

A decorative graphic on the left side of the page, featuring a large dashed circle, a solid blue circle, and several overlapping curved lines in blue and grey.

Product Manual

## **DB35.3 Series Serial ATA**

**ST3750640SCE**

**ST3750840SCE**

**ST3500830SCE**

**ST3400820SCE**

**ST3320820SCE**

**ST3300820SCE**

**ST3250820SCE**

100427570

Rev. D

August 2007

## Revision history

Revision	Date	Sheets affected or comments
Rev. A	08/04/06	Initial draft.
Rev. B	08/17/06	4-11 and 21.
Rev. C	07/18/07	ft cover, 1, 3, 4, 6, 8, 10 and 23.
Rev. D	08/23/07	1, 39 and 40.

Copyright © 2006-2007 Seagate Technology LLC. All rights reserved. Printed in USA

Publication number: 100427570, Rev. D August 2007

Seagate, Seagate Technology and the Wave logo are registered trademarks of Seagate Technology LLC in the United States and/or other countries. DB35.3 Series, SeaTools and SeaTDD are either trademarks or registered trademarks of Seagate Technology LLC or one of its affiliated companies in the United States and/or other countries. All other trademarks or registered trademarks are the property of their respective owners.

One gigabyte, or GB, equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. Seagate reserves the right to change, without notice, product offerings or specifications.

# Contents

<b>1.0</b>	<b>Introduction</b>	<b>1</b>
1.1	About the Serial ATA interface	2
<b>2.0</b>	<b>Drive specifications</b>	<b>3</b>
2.1	Specification summary tables	3
2.2	Formatted capacity	12
2.2.1	LBA mode	12
2.3	Default logical geometry	12
2.4	Recording and interface technology	13
2.5	Physical characteristics	13
2.6	Seek time	14
2.7	Start/stop times	14
2.8	Power specifications	14
2.8.1	Power consumption	14
2.8.2	Conducted noise	16
2.8.3	Voltage tolerance	16
2.8.4	Power-management modes	16
2.9	Environmental specifications	18
2.9.1	Ambient temperature	18
2.9.2	Temperature gradient	18
2.9.3	Humidity	18
2.9.4	Altitude	18
2.9.5	Shock	18
2.9.6	Vibration	19
2.10	Acoustics	20
2.11	Electromagnetic immunity	21
2.12	Reliability	21
2.13	Agency certification	21
2.13.1	Safety certification	21
2.13.2	Electromagnetic compatibility	21
2.13.3	FCC verification	22
2.14	Environmental protection	23
2.14.1	European Union Restriction of Hazardous Substances (RoHS) Directive	23
2.14.2	China Restriction of Hazardous Substances (RoHS) Directive	23
2.15	Corrosive environment	23
<b>3.0</b>	<b>Configuring and mounting the drive</b>	<b>25</b>
3.1	Handling and static-discharge precautions	25
3.2	Configuring the drive	26
3.3	Serial ATA cables and connectors	26
3.4	Drive mounting	27
<b>4.0</b>	<b>Serial ATA (SATA) interface</b>	<b>29</b>
4.1	Hot-Plug compatibility	29
4.2	Serial ATA device plug connector pin definitions	30
4.3	Supported ATA commands	31
4.3.1	Identify Device command	33
4.3.2	Set Features command	37
4.3.3	S.M.A.R.T. commands	38
<b>5.0</b>	<b>Seagate Technology support services</b>	<b>39</b>



## List of Figures

Figure 1.	Typical 5V startup and operation current profile . . . . .	15
Figure 2.	Typical 12V startup and operation current profile . . . . .	16
Figure 3.	Serial ATA connectors . . . . .	26
Figure 4.	Attaching SATA cabling . . . . .	26
Figure 5.	Mounting dimensions—top, side and end view . . . . .	27



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate DB35.3 Series Serial ATA model drives:

ST3750640SCE	ST3500830SCE	ST3320820SCE	ST3250820SCE
ST3750840SCE	ST3400820SCE	ST3300820SCE	

These drives provide the following key features:

- 7,200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 150 Mbytes per second).
- Tunneling Magnetoresistive (TMR) recording heads.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queueing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Quiet operation.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.

## 1.1 About the Serial ATA interface

The Serial ATA interface provides several advantages over the traditional Parallel ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, Serial ATA makes the transition from Parallel ATA easy by providing legacy software support. Serial ATA was designed to allow you to install a Serial ATA host adapter and Serial ATA disc drive in your current system and expect all of your existing applications to work as normal.

The Serial ATA interface connects each disc drive in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship with Serial ATA devices like there is with Parallel ATA. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

**Note.** The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate Serial ATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical Serial ATA environment.

The Serial ATA host adapter and drive share the function of emulating Parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The Serial ATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All Serial ATA devices behave like Device 0 devices. For additional information about how Serial ATA emulates parallel ATA, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification. The specification can be downloaded from [www.serialata.org](http://www.serialata.org).



## 2.0 Drive specifications

---

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

ST3750640SCE	ST3500830SCE	ST3320820SCE	ST3250820SCE
ST3750840SCE	ST3400820SCE	ST3300820SCE	

### 2.1 Specification summary tables

The specifications listed in the following table are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual.

