# Intel® Solid-State Drive Pro 1500 Series (M.2)

## Product Specification

- Capacities: 80 GB, 120 GB, 180 GB, 240 GB, 360 GB
- Components:
  - Intel® 20 nm NAND Flash Memory
  - Multi-Level Cell (MLC)
- Form Factors:
  - 80 mm (single-sided) 2280-S2-B-M (80 GB and 180 GB) and (double-sided) 2280-D2-B-M (120 GB, 240 GB and 360 GB)
  - 42 mm (double-sided) 2242-D2-B-M (120 GB)
- Thickness: up to 3.58 mm
- Weight: < 10 grams
- SATA 6 Gb/s Bandwidth Performance[1] (Iometer* Queue Depth 32)
  - Sustained Sequential Read: up to 540 MB/s
  - Sustained Sequential Write: up to 490 MB/s
- Read and Write IOPS[1] (Iometer Queue Depth 32)
  - Random 4 KB Reads: up to 41,000 IOPS
  - Random 4 KB Writes: up to 80,000 IOPS[2]
- Compatibility
  - Trusted Computing Group* (TCG) Opal Security Subsystem Class (SSC) Specification Version 1.0[3]
  - Intel® Core™ vPro™ Processor
  - Intel® Setup and Configuration Software (Intel® SCS) 9.0
  - Intel® SSD Toolbox with Intel® SSD Optimizer
  - Intel® Data Migration Software
  - Intel® Rapid Storage Technology
  - SATA Revision 3.0
  - ACS-2 (ATA/ATAPI Command Set 2)
  - SSD Enhanced SMART ATA feature set
- Data Compression
- AES 256-bit Encryption
- End-to-End Data Protection
- Power Management
  - 3.3 V SATA Supply Rail
  - SATA Link Power Management (LPM)
  - Device Sleep (DevSleep)
- Power
  - Active (BAPCo MobileMark* 2007 Workload): 140 mW
  - Idle[4]: 55 mW
  - DevSleep: 200 µW
- Temperature
  - Operating[5]: 0° C to 70° C
  - Non-Operating: -55° C to 95° C
- Reliability
  - Uncorrectable Bit Error Rate (UBER): <1 sector per $10^{16}$ bits read
  - Mean Time Between Failure (MTBF): 1,200,000 hours
  - Shock (operating and non-operating): 1,000 G/0.5 msec
- Vibration
  - Operating: 2.17 $G_{RMS}$ (5-700 Hz)
  - Non-operating: 3.13 $G_{RMS}$ (5-800 Hz)
- Certifications and Declarations:
  - UL*
  - CE*
  - C-Tick*
  - BSMI*
  - KCC*
  - Microsoft* WHCK
  - VCCI*
  - SATA-IO*
- Product Ecological Compliance
  - RoHS*

**NOTES:**

1. Performance values vary by capacity.
2. Random 4 KB writes measured using out-of-box SSD.
3. Opal available only on specific firmware SKUs. Contact your Intel representative for more info. ID Device Word 48 bit 0 = 1 if Opal Ready.
4. Non-DevSleep idle power with SATA Link Power Management (LPM) enabled.
5. As measured by temperature sensor, SMART Attribute BEh. Active airflow is recommended within the system for maintaining proper device operating temperatures on heavier workloads.

## Ordering Information

Contact your local Intel sales representative for ordering information.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or go to: http://www.intel.com/design/literature.html

Low Halogen applies only to brominated and chlorinated flame retardants (BFRs/CFRs) and PVC in the final product. Intel components as well as purchased components on the finished assembly meet JS-709 requirements, and the PCB/substrate meet IEC 61249-2-21 requirements. The replacement of halogenated flame retardants and/or PVC may not be better for the environment.

No computer system can provide absolute security under all conditions. Built-in security features available on select Intel® Solid State Drives may require additional software, hardware, services and/or an Internet connection. Results may vary depending upon configuration. Consult your system manufacturer for more details.

Intel and the Intel logo are trademarks of Intel Corporation in the U.S. and other countries.

*Other names and brands may be claimed as the property of others.

Copyright © 2013 Intel Corporation. All rights reserved.

# Contents

**Revision History** ..... **4**

**1 Introduction** ..... **5**

1.1 Terminology ..... 7
1.2 Reference Documents ..... 8

**2 Product Specifications** ..... **9**

2.1 Capacity ..... 9
2.2 Performance ..... 9
2.3 Electrical Characteristics ..... 10
2.4 Environmental Conditions ..... 11
2.4.1 Temperature, Shock, Vibration ..... 11
2.4.2 Altitude ..... 11
2.5 Product Regulatory Compliance ..... 12
2.6 Reliability ..... 13

**3 Mechanical Information** ..... **14**

**4 Pin and Signal Descriptions** ..... **17**

4.1 Pin Locations ..... 17
4.2 Signal Descriptions ..... 18
4.3 Device Sleep Feature ..... 19

**5 Supported Command Sets** ..... **20**

5.1 ATA General Feature Command Set ..... 20
5.2 Power Management ..... 21
5.3 Security Mode Feature Set ..... 21
5.4 TCG Opal SSC Support ..... 21
5.5 SMART Command Set ..... 22
5.5.1 SMART Attributes ..... 23
5.5.2 SMART Logs ..... 25
5.6 Device Statistics ..... 26
5.7 SMART Command Transport ..... 26
5.8 Data Set Management Command Set ..... 26
5.9 Host Protected Area Command Set ..... 26
5.10 48-Bit Address Command Set ..... 27
5.11 General Purpose Log Command Set ..... 27
5.12 Native Command Queuing ..... 27
5.13 Software Settings Preservation ..... 27
5.14 SATA Link Power Management (LPM) ..... 27
5.15 DevSleep ..... 28

**6 Certifications and Declarations** ..... **29**

**7 Appendix** ..... **30**

# Revision History

| Document Number | Revision Number | Description | Revision Date |
|---|---|---|---|
| 329391 | 001US | Initial release | August 2013 |
| 329391 | 002US | Added the 120 GB (80mm) and 360 GB capacity | October 2013 |
| 329391 | 003US | Correction to Electrical Characteristics | December 2013 |

# 1 Introduction

This document describes the specifications and capabilities of the Intel® Solid-State Drive Pro 1500 Series (Intel® SSD Pro 1500 Series).

The Intel® SSD Pro 1500 Series is a case-less, M.2, next generation storage solution designed for Ultrabook™. The new M.2 form factor allows ultra-compact solutions which deliver leading performance for Serial Advanced Technology Attachment (SATA)-based computers in capacities ranging up to 360 GB.

The latest feature addition is the DevSleep functionality, a low power drive state controlled by the host via the DevSleep pin. The drive will consume a mere 200 µW while in this state.

As compared to standard SATA HDDs, Intel® SSD Pro 1500 Series offers these key features:

- High I/O and throughput performance
- Low power consumption
- Increased system responsiveness
- High reliability
- Enhanced ruggedness
- Small form-factor
- Minimum weight

The Intel® SSD Pro 1500 Series also offers additional key features such as:

- Advanced Encryption Standard (AES) 256-bit Encryption

AES 256-bit encryption is an industry standard in data security, providing a hardware-based mechanism for encryption and decryption of user data. Utilizing a 256-bit encryption key, AES encryption—when combined with an ATA drive password—helps protect user data.

- End-to-End Data Protection

End-to-end data protection helps protect data from being corrupted across the data path by using cyclic redundancy check (CRC), parity, and error correction code (ECC) checks in the data path from the host interface to the NAND, and back.

- Data Compression

Data compression helps improve performance and endurance by automatically compressing information sent to the SSD so that less data has to be processed and stored on the NAND. The amount of data that can be compressed depends on the type of data.

