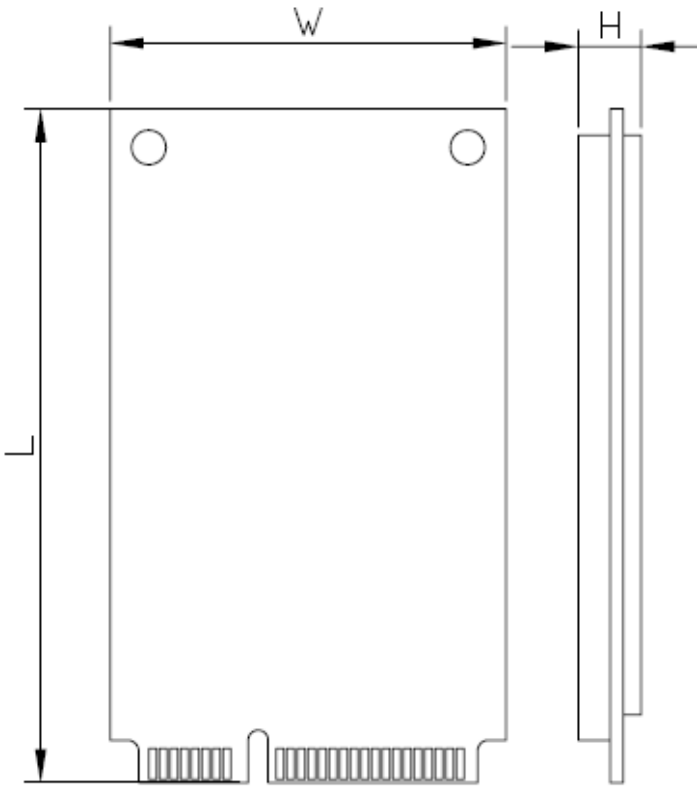
TS32GMSA340 **TS64GMSA340**
TS128GMSA340 **TS256GMSA340**

mSATA Solid State Disk

Description

Transcend MSA340 series are mSATA SSD device with SATA 6Gb/s interface which provides higher performance for storage. These product is designed specifically for varies applications, such as ultrabook, industrial PC, vehicle PC and road surveillance record.

Placement



Features

- RoHS compliant
- Fully compatible with devices and OS that support the SATA III 6Gb/s standard
- Support dynamic power management
- With DDR3 DRAM cache
- Support Shift Read feature
- Non-volatile Flash Memory for outstanding data retention
- Built-in ECC (Error Correction Code) functionality and wear-leveling algorithm ensures highly reliable of data transfer
- Support TRIM and NCQ command
- Shock resistance
- Support Intel ISRT function
- Support DevSleep mode

Dimensions

Side	Millimeters	Inches
L	50.80 ± 0.15	2.000 ± 0.006
W	29.85 ± 0.15	1.175 ± 0.006
H	4 (Max.)	0.157 (Max.)

Specifications

Physical Specification		
Form Factor		MO-300A
Storage Capacities		32G~256 GB
Dimensions (mm)	**Length**	50.80 ± 0.15
	Width	29.85 ± 0.15
	Height	4 (Max.)
Input Voltage		3.3V ± 5%
Weight		8g
Connector		PCI Express Mini Card Connector

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		AS SSD		CrystalDiskMark				IOmeter	
	Max. Read *	Max. Write *	Sequential Read **	Sequential Write **	Sequential Read ***	Sequential Write ***	Random Read (4KB QD32) ***	Random Write (4KB QD32) ***	IOPS Random Read (4KB QD32) ****	IOPS Random Write (4KB QD32) ****
TS32GMSA340	189	37	173	35	179	37	79	37	19131	9234
TS64GMSA340	365	74	298	70	304	74	135	73	32952	18060
TS128GMSA340	531	143	464	128	490	142	263	141	63433	34951
TS256GMSA340	525	277	473	268	492	274	279	270	68253	64521

