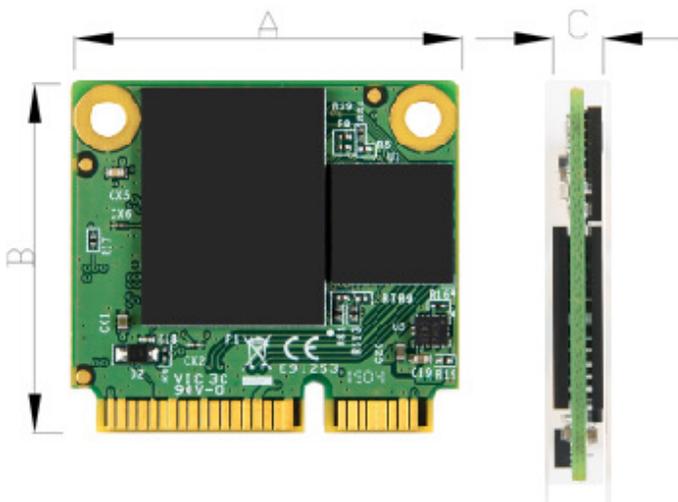


MSM360 – SATA III 6Gb/s mSATA mini SSD

Transcend MSM360 series are mSATA mini Solid State Drives (SSDs) with high performance and quality Flash Memory assembled on a printed circuit board. These devices feature cutting-edge technology to enhance product life and data retention. MSM360 is designed specifically for various applications, such as Ultrabooks, industrial PCs, vehicle PCs and road surveillance recording.

Placement



Dimensions

Side	Millimeters	Inches
A	29.85 +/-0.15	1.06 +/-0.006
B	26.8 +/-0.15	1.175 +/-0.006
C	3.85 (Max)	0.152 (Max)

Features

- RoHS compliant
- Power Supply: 3.3V±5%
- Operating Temperature: 0°C to 70°C
- Built-in 66 bits per 1KByte ECC (Error Correction Code) functionality ensures highly reliable of data transfer.
- Global wear-leveling algorithm eliminates excessive write operation and extends product life.
- Supports S.M.A.R.T (Self-defined)
- Supports Security Command
- Supports Device Sleep
- Fully compatible with devices and OS that support the SATA 6Gb/s standard
- Compliant with JEDEC MO-300B
- Supports Transcend SSD Scope Pro (Optional)

Specifications

Physical Specification		
Form Factor	MO-300B	
Storage Capacities	128GB	
Dimensions	Length	26.8 ± 0.15 mm
	Width	29.85 ± 0.15 mm
	Height	3.85 mm (Max)
Input Voltage	3.3V ± 5%	
Weight	3g	
Connector	PCI Express Mini Card Connector	

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

Performance						
Model P/N	Sequential Read*	Sequential Write*	Random Read (4KB QD32)*	Random Write (4KB QD32)*	IOPS Random Read (4KB QD32)**	IOPS Random Write (4KB QD32)**
TS128GMSM360	514.1	160.4	117.5	156.4	32743	38150

Note: Maximum transfer speed recorded

* 25 °C, test on GA-Z87Z-UD3H, 4GB, Windows[®] 8.1 x64 with AHCI mode, benchmark utility CrystalDiskMark (version 3.0.1), copied file 1000MB

** Random read/write performance based on IOMeter2008 with 4K file size and queue depth of 32

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

Reliability	
Data Reliability	Supports BCH ECC 66 bits per 1K byte
MTBF	1,000,000 hours
Endurance (Terabytes Written)	128G 83.4TB

