1.8” SATA S3 SSD

Specification

Version 1.3

Content

1. General Description

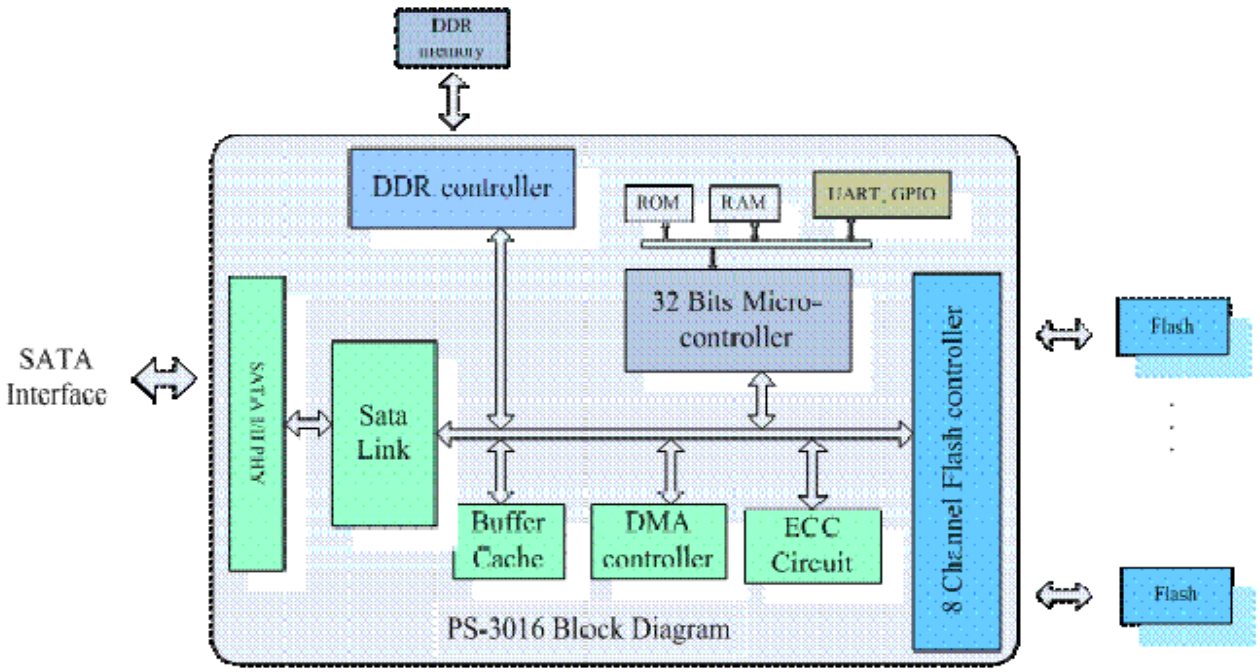
1.1 Overview

Unity Digital 1.8” SATA Solid State Disk (SSD) delivers all the advantages of Flash Disk technology with the Serial ATA II interface, fully compliant with standard 1.8-inch form factor. SATA Drives are replacing the older and slower (PATA) interface in embedded environments.

The 1.8” SATA SSD is based on the uSATA connector which contains 7-pin interface for data segment and 9-pin for power segment, designed to operate at a maximum operating frequency of 150MHz with 30MHz external crystal. Its capacity could provide a wide range from 16GB to up to 128GB. Also it can reach 210MB/s read as well as 140MB/s write high performance based on MLC flash (with 64MB DDR enabled and measured by CrystalDiskMark v2.1). The power consumption of Flash Disk is much lower than traditional Hard Drive. In addition, Unity Digital SSD provides hot-swapping abilities when removing, replacing or upgrading flash disks

1.2 Block Diagram

Unity Digital Flash Controller Block Diagram



Electrical/Physical interface

a. SATA interface

- Support SATA 1.5 Gbps and 3 Gbps interface.

