



# SMART Storage Products

Product Specification

## SMART Modular XceedUltraX2 Solid State Drive



2.5" Data Storage

December 2009, Rev F  
PN: 810100014-1N



[www.smartm.com](http://www.smartm.com)

## REVISION HISTORY

Date	Revision	Section(s)	Description
Nov 2008	A	All	Prepared for release.
Dec 2008	B	Performance	Adjusted performance numbers.
Feb 2009	C	Power	Adjusted numbers based on testing.
Apr 2009	D	Mechanical Drawing and Environmental Testing	Added center line callouts. Removed "pending."
Oct 2009	E	Power and ATA Commands	Added average and rms values for all capacities; specified commands the drive blocks when write protect is enabled.
Dec 2009	F	All	Added information for -34N drives.



### ESD Caution – Handling

Static electricity may be discharged through this disk subsystem. In extreme cases, this may temporarily interrupt the operation or damage components. To prevent this, make sure you are working in an ESD-safe environment. For example, before handling the disk subsystem, touch a grounded device, such as a computer case, prior to handling.

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Where listed for specific models, performance characteristics for other models may differ.

One gigabyte, or GByte, equals one billion bytes when referring to drive capacity. Accessible capacity may vary based on the operating environment and drive formatting.



America

## TABLE OF CONTENTS

<b>1.0</b>	<b>Introduction</b>	<b>2</b>	<b>5.0</b>	<b>Drive Configuration</b>	<b>11</b>
1.1	Product Description	2	5.1	Pin Configuration	11
1.2	Key Features	2	5.2	Power Pinout Descriptions	11
1.3	Block Diagram	3	5.3	Signal Pinout Descriptions	12
1.4	Optional Features	4	5.4	Remote LED	12
<b>2.0</b>	<b>Product Specifications</b>	<b>4</b>	5.5	J1 Jumper Options	13
2.1	Physical Characteristics	4	5.6	JP1 Jumper Options	13
2.2	Interface	6	<b>6.0</b>	<b>Supported ATA Commands</b>	<b>14</b>
2.3	Performance	6	<b>7.0</b>	<b>Supported S.M.A.R.T. Operations</b>	<b>16</b>
2.3.1	Sustained and Random Performance	6	<b>8.0</b>	<b>Ordering Information</b>	<b>18</b>
2.3.2	Access/Startup Times	6	<b>9.0</b>	<b>Related Documents</b>	<b>18</b>
2.4	Capacity	7	<b>10.0</b>	<b>Contact Information</b>	<b>19</b>
2.5	Supply Voltage	7	10.1	SMART Modular Technologies Headquarters	19
2.6	Power Consumption	7	10.2	Phoenix Design Center and North American Sales	19
<b>3.0</b>	<b>Reliability Characteristics</b>	<b>9</b>	10.3	International Sales	19
<b>4.0</b>	<b>Environmental Specifications</b>	<b>9</b>	10.4	Worldwide Technical Support	19
4.1	Temperature	9			
4.2	Operating Environment	9			
4.3	Shock and Vibration	10			
4.4	Regulations	10			

## 1.0 INTRODUCTION

This product specification defines the architecture, attributes, performance, technologies, and compliance and regulatory requirements for the XceedUltraX2 2.5" SATA data storage drive.

### 1.1 Product Description

The XceedUltraX2 2.5" SATA data storage drive is powered by the patented ArrayPro<sup>®</sup> performance engine to deliver a high-performance solution for a wide range of applications. The XceedUltraX2 2.5" SATA solid state drive (SSD) leverages this unique ArrayPro technology to provide true sustained write and read performance.

These 2.5-inch flash SSDs can easily replace standard 2.5-inch hard disk drives (HDDs), providing full HDD functionality with higher reliability and superior performance. In addition, the XceedUltraX2 2.5" SATA SSD contains no moving parts. The XceedUltraX2 2.5" SATA SSD is far superior to HDDs in terms of ruggedness, shock resistance, environmental resilience, and performance in no-compromise applications.

### 1.2 Key Features

- High capacity in a 2.5" form factor; up to 128 GBytes in 9.5 mm and 256 GBytes in 16.0 mm
- High performance
  - ◆ **Burst:** 300 MBytes/sec
  - ◆ **Sustained Read:** Up to 100 MBytes/sec <sup>1</sup>
  - ◆ **Sustained Write:** Up to 74 MBytes/sec <sup>1</sup>
  - ◆ **Access time:** 272  $\mu$ sec
- ATA-7-compliant with speeds of 1.5 Gbits/sec and 3.0 Gbits/sec
- Write protection for enhanced security
- High reliability with single-level cell (SLC) flash
  - ◆ **Mean Time Between Failure:** 1,300,000 hours <sup>2</sup>
  - ◆ **Non-Operating Shock:** 1500 g, half-sine, 0.5 ms, 1 shock along each axis: X, Y, and Z
  - ◆ **Operating Shock:** 50 g half-sine, 11 ms, 3 shocks along each axis: X, Y, and Z
  - ◆ **Operating Vibration:** Tested with the following categories: 12 for jets; 13 for propeller aircraft; 14 for helicopters; and 20 for ground vehicles
  - ◆ **Commercial Operating Temperature:** 0°C to 70°C
  - ◆ **Industrial Operating Temperature:** -40°C to 85°C
  - ◆ **Data Retention:** 10 years at 25°C

