Intel® Solid-State Drive 313 Series

Ultrabook™ Ready Caching SSD

Product Specification

- Validated for Intel® Smart Response Technology
- Capacity: 20 GB, 24 GB
- Components:
  — Intel® 25nm NAND Flash Memory
  — Single-Level Cell (SLC)
- Form Factors:
  — 2.5-inch SATA
    Thickness: 9.5 mm
    Weight: Up to 80 grams
  — Full-sized mSATA
    Dimensions: 50.80 mm x 29.85 mm
    Thickness: 3.6 mm[1]
    Weight: Up to 10 grams
- Read and Write IOPS[2] (Iometer* Queue Depth 32)
  — Random 4 KB Reads: Up to 36,000 IOPS
  — Random 4 KB Writes: 4,000 IOPS
- Bandwidth Performance[2]
  — Sustained Sequential Read: Up to 220 MB/s
  — Sustained Sequential Write: Up to 115 MB/s
- Latency
  — Read: 72 μs (TYP)
  — Write: 90 μs (TYP)
- Compatibility
  — Intel® SSD Toolbox with Intel® SSD Optimizer
  — Intel® Data Migration Software
  — Intel® Rapid Storage Technology
  — Intel® Smart Response Technology
  — Intel® 7 Series Express Chipsets and Intel® 6 Series Express Chipsets (with SATA 6Gb/s)
  — SATA Revision 2.6
  — ATA8-ACS
  — SSD-enhanced SMART ATA feature set
  — Native Command Queuing (NCQ) command set
  — Data Set Management Command Trim attribute

- Power Management
  — 5 V (2.5-inch SATA) Supply Rail
  — 3.3 V (mSATA) Supply Rail
  — SATA interface power management
- Power
  — Active (MobileMark* 2007 Workload): 150 mW (TYP)
  — Idle[3]: 100 mW (TYP)
- Temperature
  — Operating: 0° C to 70° C
  — Non-Operating: -55° C to 95° C
- Shock (operating and non-operating)
  — 1,500 G/0.5 msec
- Vibration
  — Operating: 2.17 G_{RMS} (5-700 Hz)
  — Non-operating: 3.13 G_{RMS} (5-800 Hz)
- Reliability
  — Uncorrectable Bit Error Rate (UBER): 1 sector per 10^{16} bits read
  — Mean Time Between Failures (MTBF): 1,200,000 hours
- Certifications and Declarations
  — UL*
  — CE*
  — C-Tick*
  — BSMI*
  — KCC*
  — Microsoft* WHQL
  — VCCI*
  — SATA-IO*
  — WEEE*
- Product Ecological Compliance
  — RoHS*

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1. See Section 3.2, "mSATA SSD Form Factor" on page 11 for tolerance values per standard mSATA z-height specifications.
2. Performance values vary by capacity.
3. Power defined as SSD at idle with Device Initiated Power Management (DIPM) enabled.

Ordering Information

Contact your local Intel sales representative for ordering information.

Contents

1.0 Overview

This document describes the specifications and capabilities of the Intel® Solid-State Drive 313 Series (Intel® SSD 313 Series).

The Intel SSD 313 Series combines 25nm single-level cell (SLC) Intel® NAND Flash Memory technology with our innovative high-performance controller to deliver a high-performance, high-endurance solid-state drive (SSD) targeted for solutions that use an SSD as a cache for hard disk drives — such as systems with Intel® Smart Response Technology — or for high-performance embedded solutions.

The Intel SSD 313 Series is available in two form factors:

- 2.5-inch SATA for traditional SATA designs
- mSATA for small form factor designs

2.0 Product Specifications

2.1 Capacity

Table 1. User Addressable Sectors

Intel SSD 313 Series	Unformatted Capacity (Total User Addressable Sectors in LBA Mode)
20 GB	39,091,248
24 GB	46,905,264

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. Random Read and Write Input/Output Operations Per Second (IOPS)

Specification	Unit	Intel SSD 313 Series	
		20 GB	24 GB
Random 4 KB Read (up to)	IOPS	36,000	33,000
Random 4 KB Write (up to)	IOPS	3,300	4,000

Notes: Performance measured using Iometer* with Queue Depth 32. Measurements are performed on 8 GB of LBA range. Write Cache enabled.

