



# Intel® Solid-State Drive 510 Series

*SSDSC2MH120A2XX, SSDSC2MH250A2XX*

## Product Specification

- Capacity: 120 GB, 250 GB
- Components: Intel® 34nm NAND Flash Memory Multi-Level Cell (MLC)
- Form Factor: 2.5-inch
  - Thickness: 9.5 mm
  - Weight: 80 ±2 grams
- SATA 6Gb/s Sustained Bandwidth Performance (Iometer\* Queue Depth 32)
  - 250 GB:
    - Sequential Read: Up to 500 MB/s
    - Sequential Write: Up to 315 MB/s
  - 120 GB:
    - Sequential Read: Up to 450 MB/s
    - Sequential Write: Up to 210 MB/s
- Read and Write IOPS (Iometer Queue Depth 32)
  - Random 4 KB Reads: Up to 20,000 IOPS
  - Random 4 KB Writes: Up to 8,000 IOPS
- Latency
  - Read: 65 µs
  - Write: 80 µs
- Compatibility
  - Intel® SSD Toolbox with Intel® SSD Optimizer
  - Intel® Data Migration Software
  - Intel® Rapid Storage Technology
  - SATA Revision 3.0
  - ATA8-ACS
  - SSD-enhanced S.M.A.R.T. ATA feature set
  - Native Command Queuing (NCQ) command set
  - Data Set Management Command Trim attribute
- Power Management
  - 5 V SATA
  - SATA interface power management
  - OS-aware hot plug/removal
- Power
  - Active (MobileMark\* 2007 Workload): 380 mW (TYP)
  - Idle: 100 mW (TYP)
- Temperature
  - Operating: 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 Failures (MTBF): 1,200,000 hours
- Shock (operating and non-operating)
  - 1,500 G/0.5 msec
- Vibration
  - Operating: 2.17 G<sub>RMS</sub> (7-800 Hz)
  - Non-operating: 3.08 G<sub>RMS</sub> (7-800 Hz)
- Certifications and Declarations:
  - UL\*
  - CE\*
  - C-Tick\*
  - BSMI\*
  - KCC\*
  - Microsoft\* WHQL
  - VCCI\*
  - SATA-IO\*
- Product Ecological Compliance
  - RoHS\*



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## 1.0 Overview

This document describes the specifications and capabilities of the Intel® Solid-State Drive 510 Series (Intel® SSD 510 Series).

The Intel SSD 510 Series delivers leading performance for Serial Advanced Technology Attachment (SATA)-based computers in two capacity sizes: 120 GB and 250 GB.

By combining Intel's leading 34nm NAND flash memory technology with SATA 6Gb/s interface support, the Intel SSD 510 Series delivers sequential read speeds of up to 500 MB/s and sequential write speeds of up to 315 MB/s.

The industry-standard 2.5-inch form factor enables interchangeability with existing hard disk drives (HDDs) and native SATA HDD drop-in replacement with the enhanced performance, reliability, ruggedness, and power savings offered by an SSD.

As compared to standard SATA HDDs, the Intel SSD 510 Series offers these key features:

- High I/O and throughput performance
- Low power
- Increased system responsiveness
- High reliability
- Enhanced ruggedness



## 2.0 Product Specifications

This section provides details on the Intel SSD 510 Series product specifications.

### 2.1 Capacity

Table 1. User Addressable Sectors

Unformatted Capacity	120 GB	250 GB
Total User Addressable Sectors in LBA Mode	234,441,648	488,397,168

**Notes:** 1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.

LBA count shown represents total user storage capacity and will remain the same throughout the life of the drive.

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.

