

## > SG6 SERIES (Non-SED Model) CLIENT SSD

SG6 Series is a Client SATA SSD lineup using 64-layer, 3-bit-per-cell(TLC) BiCS FLASH™.

The SG6 series SSDs with up to 1024GB capacity, delivers performance of up to 550MB/s sequential read and 535MB/s sequential write. Furthermore, active power consumption was decreased by up to 40% compared to previous SG5 series, enabling increased battery life for mobile computing.

Offered in both traditional 2.5-type(7mm height) and compact M.2 2280 form factors, SG6 series is engineered for mainstream desktop PCs and notebook PCs as well as consumer upgrades.

## SSD



### > KEY FEATURES

- 64-layer, 3-bit-per-cell (TLC) BiCS FLASH™
- Capacities up to 1024GB
- SATA Revision 3.3, 6.0 Gbit/s interface
- 2.5-type and M.2 2280 form factor options

### > APPLICATIONS

- Desktop PCs
- Notebook PCs

### > SPECIFICATIONS

Standard Models		2.5-type (7.0 mm height)			M.2 2280-S2 Single-sided		M.2 2280-D2 Double-sided
Model Number		KSG60ZSE256G	KSG60ZSE512G	KSG60ZSE1T02	KSG60ZMV256G	KSG60ZMV512G	KSG60ZM81T02
Memory		TLC (BiCS FLASH™)					
Interface		SATA Rev. 3.3					
Maximum Speed		6.0 Gbit/s					
Command		ACS-4					
Connector Type		Standard SATA			M.2 B-M		
Formatted Capacity <sup>1)</sup>		256 GB	512 GB	1024 GB	256 GB	512 GB	1024 GB
Performance <sup>2)</sup>	Sequential Read	550 MB/s {524 MiB/s}			550 MB/s {524 MiB/s}		
	Sequential Write	340 MB/s {324 MiB/s}	535 MB/s {510 MiB/s}		340 MB/s {324 MiB/s}	535 MB/s {510 MiB/s}	
Supply Voltage		5.0 V ±5 %			3.3 V ±5 %		
Power Consumption	Active	2.3 W typ.	3.1 W typ.	3.5 W typ.	2.3 W typ.	3.1 W typ.	3.5 W typ.
	Idle	60 mW typ.	65 mW typ.	70 mW typ.	55 mW typ.	60 mW typ.	65 mW typ.
	DevSleep	6 mW max.			5 mW max.		
Size		100.0 mm x 69.85 mm x 7.0 mm			80.0 mm x 22.0 mm x 2.23 mm		80.0 mm x 22.0 mm x 3.58 mm
Weight		41 g typ.	42 g typ.	43 g typ.	6.9 g typ.		8.3 g typ.

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an “as is” basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

Standard Models		2.5-type (7.0 mm Height)	M.2 2280-S2 Single-sided	M.2 2280-D2 Double-sided
Temperature	Operating	0 to 70 °C (Case Temperature)	0 to 80 °C (Components Temperature)	
	Non-operating	-40 to 85 °C		
Reliability <sup>3)</sup>		Mean Time to Failure (MTTF): 1,500,000 hours Product Life: Approximately 5 years		
More Features		Strong & highly-efficient ECC named QSBC™ is supported. Firmware security feature (only digitally signed firmware can be installed) is supported.		
Compliance		UL, cUL, TÜV, KC, FCC, BSMI, CE, RCM, ISED, VCCI		

Note: 1) Definition of capacity: Toshiba Memory Corporation 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<sup>30</sup> = 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) 1 MiB (mebibyte) = 2<sup>20</sup> bytes = 1,048,576 bytes, and 1 MB (megabyte) = 1,000,000 bytes.

3) 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.

\* Product image may represent a design model.

\* Read and write speed may vary depending on the host device, read and write conditions, and file size.

\* Company names, product names, and service names mentioned herein may be trademarks of their respective companies.

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## > ORDERING INFORMATION

K   XX   X   X   X   X   X   XXXX  
 1   2   3   4   5   6   7   8

- |                           |  |
|---------------------------|--|
| 1. Product Name           | K: SSD product   |
| 2. Product Category       | SG: SG Series  |
| 3. Development Generation | 6: Generation 6  |
| 4. Option Code 1          | 0: Non-SED   |
| 5. Option Code 2          | Z: No-option   |
| 6. Connector Type         | S: Standard SATA<br>M: M.2 B-M   |
| 7. Form Factor            | E: 2.5-type 7 mm H<br>V: M.2 2280 Single Sided<br>8: M.2 2280 Double Sided                                   |
| 8. Capacity               | 256G / 512G / 1T02<br><br>256G is 256 GB, 512G is 512 GB and 1T02 is 1024 GB<br>(1 GB = 1,000,000,000 bytes) |

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## > PRODUCT LINE UP

Model Number	Formatted Capacity	Form Factor/Connect Type	Function Note
KSG60ZSE256G	256 GB	2.5-type <sup>1)</sup> Standard SATA	Non-SED
KSG60ZSE512G	512 GB		
KSG60ZSE1T02	1,024 GB		
KSG60ZMV256G	256 GB	M.2 2280-S2 <sup>2)</sup> -B-M	Non-SED
KSG60ZMV512G	512 GB		
KSG60ZM81T02	1,024 GB	M.2 2280-D2 <sup>3)</sup> -B-M	

Note: 1) 7mm Height  
 2) Single Sided  
 3) Double Sided

## > CAPACITY

Capacity	Total Number of User Addressable Sectors in LBA Mode	
	512 bytes sector	
256 GB	500,118,192	
512 GB	1,000,215,216	
1,024 GB	2,000,409,264	

Note: 1 GB (Gigabyte) = 1,000,000,000 bytes

## > PERFORMANCE

Standard Models	KSG60ZSE256G KSG60ZMV256G	KSG60ZSE512G KSG60ZMV512G	KSG60ZSE1T02 KSG60ZM81T02
Interface Speed	6.0 Gbit/s max.		
Sequential Read <sup>1)</sup>	550 MB/s {524 MiB/s}		
Sequential Write <sup>1)</sup>	340 MB/s {324 MiB/s}	535 MB/s {510 MiB/s}	535 MB/s {510 MiB/s}

Note: 1) Under the condition of measurement with 128 KiB unit sequential access and 4KiB align and queue depth is 32.  
 (1KiB=1024 bytes.)

