

> XG3 SERIES CLIENT SSD

The Toshiba client-focused XG3 Series combines the high speed of the PCIe® 3.1 interface, the low latency of NVM Express™ (NVMe™), and Toshiba's proprietary NAND flash memory for suitable performance and reliability. The industry's highest capacity client NVMe SSD* supports up to four lanes of Gen 3 with maximum interface bandwidth of more than 6x that of SATA 6.0 Gbit/s and 3x that of SAS 12.0 Gbit/s.

The NVMe PCIe SSDs feature large capacities of up to 1024GB and come in thin, space saving Single (THNSN5xxxGPU7) and Double Side (THNSN51T02DU7) M.2 2280 module form factor. Industry standard 2.5-inch SATA Express form factor options (THNSN5xxxGCJ7) are also available for ease of integration.

Further features of the SSD include Toshiba's powerful proprietary Quadruple Swing-By Code (QSBC) and Trusted Computing Group specification, Pyrite (TCG Pyrite).

The series is perfectly designed to boost the performance of notebooks, 2-in-1 laptops and all-in-one PCs.

*As of August 2015, Toshiba survey

SSD



> KEY FEATURES

- High capacities up to 1024 GB in industry standard M.2 form factor
- High tolerance to environmental factors
- Support for 512 B and 4,096 B logical block sizes
- Device Activity Signal (DAS) is supported
- Standard (Non-SED) model supports TCG Pyrite ver. 1.0
- Toshiba's powerful proprietary QSBC (Quadruple Swing-By Code) error correction for greater reliability
- Support for six power sub-states, including PCIe® low power L1.2 states
- Automatic Thermal Control is supported

> APPLICATIONS

- For high-end notebook PCs
- Server boot

> SPECIFICATIONS

Standard Models		2.5-inch	M.2 2280-S2 (Single-sided)	M.2 2280-D2 (Double-Sided)
Memory		TOSHIBA MLC NAND Flash Memory		
Interface		PCI Express® Base Specification Revision 3.1 (PCIe®)		
Maximum Speed		16 GT/s (PCIe® Gen3x2 Lane)	32 GT/s (PCIe® Gen3x4 Lane)	
Connector Type		SATA Express	M.2 M	
Formatted Capacity ¹⁾		128/256/512/1024 GB	128/256/512 GB	1024 GB
Command		NVM Express™ Revision 1.1b (NVMe™)		
Performance ^{1),2)}	Sequential Read	up to 1572 MB/s{1500 MiB/s}	up to 2516 MB/s{2400 MiB/s}	
	Sequential Write	up to 1363 MB/s{1300 MiB/s}	up to 1572 MB/s{1500 MiB/s}	
Supply Voltage		5.0 V ±5 %	3.3 V ±5 %	
Power Consumption		Active: 6.0 W typ. Power State 5: 7.0 mW typ.	Active: 6.0 W typ. Power State 5: 6.0 mW typ.	Active: 6.4 W typ. Power State 5: 6.0 mW typ.
Temperature		Operating: 0 °C to 70 °C (case temperature) Non-operating: -40 °C to 85 °C	Operating: 0 °C to 80 °C (components temperature) Non-operating: -40 °C to 85 °C	

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Standard Models	2.5-inch	M.2 2280-S2 (Single-sided)	M.2 2280-D2 (Double-Sided)
Reliability ³⁾	Mean Time to Failure (MTTF): 1,500,000 hours Product Life: Approximately 5 years		
Size	100.0 mm x 69.85 mm x 7.0 mm	80.0 mm x 22.0 mm x 2.23 mm	80.0 mm x 22.0 mm x 3.58 mm
Weight	50 g typ.	6.8 to 7.2 g typ.	8.6 g typ.
More Features	Automatic retries and corrections for read errors		
Compliance	UL, cUL, TÜV, KC, FCC, BSMI, CE, RCM, IC, VCCI		

1) Definition of capacity: Toshiba defines a megabyte (MB) as 1,000,000 bytes, a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1GB = 2³⁰ = 1,073,741,824 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft Operating System and/or pre-installed software applications, or media content. Actual formatted capacity may vary.

