TDK

TDK

TDK FLASH STORAGE CATALOGUE

№
04

GS2 512GB
SATA SSD 6Gb/s

GS2 512GB
SATA SSD 6Gb/s

MEDICAL

FA

INFRASTRUCTURE

ENERGY

ICT

LIFE& ENTERTAINMENT

SMART INFRA : STORAGE

TDK-powered SSD solutions. Excelling anytime, anyplace, at any jobsite.

Manufacturing, transport, IT, financial, medical…
TDK flash storage devices help get the job right, in all domains.
On the land, across the seas, in the skies—24/7. SSD solutions from TDK,
securing your jobsite again, today.

SMART STORAGE, SMART FUTURE

TDK has developed the NAND-type flash memory controllers "GBDriver" series realizing high speed access while securing data reliability. TDK has also developed Solid State Drives (SSDs) combining GBDriver series inside, ideal solution for embedded systems.
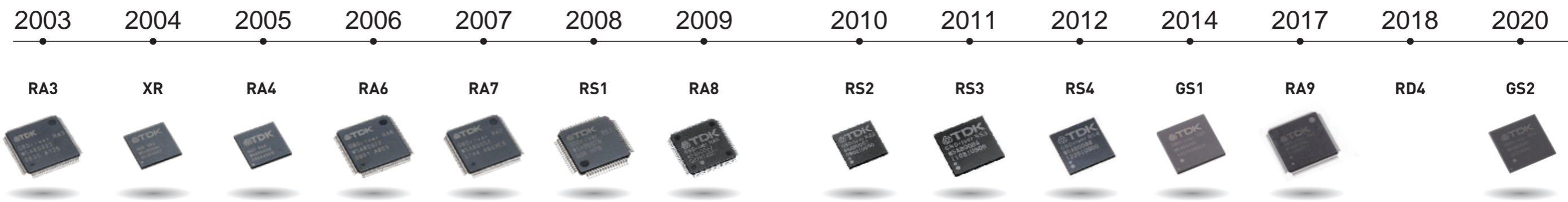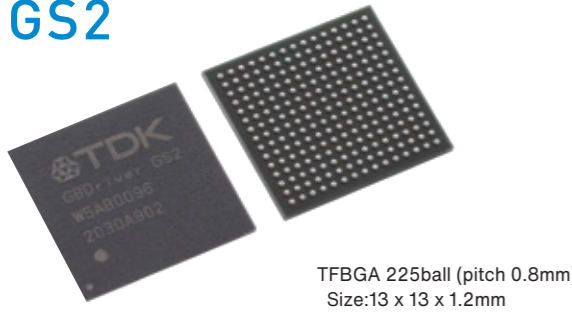
CONTENTS

GBDriver

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014	2017	2018	2020
RA3	XR	RA4	RA6	RA7	RS1	RA8	RS2	RS3	RS4	GS1	RA9	RD4	GS2

GBDriver

Flash Memory Controller IC
GBDriver series
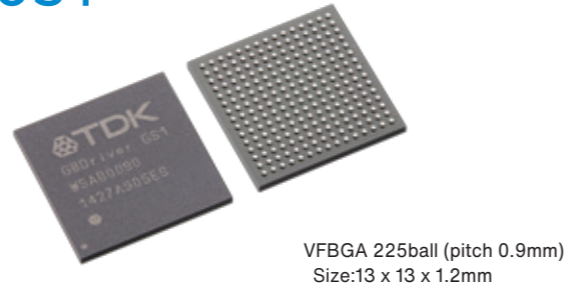
For 3D NAND

Product NAME	HOST INTERFACE	Operating Temperature
GS2 TFBGA 225ball (pitch 0.8mm) Size:13 x 13 x 1.2mm	SATA 1.5Gbps/3.0Gbps/6.0Gbps	−40 to +85℃

SSD controller for 3D NAND : GBDriver GS2

GBDriver GS2 is a highly reliable 3D flash memory controller IC with both hardware and firmware designed in-house (TDK) specifically for industrial use. As 3D flash memory technology advances, high-capacity flash storage solutions are more widely used and data reliability requirements are becoming increasingly sophisticated. Even in the industrial equipment sector, there is a growing need to improve performance while maintaining high data reliability. GBDriver GS2 not only adds new functions for 3D-NAND Flash memory but also uses TDK's proprietary technology to achieve high-speed access while enhancing power interruption tolerance and preventing data corruption.
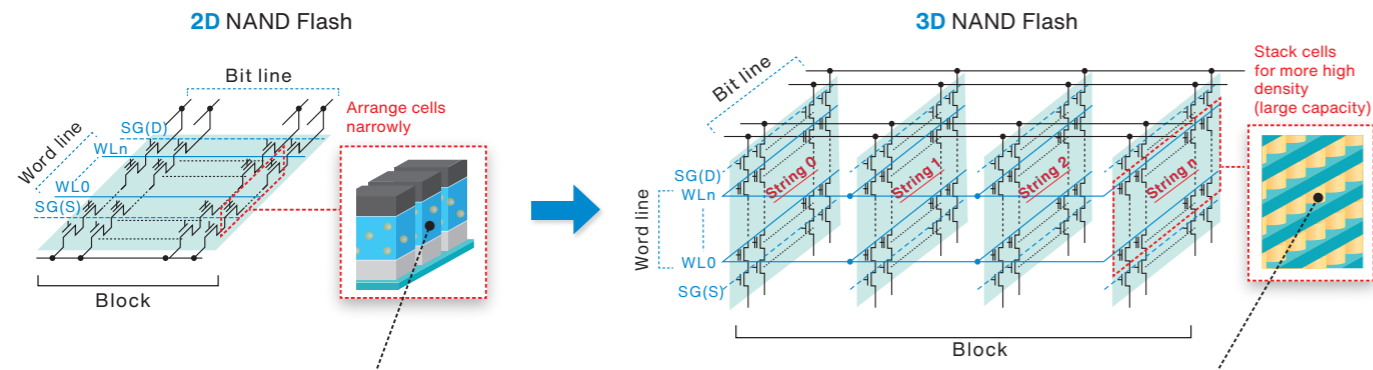
For 2D NAND

Product NAME	HOST INTERFACE	Operating Temperature
GS1 VFBGA 225ball (pitch 0.9mm) Size:13 x 13 x 1.2mm	SATA 1.5Gbps/3.0Gbps/6.0Gbps	−40 to +85℃
RS3 VFBGA 144ball (pitch 0.8mm) Size:12 x 12 x 1.4mm	SATA 1.5Gbps/3.0Gbps	−40 to +85℃

Product NAME	HOST INTERFACE					Operating Temperature
	PCMCIA ATA	Compact Flash	IDE	Direct Bus Connect	Inter-face	
RA9 TQFP 128pin (pitch 0.40mm) Size:16 x 16 x 1.2mm VFBGA 121ball (pitch 0.65mm) Size:8 x 8 x 0.99mm	○	4.1	PIO6 —— MDMA4 —— UDMA6	○	133 MByte/sec	−40 to +85℃

2D NAND vs 3D NAND

NAND flash memory has changed from the 2D plane array cell structure to the 3D stacked cell structure.
In 3D-NAND flash memory, the flash type can be selected from SLC mode and TLC.
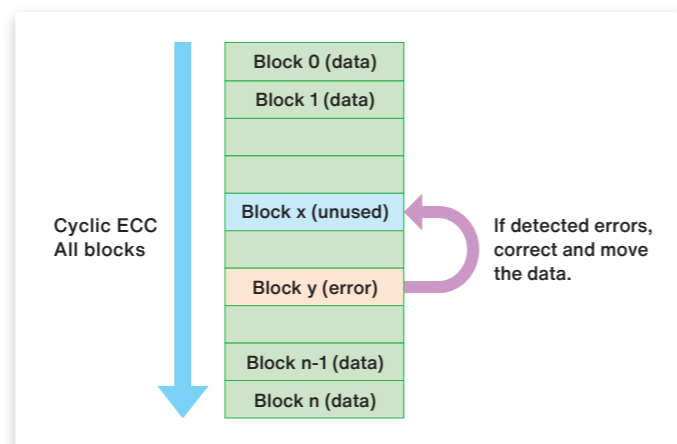
2D NAND Flash

Bit line
Word line
SG(D)
WLn
WL0
SG(S)
Block
Arrange cells narrowly

3D NAND Flash

Bit line
Word line
SG(D)
WLn
WL0
SG(S)
String 0
String 1
String 2
String n
Block
Stack cells for more high density (large capacity)

	SLC	SLC mode	MLC
Endurance [P/E per Block]	100K/50K	20K	3K
Data retention	10 years @ life begin − 10% 1year @ life end		
	0	0	01
			00
			10
	1	1	11
	1bit/cell(2state)	1bit/cell(2state)	2bit/cell(4state)

	SLC mode	TLC
Endurance [P/E per Block]	30K	3K
Data retention	10 years @ life begin 1year @ life end	
	0	011
		010
		000
		001
		101
		100
		110
	1	111
	1bit/cell(2state)	3bit/cell(8state)

Cyclic auto refresh function secures data retention.