Note: Maximum transfer speed recorded

*25 ℃, test on ASUS Z87 Z87-PRO , 4GB, Windows® 7 with AHCI mode, benchmark utility ATTO (version 2.41), unit MB/s
** 25 ℃, test onASUS Z87 Z87-PRO , 4GB, Windows® 7 with AHCI mode, benchmark utility AS SSD (version 1.6.4237.30508), unit MB/s
*** 25 ℃, test on ASUS Z87 Z87-PRO , 4GB, Windows® 7 with AHCI mode, benchmark utility CrystalDiskMark (version 3.0.1), default setting, copied file 1000MB, unit MB/s
**** 25 ℃, test on ASUS Z87 Z87-PRO, 4GB, Windows® 7 with AHCI mode, benchmark utility Iometer2008 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

Power Requirements		
Input Voltage		3.3V ± 5% @25℃
Mode P/N / Power Consumption		Typical (mA)
TS32GMSA340*	Read	251
	Write	265
	Idle	99
TS64GMSA340*	Read	267
	Write	282
	Idle	100
TS128GMSA340*	Read	325
	Write	482
	Idle	100
TS256GMSA340*	Read	356
	Write	772
	Idle	101

*Tested with Iometer running sequential reads/writes and idle mode

Reliability		
Data Reliability	Supports 40 bits in 1K bytes	
MTBF	1,000,000 hours	
Endurance (Terabytes Written) *	32G	**33 TBW**
	64G	**68 TBW**
	128G	**99 TBW**
	256G	**141 TBW**

*Tested under JESD219A Client workload endurance specification.

Vibration	
Operating	3G(peak-to-peak), 5 - 800Hz
Non-Operating	5G(peak-to-peak), 5 - 800Hz

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

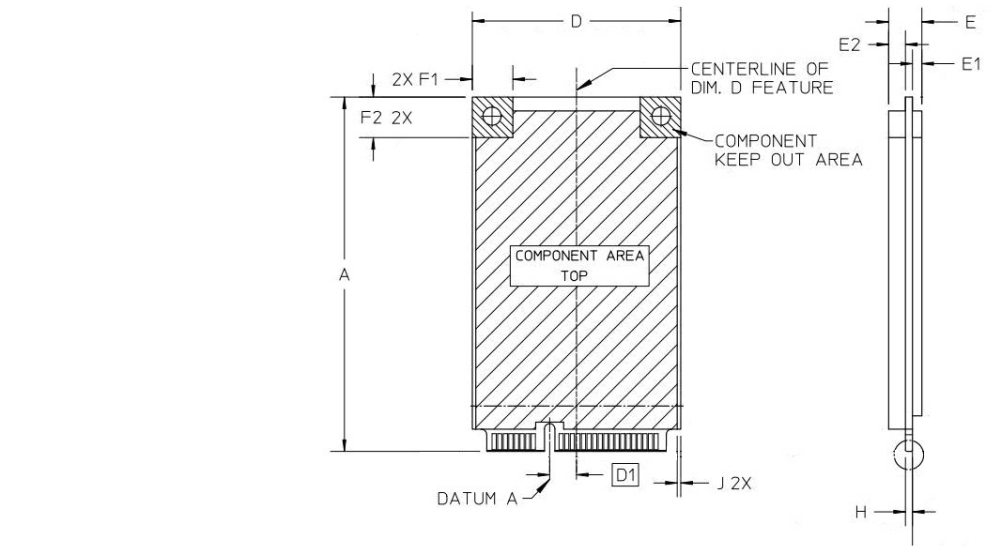
Shock	
Operating	1500G, 0.5ms
Non-Operating	1500G, 0.5ms

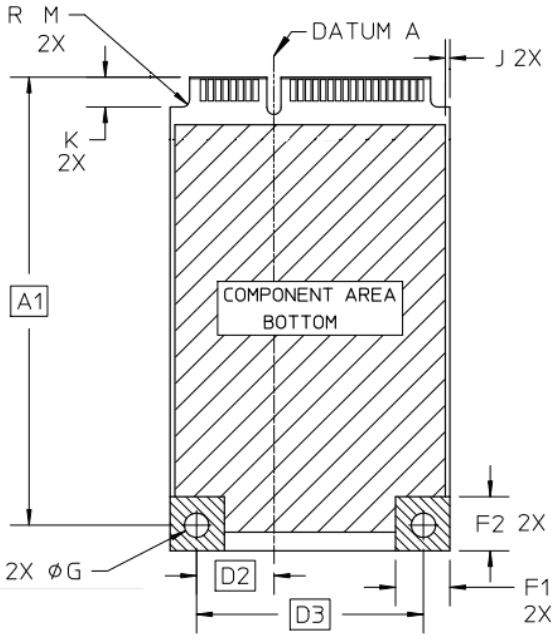
* Reference to IEC 60068-2-27 Testing procedures; Operating-Half-sine wave, 1500g, 0.5ms, 3 times/dir., total 18 times.

