SOLID STATE STORAGE
TECHNOLOGY CORP.

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ENGINEERING SPECIFICATIONS

Solid State Drives
CVC Series Product Specification

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1 INTRODUCTION

1.1 Overview:

The CVC SATA 6 Gb/s Solid State Drive (SSD) delivers leading performance in an industry standard M.2 and 2.5" form factor while simultaneously improving system responsiveness for mobile applications over standard rotating drive media or hard disk drives. By combining leading NAND flash memory technology with our innovative high-performance firmware, SOLID STATE STORAGE delivers a SSD for native Serial Advanced Technology Attachment (SATA) hard disk drive drop-in replacement with enhanced performance, reliability, ruggedness and power savings. Since there are no rotating platters, moving heads, fragile actuators, or unnecessary delays due to spin-up time or positional seek time that can slow down the storage subsystem, significant I/O and throughput performance improvement is achieved as compared to rotating media or hard disk drives. This document describes the specifications of the CVC SATA SSD.

The CVC SSD primarily targets SATA based servers, fan less laptop PCs, highly rugged mobile client devices, as well as thin and light mini/sub-notebooks. Key attributes include high performance, low power, increased system responsiveness, high reliability, and enhanced ruggedness as compared to standard mobile SATA hard drives. The CVC SSD is available in both M.2 and 2.5" form factors that are electrically, mechanically, and software compatible with existing M.2 Serial ATA slots and cables. Our flexible design allows interchangeability with existing mobile hard drives based on the SATA interface standard.

1.2 Product Specification

1.2.1. Form Factor & Capacity:

Table 1-1 Product number, Capacity and Form Factor

Model Name	Capacity	Form Factor
CVC-4D128	128 GB	M.2 Type 2242-S2-B-M
CVC-4D256	256 GB	M.2 Type 2242-D2-B-M
CVC-4D512	512 GB	M.2 Type 2242-S2-B-M
CVC-4D1024	1024 GB	M.2 Type 2242-D2-B-M
CVC-4D2048	2048 GB	
CVC-8D128	128 GB	M.2 Type 2280-S2-B-M
CVC-8D256	256 GB	
CVC-8D512	512 GB	
CVC-8D1024	1024 GB	
CVC-8D2048	2048 GB	
CVC-CD128	128 GB	2.5”
CVC-CD256	256 GB	
CVC-CD512	512 GB	
CVC-CD1024	1024 GB	
CVC-CD2048	2048 GB	
CVC-4T128	128 GB	M.2 Type 2242-S2-M
CVC-4T256	256 GB	M.2 Type 2242-D2-B-M
CVC-4T512	512 GB	M.2 Type 2280-S2-M
CVC-4T1024	1024 GB	M.2 Type 2242-D2-B-M
CVC-8T128	128 GB	M.2 Type 2280-S2-B-M
CVC-8T256	256 GB	
CVC-8T512	512 GB	
CVC-8T1024	1024 GB	
CVC-CT128	128 GB	2.5”
CVC-CT256	256 GB	
CVC-CT512	512 GB	
CVC-CT1024	1024 GB	

Table 1-2 Product number, Capacity and Form Factor for Capacity Clipping

Model Name	Capacity	Form Factor
CVC-4D120	120 GB	M.2 Type 2242-S2-B-M
CVC-4D240	240 GB	M.2 Type 2242-D2-B-M
CVC-4D480	480 GB	M.2 Type 2242-S2-B-M

1.2.2. User Addressable Sectors:

Table 2-1 User Addressable Sectors

Unformatted capacity	Total user addressable sectors in LBA mode
128GB	250,069,680
256GB	500,118,192
512GB	1,000,215,216
1024GB	2,000,409,264
2048GB	4,000,797,360

Table 2-2 User Addressable Sectors for Capacity Clipping

Unformatted capacity	Total user addressable sectors in LBA mode
120GB	234,441,648
240GB	468,862,128
480GB	937,703,088

Notes:

1). 1GB=1,000,000,000 bytes and not all the memory can be used for storage.

2). 1 Sector = 512 bytes

1.2.3. Flash:

Triple-Level Cell (TLC) component with Toggle-Mode

1.2.4. Band Performance

Table 3 Maximum Sustained Read and Write Bandwidth on Windows 10 platform

Capacity	Access Type	MB/s (typ.)
128 GB **120 GB**	Sequential Read	Up to 550
	Sequential Write	Up to 450
256 GB **240 GB**	Sequential Read	Up to 550
	Sequential Write	Up to 480
512 GB **480 GB**	Sequential Read	Up to 550
	Sequential Write	Up to 490
1024 GB	Sequential Read	Up to 550
	Sequential Write	Up to 500
2048 GB	Sequential Read	Up to 550
	Sequential Write	Up to 510

Notes:

1). Performance measured using Crystal Disk Mark 7.0.0, QD8 T1, 1GiB test size, 5 cycles.

2). Write cache enabled & 4K boundary data.

3). Test by secondary drive (data drive & clean state) under SATA 6Gb/s.

4). Test platform: ASUS Z370 PRO (Windows 10 x64)

5). These values obtained in specific test environment at SSSTC and for reference purpose only. SSSTC does not warrant those values.

1.2.5. Read and Write IOPS

Table 4 Random Read/Write Input/Output Operations per Second on Windows 10 platform

Capacity	Access Type	IOPS(typ.)
128 GB	4K Random Read	38,000
120 GB	4K Random Write	65,000
256 GB	4K Random Read	50,000
240 GB	4K Random Write	70,000
512 GB	4K Random Read	60,000
480 GB	4K Random Write	70,000
1024 GB	4K Random Read	65,000
	4K Random Write	70,000
2048 GB	4K Random Read	65,000
	4K Random Write	75,000

Notes:

1). Performance measured using Crystal Disk Mark 7.0.0, QD32 T16, 1GiB test size, 5 cycles.

2). Write cache enabled & 4K boundary data.

3). Test by secondary drive (data drive & clean state) under SATA 6Gb/s.

