TOSHIBA
Leading Innovation

HDD

MG04SCAxxEx SERIES
ENTERPRISE CAPACITY HDD

Product image may represent a design model.

The up to 6 TB[1] Enterprise Capacity HDD models (MG04SCAxxEx) come in a robust design with 3.5-inch[2] form factor and performance of 7,200 rpm.
Features of MG04SCAxxEx include 12 Gbit/s[3] SAS interface, Toshiba persistent write cache technology[4], industry-standard 4K native (4Kn) and 512e Advanced Format sector technologies for optimum performance in the latest generation of servers and storage systems.
While 4Kn models (MG04SCAxxEA) offer optimum performance and compatibility with 4K applications, the support for legacy applications and operating environments that require 512B sector lengths is provided by 512e models

Model options supporting Sanitize Instant Erase[5] (SIE) are also available. This feature may help to protect data from unintended disclosure in the event that drives are re-purposed or moved outside of data center environments.

KEY FEATURES

- Industry Standard 3.5-inch 26.1 mm Height Form Factor
- Large Capacity (6 / 5 / 4 / 2 TB Models)
- 7,200rpm Performance
- Dual-Port 12.0 Gbit/s SAS Interface
- 550 total TB Transferred per Year Workload Rating
- 4Kn or 512e Advanced Format Sector Technology
- Introducing Toshiba Persistent Write Cache Technology with PLP[6] for Data-Loss Protection in Sudden Power-Loss Events
- Sanitize Instant Erase (SIE) Option Available

APPLICATIONS

- Engineered for Mid-line / Nearline Business Critical Workloads
- Tier 2 Business-Critical Servers and Storage Systems
- Servers Supporting Application Workloads that Benefit from High Capacity per Spindle
- Capacity-Optimized Data Center Storage Systems

SPECIFICATIONS (TABLE 1)

Model Number		MG04SCA60EA MG04SCA60EE	MG04SCA50EA MG04SCA50EE
Interface		SAS-3.0 (1.5 Gbit/s, 3.0 Gbit/s, 6.0 Gbit/s, 12.0 Gbit/s)	
Formatted Capacity		6 TB	5 TB
Performance	Interface Speed	12.0 Gbit/s Max.	
	Rotation Speed	7,200 rpm	
	Average Latency Time	4.17 ms	
	Buffer Size	128 MiB[7]	
	Internal Transfer Speed (Max.)	205 MiB/s	
Logical Data Block Length	MG04SCAxxEA	HOST:4,096 B / DISK:4,096 B HOST:4,160 B / DISK:4,160 B HOST:4,224 B / DISK:4,224 B	
	MG04ACAxxEE (Emulation)	HOST:512 B / DISK:4,096 B HOST:520 B / DISK:4,160 B HOST:528 B / DISK:4,224 B	
Supply Voltage	Allowable Voltage	12 V + 5% / 5 V + 5% [8]	
Power Consumption	Read / Write	11.8 W	
	Low Power Idle	6.1 W Typ	
Acoustics (Sound Power)	Idle	34 dB Ave.	31 dB Ave.
	Random Seek	35 dB Ave.	34 dB Ave.

SPECIFICATIONS (TABLE 2)

Model Number		MG04SCA40EA MG04SCA40EE	MG04SCA20EA MG04SCA20EE
Interface		SAS-3.0 (1.5 Gbit/s, 3.0 Gbit/s, 6.0 Gbit/s, 12.0 Gbit/s)	
Formatted Capacity		4 TB	2 TB
Performance	Interface Speed	12.0 Gbit/s Max	
	Rotation Speed	7,200 rpm	
	Average Latency Time	4.17 ms	
	Buffer Size	128 MiB[7]	
	Internal Transfer Speed (Max.)	205 MiB/s	
Logical Data Block Length	MG04ACAxxxA	HOST:4,096 B / DISK:4,096 B HOST:4,160 B / DISK:4,160 B HOST:4,224 B / DISK:4,224 B	
	MG04ACAxxxE (Emulation)	HOST:512 B / DISK:4,096 B HOST:520 B / DISK:4,160 B HOST:528 B / DISK:4,224 B	
Supply Voltage	Allowable Voltage	12 V + 5% / 5 V + 5% [8]	
Power Consumption	Read / Write	11.8 W	
	Low Power Idle	6.1 W Typ	
Acoustics (Sound Power)	Idle	31 dB Ave.	31 dB Ave.
	Random Seek	34 dB Ave.	34 dB Ave.

