Western Digital.

Advanced Flash Storage Solutions for Automotive Applications

Western Digital®

Key Advantages

- Decades of innovation in the flash memory industry

- Full portfolio of NAND flash products for automotive applications

- IATF 16949 certified on embedded automotive-grade products

- Expertise in system-level architecture

- World-class fabs and manufacturing factories

- Close ties 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 computers, AI databases, data recorders, 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 automotive use cases and data center solutions for capturing and analyzing massive 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 fully vertically integrated, 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 the industry, launching new products at a regular cadence with automotive-grade NAND flash products launching in 2015.

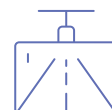|			
IVI NAV/ INFOTAINMENT	HD MAPPING	DIGITAL CLUSTERS	AUTONOMOUS DRIVE
ADAS	V2V/V21 COMMUNICATIONS	EVENT/ DRIVE RECORDERS	TELEMATICS & OTA APPS

iNAND® Automotive Embedded Flash Drives

iNAND Automotive Embedded Flash Drives (EFDs) are designed to support the harsh environments, 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

Western Digital.
iNAND EU312
Automotive ZA
AT UFS **256**GB

Western Digital.
iNAND EU312
Automotive XA
AT UFS **256**GB

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 and grade-3

e.MMC Embedded Flash Drive

Western Digital.
iNAND EM122
Automotive ZA
AT e.MMC **64**GB

Western Digital.
iNAND EM132
Automotive ZA
AT e.MMC **256**GB

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. The drives' advanced automotive feature set enables next-generation use cases in cars.

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 and grade-3

Automotive SD Card

Automotive SD cards are ideal for automotive applications that require a removable storage medium 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 highly 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 Card

Western Digital also offers extended temperature industrial microSD cards to support customers who 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
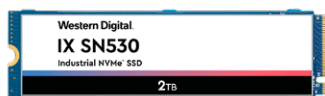
Industrial PCIe NVMe SSD

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 cameras requires terabytes of storage every day. This data is analyzed to develop better algorithms to make vehicles safer. In addition, the data may be used as evidence in the event of an accident or a legal or an insurance claim.

Features and Benefits
- PCIe Gen3×4 NVMe 1.4
- M.2 2280 and M.2 2230 form factors
- TLC and SLC storage options for high endurance of up to 24 PBW
- High capacities up to 2TB
- Supports extended temperatures of −40°C to 85°C

iNAND Automotive Embedded Flash Drives

	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[1]	16GB to 256GB	16GB to 256GB	8GB to 64GB	8GB to 64GB	32GB to 256GB	32GB to 256GB
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	—	—	11.5×13×0.8mm	11.5×13×0.8mm	—	—
16GB	11.5×13×1.2mm	11.5×13×1.2mm	11.5×13×0.8mm	11.5×13×0.8mm	—	—
32GB	11.5×13×1.2mm	11.5×13×1.2mm	11.5×13×1.0mm	11.5×13×1.0mm	11.5×13×1.0mm	11.5×13×1.0mm
64GB	11.5×13×1.2mm	11.5×13×1.2mm	11.5×13×1.2mm	11.5×13×1.2mm	11.5×13×1.0mm	11.5×13×1.0mm
128GB	11.5×13×1.2mm	11.5×13×1.2mm	—	—	11.5×13×1.0mm	11.5×13×1.0mm
256GB	11.5×13×1.2mm	11.5×13×1.2mm	—	—	11.5×13×1.2mm	11.5×13×1.2mm
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-XA1	SDINBDA6–32G-ZA1
64GB	SDINDDH6–64G-XA	SDINDDH6–64G-ZA	SDINBDG4–64G-XA	SDINBDG4–64G-ZA	SDINBDA6–64G-XA1	SDINBDA6–64G-ZA1
128GB	SDINDDH6–128G-XA	SDINDDH6–128G-ZA	—	—	SDINBDA6–128G-XA1	SDINBDA6–128G-ZA1
256GB	SDINDDH6–256G-XA	SDINDDH6–256G-ZA	—	—	SDINBDA6–256G-XA1	SDINBDA6–256G-ZA1

[1] One gigabyte (GB) is equal to 1 billion bytes, one terabyte (TB) is equal to one trillion bytes. Actual user capacity may be less due to operating environment.

Automotive SD and Industrial microSD Cards

	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[1]	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

	Industrial-grade IX SN530	Industrial-grade IX SN530	Industrial-grade IX SN530	Industrial-grade IX SN530
Interface	PCIe Gen3×4 NVMe 1.4	PCIe Gen3×4 NVMe 1.4	PCIe Gen3×4 NVMe 1.4	PCIe Gen3×4 NVMe 1.4
Form factor	M.2 2280-S3-M	M.2 2280-S3-M	M.2 2230-S3-M	M.2 2230-S3-M
Capacity[1]	256GB to 2TB	85GB to 340GB	256GB to 1TB	85GB to 340GB
Operating temperature[3]	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
NAND flash technology	3D TLC	3D SLC	3D TLC	3D SLC
Performance R/W[4]	Up to 2,500/1,800 MB/s	Up to 2,400/1,950 MB/s	Up to 2,400/1,950 MB/s	Up to 2,400/1,950 MB/s
Performance sustain W[5]	Up to 540	Up to 1,950 MB/s	Up to 540 MB/s	Up to 1,950 MB/s
Endurance[6] (Projected)	Up to 5,200 TBW	Up to 24 PBW	Up to 2,600 TBW	Up to 24 PBW
256GB / 85GB (SLC)	SDBPNPZ-256G-XI	SDBPNPZ-085G-XI	SDBPTPZ-256G-XI	SDBPTPZ-085G-XI
512GB / 170GB (SLC)	SDBPNPZ-512G-XI	SDBPNPZ-170G-XI	SDBPTPZ-512G-XI	SDBPTPZ-170G-XI
1TB / 340GB (SLC)	SDBPNPZ-1T00-XI	SDBPNPZ-340G-XI	SDBPTPZ-1T00-XI	SDBPTPZ-340G-XI
2TB	SDBPNPZ-2T00-XI	—	—	—

[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] Operational temperature is defined such as -40°C refers to ambient temperature. +85°C refers to SMART composite temperature reported by the drive (when thermal throttling is triggered).

[4] Measured with CrystalDiskMark, 1000MB LBA range, secondary 1TB drive. Sequential: 1T QD32, Random: 8T QD32. Performance may vary based on host device.

[5] Sustained performance is measured by FIO 1.97, using 100% LBA range as a secondary drive. Performance may vary based on host device.

[6] Endurance is calculated based on sustained sequential write operation without frequent idle.

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Contact Information

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