b. DDR1 IO

- Support DDR1 I/O interface

c. Flash IO

- Support 1.8V and 3.3V voltage level
- Support 1.8V for ONFI Flash
- Support 3.3V for conventional Asynchronous Flash

Controller Features

a. SATA II

- SATA Revision 2.6 compliant.
- Compatible with SATA 1.5Gbps and 3Gbps interface.
- Power management supported
- Support expanded register for SATA protocol 48 bits addressing mode
- Embedded BIST function of SATA PHY for low cost mass production

b. NAND Flash Interface

- Build‐in hardware ECC circuit (48bit/2KB).
- Support all types of SLC Small/Large Block NAND Flash.
- Support all types of MLC Small/ Large Block NAND flash.
- ONFI2.0 Interface support : 4 channels max, mode 4.
- Bus Width: 8/16 bit.
- Support 4 TSOP/uLGA Flash chip enable.

c. DDR1 interface

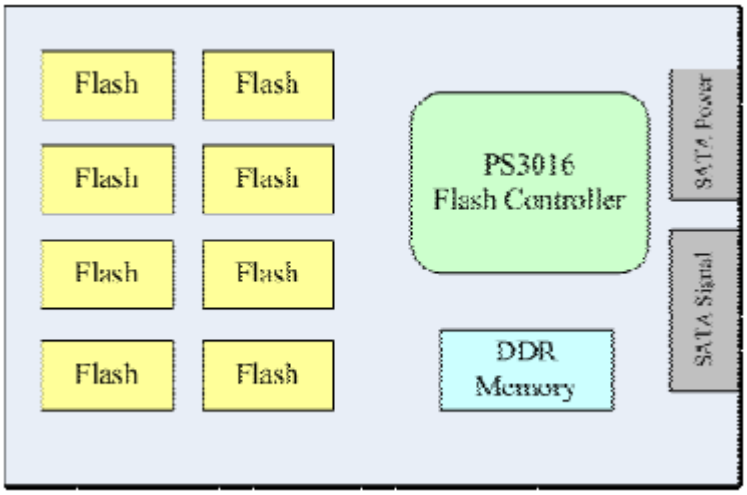
- 16 bit data bus.
- Data Rate: 300Mbps.
- Support Capacity : 64MB

d. Build in 32 bits micro‐controller

e. UART

f. GPIO

Unity Digital SSD Block Diagram with DDR cache buffer



2. Product Specifications

2.1 Support Capacity

From 16GB to up 128GB (support 48bit addressing mode)

2.2 Performance

Its performance can reach maximum 220MB/s Sequential Read and 100MB/s Sequential Write with 64MB DDR cache buffer based on empty Toshiba MLC Flash (CrystalDiskMark v2.1 1000MB test unit). The total CE number must be 32 to achieve above reference data.

2.3 ECC scheme

Support 48/32/28 bit ECC correct per 2K Byte data

2.4 Environmental Conditions

☆Temperature: －40°C to 85°C in storage / 0°C to 70°C in operating

☆Humidity: RH = 95% under 55°C

☆Shock 1500G/0.5ms

☆Vibration 80－2000Hz/20G

☆Booting feature from Windows OS

☆Acquired RoHS, WHQL, CE/FCC certificates

☆Acoustic = 0dB

3. Electrical Specifications

3.1 Pin and Signal assignment

Signal Segment Pinout

Pin Number	Function	Description
S1	GND	2nd mate
S2	A+	Differential signal pair A
S3	A-	
S4	GND	2nd mate
S5	B-	Differential signal pair B
S6	B+	
S7	GND	2nd mate

Power Segment Pinout

Pin Number	Type	Description
P1	V_{33}	3.3V power, 3rd Mate
P2	V_{33}	3.3V power, Pre-charge, 2nd Mate
P3	GND	1st Mate
P4	GND	1st Mate
P5	V_5	5V power, Pre-charge, 2nd Mate
P6	V_5	5V power, 3rd Mate
P7	R	Reserve
Key	Key	NC
P8	Optional	
P9	Optional	