Table 3. Maximum Sustained Sequential Read and Write Bandwidth

Specification	Unit	Intel SSD 313 Series	
		20 GB	24 GB
Sequential Read (up to)	MB/s	220	160
Sequential Write (up to)	MB/s	100	115

Notes: Performance measured using Iometer with Queue Depth 32.

Table 4. Latency

Specification	Intel SSD 313 Series	
	20 GB	24 GB

Latency[1]
     Read
     Write
     Power On to Ready[2]
	72 µs (TYP)
	 90 µs (TYP)
	 2.0 s (TYP)	

Notes: 1. Based on sequential 4 KB using Iometer with Queue Depth 1 workload. Write Cache Enabled.
2. Power On to Ready time assumes proper shutdown.

2.3   Electrical

Table 5.   Operating Voltage and Power Consumption

Electrical Characteristics	Intel SSD 313 Series	
	20 GB	24 GB

Operating voltage for 5 V (± 5%)
    Min
    Max
	4.75 V
	5.25 V	

Operating Voltage for 3.3 V (± 5%)
    Min
    Max
	3.14 V
	3.47 V	

Power Consumption (Typical)
    Active[1]
    Idle[2]
	150 mW
	100 mW	

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

2.4   Environmental Conditions

Table 6.   Temperature, Shock, Vibration

Temperature	Range

Case Temperature (2.5-inch SATA form factor only)
    Operating
    Non-operating[1]
	0 – 70 °C
	-55 – 95 °C

Ambient Temperature (mSATA form factor only)
    Operating
    Non-operating[1]
	0 – 70 °C
	-55 – 95 °C

Temperature Gradient[2]
    Operating
    Non-operating
	20 (Typical) °C/hr
	30 (Typical) °C/hr

Humidity
    Operating
    Non-operating
	5 – 95 %
	5 – 95 %

Shock and Vibration	**Range**

Shock[3]
    Operating
    Non-operating
	1,500 G (Max) at 0.5 msec
	1,500 G (Max) at 0.5 msec

Vibration[4]
    Operating
    Non-operating
	2.17 G_{RMS} (5-700 Hz) Max
	3.13 G_{RMS} (5-800 Hz) Max

Notes:
1.   Non-operating temperature specification does not include data retention.
2.   Temperature gradient measured without condensation.
3.   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.
4.   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. Measured specification is in Root Mean Squared (RMS) form.

2.5   Product Regulatory Compliance

The Intel SSD 313 Series meets or exceeds the regulatory or certification requirements in Table 7.

Table 7.   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 313 Series meets or exceeds SSD endurance and data retention requirements as specified in the JESD218 specification.

Reliability specifications are listed in Table 8.

Table 8.   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 per 10^{16} bits read
Mean Time Between Failures (MTBF) Mean Time Between Failures 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 Insertion/removal cycles on SATA/power cable or mSATA/power cable.	250 insertion/removal cycles

3.0 Mechanical Information

3.1 2.5-inch SATA SSD Form Factor

Figure 1 shows the physical package information for the Intel SSD 313 Series in the 9.5 mm 2.5-inch SATA form factor. All dimensions are in millimeters.