2) 1 MiB (mebibytes) = 2²⁰ bytes = 1,048,576 bytes

3) MTTF (Mean Time to Failure) is not a guarantee or estimate of product life; it is a statistical value related to mean failure rates for a large number of products which may not accurately reflect actual operation. Actual operating life of the product may be different from the MTTF.

* PCIe® and PCI Express® are registered trademarks of PCI-SIG

* NVMe™ and NVM Express™ are trademarks of NVM Express, Inc.

* SRIS(Separate RefClock with Independent SSC) is not supported

* Product image may represent a design model.

* Read and write speed may vary depending on the host device, read and write conditions, and file size.

* Standard (Non-SED) model supports TCG Pyrite ver. 1.0.

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> ORDERING INFORMATION

<u>THN</u>	<u>SX</u>	<u>X</u>	<u>XXXX</u>	<u>X</u>	<u>X</u>	<u>X</u>
1	2	3	4	5	6	7

- | | | |
|----|-----------------|--|
| 1. | Model Name | THN: Toshiba NAND drive |
| 2. | Model Type | SN: Non-SED |
| 3. | Controller Type | 5: Type 5 |
| 4. | Capacity | 128G / 256G / 512G /1T02

128G is 128 GB, 256G is 256 GB, 512G is 512 GB and 1T02 is 1024 GB
(1 GB = 1,000,000,000 bytes) |
| 5. | Form Factor | C: 2.5-inch (7.0 mm height), P: M.2 2280-S2 Module type,

D: M.2 2280-D2 Module type, |
| 6. | Host I/F Type | J: SATA Express, U: M.2 M(PCI Express® I/F) |
| 7. | NAND Type | 7: MLC |

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> PRODUCT LINE UP

Model Number	Formatted Capacity	Interface	Function Note
THNSN5128GCJ7	128 GB	2.5-inch Specification Revision	Non- SED
THNSN5256GCJ7	256 GB		
THNSN5512GCJ7	512 GB		
THNSN51T02CJ7	1024GB		
THNSN5128GPU7	128 GB	M.2 Type 2280-S2 ¹⁾ -M module	
THNSN5256GPU7	256 GB		
THNSN5512GPU7	512 GB		
THNSN51T02DU7	1024GB	M.2 Type 2280-D2 ²⁾ -M module	

1) Single Side, 2) Double Side

> CAPACITY

Capacity	Total Number of User Addressable Sectors in LBA Mode	
	512 bytes sector	4,096 bytes sector
128 GB	250,069,680	31,258,710
256 GB	500,118,192	62,514,774
512 GB	1,000,215,216	125,026,902
1024 GB	2,000,409,264	250,051,158

Note: 1 GB (Gigabyte) = 1,000,000,000 bytes

> PERFORMANCE

	THNSN5128GCJ7 THNSN5128GPU7	THNSN5256GCJ7 THNSN5256GPU7	THNSN5512GCJ7 THNSN5512GPU7	THNSN51T02CJ7 THNSN51T02DU7
Interface Speed	M.2 2280: 32 GT/s (Gen3x4 Lane), 20 GT/s (Gen2x4 Lane), 16 GT/s (Gen3x2 Lane), 10 GT/s (Gen2x2 Lane) 2.5 inch with SATA Express: 16 GT/s (Gen3x2 Lane), 10 GT/s (Gen2x2 Lane)			
@32GT/s				
Sequential Read ¹⁾	2,202 MB/s {2,100 MiB/s}	2,516 MB/s {2,400 MiB/s}	2,516 MB/s {2,400 MiB/s}	2,516 MB/s {2,400 MiB/s}
Sequential Write ¹⁾	629 MB/s {600 MiB/s}	1,153 MB/s {1,100 MiB/s}	1,572 MB/s {1,500 MiB/s}	1,572 MB/s {1,500 MiB/s}
@16GT/s				
Sequential Read ¹⁾	1,572 MB/s {1,500 MiB/s}	1,572 MB/s {1,500 MiB/s}	1,572 MB/s {1,500 MiB/s}	1,572 MB/s {1,500 MiB/s}
Sequential Write ¹⁾	629 MB/s {600 MiB/s}	1,153 MB/s {1,100 MiB/s}	1,363 MB/s {1,300 MiB/s}	1,363 MB/s {1,300 MiB/s}

1) Under the condition of measurement with 128 KiB unit sequential access (1 KiB = 1024 bytes)

