



# Intel® Solid-State Drive Pro 2500 Series (M.2)

## Product Specification

- Capacities: 180GB, 240GB, 360GB
- Form Factors:
  - 80mm (single-sided) 2280-S2-B-M (180GB) and (double-sided) 2280-D2-B-M (240GB and 360GB)
  - 60mm (double-sided) 2260-D2-B-M (180GB and 240GB)
- Thickness: up to 3.58 mm
- Weight: <10 grams
- SATA 6Gb/s Bandwidth Performance<sup>1</sup> (IOMeter\* Queue Depth 32)
  - Sustained Sequential Read: up to 540MB/s
  - Sustained Sequential Write: up to 490MB/s
- Read and Write IOPS<sup>1</sup> (IOMeter Queue Depth 32)
  - Random 4KB Reads: up to 45,000 IOPS
  - Random 4KB Writes: up to 80,000 IOPS<sup>2</sup>
- Data Compression
- Intel® Stable Image Platform Program (SIPP)
- Security and Manageability Compatibility
  - Intel® Core® vPro® Processor
  - Intel® Setup and Configuration Software (Intel® SCS)
  - AES 256-bit Encryption
  - Trusted Computing Group\* (TCG\*) Opal Security Subsystem Class (SSC) Specification Version 2.0 features
  - Windows eDrive\*
- Additional Compatibility
  - Intel® SSD Toolbox with Intel® SSD Optimizer
  - Intel® Data Migration Software
  - Intel® Rapid Storage Technology
  - SATA Revision 3.2
  - ACS-3 (ATA/ATAPI Command Set 3)
  - SSD Enhanced SMART ATA feature set
  - Intel® Dynamic Platform Thermal Framework (Intel® DPTF)
- End-to-End Data Protection
- Power Management
  - 3.3 V SATA Supply Rail
  - SATA Link Power Management (LPM)
  - Advanced Power Management (APM)
  - Device Sleep (DevSleep)
- Power
  - Active (BAPCo MobileMark\* 2007 Workload): 140 mW
  - Idle<sup>3</sup>: 55 mW
  - DevSleep: 200 μW
- Temperature
  - Operating<sup>4</sup>: 0° C to 70° C
  - Non-Operating: -55° C to 95° C
- Reliability
  - Uncorrectable Bit Error Rate (UBER): <1 sector per 10<sup>16</sup> bits read
  - Mean Time Between Failure (MTBF): 1.2 million hours
  - Shock (operating and non-operating): 1,000 G/0.5 ms
- Vibration
  - Operating: 2.17 G<sub>RMS</sub> (5-700Hz)
  - Non-operating: 3.13 G<sub>RMS</sub> (5-800Hz)
- 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 4KB writes measured using out-of-box SSD.
3. Non-DevSleep idle power with SATA Link Power Management (LPM) enabled.
4. As measured by temperature sensor, SMART Attribute BEh. Active airflow is recommended within the system for maintaining proper device operating temperatures on heavier workloads.



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# 1 Introduction

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This document describes the specifications and capabilities of the Intel® Solid-State Drive Pro 2500 Series (Intel® SSD Pro 2500 Series).

The Intel SSD Pro 2500 Series delivers the next generation of Professional storage solution with enhanced security and manageability features, power-efficient performance, and lower total cost of ownership. The latest generation of the Intel® SSD Professional Family supports Trusted Computing Group\* (TCG\*) Opal version 2.0 features and is Microsoft eDrive\* capable, although "off" is the eDrive factory default out-of-box setting. In addition, Intel's proven reliability and low power consumption provide an enhanced mobile experience.

Intel SSD Pro 2500 Series also offers the following additional key features:

- **Security and Manageability Features**

Intel SSD Pro 2500 Series is a hardware-based self-encrypting drive (SED) enhanced with Opal 2.0\* security features. The TCG Opal specification describes a secure boot capability (pre-boot authentication), protection for user data, and administrative capabilities, improving security of critical data at rest. Manageability options are expanded when the Intel SSD Pro 2500 Series is coupled with the latest Intel® Core™ vPro™ processor systems and software such as Intel® Set-up & Configuration Service (Intel® SCS) with the Intel® SSD Pro Plug-in. Offering unique manageability options, IT Administrators can proactively manage the Intel® Solid-State Drive Professional Family and reduce deployment costs while keeping their PCs running smoothly.

- **Quality and Reliability Capabilities**

Quality and reliability are the cornerstones of Intel® SSD Products and the Intel SSD Pro 2500 is no different. Limiting employee down-time is critical; the reliability of the Intel SSD Pro 2500 Series is key for Low Total Cost of Ownership (TCO).

- **Power-Efficient Performance**

The new advanced low power modes enable longer battery life and greater mobility. In addition, the Intel SSD Pro 2500 Series provides higher performance throughput for the most demanding workloads.

- **Stability**

Intel SSD Pro 2500 Series is part of the Intel® Stable Image Platform Program (Intel® SIPP). Intel SIPP aligns key Intel platform components, enabling a predictable transition from one technology generation to the next with minimal compatibility issues. Enhancing software and hardware stability, Intel SIPP aligns with key Intel platform components and drivers and is currently available for at least 15 months post platform Intel SIPP availability.

