KTA-300 2.5” SATA3 SSD Datasheet

Version 1.0

Product Overview

- **Form Factor:**
  - 2.5”
- **SATA Interface**
  - SATA Revision 3.1 compliant
  - SATA 1.5Gbps, 3Gbps, and 6Gbps interface
- **Flash：**
  - 3D TLC
- **Capacity**
  - 120GB/240GB/480GB/960GB
- **Performance**（Crystal Disk Mark）
  - Read: up to 520MB/s
  - Write: up to 510MB/s

- **Advanced Flash Management**
- ATA-8 command set
- TRIM
- S.M.A.R.T
- 4 channels with 8 CE
- AES-256
- Dynamic/static wear-leveling
- On-chip data buffer RAM

- **Compliant**
- RoHS
- FCC
- CE

- **MTBF**
- More than 1,200,000 hours

- **Temperature Range**
- Operation: 0°C ~ 70°C
- Storage: -40°C ~ 85°C

Performance

Capacity	CrystalDiskMark	
	Read(MB/s)	Write(MB/s)
120GB	500	400
240GB	500	450
480GB	510	500
960GB	520	510

TABLE OF CONTENTS

1. INTRODUCTION

1.1. General Description

The KTA-300 serise delivers all the advantages of flash disk technology with the Serial ATA I/II/III interface. The module is designed to operate at a maximum operating frequency with 25MHz external crystal. Its capacity could provide 120GB/240GB/480GB/960GB. Moreover, it can reach up to 520MB/s read as well as 510MB/s write high performance based on flash (measured by Crystal Disk Mark).

1.2. Product Block Diagram

Figure 1 Block Diagram

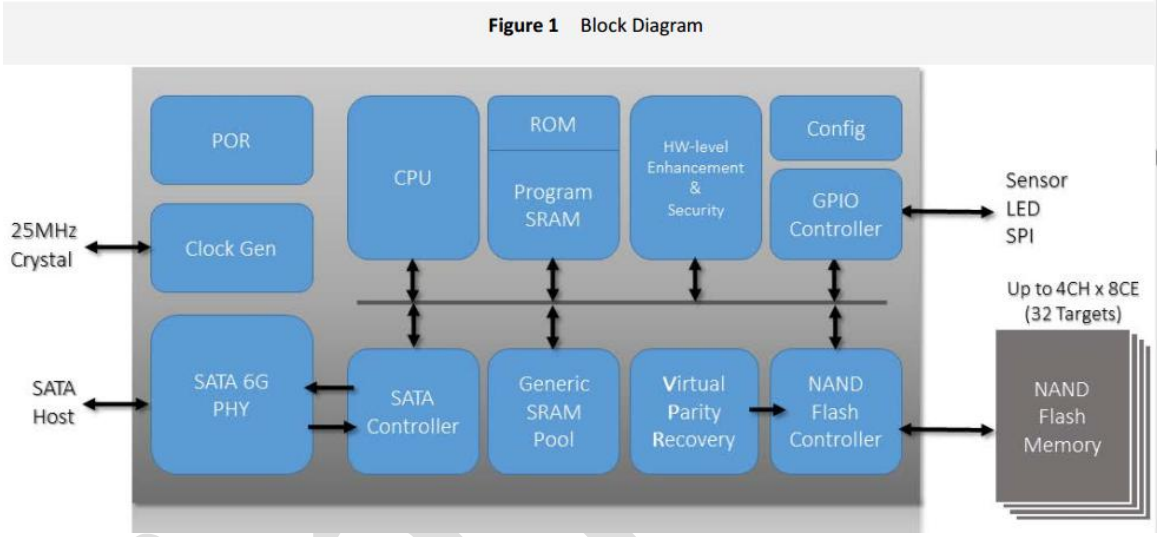


Figure 1- 1 Block Diagram

1.3. Flash Management

1.3.1. Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which might generate random bit errors in the stored data. The Hardware Error Correction Coding(ECC)engine executes parity generation and error detection/correction features, and enhances decoding throughput and data reliability. the powerful ECC engine is able to support the latest generation NAND flash.

1.3.2. Wear Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Wear leveling is to arrange data so that erasures and re-writes are distributed evenly across the Flash. In this way, no single erase block prematurely fails due to a high

concentration of write cycles. Hence, it extends the lifespan of SSD.

Tigo provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND flash is greatly improved.