TDK SSDs are equipped with a cyclic auto refresh function which automatically checks data and recovers errors by ECC. "Refresh" are executed at every boot and every 24hours.
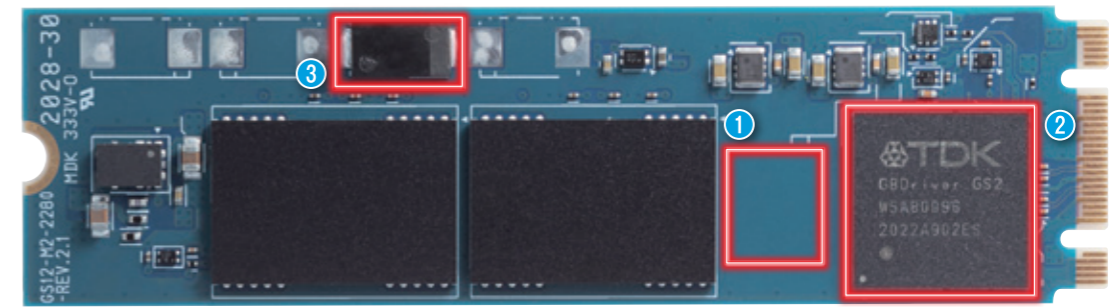
* This function works in background process when there is no access from host system.

Cyclic ECC All blocks

Block 0 (data)
Block 1 (data)
Block x (unused)
Block y (error)
Block n-1 (data)
Block n (data)
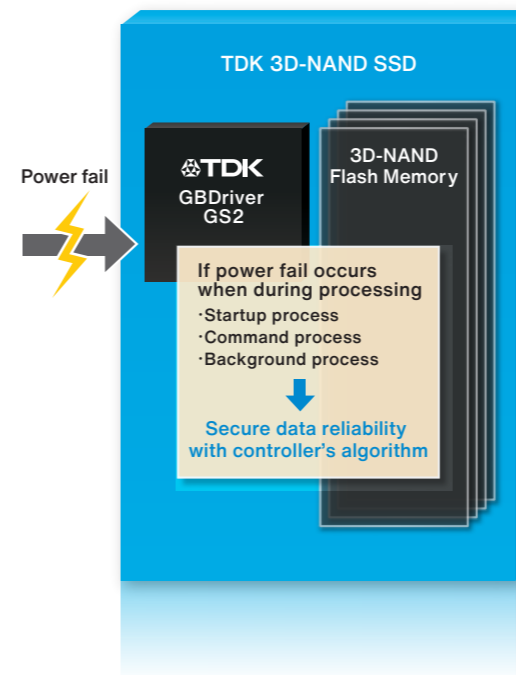
If detected errors, correct and move the data.

Countermeasures for power interruption

TDK's SSDs are designed with an emphasis on power interruption tolerance. The combination of the following three measures provides an overwhelming level of tolerance.
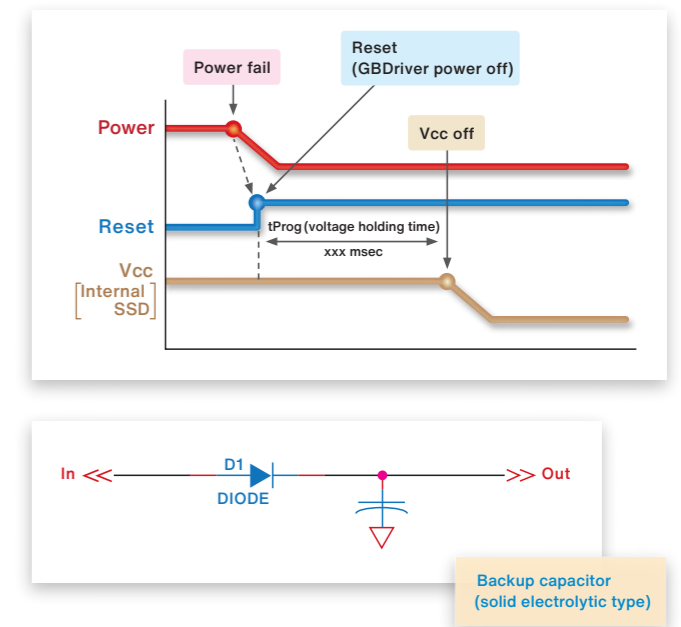
❶ DRAM-less design

❷ GBDriver GS2 algorithm (firmware)

TDK 3D-NAND SSD

TDK GBDriver GS2

3D-NAND Flash Memory

Power fail

If power fail occurs when during processing
・Startup process
・Command process
・Background process

Secure data reliability with controller's algorithm

❸ Power backup circuit (on PCB)

Power fail
Reset (GBDriver power off)
Vcc off
Power
Reset
tProg (voltage holding time)
xxx msec
Vcc [Internal SSD]

In
D1
DIODE
Out
Backup capacitor (solid electrolytic type)

TDK SSDs secure data reliability in sudden power fail.

① SSDs, Power shutdown test result

	TDK	A	B
Writing data sectors	2837558584	3966531026	2015419396
Power off cycles	677	946	481
Data errors	0 (0.00%)	859 (91%)	68 (14%)

② SD Memory cards, Power shutdown test result

	TDK	A	B
Writing data sectors	166,049,542	27,296,954	5,791,942
Power off cycles	15,989	7,155	753
Data errors	0 (0.00%)	2 (0.03%)	1 (0.13%)

High-speed performance without the use of DRAM

TDK's 3D-SSD achieves high-speed performance despite its DRAM-less design in order to prioritize power failure tolerance (power interruption tolerance)

Data error recovery (LDPC/RAID)