- **Tools**

Intel SSD Pro 2500 Series is aligned with the latest version of the Intel® SSD Toolbox for consumers and the Intel® SSD Pro Administrator Tool for business and IT professionals. Intel tools provide key capabilities to maximize your Intel SSD experience. (Visit [www.intel.com/ssd](http://www.intel.com/ssd) to access the Tools panel for download.)



## 1.1 Revision History

| Revision Number | Description   | Revision Date |
|-----------------|---|---------------|
| 001             | Initial release   | July 2014     |
| 002             | Corrections to Temperature and Notes following Table 8. | October 2014  |

## 1.2 Terminology

Table 1: Terminology

| Term       | Description   |
|------------|---|
| AHCI*      | Advanced Host Controller Interface  |
| APM        | Advanced Power Management   |
| ATA        | Advanced Technology Attachment  |
| DAS        | Device Activity Signal  |
| DevSleep   | Device Sleep  |
| DIPM       | Device Initiated Power Management   |
| DMA        | Direct Memory Access  |
| DPTF       | Dynamic Platform Thermal Framework  |
| eDrive     | Microsoft* specification for a drive that complies to the TCG Opal 2.0 and IEEE 1667* standards   |
| 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   |
| Locking SP | Locking Security Provider   |
| 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  |



| Term  | Description  |
|-------|--|
| Opal  | A Trusted Computing Group (TCG) standard that defines an interface for managing a Self-Encrypting Drive (SED). |
| PIO   | Programmed Input/Output  |
| PSID  | Physical presence Security ID  |
| RDT   | Reliability Demonstration Test   |
| RMS   | Root Mean Squared  |
| SATA  | Serial Advanced Technology Attachment  |
| SED   | Self-Encrypting Drive  |
| SMART | Self-Monitoring, Analysis and Reporting Technology   |
| SSD   | Solid-State Drive  |
| TCG   | Trusted Computing Group  |
| TYP   | Typical  |
| UBER  | Uncorrectable Bit Error Rate   |

### 1.3 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) | <a href="http://www.iec.ch/">http://www.iec.ch/</a>  |
| Dec 2008       | VCCI  | <a href="http://www.vcci.jp/vcci_e/">http://www.vcci.jp/vcci_e/</a>  |
| June 2009      | RoHS  | <a href="http://qdms.intel.com/">http://qdms.intel.com/</a><br>Click <i>Search MDDS Database</i> and search for material description datasheet |
| August 2010    | IEC 55024 Information Technology Equipment — Immunity characteristics— Limits and methods of measurement CISPR24:2010                     | <a href="http://www.iec.ch/">http://www.iec.ch/</a>  |
| Sept 2010      | Solid-State Drive (SSD) Requirements and Endurance Test Method (JESD218)  | <a href="http://www.jedec.org/standards-documents/docs/jesd218/">http://www.jedec.org/standards-documents/docs/jesd218/</a>                    |
| February 2012  | TCG Opal Specification Version 2.0 rev 1.0  | <a href="http://www.trustedcomputinggroup.com/">http://www.trustedcomputinggroup.com/</a>  |
| August 2013    | Serial ATA Revision 3.2   | <a href="http://www.sata-io.org/">http://www.sata-io.org/</a>  |
| October 2013   | ACS-3 Specification   | <a href="http://www.t13.org/">http://www.t13.org/</a>  |



## 2 Product Specifications

### 2.1 Capacity

Table 3: User Addressable Sectors

| Capacity | Unformatted Capacity (Total User Addressable Sectors in LBA mode) |
|----------|---|
| 180GB    | 351,651,888   |
| 240GB    | 468,862,128   |
| 360GB    | 703,282,608   |

### 2.2 Performance

Table 4: Compressible Performance

| Type | Capacity | Specification                        |                                       |                                     |                                    |                                     |
|------|----------|--------------------------------------|---------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
|      |          | Random 4KB Read (up to) <sup>1</sup> | Random 4KB Write (up to) <sup>2</sup> | Random 4KB Write (TYP) <sup>1</sup> | Sequential 128KB Read <sup>1</sup> | Sequential 128KB Write <sup>1</sup> |
|      |          | IOPS                                 | IOPS                                  | IOPS                                | MB/s                               | MB/s                                |
| 2280 | 180GB    | 41,000                               | 80,000                                | 49,000                              | 540                                | 490                                 |
|      | 240GB    | 41,000                               | 80,000                                | 49,000                              | 540                                | 490                                 |
|      | 360GB    | 45,000                               | 33,000                                | 28,500                              | 540                                | 490                                 |
| 2260 | 180GB    | 41,000                               | 80,000                                | 49,000                              | 540                                | 490                                 |
|      | 240GB    | 41,000                               | 80,000                                | 49,000                              | 540                                | 490                                 |

**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

| Type | Capacity | Specification                        |                                       |                                    |                                     |
|------|----------|--------------------------------------|---------------------------------------|------------------------------------|-------------------------------------|
|      |          | Random 4KB Read (up to) <sup>1</sup> | Random 4KB Write (up to) <sup>1</sup> | Sequential 128KB Read <sup>1</sup> | Sequential 128KB Write <sup>1</sup> |
|      |          | IOPS                                 | IOPS                                  | MB/s                               | MB/s                                |
| 2280 | 180GB    | 37,500                               | 17,000                                | 455                                | 165                                 |
|      | 240GB    | 37,500                               | 23,000                                | 510                                | 225                                 |
|      | 360GB    | 37,500                               | 10,000                                | 525                                | 230                                 |
| 2260 | 180GB    | 37,500                               | 17,000                                | 540                                | 165                                 |
|      | 240GB    | 37,500                               | 23,000                                | 510                                | 225                                 |

