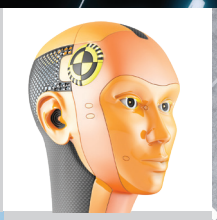
Western Digital.

Advanced Flash Storage Solutions For Automobile Applications

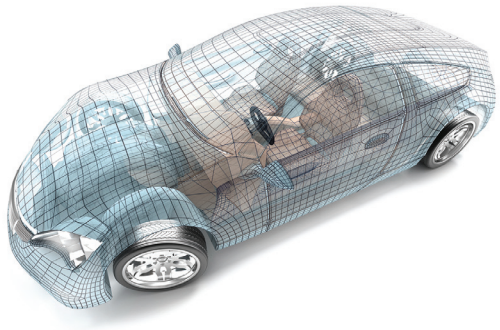
Family Brochure



Western Digital.

Key Benefits

- Decades of innovation in the flash memory industry
- Full portfolio of NAND flash products for automotive applications
- IATF 16949 certified
- Expertise in system-level architecture
- World-class fabs and manufacturing factory
- Relationships with global automotive
- OEMs and Tier-1 suppliers
- Partnerships with leading chipset vendors



Driving Automotive Innovation

The automotive industry is going through a revolutionary stage — from the driver to the driverless vehicle — generating a whole new world of applications around safety, connectivity and entertainment. Among these applications, high-definition 3D maps, advanced driver-assist systems (ADAS), autonomous computer, AI database, data recorder, enhanced infotainment, over-the-air updates, and V2X all require on-board data storage. While the cloud is an important component for analyzing data to improve algorithms and databases, it is not sufficient to meet the needs of real time edge computing.

Western Digital enables Automobile OEMs and Tier-1 suppliers to create highly reliable systems for their customers.

Providing a Complete Data Storage Solution

From the automobile to the cloud, Western Digital has a complete portfolio of storage products to support current and future vehicle system requirements. Western Digital offers embedded edge storage and removable storage for various use cases and data center solutions for capturing and analyzing massing amounts of data collected from vehicles.

Meeting Automotive's Stringent Quality Requirements

Western Digital automotive grade flash products are IATF 16949 certified and AEC-Q100 compliant. In addition, these products are designed in-house and manufactured on dedicated production lines at Western Digital's state of the art manufacturing facilities. Lastly, automotive grade products go through rigorous testing to ensure high reliability that is necessary for safety applications. This vertical integration enables Western Digital to have tight controls on every step of product development and manufacturing to achieve high quality storage solutions. Western Digital also provides supply longevity to reduce costs of additional qualifications.

A Trusted Partner

Western Digital has been a storage solution supplier to the automotive industry since 2002 when it launched its first HDD for automotive. Since then, Western Digital has continued to invest in automotive, launching new products at a regular cadence with automotive grade NAND flash products launching in 2015.

IVI NAV/ INFOTAINMENT | ADAS | HD MAPPING | V2V/V2I COMMUNICATIONS | DIGITAL CLUSTER | EVENT/DRIVE RECORDERS | AUTONOMOUS DRIVE | TELEMATICS & OTA APPS

iNAND® Automotive Embedded Flash Drives

iNAND Automotive Embedded Flash Drives (EFDs) were designed to support the harsh environ-ments, high reliability and quality required by the automotive industry. The automotive iNAND product portfolio supports both UFS and e.MMC interfaces in a small 11.5×13mm package with a wide range of capacities to provide automotive OEMs and Tier-1 suppliers with choices that best meet their needs.

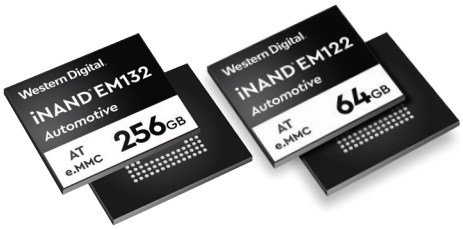
UFS Embedded Flash Drive

iNAND® AT EU312, the world's first automotive grade UFS (Universal Flash Storage) Version 2.1 based on 3D NAND technology, delivers higher capacities and up to 2.5 times the performance of previous e.MMC-based products. Utilizing the 5th generation SmartSLC technology, AT EU312 offers high performance and reliable writes.