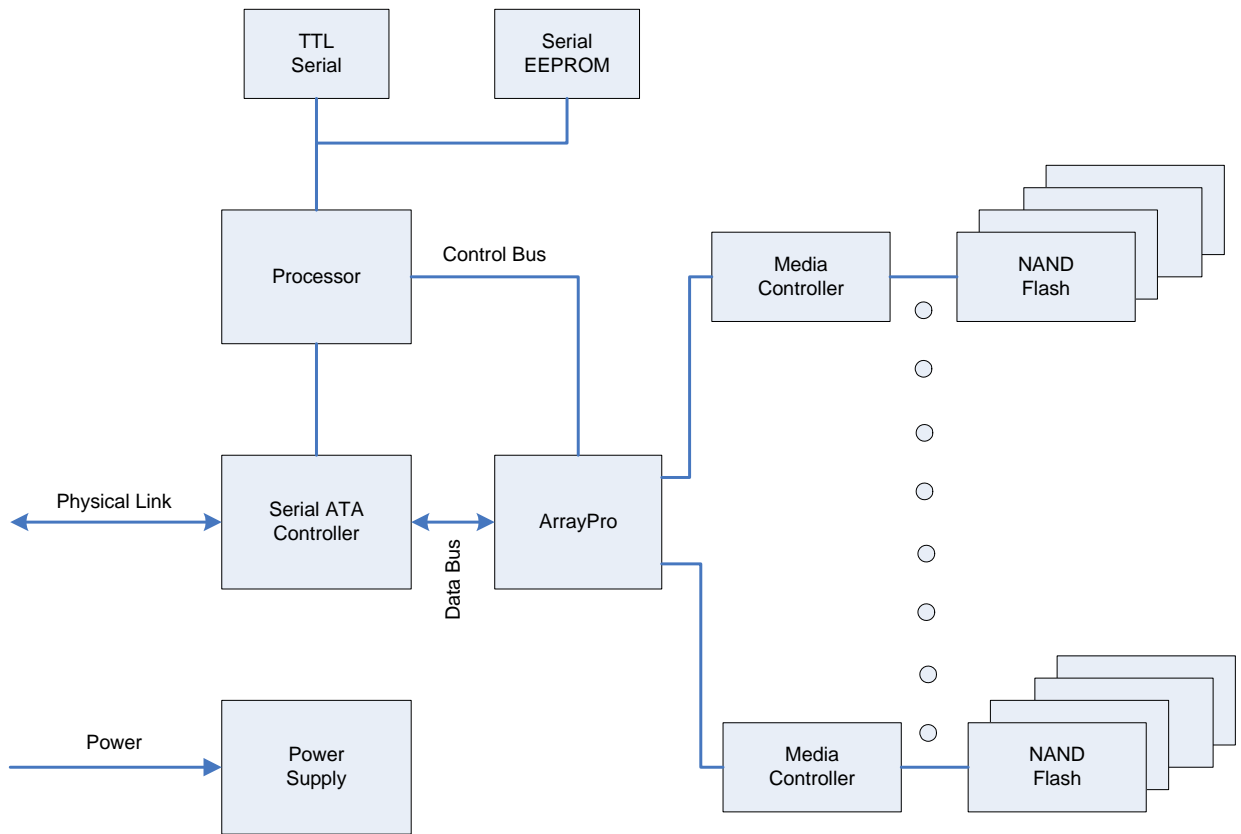
<sup>1</sup> Sustained performance numbers are calculated using an A25FBS-32GC33N drive with 128 KByte transfers.

<sup>2</sup> Calculated using an A25FBS-64GC33N. Based on Telcordia, Ground Benign Controlled at 25°C.

- Superior flash management
  - ◆ Error Correction Code (ECC)/Error Detection Code (EDC) - up to 6 bytes in a 512-byte sector
  - ◆ Static Wear Leveling
  - ◆ Bad Block Management
  - ◆ > 260 years @ 200 GBytes/day (64 GByte drive)<sup>3</sup>
- Three-year limited warranty

### 1.3 Block Diagram

Figure 1: XceedUltraX2 2.5" SATA SSD Block Diagram



<sup>3</sup> Based on 128 KByte block transfers and continuous, sequential writes to the drive. The number does not include file system overhead, which may vary depending on the file system. The total life span of the drive depends on both the write endurance numbers and MTBF. One kilobyte, or KByte, is equal to 1024 bytes.

