

# SiliconDrive III

2.5-inch PATA Drive



**SSD-Dxxxx(x)-5000**



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1 Megabyte (MB) equals 1 Million Bytes; 1 Gigabyte (GB) equals 1 Billion Bytes. Accessible capacity may vary depending on the operating environment.

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**TABLE OF CONTENTS**

1.	TABLE OF CONTENTS.....	4
2.	LIST OF FIGURES.....	5
3.	LIST OF TABLES .....	6
4.	DESCRIPTION AND FEATURES .....	7
4.1	Overview.....	7
4.2	Features.....	7
4.3	Physical Dimensions.....	8
4.4	Pin Locations.....	9
4.5	Jumper Settings.....	9
5.	PRODUCT SPECIFICATIONS.....	9
5.1	System Performance .....	9
5.2	System Power Requirements .....	10
5.3	Reliability .....	10
5.4	Projected Operational Life Span .....	10
5.5	Product Capacity Specifications .....	11
5.6	Environmental Specifications.....	11
6.	ELECTRICAL SPECIFICATION.....	11
6.1	Absolute Maximum Ratings.....	11
6.2	DC Characteristics .....	12
7.	ATA COMMANDS.....	12
7.1	Identify Device Information .....	14
8.	ATA SPECIFICATIONS .....	20
9.	PART NUMBERING .....	21
9.1	Nomenclature .....	21
9.2	Part Numbers .....	21
9.3	RoHS 6 of 6 Product Labeling — Pb-Free Identification Label .....	22
10.	RELATED DOCUMENTATION.....	22
11.	INDEX.....	23

## LIST OF FIGURES

Figure 2-1 Physical Dimensions .....	8
Figure 2-2 Pin Locations .....	9
Figure 2-3 Jumper Settings .....	9

**LIST OF TABLES**

Table 3-1 System Performance.....	9
Table 3-2 System Power Requirements.....	10
Table 3-3 Reliability.....	10
Table 3-4 Operational Life Span.....	10
Table 3-5 Product Capacity Specifications.....	11
Table 3-6 Environmental Specifications.....	11
Table 4-1 Absolute Maximum Ratings.....	11
Table 4-2 DC Characteristics.....	12
Table 5-1 ATA Commands.....	12
Table 5-2 IDENTIFY DEVICE Information.....	14
Table 8-1 Part Numbers.....	21
Table 9-1 Related Documentation.....	22

## 1.0 DESCRIPTION AND FEATURES

### 1.1 Overview

The SiliconDrive III 2.5-inch PATA Drive is an optimal time-to-market replacement for hard drives and flash cards in host systems that require low power and scalable storage solutions.

Numerous Western Digital patented and patent-pending application-specific technologies can be integrated into SiliconDrive III to safeguard application data and software IP. Application notes detailing these performance-enhancing options are available under NDA.

SiliconDrive III technology is engineered exclusively for the high performance, high reliability and multi-year product lifecycle requirements of the embedded and communications market. Typical end-market applications include broadband data and voice networks, military systems, flight system avionics, medical equipment, industrial control systems, video surveillance, storage networking, VoIP, wireless infrastructure, and interactive kiosks.

Every SiliconDrive III is integrated with Western Digital's patented PowerArmor and patent-pending SiSMART to virtually eliminate storage systems failures.

PowerArmor prevents data corruption and loss from power disturbances by integrating patented technology into every SiliconDrive III.

SiSMART acts as an early warning system to eliminate unscheduled downtime by constantly monitoring and reporting the exact amount of remaining storage system useful life.

### 1.2 Features

- RoHS 6 of 6 compliant
- Integrated PowerArmor and SiSMART technology
- Available Capacities: 15 GB to 120 GB
- MTBF: 3,000,000 hours
- ATA-7 compatible
- Targeted read transfer rate: Up to 85 MB/s
- Targeted write transfer rate: Up to 60 MB/s
- Burst transfer rate: 133 MB/s
- Temperature: -40°C to 85°C
- Power consumption:
  - Standby: 0.5W
  - Read: 1.0W
  - Write: 1.0W
- Vibration: 16.3gRMS
- Shock: 1000G
- Altitude: 80,000 ft.

