Transcend®

Transportation Application

Embedded Solutions

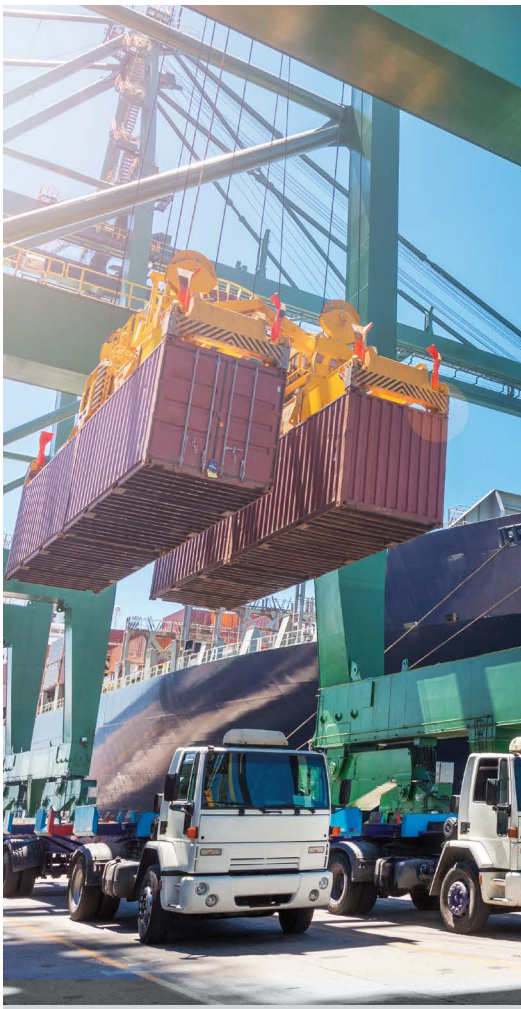
Quality, stability, reliability.

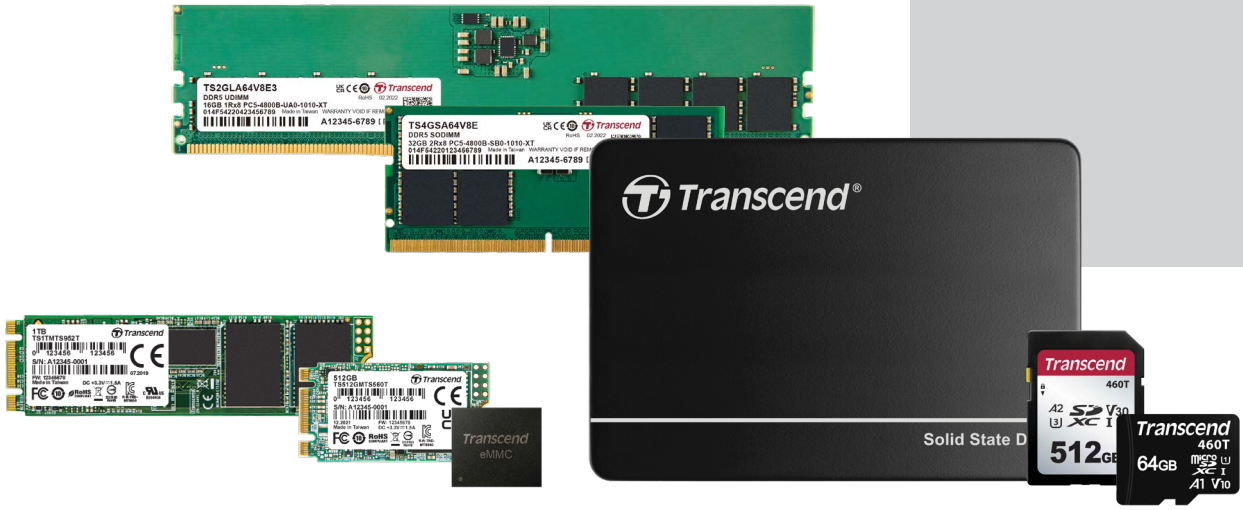
Comprehensive storage solutions for the transportation industry.