## 1.4 Optional Features

- Conformal Coating
- BGA Underfill

## 2.0 PRODUCT SPECIFICATIONS

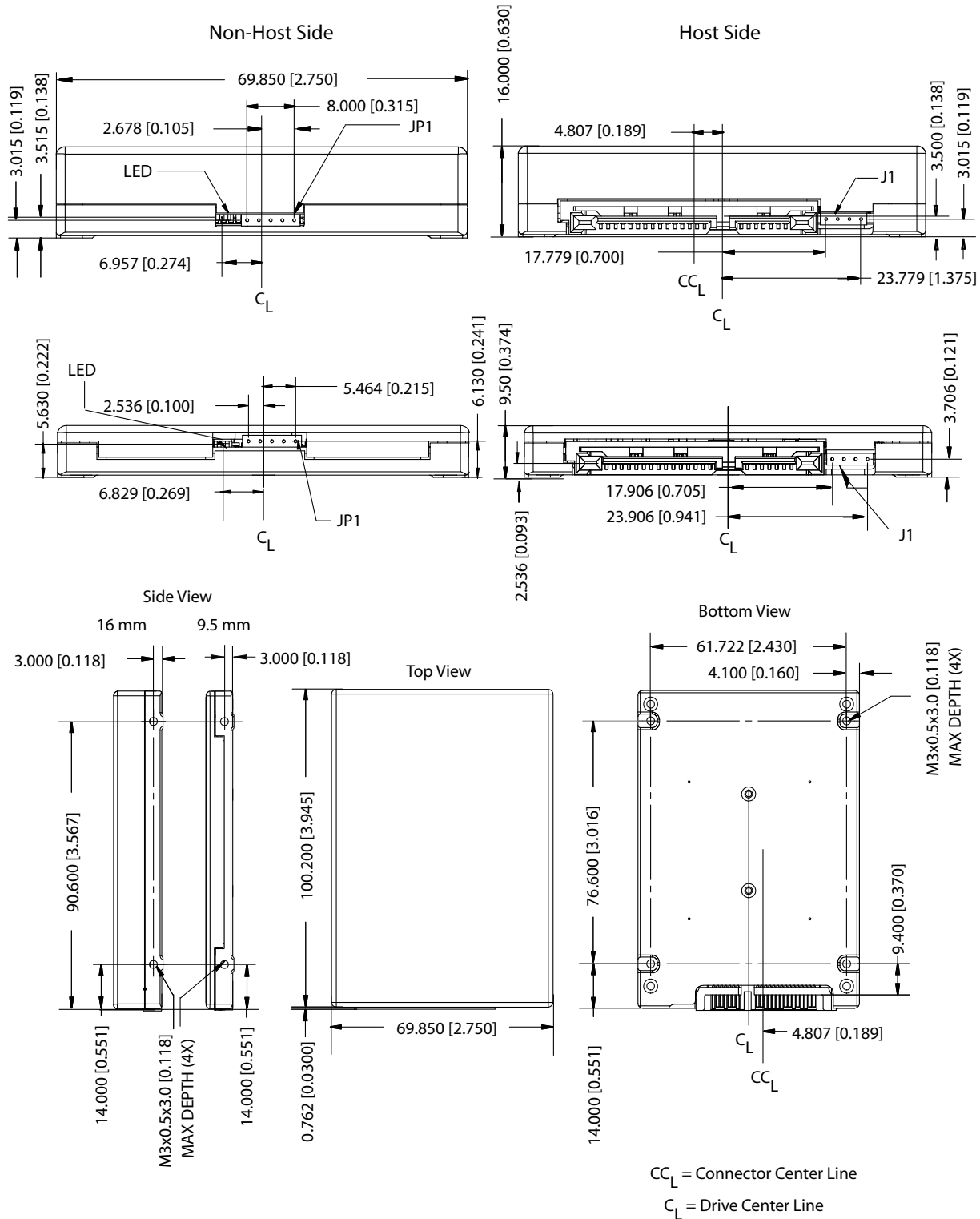
### 2.1 Physical Characteristics

The following table describes the XceedUltraX2 2.5" SATA SSD dimensions, with the maximum weight. For detailed mounting configurations, see [Figure 2](#).

**Table 1:** Physical Dimensions

Parameter	Model	Value (Max)	Capacities
Height	A25FBX-33N	9.50 mm [0.37"]	32, 64, 128 GBytes
	A25FBX-34N	16.00 mm [0.63"]	256 GBytes
Weight	A25FBX-33N	104.80 g [3.70 oz]	128 GBytes
	A25FBX-34N	172.00 g [6.07 oz]	256 GBytes
Depth	All	100.2 mm [3.94"]	
Width	All	69.9 mm [2.75"]	

Figure 2: XceedUltraX2 2.5" SATA SSD Physical Dimensions (in mm [inches])



Mechanical specifications comply with Serial ATA Revision 2.6 Specification available from the Serial ATA International Organization.

