MTS800 –

SATA III 6Gb/s M.2 SSD

Transcend MTS800 series are M.2 SSDs with high performance and quality Flash Memory assembled on a printed circuit board. These M.2 SSDs feature cutting-edge technology to enhance product life and data retention. MTS800 is designed specifically for various applications such as Ultrabooks, industrial PCs, vehicle PCs and road surveillance recording.

- Power Supply: 3.3V±5%
- Fully compatible with devices and OS that support the SATA III 6.0Gb/s standard
- Compliant with M.2 standards in SATA specification

Features

- Advanced global wear-Leveling and block management for reliability
- Built-in ECC (Error Correction Code) functionality
- Features a DDR3 DRAM cache
- Supports DEVSLP mode
- Supports Advanced Garbage Collection
- Supports enhanced S.M.A.R.T. function
- Real time full drive encryption with Advanced Encryption Standard (AES) (Optional)
- Power Shield to prevent data loss in the event of a sudden power outage
- Supports partial and slumber mode
- Supports security command
- Supports Hardware purge and write protect (Optional)
- Supports Transcend SSD scope pro (Optional)
- RoHS compliant

Specifications

Physical Specification			
Form Factor		M.2 TYPE 2280-D2-B-M	
Storage Capacities		16GB~1TB	
Dimensions	**Length**	80.00 ± 0.15 mm	3.150 ± 0.006 inch
	Width	22.00 ± 0.15 mm	0.866 ± 0.006 inch
	Height	Max 3.58 mm	Max 0.1409 inch
Input Voltage		3.3V ± 5%	
Weight		9 g ± 5%	
Connector		M.2 module notch B+M	

Environmental Specifications		
Operating Temperature		0 ℃ to 70 ℃
Storage Temperature		-40 ℃ to 85 ℃
Humidity	**Operating**	0% to 95% (Non-condensing)
	Non-Operating	0% to 95% (Non-condensing)

Performance								
Model P/N	**ATTO**		**CrystalDiskMark**				**IOmeter**	
	Max. Read *	**Max. Write** *	**Sequential Read** **	**Sequential Write** **	**Random Read** (4KB QD32) **	**Random Write** (4KB QD32) **	**IOPS Random Read** (4KB QD32) ***	**IOPS Random Write** (4KB QD32) ***
TS16GMTS800	140	30	140	30	55	30	13K	6.5K
TS32GMTS800	280	50	280	50	110	50	26K	13K
TS64GMTS800	560	100	520	100	200	100	50K	26K
TS128GMTS800	560	210	520	200	280	200	70K	50K
TS256GMTS800	560	400	520	400	290	300	70K	75K
TS512GMTS800	560	460	520	460	290	300	70K	75K
TS1TMTS800	560	460	530	460	290	310	75K	75K

Note: Maximum transfer speed recorded
* 25 ℃, test on GIGABYTE GA-Z87X-D3H, 4GB, Windows® 7 Professional with AHCI mode, benchmark utility ATTO (version 2.41), unit MB/s
** 25 ℃, test on GIGABYTE GA-Z87X-D3H, 4GB, Windows® 7 Professional with AHCI mode, benchmark utility CrystalDiskMark (version 3.0.1), copied file 1000MB, unit MB/s
*** 25 ℃, test on GIGABYTE GA-Z87X-D3H, 4GB, Windows® 7 Professional with AHCI mode, benchmark utility IOmeter2006 with 4K file size and queue depth of 32, unit IOPs

**** The recorded performance is obtained while the SSD is not operating as an OS disk Physical Specification

Actual Capacity				
Model P/N	**User Max. LBA**	**Cylinder**	**Head**	**Sector**
TS16GMTS800	31,277,232	16,383	16	63
TS32GMTS800	62,533,296	16,383	16	63
TS64GMTS800	125,045,424	16,383	16	63
TS128GMTS800	250,069,680	16,383	16	63
TS256GMTS800	500,118,192	16,383	16	63
TS512GMTS800	1,000,215,216	16,383	16	63
TS1TMTS800	2,000,409,264	16,383	16	63