4). Test platform: ASUS Z370 PRO (Windows 10 x64)

These values which are written as “typ.” are the values obtained in specific test environment at SSSTC and for reference purpose only. SSSTC does not warrant those values.

1.2.6. Ready Time

Table 5 Power on to Ready time Specifications

Type	Average Latency	Sudden POR
Power on to Ready	500ms	10s
Resume from DEVSLP	100ms	-

Notes:

1). Device measured form power-on to ready to receive first Media command.

2). Power On To Ready time assumes drive have normal shutdown process which have STANDBY IMMEDIATE command. Time varies and 90% within 10 seconds if shutdown is not preceded by STANDBY IMMEDIATE command.

3). Test results may be different on different platform.

4). Typical POR assumes proper shutdown (Power removal preceded by host Shutdown Notification)

1.2.7. Power Management

-- SATA interface power management

1.2.8. Compatibility

-- SATA Revision 3.0 compliant

Compatible with SATA 1.5Gb/s, 3.0Gb/s & 6.0Gb/s interface rates

-- ATA/ATAPI- 8 compliant

-- SSD enhanced SMART ATA feature set

-- Native Command Queuing (NCQ) command set

-- TRIM supported

1.2.9. Power Management

-- SATA interface power management

1.2.10. Power Consumption

Table 6 Operating Voltage & Current

Form-Factor	Description	Min	Max	Unit
2.5" Model	Operating voltage for 5V (+/- 5%)	4.75	5.25	V
M.2 Model	Operating voltage for 3.3V (+/- 5%)	3.135	3.465	V

Table 7 Power Consumption

Capacity	Mode	I/O Type	Typ.	Max.	Unit
128GB **120GB**	Operating	Read	0.9	1.5	W
		Write	0.9	1.5	W
	DEVSLP	-	-	5	mW
256GB **240GB**	Operating	Read	1	1.5	W
		Write	1	1.5	W
	DEVSLP	-	-	5	mW
512GB **480GB**	Operating	Read	1	1.5	W
		Write	1	1.5	W
	DEVSLP	-	-	5	mW
1024GB	Operating	Read	1	2	W
		Write	1	2	W
	DEVSLP	-	5	5	mW
2048GB	Operating	Read	1	2	W
		Write	1	2	W
	DEVSLP	-	-	5	mW

1.2.11. Temperature

Table 8 Temperature Relative Specifications

Environmental Class	Environment	Mode	Min	Max	Unit
WT-L	Ambient Temperature	Operating	-25	85[1]	°C
		Non-operating	-40	85	°C
	Humidity	Operation	5	95	%
		Non-operation	5	95	%
WT	Ambient Temperature	Operating	-40	85[1]	°C
		Non-operating	-40	85	°C
	Humidity	Operation	5	95	%
		Non-operation	5	95	%

Note:

1 Operating temperature is defined +85 °C which refers to the surface temperature of flash memory.

2 Measured without condensation.

1.2.12. Certifications

Table 9 Device Certifications

Certification	Description
CE compliant	Indicates conformity with the essential health and safety requirements set out in European Directives Low voltage Directive and EMC Directive
UL certified	Underwriters Laboratories, Inc. Component Recognition UL60950-1
BSMI	Compliance to the Taiwan EMC standard “Limits and methods of Radio Disturbance Characteristics of Information Technology Equipment, CNS 13438 Class B”
Microsoft WHQL	Microsoft Windows Hardware Quality Labs
RoHS compliant	Restriction of Hazardous Substance Directive

1.2.13. Reliability

Table 10 Reliability specifications

Parameter	Value
Mean Time between Failure (MTBF) [1]	> 3,000,000 hours
Power on/off cycle[2]	50,000 cycles

Notes:

1). MTBF is calculated based on a Part Stress Analysis. It assumes nominal voltage with all other parameters within specified range.

2). Power on/off cycles is defined as power being removed from the drive, and the restored. Most host systems remove power from the drive when entering suspend and hibernate as well as on a system shutdown.

1.2.14. Shock and Vibration

Table 11 Shock and Vibration

Item	Mode	Timing/Frequency	Max
Shock[1]	Operating Non-operating	At 0.5 msec half-sine	1500G
Vibration[2]	Operating Non-operation	10-2000 Hz	20 G Peak

Notes:

1). Shock specifications assume that the SSD is mounted securely with the input vibration applied to the drive mounting screws. Stimulus may be applied in the X, Y or Z axis.

2). Vibration specifications assume that the SSD is mounted securely with the input vibration applied to the drive mounting screws. Stimulus may be applied in the X, Y or Z axis. The measured specification is in root mean squared form.

1.2.15. Electrostatic discharge (ESD)

Electromagnetic Immunity tests assume the SSD is properly installed in the representative host system. The drive operates properly without errors degradation in performance when subjected to radio frequency (RF) environments defined in the following table.

Table 12 Radio Frequency Specifications

Test	Description	Performance criteria	Reference standard
Electrostatic discharge	Contact ±4KV Air: ±8KV	A	IEC 61000-4-2:2008
Electrostatic discharge	Contact ±6KV Air: ±12KV	B	IEC 61000-4-2:2008
Electrostatic discharge	Contact ±8KV Air: ±15KV	C	IEC 61000-4-2:2008
Radiated RF immunity	80~1000MHz, 3V/m, 80% AM with 1 KHz sine 900 MHz, 3 V/m, 50% pulse modulation at 200Hz	A	IEC 61000-4-3:2008
Electrical fast transient	±1KV on AC mains ±0.5KV on external I/O	B	IEC 61000-4-4:2004 +Corr.1:2006 +Corr.2:2007
Surge immunity	±1KV differential ±2KV common, AC mains	B	IEC 61000-4-5:2005
Conducted RF immunity	150KHz~80 MHz, 3 Vrms, 80% AM with 1KHz sine	A	IEC 61000-4-6:2008
Power frequency magnetic field	50Hz, 1A/m (r.m.s.)	A	IEC 61000-4-6:2008

Notes:

1. Performance criterion A = The device shall continue to operate as intended, i.e., normal unit operation with no degradation of performance.
2. Performance criterion B = The device shall continue to operate as intended after completion of test, however, during the test, some degradation of performance is allowed as long as there is no data loss operator intervention to restore device function.
3. Performance criterion C = Temporary loss of function is allowed. Operator intervention is acceptable to restore device function.
4. Contact electrostatic discharge is applied to drive enclosure.

