TOSHIBA
Leading Innovation

Product Catalog Mar. 2013

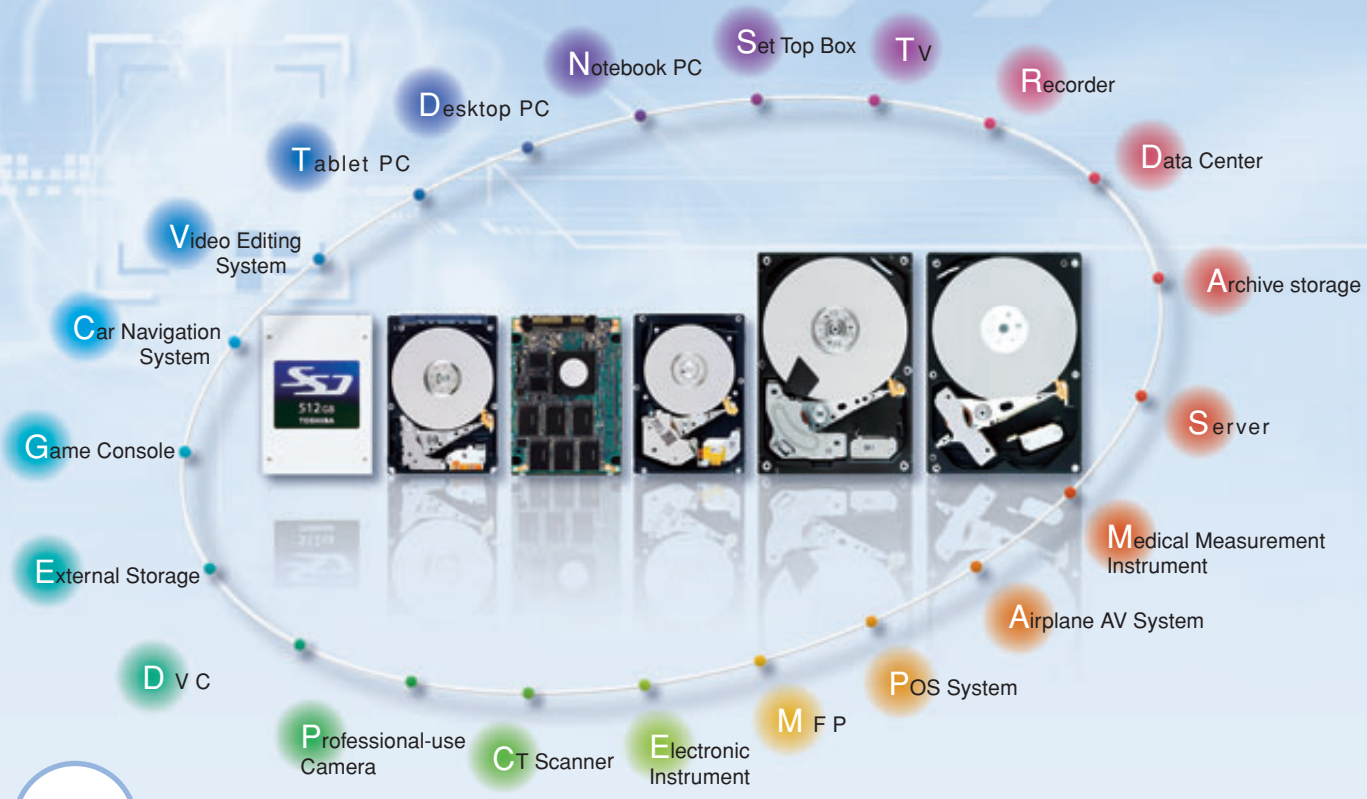
SSD/HDD

Storage Products

SEMICONDUCTOR & STORAGE PRODUCTS

http://www.toshibastorage.com

Toshiba Storage Products Underpin the Information Society



Invention

▶ NAND Flash Invention

INVENTOR OF FLASH MEMORY

In 1984, Toshiba invented a new type of semiconductor memory called flash memory. In 1987, Toshiba developed NAND flash memory, which became an internationally standardized memory device. After that, Toshiba has been striving to be a world leader in NAND flash technology and production.

