See the Serial ATA specifications for pin assignments and application information. The connector is located within the universal storage module as shown in figure 3 and figure 4.

3.2.2.2 Connector durability requirements

The interface connector shall be capable of a minimum of 1,500 insertion/removal cycles when mated to a receptacle designed for this application. The receptacle design and contact finish significantly impacts the durability of both connectors. Standard Serial ATA connectors may not achieve the desired durability.

3.2.2.3 Connector insertion/withdrawal force requirements

The following characteristics shall be maintained for the connector durability:

a) maximum insertion force = 16.5 N (3.7 lbf); and
b) maximum extraction force = 18.7 N (4.2 lbf).

4 Physical characteristics

4.1 Physical requirements of the SATA Universal Storage Module

All physical measurements shall be performed at 25°C +/- 2°C. The SATA Universal Storage Module shall not be exposed to any conditions (transit temperatures, shock, etc.) beyond the limits specified in the product specification before measurement. Table 1 and Figure 3 define the generic SATA Universal Storage Module dimensions and the location of the SATA plug connector in the module for the 9 mm version. Table 2 and Figure 4 define the generic SATA Universal Storage Module dimensions and the location of the SATA plug connector in the module for the 14.5 mm version.

Table 1 Dimensions of the 9 mm SATA Universal Storage Module

Dimension[1]	mm	inch
A1	9.00	0.354
A2	0.20	0.008
A3	1.0	0.039
A4[2]	78.10	3.075
A5	0.20	0.008
A6	108.7	4.281
A7	1.00	0.039
A8	10.70	0.421
A9	5.80	0.228
A10	0.10	0.004
A11	37.55	1.478
A12	4.60	0.181
A13	1.41	0.056
A14	23.23	0.915
A15	41.22	1.623
A16	4.11	0.162
A17	33.00	1.299
A18	1.50	0.059
A19	4.13	0.163
A20	3.36	0.132
A21	0.36	0.014
A22	1.41	0.056
A23	5.14	0.202
A24	5.85	0.230
A25[3]	15	15
A26	1.13	0.044
A27	75.28	2.964
A28	0.30	0.012
A29	0.20	0.008
A30[4]	60.0	2.362
A31[4]	80.00	3.150

Notes:

1. mm is the controlling dimension.
2. The A4 dimension is measured at the centerline of A1 but applies as a maximum to the entire surface. Recesses and contours are permitted as long as the A4 dimension is effectively met somewhere at the centerline of A1.
3. This is an angular dimension in degrees
4. The flat area defined by A30 and A31 applies to both top and bottom surfaces.
5. The contour of surfaces between the defined flat area and edge profiles are not specified but shall not extend beyond the limits defined by A1, A4, and A6.