- TCG* Opal Security Subsystem Class (SSC) Specification Version 1.0 (Select firmware only)

Intel® SSD Pro 1500 Series self-encrypting drive capabilities are enhanced with Opal security storage specifications. The TCG* Opal specification provides a secure boot capability (pre-boot authentication), protection of user data, and administrative capabilities that help protect user data from compromise, improving security of critical data on the move.

- Intel® Core™ vPro™ Processor Enrichment

Intel® SSD Pro 1500 Series is enhanced when coupled with Intel® Core™ vPro™ processors systems and software. Offering unique manageability capabilities, IT can proactively manage the Intel® SSD Pro1500 Series products and reduce operating costs while keeping their PCs running smoothly.

- Intel® SIPP

Intel® SSD Pro series will be part of the Intel® Stable Image Platform Program (SIPP). Intel® SIPP aligns key Intel platform components, enabling a predictable transition from one technology generation to the next. Enhancing software and hardware stability, Intel® SIPP targets zero changes to key platform components and drivers for at least 15 months. Intel® SIPP delivers predictability and reduces total cost of ownership.

## 1.1 Terminology

**Table 1: Terminology**

| Term | Description |
|---|---|
| ATA | Advanced Technology Attachment |
| DAS | Device Activity Signal |
| DevSleep | Device Sleep, a power feature that allows the host to initiate ultra-low power consumption by the drive. |
| DIPM | Device Initiated Power Management |
| DMA | Direct Memory Access |
| EXT | Extended |
| FPDMA | First Party Direct Memory Access |
| GB | Gigabyte (1,000,000,000 bytes)<br>Note: The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity is used for NAND flash management and maintenance purposes. |
| HDD | Hard Disk Drive |
| HIPM | Host Initiated Power Management |
| I/O | Input/Output |
| IOPS | Input/Output Operations Per Second |
| KB | Kilobyte (1,024 bytes) |
| LBA | Logical Block Address |
| LPM | Link Power Management |
| MB | Megabyte (1,000,000 bytes) |
| MLC | Multi-level Cell |
| MTBF | Mean Time Between Failures |
| NCQ | Native Command Queuing |
| NOP | No Operation |
| Opal | A security architecture standardized by the Trusted Computing Group that enforces trusted policies between the host and storage device. |
| PIO | Programmed Input/Output |
| RDT | Reliability Demonstration Test |
| RMS | Root Mean Squared |
| SATA | Serial Advanced Technology Attachment |
| SMART | Self-Monitoring, Analysis and Reporting Technology |
| SSD | Solid-State Drive |
| TYP | Typical |
| UBER | Uncorrectable Bit Error Rate |

## 1.2 Reference Documents

**Table 2: Standard References**

| Date or Rev. # | Title | Location |
|---|---|---|
| Sept 2008 | IEC 55022 Information Technology Equipment — Radio disturbance Characteristics— Limits and methods of measurement CISPR22:2008 (Modified) | http://www.iec.ch/ |
| Dec 2008 | VCCI | http://www.vcci.jp/vcci_e/ |
| June 2009 | RoHS II per directive 2011/65/EU | http://qdms.intel.com/<br>Click *Search MDDS Database* and search for material description datasheet |
| June 2009 | Serial ATA Revision 3.0 | http://www.sata-io.org/ |
| August 2009 | ACS-2- Specification | http://www.t13.org/ |
| Feb 2010 | TCG* Opal Security Subsystem Class Specification Version 1.0 rev 3.0 | http://www.trustedcomputinggroup.org |
| August 2010 | IEC 55024 Information Technology Equipment — Immunity characteristics— Limits and methods of measurement CISPR24:2010 | http://www.iec.ch/ |
| Sept 2010 | Solid-State Drive (SSD) Requirements and Endurance Test Method (JESD218) | http://www.jedec.org/standards-documents/docs/jesd218/ |
| Oct 2010 | TPR053v11_SATA31_M.2_Card_Format_for_SSDs | http://www.sata-io.org/ |

# 2 Product Specifications

## 2.1 Capacity

**Table 3: User Addressable Sectors**

| Intel® SSD Pro 1500 Series | Unformatted Capacity (Total User Addressable Sectors in LBA mode) |
|---|---|
| 80GB | 156,301,488 |
| 120 GB | 234,441,648 |
| 180 GB | 351,651,888 |
| 240 GB | 468,862,128 |
| 360 GB | 703,282,608 |

## 2.2 Performance

**Table 4: Compressible Performance**

| | | Specification | | | | |
|---|---|---|---|---|---|---|
| | | Random 4 KB Read (up to)[1] | Random 4 KB Write (up to)[2] | Random 4 KB Write (TYP)[1] | Sequential 128 KB Read[1] | Sequential 128 KB Write[1] |
| Type | Capacity | IOPS | IOPS | IOPS | MB/s | MB/s |
| 2280 | 80 GB | 24,000 | 80,000 | 33,000 | 540 | 480 |
| | 120 GB | 24,000 | 80,000 | 37,500 | 540 | 480 |
| | 180 GB | 41,000 | 80,000 | 49,000 | 540 | 490 |
| | 240 GB | 41,000 | 80,000 | 49,000 | 540 | 490 |
| | 360 GB | 45,000 | 37,000 | 29,500 | 540 | 490 |
| 2242 | 120 GB | 18,000 | 75,000 | 37,500 | 540 | 480 |

***Note:***

1. Performance measured using Iometer* with Queue Depth 32. Measurements are performed on 8 GB of Logical Block Address (LBA) range on a full SSD
2. Random 4 KB writes measured using out-of-box SSD.

**Table 5: Incompressible Performance**

| | | Specification | | | |
|---|---|---|---|---|---|
| | | Random 4 KB Read (up to)[1] | Random 4 KB Write (up to)[1] | Sequential 128 KB Read[1] | Sequential 128 KB Write[1] |
| Type | Capacity | IOPS | IOPS | MB/s | MB/s |
| 2280 | 80 GB | 20,500 | 9,200 | 430 | 100 |
| | 120 GB | 18,000 | 15,000 | 450 | 130 |
| | 180 GB | 37,500 | 17,000 | 470 | 170 |
| | 240 GB | 37,500 | 23,000 | 510 | 230 |
| | 360 GB | 37,500 | 10,000 | 525 | 240 |
| 2242 | 120 GB | 16,500 | 11,000 | 275 | 105 |

***Note:***

1. Performance measured using Iometer* with Queue Depth 32

**Table 6: Latency**

| Specification | Intel® SSD Pro 1500 Series Type 2280 | | | | | Type 2242 |
|---|---|---|---|---|---|---|
| | 80 GB | 120 GB | 180 GB | 240 GB | 360 GB | 120 GB |
| Read[1] | 80 µs (TYP) | | | | | |
| Write[1] | 85 µs (TYP) | | | | | |
| Power On To Ready[2] | 1 s (TYP) | | | | | |

***Note:***

1. Based on sequential 4 KB using Iometer with Queue Depth 1 workload with compressible (non-random) data pattern. Write Cache enabled.
2. Power On To Ready time assumes proper shutdown

## 2.3 Electrical Characteristics

**Table 7: Operating Voltage and Power Consumption**

| Electrical Characteristics | Intel® SSD Pro 1500 Series Type 2280 | | | | | Type 2242 |
|---|---|---|---|---|---|---|
| | 80 GB | 120 GB | 180 GB | 240 GB | 360 GB | 120 GB |
| Operating Voltage for 3.3 V (±5%) | | | | | | |
| Min | 3.14 V | | | | | |
| Max | 3.47 V | | | | | |
| Rise Time (Max/Min) | 100 ms / 0.1 ms | | | | | |
| Fall Time (Max/Min) | 5 s / 1 ms | | | | | |
| Noise Tolerance | 50 mV pp (10 Hz – 30 MHz) | | | | | |
| Min Off Time[1] | 1 s | | | | | |
| Power Consumption (TYP) | | | | | | |
| Active[2] | 140 mW | | | | | |
| Idle[3] | 55 mW | | | | | |
| DevSleep[4] | 200 µW | | | | | |
| Thermal Power[5] | 2.7 W | 3.1 W | 3.8 W | 4.5 W | 4.5 W | 3.1 W |
| Regulator Power[6] | 3.0 W | 3.4 W | 4.1 W | 4.9 W | 5.5 W | 3.4 W |

***Note:***

1. Minimum time from when power removed from drive (Vcc < 100 mV) to when power can be reapplied to drive.
2. Active power measured during execution of MobileMark* 2007 with SATA Link Power Management (LPM) enabled.
3. Non-DevSleep idle power with SATA Link Power Management (LPM) enabled.
4. Power consumption during DevSleep state.
5. Power measured during 128 KB sequential writes with Queue Depth 32 workload using 100 ms sample period. This represents power that would be thermal load on system during heavy workloads.
6. Power measured during 128 KB sequential writes with Queue Depth 32 workload using 500 µs sample period. This represents power that system power supply would have to regulate for proper device operation.