TDK GBDriver GS2 has advanced data error recovery. When reading data from SSD, three functions work in stages. Depending on the data error situation, (1) LDPC Hard Bit, (2) LDPC Soft Bit, and (3) RAID are operated in this order as necessary to repair the error.
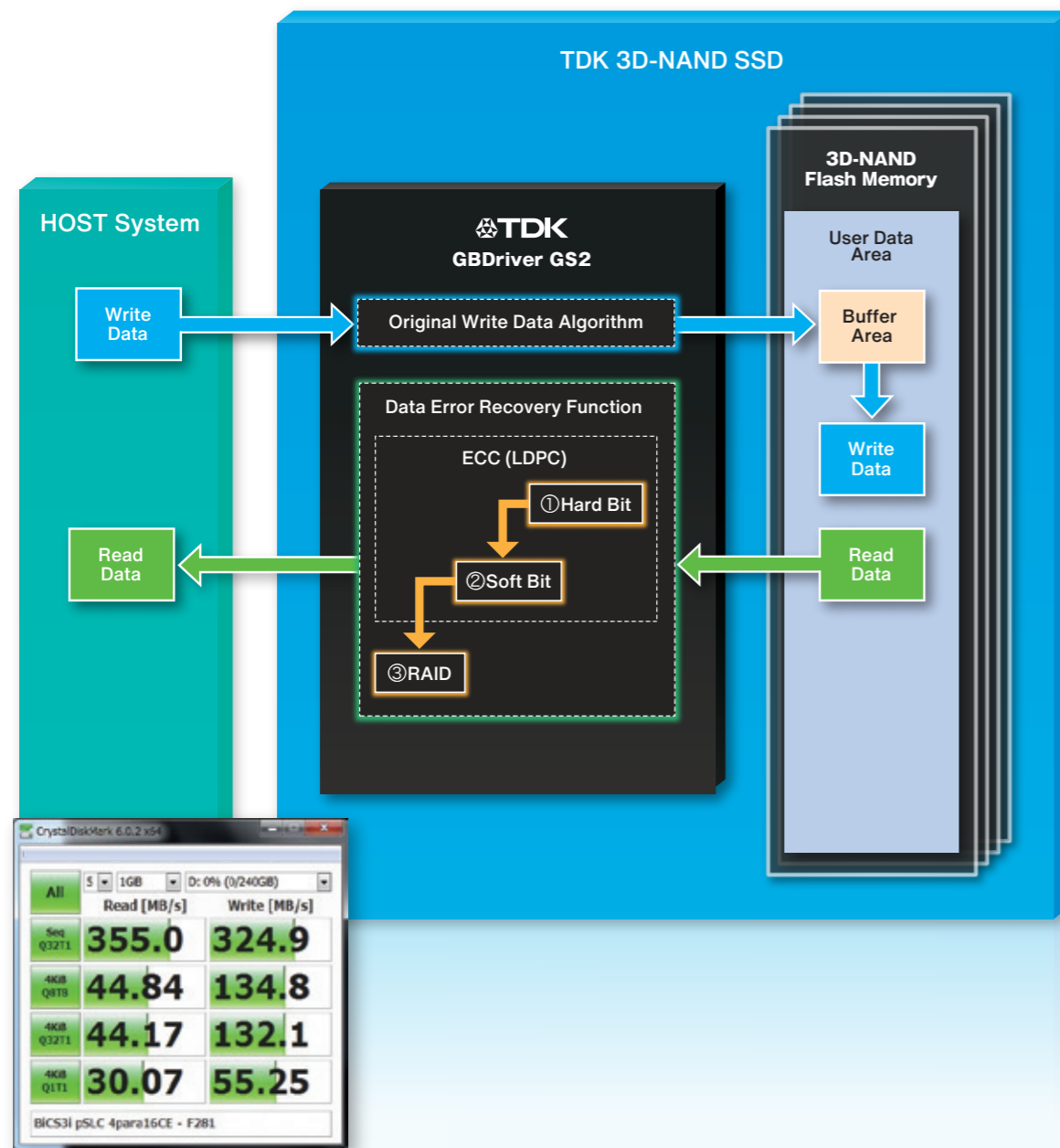
Temperature sensor and access speed limit

The on-board temperature sensor allows user to monitor the temperature of the SSD and limit access to the SSD from the host. The SSD also has a function to limit the access speed when the temperature setting value is exceeded.
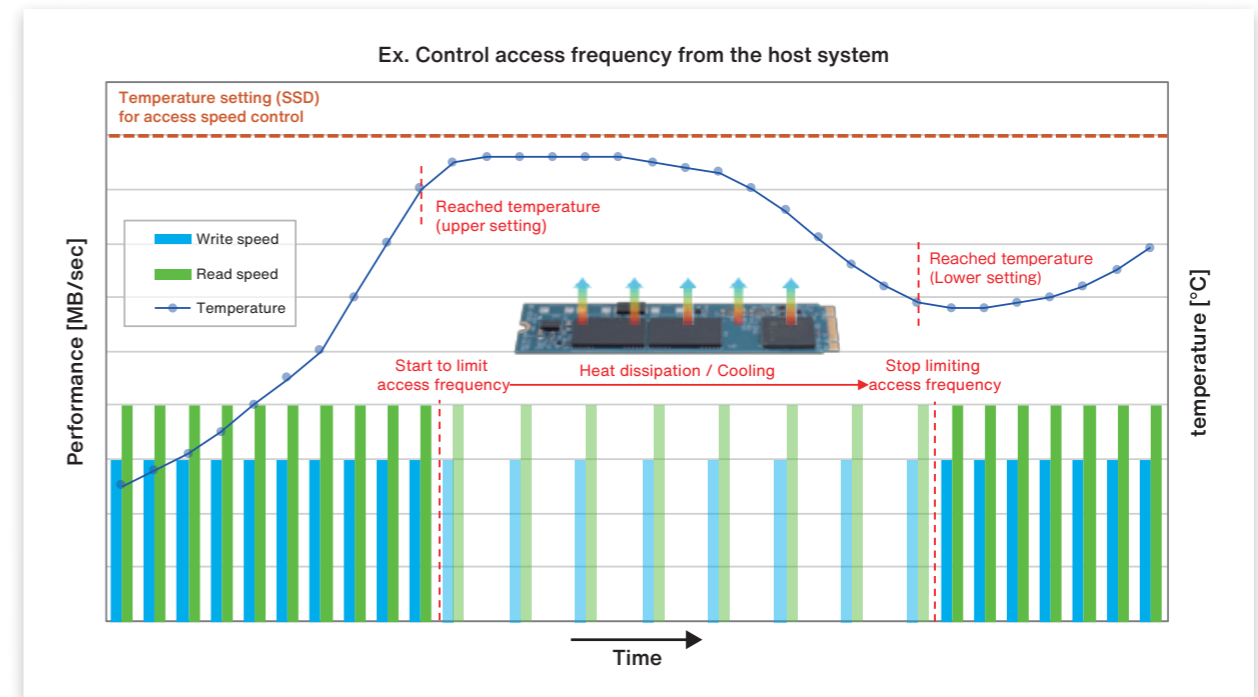
Write protected area setting function

TDK SSDs can be configured with a write-protected area, making it possible to reduce the need for power interruption (power failure) countermeasures on the host side.
(For example, to prevent writes that occur when using the Windows UWF function)
Our original software to configure this function is available upon request.
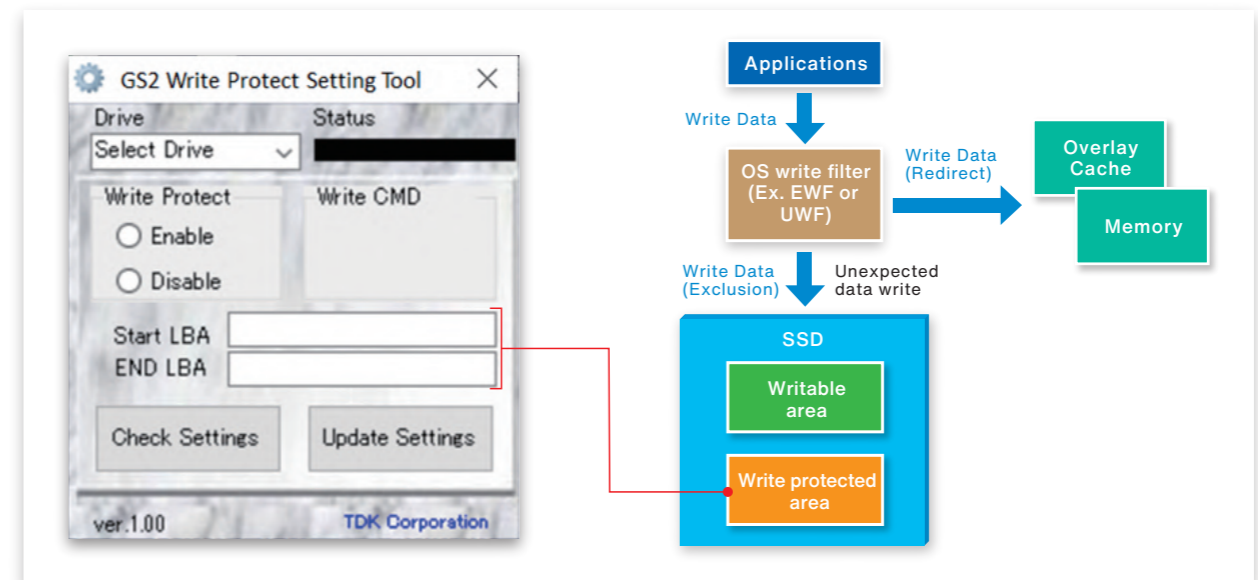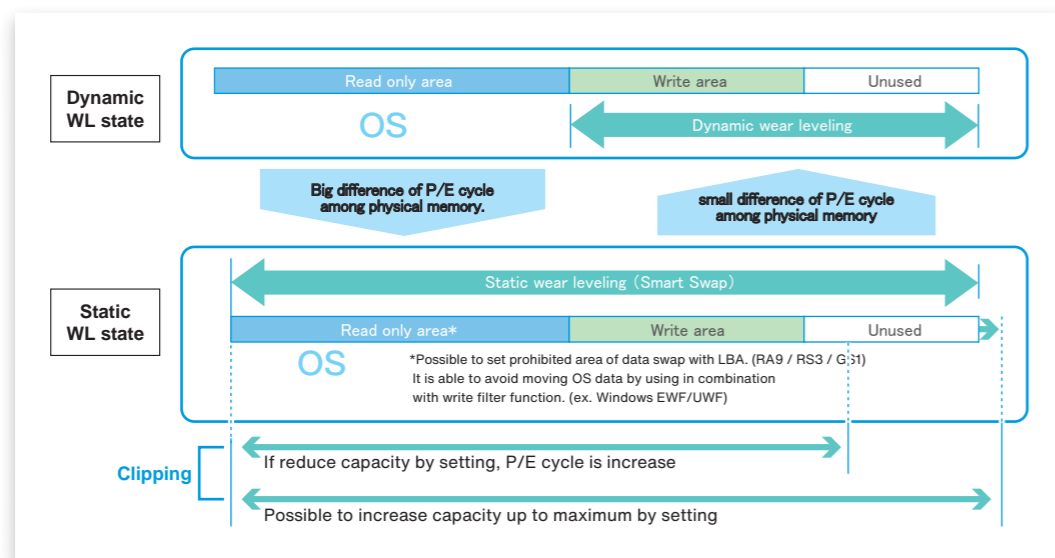
Longevity and ECO Friendly