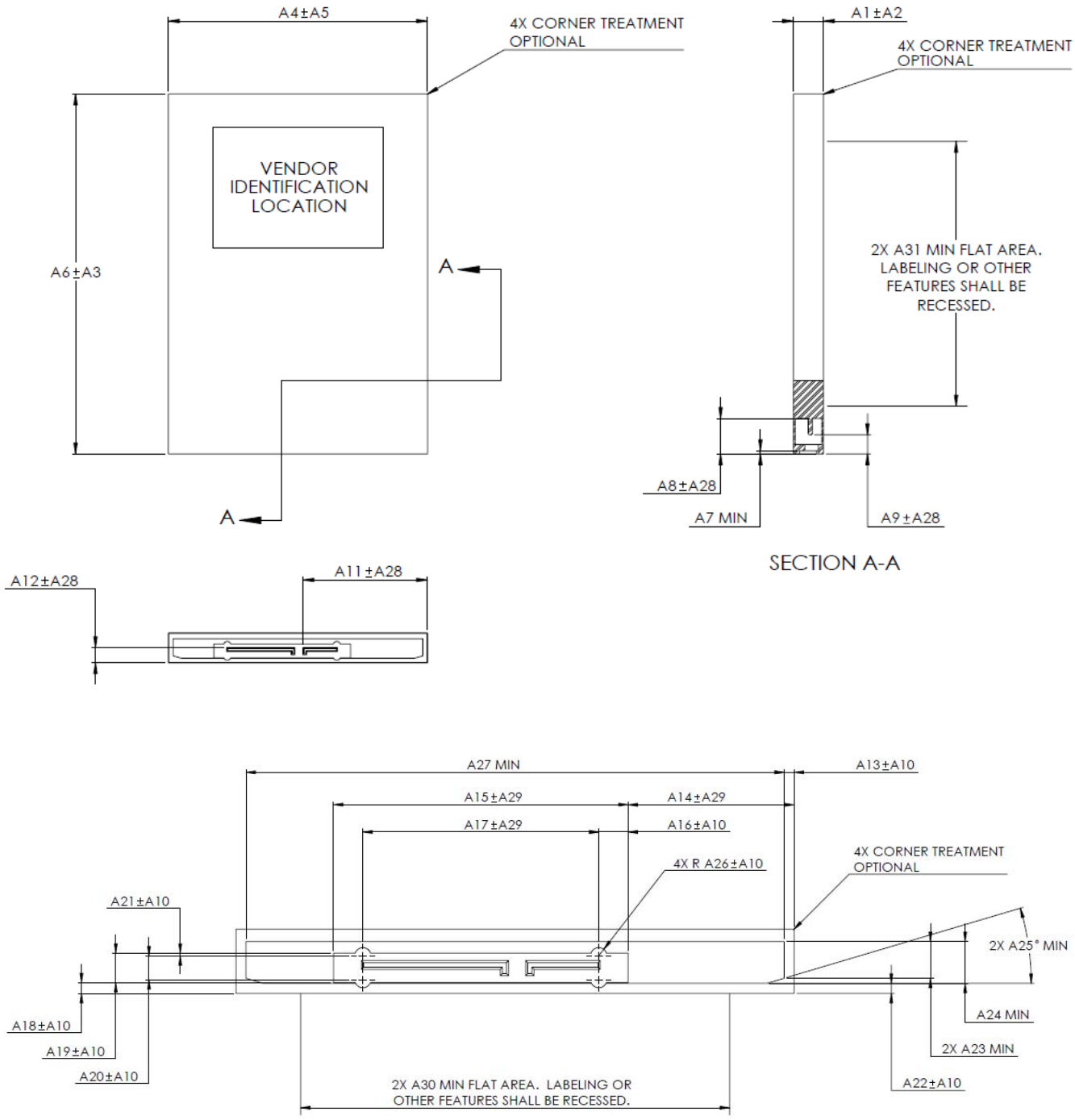

Figure 4 Dimensions of the 9 mm SATA Universal Storage Module

Table 2 Dimensions of the 14.5 mm SATA Universal Storage Module

Dimension	mm	inch
A1	14.50	0.571
A2	0.20	0.008
A3	111.68	4.397
A4	81.10	3.193
A5	0.20	0.008
A6	8.00	0.315
A7	1.14	0.045
A8	4.80	0.189
A9	9.70	0.382
A10	88.90	3.500
A11	50.80	2.000
A12	6.86	0.270
A13	11.53	0.454
A14	16.00	0.630
A15	26.04	1.025
A16	35.20	1.386
A17	76.02	2.993
A18	1.68	0.066
A19	5.46	0.215
A20	41.05	1.616
Tolerance (unless o/w specified)	< 30 +/-0.10 30 - 70 +/-0.15 > 70 +/-0.50	< 1.181 +/-0.004 1.181 - 2.756 +/-0.006 > 2.756 +/-0.20