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## 2.2 Interface

The XceedUltraX2 2.5" SATA SSD supports ATA modes of operation, as shown in [Table 2](#), and complies with the ATA/ATAPI-7; ANSI INCITS 397-2005, AT Attachment with Packet Interface-7 standard.

**Table 2:** ATA Modes of Operation

Mode	Support
PIO	0, 1, 2, 3, 4
Multiword DMA	0, 1, 2
Ultra DMA	0, 1, 2, 3, 4, 5, 6, 7

## 2.3 Performance

[Tables 3](#) and [4](#) show the performance specifications, which are based on the A25FBX-32GC33N.

### 2.3.1 Sustained and Random Performance

**Table 3:** Sustained and Random Read/Write Performance

Parameter	Value
Burst Read	300 MBytes/sec <sup>4</sup>
Burst Write	300 MBytes/sec
Sustained Read <sup>5</sup>	Up to 100 MBytes/sec
Sustained Write	Up to 74 MBytes/sec
Random Read <sup>6</sup>	2745 Input/Output Operations Per Second (IOPS)
Random Write	13 IOPS

### 2.3.2 Access/Startup Times

**Table 4:** Access/Startup Performance

Parameter	Value (Typ)
Start Up Time (Reset to Busy)	25 $\mu$ secs
Start Up Time (Reset to Not Busy)	2.5 sec
Access Time	272 $\mu$ sec
Seek Time	0

<sup>4</sup> One megabyte, or MByte, equals 1,048,576 bytes.

<sup>5</sup> Sustained performance values are based on 128 KByte transfers.

<sup>6</sup> Random performance values are based on 4 KByte transfers.

## 2.4 Capacity

Table 5 describes the available memory capacities for the XceedUltraX2 2.5" SATA SSD.<sup>7</sup>

**Table 5:** XceedUltraX2 2.5" SATA Capacities

Uninitialized Drive Capacity (GBytes)	Shipped Sector Count in LBA Mode <sup>8</sup>	Cylinder Heads Sectors (CHS)			
		Number of Logical Cylinders	Number of Logical Heads	Logical Sectors Per Track	Current Capacity (CHS)
<b>9.5 mm SSD</b>					
32	60899328	16383	16	63	16514064
64	121847040	16383	16	63	16514064
128	244012608	16383	16	63	16514064
<b>16.0 mm SSD</b>					
256	488025216	16383	16	63	16514064

## 2.5 Supply Voltage

**Table 6:** XceedUltraX2 2.5" SATA SSD Supply Voltage

Parameter	Min	Typ	Max	Units
Supply Voltage ( $V_{CC}$ )	4.75	5	5.25	V

## 2.6 Power Consumption

**Table 7:** XceedUltraX2 2.5" SATA SSD Power Consumption (A25FBX-32G33N)

Parameter	Maximum		Mean		RMS	
	mA	W	mA	W	mA	W
Sustained Read	970	4.9	340	1.7	350	1.8
Sustained Write	900	4.5	430	2.2	450	2.3
Idle	550	2.8	320	1.6	320	1.6
Startup	640	3.2	320	1.6	320	1.6
Hot Swap	620	3.1	330	1.7	340	1.7

<sup>7</sup> The ATA specification defines a limited number of bits for the cylinders, heads, and sectors (CHS). When using CHS-mode commands, the host can only access the first 16 GBytes, not the full drive capacity.

<sup>8</sup> This number does not include the OS file system overhead.

**Table 8:** XceedUltraX2 2.5" SATA SSD Power Consumption (A25FBX-64G33N)

Parameter	Maximum		Mean		RMS	
	mA	W	mA	W	mA	W
Sustained Read	900	4.5	340	1.7	350	1.8
Sustained Write	970	4.9	360	1.8	370	1.9
Idle	550	2.8	320	1.6	320	1.6
Startup	530	2.7	310	1.6	320	1.6
Hot Swap	660	3.3	350	1.8	350	1.8

**Table 9:** XceedUltraX2 2.5" SATA SSD Power Consumption (A25FBX-128G33N)

Parameter	Maximum		Mean		RMS	
	mA	W	mA	W	mA	W
Sustained Read	840	4.2	350	1.8	360	1.8
Sustained Write	860	4.3	410	2.1	430	2.2
Idle	420	2.1	330	1.7	330	1.7
Startup	660	3.3	330	1.7	330	1.7
Hot Swap	570	2.9	340	1.7	350	1.8

**Table 10:** XceedUltraX2 2.5" SATA SSD Power Consumption (A25FBX-256G34N)

Parameter	Maximum		Mean		RMS	
	mA	W	mA	W	mA	W
Sustained Read	1100	5.5	590	3.0	600	3.0
Sustained Write	1100	5.5	680	3.4	690	3.5
Idle	640	3.2	570	2.9	570	2.9
Startup	1100	5.5	580	2.9	580	2.9
Hot Swap	880	4.4	590	3.0	590	3.0

