OCZ
STORAGE SOLUTIONS
A Toshiba Group Company

Z-DRIVE 6000
OCZ
OCZ Z-Drive 6000 Solid State Drive
PN: ZD6000-XXXGB
SN: 0000000000000000
MADE IN TAIWAN
WARRANTY VOID IF REMOVED
FW: 1.009

Z-Drive 6000 Series

Enterprise PCIe NVMe SFF SSD

Product Data Sheet

PRODUCT OVERVIEW

- **Capacities**
  - 800GB, 1600GB, 3200GB
- **Form Factor**
  - 2.5" Form Factor
  - SFF-8639 connector
  - 15mm Height
- **NAND**
  - Toshiba A19 MLC
  - Toshiba A19 eMLC
- **Interface**
  - PCI Express Gen 3.0 x4 (2x2[1])
- **Compliance**
  - NVM Express 1.1b
  - PCI Express Base Specification Rev 3.0
  - Enterprise SSD Form Factor Version 1.0a
- **Operating Systems:**
  - 32/64-bit Microsoft Windows 7, 8, 8.1, 10
  - 64-bit Windows Server 2008 R2, 2012, 2012 R2
  - 64-bit Linux Red Hat Enterprise, Oracle & Centos 6.x, 7.x
  - 64-bit SLES 11 SP3, 11 SP4, 12
  - 64-bit Ubuntu Server 10.04 LTS, 14.04 LTS, 15.04
  - VMware ESX/ESXi 4.1, 5.1, 5.5, 6.0
  - UEFI support
- **Certifications**
  - RoHS, FCC , CE, BSMI, C-TICK, VCCI, KCC, UL, UNH-IOL, PCI-SIG
- **Features**
  - 2.5" U.2 form factor
  - Power loss Protection (PLP)
  - High performance
  - High Quality of Service (QoS)
  - NVMe 1.1b support
  - AES-256 encryption
  - Selectable power envelopes
  - Innovative flow-through case design
  - Dual port support[1]
  - Multi-namespace support[1]
  - T10-DIF data protection[1]
- **5 Year Warranty**
- **Sustained x4 Performance[2]**
  - Sequential 128K Read: up to 2700 MB/s
  - Sequential 128K Write: up to 1800 MB/s
  - Random 4K Read: up to 700K IOPS
  - Random 4K Write: up to 150K IOPS
  - Random Latency 4K R/W: 120µS /30µS
- **Temperature**
  - Operating: 0°C to 40°C ambient and 0°C to 60°C case temperature with specified airflow
  - Non-Operating: -45°C to 70°C
  - Temperature sensing
  - Thermal throttling
- **Airflow Requirements**
  - Up to 350 LFM (Linear Feet per Minute) at 25°C
  - Up to 350 LFM (Linear Feet per Minute) at 35°C
  - Up to 600 LFM (Linear Feet per Minute) at 40°C
- **Power**
  - PCIe 12V & 3.3V Aux
  - 25W/9W (Active/Idle)
  - 25, 20, and 15 Watt power modes
  - Power Loss Data Protection
- **Endurance Ratings:**
  - Z-Drive 6000: 1DWPD over 5 years[3]
  - Z-Drive 6300: 3 DWPD over 5 years[3]
- **Reliability**
  - Mean Time Between Failures (MTBF):2M hours
  - Unrecoverable Bit Error Rate (UBER): Less than 1 sector per 10^{17} bits read
  - T10-DIF Data Protection[1]
  - Sector Sizes: 512b, 4096b. Support[1]: 520b, 4104b, 4160b
  - Field-upgradable firmware
- **Shock**
  - 1000G / 0.5mS (Operational)
  - 1500G / 0.5mS (Non-Operational)
- **Vibration**
  - 2.7grm 5–800Hz at 15 min/axis (Operational)
  - 16.3grm 20–2000Hz at 15 min/axis (Non-Operational)
- **Weight**
  - 180grm
- **Dimensions (L x W x H):**
  - 100mm x 69.75mm x 15mm

Notes:
1: Features to be added through future firmware release
2: Measured performance
3: Rated with 4KB random write workload

TABLE OF CONTENTS

Page
1 INTRODUCTION 5

2 PRODUCT SPECIFICATIONS 6
2.1 Capacity Specification 6
Capacity Description 6
2.2 Maximum Performance 6
Maximum Sequential Throughput 6
Maximum Random IOPS 6
2.3 Latency Metrics 7
Typical Latency 7
Quality of Service 7
2.4 Endurance and Reliability 8
TBW Rating 8
Reliability 8
2.5 Electrical Characteristics 8
Operating Voltage 8
Power Consumption 8
In-rush Current 8
2.6 Environmental Specifications 9
Temperature Specifications 9
Airflow Requirements 9
Shock Specifications 9
Vibration Specifications 9
EMI/EMC Standard Compliance 9
2.7 Mechanical Specifications 9
Mechanical Drawing 10
Product Weight Specification 10
SFF-8639 PCIe Connector Pin-Out 11

3 SUPPORTED FEATURES 12
Non-Standard Sector Sizes 12
Power Management 12
SMART Logging and Alerts 12
Multi-Host 12
Power Loss Protection 13
Temperature Sensing and Reporting 13
Encryption 13
Multiple Namespace Support 13
Block Diagram 14

