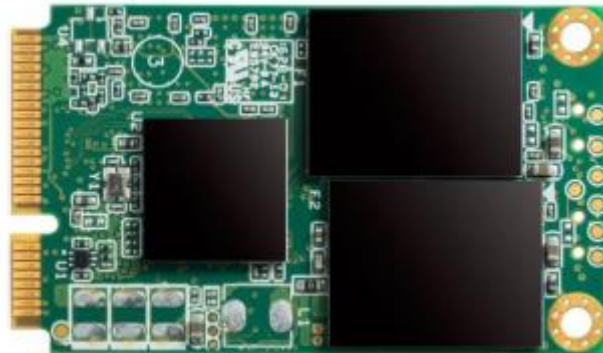


MSATA SSD



Product Model : IMSS332

Capacity :

8GB 、 16GB 、 32GB 、 64GB 、 128GB 、 256GB 、 512GB 、 1TB

Revision History

Revision	Date	Description	Editor
0	Jun. 2016	Initial release	Terry_Chu
1	Nov. 2019	Update new IA format	Steven Wang
2	Dec. 2019	Modify the word78 of identify data.	Steven Wang
3	Jan 2020	Format modified	Steven Wang
4	Mar 2020	Add MLC 16GB spec	Steven Wang
5	Mar 2020	Add A+SLC 8GB spec	Terry_Chu
6	Jun 2020	Add P/E cycles information	Austin Lee

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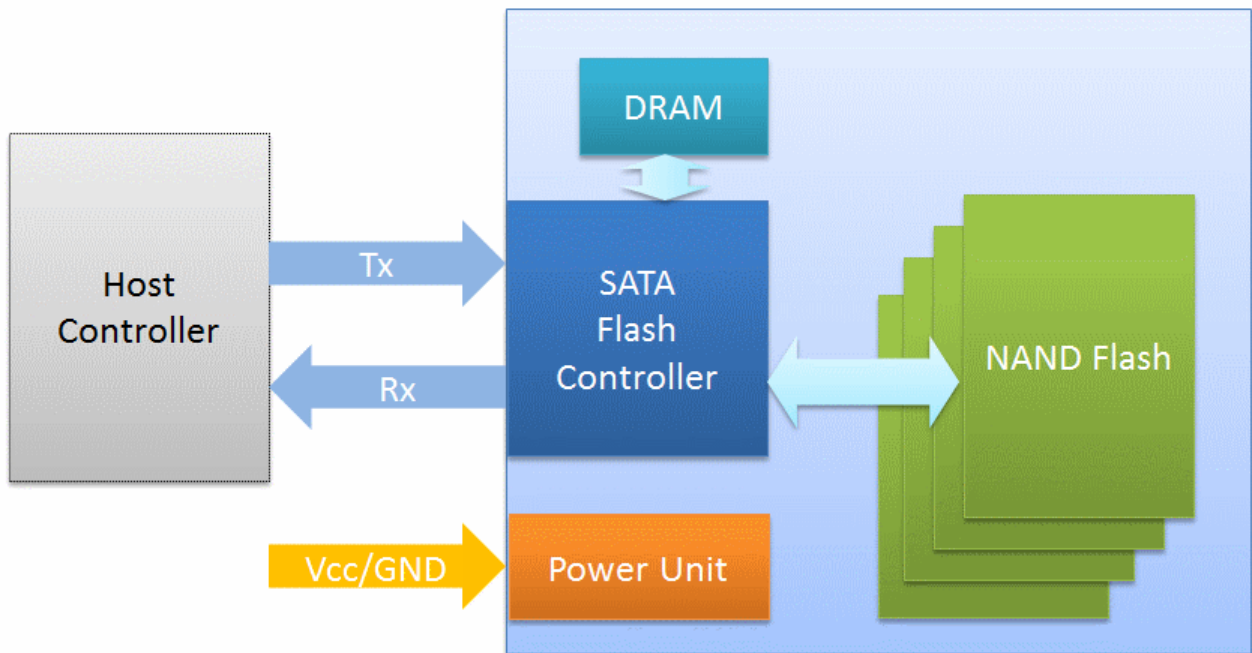
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Key Feature