Figure 1. **9.5 mm, 2.5-inch SATA Form Factor Dimensions**
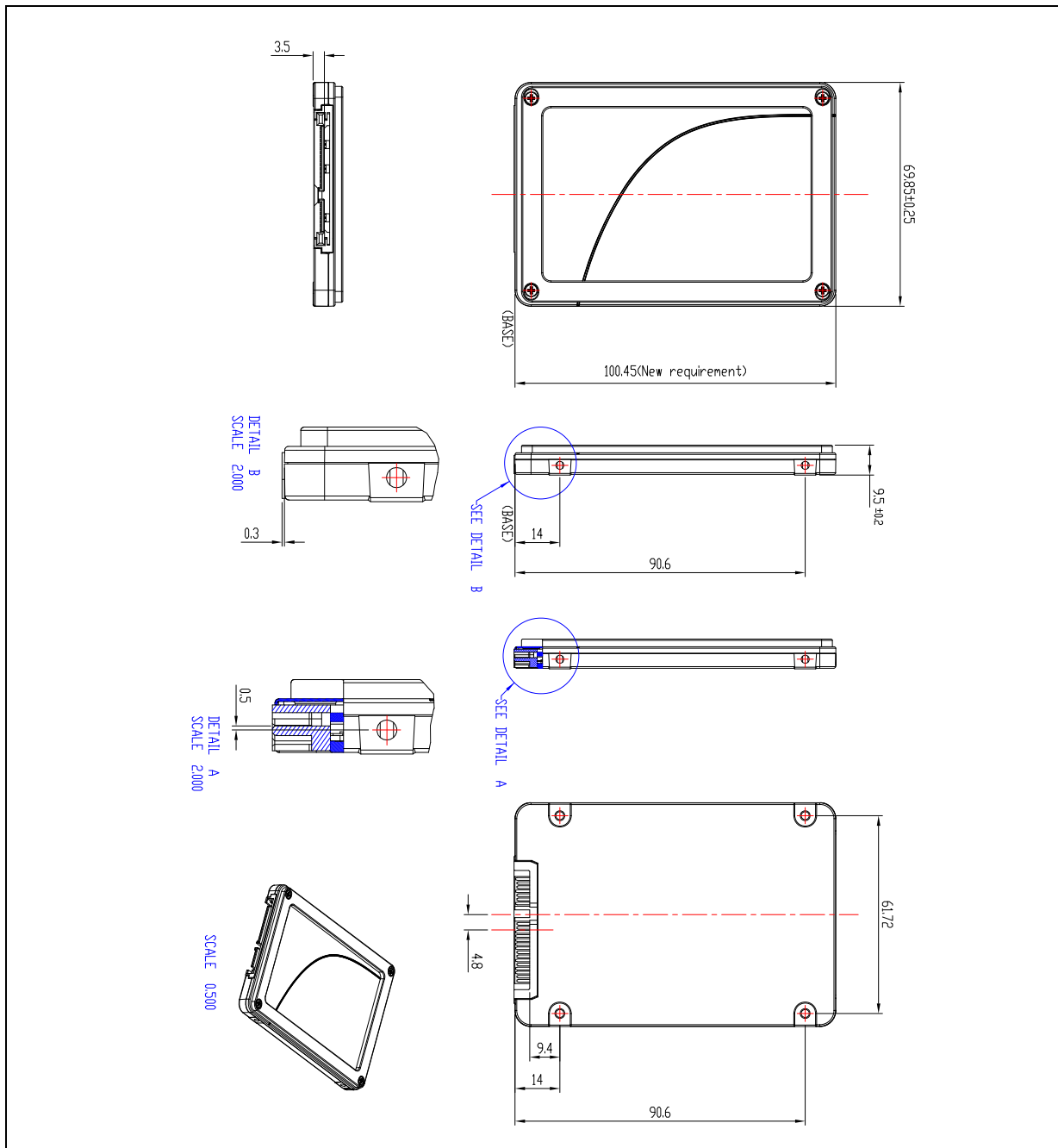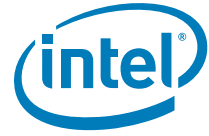
3.2 mSATA SSD Form Factor

Figure 2 shows the physical package information for the Intel SSD 313 Series in the mSATA form factor. All dimensions are in millimeters.

Note: Total typical thickness of the SSD is less than the standard mSATA z-height specification of 4.85 mm.