**Table 1: Drive specifications summary for 750 Gbyte models**

Drive specification	ST3750640SCE	ST3750840SCE
Formatted Gbytes (512 bytes/sector)*	750	
Guaranteed sectors	1,465,149,168	
Bytes per sector	512	
Default sectors per track	63	
Default read/write heads	16	
Default cylinders	16,383	
Recording density, max	926 kbits/in	
Track density, max	145 ktracks/in	
Areal density, max	128.2 Gbits/in <sup>2</sup>	
Spindle speed	7,200 RPM	
Internal data transfer rate, max	1,030 Mbits/sec	
Sustained data transfer rate, max	78 Mbytes/sec	
I/O data-transfer rate, max	300 Mbytes/sec	
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–6	
Cache buffer	16 Mbytes	8 Mbytes
Height, max	26.1 mm (1.028 inches)	
Width, max	101.6 mm (4.000 inches) +/- 0.010 inches	
Length, max	146.99 mm (5.787 inches)	
Weight, typical	720 grams	
Average latency	4.16 msec	
Power-on to ready, max	16 sec	
Standby to ready, max	16 sec	
Track-to-track seek time, typical	<0.8 msec read; <1.0 msec write	
Average seek, read, typical	<11.0 msec	
Average seek, write, typical	<12.0 msec	
Startup current (max) 12V (peak)	2.0 amps	
Voltage tolerance (including noise)	5V ± 5% 12V ± 10%	
Ambient temperature	0° to 60°C (operating) –40° to 70°C (nonoperating)	
Temperature gradient, per hour max	20°C (operating) 30°C (nonoperating)	
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient, per hour max	30%	
Wet bulb temperature, max	37.7°C (operating) 37.7°C (nonoperating)	
Altitude, operating	–60.96 m to 3,048 m (–200 ft. to 10,000+ ft.)	
Altitude, nonoperating, max	–60.96 m to 12,192 m below mean sea level (–200 ft. to 40,000+ ft. below mean sea level)	
Operational Shock, max	63 Gs at 2 msec	
Non-Operational Shock, max	300 Gs at 2 msec	
Vibration, operating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 0.50 Gs 350–500 Hz: 0.25 Gs	

Drive specification	ST3750640SCE	ST3750840SCE
Vibration, nonoperating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 5.0 Gs 350–500 Hz:: 1.0 Gs	
Drive acoustics, sound power		
Idle**	2.8 bels (typical) 3.0 bels (max)	
CE seek profile	3.0 bels (typical) 3.1 bels (max)	
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)	0.68%	
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	
Contact start-stop cycles (25°C, 50% rel. humidity)	50,000	
Supports Hotplug operation per Serial ATA Revision 2.5 specification	Yes	

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2: Drive specifications summary for 500 and 400 Gbyte models**

Drive specification	ST3500830SCE	ST3400820SCE
Formatted Gbytes (512 bytes/sector)*	500	400
Guaranteed sectors	976,773,168	781,422,768
Bytes per sector	512	
Default sectors per track	63	
Default read/write heads	16	
Default cylinders	16,383	
Recording density, max	813 kbits/in	781 kbits/in
Track density, max	145 ktracks/in	
Areal density, max	114.4 Gbits/in <sup>2</sup>	128.2 Gbits/in <sup>2</sup>
Spindle speed	7,200 RPM	
Internal data transfer rate, max	1,030 Mbits/sec	
Sustained data transfer rate, max	72 Mbytes/sec	
I/O data-transfer rate, max	300 Mbytes/sec	
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–6	
Cache buffer	8 Mbytes	
Height, max	26.1 mm (1.028 inches)	
Width, max	101.6 mm (4.000 inches) +/- 0.010 inches	
Length, max	146.99 mm (5.787 inches)	
Weight, typical	635 grams	
Average latency	4.16 msec	
Power-on to ready, max	16 sec	
Standby to ready, max	16 sec	
Track-to-track seek time, typical	<0.8 msec read, <1.0 msec write	
Average seek, read, typical	<11.0 msec	
Average seek, write, typical	<12.0 msec	
Startup current (max) 12V (peak)	2.0 amps	
Voltage tolerance (including noise)	5V ± 5% 12V ± 10%	
Ambient temperature	0° to 62°C (operating) –40° to 70°C (nonoperating)	
Temperature gradient, per hour max	20°C (operating) 30°C (nonoperating)	
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient, per hour max	30%	
Wet bulb temperature, max	37.7°C (operating) 37.7°C (nonoperating)	
Altitude, operating	–60.96 m to 3,048 m (–200 ft. to 10,000+ ft.)	
Altitude, nonoperating, max	–60.96 m to 12,192 m below mean sea level (–200 ft. to 40,000+ ft. below mean sea level)	
Operational Shock, max	63 Gs at 2 msec	
Non-Operational Shock, max	300 Gs at 2 msec	
Vibration, operating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 0.50 Gs 350–500 Hz: 0.25 Gs	

Drive specification	ST3500830SCE	ST3400820SCE
Vibration, nonoperating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 5.0 Gs 350–500 Hz:: 1.0 Gs	
Drive acoustics, sound power		
Idle**	2.8 bels (typical) 3.0 bels (max)	2.7 bels (typical) 2.9 bels (max)
CE seek profile	3.0 bels (typical) 3.1 bels (max)	2.9 bels (typical) 3.0 bels (max)
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)	0.68%	
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	
Contact start-stop cycles (25°C, 50% rel. humidity)	50,000	
Supports Hotplug operation per Serial ATA Revision 2.5 specification	Yes	

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 3: Drive specifications summary for 320 and 300 Gbyte models**

Drive specification	ST3320820SCE	ST3300820SCE
Formatted Gbytes (512 bytes/sector)*	320	300
Guaranteed sectors	625,142,448	586,072,368
Bytes per sector	512	
Default sectors per track	63	
Default read/write heads	16	
Default cylinders	16,383	
Recording density, max	781 kbits/in	
Track density, max	145 ktracks/in	
Areal density, max	114.4 Gbits/in <sup>2</sup>	
Spindle speed	7,200 RPM	
Internal data transfer rate, max	1,030 Mbits/sec	
Sustained data transfer rate, max	72 Mbytes/sec	
I/O data-transfer rate, max	300 Mbytes/sec	
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–6	
Cache buffer	8 Mbytes	
Height (mm max)	26.1 mm (1.028 inches)	
Width (mm max)	101.6 mm (4.000 inches) +/- 0.010 inches	
Length (mm max)	146.99 mm (5.787 inches)	
Weight (max)	635 grams	
Average latency	4.16 msec	
Power-on to ready, max	16 sec	
Standby to ready, max	16 sec	
Track-to-track seek time, typical	<0.8 msec read; <1.0 msec write	
Average seek, read, typical	<11.0 msec	
Average seek, write, typical	<12.0 msec	
Startup current (max) 12V (peak)	2.0 amps	
Voltage tolerance (including noise)	5V ± 5% 12V ± 10%	
Ambient temperature	0° to 65°C (operating) –40° to 70°C (nonoperating)	
Temperature gradient, per hour max	20°C (operating) 30°C (nonoperating)	
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient, per hour max	30%	
Wet bulb temperature, max	37.7°C (operating) 37.7°C (nonoperating)	
Altitude, operating	–60.96 m to 3,048 m (–200 ft. to 10,000+ ft.)	
Altitude, nonoperating, max	–60.96 m to 12,192 m below mean sea level (–200 ft. to 40,000+ ft. below mean sea level)	
Operational Shock, max	63 Gs at 2 msec	
Non-Operational Shock, max	300 Gs at 2 msec	
Vibration, operating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 0.50 Gs 350–500 Hz: 0.25 Gs	

