Industrial SATAⅢ mSATA

Solid State Drive A-Series

(Power Shield Type)

データシート

株式会社アドテック

Revision History

Revision	Description	Date
V1.0	New released	April, 2019

Table of Contents

1. Product Description....4
1.1. Product Overview....4
1.2. Product Features....4
1.3. Specifications....5
1.4. Performance....5
1.5. TBW (Tera Bytes Written)....6
1.6. System Requirement....6
1.6.1. Power Requirement....6
1.6.2. Operating System....6
1.6.3. Interface....6
1.6.4. Power Shield Function....7
2. Detailed Specification....8
2.1. Physical Specifications....8
2.1.1. Overlook....8
2.1.2. Dimension....8
2.2. Electronic Specifications....9
2.2.1. Product Definition....9
2.2.2. Pin Signal Assignment....10
2.3. Support ATA Commands....11
2.4. Shock & Vibration....12
2.5. Error Detection and Correction....13
2.6. Wear-Leveling....13
2.7. Bad Blocks Management....13
2.8. Mean Time between Failures (MTBF)....13
2.9. Endurance....14
2.10. Transfer Mode....14
3. Installation Requirements....14
3.1. mSATA Pin Directions....14
3.2. Electrical Connections for mSATA....14
3.3. Device Drive....14
4. Ordering Information....15

1. Product Description

1.1. Product Overview

ADTEC SATAIII mSATA SSD is the storage device based on NAND flash memory technology. This product complies with Serial ATA standard interface and suitable for data storage media and code storage device for embedded system and boot disk. By using **mSATA SSD Module**, it is possible to operate good performance for the systems, which have SATA interface. With small form factor, the applicable appliance can add or install SATA storage device on its Mother Board or Complete set.

Another innovative design feature is worth mention is ”Power Shield” , excellent electronic circuit design provides high efficiency power protection capacitor charging efficiency, when a suddenly power failure can protect the integrity of the data write. ADTEC SATAIII mSATA SSD is the perfect storage device for industrial PCs, Enterprise-Grade Server, Vehicle System, Professional-Grade Photography System.

1.2. Product Features

- Excellent Power Shield function, when a suddenly power failure can protect the integrity of the data write.
- Small form factor refers to the MO-300 specification which established by JEDEC.
- Memory Capacities
  MLC: 8GB/ 16GB/ 32GB/ 64GB/ 128GB
  aMLC: 4GB/ 8GB/ 16GB/ 32GB/ 64GB
  SLC: 4GB/ 8GB/ 16GB/ 32GB
- High performance and reliability.
- Support DDR3/DDR3L External DRAM Buffer.
- Build-in Global Wear-leveling and Hardware BCH ECC capable of correcting errors up to 66 bit/1KB.
- Management for long data retention.
- Compliant with SATA III 6.0Gbps (backward compatible to 3 Gb/s 1.5 G/s)
- Operating as Boot Disk.
- Support S. M. A. R. T. & Trim command.
- Noiseless and stable installation to system.
- Resistant to shock and vibration.
- Supports Bad Block Management.
- Fully Compliant with RoHS directive.
- CE and FCC Compatibility

1.3. Specifications

Interface	SATAIII 6Gb/s compatible
NAND Flash Type	MLC/aMLC/SLC
Controller	SM2246EN
Form Factor	MO-300
Connector Type	mSATA (52 pin)
External DRAM Buffer	Yes
Capacity	MLC: 8GB / 16GB / 32GB / 64GB / 128GB aMLC: 4GB / 8GB / 16GB / 32GB / 64GB SLC: 4GB / 8GB / 16GB / 32GB (TBA)
Power Consumption(Max)	Idle: 0.372W, Active: 1.973W
Temperature	Operating Temperature: Normal Temperature: 0˚C ~ +70˚C Wide Temperature: -40˚C ~ +85˚C Storage Temperature: -55˚C ~ +95˚C
Humidity	0°C~55°C /10~95%, non-condensing
Power Shield Function	Yes
TRIM	Yes
S.M.A.R.T(Health Monitor)	Yes
Vibration(Operating)	20GPeak, 10 ~ 2000Hz
Shock	1500G,0.5ms
Dimension(L x W x H)	50.95 x 30.00 x 3.30mm