1.3.3. Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks”. Bad blocks that are developed during the lifespan of the flash are named “Later Bad Blocks”. Tigo implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

1.3.4. TRIM

TRIM is a feature which helps improve the read/write performance and speed of solid-state drives (SSD). Unlike hard disk drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. TRIM allows an OS to inform SSD which blocks of data are no longer considered in use and can be wiped internally. It can enable SSD to handle garbage collection in advance to prevent slowing sown the future write operations to the involved blocks. With the TRIM command, the operating system can inform the SSD which blocks of data are no longer in use and can be removed permanently. Thus, the SSD will perform the erase action, which prevents unused data from occupying blocks all the time.

1.3.5. SMART

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a hard disk drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users of impending failures while there is still time to perform proactive actions, such as copy data to another device.

1.4. Advanced Device Security Features

1.4.1. Secure Erase

Secure Erase is a standard ATA command and will wipe all the data on hard drives and SSDs. When this command is issued, the SSD controller will erase its storage blocks and return to its factory default settings.

1.4.2. Write Protect

When a SSD contains too many bad blocks and data are continuously written in, then the SSD might not be usable anymore. Thus, Write Protect is a mechanism to prevent data from being written in and protect the accuracy of data that are already stored in the SSD.

2. PRODUCT SPECIFICATIONS

- **Capacity**

  120GB/240GB /480GB/960GB

- **Electrical/Physical Interface**
  - SATA Interface
    - Compliant with SATA Revision 3.2
    - Compliant with Standard ATA-8
    - Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface
    - Native Command Queuing up to 32 commands
    - Support power management
- **UART function**
- **GPIO**
- **Support SMART and TRIM commands**
- **Performance**

Capacity	Crystal Disk Mark	
	Read(MB/s)	Write(MB/s)
120GB	500	400
240GB	500	450
480GB	510	500
960GB	520	510

NOTES:

1. The performance was measured using Crystal Disk Mark with SATA 6Gbps host.
2. Performance may differ according to flash configuration, SDR configuration, and platform.
3. The table above is for reference only. The criteria for MP (mass production) and for accepting goods shall be discussed based on different flash configuration

- **TBW (Terabytes Written)**

Capacity	TBW(TB)
120GB	40
240GB	80
480GB	160
960GB	320

NOTES:

1. TBW may differ according to flash configuration, SDR configuration, and platform.

2. The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.

3. ENVIRONMENTAL SPECIFICATIONS

3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- Temperature:
  - Storage: -40°C to 85°C
  - Operational: 0°C to 70°C

Table 3- 1 High Temperature Test Condition

	Temperature	Humidity	Test Time
Operation	70°C	0% RH	48 hours
Storage	85°C	0% RH	48 hours

Result: No any abnormality is detected.

Table 3- 2 Low Temperature Test Condition

	Temperature	Humidity	Test Time
Operation	0°C	0% RH	48 hours
Storage	-40°C	0% RH	48 hours

Result: No any abnormality is detected.

3.1.2 MTBF

MTBF, an acronym for Mean Time between Failures, is a measure of a device's reliability. Its value represents the average time between a repair and the next failure. The measure is typically in units of hours. The higher the MTBF value, the higher the reliability of the device. The predicted result SSD is more than 1,200,000 hours.

3.2. Certification & Compliance

- RoHS
- SATA III (SATA Rev. 3.2)
- Up to ATA/ATAPI-8 (Including S.M.A.R.T)

4. ELECTRICAL SPECIFICATIONS

4.1. Supply Voltage

Table 4- 1 Supply Voltage

Parameter	Form Factor	Rating
Operating Voltage	2.5”	5V

4.2. Power Consumption

Table 4- 2 Power Consumption

Capacity	Form Factor	Read	Write	Idle
120GB	2.5”	1.5	1.7	0.55
240GB		1.60	1.90	0.55
480GB		1.70	2.00	0.60
960GB		1.90	2.10	0.60

Unit: W

NOTES:

1. The average value of power consumption is achieved based on 100% conversion efficiency.
2. The measured power voltage:2.5”is 5V.
3. Sequential R/W is measured while testing 128K sequential R/W 5minutes by IOmeter.
4. Power Consumption may differ according to flash configuration, SDR configuration, and platform.