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## > SUPPLY VOLTAGE

Standard Models	2.5-type	M.2 2280 Module
Allowable voltage	5.0 V $\pm$ 5 %	3.3 V $\pm$ 5 %
Allowable noise/ripple	100 mV p-p or less	
Allowable supply rise time	2 –100 ms	

Note: The drive has over current protection circuit. (Rated current: 3.15A)

## > POWER CONSUMPTION

Operation (Ta <sup>1</sup> =25°C)	2.5-type		
	KSG60ZSE256G	KSG60ZSE512G	KSG60ZSE1T02
Read <sup>2)</sup>	2.0 W typ.	2.1 W typ.	2.2 W typ.
Write <sup>2)</sup>	2.3 W typ.	3.1 W typ.	3.5 W typ.
Idle <sup>3)4)</sup>	60 mW typ.	65 mW typ.	70 mW typ.
Standby <sup>3)4)</sup>	60 mW typ.	65 mW typ.	70 mW typ.
Sleep <sup>3)</sup>	60 mW typ.	65 mW typ.	70 mW typ.
DevSleep	6 mW max.		

Operation (Ta <sup>1</sup> =25°C)	M.2 2280 Module		
	KSG60ZMV256G	KSG60ZMV512G	KSG60ZM81T02
Read <sup>2)</sup>	2.0 W typ.	2.1 W typ.	2.2 W typ.
Write <sup>2)</sup>	2.3 W typ.	3.1 W typ.	3.5 W typ.
Idle <sup>3)4)</sup>	55 mW typ.	60 mW typ.	65 mW typ.
Standby <sup>3)4)</sup>	55 mW typ.	60 mW typ.	65 mW typ.
Sleep <sup>3)</sup>	55 mW typ.	60 mW typ.	65 mW typ.
DevSleep	5 mW max.		

Note: 1) Ambient Temperature

2) The values are specified at the condition causing maximum power consumption, i.e., maximum workload, default maximum parallel number of flash memory operation and no thermal control effect.

3) The values are based on using SATA power management features. The Slumber mode is used for the power consumption measurements.

4) The drive may internally write to flash memory. Therefore, drive power consumption may temporarily change up to write power.

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## ENVIRONMENTAL CONDITIONS

### > TEMPERATURE

Condition	Range		Gradient
	2.5-type	M.2 2280 Module	
Operating <sup>1)</sup>	0 °C (Tc) – 70 °C (Tc) (Case Temperature)	0 °C (Tc) – 80 °C (Tc) (Components Temperature)	30 °C (Ta) / h maximum
Non-operating	-40 °C – 85 °C		30 °C / h maximum
Under Shipment <sup>2)</sup>	-40 °C – 85 °C		30 °C / h maximum

Note: 1) Ta: Ambient Temperature, Tc: Case or Components Temperature

2) Packaged in Toshiba Memory Corporation's original shipping package

### > HUMIDITY

Condition	Range
Operating	8 % – 90 % R.H. (No condensation)
Non-operating	8 % – 95 % R.H. (No condensation)
Under Shipment <sup>1)</sup>	5 % – 95 % R.H.
Max. wet bulb	32.5 °C (Operating) 40.0 °C (Non-operating / Shipping)

Note: 1) Packaged in Toshiba Memory Corporation's original shipping package

### > SHOCK

Condition	Range
Operating	14.709 km/s <sup>2</sup> {1,500 G}, 0.5 ms half sine wave
Non-operating	
Under Shipment <sup>1)</sup>	100 cm free drop

Note: 1) Apply shocks in each direction of the drive's three mutually perpendicular axes, one axis at a time.

Packaged in Toshiba Memory Corporation's original shipping package

### > VIBRATION

Condition	Range
Operating	196 m/s <sup>2</sup> {20 G} Peak, 10 - 2,000 Hz (20 minutes per axis) x 3 axis
Non-operating	

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## COMPLIANCE

### > SAFETY / EMI STANDARDS

Title	Description	Region
UL (Underwriters Laboratories)	UL 60950-1	USA <sup>1)</sup>
cUL (Underwriters Laboratories of Canada)	CSA-C22.2 No.60950-1-07	Canada
TÜV (Technischer Überwachungs Verein)	EN 60950-1	EURO
KC	KN32, KN35	Korea
FCC	FCC part 15 Subpart B	USA
BSMI (Bureau of Standards, Metrology and Inspection)	CNS13438 (CISPR Pub. 22)	Taiwan
CE	EN 55032, EN 55024	EURO
RCM	AS/NZS CISPR 32	Australia, New Zealand
ISED	ICES-003	Canada
VCCI	Class B	Japan

Note: 1) UL certification is basically on a voluntary basis.