Introduction

Transportation applications have become more sophisticated, thanks to the advanced internet access. From in-vehicle electronics, navigation components, to traffic monitoring systems and fleet surveillance; a massive amount of data need to be dealt with. More often than not, various setbacks would appear that make the data storage in transportation more difficult, which includes high temperature, shock and vibration, pollution, and unstable power supply. Thus, having durable and stable memory devices has become an imperative need.

Transcend's embedded storage solutions have been designed to cope with the challenges commonly seen in transportation, helping businesses to realize smart, secure, and sustainable transportation in the modern world.





Applications

Public Transportation Surveillance Systems

- Onboard surveillance systems
- Railroad surveillance systems
- Traffic cameras

Navigation Systems

- Marine navigation systems
- GPS navigation systems

Special-duty Vehicles

- Military
- Agriculture
- Mining
- Forestry

Vehicle Computers

Mobile Dashcam

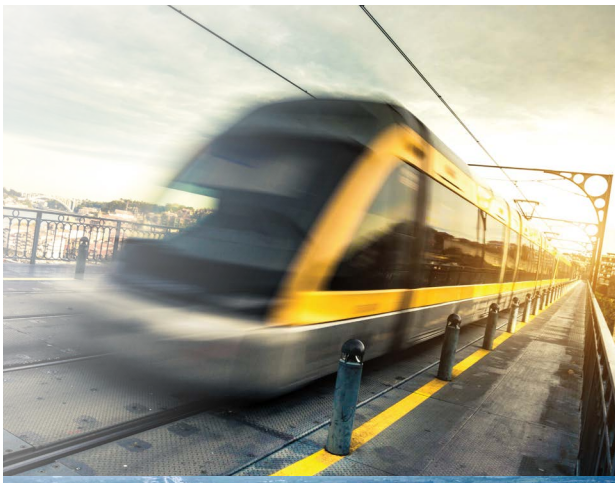
Rugged Computers

Fleet Management Systems

Car Infotainment Systems

Automatic Fare Collection Systems

Electronic Toll Collection (ETC)



Transcend Embedded Storage Solutions

- High quality
- Utmost stability
- Absolute reliability

Challenges and Transcend Solutions

Challenge/ System resilience to extreme temperatures

Solution / Wide-temperature modules

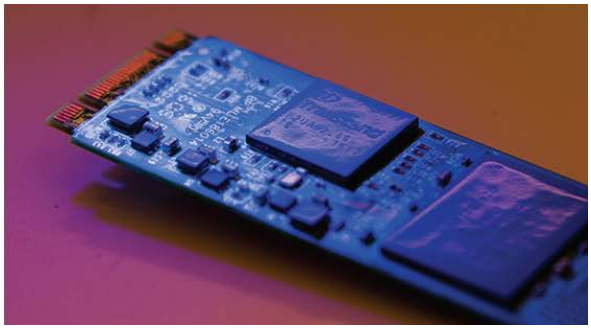
	Standard Temp.	Extended Temp.	Wide Temp.
SSDs	0°C ~70°C	-20°C ~75°C	-40°C ~85°C
DDR4 DRAM Modules	0°C ~95°C	-	-40°C ~95°C
SD/micro SD Cards	-25°C ~85°C	-	-40°C ~85°C

Comparison with and without Wide Temperature Technology

The long-term reliability of in-vehicle systems requires high tolerance to extreme temperatures and drastic climate changes. Different hazards like coastal and urban flooding, extreme heat and cold, drought, and wind, affect the infrastructure, passengers, and freight significantly. Notably today, the frequency of extreme weather events is increasing worldwide and bears great risk to the stability and reliability of transportation applications and in-vehicle systems. On top of that, the ambient temperature change of the in-vehicle engine during power-on and off also engenders device malfunction if extreme temperature tolerance is not well-maintained. Transcend's Wide Temperature technology allows devices to deliver stable and reliable performance under extreme temperatures. Devices that have passed wide temperature testing in walk-in chambers can operate normally in temperatures ranging from -40°C to 85°C. Transcend implements wide temperature technology in its industrial products including SSDs, SD/micro SD cards, and DRAM memory modules of distinctive storage capacities and form factors.