- **Capacity:**
 - 8GB,16GB, 32GB, 64GB, 128GB, 256GB, 512GB, 1TB
- **NAND Flash:** A+SLC, SLC, MLC,
- **Form Factor:** mSATA
- **Compatibility:**
 - Serial ATA 6Gb/s interface
 - Complies with ATA-8 Standard
 - Complies SATA Revision 3.1
 - S.M.A.R.T feature supported
 - NCQ Command set supported
- **Performance**
 - Sequential Read:
Up to 560MB/s
 - Sequential Write:
Up to 450MB/s
 - Max Random 4K Read:
Up to 70,000
 - Max Random 4K Write:
Up to 75,000
- **Power Consumption:**
 - Slumber: 0.05W
 - Active: 0.05W
 - SR/SW: 2W / 3.15W
 - RR/RW: 1.95W / 3.35W
 - Device Sleep: 4mW
- **Temperature:**
 - Operation: 0°C ~ 70°C (Normal)
 - Operation: -40°C ~ 85°C(Wide)
 - Non-operation: -55°C ~ 95°C
- **Reliability**
 - Shock: 1500G/0.5ms
 - Vibration 20G Peak, 20~2000Hz
 - MTBF: 2,000,000 hours

1.0 General Description

Taking the advantages of NAND flash memory, Solid State Drive (SSD) provides better solutions on durability, performance, and power efficiency over traditional hard disk drives. Employing static wear-leveling technology to maximize SSD lifetime, the SSD solutions are your best choice on wide-ranged mobile computing devices and industrial electronic products. With standard SATA form factor or customized module form factor, The ADATA mSATA SSD IMSS332 offers capacities up to 1TB using Synchronous MLC NAND type flash memories.



2.0 Mechanical Specification

All product specifications not covered in this document (electrical performance, appearance, etc.) are in accordance with ADATA's defined norms and standards.

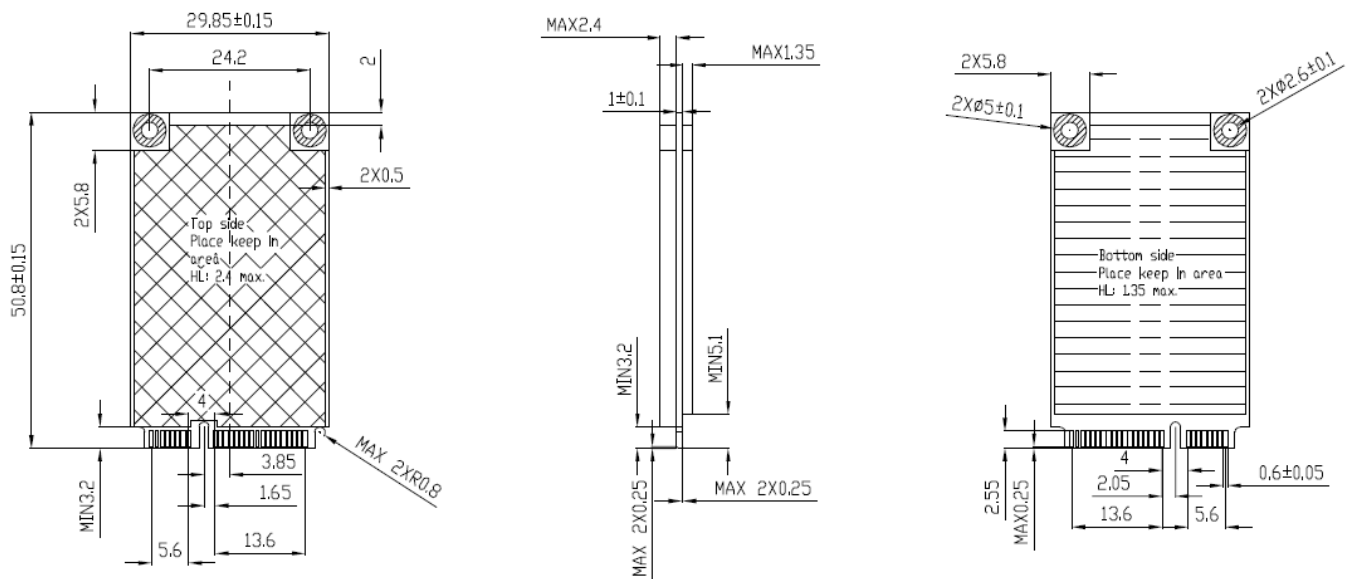
2.1 Physical dimensions and Weight

Table 2-1 Dimensions and Weight

Model	Length(mm)	Width(mm)	Height(mm)	Weight(gram)
8GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
16GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
32GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
64GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
128GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
256GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
512GB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g
1TB	50.80 +/- 0.15	29.85 +/- 0.15	4.5 +/- 0.25	5 g