### > RELIABILITY

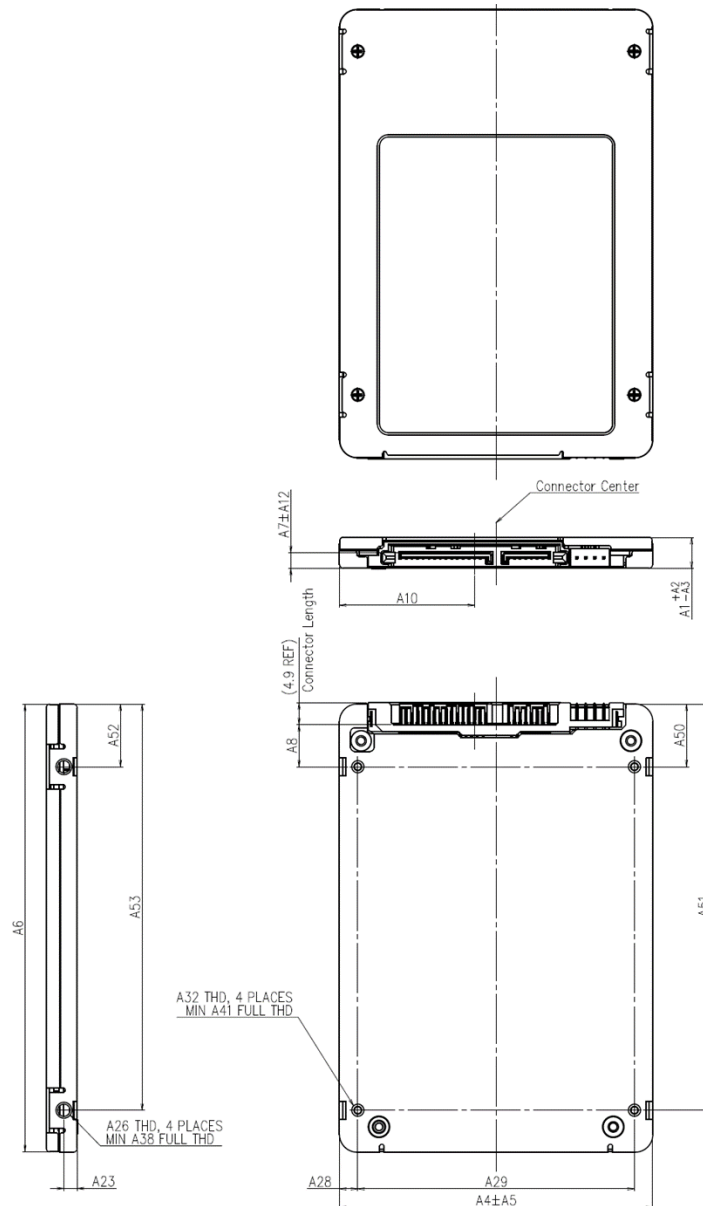
Parameter	Value
Mean Time to Failure	1,500,000 hours
Product Life	Approximately 5 years

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

**MECHANICAL SPECIFICATIONS**

> **2.5 TYPE**

Model Number	Weight	Width	Height	Length
KSG60ZSE256G	41 g typ.	69.85 mm	7.0 mm	100.0 mm
KSG60ZSE512G	42 g typ.			
KSG60ZSE1T02	43 g typ.			



**Figure 1: Dimensions of KSG60ZSExxx (2.5-type)**

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

> **DIMENSIONS OF KSG60ZSExxxx**

Dimension	SFF-8200 Rev3.2 <sup>1)</sup> SFF-8201 Rev3.3 SFF-8223 Rev2.5		SG6 Series SSD (Differences only)	
	Millimeters	Inches	Millimeters	Inches
A1	7.00	0.276		
A2	0.20	0.008	0.00	0.000
A3	0.50	0.020		
A4	69.85	2.750		
A5	0.25	0.010		
A6 <sup>2)</sup>	100.45*	3.955*	100.00 ± 0.41	3.937 ± 0.016
A7	3.5	0.138		
A8	9.40	0.370	9.40 ± 0.51	0.370 ± 0.020
A10 <sup>3)</sup>	-	-	30.125 ± 0.28	1.186 ± 0.011
A12	0.38	0.015		
A23	3.00	0.118	3.00 ± 0.20	0.118 ± 0.007
A26	M3	N/A		
A28	4.07	0.160	4.07 + 0.295/-0.305	0.060 +0.011/-0.012
A29	61.72	2.430	61.72 ± 0.25	2.430 ± 0.010
A32	M3	N/A		
A38	3 <sup>#</sup>	3 <sup>#</sup>		
A41	2.5 <sup>#</sup>	2.5 <sup>#</sup>		
A50 <sup>2)</sup>	14.00	0.551	14.00 ± 0.25	0.551 ± 0.010
A51 <sup>2)</sup>	90.60	3.567	90.60 ± 0.30	3.567 ± 0.012
A52 <sup>2)</sup>	14.00	0.551	14.00 ± 0.25	0.551 ± 0.010
A53 <sup>2)</sup>	90.60	3.567	90.60 ± 0.30	3.567 ± 0.012