Drive specification	ST3320820SCE	ST3300820SCE
Vibration, nonoperating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 5.0 Gs 350–500 Hz:: 1.0 Gs	
Drive acoustics, sound power		
Idle**	2.7 bels (typical) 2.9 bels (max)	2.5 bels (typical) 2.7 bels (max)
CE seek profile	2.9 bels (typical) 3.0 bels (max)	2.8 bels (typical) 2.9 bels (max)
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)	0.68%	
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	
Contact start-stop cycles (25°C, 50% rel. humidity)	50,000	
Supports Hotplug operation per Serial ATA Revision 2.5 specification	Yes	

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 4: Drive specifications summary for 250 Gbyte models**

Drive specification	ST3250820SCE
Formatted Gbytes (512 bytes/sector)*	250
Guaranteed sectors	488,397,168
Bytes per sector	512
Default sectors per track	63
Default read/write heads	16
Default cylinders	16,383
Recording density, max	813 kbits/in
Track density, max	145 ktracks/in
Areal density, max	114.4 Gbits/in <sup>2</sup>
Spindle speed	7,200 RPM
Internal data transfer rate, max	1,030 Mbits/sec
Sustained data transfer rate, max	72 Mbytes/sec
I/O data-transfer rate, max	300 Mbytes/sec
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–6
Cache buffer	8 Mbytes
Height, max	26.1 mm (1.028 inches)
Width, max	101.6 mm (4.000 inches) +/- 0.010 inches
Length, max	146.99 mm (5.787 inches)
Weight, typical	580 grams (1.28 lb.)
Average latency	4.16 msec
Power-on to ready, max	16 sec
Standby to ready, max	16 sec
Track-to-track seek time, typical	<0.8 msec read; <1.0 msec write
Average seek, read, typical	<11.0 msec
Average seek, write, typical	<12.0 msec
Startup current (max) 12V (peak)	2.0 amps
Voltage tolerance (including noise)	5V ± 5% 12V ± 10%
Ambient temperature	0° to 65°C (operating) –40° to 70°C (nonoperating)
Temperature gradient, per hour max	20°C (operating) 30°C (nonoperating)
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)
Relative humidity gradient, per hour max	30%
Wet bulb temperature, max	37.7°C (operating) 37.7°C (nonoperating)
Altitude, operating	–60.96 m to 3,048 m (–200 ft. to 10,000+ ft.)
Altitude, nonoperating, max	–60.96 m to 12,192 m below mean sea level (–200 ft. to 40,000+ ft. below mean sea level)
Operational Shock, max	63 Gs at 2 msec
Non-Operational Shock, max	350 Gs at 2 msec
Vibration, operating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 0.50 Gs 350–500 Hz: 0.25 Gs



<b>Drive specification</b>	<b>ST3250820SCE</b>
Vibration, nonoperating	5–22 Hz: 0.25 Gs, Limited displacement 22–350 Hz: 5.0 Gs 350–500 Hz:: 1.0 Gs
Drive acoustics, sound power	
Idle**	2.5 bels (typical) 2.7 bels (max)
CE seek profile	2.8 bels (typical) 2.9 bels (max)
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read
Annualized Failure Rate (AFR)	0.68%
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.
Contact start-stop cycles (25°C, 50% rel. humidity)	50,000
Supports Hotplug operation per Serial ATA Revision 2.5 specification	Yes

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3750640SCE	750 Gbytes	1,465,149,168	512
ST3750840SCE	750 Gbytes	1,465,149,168	512
ST3500830SCE	500 Gbytes	976,773,168	512
ST3400820SCE	400 Gbytes	781,422,768	512
ST3320820SCE	320 Gbytes	625,142,448	512
ST3300820SCE	300 Gbytes	586,072,368	512
ST3250820SCE	250 Gbytes	488,397,168	512

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137 Gbytes.

## 2.3 Default logical geometry

Cylinders	Read/write heads	Sectors per track
16,383	16	63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

	750GB	500GB	400GB	320GB	300GB	250GB
Interface	Serial ATA (SATA)					
Recording method	Perpendicular					
Recording density, KBPI (kbits/inch max)	926	813	781			813
Track density, KTPI (ktracks/inch avg)	145					
Areal density (Gbits/inch <sup>2</sup> avg)	128.2	114.4				
Spindle speed (RPM) (± 0.2%)	7,200					
Internal data transfer rate (Mbits/sec max)	1,030					
Sustained data transfer rate (Mbytes/sec max)	78	72				
I/O data-transfer rate (Mbytes/sec max)	300 (Ultra DMA mode 5)					

## 2.5 Physical characteristics

Drive specification		
Maximum height (mm) (inches)		26.1 1.028
Maximum width (mm) (inches)		101.6 4.000 +/- 0.010
Maximum length (mm) (inches)		146.99 5.787
Typical weight	ST3320820SCE, ST3300820SCE and ST3250820SCE ST3500830SCE and ST3400820SCE ST3750640SCE and ST3750840SCE	580 grams (1.28 lbs) 635 grams (1.40 lbs) 720 grams (1.59 lbs)
Cache Size	ST3750640SCE ST3750840SCE ST3500830SCE ST3400820SCE ST3320820SCE ST3300820SCE ST3250820SCE	16 Mbytes 8 Mbytes

## 2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead.

Typical seek times (msec)	Read	Write
Track-to-track	<0.8	<1.0
Average	<11.0	<12.0
Average latency:	4.16	4.16

**Note.** These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.7 Start/stop times

Power-on to Ready (sec)	16 (max)
Standby to Ready (sec)	16 (max)
Ready to spindle stop (sec)	10 (max)

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. See Figure 4 on page 26.