## 3.0 RELIABILITY CHARACTERISTICS

Table 11: Reliability Parameters

Parameter	Value
Bit Error Rate	< 1 non-recoverable in $10^{14}$ bits read
Data Retention	10 years at 25°C
ECC/EDC (Reed-Solomon)	6 bytes in a 512-byte sector
Write Endurance	> 260 years @ 200 GBytes/day for 64 GBytes <sup>9</sup>

## 4.0 ENVIRONMENTAL SPECIFICATIONS

### 4.1 Temperature

Table 12: Reliability Temperatures

Parameter	Min	Typ	Max
Commercial Operating Temperature ( $T_a$ )	0°C	25°C	70°C
Industrial Operating Temperature ( $T_a$ )	-40°C	--	85°C
Storage Temperature	-55°C	---	95°C

### 4.2 Operating Environment

Table 13: Operating Environment

Parameter	Value
Relative Humidity <sup>10</sup>	5% to 95% non-condensing
Operating Altitude <sup>11</sup>	24,384 m [80,000 ft]

<sup>9</sup> Based on 128 KByte block transfers and continuous, sequential writes to the drive. The number does not include file system overhead, which may vary depending on the file system. The total life span of the drive depends on both the write endurance numbers and MTBF. One kilobyte, or KByte, equals 1024 bytes.

<sup>10</sup> Based on MIL-STD-810F, Method 507.4.

<sup>11</sup> Based on MIL-STD-810F, Method 500.4 Procedure II.

### 4.3 Shock and Vibration

**Table 14:** Shock and Vibration

Parameter	Value
Non-Operating Shock <sup>12</sup>	1500 g half-sine, 0.5ms, 1 shock (+/- each) along the X, Y, and Z axes
Operating Shock <sup>13</sup>	50 g half-sine, 11 ms, 3 shocks (+/- each) along the X, Y, and Z axes
Operating Vibration - Random <sup>13</sup>	Drives are tested along 3-axes, X, Y, Z, in accordance with the following: <ul style="list-style-type: none"><li>• Category 12 for jets modified to 16.4 g rms, 10-2000 Hz random</li><li>• Category 12 for jets, 10 g rms</li><li>• Category 13 for propeller aircraft</li><li>• Category 14 for helicopters</li><li>• Category 20 for ground vehicle</li></ul>

### 4.4 Regulations

**Table 15:** Regulation Compliances

Regulation	Compliance
EMC/Emissions	EN 55022:1998+A1 & A2; CISPR 22:1997; FCC CFR 47 Part 15 Subpart B:2002
EMC/Immunity	EN 61000-4-2:1995; EN 61000-4-3:1998; EN 55024:1998, CISPR 24:1997
Safety	UL IEC 60950-1:2003; CSA C22.2 No. 60950-1
RoHS	EU Directive 2002/95/EC



<sup>12</sup> Based on MIL-STD-810F, Method 516.5-10 Procedure I (modified).

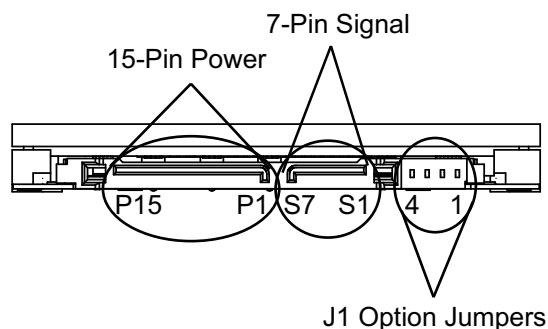
<sup>13</sup> Based on MIL-STD-810F, Method 514.5 Procedure I (modified for 16.4 g rms jet).

## 5.0 DRIVE CONFIGURATION

### 5.1 Pin Configuration

The XceedUltraX2 2.5" SATA SSD interface connector pinout is shown in Figure 3. Connector pinout descriptions are detailed in Table 16 and Table 17.

Figure 3: XceedUltraX2 2.5" SATA Connection View



### 5.2 Power Pinout Descriptions

Table 16: Power Pinout Descriptions

Pin	Signal	Description	Cable Use	Backplane Use
P1	Not Used (3.3 V)	N/A		
P2				
P3	Reserved (3.3 V)	Reserved		
P4	Not Used (GND)	N/A	1 <sup>st</sup> mate	1 <sup>st</sup> mate
P5	GND	Ground	1 <sup>st</sup> mate	2 <sup>nd</sup> mate
P6				
P7	5 V	5 V power, pre-charged, 2 <sup>nd</sup> mate	1 <sup>st</sup> mate	2 <sup>nd</sup> mate
P8	5 V	5 V power	2 <sup>nd</sup> mate	3 <sup>rd</sup> mate
P9				
P10	GND	Ground	1 <sup>st</sup> mate	2 <sup>nd</sup> mate
P11	EXTERNAL_LED	Reserved		
P12	GND	Ground	1 <sup>st</sup> mate	1 <sup>st</sup> mate
P13	Not Used (12 V)	N/A		
P14				
P15				

Values in parentheses indicate the SATA specification signal name.