### 2.2 Performance

Table 2. Read/Write IOPS, Bandwidth, Latency

Random Read/Write IOPS (Input/Output Operations Per Second) <sup>1</sup>	120 GB	250 GB
4K Read (up to)	20,000	
4K Write (up to)	Up to 8,000	
Maximum Sustained Read and Write Bandwidth <sup>2</sup>	120 GB	250 GB
Sequential Read (up to)	450 MB/s (SATA 6Gb/s) 265 MB/s (SATA 3Gb/s)	500 MB/s (SATA 6Gb/s) 265 MB/s (SATA 3Gb/s)
Sequential Write (up to)	210 MB/s (SATA 6Gb/s) 200 MB/s (SATA 3Gb/s)	315 MB/s (SATA 6Gb/s) 240 MB/s (SATA 3Gb/s)
Latency <sup>3</sup>	120 GB	250 GB
Read	65 μs	
Write	80 μs	
Power On to Ready	1.0 s (TYP)	

**Notes:**

1. Performance measured using Iometer\* with queue depth set to 32; measurements are performed on 8 GB of LBA range. Write Cache enabled.
2. Performance measured using Iometer with queue depth equal to 32.
3. Write Cache Enabled.  
Device measured using Iometer.  
Power On To Ready time assumes proper shutdown.



## 2.3 Electrical Characteristics

**Table 3. Operating Voltage and Power Consumption**

Electrical Characteristics	120 GB	250 GB
Operating Voltage for 5 V (+/- 5%)		
Min		4.75 V
Max		5.25 V
Power Consumption (Typical)		
Active <sup>1</sup>		380 mW
Idle <sup>2</sup>		100 mW

**Notes:**

1. Active power measured during execution of MobileMark\* 2007 with DIPM (Device Initiated Power Management) enabled.
2. Idle power defined as SSD at idle with DIPM enabled.

## 2.4 Environmental Conditions

**Table 4. Temperature, Shock, Vibration**

Temperature	Range
Ambient Temperature	
Operating	0 - 70 °C
Non-operating	-55 - 95 °C
Temperature Gradient <sup>1</sup>	
Operating	30 (Typical) °C/hr
Non-operating	30 (Typical) °C/hr
Humidity	
Operating	5 - 95 %
Non-operating	5 - 95 %
Shock and Vibration	Range
Shock <sup>2</sup>	
Operating	1,500 G (Max) at 0.5 msec
Non-operating	1,500 G (Max) at 0.5 msec
Vibration <sup>3</sup>	
Operating	2.17 G <sub>RMS</sub> (7-800 Hz) Max
Non-operating	3.08 G <sub>RMS</sub> (7-800 Hz) Max

**Notes:**

1. Temperature gradient measured without condensation.
2. 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 root mean squared (RMS) value.
3. 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. The measured specification is in root mean squared form. Vibration specification is measured using RMS value.



## 2.5 Product Regulatory Compliance

The Intel SSD 510 Series meets or exceeds the regulatory or certification requirements in Table 5.

**Table 5. Product Regulatory Compliance Specifications**

Title	Description	Region for which conformity declared
European Union Low Voltage Directive (LVD) 2006/95/EC	EN 60950-1 2nd edition for Information Technology Equipment - Safety - Part 1: General Requirements	European Union
UL/CSA 60950-1, Second Edition CAN/CSA-C22.2 No. 60950-1-07 Second Edition	Information Technology Equipment - Safety - Part 1: General Requirements	USA/Canada
CFR Title 47 Part 15	Radio Frequency Devices - Subpart B (Unintentional Radiators)	USA
ICES-003 Issue 4	Interference Causing Equipment Standard	Canada
EN 55022:2006	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	European Union
CNS 14348:2006	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	Taiwan
VCCI V3/2010.04	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	Japan
KN22 (2008-5)	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	Korea
CISPR 22:2006	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	International
EN 55024:1998	Information technology equipment - Immunity characteristics - Limits and methods of measurement (CISPR 24:1997, modified)	European Union
KN24 (2008-5)	Information technology equipment - Immunity characteristics - Limits and methods of measurement (CISPR 24:1997, modified)	Korea





## 2.6 Reliability

The Intel SSD 510 Series meets or exceeds SSD endurance and data retention requirements as specified in the JESD218 specification.

Reliability specifications are listed in [Table 6](#).