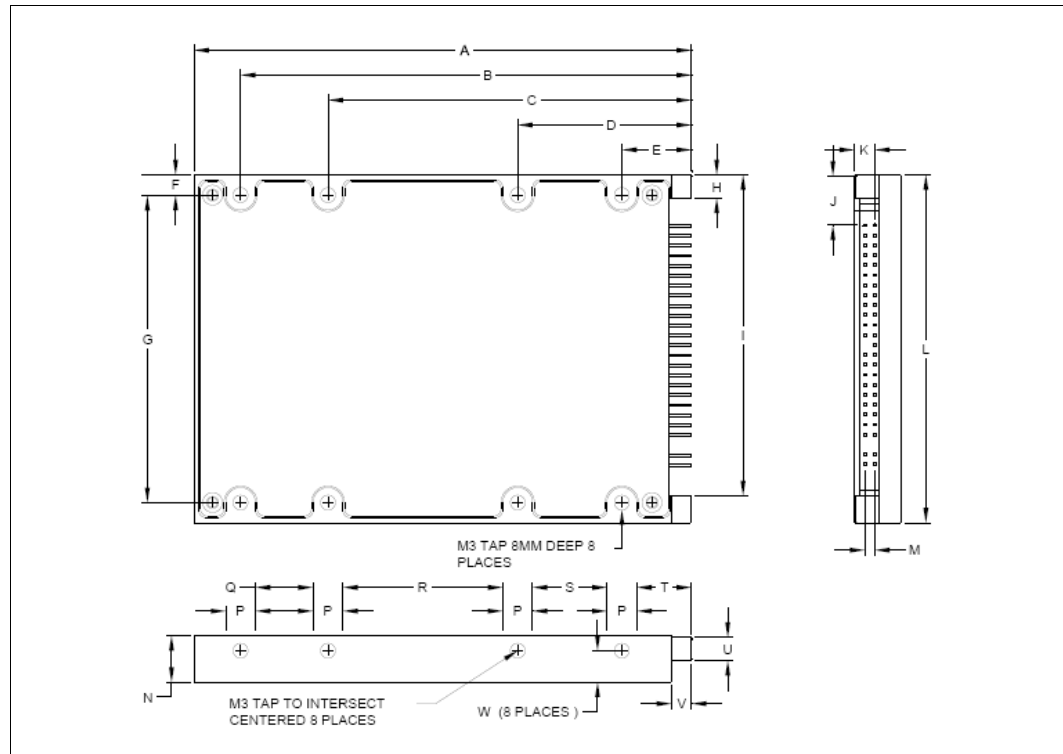
## 2.0 PHYSICAL SPECIFICATIONS

The SiliconDrive III 2.5-inch PATA Drive product is offered in an industry-standard 2.5-inch PATA Drive form factor. See “Part Numbering” on page 21 for details regarding 2.5-inch PATA Drive capacities.

### 2.1 Physical Dimensions

This section provides diagrams that describe the physical dimensions for the 2.5-inch PATA Drive.

Figure 2-1. Physical Dimensions



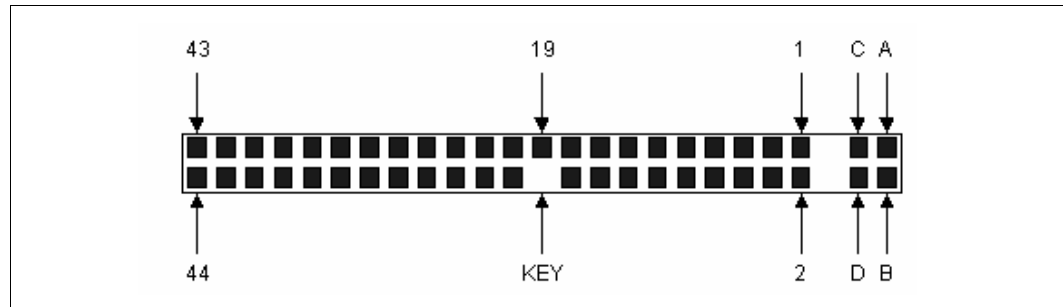
Dimension	Millimeters	Tolerance (mm)
A	100.00	±0.25
B	90.60	±0.125
C	73.03	±0.125
D	34.93	±0.125
E	14.00	±0.125
F	4.08	±0.125
G	61.70	±0.125
H	4.68	±0.125
I	64.42	±0.125
J	10.14	±0.51
K	3.99	±0.43

Dimension	Millimeters	Tolerance (mm)
L	69.85	±0.25
M	2.00	±0.125
N	9.40	±0.10
P	6.00	±0.125
Q	11.57	±0.125
R	32.10	±0.125
S	14.93	±0.125
T	11.00	±0.125
U	4.65	±0.125
V	4.00	±0.125
W	6.15	±0.125

## 2.2 Pin Locations

The following diagram identifies the pin locations of the 2.5-inch PATA Drive.

