Intel® Solid-State Drive 335 Series

- Capacity: 80GB, 180GB, 240GB
- Components:
  - Intel® 20nm NAND Flash Memory
  - Multi-Level Cell (MLC)
- Form Factor: 2.5-inch
- Thickness: 9.5mm
- Weight: Up to 78 grams
- SATA 6Gb/s Bandwidth Performance (Iometer* Queue Depth 32)[1]
  - Sustained Sequential Read: up to 500 MB/s
  - Sustained Sequential Write: up to 450 MB/s
- Read and Write IOPS (Iometer Queue Depth 32)[1]
  - Random 4 KB Reads: up to 42,000 IOPS
  - Random 4 KB Writes: up to 52,000 IOPS
- Compatibility
  - Intel® SSD Toolbox with Intel® SSD Optimizer
  - Intel® Data Migration Software
  - Intel® Rapid Storage Technology
  - Intel® 6 Series Express Chipsets (with SATA 6.0 Gb/s)
  - SATA Revision 3.0
  - ACS-2 (ATA/ATAPI Command Set 2)
  - Limited SMART ATA feature set
  - Native Command Queuing (NCQ) command set
  - Data Set Management Command Trim attribute

- Power Management
  - 5 V SATA Supply Rail
  - SATA Link Power Management (LPM)
- Power
  - Active (MobileMark* 2007 Workload): 350 mW (TYP)
  - Idle: 275 mW (TYP)
- Temperature
  - Operating: 0° C to 70° C
  - Non-Operating: -55° C to 95° C
- Certifications and Declarations:
  - UL*
  - CE*
  - C-Tick*
  - BSMI*
  - KCC*
  - Microsoft* WHQL
  - VCCI*
  - SATA-IO*
- Product Ecological Compliance
  - RoHS*

1. Performance values vary by capacity
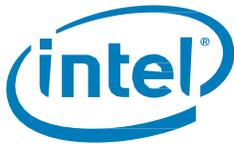
Ordering Information

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 335 Series (Intel® SSD 335 Series) [1].

The Intel® SSD 335 Series delivers leading performance for Serial Advanced Technology Attachment (SATA)-based computers in 80GB, 180GB and 240GB capacities.

By combining Intel® 20nm NAND Flash Memory technology with SATA 6.0 Gb/s interface support, the Intel® SSD 335 Series delivers sequential read speeds of up to 500 MB/s and sequential write speeds of up to 450 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, and ruggedness offered by an SSD.

As compared to standard SATA HDDs, Intel® SSD 335 Series offers these key features:

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

Note: 1. The Intel SSD 335 Series is currently not validated for data center usage.

2.0   Product Specifications

2.1   Capacity

Table 1.   User Addressable Sectors

Intel® SSD 335 Series	Unformatted Capacity (Total User Addressable Sectors in LBA Mode)
80GB	156,301,488
180GB	351,651,888
240GB	468,862,128

Notes:

- 1GB = 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/Write Input/Output Operations Per Second (IOPS)

Specification	Unit	Intel® SSD 335 Series		
		80GB	180GB	240GB
Random 4KB Read (up to)[1]	IOPS	15,000	42,000	42,000
Random 4KB Write (up to)[1]	IOPS	25,000	52,000	52,000

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

Table 3.   Sequential Read and Write Bandwidth

Specification	Unit	Intel® SSD 335 Series		
		80GB	180GB	240GB
Sequential 128KB Read (SATA 6Gb/s)[1]	MB/s	500	500	500
Sequential 128KB Write (SATA 6Gb/s)[1]	MB/s	400	450	450

Note: 1. Performance measured using Iometer* with Queue Depth 32.

2.3 Electrical Characteristics

Table 4. Operating Voltage and Power Consumption

Electrical Characteristics	Value
Operating Voltage for 5 V (±5%)	
Min	4.75 V
Max	5.25 V
Power Consumption (TYP)	
Active[1]	350 mW
Idle[2]	275 mW

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

2.4 Environmental Conditions

Table 5. Temperature, Shock, Vibration

Temperature	Range
Case Temperature	
Operating	$0 - 70^o$ C
Non-operating	$-55 - 95$ ^{o} C
Temperature Gradient[1]	
Operating	30 (TYP)^o C/hr
Non-operating	30 (TYP)^o C/hr
Humidity	
Operating	5 – 95 %
Non-operating	5 – 95 %
Shock and Vibration	**Range**
Shock[2]	
Operating	1,500 G (Max) at 0.5 msec
Non-operating	1,500 G (Max) at 0.5 msec
Vibration[3]	
Operating	2.17 G_{RMS} (5-700 Hz) Max
Non-operating	3.13 G_{RMS} (5-800 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. Vibration specification is measured using Root Mean Squared (RMS) value.
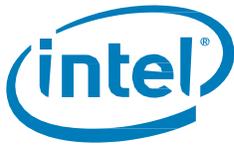
2.5 Product Regulatory Compliance

The Intel® SSD 335 Series meets or exceeds the regulatory or certification requirements in Table 6.