5. INTERFACE

5.1. Pin Assignment and Descriptions

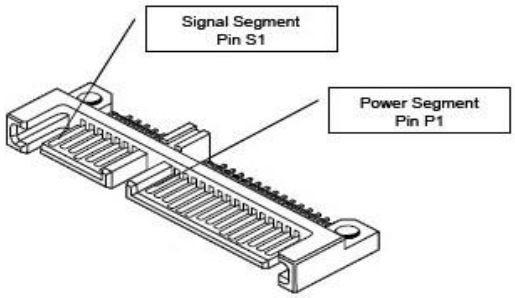


Figure 5- 1 2.5'' SATA SSD Pin Assignment

Table 5- 1 Signal Segment Pin Assignment and Descriptions

Pin Number	Function
S1	GND
S2	A+ (Differential Signal Pair A)
S3	A – (Differential Signal Pair A)
S4	GND
S5	B – (Differential Signal Pair B)
S6	B+ (Differential Signal Pair B)
S7	GND

Table 5- 2 Power Segment Pin Assignment and Descriptions

Pin Number	Function
P1	Not Used (3.3V)
P2	Not Used (3.3V)
P3	DEVSLP
P4	GND
P5	GND
P6	GND
P7	5V pre-charge
P8	5V
P9	5V
P10	GND
P11	Reserved
P12	GND
P13	Not Used (12V pre-charge)
P14	Not Used (12V)
P15	Not Used (12V)

6. SUPPORTED COMMANDS

6.1. ATA Command List

Table 6- 1 ATA Command List

Op Code	Description	Op Code	Description
00h	NOP	97h	IDLE
06h	Data Set Management	98h	CHECK POWER MODE
10h-1Fh	Recalibrate	99h	SLEEP
20h	Read Sectors	B0h	SMART
21h	Read Sectors without Retry	B1h	DEVICE CONFIGURATION
24h	Read Sectors EXT	C4h	Read Multiple
25h	Read DMA EXT	C5h	Write Multiple
27h	Read Native Max Address EXT	C6h	Set Multiple Mode
29h	Read Multiple EXT	C8h	Read DMA
2Fh	Read Log EXT	C9h	Read DMA without Retry
30h	Write Sectors	CAh	Write DMA
31h	Write Sectors without Retry	CBh	Write DMA without Retry
34h	Write Sectors EXT	Ceh	Write Multiple FUA EXT
35h	Write DMA EXT	E0h	Standby Immediate
37h	Set Native Max Address EXT	E1h	Idle Immediate
38h	CFA WRITE SECTORS WITHOUT ERASE	E2h	Standby
39h	Write Multiple EXT	E3h	Idle
3Dh	Write DMA FUA EXT	E4h	Read Buffer
3Fh	Write Long EXT	E5h	Check Power Mode
40h	Read Verify Sectors	E6h	Sleep
41h	Read Verify Sectors without Retry	E7h	Flush Cache
42h	Read Verify Sectors EXT	E8h	Write Buffer
45h	WRITE UNCORRECTABLE EXT	Eah	Flush Cache EXT
60h	Read FPDMA Queued	Ech	Identify Device
61h	Write FPDMA Queued	Efh	Set Features
70h-7Fh	Seek	F1h	Security Set Password
90h	Execute Device Diagnostic	F2h	Security Unlock
91h	Initialize Device Parameters	F3h	Security Erase Prepare
92h	Download Microcode	F4h	Security Erase Unit
93h	DOWNLOAD MICROCODE DMA	F5h	Security Freeze Lock
94h	STANDBY IMMEDIATE	F6h	Security Disable Password
95h	IDLE IMMEDIATE	F8h	Read Native Max Address
96h	STANDBY	F9h	Set Max Address

6.2. Identify Device Data

The following table details the sector data returned by the IDENTIFY DEVICE command.

Table 6- 2 List of Device Identification

Word	F: Fixed V: Variable X: Both	Default Value	Description
0	F	0040h	General configuration bit-significant information
1	X	XXXXh	Default number of logical cylinders
2	V	0000h	Reserved
3	X	00XXh	Default number of heads
4-5	X	00000000h	Obsolete
6	F	XXXXh	Default number of logical sectors pertrack)
7-8	V	XXXXXXXXh	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)
20-21	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 number of logical cylinders
55	X	XXXXh	Current number ofheads
56	X	XXXXh	Current sectors per track
57-58	X	XXXXXXXXh	Current capacity in sectors(LBAs) (Word 57 = LSW, Word 58 = MSW)
59	F	0101h	Multiple sector setting
Word	**F: Fixed**	**Default Value**	**Description**

	V: Variable X: Both		
60-61	F	XXXXXXXXh	Total number of user addressable logical sectors for 28-bit commands(DWord)
62	X	0000h	Reserved
63	F	0207h	Multiword DMA transfer Supports MDMA mode0,1 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
77	F	0080h	Serial ATA Additional Capabilities
78	F	0148h	Serial ATA features supported
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 Modes supported and selected
89	F	0003h	Time required for a Normal Erase mode Security Erase Unit command
90	F	0001h	Time required for 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
Word	**F: Fixed**	**Default Value**	**Description**