1.2.16. Weight:

Form-factor:

2.5”: 35g Max

M.2 2242: 4.5g Max

M.2 2280: 6.8g Max

1.2.17. Dimension:

Form-factor:

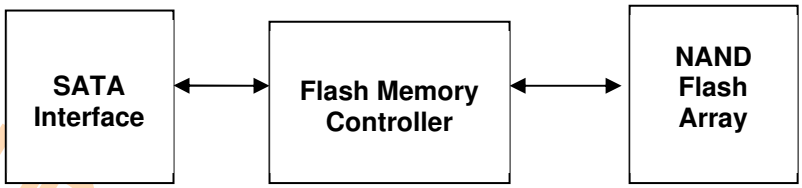
2.5”: 100.45 mm x 69.85 mm x 7.00 mm (L x W x H)

M.2 2242-S2: 42.0 mm x 22.0 mm x 2.23 mm (L x W x H)

M.2 2242-D2: 42.0 mm x 22.0 mm x 3.58 mm (L x W x H)

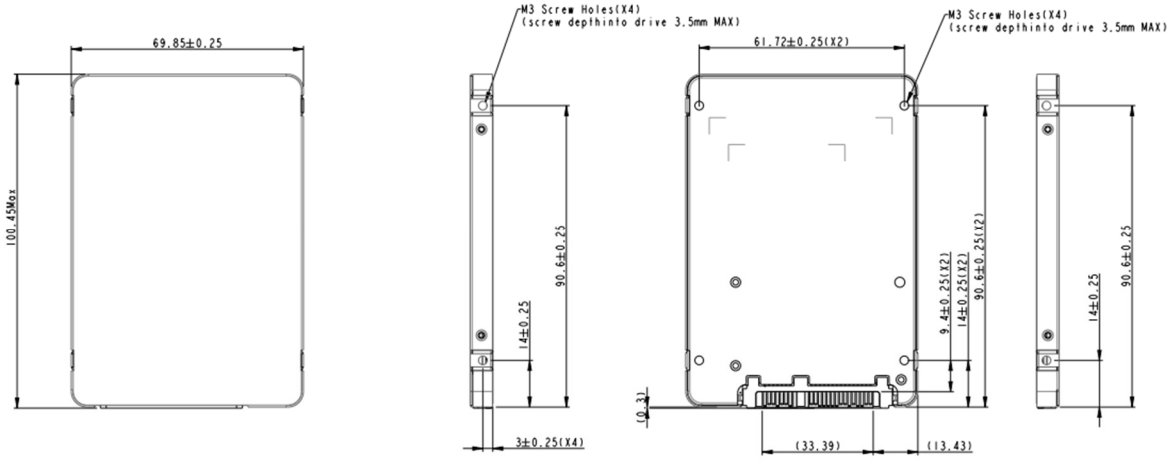
M.2 2280-S2: 80.0 mm x 22.0 mm x 2.23 mm (L x W x H)

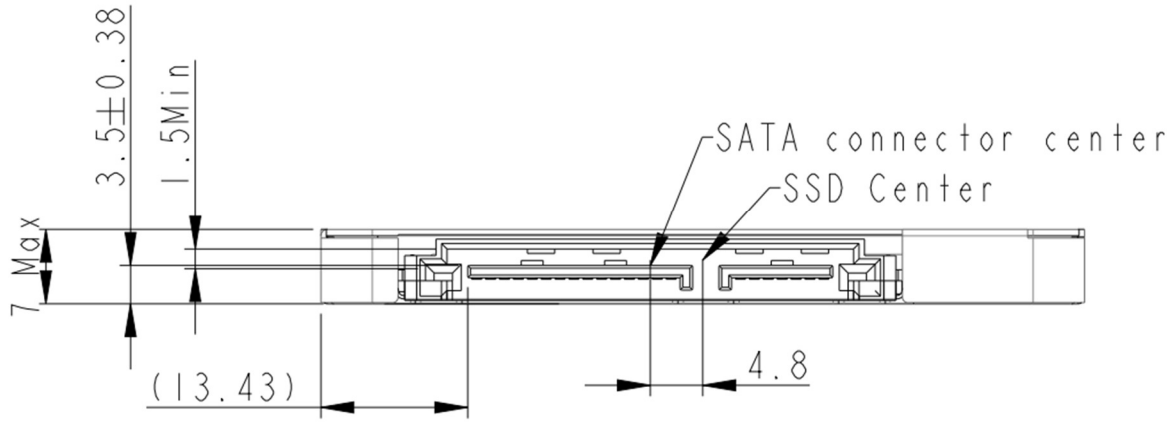
1.3 Functional Block Diagram



1.4 Mechanical Drawing:

2.5”