\* = maximum

# = minimum number of threads

Note:1) SFF-8200: Small Form Factor Standard

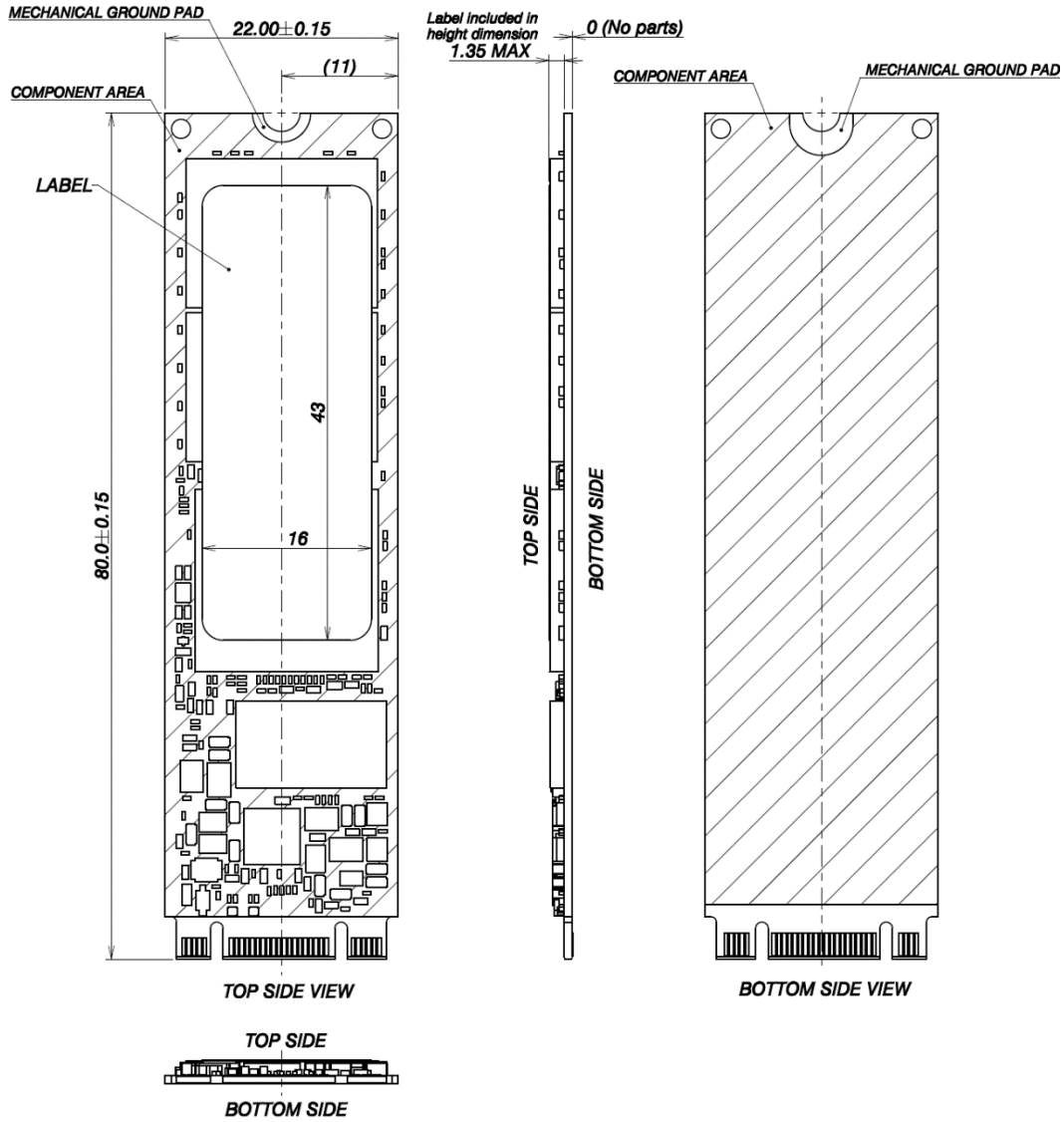
2) PCA, Connector not included

3) Connector center defined the same as SFF-8223 All

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

> M.2 2280 MODULE

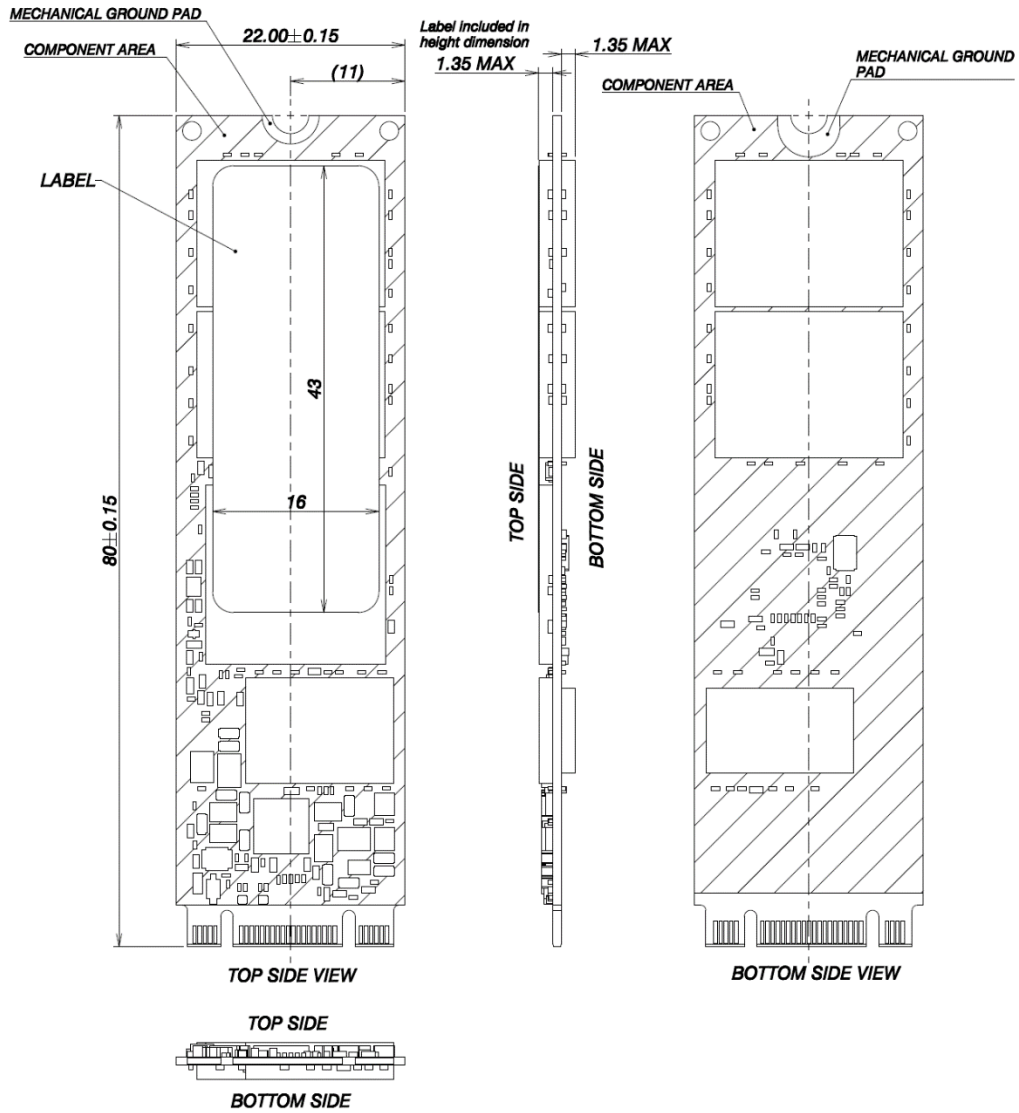
Model Number	Weight	Width	Height	Length
KSG60ZMV256G	6.9 g typ.	22.00 mm	2.23 mm	80.00 mm
KSG60ZMV512G	6.9 g typ.		3.58 mm	
KSG60ZM81T02	8.3 g typ.			