Features and Benefits

- Fast boot, auto refresh, manual refresh, enhanced health status
- UFS 2.1 interface for high data speeds with additional UFS 3.0 automotive features
- Capacities up to 256GB in small form-factor BGA
- AEC-Q100 temperature grade 2/3

e.MMC Embedded Flash Drive



Automotive iNAND® e.MMC embedded flash drives are based on e.MMC 5.1 standards and are available with 2D and 3D NAND technology. The EM122 is already qualified and in production for many automotive designs. The EM132 is the first 256GB and 3D NAND-based e.MMC in the automotive market. Their advanced automotive feature set enables the next generation use cases in a car.

Features and Benefits

- Auto refresh, manual refresh, enhanced health status
- e.MMC 5.1 interface with additional automotive features
- Capacities up to 256GB in small form-factor BGA
- AEC-Q100 temperature grade 2/3

Automotive SD Cards

Automotive SD cards are ideal for automotive applications that require a removable storage media such as navigation map data and data/video recorders. Western Digital (SanDisk), as a pioneer in SD cards, has shipped billions of cards and is well known to both retail and commercial customers. Automotive grade SD cards provide a very reliable data storage solution to capture and store the vehicle's data.

Features and Benefits

- Auto refresh, manual refresh, health status, host lock
- SD 5.1 specification
- Up to 64GB
- AEC-Q100 temperature grade 3

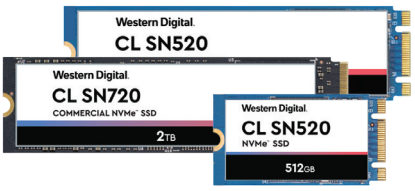
Industrial microSD Cards

Western Digital also offers extended temp-erature industrial microSD cards to support customers that not only want a removable solution but also a small form factor. Western Digital offers both SLC and MLC solutions to meet a variety of use cases.

Features and Benefits

- Health status, host lock
- Available in SLC
- Up to 64GB
- Supports extended temperatures of –40°C to 85°C

PCIe SSD



The need for high capacity solutions continues to increase as the automotive industry develops autonomous vehicles. Capturing and analyzing all of the massive amounts of data from sensors and videos takes terabytes a day. This data is captured to help engineers develop better algorithms to make vehicles safer. Fleet and TaaS management also takes advantage of all of the data available to make improvements. The data is also used as an evidence in the event of an accident or a claim.

Features and Benefits

- PCIe Gen3×4 and PCIe Gen3×2 NVMe
- M.2 2280 and M.2 2242 form factors
- High capacities up to 2TB
- Up to 1600 TBW endurance
- SED TCG OPAL 2.01 (in CL SN720)

iNAND® Automotive Embedded Flash Drives[3]	iNAND® AT EU312	iNAND® AT EU312	iNAND® AT EM122	iNAND® AT EM122	iNAND® AT EM132	iNAND® AT EM132
Product Specification						
Interface	UFS 2.1	UFS 2.1	e.MMC 5.1	e.MMC 5.1	e.MMC 5.1	e.MMC 5.1
Capacity	16GB to 256GB[1]	16GB to 256GB[1]	8GB to 64GB[1]	8GB to 64GB[1]	32GB to 256GB[1]	32GB to 256GB[1]
Operating Temperature	–40°C to 85°C	–40°C to 105°C	–40°C to 85°C	–40°C to 105°C	–40°C to 85°C	–40°C to 105°C
NAND flash technology	3D TLC	3D TLC	2D MLC	2D MLC	3D TLC	3D TLC
Package (mm)						
8GB	—	—	11.5x13x0.8mm	11.5x13x0.8mm	—	—
16GB	11.5x13x1.2mm	11.5x13x1.2mm	11.5x13x0.8mm	11.5x13x0.8mm	—	—
32GB	11.5x13x1.2mm	11.5x13x1.2mm	11.5x13x1.0mm	11.5x13x1.0mm	11.5x13x1.0mm	11.5x13x1.0mm
64GB	11.5x13x1.2mm	11.5x13x1.2mm	11.5x13x1.2mm	11.5x13x1.2mm	11.5x13x1.0mm	11.5x13x1.0mm
128GB	11.5x13x1.2mm	11.5x13x1.2mm	—	—	11.5x13x1.0mm	11.5x13x1.0mm
256GB	11.5x13x1.2mm	11.5x13x1.2mm	—	—	11.5x13x1.2mm	11.5x13x1.2mm
Ordering Information						
8GB	—	—	SDINBDG4-8G-XA	SDINBDG4-8G-ZA	—	—
16GB	SDINDDH6-16G-XA	SDINDDH6-16G-ZA	SDINBDG4-16G-XA	SDINBDG4-16G-ZA	—	—
32GB	SDINDDH6-32G-XA	SDINDDH6-32G-ZA	SDINBDG4-32G-XA	SDINBDG4-32G-ZA	SDINBDA6-32G-XA	SDINBDA6-32G-ZA
64GB	SDINDDH6-64G-XA	SDINDDH6-64G-ZA	SDINBDG4-64G-XA	SDINBDG4-64G-ZA	SDINBDA6-64G-XA	SDINBDA6-64G-ZA
128GB	SDINDDH6-128G-XA	SDINDDH6-128G-ZA	—	—	SDINBDA6-128G-XA	SDINBDA6-128G-ZA
256GB	SDINDDH6-256G-XA	SDINDDH6-256G-ZA	—	—	SDINBDA6-256G-XA	SDINBDA6-256G-ZA