Figure 2. mSATA Form Factor Dimensions
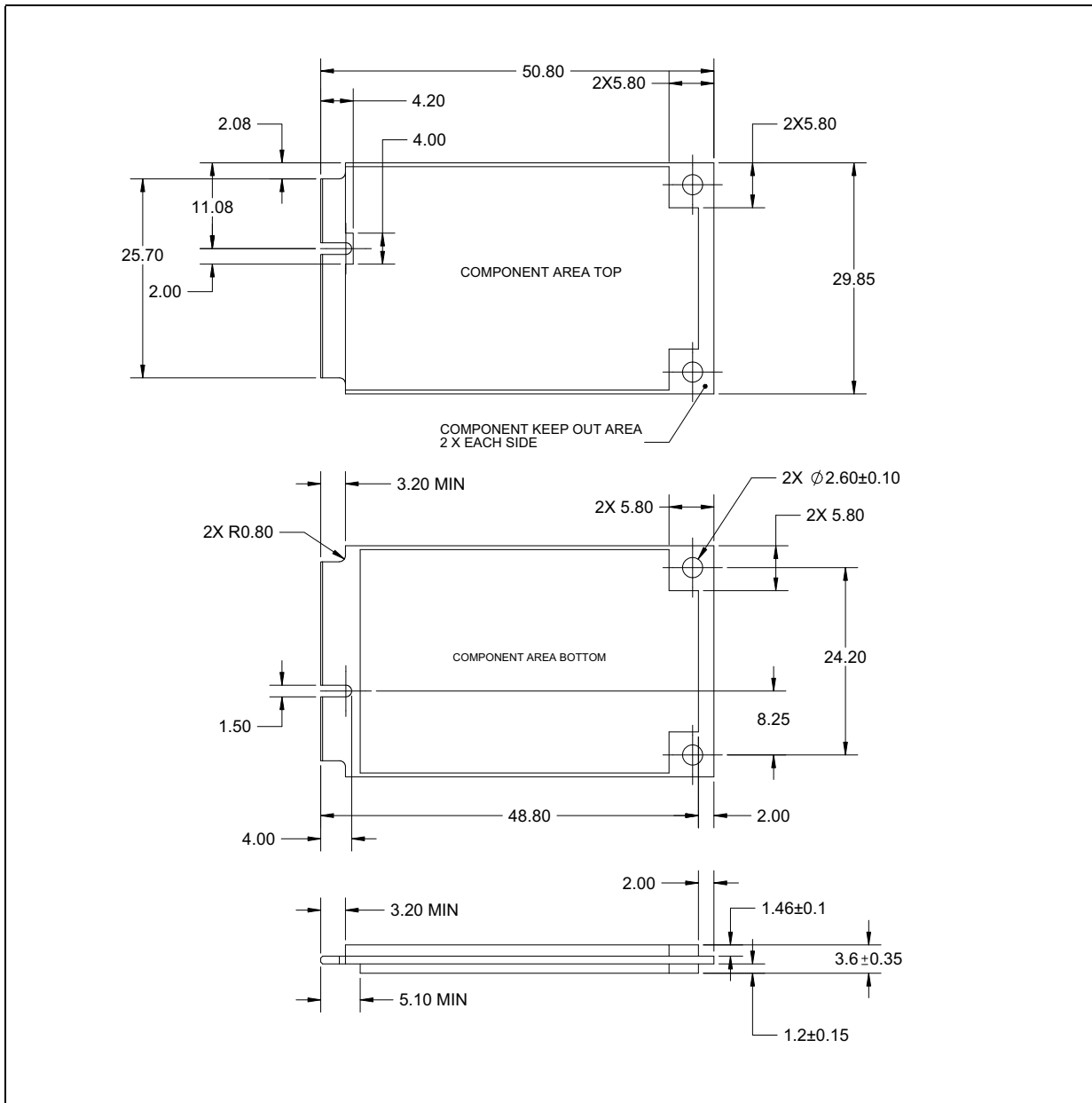
4.0 Pin and Signal Descriptions

This section identifies the pin locations and signal descriptions for the Intel SSD 313 Series.

4.1 2.5-inch SATA SSD Pin Locations

Figure 3. SATA Signal and Power Segment Pins

Signal Segment S1   Power Segment P1
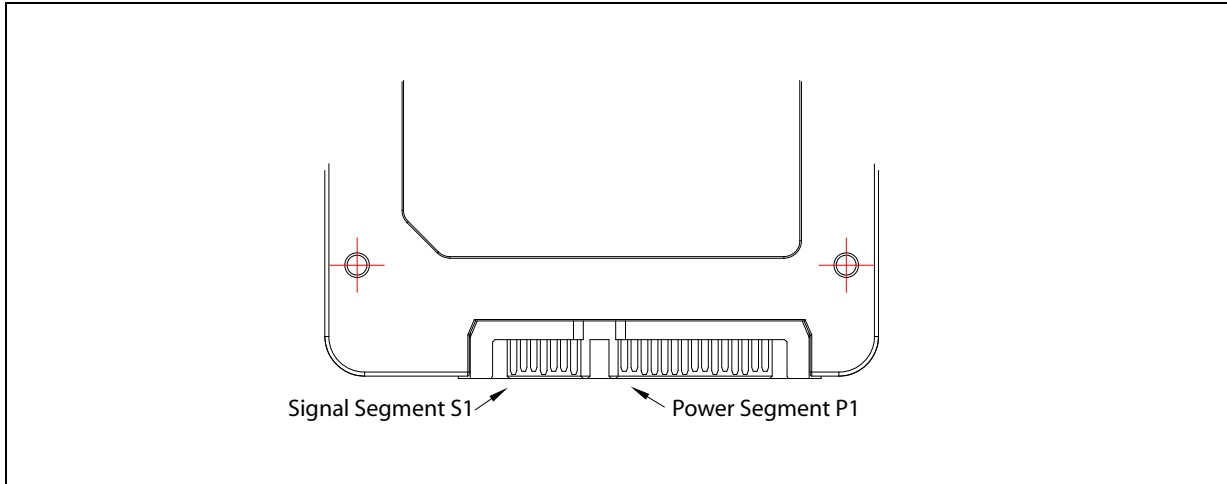
Note: 2.5-inch connector supports in-built latching capability.