**Table 6. Reliability Specifications**

Parameter	Value
Uncorrectable Bit Error Rate (UBER)  Uncorrectable bit error rate will not exceed one sector in the specified number of bits read. In the unlikely event of a nonrecoverable 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 in $10^{16}$ bits read, max
Mean Time Between Failure (MTBF)  Mean Time Between Failure is estimated based on Telcordia* methodology and demonstrated through Reliability Demonstration Test (RDT).	1,200,000 hours
Power On/Off Cycles  Power On/Off Cycles is defined as power being removed from the SSD, and then restored. Most host systems remove power from the SSD when entering suspend and hibernate as well as on a system shutdown.	50,000 cycles
Minimum Useful Life/Endurance Rating  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
Insertion Cycles  The SSD supports up to 250 insertion/removal cycles on SATA/ power cable.	250 insertion/removal cycles

## 2.7 Hot Plug Support

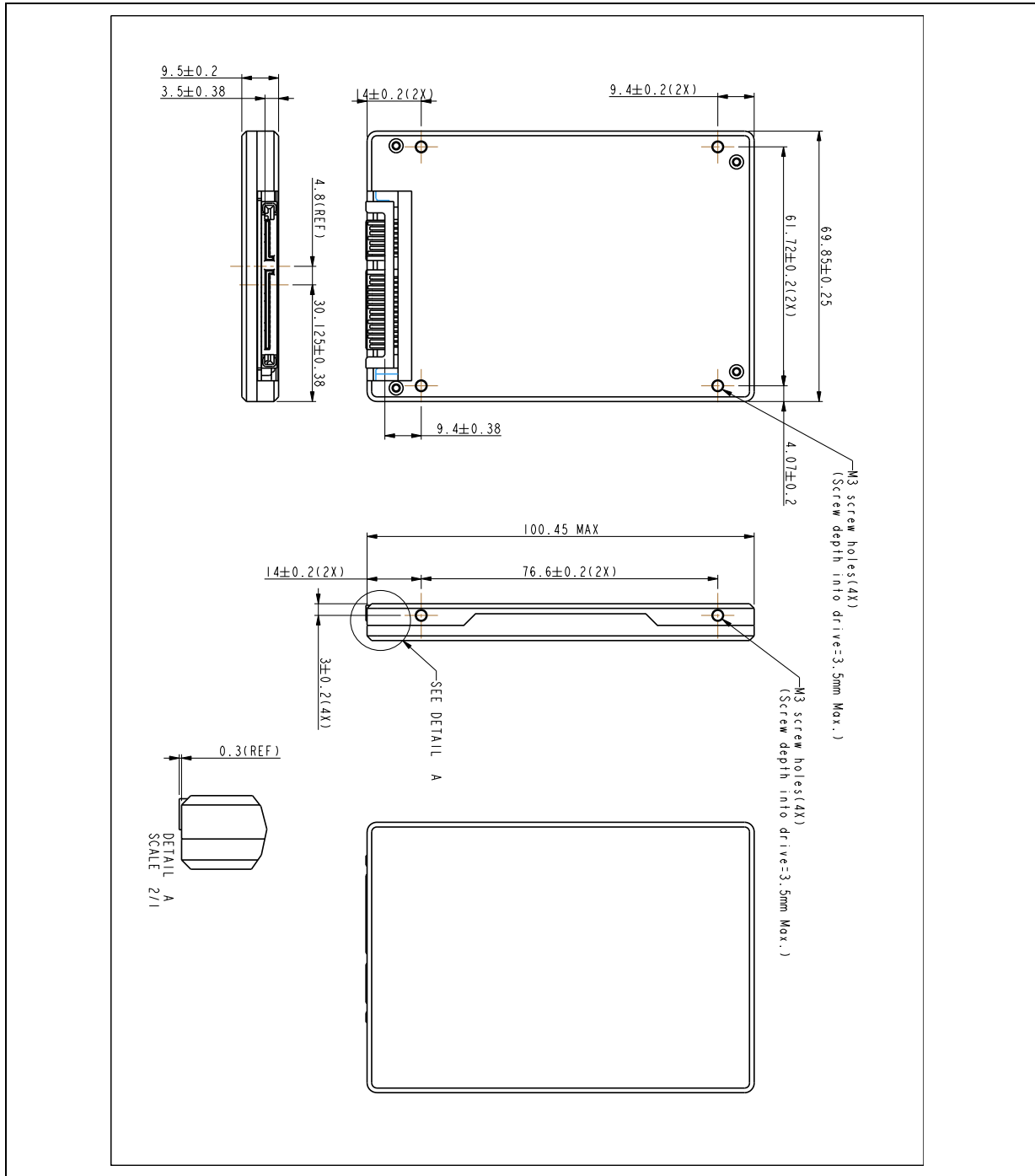
Hot Plug insertion and removal is supported in the presence of a proper connector and appropriate operation system, as described in the SATA 2.6 specification.