Regulations	
Compliance	CE, FCC and BSMI

Package Dimensions

Below figure illustrates the Transcend mSATA Solid State Disk. All dimensions are in mm.



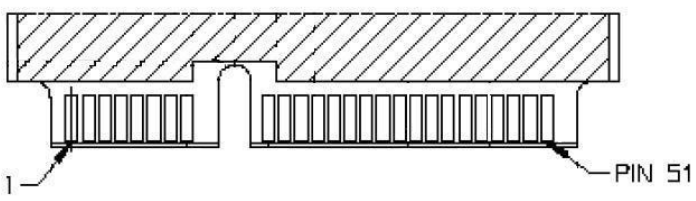


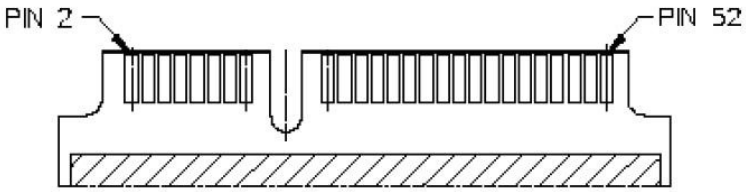
Symbol	Min.	Nom.	Max
A	50.75	50.80	50.95
A1	47.95	48.05	48.15
D	29.70	29.85	30.00
D1	-	3.85	-
D2	-	8.25	-
D3	-	24.20	-
E	-	-	4.00
E1	-	-	1.30
E2	-	-	1.60
F1	5.65	5.80	5.95
F2	5.65	5.80	5.95
G	2.50	2.60	2.70
H	0.90	1.00	1.10
J	0.50	-	-
M	-	0.80	-

Pin Assignments

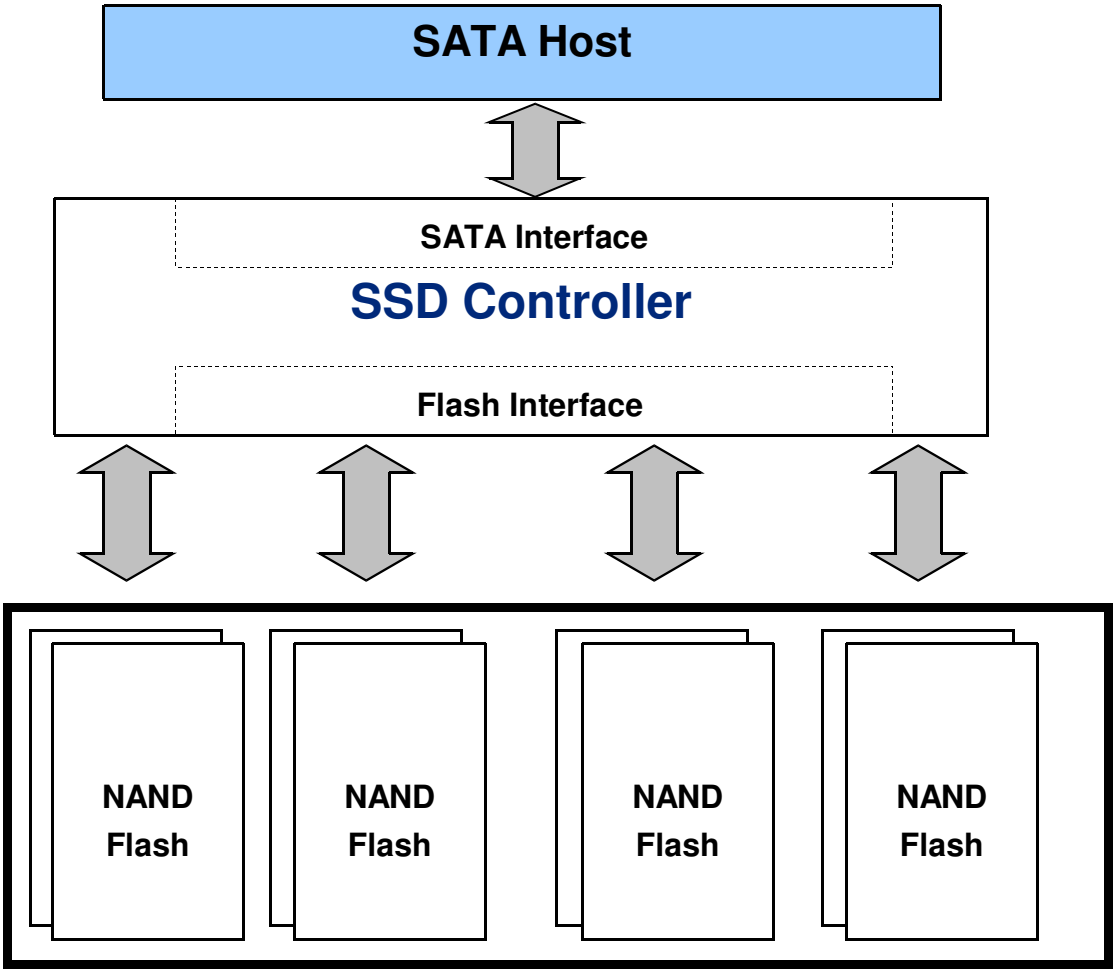
Pin No.	Pin Name	Pin No.	Pin Name
01	NC	02	3.3V
03	NC	04	GND
05	NC	06	NC
07	NC	08	NC
09	GND	10	NC
11	NC	12	NC
13	NC	14	NC
15	GND	16	NC
17	NC	18	GND
19	NC	20	NC
21	GND	22	NC
23	TX+	24	3.3V
25	TX-	26	GND
27	GND	28	NC
29	GND	30	NC
31	RX-	32	NC
33	RX+	34	GND
35	GND	36	NC
37	GND	38	NC
39	3.3V	40	GND
41	3.3V	42	NC
43	Device Type (NC)	44	DevSleep
45	Vendor	46	NC
47	Vendor	48	NC
49	DAS	50	GND
51	Presence Detection	52	3.3V

