

Serial ATA NAND Flash Drive

--- SATxx-xxxB Series ---

Overview

The NAND Flash Drive SATxx-xxxB series is a family of flash memory drives that incorporate a controller chip and nonvolatile NAND flash memory with an Serial ATA interface. The series consists having capacities of 128MB to 8.0GB. Each drive supports a range of data transfer modes up to Ultra DMA mode 4 (66.6MB/sec).

These semiconductor-based nonvolatile drives are ideal for ATMs, industrial machines, POS terminals, measuring equipment, ticket vending machines, parking systems, and other applications requiring environmental resistance.

Features

- Capacity
512MB ~ 8.0GB (2.5/3.5inch)
- Form Factor
2.5 inch type (HDD compatible)
3.5 inch type (HDD compatible)
- IDE Interface
Ultra SATA/1500 ; 1.5Gbps
- Power supply
VCC 5.0 V \pm 10%
- Operating temperature
Commercial grade : 0°C ~70°C
Industrial grade : -20°C~85°C
- Performance

To/From host	1.5Gbps/sec. (150MB/sec.) (Theoretically)
Sustained Read speed	25 MB/sec. (MAX) [512MB,1GB,2GB,4GB] 20 MB/sec. (MAX) [8GB]
Sustained Write speed	15 MB/sec. (MAX)
Shock resistance	1100G(MAX) [non-operating state]
Vibration resistance	16.5G peak (20~2000 Hz) [operating state]
Write/Erase endurance	100,000 cycles
- Functions
 - SMART function for managing drive lifetime
 - SECURITY function for data protection

Product Models2.5-inch

Model No.	Unformatted[MB] (*1)	Capacity[byte]	Max LBA	Cylinder	Head	Sector
SAT25-512B	488MB	512,483,328	1,000,944	993	16	63
SAT25-01GB	976MB	1,024,450,560	2,000,880	1985	16	63
SAT25-02GB	1946MB	2,040,643,584	3,985,632	3954	16	63
SAT25-04GB	3882MB	4,071,481,344	7,952,112	7889	16	63
SAT25-08GB	7765MB	8,142,962,688	15,904,224	15778	16	63

3.5-inch

Model No.	Unformatted[MB] (*1)	Capacity[byte]	Max LBA	Cylinder	Head	Sector
SAT35-512B	488MB	512,483,328	1,000,944	993	16	63
SAT35-01GB	976MB	1,024,450,560	2,000,880	1985	16	63
SAT35-02GB	1946MB	2,040,643,584	3,985,632	3954	16	63
SAT35-04GB	3882MB	4,071,481,344	7,952,112	7889	16	63
SAT35-08GB	7765MB	8,142,962,688	15,904,224	15778	16	63

(*1) Capacity when shipped. The actual capacity (after formatting) in the user environment may be smaller than this value.

Product Specifications

- Capacity:
488MB, 976MB, 1946MB, 3882MB, 7765MB (unformatted)

- Performance:

To/From host	1.5Gbps/sec. (150MB/sec.) (Theoretically)
Sustained Read	25 MB/sec. (Max) [512MB,1GB,2GB,4GB]
	20MB/sec. (Max) [8GB]
Sustained Write	15 MB/sec. (Max)

- Power supply voltage:
5.0 V \pm 10%

- Power consumption:

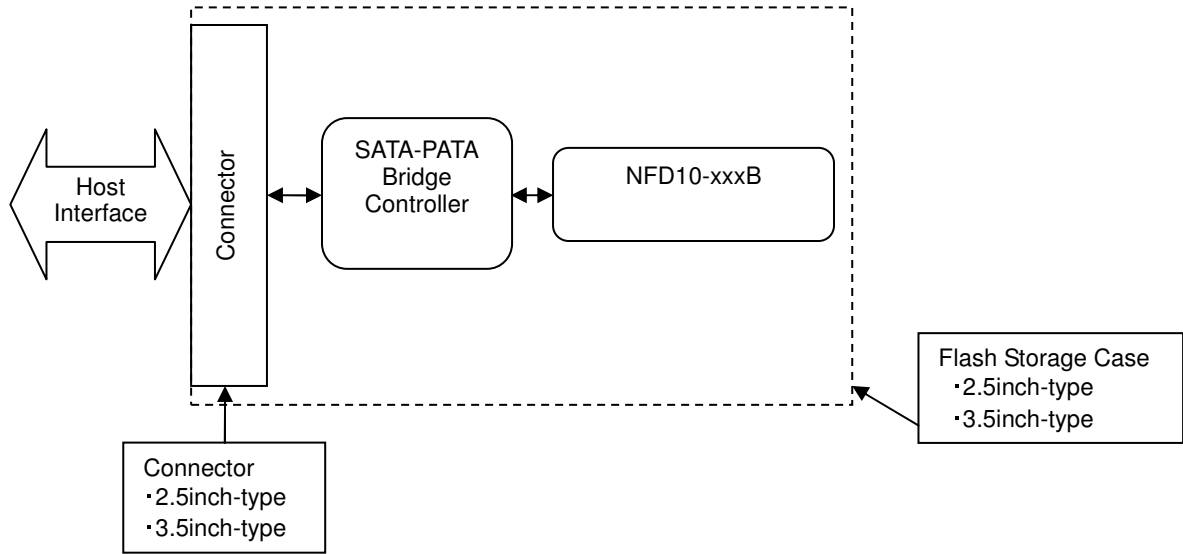
Read mode	175 mA (Typ.)
Write mode	180 mA (Typ.)
Idle mode	85 mA (Typ.)

- Environmental conditions:

Operating temperature	-20°C ~ 85°C (Industrial grade)
Storage temperature	-40°C ~ 90°C (Industrial grade)
Humidity	95% (Max) [non condensing]
Shock	1100G (Max) (along 3 axes) [non-operating]
Vibration	16.5G peak (20Hz~2000Hz) [operating]

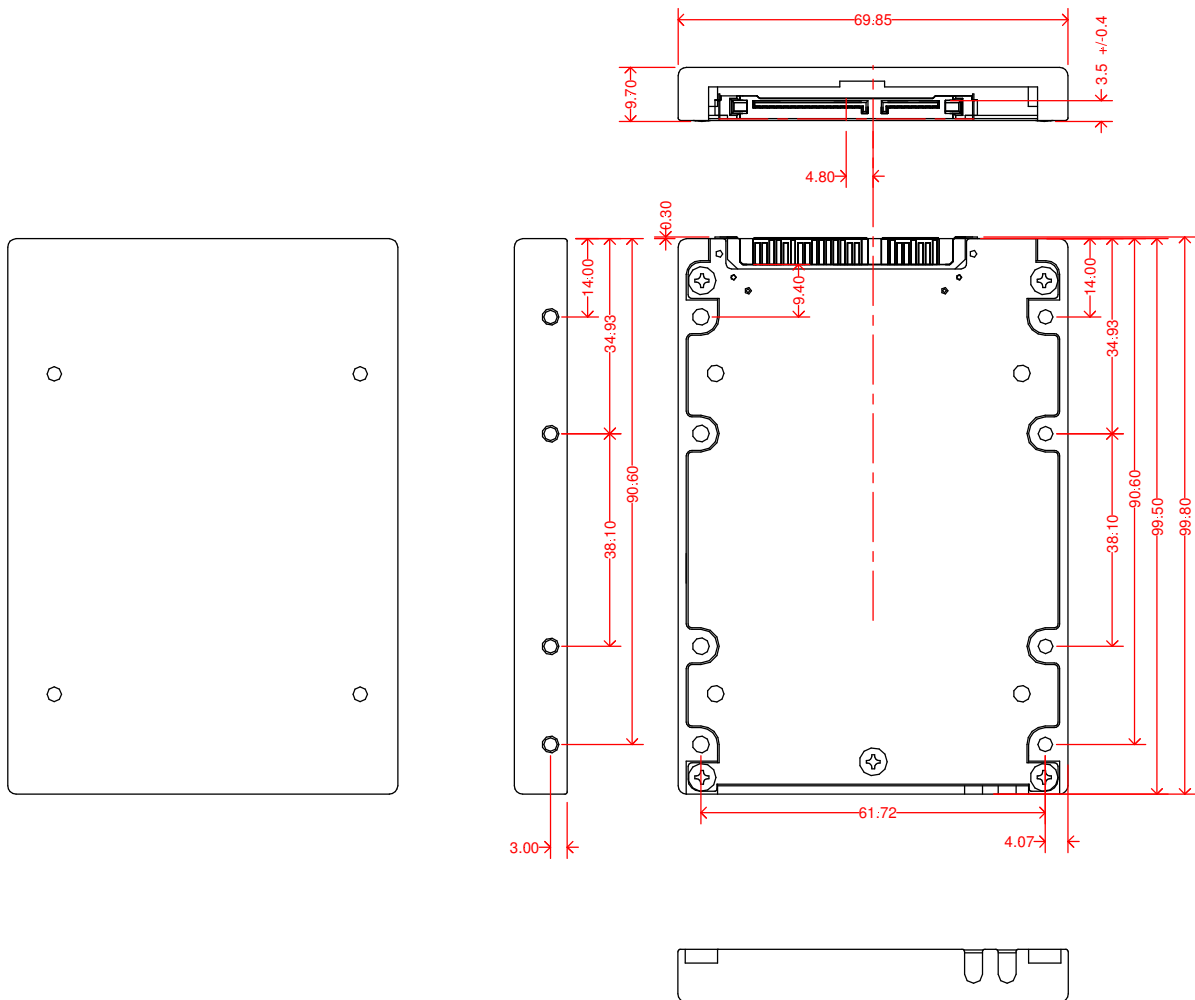
- Reliability:
ECC 4-bit error correction