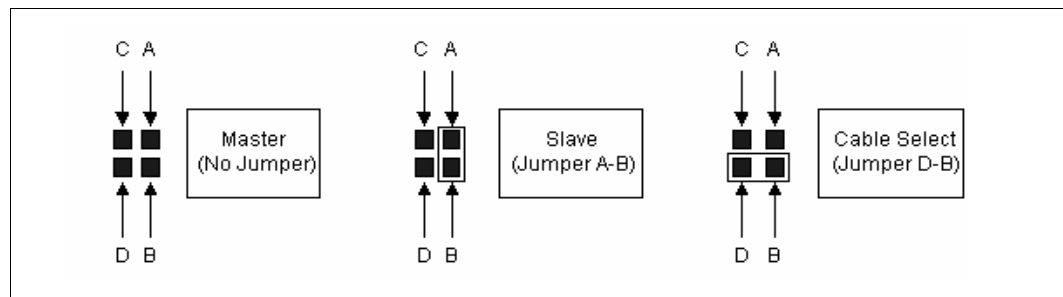
Figure 2-2. Pin Locations



## 2.3 Jumper Settings

The following diagram defines the SiliconDrive III 2.5-inch PATA Drive jumper settings.

Figure 2-3. Jumper Settings



## 3.0 PRODUCT SPECIFICATIONS

**Note:** All SiliconDrive III 2.5-inch PATA Drive values quoted are typical at 25°C and nominal supply voltage.

### 3.1 System Performance

Table 3-1. System Performance

Targeted Read Transfer Rate (Typical)	Up to 85 MB/s
Targeted Write Transfer Rate (Typical)	Up to 60 MB/s
Burst Transfer Rate	133 MB/s
Reset to Ready Startup Time	300 ms
Latency (Command to DRQ)	250 $\mu$ s (Typical)

### 3.2 System Power Requirements

Table 3-2. System Power Requirements

DC Input Voltage	5.0 ± 10%
Sleep (Standby)	0.5W
Read (Peak)	1.0W
Write (Peak)	1.0W

### 3.3 Reliability

Table 3-3. Reliability

MTBF (@ 25°C)	3,000,000 hours
Bit Error Rate	Bit Error Rate: < 1 non-recoverable error in 10 <sup>16</sup> bits read
Data Retention	10 years

### 3.4 Projected Operational Life Span

Table 3-4. Operational Life Span

SiliconDrive Part#	Capacity	Service Life*		GB Written per Day
SSD-D0120P(C/I)-5000	120 GB	26.0 Years	@	1265.6 GB
SSD-D0090P(C/I)-5000	90 GB	19.5 Years	@	1265.6 GB
SSD-D0060P(C/I)-5000	60 GB	13.0 Years	@	1265.6 GB
SSD-D0030P(C/I)-5000	30 GB	6.5 Years	@	1265.6 GB
SSD-D0015P(C/I)-5000	15 GB	3.2 Years	@	1265.6 GB

\* There are unlimited read cycles. Service life is determined using WD's LifeEST calculation at 100% duty cycle with 25% write cycles.

LifeEST is a comprehensive measurement that considers numerous factors to determine the projected life span of a SiliconDrive. A white paper that describes the benefits of LifeEST and how to calculate it can be found at [http://www.wdc.com/WDProducts/SSD/whitepapers/en/NAND\\_Evolution\\_0812.pdf](http://www.wdc.com/WDProducts/SSD/whitepapers/en/NAND_Evolution_0812.pdf).