Challenge/ Dusty and humid automotive environment

Solution / Conformal Coating



A Transcend M.2 SSD with acrylic conformal coating under UV light inspection

In order to increase protection of in-vehicle systems and automotive devices against diverse hostile environmental conditions such as moisture, dust, corrosion, vulcanization, and chemical contaminants, the Conformal Coating technology is distinctive flash and memory solutions. Transcend offers an acrylic conformal coating solution supplied by HumiSeal, one of the leading conformal coating manufacturers. The acrylic coating is quick-drying and features excellent flexibility, moisture protection, electrical isolation, as well as fungus resistance. Transcend's conformal coating technology is applied directly to the module surface, except for the "golden-fingers", to completely encapsulate the PCB and the mounted components. The coating shields the DRAM or flash modules from hostile environmental factors, including moisture immersion and dust ingression, and thus increasing overall durability and reliability to the system. In order to guarantee that Transcend offers the highest quality of embedded solutions, the coating process meets the IPC-A-610D standards, which specify the coating color, coverage, and thickness.

Challenge/ **Anti-shock and anti-vibration requirement**

Solution / **Corner Bond / System in a Package (SIP)**

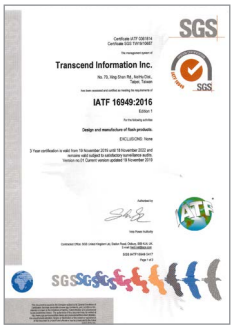
A mechanical bond is applied around the key components

As vehicles transport goods across challenging environments, storage solutions employed in transportation applications require rugged design to withstand harsh conditions, including shock and vibration. In order to ensure device reliability under vibratory stress, Corner Bond technology is employed to serve as a stress relieving agent by spreading stresses throughout the chip and PCB interface with a mechanical bond. Corner Bond applies fluid encapsulates or liquid epoxy around the perimeter of silicon chips, leaving just one gap unapplied to allow space for future thermal expansion. Memory solutions are also packaged with System in a Package (SIP) technology, in which processors and memory are integrated into a single package that achieves a completely functional system unit. This enhances the resistance of shock and vibration and secures the in-vehicle devices with the utmost reliability under vibratory stress. Industrial flash products for the automotive industry are strictly compliant with the U.S. Military standard MIL-STD-810G.

Note: Refer to the standard IEC 68-2-27 / IEC 68-2-6

Challenge/ **Product Design and Production flow**

Solution / **IATF 16949**

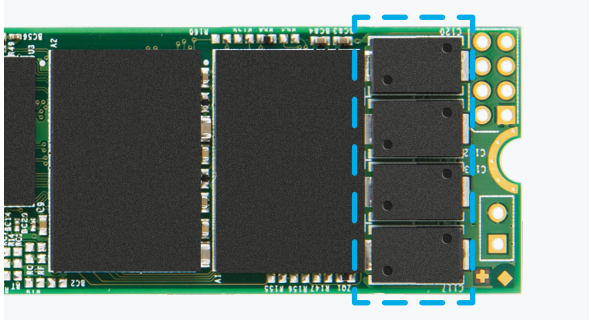


IATF 16949:2016 certification

Transcend continues to improve its product quality management and service processes to satisfy the stringent quality requirements demanded by the automotive industry. In 2019, Transcend was certified with the automotive-grade IATF 16949, a certification issued by SGS, demonstrating the company's connection with the automotive supply chain and its compliance with important quality standards for automotive products worldwide. IATF 16949 is a technical specification, prepared by the International Automotive Task Force (IATF), aimed at the development of a quality management system which provides for continual improvement, emphasizing defect prevention and variation reduction in the automotive industry assembly process. Transcend employs innovative techniques in the design, development and production, in order to build up a connection with the automotive supply chain. Thanks to the certification, customers have additional assurance that Transcend are conformed to international standards and can be trusted to provide the global automotive market with products of the highest quality.