Block Diagram



Package view

2.5-inch type

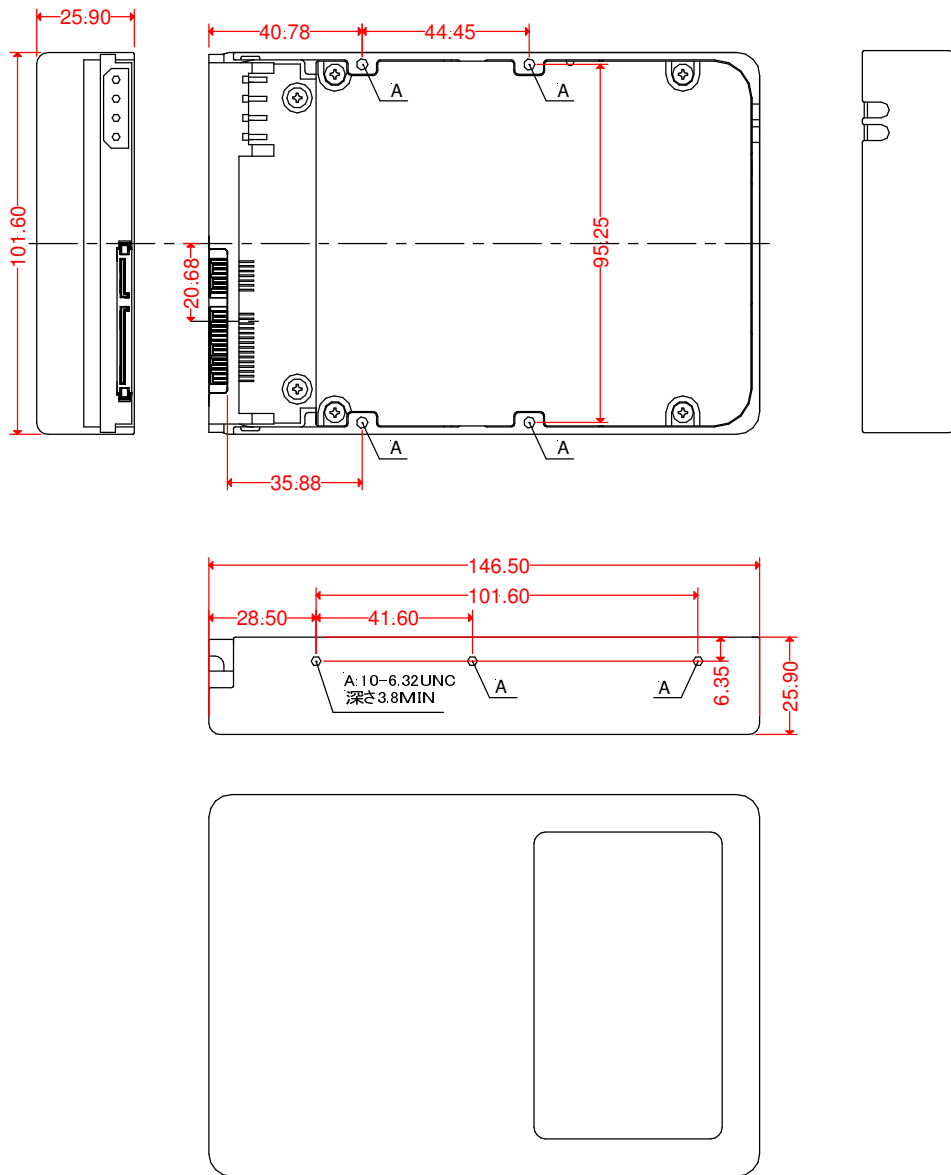


2.5-inch Flash Drive

Specification

SFF-8223 2.5" Drive w/Serial Attachment Connector
 SFF-8201 2 1/2" drive form factor dimensions

3.5-inch type



3.5-inch Flash Drive

Specification

- SFF-8323 3 1/2" drive w/Serial Attachment Connector
- SFF-8301 3 1/2" drive form factor dimensions

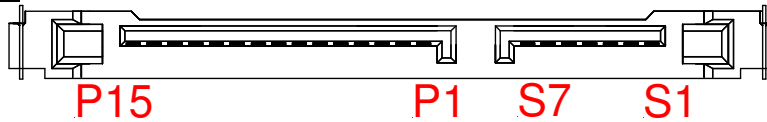
Pin Assignment (2.5inch/3/5inch)

	No.	Plug Connector pin definition		Singal	I/O
Signal	S1	Gnd	2 nd mate	Gnd	-
	S2	A+	Differential signal A	RX+	Input
	S3	A-		RX-	Input
	S4	Gnd	2 nd mate	Gnd	-
	S5	B-	Differential signal B	TX-	Output
	S6	B+		TX+	Output
	S7	Gnd	2 nd mate	Gnd	-

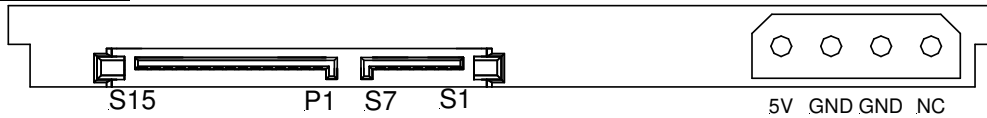
Power	P1	V33	3.3V power(Unused)	3.3V
	P2	V33	3.3V power(Unused)	3.3V
	P3	V33	3.3V power, pre-charge, 2 nd mate(Unused)	3.3V
	P4	Gnd	1 st mate	Gnd
	P5	Gnd	2 nd mate	Gnd
	P6	Gnd	2 nd mate	Gnd
	P7	V5	5V power, pre-charge, 2 nd mate	5V
	P8	V5	5V power	5V
	P9	V5	5V power	5V
	P10	Gnd	2 nd mate	Gnd
	P11	Reserved	Reserved	Reserved
	P12	Gnd	1 st mate	Gnd
	P13	V12	12V power, pre-charge, 2 nd mate(Unused)	V12
	P14	V12	12V power(Unused)	V12
	P15	V12	12V power(Unused)	V12

Notes; This drive used 5V power only. 3.3V and 12V power are not used.