This product supports asynchronous signal recovery and issues an unsolicited COMINIT when first mated with a powered connector to guarantee reliable detection by a host system without hardware device detection.

### 3.0 Mechanical Information

Figure 1 shows the physical dimensions of the Intel SSD 510 Series. All dimensions are in millimeters.

Figure 1. Intel SSD 510 Series 120 GB and 250 GB Dimensions

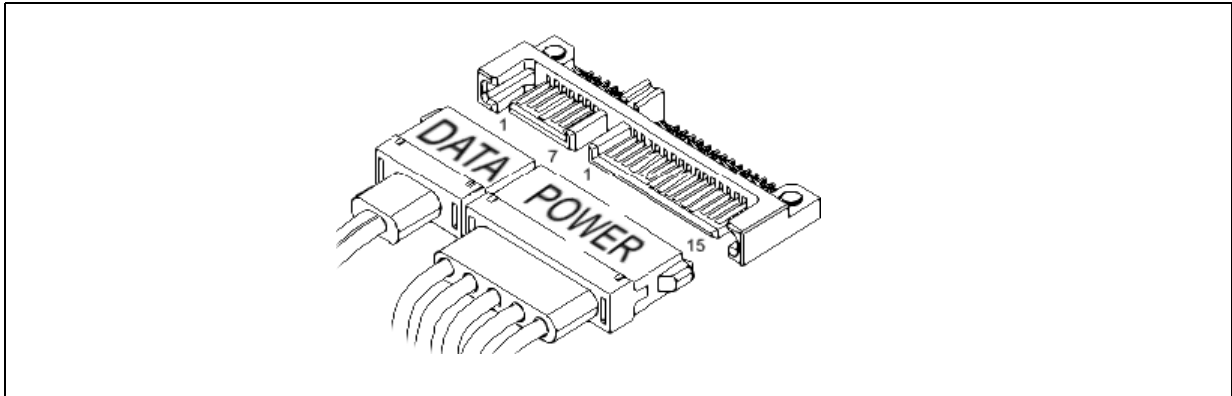




## 4.0 Pin and Signal Descriptions

### 4.1 Pin Locations

Figure 2. Signal and Power Segment Pins



### 4.2 Signal Descriptions

Table 7. Connector Pin Signal Definitions

Pin	Function	Definition
S1	Ground	1st mate
S2	A+	Differential signal pair A
S3	A-	
S4	Ground	1st mate
S5	B-	Differential signal pair B
S6	B+	
S7	Ground	1st mate

**Note:** Key and spacing separate signal and power segments.



Table 8. Power Pin Signal Definitions

Pin <sup>1</sup>	Function	Definition	Mating order
P1 <sup>2</sup>	Not connected	(3.3 V power)	
P2 <sup>2</sup>	Not connected	(3.3 V power)	
P3 <sup>2</sup>	Not connected	(3.3 V power, pre-charge)	2nd mate
P4 <sup>3,4</sup>	Ground		1st mate
P5 <sup>3</sup>	Ground		1st mate
P6 <sup>3</sup>	Ground		1st mate
P7 <sup>3,5</sup>	V <sub>5</sub>	5V power	1st mate
P8 <sup>3,5</sup>	V <sub>5</sub>	5V power	2nd mate
P9 <sup>3,5</sup>	V <sub>5</sub>	5V power	2nd mate
P10 <sup>3</sup>	Ground		1st mate
P11 <sup>6</sup>	DAS	Device Activity Signal	2nd mate
P12 <sup>3,4</sup>	Ground		1st mate
P13 <sup>7</sup>	V <sub>12</sub>	12V Power, not used	2nd mate
P14 <sup>7</sup>	V <sub>12</sub>	12V Power, not used	2nd mate
P15 <sup>7</sup>	V <sub>12</sub>	12V Power, not used	2nd mate