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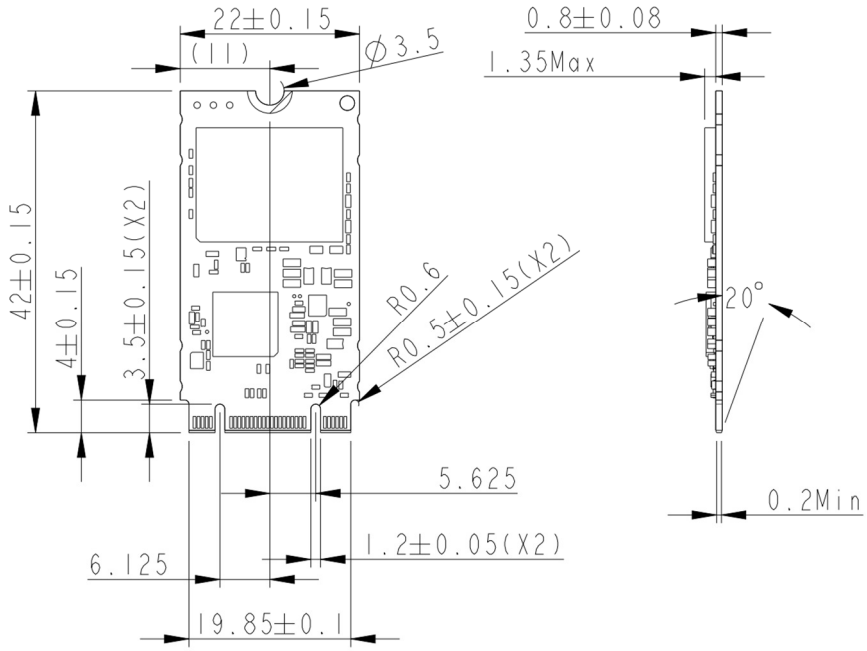
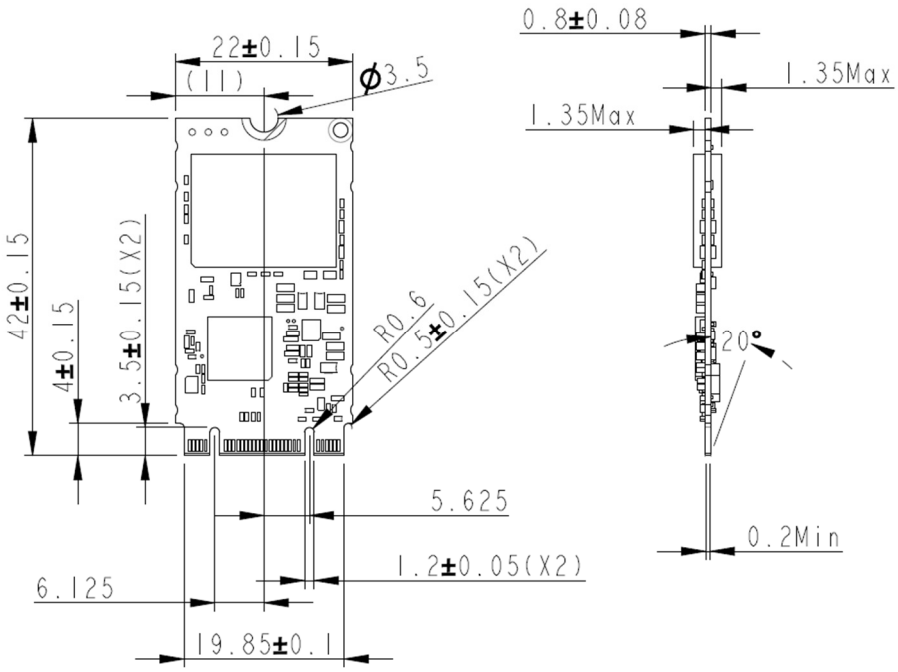
M.2 2242-S2



M.2 2242-D2



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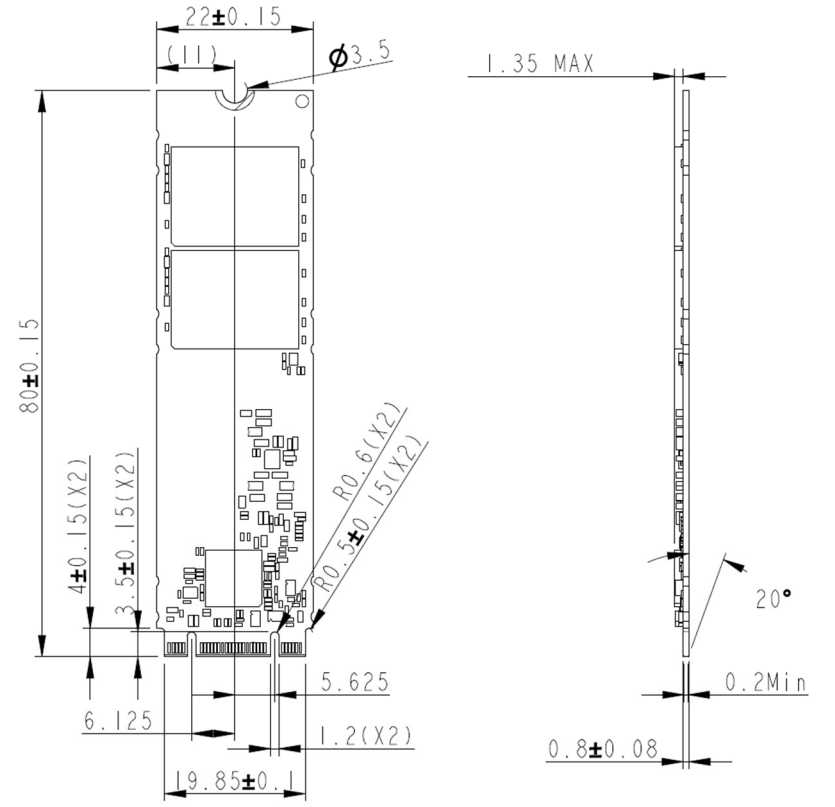
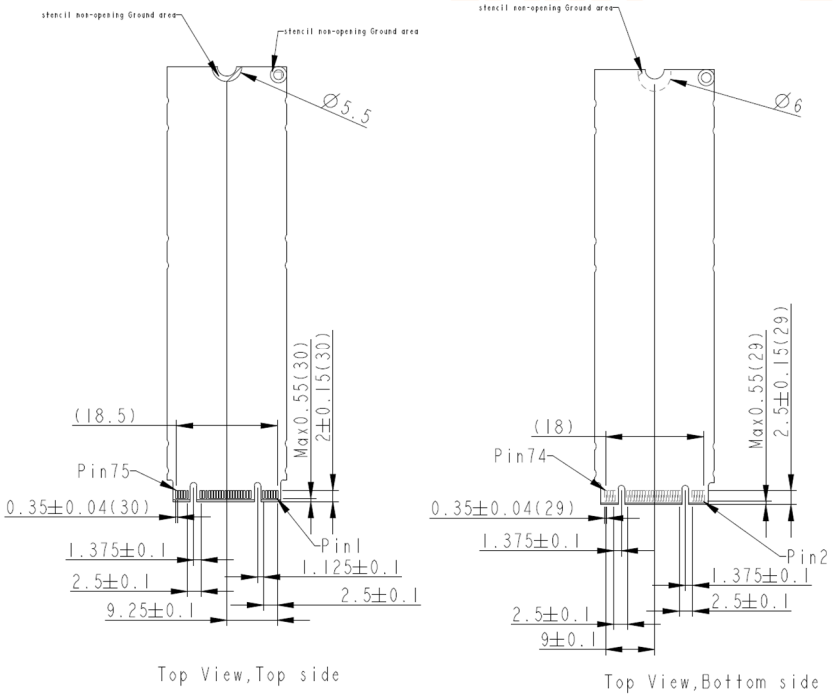
M.2 2280