### 2.8.1 Power consumption

Power requirements for the drives are listed in the table on page 9. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- **Spinup power**

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

- **Seek mode**

During seek mode, the read/write actuator arm moves toward a specific position on the disc surface and does not execute a read or write operation. Servo electronics are active. Seek mode power represents the worst-case power consumption, using only random seeks with read or write latency time. This mode is not typical and is provided for worst-case information.

- **Read/write power and current**

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-msec delay, then a 16-sector read followed by a 32-msec delay.

- **Operating power and current**

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

- **Idle mode power**

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

- **Standby mode**

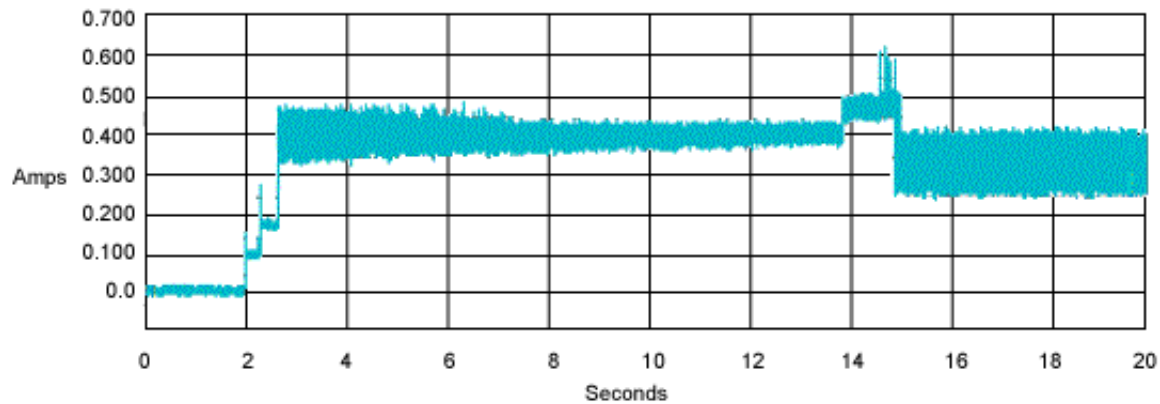
During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 5: DC power requirements**

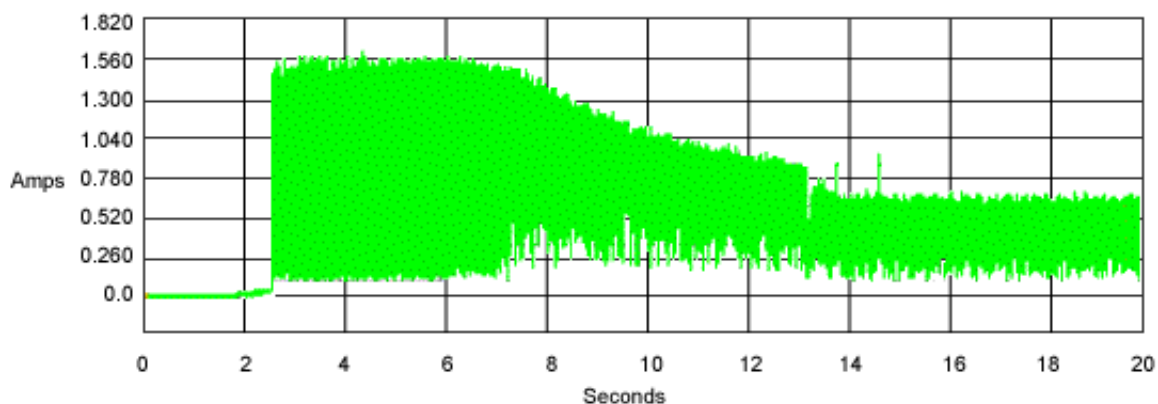
Power dissipation (ST3750640SCE values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0 (peak)
Idle*	9.30	0.611	0.540
Idle* (with offline activity)	10.40	0.719	0.567
Operating (CE seeks)	9.4	0.580	0.540
Standby	0.80	0.106	0.023
Sleep	0.80	0.106	0.023

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.8.1.1 Typical current profiles



**Figure 1. Typical 5V startup and operation current profile**



**Figure 2. Typical 12V startup and operation current profile**

### 2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10 MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10 MHz.

**Note.** Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V  $\pm$  5%
- 12V  $\pm$  10%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**

The drive is in Active mode during the read/write and seek operations.

- **Idle mode**

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disc access is necessary.

- **Standby mode**

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disc access is necessary.

- **Sleep mode**

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

- **Idle and Standby timers**

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disc access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 75°C (167°F) within the operating ambient conditions. Recommended measurement locations are shown in Figure 5 on page 27.

Above 1,000 feet (305 meters), the maximum temperature is derated linearly to 112°F (44°C) at 10,000 feet (3,048 meters).

Operating: ST3320820SCE, ST3300820SCE and ST3250820SCE ST3500830SCE and ST3400820SCE ST3750640SCE and ST3750840SCE	0° to 65°C (32° to 149°F) 0° to 62°C (32° to 143.6°F) 0° to 60°C (32° to 140°F)
Nonoperating:	−40° to 70°C (−40° to 158°F)

### 2.9.2 Temperature gradient

Operating:	20°C per hour (68°F per hour max), without condensation
Nonoperating:	30°C per hour (86°F per hour max)

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

Operating:	5% to 90% noncondensing (30% per hour max)
Nonoperating:	5% to 95% noncondensing (30% per hour max)

#### 2.9.3.2 Wet bulb temperature

Operating:	37.7°C (99.9°F max)
Nonoperating:	37.7°C (99.9°F max)

### 2.9.4 Altitude

Operating:	−60.96 m to 3,048 m (−200 ft. to 10,000+ ft.)
Nonoperating:	−60.96 m to 12,192 m (−200 ft. to 40,000+ ft.)

### 2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

#### 2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 63 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second.