The actual life of a SiliconDrive is dependent on the customer usage model. SiSMART is a patented technology of WD that enables host systems to monitor actual usage of a SiliconDrive in real time. SiSMART measures and reports the remaining life of a SiliconDrive. For more information on SiSMART, refer to the *Eliminating Unscheduled Downtime by Forecasting Useable Life* white paper at [http://www.wdc.com/WDProducts/SSD/whitepapers/en/SiliconDrive\\_SiSMART.pdf](http://www.wdc.com/WDProducts/SSD/whitepapers/en/SiliconDrive_SiSMART.pdf).

### 3.5 Product Capacity Specifications

Table 3-5. Product Capacity Specifications

Product Capacity*	Formatted Capacity (Bytes)	Number of Sectors
15GB	15,013,748,736	29,323,728
30 GB	30,016,659,456	58,626,288
60 GB	60,022,480,896	117,231,408
90 GB	90,028,302,336	175,836,528
120 GB	120,034,123,776	234,441,648

\* = Product capacity is calculated as per the IDEMA standard.

**Note:** As used for storage capacity, one megabyte (MB) = one million bytes and one gigabyte (GB) = one billion bytes. Total accessible capacity varies depending on operation environment.

### 3.6 Environmental Specifications

Table 3-6. Environmental Specifications

Temperature	0°C to 70°C (Commercial) -40°C to 85°C (Industrial)
Humidity	8% to 95% non-condensing
Vibration	16.3gRMS, MIL-STD-810F, Method 514.5, Procedure I, Category 24
Shock	1000G, Half-sine, 0.5 ms Duration 50g Pk, MIL-STD-810F, Method 516.5, Procedure I
Altitude	80,000 ft., MIL-STD-810F, Method 500.4, Procedure II

## 4.0 ELECTRICAL SPECIFICATION

For 2.5" PATA Drive signal descriptions, pin assignments, and AC characteristics, refer to the *Supplemental ATA Specifications* document (<http://ssdportal.wdc.com/documents/datasheets/003M-DP3R.pdf>).

### 4.1 Absolute Maximum Ratings

Table 4-1. Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Units
T <sub>S</sub>	Storage Temperature	-55	125	°C
T <sub>A</sub>	Operating Temperature	-40	85	°C
V <sub>CC</sub>	V <sub>CC</sub> with Respect to GND	-0.5	V <sub>CC</sub> + 0.5	V
V <sub>IN</sub>	Input Voltage	-0.3	V <sub>CC</sub> + 0.3	V

## 4.2 DC Characteristics

Table 4-2. DC Characteristics

Symbol	Parameter	5V $\pm$ 10%		Units
		Minimum	Maximum	
I <sub>LI</sub>	Input Leakage Current	-	10	$\mu$ A
I <sub>LO</sub>	Output Leakage Current	-	10	$\mu$ A
I <sub>CCR</sub>	I <sub>CC</sub> Read Current	-	200	mA
I <sub>CCW</sub>	I <sub>CC</sub> Write Current	-	200	mA
I <sub>CCS</sub>	I <sub>CC</sub> Standby Current	-	100	mA
V <sub>IL</sub>	Input Low Voltage	-	0.8	V
V <sub>IH</sub>	Input High Voltage	2.0	5.5	V
V <sub>OL</sub>	Output Low Voltage	-	0.5	V
V <sub>OH</sub>	Output High Voltage	2.4	-	V

## 5.0 ATA COMMANDS

The following table specifies which commands are supported by SiliconDrive III. Refer to the *ATA-7* specification for more information on the commands.

Table 5-1. ATA Commands

Command	Command Code	Supported?
NOP	00h	Yes
CFA REQUEST EXTENDED ERROR	03h	No
DEVICE RESET	08h	No
READ SECTOR(S)	20h	Yes
READ SECTOR(S) EXT	24h	No
READ DMA EXT	25h	No
READ DMA QUEUED EXT	26h	No
READ NATIVE MAX ADDRESS EXT	27h	No
READ MULTIPLE EXT	29h	No
READ LOG EXT	2Fh	No
WRITE SECTOR(S)	30h	Yes
WRITE SECTOR(S) EXT	34h	No
WRITE DMA EXT	35h	No
WRITE DMA QUEUED EXT	36h	No
SET MAX ADDRESS EXT	37h	No
CFA WRITE SECTORS W/OUT ERASE	38h	No
WRITE MULTIPLE EXT	39h	No
WRITE LOG EXT	3Fh	No