Challenge/ Unstable Power Supply

Solution / Intelligent Power Shield SSD



Polymer tantalum capacitors (PTCs) on SSD

Power failure protection serves an indispensable role in automotive storage devices as vehicle shutdown is mostly triggered by engine shut-off. In order to safeguard data integrity during an unexpected power outage, Transcend's SSDs are well equipped with its IPS technology. Intelligent Power Shield (IPS) is an exclusively patented Transcend technology for SSDs with a DRAM cache that ensures the data transfer integrity and minimizes the possibility of device failure in the event of a sudden power outage. For top performance, Transcend employs an advanced voltage detector to trigger IPS and utilizes polymer tantalum capacitors – heavy-duty, low-profile capacitors that maintain stable operation in harsh environments. IPS makes use of capacitors to prolong the time available to shift data in the DRAM cache to the SSD's permanent NAND flash memory after a sudden power loss. This way, SSDs are able to complete more writes from the DRAM cache to the NAND flash.

Challenge/ Excessive Heat Buildup in Automotive Systems

Solution / Dynamic Thermal Throttling function

Apart from designing the SSDs to tolerate higher temperature, another effective solution to address the overheating issue is to have a great thermal management. Vehicles heat up fast when the engine is initiated. If excessive heat is not mitigated, the SSD temperature would exceed the thermal limit, thus leading to potential hardware damage or data error. The Dynamic Thermal Throttling mechanism is fundamental for SSDs to retain optimal performance, sustained product lifespan and improved data integrity. A thermal sensor is implemented in the drive to monitor the temperature via S.M.A.R.T. command. Once the temperature overpasses the threshold value, the mechanism is activated automatically to reduce the drive speed and throttle down the performance. The mechanism allows the SSD to self-cool, and thus increasing the SSD's reliability and prolonging product lifespan. All in all, the Dynamic Thermal Throttling mechanism is crucial for optimal performance, sustained product lifespan, and improved data integrity.

Challenge/ In-vehicle Power Limitation
Solution / DEVSLP Function

Electric mobility options are growing rapidly, seeing year-on-year growth throughout recent decades. Electric vehicles are mainly powered by batteries and thus power saving mechanism in automotive devices turns out to be extremely important. The ability to enter an ultra-low power state is therefore crucial for battery-powered devices. In traditional low-power modes, the SATA links are still required to remain powered-on to allow devices to receive a wake-up command. With the DevSleep function (also known as DevSlp, Device Sleep or SATA DEVSLP), it allows SATA SSDs to enter and remain in a low power "Device Sleep" mode when the DEVSLP signal is de-asserted. One or two orders of magnitude less power than the traditional idle (about 5 mW) is consumed when under the device sleep mode. The DEVSLP function helps remove the power hungry requirement by using a separate low-speed pin and having the current power consumption reduced to a minimum.

Challenge/ Customization ability and technical support
Solution / Customization and professional tech support

Transcend is committed to offering the best solutions for all industrial applications, taking into account all special requirements demanded by its customers. Product durability and stability can be achieved by Transcend's tailor-made storage solutions, including DRAM modules SSD solutions. Transcend's R&D team has years of experience with the mass production of motherboards. From product development to the mass production stage, products are put to rigorous reliability, compatibility, thermal stress, intense read/write cycles, and dynamic burn-in quality tests. Transcend responds quickly to customers' needs and provide them with the latest information, facilitating seamless internal coordination and external communication. Transcend collaborates with OEM suppliers in providing technical analysis reports, on-site technical support and firmware adjustments to comply with the requirements of customers' terminal devices. Transcend provides both pre-sales and post sales technical engagement services where localized Sales and FAE staffs are well-trained to offer in-time professional technical support to all customers worldwide.

