



Industrial 2.5" SATA SSD Specification

(XCEL SERIES, 3D TLC)

Version 1.6

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1. GENERAL DESCRIPTION



1.1. Introduction

FLEXXON's XCEL 2.5" SATA Solid State Disk (SSD) has SATA III interface, and is fully compliant with the standard 2.5-inch form factor. It is designed with high density, ultimate performance and high reliability, suitable for enterprise applications.

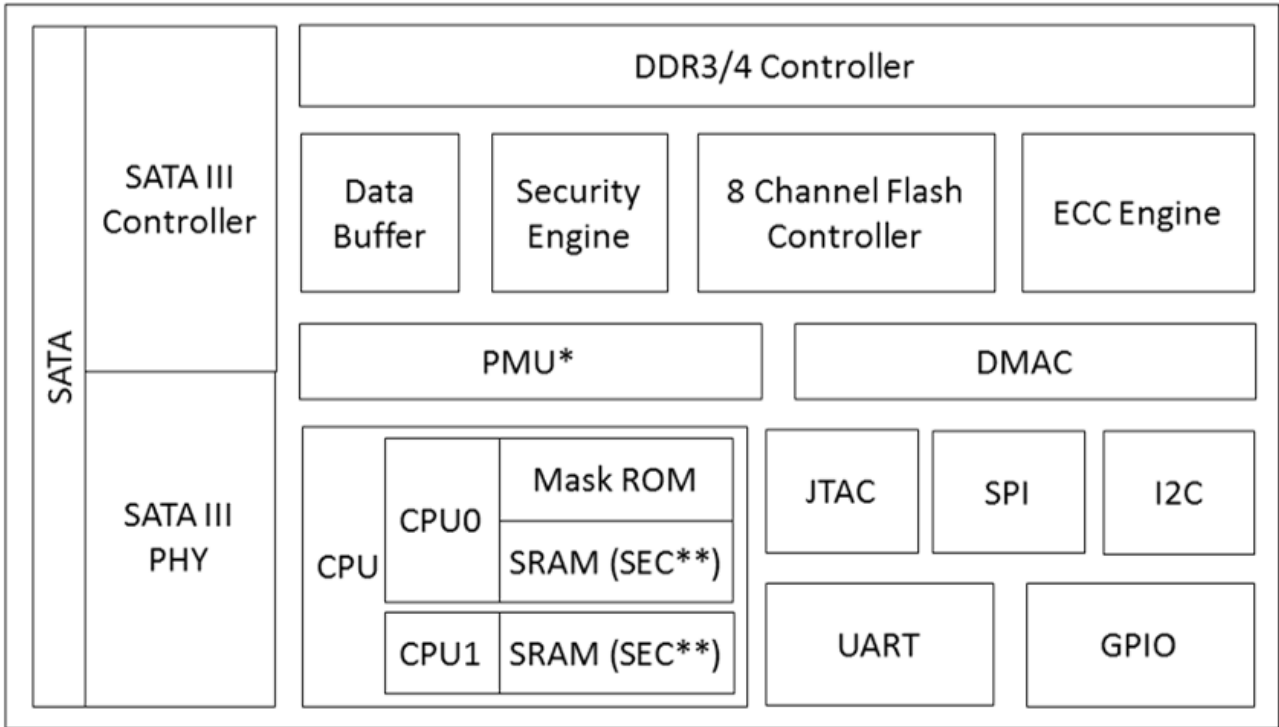


Figure 1-1 XCEL 2.5" SATA SSD Controller Block Diagram

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1.2. Product Overview

❖ Flash

- 3D TLC

❖ Capacity

- 240GB up to 7680GB

❖ SATA Interface

- Compliant with SATA Revision 3.2
- Compatible with SATA 1.5Gbps, 3Gbps and 6Gbps interface

❖ ECC Scheme

- XCEL applies LDPC (Low Density Parity Check) of ECC algorithm

❖ UART Function

❖ GPIO

❖ Support SMART and TRIM commands

❖ Low Power Management

❖ Power Loss Protection Algorithm

❖ Support TCG OPAL/AES256

❖ Temperature Range

- Operation (Silver): 0°C ~ 70°C
- Operation (Diamond): -40°C ~ 85°C
- Storage: -40°C ~ 85°C