Table 5-1. ATA Commands (Continued)

<b>Command</b>	<b>Command Code</b>	<b>Supported?</b>
READ VERIFY SECTOR(S)	40h	Yes
READ VERIFY SECTOR(S) EXT	42h	No
SEEK	70h	Yes
CFA TRANSLATE SECTOR	87h	No
EXECUTE DEVICE DIAGNOSTIC	90h	Yes
DOWNLOAD MICROCODE	92h	No
PACKET	A0h	No
IDENTIFY PACKET DEVICE	A1h	No
SERVICE	A2h	No
SMART DISABLE OPERATIONS	B0h	No
SMART ENABLE/DISABLE AUTOSAVE	B0h	No
SMART ENABLE OPERATIONS	B0h	No
SMART EXECUTE OFF_LINE	B0h	No
SMART READ DATA	B0h	No
SMART READ LOG SECTOR	B0h	No
SMART RETURN STATUS	B0h	No
SMART WRITE LOG SECTOR	B0h	No
DEVICE CONFIGURATION FREEZE LOCK	B1h	No
DEVICE CONFIGURATION IDENTIFY	B1h	No
DEVICE CONFIGURATION RESTORE	B1h	No
DEVICE CONFIGURATION SET	B1h	No
CFA ERASE SECTORS	C0h	No
READ MULTIPLE	C4h	Yes
WRITE MULTIPLE	C5h	Yes
SET MULTIPLE MODE	C6h	Yes
READ DMA QUEUED	C7h	No
READ DMA	C8h	Yes
WRITE DMA	CAh	Yes
WRITE DMA QUEUED	CCh	No
CFA WRITE MULTIPLE W/OUT ERASE	CDh	No
CHECK MEDIA CARD TYPE	D1h	No
GET MEDIA STATUS	DAh	No
MEDIA LOCK	DEh	No
MEDIA UNLOCK	DFh	No
STANDBY IMMEDIATE	E0h	Yes
IDLE IMMEDIATE	E1h	Yes

Table 5-1. ATA Commands (Continued)

Command	Command Code	Supported?
STANDBY	E2h	Yes
IDLE	E3h	Yes
READ BUFFER	E4h	Yes
CHECK POWER MODE	E5h	Yes
SLEEP	E6h	Yes
FLUSH CACHE	E7h	Yes
WRITE BUFFER	E8h	Yes
FLUSH CACHE EXT	EAh	No
IDENTIFY DEVICE	ECh	Yes
MEDIA EJECT	EDh	No
SET FEATURES (Set Transfer Mode 03h Only)	EFh	Yes
SECURITY SET PASSWORD	F1h	No
SECURITY UNLOCK	F2h	No
SECURITY ERASE PREPARE	F3h	No
SECURITY ERASE UNIT	F4h	No
SECURITY FREEZE LOCK	F5h	No
SECURITY DISABLE PASSWORD	F6h	No
READ NATIVE MAX ADDRESS	F8h	No
SET MAX ADDRESS	F9h	No

## 5.1 Identify Device Information

The information in the following table is returned upon issuing an IDENTIFY DEVICE command to the SiliconDrive III. Fields marked as Reserved or Obsolete in the ATA-6 specification are omitted in this table.

Table 5-2. IDENTIFY DEVICE Information

Word	Value		Description
0	0040h	15 7 6	General configuration bit-significant information: 0 = ATA device 0 = Fixed device 1 = Device is not removable
2	C837h	-	Specific configuration
23-26	XXXXh	-	Firmware revision (eight ASCII characters)
27-46	XXXXh	-	Model number (40 ASCII characters)

Table 5-2. IDENTIFY DEVICE Information (Continued)