2.2 Product Dimensions

Figure 2-1 Product Dimensions



3.0 Product Specification

3.1 Interface and configuration

- Burst read/write rate is 600 MB/sec (6.0 Gb/sec).
- Supports 1-port 1.5/3.0/6.0 Gbps SATA I/II/III interface.
- Compliant with Serial ATA International Organization: Serial ATA Revision 3.1.
- Compliant SSD Alliance compliance program

3.2 Capacity

Table 3-1 User Addressable Sectors

Model	IMSS332							
	8GB	16GB	32GB	64GB	128GB	256GB	512GB	1TB
Unformatted Capacity								
Total User Addressable Sectors (LBA Mode)	15,649,200	31,277,232	62,533,296	125,045,424	250,069,680	500,118,192	1,000,215,216	2,000,409,264

Total useable capacity may be less (duo to formatting, flash management, and other functions).
 1GB=1,000,000,000 bytes; 1sector = 512bytes.

3.3 Performance

3.3.1 Read/Write & ATTO Performance

Table 3-2 Read/Write Performance (ATTO)

MLC	16GB	32GB	64GB	128GB	256GB	512GB	1TB	Unit
Sequential Read	125	250	550	550	550	550	550	MB/s
Sequential Write	20	40	80	180	350	450	450	MB/s

A+SLC	8GB	16GB	32GB	64GB	128GB	256GB	512GB	Unit
Sequential Read	150	450	550	550	550	550	550	MB/s
Sequential Write	60	120	250	380	400	450	450	MB/s

-Seq. Read & Write speed test by ATTO

-The system conditions and test environment may affect test result

3.3.2 Read/Write & CDM Performance

Table 3-3 Read/Write Performance (CDM)

MLC	16GM	32GB	64GB	128GB	256GB	512GB	1TB	Unit
Sequential Q32 Read	125	250	500	500	500	500	500	MB/s
Sequential Q32 Write	20	40	80	180	350	400	450	MB/s

A+SLC	8GB	16GB	32GB	64GB	128GB	256GB	512GB	Unit
Sequential Q32 Read	150	450	500	500	500	500	500	MB/s
Sequential Q32 Write	60	120	250	350	400	450	450	MB/s

-Seq. Read & Write speed test by Crystal Disk Mark 5.1.2

3.3.3 IOPS Performance

Table 3-4 Read/Write & IOPS Performance

MLC	16GB	32GB	64GB	128GB	256GB	512GB	1TB	Unit
4K Random Read	12K	25K	50K	70K	70K	70K	70K	IOPS
4K Random Write	5K	10K	20K	45K	70K	70K	70K	IOPS

A+SLC	8GB	16GB	32GB	64GB	128GB	256GB	512GB	Unit
4K Random Read	15K	60K	75K	70K	70K	75K	75K	IOPS
4K Random Write	15K	30K	50K	70K	70K	70K	70K	IOPS

-Seq. Read & Write speed test by IOmeter 2010 with "00" pattern (Queue depth of 32; Measurements are performed on 10% capacity of LBA range. Write cache enable)

-IOPS Test Utility: IOmeter 2010 (Queue depth of 32; Measurements are performed on 10% capacity of LBA range. Write cache enable)

-The system conditions and test environment may affect test result

3.3.4 Read/Write & AS-SSD Performance

Table 3-5 Read/Write Performance (AS-SSD)

MLC	16GB	32GB	64GB	128GB	256GB	512GB	1TB	Unit
Sequential Read	120	200	450	450	500	500	500	MB/s
Sequential Write	20	35	90	180	350	400	400	MB/s
4K-64 Thrd Read	50	70	150	250	270	280	280	MB/s
4K-64 Thrd Write	20	30	80	160	230	250	250	MB/s

A+SLC	8GB	16GB	32GB	64GB	128GB	256GB	512GB	Unit
Sequential Read	140	450	500	500	500	500	500	MB/s
Sequential Write	60	200	240	400	400	400	400	MB/s
4K-64 Thrd Read	65	200	250	300	320	320	320	MB/s
4K-64 Thrd Write	50	180	220	260	260	260	260	MB/s