In order to extend the longevity, our products execute "TDK global static wear leveling (TDK SMART SWAP)" and level P/E count of NAND flash cells(blocks) efficiently.
Storages replacement is Low frequency and it is Lower TCO (Total Cost of Ownership).
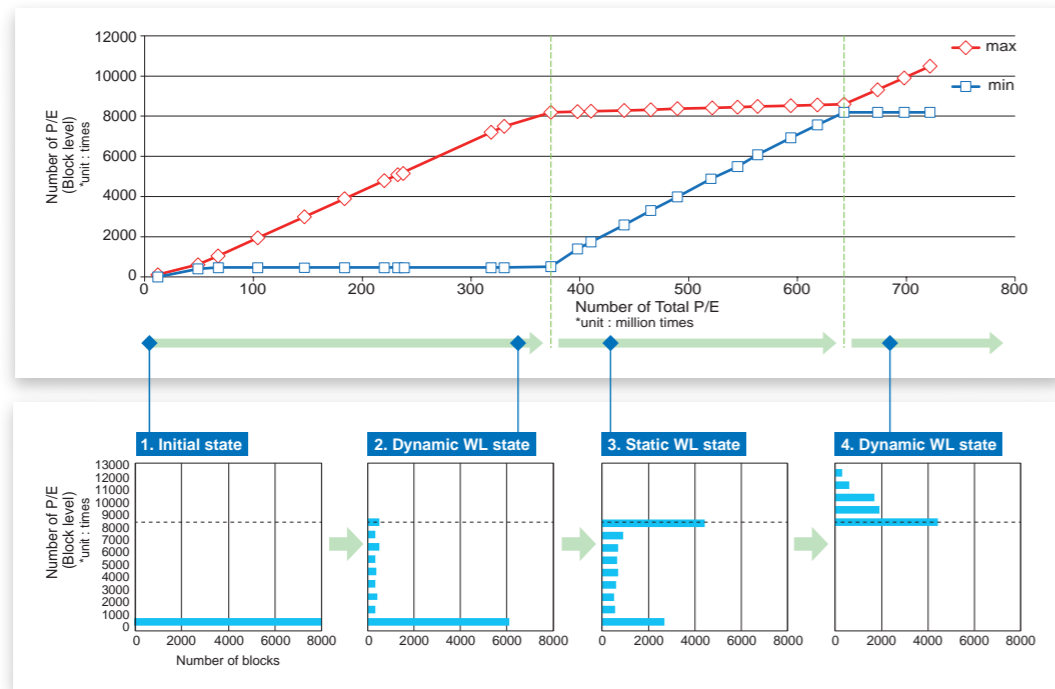
TDK global static wear leveling （TDK SMART SWAP）

Clipping （Number of sector setting）

Possible to adjust number of sector for user data area in unit of a sector.

TDK SMART （Flash storage life monitor – Endurance analysis program）

TDK SMART provides various information(following) and could predict storages life.

- Number of flash memory chips, number of blocks
- Number of total P/E cycles,Number of highest/lowest P/E cycles among blocks
- Total P/E cycles for all blocks(in a 10-level histogram)
- Memory usage[%], Life indicator[%]

Tools for Windows OS are Available for download on TDK web site. https://product.tdk.com/info/en/products/flash-storage/flash-storage/tdksmart.html
*Please contact us if you need to receive detailed information. (addresses of various parameters, command operation, etc...)
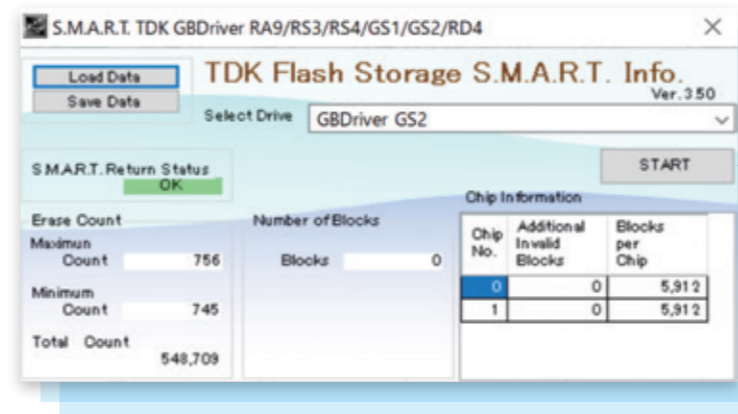
Main Window
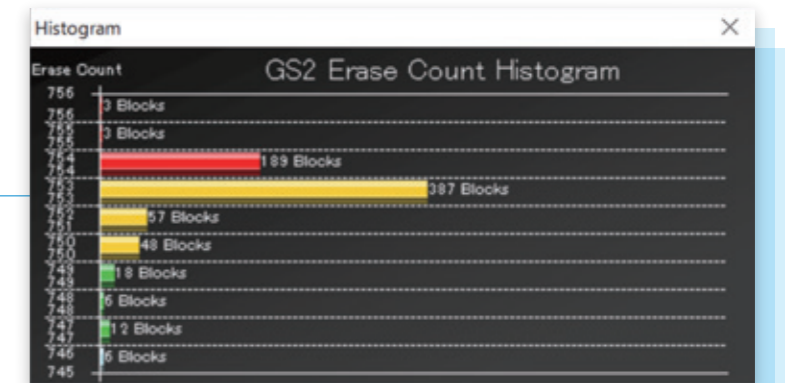
Erase Count Histogram

Memory Usage

Life Indicator [%]

[3D NAND Storage]
CFast™

CAT2A

GENERAL INFORMATION

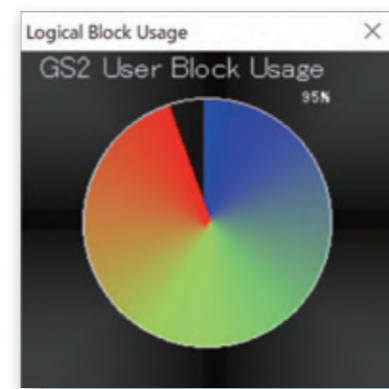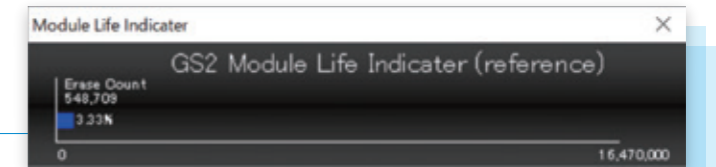| TYPE	CFast™			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.2 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps			
CONNECTOR	CFast™ Type I			
OUTLINE DIMENSIONS	36.4 x 42.8 x 3.6 mm			
SERIES	CAT2A			
CONTROLLER TYPE	TDK GBDriver GS2			
FLASH TYPE	3D - SLC mode		3D - TLC mode	
	3D - Gen3	3D - Gen5	3D - Gen3	3D - Gen5
DENSITY RANGE	16 GB - 128 GB	16 GB - 256 GB	50 GB - 400 GB	50 GB - 800 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	30,000 P/E Cycles *Flash Block Level		3,000 P/E Cycles *Flash Block Level	