## 2.4 Environmental Conditions

### 2.4.1 Temperature, Shock, Vibration

**Table 8: Temperature, Shock, Vibration**

| Electrical Characteristics | Range |
|---|---|
| Module Temperature | |
| Operating[1] | 0º C - 70º C |
| Non-operating[2] | -55º C - 95º C |
| Temperature Gradient[3] | |
| Operating | 30 (TYP) ºC/hr |
| Non-operating | 30 (TYP) ºC/hr |
| Humidity | |
| Operating | 5 – 95 % |
| Non-operating | 5 – 95 % |
| **Shock and Vibration** | **Range** |
| Shock[4] | |
| Operating | 1,000 G (Max) at 0.5 msec |
| Non-operating | 1,000 G (Max) at 0.5 msec |
| Vibration[5] | |
| Operating | 2.17 GRMS (5-700 Hz) Max |
| Non-operating | 3.13 GRMS (5-800 Hz) Max |

***Note:***

1. As measured by temperature sensor, SMART Attribute BEh. Active airflow is recommended within the system for maintaining proper device operating temperature on heavier workloads.
2. Please contact your Intel representative for details on the non-operating temperature range.
3. Temperature gradient measured without condensation.
4. Shock specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws. Stimulus may be applied in the X, Y or Z axis. Shock specification is measured using peak acceleration and pulse width value.
5. Vibration specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws. Stimulus may be applied in the X, Y or Z axis. Vibration specification is measured using Root Mean Squared (RMS) value.

### 2.4.2 Altitude

The drive is not sensitive to changes in atmospheric pressure because it has no moving parts. Drive tested under non-operational conditions to pressures representative of -1 K and +40 K feet.

## 2.5 Product Regulatory Compliance

The Intel® SSD Pro 1500 Series meets or exceeds the regulatory or certification requirements in the table below.

**Table 9: Product Regulatory Compliance Specifications**

| Title | Description | Region For Which Conformity Declared |
|---|---|---|
| TITLE 47-Telecommunications CHAPTER 1— FEDERAL COMMUNMICATIONS COMMISSION PART 15 — RADIO FREQUENCY DEVICES | FCC Part 15B Class B | USA |
| ICES-003, Issue 4 Interference-Causing Equipment<br>Standard Digital Apparatus | CA/CSA-CEI/IEC CISPR 22-10 (Ref. CISPR 22:2008). | Canada |
| IEC 55024 Information Technology Equipment — Immunity characteristics— Limits and methods of measurement CISPR24:2010 | EN-55024: 2010 and its amendments | European Union |
| IEC 55022 Information Technology Equipment — Radio disturbance Characteristics— Limits and methods of measurement CISPR22:2008 (Modified) | EN-55022: 2010 and its amendments | European Union |
| EN-60950-1 2nd Edition | Information Technology Equipment — Safety — Part 1: General Requirements | USA/Canada |
| UL/CSA EN-60950-1 2nd Edition | Information Technology Equipment — Safety — Part 1: General Requirements | USA/Canada |

## 2.6 Reliability

The Intel® SSD Pro 1500 Series meets or exceeds SSD endurance and data retention requirements as specified in the JESD218 specification.

**Table 10: Reliability Specifications**

| Parameter | Value |
|---|---|
| Uncorrectable Bit Error Rate (UBER)<br><br>Uncorrectable bit error rate will not exceed one sector in the specified number of bits read. In the unlikely event of a non-recoverable read error, the SSD will report it as a read failure to the host; the sector in error is considered corrupt and is not returned to the host. | < 1 sector per $10^{16}$ bits read |
| Mean Time Between Failures (MTBF)<br><br>Mean Time Between Failures is estimated based on Telcordia* methodology and demonstrated through Reliability Demonstration Test (RDT). | ≥ 1.2 million hours |
| Minimum Useful Life/Endurance Rating<br><br>The SSD will have a minimum useful life based on a typical client workload assuming up to 20 GB of host writes per day. | 5 years |
| Insertion Cycles<br><br>Maximum insertion/removal cycles on M.2 port | 250 insertion/removal cycles |

# 3 Mechanical Information

The Intel® SSD Pro 1500 Series meets the proposed specification for 80mm M.2 form factor

The figure below shows the physical package information for the 80 mm height, M.2 Intel® SSD Pro 1500 Series SSD. All dimensions are in millimeters.