Power Consumption		
Input Voltage		3.3V ± 5%
Model P/N / Power Consumption		**Average (mA)**
TS16GMTS800	**Max Read**	180
	Max Write	185
	Idle	85
TS32GMTS800	**Max Read**	195
	Max Write	210
	Idle	85
TS64GMTS800	**Max Read**	230
	Max Write	245
	Idle	85
TS128GMTS800	**Max Read**	250
	Max Write	365
	Idle	85
TS256GMTS800	**Max Read**	260
	Max Write	545
	Idle	85
TS512GMTS800	**Max Read**	280
	Max Write	760
	Idle	95
TS1TMTS800	**Max Read**	560
	Max Write	800
	Idle	125

Reliability			
Data Reliability	Supports 42 bits in 1024 bytes		
MTBF	1,500,000 hours		
Endurance (Terabytes Written)	Capacity	* TBW	** TBW (Base on JEDEC Standard)
	TS16GMTS800	45 (TB)	23 (TB)
	TS32GMTS800	90 (TB)	45 (TB)
	TS64GMTS800	180 (TB)	90 (TB)
	TS128GMTS800	360 (TB)	180 (TB)
	TS256GMTS800	740 (TB)	370 (TB)
	TS512GMTS800	1480 (TB)	740 (TB)
	TS1TMTS800	2360 (TB)	1180 (TB)
DWPD (Drive Writes Per Day for 3years)	2.6 DWPD		

* Tested under burn-in tool, TBW value may vary due to host environment.

**Tested under JESD219A endurance workloads specification.

Vibration	
Operating	3.0G, 5 - 800Hz
Non-Operating	5.0G, 5 - 800Hz

Reference to IEC 60068-2-6 Testing procedures; Operating-Sine wave, 5-800Hz/1 oct., 1.5mm, 3g, 0.5 hr./axis, total 1.5 hrs.

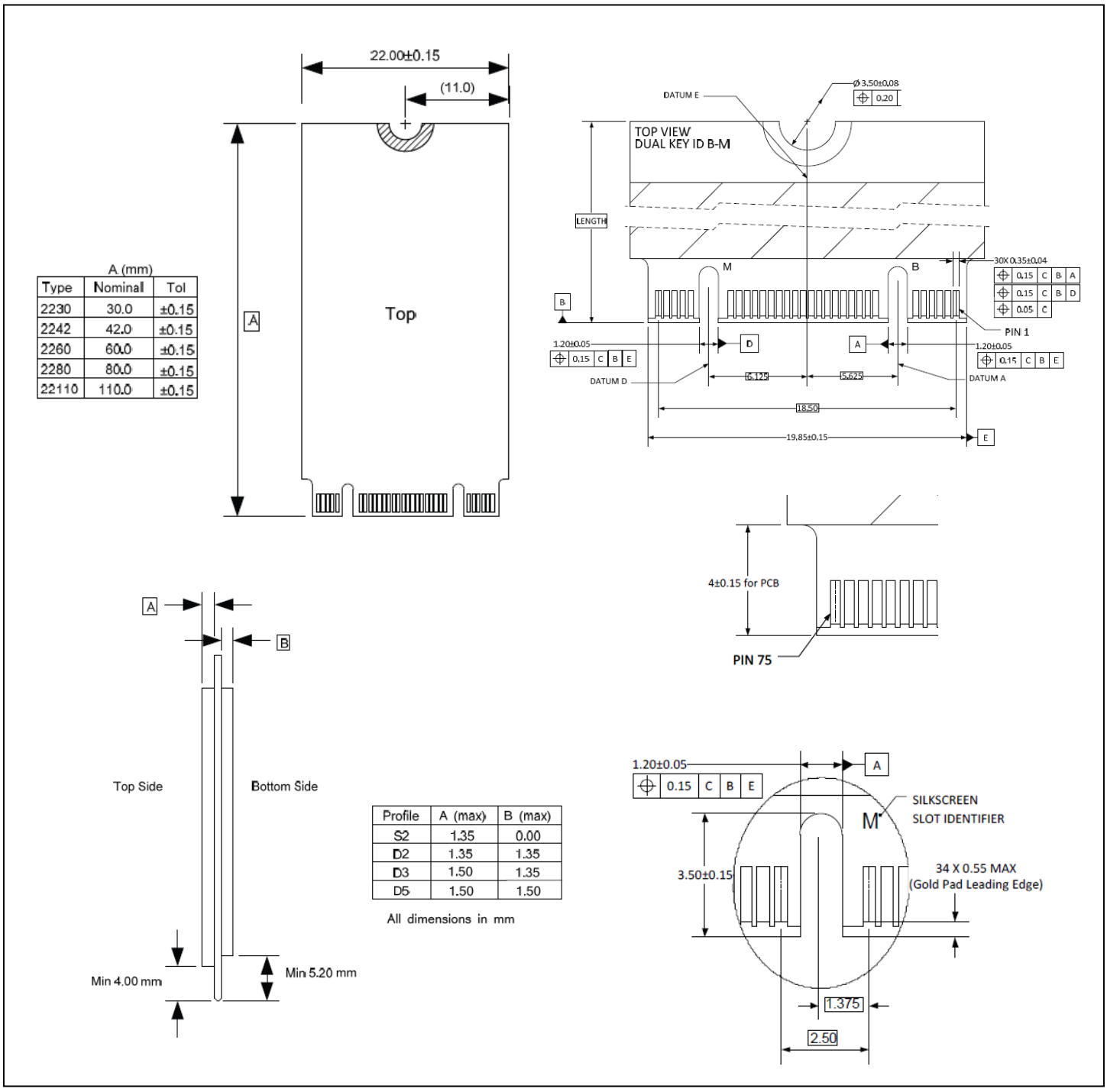
Shock	
Operating	1500G, 0.5ms
Non-Operating	1500G, 0.5ms

