



## Industrial 3D TLC

Phillip Blume

A large, dark red arrow pointing to the right, with a white outline. The word 'Agenda' is written in white, bold, sans-serif font inside the arrow.

# Agenda

**01**

**Company Introduction**

**02**

**Next Level Industrial  
Memory Solutions**

**03**

**Future Outlook**



# *Company Introduction*

# About Transcend



Founded in  
**1988**



Made in  
**Taiwan**



**13**  
Offices Worldwide



Total Employees  
**1300**



Total Products  
**2000**



Went Public Since  
**2001**



# Global Network



## Europe



United Kingdom



The Netherlands



Germany

## Asia



Korea



Japan

## HQ



Taiwan Headquarters



Taipei Factory

## China



Beijing



Shanghai



Shenzhen



Hong Kong

## United States



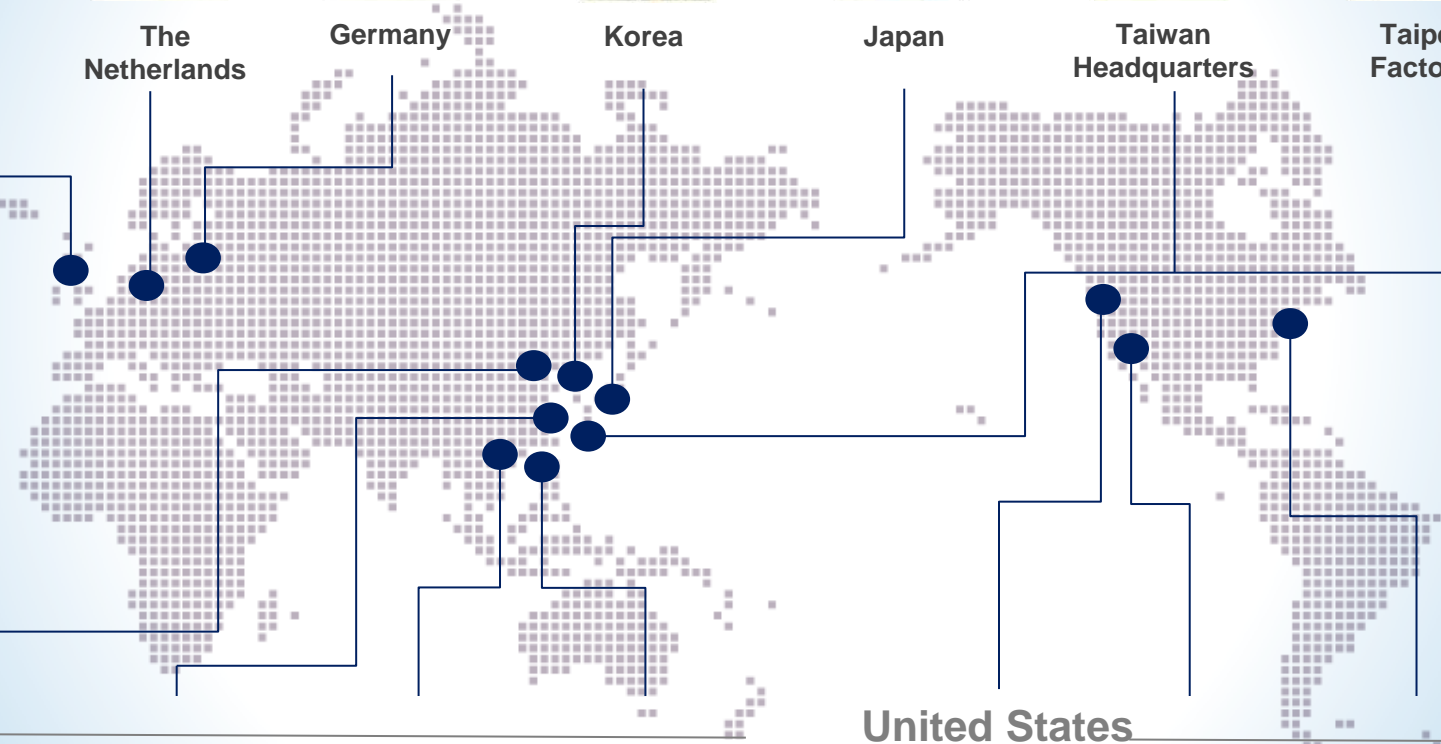
Los Angeles



Silicon Valley



Maryland



# Embedded Solutions



## SSD Solutions

2.5" SSDs  
2.5" PATA SSDs  
M.2 SSDs  
PCIe SSDs  
mSATA SSDs  
Half-Slim SSDs

## Memory Cards

SD Cards  
microSD Cards  
CompactFlash Cards  
CFast Cards  
CF Express Cards  
MMC

## Flash Solutions

PATA DOM  
USB Drives  
Flash Modules

## DRAM Modules

DDR4  
DDR3  
DDR2/DDR/SDRAM

# Management of Product Life Cycle



## Rigorous Testing

100% Testing

- No exception (every part is tested)



## Fixed BOM Management

Customers can receive fixed solutions with consistent compatibility



## Roadmaps & Failure Analysis Report

- Streamline the transition to alternative solutions
- Instant report about product failure