Page

4 OCZ SMART LOG 14

OCZ SMART Log Data Structure 14

OCZ SMART Log Critical Warning Structure 15

OCZ SMART Log Attributes 15

5 NVMe COMMAND SET 16

Supported NVMe Admin Commands 16

Supported NVMe Data Commands 17

Supported NVMe Set/Get Feature Commands 18

6 OUT-OF-BAND MANAGEMENT (VIA SMBUS) 19

VPD Structure 19

Temperature Sensor Capability 20

Ref. Clk. Extended Capability 20

Dual Port Extended Capability 20

7 NVMe DRIVER SUPPORT 21

Operating System Support 21

System Boot Support 21

8 CERTIFICATIONS AND COMPLIANCE 22

9 GLOSSARY 23

10 REVISION HISTORY 23

1 Introduction

This datasheet covers all aspects of the OCZ Z-Drive 6000 Series U.2 SSDs.

Product Overview:

The Z-Drive 6000 NVMe PCIe 3.0 U.2 SSD Series are driven by OCZ's enterprise class firmware architecture on a robust hardware platform. The Z-Drive 6000 Series delivers high performance for NVMe SSDs including maximum read bandwidth of up to 2,700 MB/s, maximum write bandwidth of up to 1,800 MB/s, random 4K block read IOPS of up to 700,000 and random 4K block write IOPS of up to 150,000. The Z-Drive 6000 family is ideally suited for I/O intensive enterprise applications where storage density and performance are critical.

Key Features:

- 2.5" U.2 form factor
- Power loss Protection (PLP)
- High performance
- High Quality of Service (QoS)
- NVMe 1.1b support
- AES-256 encryption
- Selectable power envelopes
- Innovative flow-through case design
- Dual port support*
- Multi-namespace support*
- T10-DIF data protection*

*Dual Port and T10 data integrity features available through 2.0.XX firmware update.

Ordering Information:

Part Number	Description
ZD605M020-0800G	Z-Drive 6000, PCIe, 2.5", 800GB
ZD605M020-1.60T	Z-Drive 6000, PCIe, 2.5", 1600GB
ZD605M020-3.20T	Z-Drive 6000, PCIe, 2.5", 3200GB
ZD635E020-0800G	Z-Drive 6300, PCIe, 2.5", 800GB
ZD635E020-1.60T	Z-Drive 6300, PCIe, 2.5", 1600GB
ZD635E020-3.20T	Z-Drive 6300, PCIe, 2.5", 3200GB

2 Product Specifications

2.1 Capacity Specification

Capacity Description

RAW Capacity	Usable Capacity
1TB	800GB
2TB	1,600GB
4TB	3,200GB

2.2 Maximum Performance

Maximum Sequential Throughput

Z-Drive 6000	800GB	1600GB	3200GB
Max Sequential Read (MB/s)	2200	2700	2700
Max Sequential Write (MB/s)	1200	1800	1700

Z-Drive 6300	800GB	1600GB	3200GB
Max Sequential Read (MB/s)	2000	2700	2700
Max Sequential Write (MB/s)	900	1500	1400

Note: Performance tested on Calypso RTP 3.0 Linux platform, 128K block size, single threaded I/O, steady state, 100% data entropy.

Maximum Random IOPS

Z-Drive 6000	800GB	1600GB	3200GB
4KB Random Read (KIOPS)	575	700	700
4KB Random Write (KIOPS)	110	150	140

Z-Drive 6300	800GB	1600GB	3200GB
4KB Random Read (KIOPS)	570	700	700
4KB Random Write (KIOPS)	85	140	125

Note: Performance tested on Calypso RTP 3.0 Linux platform, 4K block size, multi-threaded I/O, steady state, 100% data entropy.

2.3 Latency Metrics

Typical Latency

Metric	Z-Drive 6000	Z-Drive 6300
Typ. 4K Random Read	120µS	120µS
Typ. 4K Random Write	30µS	30µS

Note: Performance tested on Calypso RTP 3.0 Linux platform, 4K block size, single threaded I/O, QD=1, steady state, 100% data entropy.

Quality of Service

Z-Drive 6000

QoS (99%)	Unit	800GB		1600GB		3200GB	
		QD=1	QD=128	QD=1	QD=128	QD=1	QD=128
4K Random Read	mS	0.15	1.00	0.15	1.00	0.15	1.50
4K Random Write		0.07	10.00	0.07	7.50	0.07	7.50
QoS (99.99%)	**Unit**	**800GB**		**1600GB**		**3200GB**	
		QD=1	QD=128	QD=1	QD=128	QD=1	QD=128
4K Random Read	mS	0.50	3.00	0.50	3.00	0.75	10.00
4K Random Write		0.25	22.00	0.25	15.00	0.50	15.00

Note: Performance tested on Calypso RTP 3.0 Linux platform, 4K block size, 1-4 threads, steady state, 100% data entropy.

Z-Drive 6300

QoS (99%)	Unit	800GB		1600GB		3200GB	
		QD=1	QD=128	QD=1	QD=128	QD=1	QD=128
4K Random Read	mS	0.15	1.00	0.30	1.00	0.30	1.50
4K Random Write		0.10	15.00	0.10	10.00	0.10	10.00
QoS (99.99%)	**Unit**	**800GB**		**1600GB**		**3200GB**	
		QD=1	QD=128	QD=1	QD=128	QD=1	QD=128
4K Random Read	mS	0.50	3.00	0.50	3.00	0.75	10.00
4K Random Write		0.50	28.00	0.50	20.00	1.00	20.00

Note: Performance tested on Calypso RTP 3.0 Linux platform, 4K block size, 1-4 threads, steady state, 100% data entropy.