Award

▶ GOOD FACTORY AWARD

GOOD FACTORY AWARD

The Good Factory Awards were founded in 2011 by the Japan Management Association (JMA) to commend excellent Japanese factories in Asia for achieving excellent results in terms of kaizen (continuous improvement) and kakushin (innovation). Toshiba Information Equipment (Philippines), Inc., which manufactures hard disk drives (HDDs) and solid state drives (SSDs), won the Factory Management Award in October 2011 for "a generally high level of factory operation and good overall balance."

▶ Grand Prize for Excellence in Energy Efficiency and Conservation

Director-General's Prize, the Agency for Natural Resources and Energy (Product Category & Business Model Category)

Enterprise SSDs: MK4001GRZB, MK2001GRZB, MK1001GRZB

This commendation program publicly recognizes enterprises, factories and offices in Japan's industrial, business and transportation sectors for their efforts in energy conservation as well as business organizations that have developed products with excellent energy efficiency. Its objectives are to raise energy conservation awareness, promote energy conservation products, cultivate industrial fields involved in energy conservation and help create a society where energy conservation is the norm. In 2011, Toshiba's enterprise SSDs, MK4001GRZB, MK2001GRZB and MK1001GRZB, were awarded the Director-General's Prize of the Agency for Natural Resources and Energy in the Product Category & Business Model Category.

Environment

▶ Halogen-Free

The built-in type solid state drive (SSD) and hard disk drive (HDD) products in this catalog are classified as Halogen-Free. For the avoidance of doubt, Halogen-Free SSD or HDD products may not be entirely free of bromine and chlorine, and may contain any other element of the halogen family. For the definitions of Halogen-Free of Toshiba Semiconductor & Storage Products Company, and details in each product series, please contact your TOSHIBA sales representative in the last page of this catalog.

▶ RoHS

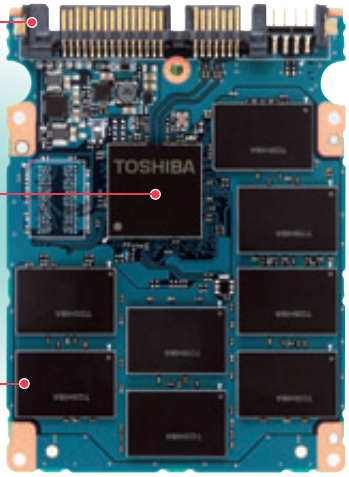
Restriction of the use of certain Hazardous Substances (2011/65/EU)

The directive adopted by the European Union (EU) that restricts the use of six hazardous materials, lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE), in the manufacture of computers, telecommunication equipment, home appliances, etc. The RoHS directive was recast in 2011 and has been enforced in January 2013. All the SSDs and HDDs listed in this catalog are compatible with the RoHS directive.

Client SSDs and HDDs Overview and Structure >>

SSD Solid State Drive

Client SSD



Connector (Interface)
Has an HDD-compatible SATA interface and an mSATA interface suitable for small-form-factor appliances.

Controller
The heart of an SSD that delivers fast read/write performance, prolonged write/erase cycle life and enhanced reliability.

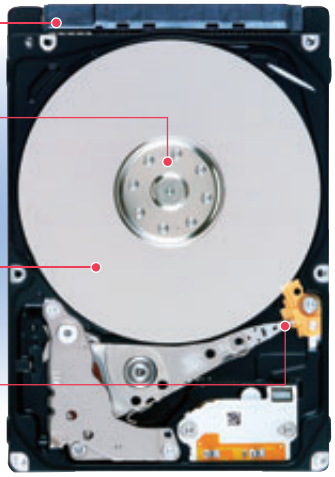
NAND Flash Memory
Data is stored in a NAND flash memory array, which features Toshiba's MLC NAND technology to achieve low costs and high storage capacities.

SSD is a storage product*1 that uses semiconductor memory (NAND flash memory)*2 as a storage element. Since SSDs have no mechanical moving parts, they are superior to HDDs in terms of:
1) read performance, 2) resistance to shock and vibration and 3) silent operation. Additionally, SSDs feature low power consumption in standby mode.

*1 Toshiba collectively refers to products that can store data such as SSDs and HDDs as "storage products".
*2 NAND flash memory is a nonvolatile semiconductor memory.

HDD Hard Disk Drive

Client HDD



Connector (Interface)
Has the most commonly used SATA port for system interfacing.