**Note:**

1. Performance measured using IOMeter \* with Queue Depth 32





**Table 6: Latency**

| Specification                      | Intel® SSD Pro 2500 Series Type 2280 |       |       | Type 2260 |       |
|------------------------------------|--------------------------------------|-------|-------|-----------|-------|
|                                    | 180GB                                | 240GB | 360GB | 180GB     | 240GB |
| Read <sup>1</sup>                  | 80 μs (TYP)                          |       |       |           |       |
| Write <sup>1</sup>                 | 85 μs (TYP)                          |       |       |           |       |
| Power On To Ready <sup>2</sup>     | 500 ms (TYP)                         |       |       |           |       |
| Max Power On To Ready <sup>3</sup> | <10 s                                |       |       |           |       |

**Note:**

1. Based on sequential 4KB using IOMeter with Queue Depth 1 workload with compressible (non-random) data pattern. Write Cache enabled.
2. Power On To Ready time assumes safe shutdown
3. Max Power On To Ready time assumes unsafe shutdown. Based on statistical measurement of 95% quality of service.

## 2.3 Electrical Characteristics

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

| Electrical Characteristics        | Intel® SSD Pro 2500 Series Type 2280 |       |       | Type 2260 |       |
|-----------------------------------|--------------------------------------|-------|-------|-----------|-------|
|                                   | 180GB                                | 240GB | 360GB | 180GB     | 240GB |
| 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                   | 70 mV pp (10 Hz – 30 MHz)            |       |       |           |       |
| Min Off Time <sup>1</sup>         | 1 s                                  |       |       |           |       |
| Power Consumption (TYP)           |                                      |       |       |           |       |
| Active <sup>2</sup>               | 140 mW                               |       |       |           |       |
| Idle <sup>3</sup>                 | 55 mW                                |       |       |           |       |
| DevSleep <sup>4</sup>             | 200 μW                               |       |       |           |       |
| Thermal Power <sup>5</sup>        | 3.8 W                                | 4.5 W | 4.5 W | 3.8 W     | 4.5 W |
| Regulator Power <sup>6</sup>      | 4.1 W                                | 4.9 W | 5.5 W | 4.1 W     | 4.9 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 128kB 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 128kB sequential writes with Queue Depth 32 workload using 500 us 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<br>Operating <sup>1</sup><br>Non-operating <sup>2</sup> | 0° C – 70° C<br>-55° C – 95° C                         |
| Temperature Gradient <sup>3</sup><br>Operating<br>Non-operating            | 30 (TYP)° C/hr<br>30 (TYP)° C/hr                       |
| Humidity<br>Operating<br>Non-operating                                     | 5 – 95 %<br>5 – 95 %                                   |
| Shock and Vibration  | Range  |
| Shock <sup>4</sup><br>Operating<br>Non-operating                           | 1,000 G (Max) at 0.5 msec<br>1,000 G (Max) at 0.5 msec |
| Vibration <sup>5</sup><br>Operating<br>Non-operating                       | 2.17 GRMS (5-700 Hz) Max<br>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 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 G Root Mean Squared (GRMS) value.

#### 2.13.1 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.



## 2.14 Product Regulatory Compliance

The Intel SSD Pro 2500 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—<br>FEDERAL COMMUNICATIONS COMMISSION<br>PART 15 — RADIO FREQUENCY DEVICES<br><br>ICES-003, Issue 4 Interference-Causing<br>Equipment<br>Standard Digital Apparatus | FCC Part 15B Class B<br><br>CAN/CSA – CEI/IEC CISPR 22-10 (Ref. CISPR<br>22:2008) | USA<br><br>Canada                    |
| IEC 55024 Information Technology Equipment<br>— Immunity characteristics— Limits and<br>methods of measurement CISPR24:2010   | EN-55024: 2010 and its amendments   | European Union                       |
| IEC 55022 Information Technology Equipment<br>— Radio disturbance Characteristics— Limits<br>and methods of measurement CISPR22:2008<br>(Modified)  | EN-55022: 2010 and its amendments   | European Union                       |
| EN-60950-1 2 <sup>nd</sup> Edition  | Information Technology Equipment — Safety —<br>Part 1: General Requirements       | USA/Canada                           |
| UL/CSA EN-60950-1 2 <sup>nd</sup> Edition   | Information Technology Equipment — Safety —<br>Part 1: General Requirements       | USA/Canada                           |



## 2.15 Reliability

The Intel SSD Pro 2500 Series meets or exceeds SSD endurance and data retention requirements as specified in the JESD218 specification.