2.4 Endurance and Reliability

TBW Rating

Description	800GB	1600GB	3200GB
Minimum Total Bytes Written (6000 Series)	1.17 PB	2.34 PB	4.67 PB
Minimum Total Bytes Written (6300 Series)	4.10 PB	8.18 PB	16.35 PB

Reliability

Parameter	Value
UBER	1 sector per 10^{17} bits read
MTBF	2,000,000 Hours
Z-Drive 6000 Data Retention at EOL	3 months
Z-Drive 6300 Data Retention at EOL	3 months

2.5 Electrical Characteristics

Operating Voltage

Description	Min	Max	Unit
Operating Voltage for 3.3 V (+/- 9%)	3.003	3.597	V
Operating Voltage for 12 V (+/- 8%)	11.04	12.96	V

Note: In compliance with PCIe CEM 3.0 specification.

Power Consumption

Mode	800GB	1600GB	3200GB	Unit
Active Read	17	22	24	W
Active Write	17	22	24	W
Idle	8	9	9	W

Note: Power consumption is recorded over a 10 minute period with 1MB read and write workloads at 'steady state'. Average consumption is shown.

In-rush Current

Z-Drive 6000			**Z-Drive 6300**		
Capacity	Current (A)	Duration (µS)	Capacity	Current (A)	Duration (µS)
800GB	2.5	14	800GB	2.5	14
1600GB	2.2	14	1600GB	2.2	14
3200GB	2.1	14	3200GB	2.1	14

2.6 Environmental Specifications

Temperature Specifications

Mode	Min	Max	Unit
Ta	0	40	°C
Tc	0	60	°C
Non-Operating	-45	70	°C

Note: Exceeding Tc will result in thermal throttling.

Airflow Requirements

Ambient Temp	800GB	1600GB	3200GB	Unit
27°C	200	300	350	LFM (linear feet per minute)
35°C	300	350	350	LFM (linear feet per minute)
40°C	300	600	600	LFM (linear feet per minute)

Note: Airflow requirements measured as approach velocity is toward device in a populated chassis. Spacing between drives is 3mm. Airflow is applied towards server - approach velocity is measured 1” away from front of device.

Shock Specifications

Mode	Specification
Operating	1000G /.5mS
Non-Operating	1500G /.5mS

Vibration Specifications

Mode	Specification
Operating	2.7grm 5–800Hz at 15 min/axis
Non-Operating	16.3grm 20–2000Hz at 15 min/axis