4.2 mSATA SSD Pin Locations

Figure 4. mSATA Signal and Power Segment Pins

AREA DETAIL TOP

PIN 1   PIN 51

PIN 2   AREA DETAIL BOTTOM   PIN 52
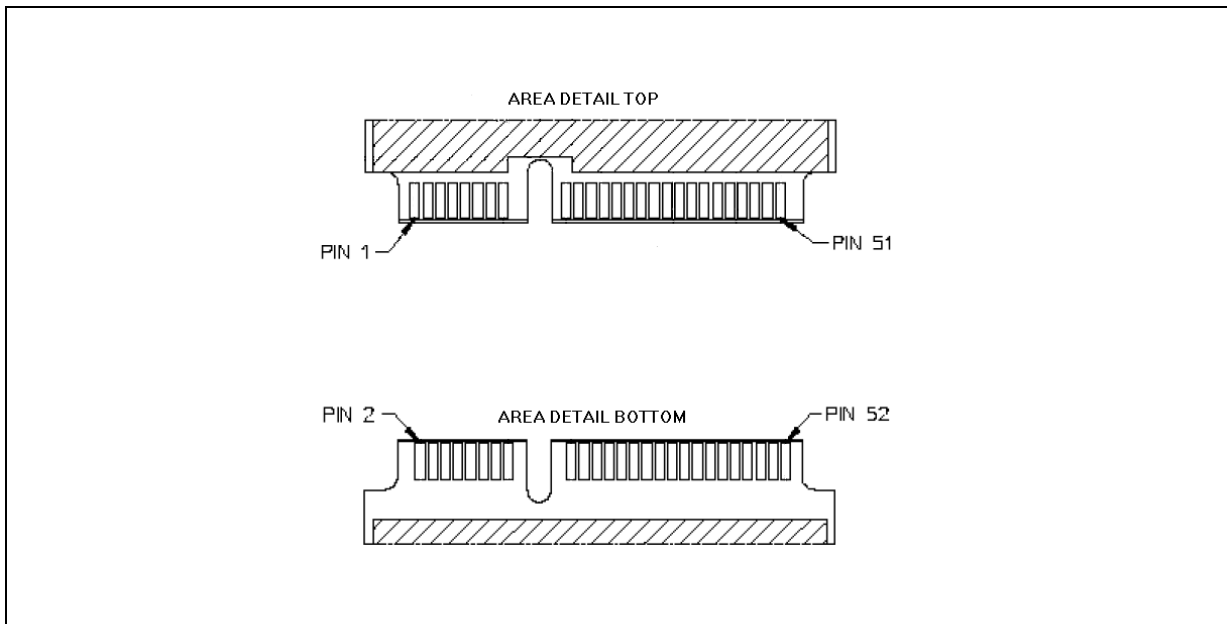
4.3 Signal Descriptions

4.3.1 2.5-inch SATA SSD Signal Descriptions

Table 9. SATA Connector Pin Signal Definitions

Pin	Function	Definition
S1	Ground	1st mate
S2	A+	Device Transmit Pair
S3	A-	
S4	Ground	1st mate
S5	B-	Device Receive Pair
S6	B+	
S7	Ground	1st mate

Note: Key and spacing separate signal and power segments.

Table 10. SATA Power Pin Definitions

Pin[1]	Function	Definition	Mating Order
P1[2]	V_{33}	3.3 V Power; not used	2nd Mate
P2[2]	V_{33}	3.3 V Power; not used	2nd Mate
P3[2]	V_{33}	3.3 V Power; not used	1st Mate
P4[3,4]	Ground		1st Mate
P5[3]	Ground		1st Mate
P6[3]	Ground		1st Mate
P7[3,5]	V_5	5 V Power	1st Mate
P8[3,5]	V_5	5 V Power	2nd Mate
P9[3,5]	V_5	5 V Power	2nd Mate
P10[3]	Ground		1st Mate
P11[6]	DAS	Device Activity Signal	2nd Mate
P12[3,4]	Ground		1st Mate
P13[7]	V_{12}	12 V Power; not used	1st Mate
P14[7]	V_{12}	12 V Power; not used	2nd Mate
P15[7]	V_{12}	12 V Power; not used	2nd Mate

Notes:
1. All pins are in a single row, with a 1.27 mm (0.050-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:
   — Ground pins P4-P6, P10, P12 and the 5V power pin P7.
   — 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 and P15 are connected together, although they are not connected internally to the device. The host may put 12 V on these pins.