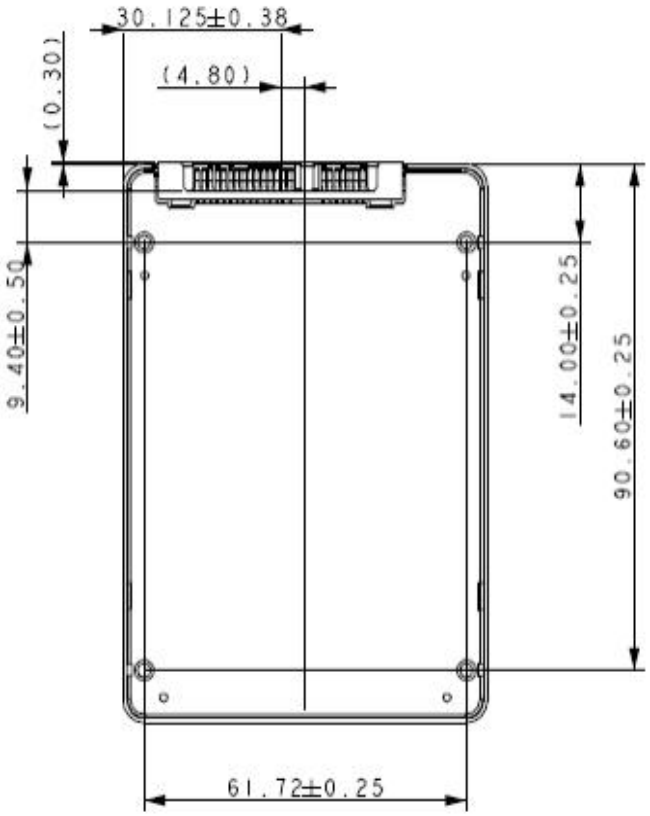
	V: Variable X: Both		
105	F	0100h	Maximum number of 512-byte blocks per Data Set Management command
106-127	V	0000h	Reserved
128	V	0001h	Security status
129-159	X	XXXXh	Vendor specific
160	F	0000h	Power requirement description
161	X	0000h	Reserved
162	F	0000h	Key management schemes supported
163	F	0000h	CF Advanced True IDE Timing mode capability and setting
164-168	X	0000h	Reserved
169	F	0001h	Data Set Management supported
170-216	V	XXXXh	Reserved
217	F	0001h	Non-rotating media device(SSD)
218-221	X	0000h	Reserved
222	F	107Fh	Transport major version(SATA Rev3.1)
223-254	X	0000h	Reserved
255	X	XXXXh	Integrity word

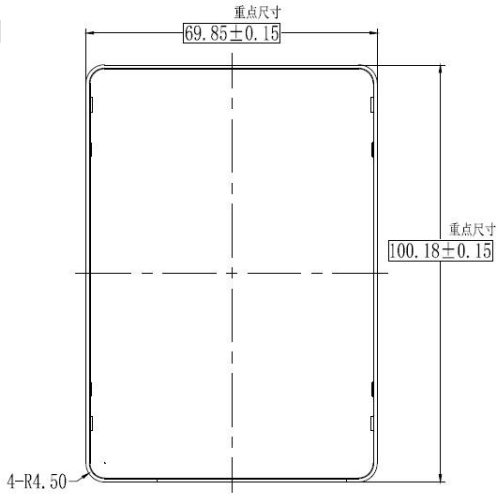
7. PHYSICAL DIMENSION

- 100.00mm (L) x 69.85mm (W) x 7.00mm (H)

Dimension: 100.00mm (L) x 69.85mm (W) x 7.00mm (H)

Bottom View





8.REFERENCE

The following table is to list out the standards that have been adopted for designing the product.

Table 8- 1List of References

Title	Acronym/Source
RoHS	Support
Serial ATA Revision 3.2	http://www.sata-io.org
ATA-8 spec	http://www.t13.org

9.TERMINOLOGY

The following table is to list out the acronyms that have been applied throughout the document.

Table 9- 1 List of Terminology

Term	Definitions
ATTO	Commercial performance benchmark application
DEVSLP	Device sleep mode
LBA	Logical block addressing
MB	Mega-byte
MTBF	Mean time between failures
NCQ	Native command queue
SATA	Serial advanced technology attachment
SDR	Synchronous dynamic access memory
S.M.A.R.T.	Self-monitoring, analysis and reporting technology
SSD	Solid state disk