Word	Value		Description
47	8001h	15-8 7-0 - -	Multiple count: 80h 00h = Reserved 01h-10h = Maximum number of sectors that shall be transferred per interrupt on READ/WRITE MULTIPLE commands 11h-FFh = Reserved
49	0F00h	13 11 10 9 8	Capabilities: 0 = Standby timer values shall be managed by the device 1 = IORDY is supported 1 = IORDY may be disabled 1 = LBA is supported 1 = DMA is supported 1 = IORDY is supported
50	4000h	15 14 0	Capabilities: Shall be cleared to 0 Shall be set to 1 Shall be set to one to indicate a device specific Standby timer value minimum
53	0007h	2 1	Field validity: 1 = Fields reported in word 88 are valid 1 = Fields reported in words 64-70 are valid
59	0101h	8 7-0	1 = Multiple sector setting is valid Xxh = Current setting for number of sectors that shall be transferred per interrupt on R/W Multiple command
60-61	XXXXh	-	Total number of user addressable sectors
63	XXX7h	10 9 8 2 1 0	1/0 = Multiword DMA mode 2 is selected/not selected 1/0 = Multiword DMA mode 1 is selected/not selected 1/0 = Multiword DMA mode 0 is selected/not selected 1 = Multiword DMA mode 2 and below are supported 1 = Multiword DMA mode 1 and below are supported 1 = Multiword DMA mode 0 is supported
64	0003h	7-0	PIO modes supported
65	0078h	15-0	Minimum Multiword DMA transfer cycle time per word: Cycle time in nanoseconds
66	0078h		Manufacturer's recommended Multiword DMA transfer cycle time:

Table 5-2. IDENTIFY DEVICE Information (Continued)

Word	Value		Description
		15-0	Cycle time in nanoseconds
67	0078h	15-0	Minimum PIO transfer cycle time without flow control: Cycle time in nanoseconds
68	0078h	15-0	Minimum PIO transfer cycle time with IORDY flow control: Cycle time in nanoseconds
75	0000h	4-0	Queue depth: Maximum queue depth -1
80	0070h	- 7 6 5 4 3	Major version number: 0000h or FFFFh = Device does not report version 1 = Supports ATA/ATAPI-7 1 = Supports ATA/ATAPI-6 1 = Supports ATA/ATAPI-5 1 = Supports ATA/ATAPI-4 0 = Does not support ATA-3
81	0000h	-	Minor version number: 0000h or FFFFh = device does not report version
82	7008h	14 13 12 10 9 8 7 6 5 4 3 2 1	Command set supported: 1 = NOP command is supported 1 = READ BUFFER command is supported 1 = WRITE BUFFER command is supported 0 = Host Protected Area feature set is not supported 0 = DEVICE RESET command is not supported 0 = SERVICE interrupt is not supported 0 = Release interrupt is not supported 0 = Look-ahead is not supported 0 = Write cache is not supported Shall be cleared to 0 to indicate that the PACKET Command feature set is not supported 1 = Mandatory Power Management feature set is supported 0 = Does not support Removable Media feature set 0 = Does not support Security Mode feature set

Table 5-2. IDENTIFY DEVICE Information (Continued)

Word	Value		Description
		0	0 = Does not support SMART feature set
83	5000h	15	Command sets supported: Shall be cleared to 0
		14	Shall be set to 1
		13	0 = FLUSH CACHE EXT command is not supported
		12	1 = Mandatory FLUSH CACHE command is supported
		11	0 = Device Configuration Overlay feature set is not supported
		10	0 = 48-bit Address feature set is not supported
		9	0 = Automatic Acoustic Management feature set is not supported
		8	0 = SET MAX security extension is not supported
		7	See Address Offset Reserved Area Boot, NCITS TR27:2001
		6	0 = SET FEATURES subcommand is not required to spinup after power-up
		5	0 = Power-Up In Standby feature set is not supported
		4	0 = Removable Media Status Notification feature set is not supported
		3	0 = Advanced Power Management feature set is not supported
		2	0 = CFA feature set is not supported
		1	0 = READ/WRITE DMA QUEUED is not supported
		0	0 = DOWNLOAD MICROCODE command is not supported
84	4000h		Command set/feature supported extension:
		15	Shall be cleared to 0
		14	Shall be set to 1
		5	0 = General Purpose Logging feature set is not supported
		3	0 = Media Card Pass Through Command feature set is not supported
		2	0 = Media serial number is not supported
		1	0 = SMART self-test is not supported

Table 5-2. IDENTIFY DEVICE Information (Continued)