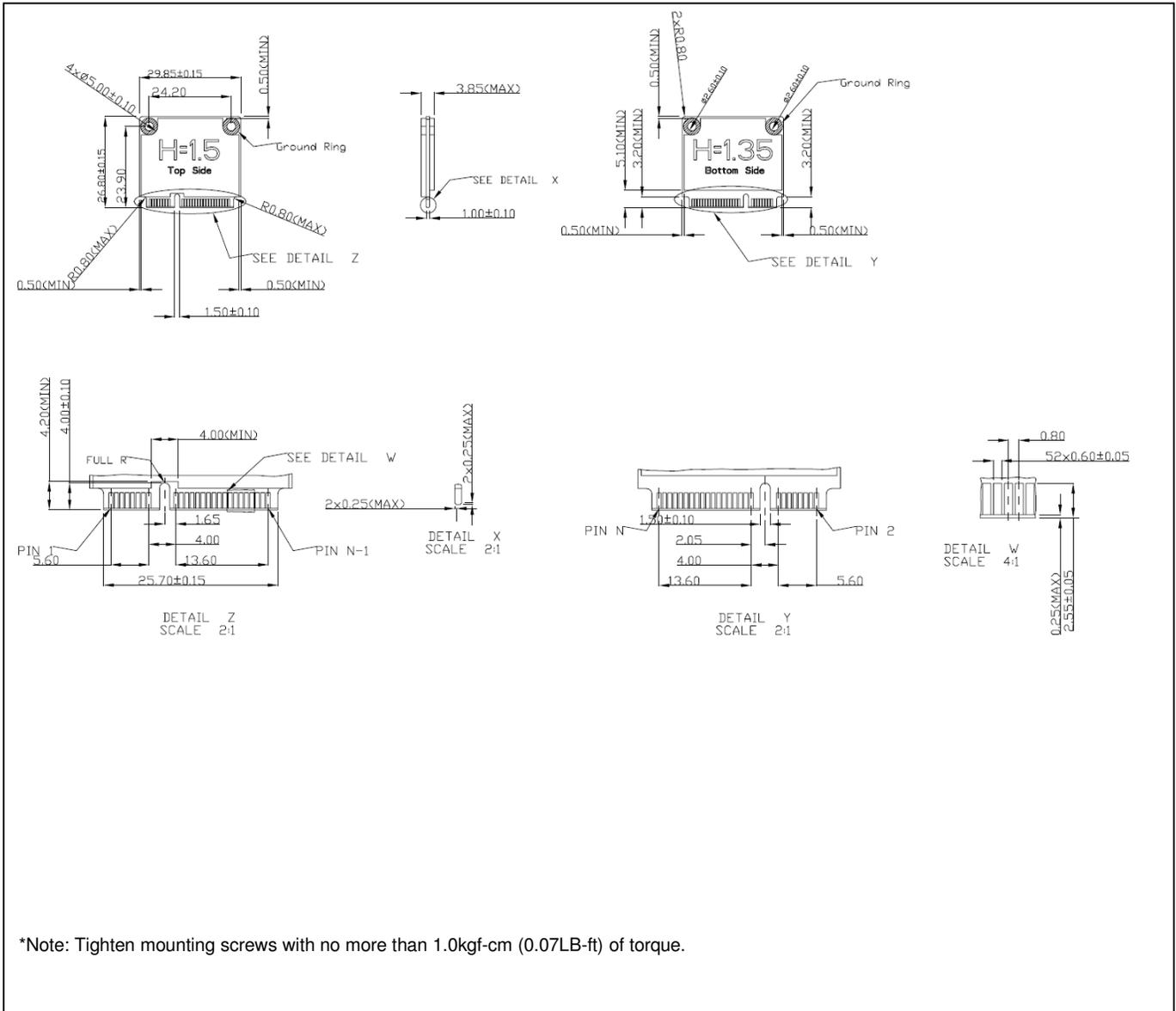
Regulations	
Compliance	CE, FCC and BSMI

Actual Capacity				
Model P/N	User Max. LBA	Cylinder	Head	Sector
TS128GMSM360	250,069,680	16,383	16	63

Power Requirements		
Input Voltage		3.3V ± 5%
Mode		Max. (mA)
TS128GMSM360	Write _(peak)	523
	Read _(peak)	379
	Idle _(peak)	115
	Devslp _(peak)	1.5

Package Dimensions

The figure below illustrates the Transcend MSM360 mSATA mini Solid State Disk. All dimensions are in mm.