❖ RoHS Compliant

2. PRODUCT SPECIFICATIONS



2.1. Performance

Table 2-1 Performance of XCEL 2.5" SATA SSD

Capacity	Sequential	
	Read (MB/s)	Write (MB/s)
240GB ~7680GB	550	530

NOTES:

1. The performance was measured using CrystalDiskMarkv5.0x64 with SATA 6Gbps host.
2. Performance may differ according to flash configuration and platform.

2.2. Power

Table 2-2 Supply Voltage of XCEL 2.5" SATA SSD

Parameter	Rating
Operating Voltage	5V

2.3. TBW (Terabytes Written)

Capacity	TBW
240GB	378
480GB	794
960GB	1580
1920GB	3118
3840GB	6114
7680GB	11751

NOTES:

1. TBW may differ according to flash configuration and platform.
2. Samples were tested under JESD218A endurance test method and JESD219A endurance workloads specification.

2.4. 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 predicted result of FLEXXON's XCEL 2.5" SATA SSD is more than 2 million hours.

2.5. Data Retention

- 10 years if > 90% life remaining (@25C)
- 1 year if < 10% life remaining (@25C)

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3. ENVIRONMENTAL SPECIFICATIONS



Test Items	Test Conditions
Storage Temperature	-40°C ~ 85°C
Operating Temperature	Silver Grade: 0°C ~ 70°C Diamond Grade: -40°C ~ 85°C
Storage Humidity	40°C, 93% RH
Operating Humidity	40°C, 90% RH
Shock	1500G, Half Sin Pulse Duration 0.5ms
Vibration	80Hz ~ 2000Hz/20G, 20Hz ~ 80Hz/1.52mm, 3 axis/60min
Drop	80cm free fall, 6 face of each unit
Bending	≥ 20N, Hold 1 min/5 times
ESD	24°C, 49% RH, +/-4KV

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4. ATA COMMANDS



Table 4-1 ATA Command List

Op Code	Support	Description	Op Code	Support	Description	
00h	Y	NOP	B6h	12h	-	NV Cache: QUERY NV CACHE PINNED SET DMA EXT
03h	-	CFA REQUEST EXTENDED ERROR	B6h	13h	-	NV Cache: QUERY NV CACHE MISSES DMA EXT
06h	Y	DATA SET MANAGEMENT	B6h	14h	-	NV Cache: FLUSH NV CACHE
08h	-	DEVICE RESET	C4h		Y	READ MULTIPLE
0Bh	-	REQUEST SENSE DATA EXT	C5h		Y	WRITE MULTIPLE
10h	Y	RECALIBRATE	C6h		Y	SET MULTIPLE MODE
11h-1Fh	-	RECALIBRATE	C7h		-	READ DMA QUEUED
20h	Y	READ SECTOR(S)	C8h		Y	READ DMA
21h	Y	READ SECTOR(S) WITHOUT RETRY	C9h		Y	READ DMA WITHOUT RETRY
22h	-	READ LONG	CAh		Y	WRITE DMA
23h	-	READ LONG WITHOUT RETRY	CBh		Y	WRITE DMA WITHOUT RETRY
24h	Y	READ SECTOR(S) EXT	CCh		-	WRITE DMA QUEUED
25h	Y	READ DMA EXT	CDh		-	CFA WRITE MULTIPLE WITHOUT ERASE
26h	-	READ DMA QUEUED EXT	CEh		Y	WRITE MULTIPLE FUA EXT
27h	Y	READ NATIVE MAX ADDRESS EXT	D1h		-	CHECK MEDIA CARD TYPE
29h	Y	READ MULTIPLE EXT	DAh		-	GET MEDIA STATUS
2Ah	-	READ STREAM DMA EXT	DEh		-	MEDIA LOCK
2Bh	-	READ STREAM EXT	DFh		-	MEDIA UNLOCK