3.3 Power Consumption

Parameter	Value (mA)
Idle	39
Write	989
Read	449

4. Command Description

4.1 ATA Command List

Description	OP Code	Support
Check power mode	E5h	◎
Check power mode	98h	◎
Download Microcode	92h	◎
Execute drive diagnostic	90h	◎
Flush cache	E7h	◎
Flush cache Ext	Eah	◎
Identify device	Ech	◎
Idle	E3h	◎
Idle immediate	E1h	◎
Idle immediate	95h	◎
Idle	97h	◎
Initialize drive parameters	91h	◎
NOP	00h	◎
Read buffer	E4h	◎
Read DMA (w/retry)	C8h	◎
Read DMA (w/o retry)	C9h	◎
Read Log Ext	2Fh	◎
Read multiple	C4h	◎
Read multiple Ext	29h	◎
Read sector(s) (w/retry)	20h	◎
Read sector(s) (w/o retry)	21h	◎
Read sector(s) Ext	24h	◎
Read DMA Ext	25h	◎
Read verify sector(s) (w/retry)	40h	◎
Read verify sector(s) (w/o retry)	41h	◎
Read FPDMA Ext	60h	◎
Read Verify Ext	42h	◎
Recalibrate	1xh	◎
Security Disable Password	F6h	◎
Security Erase Prepare	F3h	◎

Security Erase Unit	F4h	◎
Security Freeze Lock	F5h	◎
Security Set Password	F1h	◎
Security Unlock	F2h	◎
Seek	7xh	◎
Set features	Efh	◎
Set Max Address Ext	37h	◎
Set multiple mode	C6h	◎
Sleep	E6h	◎
Sleep	99h	◎
Smart	B0h	◎
Standby	E2h	◎
Standby immediate	E0h	◎
Standby immediate	94h	◎
Standby	96h	◎
Write buffer	E8h	◎
Write DMA (w/retry)	Cah	◎
Write DMA (w/o retry)	CBh	◎
Write Log Ext	3Fh	◎
Write multiple	C5h	◎
Write sector(s) (w/retry)	30h	◎
Write sector(s) (w/o retry)	31h	◎
Write sector(s) Ext	34h	◎
Write DMA Ext	35h	◎
Write sector(s) (w/o erase)	38h	◎
Write FPDMA Ext	61h	◎
Write multiple Ext	39h	◎

4.2 Identify Device Data

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

Word	F: Fixed V: Variable X: Both	Default Value	Description
0	F	045Ah	General configuration bit-significant information
1	X	3FFFh	Obsolete – Number of logical cylinders (16383)
2	V	0000h	Specific configuration
3	X	0010h	Obsolete – Number of logical heads (16)
4-5	X	02007E00h	Retired
6	X	003Fh	Obsolete – Number of logical sectors per logical track (63)
7-8	V	0h	Reserved for assignment by the Compact Flash Association
9	X	0h	Retired
10-19	F	Varies	Serial number (20 ASCII characters)
20-21	X	0h	Retired
22	X	0h	Obsolete
23-26	F	Varies	Firmware revision (8 ASCII characters)
27-46	F	Varies	Model number (xxxxxxxx)
47	F	8001h	7:0- Maximum number of sectors transferred per interrupt on MULTIPLE commands
48	F	0h	Reserved
49	F	0F00h	Capabilities
50	F	4000h	Capabilities
51-52	X	00000200h	Obsoleted
53	F	0007h	Words 88 and 70:64 valid
54	X	3FFFh	Obsolete – Number of logical cylinders (16383)
55	X	0010h	Obsolete – Number of logical heads (16)
56	X	003Fh	Obsolete – Number of logical sectors per track (63)
57-58	X	00FBFC10h	Obsolete
59	F	0100h	Number of sectors transferred per interrupt on MULTIPLE commands
60-61	F	037DFF40h (32G) xxxxxxxxh	Total number of user addressable sectors