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> SUPPLY VOLTAGE

	2.5-inch	M.2 2280 Module
Allowable voltage	5.0 V \pm 5 %	3.3 V \pm 5 %
Allowable noise/ripple	100 mV p-p or less	
Allowable supply rise time	2 –100 ms	

Note: These drive have over current protection circuit. (Rated current: 3.15A)

> POWER CONSUMPTION

Operation (Ta ¹⁾ =25°C)	2.5-inch			
	THNSN5128GCJ7	THNSN5256GCJ7	THNSN5512GCJ7	THNSN51T02CJ7
Read ²⁾	3.6 W typ.	3.7 W typ.	3.7 W typ.	4.0 W typ.
Write ²⁾	3.5 W typ.	4.8 W typ.	5.7 W typ.	6.0 W typ.
Power State 3 ³⁾	250.0 mW typ.	250.0 mW typ.	250.0 mW typ.	250.0 mW typ.
Power State 4 ³⁾	13.0 mW typ.	13.0 mW typ.	13.0 mW typ.	13.0 mW typ.
Power State 5 ³⁾	7.0 mW typ.	7.0 mW typ.	7.0 mW typ.	7.0 mW typ.

Operation (Ta ¹⁾ =25°C)	M.2 2280 Module			
	THNSN5128GPU7	THNSN5256GPU7	THNSN5512GPU7	THNSN51T02DU7
Read ²⁾	4.0 W typ.	5.5 W typ.	5.5 W typ.	5.5 W typ.
Write ²⁾	3.5 W typ.	4.8 W typ.	6.0 W typ.	6.4 W typ.
Power State 3 ³⁾	160.0 mW typ.	160.0 mW typ.	160.0 mW typ.	160.0 mW typ.
Power State 4 ³⁾	12.0 mW typ.	12.0 mW typ.	12.0 mW typ.	12.0 mW typ.
Power State 5 ³⁾	6.0 mW typ.	6.0 mW typ.	6.0 mW typ.	6.0 mW typ.

Note: 1) Ambient Temperature

2) The values are specified at the condition causing maximum power consumption and Power State 0.

3) PCIe Link state is L1.2. Power consumption during the Admin command processing is excluded.

ENVIRONMENTAL CONDITIONS

> TEMPERATURE

Condition	Range		Gradient
	2.5-inch	M.2 2280 Module	
Operating ¹⁾	0 °C (Tc) – 70 °C (Tc)	0°C (Tc) – 80°C (Tc)	30 °C (Ta) / h maximum
Non-operating	-40 °C – 85 °C		30 °C / h maximum
Under Shipment ²⁾	-40 °C – 85 °C		30 °C / h maximum

1) Ta: Ambient Temperature, Tc: Case or Components Temperature

2) Packaged in Toshiba's original shipping package

> HUMIDITY

Condition	Range
Operating	8 % – 90 % R.H. (No condensation)
Non-operating	8 % – 95 % R.H. (No condensation)
Under Shipment ¹⁾	5 % – 95 % R.H.

1) Packaged in Toshiba's original shipping package

> SHOCK

Condition	Range
Operating	14.709 km/s ² {1500 G}, 0.5 ms, half sine wave
Non-operating	
Under Shipment ¹⁾	100 cm free drop

1) Apply shocks in each direction of the drive's three mutually perpendicular axes, one axis at a time.

Packaged in Toshiba's original shipping package.

> VIBRATION

Condition	Range
Operating	196 m/s ² {20 G} Peak, 10 - 2,000 Hz (20 minutes per axis) x 3 axis
Non-operating	

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COMPLIANCE

> SAFETY / EMI STANDARDS

Title	Description	Region
UL (Underwriters Laboratories)	UL 60950-1	USA
cUL (Underwriters Laboratories of Canada)	CSA-C22.2 No.60950-1	Canada
TÜV (Technischer Überwachungs Verein)	EN 60950-1	EURO
KC	KN22, KN24	Korea
FCC	FCC part 15 Subpart B	USA
BSMI (Bureau of Standards, Metrology and Inspection)	CNS13438(CISPR Pub. 22)	Taiwan
CE	EN 55022, EN 55024	EURO
RCM	AS/NZS CISPR Pub. 22	Australia, New Zealand
IC	ICES-003	Canada
VCCI	Class B	Japan