## 2.9.5.2 Nonoperating shock

### 2 Disc models

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

### 3 and 4 Disc models

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

## 2.9.6 Vibration

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis.

### 2.9.6.1 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

5–22 Hz	0.25 Gs (Limited displacement)
22–350 Hz	0.50 Gs
350–500 Hz	0.25 Gs

### 2.9.6.2 Nonoperating vibration

The maximum nonoperating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5–22 Hz	0.25 Gs (limited displacement)
22–350 Hz	5.0 Gs
350–500 Hz	1.0 Gs

## 2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note.** For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

**Table 6: Fluid Dynamic Bearing (FDB) motor acoustics**

	Idle*	CE seek profile
ST3750640SCE ST3750840SCE	2.8 bels (typ) 3.0 bels (max)	3.0 bels (typ) 3.1 bels (max)
ST3500830SCE	2.8 bels (typ) 3.0 bels (max)	3.0 bels (typ) 3.1 bels (max)
ST3400820SCE	2.7 bels (typ) 2.9 bels (max)	2.9 bels (typ) 3.0 bels (max)
ST3320820SCE	2.7 bels (typ) 2.9 bels (max)	2.9 bels (typ) 3.0 bels (max)
ST3300820SCE	2.5 bels (typ) 2.7 bels (max)	2.8 bels (typ) 2.9 bels (max)
ST3250820SCE	2.5 bels (typ) 2.7 bels (max)	2.8 bels (typ) 2.9 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in the following table:

**Table 7: Radio frequency environments**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN 61000-4-2: 95
Radiated RF immunity	80 to 1,000 MHz, 3 V/m, 80% AM with 1 kHz sine 900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz	A	EN 61000-4-3: 96 ENV 50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN 61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN 61000-4-5: 95
Conducted RF immunity	150 kHz to 80 MHz, 3 Vrms, 80% AM with 1 kHz sine	A	EN 61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN 61000-4-11: 94

## 2.12 Reliability

Nonrecoverable read errors	1 per $10^{14}$ bits read, max
Annualized Failure Rate (AFR)	0.68% (nominal power, 25°C ambient temperature)
Contact start-stop cycles	50,000 cycles (at nominal voltage and temperature, with 60 cycles per hour and a 50% duty cycle)
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.
Preventive maintenance	None required.

## 2.13 Agency certification

### 2.13.1 Safety certification

The drives are recognized in accordance with UL 1950 and CSA C22.2 (950) and meet all applicable sections of IEC950 and EN 60950 as tested by TUV North America.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (89/336/EEC). Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Seagate uses an independent laboratory to confirm compliance with the EC directives specified in the previous paragraph. Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

### **Korean RRL**

If these drives have the Korea Ministry of Information and Communication (MIC) logo, they comply 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.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

- EUT name (model numbers): DB35 Series
- Certificate number: STX-L3510 (B)
- Trade name or applicant: Seagate Technology
- Manufacturing date: March 2006
- Manufacturer/nationality: Singapore and China

### **Australian C-Tick (N176)**

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZS3548 1995 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

### **2.13.3 FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate Technology LLC has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disc drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.14.1 European Union Restriction of Hazardous Substances (RoHS) Directive

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances. A new law, the European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

### 2.14.2 China Restriction of Hazardous Substances (RoHS) Directive

#### 2.14.2 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements 有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Biphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

## 2.15 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive

chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and mounting the drive

---

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

**Caution:**

- Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until you mount it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Configuring the drive

Each drive on the Serial ATA interface connects point-to-point with the Serial ATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

Serial ATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a “drive not detected” error, your SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation. If you have a motherboard or host adapter that does not support autonegotiation:

- Install a jumper as shown in Figure 3 below to limit the data transfer rate to 1.5 Gbits per second (and leave the drive connected to the SATA-equipped motherboard or host adapter that doesn't support autonegotiation) or
- Install a SATA host adapter that supports autonegotiation, leave the drive jumper block set to “Normal operation” (see Figure 3 below), and connect the drive to that adapter. This option has the benefit of not limiting the drive to a 1.5 Gbits/sec transfer rate.

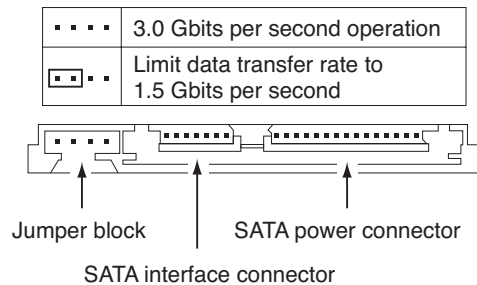


Figure 3. Serial ATA connectors

### 3.3 Serial ATA cables and connectors

The Serial ATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See Table 8 for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, you can connect the drive as illustrated in Figure 4.

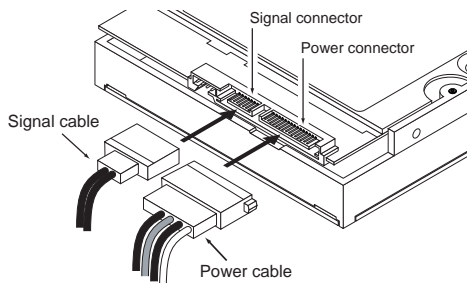


Figure 4. Attaching SATA cabling

Each cable is keyed to ensure correct orientation. DB35.3 Series Serial ATA drives support latching SATA connectors.