Word	Value		Description
		0	0 = SMART error logging is not supported
85	7008h	14	Command set/feature enabled: 1 = NOP command is enabled
		13	1 = READ BUFFER command is enabled
		12	1 = WRITE BUFFER command is enabled
		10	0 = Host Protected Area feature set is disabled
		9	0 = DEVICE RESET command is disabled
		8	0 = SERVICE interrupt is disabled
		7	0 = Release interrupt is disabled
		6	0 = Look-ahead is disabled
		5	0 = Write cache is disabled
		4	Shall be cleared to 0 to indicate that the PACKET Command feature set is not supported
		3	1 = Power Management feature set is enabled
		2	0 = Removable Media feature set is disabled
		1	0 = Security Mode feature set is disabled
		0	0 = SMART feature set is disabled
86	1000h	13	Command set/feature enabled: 0 = FLUSH CACHE EXT command is not supported
		12	1 = FLUSH CACHE command is supported
		11	0 = Device Configuration Overlay is not supported
		10	0 = 48-bit Address features set is not supported
		9	0 = Automatic Acoustic Management feature set is disabled
		8	0 = SET MAX security extension is disabled by SET MAX SET PASSWORD
		7	See Address Offset Reserved Area Boot, NCITS TR27:2001

Table 5-2. IDENTIFY DEVICE Information (Continued)

Word	Value		Description
		6	0 = SET FEATURES subcommand is not required to spin-up after power-up
		5	0 = Power-Up In Standby feature set is disabled
		4	0 = Removable Media Status Notification feature set is disabled
		3	0 = Advanced Power Management feature set is disabled
		2	0 = CFA feature set is disabled
		1	0 = READ/WRITE DMA QUEUED command is not supported
		0	0 = DOWNLOAD MICROCODE command is not supported
87	4000h	15	Command set/feature default: Shall be cleared to 0
		14	Shall be set to 1
		5	0 = General Purpose Logging feature set is not supported
		3	0 = Media Card Pass Through Command feature set is disabled
		2	0 = Media serial number is invalid
		1	0 = SMART self-test is not supported
		0	0 = SMART error logging is not supported
88	XX7Fh	13	1/0 = UDMA mode 5 is selected/not selected
		12	1/0 = UDMA mode 4 is selected/not selected
		11	1/0 = UDMA mode 3 is selected/not selected
		10	1/0 = UDMA mode 2 is selected/not selected
		9	1/0 = UDMA mode 1 is selected/not selected
		8	1/0 = UDMA mode 0 is selected/not selected
		6	1 = Ultra DMA mode 6 and below are supported
		5	1 = Ultra DMA mode 5 and below are supported
		4	1 = Ultra DMA mode 4 and below are supported
		3	1 = Ultra DMA mode 3 and below are supported
		2	1 = Ultra DMA mode 2 and below are supported
		1	1 = Ultra DMA mode 1 and below are supported
		0	1 = Ultra DMA mode 0 is supported
89	0000h	-	Time required for security erase unit completion

Table 5-2. IDENTIFY DEVICE Information (Continued)

Word	Value		Description
90	0000h	-	Time required for Enhanced security erase completion
91	0000h	-	Current advanced power management value
92	0000h	-	Master Password Revision Code
94	0000h	15-8 7-0	Vendor's recommended acoustic management value Current automatic acoustic management value
100-103	0000h 0000h 0000h 0000h	-	Maximum user LBA for 48-bit Address feature set
127	0000h	1-0	00 = Removable Media Status Notification feature set is not supported
128	0000h	8 5 4 3 2 1 0	Security status: Security level 0 = High 0 = Enhanced security erase is not supported 0 = Security count is not expired 0 = Security is not frozen 0 = Security is unlocked 0 = Security is disabled 0 = Security is not supported

## 6.0 ATA SPECIFICATIONS

For 2.5" PATA Drive ATA specifications, refer to the *Supplemental ATA Specifications* document (<http://ssdportal.wdc.com/documents/datasheets/003M-DP3R.pdf>).

## 7.0 SALES AND SUPPORT

To order or obtain information on pricing and delivery, contact your WD Sales Representative.

## 8.0 PART NUMBERING

### 8.1 Nomenclature

The following table defines the SiliconDrive III 2.5-inch PATA Drive part numbering scheme.