Spindle Motor
A key part for rotating a medium at high rpm. The platters are spun at speeds varying from 5,400 rpm in HDDs for PC applications to 15,000 rpm in enterprise HDDs.

Medium
A storage medium that holds data. 2.5-inch HDDs can hold up to 500 GB of data per platter.

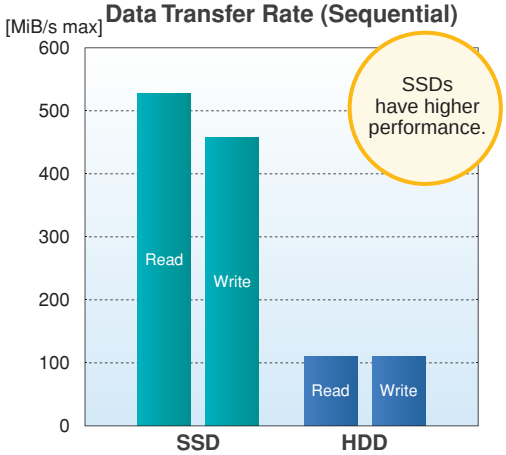
Magnetic Head
Data is read from and written to a medium via the magnetic head.

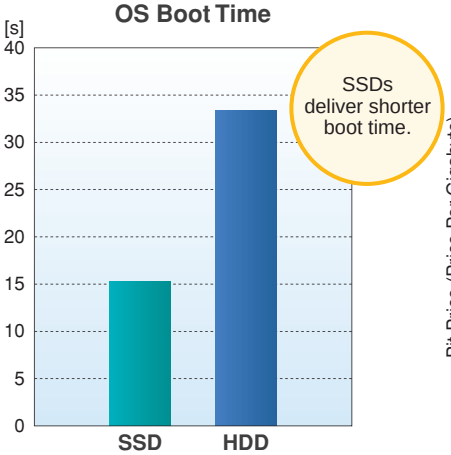
An HDD is a storage product that magnetically stores data in a disk recording medium. Data is written to and read from a platter, which rotates at high speeds, via a magnetic head that operates very close to the disk surface. Compared to SSDs, increasing storage capacities is easier for HDDs. Additionally, HDDs provide higher cost performance (lower price per gigabyte) than SSDs.

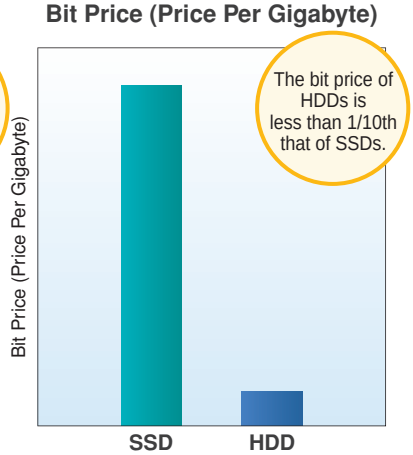
SSD and HDD Characteristics >>

(Tested by Toshiba)

	SSD (THNSNF128GBSS)	HDD (MQ01ABD100)
Case Temperature	(Op.): 0˚C to 70˚C (Non-Op.): –40˚C to 85˚C	(Op.): 5˚C to 55˚C (Non-Op.): –40˚C to 65˚C
Vibration	(Op.): 196 m/s² {20 G} (Non-Op.): 196 m/s² {20 G}	(Op.): 9.8 m/s² {1.0 G} (Non-Op.): 49 m/s² {5.0 G}
Shock	(Op.): 14,700 m/s² {1,500 G} (Non-Op.): 14,700 m/s² {1,500 G}	(Op.): 1,960 m/s² {200 G} (Non-Op.): 8,820 m/s² {900 G}
Acoustic Noise	None	23 dB







Client SSDs and HDDs >>

Client storage products suitable for everyday digital devices

Various electronic products such as high-end PCs, desktop PCs, televisions and video recorders are equipped with storage devices. However, different products have different requirements for data storage. To meet diverse customer needs, Toshiba offers a wide range of client storage products suitable for various applications.

Client SSDs HG5d Series

- Combines multi-level-cell (MLC) NAND flash technology with a high-performance flash controller to improve storage capacity and performance.
- Offers sufficient reliability for general and high-end PC applications.
- Low power consumption of less than 0.1 W at MobileMark® 2007 workload.