**Notes:**

1. All pins are in a single row, with a 1.27 mm (0.05-inch) pitch.
2. Pins P1, P2 and P3 are connected together, although they are not connected internally to the device. The host may put 3.3 V on these pins.
3. The mating sequence is:
  - The ground pins P4-P6, P10, P12 and the 5 V power pin P7.
  - The signal pins and the rest of the 5V power pins P8-P9.
4. Ground connectors P4 and P12 may contact before the other 1st mate pins in both the power and signal connectors to discharge ESD (Electro-Static Discharge) in a suitably configured backplane connector.
5. Power pins P7, P8 and P9 are internally connected to one another within the device.
6. The host may ground P11 if it is not used for Device Activity Signal (DAS).
7. Pins P13, P14, P15 are connected together, although they are not connected internally to the device.



## 5.0 Supported Command Sets

The Intel SSD 510 Series supports all mandatory ATA (Advanced Technology Attachment) commands defined in the ATA8-ACS specification described in this section.

### 5.1 ATA General Feature Command Set

The Intel SSD 510 Series supports the ATA General Feature command set (non-PACKET), which consists of:

- EXECUTE DEVICE DIAGNOSTIC
- FLUSH CACHE
- IDENTIFY DEVICE

**Note:** See [Appendix A, "IDENTIFY DEVICE Command Data"](#) on page 21 for details on the sector data returned after issuing an IDENTIFY DEVICE command.

- 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 510 Series also supports the following optional commands:

- READ BUFFFER
- WRITE BUFFER
- NOP
- DOWNLOAD MICROCODE

### 5.2 Power Management Command Set

The Intel SSD 510 Series supports the Power Management command set, which consists of:

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



### 5.3 Security Mode Feature Set

The Intel SSD 510 Series supports the Security Mode command set, which consists of:

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT
- SECURITY FREEZE LOCK
- SECURITY DISABLE PASSWORD

### 5.4 SMART Command Set

The Intel SSD 510 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
- SMART ENABLE/DISABLE AUTOMATIC OFFLINE

#### 5.4.1 SMART Attributes

Table 9 lists the SMART attributes supported by the Intel SSD 510 Series and the corresponding status flags and threshold settings.

**Table 9. SMART Attributes**

ID	Attribute	Status Flags <sup>1</sup>						Threshold
		SP	EC	ER	PE	OC	PW	
03h	Spin Up Time Reports a fixed value of zero (0).	1	0	0	0	0	0	0 (none)
04h	Start/Stop Count Reports a fixed value of zero (0).	1	1	0	0	0	0	0 (none)
05h	Re-allocated Sector Count 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)



Table 9. SMART Attributes (Continued)

ID	Attribute	Status Flags <sup>1</sup>						Threshold
		SP	EC	ER	PE	OC	PW	
09h	<p>Power-On Hours Count</p> <p>Reports the cumulative number of power-on hours over the life of the device. However, 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.</p>	1	1	0	0	1	0	0 (none)
0Ch	<p>Power Cycle Count</p> <p>The raw value of this attribute reports the cumulative number of power cycle events over the life of the device.</p>	1	1	0	0	1	0	0 (none)
C0h	<p>Unsafe Shutdown Count</p> <p>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.</p>	1	1	0	0	1	0	0 (none)
E1h	<p>Host Writes</p> <p>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.</p>	1	1	0	0	0	0	0 (none)
E8h	<p>Available Reserved Space</p> <p>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.</p>	1	1	0	0	1	1	10
E9h	<p>Media Wearout Indicator</p> <p>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.</p>	1	1	0	0	1	0	0 (none)

**Note:** 1. The following table defines the SMART Attributes 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



### 5.4.2 S.M.A.R.T. Logs

The Intel SSD 510 Series implements the following Log Addresses: 00h, 02h, 03h, 06h, and 07h.

The Intel SSD 510 Series implements host vendor specific logs (addresses 80h-9Fh) as read and write scratchpads, where the default value is zero (0). The Intel SSD 510 Series does not write any specific values to these logs unless directed by the host through the appropriate commands.

The Intel SSD 510 Series also implements a device vendor specific log at address A9h as a read-only log area with a default value of zero (0).