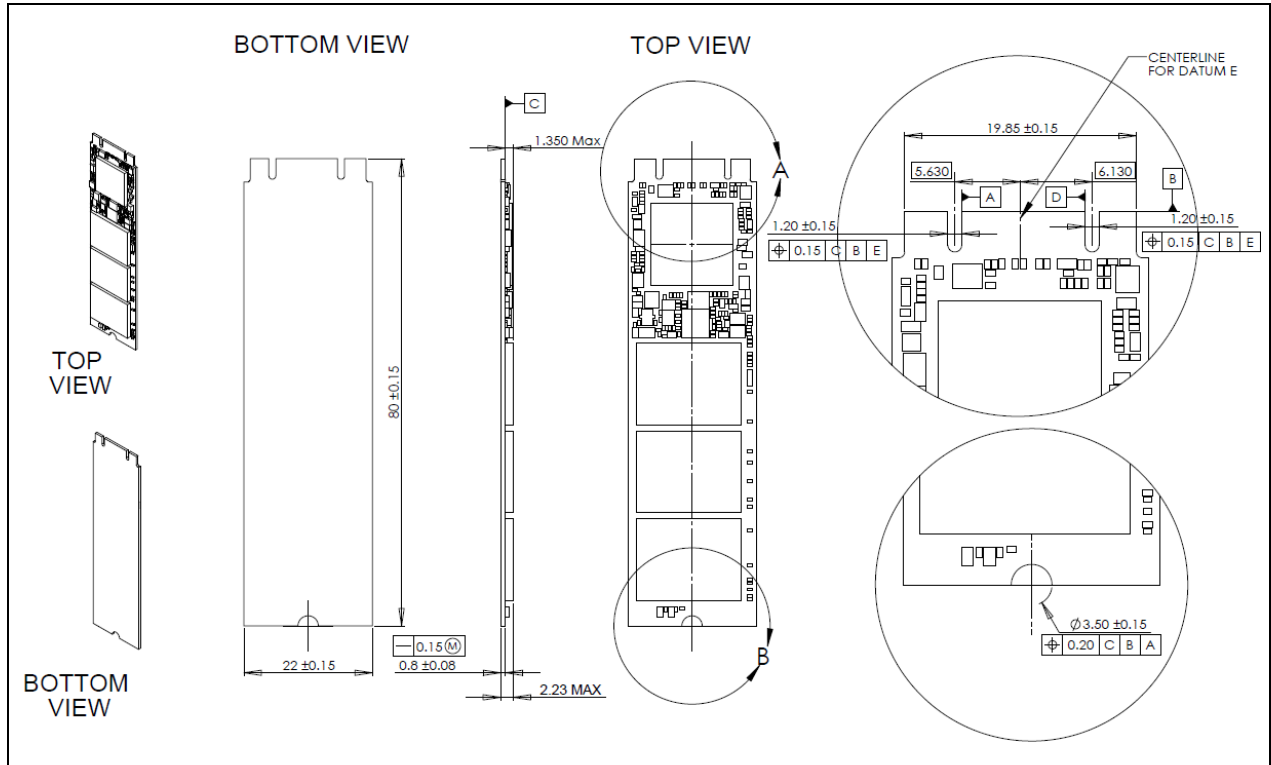
**Table 10: Reliability Specifications**

| Parameter   | Value                                     |
|---|---|
| <b>Uncorrectable Bit Error Rate (UBER)</b><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 <sup>16</sup> bits read |
| <b>Mean Time Between Failures (MTBF)</b><br>Mean Time Between Failures is estimated based on Telcordia* methodology and demonstrated through Reliability Demonstration Test (RDT).  | ≥ 1.2 million hours                       |
| <b>Minimum Useful Life/Endurance Rating</b><br>The SSD will have a minimum of five years of useful life under typical client workloads with up to 20 GB of host writes per day.   | 5 years                                   |
| <b>Insertion Cycles</b><br>Maximum insertion/removal cycles on M.2 port   | 250 insertion/removal cycles              |

### 3 Mechanical Information

The figure below shows the mechanical information for the 80 mm and 60 mm height, M.2 Intel® SSD Pro 2500 Series. All dimensions are in millimeters.