-Seq. Read & Write speed test by AS-SSD with Random pattern

3.4 Electrical

3.4.1 Operating Voltage

Table 3-6 Operating Voltage

Operating Voltage	
Input Power	DC 3.3V ± 10%
Maximum Ripple	100mV p-p or less

3.4.2 Power Consumption (Typical)

Table 3-7 Power Consumption (Typical)

MLC	16GB	32GB	64GB	128GB	256GB	512GB	1TB	Unit
Slumber	0.04	0.04	0.04	0.04	0.04	0.04	0.04	W
Active	0.05	0.05	0.05	0.05	0.05	0.05	0.05	W
Sequential Read	0.7	0.95	1.10	1.35	1.45	1.60	1.70	W
Sequential Write	0.7	1.00	1.25	1.60	2.55	3.00	3.15	W
Random Read	0.8	0.95	1.20	1.40	1.60	1.80	1.95	W
Random Write	0.8	1.05	1.45	2.20	2.80	3.25	3.35	W
Device Sleep	4	4	4	4	4	4	4	mW

A+SLC	8GB	16GB	32GB	64GB	128GB	256GB	512GB	Unit
Slumber	0.05	0.05	0.05	0.05	0.05	0.05	0.05	W
Active	0.05	0.05	0.05	0.05	0.05	0.05	0.05	W
Sequential Read	1.30	1.30	1.60	1.70	1.70	1.9	2.0	W
Sequential Write	1.30	1.30	1.80	2.50	2.50	2.50	2.50	W
Random Read	1.35	1.35	1.65	1.75	1.75	1.85	1.95	W
Random Write	1.50	1.50	2.10	2.75	2.75	2.85	2.85	W
Device Sleep	4	4	4	4	4	4	4	mW

To measure consumption in /Slumber/ Active mode and Sequential Read/Write and Random Read/Write

3.5 Environmental Conditions

Table 3-8 Temperature, Humidity, Shock, Vibration

Feature	Operating	Non-Operating
Normal Temperature	0°C to 70°C	-55°C to 95°C
Wide Temperature	-40°C to 85°C	-55°C to 95°C
Humidity	5%~95% RH, non-condensing	
Vibration	20G Peak, 20~2000Hz	
Shock	1500G, duration 0.5ms, Half Sine Wave	

3.6 Reliability

3.6.1 Reliability

Table 3-9 Reliability Specification

Parameter	Simulate Value
Mean Time Between Failures (MTBF) The MTBF statistics were calculated by Part Count Method, not relevant to individual units	2,000,000 hours

3.7 Endurance

Endurance for the SSD can be predicted based on the operating workload. The tables as below shows the drive lifetime for each SSD capacity based JESD219 client workload.

[Table 3-10] Total Bytes Written

MLC	16GB	32GB	64GB	128GB	256GB	512GB	1TB	Unit
Total Byte Written (TBW)	20	40	80	160	320	640	1000	TB

A+SLC	8GB	16GB	32GB	64GB	128GB	256GB	512GB	Unit
Total Byte Written (TBW)	100	200	400	800	1600	3200	6400	TB

4.0 Supported Command Sets

4.1 Identify Device

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.

[Table 4-1] Identify Device Table

Word	F / V	Default Value	Description
0	F	0040h	General configuration
1	X	XXXXh	Default number of cylinders
2	V	0000h	Reserved
3	X	00XXh	Default number of heads
4	X	0000h	Obsolete
5	X	0240h	Obsolete
6	F	XXXXh	Default number of sectors per track
7 - 8	V	XXXXh	Number of sectors per card (Word 7 = MSW, Word 8 = LSW)
9	X	0000h	Obsolete
10 - 19	F	XXXXh	Serial number in ASCII (Right justified)
20	X	0002h	Obsolete
21	X	0002h	Obsolete
22	X	0000h	Obsolete
23 - 26	F	XXXXh	Firmware revision in ASCII Big Endian Byte Order in Word
27 - 46	F	XXXXh	Model number in ASCII (Left justified) Big Endian Byte Order in Word
47	F	8001h	Maximum number of sectors on Read/Write Multiple command
48	F	0000h	Reserved
49	F	0F00h	Capabilities
50	F	4000h	Capabilities
51	F	0200h	PIO data transfer cycle timing mode
52	X	0000h	Obsolete
53	F	0007h	Field validity
54	X	XXXXh	Current numbers of cylinders
55	X	XXXXh	Current numbers of heads
56	X	XXXXh	Current sectors per track
57 - 58	X	XXXXh	Current capacity in sectors (LBAs) (Word 57 = LSW , Word 58 = MSW)
59	F	0101h	Multiple sector setting