[1] Definition of capacity: Toshiba defines a megabyte (MB) as 1,000,000 bytes, a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1GB = 2^{30} = 1,073,741,824 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft Operating System and/or pre-installed software applications, or media content. Actual formatted capacity may vary.
[2] "2.5-inch" and "3.5-inch" mean the form factor of HDDs or SSDs. They do not indicate drive's physical size.
[3] Read and write speed may vary depending on the host device, read and write conditions, and file size.
[4] PWC with PLP is a function to handle the write data that the drive reports "Normal completion" to the host but not being stored to hard disk media yet. The write data may be written to the commanded LBA on the hard disk media. The un-written data to hard disk media is stored to Flash memory using back up power by PLP when the power supply to the drive suddenly is shut down. And, after PLP operation, it may be required more time to start up the drive than in case of normal shutdown.
1) PLP does not secure data in the mode of all the power shutdowns. When power supplies other than recommended procedure are intercepted, data might be lost.
2) In the power shutdown before it reports on the Write completion, data not anticipated might be lost.
[5] Sanitize Instant Erase. SIE is compatible with Sanitize Device Feature set. Sanitize Device Feature set is the standard prescribed by T10(SAS) and T13(SATA) committees of American National Standards Association（ANSI), which makes it possible to invalidate the data recorded on the magnetic disks at a blink.
[6] PLP supports to record data in buffer memory to hard disk media utilizing back electromotive force along with media rotation inertia in case of sudden supply shut down.
[7] A kibibyte (KiB) means 2^{10}, or 1,024 bytes, a mebibyte (MiB) means 2^{20}, or 1,048,576 bytes, and a gibibyte (GiB) means 2^{30}, or 1,073,471,824 bytes.
[8] Make sure the value is not less than -0.3V DC (less than -0.6V, 0.1ms) when turning on or off the power.

ENVIRONMENTAL LIMITS

Item		Specification
Temperature	Operating[9]	5 °C to 55 °C
	Non-Operating	- 40 °C to 70 °C
	Gradient	20 °C/h or less
Humidity	Operating	5 % to 90 % R.H. (No condensation)
	Non-Operating	5 % to 95 % R.H. (No condensation)
Shock	Operating	686 m/s^2 {70 G} (2 ms duration)
	Non-Operating	2,940 m/s^2 {300 G} (2 ms duration)
Vibration	Operating	7.35 m/s^2 {0.75 G} (5- 300Hz) 2.45 m/s^2 {0.25 G} (300- 500Hz)
	Non-Operating	49 m/s^2 {5 G} (5- 500Hz)
Altitude	Operating	- 305 m to +3,048 m {-1,000 to +10,000 feet}
	Non-Operating	- 305 m to +12,192 m {-1,000 to +40,000 feet}

ENVIRONMENTAL FEATURE

Model Number	MG04SCAxxEA / MG04SCAxxEE
RoHS[10]	Compatible
Halogen free[11]	Yes
Antimony free[11]	Yes

[9] The temperature of the enclosure surface must be kept under 60 °C at any moment.
[10] Toshiba Semiconductor & Storage Products Company defines "RoHS-Compatible" products as products that either (i) contain no more than a maximum concentration value of 0.1% by weight in Homogeneous Materials for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) and of 0.01% by weight in Homogeneous Materials for cadmium; or (ii) fall within any of the application exemptions set forth in the Annex to the RoHS Directive (Directive 2011/65/EC of the European Parliament and of the Council of 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment). "Homogeneous Material" means a material of uniform composition that cannot be mechanically disjointed (meaning separated, in principle, by mechanical actions such as unscrewing, cutting, crushing, grinding and/or abrasive processes) into different materials. Examples of "Homogeneous Materials" would be individual types of plastics, ceramics, glass, metals, alloys, paper, board, resins and coatings.
[11] Toshiba Semiconductor & Storage Products Company defines halogen-free and antimony-free SSD and HDD products as those meeting all of the following requirements: (a) containing bromine (Br) and chlorine (Cl) at no more than 900 parts per million (ppm) by weight for each element, and containing bromine and chlorine in an aggregate amount not exceeding 1500 ppm by weight; and (b) containing no more than 1000 ppm antimony (Sb) by weight. For the avoidance of doubt, Halogen-Free/Antimony-Free SSD or HDD products may not be entirely free of bromine, chlorine, or antimony, and may contain other element of the halogen family.