2Fh	Y	READ LOG EXT	E0h		Y	STANDBY IMMEDIATE
30h	Y	WRITE SECTOR(S)	E1h		Y	IDLE IMMEDIATE
31h	Y	WRITE SECTOR(S) WITHOUT RETRY	E2h		Y	STANDBY
32h	-	WRITE LONG	E3h		Y	IDLE
33h	-	WRITE LONG WITHOUT RETRY	E4h		Y	READ BUFFER
34h	Y	WRITE SECTOR(S) EXT	E5h		Y	CHECK POWER MODE
35h	Y	WRITE DMA EXT	E6h		Y	SLEEP
36h	-	WRITE DMA QUEUED EXT	E7h		Y	FLUSH CACHE
37h	Y	SET MAX ADDRESS EXT	E8h		Y	WRITE BUFFER
38h	-	CFA WRITE SECTORS WITHOUT ERASE	E9h		Y	READ BUFFER DMA
39h	Y	WRITE MULTIPLE EXT	EAh		Y	FLUSH CACHE EXT
3Ah	-	WRITE STREAM DMA EXT	EBh		Y	WRITE BUFFER DMA
3Bh	-	WRITE STREAM EXT	ECh		Y	IDENTIFY DEVICE
3Ch	-	WRITE VERIFY	EDh		-	MEDIA EJECT
3Dh	Y	WRITE DMA FUA EXT	EEh		-	IDENTIFY DEVICE DMA
3Eh		WRITE DMA QUEUED FUA EXT	EFh	01h	-	SET FEATURES: Enable 8-bit PIO transfer mode (CFA feature set only)
3Fh	-	WRITE LOG EXT	EFh	02h	Y	SET FEATURES: Enable write cache
40h	Y	READ VERIFY SECTOR(S)	EFh	03h	Y	SET FEATURES: Set transfer mode based on value in Count field
41h	Y	READ VERIFY SECTOR(S) WITHOUT RETRY	EFh	05h	Y	SET FEATURES: Enable advanced power management
42h	Y	READ VERIFY SECTOR(S) EXT	EFh	06h	-	SET FEATURES: Enable Power-Up In Standby feature set

44h	-	Reserved	EFh	07h	-	SET FEATURES: Power-Up In Standby feature set device spin-up	
45h	O	WRITE UNCORRECTABLE EXT	EFh	0Ah	-	SET FEATURES: Enable CFA power mode 1	
47h	Y	READ LOG DMA EXT	EFh	0Bh	-	SET FEATURES: Enable Write-Read-Verify feature set	
50h	-	FORMAT TRACK	EFh	10h	01h	-	SET FEATURES: Enable use of Serial ATA feature
51h	-	CONFIGURE STREAM	EFh	10h	02h	Y	SET FEATURES: Enable DMA Setup FIS Auto-Activate optimization
57h	Y	WRITE LOG DMA EXT	EFh	10h	03h	Y	SET FEATURES: Enable Device-initiated interface power state (DIPM) transitions
60h	Y	READ FPDMA QUEUED	EFh	10h	04h	-	SET FEATURES: Enable use of Serial ATA feature
61h	Y	WRITE FPDMA QUEUED	EFh	10h	05h	-	SET FEATURES: Enable use of Serial ATA feature
70h	Y	SEEK	EFh	10h	06h	O	SET FEATURES: Enable Software Settings Preservation (SSP)
71-76h	-	SEEK	EFh	10h	07h	Y	SET FEATURES: Enable Device Automatic Partial to Slumber transitions
77h	Y	SET DATE AND TIME EXT	EFh	10h	09h	O	SET FEATURES: Enable Device Sleep