Pin Layout





Block Diagram



Reliability

Wear-Leveling algorithm

The controller supports static/dynamic wear leveling. When the host writes data, the controller will find and use the block with the lowest erase count among the free blocks. This is known as dynamic wear leveling. When the free blocks' erase count is higher than the data blocks', it will activate the static wear leveling, replacing the not so frequently used user blocks with the high erase count free blocks.

ECC algorithm

The controller uses 40 bit ECC algorithm per 1024 bytes. ECC can correct up to 40 random error bits within 1024 data bytes.

Bad-block management

When the flash encounters ECC failed, program fail or erase fail, the controller will mark the block as bad block to prevent the used of this block and caused data lost later on.

ATA Command Register

This table with the following paragraphs summarizes the ATA command set.

Command Table

Command Name	Code	PARAMETERS USED					
		SC	SN	CY	DR	HD	FT
CHECK POWER MODE	E5h	X	X	X	O	X	X
EXECUTE DIAGNOSTICS	90h	X	X	X	O	X	X
FLUSH CACHE	E7h	X	X	X	O	O	X
IDENTIFY DEVICE	ECh	X	X	X	O	O	X
IDLE	E3h	O	X	X	O	X	X
IDLE IMMEDIATE	E1h	X	X	X	O	X	X
INITIALIZE DEVICE PARAMETERS	91h	O	X	X	O	O	X
READ DMA	C8h	O	O	O	O	O	X
READ DMA EXT	25h	O	O	O	O	O	X
READ FPDMA QUEUED	60h	O	O	O	O	O	X
READ LOG DMA EXT	47h	O	O	O	O	O	X
READ LOG EXT	2Fh	O	O	O	O	O	X
READ MULTIPLE	C4h	O	O	O	O	O	X
READ SECTOR(S)	20h or 21h	O	O	O	O	O	X
READ VERIFY SECTOR(S)	40h or 41h	O	O	O	O	O	X
RECALIBRATE	10h	X	X	X	O	X	X
SECURITY DISABLE PASSWORD	F6h	X	X	X	O	X	X
SECURITY ERASE PREPARE	F3h	X	X	X	O	X	X
SECURITY ERASE UNIT	F4h	X	X	X	O	X	X
SECURITY FREEZE LOCK	F5h	X	X	X	O	X	X
SECURITY SET PASSWORD	F1h	X	X	X	O	X	X
SECURITY UNLOCK	F2h	X	X	X	O	X	X