MobileMark® is a registered trademark of the Business Applications Performance Corporation in the United States.

	Model	Capacity*4	NAND Type	Interface	Data Transfer Rate (MB/s{MiB/s}Max)*5		Shock (Op.) 0.5 ms half s/w. (m/s²){G}	Case Temp. (Op.) (˚C)	Dimensions Height / Width / Length (mm)	Weight (g Typ.)	Supply Voltage (V)
					Seq.Read	Seq.Write					
2.5-inch {64mm}, 9.5-mmH Case*3	**THNSNH512GBST**	512 GB	MLC	SATA	534 {510}	482{460}	14,700 {1,500}	0-70	9.5/69.85/100.0	55	5
	THNSNH256GBST	256 GB									
	THNSNH128GBST	128 GB				471{450}				51	
	THNSNH060GBST	60 GB				450{430}					
2.5-inch {64mm}, 7.0-mmH Case*3	**THNSNH512GCST**	512 GB	MLC	SATA	534 {510}	482{460}	14,700 {1,500}	0-70	7.0/69.85/100.0	53	5
	THNSNH256GCST	256 GB									
	THNSNH128GCST	128 GB				471{450}				49	
	THNSNH060GCST	60 GB				450{430}					
mSATA Modules	**THNSNH256GMCT**	256 GB	MLC	mini SATA	534 {510}	471{450}	14,700 {1,500}	0-80	3.95/30.0/50.95	7.8	3.3
	THNSNH128GMCT	128 GB								7.5	
	THNSNH060GMCT	60 GB				450{430}					

Hybrid Drives >>

Hybrid drives combine an HDD and NAND flash memory to provide the HDD advantages of high capacity and low cost and the SSD advantage of fast access speed. Toshiba's hybrid drives integrate its advanced and well-proven technologies that Toshiba, the inventor of flash memory, has accumulated through years of development of NAND flash memory, SSDs and HDDs. Toshiba's hybrid drives can be installed in electronic devices as a single entity without requiring any special BIOS settings or driver software.

(Image of Hybrid Drive)

Model	Capacity*4	NAND Type	Rotation Speed (rpm)	Interface	Power Con ption		Shock (Op.)/ 2 ms half s/w. (m/s²){G}	Buffer Size (MiB)*5	Acoustic Noise / Idle (dB Ave.)	Temp. (Op.) (˚C)	Dimensions Height / Width / Length (mm)	Weight (g Max)	Supply Voltage (V)
					Low Power Idle (W Typ.)	Read / Write (W Typ.)							
MQ01ABD100H	1 TB	SLC 8 GiB*5	5,400	SATA	0.75	3.30/3.00	3,920 {400}	32	23	5-55	9.5/69.85/100.0	117	5
MQ01ABD075H	750 GB												

"2.5-inch" and "3.5-inch" mean the form factors of HDDs or SSDs. They do not indicate drive's physical size.
*3: The 2.5-inch case has the same form factor as 2.5-inch HDD.
*4: 1 MB (megabytes) = 1,000,000 bytes, 1 GB (gigabytes) = 1,000,000,000 bytes, 1 TB (terabytes) = 1,000,000,000,000 bytes
*5: KiB (kebibytes) = 1,024 (2^{10} bytes), MiB (mebibytes) = 1,048,576 (2^{20}) bytes, GiB (gibibytes) = 1,073,741,824 (2^{30}) bytes
*6: Ultrabook™ is a trademark of Intel Corporation in the United States and other countries.
*7: TCG is the Trusted Computing Group.
*8: A technology that utilizes the encryption feature by securely invalidating data when accessed from any unauthorized system.
*9: Does not support high availability operation required for mission-critical systems.
*10: Temperature range for 24x7 operation: –15 to +70˚C (HDD case). Does not support high-availability operation required for business-critical systems.

2.5-inch {64mm} 5,400-rpm Series

- Available in a wide range of capacities.
- Suitable for notebook and mobile PCs.
- Also suitable for applications that require high-capacity storage such as TVs and HDD recorders.