> RELIABILITY

Parameter	Value
Mean Time to Failure	1,500,000 hours
Product Life	Approximately 5 years

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MECHANICAL SPECIFICATIONS

> 2.5-INCH

	Model	Weight	Width	Height	Length
7.0 mm	THNSN5128GCJ7	50 g typ.	69.85 mm	7.0 mm	100.0 mm
	THNSN5256GCJ7				
	THNSN5512GCJ7				
	THNSN51T02CJ7				

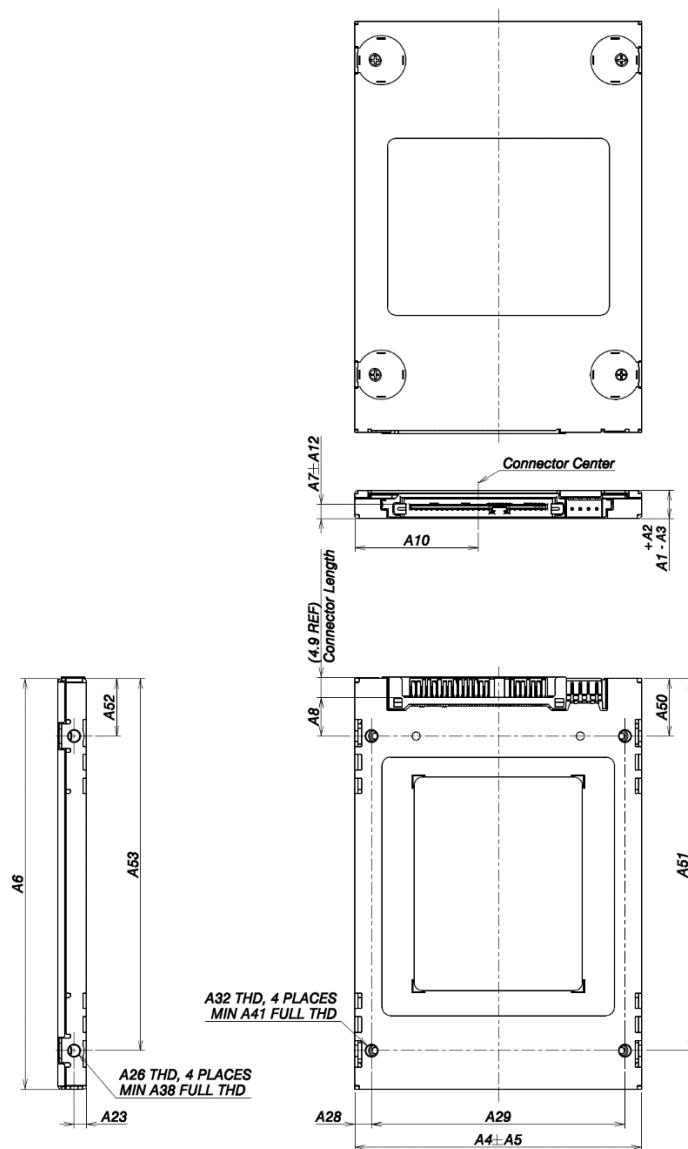


Figure 1: 2.5-inch Drive Dimension

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> 2.5-INCH DIMENSIONS

Dimension	SFF-8200 Rev3.2 ¹⁾ SFF-8201 Rev3.3 SFF-8223 Rev2.7		Toshiba XG3 SSD (Differences only)	
	Millimeters	Inches	Millimeters	Inches
A1	7.00	0.276		
A2	0.20	0.007		
A3	0.50	0.020		
A4	69.85	2.750		
A5	0.25	0.010		
A6 ²⁾	100.45 *	3.955 *	100.00 ± 0.41	3.937 ± 0.016
A7	3.5	0.138		
A8	9.40	0.370	9.40 ± 0.51	0.370 ± 0.020
A10 ³⁾	-	-	30.125 ± 0.28	1.186 ± 0.011
A12	0.38	0.015		
A23	3.00	0.118	3.00 ± 0.20	0.118 ± 0.007
A26	M3	N/A		
A28	4.07	0.160	4.07 + 0.295/-0.305	0.060 +0.011/-0.012
A29	61.72	2.430	61.72 ± 0.25	2.430 ± 0.010
A32	M3	N/A		
A38	3 #	3 #		
A41	2.5 #	2.5 #		
A50 ²⁾	14.00	0.551	14.00 ± 0.25	0.551 ± 0.010
A51 ²⁾	90.60	3.567	90.60 ± 0.30	3.567 ± 0.012
A52 ²⁾	14.00	0.551	14.00 ± 0.25	0.551 ± 0.010
A53 ²⁾	90.60	3.567	90.60 ± 0.30	3.567 ± 0.012