Automotive SD and Industrial microSD Cards[3]	Automotive AT LD332	Industrial Wide Temp IX QD332	Industrial Ext Temp IX QD332	Industrial Ext Temp IX QD334	Industrial Wide Temp IX QD342
Interface	UHS-1 104	UHS-1 104	UHS-1 104	UHS-1 104	UHS1-104
Form factor	SD	microSD	microSD	microSD	microSD
Capacity	8GB to 64GB	8GB to 128GB	8GB to 128GB	8GB to 64GB	16GB to 256GB
Operating Temperature	–40°C to 85°C	–25°C to 85°C	–40°C to 85°C	–40°C to 85°C	–25°C – 85°C
NAND flash technology	2D MLC	2D MLC	2D MLC	2D SLC	3D TLC
Speed Class	C10	C10, U1	C10, U1	C10, U3	C10, U1, U3, V10, V30
Performance R/W[2]	Up to 80/50 MB/s	Up to 80/50 MB/s	Up to 80/50 MB/s	Up to 90/50 MB/s	Up to 100/50 MB/s
Ordering Information					
8GB	SDSDAG3-008G-XA	SDSDQAF3-008G-I	SDSDQAF3-008G-XI	SDSDQED-008G-XI	—
16GB	SDSDAG3-016G-XA	SDSDQAF3-016G-I	SDSDQAF3-016G-XI	SDSDQED-016G-XI	SDSDQAF4-016G-I
32GB	SDSDAG3-032G-XA	SDSDQAF3-032G-I	SDSDQAF3-032G-XI	SDSDQED-032G-XI	SDSDQAF4-032G-I
64GB	SDSDAG3-064G-XA	SDSDQAF3-064G-I	SDSDQAF3-064G-XI	SDSDQED-064G-XI	SDSDQAF4-064G-I
128GB	—	SDSDQAF3-128G-I	SDSDQAF3-128G-XI	—	SDSDQAF4-128G-I
256GB	—	—	—	—	SDSDQAF4-256G-I

Solid State Drives[3]	Commercial CL SN720	Commercial CL SN520	Commercial CL SN520
Interface	PCIe Gen3x4 NVMe 1.3	PCIe Gen3x2 NVMe 1.3	PCIe Gen3x2 NVMe 1.3
Form factor	M.2 2280	M.2 2242	M.2 2280
Capacity	256GB to 2TB	128GB to 512GB	128GB to 512GB
Operating Temperature	0°C to 85°C	0°C to 85°C	0°C to 85°C
NAND flash technology	3D TLC	3D TLC	3D TLC
Performance R/W[2]	Up to 3,470/3,000 MB/s	Up to 1,700/1,450 MB/s	Up to 1,700/1,450 MB/s
Endurance	Up to 1600 TBW	Up to 400 TBW	Up to 400 TBW
Ordering Information			
128GB	—	SDAPMUW-128G-1022	SDAPNUW-128G-1022
256GB	SDAQNTW-256G-1022	SDAPMUW-256G-1022	SDAPNUW-256G-1022
512GB	SDAQNTW-512G-1022	SDAPMUW-512G-1022	SDAPNUW-512G-1022
1TB	SDAQNTW-1T00-1022	—	—
2TB	SDAQNTX-2T00-1022	—	—

[1] 1 gigabyte (GB) = 1 billion bytes.

[2] Based on Western Digital internal testing. Performance based on e.MMC high speed interface, using an 8-bit bus. Read and Write speeds may vary depending on read/write conditions. 1 megabyte (MB) = 1 million bytes.

[3] Product specifications subject to change without notice. Pictures shown may vary from actual products. Not all products are available in all regions of the world.

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