RELIABILITY

Model Number	MG04SCAxxEA / MG04SCAxxEE
MTTF [12]	1,400,000 hours
AFR (Annual Failure Rate)	0.626 %
Non-recoverable Error Rate	10 error per 10^{16} bits read
Load / Unload	600,000 times (Max.)
Availability	24 hours/day, 7 days/week
Rated Annual Workload (Total TB Transferred per Year, R/W)	550 TB/year
POH (Power On Hours per Year)[13]	8,760 hours

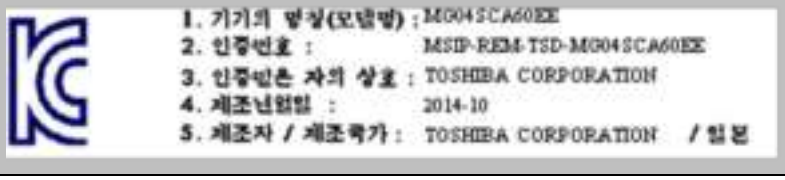
MODEL NUMBERS

Model Number	Interface	Formatted Capacity	Sector Format
MG04SCA60EA	SAS-3.0	6 TB	4Kn
MG04SCA50EA	SAS-3.0	5 TB	4Kn
MG04SCA40EA	SAS-3.0	4 TB	4Kn
MG04SCA20EA	SAS-3.0	2 TB	4Kn
MG04SCA60EE	SAS-3.0	6 TB	512e
MG04SCA50EE	SAS-3.0	5 TB	512e
MG04SCA40EE	SAS-3.0	4 TB	512e
MG04SCA20EE	SAS-3.0	2 TB	512e

[12] MTTF (Mean Time to Failure) is not a guarantee or estimate of product life; it is a statistical value related to mean failure rates for a large number of products which may not accurately reflect actual operation. Actual operating life of the product may be different from the MTTF.
[13] POH: 24 hours/day, 7 days/week, average HDA surface temperature: 40°C or less, workload: up to 550 TB/year, which is defined as the amount of data written, read or verified by commands from host system