60 - 61	F	XXXXh	Total number of user addressable logical sectors for 28-bit commands (DWord)
62	X	0000h	Reserved
63	F	0207h	Multiword DMA transfer Supports MDMA mode 0, 1 and 2
64	F	0003h	Advanced PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	Recommended Multiword DMA transfer cycle time
67	F	0078h	Minimum PIO transfer cycle time without flow control
68	F	0078h	Minimum PIO transfer cycle time with IORDY flow control
69	F	4000h	Additional supported
70 - 74	F	0000h	Reserved
75	F	001Fh	Queue depth
76	F	070Eh	Serial ATA capabilities <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	F	0080h	Serial ATA additional capability <ul style="list-style-type: none"> • DevSleep_to_ReducedPwrState
78	F	014Ch	Serial ATA features supported <ul style="list-style-type: none"> • Supports Device Sleep • Supports software settings preservation • Device supports initiating power management • Device supports DMA Setup auto-activation
79	V	0040h	Reserved
80	F	03F0h	Major version number (ACS-2)
81	F	0000h	Minor version number
82	F	742Bh	Command sets supported 0
83	F	7500h	Command sets supported 1
84	F	4023h	Command sets supported 2
85 - 87	V	XXXXh	Command set/feature enabled
88	V	007Fh	Ultra DMA mode supported and selected
89	F	0003h	Time required for a Normal Erase mode Security Erase Unit command
90	F	0001h	Time required for an Enhanced Erase mode Security Erase Unit command
91	V	0000h	Current advanced power management value
92	V	FFFEh	Master password identifier

93 - 99	V	0000h	Reserved
100 - 103	V	XXXXh	Maximum user LBA for 48-bit address feature set
104	V	0000h	Reserved
105	F	0100h	Maximum number of 512-byte blocks per Data Set Management command
106 - 127	V	0000h	Reserved
128	V	0001h	Security status
129 - 159	X	XXXXh	Vendor specific
160	F	0000h	Power requirement description
161	X	0000h	Reserved
162	F	0000h	Key management schemes supported
163	F	0000h	CF Advanced True IDE Timing mode capability and setting
164 - 168	V	0000h	Reserved
169	F	0001h	Data Set Management supported
170 - 216	V	XXXXh	Reserved
217	F	0001h	Non-rotating media (SSD)
218 - 221	X	0000h	Reserved
222	F	107Fh	Transport major revision (SATA Rev 3.1)
223 - 254	X	0000h	Reserved
255	X	XXXXh	Integrity word

Notes:

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.

4.2 SMART Attribute

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

[Table 4-2] S.M.A.R.T. Attribute

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 sector count when read/write
A1	LSB	MSB	00	00	00	00	Number of valid spare 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
A8	LSB	-	-	MSB	00	00	Max. erase count of Spec.
A9	LSB	-	-	MSB	00	00	Remain Life(percentage)
AF	LSB	-	-	MSB	00	00	Program fail count in worst die
B0	LSB	MSB	00	00	00	00	Erase fail count in worst die
B1	LSB	-	-	MSB	00	00	Total wear level count
B2	LSB	MSB	00	00	00	00	Runtime invalid block count
B5	LSB	-	-	MSB	00	00	Total program fail count
B6	LSB	MSB	00	00	00	00	Total erase fail count
C0	LSB	MSB	00	00	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
C5	LSB	-	-	MSB	00	00	Current pending sector count
C6	LSB	-	-	MSB	00	00	Uncorrectable error count off-line
C7	LSB	MSB	00	00	00	00	Ultra DMA CRC error count
E8	LSB	MSB	00	00	00	00	Available reserved space
F1	LSB	-	-	-	-	MSB	Host written LBAs (each write unit = 32MB)
F2	LSB	-	-	-	-	MSB	Host read LBAs (each read unit = 32MB)
F5	LSB	-	-	-	-	MSB	Total data written to flash (each write unit = 32MB)