**Figure 1: Dimensions for 80 mm double-sided M.2 Form Factor (2280-D2-B-M) 120 GB, 240 GB and 360 GB**

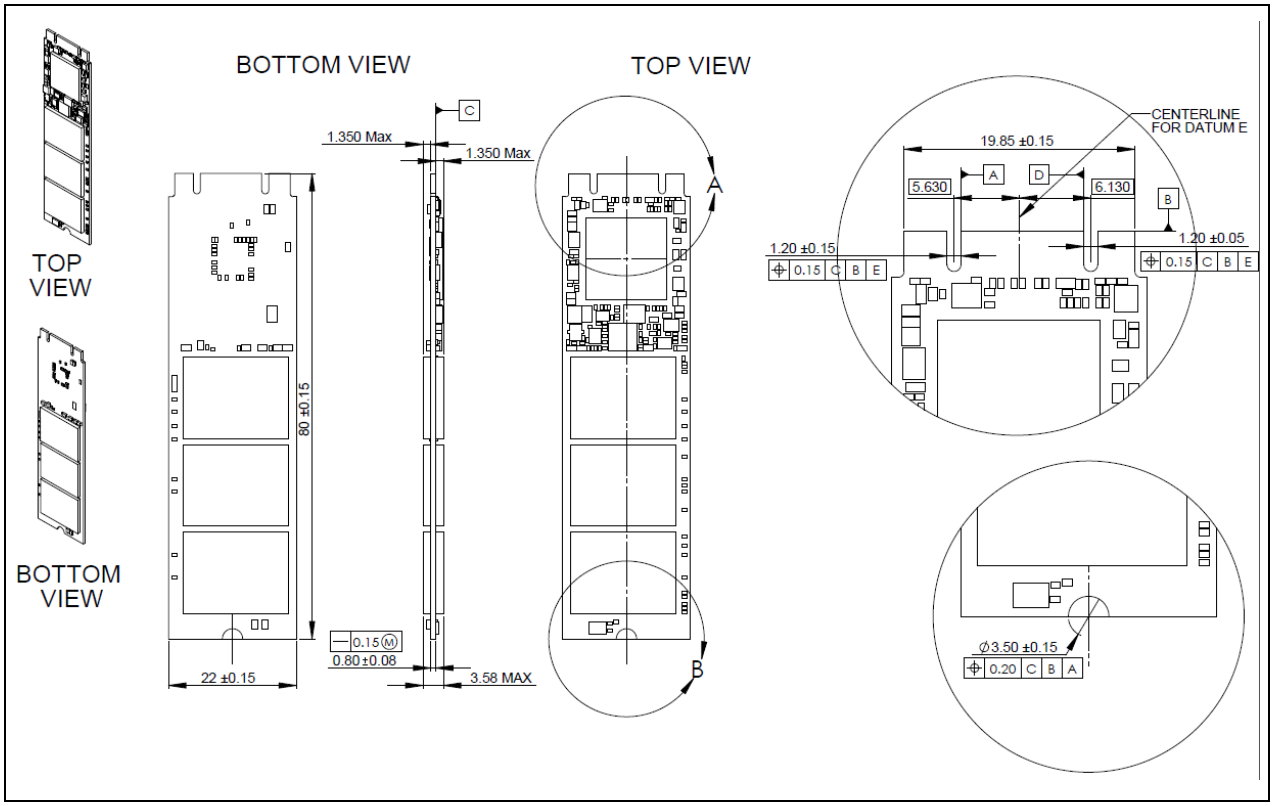


**Figure 2: Dimensions for 80 mm single-sided M.2 Form Factor (2280-S2-B-M) 80 GB and 180 GB**

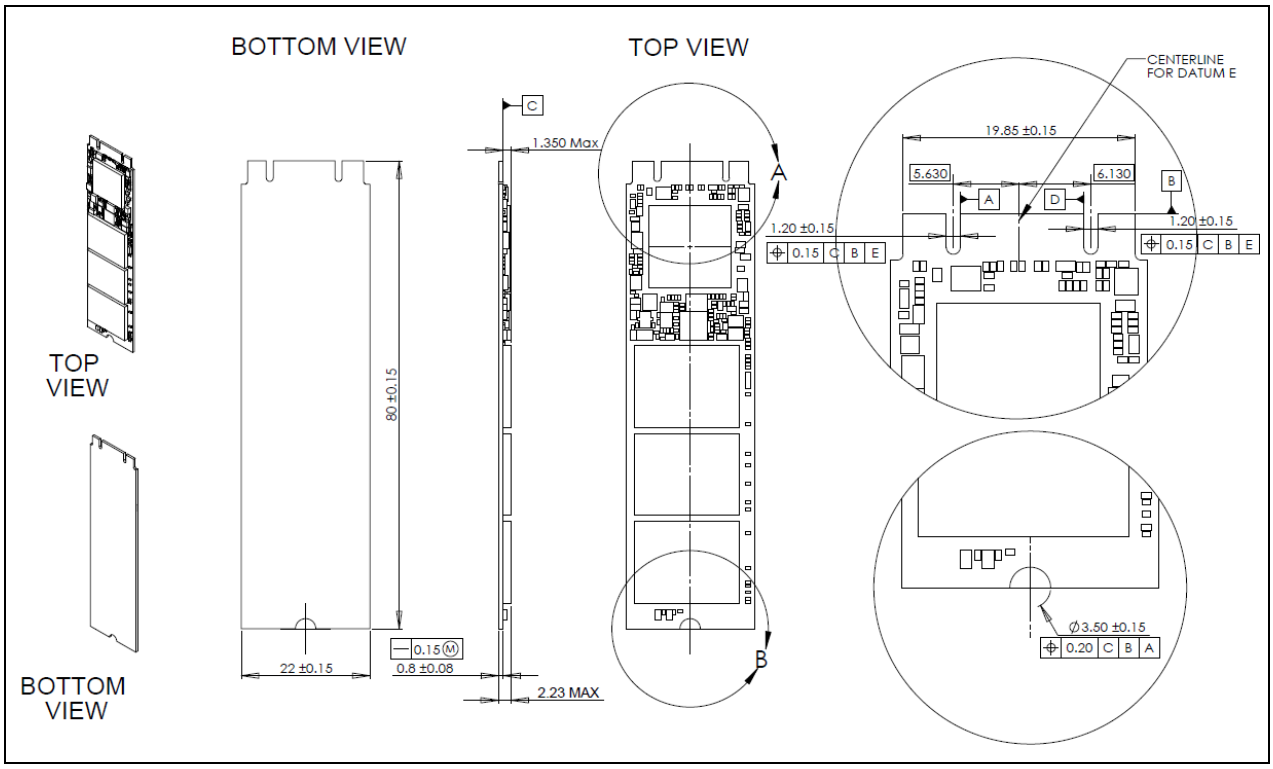
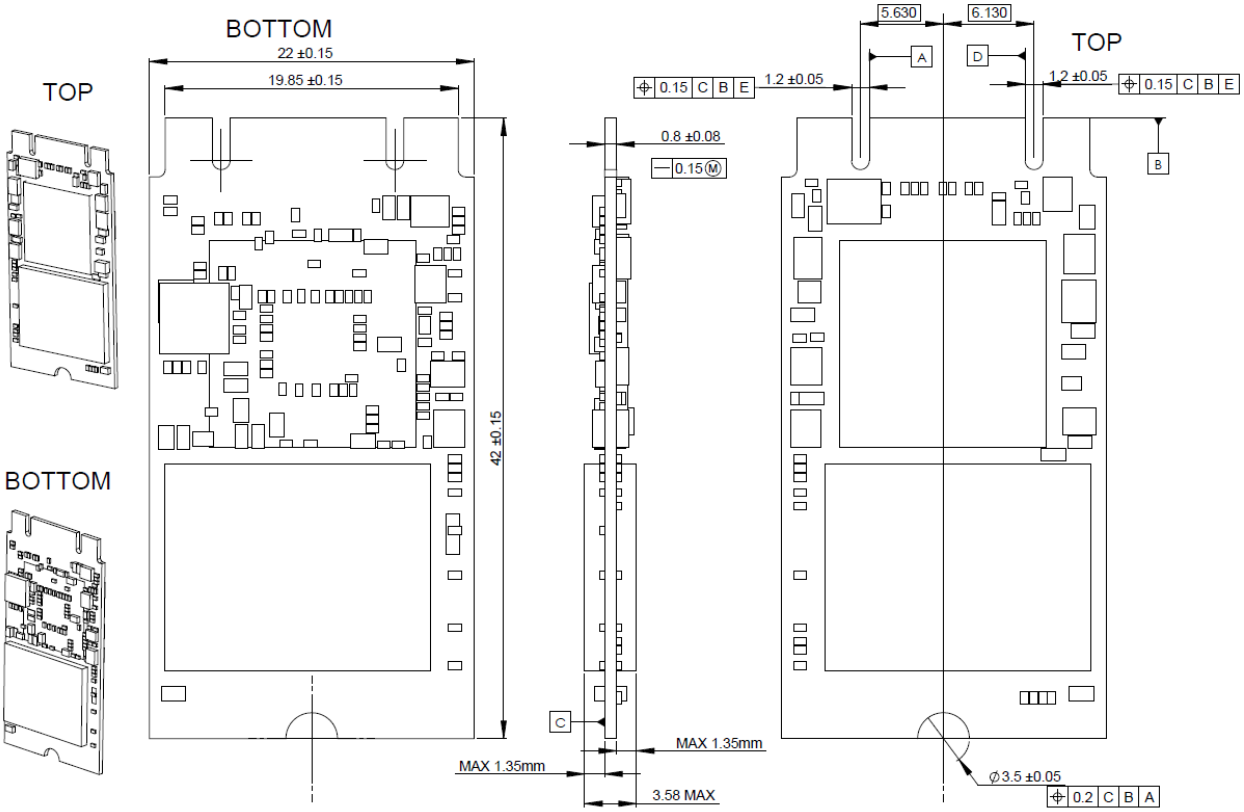