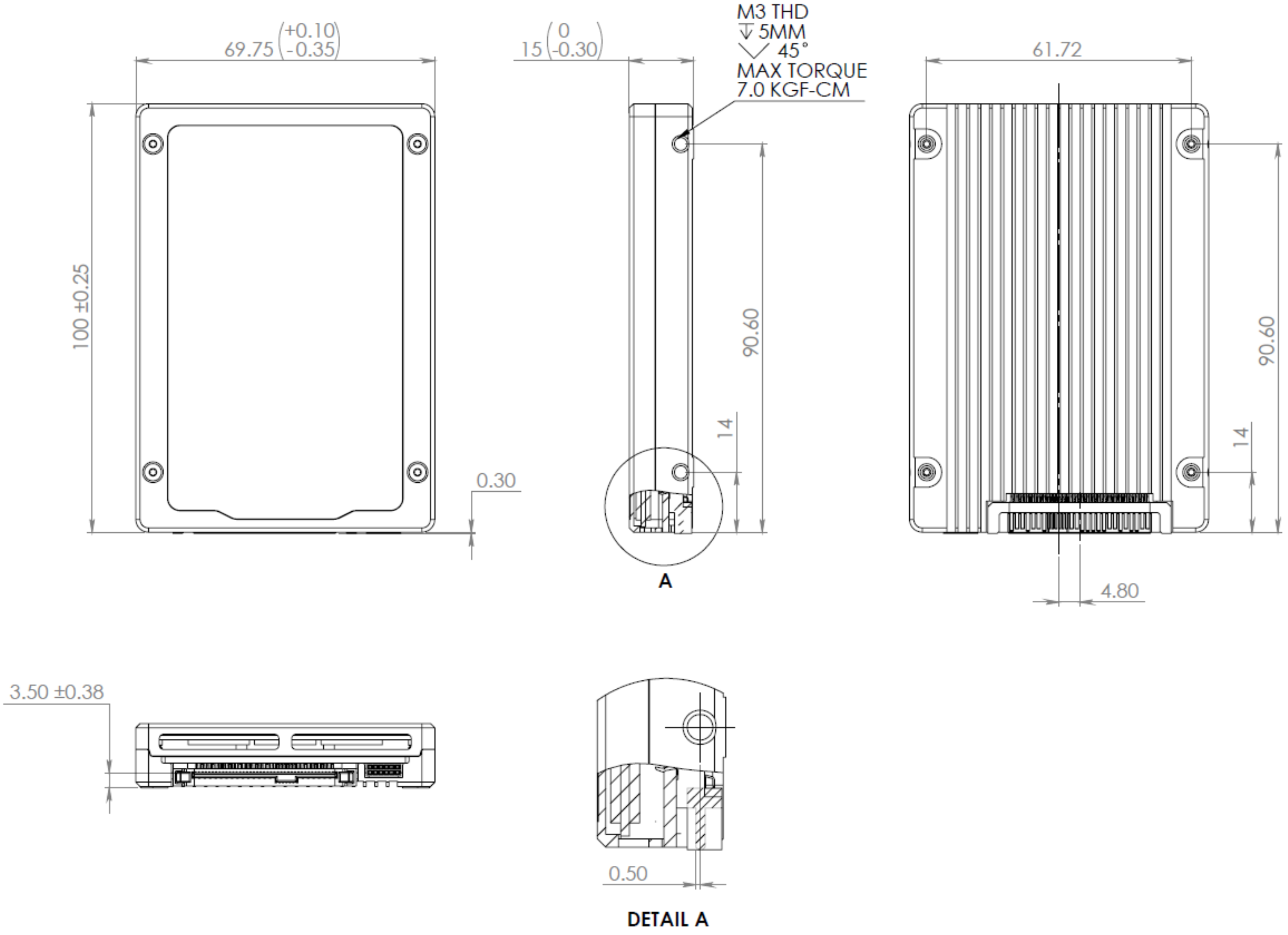
EMI/EMC Standard Compliance

Standard	Result
EN 55033:2010:Class B	Pass
IEC 61000-3-2:2005+A1:2008+A2:2009	Pass
IEC 61000-3-3:2008	Pass

2.7 Mechanical Specifications

The Z-Drive 6000 Series utilizes an innovative casing design that features open slots across the front and back of the device. These slots allow air to flow through the device in a traditional chassis environment, improving thermal performance.

Mechanical Drawing


69.75 (+0.10 / -0.35)
15 (0 / -0.30)
M3 THD
↧ 5MM
⌵ 45°
MAX TORQUE
7.0 KGF-CM
61.72
100 ±0.25
90.60
14
0.30
A
90.60
14
4.80
3.50 ±0.38
0.50
DETAIL A

Product Weight Specification

P/N	Weight
ZD605M020-0800G	180g
ZD605M020-1.60T	180g
ZD605M020-3.20T	180g
ZD635E020-0800G	180g
ZD635E020-1.60T	180g
ZD635E020-3.20T	180g

Note: Weights above are product specification. Actual weight may vary, but will never exceed specified weight.

SFF-8639 PCIe Connector Pin-Out

Name	Pin #	Pin #	Name
GND	S1	E7	RefClk0+
Open	S2	E8	RefClk0-
Open	S3	E9	GND
GND	S4	E10	PETp0
Open	S5	E11	PETn0
Open	S6	E12	GND
GND	S7	E13	PERn0
		E14	PERP0
		E15	GND
		E16	Open
		S8	GND
RefClk1+	E1	S9	Open
RefClk1-	E2	S10	Open
3.3Vaux	E3	S11	GND
ePERst1n	E4	S12	Open
ePERst0n	E5	S13	Open
Open	E6	S14	GND
Open	P1	S15	Open
Open	P2	S16	GND
Open	P3	S17	PETp1
IfDetn	P4	S18	PETn1
GND	P5	S19	GND
GND	P6	S20	PERn1
Open	P7	S21	PERp1
Open	P8	S22	GND
Open	P9	S23	PETp2
PRSNTn	P10	S24	PETn2
Activity	P11	S25	GND
		S26	PERn2
		S27	PERp2
		S28	GND
		E17	PETp3
		E18	PETn3
		E19	GND
		E20	PERn3
		E21	PERp3
GND	P12	E22	GND
12V	P13	E23	SMClk
12V	P14	E24	SMDat
12V	P15	E25	nDualPortEn

3 Supported Features

Non-Standard Sector Sizes

The Z-Drive 6000 Series supports multiple non-standard sector sizes starting with the 2.0.XX firmware release in addition to traditional 512B and 4096B formats. T10-DIF/DIX Types 1, 2, and 3 are supported.

Sector Size	F/W Support
512B	1.4.13
512B+8B	2.0.XX
4096B	2.0.XX
4096B+8B	2.0.XX
4096B+64B	2.0.XX

Power Management

The Z-Drive 6000 Series supports multiple low power modes as defined by the NVMe specification. These power modes can be changed with the NVMe Feature Set command (Feature Identifier 02h).

Mode	Power Limit
0	25W
1	20W
2	15W

SMART Logging and Alerts

The Z-Drive 6000 Series supports all mandatory NVMe logs, as well as a vendor-unique OCZ SMART log. Logs can be retrieved with the NVMe Get Log Page command.

Log Identifier	Optional (O) or Mandatory (M)	Description
01h	M	Error Information
02h	M	SMART / Health Information
03h	M	Firmware Slot Information
E0h	O	OCZ SMART Information

Multi-Host

The Z-Drive 6000 Series supports multi-host access for two data paths. This functionality is enabled starting with the 2.0.XX firmware release. The SSD will auto negotiate between a single PCIe Gen. 3.0 x4 link or two concurrent PCIe Gen 3.0 x2 links upon power-up. This functionality is controlled by the nDualPortEn pin within the SFF-8639 connector.