# Technologies

## DURABILITY:



Bad Block Management



TRIM



Read Disturbance



Wear Leveling

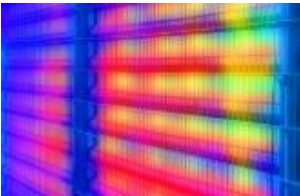


Garbage Collection

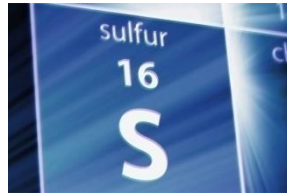


96-layer  
3D NAND Flash

## RELIABILITY:



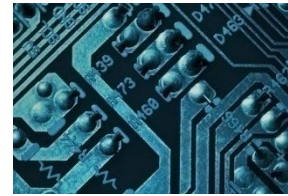
Thermal Sensor



Anti-sulfur



Wide Temperature



Corner Bond &  
Underfill



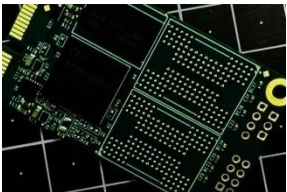
Conformal Coating



Intelligent Power  
Shield & Power Shield

## STABILITY:

## SECURITY:



Hardware Purge



TCG Opal  
Specifications

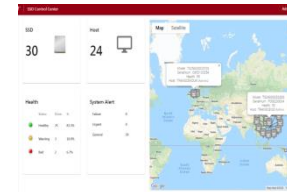


AES Encryption



Scope Pro

## MANAGEMENT:



SSD Control Center



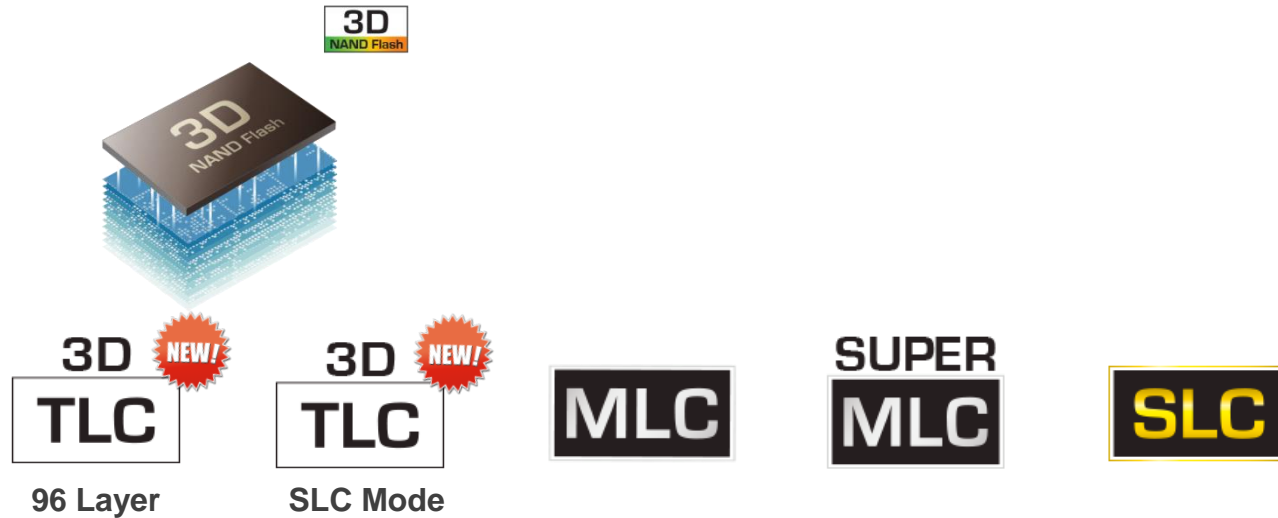


***Next Level Industrial  
Memory Solutions***

# Mainstream Flash Solutions



# NAND Flash Technologies



	3D TLC 96 Layer	3D TLC SLC Mode	MLC	SUPER MLC	SLC