2.5inch Connector



3.5inch Connector



Signal Description

- TX+/TX-
High speed differential signal for data receiving.
- RX+/RX-
High speed differential signal for data transmission.

Please refer to following specification for detail.

Serial ATA: High Speed Serialized AT Attachment Revision 1.0a 7-January – 2003

Maximum Ratings

Symbol	Parameter	Rating	Units
		Industrial Grade	
V _{CC}	Power Supply	-0.6 to 6.0	V
T _{STG}	Storage temperature	-40 to 90	°C
T _{OPR}	Operating temperature	-20 to 85	°C

Allowable DC Operating Conditions (2.5/3.5inch type ; Ta = 0°C~70°C, V_{CC} = 5.0 V ± 10%)

Symbol	Parameter	Min	Typ	Max	Units
V _{CC}	Power Supply	4.5	5.0	5.5	V

DC Characteristics (Ta = 0°C~70°C, V_{CC} = 5.0 V ± 10%)

Symbol	Parameter	Min	Typ	Max	Units
I _{CCR}	Operating current (Read)	-	175	-	mA
I _{CCW}	Operating current (Write)	-	180	-	mA
I _{CCI}	Idle mode current	-	85	-	mA

System Performance (Ta = 0°C ~ 70°C, V_{CC} = 5.0 V ± 10%)

Parameter	Performance
Data transfer rate to / from host	150M byte / sec burst(max.) , theoretically
Sustained read transfer rate	25M byte / sec (max.) , actually 512MB~4GB 20M byte / sec (max.) , actually 8GB
Sustained write transfer rate	15M byte / sec (max.) , actually

Frame Information Structure (FIS)

A FIS is a group of DWORD that convey information between host and drive.

- Register - Host to Device
- Register - Device to Host
- Set Device Bits - Device to Host
- DMA Activate - Device to Host
- DMA Setup First Party DMA Setup - Device to Host or Host to Device (Bidirectional)
- BIST Activate - Bidirectional
- PIO Setup - Device to Host
- Data - Host to Device or Device to Host (Bidirectional)

Register - Host to Device(RegHD)

Register - Host to Device layout(CHS mode)

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Features							Command							C	R	R	Reserved (0)							FIS Type (27h)							
1	Device/Head							Cylinder High							Cylinder Low							Sector Number										
2	Reserved (0)							Reserved (0)							Reserved (0)							Reserved (0)										
3	Control							Reserved (0)							Reserved (0)							Sector Count										
4	Reserved (0)							Reserved (0)							Reserved (0)							Reserved (0)										

Register - Host to Device layout(LBA mode)

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Features							Command							C	R	R	Reserved (0)							FIS Type (27h)							
1	Device/LBA 27:24							LBA 23:16							LBA 15:8							LBA 7:0										
2	Reserved (0)							Reserved (0)							Reserved (0)							Reserved (0)										
3	Control							Reserved (0)							Reserved (0)							Sector Count										
4	Reserved (0)							Reserved (0)							Reserved (0)							Reserved (0)										

Field Name	Description
FIS Type	Set to a value of 27h
C	This bit is set to one when the register transfer is due to an update of the Command register. The bit is set to zero when the register transfer is due to an update of the Device Control register.
Command	Contains the contents of the Command register of the Shadow Register Block.
Sector Number	Contains the contents of the Sector Number register of the Shadow Register Block. CHS mode : Initial sector number that transfer begins LBA mode : LBA[7:0] setting
Control	Contains the contents of the Device Control register of the Shadow Register Block.
Cyl Low	Contains the contents of the Cylinder Low register of the Shadow Register Block.
Cyl High	Contains the contents of the Cylinder High register of the Shadow Register Block.
Dev / Head	Contains the contents of the Device / Head register of the Shadow Register Block.
Features	Contains the contents of the Features register of the Shadow Register Block.
R	Reserved bits – shall be set to 0.
Sector Count	Contains the contents of the Sector Count register of the Shadow Register Block.
Sector Number	Contains the contents of the Sector Number register of the Shadow Register Block.

Register - Device to Host

Register - Device to Host layout(CHS mode)

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Error								Status								R	I	R	Reserved (0)								FIS Type (34h)							
1	Device/Head								Cylinder High								Cylinder Low								Sector Number										
2	Reserved (0)								Reserved (0)								Reserved (0)								Reserved (0)										
3	Reserved (0)								Reserved (0)								Reserved (0)								Sector Count										
4	Reserved (0)								Reserved (0)								Reserved (0)								Reserved (0)										

Register - Device to Host layout(LBA mode)

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Error								Status								R	I	R	Reserved (0)								FIS Type (34h)							
1	Device/LBA 27:24								LBA 23:16								LBA 15:8								LBA 7:0										
2	Reserved (0)								Reserved (0)								Reserved (0)								Reserved (0)										
3	Reserved (0)								Reserved (0)								Sector Count (exp)								Sector Count										
4	Reserved (0)								Reserved (0)								Reserved (0)								Reserved (0)										

Set Device Bits - Device to Host

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0					
0	Error								R	Status Hi				R	Status Lo				R	I	R	Reserved (0)								FIS Type (A1h)							
1	Reserved (0)																																				

DMA Activate - Device to Host

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Reserved (0)								Reserved (0)								R	R	R	Reserved (0)								FIS Type (39h)							

DMA Setup First Party DMA Setup - Device to Host or Host to Device (Bidirectional)

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Reserved (0)								Reserved (0)								R	I	D	Reserved (0)								FIS Type (41h)							
1	DMA Buffer Identifier Low																																		
2	DMA Buffer Identifier High																																		
3	Reserved (0)																																		
4	DMA Buffer Offset																																		
5	DMA Transfer Count																																		
6	Reserved (0)																																		

BIST Activate - Bidirectional

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Reserved (0)								Pattern definition T A S L F P R V								R	R	R	Reserved (0)								FIS Type (58h)							
1	Data [31:24]								Data [23:16]								Data [23:16]								Data [7:0]										
2	Data [31:24]								Data [23:16]								Data [23:16]								Data [7:0]										

PIO Setup - Device to Host

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Error								Status								R	I	D	Reserved (0)								FIS Type (5Fh)							
1	Device								LBA High								LBA Mid								LBA Low										
2	Reserved (0)								LBA High (exp)								LBA Mid (exp)								LBA Low (exp) (0)										
3	E_Status								Reserved (0)								Sector Count (exp)								Sector Count										
4	Reserved (0)																Transfer Count																		

Data - Host to Device or Device to Host (Bidirectional)

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
0	Reserved (0)								Reserved (0)								R	R	R	Reserved (0)								FIS Type (46h)							
...	N DWORDs of data (minimum of one DWORD - maximum of 2048 DWORDs)																																		
...																																			
n																																			

Data register

Write/Read register. Used to transfer data between the host and drive.

Bit															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DD[15:8]								DD[7:0]							

Error register

Read-only register. Valid when the error bit (bit 0) in the Status register is set to "1".

Bit assignment and values in the Error register may vary with the ATA command.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved	UNC or WTERR	0	IDNF	0	ABRT	0	AMNF

Bit	Name	Function
7	Reserved	Reserved Bit
6	UNC (Uncorrectable Data Error) or WTERR(Write Error)	Indicates that an uncorrectable error has been detected during data transfer for a Read command. This bit is also set if an attempt has been made to write data to a write-protected area or if a write has been attempted when the alternate block count was close to 0%.
4	IDNF (ID Not Found)	Indicates that the requested sector has not been found.
2	ABRT (Aborted Command)	Indicates that the requested command has aborted. If an error occurs, the Status register and Error register are only used to determine the cause of the error.
0	AMNF (Address Mark Not Found)	Set when a general error occurs.