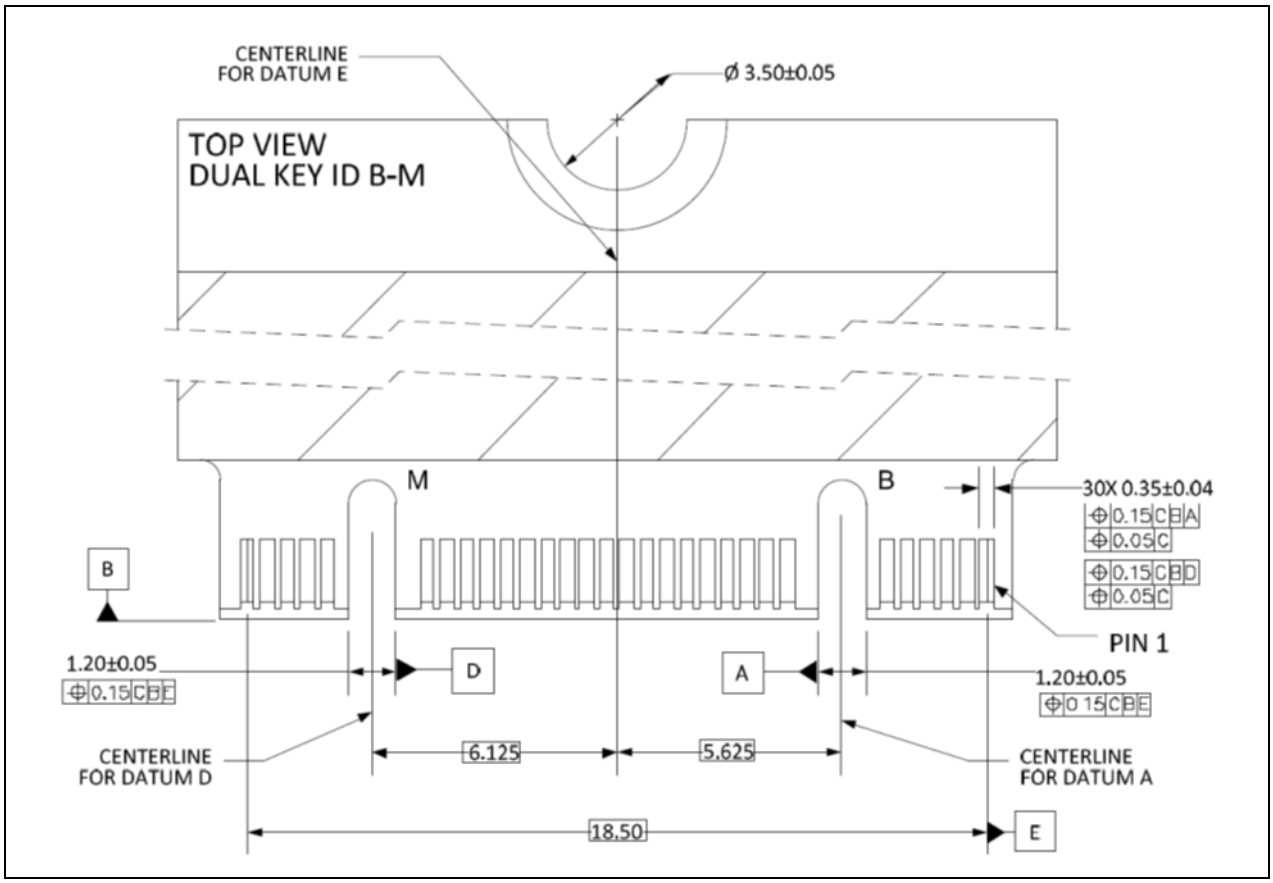
**Figure 3: Dimensions for 42 mm double-sided M.2 Form Factor (2242-D2-B-M) 120 GB**



# 4 Pin and Signal Descriptions

## 4.1 Pin Locations

**Figure 4: Layout of Signal and Power Segment Pins**



## 4.2 Signal Descriptions

**Table 11: M.2 Serial ATA Power Pin Definitions**

| Pin | Function | Definition |
|---|---|---|
| P1 | CONFIG_3 | Ground |
| P2 | +3.3 V | 3.3 V Source |
| P3 | GND | Ground |
| P4 | +3.3 V | 3.3 V Source |
| P5 | Reserved | No Connect |
| P6 | Reserved | No Connect |
| P7 | Reserved | No Connect |
| P8 | Reserved | No Connect |
| P9 | Reserved | No Connect |
| P10 | DAS/DSS# | Device Activity Signal / Disable Staggered Spin-up |
| P11 | Reserved | No Connect |
| P12 | Notch | No Connect |
| P13 | Notch | No Connect |
| P14 | Notch | No Connect |
| P15 | Notch | No Connect |
| P16 | Notch | No Connect |
| P17 | Notch | No Connect |
| P18 | Notch | No Connect |
| P19 | Notch | No Connect |
| P20 | Reserved | No Connect |
| P21 | CONFIG_0 | Ground |
| P22 | Reserved | No Connect |
| P23 | Reserved | No Connect |
| P24 | Reserved | No Connect |
| P25 | Reserved | No Connect |
| P26 | Reserved | No Connect |
| P27 | GND | Ground |
| P28 | Reserved | No Connect |
| P29 | Reserved | No Connect |
| P30 | Reserved | No Connect |
| P31 | Reserved | No Connect |
| P32 | Reserved | No Connect |
| P33 | GND | Ground |
| P34 | Reserved | No Connect |
| P35 | Reserved | No Connect |
| P36 | Reserved | No Connect |
| P37 | Reserved | No Connect |
| P38 | DEVSLP | DevSleep Pin |
| P39 | GND | Ground |
| P40 | Reserved | No Connect |
| P41 | +B | Host Receiver Differential Signal Pair (This is an output of the SSD) |
| P42 | Reserved | No Connect |
| P43 | -B | Host Receiver Differential Signal Pair (This is an output of the SSD) |
| P44 | Reserved | No Connect |
| P45 | GND | Ground |
| P46 | Reserved | No Connect |
| P47 | -A | Host Transmitter Differential Signal Pair (This is an input of the SSD) |

| Pin | Function | Definition |
|---|---|---|
| P48 | Reserved | No Connect |
| P49 | +A | Host Transmitter Differential Signal Pair (This is an input of the SSD) |
| P50 | Reserved | No Connect |
| P51 | GND | Ground |
| P52 | Reserved | No Connect |
| P53 | Reserved | No Connect |
| P54 | Reserved | No Connect |
| P55 | Reserved | No Connect |
| P56 | Two Wire Interface | Two Wire Interface Clock |
| P57 | GND | Ground |
| P58 | Two Wire Interface | Two Wire Interface Data |
| P59 | Notch | No Connect |
| P60 | Notch | No Connect |
| P61 | Notch | No Connect |
| P62 | Notch | No Connect |
| P63 | Notch | No Connect |
| P64 | Notch | No Connect |
| P65 | Notch | No Connect |
| P66 | Notch | No Connect |
| P67 | Reserved | No Connect |
| P68 | Reserved | No Connect |
| P69 | CONFIG_1 | Ground |
| P70 | +3.3 V | 3.3 V Source |
| P71 | GND | Ground |
| P72 | +3.3 V | 3.3 V Source |
| P73 | GND | Ground |
| P74 | +3.3 V | 3.3 V Source |
| P75 | CONFIG_2 | Ground |

## 4.3 Device Sleep Feature

Device Sleep (or DevSleep/DEVSLP) is the latest feature aligned with Intel® 4th Generation Core™-based Ultrabooks™. Ultrabook™ has stringent power requirements for SSDs and as such requires an ability to put the drive in a low power state. Although Link Power Management allows some control over power consumption, both methods still require the SATA link to remain online. The DevSleep pin is an enable high pin.

# 5 Supported Command Sets

The Intel® SSD Pro 1500 Series supports all mandatory Advanced Technology Attachment (ATA) and Serial ATA (SATA) commands defined in the ACS-2 and SATA Revision 3.0 specifications. The mandatory and optional commands are defined in this section.