## 5.5 Data Set Management Command Set

The Intel SSD 510 Series supports the Data Set Management command set Trim attribute, which consists of:

- DATA SET MANAGEMENT

## 5.6 Host Protected Area Command Set

The Intel SSD 510 Series supports the Host Protected Area command set, which consists of:

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

The Intel SSD 510 Series also supports the following optional commands:

- SET MAX SET PASSWORD
- SET MAX LOCK
- SET MAX FREEZE LOCK
- SET MAX UNLOCK

## 5.7 48-Bit Address Command Set

The Intel SSD 510 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





## 5.8 Device Configuration Overlay Command Set

The Intel SSD 510 Series supports the Device Configuration Overlay command set, which consists of:

- DEVICE CONFIGURATION FREEZE LOCK
- DEVICE CONFIGURATION IDENTITY
- DEVICE CONFIGURATION RESTORE
- DEVICE CONFIGURATION SET

## 5.9 General Purpose Log Command Set

The Intel SSD 510 Series supports the General Purpose Log command set, which consists of:

- READ LOG EXT
- WRITE LOG EXT

## 5.10 Native Command Queuing

The Intel SSD 510 Series supports the Native Command Queuing (NCQ) command set, which includes:

- READ FPDMA QUEUED
- WRITE FPDMA QUEUED

**Note:** With a maximum queue depth equal to 32.

## 5.11 Software Settings Preservation

The Intel SSD 510 Series supports the SET FEATURES parameter to enable/disable the preservation of software settings.

## 5.12 Device Initiated Power Management (DIPM)

The Intel SSD 510 Series supports the SET FEATURES parameter to enable Device Initiated Power Management.



## 6.0 Certifications and Declarations

Table 10 describes the Device Certifications supported by the Intel SSD 510 Series.

**Table 10. Device Certifications and Declarations**

Certification	Description
CE Compliant	Indicates conformity with the essential health and safety requirements described in European Directives Low Voltage Directive and EMC Directive.
UL Recognized	Underwriters Laboratories, Inc. Component Recognition UL60950-1.
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 "Limits and methods of measurement of radio disturbance characteristics of information technology equipment, CNS 13438 Class B."
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 WHQL	Microsoft Windows Hardware Quality Labs.
RoHS Compliant	Meets European Restrictions 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.

## 7.0 References

Table 11 identifies the standards information referenced in this document.

**Table 11. Standards References**

Date or Rev. #	Title	Location
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>
Dec 2008	VCCI	<a href="http://www.vcci.jp/vcci_e/">http://www.vcci.jp/vcci_e/</a>
June 2009	RoHS	Search for material description datasheet at <a href="http://qdms.intel.com/">http://qdms.intel.com/</a>
August 2009	ATA8-ACS Specification	<a href="http://www.t13.org/">http://www.t13.org/</a>
June 2009	Serial ATA Revision 3.0	<a href="http://www.sata-io.org">http://www.sata-io.org</a>
May 2006	SFF-8223, 2.5-inch Drive w/Serial Attachment Connector	<a href="http://www.sffcommittee.org">http://www.sffcommittee.org</a>
May 2005	SFF-8201, 2.5-inch drive form factor	<a href="http://www.sffcommittee.org">http://www.sffcommittee.org</a>
1995 1996 1995 1995 1997 1994	International Electrotechnical Commission EN 61000 4-2 (Electrostatic discharge immunity test) 4-3 (Radiated, radio-frequency, electromagnetic field immunity test) 4-4 (Electrical fast transient/burst immunity test) 4-5 (Surge immunity test) 4-6 (Immunity to conducted disturbances, induced by radio-frequency fields) 4-11 (Voltage Variations, voltage dips, short interruptions and voltage variations immunity tests)	<a href="http://www.iec.ch">http://www.iec.ch</a>
1995	ENV 50204 (Radiated electromagnetic field from digital radio telephones)	<a href="http://www.dbicorporation.com/radimmun.htm">http://www.dbicorporation.com/radimmun.htm</a>

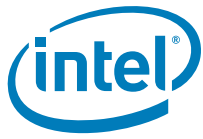


## 8.0 Terms and Acronyms

Table 12 defines the terms and acronyms used in this document.