Reference to IEC 60068-2-27 Testing procedures; Operating-Half-sine wave, 1500G, 0.5ms, 3 times/dir., total 18 times.

Regulations	
Compliance	CE, FCC and BSMI

Package Dimensions

The figure below illustrates the Transcend M.2 Type 2280-D2-B-M Solid State Drive. All dimensions are in mm.



A (mm)

Type	Nominal	Tol
2230	30.0	±0.15
2242	42.0	±0.15
2260	60.0	±0.15
2280	80.0	±0.15
22110	110.0	±0.15

Profile	A (max)	B (max)
S2	1.35	0.00
D2	1.35	1.35
D3	1.50	1.35
D5	1.50	1.50

All dimensions in mm

Pin Assignments

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
01	CONFIG_3*	02	3.3V	39	GND	40	NC
03	GND	04	3.3V	41	TX+	42	NC
05	NC	06	NC	43	TX-	44	NC
07	NC	08	NC	45	GND	46	NC
09	NC	10	DAS/DSS**	47	RX-	48	NC
11	NC	12	NOTCH	49	RX+	50	NC
13	NOTCH	14	NOTCH	51	GND	52	NC
15	NOTCH	16	NOTCH	53	NC	54	NC
17	NOTCH	18	NOTCH	55	NC	56	MFG1****
19	NOTCH	20	NC	57	GND	58	MFG2****
21	CONFIG_0*	22	NC	59	NOTCH	60	NOTCH
23	NC	24	NC	61	NOTCH	62	NOTCH
25	NC	26	NC	63	NOTCH	64	NOTCH
27	GND	28	NC	65	NOTCH	66	NOTCH
29	NC	30	NC	67	NC	68	NC
31	NC	32	NC	69	CONFIG_1*	70	3.3V
33	GND	34	NC	71	GND	72	3.3V
35	NC	36	NC	73	GND	74	3.3V
37	NC	38	DEVSLP***	75	CONFIG_2*		