Table 6. **Product Regulatory Compliance Specifications**

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

2.6 Reliability

The Intel® SSD 335 Series meets or exceeds SSD endurance and data retention requirements as specified in the JESD218 specification.

Table 7. **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).	≥ 1.2 million hours
Minimum Useful Life/Endurance Rating The SSD will have a minimum of three years of useful life under typical client workloads with up to 20 GB of host writes per day.	3 years
Insertion Cycles The SSD supports up to 250 insertion/removal cycles on SATA/power cable.	250 insertion/removal cycles

3.0   Mechanical Information

The Intel® SSD 335 Series meets the SFF-8201 specification for 9.5mm 2.5-inch drive form factor and SFF-8223 specification for 2.5-inch Drive w/Serial Attachment Connector.

4.0   Pin and Signal Descriptions

See the Serial ATA (SATA) Revision 3.0 specification for pin and signal descriptions.

5.0   SMART Attributes

Table 8 lists the limited SMART attributes supported by the Intel® SSD 335 Series.

Table 8.   SMART Attributes

ID	Attribute	Status Flags[1]						Threshold
		SP	EC	ER	PE	OC	PW	
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 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. 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)
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 STANDBYIMMEDIATE being the last command.	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)
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

ID	Attribute	Status Flags[1]						Threshold
		SP	EC	ER	PE	OC	PW	
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 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 The raw value of this attribute reports the total number of sectors read by the host system. The raw value is increased by 1 for every 65,536 sectors (32MB) read by the host.	1	1	0	0	1	0	0 (none)
F9h	Total NAND Writes Raw value reports the number of writes to NAND in 1 GB increments.	1	1	0	0	1	0	0 (none)

6.0 Certifications and Declarations

Table 9 describes the Device Certifications supported by the Intel® SSD 335 Series.

Table 9. 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 Recognized	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 meets the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Ministry of Information and Communication Republic of Korea.
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.
RoHS Compliant	Restriction of Hazardous Substance Directive
WEEE	Directive on Waste Electrical and Electronic Equipment
Microsoft WHQL	Microsoft Windows Hardware Quality Labs

7.0   References

Table 10 identifies the standards information referenced in this document.

Table 10.   Standards References

Date	Title	Location
Sept 2010	Solid-State Drive (SSD) Requirements and Endurance Test Method (JESD218)	http://www.jedec.org/standards-documents/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 2009	ACS-2-ATA/ATAPI Command Set 2 Specification	http://www.t13.org/
June 2009	Serial ATA Revision 3.0	http://www.sata-io.org/
May 2006	SFF-8223, 2.5-inch Drive w/Serial Attachment Connector	http://www.sffcommittee.org/
May 2005	SFF-8201, 2.5-inch drive form factor	http://www.sffcommittee.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 11 defines the terms and acronyms used in this document.

Table 11.   Glossary of Terms and Acronyms

Term	Definition
ATA	Advanced Technology Attachment
DIPM	Device Initiated Power Management
GB	Gigabyte (1,000,000,000 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 management and maintenance purposes.
HDD	Hard Disk Drive
HIPM	Host Initiated Power Management
I/O	Input/Output
IOPS	Input/Output Operations Per Second
KB	Kilobyte (1,024 bytes)
LBA	Logical Block Address
LPM	Link Power Management
MB	Megabyte (one million bytes)
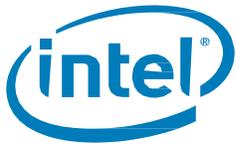
Term	Definition
MLC	Multi-level Cell
MTBF	Mean Time Between Failures
NCQ	Native Command Queuing
NOP	No Operation
RDT	Reliability Demonstration Test
RMS	Root Mean Squared
SATA	Serial Advanced Technology Attachment
SMART	Self-Monitoring, Analysis and Reporting Technology
SSD	Solid-State Drive
TYP	Typical
UBER	Uncorrectable Bit Error Rate

9.0   Revision History

Date	Revision	Description
October 2012	001	Initial release.
January 2013	002	Release of the 180GB capacity
January 2013	003	Removal of 7mm SKUs
March 2013	004	Release of the 80GB capacity