## 5.1 ATA General Feature Command Set

General Feature command set (non-PACKET), which consists of:

- EXECUTE DEVICE DIAGNOSTIC
- FLUSH CACHE
- IDENTIFY DEVICE [1]
- READ DMA
- READ SECTOR(S)
- READ VERIFY SECTOR(S)
- SEEK
- SET FEATURES
- WRITE DMA
- WRITE SECTOR(S)
- READ MULTIPLE
- SET MULTIPLE MODE
- WRITE MULTIPLE

The Intel® SSD Pro 1500 Series also supports the following optional commands:

- READ BUFFFER
- WRITE BUFFER
- NOP
- DOWNLOAD MICROCODE

***Note:***

1. See the Appendix for details on the sector data returned after issuing an IDENTIFY DEVICE command.

## 5.2 Power Management

The Intel® SSD Pro 1500 Series supports several power management feature sets as defined by the ATA specification: general Power Management feature set, Advanced Power Management feature set, and Power-Up in Standby (PUIS) feature set.

The Advanced Power Management and PUIS features can be enabled or disabled using the SET FEATURES command.

The Power Management feature set includes the following commands:

- CHECK POWER MODE
- IDLE
- IDLE IMMEDIATE
- SLEEP
- STANDBY
- STANDBY IMMEDIATE

## 5.3 Security Mode Feature Set

The Intel SSD Pro 1500 Series supports the ATA Security Feature Set, which consists of:

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT
  - Normal Mode – Full NAND erase of user available space and spare area
  - Enhanced Mode – Cryptographically erase data
- SECURITY FREEZE LOCK
- SECURITY DISABLE PASSWORD

Note: Security features disabled and not supported if Opal activated.

## 5.4 TCG Opal SSC Support

The Intel SSD Pro 1500 Series drive is a Self-Encrypting Drive (SED) that supports the TCG Opal SSC Specification Version 1.0 Rev 3.0 mandatory commands along with the following features:

- PSID (Physical presence Security ID) Revert for SSD Repurposing
- AES mode: XTS-AES 256-bit
- FIPS 197 certified

Once Opal is activated by user(Locking SP in “Manufactured” state), per Opal specification, ATA Security Features are not supported by the drive. Word 82, bit 1 and Word 128, bit 0 will indicate no support (bit = 0). Host should not attempt any ATA Security Features when Opal activated. Table 12 indicates changes in ID Device word values when Opal activated.

**Table 12: ID Device Changes with Opal Activation**

| Word | Description | Value (Opal Deactivated) | Value (Opal Activated) |
|---|---|---|---|
| 82 | Features/Command Sets Support(Bit 1 Security Support) | 746Bh | 7469h |
| 89 | SECURITY ERASE UNIT Time | 0002h | 0000h |
| 90 | ENHANCED SECURITY ERASE UNIT Time | 0001h | 0000h |
| 92 | Master Password Revision Code | FFFEh | 0000h |
| 128 | Security Status | 0021h | 0000h |

## 5.5 SMART Command Set

The Intel SSD Pro 1500 Series supports the SMART command set, which consists of:

- SMART READ DATA
- SMART READ ATTRIBUTE THRESHOLDS
- SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE
- SMART SAVE ATTRIBUTE VALUES
- SMART EXECUTE OFF-LINE IMMEDIATE
- SMART READ LOG SECTOR
- SMART WRITE LOG SECTOR
- SMART ENABLE OPERATIONS
- SMART DISABLE OPERATIONS
- SMART RETURN STATUS

### 5.5.1 SMART Attributes

Table 13 lists the SMART attributes supported by the Intel SSD Pro 1500 Series; Table 14 lists the corresponding status flags and threshold settings.

**Table 13: SMART Attributes**

| ID | Attribute | Status Flags | | | | | | Threshold |
|---|---|---|---|---|---|---|---|---|
| | | SP | EC | ER | PE | OC | PW | |
| 05h | Re-allocated Sector Count<br>The raw value of this attribute shows the number of retired blocks since leaving the factory (grown defect count). | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| 09h | Power-On Hours Count<br>The raw value reports two values: the first 4 bytes report the cumulative number of power-on hours over the life of the device, the remaining bytes report the number of milliseconds since the last hour increment.<br>The On/Off status of the Device Initiated Power Management (DIPM) feature will affect the number of hours reported. If DIPM is turned On, the recorded value for power-on hours does not include the time that the device is in a "slumber" state. If DIPM is turned Off, the recorded value for power-on hours should match the clock time, as all three device states are counted: active, idle and slumber. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| 0Ch | Power Cycle Count<br>The raw value of this attribute reports the cumulative number of power cycle events over the life of the device. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| AAh | Available Reserved Space | 1 | 1 | 0 | 0 | 1 | 1 | 10 |
| ABh | Program Fail Count<br>The raw value of this attribute shows total count of program fails and the normalized value, beginning at 100, shows the percent remaining of allowable program fails. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| ACh | Erase Fail Count<br>The raw value of this attribute shows total count of erase fails and the normalized value, beginning at 100, shows the percent remaining of allowable erase fails. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| AEh | Unexpected Power Loss<br>The raw value of this attribute reports the cumulative number of unsafe (unclean) shutdown events over the life of the device. An unsafe shutdown occurs whenever the device is powered off without STANDBY IMMEDIATE being the last command | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| B7h | SATA Downshift Count<br>The count of the number of times SATA interface selected lower signaling rate due to error. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |

| ID | Attribute | Status Flags | | | | | | Threshold |
|---|---|---|---|---|---|---|---|---|
| | | SP | EC | ER | PE | OC | PW | |
| B8h | End-to-End Error Detection Count<br>Reports number of errors encountered during end-to-end error detection within the SSD data path. | 1 | 1 | 0 | 0 | 1 | 1 | 90 |
| BBh | Uncorrectable Error Count<br>The raw value shows the count of errors that could not be recovered using Error Correction Code (ECC). | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| BEh | Temperature<br>Reports real-time temperature of drive as measured by temperature sensor on drive PCB. The normalized value reports the current temperature value. The raw value shows current, lifetime highest and lifetime lowest temperatures. Byte 1:0 = current temp Celsius; Byte 3:2 = lifetime highest temp Celsius; Byte 5:4 = lifetime lowest temp Celsius. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| C0h | Power-Off Retract Count (Unsafe Shutdown Count)<br>The raw value of this attribute reports the cumulative number of unsafe (unclean) shutdown events over the life of the device. An unsafe shutdown occurs whenever the device is powered off without STANDBY IMMEDIATE being the last command. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| C7h | CRC Error Count<br>The total number of encountered SATA interface cyclic redundancy check (CRC) errors. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| E1h | Host Writes<br>The raw value of this attribute reports the total number of sectors written by the host system. The raw value is increased by 1 for every 65,536 sectors (32 MB) written by the host. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| E2h | Timed Workload Media Wear<br>Measures the wear seen by the SSD (since reset of the workload timer, attribute E4h), as a percentage of the maximum rated cycles. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| E3h | Timed Workload Host Read/Write Ratio<br>Shows the percentage of I/O operations that are read operations (since reset of the workload timer, attribute E4h). | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| E4h | Timed Workload Timer<br>Measures the elapsed time (number of minutes since starting this workload timer). | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| E8h | Available Reserved Space<br>This attribute reports the number of reserve blocks remaining. The normalized value begins at 100 (64h), which corresponds to 100 percent availability of the reserved space. The threshold value for this attribute is 10 percent availability. | 1 | 1 | 0 | 0 | 1 | 1 | 10 |

| ID | Attribute | Status Flags | | | | | | Threshold |
|---|---|---|---|---|---|---|---|---|
| | | SP | EC | ER | PE | OC | PW | |
| E9h | Media Wearout Indicator<br>This attribute reports the number of cycles the NAND media has undergone. The normalized value declines linearly from 100 to 1 as the average erase cycle count increases from 0 to the maximum rated cycles.<br>Once the normalized value reaches 1, the number will not decrease, although it is likely that significant additional wear can be put on the device. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| F1h | Total LBAs Written<br>The raw value of this attribute reports the total number of sectors written by the host system. The raw value is increased by 1 for every 65,536 sectors (32 MB) written by the host. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| F2h | Total LBAs Read<br>The raw value of this attribute reports the total number of sectors read by the host system. The raw value is increased by 1 for every 65,536 sectors (32 MB) read by the host. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |
| F9h | Total NAND Writes<br>Raw value reports the number of writes to NAND in 1 GB increments. | 1 | 1 | 0 | 0 | 1 | 0 | 0 (none) |