**Figure 1: Dimensions for 80 mm single-sided M.2 Form Factor Drives (2280-S2-B-M) 180GB**



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

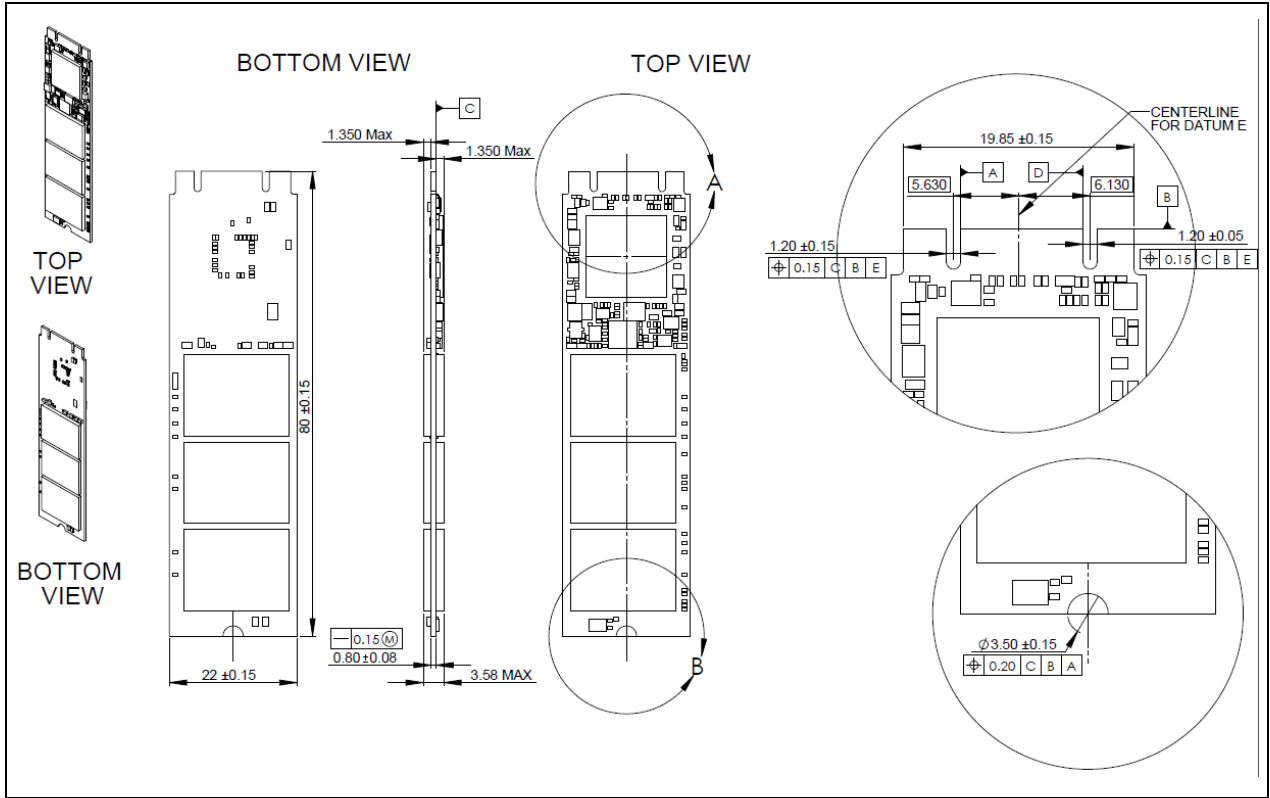


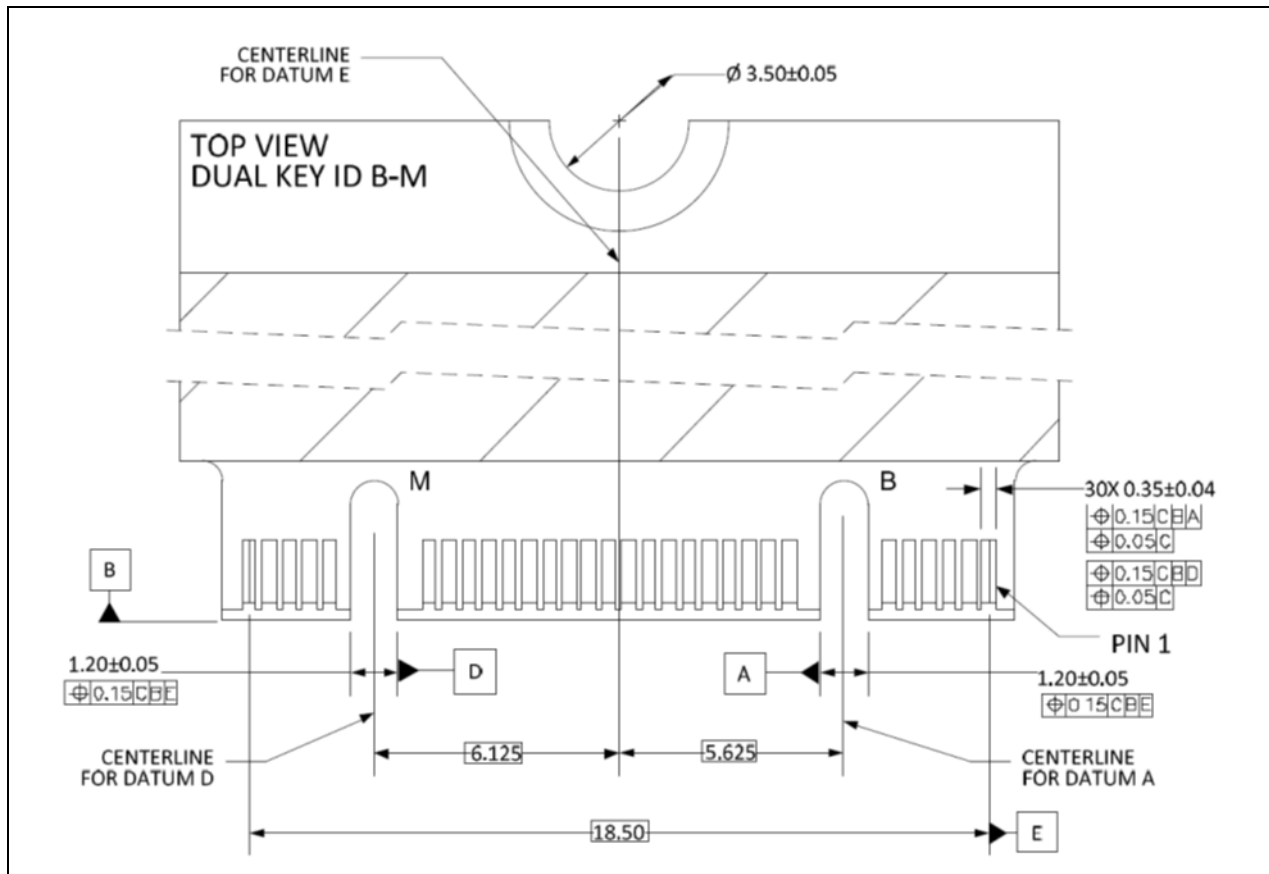
Figure 3: Dimensions for 60 mm double-sided M.2 Form Factor Drives (2260-D2-B-M) 180GB and 240GB



## 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) |
| P48 | Reserved | No Connect  |



| Pin | Function           | Definition  |
|-----|--------------------|---|
| 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 Ultrabook™. 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 which is pulled up by the drive.