		(64G)	
62	X	0h	Obsolete
63	F	0007h	Multi-word DMA modes supported/selected
64	F	0003h	PIO modes supported
65	F	0078h	Minimum Multiword DMA transfer cycle time per word
66	F	0078h	Manufacturer's 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
69-70	F	0h	Reserved
71-74	F	0h	Reserved for the IDENTIFY PACKET DEVICE command
75	F	0h	Queue depth
76	F	0002h	Serial SATA capabilities
77	F	0h	Reserved for future Serial ATA definition
78	F	0000h	Serial ATA features supported
79	V	0000H	Serial ATA features enabled
80	F	00F8h	Major Version Number
81	F	0021h	Minor Version Number
82	F	7429h	Command set supported
83	F	7008h	Command set supported
84	F	4000h	Command set/feature supported extension
85	V	7028h	Command set/feature enabled
86	V	3000h	Command set/feature enabled
87	V	4000h	Command set/feature default
88	V	007Fh	Ultra DMA Modes
89	F	0000h	Time required for security erase unit completion
90	F	0000h	Time required for Enhanced security erase completion
91	V	0h	Current advanced power management value
92	V	0000h	Master Password Revision Code
93	F	0h	Hardware reset result. The contents of the bits (12:0) of this word shall change only during the executeion of s hardware reset.
94	V	0h	Vebdor's recommended and actual acoustic management value
95	F	0h	Stream Minimum Request Size
96	V	0h	Streaming Transfer Time – DMA
97	V	0h	Streaming Access Latency – DMA and PIO
98-99	F	0h	Streaming Performance Granularity
100-103	V	Xxxxxxxxh	Maximum user LBA for 48 bit Address feature set