**Table 12. Glossary of Terms and Acronyms**

Term	Definition
ATA	Advanced Technology Attachment
DAS	Device Activity Signal
DIPM	Device Initiated Power Management
DMA	Direct Memory Access
EXT	Extended
FPDMA	First Party Direct Memory Access
GB	Gigabyte 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.
Gb	Gigabit
HDD	Hard Disk Drive
KB	Kilobyte
I/O	Input/Output
IOPS	Input/Output Operations Per Second
ISO	International Standards Organization
LBA	Logical Block Address
MB	Megabyte
MLC	Multi-level Cell
MTBF	Mean Time Between Failures
NCQ	Native Command Queuing
NOP	No Operation
PIO	Programmed Input/Output
RDT	Reliability Demonstration Test
RMS	Root Mean Square
RoHS	Restriction of Hazardous Substances
SATA	Serial Advanced Technology Attachment
SMART	Self-Monitoring, Analysis and Reporting Technology An open standard for developing hard drives and software systems that automatically monitors the health of a drive and reports potential problems.
SSD	Solid-State Drive
TYP	Typical
UBER	Uncorrectable Bit Error Rate
VCCI	Voluntary Control Council for Interface
WHQL	Microsoft* Windows Hardware Quality Labs



## 9.0 Revision History

Date	Revision	Description
March 2011	001	Initial Release.



## Appendix A IDENTIFY DEVICE Command Data

Table 13 details the sector data returned after issuing an IDENTIFY DEVICE command.

**Table 13. Returned Sector Data**

Word	F = Fixed V = Variable 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	4000h	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	F	0101h	Number of sectors transferred per interrupt on multiple commands
60-62	F	120 GB: 0DF94BB0h	Total number of user-addressable sectors
		250 GB: 0FFFFFFFh	
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	0000h	Additional Supported
70	F	0000h	Reserved
71-74	F	0h	Reserved for IDENTIFY PACKET DEVICE command



Table 13. Returned Sector Data (Continued)

Word	F = Fixed V = Variable X = Both	Default Value	Description
75	F	001Fh	Queue depth
76	F	070Eh	Serial ATA capabilities
77	F	0h	Reserved for future Serial ATA definition
78	F	004Ch	Serial ATA features supported
79	V	0040h	Serial ATA features enabled
80	F	01FCh	Major version number
81	F	0107h	Minor version number
82	F	746Bh	Command set supported
83	F	7D01h	Command sets supported
84	F	6163h	Command set/feature supported extension
85	V	7469h	Command set/feature enabled
86	V	BC01h	Command set/feature enabled
87	V	6163h	Command set/feature default
88	V	407Fh	Ultra DMA Modes
89	F	0001h	Time required for security erase unit completion
90	F	0001h	Time required for enhanced security erase completion
91	V	0h	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	120GB: 0DF94BB0h 250GB: 1D1C5970h	Maximum user LBA for 48-bit address feature set
104	V	0h	Streaming transfer time - PIO
105	F	0008h	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	4010h	Supported settings
120	F	4010h	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



Table 13. Returned Sector Data (Continued)

Word	F = Fixed V = Variable X = Both	Default Value	Description
129-159	X	0h	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
170-175	X	0h	Reserved for assignment by the CFA
176-205	V	0h	Current media serial number
206	X	003Dh	SCT Command Transport
207-208	X	0000h	Reserved
209	X	0000h	Alignment of logical blocks within a physical block
210-211	X	0000h	Write-Read-Verify Sector Count Mode 3 (DWord)
212-213	X	0000h	Write-Read-Verify Sector Count Mode 2 (DWord)
214	X	0000h	NV Cache Capabilities
215-216	X	0000h	NV Cache Size in Logical Blocks (DWord)
217	X	0001h	Nominal media rotation rate
218	X	0000h	Reserved
219	X	0000h	NV Cache Options
220	X	0000h	Write-Read-Verify feature set
221	X	0000h	Reserved
222	X	103Fh	Transport major version number
223	X	0000h	Transport minor version number
224-229	X	0000h	Reserved
230-233	X	0000h	Extended Number of User Addressable Sectors (QWord)
234	X	0001h	Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
235	X	0200h	Maximum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
236-254	X	0000h	Reserved
255	X	varies	Integrity word

**Notes:** **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.