SEEK	7xh	X	X	O	O	O	X
SET FEATURES	EFh	O	X	X	O	X	O
SET MULTIPLE MODE	C6h	O	X	X	O	X	X
SLEEP	E6h	X	X	X	O	X	X
SMART	B0h	X	X	O	O	X	O
STANDBY	E2h	X	X	X	O	X	X
STANDBY IMMEDIATE	E0h	X	X	X	O	X	X
WRITE DMA	CAh	O	O	O	O	O	X
WRITE DMA EXT	35h	O	O	O	O	O	X
WRITE FPDMA QUEUED	61h	O	O	O	O	O	X
WRITE LOG DMA EXT	57h	O	O	O	O	O	X
WRITE LOG EXT	3Fh	O	O	O	O	O	X
WRITE MULTIPLE	C5h	O	O	O	O	O	X
WRITE SECTOR(S)	30h or 31h	O	O	O	O	O	X

Note:

O = Valid, X = Don't care

SC = Sector Count Register

SN = Sector Number Register

CY = Cylinder Low/High Register

DR = DEVICE SELECT Bit (DEVICE/HEAD Register Bit 4)

HD = HEAD SELECT Bit (DEVICE/HEAD Register Bit 3-0)

FT = Features Register

Identify Device Information Default Value

Word	Value	F/V	Description
0	0040h		General configuration bit-significant information:
		F	15 0 = ATA device
		X	14-8 Retired
		F	7 1 = removable media device
		X	6 Obsolete
		X	5-3 Retired
		F	2 Reserved
		X	1 Retired
		F	0 Reserved
1	XXXXh	X	Number of logical cylinders
2	C837h	V	Specific configuration
3	00XXh	X	Number of logical heads
4-5	XXXXh	X	Retired
6	XXXXh	X	Number of logical sector per logical track
7-8	XXXXh	V	Reserved for assignment by the CompactFlash_ Association
9	000Eh	X	Retired
10-19	XXXXh	F	Serial number (20 ASCII characters)
20-21	0000h	X	Retired
22	003Fh	X	Obsolete
23-26	XXXXh	F	Firmware revision (8 ASCII characters)
27-46	XXXXh	F	Model number (40 ASCII characters)
47	8000h	F	15-8 80h
		F	7-0 00h = Reserved
		F	01h = Maximum number of 1 sectors on READ/WRITE MULTIPLE commands
48	4000h	F	Reserved
49	2F00h		Capabilities
			15-14 Reserved for the IDENTIFY PACKET DEVICE command.
		F	13 1 = Standby timer values as specified in this standard are supported
			0 = Standby timer values shall be managed by the device
			12 Reserved for the IDENTIFY PACKET DEVICE command.
		F	11 1 = IORDY supported

			0 = IORDY may be supported
		F	10 1 = IORDY may be disabled
		F	9 1 = LBA supported
		F	8 1 = DMA supported.
		X	7-0 Retired
50	4000h		Capabilities
		F	15 Shall be cleared to zero.
		F	14 Shall be set to one.
		F	13-2 Reserved.
		X	1 Obsolete
		F	0 Shall be set to one to indicate a device specific Standby timer value minimum.
51-52	0000h	X	Obsolete
53	0007h	F	15-3 Reserved
		F	2 1 = the fields reported in word 88 are valid
			0 = the fields reported in word 88 are not valid
		F	1 1 = the fields reported in words 70:64 are valid
			0 = the fields reported in words 70:64 are not valid
		X	0 1 = the fields reported in words 58:54 are valid
			0 = the fields reported in words 58:54 are not valid
54-58	XXXXh	X	Obsolete
59	0110h		15-9 Reserved
		V	8 1 = Multiple sector setting is valid
		V	7-0 xxh = Setting for number of sectors that shall be transferred per interrupt on R/W Multiple command
60-61	XXXXh	F	Total number of user addressable sectors
62	0000h	X	Obsolete
63	0007h	F	15-11 Reserved
		V	10 1 = Multiword DMA mode 2 is selected
			0 = Multiword DMA mode 2 is not selected
		V	9 1 = Multiword DMA mode 1 is selected
			0 = Multiword DMA mode 1 is not selected
		V	8 1 = Multiword DMA mode 0 is selected
			0 = Multiword DMA mode 0 is not selected
			7-3 Reserved
		F	2 1 = Multiword DMA mode 2 and below are supported
		F	1 1 = Multiword DMA mode 1 and below are supported
		F	0 1 = Multiword DMA mode 0 is supported
64	0003h	F	15-8 Reserved
		F	7-0 Advanced PIO modes supported
65	0078h	F	Minimum Multiword DMA transfer cycle time per word