5.0 Pin assignment and descriptions

Pin		Description
P1	Reserved	No Connect
P2	+3.3V	3.3V Source
P3	Reserved	No Connect
P4	GND	Ground
P5	Reserved	No Connect
P6	+1.5V	No Connect
P7	Reserved	No Connect
P8	Reserved	No Connect
P9	GND	Ground
P10	Reserved	No Connect
P11	Reserved	No Connect
P12	Reserved	No Connect
P13	Reserved	No Connect
P14	Reserved	No Connect
P15	GND	Ground
P16	Reserved	No Connect
P17	Reserved	No Connect
P18	GND	Ground
P19	Reserved	No Connect
P20	Reserved	No Connect
P21	GND	Ground
P22	Reserved	No Connect
P23	+B	Host Receiver Differential Signal Pair (This is an output of the SSD)
P24	+3.3V	3.3V Source
P25	-B	Host Receiver Differential Signal Pair (This is an output of the SSD)
P26	GND	Ground
P27	GND	Ground
P28	+1.5V	No Connect
P29	GND	Ground
P30	Two wire Interface	No Connect
P31	-A	Host Transmitter Differential Signal Pair (This is an input of the SSD)
P32	Two wire Interface	No Connect
P33	+A	Host Transmitter Differential Signal Pair (This is an input of the SSD)
P34	GND	Ground
P35	GND	Ground
P36	Reserved	No Connect
P37	GND	Ground
P38	Reserved	No Connect

P39	+3.3V	3.3V Source
P40	GND	Ground
P41	+3.3V	3.3V Source
P42	Reserved	No Connect
P43	Device Type	No Connect
P44	DevSleep	Device Sleep pin
P45	Vendor	No Connect
P46	Reserved	No Connect
P47	Vendor	No Connect
P48	+1.5V	No Connect
P49	DAS/DSS	Device Activity Signal
P50	GND	Ground
P51	Presence Detection	Ground
P52	+3.3V	3.3V Source

6.0 Product Line up

Table 6-1 Product Line up

Part Number	Capacity	P/E cycles	Type	Remark
IMSS332-008GA	8GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-008GE	8GB	3K	mSATA	A+SLC,-40 ~ 85°C
IMSS332-016GA	16GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-016GE	16GB	3K	mSATA	A+SLC,-40 ~ 85°C
IMSS332-016GM	16GB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-016GMP	16GB	3K	mSATA	MLC,PLP,0~ 70°C
IMSS332-016GT	16GB	3K	mSATA	MLC, -40 ~ 85°C
IMSS332-032GA	32GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-032GE	32GB	3K	mSATA	A+SLC,-40 ~ 85°C
IMSS332-032GM	32GB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-032GMP	32GB	3K	mSATA	MLC,PLP,0~ 70°C
IMSS332-032GT	32GB	3K	mSATA	MLC, -40 ~ 85°C
IMSS332-032GTP	32GB	3K	mSATA	MLC,PLP,-40~85°C
IMSS332-064GA	64GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-064GE	64GB	3K	mSATA	A+SLC, -40 ~85°C
IMSS332-064GM	64GB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-064GMP	64GB	3K	mSATA	MLC, PLP, 0 ~ 70°C
IMSS332-064GT	64GB	3K	mSATA	MLC, -40 ~ 85°C
IMSS332-064GTP	64GB	3K	mSATA	MLC,PLP,-40~85°C
IMSS332-128GA	128GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-128GE	128GB	3K	mSATA	A+SLC, -40 ~ 85°C
IMSS332-128GM	128GB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-128GMP	128GB	3K	mSATA	MLC, PLP, 0 ~ 70°C
IMSS332-128GT	128GB	3K	mSATA	MLC, -40 ~ 85°C
IMSS332-128GTP	128GB	3K	mSATA	MLC,PLP,-40~85°C
IMSS332-256GA	256GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-256GE	256GB	3K	mSATA	A+SLC, -40 ~ 85°C
IMSS332-256GM	256GB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-256GT	256GB	3K	mSATA	MLC, -40 ~ 85°C
IMSS332-256GTP	256GB	3K	mSATA	MLC,PLP,-40~85°C
IMSS332-512GA	512GB	3K	mSATA	A+SLC, 0 ~ 70°C
IMSS332-512GE	512GB	3K	mSATA	A+SLC, -40 ~ 85°C
IMSS332-512GM	512GB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-512GT	512GB	3K	mSATA	MLC, -40 ~ 85°C
IMSS332-001TM	1TB	3K	mSATA	MLC, 0 ~ 70°C
IMSS332-001TT	1TB	3K	mSATA	MLC, -40 ~ 85°C

7.0 Package Specifications