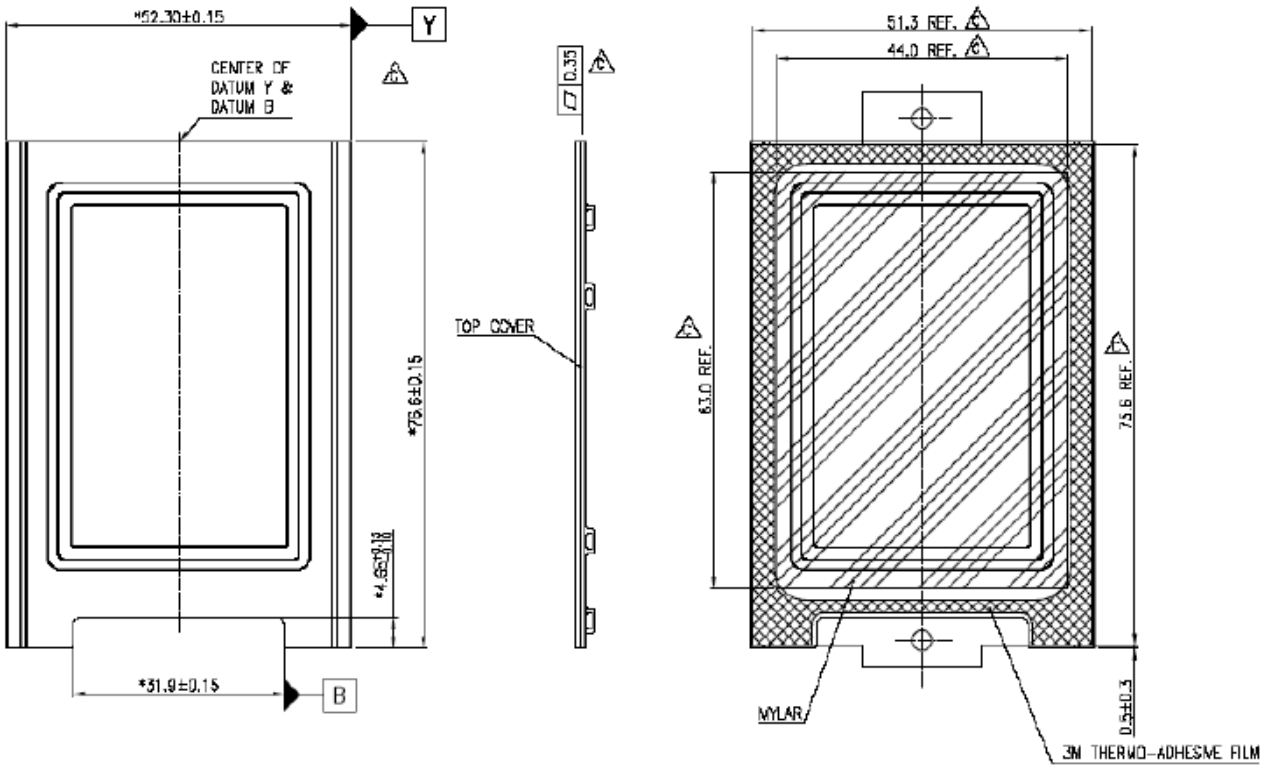
		(32G) xxxxxxxxh (64G) xxxxxxxxh (128G) xxxxxxxxh (256G)	
104	V	0h	Streaming Transfer Time – PIO
105	F	0h	Reserved
106	F	0h	Physical sector size / Logical sector size
107	F	0h	Inter-seek delay for ISO-7779 acoustic testing in microseconds
108-111	F	0h	Unique ID
112-115	F	0h	Reserved
116	V	0h	Reserved
117-118	F	0h	Words per logical Sector
119	F	0h	Supported settings
120	F	0h	Command set/Feature Enabled/Supported
121-126	F	0h	Reserved
127	F	0h	Removable Media Status Notification feature set support
128	V	0h	Security status
129-159	X	0h	Vendor specific
160	F	0h	Compact Flash Association (CFA) power mode 1
161-175	X	0h	Reserved for assignment by the CFA
176-205	V	0h	Current media serial number
206-216	F	0h	Reserved
217	F	0h	Non-rotating media device
218-221	F	0h	Reserved
222	F	0h	Reserved
223-233	F	0h	Reserved
234		0h	Reserved
235		0h	Reserved
236-254	F	0h	Reserved
255	X	Varies	Integrity word (Checksum and Signature)

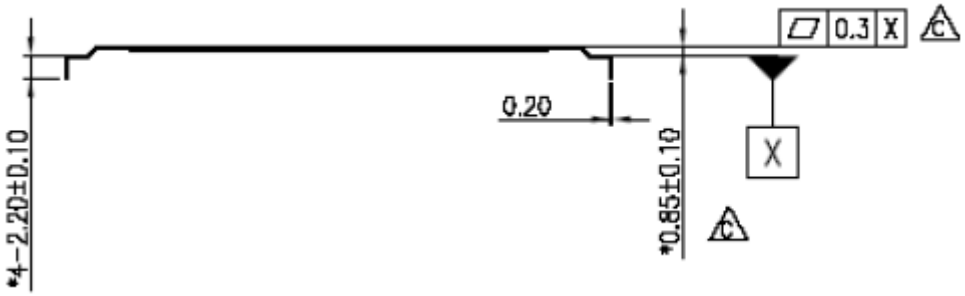
5. Physical Dimension

Dimension: 77mm(L) x 54mm(W) x 5mm(H)