Endurance (P/E cycles)	3000	50,000 to 100,000	3000	30000	50000
Bit per cell	3	1	2	1	1
Performance	●●●	●●●●	●●	●●●	●●●●
Cost	●	●●●	●●	●●●●	●●●●●●●●●●
Features	For price sensitive applications, who need an endurance better than std. 3D	For price sensitive applications, who need an endurance better than std. 3D	Majorly used in SSD and most industrial applications	More affordable than SLC, better performance than MLC	Where cost may be less important than disk lifetime

# Transcend 2<sup>nd</sup> Gen BiCS4 SSD



## Transcend's 2<sup>nd</sup> Generation BiCS4 SSDs for Embedded Applications

More Features:

- 3000 P/E-Cycles
- -20°C ~ 75°C Extended Operating Temperature
- 30μ" PCB Gold Fingers (Except SSD452K2)
- Dynamic Thermal Throttling
- Corner Bond



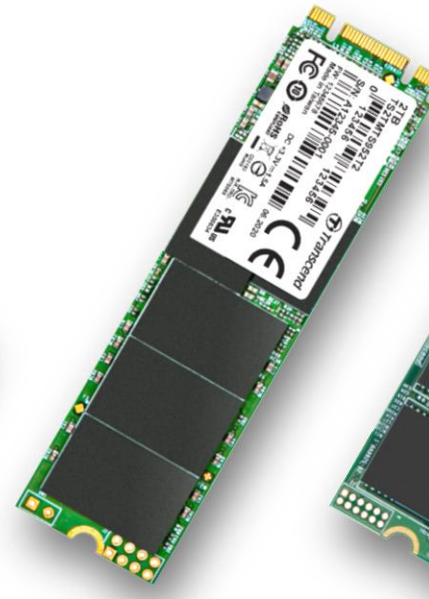
**SSD452K2**  
SATA3  
2.5"