Power Loss Protection (PLP)

The Z-Drive 6000 Series supports power loss protection to protect against unplanned power loss. In-flight data that has reached the SSD upon the power loss event will be committed. The SSD provides PLP with a small amount of capacitance that will power the SSD for a short time in the event of a system power loss. During this time, the SSD commits any in-flight data to non-volatile memory. The SSD will periodically test the capacitors to ensure continuous protection. If a failure is detected, the SSD will enter a read only state.

Capacitor health status can be retrieved through the OCZ SMART Log (Log Identifier E0h). The value will be '1' if the power fail backup is charged, otherwise, '0' will be returned.

Data Structure	Location	Description
OCZ SMART Log	1063:1032 (byte 2)	Power Fail Backup Health

Temperature Sensing and Reporting

The Z-Drive 6000 supports real-time temperature sensing and reporting. Current temperature can be retrieved through either the NVMe SMART/Health Log (Log Identifier 02h) or the OCZ SMART Log (Log Identifier E0h). Temperature can also be retrieved through the SMBus, as described in the *Out of Band Management* section of this document.

Data Structure	Location	Description
OCZ SMART Log	551:520 (Byte 2)	Current Temperature in Celsius
NVMe SMART/Health Log	2:1	Current Temperature in Kelvin

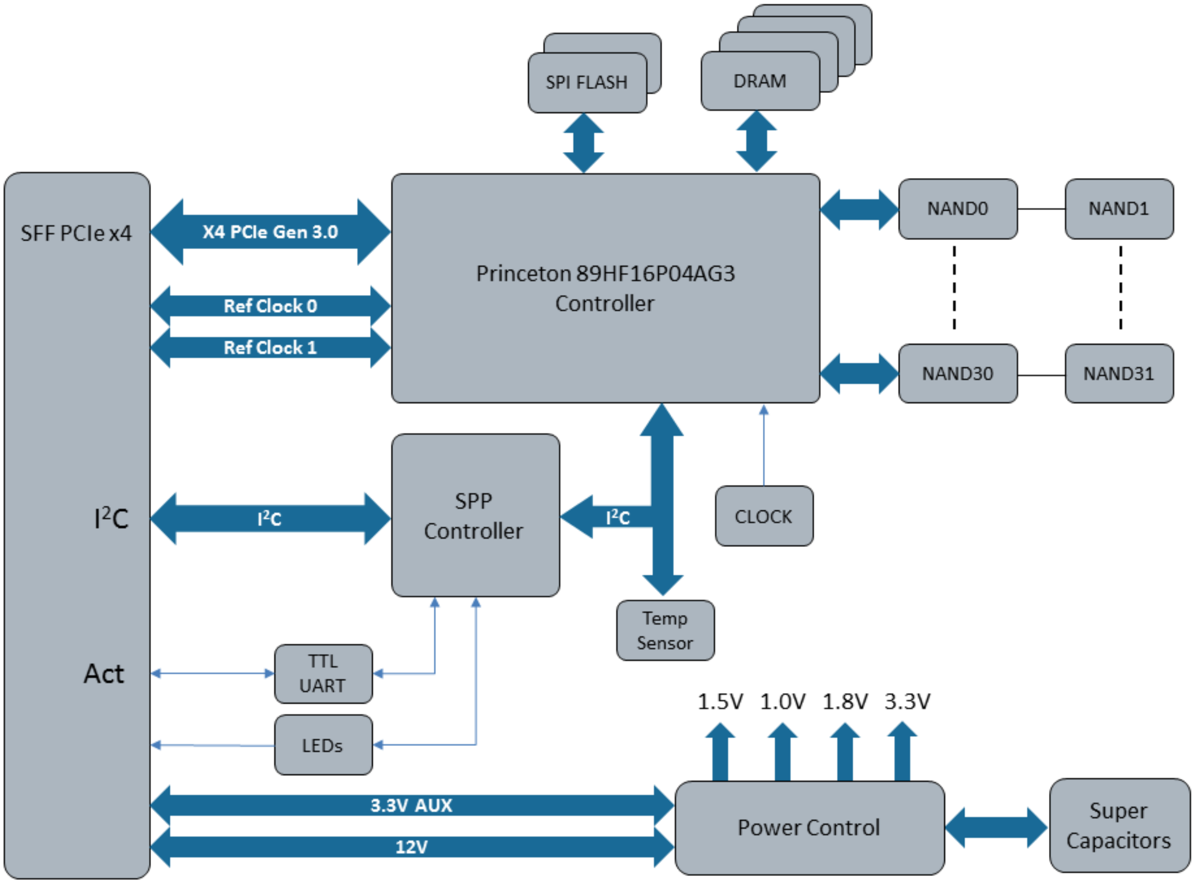
Encryption

Z-Drive 6000 Series SSDs are Data Encrypting Drives (DEDs) that utilize XTS-AES-256 encryption. All data is encrypted and all Data Encryption Keys (DEKs) are managed by the SSD. Each namespace has a unique DEK. An NVMe format command must be issued to the target namespace to erase the unique key, rendering all LBAs within the namespace unrecoverable. A new DEK will be generated automatically.

Multiple Namespace Support

Z-Drive 6000 Series SSDs support up to 4 separate namespaces. Each namespace can be formatted independently from each other, and has a unique encryption key. Formatting a namespace will result in the internal encryption key being deleted and all data in the target namespace will be unrecoverable. A new key is generated automatically.