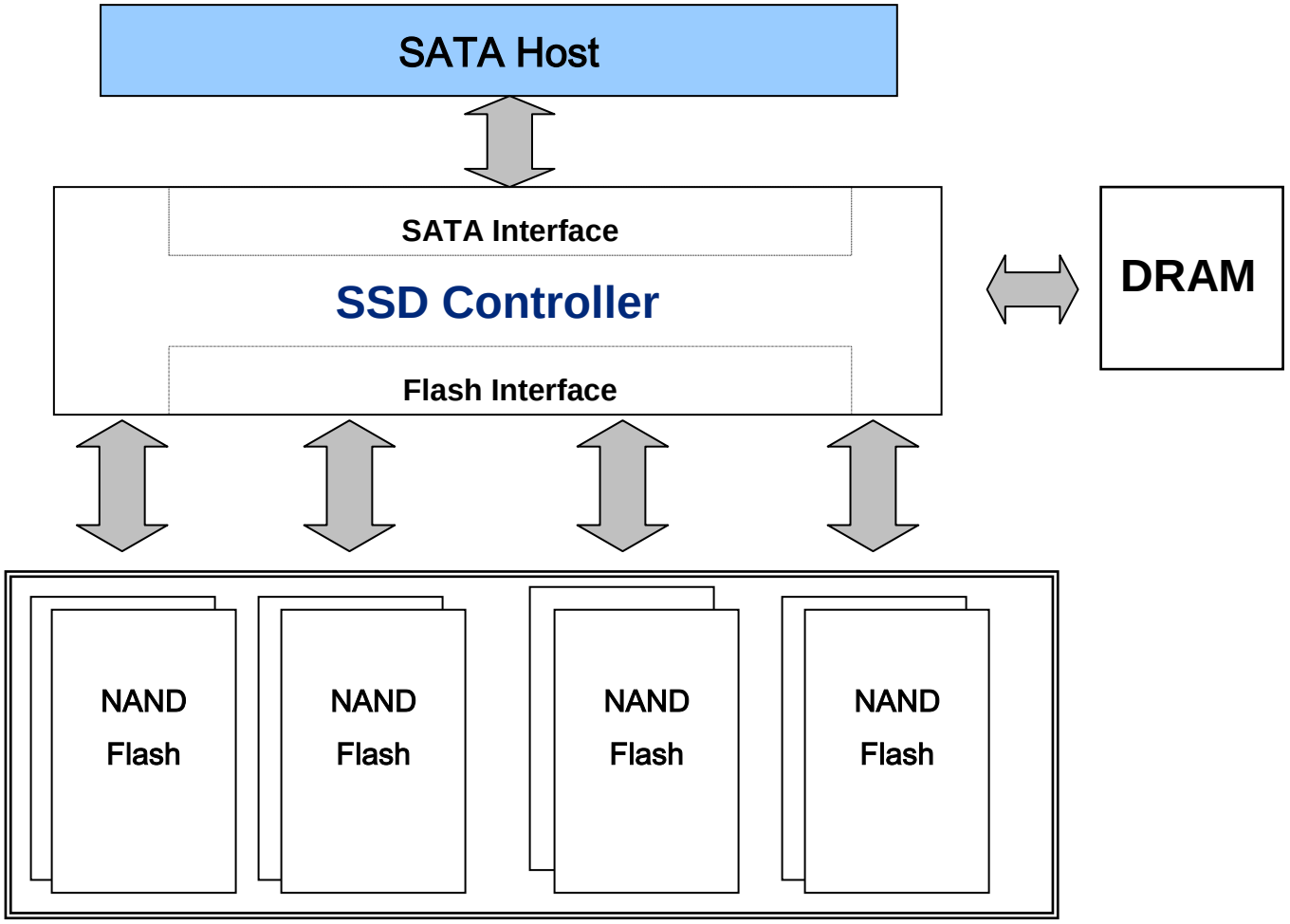
* For SATA application, these pins connect to GND internally

** Device Activity Signal / Disable Staggered Spin-up

*** Device Sleep, Input. If driven high the host is informing the SSD to enter a low power state

**** Manufacturing pins. Do not connect

Block Diagram



Features

- **Global Wear Leveling – Advanced algorithms to enhance wear-leveling efficiency.**

  Global wear leveling ensures that every block has an even erase count. This helps to extend the life expectancy of an SSD.