**MSA452T2**  
SATA3  
mSATA



**MTS552T2**  
SATA3  
M.2 2242



**MTS952T2**  
SATA3  
M.2 2280



**MTE652T2/662T2**  
PCIe  
M.2 2280

# Why Transcend 2<sup>nd</sup> Gen BiCS4 SSD?



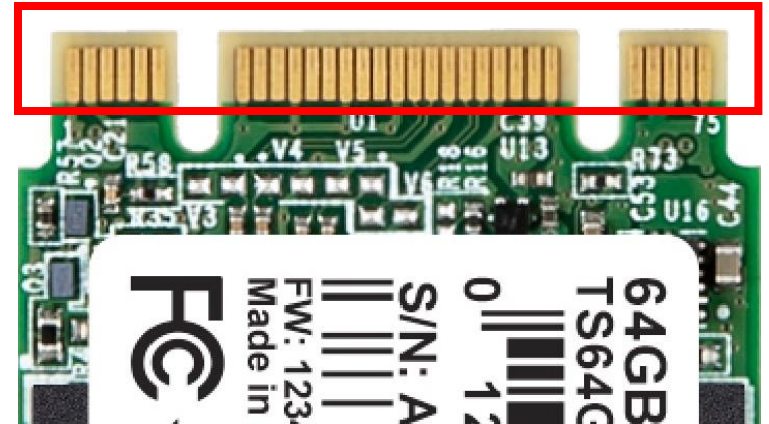
## Extended Temperature -20°C~75°C

- Strengthened **Reliability**
- 100% environmental chamber testing



## 30μ” PCB Gold Finger

- Increased **Durability**
- Electroplated hard gold 30u”

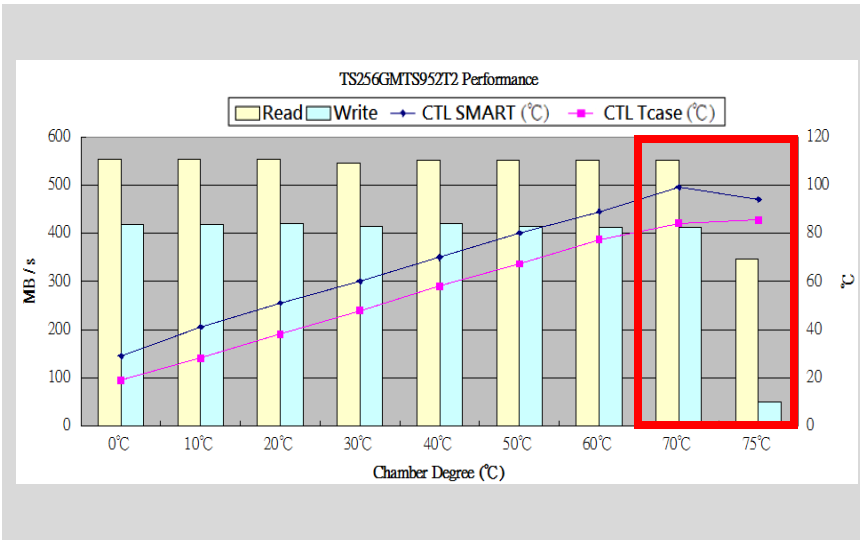


# Why Transcend 2<sup>nd</sup> Gen BiCS4 SSD?



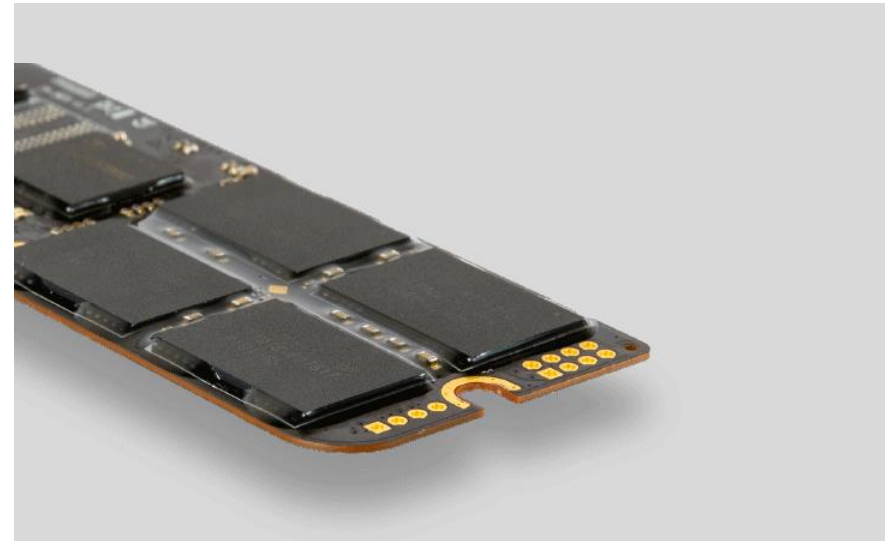
## Dynamic Thermal Throttling

- Optimized **Stability**
- Protects against overheating
- Dynamically adjusts speed & temp.