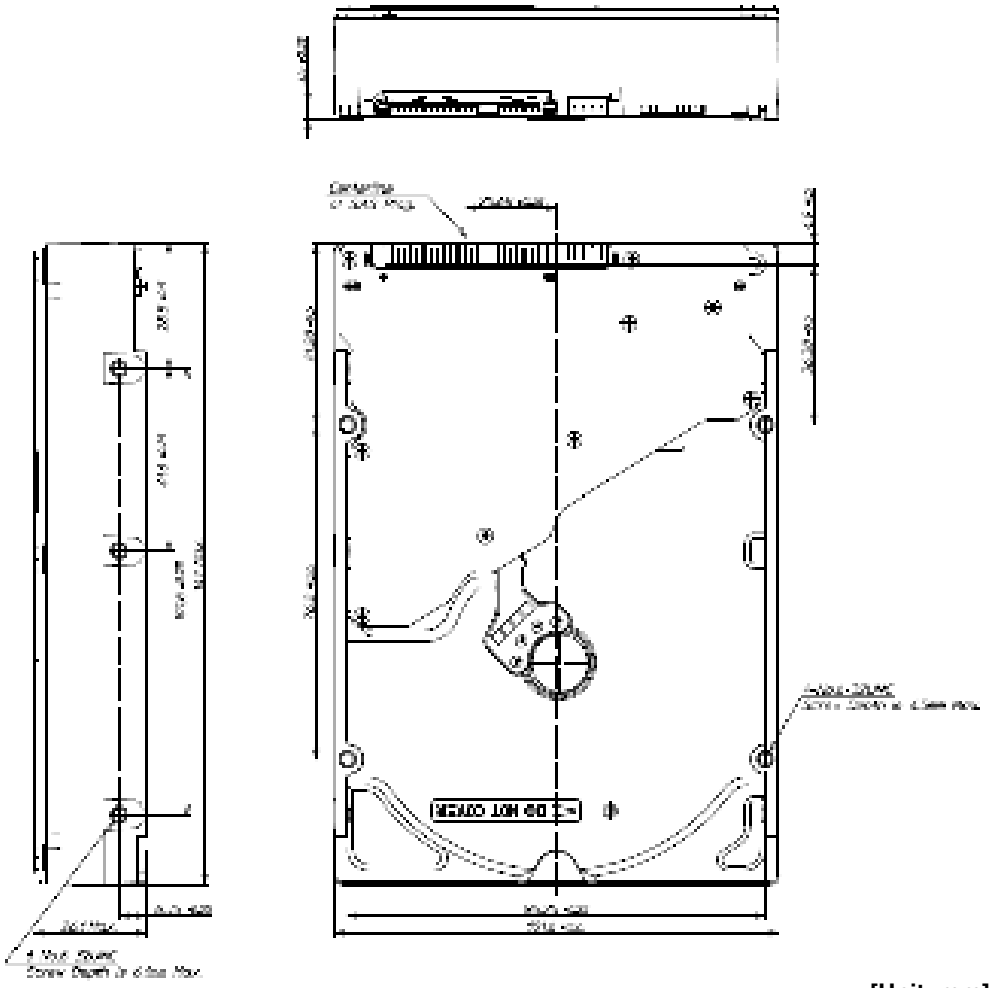
SAFETY / EMI STANDARDS

Title	Description	Region
UL (Underwriters Laboratories)	UL 60950-1, 2nd Edition, 2011-12-19	USA
CSA (Canadian Standard Association)	CAN/CSA-C22.2 No.60950-1-07 2nd Edition.	Canada
TÜV (Technischer Überwachungs Verein)	EN 60950-1:2006+A11+A1+A12	Germany
BSMI (Bureau of Standards, Metrology and Inspection)	CNS 13438 (CISPR Pub. 22 Class B):D33003	Taiwan
MSIP (Ministry of Science, ICT & Future Planning)	電磁波障害防止基準 KN22, KN24 (CISPR Pub. 22 Class B) (Note)	Korea
ACMA (Australian Communications and Media Authority)	AS/NZS CISPR22	Australia