Model	Capacity*4	Rotation Speed (rpm)	Interface	Power Consumption		Shock (Op.)/ 2 ms half s/w. (m/s²){G}	Buffer Size (MiB)*5	Acoustic Noise / Idle (dB Ave.)	Temp. (Op.) (˚C)	Dimensions Height / Width / Length (mm)	Wipe technology	24x7 Operation	Weight (g Max)	Supply Voltage (V)
				Low Power Idle (W Typ.)	Read / Write (W Typ.)									
MQ01ABD100	1 TB	5,400	SATA	0.55	1.5	3,920 {400}	8	23	5-55	9.5/69.85/100.0			117	5
MQ01ABD075	750 GB													
MQ01ABD050	500 GB							17					107	
MQ01ABD032	320 GB													
MQ01ABD025	250 GB													

2.5-inch {64mm} 5,400-rpm, 7-mmH Series

- Thin-form-factor series.
- Suitable for mobile applications such as Ultrabooks™*6 and notebook PCs.

MQ01ABF050	500 GB	5,400	SATA	0.55	1.5	3,920 {400}	8	19	5-55	7.0/69.85/100.0			92	5
MQ01ABF032	320 GB													
MQ01ABF025	250 GB													

2.5-inch {64mm} 7,200-rpm Wipe Technology Series

- Suitable for PCs, multifunction printers (MFPs) and security-sensitive appliances.
- Self-encrypting drives without wipe technology are also available (Compliant with TCG*7 Opal V1.0).

MK6461GSYG	640 GB	7,200	SATA	0.8	2.1	3,185 {325}	16	26	5-55	9.5/69.85/100.0	●*9		115	5
MK5061GSYG	500 GB													
MK3261GSYG	320 GB							23					98	
MK2561GSYG	250 GB													
MK1661GSYG	160 GB													

2.5-inch {64mm} Value-Added Series

- Rotational vibration compensation and 24x7 operation.
- Suitable for industrial applications and blade server systems.

MK5061GSYB	500 GB	7,200	SATA	0.8	2.1	3,185 {325}	16	26	5-55	9.5/69.85/100.0		●*10	115	5
MK2561GSYB	250 GB													
MK1661GSYB	160 GB							23						
MK8061GSYB	80 GB													
MK8050GACY	80 GB	4,200	PATA	0.8	2.0	2,940 {300}	8	22	-20-70	9.5/69.85/100.0		●*11	98	5
MK1060GSCX	100 GB		SATA						-30-85					

3.5-inch {89mm} Series

- High capacity and high performance.
- Suitable for desktop PCs and PC servers.
- Also usable for digital home appliances.

DT01ACA300	3 TB	7,200	SATA	5.2	6.4	686 {70}	64	27	0-60	26.1/101.6/147			680	5 12
DT01ACA200	2 TB													
DT01ACA100	1 TB			3.7	6.4		32	25					450	
DT01ACA050	500 GB													
DT01ABA300V	3 TB	5,940	SATA	4.2	5.4	686 {70}	32	24	0-60	26.1/101.6/147			680	5 12
DT01ABA200V	2 TB	5,700		3.3	4.7			22						
DT01ABA100V	1 TB			3.0	5.7			19					450	
DT01ABA050V	500 GB													

Enterprise SSDs and HDDs >>

Features of High-Performance Enterprise HDDs

- Offers high data transfer rates for high-end and mid-range servers.
- Provides excellent data transfer and random read/write performance at 15k and 10k rpm.
- The high-performance 2.5-inch HDDs are physically smaller and consume less power than 3.5-inch HDDs. The 2.5-inch HDDs help reduce the overall size and power consumption of the systems in which they are used.
- The AL13SEL Series has a 2.5-inch high-speed drive in a 3.5-inch bracket. It excels typical 3.5-inch high-speed drives in terms of energy efficiency.

Features of High-Capacity Enterprise HDDs

- Toshiba offers high-capacity HDDs with capacities up to 4 TB, which are suitable for storage system and data center applications.
- Supports a highly reliable and highly extensible 6-Gbps Serial Attached SCSI (SAS) interface (MG03SCA300/200/100).
- Supports Serial ATA (SATA) 6 Gbps and thus helps reduce system costs (MG03ACA400/300/200/100).
- Provides rotational vibration compensation to maintain performance in the presence of vibrations from a cooling fan or an adjacent HDD.