66	0078h	F	Manufacturer's recommended Multiword DMA transfer cycle time
67	0078h	F	Minimum PIO transfer cycle time without flow control
68	0078h	F	Minimum PIO transfer cycle time with IORDY flow control
69-74	0000h	F	Reserved (for future command overlap and queuing)
75	001Fh	F	Queue depth 15-5 Reserved 4-0 Maximum queue depth – 1
76	Xh	F	Serial ATA Capabilities 15:13 Reserved for Serial ATA 12 1 = Supports NCQ priority information 11 1 = Supports Unload while NCQ commands are outstanding 10 1 = Supports the SATA Phy Event Counters log 9 1 = Supports receipt of host initiated power management requests 8 1 = Supports the NCQ feature set 7:4 Reserved for Serial ATA 3 1 = Supports SATA Gen3 Signaling Speed (6.0Gb/s) 2 1 = Supports SATA Gen2 Signaling Speed (3.0Gb/s) 1 1 = Supports SATA Gen1 Signaling Speed (1.5Gb/s) 0 Shall be cleared to zero
77			Reserved
78	Xh		Serial ATA features supported 15:7 Reserved for Serial ATA 6 1 = Device supports Software Settings Preservation 5 Reserved for Serial ATA 4 1 = Device supports in-order data delivery 3 1 = Device supports initiating power management 2 1 = Device supports DMA Setup auto-activation 1 1 = Device supports non-zero buffer offsets 0 Shall be cleared to zero
79	Xh		Serial ATA features enabled 15:7 Reserved for Serial ATA 6 1 = Software Settings Preservation enabled 5 Reserved for Serial ATA 4 1 = In-order data delivery enabled 3 1 = Device initiated power management enabled 2 1 = DMA Setup auto-activation enabled 1 1 = Non-zero buffer offsets enabled F 0 Shall be cleared to zero

80	01FEh		Major version number 0000h or FFFFh = device does not report version
		F	15 Reserved
		F	14 Reserved for ATA/ATAPI-14
		F	13 Reserved for ATA/ATAPI-13
		F	12 Reserved for ATA/ATAPI-12
		F	11 Reserved for ATA/ATAPI-11
		F	10 Reserved for ATA/ATAPI-10
		F	9 Reserved for ATA/ATAPI-9
		F	8 Reserved for ATA/ATAPI-8
		F	7 1 = supports ATA/ATAPI-7
		F	6 1 = supports ATA/ATAPI-6
		F	5 1 = supports ATA/ATAPI-5
		F	4 1 = supports ATA/ATAPI-4
		F	3 Obsolete
		X	2 Obsolete
		X	1 Obsolete
		F	0 ReservedMajor version number 0000h or FFFFh = device does not report version
81	0021h	F	Minor version number
82	0068h		Command and feature sets supported
		X	15 Obsolete
		F	14 1 = NOP command supported
		F	13 1 = READ BUFFER command supported
		F	12 1 = WRITE BUFFER command supported
		X	11 Obsolete
		F	10 1 = Host Protected Area feature set supported
		F	9 1 = DEVICE RESET command supported
		F	8 1 = SERVICE interrupt supported
		F	7 1 = release interrupt supported
		F	6 1 = look-ahead supported
		F	5 1 = write cache supported
		F	4 Shall be cleared to zero to indicate that the PACKET Command feature set is not supported.
		F	3 1 = mandatory Power Management feature set supported
		F	2 1 = Removable Media feature set supported
		F	1 1 = Security Mode feature set supported
		F	0 1 = SMART feature set supported