Air freights

Fleet management systems

Car infotainment systems

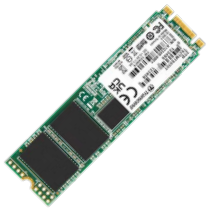
Public transportation

SSD Solutions

Model	MTE710T & MTE710T-I	MTE670T
Form Factor	M.2	
M.2 Type	2280-D2-M (Double-sided)	2280-S2-M (Single-sided)
Bus Interface	NVMe PCIe Gen4 x4	NVMe PCIe Gen3 x4
Capacity	256GB~2TB	256GB~1TB
DRAM Cache	Supported	-
Flash Type	112-layer 3D NAND flash	
Sequential R/W*	3,800/3,200 MB/s	2,100/1,600 MB/s
P/E Cycle	3K	
DWPD*	1.55 (3 yrs)	0.88 (3 yrs)
Operating Temperature	Extended Temp. -20°C(-4°F)~75°C (167°F) Wide Temp. -40°C (-40°F) ~ 85°C (185°F)	Extended Temp. -20°C (-4°F) ~ 75°C (167°F)
Operating Voltage	3.3V±5%	
Corner Bond	Supported	
Thermal Throttling	Supported	
Warranty	Three-year Limited Warranty	

* Value varies by capacity, user hardware, system configuration, and calculation method.

SSD Solutions




Model	MTS970T	MTS960T	MTS570T	MTS560T
Form Factor	M.2			
M.2 Type	2280-D2-B-M (Double-sided)	2280-S2-B-M (Single-sided)	2242-D2-B-M (Double-sided)	
Bus Interface	SATA III 6Gb/s			
Capacity	128GB~2TB	128GB~1TB		
DRAM Cache	Supported	-	Supported	-
Flash Type	112-layer 3D NAND flash			
Sequential R/W*	560/520 MB/s	560/500 MB/s	560/520 MB/s	560/500 MB/s
P/E Cycle	3K			
DWPD*	1.35 (3yrs)	0.73 (3yrs)	1.35 (3yrs)	0.73 (3yrs)
Operating Temperature	Extended Temp. -20°C (-4°F) ~ 75°C (167°F)			
Operating Voltage	3.3V±5%			
Corner Bond	Supported			
Thermal Throttling	Supported			
Warranty	Three-year Limited Warranty			

* Value varies by capacity, user hardware, system configuration, and calculation method.

SSD Solutions

Model	SSD470K	SSD460K
Form Factor	2.5"	
Bus Interface	SATA III 6Gb/s	
Capacity	128GB~4TB	128GB~2TB
DRAM Cache	Supported	-
Flash Type	112-layer 3D NAND flash	
Sequential R/W*	560/520 MB/s	560/500 MB/s
P/E Cycle	3K	
DWPD*	1.35 (3yrs)	0.73 (3 yrs)
Operating Temperature	Extended Temp. -20°C (-4°F) ~ 75°C (167°F)	
Operating Voltage	5V±5%	
Corner Bond	-	
Thermal Throttling	Supported	
Warranty	Three-year Limited Warranty	

* Value varies by capacity, user hardware, system configuration, and calculation method.

SSD Solutions

Model	HSD470T	MSA470T
Form Factor	Half-Slim (MO-297)	mSATA (MO-300A)
Bus Interface	SATA III 6Gb/s	
Capacity	256GB~1TB	
DRAM Cache	Supported	
Flash Type	112-layer 3D NAND flash	
Sequential R/W*	560/520 MB/s	
P/E Cycle	3K	
DWPD*	1.35 (3 yrs)	
Operating Temperature	Extended Temp. -20°C (-4°F) ~ 75°C (167°F)	
Operating Voltage	5V±5%	3.3V±5%
Corner Bond	Supported	
Thermal Throttling	Supported	
Warranty	Three-year Limited Warranty	

* Value varies by capacity, user hardware, system configuration, and calculation method.

DRAM Modules

DDR5 Unbuffered Long-DIMM

PN	Capacity	Data Rate	Component Composition
TS4GLA64V8E	32GB	4800	(2Gx8)x16
TS2GLA64V8E	16GB	4800	(2Gx8)x8

DDR5 Unbuffered SO-DIMM

PN	Capacity	Data Rate	Component Composition
TS4GSA64V8E	32GB	4800	(2Gx8)x16
TS2GSA64V8E	16GB	4800	(2Gx8)x8

DDR5 ECC Long-DIMM

PN	Capacity	Data Rate	Component Composition
TS4GLA72V8E	32GB	4800	(2Gx8)x20
TS2GLA72V8E	16GB	4800	(2Gx8)x10