Block Diagram


SPI FLASH
DRAM
SFF PCIe x4
X4 PCIe Gen 3.0
Ref Clock 0
Ref Clock 1
Princeton 89HF16P04AG3 Controller
NAND0
NAND1
NAND30
NAND31
I²C
I²C
SPP Controller
I²C
CLOCK
Temp Sensor
Act
TTL UART
LEDs
1.5V 1.0V 1.8V 3.3V
3.3V AUX
12V
Power Control
Super Capacitors

4 OCZ SMART Log

The Z-Drive 6000 Series features an additional diagnostic log to the mandatory NVMe SMART / Health log. This log can be retrieved through the NVMe Get Log Page command (Log Identifier E0h).

OCZ SMART Log Data Structure

Byte	Definition
0	**OCZ Attribute ID**: A unique identifier for each OCZ SMART attribute
1	**Flags**: TBD
2	**Normalized Value**
7:03	**Reserved**

8	**Threshold**: The threshold at which a given attribute causes an Asynchronous Event Notification to be sent to the host. Not all attributes have associated thresholds.
15:09	**Reserved**
16	**Worst Case**: This is the highest or lowest value for a given attribute. Generally, it is in terms of the normalized value. This value is persistent across resets and power cycles.
23:17	**Reserved**
31:24:00	**Raw Value**: This is the current value for the given attribute.

OCZ SMART Log Critical Warning Structure

Bit	Definition
0	A '1' indicates that available spares have fallen below the threshold
1	A '1' indicates that the temperature has exceeded the threshold
2	A '1' indicates that the device reliability has degraded, significantly
3	A '1' indicates that the media is in read-only mode
4	A '1' indicates that the volatile memory backup has failed
9:05	Reserved
10	Warranty Expired (Firmware 2.x, only)
31:06:00	Reserved

OCZ SMART Log Attributes

Bytes	Attribute ID	Description	Comments
39:8	1	Raw Read Error Rate	
71:40	2	Accumulated runtime bad blocks (grown defects)	
103:72	3	Power-on hours count	
135:104	4	Power cycle count	
167:136	5	Soft Read Error Rate (ECC corrected)	
199:168	6	Total blocks erased	In GiB
231:200	7	Total blocks erased	In 512-byte data units
263:232	8	Reserved Block Count (OP)	Available Spare
295:264	9	Program Fail Count	In NAND write units
327:296	10	Erase Fail Count	
359:328	11	Power Cycle Count (unplanned)	
391:360	12	Wear range delta	
423:392	13	Factory bad block count total	
455:424	14	End-to-end CRC errors	
487:456	15	Total count uncorrectable NAND reads	Errors that could not be recovered using ECC

519:488	16	Media and Data Integrity Errors	N: all errors – read, write, erase, CRC, LBA Mismatches
551:520	17	Temperature	Kelvin/Celsius (Normalized)
583:552	18	Soft ECC Correction Rate	
615:584	19	Total Count of Uncorrectable RAID Failures	
647:616	20	Total Host Reads in Data Units	In 512-byte data units
679:648	21	Uncorrectable sectors	In 512-byte data units
711:680	22	Total Host Writes in Data Units	In 512-byte data units
743:712	23	Total number of read bits corrected	
775:744	24	Max rated PE count	
807:776	25	Min erase count	
839:808	26	Max erase count	
871:840	27	Average Erase Count	
903:872	28	Total number of adaptive read retry attempts	In NAND Read Units
935:904	29	RAID recovery count	
967:936	30	Write throttling activation flag	
999:968	31	Lifetime Used	NVMe Percentage Used
1031:1000	32	Lifetime remaining	Life remaining
1063:1032	33	Power fail backup health	
1095:1064	34	Total reads (OCZ SMART: Total Host Reads in GiB)	In GiB
1127:1096	35	Total writes (OCZ SMART: Total Host Writes in GiB)	In GiB
1159:1128	36	Total NAND programming count	In GiB
1191:1160	37	Total NAND read count	In GiB
1223:1192	38	I/O Busy Time	NVMe Controller Busy Time
1255:1224	39	Host Read Count	
1287:1256	40	Host Write Count	
1319:1288	41	Error Log Count	
1351:1320	42	Total Count of Single Bit DRAM Errors	

5 NVMe Command Set

The Z-Drive 6000 Series is certified to support the NVMe 1.1b standard and supports the following mandatory and optional commands:

Supported NVMe Admin Commands

Item	Type	Optional / Mandatory	F/W Support
Delete I/O Submission Queue	Admin	M	1.4.13
Create I/O Submission Queue	Admin	M	1.4.13
Get Log Page	Admin	M	1.4.13
Delete I/O Completion Queue	Admin	M	1.4.13

Create I/O Completion Queue	Admin	M	1.4.13
Identify	Admin	M	1.4.13
Abort	Admin	M	1.4.13
Set Features	Admin	M	1.4.13
Get Features	Admin	M	1.4.13
Asynchronous Event Request	Admin	M	1.4.13
Firmware Activate	Admin	O	1.4.13
Firmware Image Download	Admin	O	1.4.13
Format NVM – 512	Admin	O	1.4.13
Format NVM – 512+DIF	Admin	O	2.0.XX
Format NVM – 512+8	Admin	O	2.0.XX
Format NVM – 4096	Admin	O	2.0.XX
Format NVM – 4096+DIF	Admin	O	2.0.XX
Format NVM – 4096+8	Admin	O	2.0.XX
Format NVM – 4096+64	Admin	O	2.0.XX
Namespace Attachment	Admin	O	2.0.XX
Namespace Management	Admin	O	2.0.XX