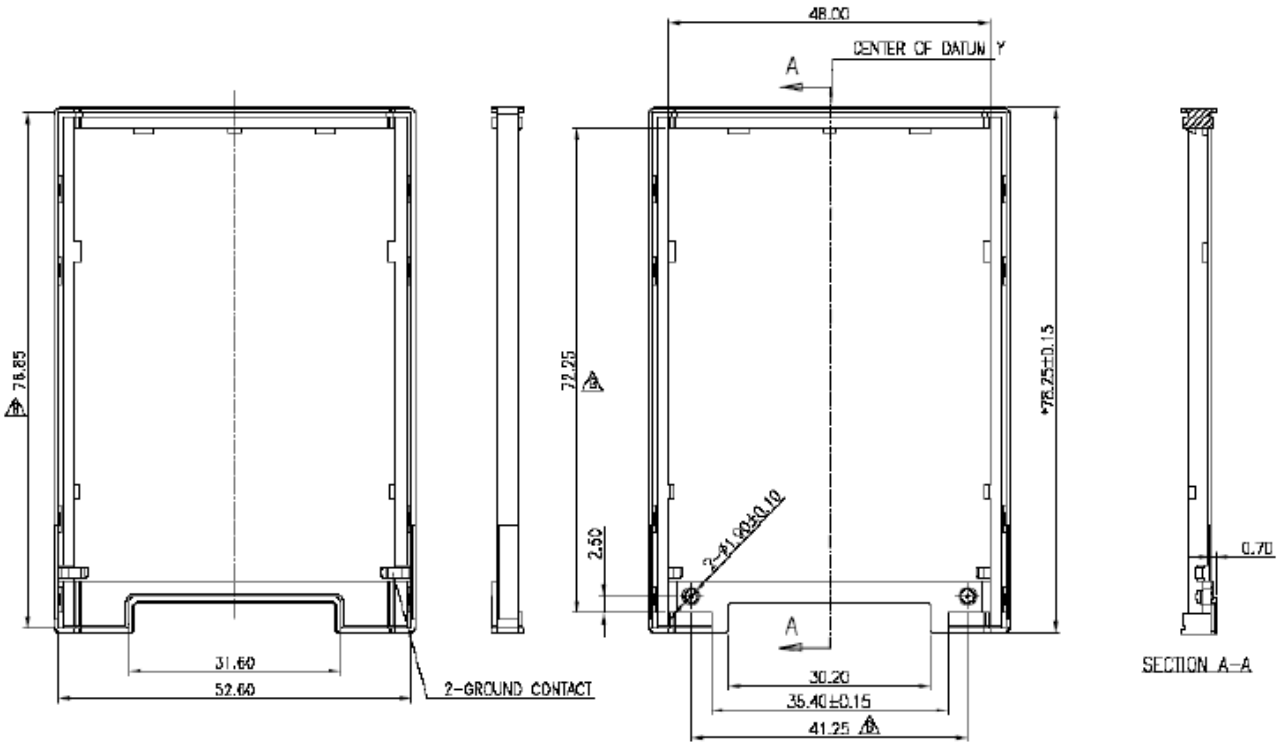
Weight: 33.3g

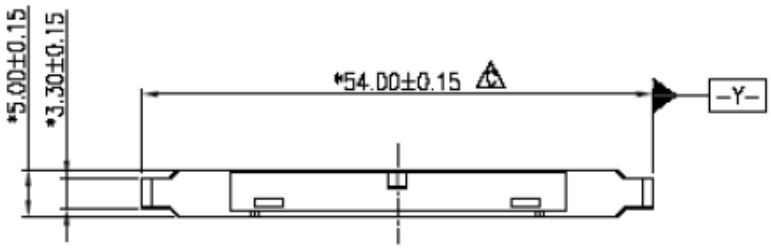
Bottom/Top view





Frame


48.00
CENTER OF DATUM Y
A
78.85
72.25
2.50
*78.75±0.15
2-ø1.90±0.10
0.70
31.60
52.60
2-GROUND CONTACT
30.20
35.40±0.15
41.25
SECTION A-A


*5.00±0.15
*3.30±0.15
*54.00±0.15
-Y-

Revision History

Revision	History	Draft Date	Remark
1.0	First Release	2009/10/6	
1.1	Modify the range of available capacity	2009/10/19	
1.2	Modify the performance data Add the data of power consumption and weight	2009/11/13	
1.3	Modify the performance data	2010/5/13	