78h	Y	ACCESSIBLE MAX ADDRESS CONFIGURATION	EFh	42h	-	SET FEATURES: Enable Automatic Acoustic Management feature set
79-7Fh	-	SEEK	EFh	43h	-	SET FEATURES: Set Maximum Host Interface Sector Times
87h	-	CFA TRANSLATE SECTOR	EFh	44h	-	SET FEATURES: Vendor Specific ECC byte
90h	Y	EXECUTE DEVICE DIAGNOSTIC	EFh	55h	Y	SET FEATURES: Disable read look-ahead feature
91h	Y	INITIALIZE DEVICE PARAMETERS	EFh	5Dh	-	SET FEATURES: Enable release interrupt
92h	Y	DOWNLOAD MICROCODE	EFh	5Eh	-	SET FEATURES: Enable service interrupt
93h	Y	DOWNLOAD MICROCODE DMA	EFh	5Fh	-	SET FEATURES: Enable NDRQ Feature
94h	-	STANDBY IMMEDIATE	EFh	66h	Y	SET FEATURES: Disable reverting to power-on defaults
95h	-	IDLE IMMEDIATE	EFh	81h	-	SET FEATURES: Disable 8-bit PIO transfer mode (CFA feature set only)
96h	-	STANDBY	EFh	82h	Y	SET FEATURES: Disable write cache
97h	-	IDLE	EFh	85h	Y	SET FEATURES: Disable advanced power management
98h	-	CHECK POWER MODE	EFh	86h	-	SET FEATURES: Disable Power-Up In Standby feature set
99h	-	SLEEP	EFh	8Ah	-	SET FEATURES: Disable

							CFA power mode	
A0h	-	PACKET	EFh	8Bh	-		SET FEATURES: Disable Write-Read-Verify feature set	
A1h	-	IDENTIFY PACKET DEVICE	EFh	90h	01h	-	SET FEATURES: Disable use of Serial ATA feature	
A2h	-	SERVICE	EFh	90h	02h	Y	SET FEATURES: Disable DMA Setup FIS Auto Activate optimization	
B0h	D0h	Y	SMART: READ DATA	EFh	90h	03h	Y	SET FEATURES: Disable Device-initiated interface power state (DIPM) transitions
B0h	D1h	Y	SMART: READ ATTRIBUTE THRESHOLDS	EFh	90h	03h	-	SET FEATURES: Disable use of Serial ATA feature
B0h	D2h	Y	SMART: ENABLE/DISABLE AUTOSAVE	EFh	90h	06h	Y	SET FEATURES: Disable Software Settings Preservation (SSP)
B0h	D4h	Y	SMART: EXECUTE OFF-LINE IMMEDIATE	EFh	90h	07h	Y	SET FEATURES: Disable Device Automatic Partial to Slumber transitions
B0h	D5h	Y	SMART: READ LOG	EFh	90h	09h	0	SET FEATURES: Disable Device Sleep
B0h	D6h	Y	SMART: WRITE LOG	EFh	AAh		Y	SET FEATURES: Enable read look-ahead feature
B0h	D8h	Y	SMART: ENABLE OPERATIONS	EFh	BBh		-	SET FEATURES: Default ECC byte
B0h	D9h	Y	SMART: DISABLE OPERATIONS	EFh	C2h		-	SET FEATURES: Disable Automatic Acoustic Management feature set

B0h	DAh	Y	SMART: RETURN STATUS	EFh	C3h	-	SET FEATURES: Enable/Disable the Sense Data Reporting feature set
B0h	DBh	Y	SMART: ENABLE/DISABLE AUTOMATIC OFF-LINE	EFh	CCh	Y	SET FEATURES: Enable reverting to power-on defaults
B0h	E0h	-	SMART: Vendor specific	EFh	DDh	-	SET FEATURES: Disable release interrupt
B1h	C0h	Y	DEVICE CONFIGURATION: RESTORE	EFh	DEh	-	SET FEATURES: Disable SERVICE interrupt
B1h	C1h	Y	DEVICE CONFIGURATION: FREEZE LOCK	EFh	DFh	-	SET FEATURES: Disable NDRQ Feature
B1h	C2h	Y	DEVICE CONFIGURATION: IDENTIFY	F1h		Y	SECURITY SET PASSWORD
B1h	C3h	Y	DEVICE CONFIGURATION: SET	F2h		Y	SECURITY UNLOCK
B1h	C4h	Y	DEVICE CONFIGURATION: IDENTIFY DM	F3h		Y	SECURITY ERASE PREPARE
B1h	C5h	Y	DEVICE CONFIGURATION: SET DMA	F4h		Y	SECURITY ERASE UNIT
B4h	0000h	O	SANITIZE DEVICE: SANITIZE STATUS EXT	F5h		Y	SECURITY FREEZE LOCK
B4h	0011h	O	SANITIZE DEVICE: CRYPTO SCRAMBLE EXT	F6h		Y	SECURITY DISABLE PASSWORD
B4h	0012h	O	SANITIZE DEVICE: BLOCK ERASE EXT	F8h		Y	READ NATIVE MAX ADDRESS
B4h	0014h	O	SANITIZE DEVICE: OVERWRITE EXT	F9h	00h	Y	SET MAX: SET MAX ADDRESS

