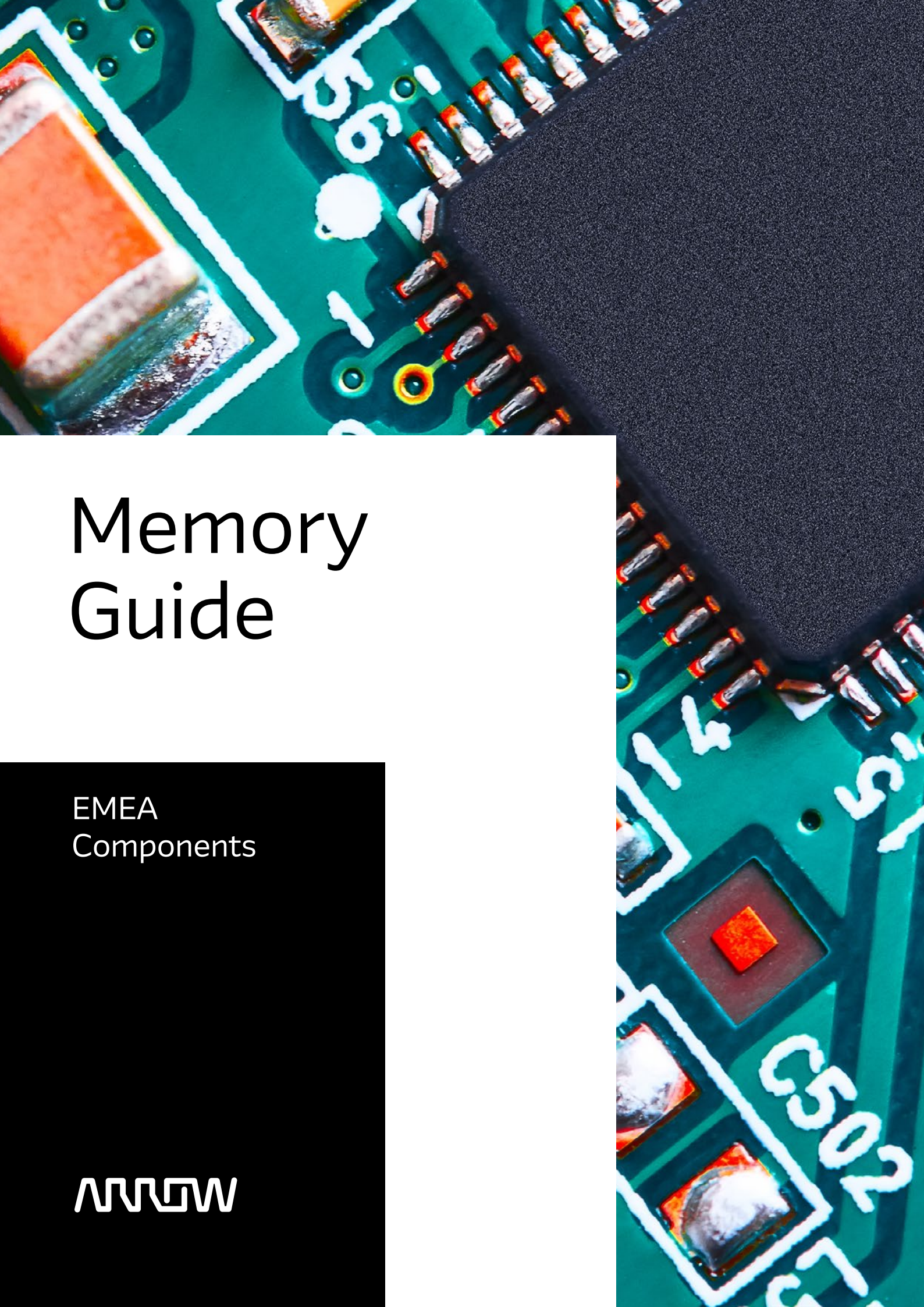




Memory Guide

EMEA
Components



Micron® Industrial Multimarket Application Memory



The Industrial IoT/Industry 4.0 is transforming the world of manufacturing – extending automation and connectivity beyond traditional factory walls and driving strong demand for more data acquisition, communication, real-time analytics and data-driven decisions across a wide range of industrial verticals.