1.5 Architecture

The CVC SATA 6Gb/s Solid State Drive (SSD) utilizes a cost-effective system-on-chip (SoC) design to provide a full 6Gb/s bandwidth with the host while managing multiple flash memory devices on multiple channels internally.

1.6 DEVSLP Power Mode:

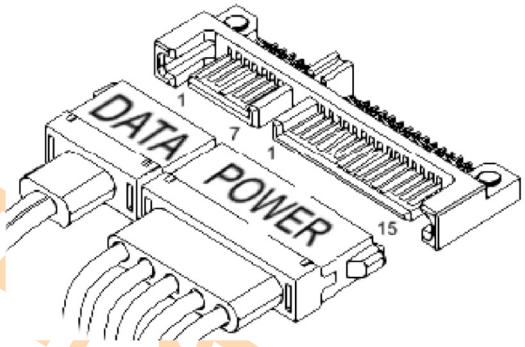
SOLID STATE STORAGE SSD support DEVSLP power mode. After power up and enabled by a SET FEATURES command from the host, device will enter DEVSLP mode from any state after receive HW DEVSLP signal pin trigger. And return to Reset state after HW DEVSLP signal pin negated.

2 PIN LOCATIONS AND SIGNAL DESCRIPTIONS

2.1 Pin Locations

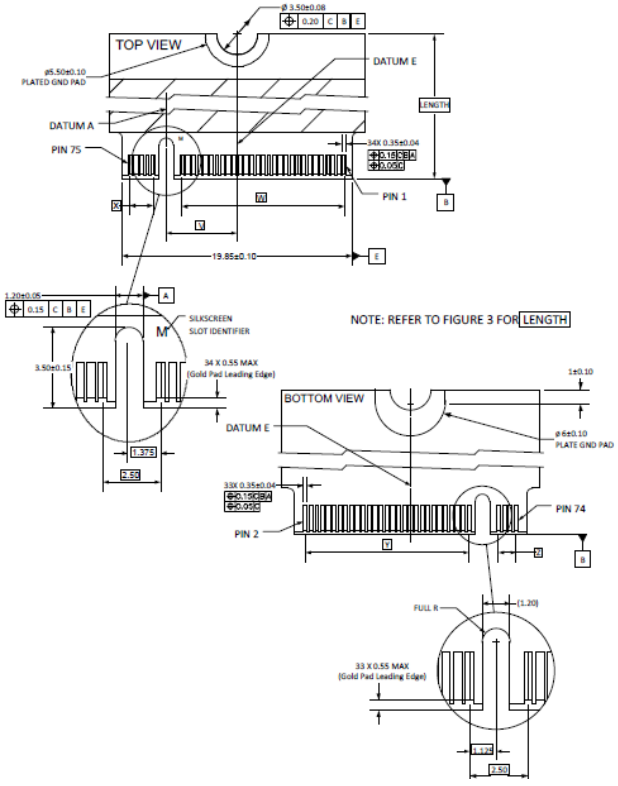
2.5" Models

The data and power connector pin locations of the CVC 2.5" SATA 6Gb/s SSD are shown below.



M.2 Models

The data and power connector pin locations of the CVC M.2 SATA 6Gb/s SSD are shown below.



2.2 Signal Descriptions

2.5" Models

Data Connector:

Table 13-1 2.5" Model Serial ATA Data Connector Pin Definitions

Name	Type	Description
S1	GND	
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	

Power Connector:

Table 13-2 2.5" Model Serial ATA Power Connector Pin Definitions

Name	Type	Description
P1	Retired	No Use
P2	Retired	
P3	Device Sleep Signal	If system didn't support DEVSLP, set DEVSLP Sleep Signal pin power high and keep (from power on), device will ignore. If system support DEVSLP, set DEVSLP Sleep Signal pin power low (from power on), device will support DEVSLP function. Device Sleep Signal H: SSD enter sleep mode. Device Sleep Signal L: SSD exit sleep mode.
P4	GND	
P5	GND	
P6	GND	
P7	V5	5V Power, Pre-change
P8	V5	5V Power
P9	V5	5V Power
P10	GND	
P11	DAS	Device Activity Signal
P12	GND	
P13	V12	No Use
P14	V12	No Use
P15	V12	No Use

M.2 Models

Data Connector:

