TS25N51TAR00IS1

TS51N51TAR00IS1

PCIe Gen 3 x4 M.2 SSD

Transcend's PCIe M.2 SSDs are with high performance and quality flash memory assembled on a printed circuit board. These M.2 SSDs feature cutting-edge technology to enhance product lifespan and data retention. It is designed specifically for various applications such as Ultrabooks, industrial PCs, vehicle PCs and road surveillance recording.

- Power Supply: 3.3V±5%
- Fully compatible with devices and OS that support the PCIe Gen 3 standard
- Compliant with M.2 standards in PCIe specification

Features

- 3D TLC used
- DRAM-less
- PCIe Gen 3 interface, up to 4 lanes
- Compliant with PCI Express specification Rev. 3.1
- Compliant with NVM Express specification Rev. 1.3
- Supports NVM command
- SLC caching technology
- LDPC ECC algorithm
- Dynamic thermal throttling
- Supports Transcend SSD Scope Pro (Optional)
- RoHS compliant

Specifications

Physical Specification			
Form Factor		M.2 TYPE 2280-D2-M	
Storage Capacities		128GB, 256GB, 512GB	
Dimensions	**Length**	80.00 ± 0.15 mm	3.150 ± 0.006 inch
	Width	22.00 ± 0.15 mm	0.866 ± 0.006 inch
	Height	Max 3.58 mm	Max 0.1409 inch
Input Voltage		3.3V ± 5%	
Weight		8 g ± 5%	
Connector		M.2 module notch M	

Environmental Specifications		
Operating Temperature		0 ℃ to 70 ℃
Storage Temperature		-40 ℃ to 85 ℃
Humidity	**Operating**	0% to 95% (Non-condensing)
	Non-Operating	0% to 95% (Non-condensing)

Performance						
Capacity	**ATTO**		**CrystalDiskMark**		**IOmeter**	
	Max. Read *	**Max. Write** *	**Sequential Read** **	**Sequential Write** **	**IOPS Random Read** (4KB QD32) ***	**IOPS Random Write** (4KB QD32) ***
256GB	1800	800	1800	800	110K	95K
512GB	1800	1500	1800	1450	180K	150K

Note: Maximum transfer speed recorded

* 25 ℃, test on ASUS Z170-E, 4GB, Windows® 10 64bit Professional version 1709 ,enable HMB(Host Memory Buffer) function, benchmark utility ATTO (version 3.05), unit MB/s

** 25 ℃, test on ASUS Z170-E, 4GB, Windows® 10 64bit Professional version 1709 ,enable HMB(Host Memory Buffer) function, benchmark utility CrystalDiskMark (version 5.1.2), copied file 1000MB, unit MB/s

*** 25 ℃, test on ASUS Z170-E, 4GB, Windows® 10 64bit Professional version 1709 ,enable HMB(Host Memory Buffer) function,, benchmark utility IOmeter 1.1.0 with 4K file size and queue depth of 32, unit IOPs

**** The recorded performance is obtained while the SSD is not operating as an OS disk Physical Specification

Actual Capacity	
Capacity	**Max. LBA**
TS256GMTE510T	500,118,192
TS512GMTE510T	1,000,215,216

Power Requirements		
Input Voltage		3.3V ± 5% @ 25 °C
Mode P/N / Power Consumption		**Typical (mA)**
TS256GMTE510T	**Max Write**	1100
	Max Read	1180
	Idle	165
TS512GMTE510T	**Max Write**	1280
	Max Read	1250
	Idle	165

Reliability			
MTBF	1,500,000 hours		
Endurance (Terabytes Written)	Capacity	* TBW	** TBW (Base on JEDEC Standard)
	256G	150	75
	512G	300	150
DWPD (Drive Writes Per Day for 3 years)	0.27 DWPD		

*Tested under burn-in tool, TBW value may vary due to host environment.
**Tested under JESD219A endurance workloads specification.

Vibration	
Operating	3.0G, 5 - 800Hz
Non-Operating	5.0G, 5 - 800Hz

Reference to IEC 60068-2-6 Testing procedures; Operating-Sine wave, 5-800Hz/1 oct., 1.5mm, 3g, 0.5 hr./axis, total 1.5 hrs.