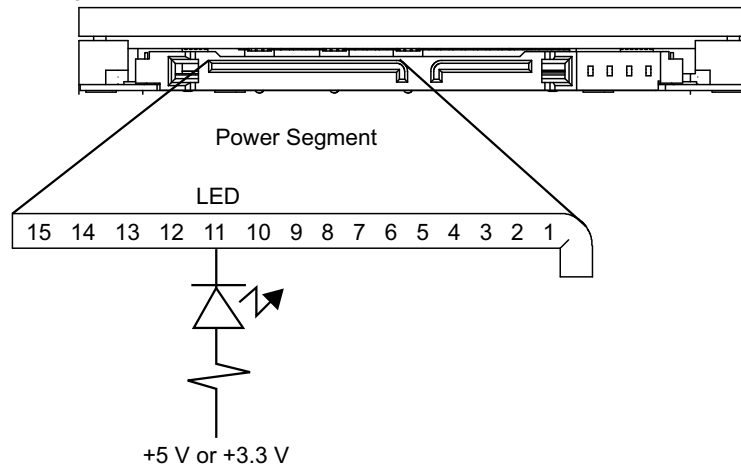
### 5.3 Signal Pinout Descriptions

**Table 17:** Signal Pinout Descriptions

Pin(s)	Signal	Description	Cable Use	Backplane Use
S2	Dev Rx+	Differential signal pair A from Phy	2 <sup>nd</sup> mate	3 <sup>rd</sup> mate
S3	Dev Rx-			
S5	Dev Tx-	Differential signal pair B from Phy	2 <sup>nd</sup> mate	3 <sup>rd</sup> mate
S6	Dev Tx+			
S1, S4, S7	GND	Ground	1 <sup>st</sup> mate	2 <sup>nd</sup> mate

### 5.4 Remote LED

In compliance with the SATA specification, Pin 11 on the SATA 15-pin power connector supports a remote LED to a 3.3 V or 5 V power source. If connecting a remote LED, select a series resistor to limit current to 10 mA or less. When connected, the remote LED indicates activity. Refer to the SATA specification for more details.

**Figure 4:** Remote LED Configuration

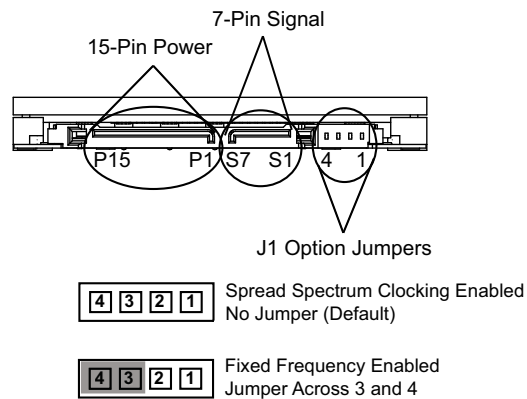
## 5.5 J1 Jumper Options

Table 18: J1 Jumper Options

Pin	Signal
1	Reserved
2	Reserved
3	SSC Disable
4	GND

Spread spectrum clocking (SSC) is enabled by default. To enable fixed frequency clocking, install a jumper across pins 3 and 4 on J1. See Figure 5 for the pin configuration.

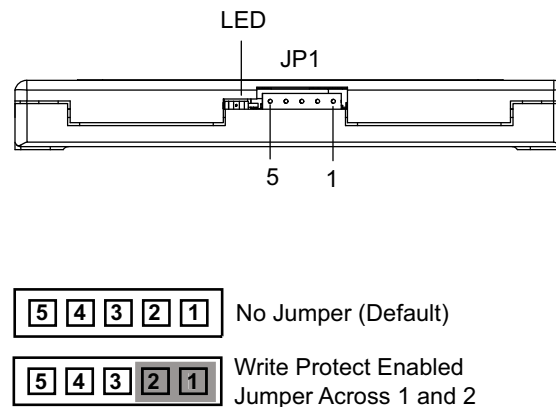
Figure 5: J1 Configuration



## 5.6 JP1 Jumper Options

The jumper on the XceedUltraX2 2.5" SATA SSD is shown in Figure 6. Pins 1 and 2 enable the Write Protect feature. By default, these pins are open.

Figure 6: JP1 Configurations



All other pins are reserved.

## 6.0 SUPPORTED ATA COMMANDS

The XceedUltraX2 2.5" SATA SSD supports the commands listed in the following table. For a complete description of these commands, see the ATA-7 Standard Specification. Commands listed with an asterisk (\*) are blocked if write protect is enabled on the drive.