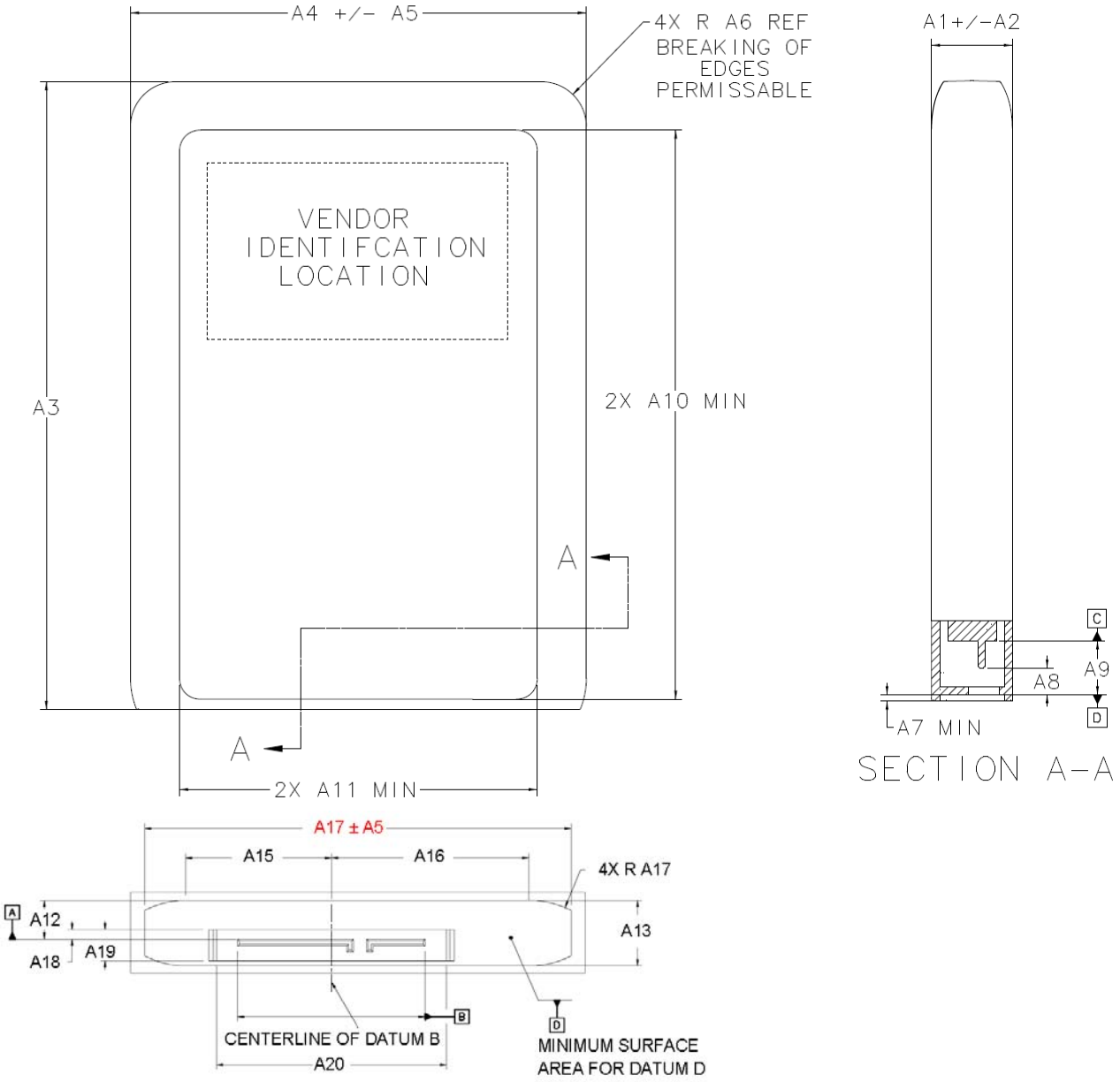

Figure 5 Dimensions of the 14.5 mm SATA Universal Storage Module

4.2 SATA Universal Storage Module mounting

4.2.1 SATA Universal Storage Module mounting overview

There are three primary orientations for the mounted SATA Universal Storage Module. The module contact surfaces during insertion and removal are different for each orientation. The passive cooling thermodynamics are also different between the horizontal, left/right side, and vertical orientations. The three primary orientations are:

a) horizontal insertion;
b) left/right side insertion; and
c) vertical insertion

4.2.2 Horizontal Insertion

The SATA Universal Storage Module may be horizontally inserted into the receiver.

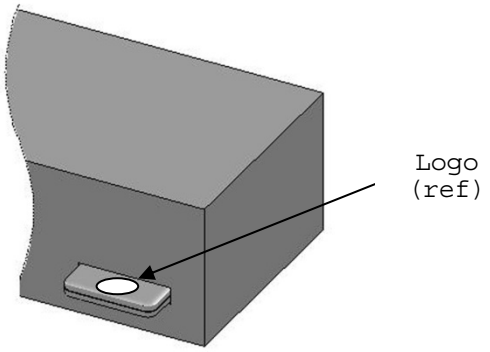

Figure 6 SATA Universal Storage Module horizontal insertion

In this orientation it is important that the width of the receiver be tightly controlled and that the SATA connector is accurately located with respect to the width of the receiver and with respect to the horizontal surface the module rests on.