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	345 MByte/sec
Write (max.)	295 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %
POWER CONSUMPTION (*RT)	- Read: 1140 mW max. - Write: 1370 mW max. - Slumber: 200mW

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller (HW/FW) - SLC Cache, LDPC-ECC, RAID - Temperature monitoring function - Write-protected area setting tool (on request) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART (life monitor) - NCQ, TRIM - AES 256 bit encryption, TCG-OPAL (on request)

PART NUMBER	CAT2AxxxxKHxxA00EAA0	CAT2AxxxxKMxxA00EAA0	CAT2AxxxxKGxxA00EAA0	CAT2AxxxxKLxxA00EAA0

[2D NAND Storage]
CFast™

CAE3B　　　　CAE1B

GENERAL INFORMATION

TYPE	CFast™			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 2.6 SATA 1.5Gbps, 3.0Gbps	Serial ATA Revision 3.1 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps		
CONNECTOR	CFast™ Type I			
OUTLINE DIMENSIONS	36.4 x 42.8 x 3.6 mm			
SERIES	CAE3B	CAE1B		
CONTROLLER TYPE	TDK GBDriver RS3	TDK GBDriver GS1		
FLASH TYPE	SLC	SLC	pSLC	MLC
DENSITY RANGE	512 MB - 8 GB	16 GB - 64 GB	16 GB - 128 GB	32 GB - 256 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end			
ENDURANCE ENTERPRISE WL	50,000 P/E Cycles *Flash Block Level	100,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level	3,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	105 MByte/sec	340 MByte/sec	345 MByte/sec	295 MByte/sec
Write (max.)	60 MByte/sec	105 MByte/sec	145 MByte/sec	75 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %	
POWER CONSUMPTION (*RT)	- Read Write: 125 / 215 / 365mA max. (Single / 2ch / 4ch) - Slumber: less than 50mA	- Read: 385mA max. - Write: 370mA max. - Slumber: less than 100mA

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Global static wear leveling - SMART - NCQ, TRIM - AES 128bit encryption (on request)	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - NCQ, TRIM - AES 128/256bit encryption (on request)

PART NUMBER	CAE3BxxxxTxxxB00EAA0	CAE1BxxxxTXDxB00EAA0	CAE1BxxxxTKDxB00EAA0	CAE1BxxxxTFDxB00EAA0

[3D NAND Storage]
2.5" SATA SSD

SDT2A

FC ⚠ CE UKCA

GENERAL INFORMATION

TYPE	2.5 inch SATA SSD (7mm / 9mm)			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.2 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps			
CONNECTOR	15 + 7 pin Serial ATA			
OUTLINE DIMENSIONS	100.2 x 69.85 x 7 mm / 9.5 mm			
SERIES	SDT2A			
CONTROLLER TYPE GBDriver	TDK GBDriver GS2			
FLASH TYPE	3D - SLC mode		3D - TLC mode	
	3D - Gen3	3D - Gen5	3D - Gen3	3D - Gen5
DENSITY RANGE	16 GB - 256GB	16 GB - 512 GB	50 GB - 800 GB	50 GB - 1600 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	30,000 P/E Cycles *Flash Block Level		3,000 P/E Cycles *Flash Block Level	

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	345 MByte/sec
Write (max.)	295 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1,000G,1.0ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	5 V ± 10 %
POWER CONSUMPTION (*RT)	- Read: 1070 mW max. - Write: 1270 mW max. - Slumber: 200mW

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller (HW/FW) - SLC Cache, LDPC-ECC, RAID - Temperature monitoring function - Write-protected area setting tool (on request) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART (life monitor) - NCQ, TRIM - AES 256 bit encryption, TCG-OPAL (on request)			
PART NUMBER	SDT2AxxxxKHxxAx0ESA0	SDT2AxxxxKMxxAx0ESA0	SDT2AxxxxKGxxAx0ESA0	SDT2AxxxxKLxxAx0ESA0

[2D NAND Storage]
2.5" SATA SSD

SDE1B

FC ⚠ CE

GENERAL INFORMATION

TYPE	2.5 inch SATA SSD (7mm / 9mm)		
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.1 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps		
CONNECTOR	15 + 7 pin Serial ATA		
OUTLINE DIMENSIONS	100.2 x 69.85 x 7 mm / 9.5 mm		
SERIES	SDE1B		
CONTROLLER TYPE GBDriver	TDK GBDriver GS1		
FLASH TYPE	SLC	pSLC	MLC
DENSITY RANGE	16 GB - 128 GB	16 GB - 256 GB	32 GB - 512 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end		
ENDURANCE ENTERPRISE WL	100,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level	3,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	420 MByte/sec	430 MByte/sec	365 MByte/sec
Write (max.)	305 MByte/sec	325 MByte/sec	235 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1,000G,1.0ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

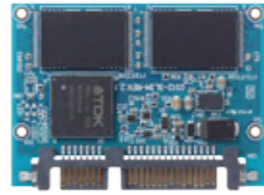| VOLTAGE	5 V ± 10 %
POWER CONSUMPTION (*RT)	- Read: 320mA max. - Write: 600mA max. - Slumber: less than 100mA

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - NCQ, TRIM - AES 128/256bit encryption (on request)		
PART NUMBER	SDE1BxxxxTXxxBx0ESA0	SDE1BxxxxTKxxBx0ESA0	SDE1BxxxxTFxxBx0ESA0

[3D NAND Storage]
Half Slim

SHT2A

FC ☒ ⚠ C€ UK CA

GENERAL INFORMATION

TYPE	Half Slim			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.2 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps			
CONNECTOR	15 + 7 pin Serial ATA			
OUTLINE DIMENSIONS	54 x 39 mm			
SERIES	SHT2A			
CONTROLLER TYPE GBDriver	TDK GBDriver GS2			
FLASH TYPE	3D - SLC mode		3D - TLC mode	
	3D - Gen3	3D - Gen5	3D - Gen3	3D - Gen5
DENSITY RANGE	8 GB - 256GB	16 GB - 512 GB	25 GB - 800 GB	50 GB - 1600 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	30,000 P/E Cycles *Flash Block Level		3,000 P/E Cycles *Flash Block Level	

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	345 MByte/sec
Write (max.)	295 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	5 V ± 10 %
POWER CONSUMPTION (*RT)	- Read: 1070 mW max. - Write: 1270 mW max. - Slumber: 200mW

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller (HW/FW) - SLC Cache, LDPC-ECC, RAID - Temperature monitoring function - Write-protected area setting tool (on request) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART (life monitor) - NCQ, TRIM - AES 256 bit encryption, TCG-OPAL (on request)
PART NUMBER	SHT2AxxxxKxxxA00ESA0 | SHT2AxxxxKMxxA00ESA0 | SHT2AxxxxKxxxA00ESA0 | SHT2AxxxxKLxxA00ESA0

[2D NAND Storage]
Half Slim

SHE1B

FC ☒ ⚠ C€

GENERAL INFORMATION

TYPE	Half Slim		
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.1 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps		
CONNECTOR	15 + 7 pin Serial ATA		
OUTLINE DIMENSIONS	54 x 39 mm		
SERIES	SHE1B		
CONTROLLER TYPE GBDriver	TDK GBDriver GS1		
FLASH TYPE	SLC	pSLC	MLC
DENSITY RANGE	16 GB - 128 GB	16 GB - 256 GB	32 GB - 512 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end		
ENDURANCE ENTERPRISE WL	100,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level	3,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	340 MByte/sec	400 MByte/sec	320 MByte/sec
Write (max.)	115 MByte/sec	165 MByte/sec	75 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	5 V ± 10 %
POWER CONSUMPTION (*RT)	- Read: 250mA max. - Write: 270mA max. - Slumber: less than 100mA