83	5000h		Command sets supported.
		F	15 Shall be cleared to zero
		F	14 Shall be set to one
		F	13-9 Reserved
		F	8 1 = SET MAX security extension supported
		F	7 Reserved
		F	6 1 = SET FEATURES subcommand required to spinup after power-up
		F	5 1 = Power-Up In Standby feature set supported
		F	4 1 = Removable Media Status Notification feature set supported
		F	3 1 = Advanced Power Management feature set supported
		F	2 1 = CFA feature set supported
		F	1 1 = READ/WRITE DMA QUEUED supported
		F	0 1 = DOWNLOAD MICROCODE command supported
84	4000h		CCommand set/feature supported extension.
		F	15 Shall be cleared to zero
		F	14 Shall be set to one
		F	13-2 Reserved
		F	1 1 = SMART self-test supported
		F	0 1 = SMART error logging supported
85	0008h		Command set/feature enabled.
		X	15 Obsolete
		F	14 1 = NOP command enabled
		F	13 1 = READ BUFFER command enabled
		F	12 1 = WRITE BUFFER command enabled
		X	11 Obsolete
		V	10 1 = Host Protected Area feature set enabled
		F	9 1 = DEVICE RESET command enabled
		V	8 1 = SERVICE interrupt enabled
		V	7 1 = release interrupt enabled
		V	6 1 = look-ahead enabled
		V	5 1 = write cache enabled
		F	4 Shall be cleared to zero to indicate that the PACKET Command feature set is not
		F	supported.
		F	3 1 = Power Management feature set enabled
		V	2 1 = Removable Media feature set enabled
		V	1 1 = Security Mode feature set enabled
			0 1 = SMART feature set enabled
86	5000h		Command set/feature enabled.
		F	15-9 Reserved
		F	8 1 = SET MAX security extension enabled by SET MAX SET PASSWORD

		F	7 See Address Offset Reserved Area Boot, INCITS TR27:2001
		F	6 1 = SET FEATURES subcommand required to spin-up after power-up
		V	5 1 = Power-Up In Standby feature set enabled
		V	4 1 = Removable Media Status Notification feature set enabled
		V	3-1 1 = Advanced Power Management feature set enabled
		F	0 1 = DOWNLOAD MICROCODE command supported
87	4000h		Command set/feature default.
		F	15 Shall be cleared to zero
		F	14 Shall be set to one
		F	13-2 Reserved
		F	1 1 = SMART self-test supported
		F	0 1 = SMART error logging supported
88	Xh		15-14 Reserved
		V	13 1 = Ultra DMA mode 5 is selected
			0 = Ultra DMA mode 5 is not selected
		V	12 1 = Ultra DMA mode 4 is selected
			0 = Ultra DMA mode 4 is not selected
		V	11 1 = Ultra DMA mode 3 is selected
			0 = Ultra DMA mode 3 is not selected
		V	10 1 = Ultra DMA mode 2 is selected
			0 = Ultra DMA mode 2 is not selected
		V	9 1 = Ultra DMA mode 1 is selected
			0 = Ultra DMA mode 1 is not selected
		F	8 1 = Ultra DMA mode 0 is selected
		F	0 = Ultra DMA mode 0 is not selected
		F	7-6 Reserved
		F	5 1 = Ultra DMA mode 5 and below are supported
		F	4 1 = Ultra DMA mode 4 and below are supported
		F	3 1 = Ultra DMA mode 3 and below are supported
			2 1 = Ultra DMA mode 2 and below are supported
			1 1 = Ultra DMA mode 1 and below are supported
			0 1 = Ultra DMA mode 0 is supported
89	0000h	F	Time required for security erase unit completion
90	0000h	F	Time required for Enhanced security erase completion
91	0000h	V	Current advanced power management value
92	0000h	V	Master Password Revision Code
93	0000h	X	Hardware reset result
94-126	0000h	V	Reserved

127	0000h		Removable Media Status Notification feature set support
		F	15-2 Reserved
		F	1-0 00 = Removable Media Status Notification feature set not supported
			01 = Removable Media Status Notification feature supported
			10 = Reserved
			11 = Reserved
128	0001h		Security status
		F	15-9 Reserved
		V	8 Security level 0 = High, 1 = Maximum
		F	7-6 Reserved
		F	5 1 = Enhanced security erase supported
		V	4 1 = Security count expired
		V	3 1 = Security frozen
		V	2 1 = Security locked
		V	1 1 = Security enabled
		F	0 1 = Security supported
129-159	0000h	X	Vendor specific
160-254	0000h	X	Reserved
255	0000h	X	Integrity word
			15-8 Checksum
			7-0 Signature

Key:

F/V = Fixed/variable content

F = the content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.