### 3.4 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 5 on page 27 for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- The screws should be inserted no more than 0.150 inch (3.81 mm) into the bottom or side mounting holes.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

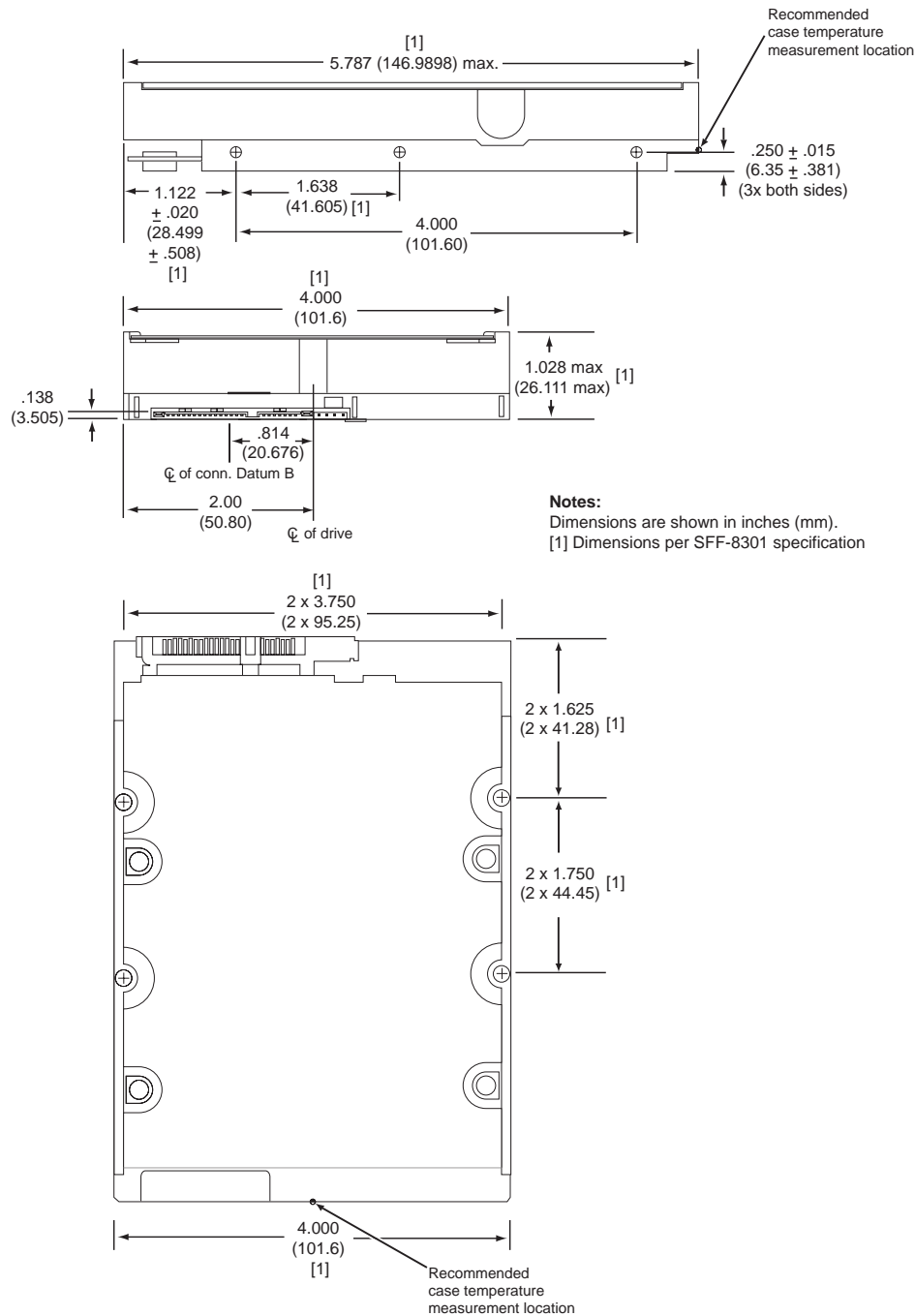


Figure 5. Mounting dimensions—top, side and end view



## **4.0 Serial ATA (SATA) interface**

---

These drives use the industry-standard Serial ATA interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0–4; multiword DMA modes 0–2, and Ultra DMA modes 0–6.

For detailed information about the Serial ATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### **4.1 Hot-Plug compatibility**

DB35.3 Series Serial ATA drives incorporate connectors which enable you to hot plug these drives in accordance with the Serial ATA II: Extension to Serial ATA 1.0a specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

## 4.2 Serial ATA device plug connector pin definitions

Table 8 summarizes the signals on the Serial ATA interface and power connectors..

**Table 8: Serial ATA connector pin definitions**

Segment	Pin	Function	Definition
<b>Signal</b>	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate

Key and spacing separate signal and power segments

<b>Power</b>	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

### Notes:

- All pins are in a single row, with a 1.27 mm (0.050") pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
  - the ground pins P4 and P12.
  - the pre-charge power pins and the other ground pins.
  - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
- All used voltage pins (V<sub>x</sub>) must be terminated.

### 4.3 Supported ATA commands

The following table lists Serial ATA standard commands that the drive supports. For a detailed description of the ATA commands, refer to the Serial ATA: High Speed Serialized AT Attachment specification. See “S.M.A.R.T. commands” on page 38 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 9: Supported ATA commands**

Command name	Command code (in hex)
Check Power Mode	98 <sub>H</sub> or E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	97 <sub>H</sub> or E3 <sub>H</sub>
Idle Immediate	95 <sub>H</sub> or E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>

Command name	Command code (in hex)
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address  Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	F9 <sub>H</sub>  Address: 00 <sub>H</sub> Password: 01 <sub>H</sub> Lock: 02 <sub>H</sub> Unlock: 03 <sub>H</sub> Freeze Lock: 04 <sub>H</sub>
Set Max Address Extended	37 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	99 <sub>H</sub> or E6 <sub>H</sub>
S.M.A.R.T. Disable Operations	B0 <sub>H</sub> / D9 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	B0 <sub>H</sub> / D2 <sub>H</sub>
S.M.A.R.T. Enable Operations	B0 <sub>H</sub> / D8 <sub>H</sub>
S.M.A.R.T. Execute Offline	B0 <sub>H</sub> / D4 <sub>H</sub>
S.M.A.R.T. Read Attribute Thresholds	B0 <sub>H</sub> / D1 <sub>H</sub>
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D0 <sub>H</sub>
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D5 <sub>H</sub>
S.M.A.R.T. Return Status	B0 <sub>H</sub> / DA <sub>H</sub>
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D3 <sub>H</sub>
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D6 <sub>H</sub>
Standby	96 <sub>H</sub> or E2 <sub>H</sub>
Standby Immediate	94 <sub>H</sub> or E0 <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write DMA FUA Extended	CD <sub>H</sub>
Write DMA Without Retries	CB <sub>H</sub>
Write Log Extended	3F <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Multiple FUA Extended	CE <sub>H</sub>
Write Sectors	30 <sub>H</sub>
Write Sectors Without Retries	31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in Table 9 on page 31. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive. See Section 2.0 on page 3 for default parameter settings.