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - NCQ, TRIM - AES 128/256bit encryption (on request)
PART NUMBER	SHE1BxxxxTXDxB00SSA0 | SHE1BxxxxTKDxB00SSA0 | SHE1BxxxxTFDxB00SSA0

[3D NAND Storage]
mSATA

SMT2A

GENERAL INFORMATION

TYPE	mSATA			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.2 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps			
CONNECTOR	52 pin. Edge			
OUTLINE DIMENSIONS	50.8 x 29.85 mm			
SERIES	SMT2A			
CONTROLLER TYPE	TDK GBDriver GS2			
FLASH TYPE	3D - SLC mode		3D - TLC mode	
	3D - Gen3	3D - Gen5	3D - Gen3	3D - Gen5
DENSITY RANGE	16 GB - 128 GB	16 GB - 256 GB	50 GB - 400 GB	50 GB - 800 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	30,000 P/E Cycles *Flash Block Level		3,000 P/E Cycles *Flash Block Level	

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	345 MByte/sec
Write (max.)	295 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %
POWER CONSUMPTION (*RT)	- Read: 1140 mW max. - Write: 1370 mW max. - Slumber: 200mW

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller (HW/FW) - SLC Cache, LDPC-ECC, RAID - Temperature monitoring function - Write-protected area setting tool (on request) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART (life monitor) - NCQ, TRIM - AES 256 bit encryption, TCG-OPAL (on request)			
PART NUMBER	SMT2AxxxxKHxxA00ESA0	SMT2AxxxxKMxxA00ESA0	SMT2AxxxxKGxxA00ESA0	SMT2AxxxxKLxxA00ESA0

[2D NAND Storage]
mSATA

SME3B   **SME1B**

GENERAL INFORMATION

TYPE	mSATA			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 2.6 SATA 1.5Gbps, 3.0Gbps	Serial ATA Revision 3.1 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps		
CONNECTOR	52 pin. Edge			
OUTLINE DIMENSIONS	50.8 x 29.85 mm			
SERIES	SME3B	SME1B		
CONTROLLER TYPE	TDK GBDriver RS3	TDK GBDriver GS1		
FLASH TYPE	SLC	SLC	pSLC	MLC
DENSITY RANGE	512 MB - 8 GB	16 GB - 64 GB	16 GB - 128 GB	32 GB - 256 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end			
ENDURANCE ENTERPRISE WL	50,000 P/E Cycles *Flash Block Level	100,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level	3,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	160 MByte/sec	340 MByte/sec	345 MByte/sec	295 MByte/sec
Write (max.)	80 MByte/sec	105 MByte/sec	145 MByte/sec	75 MByte/sec

ROBUSTNESS

MTBF	≥ 2,000,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

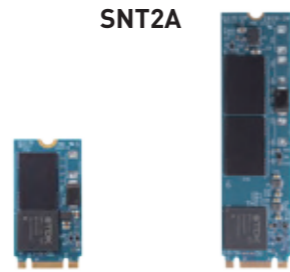| VOLTAGE	3.3 V ± 5 %	
POWER CONSUMPTION (*RT)	- Read Write: 160 / 275 / 470mA max. (Single / 2ch / 4ch) - Slumber: less than 50mA	- Read: 385mA max. - Write: 370mA max. - Slumber: less than 100mA

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Global static wear leveling - SMART - NCQ, TRIM - AES 128bit encryption (on request)	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - NCQ, TRIM - AES 128/256bit encryption (on request)		
PART NUMBER	SME3BxxxxTxxxB00SSA0	SME1BxxxxTXDxB00SSA0	SME1BxxxxTKDxB00SSA0	SME1BxxxxTFDxB00SSA0

[3D NAND Storage]
M.2

SNT2A

FC ℞ ⚡ C E UK CA

GENERAL INFORMATION

TYPE	M.2 (2242 / 2280)			
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.2 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps			
CONNECTOR	75 pin. Edge B & M key			
OUTLINE DIMENSIONS	22 x 42 mm / 80mm			
SERIES	SNT2A			
CONTROLLER TYPE ◆GBDriver	TDK GBDriver GS2			
FLASH TYPE	3D - SLC mode		3D - TLC mode	
	3D - Gen3	3D - Gen5	3D - Gen3	3D - Gen5
DENSITY RANGE	2242 : 16 GB - 128 GB 2280 : 16 GB - 256 GB	2242 : 16 GB - 256 GB 2280 : 16 GB - 512 GB	2242 : 50 GB - 400 GB 2280 : 50 GB - 800 GB	2242 : 50 GB - 800 GB 2280 : 50 GB - 1600 GB
DATA RETENTION	10 years @ life begin 1 year @ life end			
ENDURANCE ENTERPRISE WL	30,000 P/E Cycles *Flash Block Level		3,000 P/E Cycles *Flash Block Level	

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	345 MByte/sec
Write (max.)	295 MByte/sec

ROBUSTNESS

MTBF	≥ 2,500,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %
POWER CONSUMPTION (*RT)	- Read: 1140 mW max. - Write: 1370 mW max. - Slumber: 200mW

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller (HW/FW) - SLC Cache, LDPC-ECC, RAID - Temperature monitoring function - Write-protected area setting tool (on request) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART (life monitor) - NCQ, TRIM - AES 256 bit encryption, TCG-OPAL (on request)			
PART NUMBER	SNT2AxxxxKHxxAx0ESA0	SNT2AxxxxKMxxAx0ESA0	SNT2AxxxxKGxxAx0ESA0	SNT2AxxxxKLxxAx0ESA0

[2D NAND Storage]
M.2

SNE1B

FC ℞ ⚡ C E

GENERAL INFORMATION

TYPE	M.2 (2242 / 2280)		
INTERFACE DATA TRANSFER MODE	Serial ATA Revision 3.1 SATA 1.5Gbps, 3.0Gbps, 6.0Gpps		
CONNECTOR	75 pin. Edge B & M key		
OUTLINE DIMENSIONS	22 x 42 mm / 80mm		
SERIES	SNE1B		
CONTROLLER TYPE ◆GBDriver	TDK GBDriver GS1		
FLASH TYPE	SLC	pSLC	MLC
DENSITY RANGE	2242 : 16 GB - 64 GB 2280 : 16GB - 128GB	2242 : 16 GB - 128 GB 2280 : 16 GB - 256 GB	2242 : 32 GB - 256 GB 2280 : 32 GB - 512 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end		
ENDURANCE ENTERPRISE WL	100,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level	3,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial: 0°C to +70°C Industrial: -40°C to +85°C
STORAGE TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C

PERFORMANCE

Read (max.)	340 MByte/sec	345 MByte/sec	295 MByte/sec
Write (max.)	105 MByte/sec	145 MByte/sec	75 MByte/sec

ROBUSTNESS

MTBF	≥ 2,500,000 hours
SHOCK	1500G,0.5ms
VIBRATION	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 %
POWER CONSUMPTION (*RT)	- Read: 385mA max. - Write: 370mA max. - Slumber: less than 100mA

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - NCQ, TRIM - AES 128/256bit encryption (on request)		
PART NUMBER	SNE1BxxxxTXDxBx0SSA0	SNE1BxxxxTKDxBx0SSA0	SNE1BxxxxTFDxBx0SSA0

[2D NAND Storage]
Compact Flash™ / 2.5" PATA SSD

CFE9D   **SDE9D**

GENERAL INFORMATION

	CompactFlash™	2.5 inch PATA SSD
TYPE	CompactFlash™	2.5 inch PATA SSD
INTERFACE DATA TRANSFER MODE	PCMCIA/IDE UDMA0-6, MDMA0-4 & PIO0-6	IDE UDMA0-6, MDMA0-4 & PIO0-6
CONNECTOR	CFC Type I	44PIN
OUTLINE DIMENSIONS	36.4 x 42.8 x 3.3 mm	100 x 69.85 x 9.5 mm
SERIES	CFE9D	SDE9D
CONTROLLER TYPE *GBDriver*	TDK GBDriver RA9	
FLASH TYPE	SLC	SLC
DENSITY RANGE	128 MB - 32 GB	1 GB - 64 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end	
ENDURANCE ENTERPRISE WL	128 MB ~ 4 GB : 50,000 P/E Cycles 8 GB ~ 32 GB : 100,000 P/E Cycles *Flash Block Level	1 GB ~ 4 GB : 50,000 P/E Cycles 8 GB ~ 32 GB : 100,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial : 0°C to +70°C Industrial : -40°C to +85°C	
STORAGE TEMPERATURE	Commercial : -25°C to +85°C Industrial : -40°C to +85°C	