B4h	0020h	O	SANITIZE DEVICE: SANITIZE FREEZE LOCK EXT	F9h	01h	Y	SET MAX: SET MAX PASSWORD
B4h	0040h	O	SANITIZE DEVICE: SANITIZE ANTIFREEZE LOCK EXT	F9h	02h	Y	SET MAX: SET MAX LOCK
B6h	00h	-	NV Cache: SET NV CACHE POWER MODE EXT	F9h	03h	Y	SET MAX: SET MAX UNLOCK
B6h	01h	-	NV Cache: RETURN FROM NV CACHE POWER MODE EXT	F9h	04h	Y	SET MAX: SET MAX FREEZE LOCK
B6h	10h	-	NV Cache: ADD LBA(S) TO NV CACHE PINNED SET DMA EXT	F9h	05h	Y	SET MAX: SET MAX PASSWORD DMA
B6h	11h	-	NV Cache: REMOVE LBA(S) FROM NV CACHE PINNED SET DMA EXT	F9h	06h	Y	SET MAX: SET MAX UNLOCK DMA

NOTE: "Y" means "Support".

"O" means "Option, default No support".

"-" means "No support".

5. PIN ASSIGNMENT

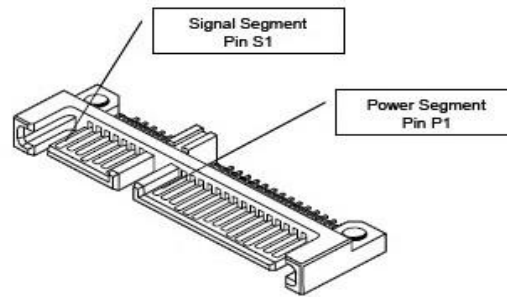


Figure 5-1 XCEL 2.5" SATA SSD Pin Assignment

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

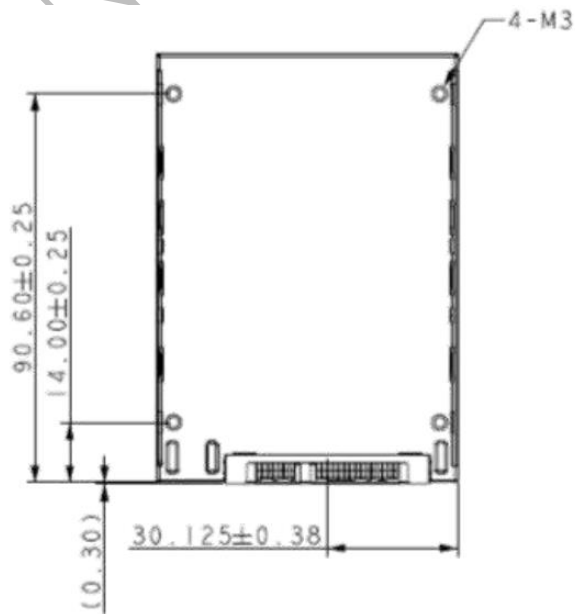
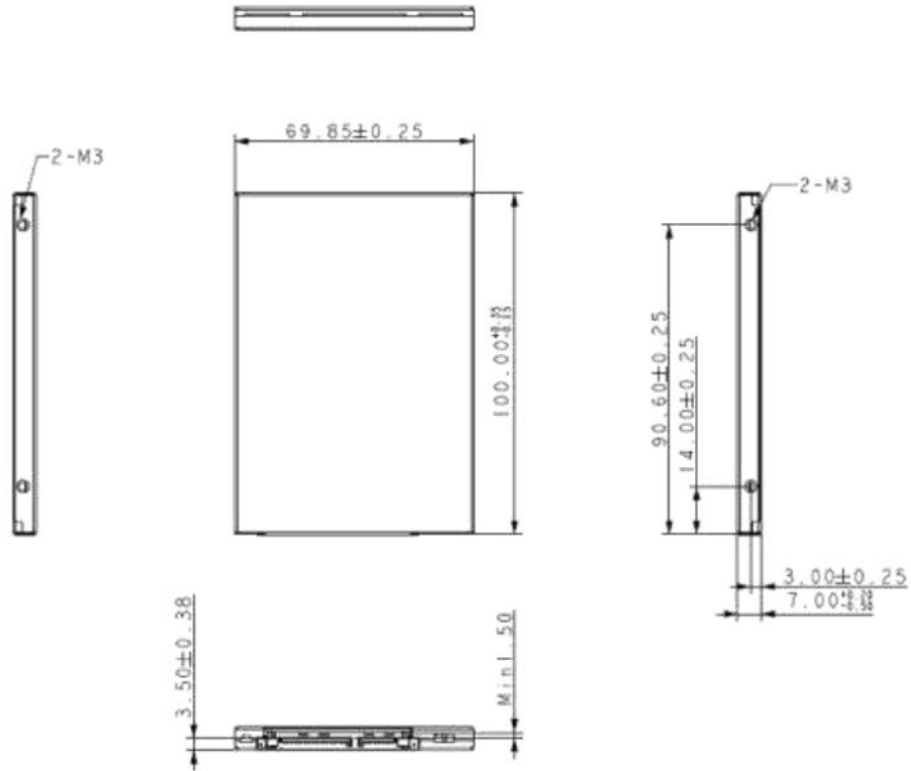
Table 5-2 Power Segment Pin Assignment and Descriptions

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. PHYSICAL DIMENSION