Unit:mm

Figure 2: Dimensions of KSG60ZMVxxx (M.2 2280-S2 Module)

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.



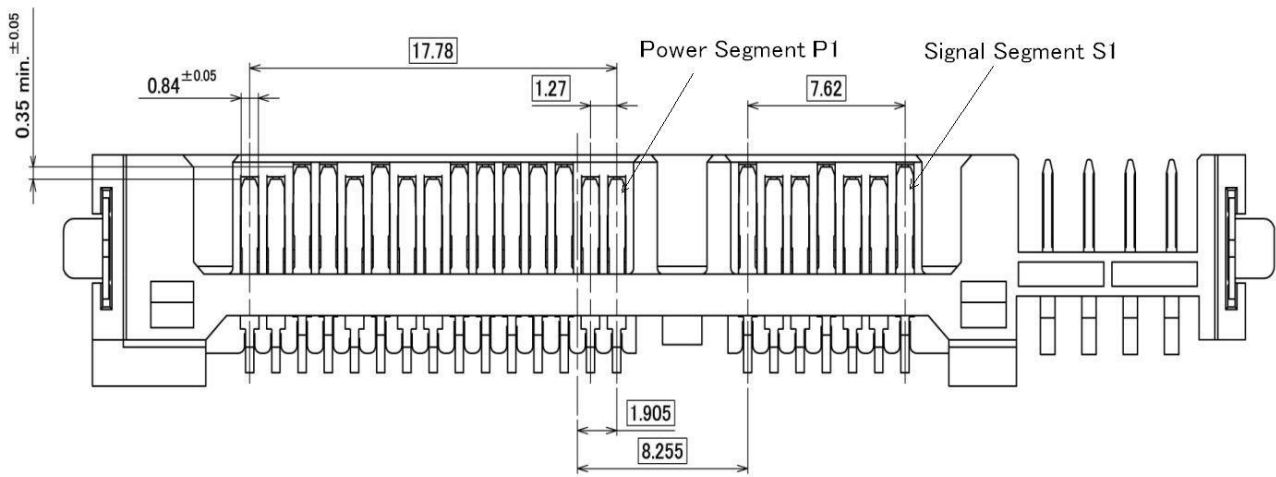
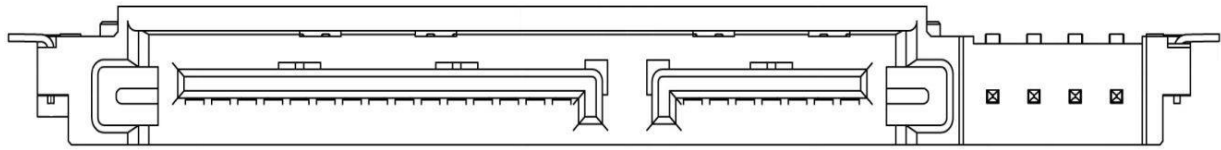
Unit:mm

**Figure 3: Dimensions of KSG60ZM81T02 (M.2 2280-D2 Module)**

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## INTERFACE CONNECTOR

### > 2.5 TYPE



Unit:mm

**Figure 4: 2.5-type Serial ATA Interface Connector**

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## > 2.5 TYPE DRIVE CONNECTER PIN ASSIGNMENT<sup>1)</sup>

Segment	Pin Position	Name	Description
Signal Segment	S1	GND	2 <sup>nd</sup> Mate
	S2	A+	Differential Signal Pair A (Device Rx), 3 <sup>rd</sup> Mate
	S3	A-	
	S4	GND	2 <sup>nd</sup> Mate
	S5	B-	Differential Signal Pair B (Device Tx), 3 <sup>rd</sup> Mate
	S6	B+	
	S7	GND	2 <sup>nd</sup> Mate

Signal segment "L"

Central connector polarizer

Power segment "L"