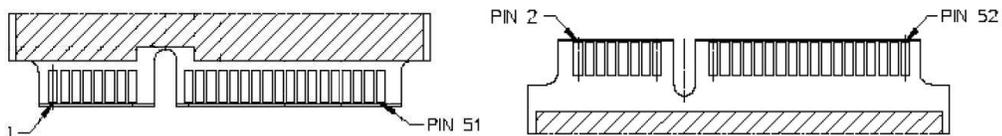
Pin Assignments

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	NC	44	NC/DEVSLP(optional)
45	Vendor	46	NC
47	Vendor	48	NC
49	DAS/DSS*	50	GND
51	Presence Detection**	52	3.3V

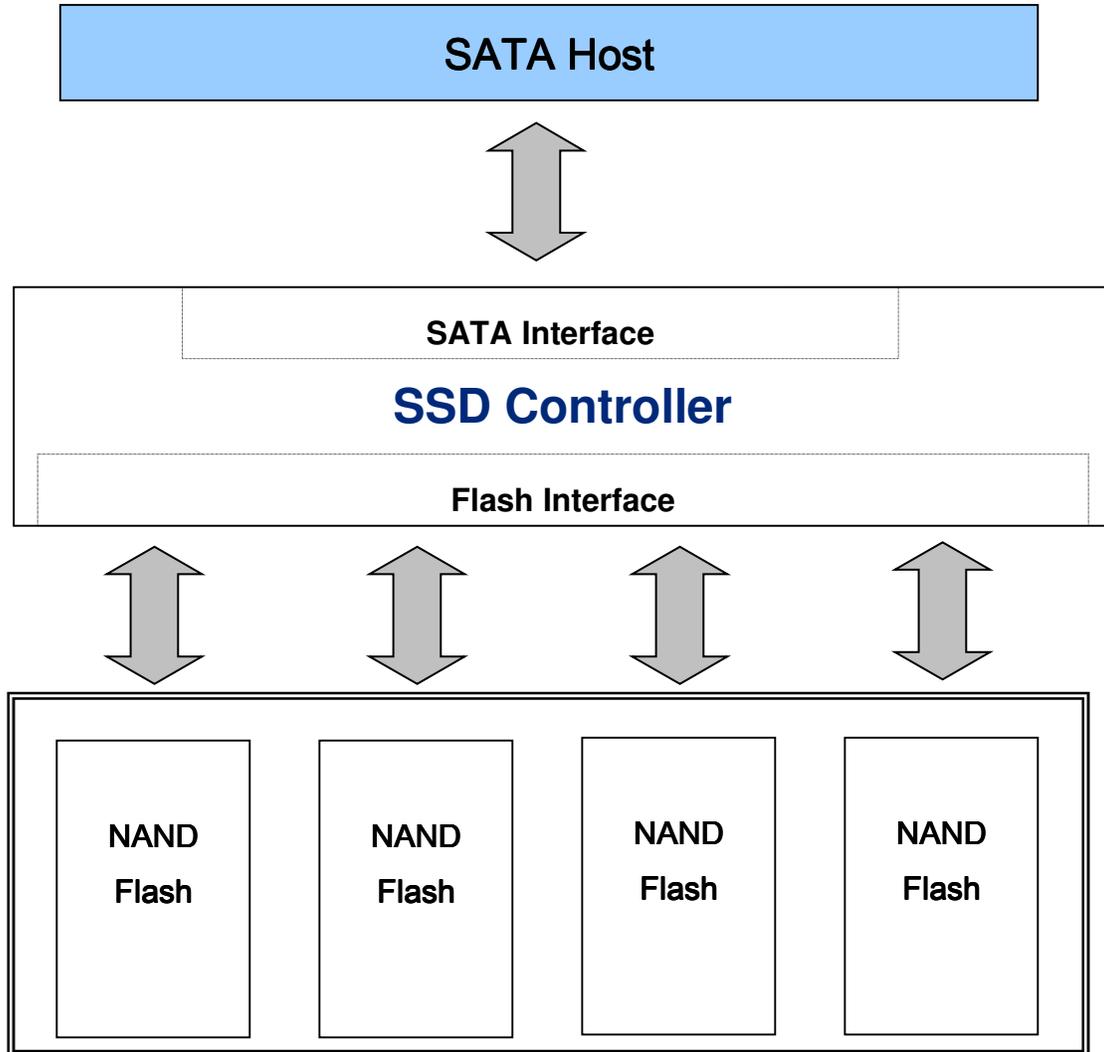
* Device Activity Signal / Disable Staggered Spin-up

** Connect to GND internally

Pin Layout



Block Diagram



Features

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. If the free block erase count is higher than a threshold value plus 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

Using a BCH 66 bit Error Correction Code algorithm with each channel, the controller can correct up to 66 random bit errors per 1K byte data sector for MLC NAND flash. The hardware executes parity generation and error detection/correction features.