(Note) Marks of KC	MG04SCA60EE
Made in Japan	
Made in Philippines	

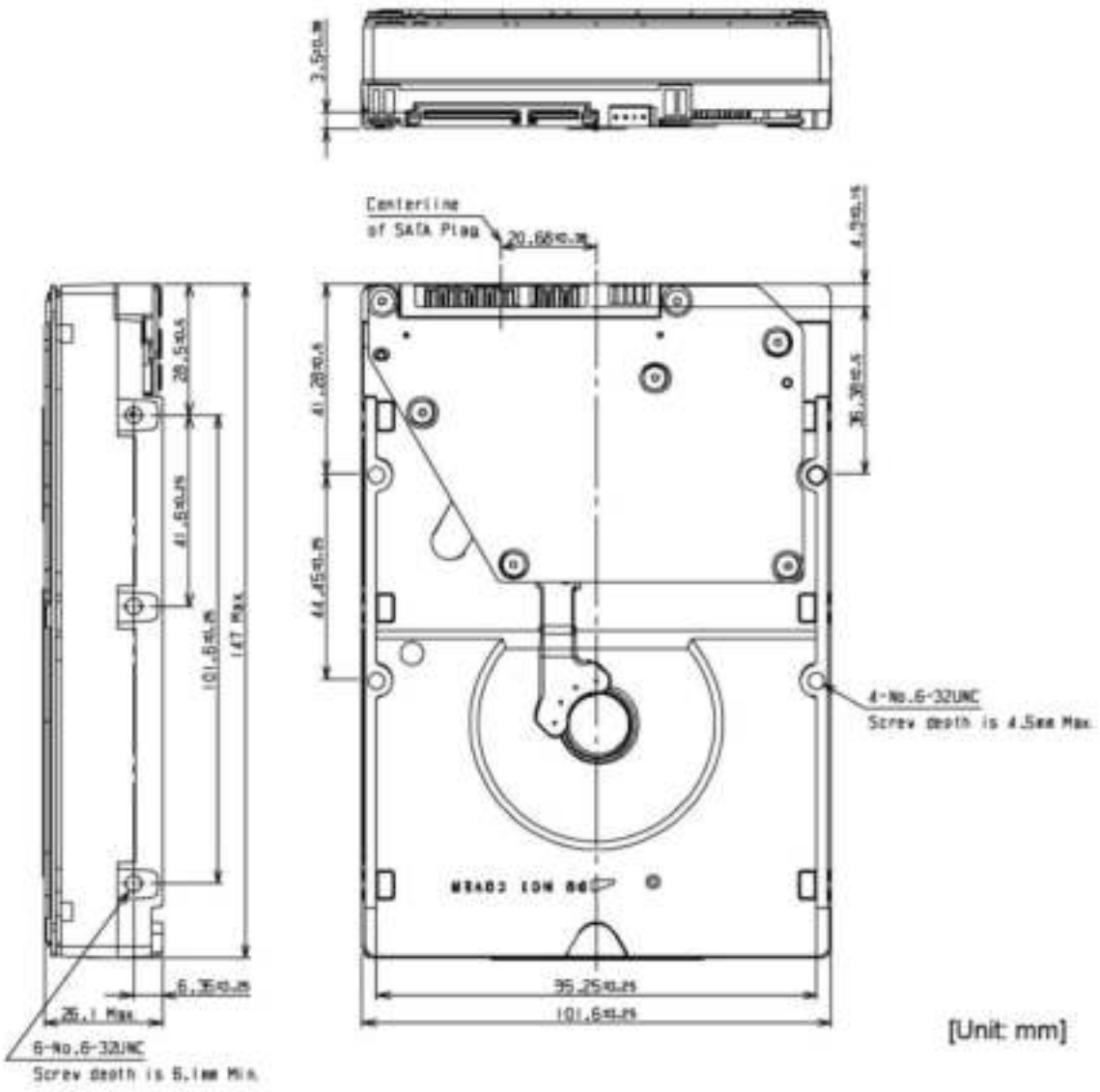
MECHANICAL SPECIFICATIONS

Model Number	MG04SCA60EA / MG04SCA60EE
Width	101.6 mm ±0.25 mm
Height	26.1 mm Max.
Length	147 mm Max.
Weight	770 g Max.

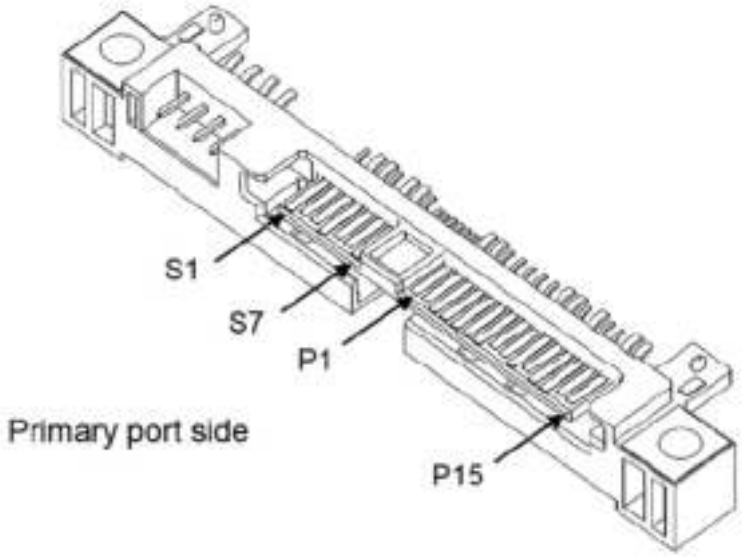


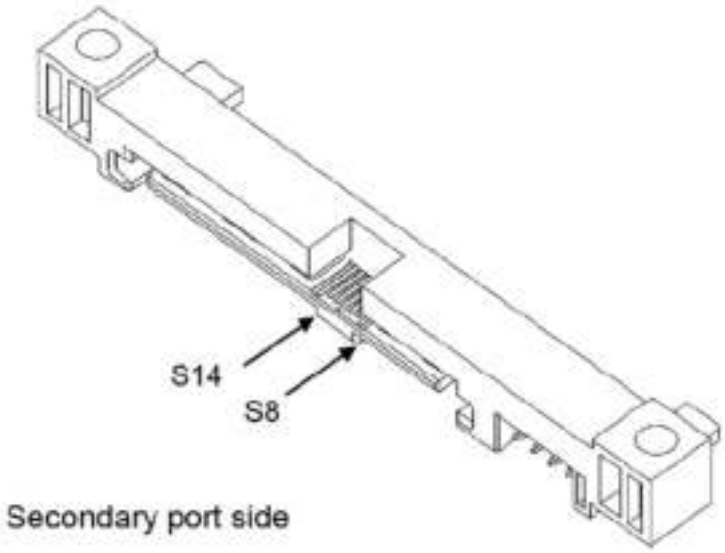
[Unit: mm]

Model Number	MG04SCA50EA / MG04SCA50EE MG04SCA40EA / MG04SCA40EE MG04SCA20EA / MG04SCA20EE
Width	101.6 mm ±0.25 mm
Height	26.1 mm Max.
Length	147 mm Max.
Weight	720 g Max.