Features register

Write-only register. The value written to this register depends on the ATA command. Bit assignment and values are defined for each command.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Features byte							

Sector count register

Write/read register. Specifies the number of data sectors requested for a write or read between the host and drive. A value of "00h" in this register specifies 256 sectors.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Sector count byte							

Sector number register

This register contains the starting sector number, which is started by following sector transfer command.

CHS mode : Initial sector number that transfer begins

LBA mode : LBA[7:0] setting

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Sector number byte (CHS mode) / LBA 07 – 00 (LBA mode)							

Cylinder Low registers

This register contains the low 8-bit of the starting cylinder address, which is started by following sector transfer command.

CHS mode : Lower byte of the cylinder

LBA mode : LBA [15:8] setting

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Cylinder low byte (CHS mode) / LBA 15 – 08 (LBA mode)							

Cylinder High Registers

This register contains the high 8-bit of the starting cylinder address, which is started by following sector transfer command.

CHS mode : Upper byte of the cylinder

LBA mode : LBA[23:16] setting

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Cylinder high byte (CHS mode) / LBA 23 – 16 (LBA mode)							

Device/Head Register

This register must be set first before other registers are set.

Write/read register. Bit assignment and values vary with the ATA command.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
obs	LBA	obs	DEV	Head number			

Bit	Name	Function
7	obs (Obsolete)	Always set to "1".
6	LBA	Flag for selecting CHS or LBA mode. Setting LBA to 0 selects CHS mode while setting the bit to 1 selects LBA mode. In LBA mode, logical block addresses are assigned as follows: LBA07-00: Sector number register D7-0 LBA15-08: Cylinder low register D7-0 LBA23-16: Cylinder high register D7-0 LBA27-24: Device/Head register HS3-0
5	obs (Obsolete)	Always set to "1".
4	DEV (Device select)	Used in master/slave configuration to select either the master (drive 0) or a slave (drive 1). Setting the bit to "0" selects the drive as the master.
3 - 0	HS3-HS0 (Head select)	Used to select the head number. Bit 3 is the MSB. When the LBA bit is set to "1", HS3 to HS0 function as bits 27 to 24 in LBA mode, respectively.

Status Register

Read-only register. This register notifies the host of the drive state when a command is executed. Its contents reflect the progress of the command executed by the device and the state at each stage of command execution. When INTRQ signal is asserted, reading the Status register causes it to be negated.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
BSY	DRDY	DF	DSC	DRQ	obs	obs	ERR

Bit	Name	Function
7	BSY (Busy)	Set to "1" when the drive is executing internal processing. Other bits in the register are invalid while this bit is set to "1".
6	DRDY (Device ready)	Set to "1" when the drive has completed internal processing and become ready to accept access from the host.
5	DF (Device Fault)	Set to "1" when an error has occurred during the execution of a read or write command within the drive.
4	DSC (Device Seek Complete)	Set to "1" when a drive seek has finished.
3	DRQ (Data Request)	Set to "1" when the Data register has become ready to transfer data to or from the host. It is cleared to "0" when the drive receives another command.
2-1	obs (Obsolete)	Always set to "0".
0	ERR (Error)	Set to "1" if an error occurs during the execution of the command that has been input. Additional error information is stored in the Error register. The ERR bit is cleared when the next command is input.

Alternate status Register

Read-only register. This register differs from the Status register in that reading the Alternate status register does not affect INTRQ.

Device control Register

Write-only register. Used to control drive interrupt requests and trigger a software reset.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved				1	SRST	nIEN	0

Bit	Name	Function
7-3	Reserved	Reserved bits
2	SRST (Soft Reset)	Set to "1" so that the drive applies a software reset. The drive stays in the reset state until the bit is cleared to "0".
1	nIEN (Interrupt Enable)	Used to control the enabling of the INTRQ signal. When this bit is set to "0", INTRQ is active. When the bit is set to "1", INTRQ is high impedance.
0	not used	Always set to "0".

Command Register

Write-only register. Writing a command to this register causes the command to be executed immediately. When INTRQ is asserted, issuing a command causes it to be negated.

Command Code

Command Name	Code	PARAMETERS USED					
		SC	SN	CY	DEV	HD	FT
CFA ERASE SECTOR(S)	C0h	O	O	O	O	O	X
CFA REQUEST EXTENDED ERROR CODE	03h	X	X	X	O	X	X
CFA TRANSLATE SECTOR	87h	O	O	O	O	O	X
CFA WRITE MULTIPLE w/o ERASE	CDh	O	O	O	O	O	X
CFA WRITE SECTOR w/o ERASE	38h	O	O	O	O	O	X
CHECK POWER MODE	E5 / 98h	X	X	X	O	X	X
EXECUTE DIAGNOSTICS	90h	X	X	X	O	X	X
FORMAT TRACK	50h	X	X	O	O	O	X
IDENTIFY DEVICE	ECh	X	X	X	O	X	X
IDLE	E3 / 97h	O	X	X	O	X	X
IDLE IMMEDIATE	E1 / 95h	X	X	X	O	X	X
INITIALIZE DEVICE PARAMETERS	91h	O	X	X	O	O	X
NOP	00h	X	X	X	O	X	X
READ BUFFER	E4h	X	X	X	O	X	X
READ DMA	C8h	O	O	O	O	O	X
READ LONG SECTOR	22/23h	O	O	O	O	O	X
READ MULTIPLE	C4h	O	O	O	O	O	X
READ SECTOR(S)	20/21h	O	O	O	O	O	X
READ VERIFY SECTOR(S)	40/41h	O	O	O	O	O	X
RECALIBRATE	1xh	X	X	X	O	X	X
SECURITY DISABLE PASSWORD	F6h	X	X	X	O	X	X
SECURITY ERASE PREPARE	F3h	X	X	X	O	X	X
SECURITY ERASE UNIT	F4h	X	X	X	O	X	X
SECURITY FREEZE	F5h	X	X	X	O	X	X
SECURITY SET PASSWORD	F1h	X	X	X	O	X	X
SECURITY UNLOCK	F2h	X	X	X	O	X	X
SEEK	70h	X	X	O	O	O	X
SET FEATURES	EFh	C	X	X	O	X	O
SET MULTIPLE MODE	C6h	O	X	X	O	X	X
SLEEP	E6 / 99h	X	X	X	O	X	X
SMART	B0h	X	X	O	O	X	O
STANDBY	E2 / 96h	X	X	X	O	X	X
STANDBY IMMEDIATE	E0 / 94h	X	X	X	O	X	X
WRITE BUFFER	E8h	X	X	X	O	X	X
WRITE DMA	CAh	O	O	O	O	O	X
WRITE LONG	32/33h	O	O	O	O	O	X
WRITE MULTIPLE	C5h	O	O	O	O	O	X
WRITE SECTOR(S)	30/31h	O	O	O	O	O	X
WRITE VERIFY	3Ch	O	O	O	O	O	X

Note: O = Valid
X = Don't care

SC = Sector Count Register
SN = Sector Number Register
CY = Cylinder Low/High Register
DEV = DEVICE SELECT Bit (DEVICE/HEAD Register Bit 4)
HD = HEAD SELECT Bit (DEVICE/HEAD Register Bit 3-0)
FT = Features Register

ATA Command Specifications

CFA ERASE SECTOR(S) (C0h)

This command is used to erase data sectors, but sector data is not erased in this product.

CFA REQUEST EXTENDED ERROR CODE (03h)

This command requests an extended error code after command ends with an error.

CFA TRANSLATE SECTOR (87h)

This command effectively a NOP command and only implemented for backward compatibility.

CFA WRITE MULTIPLE w/o ERASE (CDh)

This command is similar to the Write Multiple command with the exception that an implied erase before write operation is not performed.

CFA WRITE w/o ERASE (38h)

This command is similar to the Write Sector(s) command with the exception that an implied erase before write operation is not performed.

CHECK POWER MODE (E5h/98h)

The host can use this command to determine the current power management mode.

EXECUTE DIAGNOSTICS (90h)

Performs self-diagnostics of the drive. This command does not require selection of a device. It is executed simultaneously for both the master and slave.

