MTE652T –

PCIe Gen 3 x4 M.2 SSD

Transcend's MTE652T series are PCIe M.2 SSDs 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. MTE652T 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
- 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
- RAID engine
- LDPC ECC algorithm
- Feature a DDR3 DRAM cache
- Dynamic thermal throttling
- Supports Transcend SSD Scope Pro
- RoHS compliant
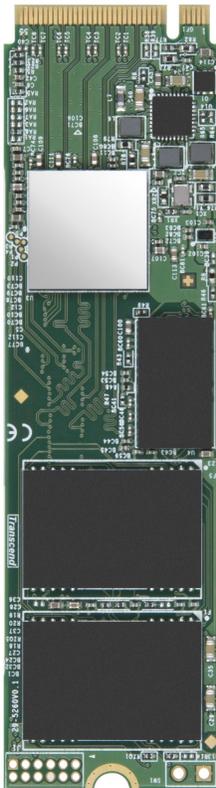
Specifications

Physical Specification			
Form Factor	M.2 TYPE 2280-D2-M		
Storage Capacities	128GB, 256GB, 512GB,1TB		
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	$3.3V \pm 5\%$		
Weight (MAX)	9 g		
Connector	M.2 module notch M		

Environmental Specifications	
Operating Temperature	Commercial (0 ºC to +70 ºC)
Humidity	5% to 95%, non-condensing
Vibration	5 - 800 Hz, 20 G (peak-to-peak)
Shock	1500 G, 0.5 ms, 3axis
Warranty	3 years limited

Performance						
	ATTO		CrystalDiskMark		IOmeter	
Model P/N	**Max. Read** *	**Max. Write** *	**Sequential Read** **	**Sequential Write** **	**IOPS Random Read** (4KB QD32) ***	**IOPS Random Write** (4KB QD32) ***
TS128GMTE652T	1600	660	1600	600	100K	150K
TS256GMTE652T	1700	1350	1700	1250	190K	290K
TS512GMTE652T	1700	1600	1700	1600	290K	300K
TS1TMTE652T	1700	1600	1700	1600	165K	125K

Note: Maximum transfer speed recorded

* 25 ℃, test on ASUS Z170-E, 4GB, Windows® 10 64bit Professional, benchmark utility ATTO (version 2.41), unit MB/s

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

*** 25 ℃, test on ASUS Z170-E, 4GB, Windows® 10 64bit Professional, 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

Model P/N	Max. LBA
TS128GMTE652T	250,069,680
TS256GMTE652T	500,118,192
TS512GMTE652T	1,000,215,216
TS1TMTE652T	2,000,409,264

Power Consumption

Input Voltage		3.3V ± 5%
Model P/N / Power Consumption		**Typical**
TS128GMTE652T	Max Write	TBD
	Max Read	TBD
	Idle	TBD
TS256GMTE652T	Max Write	3.3W
	Max Read	2.9W
	Idle	0.6W
TS512GMTE652T	Max Write	TBD
	Max Read	TBD
	Idle	TBD
TS1TMTE652T	Max Write	3.5W
	Max Read	2.7W
	Idle	0.6W