INTERFACE CONNECTOR





Interface Connector (SAS plug) Signal Allocation: CN1			
Signal Segment	S1	GND	GND for SAS Primary Port
	S2	RP+	SAS Primary Port Receive (Positive) Signal
	S3	RP-	SAS Primary Port Receive (Negative) Signal
	S4	GND	GND for SAS Primary Port
	S5	TP-	SAS Primary Port Transmit (Negative) Signal
	S6	TP+	SAS Primary Port Transmit (Positive) Signal
	S7	GND	GND for SAS Primary Port
	S8	GND	GND for SAS Secondary Port
	S9	RS+	SAS Secondary Port Receive (Positive) Signal
	S10	RS-	SAS Secondary Port Receive (Negative) Signal
	S11	GND	GND for SAS Secondary Port
	S12	TS-	SAS Secondary Port Transmit (Negative) Signal
	S13	TS+	SAS Secondary Port Transmit (Positive) Signal
	S14	GND	GND for SAS Secondary Port
Power Segment	P1[14]	Reserved	Not used
	P2[14]	Reserved	Not used
	P3[14]	Reserved	Not used
	P4	GND	GROUND
	P5	GND	GROUND
	P6	GND	GROUND
	P7	+5V-Charge	Pre-charge pin for +5V
	P8	+5V	+5V power supply input
	P9	+5V	+5V power supply input
	P10	GND	GROUND
	P11	READY LED	READY LED output
	P12	GND	GROUND
	P13	+12V-Charge	Pre-charge pin for +12V
	P14	+12V	+12V power supply input
	P15	+12V	+12V power supply input

[14] P1 to P3 are +3.3V power supply input and pre-charge signals, and not used on the MG04SCAxxEx series.

.

COMMAND TABLE (Part 1)

Op-Code	Command Name
00h	TEST UNIT READY
12h	INQUIRY
25h	READ CAPACITY (10)
9Eh/10h	READ CAPACITY (16)
15h	MODE SELECT (6)
55h	MODE SELECT (10)
1Ah	MODE SENSE (6)
5Ah	MODE SENSE (10)
01h	REZERO UNIT
1Bh	START/STOP UNIT
16h	RESERVE (6)
56h	RESERVE (10)
17h	RELEASE (6)
57h	RELEASE (10)
03h	REQUEST SENSE
4Ch	LOG SELECT
4Dh	LOG SENSE
5Eh	PERSISTENT RESERVE IN
5Fh	PERSISTENT RESERVE OUT
A0h	REPORT LUNS
A3h/05h	REPORT IDENTIFYING INFORMATION
A4h/06h	SET IDENTIFYING INFORMATION
A3h/0Ch	REPORT SUPPORTED OPERATION CODES
A3h/0Dh	REPORT SUPPORTED TASK MANAGEMENT FUNCTIONS

COMMAND TABLE (Part 2)

Op-Code	Command Name
08h	READ (6)
28h	READ (10)
A8h	READ (12)
88h	READ (16)
0Ah	WRITE (6)
2Ah	WRITE (10)
AAh	WRITE (12)
8Ah	WRITE (16)
2Eh	WRITE AND VERIFY (10)
AEh	WRITE AND VERIFY (12)
8Eh	WRITE AND VERIFY (16)
2Fh	VERIFY (10)
AFh	VERIFY (12)
8Fh	VERIFY (16)
0Bh	SEEK (6)
2Bh	SEEK (10)
35h	SYNCHRONIZE CACHE (10)
91h	SYNCHRONIZE CACHE (16)
04h	FORMAT UNIT
07h	REASSIGN BLOCKS
37h	READ DEFECT DATA (10)
B7h	READ DEFECT DATA (12)
1Dh	SEND DIAGNOSTIC
1Ch	RECEIVE DIAGNOSTIC RESULTS
3Bh	WRITE BUFFER
3Ch	READ BUFFER
3Eh	READ LONG (10)
9Eh/11h	READ LONG (16)
3Fh	WRITE LONG (10)
9Fh/11h	WRITE LONG (16)
41h	WRITE SAME (10)
93h	WRITE SAME (16)

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Product may include products subject to foreign exchange and foreign trade control laws.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**