Table 1: mSATA SSD Specifications

1.4. Performance

MLC

Capacity	8GB	16GB	32GB	64GB	128GB
Sequential Read(Max)	146MB/sec	281MB/sec	485MB/sec	475MB/sec	482MB/sec
Sequential Write(Max)	30MB/sec	52MB/sec	103MB/sec	91MB/sec	178MB/sec

aMLC

Capacity	4GB	8GB	16GB	32GB	64GB
Sequential Read(Max)	135MB/sec	258MB/sec	482MB/sec	475MB/sec	485MB/sec
Sequential Write(Max)	88MB/sec	110MB/sec	133MB/sec	220MB/sec	300MB/sec

SLC

Capacity	4GB	8GB	16GB	32GB
Sequential Read(Max)	43MB/sec	86MB/sec	170MB/sec	174MB/sec
Sequential Write(Max)	37MB/sec	78MB/sec	150MB/sec	158MB/sec

*Performance may vary based on SSD capacity, hardware test platform, test software, operating system and other system variables.

Table 2: mSATA SSD Performance

1.5. TBW (Tera Bytes Written)

Capacity	TBW(MLC)	TBW(aMLC)	TBW(SLC)
4GB	—	40TB	120TB
8GB	12TB	80TB	240TB
16GB	24TB	160TB	480TB
32GB	48TB	320TB	961TB
64GB	96TB	641TB	—
128GB	192TB	—	—

Table 3: mSATA SSD TBW

1.6. System Requirement

The Host system which is connected to mSATA SSD should meet system requirements at minimum.

1.6.1. Power Requirement

Item	Symbol	Rating	Unit
Input voltage	VIN	+3.3DC ± 5% 500mA (max.)	V

Table 4: mSATA SSD Power Requirement

1.6.2. Operating System

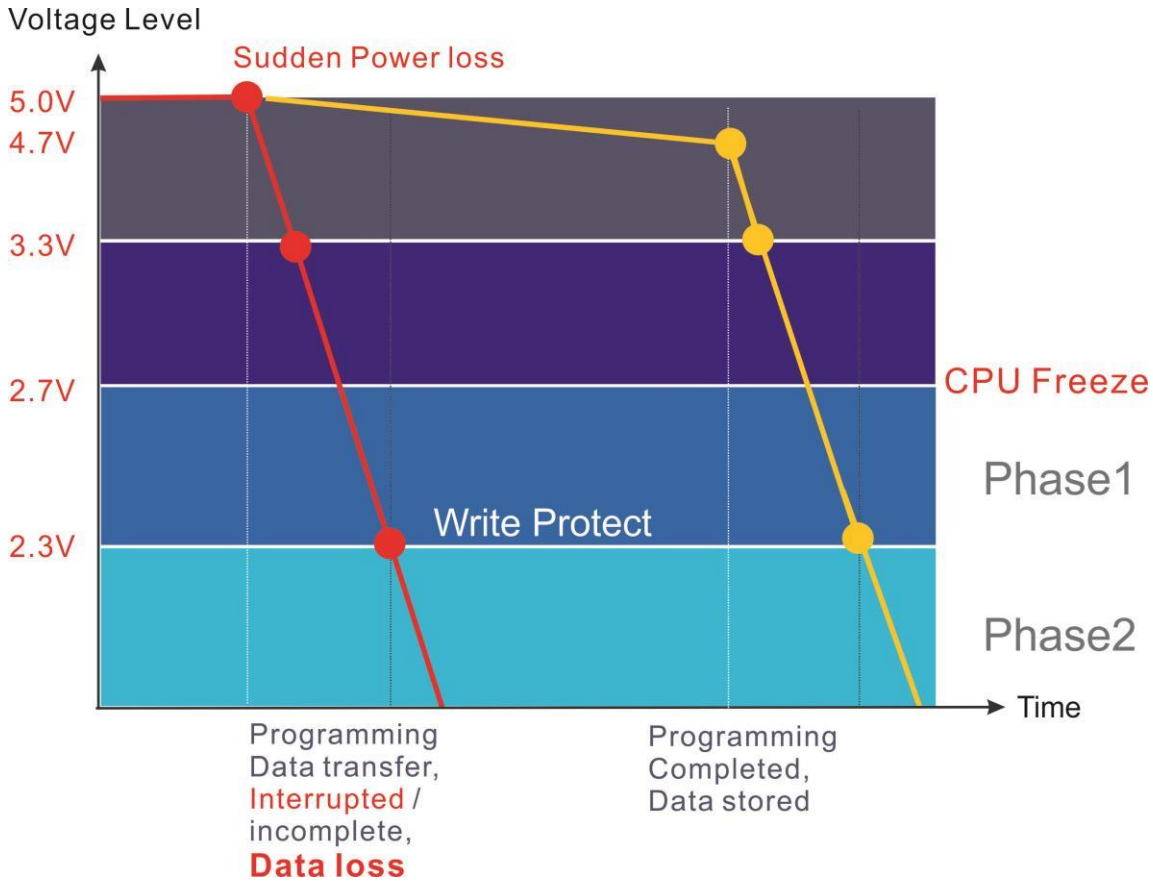
- Windows family.
- Linux family.
- DOS or embedded system.