FORMAT TRACK (50h)

This command writes the desired head and cylinder of the selected drive with a vendor unique data pattern (typically FFh or 00h). To remain host backward compatible, the card expects one sector (512Bytes) of data from the host to follow the command with same protocol as the Write Sector Command.

IDENTIFY DEVICE (ECh)

This commands read out 512Bytes of drive parameter information.
Parameter Information consists of the arrangement and value as shown in the following table.

This command enables the host to receive the Identify Drive Information from the card.

Identify Device Information Default Value

Word	Value	F/V	Description
0	044Ah	F X F X X F X F	General configuration bit-significant information: 15 0 = ATA device 14-8 Retired 7 1 = removable media device 6 Obsolete 5-3 Retired 2 Reserved 1 Retired 0 Reserved
1	XXXXh	X	Number of logical cylinders
2	0000h	V	Specific configuration
3	00XXh	X	Number of logical heads
4-5	XXXXh	X	Retired
6	XXXXh	X	Number of logical sector per logical track
7-8	XXXXh	V	Reserved for assignment by the CompactFlash™ Association
9	0000h	X	Retired
10-19	XXXXh	F	Serial number (20 ASCII characters)
20-21	XXXXh	X	Retired
22	0004h	X	Obsolete
23-26	XXXXh	F	Firmware revision (8 ASCII characters)
27-46	XXXXH	F	Model number (40 ASCII characters)
47	8001h	F F F	15-8 80h 7-0 00h = Reserved 01h = Maximum number of 1 sectors on READ/WRITE MULTIPLE commands
48	0000h	F	Reserved
49	0F00h	F F F F F F F X	Capabilities 15-14 Reserved for the IDENTIFY PACKET DEVICE command. 13 1 = Standby timer values as specified in this standard are supported 0 = Standby timer values shall be managed by the device Reserved for the IDENTIFY PACKET DEVICE command. 12 11 1 = IORDY supported 0 = IORDY may be supported 10 1 = IORDY may be disabled 9 1 = LBA supported 8 1 = DMA supported. 7-0 Retired
50	0000h		Capabilities
51	0200h		15-8 PIO data transfer cycle timing mode 7-0 Reserved
52	0000h	X	Obsolete
53	0007h	F F F X	15-3 Reserved 2 1 = the fields reported in word 88 are valid 0 = the fields reported in word 88 are not valid 1 1 = the fields reported in words 70:64 are valid 0 = the fields reported in words 70:64 are not valid 0 1 = the fields reported in words 58:54 are valid 0 = the fields reported in words 58:54 are not valid
54	XXXXh	X	Number of current cylinders
55	00XXh	X	Number of current heads
56	XXXXh	X	Number of current sector per track
57-58	XXXXh	X	Current capacity in sectors
59	0101h	F V V	15-9 Reserved 8 1 = Multiple sector setting is valid 7-0 xxh = Current setting for number of sectors that shall be transferred per interrupt on R/W Multiple command
60-61	XXXXh	F	Total number of user addressable sectors
62	0000h	X	Obsolete

(continued)

Identify Device Information Default Value (continued)

Word	Value	F/V	Description
63	0007h	F	15-11 Reserved
		V	10 1 = Multiword DMA mode 2 is selected 0 = Multiword DMA mode 2 is not selected
		V	9 1 = Multiword DMA mode 1 is selected 0 = Multiword DMA mode 1 is not selected
		V	8 1 = Multiword DMA mode 0 is selected 0 = Multiword DMA mode 0 is not selected
		F	7-3 Reserved
		F	2 1 = Multiword DMA mode 2 and below are supported
		F	1 1 = Multiword DMA mode 1 and below are supported
		F	0 1 = Multiword DMA mode 0 is supported
64	0003h	F	15-8 Reserved
		F	7-0 Advanced PIO modes supported
65	0078h	F	Minimum Multiword DMA transfer cycle time per word 15-0 Cycle time in nanoseconds
66	0078h	F	Manufacturer's recommended Multiword DMA transfer cycle time 15-0 Cycle time in nanoseconds
67	0078h	F	Minimum PIO transfer cycle time without flow control 15-0 Cycle time in nanoseconds
68	0078h	F	Minimum PIO transfer cycle time with IORDY flow control 15-0 Cycle time in nanoseconds
69-75	0000h	F	Reserved (for future command overlap and queuing)
76	0202h	F	Serial ATA capabilities
77-79	0000h	F	Reserved (for future command overlap and queuing)
80	007Eh		Major version number 0000h or FFFFh = device does not report version
		F	15 Reserved
		F	14 Reserved for ATA/ATAPI-14
		F	13 Reserved for ATA/ATAPI-13
		F	12 Reserved for ATA/ATAPI-12
		F	11 Reserved for ATA/ATAPI-11
		F	10 Reserved for ATA/ATAPI-10
		F	9 Reserved for ATA/ATAPI-9
		F	8 Reserved for ATA/ATAPI-8
		F	7 1 = supports ATA/ATAPI-7
		F	6 1 = supports ATA/ATAPI-6
		F	5 1 = supports ATA/ATAPI-5
		F	4 1 = supports ATA/ATAPI-4
		F	3 1 = supports ATA/ATAPI-3
X	2 1 = supports ATA/ATAPI-2		
X	1 Obsolete		
F	0 Reserved		
81	0000h	F	Minor version number 0000h or FFFFh = device does not report version
82	300Bh		Command set supported.
		X	15 Obsolete
		F	14 1 = NOP command supported
		F	13 1 = READ BUFFER command supported
		F	12 1 = WRITE BUFFER command supported
		X	11 Obsolete
		F	10 1 = Host Protected Area feature set supported
		F	9 1 = DEVICE RESET command supported
		F	8 1 = SERVICE interrupt supported
		F	7 1 = release interrupt supported
		F	6 1 = look-ahead supported
		F	5 1 = write cache supported
		F	4 Shall be cleared to zero to indicate that the PACKET Command feature set is not supported.
		F	3 1 = mandatory Power Management feature set supported
F	2 1 = Removable Media feature set supported		
F	1 1 = Security Mode feature set supported		
F	0 1 = SMART feature set supported		

(continued)

Identify Device Information Default Value (continued)

Word	Value	F/V	Description
83	0000h	F	Command sets supported. 0000h or FFFFh = command set notification not supported. 15 Shall be cleared to zero 14 Shall be set to one 13-9 Reserved 8 1 = SET MAX security extension supported 7 Reserved 6 1 = SET FEATURES subcommand required to spinup after power-up 5 1 = Power-Up In Standby feature set supported 4 1 = Removable Media Status Notification feature set supported 3 1 = Advanced Power Management feature set supported 2 1 = CFA feature set supported 1 1 = READ/WRITE DMA QUEUED supported 0 1 = DOWNLOAD MICROCODE command supported
84	4000h	F	Command set/feature supported extension. 15 Shall be cleared to zero 14 Shall be set to one 13-2 Reserved 1 1 = SMART self-test supported 0 1 = SMART error logging supported
85	3008h	X	Command set/feature enabled. 15 Obsolete 14 1 = NOP command enabled 13 1 = READ BUFFER command enabled 12 1 = WRITE BUFFER command enabled 11 Obsolete 10 1 = Host Protected Area feature set enabled 9 1 = DEVICE RESET command enabled 8 1 = SERVICE interrupt enabled 7 1 = release interrupt enabled 6 1 = look-ahead enabled 5 1 = write cache enabled 4 Shall be cleared to zero to indicate that the PACKET Command feature set is not supported. 3 1 = Power Management feature set enabled 2 1 = Removable Media feature set enabled 1 1 = Security Mode feature set enabled 0 1 = SMART feature set enabled
86	0000h	F	Command set/feature enabled. 15-9 Reserved 8 1 = SET MAX security extension enabled by SET MAX SET PASSWORD 7 See Address Offset Reserved Area Boot, INCITS TR27:2001 6 1 = SET FEATURES subcommand required to spin-up after power-up 5 1 = Power-Up In Standby feature set enabled 4 1 = Removable Media Status Notification feature set enabled 3-1 1 = Advanced Power Management feature set enabled 0 1 = DOWNLOAD MICROCODE command supported
87	4000h	F	Command set/feature default. 15 Shall be cleared to zero 14 Shall be set to one 13-2 Reserved 1 1 = SMART self-test supported 0 1 = SMART error logging supported