Table 13-3 M.2 Model Serial ATA Data Connector Pin Definitions

Name	Type	Description
P1	CONFIG_3	This pin is following standard spec connect to ground.
P2	3.3V AUX	Supply pin, 3.3V
P3	GND	Ground
P4	3.3V AUX	Supply pin, 3.3V
P5	Not Available	no connect on SSD
P6	Not Available	no connect on SSD
P7	Not Available	no connect on SSD
P8	Not Available	no connect on SSD
P9	Not Available	no connect on SSD
P10	DAS#	Device Activity Signal
P11	Not Available	no connect on SSD
P12	(Removed for key)	Mechanical Notch B (Removed for Key)
P13	(Removed for key)	Mechanical Notch B (Removed for Key)
P14	(Removed for key)	Mechanical Notch B (Removed for Key)
P15	(Removed for key)	Mechanical Notch B (Removed for Key)
P16	(Removed for key)	Mechanical Notch B (Removed for Key)
P17	(Removed for key)	Mechanical Notch B (Removed for Key)
P18	(Removed for key)	Mechanical Notch B (Removed for Key)
P19	(Removed for key)	Mechanical Notch B (Removed for Key)
P20	Not Available	no connect on SSD
P21	CONFIG_0	This pin is following standard spec connect to ground.
P22	Not Available	no connect on SSD
P23	Not Available	no connect on SSD
P24	Not Available	no connect on SSD
P25	Not Available	no connect on SSD
P26	Not Available	no connect on SSD
P27	GND	Ground
P28	Not Available	no connect on SSD
P29	Not Available	no connect on SSD
P30	Not Available	no connect on SSD
P31	Not Available	no connect on SSD
P32	Not Available	no connect on SSD
P33	GND	Ground
P34	Not Available	no connect on SSD
P35	Not Available	no connect on SSD
P36	Not Available	no connect on SSD
P37	Not Available	no connect on SSD
P38	Device Sleep Signal	If system didn't support DEVSLP, set Device Sleep Signal high and keep (from power on), device will ignore. If system support DEVSLP, set Device Sleep Signal low (from power on) device, device will support DEVSLP function as below: Device Sleep Signal H: SSD enter sleep model. Device Sleep Signal L: SSD exit sleep model.
P39	GND	Ground
P40	Not Available	no connect on SSD

Table 13-4 M.2 Model Serial ATA Data Connector Pin Definitions

Name	Type	Description
P41	SATA-B+/PETn0	Host receiver differential signal pair
P42	Not Available	no connect on SSD
P43	SATA-B-/PETp0	Host receiver differential signal pair
P44	Not Available	no connect on SSD
P45	GND	Ground
P46	Not Available	no connect on SSD
P47	SATA-A-/PERn0	Host transmitter differential signal pair
P48	Not Available	no connect on SSD
P49	SATA-A+/PERp0	Host transmitter differential signal pair
P50	Not Available	no connect on SSD
P51	GND	Ground
P52	Not Available	no connect on SSD
P53	Not Available	no connect on SSD
P54	Not Available	no connect on SSD
P55	Not Available	no connect on SSD
P56	MFG1	Manufacturing pin. Use determined by vendor. Must be a no-connect on the host board
P57	GND	Ground
P58	MFG2	Manufacturing pin. User determined by vendor. Must be a no-connect on a host board
P59	(Removed for key)	Mechanical Notch M (Removed for Key)
P60	(Removed for key)	Mechanical Notch M (Removed for Key)
P61	(Removed for key)	Mechanical Notch M (Removed for Key)
P62	(Removed for key)	Mechanical Notch M (Removed for Key)
P63	(Removed for key)	Mechanical Notch M (Removed for Key)
P64	(Removed for key)	Mechanical Notch M (Removed for Key)
P65	(Removed for key)	Mechanical Notch M (Removed for Key)
P66	(Removed for key)	Mechanical Notch M (Removed for Key)
P67	Not Available	no connect on SSD
P68	SUSCLK	no connect on SSD
P69	CONFIG_1	This pin is follow standard spec connect to ground.
P70	3.3V AUX	Supply pin, 3.3V
P71	GND	Ground
P72	3.3V AUX	Supply pin, 3.3V
P73	GND	Ground
P74	3.3V AUX	Supply pin
P75	CONFIG_2	This pin is following standard spec connect to ground.

3 ATA COMMAND SETS

3.1 ATA Command

The SSD supports all the mandatory ATA commands defined in the ATA/ATAPI-8 specification.

3.1.1 ATA General Feature Command Set

The SSD supports the ATA General feature Command set (non-packet), which consists of

- EXECUTE DEVICE DIAGNOSTIC
- FLUSH CACHE
- IDENTIFY DEVICE
- READ DMA
- READ DMA WITHOUT RETRIES
- READ SECTOR(S)
- READ SECTORS(S) WITHOUT RETRIES
- READ VERIFY SECTORS(S)
- READ VERIFY SECTORS(S) WITHOUT RETRIES
- SEEK
- SET FEATURES
- WRITE DMA
- WRITE DMA WITHOUT RETRIES
- WRITE SECTOR(S)
- WRITE SECTOR(S) WITHOUT RETRY
- READ MULTIPLE
- SET MULTIPLE MODE
- WRITE MULTIPLE
- INITIALIZE DEVICE PARAMETERS
- DATA SET MANAGEMENT

The SSD supports all the following optional commands

- READ BUFFER
- WRITE BUFFER
- DOWNLOAD MICROCODE

3.1.2 Identify Device Data

The following table details the sector data returned after issuing an IDENTIFY DEVICE command.

Table 14-1 Returned Sector Data

Word	F=Fixed V=Variable X=Both	Default Value	Description
0	F	0040h	General configuration bit-significant information
1	F	3FFFh	Obsolete-Number of logical cylinders (16,383)
2	F	C837h	Specific configuration
3	F	0010h	Obsolete-Number of logical heads (16)
4-5	F	0000h	Retired
6	F	003Fh	Obsolete-Number of logical sectors per logical track (63)
7-8	F	0000h	Reserved for assignment by the Compact Flash Association
9	F	0000h	Retired
10-19	V	Var.	Serial number (20 ASCII characters)
20-22	F	0000h	Retired / Obsolete
23-26	V	Var.	Firmware revision (8 ASCII characters)
27-46	V	Var.	Model number
47	F	8002h	7:0 – Maximum number of sectors transferred per interrupt on multiple commands
48	F	4000h	Trusted Computing feature set options, bit14 should be 1
49	F	2F00h	Capabilities
50	F	4000h	Capabilities
51-52	F	0000h	Obsolete
53	F	0007h	Words 88 and 70:64 valid
54	V	Var.	Obsolete - Number of logical cylinders (16,383)
55	V	Var.	Obsolete - Number of logical heads (16)
56	V	Var.	Obsolete - Number of logical sectors per logical track (63)
57-58	V	Var.	Capacity (Cylinders*heads*sectors)
59	V	0101h	Number of sectors transferred per interrupt on multiple commands
60-61	V	250,069,680 (128GB)	Total number of user addressable logical sectors for 28-bit commands (DWord)
		500,118,192 (256GB)	
		1,000,215,216 (512GB)	
62	F	0000h	Obsolete
63	V	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	Manufacture'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	4D20h	Reserved (for future command overlap and queuing)