## Corner-Bond

- Enhanced **Quality**
- Protects against vibratory stress
- Applied in-house



# PCIe M.2 SSD

96-layer 3D TLC Lineup



**MTE352T2  
MTE352T-I**



**MTE452T2  
MTE452T-I  
(2 Channel)**



**MTE652T2  
MTE652T-I  
(4 Channel)**



**MTE662T2  
MTE662T-I  
(8 Channel)**

NAND Flash

3D TLC  
96-layer

3D TLC  
96-layer

3D TLC  
96-layer

3D TLC  
96-layer

Capacity

64GB – 512GB

64GB – 512GB

64GB – 512GB

512GB – 2TB

Operating  
Temperature

Extended/  
Wide Temperature

Extended/  
Wide Temperature

Extended/  
Wide Temperature

Extended/  
Wide Temperature

3K P/E cycles



DRAM Cache

-



# SATA III M.2 SSD



## Lineup



**MTS552T2**  
**MTS552T-I**



**MTS400**  
**MTS400I**



**MTS600**  
**MTS600I**



**MTS952T2**  
**MTS952T-I**



**MTS800**  
**MTS800I**

<b>NAND Flash</b>	3D TLC 96-layer	MLC	MLC	3D TLC 96-layer	MLC
<b>Capacity</b>	64GB – 512GB	16GB - 512GB	32GB - 512GB	64GB – 2TB	16GB – 1TB
<b>Operating Temperature</b>	Extended/ Wide Temperature	Standard / Wide Temperature	Standard / Wide Temperature	Extended/ Wide Temperature	Standard / Wide Temperature
<b>P/E cycles</b>	3K	3K	3K	3K	3K
<b>DRAM Cache</b>	●	●	●	●	●

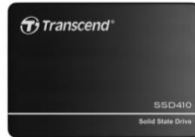


# 2.5" SATA SSD

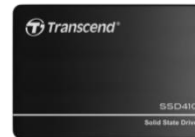
## Lineup



**SSD452K2  
SSD452K-I**



**SSD420K  
SSD420I**



**SSD510K**



**SSD570K  
SSD570KI**



**SSD530K**

<b>NAND Flash</b>	3D TLC 96-layer	MLC	SuperMLC	SLC	3D TLC SLC Mode
<b>Capacity</b>	64GB – 2TB	16GB - 1TB	16GB - 128GB	8GB - 128GB	64GB – 128GB
<b>Operating Temperature</b>	Extended / Wide Temperature	Standard / Wide Temperature	Standard Temperature	Standard / Wide Temperature	Extended Temperature
<b>P/E cycles</b>	3K	3K	30K	50K	100K
<b>DRAM Cache</b>	●	●	●	●	●

# Half-Slim SSD

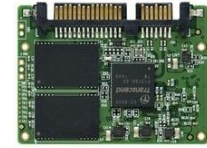
## Lineup



**HSD452T2**  
**HSD452T-I**



**HSD450T**



**HSD370**  
**HSD370I**

NAND Flash	3D TLC 96-layer	3D TLC 64-layer	MLC
Capacity	64GB - 512GB	32GB - 128GB	16GB - 128GB
Operating Temperature	Extended / Wide Temperature	Standard Temperature	Standard / Wide Temperature
3K P/E cycles	●	-	-
DRAM Cache	●	●	●