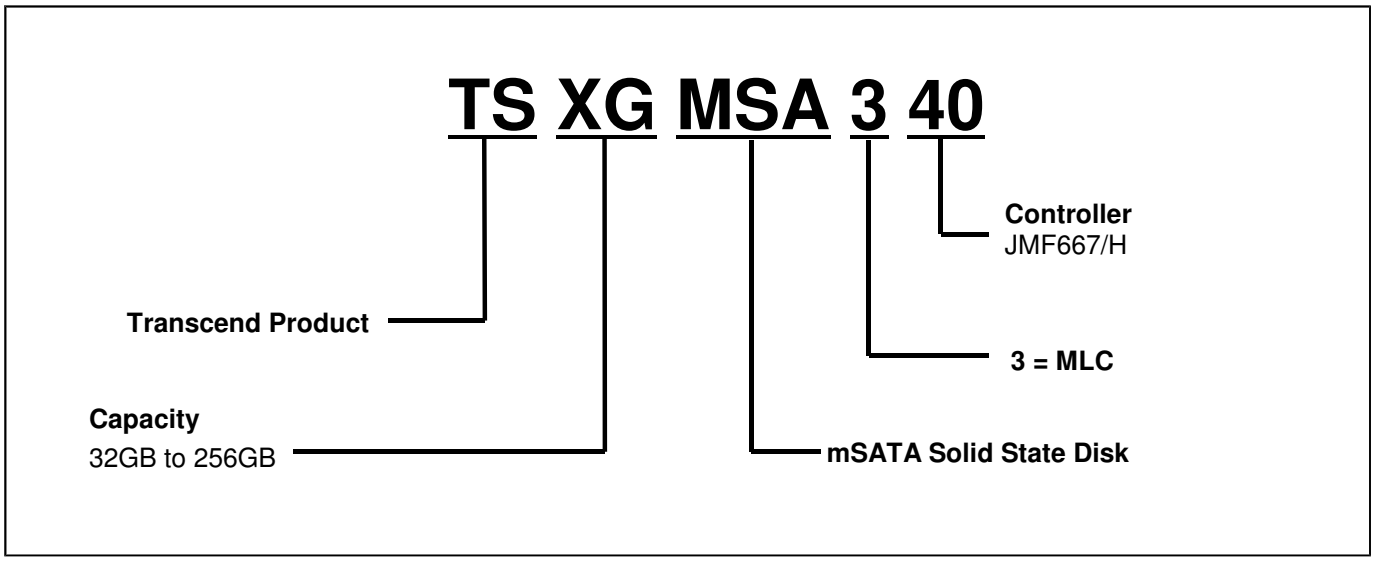
V = the contents of the word is variable and may change depending on the state of the device or the commands executed by the device.

X = the content of the word may be fixed or variable.

SMART Data Structure

ID	Description	Detail Information	
		Byte	Description
09h	Power-On hours Count	5,6	Power-On Hours Count
0Ch	Drive Power Cycle Count	5,6	Power-On Cycle Count
A8h	SATA PHY Error Count	5,6	SATA PHY Error Count
A9h	Bad Block Count	7,8	Total Bad Block Number of System
		9,10	Later Bad Block Number of System
ADh	Erase Count	5,6	Minimum Erase Count
		7,8	Maximum Erase Count
		9,10	Average Erase Count
AFh	Bad Cluster Table Count	3	ECC Fail Count
C0h	Unexpected Power Loss Count	5,6	Power Loss Count
C2h	Temperature	5	Current Temperature
		7	Minimum Temperature
		9	Maximum Temperature
ECh-FFh	Reserved		

Ordering Information



The above technical information 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.

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Revision History			
Version	**Date**	**Modification Content**	**Modified Page**
1.0	2014/02/14	Initial release	