* = maximum

= minimum number of threads

1) SFF-8200: Small Form Factor Standard

2) PCB, Connector not included

3) Connector center defined is the same as SFF-8223

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> M.2 2280 MODULE

Model	Weight	Width	Height	Length
THNSN5128GPU7	6.8 g typ.	22.0 mm	2.23 mm	80.0 mm
THNSN5256GPU7	7.1 g typ.			
THNSN5512GPU7	7.2 g typ.		3.58 mm	
THNSN51T02DU7	8.6 g typ.			

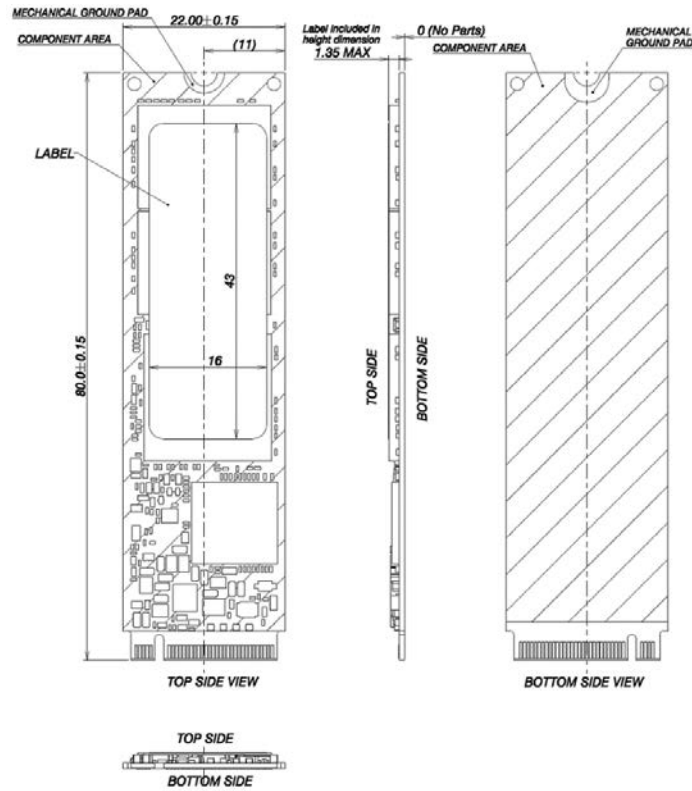


Figure 2: M.2 2280-S2 Module Dimension

Unit:mm

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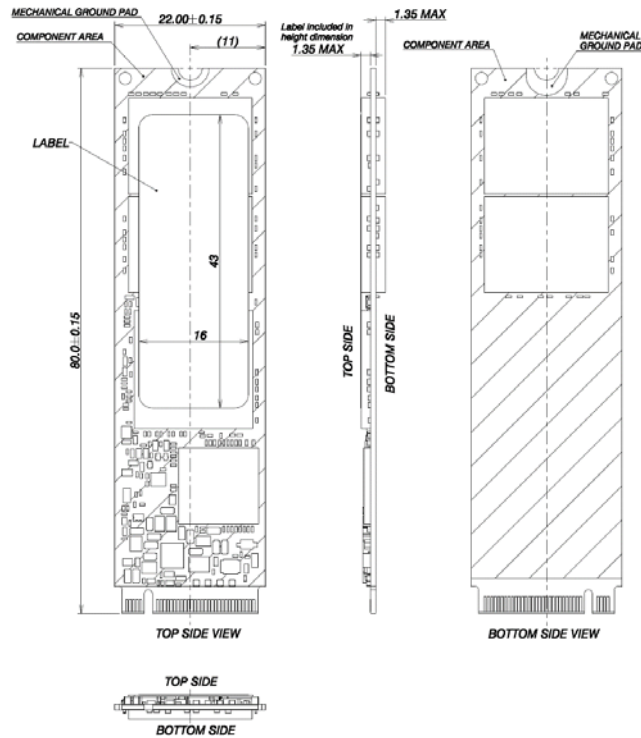