(continued)

Identify Device Information Default Value (continued)

Word	Value	F/V	Description
88	001Fh	F V V V V V F F F F F	15-13 Reserved 12 1 = Ultra DMA mode 4 is selected 0 = Ultra DMA mode 4 is not selected 11 1 = Ultra DMA mode 3 is selected 0 = Ultra DMA mode 3 is not selected 10 1 = Ultra DMA mode 2 is selected 0 = Ultra DMA mode 2 is not selected 9 1 = Ultra DMA mode 1 is selected 0 = Ultra DMA mode 1 is not selected 8 1 = Ultra DMA mode 0 is selected 0 = Ultra DMA mode 0 is not selected 7-5 Reserved 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	000xh	F	Time required for security erase unit completion
90	0000h	F	Time required for Enhanced security erase completion
91	0000h	V	Current advanced power management value
92	FFFEh	V	Master Password Revision Code
93	xxxxh		Hardware reset result. The contents of bits 12-0 of this word shall change only during the execution of a hardware reset. 15 Shall be cleared to zero. 14 Shall be set to one. 13 1 = device detected CBLID- above ViH 0 = device detected CBLID- below ViL 12-8 Device 1 hardware reset result. Device 0 shall clear these bits to zero. Device 1 shall set these bits as follows: 12 Reserved. 11 0 = Device 1 did not assert PDIAG-. 1 = Device 1 asserted PDIAG-. 10-9 These bits indicate how Device 1 determined the device number: 00 = Reserved. 01 = a jumper was used. 10 = the CSEL signal was used. 11 = some other method was used or the method is unknown. 8 Shall be set to one. 7-0 Device 0 hardware reset result. Device 1 shall clear these bits to zero. Device 0 shall set these bits as follows: 7 Reserved. 6 0 = Device 0 does not respond when Device 1 is selected. 1 = Device 0 responds when Device 1 is selected. 5 0 = Device 0 did not detect the assertion of DASP-. 1 = Device 0 detected the assertion of DASP-. 4 0 = Device 0 did not detect the assertion of PDIAG-. 1 = Device 0 detected the assertion of PDIAG-. 3 0 = Device 0 failed diagnostics. 1 = Device 0 passed diagnostics. 2-1 These bits indicate how Device 0 determined the device number: 00 = Reserved. 01 = a jumper was used. 10 = the CSEL signal was used. 11 = some other method was used or the method is unknown. 0 Shall be set to one.
94-126	0000h	V	Reserved
127	0000h	F F	Removable Media Status Notification feature set support 15-2 Reserved 1-0 00 = Removable Media Status Notification feature set not supported 01 = Removable Media Status Notification feature supported 10 = Reserved 11 = Reserved

(continued)

Identify Device Information Default Value (continued)

Word	Value	F/V	Description
128	0001h	F	Security status
		V	15-9 Reserved
		F	8 Security level 0 = High, 1 = Maximum
		F	7-6 Reserved
		F	5 1 = Enhanced security erase supported
		V	4 1 = Security count expired
		V	3 1 = Security frozen
		V	2 1 = Security locked
		V	1 1 = Security enabled
		F	0 1 = Security supported
129-159	0000h	X	Vendor specific
160-175	XXXXh	X	Reserved for assignment by the CompactFlash™ Association
176-254	0000h	F	Reserved
255	0000h	X	Integrity word
			15-8 Checksum
			7-0 Signature

Key:

F/V = Fixed/variable content

F = the content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.

V = the contents of the word is variable and may change depending on the state of the device or the commands executed by the device.

X = the content of the word may be fixed or variable.

Identifier and security level

Identifier	Level	Command result
User	High	The password supplied with the command will be saved as the new User password. The Lock mode will be enabled from the next power-on or hardware reset. The drive can be unlocked by either the User password or the previously set Master password.
	Maximum	The password supplied with the command will be saved as the new User password. The Lock mode will be enabled from the next power-on or hardware reset. The drive will then be unlocked only by the User password.
Master	High or Maximum	This combination will set a Master password but will not enable or disable the Lock mode.

SECURITY UNLOCK (F2h)

This command disable LOCKED MODE of the device
This command transfers 512 bytes of data from the host with PIO data-out protocol. The following table defines the content of this information.

Security Unlock Information

Word	Content
0	Control word Bit 15-1 Reserved Bit 0 Identifier 0=compare user password 1=compare master password
1-16	Password (32 bytes)
17-255	Reserved

If the Identifier bit is set to Master and the drive is in high security level in LOCKED MODE, then the password supplied will be compared with the stored Master password. When matched, the drive will be released from the Lock mode. If not matched, Aborted Command is returned.

If the drive is Maximum Security Level and in LOCKED MODE, Aborted Command is always returned.

When a master password has been issued:

If the Security Level for the LOCKED MODE state is set to High:
The password is compared with the saved master password. If they match, the drive is released from the LOCKED MODE state. If they do not match, the Aborted Command error is returned.

If the Security Level for the LOCKED MODE state is set to Maximum:
The Aborted Command error is always returned.

When a user password has been issued:
The password is compared with the saved user password. If they match, the drive is released from the LOCKED MODE state. If they do not match, the Aborted Command error is returned and the drive decrements the UNLOCK counter by one. This counter is initially set to five. Once it becomes zero, all SECURITY UNLOCK and SECURITY ERASE UNIT commands cause the Aborted Command error until a next power-on or hard reset.

When the drive is placed in the UNLOCK state, the SECURITY UNLOCK command does not affect the UNLOCK counter.

SEEK (7xh)

This command is effectively a NOP command to the Card although it does perform a range check.

SET FEATURES (EFh)

This command set parameter to Features register and set drive's operation. For transfer mode, parameter is set to Sector Count register.

This command is used by the host to establish or select certain features.

Features register Value and settable operating mode

Value	Function
02h	Enable write cache
03h	Set transfer mode based on value in Sector Count register.
05h	Enable advanced power management
55h	Disable read look-ahead feature
66h	Disable reverting to power-on defaults
82h	Disable write cache
85h	Disable advanced power management
AAh	Enable read look-ahead feature
CCh	Enable reverting to power on defaults by soft reset
others	Invalid (reporting with Aborted Command Error)

Sector Count register value and transfer mode

Mode	Value
PIO default transfer mode	00000 000
PIO default transfer mode, disable IORDY	00000 001
PIO flow control transfer mode xxx	00001 xxx
Multiword DMA mode xxx	00100 xxx
Ultra DMA mode xxx	01000 xxx
Reserved	10000 xxx

SET MULTIPLE MODE (C6h)

This command enables the Card to perform READ MULTIPLE and WRITE MULTIPLE operations and establishes the block count for these commands.

SLEEP (E6h/99h)

This command causes the Card to set BSY, enter the Sleep mode, clear BSY and generate an interrupt.

STANDBY (E2h/96h)

This command causes the Card to set BSY, enter the Sleep mode (which corresponds to the ATA "Standby" Mode), clear BSY and return the interrupt immediately.

STANDBY IMMEDIATE (E0h/94h)

This command causes the drive to set BSY, enter the Sleep mode (which corresponds to the ATA "Standby" Mode), clear BSY and return the interrupt immediately.

WRITE MULTIPLE (C5h)

This command is similar to the Write Sectors command. Interrupts are not presented on each sector, but on the transfer of a block which contains the number of sectors defined by Set Multiple command.

WRITE BUFFER (E8h)

This command enables the host to overwrite contents of the Drive's sector buffer with any data pattern desired.