## 5 Supported Command and Feature Sets

The Intel SSD Pro 2500 Series supports all mandatory Advanced Technology Attachment (ATA) and Serial ATA (SATA) commands defined in the ACS-3 and SATA Revision 3.2 specifications. The mandatory and optional commands are defined in this section.

### 5.1 Supported ATA General Feature Command Set

Below are mandatory and optional ATA feature sets supported by Intel SSD Pro 2500 Series.

- 48-Bit Address
- Advanced Power Management (APM)
- General
- General Purpose Logging (GPL)
- Native Command Queuing (NCQ)
- Power Management
- Sanitize Device
- Security
- SMART
- Software Settings Preservation (SSP)
- Trusted Computing

Below are mandatory and optional ATA commands supported by Intel SSD Pro 2500 Series.

**Table 12: Supported ATA Commands and Feature Sets**

| Commands                     | Feature Set                  |
|------------------------------|------------------------------|
| BLOCK ERASE EXT              | Sanitize Device <sup>3</sup> |
| CHECK POWER MODE             | Power Management             |
| CRYPTO SCRAMBLE EXT          | Sanitize Device <sup>3</sup> |
| DATA SET MANAGEMENT          | ATA General Feature          |
| DOWNLOAD MICROCODE           | ATA General Feature          |
| EXECUTE DEVICE DIAGNOSTIC    | ATA General Feature          |
| FLUSH CACHE                  | ATA General Feature          |
| FLUSH CACHE EXT              | 48-Bit Address               |
| IDENTIFY DEVICE <sup>1</sup> | ATA General Feature          |
| IDLE                         | Power Management             |
| IDLE IMMEDIATE               | Power Management             |
| NOP                          | ATA General Feature          |
| READ BUFFER                  | ATA General Feature          |
| READ DMA                     | ATA General Feature          |
| READ DMA EXT                 | 48-Bit Address               |



| Commands                                | Feature Set                  |
|---|------------------------------|
| READ FPDMA QUEUED                       | Native Command Queuing       |
| READ LOG DMA EXT                        | General Purpose Logging      |
| READ LOG EXT                            | General Purpose Logging      |
| READ MULTIPLE                           | ATA General Feature          |
| READ MULTIPLE EXT                       | 48-Bit Address               |
| READ NATIVE MAX ADDRESS                 | 48-Bit Address               |
| READ NATIVE MAX ADDRESS EXT             | 48-Bit Address               |
| READ SECTOR(S)                          | ATA General Feature          |
| READ SECTOR(S) EXT                      | 48-Bit Address               |
| READ VERIFY SECTOR(S)                   | ATA General Feature          |
| READ VERIFY SECTOR(S) EXT               | 48-Bit Address               |
| SANITIZE FREEZE LOCK EXT                | Sanitize Device <sup>3</sup> |
| SANITIZE STATUS EXT                     | Sanitize Device <sup>3</sup> |
| SECURITY DISABLE PASSWORD               | ATA Security <sup>2</sup>    |
| SECURITY ERASE PREPARE                  | ATA Security <sup>2</sup>    |
| SECURITY ERASE UNIT                     | ATA Security <sup>2</sup>    |
| SECURITY FREEZE LOCK                    | ATA Security <sup>2</sup>    |
| SECURITY SET PASSWORD                   | ATA Security <sup>2</sup>    |
| SECURITY UNLOCK                         | ATA Security <sup>2</sup>    |
| SEEK                                    | ATA General Feature          |
| SET FEATURES                            | ATA General Feature          |
| SET MAX ADDRESS EXT                     | 48-Bit Address               |
| SET MULTIPLE MODE                       | ATA General Feature          |
| SLEEP                                   | Power Management             |
| SMART DISABLE OPERATIONS                | SMART                        |
| SMART ENABLE OPERATIONS                 | SMART                        |
| SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE | SMART                        |
| SMART EXECUTE OFF-LINE IMMEDIATE        | SMART                        |
| SMART READ DATA                         | SMART                        |
| SMART READ ATTRIBUTE THRESHOLDS         | SMART                        |
| SMART READ LOG                          | SMART                        |
| SMART READ LOG SECTOR                   | SMART                        |
| SMART RETURN STATUS                     | SMART                        |



| Commands                    | Feature Set             |
|-----------------------------|-------------------------|
| SMART SAVE ATTRIBUTE VALUES | SMART                   |
| SMART WRITE LOG SECTOR      | SMART                   |
| STANDBY                     | Power Management        |
| STANDBY IMMEDIATE           | Power Management        |
| TRUSTED RECEIVE             | Trusted Computing       |
| TRUSTED RECEIVE DMA         | Trusted Computing       |
| TRUSTED SEND                | Trusted Computing       |
| TRUSTED SEND DMA            | Trusted Computing       |
| WRITE BUFFER                | ATA General Feature     |
| WRITE DMA                   | ATA General Feature     |
| WRITE DMA EXT               | 48-Bit Address          |
| WRITE DMA FUA EXT           | 48-Bit Address          |
| WRITE FPDMA QUEUED          | Native Command Queuing  |
| WRITE LOG DMA EXT           | General Purpose Logging |
| WRITE LOG EXT               | General Purpose Logging |
| WRITE MULTIPLE              | ATA General Feature     |
| WRITE MULTIPLE EXT          | 48-Bit Address          |
| WRITE MULTIPLE FUA EXT      | 48-Bit Address          |
| WRITE SECTOR(S)             | ATA General Feature     |
| WRITE SECTOR(S) EXT         | 48-Bit Address          |
| WRITE UNCORRECTABLE EXT     | ATA General Feature     |