**Table 19:** Supported ATA Commands

Command Name	Op Code (Hex)	Command Set (Category)
CFA Write Sectors w/o Erase*	38	CFA
Check Power Mode	E5	PwrMgmt
	98	PwrMgmt
Door Lock	DE	<i>See Media Lock</i>
Door Unlock	DF	<i>See Media Unlock</i>
Execute Device Diagnostic	90	General
Flush Cache	E7	General
Flush Cache Extended	EA	ExtLBA
Identify Device	EC	General
Idle	E3	PwrMgmt
	97	PwrMgmt
Idle Immediate	E1	PwrMgmt
	95	PwrMgmt
Initialize Device Parameters	91	General
Media Lock	DE	Removable Media
Media Unlock	DF	Removable Media
Read Buffer	E4	General
Read DMA	C8	General
Read DMA Ext	25	ExtLBA
Read DMA w/o Retries	C9	General
Read Log Ext	29	ExtLBA
Read Multiple	C4	General
Read Multiple Ext	29	ExtLBA
Read Native Max Address	F8	Protected
Read Native Max Address Ext	27	ExtLBA
Read Sectors	20	General
Read Sectors Ext	24	ExtLBA
Read Sectors w/o Retries	21	General
Read Verify Sectors	40	General

**Table 19:** Supported ATA Commands (Continued)

Command Name	Op Code (Hex)	Command Set (Category)
Read Verify Ext	42	ExtLBA
Read Verify w/o Retries	41	General
Recalibrate	10	General
	11-1F	General
Seek	70	General
	71-7F	General
Set Features	EF	General
Set Max Address	F9	Protected
Set Max Address Ext	37	ExtLBA
Set Multiple Mode	C6	General
Sleep	E6	PwrMgmt
	99	PwrMgmt
S.M.A.R.T. Operations	B0	S.M.A.R.T.
Standby	E2	PwrMgmt
	96	PwrMgmt
Standby Immediate	E0	PwrMgmt
	94	PwrMgmt
Write Buffer*	E8	General
Write DMA*	CA	General
Write DMA Ext*	35	ExtLBA
Write DMA w/o Retries*	CB	General
Write Log Ext*	3F	ExtLBA
Write Multiple*	C5	General
Write Multiple Ext*	39	ExtLBA
Write Sectors*	30	General
Write Sectors Ext*	34	ExtLBA
Write Sectors w/o Retries*	31	General
Write Verify*	3C	General

## 7.0 SUPPORTED S.M.A.R.T. OPERATIONS

Self-monitoring analysis and reporting technology (S.M.A.R.T.) commands provide diagnostic information regarding drive operation and, in certain cases, can assist in predicting drive degradation. Because S.M.A.R.T. alerts the host of possible drive problems, you can assess the situation and back up data prior to an operational failure.

Each S.M.A.R.T. attribute monitors a specific drive condition, with threshold levels configured for select attributes. When the drive exceeds these thresholds, the S.M.A.R.T. attribute reports the condition. In many cases, exceeding the threshold simply indicates you should monitor the drive more closely. Host systems initiate commands, generated manually or with a third-party diagnostic tool, to monitor S.M.A.R.T. attributes.

Although XceedUltraX2 2.5" SATA drives support several S.M.A.R.T. operations, which are subcommands of the S.M.A.R.T. Operations command (see [Table 20](#)), the S.M.A.R.T. Return Status and S.M.A.R.T. Read Data subcommands are used for monitoring the drive.

Initiating a S.M.A.R.T. Return Status command returns the current state of the drive, specifying whether or not an attribute exceeded the assigned threshold. If an attribute has exceeded a threshold level, SMART Modular Technologies recommends issuing the S.M.A.R.T. Read Data command to identify the specific attribute.

The S.M.A.R.T. Read Data command reads the following data from the S.M.A.R.T. attribute table (see [Table 21](#) for a description of the raw data returned for each attribute):

- Power-On Time
- Minimum Spares
- Temperature

**NOTE:**

For more details about S.M.A.R.T. operations, ask your representative for the *S.M.A.R.T. Attributes Technical Reference* for XceedUltraX2 drives.