Power Segment	P1	Retired <sup>2)</sup>	
	P2	Retired <sup>2)</sup>	
	P3	DEVSLP <sup>2)</sup>	Enter/Exit DevSleep
	P4	GND	1 <sup>st</sup> Mate
	P5	GND	2 <sup>nd</sup> Mate
	P6	GND	2 <sup>nd</sup> Mate
	P7	V5	5 V power, pre-charge <sup>3)</sup> , 2 <sup>nd</sup> Mate
	P8	V5	5 V power, 3 <sup>rd</sup> Mate
	P9	V5	5 V power, 3 <sup>rd</sup> Mate
	P10	GND	2 <sup>nd</sup> Mate
	P11	DAS/DSS	Drive Activity Signal / Disable Staggered Spin-up, 3 <sup>rd</sup> Mate
	P12	GND	1 <sup>st</sup> Mate
	P13	V12	12 V power, pre-charge, 2 <sup>nd</sup> Mate (Unused)
	P14	V12	12 V power (Unused), 3 <sup>rd</sup> Mate
	P15	V12	12 V power (Unused), 3 <sup>rd</sup> Mate

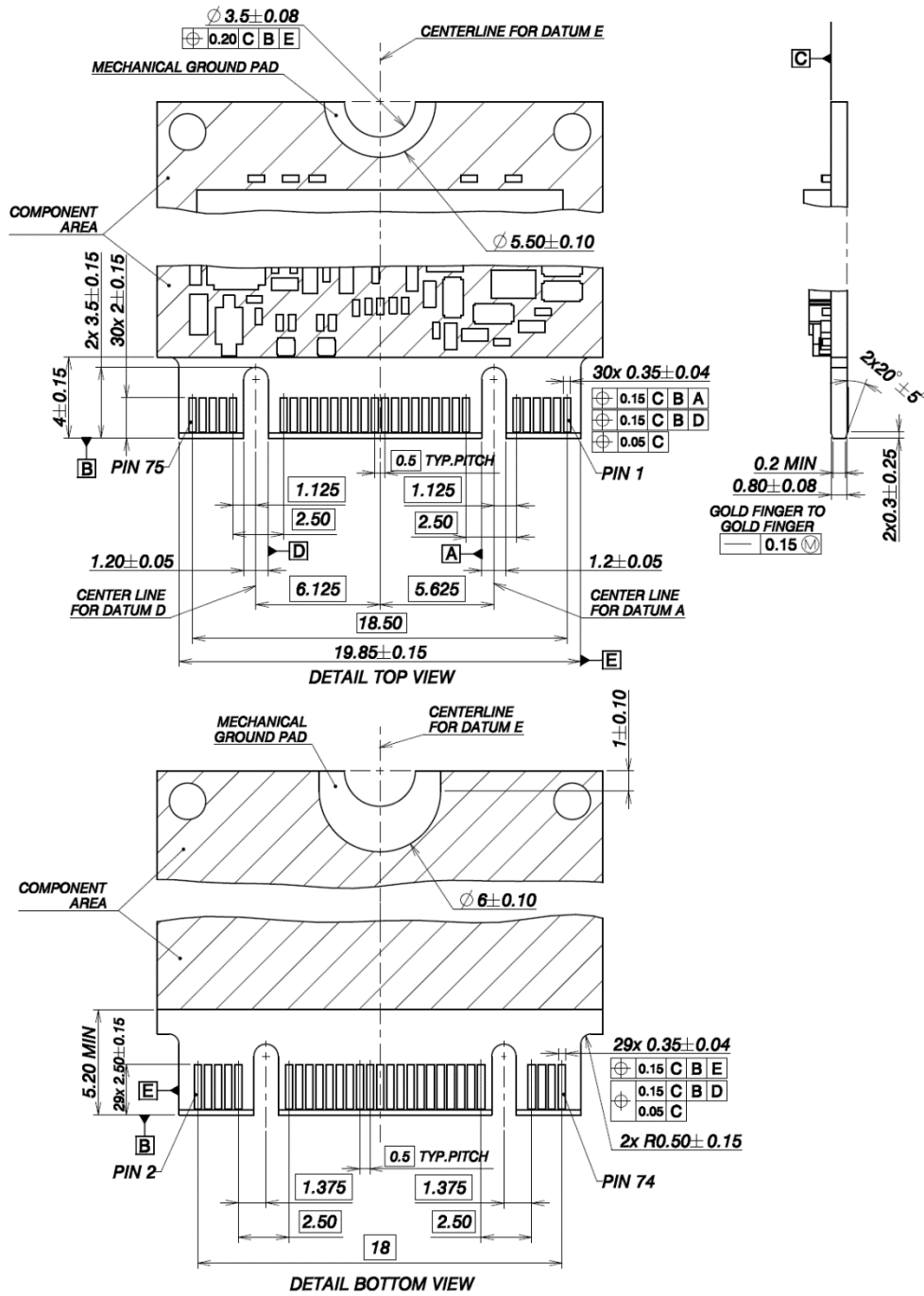
Power segment key

Note: 1) The Mate orders are for backplane usage. Hot-Plug and OS-Aware Hot Removal are supported when using with a backplane connector.

2) Previously, 3.3 V was assigned to pins P1, P2 and P3 by Serial ATA International Organization.

3) Direct connect to non pre-charge pins.