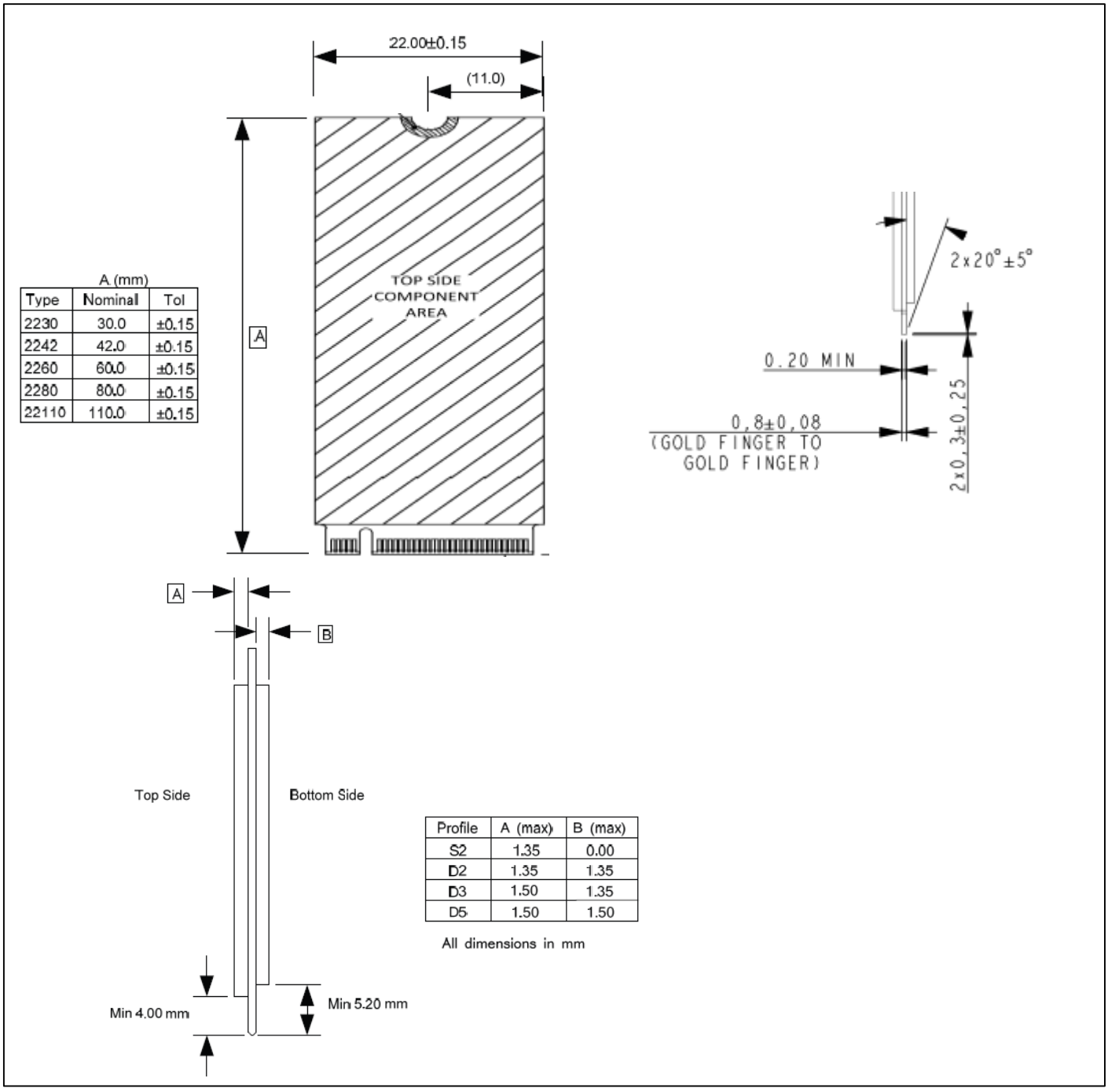
Shock	
Operating	1500G, 0.5ms
Non-Operating	1500G, 0.5ms

Reference to IEC 60068-2-27 Testing procedures; Operating-Half-sine wave, 1500G, 0.5ms, 3 times/dir., total 18 times.

Regulations	
Compliance	CE, FCC and BSMI

Package Dimensions

The figure below illustrates the Transcend M.2 Type 2280-D2-M Solid State Drive. All dimensions are in mm.