4.3.2 mSATA SSD Signal Descriptions

Table 11. mSATA Connector Pin Signal Definitions

Pin	Function	Definition
P1	Reserved	No Connect
P2	+3.3 V	3.3 V Source
P3	Reserved	No Connect
P4	GND	Return Current Path
P5	Reserved	No Connect
P6[1]	+1.5 V	1.5 V Source
P7	Reserved	No Connect
P8	Reserved	No Connect
P9	GND	Return Current Path
P10	Reserved	No Connect
P11	Reserved	No Connect
P12	Reserved	No Connect
P13	Reserved	No Connect
P14	Reserved	No Connect
P15	GND	Return Current Path
P16	Reserved	No Connect
P17	Reserved	No Connect
P18	GND	Return Current Path
P19	Reserved	No Connect
P20	Reserved	No Connect
P21	GND	Return Current Path
P22	Reserved	No Connect
P23	+B	Host Receiver Differential Signal Pair This is an output of the SSD.
P24	+3.3 V	3.3 V Source
P25	-B	Host Receiver Differential Signal Pair This is an output of the SSD.
P26	GND	Return Current Path
P27	GND	Return Current Path
P28[1]	+1.5 V	1.5 V Source
P29	GND	Return Current Path
P30[2]	Two Wire Interface	Two Wire Interface Clock
P31	-A	Host Transmitter Differential Signal Pair This is an input of the SSD.
P32[2]	Two Wire Interface	Two Wire Interface Data
P33	+A	Host Transmitter Differential Signal Pair This is an input of the SSD.
P34	GND	Return Current Path
P35	GND	Return Current Path
P36	Reserved	No Connect
P37	GND	Return Current Path
P38	Reserved	No Connect
P39	+3.3 V	3.3 V Source
P40	GND	Return Current Path
P41	+3.3 V	3.3 V Source
P42	Reserved	No Connect
P43	Device Type	No Connect
P44	Reserved	No Connect
P45[3]	Vendor	Vendor Specific / Manufacturing Pin
P46	Reserved	No Connect

Table 11.   mSATA Connector Pin Signal Definitions (Continued)

Pin	Function	Definition
P47[3]	Vendor	Vendor Specific / Manufacturing Pin
P48[1]	+1.5 V	1.5 V Source
P49	DA/DSS	Device Activity Signal / Disable Staggered Spin-up
P50	GND	Return Current Path
P51[4]	Presence Detection	Shall be pulled to GND by device
P52	+3.3 V	3.3 V Source

Notes:

1.   1.5 V rail is not used on the Intel SSD 313 Series. No connect on the host side.

2.   Pins 30 and 32 are intended for use as a two-wire interface to read a memory device to determine device information (an example of this would be for use as SMB bus pins). These pins are not designed to be active in conjunction with the SATA signal differential pairs. Not used in the Intel SSD 313 Series. No connect on the host side.

3.   Vendor-specific pins are not used in the Intel SSD 313 Series. No connect on the host side.

4.   Presence detection pin indicates presence of an mSATA device.

5.0   Supported Command Sets

The Intel SSD 313 Series supports 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 313 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 27 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 313 Series also supports the following optional commands:

- READ BUFFFER
- WRITE BUFFER
- NOP
- DOWNLOAD MICROCODE

5.2   Power Management Command Set

The Intel SSD 313 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 313 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 313 Series supports the SMART command set, which consists of:

- SMART ENABLE OPERATIONS
- SMART DISABLE OPERATIONS
- SMART READ ATTRIBUTES THRESHOLDS
- SMART SAVE ATTRIBUTES VALUES
- SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE
- SMART RETURN STATUS
- SMART ENABLE/DISABLE AUTOMATIC OFFLINE

The Intel SSD 313 Series also supports the following optional commands:

- SMART EXECUTE OFF-LINE IMMEDIATE
- SMART READ DATA
- SMART READ LOG SECTOR
- SMART WRITE LOG SECTOR

5.4.1 SMART Attributes

Table 12 lists the SMART attributes supported by the Intel SSD 313 Series; Table 13 shows the corresponding status flags and threshold settings.