Supported NVMe Data Commands

Item	Type	Optional / Mandatory	F/W Support
Flush	Data	M	1.4.13
Write – 512	Data	M	1.4.13
Read – 512	Data	M	1.4.13
Write – 512+DIF	Data	M	2.0.XX
Read – 512+DIF	Data	M	2.0.XX
Write – 512+8	Data	M	2.0.XX
Read – 512+8	Data	M	2.0.XX
Write – 4096	Data	M	2.0.XX
Read – 4096	Data	M	2.0.XX
Write – 4096+DIF	Data	M	2.0.XX
Read – 4096+DIF	Data	M	2.0.XX
Write – 4096+8	Data	M	2.0.XX
Read – 4096+8	Data	M	2.0.XX
Write – 4096+64	Data	M	2.0.XX
Read – 4096+64	Data	M	2.0.XX
Write Uncorrectable – 512	Data	O	1.4.13
Write Uncorrectable – 512+DIF	Data	O	2.0.XX
Write Uncorrectable – 512+8	Data	O	2.0.XX
Write Uncorrectable – 4096	Data	O	2.0.XX
Write Uncorrectable – 4096+DIF	Data	O	2.0.XX
Write Uncorrectable – 4096+8	Data	O	2.0.XX
Write Uncorrectable – 4096+64	Data	O	2.0.XX
Dataset Management – 512	Data	O	1.4.13
Dataset Management – 512+DIF	Data	O	2.0.XX
Dataset Management – 512+8	Data	O	2.0.XX
Dataset Management – 4096	Data	O	2.0.XX

Dataset Management – 4096+DIF	Data	O	2.0.XX
Dataset Management – 4096+8	Data	O	2.0.XX
Dataset Management – 4096+64	Data	O	2.0.XX
Reservation Register	Data	O	2.0.XX
Reservation Report	Data	O	2.0.XX
Reservation Acquire	Data	O	2.0.XX
Reservation Release	Data	O	2.0.XX

Supported NVMe Set/Get Feature Commands

Item	Type	Optional / Mandatory	F/W Support
Arbitration[1]	Feature	M	1.4.13
Power Management	Feature	M	1.4.13
LBA Range Type	Feature	O	1.4.13
Volatile Write Cache[1]	Feature	O	1.4.13
Number of Queues	Feature	O	1.4.13
Interrupt Coalescing	Feature	M	1.4.13
Interrupt Vector Configuration	Feature	M	1.4.14
Host Identifier	Feature	O	2.0.XX
Reservation Notification Mask	Feature	O	2.0.xx
Reservation Persistence	Feature	O	2.0.XX
Pin 11 inversion	Feature	VUC	1.4.13

[1] No effect, echos setting.

6 Out of Band Management (via SMBUS)

The Z-Drive 6000 Series provides out of band management by means of the SMBUS interface. SMBUS allows access to the Vital Product Data (VPD) Structure and temperature sensor. A properly connected Z-Drive 6000 SSD should present two devices – the EEPROM containing the VPD at address 0x53 (8Bit: 0xa6) and the temperature sensor at address 0x1b (8Bit: 0x36).

VPD Structure

Bytes	Function	Type	Size (B)	Default Value	Description
2:0	Class Code	RO	3	0x010802	Device type and programming interface
4:3	ID	RO	2	0x1b85	PCI-SIG Vendor ID
24:5		RO	20	Unique	Serial Number (vendor unique)
64:25		RO	40	Unique	Model Number (ASCII string)
65	PCIe Port 0 Capabilities	RO	1	0x03	Maximum Link Speed
66		RO	1	0x04	Maximum Link Width
67	PCIe Port 1 Capabilities	RO	1	0x00[1]	Maximum Link Speed
68		RO	1	0x00[1]	Maximum Link Width
69	Initial Power Requirements	RO	1	0x19	12V power rail initial power requirement (W)
70		RO	1	0x00	Reserved
71		RO	1	0x00	Reserved
72	Maximum Power Requirements	RO	1	0x19	12V power rail maximum power requirement (W)
73		RO	1	0x00	Reserved
74		RO	1	0x00	Reserved
76:75	Capability List Pointer	RO	2	Vendor	16-bit address pointer to start of capability list (zero means no capability list)
79:77	Temperature Sensor Capability	RO	3	0x00	Reserved
91:80		RO	12	Details on Page 20	Details on Page 20
99:92	Ref. Clk Extended Capability	RO	8	Details on Page 20	Details on Page 20
103:100	Dual Port Extended Capability	RO	4	Details on Page 20	Details on Page 20

[1] *Single Port configuration. Dual Port configuration will show capability on both port 0 and 1.*

Temperature Sensor Capability

Bytes	Function	Type	Size (B)	Default Value
1:0	Capability ID	RO	2	0x00a2
3:2	Next Capability Address	RO	2	0x005c
4	Sensor Type	RO	1	0x01
5	SMBUS Address	RO	1	0x1b
7:6	Reserved	RO	2	0x00
9:8	Warning Threshold	RO	2	0x0460 (70c)[1]
11:10	Overtemp Threshold	RO	2	0x04a0 (74c)[1]

[1] 12bit value

Ref. Clk Extended Capability

Bytes	Function	Type	Size (B)	Default Value
1:0	Capability ID	RO	2	0x00a1
3:2	Next Capability Address	RO	2	0x0064
4	Sensor Type	RO	1	0x01
5:7	Reserved	RO	2	0x0000

Dual Port Extended Capability

Bytes	Function	Type	Size (B)	Default Value
1:0	Capability ID	RO	2	0x00a0
3:2	Next Capability Address	RO	2	0x0000 (end of list)

SMBUS Temperature Sensor

The Z-Drive 6000 Series supports temperature reporting through the SMBUS. The temperature sensor is located at address 0x1b (8Bit: 0x36). The sensor contains eight (8) 16-bit registers. Current temperature data is contained within register 0x05.