A (mm)		
Type	Nominal	Tol
2230	30.0	±0.15
2242	42.0	±0.15
2260	60.0	±0.15
2280	80.0	±0.15
22110	110.0	±0.15

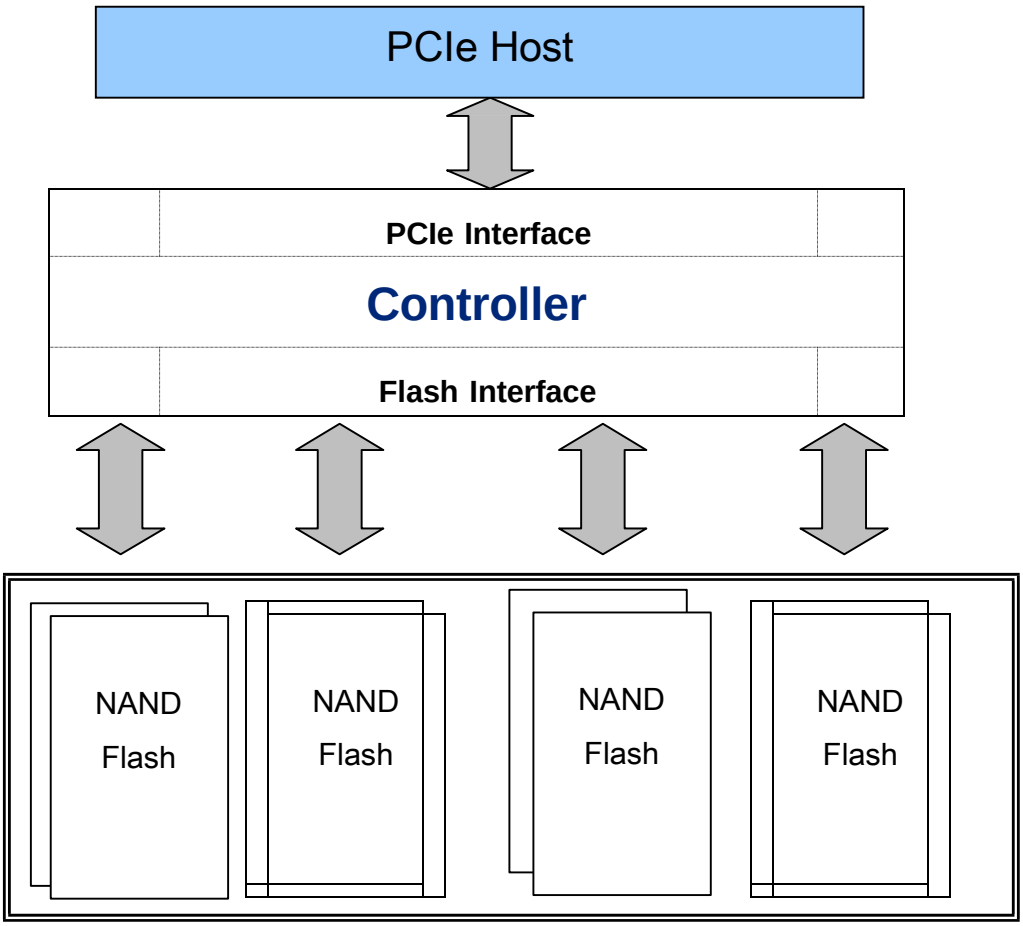
Profile	A (max)	B (max)
S2	1.35	0.00
D2	1.35	1.35
D3	1.50	1.35
D5	1.50	1.50

All dimensions in mm

Pin Assignments

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
01	GND	02	3.3V	39	GND	40	NC
03	GND	04	3.3V	41	PETn0	42	NC
05	PETn3	06	NC	43	PETp0	44	NC
07	PETp3	08	NC	45	GND	46	NC
09	GND	10	LED1	47	PERn0	48	NC
11	PERn3	12	3.3V	49	PERp0	50	PERST#
13	PERp3	14	3.3V	51	GND	52	CLKREQ#
15	GND	16	3.3V	53	REFCLKN	54	NC
17	PETn2	18	3.3V	55	REFCLKP	56	NC
19	PETp2	20	NC	57	GND	58	NC
21	GND	22	NC	59	NOTCH	60	NOTCH
23	PERn2	24	NC	61	NOTCH	62	NOTCH
25	PERp2	26	NC	63	NOTCH	64	NOTCH
27	GND	28	NC	65	NOTCH	66	NOTCH
29	PETn1	30	NC	67	NC	68	NC
31	PETp1	32	NC	69	NC	70	3.3V
33	GND	34	NC	71	GND	72	3.3V
35	PERn1	36	NC	73	GND	74	3.3V
37	PERp1	38	NC	75	GND		