Table 12. SMART Attributes

ID	Attribute	Status Flags						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)
09h	Power-On Hours Count 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.	1	1	0	0	1	0	0 (none)
0Ch	Power Cycle Count 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 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 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)
BBh	Uncorrectable Error Count 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)
B7h	SATA Downshift Count The count of the number of times SATA interface selected lower signaling rate due to error.	1	1	0	0	1	0	0 (none)
B8h	End-to-End Error Detection Count Reports number of errors encountered during LBA tag checks, within the SSD data path.	1	1	0	0	1	1	90
C0h	Power-Off Retract Count (Unsafe Shutdown Count) 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)

Table 12.   SMART Attributes (Continued)

ID	Attribute	Status Flags						Threshold
		SP	EC	ER	PE	OC	PW	
C7h	CRC Error Count The total number of encountered SATA interface cyclic redundancy check (CRC) errors.	1	1	0	0	1	0	0 (none)
E1h	Host Writes 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 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 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 Measures the elapsed time (number of minutes since starting this workload timer).	1	1	0	0	1	0	0 (none)
E8h	Available Reserved Space 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 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 Counts sectors written by the host.	1	1	0	0	1	0	0 (none)
F2h	Total LBAs Read Counts sectors read by the host.	1	1	0	0	1	0	0 (none)

Table 13 defines the SMART attributes status flags.

Table 13. 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

5.4.2 SMART Logs

The Intel SSD 313 Series implements the following Log Addresses: 00h, 02h, 03h, 06h, and 07h.

The Intel SSD 313 Series implements host vendor specific logs (addresses 80h-9Fh) as read and write scratchpads, where the default value is zero (0). The Intel SSD 313 Series does not write any specific values to these logs unless directed by the host through the appropriate commands.

The Intel SSD 313 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 Device Statistics

In addition to the SMART attribute structure, statistics pertaining to the operation and health of the Intel SSD 313 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.

Table 14 lists the Device Statistics supported by the Intel SSD 313 Series.

Table 14. 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
	0x20	Num Write Commands - incremented by one for every host write command	-
	0x28	Logical Sectors Read	F2h
	0x30	Num Read Commands - incremented by one for every host write command	-
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	-

Table 14.   Device Statistics Log (Continued)

Page	Offset	Description	Equivalent SMART attribute if applicable
0x07 - Solid State Device Statistics	0x08	Percentage Used Endurance Indicator	E9h Note: This device statistic counts up from 0 rather than down from 100, and may go beyond 100 for drives that exceed their expected lifetime.

5.6   SMART Command Transport (SCT)

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

The Intel SSD 313 Series supports the following standard SCT actions:

- Write Same — Intel SSD 313 Series implements this action code as described in the ATA specification.
- Error Recovery Control — Intel SSD 313 Series accepts this action code, and will store and return error-recovery time limit values.
- Feature Control - Intel SSD 313 Series supports feature code 0001h (write cache) and feature code 0002h (write cache reordering).

5.7   Data Set Management Command Set

The Intel SSD 313 Series supports the Data Set Management command set Trim attribute, which consists of:

- DATA SET MANAGEMENT EXT

5.8   Host Protected Area Command Set

The Intel SSD 313 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 313 Series also supports the following optional commands:

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

5.9 48-Bit Address Command Set

The Intel SSD 313 Series supports the 48-bit Address command set, which consists of:

- FLUSH CACHE EXT
- READ DMA EXT
- READ DATA 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
- WRITE UNCORRECTABLE EXT

5.10 Device Configuration Overlay Command Set

The Intel SSD 313 Series supports the Device Configuration Overlay command set, which consists of:

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

5.11 General Purpose Log Command Set

The Intel SSD 313 Series supports the General Purpose Log command set, which consists of:

- READ LOG EXT
- WRITE LOG EXT

5.12 Native Command Queuing

The Intel SSD 313 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.
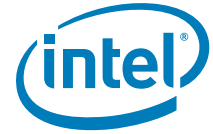
5.13 Software Settings Preservation

The Intel SSD 313 Series supports the SET FEATURES parameter to enable/disable the preservation of software settings.