  There are three main processes in global wear leveling:

  (1) Record the block erase count and save this in the wear-leveling table.

  (2) Find the static-block and save this in the wear-leveling pointer.

  (3) Check the erase count when a block is pulled from the pool of spare blocks. If the block erase count is larger than WEARCNT, then swap the static-block and over-count-block.

- **ECC Algorithm**

  The controller uses BCH 60 Bit ECC algorithm per 1024 bytes depending on the structure of the flash. BCH60 may correct up to 60 random error bits within 1024 data bytes. With the help of BCH60 ECC, the endurance of Transcend SSD is greatly improved.

- **Bad Block Management**

  When the flash encounters ECC failed, program fail or erase fail, the controller will mark the block as a bad block. This will prevent the usage of bad blocks which may result in data loss in the future.

- **Advanced Garbage Collection**

  Transcend SSD has perfect garbage collection mechanism to help SSD improve performance. Advanced Garbage collection can efficiently manage memory management to let SSD can always has stable performance. With Transcend advanced flash management, the drive can still keep high performance after long time operation

- **Enhanced S.M.A.R.T. function**

  Transcend SSD supports S.M.A.R.T. command (Self-Monitoring, Analysis, and Reporting Technology) that allows the user to read the health information of the SSD. Transcend also define some innovated S.M.A.R.T. features which allows the user to evaluate the status of the SSD in a much more efficient way.

- **Hardware Purge and Write Protect**

  The SSD has optional features which include hardware trigger for quick data erase and write protect. These features may be enabled by simply connecting a switch to the designated pins.

- **DEVSLP**

  DEVSLP is a new host-controlled SATA interface power state which together enables a SATA host and device to enter an ultra-low interface power state, including the possibility of completely powering down host and device PHYs.

- **StaticDataRefresh Technology**

  Normally, ECC engine corrections are taken place without affecting the host normal operations. As time passes by, the number of error bits accumulated in the read transaction exceeds the correcting capability of the ECC engine, resulting in corrupted data being sent to the host. To prevent this, the controller monitors the error bit levels at each read operation; when it reaches the preset threshold value, the controller automatically performs data refresh to “restore” the correct charge levels in the cell. This implementation practically restores the data to its original, error-free state, and hence, lengthening the life of the data.

ATA Command Register

This table and the following paragraphs summarize the ATA command set.

Command Table

Support ATA/ATAPI Command	Code	Protocol
General Feature Set		
EXECUTE DIAGNOSTICS	90h	Device diagnostic
FLUSH CACHE	E7h	Non-data
IDENTIFY DEVICE	ECh	PIO data-In
Initialize Drive Parameters	91h	Non-data
READ DMA	C8h	DMA
READ LOG Ext	2Fh	PIO data-In
READ MULTIPLE	C4h	PIO data-In
READ SECTOR(S)	20h	PIO data-In
READ VERIFY SECTOR(S)	40h or 41h	Non-data
SET FEATURES	EFh	Non-data
SET MULTIPLE MODE	C6h	Non-data
WRITE DMA	Cah	DMA
WRITE MULTIPLE	C5h	PIO data-out
WRITE SECTOR(S)	30h	PIO data-out
NOP	00h	Non-data
READ BUFFER	E4h	PIO data-In
WRITE BUFFER	E8h	PIO data-out
Power Management Feature Set		
CHECK POWER MODE	E5h or 98h	Non-data
IDLE	E3h or 97h	Non-data
IDLE IMMEDIATE	E1h or 95h	Non-data
SLEEP	E6h or 99h	Non-data
STANDBY	E2h or 96h	Non-data
STANDBY IMMEDIATE	E0h or 94h	Non-data
Security Mode Feature Set		
SECURITY SET PASSWORD	F1h	PIO data-out
SECURITY UNLOCK	F2h	PIO data-out
SECURITY ERASE PREPARE	F3h	Non-data
SECURITY ERASE UNIT	F4h	PIO data-out
SECURITY FREEZE LOCK	F5h	Non-data
SECURITY DISABLE PASSWORD	F6h	PIO data-out
SMART Feature Set		
SMART Disable Operations	B0h	Non-data
SMART Enable/Disable Autosave	B0h	Non-data
SMART Enable Operations	B0h	Non-data
SMART Execute Off-Line Immediate	B0h	Non-data
SMART Read LOG	B0h	PIO data-In
SMART Read Data	B0h	PIO data-In
SMART Read THRESHOLD	B0h	PIO data-In
SMART Return Status	B0h	Non-data
SMART SAVE ATTRIBUTE VALUES	B0h	Non-data
SMART WRITE LOG	B0h	PIO data-out
Host Protected Area Feature Set		