**Note:**

1. See the Appendix for details on the sector data returned after issuing an IDENTIFY DEVICE command.
2. Security features disabled and not supported if Opal activated
3. Sanitize Device features not supported if Opal activated

## 5.2 Advanced Power Management (APM)

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

**Table 13: APM Subcommand Codes for Power Management and Definitions**

| Subcommand Codes | Definition   |
|------------------|--|
| 10h              | Power optimized for connected standby power          |
| 40h              | Power optimized for lid up                           |
| 80h              | Balanced power/performance for non-connected standby |
| FEh              | Optimized for high performance (Default)             |



**Table 14: APM Subcommand Codes for Thermal Power Management and Definitions**

| Subcommand Codes | Definition                      |
|------------------|---------------------------------|
| 60h              | Most aggressive thermal setting |
| 6Fh              | Light thermal setting           |

## 5.3 Security

### 5.3.1 Sanitization Methods

Sanitization refers to a process to render data inaccessible. Various sanitization methods are listed below.

#### 5.3.1.1 Secure Erase

Secure Erase runs the SECURITY ERASE UNIT command

**Table 15: Supported Secure Erase Modes and Definitions**

| Secure Erase Mode | Definition   |
|-------------------|--|
| Normal Mode       | Full NAND erase of user available space and spare area |
| Enhanced Mode     | Cryptographically erase data                           |

**Note:** Secure Erase Modes are not supported if drive is in an Opal Activated state.

#### 5.3.1.2 Sanitize Device

**Table 16: Supported Sanitize Device Modes and Definitions**

| Mode                | Definition   |
|---------------------|--|
| Block Erase         | Block erase method, all user data areas including user data not currently allocated, irretrievable |
| Crypto Scramble Ext | Changes the internal encryption keys   |

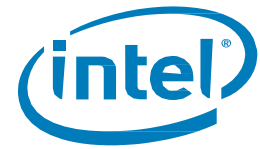
**Note:** Sanitize Device Modes are not supported if drive is in an Opal Activated state.

### 5.3.2 TCG Opal SSC Support

The Intel SSD Pro 2500 Series drive is a Self-Encrypting Drive (SED) that supports the TCG Opal SSC Specification Version 2.0 rev 1.0 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 is activated.



The following table indicates changes in ID Device word values when Opal is activated.

Table 17: 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                  |

### 5.3.3 Windows eDrive\*

The Intel SSD Pro 2500 Series allows up to 4 independent user locking ranges with hardware-based 256-bit AES encryption. If additional locking ranges are needed, Windows eDrive\* will support additional ranges enabled with Windows BitLocker\* software encryption.

**Note:** Microsoft\* eDrive support is disabled as Out-of-box factory default setting. Use the Intel® SSD Pro Administrator Tool to enable eDrive support. (Visit [www.intel.com/ssd](http://www.intel.com/ssd) to access the Tools panel for download.)

## 5.4 Device Statistics

In addition to the SMART attribute structure, statistics pertaining to the operation and health of the Intel® SSD Pro 2500 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 following table lists the Device Statistics supported by the Intel SSD Pro 2500 Series.

Table 18: 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                             | -  |



| Page                                 | Offset | Description                         | Equivalent SMART attribute if applicable  |
|--------------------------------------|--------|-------------------------------------|---|
| 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. |

## 5.5 Software Settings Preservation

Intel® SSD Pro 2500 Series supports the SET FEATURES parameter to enable/disable the preservation of software settings. The following table lists the software setting that will be preserved across a COMRESET.

**Table 19: Preserved Software Settings**

| Feature                           | Preserved Settings   |
|-----------------------------------|--|
| Advanced Power Management         | Enabled or Disabled  |
| Multiple Mode                     | Block size from the last set multiple mode   |
| NCQ Streaming commands processing | WDNC bit and RDNC bit states   |
| Password Attempt Counter          | Password Attempt Counter value   |
| Read look-ahead                   | Enabled or Disabled  |
| Read/Write Stream Error Logs      | Log contents   |
| Reverting to defaults mode        | Enabled or disabled  |
| Sanitize Device                   | Whether device is in the Sanitize Frozen state   |
| Security                          | Current Security state   |
| Standby Timer                     | Standby Timer setting  |
| Transfer Mode                     | DMA and UDMA transfer mode settings  |
| Volatile Write Cache              | Enabled or Disabled  |
| Write-Read Verify                 | Write-Read-Verify feature set settings. Device shall not return to factory default Write-Read-Verify settings after a COMRESET |

## 5.6 DevSleep

Intel® SSD Pro 2500 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 2500 Series also supports DevSleep\_to\_ReducedPwrState which allows the host to wake the drive using normal LPM COMWAKE out-of-band signaling.