4.2.3 Left or right side insertion

The SATA Universal Storage Module may be mounted in the receiver resting on the module's left side or right side.

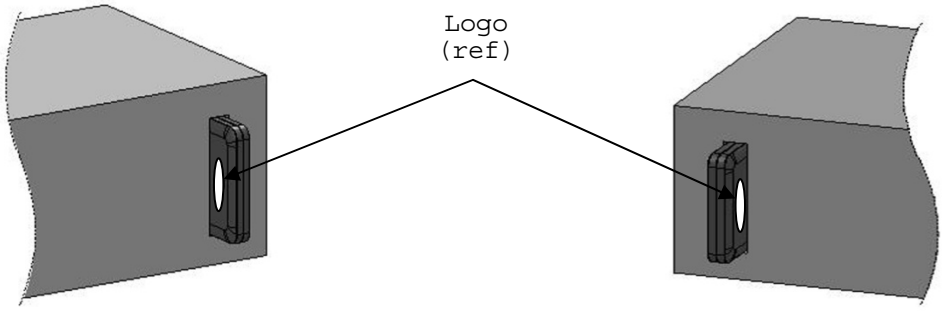

Figure 7 SATA Universal Storage Module left and right side insertion

In these orientations it is important that the height of the receiver be tightly controlled and that the SATA connector is accurately located with respect to the height of the receiver and with respect to the horizontal surface the module rests on.

4.2.4 Vertical insertion

The SATA Universal Storage Module may be vertically inserted into the receiver.

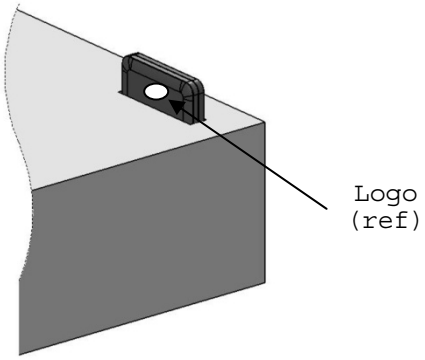

Figure 8 SATA Universal Storage Module vertical insertion

In this orientation, it is important that the width and height of the receiver be tightly controlled and that the SATA connector is accurately located with respect to the width and the height of the receiver.

4.2.5 General mounting recommendations

The SATA Universal Storage Module should be inserted into the receiver to a depth of at least 62mm (50mm extending outside of the receiver) but no more than 87mm (25mm extending outside of the receiver) to provide the user with easy access for module removal, to maintain module attachment integrity, and to assist with the passive cooling of the module.

The vertical insertion orientation is more stable mechanically and consequently, a smaller insertion depth (i.e., as little as 25mm) may be used to take full advantage of convective cooling of the module surfaces.

In certain applications the SATA Universal Storage Module may be completely inserted into the receiver with no portion of the module extending outside of the enclosure. Finger access or an ejection mechanism may be necessary to remove the module from the receiver. In this implementation a cooling fan may be required so that the SATA Universal Storage Module does not exceed the maximum operating temperature requirement.

All surfaces which contact the SATA Universal Storage Module should be smooth and rounded so as not to mar or scratch the outer surface of the module. It may be necessary to apply a low friction material, such as Teflon tape, to the contact surface area to avoid scratching the module during repeated insertions.

All doors or flappers that may contact the SATA Universal Storage Module should be designed so that they do not scratch or mar the outer surface of the module.

5 Shock performance

5.1 Drop and shock tests

Drop test specification applies to the SATA Universal Storage Module only. Shock test specifications assume that the module is properly inserted into the receiver and that the host system and SATA Universal Storage Module are tested as an assembly.

5.2 Drop test

The SATA Universal Storage Module may be dropped 0.75 meters from any orientation to a hard concrete surface covered with industrial carpet. The maximum acceleration shall be 800 G. No grown media defects allowed.

5.3 Operating Shock Test

The maximum operating shock applied to the SATA Universal Storage Module shall be 300 G when the host system is subjected to its maximum operating shock conditions. A single aborted write during the shock event is allowed. No grown media defects allowed.