Read Native Max Address	F8h	Non-data
Set Max Address	F9h	Non-data
Set Max Set Password	F9h	PIO data-out
Set Max Lock	F9h	Non-data
Set Max Freeze Lock	F9h	Non-data
Set Max Unlock	F9h	PIO data-out
48-bit Address Feature Set		
Flush Cache Ext	Eah	Non-data
Read Sector(s) Ext	24h	PIO data-in
Read DMA Ext	25h	DMA
Read Multiple Ext	29h	PIO data-in
Read Native Max Address Ext	27h	Non-data
Read Verify Sector(s) Ext	42h	Non-data
Set Max Address Ext	37h	Non-data
Write DMA Ext	35h	DMA
Write Multiple Ext	39h	PIO data-out
Write Sector(s) Ext	34h	PIO data-out
NCQ Feature Set		
Read FPDMA Queued	60h	DMA Queued
Write FPDMA Queued	61h	DMA Queued
Other		
Data Set Management	06h	DMA
SEEK	70h	Non-data

SMART Data Structure

BYTE	F / V	Description
0-1	X	Revision code
2-361	X	Vendor specific
362	V	Off-line data collection status
363	X	Self-test execution status byte
364-365	V	Total time in seconds to complete off-line data collection activity
366	X	Vendor specific
367	F	Off-line data collection capability
368-369	F	SMART capability
370	F	Error logging capability 7-1 Reserved 0 1=Device error logging supported
371	X	Vendor specific
372	F	Short self-test routine recommended polling time (in minutes)
373	F	Extended self-test routine recommended polling time (in minutes)
374	F	Conveyance self-test routine recommended polling time (in minutes)
375-385	R	Reserved
386-395	F	Firmware Version/Date Code
396-397	F	Reserved
398-399	V	Reserved
400-406	V	TS6500
407-415	X	Vendor specific
416	F	Reserved
417	F	Program/write the strong page only
418-419	V	Number of spare block
420-423	V	Average Erase Count
424-510	X	Vendor specific
511	V	Data structure checksum

F = content (byte) is fixed and does not change.

V= content (byte) is variable and may change depending on the state of the device or the commands executed by the device.

X= content (byte) is vendor specific and may be fixed or variable.

R= content (byte) is reserved and shall be zero.

SMART Attributes

The following table shows the vendor specific data in byte 2 to 361 of the 512-byte SMART data