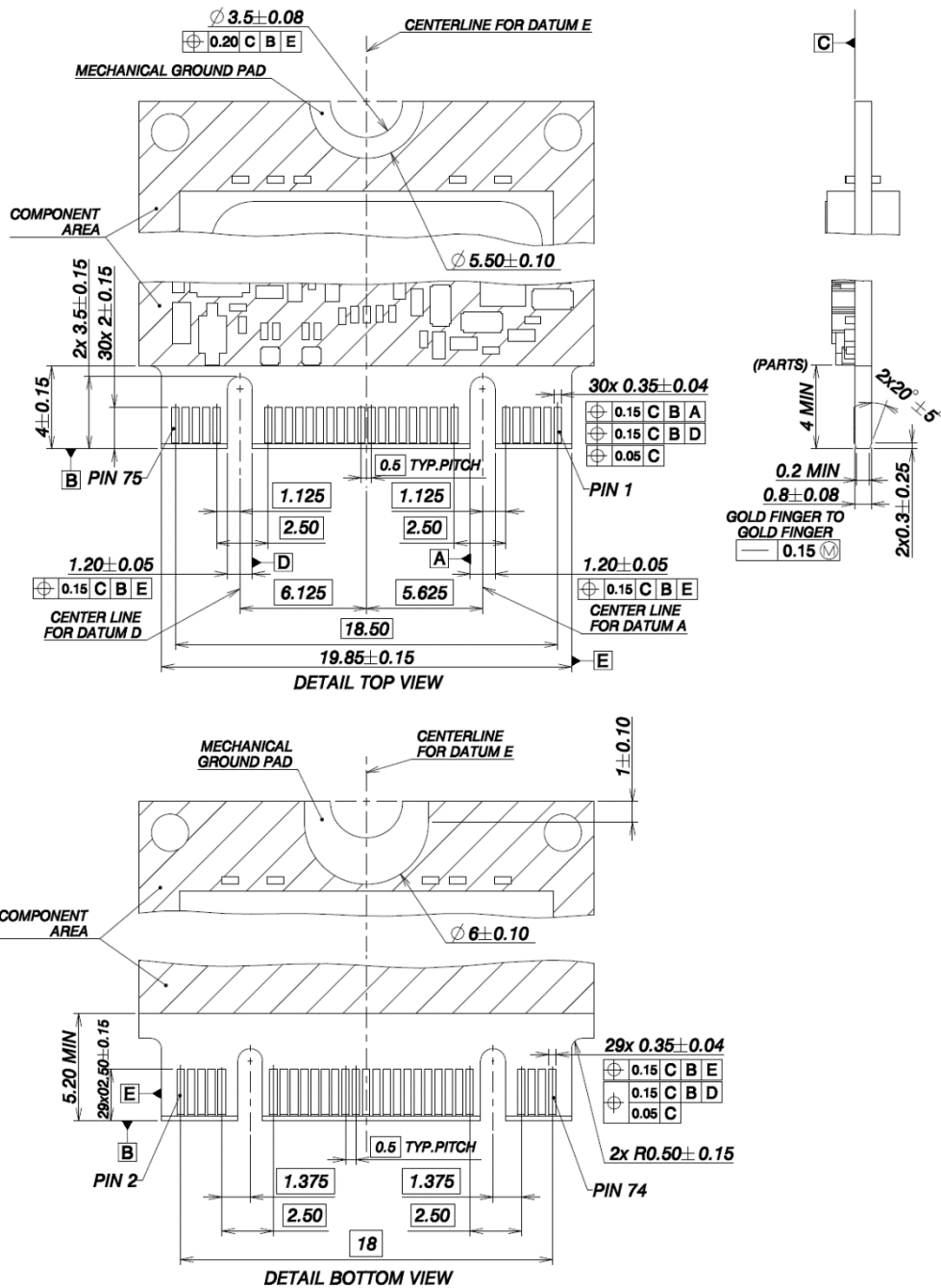
> M.2 2280 MODULE



Unit:mm

Figure 5: Interface Dimensions of KSG60ZMVxxxx (M.2 2280-S2 Module)

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.



Unit:mm

**Figure 6: Interface Dimensions of KSG60ZM81T02 (M.2 2280-D2 Module)**

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## > M.2 2280 MODULE CONNECTOR PIN ASSIGNMENT

Pin #	Name	Description
1	CONFIG_3	Defines module type(GND)
3	GND	GND
5	Reserved	NC
7	Reserved	NC
9	Reserved	NC
11	Reserved	NC
Notch		
21	CONFIG_0	Defines module type(GND)
23	Reserved	NC
25	Reserved	NC
27	GND	GND
29	Reserved	NC
31	Reserved	NC
33	GND	GND
35	Reserved	NC
37	Reserved	NC
39	GND	GND
41	B+	Host Receiver Differential Signal Pair
43	B-	
45	GND	GND
47	A-	Host Transmitter Differential Signal Pair
49	A+	
51	GND	GND
53	Reserved	NC
55	Reserved	NC
57	GND	GND
Notch		
67	Reserved	NC
69	CONFIG_1	Defines module type(GND)
71	GND	GND
73	GND	GND
75	CONFIG_2	Defines module type(GND)

Pin #	Name	Description
2	+3.3V	3.3 V Source
4	+3.3V	3.3 V Source
6	Reserved	NC
8	Reserved	NC
10	DAS/DSS	Drive Activity Signal / Disable Staggered Spin-up
Notch		
20	Reserved	NC
22	Reserved	NC
24	Reserved	NC
26	Reserved	NC
28	Reserved	NC
30	Reserved	NC
32	Reserved	NC
34	Reserved	NC
36	Reserved	NC
38	DEVSLP	DEVSLP signal
40	Reserved	NC
42	Reserved	NC
44	Reserved	NC
46	Reserved	NC
48	Reserved	NC
50	Reserved	NC
52	Reserved	NC
54	Reserved	NC
56	MFG1	Manufacturing pin. Must be a no-connect on the host board.
58	MFG2	
Notch		
68	Reserved	NC
70	+3.3V	3.3 V Source
72	+3.3V	3.3 V Source
74	+3.3V	3.3 V Source