Dimension: 100mm (L) x 69.85mm (W) x 7.00mm(H)



7. ORDERING INFORMATION



Support TCG OPAL/AES

Capacity	MPN (Silver Grade)	MPN (Diamond Grade)
240GB	FSSB240GBS-SE0S	FSSB240GBE-SE0S
480GB	FSSB480GBS-SE0S	FSSB480GBE-SE0S
960GB	FSSB960GBS-SE0S	FSSB960GBE-SE0S
1920GB	FSSB1920BS-SE0S	FSSB1920BE-SE0S
3840GB	FSSB3840BS-SE0S	FSSB3840BE-SE0S
7680GB	FSSB7680BS-SE0S	FSSB7680BE-SE0S *

Support TCG OPAL/AES with conformal coating

Capacity	MPN (Silver Grade)	MPN (Diamond Grade)
240GB	FSSB240GBS-SE0V	FSSB240GBE-SE0V
480GB	FSSB480GBS-SE0V	FSSB480GBE-SE0V
960GB	FSSB960GBS-SE0V	FSSB960GBE-SE0V
1920GB	FSSB1920BS-SE0V	FSSB1920BE-SE0V
3840GB	FSSB3840BS-SE0V	FSSB3840BE-SE0V
7680GB	FSSB7680BS-SE0V	FSSB7680BE-SE0V *

* Please check with FLEXXON

Revision History

Revision	Draft Date	History
1.0	2018/11	Preliminary Release
1.1	2019/02	Update template and TBW
1.2	2019/04	Update ordering information
1.3	2019/04	Update ordering number with conformal coating
1.4	2019/05	Update ordering number
1.5	2019/06	Update capacity
1.6	2020/02	Update TBW