5.14 Device Initiated Power Management (DIPM)

The Intel SSD 313 Series supports the SET FEATURES parameter to enable Device Initiated Power Management.

6.0 Certifications and Declarations

Table 15 describes the Device Certifications supported by the Intel SSD 313 Series.

Table 15. Device Certifications and Declarations

Certification	Description
CE Compliant	Low Voltage DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2006, and EMC Directive 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004.
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) 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 meet 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	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.
WEEE	Directive on Waste Electrical and Electronic Equipment

7.0 References

Table 16 identifies the standards information referenced in this document.

Table 16. Standards References

Date or Rev. #	Title	Location
Sept 2010	Solid-State Drive (SSD) Requirements and Endurance Test Method (JESD218)	http://www.jedec.org/ standardsdocuments/docs/jesd218/
Dec 2008	VCCI	http://www.vcci.jp/vcci_e/
June 2009	RoHS	http://qdms.intel.com/ Click *Search MDDS Database* and search for material description datasheet.
August 2004	ATA8-ACS Specification	http://www.t13.org/
February 2007	Serial ATA Revision 2.6	http://www.sata-io.org/
	Compliance with EN 55022:1998 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement CISPR 22:1997 (Modified)	http://www.iec.ch/

8.0 Terms and Acronyms

Table 17 defines the terms and acronyms used in this document.

Table 17. Glossary of Terms and Acronyms

Term	Definition
ATA	Advanced Technology Attachment
DAS	Device Activity Signal
DIPM	Device Initiated Power Management
DMA	Direct Memory Access
ESD	Electro-Static Discharge
EXT	Extended
FPDMA	First Party Direct Memory Access
GB	Gigabyte (1,000,000 bytes) 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 maintenance purposes.
GND	Ground
KB	Kilobytes (1,024 bytes)
IOPS	Input/Output Operations Per Second
LBA	Logical Block Address
MB	Megabyte (1,000,000 bytes)
mSATA	Mini-SATA
MTBF	Mean Time Between Failures
NCQ	Native Command Queuing
NOP	No Operation
PIO	Programmed Input/Output
RDT	Reliability Demonstration Test
RMS	Root Mean Squared
SATA	Serial Advanced Technology Attachment
SLC	Single-level Cell
SMART	Self-Monitoring, Analysis and Reporting Technology
SSD	Solid-State Drive
TYP	Typical
UBER	Uncorrectable Bit Error Rate

9.0 Revision History

Date	Revision	Description
February 2012	001	Initial release.

Appendix A IDENTIFY DEVICE Command Data

Table 18 details the sector data returned after issuing an IDENTIFY DEVICE command.

Table 18. 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	0h	Reserved
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51-52	X	0h	Obsolete
53	F	0007h	Words 88 and 70:64 Valid
54	X	3FFFh	Obsolete - Number of logical cylinders (16,383)
55	X	0010h	Obsolete - Number of logical heads (16)
56	X	003Fh	Obsolete - Number of logical sectors per logical track (63)
57-58	X	00FBFC10h	Obsolete
59	V	0110h	Number of sectors transferred per interrupt on MULTIPLE commands
60-61	F	20GB: 2547C30h 24GB: 2CBB7B0h	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	4020h	Additional Supported
70	F	0h	Reserved

Table 18. Returned Sector Data (Continued)

Word	F = Fixed V = Variable X = Both	Default Value	Description
71-74	F	0h	Reserved for the IDENTIFY PACKET DEVICE command
75	F	001Fh	Queue depth
76	F	0506h	Serial ATA capabilities
77	F	0h	Reserved for future Serial ATA definition
78	F	0048h	Serial ATA features supported
79	V	0040h	Serial ATA features enabled
80	F	01FCh	Major version number
81	F	0029h	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	20GB: 2547C30h 24GB: 2CBB7B0h	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	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

Table 18.   Returned Sector Data (Continued)

Word	F = Fixed V = Variable X = Both	Default Value	Description
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	003Dh	SCT Command Transport
207-208	X	0h	Reserved
209	X	0h	Alignment of logical blocks within a physical block
210-211	X	0h	Write-Read-Verify Sector Count Mode 3 (DWord)
212-213	X	0h	Write-Read-Verify Sector Count Mode 2 (DWord)
214	X	0h	NV Cache Capabilities
215-216	X	0h	NV Cache Size in Logical Blocks (DWord)
217	X	0001h	Nominal Media Rotational 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	101Fh	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	0001h	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

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.