Hex	Temperature
000	0°C
001	0.0625°C
190	25°C
320	50°C
460	70°C

7 NVMe Driver Support

Z-Drive 6000 Series SSDs are fully NVMe 1.1b compliant, and as such, support community and in-box NVMe drivers. Due to the nature of the NVMe 1.1b standard, not all features of the Z-Drive 6000 Series are guaranteed to be supported with 3rd party drivers.

OCZ provides native, precompiled NVMe drivers for the Z-Drive 6000 Series that can be found on the OCZ Enterprise Support website by accessing this link: < http://ocz.com/enterprise/download/drivers>

Source code for Linux OCZ NVMe drivers is also available on the OCZ Enterprise Support website.

Operating System Support

Supported Operating System	Supported Versions	In-Box / OCZ Driver
Microsoft Windows	7, 8 (32/64-bit)	OCZ
Microsoft Windows	8.1, 10 (32/64-bit)	In-Box / OCZ
Microsoft Windows Server	2008 R2, 2012 (64-bit)	OCZ
Microsoft Windows Server	2012 R2 (64-bit)	In-Box / OCZ
Red Hat Enterprise Linux	6.x, 7.x	In-Box / OCZ
CentOS	6.x, 7.x	In-Box / OCZ
Oracle Linux	6.x, 7.x	In-Box / OCZ
Oracle Linux (Unbreakable)	6.x, 7.x	In-Box / OCZ
SUSE Linux Enterprise Server	11 SP3, 11 SP4, 12	In-Box / OCZ
Ubuntu Server	12.04 LTS	OCZ
Ubuntu Server	14.04 LTS, 15.04	In-Box / OCZ
VMWare	ESXi 5.0, 5.1	OCZ
VMWare	ESXi 5.5, 6.0	In-Box

System Boot Support

The Z-Drive 6000 Series supports boot use cases on current platforms through a UEFI NVMe driver installed in the host platform, and on legacy systems through an optional OptionROM. The OptionROM required for boot support on legacy platforms (and does not load a UEFI NVMe driver) is available for download on the OCZ Enterprise support website by accessing this link:
< http://ocz.com/enterprise/download/firmware>

OptionROM may be installed using the OCZ CLOUT tool.

8 Certifications and Compliance

Certification/Compliance	Description
CE Compliant	Indicates conformity with the essential health and safety requirements set out in European Directives Low Voltage Directive and EMC directive.
FCC Compliant B	FCC Class B devices are those that are for use in a commercial, industrial or business environment. Class B devices are those that are marketed for use in the home.
RoHS Compliant	Restriction of Hazardous Substance Directive
BSMI	Bureau of Standards, Metrology and Inspection
C-TICK	Australia's equivalent to the FCC Declaration of Conformity
VCCI	Voluntary Control Council for Interference by Information Technology Equipment or VCCI is the Japanese body governing RF emissions
KCC	Korea Communications Commission equivalent to the FCC Declaration of Conformity
UL	UL safety consulting and certification company
VMware driver certification	I/O Vendor Partner Program (IOVP) certification
UNH-IOL	NVMe Integrators List published by University of New Hampshire Interoperability Laboratory (UNH-IOL)
PCI-SIG	PCI consortium

9 Glossary

Term	Definition
CRC	Cyclic Redundancy Check
DAS	Device Activity Signal
DMA	Direct Memory Access
ECC	Error-Correction Code
EEPROM	Electrically Erasable Programmable Read Only Memory
GB	Gigabyte
Hot Plug	The removal or insertion of a drive when the system is powered on
IOPS	Input output operations per second
LBA	Logical Block Address
MB	Megabyte
MLC	Multi-Level Cell NAND
MTBF	Mean Time Between Failures
NVMe	Non-Volatile Memory express
OS	Operating System
PB	Petabyte
P/E	Program / Erase cycles (defines NAND life expectancy)
U.2	NVMe SFF Specification
SFF	Small Form Factor
SMART	Self-Monitoring, Analysis and Reporting Technology: open standard for SSDs, HDDs and software systems that automatically monitors a drive's health and reports potential problems.
SSD	Solid State Drive
TB	Terabyte
UBER	Uncorrectable Bit Error Rate

10 Revision History

Section	Description
Revision 1.0 (December 23, 2015)	
	Initial Release
Revision 1.1 (January 5, 2016)	
6 - Out of Band Management	Expanded VPD address information
Revision 1.2 (January 8, 2016)	
2.5 - Electrical Characteristics	Fixed In-rush spec for ZD6300
6 - Out of Band Management	Expanded temperature sensor information