It is estimated 20 billion+ new smart connected devices will be deployed over the next decade. The best devices will be those that enable businesses to run more efficiently, require the least amount of maintenance and enable the least possible downtime.

Micron memory and storage solutions are the top choice across IIoT verticals like IPC/factory automation, surveillance, M2M, retail, digital signage, smart grid, transportation/fleet management, healthcare, and aerospace and defense applications.

Micron has been a trusted advisor to our industrial customers for more than 25 years. We understand the unique needs of this market and we bring a mindset to deliver sustainable value to our customers – because we firmly believe that IQ matters to our customers' success in IIoT.

What is Micron's Industrial Quotient (IQ)?

We bring to market a mindset and portfolio that delivers sustainable value to our customers with:

Application-Specific Tuning

Extensive collaboration with global customers to develop in-depth understanding of application use cases and deliver products and features to meet those specific application needs.

Ruggedized Products

Product enhancements that enable consistent performance across extreme environments: extended temperature, thermal cycling, shock, humidity, etc.

High Reliability

Design and testing processes that add a high level of endurance and reliability to align with needs of long-lifecycle embedded applications.

Extensive Quality Testing

Rigorous testing to deliver the consistent performance across products and processes necessary in embedded and mission-critical applications.

Product Longevity

Extended lifecycle support for eligible products via our Product Longevity Program, which goes a step beyond standard lifecycle support to suit long-life applications.

Security by Design

Integrating the latest Micron Authentia™ technology solution in memory to provide platform- and solution-level values that translate to reliable, safety-conscious solutions with best-in-class time to market.

Orderable at [arrow.com](https://www.arrow.com)

Arrow Memory

Ready for the Future

Components – EMEA

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Winning the Race to the IoT Edge

The IoT Edge – Enabling the Connected Enterprise

With billions of industrial IoT devices expected to be connected to the cloud, the IoT edge will bridge enterprise and industrial systems in markets such as factory automation, oil and gas, smart cities, surveillance, health care and many others*.

IoT edge solutions will bring compute and AI closer to the source of the data, incorporating new software paradigms and introducing new business models that will inspire traditional OEMs and IoT platform providers to develop strategies to win the race to the IoT edge.

Evolving Architectures

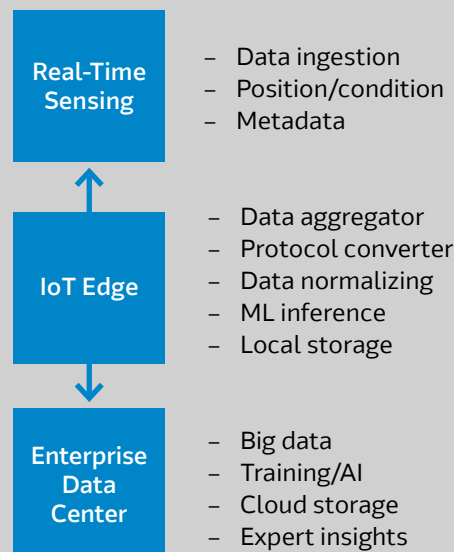
IoT edge solutions will continue to evolve as compute and storage demands are expected to increase, leading to a need for:

- Data aggregation and connectivity in real-time
- Multicore processor systems that support deep learning inference and higher compute requirements
- Embedded local storage for on-premise data management
- New software middleware and APIs to support containers for microservices

As a result, memory size for code and data will increase to support new software cloud agents, middleware, and edge management. Processors will require higher DRAM performance with wider bus width for more efficient machine learning execution. And embedded storage size will increase as more endpoints are managed by a single edge device.

Authenta™ Technology (Simple, Integrated, Secure)

With upcoming US and EU heightened security requirements facing OEMs supporting critical infrastructure, industrial automation and other industries; simplify your secure boot implementation. QSPI NOR (up to 256 Mb) & eMMC (16 GB & 32 GB) Authenta families coming soon. Launch updates coming next year.