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## COMMAND TABLE

Op-Code	Command Name	
00h	NOP	
06h	DATA SET MANAGEMENT	
10h	RECALIBRATE	
20h	READ SECTOR(S)	
21h	READ SECTOR(S) without retries	
24h	READ SECTOR(S) EXT	
25h	READ DMA EXT	
27h	READ NATIVE MAX ADDRESS EXT	
29h	READ MULTIPLE EXT	
2Fh	READ LOG EXT	
30h	WRITE SECTOR(S)	
31h	WRITE SECTOR(S) without retries	
34h	WRITE SECTOR(S) EXT	
35h	WRITE DMA EXT	
37h	SET MAX ADDRESS EXT	
39h	WRITE MULTIPLE EXT	
3Dh	WRITE DMA FUA EXT	
3Fh	WRITE LOG EXT	
40h	READ VERIFY SECTOR(S)	
41h	READ VERIFY SECTOR(S) without retries	
42h	READ VERIFY SECTOR(S) EXT	
45h	WRITE UNCORRECTABLE EXT	
45h	55h	Create a pseudo-uncorrectable error with logging
45h	AAh	Create a flagged error without logging
47h	READ LOG DMA EXT	
57h	WRITE LOG DMA EXT	
5Bh	TRUSTED NON-DATA	
5Ch	TRUSTED RECEIVE	
5Dh	TRUSTED RECEIVE DMA	
5Eh	TRUSTED SEND	
5Fh	TRUSTED SEND DMA	
60h	READ FPDMA QUEUED	
61h	WRITE FPDMA QUEUED	
70h	SEEK	
90h	EXECUTE DEVICE DIAGNOSTIC	
91h	INITIALIZE DEVICE PARAMETERS	

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

Op-Code		Feature Name
92h		DOWNLOAD MICROCODE
92h	03h	Download with offsets and save microcode for immediate and future use
92h	07h	Download and save microcode for immediate and future use
92h	0Eb	Download with offsets and save microcode for future use
92h	0Fb	Activate downloaded microcode
93h		DOWNLOAD MICROCODE DMA
93h	03h	Download with offsets and save microcode for immediate and future use
93h	07h	Download and save microcode for immediate and future use
93h	0Eb	Download with offsets and save microcode for future use
93h	0Fb	Activate downloaded microcode
B0h		SMART
B0h	D0h	SMART READ DATA
B0h	D1h	SMART READ ATTRIBUTE THRESHOLDS
B0h	D2h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE
B0h	D3h	SMART SAVE ATTRIBUTE VALUES
B0h	D4h	SMART EXECUTE OFF-LINE IMMEDIATE
B0h	D5h	SMART READ LOG
B0h	D6h	SMART WRITE LOG
B0h	D8h	SMART ENABLE OPERATIONS
B0h	D9h	SMART DISABLE OPERATIONS
B0h	DAh	SMART RETURN STATUS
B0h	DBh	SMART ENABLE/DISABLE AUTOMATIC OFF-LINE
B1h		DEVICE CONFIGURATION OVERLAY
B1h	C0h	DEVICE CONFIGURATION RESTORE
B1h	C1h	DEVICE CONFIGURATION FREEZE LOCK
B1h	C2h	DEVICE CONFIGURATION IDENTIFY
B1h	C3h	DEVICE CONFIGURATION SET
B1h	C4h	DEVICE CONFIGURATION IDENTIFY DMA
B1h	C5h	DEVICE CONFIGURATION SET DMA
B4h		SANITIZE DEVICE
B4h	00h	SANITIZE STATUS EXT
B4h	11h	CRYPTO SCRAMBLE EXT
B4h	12h	BLOCK ERASE EXT
B4h	20h	SANITIZE FREEZE LOCK EXT

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

Op-Code		Feature Name
C4h		READ MULTIPLE
C5h		WRITE MULTIPLE
C6h		SET MULTIPLE MODE
C8h		READ DMA
C9h		READ DMA without retries
CAh		WRITE DMA
CBh		WRITE DMA without retries
CEh		WRITE MULTIPLE FUA EXT
E0h		STANDBY IMMEDIATE
E1h		IDLE IMMEDIATE
E2h		STANDBY
E3h		IDLE
E4h		READ BUFFER
E5h		CHECK POWER MODE
E6h		SLEEP
E7h		FLUSH CACHE
E8h		WRITE BUFFER
E9h		READ BUFFER DMA
EAh		FLUSH CACHE EXT
EBh		WRITE BUFFER DMA
ECh		IDENTIFY DEVICE
EFh		SET FEATURES
EFh	02h	Enable volatile write cache
EFh	03h	Set transfer mode
EFh	05h	Enable the APM feature set
EFh	10h	Enable use of SATA feature set
EFh	55h	Disable read look-ahead
EFh	66h	Disable reverting to power-on defaults
EFh	82h	Disable volatile write cache
EFh	85h	Disable the APM feature set
EFh	90h	Disable use of SATA feature set
EFh	AAh	Enable read look-ahead
EFh	CCh	Enable reverting to power-on defaults

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

Op-Code		Feature Name
F1h		SECURITY SET PASSWORD
F2h		SECURITY UNLOCK
F3h		SECURITY ERASE PREPARE
F4h		SECURITY ERASE UNIT
F5h		SECURITY FREEZE LOCK
F6h		SECURITY DISABLE PASSWORD
F8h		READ NATIVE MAX ADDRESS
F9h		SET MAX ADDRESS
F9h	01h	SET MAX SET PASSWORD
F9h	02h	SET MAX LOCK
F9h	03h	SET MAX UNLOCK
F9h	04h	SET MAX FREEZE LOCK
F9h	05h	SET MAX SET PASSWORD DMA
F9h	06h	SET MAX UNLOCK DMA

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.

## > RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA". Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related 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.**

Products and specifications discussed herein are for reference purposes only and are subject to change without notice. All information discussed herein is provided on an "as is" basis, without warranties of any kind. Before creating and producing designs and using, customers must refer to and comply with the latest versions of the product specifications.