DDR5 ECC SO-DIMM

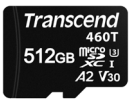
PN	Capacity	Data Rate	Component Composition
TS4GSA72V8E	32GB	4800	(2Gx8)x20
TS2GSA72V8E	16GB	4800	(2Gx8)x10

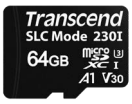
DDR5 Registered Long-DIMM

PN	Capacity	Data Rate	Component Composition
TS4GAR80V8E	32GB	4800	(2Gx8)x20
TS2GAR80V8E	16GB	4800	(2Gx8)x10

SD and microSD Cards

Model	SDXC460T	SD/SDHC410M	SD/SDHC220I
Capacity	64GB~512GB	2GB~32GB	2GB / 4GB
Flash Type	112-layer 3D NAND flash	MLC NAND flash	SuperMLC
Sequential R/W*	100/85 MB/s	95/30 MB/s	22/20 MB/s
P/E Cycle	3K		30K
Operating Temperature	Standard Temp. -25°C (-13°F) ~ 85°C (185°F)		Wide Temp. -40°C (-40°F) ~ 85°C (185°F)
Operating Voltage	2.7V ~ 3.6V		
S.M.A.R.T.	Supported	-	Supported
Warranty	Three-year Limited Warranty		

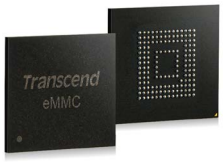


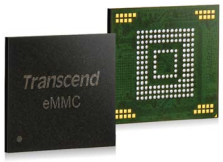


Model	microSDXC460T	microSD/SDHC410M	microSDHC/SDXC230I
Capacity	64GB~512GB	2GB~32GB	2GB~64GB
Flash Type	112-layer 3D NAND flash	MLC NAND flash	3D NAND flash (SLC mode)
Sequential R/W*	100/80 MB/s	95/50 MB/s	100/70 MB/s
P/E Cycle	3K		50K/100K
Operating Temperature	Standard Temp. -25°C (-13°F) ~ 85°C (185°F)		Wide Temp. -40°C (-40°F) ~ 85°C (185°F)
Operating Voltage	2.7V ~ 3.6V		
S.M.A.R.T	Supported	-	Supported
Warranty	Three-year Limited Warranty		

* Value varies by capacity, user hardware, system configuration, and calculation method.

e.MMC and Flash Solutions





Model	EMC410T	EMC310M
Form Factor	e.MMC5.1 (BGA-153)	
Bus Width Supported	x1, x4, x8	
Bus Speed Mode	HS400	
Capacity	32 GB	8GB / 16GB
Flash Type	96-layer 3D NAND flash	MLC NAND flash
Sequential R/W*	290/155 MB/s	280/100 MB/s
P/E Cycle	3K	
Operating Temperature	Standard Temp. -25°C (-13°F) ~ 85°C (185°F)	
Warranty	Three-year Limited Warranty	

Model	JF280T	JF270M
USB Type	USB Type-A	
Connection Interface	USB 3.1 Gen 1	
Capacity	16GB~128GB	8GB~32GB
Flash Type	3D NAND flash	MLC NAND flash
Sequential R/W*	140/40 MB/s	160/40 MB/s
P/E Cycle	3K	
Operating Temperature	Standard Temp. 0°C (32°F) ~ 70°C (158°F)	
Warranty	Three-year Limited Warranty	

* Value varies by capacity, user hardware, system configuration, and calculation method.