# mSATA SSD

## Lineup



**MSA452T2  
MSA452T-I**



**MSA450T**



**MSA370  
MSA370I**



**MSA510**



**MSM360**

<b>NAND Flash</b>	3D TLC 96-layer	3D TLC	MLC	SuperMLC	MLC
<b>Capacity</b>	64GB – 1TB	32GB - 512GB	16GB - 1TB	8GB - 64GB	16GB - 128GB
<b>Operating Temperature</b>	Extended / Wide Temperature	Standard Temperature	Standard / Wide Temperature	Standard Temperature	Standard Temperature
<b>P/E cycles</b>	3K	-	3K	30K	3K
<b>DRAM Cache</b>	●	●	●	●	-

# High Endurance Solutions (SLC Mode)



# Applications

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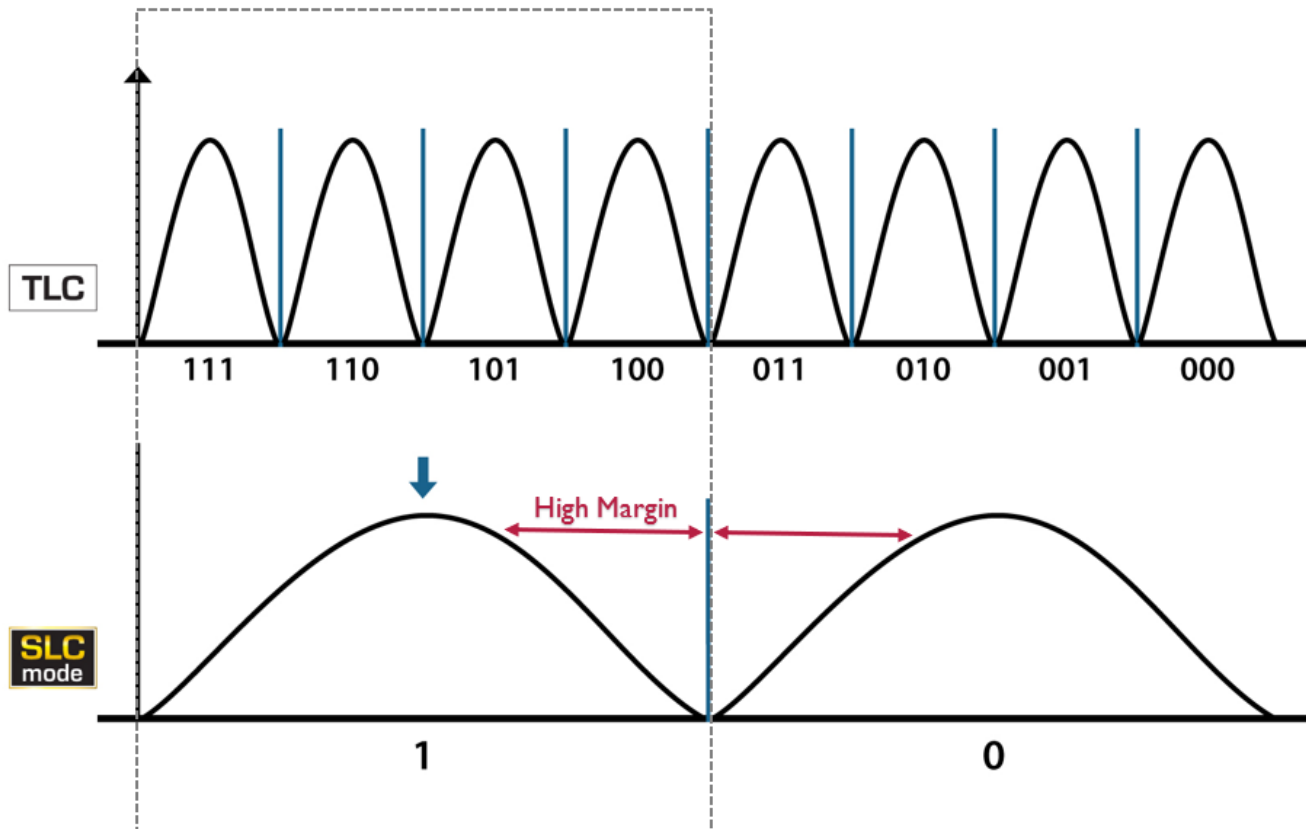
- Compatible platforms: Any devices can use SLC mode (3D TLC) products
- Reasons to use it
  - Demands with **high endurance and high reliability**  
With P/E cycles > 3K times
  - Demands with **high-capacity SLC** products  
The pure SLC solution is less available in the future.
  - Demands with **constant write performance**  
No SLC cache design