Figure 3: M.2 2280-D2 Module Dimension

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INTERFACE CONNECTOR

> 2.5-INCH SATA EXPRESS CONNECTOR

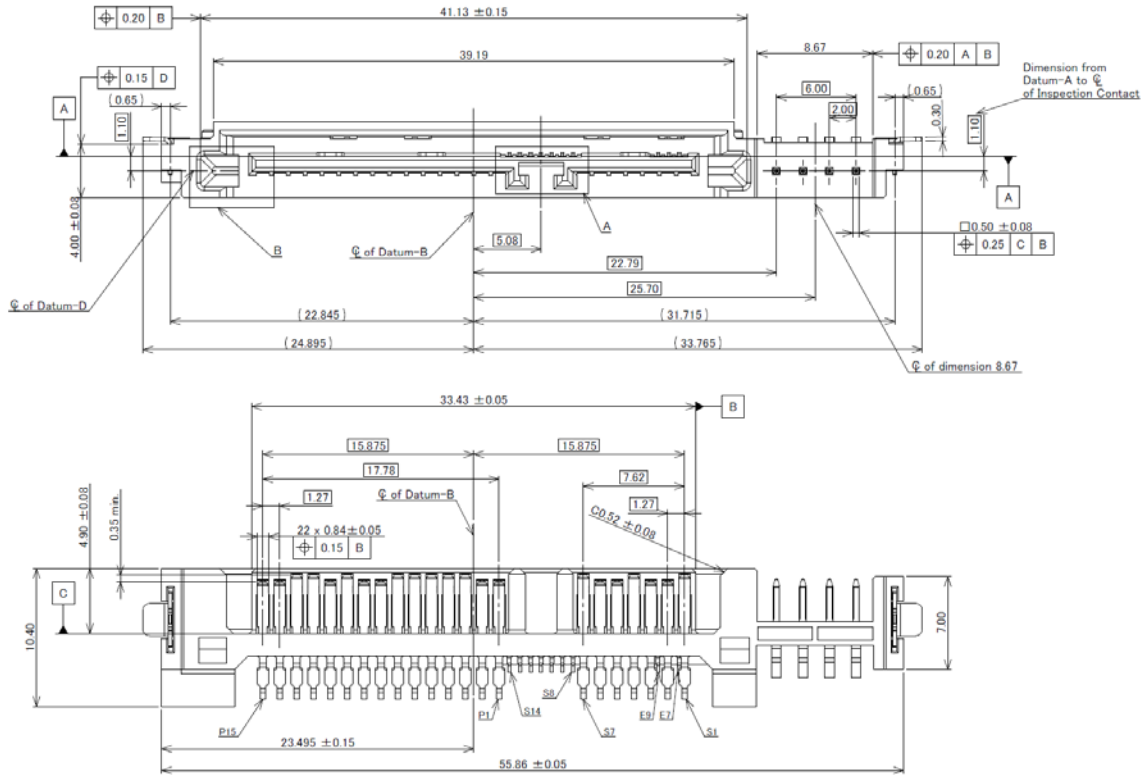


Figure 4: 2.5-inch SATA Express connector

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> 2.5-INCH DRIVE CONNECTER PIN ASSIGNMENT