*Tested with IOmeter running sequential reads/writes and idle mode
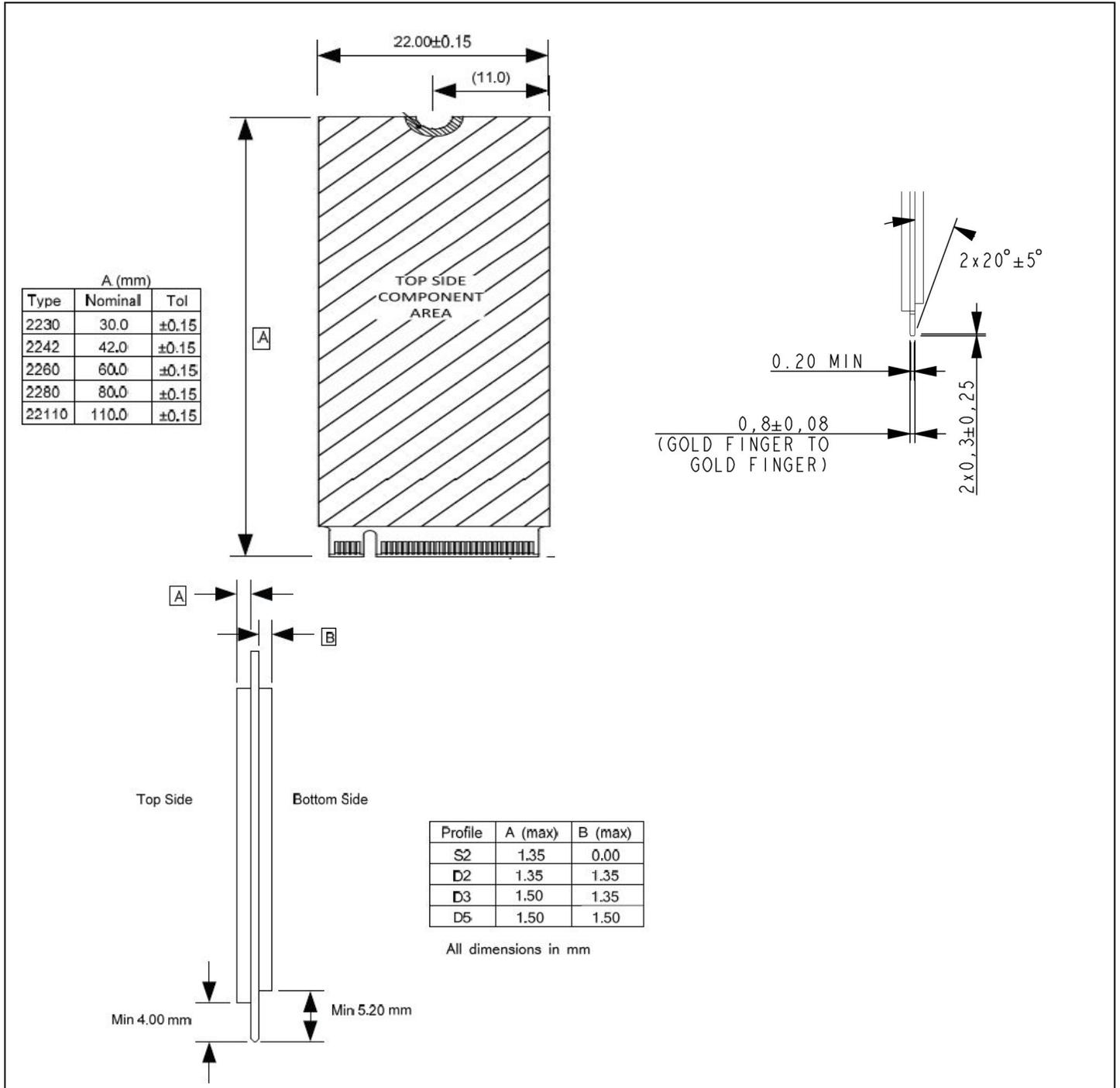**PCIe L1.2 link state with NVMe PS4 for lowest power consumption

Reliability

MTBF		1,500,000 hours	
Endurance (Terabytes Written)	Capacity	* TBW	** TBW (Base on JEDEC Standard)
	128G	270	135
	256G	540	270
	512G	1080	540
	1T	2160	1080
DWPD (Drive Writes Per Day for 3 years)		2	

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

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.

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

A (mm)

22.00±0.15
(11.0)

TOP SIDE COMPONENT AREA

2 x 20° ±5°
0.20 MIN
2 x 0.3±0.25
0.8±0.08
(GOLD FINGER TO GOLD FINGER)