5.4 Non-operating Shock Test

The maximum non-operating shock applied to the SATA Universal Storage Module shall be 800 G when the host system is subjected to its maximum non-operating shock conditions. No grown media defects allowed.

6 Vibration performance

6.1 Vibration performance tests

All vibration specifications apply when the SATA Universal Storage Module is properly inserted into the receiver and the host system and SATA Universal Storage Module are tested as an assembly. The host system design should avoid coupling significant system vibrations into the SATA Universal Storage Module.

6.2 Operating Vibration

The external operating vibration levels applied to the SATA Universal Storage Module are:

a) 0.50 G maximum, 5 Hz to 350 Hz; and
b) 0.50 G maximum, 350 Hz to 500 Hz.

If the host system produces intense vibration modes in the frequency range from 5 to 500 Hz, isolation between the SATA Universal Storage Module receiver and the vibration source should be provided.

6.3 Non-operating Vibration

The external non-operating vibration levels applied to the SATA Universal Storage Module is 5.0 G maximum, 5 Hz to 500 Hz.

If the host system produces intense vibration modes in the frequency range from 5 to 500 Hz, isolation between the SATA Universal Storage Module receiver and the vibration source should be provided.

7 Environmental requirements

The host system with receiver (docking bay) shall provide adequate cooling for the SATA Universal Storage Module during operation at the product maximum operating temperature such that the maximum temperature of the storage device (e.g., HDD) inside of the module does not exceed 69°C. This temperature may be determined by reading the SATA Universal Storage Module's Device Statistics log or by measuring directly using thermocouples attached to the storage device (e.g., HDD base). With proper attention to heat dissipation and convective cooling, most receiver applications do not require the use of a cooling fan to meet the thermal requirements.

The following thermal recommendations should be considered in the host system design:

a) do not place high temperature devices or components in close proximity to the top or bottom of the SATA Universal Storage Module receiver;
b) if no cooling fan is used, the host system and receiver shall provide adequate venting for convective cooling of the SATA Universal Storage Module;
c) except for guiding features, it is recommended to allocate at least 5 mm of clearance (air space) above the module (venting is required to provide adequate convective cooling);
d) when used in a horizontal orientation, except for guiding features, it is recommended to allocate at least 1 mm of clearance (air space) below the module (venting for convective cooling should consider the placement of cool air intake vents and hot air exhaust vents); and
e) thermal tests should be conducted at the maximum product operating temperature conditions.

8 EMC recommendations

8.1 Overview

The SATA Universal Storage Module should be designed to meet world-wide regulatory requirements for electromagnetic compatibility (EMC) of a CISPR Class B level product. Metal shielding inside of the module may use spring fingers to make electrical contact with a metal plate on the SATA connector. This shielding allows the SATA Universal Storage Module to pass the regulatory requirements for ESD and EMI. The host system design may add electrically grounded springs that touch the metal plate on the SATA connector in order to comply with system-level, regulatory EMI and ESD testing. See table 2 for specified levels.

8.2 Electromagnetic Immunity

When properly installed in a typical receiver, the SATA Universal Storage Module should operate without errors or degradation in performance when subjected to acceptable levels of environmental radio frequencies (RF).

8.3 Electromagnetic Radiation

When properly installed in a typical receiver, the SATA Universal Storage Module should complie with the operating limits specified for CISPR Class B products.

8.4 Conducted Noise

When properly installed in a typical receiver, the SATA Universal Storage Module should complie with the operating limits specified for CISPR Class B products.

Table 3 EMI and ESD recommendations

Test	Description	Performance Level	Reference Standard
Electrostatic Discharge	Contact, HCP, VCP: +/- 4kV; Air: +/- 8 kV	B	EN61000-4-2: 95
Radiated RF Immunity	80 to 1,000MHz, 3V/m 80% AM with 1kHz sine 900MHz, 3V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical Fast Transient	+/- 1kV on AC mains, +/- 0.5kV on external I/O	B	EN61000-4-4: 95
Surge Immunity	+/- 1kV differential, +/- 2 kV common, AC mains	B	EN61000-4-5: 95
Conducted RF Immunity	150kHz to 80MHz, 3Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage Dips, Interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.10 seconds	C C C B	EN61000-4-11: 94