**Table 14: SMART Attribute Status Flags**

| Status Flag | Description | Value = 0 | Value = 1 |
|---|---|---|---|
| SP | Self-preserving attribute | Not a self-preserving attribute | Self-preserving attribute |
| EC | Event count attribute | Not an event count attribute | Event count attribute |
| ER | Error rate attribute | Not an error rate attribute | Error rate attribute |
| PE | Performance attribute | Not a performance attribute | Performance attribute |
| OC | Online collection attribute | Collected only during offline activity | Collected during both offline and online activity |
| PW | Pre-fail warranty attribute | Advisory | Pre-fail |

### 5.5.2 SMART Logs

The Intel SSD Pro 1500 Series implements the following Log Addresses: 00h, 02h, 03h, 06h, and 07h.

The Intel SSD Pro 1500 Series implements host vendor specific logs (addresses 80h-9Fh) as read and write scratchpads, where the default value is zero (0). Intel SSD Pro 1500 Series does not write any specific values to these logs unless directed by the host through the appropriate commands.

The Intel SSD Pro 1500 Series also implements a device vendor specific log at address A9h as a read-only log area with a default value of zero (0).

## 5.6 Device Statistics

In addition to the SMART attribute structure, statistics pertaining to the operation and health of the Intel SSD Pro 1500 Series can be reported to the host on request through the Device Statistics log as defined in the ATA specification.

The Device Statistics log is a read-only GPL/SMART log located at read log address 0x04 and is accessible using READ LOG EXT, READ LOG DMA EXT or SMART READ LOG commands.

The table below lists the Device Statistics supported by the Intel SSD Pro 1500 Series.

**Table 15: Device Statistics Log**

| Page | Offset | Description | Equivalent SMART attribute if applicable |
|---|---|---|---|
| 0x00 | - | List of Supported Pages | - |
| 0x01 - General Statistics | 0x08 | Power Cycle Count | 0Ch |
| | 0x10 | Power-On Hours | 09h |
| | 0x18 | Logical Sectors Written | E1h |
| | 0x28 | Logical Sectors Read | F2h |
| 0x04 - General Errors Statistics | 0x08 | Num Reported Uncorrectable Errors | BBh |
| | 0x10 | Num Resets Between Command Acceptance and Completion | - |
| 0x06 - Transport Statistics | 0x08 | Num Hardware Resets | - |
| | 0x10 | Num ASR Events | - |
| | 0x18 | Num Interface CRC Errors | - |
| 0x07 - Solid State Device Statistics | 0x08 | Percentage Used Endurance Indicator | E9h<br>This statistic counts up from 0 rather than down from 100, and may go beyond 100 for drives that exceed their expected lifetime. |

## 5.7 SMART Command Transport

With SMART Command Transport (SCT), a host can send commands and data to an SSD and receive status and data from an SSD using standard write/read commands to manipulate two SMART Logs:

- Log Address E0h ("SCT Command/Status") — used to send commands and retrieve status
- Log Address E1h ("SCT Data Transfer") — used to transport data

## 5.8 Data Set Management Command Set

The Intel SSD Pro 1500 Series supports the Data Set Management command set Trim attribute, which consists of:

- DATA SET MANAGEMENT

## 5.9 Host Protected Area Command Set

- READ NATIVE MAX ADDRESS
- SET MAX ADDRESS
- READ NATIVE MAX ADDRESS EXT
- SET MAX ADDRESS EXT

## 5.10 48-Bit Address Command Set

The Intel SSD Pro 1500 Series supports the 48-bit Address command set, which consists of:

- FLUSH CACHE EXT
- READ DMA EXT
- READ NATIVE MAX ADDRESS
- READ NATIVE MAX ADDRESS EXT
- READ SECTOR(S) EXT
- READ VERIFY SECTOR(S) EXT
- SET MAX ADDRESS EXT
- WRITE DMA EXT
- WRITE MULTIPLE EXT
- WRITE SECTOR(S) EXT

## 5.11 General Purpose Log Command Set

The Intel SSD Pro 1500 Series supports the General Purpose Log command set, which consists of:

- READ LOG EXT
- WRITE LOG EXT
- READ LOG DMA EXT
- WRITE LOG DMA EXT

## 5.12 Native Command Queuing

- READ FPDMA QUEUED
- WRITE FPDMA QUEUED

## 5.13 Software Settings Preservation

The Intel SSD Pro 1500 Series supports the SET FEATURES parameter to enable/disable the preservation of software settings.

## 5.14 SATA Link Power Management (LPM)

The Intel SSD Pro 1500 Series supports the SET FEATURES parameter to enable Device Initiated Power Management (DIPM). The SSD also supports Host Initiated Power Management (HIPM).

## 5.15 DevSleep

The Intel SSD Pro 1500 Series supports the DevSleep feature. DevSleep must be enabled on the device by the host system through the SET FEATURES command. If DevSleep is enabled by the host, the host must drive the DevSleep signal to proper assert/de-assert voltage levels according to the SATA specification. Entry into DevSleep must be preceded by LPM slumber entry by host and device. The Intel SSD Pro 1500 Series also supports DevSleep_to_ReducedPwrState which allows host to wake the drive using normal LPM COMWAKE out-of-band signaling.

For the Intel® SSD Pro 1500 Series, the total time to DevSleep for system active state is recommended to be 6 sec. The AHCI controller has 4 parameters that need to be defined for proper DevSleep operation between the host and drive. Table 16 defines those values for the Intel® SSD Pro 1500 Series drive.

**Table 16: DevSleep Control Parameters**

| Parameter | Definition | Control | Intel® SSD Pro 1500 Values |
|---|---|---|---|
| **DITO** | DevSleep Idle Time Out – number of milliseconds prior to host asserting DevSleep | Set by Host | Active (lid-up): 375 |
| **DM** | DITO Multiplier – set once at boot-up | Set by Host | 15 |
| **MDAT** | Minimum Devsleep Assertion Time – minimum time in milliseconds for host to assert devsleep | Reported by Drive | 10 |
| **DETO** | DevSleep Exit Time Out – max time in milliseconds from when DevSleep is negated to when device ready to detect OOB | Reported by Drive | 20 |

**Total time to devsleep entry = DITO * (DM+1)**

# 6 Certifications and Declarations

The table below describes the Device Certifications supported by the Intel SSD Pro 1500 Series.