	Model	Capacity*4	Rotation Speed (rpm)	Interface	Max Data Rate (sustained) (MB/s)	Power Consumption (Low Power/Idle) (W Typ.)	Average Seek Time (Read/Write) (ms)	Average Latency (ms)	Buffer Size (MiB)*5	Acoustic Noise / Idle (dB Typ.)	Case Temp. (Op.) (°C)	Encrypt. (Optional)	Dimensions Height / Width / Length (mm)	Weight (g Max)	Supply Voltage (V)
2.5-inch {64mm}, 15,000rpm 	**MK3001GRRB**	300 GB	15,000	SAS 6 Gbps	211	4.0	2.7/3.0	2.00	32	33	5-55	●	15.00 69.85 100.45	225	5 12
	MK1401GRRB	147 GB				3.8									
2.5-inch {64mm}, 10,500rpm 	**AL13SEB900**	900 GB	10,500	SAS 6 Gbps	195	3.9	3.7/4.1	2.86	64	30	5-55	●*	15.00 69.85 100.45	240	5 12
	AL13SEB600	600 GB				3.4									
	AL13SEB450	450 GB				3.4									
	AL13SEB300	300 GB				3.0									
3.5-inch {89mm}, 10,500rpm 	**AL13SEL900**	900 GB	10,500	SAS 6 Gbps	195	3.9	3.7/4.1	2.86	64	31	5-55		26.1 101.6 147.0	500	5 12
	AL13SEL600	600 GB				3.4									
	AL13SEL450	450 GB				3.4									
	AL13SEL300	300 GB				3.0									
3.5-inch {89mm}, 7,200rpm 	**MG03SCA400**	4 TB	7,200	SAS 6 Gbps	165	6.0	8.5/9.5	4.17	64	31	5-55	●*	26.1 101.6 147.0	720	5 12
	MG03SCA300	3 TB			155										
	MG03SCA200	2 TB													
	MG03SCA100	1 TB													
	MG03ACA400	4 TB	7,200	SATA 6 Gbps	165	6.0	8.5/9.5	4.17	64	31	5-55	●	26.1 101.6 147.0	720	5 12
	MG03ACA300	3 TB			155										
	MG03ACA200	2 TB													
	MG03ACA100	1 TB													

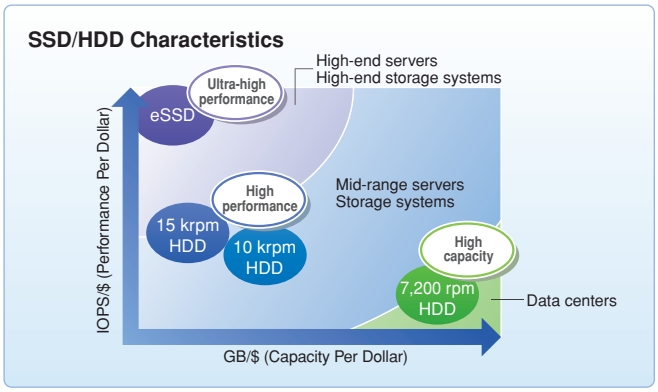
* Scheduled to be available in March 2013

>> Self Encrypting Drives (SEDs) for Enterprise Applications

Toshiba offers various SSDs and HDDs for enterprise use with self-encrypting capabilities.
Called SEDs, these drives support 256-bit AES to safeguard sensitive data against incidents of negligence such as loss or theft of equipment or inappropriate disposal.
Additionally, SEDs provide Cryptographic Erase, a feature that allows you to instantly make data unreadable by wiping the encryption key when a storage medium is reused or disposed of. It also saves time and costs required for data erasure processes.

Features of Enterprise SSDs

- SSDs provide faster random access performance than HDDs. Therefore, when used as cache and storage, SSDs help improve the overall performance of servers and storage systems. SSDs are also a suitable solution to improve the performance of industrial equipment.
- Uses NAND flash memory specifically designed for enterprise applications to provide enhanced reliability.
- Supports the Power Loss Protection feature to safeguard data against temporary power interruption.
- Offers excellent Power Consumption Efficiency*11 (IOPS/W), reducing the total cost of ownership (TCO) for an overall system.