The following commands contain drive-specific features that may not be included in the Serial ATA specification.

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137 Gbytes). Drives with capacities over 137 Gbytes will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	00F0 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	0000 <sub>H</sub>
76	Serial ATA capabilities	xxxx <sub>H</sub>
77	Reserved for future Serial ATA definition	xxxx <sub>H</sub>
78	Serial ATA features supported	xxxx <sub>H</sub>
79	Serial ATA features enabled	xxxx <sub>H</sub>
80	Major version number	003E <sub>H</sub>
81	Minor version number	0000 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7C03 <sub>H</sub>
84	Command sets support extension	4003 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	0001 <sub>H</sub>
87	Command sets enable extension	4000 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx3F <sub>H</sub>
89	Security erase time	0000 <sub>H</sub>
90	Enhanced security erase time	0000 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value (see description following this table)	xxxx <sub>H</sub>
95–99	ATA-reserved	0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3750640SCE = 1,465,149,168 ST3750840SCE = 1,465,149,168 ST3500830SCE = 976,773,168 ST3400820SCE = 781,422,768 ST3320820SCE = 625,142,448 ST3300820SCE = 586,072,368 ST3250820SCE = 488,397,168 ST3200820SCE = 390,721,968



<b>Word</b>	<b>Description</b>	<b>Value</b>
104–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note.** Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported

**Note.** See the bit descriptions below for words 63, 88, and 93 of the Identify Drive data.

<b>Description (if bit is set to 1)</b>		
	<b>Bit</b>	<b>Word 63</b>
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	<b>Bit</b>	<b>Word 88</b>
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

### 4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 10: Set Features command values**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
10 <sub>H</sub>	Enable use of SATA features
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note.** At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

### 4.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disc drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4<sub>H</sub>) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 11: S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note.** If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.

## 5.0 Seagate Technology support services

---

### Internet

For information regarding Seagate products and services, visit [www.seagate.com](http://www.seagate.com). Worldwide support is available 24 hours daily by email for your questions.

### Presales Support:

Presales@Seagate.com

### Technical Support:

DiscSupport@Seagate.com

### Warranty Support:

<http://www.seagate.com/support/service/index.html>

### mySeagate

my.seagate.com is the industry's first Web portal designed specifically for OEMs and distributors. It provides self-service access to critical applications, personalized content and the tools that allow our partners to manage their Seagate account functions. Submit pricing requests, orders and returns through a single, password-protected Web interface-anytime, anywhere in the world.

### spp.seagate.com

spp.seagate.com supports Seagate resellers with product information, program benefits and sales tools. You may register for customized communications that are not available on the web. These communications contain product launch, EOL, pricing, promotions and other channel-related information. To learn more about the benefits or to register, go to spp.seagate.com, any time, from anywhere in the world.

## Seagate Service Centers

### Presales Support

Our Presales Support staff can help you determine which Seagate products are best suited for your specific application or computer system, as well as product availability and compatibility.

### Technical Support

Seagate technical support is available to assist you online at [support.seagate.com](http://support.seagate.com) or through one of our call centers. Have your system configuration information and your "ST" model number available.

**SeaTDD™ (+1-405-324-3655)** is a telecommunications device for the deaf (TDD). You can send questions or comments 24 hours daily and exchange messages with a technical support specialist during normal business hours for the call center in your region.

## Customer Service Operations

### Warranty Service

Seagate offers worldwide customer support for Seagate products. Seagate distributors, OEMs and other direct customers should contact their Seagate Customer Service Operations (CSO) representative for warranty-related issues. Resellers or end users of drive products should contact their place of purchase or Seagate warranty service for assistance. Have your serial number and model or part number available.

### Data Recovery Services

Seagate offers data recovery services for all formats and all brands of storage media. Our data recovery services labs are currently located throughout the world. . Additional information, including an online request form and data loss prevention resources, is available at <http://services.seagate.com/index.aspx>

### Authorized Service Centers

Seagate Service Centers are available on a global basis for the return of defective products. Contact your customer support representative for the location nearest you.

### USA/Canada/Latin America support services

For an extensive list of telephone numbers to technical support, presales and warranty service in USA/Canada/Latin America, including business hours, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

## Global Customer Support

### Presales, Technical, and Warranty Support

Call Center	Toll-free	Direct dial
USA, Canada, and Mexico	1-800-SEAGATE	+1-405-324-4700

### Data Recovery Services

Call Center	Toll-free	Direct dial	FAX
USA, Canada, and Mexico	1-800-475-01435	+1-905-474-2162	1-800-475-0158 +1-905-474-2459

## Europe, the Middle East and Africa Support Services

For an extensive list of telephone numbers to technical support, presales and warranty service in Europe, the Middle East and Africa, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

## Asia/Pacific Support Services

For an extensive list of telephone numbers to technical support, presales and warranty service in Asia/Pacific, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

# Index

## A

ACA 22  
acceleration 19  
acoustics 20  
Active 16  
Active mode 16  
actuator arm 14  
Agency certification 21  
altitude 18  
Ambient temperature 18  
ambient temperature 14  
Annualized Failure Rate (AFR) 21  
areal density 13  
ATA commands 31  
Australia/New Zealand Standard AS/NZS3548 1995 22  
Australian Communication Authority (ACA) 22  
Australian C-Tick 22  
Average latency 14  
Average seek time 14

## B

BPI 13

## C

cables and connectors 26  
capacity 12  
case temperature 18  
CE mark 21  
certification 21  
Check Power Mode 31  
China RoHS directive 23  
Class B computing device 22  
compatibility 21  
Conducted noise 16  
Conducted RF immunity 21  
Configuring the drive 25  
connectors 26  
Corrosive environment 23  
CSA C22.2 (950) 21  
cycles 21  
Cylinders 12