Block Diagram



Features

- **Global Wear Leveling – Advanced algorithm to enhance the Wear-Leveling Efficiency**
  Global wear leveling ensures every block has an even erase count. By ensuring all spare blocks in the SSD's flash chips are managed in a single pool, each block can then have an even erase count. This helps to extend the lifespan of a SSD and to provide the best possible endurance.

  There are three main processes in global wear-leveling:

  1 Record the block erase count and save this in the wear-leveling table.

  2 Finds the static-block and saves this in the wear-leveling pointer.

  3 Checks the erase count when a block is pulled from the pool of spare blocks. If the erased block count is larger than the Wear Count (WEARCNT), then the static blocks are leveraged against the over-count blocks.

- **Bad Block Management**
  When the flash encounters an ECC, program or erase failure, the controller will mark the block as a bad block to prevent use of this block and cause data loss in the future.

- **Advanced Garbage Collection**
  Transcend's SSDs have a perfect garbage collection mechanism to help improve performance. Advanced Garbage collection can efficiently improve memory management to ensure the SSD's stable performance. With Transcend advanced flash management, the drive can still keep high performance even after a long operating time.

- **Enhanced S.M.A.R.T. function**
  Transcend SSD supports the innovative S.M.A.R.T. command (Self-Monitoring, Analysis, and Reporting Technology) that allows the user to read the health information of the SSD in a much more efficient way.

- **Power Shield**
  The controller uses internal power shield circuit to prevent SSD from being damaged when a sudden power outage occurs. The SSD's internal power detection mechanism can monitor power provided by the host. When a sudden power outage happens, the SSD can execute power shield mechanism to protect data stored on the SSD.

- **LDPC ECC algorithm**
  LDPC (Low-Density Parity Check) is a powerful ECC algorithm which offers better quality and reliability in order to keep your data secure. LDPC mechanism is better for massive data transmission environment.

- **SLC Caching**
  SLC caching allows TLC NAND to operate in SLC mode and boosts performance and endurance as the write amplification on the TLC NAND is minimized.

- **Dynamic Thermal Throttling**
  For PCIe SSD applications, when operation temperature increases, system CLK will decrease to protect the SSD and controller with dynamic thermal throttling algorithm. The read/write speeds of the SSD will change at different temperature levels in order to extend its lifespan.

Admin Command Register

The Admin command set is the commands that are submitted to the Admin Submission Queues. The detailed specifications are described in NVM Express specification document.

Opcode (Hex)	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 Feature
0Ah	Get Feature
0Ch	Asynchronous Event Request
10h	Firmware Commit
11h	Firmware Image Download
80h - BFh	I/O Command Set Specific
C0h - FFh	Vendor Specific

SMART / Health Log Page

Bytes	Description	Default Value
0	Critical Warning Bits: Description 07:05 Reserved 04 If set to 1, then the volatile memory backup device has failed. This field is only valid if the controller has a volatile memory backup solution. 03 If set to 1, then the media has been placed in read only mode. 02 If set to 1, then the NVM subsystem reliability has been degraded due to significant media related errors or any internal error that degrades NVM subsystem reliability. 01 If set to 1, then a temperature is above an over temperature threshold or below an under temperature threshold. 00 If set to 1, then the available spare has fallen below the threshold.	0
2:1	Composite Temperature	Current temperature
3	Available Spare	Base on capacity
4	Available Spare Threshold	Base on capacity
5	Percentage Used	0
31:6	Reserved	-
47:32	Data Units Read	0
63:48	Data Units Written	0
79:64	Host Read Commands	0
95:80	Host Write Commands	0
111:96	Controller Busy Time	0
127:112	Power Cycles	0
143:128	Power On Hours	0
159:144	Unsafe Shutdowns	0
175:160	Media and Data Integrity Errors	0
191:176	Number of Error Information Log Entries	0
195:192	Warning Composite Temperature Time	0
199:196	Critical Composite Temperature Time	0