Top Side   Bottom Side

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

Min 4.00 mm   Min 5.20 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
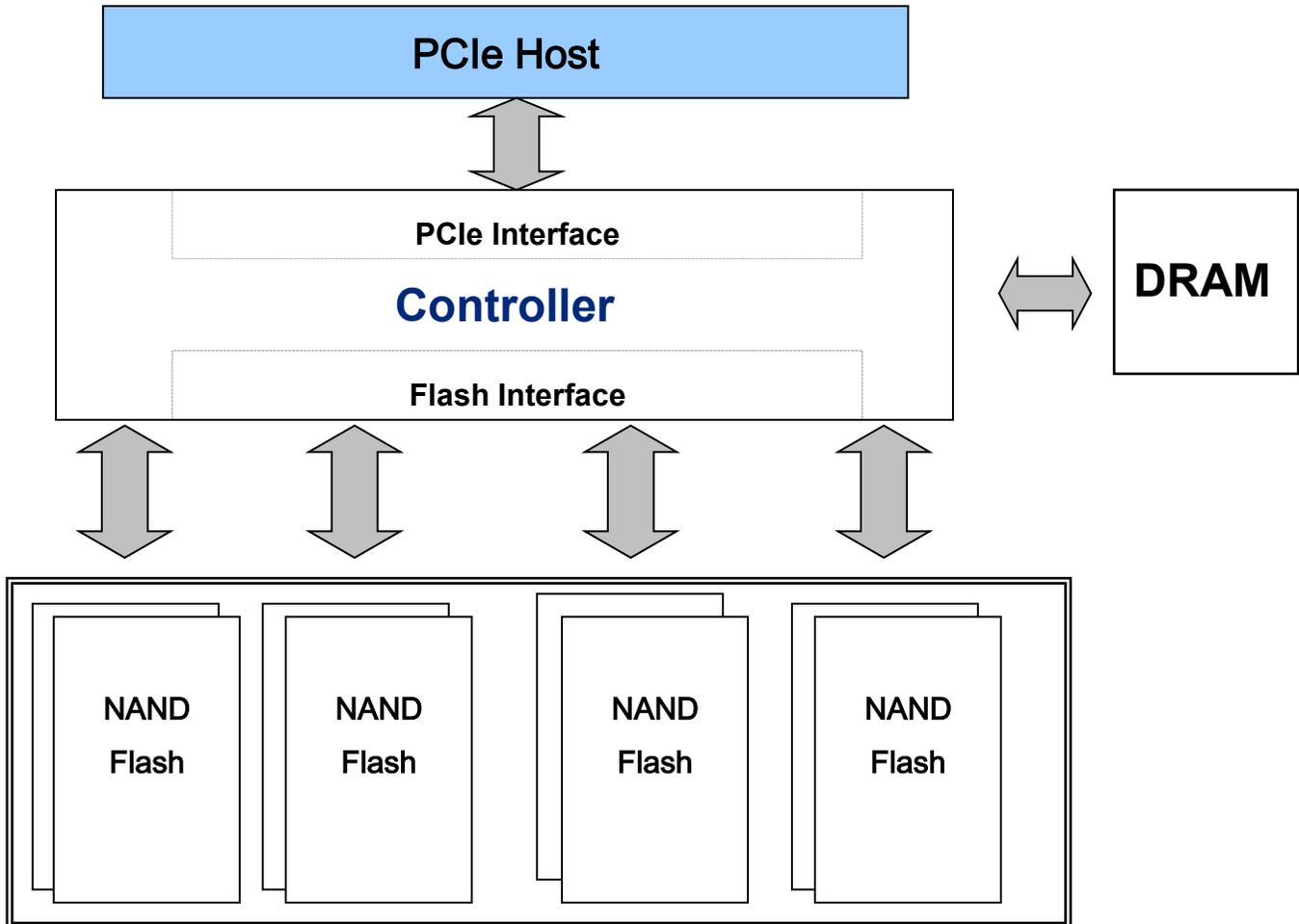
Features

- **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.

- **RAID engine**

  RAID engine technology stores data parity information in a specific area. The parity information can restore damaged data back which can enhance data reliability.

- **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 MLC NAND to operate in SLC mode (like the way our SuperMLC technology does) and boosts performance and endurance as the write amplification on the MLC NAND is minimized.

  Data writing flow: Host -> Controller -> DRAM -> Controller -> SLC cache -> MLC NAND

- **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 Activate
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**		0
	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.	
2:1	Composite Temperature		Current temperature
3	Available Spare		100
4	Available Spare Threshold		10
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

Ordering Information

Capacity	Model P/N
128GB	TS128GMTE652T
256GB	TS256GMTE652T
512GB	TS512GMTE652T
1TB	TS1TMTE652T

The technical information above is based on industry standard data and has been tested to be reliable. However, Transcend makes no warranty, either expressed or implied, as to its accuracy and assumes no liability in connection with the use of this product. Transcend reserves the right to make changes to the specifications at any time without prior notice. Due to the complexity and variety of industrial applications, for special applications and environments, it is strongly suggested to contact Transcend or its authorized resellers beforehand for compatibility confirmation.

TAIWAN
No.70, XingZhong Rd., NeiHu Dist., Taipei, Taiwan, R.O.C
TEL +886-2-2792-8000
Fax +886-2-2793-2222
E-mail: sales-tw@transcend-info.com
http://tw.transcend-info.com

USA
Los Angeles:
E-mail:sales-us@transcend-info.com
Maryland:
E-mail:sales-us@transcend-info.com
Florida:
E-mail:sales-us@transcend-info.com
Silicon Valley:
E-mail:sales-us@transcend-info.com
http://www.transcend-info.com

CHINA
Shanghai:
E-mail: sales-cn@transcendchina.com
Beijing:
E-mail: sales-cn@transcendchina.com
Shenzhen:
E-mail:sales-cn@transcendchina.com
http://cn.transcend-info.com
GERMANY
E-mail:sales-de@transcend-info.com
http://de.transcend-info.com
HONG KONG
E-mail: sales-hk@transcend-info.com
http://hk.transcend-info.com
JAPAN
E-mail: sales-jp@transcend-info.com
http://jp.transcend-info.com
THE NETHERLANDS
E-mail: sales-nl@transcend-info.com
http://nl.transcend-info.com
United Kingdom
E-mail: sales-uk@transcend-info.com
http://uk.transcend-info.com
KOREA
E-mail: sales-kr@transcend-info.com
http://kr.transcend-info.com

Revision History		
Version	**Date**	**Modification Content**
V0.1	2019/07/31	Draft Release
V0.2	2019/09/04	Update 128GB/256GB Performance
V0.3	2019/09/10	Update 512GB Performance
V0.4	2019/09/12	Change DWPD Value