Table 14-2 Returned Sector Data

Word	F=Fixed V=Variable X=Both	Default Value	Description
71-74	F	0000h	Reserved for the IDENTIFY packet DEVICE command
75	F	001Fh	4:0 Maximum Queue depth-1=31
76	V	070Eh	Serial ATA capabilities
77	V	Var.	Reserved for Serial ATA
78	V	014Ch	Serial ATA features supported
79	V	Var.	Serial ATA features enabled
80	F	03F0h	Major Version Number
81	F	0000h	Minor Version Number
82	F	746Bh	Commands and feature sets supported
83	F	7D01h	Commands and feature sets supported
84	F	4163h	Commands and feature sets supported
85	V	3469h	Commands and feature sets supported or enabled
86	V	BC01h	Commands and feature sets supported or enabled
87	F	4163h	Commands and feature sets supported or enabled
88	V	407Fh	Ultra DMA modes
89	F	0003h	Time required for security erase unit completion
90	F	0003h	Time required for enhanced security erase completion
91	F	0000h	Current advanced power management value
92	V	Var.	Master Password Identifier
93	V	0000h	Hardware reset result. The contents of bits (12:0) of this word shall change only during the execution of a hardware reset.
94	F	0000h	Current AAM value
95	F	0000h	Stream Minimum Request Size
96	F	0000h	Streaming Transfer Time - DMA
97	F	0000h	Streaming Access Latency - DMA and PIO
98-99	F	0000h	Streaming Performance Granularity
100-103	V	125,045,424 (64GB)	Maximum user LBA for 48-bit Address feature set
		250,069,680 (128GB)	
		500,118,192 (256GB)	
104	F	0000h	Streaming Transfer Time - PIO
105	F	0008h	Maximum number of 512-byte blocks per DATA SET MANAGEMENT command
106	F	4000h	Physical sector size/logical sector size
107	F	0000h	Inter-seek delay for ISO-7779 acoustic testing in microseconds
108-111	V	0000h 0000h 0000h 0000h	World wide name
112-115	F	0000h	Reserved for word wide name extension to 128 bits
116	F	0000h	Reserved for TLC
117-118	F	0000h	Words per logical sector
119	F	401Ch	Commands and feature sets supported
120	F	401Ch	Commands and feature sets supported or enabled

Table 14-3 Returned Sector Data

Word	F=Fixed V=Variable X=Both	Default Value	Description
121-126	F	0000h	Reserved for expanded supported and enabled settings
127	F	0000h	Removable Media Status Notification feature set support
128	V	0021h	Security status
129-159	F	0000h	Vendor specific
160	F	0000h	Compact Flash Association (CFA) power mode 1
161-167	F	0000h	Reserved for the CompactFlash Association
168	F	0007h	
169	F	0001h	DATA SET MANAGEMENT command is supported
170-173	V	Var.	Additional Product Identifier (ATA String)
174-175	F	0000h	Reserved
176-205	F	0000h	Current media serial number (ATA string)
206	F	003Dh	SCT Command Transport
207-208	F	0000h	Reserved
209	F	4000h	Alignment of logical blocks within a physical block
210-211	F	0000h	Write-Read-Verify Sector Count Mode 3 (DWord)
212-213	F	0000h	Write-Read-Verify Sector Count Mode 2 (DWord)
214	F	0000h	NV Cache Capabilities
215-216	F	0000h	NV Cache Size in Logical Blocks (DWord)
217	F	0001h	Nominal media rotation rate
218	F	0000h	Reserved
219	F	0000h	NV Cache Options
220	F	0000h	7:0 Write-Read-Verify feature set current mode
221	F	0000h	Reserved
222	F	107Fh	Transport major version number
223	F	0000h	Transport minor version number
224-229	F	0000h	Reserved
230-233	F	0000h	Extended Number of User Addressable Sectors (QWord)
234	F	0001h	Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
235	F	0200h	Minimum number of 512-byte data blocks per DOWNLOAD MICROCODE command for mode 03h
236-254	F	0000h	Reserved
255	V	Var.	Integrity word

Note:

1. F=Fixed. The content of the word is fixed and does not change for removable media devices, these values may change when media is Removed or changed.
2. V=Variable. The state of at least one bit in a word is variable and may change depending on the state of the device or the commands executed by the device.
3. X=F or V. The content of the word may be fixed or variable.

3.2 Power Management Command Set

The SSD supports the power management command set, which consists of

- CHECK POWER MODE
- IDLE
- IDLE IMMEDIATE
- SLEEP
- STANDBY
- STANDBY IMMEDIATE

3.3 Security Mode Feature Set

The SSD supports the Security Mode command set, which consist of

- SECURITY SET PASSWORD
- SECURITY UNLOCK
- SECURITY ERASE PREPARE
- SECURITY ERASE UNIT
- SECURITY FREEZE LOCK
- SECURITY DISABLE PASSWORD

3.4 SMART Command Set

The SSD supports the SMART command set, which consist of

- SMART ENABLE OPERATIONS
- SMART DISABLE OPERATIONS
- SMART ENABLE/DISABLE AUTOSAVE
- SMART RETURN STATUS

The SSD supports the following optional commands.