Bad Block Management

When the flash encounters an ECC, program or erase failure, the controller will mark the block as a bad block to prevent use of this block and cause data loss in the future.

ATA Command Register

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

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
Others		
Data Set Management	06h	DMA
Seek	70h	Non-data

ATA Command Specifications

FLUSH CACHE (E7h)

This command is used by the host to request the device to flush the write cache. If there is data in the write cache, that data shall be written to the media. The BSY bit shall remain set to one until all data has been successfully written or an error occurs.

IDENTIFY DEVICE (ECh)

This commands read out 512Bytes of drive parameter information. Parameter Information consists of the arrangement and value as shown in the following table. This command enables the host to receive the Identify Drive Information from the device.

INITIALIZE DEVICE PARAMETERS (91h)

This command enables the host to set the number of logical sectors per track and the number of logical heads minus 1, per logical cylinder for the current CHS translation mode.

READ DMA (C8h)

Read data from sectors during Ultra DMA and Multiword DMA transfer. Use the SET FEATURES command to specify the mode value. A sector count of zero requests 256 sectors.

READ LOG EXT (2Fh)

This 48-bit command is for devices implementing the GPL feature set. It returns the specified log to the host.

READ MULTIPLE (C4h)

This command performs similarly to the Read Sectors command. Interrupts are not generated on each sector, but on the transfer of a block which contains the number of sectors defined by a Set Multiple command.

READ SECTOR(S) (20h)

This command reads 1 to 256 sectors as specified in the Sector Count register from sectors which is set by Sector number register. A sector counts of 0 requests 256 sectors. The transfer beings specified in the Sector Number register.

READ VERIFY SECTOR(S) (40h/41h)

This command verifies one or more sectors on the drive by transferring data from the flash media to the data buffer in the drive and verifying that the ECC is correct. This command is identical to the Read Sectors command, except that DRQ is never set and no data is transferred to the host.

SET FEATURES (EFh)

This command set parameter to Features register and set drive's operation. For transfer mode, parameter is set to Sector Count register. This command is used by the host to establish or select certain features.

SET MULTIPLE MODE (C6h)

This command enables the device to perform READ MULTIPLE and WRITE MULTIPLE operations and establishes the block count for these commands.

WRITE DMA (CAh)

Write data to sectors during Ultra DMA and Multiword DMA transfer. Use the SET FEATURES command to specify the mode value.

WRITE MULTIPLE (C5h)

This command is similar to the Write Sectors command. Interrupts are not presented on each sector, but on the transfer of a block which contains the number of sectors defined by Set Multiple command.

WRITE SECTOR(S) (30h)

Write data to a specified number of sectors (1 to 256, as specified with the Sector Count register) from the specified address. Specify "00h" to write 256 sectors.

NOP (00h)

The device shall respond with command aborted. For devices implementing the Overlapped feature set, subcommand code 00h in the Features register shall abort any outstanding queue. Subcommand codes 01h through FFh in the Features register shall not affect the status of any outstanding queue.

READ BUFFER (E4h)

The READ BUFFER command enables the host to read a 512-byte block of data.

WRITE BUFFER (E8h)

This command enables the host to write the contents of one 512-byte block of data to the device's buffer.

Power Management Feature Set**CHECK POWER MODE (E5h or 98h)**

The host can use this command to determine the current power management mode.

IDLE (E3h or 97h)

This command causes the device to set BSY, enter the Idle mode, clear BSY and generate an interrupt. If sector count is non-zero, the automatic power down mode is enabled. If the sector count is zero, the automatic power mode is disabled.

IDLE IMMEDIATE (E1h or 95h)

This command causes the device to set BSY, enter the Idle(Read) mode, clear BSY and generate an interrupt.