Attribute ID (hex)	Raw Attribute Value							Attribute Name
01	MSB	00	00	00	00	00	00	Read Error Rate
05	LSB	MSB	00	00	00	00	00	Reallocated sectors count
09	LSB	-	-	MSB	00	00	00	Power-on hours
0C	LSB	-	-	MSB	00	00	00	Power Cycle Count
A0	LSB	-	-	MSB	00	00	00	Uncorrectable sectors count when read/write
A1	LSB	MSB	00	00	00	00	00	Number of valid spare blocks
A3	LSB	MSB	00	00	00	00	00	Number of initial invalid blocks
A4	LSB	-	-	MSB	00	00	00	Total erase count
A5	LSB	-	-	MSB	00	00	00	Maximum erase count
A6	LSB	-	-	MSB	00	00	00	Minimum erase count
A7	LSB	-	-	MSB	00	00	00	Average erase count
A8	LSB	-	-	MSB	00	00	00	Max erase count of spec
A9	LSB	-	-	MSB	00	00	00	Remain Life (percentage)
AF	LSB	-	-	MSB	00	00	00	Program fail count in worst die
B0	LSB	MSB	00	00	00	00	00	Erase fail count in worst die
B1	LSB	-	-	MSB	00	00	00	Total wear level count
B2	LSB	MSB	00	00	00	00	00	Runtime invalid block count
B5	LSB	-	-	MSB	00	00	00	Total program fail count
B6	LSB	MSB	00	00	00	00	00	Total erase fail count
C0	LSB	MSB	00	00	00	00	00	Power-off retract Count
C2	MSB	00	00	00	00	00	00	Controlled temperature
C3	LSB	-	-	MSB	00	00	00	Hardware ECC recovered
C4	LSB	-	-	MSB	00	00	00	Reallocation event count
C5	LSB	MSB	00	00	00	00	00	Current Pending Sector Count
C6	LSB	-	-	MSB	00	00	00	Uncorrectable error count off-line
C7	LSB	MSB	00	00	00	00	00	Ultra DMA CRC Error Count
E8	LSB	MSB	00	00	00	00	00	Available reserved space
F1	LSB	-	-	-	-	-	MSB	Total LBA written (each write unit = 32MB)
F2	LSB	-	-	-	-	-	MSB	Total LBA read (each read unit = 32MB)
F5	LSB	-	-	-	-	-	MSB	Flash write sector count

Ordering Information

Capacity	Model P/N
16GB	TS16GMTS800
32GB	TS32GMTS800
64GB	TS64GMTS800
128GB	TS128GMTS800
256GB	TS256GMTS800
512GB	TS512GMTS800
1TB	TS1TMTS800

The technical information above is based on industry standard data and has been tested to be reliable. However, Transcend makes no warranty, either expressed or implied, as to its accuracy and assumes no liability in connection with the use of this product. Transcend reserves the right to make changes to the specifications at any time without prior notice. Due to the complexity and variety of industrial applications, for special applications and environments, it is strongly suggested to contact Transcend or its authorized resellers beforehand for compatibility confirmation.

Transcend®
good memories start here

TAIWAN
No.70, XingZhong Rd., NeiHu Dist., Taipei, Taiwan, R.O.C
TEL +886-2-2792-8000
Fax +886-2-2793-2222
E-mail: sales-tw@transcend-info.com
http://tw.transcend-info.com

USA
Los Angeles:
E-mail:sales-us@transcend-info.com
Maryland:
E-mail:sales-us@transcend-info.com
Florida:
E-mail:sales-us@transcend-info.com
Silicon Valley:
E-mail:sales-us@transcend-info.com
http://www.transcend-info.com

CHINA
Shanghai:
E-mail: sales-cn@transcendchina.com
Beijing:
E-mail: sales-cn@transcendchina.com
Shenzhen:
E-mail:sales-cn@transcendchina.com
http://cn.transcend-info.com

GERMANY
E-mail:sales-de@transcend-info.com
http://de.transcend-info.com

HONG KONG
E-mail: sales-hk@transcend-info.com
http://hk.transcend-info.com

JAPAN
E-mail: sales-jp@transcend-info.com
http://jp.transcend-info.com

THE NETHERLANDS
E-mail: sales-nl@transcend-info.com
http://nl.transcend-info.com

United Kingdom
E-mail: sales-uk@transcend-info.com
http://uk.transcend-info.com

KOREA
E-mail: sales-kr@transcend-info.com
http://kr.transcend-info.com

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Version	**Date**	**Modification Content**
V1.0	**2017/03/30**	**Initial Release**