WRITE DMA (CAh)

Writes data to sectors during Multiword DMA transfer. Use the SET FEATURES command to specify the mode value.

WRITE LONG (32h/33h)

Writes data from the host and its ECC information. The data is transferred in 16 bits while ECC is transferred in eight bits. The LONG command is valid only for single-sector transfers. This command does not cause the device itself to generate an ECC byte.

It is supported for backward compatibility with previous devices.

WRITE MULTIPLE (C5h)

This command is similar to the Write Sectors command. Interrupts are not presented on each sector, but on the transfer of a block which contains the number of sectors defined by Set Multiple command. This card support 1 sector

WRITE SECTOR(S) (30h/31h)

Writes data to a specified number of sectors (1 to 256, as specified with the Sector Count register) from the specified address. Specify "00h" to write 256 sectors.

WRITE VERIFY (3Ch)

This command is the same as WRITE SECTOR(S) with the exception that it verifies data in each sector upon the completion of writing.

It is supported for backward compatibility with previous devices.

SMART Function Set (B0h)

Performs different processing required for predicting device failures, according to the subcommand specified in the Features register. If the Features register contains an unsupported value, the Aborted Command error is returned. If the SMART function is disabled, any subcommand other than SMART ENABLE OPERATIONS results in the Aborted Command error.

Code	SMART Subcommand
D0h	READ DATA
D1h	READ ATTRIBUTE THRESHOLDS
D2h	ENABLE/DISABLE ATTRIBUTE AUTOSAVE
D3h	SAVE ATTRIBUTE VALUES
D4h	EXECUTE OFF-LINE IMMEDIATE
D5h	Reserved
D6h	Reserved
D8h	ENABLE OPERATIONS
D9h	DISABLE OPERATIONS
DAh	RETURN STATUS
DBh	ENABLE/DISABLE AUTO OFF-LINE

SMART READ DATA

This command returns 512-byte SMART Data Structure to the host with PIO data-in protocol. The register file has to contain D0h for Features register, 4Fh for LBA Mid register and C2h for the LBA High register.

Byte	Description
0-1	00-01h Data structure revision number
2-13	02-0Dh 1st attribute data
14-361	0E-169h 2nd-30th Individual attribute data
362	16Ah Off-line data collection status
363	16Bh Reserved
364-365	16D-16Dh Total time in seconds to complete off-line data collection activity
366	16Eh Reserved
367	16Fh Off-line data collection capability
368-369	170-171h SMART capability
370-385	172-181h Reserved
386-510	182-1FEh Reserved
511	1FFh Data structure Checksum

Byte 0-1: Data structure revision number

Indicates the revision of the device attribute values and data format.

Any modification to the data format results in the revision number being updated. The data format revisions of device attribute values and failure thresholds represent the same value.

This indicates the revision of the device attribute values and data format.

Any modification to the data format results in the revision number being updated.

Byte 2-361: Individual attribute data

Individual units of attribute value information consist of the following 12 bytes each:

Byte	Description
0	Attribute ID number 01 – FFh (see below for details)
1-2	<p>Status flag bit</p> <p>15-6 Reserved</p> <p>5 Self-Preserving Attribute Bit 1: Indicates that the attribute value is collected and saved even if the SMART function is disabled.</p> <p>4 Event Count Attribute Bit 1: Indicates that the attribute value represents the number of occurrences.</p> <p>3 Error rate attribute Bit 1: Indicates that the attribute value represents an error rate.</p> <p>2 Performance Attribute Bit 1: Indicates that the attribute value represents performance.</p> <p>1 on-line data collection Bit 1: Only updated by On-line data collection. 0: Only updated by Off-line data collection.</p> <p>0 pre-failure/advisory Bit 1: Indicates that the drive operates normally when the attribute value exceeds the threshold.</p>
3	<p>Current attribute value : 01h-FDh Indicates the value obtained by normalizing the raw attribute data. The value falls within the range from 01h to FDh. A value closer to 01h indicates higher possibility of a failure. The host compares the attribute value with the threshold and, if the attribute value is greater, determines that the drive is normal. 00h, FEh, FFh = Not in use 01h = Minimum value 64h = Initial value FDh = Maximum value</p>
4	<p>Worst attribute value ever Indicates the worst attribute value that has been collected ever, that is, the value when the drive was most likely to fail. (valid values from 01h-FEh) 00h, FEh, FFh = Not in use</p>
5-10	<p>Raw attribute value Contains the raw attribute data. (FFFF FFFF FFFFh - reserved as saturated value)</p>
11	Reserved (00h)

The attribute ID information is listed in the following table

ID	Attribute	Description
20 (14h)	Redundant block count	Number of alternate blocks on the chip with the fewest alternate blocks
22 (16h)	Current W/R cycle count	Number of erasure of the chip with the greatest number of block erasure.

Alternate block : Indicates total number of alternate block on the chips mounted on the product.

Byte 362: Off-line data collection status

Value	Description
00h or 80h	Off-line data collection activity was never started.
01h	Reserved
02h or 82h	Off-line data collection was completed without error.
03h	Reserved
04h or 84h	Off-line data collection activity was suspended by an interrupting command from the host.
05h or 85h	Off-line data collection activity was aborted by an interrupting command from the host.
06h or 86h	Off-line data collection activity was aborted by a fatal error from the drive.
Others	Reserved

Byte 363: Reserved**Byte 364-365: Total time in seconds to complete off-line data collection activity**

Off-line data

This word specifies how many seconds the controller requires completing the sequence of off-line data collection activity. The values are from 0001h to FFFFh.

Byte 366: Reserve

Byte 367: Off-line data collection capability

Bit 0 (Execute off-line immediate implemented Bit)

Bit0 = 1 This means Smart Execute Off-line Immediate command is implemented.

Bit 1 (enable/disable automatic off-line implemented Bit)

Bit1 = 1 This means Smart Enable/Disable Automatic Off-line command is supported.

Bit 2 (abort/restart off-line by host)

Bit2 = 1 If this bit is set to one, then this controller will abort all off-line data collection activity initiated by a Smart Execute Off-line Immediate command upon receipt of a new command within 2 seconds of receiving the new command.

Bit2 = 0 If this bit is cleared to zero, this controller will suspend off-line data collection activity after an interrupting command and resume off-line data collection activity after some vendor-specified event.

Bit 3 (off-line read scanning implemented Bit)

Bit3 = 1 This means Smart Off-line read scanning is supported.

Bit 4-7 (reserved).

Reserved

Byte 368-369: SMART capability

Bit 0 (power mode SMART data saving capabilities Bit)

Bit0 = 1 This means Smart data is saved prior to going into a power saving mode.

Bit 1 (SMART data autosave after event capability Bit)

Bit1 = 1 This means Smart Enable/Disable Attribute Autosave command data is saved prior to going into a power saving mode.

Bit 2-15 Reserved

Byte 370-385: Reserved**Byte 386-510: Reserved****Byte 511: Data structure checksum**

The data structure checksum is the two's complement of the sum of the first 511 bytes in the data structure.

SMART READ ATTRIBUTE THRESHOLD

This transfers 512 bytes of drive failure threshold data to the host.

Byte	Descriptions
0-1	Data structure revision number
2-361	1st-30th Individual attribute threshold data
362-385	Reserved
386-510	Vendor specific
511	Data structure checksum

BYTE 0-1: Data structure revision number

This word indicates the revision of the data format of failure thresholds.

BYTE 2-361: Individual attribute threshold data

Individual units of failure threshold data consist of 12 bytes each:

Byte	Description
0	Attribute ID number: 01 – FFh details are the same as those for Smart Read Data
1	Failure threshold 00h= No threshold 01h= Minimum value FDh= Maximum value FEh, FFh= Not used.
2-11	Reserved

BYTE 362-385: Reserved

BYTE 386-510: Vendor specific

BYTE 511: Data structure checksum

Value of the checksum for the first 511 bytes.

SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE

Enables or disables the attribute value autosave function. This command specifies whether the current attribute values are automatically saved to the drive when it changes the mode. This setting is maintained when the power is turned on and off.

The function of the command varies with the contents of the Sector Count register, as follows:

- Sector Count register = "00h" : Disable autosave
- Sector Count register = "F1h" : Enable autosave

SMART SAVE ATTRIBUTE VALUE

Saves any modified attribute values.

SMART EXECUTE OFF-LINE IMMEDIATE

This command of Non-data input causes the controller to immediately initiate the set of activities that collect SMART data in a off-line mode and then save data to the Nand flash memory, or execute a selfdiagnostic test routine in either captive or off-line mode.

The following table defines the subcommand that is executed base on the value in the Sector Number register.

Value	Description of subcommand to be executed
00h	Execute SMART off-line routine immediately in off-line mode
01h-7Eh	Reserved
7Fh	Abort off-line mode
80h-FFh	Reserved

When a subcommand with Sector Number register = 00h is received:
Assert and clear BSY, and then collect data in off-line mode.

When a subcommand with Sector Number register = 7Fh is received:
Assert BSY. If off-line data collection is in progress, stop data collection and clear BSY.

SMART ENABL OPERATIONS

Enables the SMART function. This setting is maintained when the power is turned off and then back on. Once the SMART function is enabled, subsequent SMART ENABLE OPERATIONS commands do not affect any parameters.

SMART DISABLE OPERATIONS

Disables the SMART function. Upon receiving the command, the drive disables all SMART operations. This setting is maintained when the power is turned off and then back on.

Once this command has been received, all SMART commands other than SMART ENABLE OPERATIONS are aborted with the Aborted Command error.

This command disables all SMART capabilities including any and all timer and event count functions related exclusively to this feature. After command acceptance, this controller will disable all SMART operations. SMART data in no longer be monitored or saved. The state of SMART is preserved across power cycles.

SMART RETURN STATUS

Reports the drive reliability status.

Values reported when a predicted defect has not been detected:

Cylinder Low register: 4Fh

Cylinder High register: C2h

Values reported when a predicted defect has been detected:

Cylinder Low register: F4h

Cylinder High register: 2Ch

SMART ENABLE/DISABLE AUTOMATIC OFF-LINE

Enables (when Sector Count register = "F8h") or disables (Sector Count register = "00h") the automatic off-line data collection function.

The automatic collection is disabled if a value of "00h" is set in the Sector Count register before a subcommand is issued. If automatic collection is disabled, the drive can still save attribute information during normal operation, such as during the power-on/off sequence or error correction sequence.

The automatic collection function is enabled if a value of "F8h" is set in the Sector Count register before the command is issued. Values other than "00h" and "F8h" are vendor-specific.

Command Table

The following command table lists show drive responses to commands when the SECURITY function is enabled.

Command Name	Locked mode	Unlocked mode	Frozen mode
CFA ERASE SECTOR(S)	x	o	o
CFA REQUEST EXTENDED ERROR CODE	o	o	o
CFA TRANSLATE SECTOR	o	o	o
CFA WRITE MULTIPLE w/o ERASE	x	o	o
CFA WRITE SECTOR w/o ERASE	x	o	o
CHECK POWER MODE	o	o	o
EXECUTE DIAGNOSTICS	o	o	o
FORMAT TRACK	x	o	o
IDENTIFY DEVICE	o	o	o
IDLE	o	o	o
IDLE IMMEDIATE	o	o	o
INITIALIZE DEVICE PARAMETERS	o	o	o
NOP	o	o	o
READ BUFFER	o	o	o
READ DMA	x	o	o
READ LONG SECTOR	x	o	o
READ MULTIPLE	x	o	o
READ SECTOR(S)	x	o	o
READ VERIFY SECTOR(S)	x	o	o
RECALIBRATE	o	o	o
SECURITY DISABLE PASSWORD	x	o	x
SECURITY ERASE PREPARE	o	o	x
SECURITY ERASE UNIT	o	o	x
SECURITY FREEZE	x	o	o
SECURITY SET PASSWORD	x	o	x
SECURITY UNLOCK	o	o	x
SEEK	o	o	o
SET FEATURES	o	o	o
SET MULTIPLE MODE	o	o	o
SLEEP	o	o	o
SMART	o	o	o
STANDBY	o	o	o
STANDBY IMMEDIATE	o	o	o
WRITE BUFFER	o	o	o
WRITE DMA	x	o	x
WRITE LONG	x	o	x
WRITE MULTIPLE	x	o	x
WRITE SECTOR(S)	x	o	x
WRITE VERIFY	x	o	x

O: Normal operation

X: Aborted Command error

Responses in End-of-drive-life State

Command Name	Number of alternate blocks Approx.0%(End of Life)
CFA ERASE SECTOR(S)	○
CFA REQUEST EXTENDED ERROR CODE	○
CFA TRANSLATE SECTOR	○
CFA WRITE MULTIPLE w/o ERASE	○
CFA WRITE SECTOR w/o ERASE	○
CHECK POWER MODE	○
EXECUTE DIAGNOSTICS	○
FORMAT TRACK	○
IDENTIFY DEVICE	○
IDLE	○
IDLE IMMEDIATE	○
INITIALIZE DEVICE PARAMETERS	○
NOP	○
READ BUFFER	○
READ DMA	○
READ LONG SECTOR	○
READ MULTIPLE	○
READ SECTOR(S)	○
READ VERIFY SECTOR(S)	○
RECALIBRATE	○
SECURITY DISABLE PASSWORD	○
SECURITY ERASE PREPARE	○
SECURITY ERASE UNIT	○
SECURITY FREEZE	○
SECURITY SET PASSWORD	○
SECURITY UNLOCK	○
SEEK	○
SET FEATURES	○
SET MULTIPLE MODE	○
SLEEP	○
SMART	○
STANDBY	○
STANDBY IMMEDIATE	○
WRITE BUFFER	○
WRITE DMA	×
WRITE LONG	×
WRITE MULTIPLE	×
WRITE SECTOR(S)	×
WRITE VERIFY	×

○: Normal operation

× : Aborted Command error

Precautions on use – SATxx-xxxx series

- The information on all registers is cleared at the time of reset or power supply OFF.
- Do not insert or remove the drive during host operation.
- After hardware reset, software reset, and power-on reset or command application, while the BSY bit of Status register is "1", drive cannot be accessed.
- Do not turn off power supply until write/read completed. Data disappears or breaks or a drive breaks.
- It is recommended to back up data.
- It is recommended to format the device by OS before using it.
- SATxx-xxxx series conforms to ATA specification. The host environment shall also be ATA specification compliant.

Restrictions on product use

- All efforts have been made to improve the quality and reliability of these products, but semiconductor devices in general are prone to malfunction and failure. Purchasers of these products are responsible for designing safe systems that will not endanger human life or cause bodily injury or property damage because of malfunctions or failures of these semiconductor products. Designers are requested to check the latest specifications and use these products within their guaranteed ranges.
- These products are neither intended or warranted for usage in military, nuclear energy control, aerospace, and other special purpose applications, or in control systems for automobiles including motorcycles and bicycles, control systems for trains, ships, and transportation equipment, safeguard systems such as crime and disaster prevention systems, and medical devices including medical measurement instrument. We assume no liability for any alleged or actual damages arising from the use of this product for such purposes. Please contact one of our representatives for more detailed information.
- Restriction is imposed on the export and overseas provision of the products covered herein by the Foreign Exchange and Foreign Trade Control Law.
- The technical information herein is provided to describe the typical operations and applications of our products. No warranty of any kind is made herein with regard to intellectual property rights and other rights of our company and the third parties, nor is any license for use thereof granted herein.
- The information described herein is subject to change without notice due to technological advances and other factors.

Revision History

	Revision	Date	Details of revision
		07.3.26	Preliminary version
		07.4.4	P41 : Added Precautions