PERFORMANCE

Read (max.)	50 MByte/sec	
Write (max.)	35 MByte/sec	

ROBUSTNESS

MTBF	≥ 2,500,000 hours	≥ 2,000,000 hours
SHOCK	1000G,0.5ms	1500G,1.0ms
VIBRATION	15G,10-500Hz	20G,10-2000Hz
HUMIDITY	0 to 90 % RH (No condensation)	

ELECTRICAL DATA

VOLTAGE	3.3 V ± 5 % / 5 V ± 10 %	5 V ± 10 %

POWER CONSUMPTION
(*RT)
	- Single mode UDMA Read Write:
	  145mA @ 3.3V / 85mA @ 5.0V
	- 2ch mode UDMA Read Write:
	  220mA @ 3.3V / 130mA @ 5.0V
	- Stand-by:10mA @ 3.3V / 10mA @ 5.0V
		- Single mode UDMA Read Write:80mA
		- 2ch mode UDMA Read Write:135mA
		- Stand-by:5mA

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller (HW/FW) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - TRIM	- In-House Designed Controller (HW/FW) - DRAM-less Design - Power Fail Data Safety - Power Back-up Circuit - Global static wear leveling - SMART - TRIM
PART NUMBER	CFE9DxxxxTxxxB00EAA0	SDE9DxxxxTxxxB00ESA0

[2D NAND Storage]
SD Card / Micro SD Card

MMRD4   **MURD4**

GENERAL INFORMATION

	SD MEMORY CARD (SD / SDHC)		microSD MEMORY CARD (SD / SDHC)	
TYPE	SD MEMORY CARD (SD / SDHC)		microSD MEMORY CARD (SD / SDHC)	
INTERFACE DATA TRANSFER MODE	SD 3.0, UHS-I/Class 10 (SDHC) , Class 6 (SD)			
CONNECTOR	SD		microSD	
OUTLINE DIMENSIONS	32 x 24 x 2.1 mm		15 x 11 x 0.7 / 1 mm	
SERIES	MMRD4		MURD4	
CONTROLLER TYPE *GBDriver*	TDK GBDriver RD4			
FLASH TYPE	SLC	pSLC	SLC	pSLC
DENSITY RANGE	512 MB - 32 GB	4 GB - 32 GB	512 MB - 4 GB	4 GB - 32 GB
DATA RETENTION	10 years @ life begin-10% 1 year @ life end			
ENDURANCE ENTERPRISE WL	512 MB ~ 2 GB: 50,000 P/E Cycles 4 GB ~ 32 GB: 100,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level	50,000 P/E Cycles *Flash Block Level	20,000 P/E Cycles *Flash Block Level

TEMPERATURE

OPERATING TEMPERATURE	Commercial: -25°C to +85°C Industrial: -40°C to +85°C			
STORAGE TEMPERATURE	-40°C to +85°C			

PERFORMANCE

Read (max.)	75 MByte/sec	70 MByte/sec	75 MByte/sec	70 MByte/sec
Write (max.)	50 MByte/sec	67 MByte/sec	50 MByte/sec	67 MByte/sec

ROBUSTNESS

MTBF	≥ 3,000,000 hours			
SHOCK	1000G,0.5ms			
VIBRATION	15G,10-2000Hz			
HUMIDITY	0 to 90 % RH (No condensation)			

ELECTRICAL DATA

VOLTAGE	2.7 ~ 3.6 V			
POWER CONSUMPTION (*RT)	- Read: 100mA max. - Write: 100mA max. - Stand-by: 0.4mA			

FEATURE LIST

FEATURES & TOOLS	- In-House Designed Controller - DRAM-less Design - Power Fail Data Safety - Global static wear leveling - SMART			
PART NUMBER	MMRD4xxxxVxxxA00ABA0		MURD4xxxxVxxxA00ABA0	

Part Number

[3D NAND Storage]

Gen3: 3D-NAND 3rd generation (Commercial: 0°C to +70°C / Industrial: -40°C to +85°C)
Gen5: 3D-NAND 5th generation (Commercial: 0°C to +70°C / Industrial: -40°C to +85°C)

CFast

SLC mode Gen3	CAT2A016GKHBCA00EAA0
	CAT2A032GKHDCA00EAA0
	CAT2A064GKHDCA00EAA0
	CAT2A128GKHDCA00EAA0
SLC Mode Gen5	CAT2A016GKMACA00EAA0
	CAT2A032GKMBCA00EAA0
	CAT2A064GKMDCA00EAA0
	CAT2A128GKMDCA00EAA0
	CAT2A256GKMDCA00EAA0
TLC mode Gen3	CAT2A050GKGBCA00EAA0
	CAT2A100GKGDCA00EAA0
	CAT2A200GKGDCA00EAA0
	CAT2A400GKGDCA00EAA0
TLC Mode Gen5	CAT2A050GKLACA00EAA0
	CAT2A100GKLBCA00EAA0
	CAT2A200GKLDCA00EAA0
	CAT2A400GKLDCA00EAA0
	CAT2A800GKLDCA00EAA0

1) C:0~70°C>>>W:-40~85°C

SATA SSD

SLC mode Gen3	SDT2A016GKHBCAA0ESA0
	SDT2A032GKHDCAA0ESA0
	SDT2A064GKHDCAA0ESA0
	SDT2A128GKHDCAA0ESA0
	SDT2A256GKHDCAA0ESA0
SLC Mode Gen5	SDT2A016GKMACAA0ESA0
	SDT2A032GKMBCAA0ESA0
	SDT2A064GKMDCAA0ESA0
	SDT2A128GKMDCAA0ESA0
	SDT2A256GKMDCAA0ESA0
	SDT2A512GKMDCAA0ESA0
TLC mode Gen3	SDT2A050GKGBCAA0ESA0
	SDT2A100GKGDCAA0ESA0
	SDT2A200GKGDCAA0ESA0
	SDT2A400GKGDCAA0ESA0
	SDT2A800GKGDCAA0ESA0
TLC Mode Gen5	SDT2A050GKLACAA0ESA0
	SDT2A100GKLBCAA0ESA0
	SDT2A200GKLDCAA0ESA0
	SDT2A400GKLDCAA0ESA0
	SDT2A800GKLDCAA0ESA0
	SDT2A1R6TKLDCAA0ESA0

1) C:0~70°C >>> W:-40~85°C
2) A:Case7mm>>>O:Case9.5mm

Half Slim

SLC mode Gen3	SHT2A008GKPACA00ESA0
	SHT2A016GKHBCA00ESA0
	SHT2A032GKHDCA00ESA0
	SHT2A064GKHDCA00ESA0
	SHT2A128GKHDCA00ESA0
	SHT2A256GKHDCA00ESA0
SLC Mode Gen5	SHT2A016GKMACA00ESA0
	SHT2A032GKMBCA00ESA0
	SHT2A064GKMDCA00ESA0
	SHT2A128GKMDCA00ESA0
	SHT2A256GKMDCA00ESA0
	SHT2A512GKMDCA00ESA0
TLC mode Gen3	SHT2A025GKNACA00ESA0
	SHT2A050GKGBCA00ESA0
	SHT2A100GKGDCA00ESA0
	SHT2A200GKGDCA00ESA0
	SHT2A400GKGDCA00ESA0
	SHT2A800GKGDCA00ESA0
TLC Mode Gen5	SHT2A050GKLACA00ESA0
	SHT2A100GKLBCA00ESA0
	SHT2A200GKLDCA00ESA0
	SHT2A400GKLDCA00ESA0
	SHT2A800GKLDCA00ESA0
	SHT2A1R6TKLDCA00ESA0