# SLC mode (WD 3D TLC BiSC4)

- Using **96 Layer 3D TLC** chips, Transcend SLC mode technology (by adjusting firmware coding) reduces total bit capacity, but greatly improves reliability and data retention.

SLC mode technology makes  
3D TLC act like SLC



Bit error from small  
charge loss, more  
precise charge level  
placement required

Bit error requires  
large charge loss

# Transcend SSD530K Series



## SSD SLC mode on TLC

### SSD530K

- 2.5" SATA III
- SLC mode on TLC
- 64GB/128GB samples available. Other densities available upon request



### Hardware Features

- SLC mode on 96-Layer 3D TLC NAND Flash, **100K P/E cycles**
- Extended Temp: **-20°C to 75°C**
- Embedded **DRAM cache**
- **Corner bond**

### Firmware Features

- LDPC ECC
- Internal RAID Engine
- **Dynamic Thermal Throttling**

### Software Features

- Transcend **Scope Pro**

# 3D TLC as industry solution



Model	TS128GSSD570K	TS128GSSD510K	TS128GSSD420K	TS128GSSD452K2	TS128GSSD530K (SLC mode)*
NAND Flash	SLC	SuperMLC (SLC Mode based on MLC)	MLC	3D TLC	SLC mode (3D TLC)
P/E Cycles	60.000	30.000	3.000	3.000	100.000
Maximum sequential read/write	Read: 300MB/s Write: 130MB/s	Read: 300MB/s Write: 150MB/s	Read: 530MB/s Write: 210MB/s	Read: 560MB/s Write: 410MB/s	Read: 560MB/s Write: 420MB/s
Pricing factor	35,0	4,4	2,0	1,0	2,5



# Flash Card Solutions

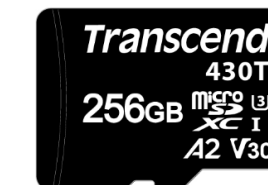
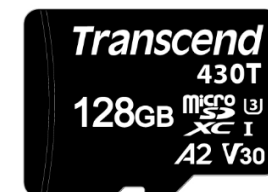
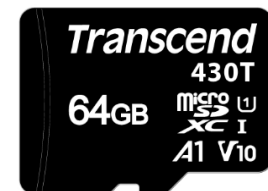
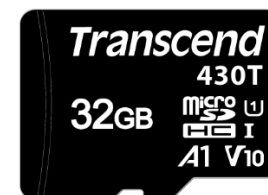