For the Intel SSD Pro 2500 Series, the recommended total time to DevSleep for system active state is 6 sec. The AHCI\* controller has 4 parameters used to define proper DevSleep operation between the host and drive. The following table provides those recommended values for the Intel SSD Pro 2500 Series drive.





Table 20: DevSleep Control Parameters

| Parameter   | Definition   | Control           | Recommended Settings |
|-------------|--|-------------------|----------------------|
| <b>DITO</b> | DevSleep Idle Time Out – number of milliseconds prior to host asserting DevSleep                                   | Set by Host       | Active (lid-up): 375 |
| <b>DM</b>   | DITO Multiplier – set once at boot-up  | Set by Host       | 15                   |
| <b>MDAT</b> | Minimum DevSleep Assertion Time – minimum time in milliseconds for host to assert DevSleep                         | Reported by Drive | 10                   |
| <b>DETO</b> | 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)**

## 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:

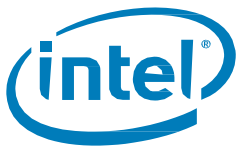
- Log Address E0h ("SCT Command/Status") — used to send commands and retrieve status
- Log Address E1h ("SCT Data Transfer") — used to transport data

## 5.8 SMART Attributes

The following two tables list the SMART attributes supported by the Intel® SSD Pro 2500 Series, and the corresponding status flags and threshold settings.

Table 21: 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 | 1            | 1  | 0  | 0  | 1  | 0  | 0 (none)  |



| ID  | Attribute   | Status Flags |    |    |    |    |    | Threshold |
|-----|---|--------------|----|----|----|----|----|-----------|
|     |   | SP           | EC | ER | PE | OC | PW |           |
|     | power-on hours should match the clock time, as all three device states are counted: active, idle and slumber.   |              |    |    |    |    |    |           |
| 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         |
| 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  | 1            | 1  | 0  | 0  | 1  | 0  | 0 (none)  |



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| ID  | Attribute   | Status Flags |    |    |    |    |    | Threshold |
|-----|---|--------------|----|----|----|----|----|-----------|
|     |   | SP           | EC | ER | PE | OC | PW |           |
|     | 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.  |              |    |    |    |    |    |           |
| 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 (32MB) 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        |
| 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. 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 (32MB) 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  | 1            | 1  | 0  | 0  | 1  | 0  | 0 (none)  |



| ID  | Attribute  | Status Flags |    |    |    |    |    | Threshold |
|-----|--|--------------|----|----|----|----|----|-----------|
|     |  | SP           | EC | ER | PE | OC | PW |           |
|     | number of sectors read by the host system. The raw value is increased by 1 for every 65,536 sectors (32MB) read by the host. |              |    |    |    |    |    |           |
| 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 22: 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  |

## 5.9 SMART Logs

Intel® SSD Pro 2500 Series implements the following Log Addresses: 00h, 02h, 03h, 06h, and 07h.

The Intel SSD Pro 2500 Series implements host vendor specific logs (addresses 80h-9Fh) as read and write scratchpads, where the default value is zero (0). Intel SSD Pro 2500 Series does not write any specific values to these logs unless directed by the host through the appropriate commands.

The Intel SSD Pro 2500 Series also implements a device vendor specific log at address A9h as a read-only log area with a default value of zero (0).



## 6 Certifications and Declarations

The following table describes the Device Certifications supported by the Intel® SSD Pro 2500 Series.

**Table 23: 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* Certified     | 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>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

### 7.1 Identify Device

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

**Table 24: Identify Device Returned Sector Data**

| Word  | F = Fixed<br>V = Variable<br>X = Both | Default Value | 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                                     | 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                                     | B110h         | Number of sectors transferred per interrupt on multiple commands             |



Intel® Solid-State Drive Pro 2500 Series (M.2)

| Word  | F = Fixed<br>V = Variable<br>X = Both | Default Value | Description  |
|-------|---------------------------------------|---------------|--|
| 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  |
| 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                                     | 070Eh         | Serial ATA capabilities  |
| 77    | F                                     | 0086h         | Reserved for future Serial ATA definition  |
| 78    | F                                     | 014Ch         | Serial ATA features supported  |
| 79    | V                                     | 0044h         | Serial ATA features enabled  |
| 80    | F                                     | 07FCh         | 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 |



| Word    | F = Fixed<br>V = Variable<br>X = Both | Default Value | Description  |
|---------|---------------------------------------|---------------|--|
| 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         | 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 world wide 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   |
| 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)                  |





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| Word    | F = Fixed<br>V = Variable<br>X = Both | Default Value | Description  |
|---------|---------------------------------------|---------------|--|
| 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                                     | 10FFh         | 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.



## 7.2 Models

The following table lists the available M.2 models of the Intel® SSD Pro 2500 Series.

**Table 25: Available Models**

| Model String  | Capacity | Type |
|---------------|----------|------|
| SSDSCKJF180A5 | 180GB    | 2280 |
| SSDSCKJF240A5 | 240GB    |      |
| SSDSCKJF360A5 | 360GB    |      |
| SSDSCJF180A5  | 180GB    | 2260 |
| SSDSCJF240A5  | 240GB    |      |

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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
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