Segment	Pin Position	Name	Signal Description	Signal Direction
Signal Segment	S1	GND	Ground	
	S2	PETp0	PCIe Lane 0 Host Tx	Host Output
	S3	PETn0		
	S4	GND	Ground	
	S5	PERn0	PCIe Lane 0 Host Rx	Input to Host
	S6	PERp0		
	S7	GND	Ground	
	S8	GND	Ground	
	S9	PETp1	PCIe Lane 1 Host Tx pair	Host Output
	S10	PETn1		
	S11	GND	Ground	
	S12	PERn1	PCIe Lane 1 Host Rx pair	Input to Host
	S13	PERp1		
	S14	GND	Ground	
Power Segment	P1	Reserved	NC	
	P2	PERST#	PCIe reset	Host Output
	P3	CLKREQ#	L1 PM substate	Host Output
	P4	IFDet	Interface detect	Input to Host
	P5	GND	Ground	
	P6	GND	Ground	
	P7	V5	5 V power	Host Output
	P8	V5	5 V power	Host Output
	P9	V5	5 V power	Host Output
	P10	GND	Ground	
	P11	LED#1	Device Activity	Input to Host
	P12	GND	Ground	
	P13	V12	12 V power (No Use/NC)	Host Output
	P14	V12	12 V power (No Use/NC)	Host Output
	P15	V12	12 V power (No Use/NC)	Host Output
RefClk Segment	E7	RefClk+	PCIe common RefClk	Host Output
	E8	RefClk-		
	E9	ClkDet	PCIe RefClk detect (NC)	Input to Host

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> M.2 2280 MODULE INTERFACE CONNECTOR