1) C:0~70°C >>> W:-40~85°C

mSATA

SLC mode Gen3	SMT2A016GKHBCA00ESA0
	SMT2A032GKHDCA00ESA0
	SMT2A064GKHDCA00ESA0
	SMT2A128GKHDCA00ESA0
SLC Mode Gen5	SMT2A016GKMACA00ESA0
	SMT2A032GKMBCA00ESA0
	SMT2A064GKMDCA00ESA0
	SMT2A128GKMDCA00ESA0
	SMT2A256GKMDCA00ESA0
TLC mode Gen3	SMT2A050GKGBCA00ESA0
	SMT2A100GKGDCA00ESA0
	SMT2A200GKGDCA00ESA0
	SMT2A400GKGDCA00ESA0
TLC Mode Gen5	SMT2A050GKLACA00ESA0
	SMT2A100GKLBCA00ESA0
	SMT2A200GKLDCA00ESA0
	SMT2A400GKLDCA00ESA0
	SMT2A800GKLDCA00ESA0

1) C:0~70°C >>> W:-40~85°C

M.2

SLC mode Gen3	SNT2A016GKHBCA00ESA0
	SNT2A032GKHDCA00ESA0
	SNT2A064GKHDCA00ESA0
	SNT2A128GKHDCA00ESA0
	SNT2A256GKHDCAA0ESA0
SLC Mode Gen5	SNT2A016GKMACA00ESA0
	SNT2A032GKMBCA00ESA0
	SNT2A064GKMDCA00ESA0
	SNT2A128GKMDCA00ESA0
	SNT2A256GKMDCA00ESA0
	SNT2A512GKMDCAA0ESA0
TLC mode Gen3	SNT2A050GKGBCA00ESA0
	SNT2A100GKGDCA00ESA0
	SNT2A200GKGDCA00ESA0
	SNT2A400GKGDCA00ESA0
	SNT2A800GKGDCAA0ESA0
TLC Mode Gen5	SNT2A050GKLACA00ESA0
	SNT2A100GKLBCA00ESA0
	SNT2A200GKLDCA00ESA0
	SNT2A400GKLDCA00ESA0
	SNT2A800GKLDCAA0ESA0
	SNT2A1R6TKLDCAA0ESA0

1) C:0~70°C >>> W:-40~85°C
2) O:Type2242>>>A:Type2280

[2D NAND Storage]

CFast

SLC	CAE3B512MTNACB00EAA0
	CAE3B001GTNACB00EAA0
	CAE3B002GTNBCB00EAA0
	CAE3B004GTNBCB00EAA0
	CAE3B008GTNDCB00EAA0

1) C:0~70°C>>>W:-40~85°C

SLC	CAE1B016GTXDCB00EAA0
	CAE1B032GTXDCB00EAA0
	CAE1B064GTXDCB00EAA0
pSLC	CAE1B016GTKDCB00EAA0
	CAE1B032GTKDCB00EAA0
	CAE1B064GTKDCB00EAA0
	CAE1B128GTKDCB00EAA0
MLC	CAE1B032GTFDCB00EAA0
	CAE1B064GTFDCB00EAA0
	CAE1B128GTFDCB00EAA0
	CAE1B256GTFDCB00EAA0

1) C:0~70°C >>> W:-40~85°C

SATA SSD

SLC	SDE1B016GTXDCBA0ESA0
	SDE1B032GTXECBA0ESA0
	SDE1B064GTXFCBA0ESA0
	SDE1B128GTXFCBA0ESA0
pSLC	SDE1B016GTKDCBA0ESA0
	SDE1B032GTKDCBA0ESA0
	SDE1B064GTKECBA0ESA0
	SDE1B128GTKFCBA0ESA0
	SDE1B256GTKFCBA0ESA0
MLC	SDE1B032GTFDCBA0ESA0
	SDE1B064GTFDCBA0ESA0
	SDE1B128GTFECBA0ESA0
	SDE1B256GTFFCBA0ESA0
	SDE1B512GTFFCBA0ESA0

1) C:0~70°C >>> W:-40~85°C
2) A:Case7mm>>>O:Case9.5mm

Half Slim

SLC	SHE1B016GTXDCB00SSA0
	SHE1B032GTXDCB00SSA0
	SHE1B064GTXDCB00SSA0
	SHE1B128GTXDCB00SSA0
pSLC	SHE1B016GTKDCB00SSA0
	SHE1B032GTKDCB00SSA0
	SHE1B064GTKDCB00SSA0
	SHE1B128GTKDCB00SSA0
	SHE1B256GTKDCB00SSA0
MLC	SHE1B032GTFDCB00SSA0
	SHE1B064GTFDCB00SSA0
	SHE1B128GTFDCB00SSA0
	SHE1B256GTFDCB00SSA0
	SHE1B512GTFDCB00SSA0

1) C:0~70°C >>> W:-40~85°C

mSATA

SLC	SME3B512MTNACB00SSA0
	SME3B001GTNACB00SSA0
	SME3B002GTNBCB00SSA0
	SME3B004GTNBCB00SSA0
	SME3B008GTNDCB00SSA0

1) C:0~70°C >>> W:-40~85°C

SLC	SME1B016GTXDCB00SSA0
	SME1B032GTXDCB00SSA0
	SME1B064GTXDCB00SSA0
pSLC	SME1B016GTKDCB00SSA0
	SME1B032GTKDCB00SSA0
	SME1B064GTKDCB00SSA0
	SME1B128GTKDCB00SSA0
MLC	SME1B032GTFDCB00SSA0
	SME1B064GTFDCB00SSA0
	SME1B128GTFDCB00SSA0
	SME1B256GTFDCB00SSA0

1) C:0~70°C >>> W:-40~85°C

M.2

SLC	SNE1B016GTXDCB00SSA0
	SNE1B032GTXDCB00SSA0
	SNE1B064GTXDCB00SSA0
	SNE1B128GTXDCBA0SSA0
pSLC	SNE1B016GTKDCB00SSA0
	SNE1B032GTKDCB00SSA0
	SNE1B064GTKDCB00SSA0
	SNE1B128GTKDCB00SSA0
	SNE1B256GTKDCBA0SSA0
MLC	SNE1B032GTFDCB00SSA0
	SNE1B064GTFDCB00SSA0
	SNE1B128GTFDCB00SSA0
	SNE1B256GTFDCB00SSA0
	SNE1B512GTFDCBA0SSA0

1) C:0~70°C >>> W:-40~85°C
2) O:Type2242>>>A:Type2280

CF CARD

SLC	CFE9D128MTPACB00EAA0
	CFE9D256MTPACB00EAA0
	CFE9D512MTNACB00EAA0
	CFE9D001GTNACB00EAA0
	CFE9D002GTNACB00EAA0
	CFE9D004GTNBCB00EAA0
	CFE9D008GTYBCB00EAA0
	CFE9D016GTYBCB00EAA0
	CFE9D032GTYBCB00EAA0

1) C:0~70°C >>> W:-40~85°C

PATA SSD

SLC	SDE9D001GTNACB00ESA0
	SDE9D002GTNBCB00ESA0
	SDE9D004GTNBCB00ESA0
	SDE9D008GTYBCB00ESA0
	SDE9D016GTYBCB00ESA0
	SDE9D032GTYBCB00ESA0
	SDE9D064GTYBCB00ESA0

1) C:0~70°C >>> W:-40~85°C

SD

SLC	MMRD4512MVNACA00ABA0
	MMRD4001GVNBCA00ABA0
	MMRD4002GVNBCA00ABA0
	MMRD4004GVYACA00ABA0
	MMRD4008GVYBCA00ABA0
	MMRD4016GVYBCA00ABA0
	MMRD4032GVYBCA00ABA0
pSLC	MMRD4004GVHACA00ABA0
	MMRD4008GVJACA00ABA0
	MMRD4016GVJBCA00ABA0
	MMRD4032GVJBCA00ABA0

1) C:-25~85°C >>> W:-40~85°C

micro SD

SLC	MURD4512MVNACA00ABA0
	MURD4001GVNBCA00ABA0
	MURD4002GVNBCA00ABA0
	MURD4004GVNBCA00ABA0
pSLC	MURD4004GVHACA00ABA0
	MURD4008GVHBCA00ABA0
	MURD4016GVHBCA00ABA0
	MURD4032GVHBCA00ABA0

1) C:-25~85°C >>> W:-40~85°C