1.6.3. Interface

- miniPCIe Interface.

1.6.4. Power Shield Function

Excellent Power Shield function, when a suddenly power failure can protect the integrity of the data write.



2. Detailed Specification

2.1. Physical Specifications

2.1.1. Overlook

Figure 1: mSATA SSD Overlook Diagram

2.1.2. Dimension

The Dimensions of mSATA SSD are illustrated in Figure 2 and described in Table 4.

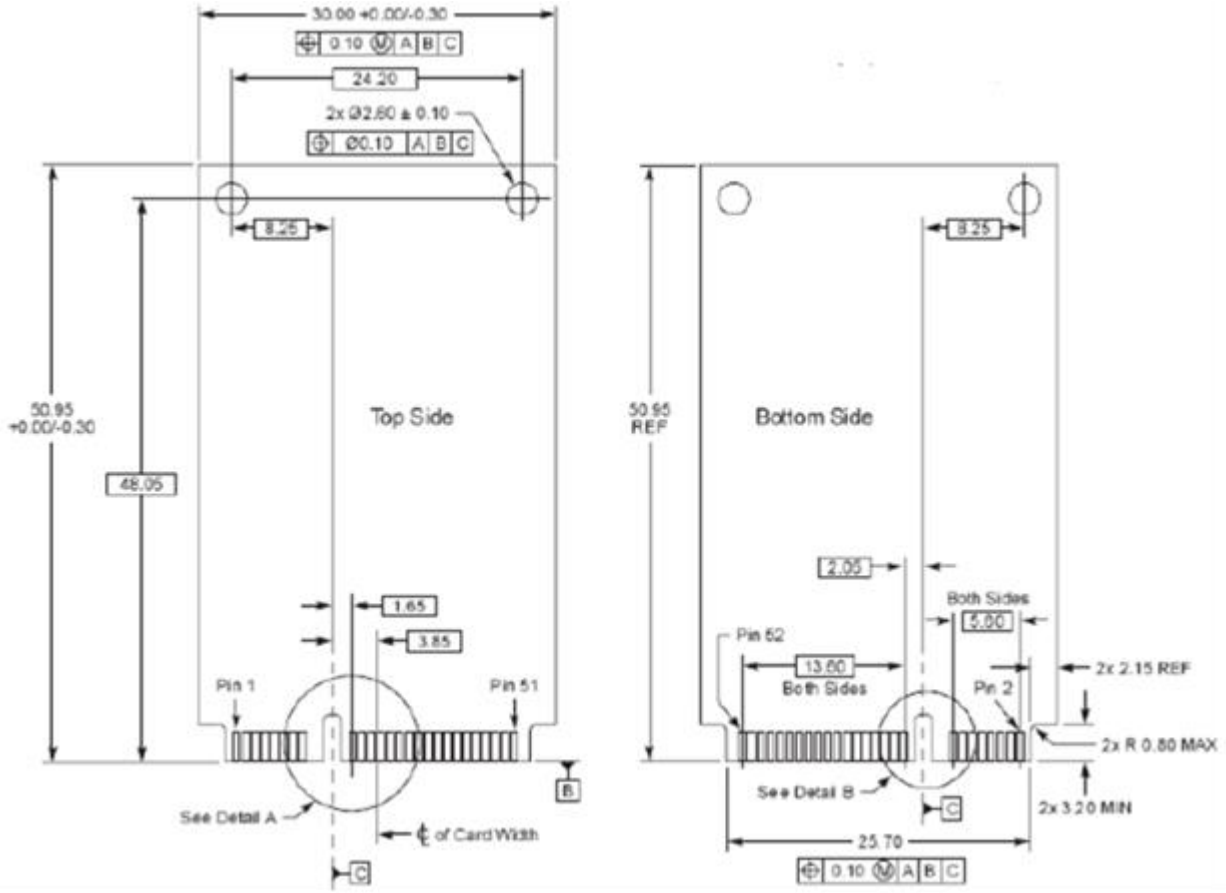


Figure 2: mSATA SSD Module Dimensions

Parameter	Specifications
Width	30.00mm ± 0.30mm
Length	50.95mm ± 0.30mm
Height	3.30mm ± 0.40mm

Table 4: mSATA SSD Module Physical Dimension

2.2. Electronic Specifications

2.2.1. Product Definition

mSATA SSD Module is designed to operate and work as Data or Code Storage device by NAND Flash Memory and its Controller through Serial ATA Standard Interface to Host Systems.