SLEEP (E6h or 99h)

This command causes the device to set BSY, enter the Sleep mode, clear BSY and generate an interrupt.

STANDBY (E2h or 96h)

This command causes the device to set BSY, enter the Sleep mode (which corresponds to the ATA "Standby" Mode), clear BSY and return the interrupt immediately.

STANDBY IMMEDIATE (E0h or 94h)

This command causes the drive to set BSY, enter the Sleep mode (which corresponds to the ATA "Standby" Mode), clear BSY and return the interrupt immediately.

Security Mode Feature Set

SECURITY SET PASSWORD (F1h)

This command set user password or master password. The host outputs sector data with PIO data-out protocol to indicate the information defined in the following table.

Security set Password data content1

Word	Content		
0	Control word		
	Bit 0	Identifier	0=set user password 1=set master password
	Bits 1-7	Reserved	
	Bit 8	Master Password Capability	0=High 1=Maximum
	Bits 9-15	Reserved	
1-16	Password (32 bytes)		
17	Master Password Identifier. This word is valid if word 0 bit 0 is set to one.		
18-255	Reserved		

SECURITY UNLOCK (F2h)

This command disables LOCKED MODE of the device. This command transfers 512 bytes of data from the host with PIO data-out protocol. The following table defines the content of this information

Security Unlock information2

Word	Content		
0	Control word		
	Bit 0	Identifier	0=compare user password 1=compare master password
	Bits 1-15	Reserved	
1-16	Password (32 bytes)		
17-255	Reserved		

SECURITY DISABLE PASSWORD (F6h)

Disables any previously set user password and cancels the lock. The host transfers 512 bytes of data, as shown in the following table, to the drive. The transferred data contains a user or master password, which the drive compares with the saved password. If they match, the drive cancels the lock. The master password is still saved. It is re-enabled by issuing the SECURITY SET PASSWORD command to re-set a user password.

SECURITY ERASE PREPARE (F3h)

This command shall be issued immediately before the Security Erase Unit command to enable erasing and unlocking. This command prevents accidental loss of data on the drive.

SECURITY ERASE UNIT (F4h)

The host uses this command to transfer 512 bytes of data, as shown in the following table, to the drive. The transferred data contains a user or master password, which the drive compares with the saved password. If they match, the drive deletes user data, disables the user password, and cancels the lock. The master password is still saved. It is re-enabled by issuing the SECURITY SET PASSWORD command to re-set a user password.

SECURITY FREEZE LOCK (F5h)

Causes the drive to enter Frozen mode. Once this command has been executed, the following commands to update a lock result in the Aborted Command error:

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY DISABLE PASSWORD
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT

The drive exits from Frozen mode upon a power-off or hard reset. If the SECURITY FREEZE LOCK command is issued when the drive is placed in Frozen mode, the drive executes the command, staying in Frozen mode.

Identify Device Information Default Value

Word Address	Default Value	Total Bytes	Data Field Type Information
0	0040h	2	General configuration
1	XXXXh	2	Default number of cylinders
2	0000h	2	Reserved
3	00XXh	2	Default number of heads
4	0000h	2	Obsolete
5	0240h	2	Obsolete
6	XXXXh	2	Default number of sectors per track
7-8	XXXXh	4	Number of sectors per card (Word 7 = MSW, Word 8 = LSW)
9	0000h	2	Obsolete
10-19	XXXXh	20	Serial number in ASCII (Right Justified)
20	0002h	2	Obsolete
21	0002h	2	Obsolete
22	0000h	2	Obsolete
23-26	XXXXh	8	Firmware revision in ASCII. Big Endian Byte Order in Word
27-46	XXXXh	40	Model number in ASCII (Left Justified) Big Endian Byte Order in Word
47	8001h	2	Maximum number of sectors on Read/Write Multiple command
48	0000h	2	Reserved
49	0F00h	2	Capabilities
50	4000h	2	Capabilities
51	0200h	2	PIO data transfer cycle timing mode
52	0000h	2	Obsolete
53	0007h	2	Field Validity
54	XXXXh	2	Current numbers of cylinders
55	XXXXh	2	Current numbers of heads
56	XXXXh	2	Current sectors per track
57-58	XXXXh	4	Current capacity in sectors (LBAs)(Word 57 = LSW, Word 58 = MSW)
59	0101h	2	Multiple sector setting
60-61	XXXXh	4	Total number of sectors addressable in LBA Mode
62	0000h	2	Reserved
63	0207h	2	Multiword DMA transfer. Supports MDMA Mode 0,1,and 2
64	0003h	2	Advanced PIO modes supported
65	0078h	2	Minimum Multiword DMA transfer cycle time per word. In PC Card modes this value shall be 0h
66	0078h	2	Recommended Multiword DMA transfer cycle time. In PC Card modes this value shall be 0h
67	0078h	2	Minimum PIO transfer cycle time without flow control