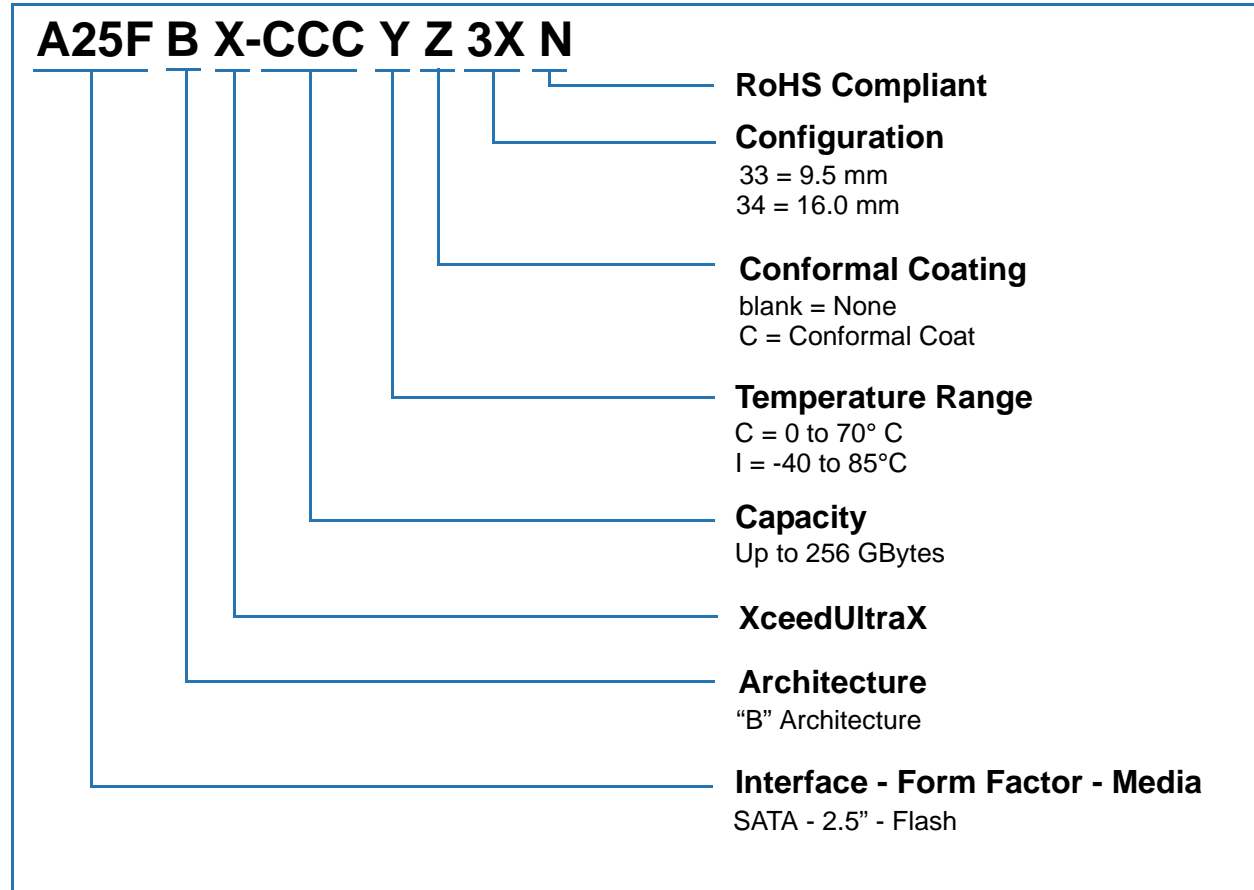
**Table 20:** Supported S.M.A.R.T. Subcommands

Subcommand Name	Feature Code (Hex)
S.M.A.R.T. Read Data	D0
S.M.A.R.T. Read Attribute Thresholds	D1
S.M.A.R.T. Read Log	D5
S.M.A.R.T. Write Log	D6
S.M.A.R.T. Enable Operations	D8
S.M.A.R.T. Disable Operations	D9
S.M.A.R.T. Return Status	DA
Read Configuration Page	E0
Write Configuration Page	E1
Set Passthrough	E2

**Table 21:** Supported S.M.A.R.T. Attributes

Attribute ID	Name	Description
9	Power-On Time	Indicates the total number of seconds the drive has had power applied to it.
130	Minimum Spares	Specifies the number of spare blocks remaining as a percentage of the spare blocks in the wear-leveling zone with the least number of spares.
194	Temperature	Returns the drive temperature in degrees Celsius.

## 8.0 ORDERING INFORMATION



**Table 22:** Available Model Numbers and Capacities

Model <sup>14</sup>	Capacity (GBytes)	Height (mm)
A25FBX-32GYZ33N	32	9.5
A25FBX-64GYZ33N	64	9.5
A25FBX-128GYZ33N	128	9.5
A25FBX-256GY34N	256	16.0

## 9.0 RELATED DOCUMENTS

- ATA/ATAPI-7 Standard Specification
- XceedUltraX2 2.5" SATA Product Summary
- XceedUltraX2 2.5" SATA Installation Manual
- S.M.A.R.T. Attributes Technical Reference (for XceedUltraX2 drives)

<sup>14</sup> In the model number, "Y" identifies the temperature range of the media (C = Commercial; I = Industrial), and "Z" indicates the conformal coating option (blank = None; C = Conformal Coated).

## 10.0 CONTACT INFORMATION

### 10.1 SMART Modular Technologies Headquarters

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