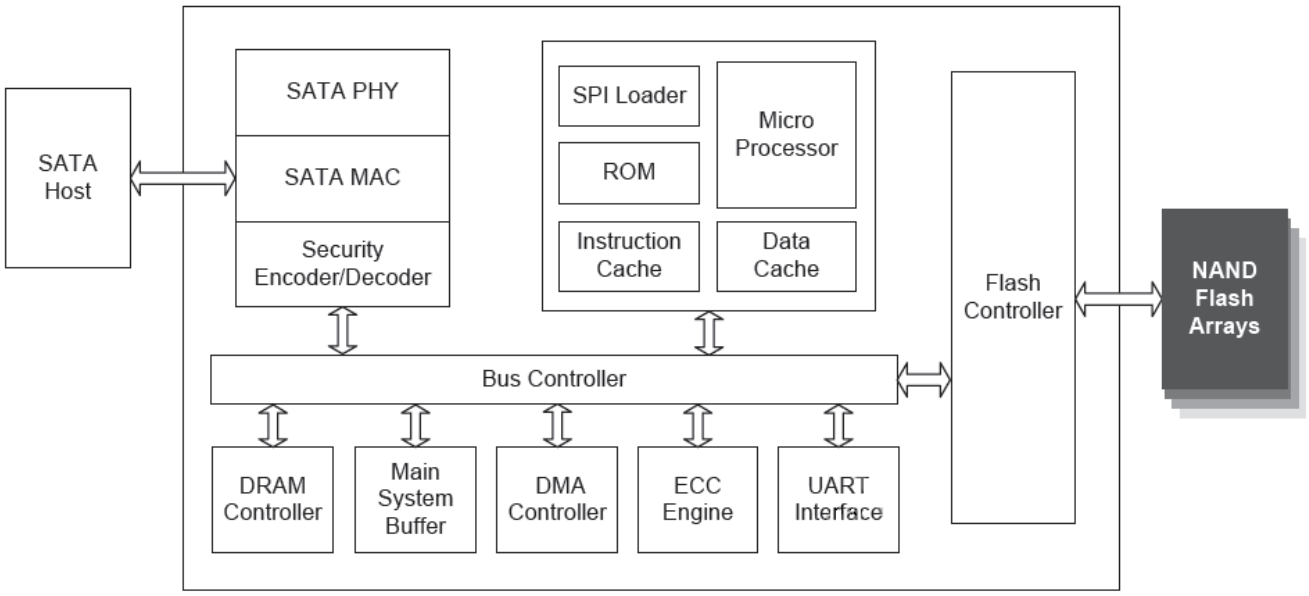


Figure 3: mSATA SSD Block Diagram

2.2.2. Pin Signal Assignment

The signals assigned for Serial ATA applications are described in Table 5

Pin definition	Pin No.
GND	4,9,15,18,21,26,27,29,34,35,37,40,43,50
3V3 power+in	2,24,39,41,52
SATA Txn	25
SATA Txp	23
SATA Rxn	31
SATA Rxp	33
Presence Detection	51
DA/DSS	49

Table 5: mSATA SSD connector pin definition

Signal Name	Pin #	Pin #	Signal Name
Presence Detection	51	52	+3.3V
DA/DSS	49	50	GND
NC	47	48	NC
NC	45	46	NC
GND	43	44	NC
+3.3V	41	42	NC
+3.3V	39	40	GND
GND	37	38	NC
GND	35	36	NC
+A – RX-	33	34	GND
-A – RX-	31	32	NC
GND	29	30	NC
GND	27	28	NC
-B – TX-	25	26	GND
+B – TX-	23	24	+3.3V
GND	21	22	NC
NC	19	20	NC
NC	17	18	GND
GND	15	16	NC
NC	13	14	NC
NC	11	12	NC
GND	9	10	NC
NC	7	8	NC
NC	5	6	NC
NC	3	4	GND
NC	1	2	+3.3V

Figure 4: mSATA SSD Connector Pin Assignment

2.3. Support ATA Commands

ATA Command Set summarizes the ATA command set with the paragraphs that follow describing the individual commands and the task file for each.