Word Address	Default Value	Total Bytes	Data Field Type Information
68	0078h	2	Minimum PIO transfer cycle time with IORDY flow control
69	4000h	2	Additional supported
70-74	0000h	10	Reserved
75	001Fh	2	Queue depth
76	070Eh	2	Serial ATA capacities <ul style="list-style-type: none"> · Supports Serial ATA Gen3 · Supports Serial ATA Gen2 · Supports Serial ATA Gen1 · Supports PHY event counters log · Supports receipt of host initiated power management requests · Supports Native Command Queuing
77	0080h	2	Serial ATA additional capability <ul style="list-style-type: none"> · DevSleep_to_ReducedPwrState
78	0148h	2	Serial ATA features supported <ul style="list-style-type: none"> · Supports Device Sleep · Supports software setting preservation · Device supports initiating power management
79	0040h	2	Reserved
80	03F0h	2	Mijor version number (ACS-2)
81	0000h	2	Minor version number
82	742Bh	2	Command sets supported 0
83	7500h	2	Command sets supported 1
84	4023h	2	Command sets supported 2
85-87	XXXXh	6	Command set/feature enabled
88	007Fh	2	Ultra DMA Mode Supported and Selected
89	0003h	2	Time required for a Normal Erase mode Security Erase Unit command
90	0001h	2	Time required for an Enhanced Erase mode Security Erase Unit command
91	0000h	2	Current Advanced power management value
92	FFFEh	2	Master password identifier
93-99	0000h	14	Reserved
100-103	XXXXh	8	Maximum user LBA for 48-bit address feature set
104	0000h	2	Reserved
105	0100h	2	Maximum number of 512-byte blocks per Data Set Management command
106-127	0000h	44	Reserved
128	0001h	2	Security status
129-159	XXXXh	64	Vendor specific
160	0000h	2	Power requirement description
161	0000h	2	Reserved
162	0000h	2	Key management schemes supported
163	0000h	2	CF Advanced True IDE Timing Mode Capability and Setting
164-168	0000h	10	Reserved

169	0001h	2	Data Set Management supported
170-216	XXXXh	94	Reserved
217	0001h	2	Non-rotating media (SSD)
218-221	0000h	8	Reserved
222	107Fh	2	Transport major revision (SATA Rev 3.1)
223-254	0000h	64	Reserved
255	XXXXh	2	Integrity word

SMART Command Support

Value	Command	Value	Command
D0h	Read Data	D5h	Read Log
D1h	Read Attribute Threshold	D6h	Write Log
D2h	Enable/Disable Autosave	D8h	Enable SMART Operations
D3h	Save Attribute Values	D9h	Disable SMART Operations
D4h	Execute OFF-Line Immediate	DAh	Return Status

If the reserved size is below a threshold, status can be read from the Cylinder Register using the Return Status command (DAh).