<b>SSD-</b> (Product Family)	<b>D</b> (Form Factor)	<b>YYYY</b> (Capacity)	<b>X</b> (Interface)	<b>X</b> (Temperature)	<b>-5000</b> (Part Number Suffix) K = Kit
			P = PATA	<ul style="list-style-type: none"> <li>I = -40°C to 85°C (Industrial)</li> <li>C = 0°C to 70°C (Commercial)</li> </ul>	
		Capacity: 0015 = 15 GB to 0120 = 120 GB			
	D = 2.5" Drive				
WD's SiliconDrive					

### 8.2 Part Numbers

The following table lists the SiliconDrive III part numbers.

Table 8-1. Part Numbers

Part Number	Capacity
SSD-D0120P(C/I)-5000	120 GB
SSD-D0090P(C/I)-5000	90 GB
SSD-D0060P(C/I)-5000	60 GB
SSD-D0030P(C/I)-5000	30 GB
SSD-D0015P(C/I)-5000	15 GB

### 8.3 RoHS 6 of 6 Product Labeling — Pb-Free Identification Label



The Pb-free identification label indicates that the enclosed components/devices and/or assemblies do not contain any lead (i.e., they are lead-free, as defined in RoHS directive 2002/95/ED). The above symbol is on all RoHS 6 of 6 compliant product labels.

## 9.0 RELATED DOCUMENTATION

For more information, visit <http://www.wdc.com> or contact your WD Sales Representative.

Table 9-1. Related Documentation

<b>SiliconDrive III Application-Specific Technology</b>	<b>Description</b>	<b>Document</b>
ATA Specification Reference Document	Supplemental ATA specification information.	<i>Supplemental ATA Specifications document (<a href="http://ssdportal.wdc.com/documents/datasheets/003M-DP3R.pdf">http://ssdportal.wdc.com/documents/datasheets/003M-DP3R.pdf</a>)</i>
PowerArmor	Eliminates drive corruption.	<i>Eliminating Drive Corruption from Power Disturbances White Paper (<a href="http://www.wdc.com/WDPProducts/SSD/whitepapers/en/SiliconDrive_PowerArmor.pdf">http://www.wdc.com/WDPProducts/SSD/whitepapers/en/SiliconDrive_PowerArmor.pdf</a>)</i>
SiSMART	Calculates remaining useful life.	<i>Eliminating Unscheduled Downtime by Forecasting Solid State Drive (SSD) Useable Life White Paper (<a href="http://www.wdc.com/WDPProducts/SSD/whitepapers/en/SiliconDrive_SiSMART.pdf">http://www.wdc.com/WDPProducts/SSD/whitepapers/en/SiliconDrive_SiSMART.pdf</a>)</i>

**INDEX****—A—**

Absolute Maximum Ratings, 11  
Altitude, 11  
ATA Commands, 12  
ATA Specifications, 20

**—B—**

Bit Error Rate, 10  
Burst transfer rate, 7, 9

**—C—**

Capacities, 7  
Capacity Specifications, 11  
Copyright, 2

**—D—**

Data Retention, 10  
DC Characteristics, 12  
DC Input Voltage, 10  
Description, 7  
Documentation, 22

**—E—**

Electrical Specification, 11  
Environmental Specifications, 11

**—F—**

Features, 7

**—G—**

GB Written per Day, 10

**—H—**

Humidity, 11

**—I—**

Identify Device Information, 14

**—J—**

Jumper Settings, 9

**—L—**

Latency, 9  
LifeEST, 10

**—M—**

MTBF, 7, 10

**—N—**

Nomenclature, 21

**—O—**

Operational Life Span, 10

**—P—**

Part Numbering, 21

Part Numbers, 21  
Physical Dimensions, 8  
Pin Locations, 9  
Power consumption, 7  
PowerArmor, 7

**—R—**

Read, 7  
Read (Peak), 10  
Related Documentation, 22  
Reset to Ready Startup Time, 9  
Revision History, 3  
RoHS 6 of 6, 7, 22

**—S—**

Sales and Support, 21  
Service Life, 10  
Shock, 7, 11  
SiSMART, 7  
Sleep, 10  
Standby, 7, 10

**—T—**

Targeted read transfer rate, 7, 9  
Targeted write transfer rate, 7, 9  
Temperature, 7, 11  
Trademarks, 2

**—V—**

Vibration, 7, 11

**—W—**

Write, 7  
Write (Peak), 10

Western Digital  
Solid State Storage Business Unit  
20511 Lake Forest Drive  
Lake Forest, CA 92630 U.S.A.

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