Command	Code	Protocol
General Feature Set		
Execute Drive Diagnostic	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 Feature	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

Command	Code	Protocol
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 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
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

Table 6: ATA Command List

2.4. Shock & Vibration

Reliability	Test Conditions	Reference Standards
Vibration	10Hz to 2KHz, 20G, 3 axes	IEC 60068-2-6
Mechanical Shock	Duration: 0.5ms, 1500G, 3 axes	IEC 60068-2-27

Table 7: Shock/Vibration Testing for mSATA SSD

2.5. Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 66 bits per 1024 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

2.6. Wear-Leveling

Flash memory can be erased within a limited number of times. This number is called the erase cycle limit or write endurance limit and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

mSATA uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

2.7. Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may generate during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management and replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit. After the reserved block less than 10 of each channel, the SSD will be locked, and cannot be read and written anymore. Host can send a vendor ATA command to unlock the SSD for backup data or system from SSD.

2.8. Mean Time between Failures (MTBF)

Failure Rate: The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.

Mean Time between Failures (MTBF): A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Product	Condition	MTBF (Hours)
mSATA SSD	Telcordia SR-332 GB, 25°C	>2,000,000

Table8: mSATA SSD MTBF

2.9. Endurance

- Data Retention: 10 years.
- Flash Endurance: MLC: 3,000 P/E Cycle
  aMLC:20,000 P/E Cycle
  SLC: 50,000 P/E Cycle
- Wear-Leveling Algorithm: Support.
- Bad Blocks Management: Support.
- Error Correct Code: Support.

2.10. Transfer Mode

- mSATA SSD support following transfer mode:
  - Serial ATA I 1.5Gbps
  - Serial ATA II 3.0Gbps
  - Serial ATA III 6.0Gbps

3. Installation Requirements

3.1. mSATA Pin Directions

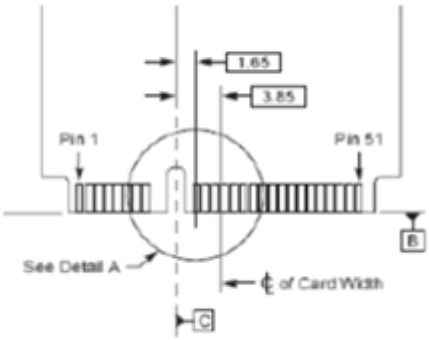


Figure 5: Signal Segment and Power Segment

3.2. Electorical Connections for mSATA

A Serial ATA device may be either directly connected to a host or connected to a host through a cable. For connection via cable, the cable should be no longer than 1 meter. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

3.3. Device Drive

No additional device drives are required. The mSATA can be configured as a boot device.

4. Ordering Information

P/N	Capacity	Remark
CMS08GMCTGFSVGA	8GB	Toshiba MLC 15nm TSOP Type Normal Temp
CMS16GMCTHFSVGA	16GB	
CMS32GMCTIFSVGA	32GB	
CMS64GMCTIFSVGA	64GB	
CMS12GMCTIFSVGA	128GB	
CMS08GMITGFSVGA	8GB	Toshiba MLC 15nm TSOP Type Wide Temp
CMS16GMITHFSVGA	16GB	
CMS32GMITIFSVGA	32GB	
CMS64GMITIFSVGA	64GB	
CMS12GMITIFSVGA	128GB	
CMS04GACTGFSVGA	4GB	Toshiba aMLC 15nm TSOP Type Normal Temp
CMS08GACTHFSVGA	8GB	
CMS16GACTIFSVGA	16GB	
CMS32GACTIFSVGA	32GB	
CMS64GACTIFSVGA	64GB	
CMS04GAITGFSVGA	4GB	Toshiba aMLC 15nm TSOP Type Wide Temp
CMS08GAITHFSVGA	8GB	
CMS16GAITIFSVGA	16GB	
CMS32GAITIFSVGA	32GB	
CMS64GAITIFSVGA	64GB	
TBD	4GB	Toshiba SLC 24nm TSOP Type Normal Temp
TBD	8GB	
TBD	16GB	
TBD	32GB	
TBD	4GB	Toshiba SLC 24nm TSOP Type Wide Temp
TBD	8GB	
TBD	16GB	
TBD	32GB	