SMART DATA Structure

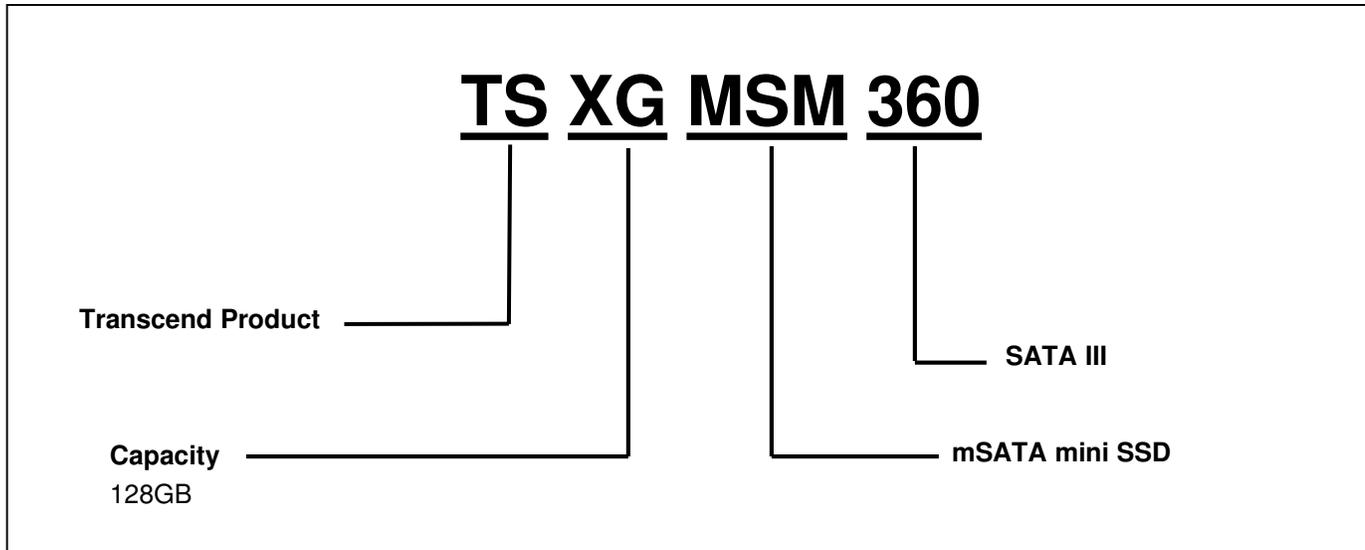
BYTE	F / V	Description
0-1	X	Revision code
2-361	X	Vendor specific
362	V	Off-line data collection status
363	X	Self-test execution status byte
364-365	V	Total time in seconds to complete off-line data collection activity
366	X	Vendor specific
367	F	Off-line data collection capability
368-369	F	SMART 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
396-399	F	Reserved
400-406	V	'SMI2246XT'
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
<p>F=the content of the byte is fixed and does not change.</p> <p>V=the content of the byte is variable and may change depending on the state of the device or the commands executed by the device.</p> <p>X=the content of the byte is vendor specific and may be fixed or variable.</p> <p>R=the content of the byte is reserved and shall be zero.</p>		

SMART Attributes

The table below 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	Read Error Rate
05	LSB	MSB	00	00	00	00	Reallocated sectors count
09	LSB	-	-	MSB	00	00	Reserved
0C	LSB	-	-	MSB	00	00	Power Cycle Count
A0	LSB	-	-	MSB	00	00	Uncorrectable sectors count when read/write
A1	LSB	MSB	00	00	00	00	Number of valid spare block
A2	LSB	MSB	00	00	00	00	Number of cache data block
A3	LSB	MSB	00	00	00	00	Number of initial invalid block
A4	LSB	-	-	MSB	00	00	Total erase count
A5	LSB	-	-	MSB	00	00	Maximum erase count
A6	LSB	-	-	MSB	00	00	Minimum erase count
A7	LSB	-	-	MSB	00	00	Average erase count
C0	LSB	-	-	MSB	00	00	Power-off retract Count
C2	MSB	00	00	00	00	00	Controlled temperature
C3	LSB	-	-	MSB	00	00	Hardware ECC recovered
C4	LSB	-	-	MSB	00	00	Reallocation event count
C7	LSB	MSB	00	00	00	00	UltraDMA CRC Error Count
F1	LSB	-	-	MSB	00	00	Total LBA written (each write unit = 32MB)
F2	LSB	-	-	MSB	00	00	Total LBA read (each read unit = 32MB)

Ordering Information



The above technical information is based on commercial 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
V1.0	2015/03/03	Formal release	