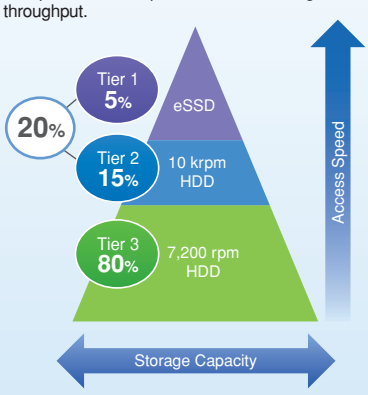
	Model	Capacity*4	NAND Type	Interface	Sector Size (bytes)	Data Transfer Rate (sustained)(MB/s)		IOPS*12 (sustained) Read / Write (4-kB Random)*5		Average Power Consumption (W Typ.)	Power Loss Protection	Ambient Temp. (°C)	Encrypt. (Optional)	Dimensions Height / Width / Length (mm)	Weight (g Max)	Supply Voltage (V)
						Seq.Read	Seq.Write	Read	Write							
Enterprise SSDs 	**MK4001GRZB**	400 GB	SLC	SAS 6 Gbps	512 520 528	500	250	90,000	16,000	6.5	●	0-55		15.00 69.85 100.45	160	5 12
	MK2001GRZB	200 GB														
	MK1001GRZB	100 GB														
	PX02SMB160	1.6 TB	eMLC	SAS 6 Gbps / 12 Gbps	512 520 528 4096 4160 4224	900	400	120,000	25,000	9.0	●	0-55	●	7.00 69.85 100.00	170	5 12
	PX02SMF080	800 GB								8.5					70	
	PX02SMF040	400 GB														
	PX02SMF020	200 GB														

Benefits of a Tiered Storage System >>

Tiered storage combines high-speed enterprise SSDs and low-cost, high-capacity HDDs, as opposed to conventional storage that consists of only enterprise HDDs. Compared to the conventional storage system, a tiered storage system improves access performance by approx. 7.5 times, eliminating I/O bottlenecks. Compared with the conventional storage system, the tiered storage system cuts the number of drives by approx. two-thirds and cuts power consumption by approx. 55%. The tiered storage system greatly reduces the total cost of ownership (TCO) and contributes to a reduction in environmental impact. (Estimates by Toshiba)
Toshiba offers a suitable portfolio of enterprise SSDs and HDDs needed to build tiered storage systems. You can select storage products that best fit your needs.

>> Tiered Storage System

According to an access model of a typical enterprise storage system, 80% of all accesses are made to 20% of data. By storing the 20% most frequently accessed data in eSSDs with fast access times and high-speed HDDs, you can dramatically reduce the overall drive count and power consumption while increasing data throughput.



>> Benefits of a Tiered Storage System Using eSSDs (Example Estimated for a 300-TB Storage System)

Tiered Storage System Using eSSDs

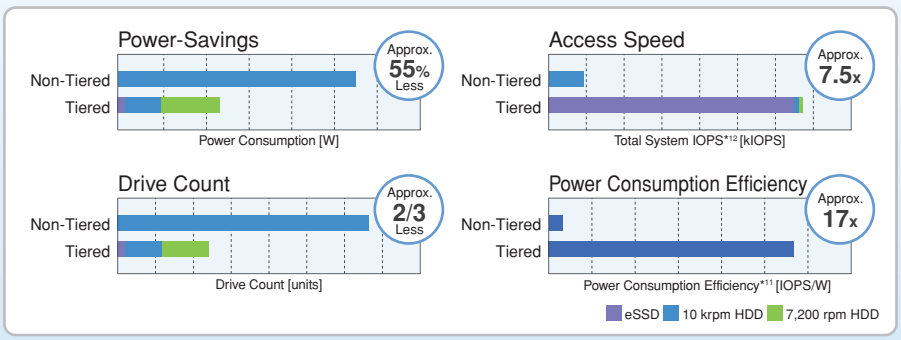
▶ Storage Organization

Drive	Capacity	#Units	Capacity Ratio
eSSD	1.6 TB	10	5%
10 krpm HDD	900 GB	50	15%
7,200 rpm HDD	4 TB	60	80%

Conventional Non-Tiered HDD Storage System

▶ Storage Organization

Drive	Capacity	#Units	Capacity Ratio
10 krpm HDD	900 GB	334	100%



*11: Power Consumption Efficiency (IOPS/W): IOPS per watt consumed
*12: IOPS: Input/Output Per Second (or the number of I/O operations per second)

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(As of February 12, 2013)

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