# New Item : USD430T

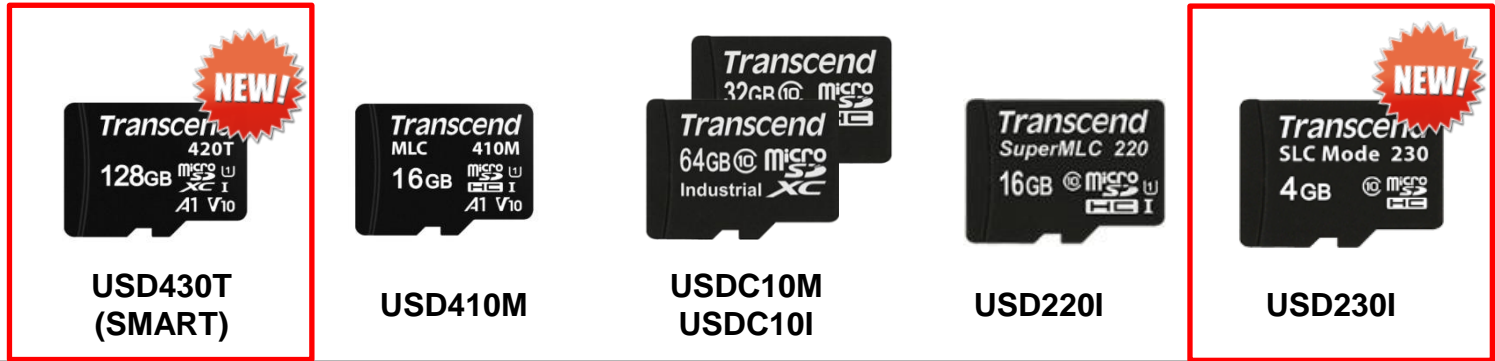


- LDPC ECC engine for higher data stability
- Higher performance
- S.M.A.R.T. support for MicroSD health monitor

TS32-256GUSD430T	
NAND Flash	3D TLC (96-Layer)
Capacity	32/64/128/256GB
SD Compliance	<b>SD 5.1</b>
Speed Class	32-64GB :UHS-I U1 A1 128-256GB:UHS-I U2 A2
Performance	32-64GB: 100/40 MB/S 128-256GB : 100/60 MB/S
Operating Temp.	-25°C ~ 85°C
Storage Temp.	-40°C ~ 85°C
S.M.A.R.T	Support
Warranty	Three-year Limited



# Transcend starkes SD Karten Lineup



**USD430T  
(SMART)**

**USD410M**

**USDC10M  
USDC10I**

**USD220I**

**USD230I**

<b>NAND Flash</b>	3D TLC	MLC	MLC	SuperMLC	3D TLC SLC Mode
<b>Capacity</b>	32 – 256GB	2GB – 16GB	8GB - 64GB	4GB - 16GB	2GB - 64GB
<b>Operating Temperature</b>	Standard / Wide Temperature	Standard Temperature	Wide Temperature	Wide Temperature	Wide Temperature
<b>3K P/E cycles</b>	3k	3k	3k	30k	60/100k

# DRAM Modules



# DRAM Modules



**Wide Temperature**



**Standard**



**Server**

# Standard

## DRAM Modules



### DDR4

### DDR3

Module Type	U-DIMM	SO-DIMM	U-DIMM	SO-DIMM
Frequency	2133/ 2400/ 2666/3200		1066/ 1333/ 1600/ 1866	
Pin Count	U-DIMM: 288 pin SO-DIMM: 260 pin		U-DIMM: 240 pin SO-DIMM: 204 pin	
Capacity	2GB~32GB	2GB~32GB	1GB~8GB	1GB~16GB
DRAM Configuration	256Mx16 512Mx8 1Gx8 2Gx8	256Mx16 512Mx8 1Gx8 2Gx8	128Mx8 256Mx8 512Mx8	128Mx8 256Mx8 256Mx16 512Mx8
Voltage	1.2V	1.2V	1.35V/ 1.5V	1.35V/ 1.5V
PCB Height	1.23 inches	1.18 inches	1.18 inches	1.18 inches
Operating Temperature	Commercial Temp: 0°C ~ 85°C Industrial Temp: -40°C ~ 85°C			
VLP*	●	-	●	-
ECC/Reg-Option	●	●	●	●

# Future Outlook

```
mirror_mod.use_  
mirror_mod.use_  
mirror_mod.use_  
  
#selection at t  
mirror_ob.select= 1  
modifier_ob.select=  
bpy.context.scene.ob  
print("Selected" + .  
#mirror_ob.sele  
done = bpy.context.  
bpy.data.objects[  
    ]
```



# 5G Industry Market Trends



eMBB  
10Gbps  
Enhanced Mobile Broadband

Smart home/  
building



3D video, 4K screen



Work and play in the cloud

Future IMT



Augmented reality

Industry automation

Smart city



Self-driving car







**Thank you!**