Case Study

Intro

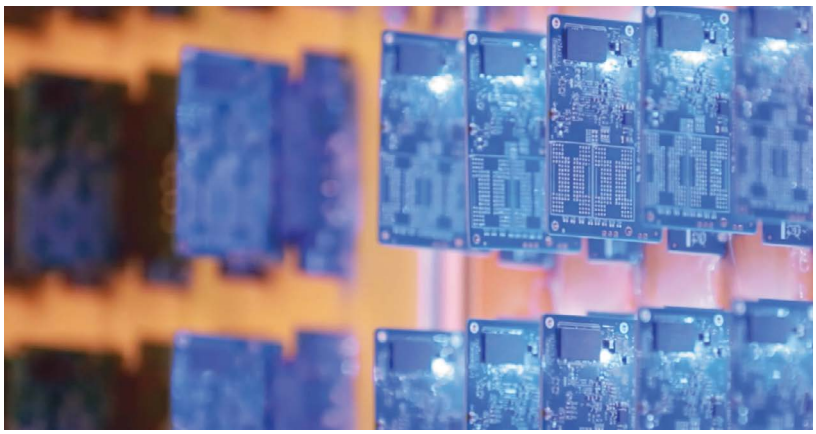
Autonomous vehicles contribute a big wave in advancements to the transportation industry, minimizing the cost of transportation and improving convenience and safety. The autonomous vehicles evolution has compelled the transportation industry to embrace adoption of the IoV (Internet of Vehicles) technologies in its full capacity.

As a case in point, smart buses offer passengers an efficient means of traveling while allowing bus operators to consolidate fleet management and improve safety. In order to respond to emergency events and to ensure the security of drivers and passengers as well as the public, real-time live surveillance and video analytics of bus fleets play a critical role in automotive application.

Potential Challenges and Recommended Solutions

High tolerance to extreme temperatures

- The Wide Temperature technology allows devices to deliver stable, reliable performance under extreme temperatures. All tests are conducted in a wide-temperature walk-in chamber and all embedded-use products are required to pass the rigorous tests.



Resistance to vibratory stress

- Transcend's SIP (System in a Package) technology helps enhance the resistance of shock and vibration for SD cards to secure the in-vehicle devices with the utmost reliability under vibratory stress.

Product longevity

- Product longevity is of utmost importance in transportation applications.
- Transcend manages the complete life cycle of a product and provides pain-free transitions throughout the manufacturing process with full support from MLC to 3D TLC NAND flash.

About Us

Transcend is a globally recognized leader in the manufacture of industrial storage solutions. Established in Taiwan in 1988, Transcend has gained over 30 years of experience in storage manufacture. With its mature production process and persistence to high quality, Transcend offers a full line of standard and proprietary internal SSDs (PCIe M.2/SATA III 2.5", M.2, mSATA, and half-slim type), different generations of DRAM memory modules, SD/microSD cards, e.MMC memory, and flash solutions. Transcend products are widely used in various industries, from transportation, healthcare, to 5G communication, AIoT and embedded applications.

We solve clients' obstacles by tapping advanced technology and offering customized services exclusively for each client. As a customer-oriented company, Transcend responds quickly to the market's changing needs. Transcend does not merely provide durable industrial-grade storage devices, but serves as a trusted partner in the long run. For more information, please visit www.transcend-info.com

Our Strengths

Storage Solutions with Best Quality

- Branded chips to ensure high quality
- In-house software for efficient management
- Technology integration for innovative products

Reliable Supply

- Strategic alliance with top-tier suppliers

R&D Expertise

- More than 140 patents
- 100+ R&D talents
- National Invention & Creation Award

Global Operation & Worldwide Support

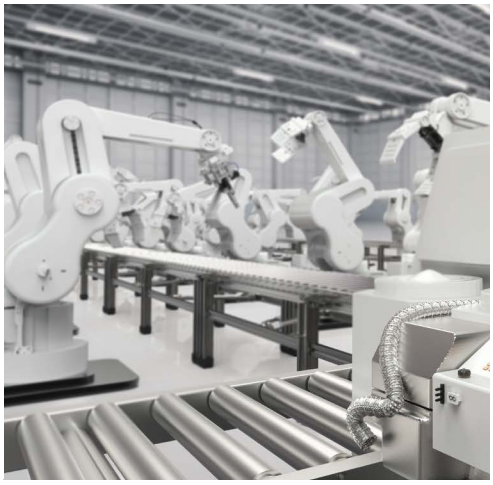
- In-time professional technical support
- 12 branch offices worldwide
- Localized sales and FAE support

Management of Product Life Cycle

- Fixed BOM
- In-house ERP system
- Roadmap & failure analysis report

Facilities & Production Process

- Automatic production
- Enhanced reliability tests
- Rigorous quality control: IQC, IPQC, FQC, OQC



Your trusted partner to high quality

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