**Table 17: Device Certifications and Declarations**

| Certification | Description |
|---|---|
| CE Compliant | European Economic Area (EEA): Compliance with the essential requirements of EC Council Directives Low Voltage Directive (LVD) 2006/95/EC, EMC Directive 2004/108/EC and Directive 2011/65/EU. |
| UL Recognized | Certified Underwriters Laboratories, Inc. Bi-National Component Recognition; UL 60950-1, 2nd Edition, 2007-03-27 (Information Technology Equipment - Safety - Part 1: General Requirements)<br><br>CSA C22.2 No. 60950-1-07, 2nd Edition, 2007-03 (Information Technology Equipment - Safety - Part 1: General Requirements) |
| C-Tick Compliant | Compliance with the Australia/New Zealand Standard AS/NZS3548 and Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA). |
| BSMI Compliant | Compliance to the Taiwan EMC standard CNS 13438: Information technology equipment - Radio disturbance Characteristics - limits and methods of measurement, as amended on June 1, 2006, is harmonized with CISPR 22: 2005.04. |
| KCC | Compliance with paragraph 1 of Article 11 of the Electromagnetic Compatibility Control Regulation and meets the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Ministry of Information and Communication Republic of Korea. |
| Microsoft WHCK | Microsoft Windows Hardware Certification Kit |
| RoHS Compliant | Restriction of Hazardous Substance Directive |
| VCCI | Voluntary Control Council for Interface to cope with disturbance problems caused by personal computers or facsimile. |
| SATA-IO | Indicates certified logo program from Serial ATA International Organization. |
| Low Halogen | Applies only to brominated and chlorinated flame retardants (BFRs/CFRs) and PVC in the final product. Intel components as well as purchased components on the finished assembly meet JS-709 requirements, and the PCB/substrate meet IEC 61249-2-21 requirements. The replacement of halogenated flame retardants and/or PVC may not be better for the environment. |

# 7 Appendix

The table below describes the sector data returned from an identify device command

**Table 18: Identify Device Returned Sector Data**

| Word | F = Fixed<br>V = Variable<br>X = Both | Default Value (Opal Ready) | Description |
|---|---|---|---|
| 0 | F | 0040h | General configuration bit-significant information |
| 1 | X | 3FFFh | Obsolete - Number of logical cylinders (16,383) |
| 2 | V | C837h | Specific configuration |
| 3 | X | 0010h | Obsolete - Number of logical heads (16) |
| 4-5 | X | 0h | Retired |
| 6 | X | 003Fh | Obsolete - Number of logical sectors per logical track (63) |
| 7-8 | V | 0h | Reserved for assignment by the CompactFlash* Association (CFA) |
| 9 | X | 0h | Retired |
| 10-19 | F | varies | Serial number (20 ASCII characters) |
| 20-21 | X | 0h | Retired |
| 22 | X | 0h | Obsolete |
| 23-26 | F | varies | Firmware revision (8 ASCII characters) |
| 27-46 | F | varies | Model number (Intel® Solid-State Drive) |
| 47 | F | 8010h | 7:0—Maximum number of sectors transferred per interrupt on multiple commands |
| 48 | F | 4000h (4001h) | Reserved |
| 49 | F | 2F00h | Capabilities |
| 50 | F | 4000h | Capabilities |
| 51-52 | X | 0h | Obsolete |
| 53 | F | 0007h | Words 88 and 70:64 valid |
| 54 | X | 3FFFh | Obsolete - Number of logical cylinders (16,383) |
| 55 | X | 0010h | Obsolete - Number of logical heads (16) |
| 56 | X | 003Fh | Obsolete - Number of logical sectors per logical track (63) |
| 57-58 | X | 00FBFC10h | Obsolete |
| 59 | V | 0110h | Number of sectors transferred per interrupt on multiple commands |
| 60-61 | F | varies | Total number of user-addressable sectors |
| 62 | X | 0h | Obsolete |
| 63 | F | 0007h | Multi-word DMA modes supported/selected |
| 64 | F | 0003h | PIO modes supported |
| 65 | F | 0078h | Minimum multiword DMA transfer cycle time per word |
| 66 | F | 0078h | Manufacturer's recommended multiword DMA transfer cycle time |
| 67 | F | 0078h | Minimum PIO transfer cycle time without flow control |
| 68 | F | 0078h | Minimum PIO transfer cycle time with IORDY flow control |

| Word | F = Fixed<br>V = Variable<br>X = Both | Default Value (Opal Ready) | Description |
|---|---|---|---|
| 69 | F | 4010h | Additional Supported |
| 70 | F | 0h | Reserved |
| 71-74 | F | 0h | Reserved for IDENTIFY PACKET DEVICE command |
| 75 | F | 001Fh | Queue depth |
| 76 | F | 270Eh | Serial ATA capabilities |
| 77 | F | 0086h | Reserved for future Serial ATA definition |
| 78 | F | 054Ch | Serial ATA features supported |
| 79 | V | 0040h | Serial ATA features enabled |
| 80 | F | 03FCh | Major version number |
| 81 | F | FFFFh | Minor version number |
| 82 | F | 746Bh | Command set supported |
| 83 | F | 7429h | Command sets supported |
| 84 | F | 6163h | Command set/feature supported extension |
| 85 | V | 7469h | Command set/feature enabled |
| 86 | V | B409h | Command set/feature enabled |
| 87 | V | 6163h | Command set/feature default |
| 88 | V | 407Fh | Ultra DMA Modes |
| 89 | F | 0002h | Time required for security erase unit completion |
| 90 | F | 0001h | Time required for enhanced security erase completion |
| 91 | V | 00FEh | Current advanced power management value |
| 92 | V | FFFEh | Master Password Revision Code |
| 93 | F | 0h | Hardware reset result: the contents of bits (12:0) of this word shall change only during the execution of a hardware reset |
| 94 | V | 0h | Vendor's recommended and actual acoustic management value |
| 95 | F | 0h | Stream minimum request size |
| 96 | V | 0h | Streaming transfer time - DMA |
| 97 | V | 0h | Streaming access latency - DMA and PIO |
| 98-99 | F | 0h | Streaming performance granularity |
| 100-103 | V | varies | Maximum user LBA for 48-bit address feature set |
| 104 | V | 0h | Streaming transfer time - PIO |
| 105 | F | 0001h | Reserved |
| 106 | F | 4000h (6003h) | Physical sector size / logical sector size |
| 107 | F | 0h | Inter-seek delay for ISO-7779 acoustic testing in microseconds |
| 108-111 | F | varies | Unique ID |
| 112-115 | F | 0h | Reserved for worldwide name extension to 128 bits |
| 116 | V | 0h | Reserved for technical report |
| 117-118 | F | 0h | Words per logical sector |
| 119 | F | 401Ch | Supported settings |

| Word | F = Fixed<br>V = Variable<br>X = Both | Default Value (Opal Ready) | Description |
|---|---|---|---|
| 120 | F | 401Ch | Command set/feature enabled/supported |
| 121-126 | F | 0h | Reserved |
| 127 | F | 0h | Removable Media Status Notification feature set support |
| 128 | V | 0021h | Security status |
| 129-159 | X | varies | Vendor-specific |
| 160 | F | 0h | CompactFlash Association (CFA) power mode 1 |
| 161-168 | X | 0h | Reserved for assignment by the CFA |
| 169 | X | 0001h | Data set management Trim attribute support |
| 170-173 | F | 0h | Additional Product Identifier |
| 174-175 | F | 0h | Reserved |
| 176-205 | V | 0h | Current media serial number |
| 206 | X | 0025h | SCT Command Transport |
| 207-208 | X | 0h | Reserved |
| 209 | X | 4000h | Alignment of logical blocks within a physical block |
| 210-211 | X | 0h | Write-Read-Verify Sector Count Mode 3 (DWord) |
| 212-213 | X | 0h | Write-Read-Verify Sector Count Mode 2 (DWord) |
| 214 | X | 0h | NV Cache Capabilities |
| 215-216 | X | 0h | NV Cache Size in Logical Blocks (DWord) |
| 217 | X | 0001h | Nominal media rotation rate |
| 218 | X | 0h | Reserved |
| 219 | X | 0h | NV Cache Options |
| 220 | X | 0h | Write-Read-Verify feature set |
| 221 | X | 0h | Reserved |
| 222 | X | 103Fh | Transport major version number |
| 223 | X | 0h | Transport minor version number |
| 224-229 | X | 0h | Reserved |
| 230-233 | X | 0h | Extended Number of User Addressable Sectors (QWord) |
| 234 | X | 0002h | Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 235 | X | 0400h | Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h |
| 236-254 | X | 0h | Reserved |
| 255 | X | varies | Integrity word |

***Note:***

**F = Fixed**. The content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.

**V = Variable**. The state of at least one bit in a word is variable and may change depending on the state of the device or the commands executed by the device.

**X = F or V**. The content of the word may be fixed or variable.