## D

data-transfer rates 1  
DC power 14  
Default logical geometry 12  
density 13  
Device Configuration Freeze Lock 31  
Device Configuration Identify 31

Device Configuration Restore 31  
Device Configuration Set 31  
Device Reset 31  
dimensions 27  
disc surface 14  
dissipation 15  
Download Microcode 31

## E

ecording heads 1  
Electrical fast transient 21  
Electromagnetic compatibility 21  
Electromagnetic Compatibility (EMC) 22  
Electromagnetic Compatibility control Regulation 22  
Electromagnetic Compatibility Directive (89/336/EEC) 21  
Electromagnetic immunity 21  
Electrostatic discharge 21  
electrostatic discharge (ESD) 25  
EN 55022, Class B 21  
EN 55024 21  
EN 60950 21  
Environmental specifications 18  
error-correction algorithms 1  
errors 21  
ESD 25  
EU 21  
EU RoHS directive 23  
European Union (EU) requirements 21  
Execute Device Diagnostics 31

## F

FCC verification 22  
features 1  
Federal Communications Commission 22  
Flush Cache 31  
Flush Cache Extended 31  
Format Track 31  
Formatted capacity 12

## G

geometry 12  
Gs 19  
guaranteed sectors 12

## H

Handling precautions 25  
heads 1, 12  
height 13  
humidity 18

## I

I/O data-transfer rate 13

- Identify Device 31
- Identify Device command 33
- Idle 16, 31
- Idle Immediate 31
- Idle mode 15, 17
- IEC950 21
- Information Technology Equipment (ITE) 21
- Initialize Device Parameters 31
- Input noise ripple 16
- input voltage 14
- interface 13, 29
- internal data-transfer rate OD 13
- is 14
- ISO document 7779 20
- ITE 21

## K

- Korea Ministry of Information and Communication (MIC) 22
- Korean RRL 22

## L

- latency 14
- latency time 14
- LBA mode 12
- length 13
- logical geometry 12

## M

- maintenance 21
- master/slave 2
- maximum temperature 18
- MIC 22
- mounting 27
- mounting screws 18
- mounting the drive 25

## N

- noise 16
- nominal power 14
- Nonoperating shock 19
- Nonoperating vibration 19
- Nonrecoverable read errors 21

## O

- operating 15
- Operating power 15
- Operating shock 18
- Operating vibration 19

## P

- Physical characteristics 13

- point-to-point 2, 26
- Power consumption 14
- power consumption 14
- power dissipation 15
- Power modes 16
- Power specifications 14
- Power-management modes 16
- Power-on to Ready 14
- precautions 25
- printed circuit board 25
- programmable power management 16

## Q

- quick reference 3

## R

- Radiated RF immunity 21
- Radio and television interference 22
- radio frequency (RF) 21
- random seeks 14, 15
- Read Buffer 31
- Read DMA 31
- Read DMA Extended 31
- Read DMA without Retries 31
- read errors 21
- Read Log Ext 31
- Read Multiple 31
- Read Multiple Extended 31
- Read Native Max Address 31
- Read Native Max Address Extended 31
- Read Sectors 31
- Read Sectors Extended 31
- Read Sectors Without Retries 31
- Read Verify Sectors 31
- Read Verify Sectors Extended 31
- Read Verify Sectors Without Retries 31
- read/write actuator arm 14
- Read/write heads 12
- Read/write power 14
- Recalibrate 31
- recording density 13
- recording method 13
- Recording technology 13
- relative humidity 18
- Reliability 21
- RF 21
- RMS read/write current 16
- RoHS 23
- RRL 22

## S

- S.M.A.R.T. Disable Operations 32
- S.M.A.R.T. Enable/Disable Autosave 32
- S.M.A.R.T. Enagle Operations 32



- S.M.A.R.T. Execute Offline 32
- S.M.A.R.T. implementation 31
- S.M.A.R.T. Read Attribute Thresholds 32
- S.M.A.R.T. Read Data 32
- S.M.A.R.T. Read Log Sector 32
- S.M.A.R.T. Return Status 32
- S.M.A.R.T. Save Attribute Values 32
- S.M.A.R.T. Write Log sector 32
- Safety certification 21
- SATA 29
- screws 18
- sectors 12
- Sectors per track 12
- Security Disable Password 31
- Security Erase Prepare 31
- Security Erase Unit 32
- Security Freeze 32
- Security Set Password 32
- Security Unlock 32
- Seek 32
- seek mode 14
- Seek mode power 14
- Seek time 14
- Serial ATA (SATA) interface 29
- serial ATA ports 2
- Servo electronics 14
- servo electronics 15
- Set Features 32
- Set Max Address 32
- Set Max Address Extended 32
- Set Multiple Mode 32
- Shock 18
- single-track seeks 14
- Sleep 15, 16, 32
- Sleep mode 17
- sound 20
- Specification summary table 3
- spindle speed 13
- Spinup 15
- Spinup power 14
- Standby 15, 16, 32
- Standby Immediate 32
- Standby mode 15, 17
- standby timer 17
- Standby to Ready 14
- Start/stop times 14
- start-stop cycles 21
- static-discharge 25
- support services 39
- Surge immunity 21

## T

- technical support services 39
- temperature 14, 18
- temperature gradient 18

- timer 17
- timers 17
- TMR 1
- track density 13
- Track-to-track 14
- Track-to-track seek time 14
- Tunneling Magnetoresistive 1
- TUV North America 21

## U

- UL 1950 21

## V

- Vibration 19
- voltage 14
- Voltage dips, interrupts 21
- Voltage tolerance 16

## W

- weight 13
- wet bulb temperature 18
- width 13
- Write Buffer 32
- Write DMA 32
- Write DMA Extended 32
- Write DMA FUA Extended 32
- Write DMA Without Retries 32
- Write Log Extended 32
- Write Multiple 32
- Write Multiple Extended 32
- Write Multiple FUA Extended 32
- Write Sectors 32
- Write Sectors Extended 32
- Write Sectors Without Retries 32







**Seagate Technology LLC**  
**920 Disc Drive, Scotts Valley, California 95066-4544, USA**  
*Publication Number: 100427570, Rev. D, Printed in U.S.A.*