- SMART EXECUTE OFF-LINE IMMEDIATE
- SMART READ DATA
- SMART READ LOG
- SMART WRITE LOG

Table 15 SMART commands

Subcommand	Code	LBA Low value
SMART ATTRIBUTE VALUES (READ DATA)	D0h	
READ ATTRIBUTE THRESHOLDS	D1h	
ENABLE/DISABLE ATTRIBUTE AUTOSAVE	D2h	
SAVE ATTRIBUTE VALUES	D3h	
EXECUTE OFF-LINE IMMEDIATE	D4h	
EXECUTE SMART OFF-LINE ROUTINE		00h
EXECUTE SMART SHORT SELF-TEST ROUTINE (OFFLINE)		01h
EXECUTE SMART EXTENDED SELF-TEST ROUTINE (OFFLINE)		02h
ABORT OFF-LINE ROUTINE		7Fh
EXECUTE SMART SHORT SELF-TEST ROUTINE (CAPTIVE)		81h
EXECUTE SMART EXTENDED SELF-TEST ROUTINE (CAPTIVE)		82h
READ LOG SECTOR	D5h	
WRITE LOG SECTOR	D6h	
ENABLE SMART OPERATIONS	D8h	
DISABLE SMART OPERATIONS	D9h	
RETURN SMART STATUS	DAh	
Enable/Disable Automatic OFFLINE	DBh	

3.5 Host Protected Area Command Set

The SSD supports the Host Protected Area command set which consists of the following events.

- READ NATIVE MAX ADDRESS
- SET MAX ADDRESS
- READ NATIVE MAX ADDRESS EXT
- SET MAX ADDRESS EXT

The SSD supports the following optional commands.

- SET MAX SET PASSWORD
- SET MAX LOCK
- SET MAX FREEZE LOCK
- SET MAX UNLOCK

3.6 48-Bit Address Command Set

The SSD supports the Host Protected Area command set, which consists of the following events.

- FLUSH CACHE EXT
- READ DMA EXT
- READ NATIVE MAX ADDRESS EXT
- READ SECTOR(S) EXT
- READ VERIFY SECTOR(S) EXT
- READ MULTIPLE EXT
- SET MAX ADDRESS EXT
- WRITE DMA EXT
- WRITE MULTIPLE EXT
- WRITE MULTIPLE FUA EXT
- WRITE SECTOR(S) EXT

3.7 Device Configuration Overlay Command Set

The SSD supports the Device configuration Overlay command set, which consists of the following events.

- DEVICE CONFIGURATION FREEZE LOCK
- DEVICE CONFIGURATION IDENTITY
- DEVICE CONFIGURATION RESTORE
- DEVICE CONFIGURATION SET

3.8 General Purpose Log Command Set

The SSD supports the general purpose log command set, which consists of the following events.

- READ LOG EXT
- WRITE LOG EXT

4 SATA COMMAND SETS

4.1 SATA Command

The SATA 3.0 Specification is a super set of the ATA/ATAPI-8 specification with regard to supported commands. The SSD supports the following features which are unique to the SATA 3.0 Specification.

4.1.1. Software Settings Preservation

The SSD supports the SET FEATURES parameter to enable/disable the preservation of software settings.

4.1.2. Native Command Queuing

The SSD supports the Native Command Queuing (NCQ) command set, which includes the following events.

- READ FPDMA QUEUED
- WRITE FPDMA QUEUED

Note: with a maximum queue depth equal to 32

5 REFERENCES

This document references standards defined by a variety of organizations as listed below.

Table 16 Standards References

Date	Title	Location
Dec 2008	VCCI	http://www.vcci.or.jp/vcci_e/general/join/index.html
July 2007	ROHS	Search for material description datasheet at http://intel.pcnalert.com
July 2007	SFF-8144, 1.8" drive form factor	http://www.sffcommittee.org
February 2007	Serial ATA Revision 2.6	http://www.sata-io.org
May 2006	SFF-8223, 2.5" Drive w/Serial Attachment Connector	http://www.sffcommittee.org
May 2005	SFF-8201, 2.5" drive form factor	http://www.sffcommittee.org
April 2004	ATA-7 Spec. Volume 1	http://www.t13.org/
Aug. 2009	ATA-8 Spec. Rev 2	http://www.t13.org/
2008 2008 2004 2005 2008 2008	International Electro Technical Commission EB61000 4-2 Personnel Electrostatic Discharge Immunity 4-3 Electromagnetic compatibility (EMC) 4-4 Electromagnetic compatibility (EMC) 4-5 Electromagnetic compatibility (EMC) 4-6Electromagnetic compatibility (EMC) 4-11 (Voltage variations)	http://www.iec.ch
2004	ENV 50204 (Radiated electromagnetic field from digital radio telephones)	http://www.iec.ch

6 TERMS AND ACRONYMS

This document incorporates many industry- and device-specific words use the following list to define a variety of terms and acronyms.

Table 17 Glossary of Terms and Acronyms

Term	Definition
ATA	Advanced Technology Attachment
ATAPI	Advanced Technology Attachment Packet Interface
BER	Bit Error Rate, or percentage of bits that have errors relative to the total number of bits received
BIOS	Basic Input/Output System
Chipset	A term used to define a collection of integrated components required to make a PC function
DIPM	Device Initiated Power Management The ability of the device to request SATA link power state changes
DMA	Direct Memory Access
DRAM	Dynamic Random Access Memory
EXT	Extended
FP	First Party
GB	Giga-byte defined as $1X10^9$ bytes
HCI	Host Controller Interface
HCT	Hardware Compatibility Test
HDD	Hard Disk Drive
HIPM	Host Initiated Power Management The ability of the host to request SATA link power state changes
Hot Plug	A term used to describe the removal or insertion of a SATA hard drive when the system is powered on
IOPS	Input output operations per second
LBA	Logical Block Address
LPM	Link Power Management: the ability of the SATA link layer to enter one of two lower power consuming states, partial and slumber
MB	Mega-bytes defined as $1x10^6$ bytes
mSATA	Mini-SATA

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