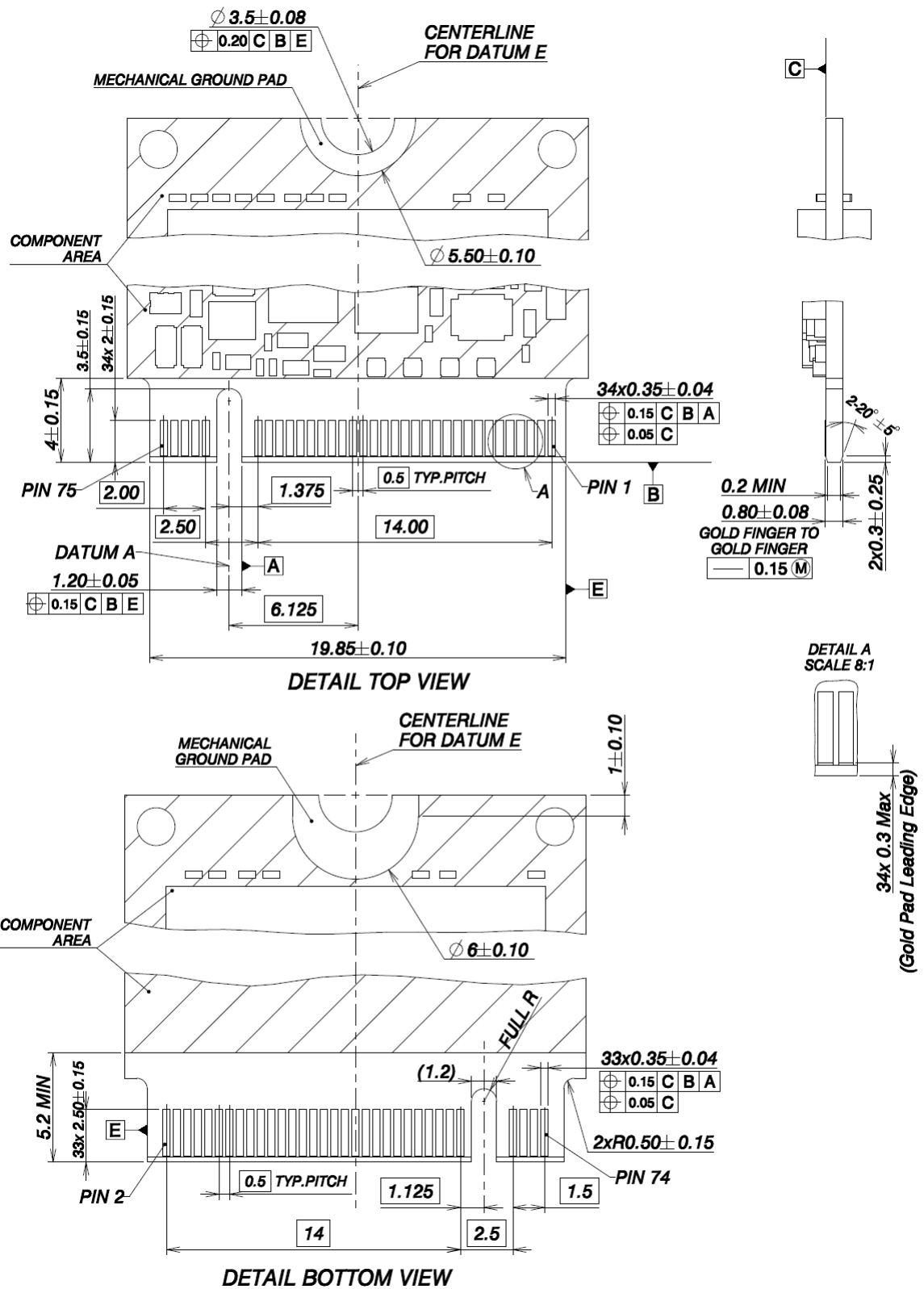


Figure 5: M.2 2280 Module Interface Connector

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> PIN ASSIGNMENT ON M.2 2280 MODULE CONNECTOR

Pin #	Name	Description
1	GND	GND
3	GND	GND
5	PETn3	PCIe Lane 3 Device Transmitter
7	PETp3	
9	GND	GND
11	PERn3	PCIe Lane 3 Device Receiver
13	PERp3	
15	GND	GND
17	PETn2	PCIe Lane 2 Device Transmitter
19	PETp2	
21	GND	GND
23	PERn2	PCIe Lane 2 Device Receiver
25	PERp2	
27	GND	GND
29	PETn1	PCIe Lane 1 Device Transmitter
31	PETp1	
33	GND	GND
35	PERn1	PCIe Lane 1 Device Receiver
37	PERp1	
39	GND	GND
41	PETn0	PCIe Lane 0 Device Transmitter
43	PETp0	
45	GND	GND
47	PERn0	PCIe Lane 0 Device Receiver
49	PERp0	
51	GND	GND
53	REFCLKn	PCIe Reference Clock
55	REFCLKp	PCIe Reference Clock
57	GND	GND
Notch		
67	Reserved	NC
69	PEDET	NC-PCIe
71	GND	GND
73	GND	GND
75	GND	GND

Pin #	Name	Description
2	+3.3V	3.3 V Source
4	+3.3V	3.3 V Source
6	Reserved	NC
8	Reserved	NC
10	LED1#	Device Activity
12	+3.3V	3.3 V Source
14	+3.3V	3.3 V Source
16	+3.3V	3.3 V Source
18	+3.3V	3.3 V Source
20	Reserved	NC
22	Reserved	NC
24	Reserved	NC
26	Reserved	NC
28	Reserved	NC
30	Reserved	NC
32	Reserved	NC
34	Reserved	NC
36	Reserved	NC
38	Reserved	NC
40	Reserved	NC
42	Reserved	NC
44	Reserved	NC
46	Reserved	NC
48	Reserved	NC
50	PERST#	PE-Reset
52	CLKREQ#	Clock Request
54	PEWAKE#	NC
56	MFG1	Manufacturing pin. Must be no- connect on the host board.
58	MFG2	
Notch		
68	SUSCLK	NC
70	+3.3V	3.3 V Source
72	+3.3V	3.3 V Source
74	+3.3V	3.3 V Source

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> COMMAND TABLE

ADMIN Command set

Op-Code	Command Name
00h	Delete I/O Submission Queue
01h	Create I/O Submission Queue
02h	Get Log Page
04h	Delete I/O Completion Queue
05h	Create I/O Completion Queue
06h	Identify
08h	Abort
09h	Set Features
0Ah	Get Features
0Ch	Asynchronous Event Request
0Dh	Namespace Management
10h	Firmware Commit
11h	Firmware Image Download
15h	Namespace Attachment
80h	Format NVM
81h	Security Send ¹⁾
82h	Security Receive ¹⁾

1) A command is supported by TCG Pyrite and SED model only

Set Features / Get Features Set

Op-Code	Feature Name
01h	Arbitration
02h	Power Management
03h	LBA Range Type
04h	Temperature Threshold
05h	Error Recovery
06h	Volatile Write Cache
07h	Number of Queues
08h	Interrupt Coalescing
09h	Interrupt Vector Configuration
0Ah	Write Atomicity Normal
0Bh	Asynchronous Event Configuration
0Ch	Autonomous Power State Transition
80h	Software Progress Marker

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NVM Command Set

Op-Code	Command Name
00h	Flush
01h	Write
02h	Read
04h	Write Uncorrectable
08h	Write Zeroes
09h	Dataset Management

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