Micron Intelligence Accelerated at the IoT Edge

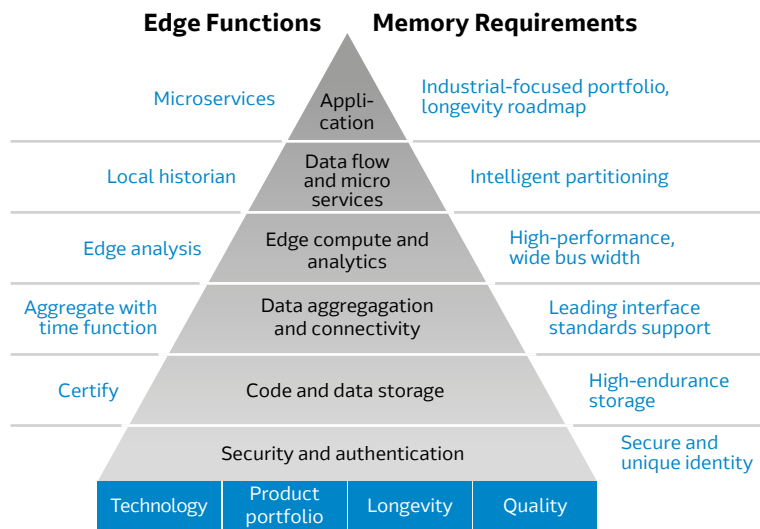
As the leader in industrial and automotive applications, Micron offers the industry's broadest memory and storage solutions to support the essential demands of the IoT edge:

- High-performance DRAM/LPDRAM and modules for compute and deep learning at the edge
- Broad NOR/NAND portfolio for code and data storage versatility
- Multichip package (MCP) solutions for space-constrained applications and cellular IoT modules
- Industrial-grade eMMC, PCIe NVMe flash storage SSD and SD/microSD solutions for on-premise storage

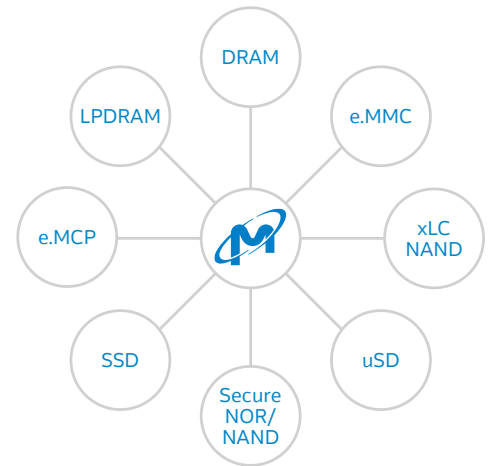
*Projections of the edge compute market estimated at \$28B by 2025 (source: Edge Computing Market, Grand View Research, 2019)

Memory and Storage Requirements for the IoT Edge

The new breed of edge devices will require high-performance DRAM to support deep learning inference acceleration, managed NAND solutions with features and densities to support code size and complex OS functions, and high endurance storage for on-premise data logging and historian systems.



Micron Memory Solutions



Complete Edge Essentials

DRAM Solutions

- DDR3/DDR4 and LPDDR4: market-proven, best system cost/performance tradeoff and long-term support
- LPDDR5x: data rates up to 8.5 Gb/s; improved power efficiency; up to x64 bus width-packaged solutions enable high bandwidth interface for AI/ML workloads
- Variety of DRAM modules from high-performance SODIMMs to high-density LRDIMMs

NOR/NAND Portfolio

- SLC NAND with adaptive FTL: on-die ECC, industrial temperature range, OTP data protection
- Xccela® Flash: x8 (Octal SPI) SDR/DDR JEDEC xSPI standard compliant; up to 2 Gb full featured flash, supports direct code execution and parametric data storage with up to 400 MB/s reads, reducing pin count 5X compared with parallel NOR devices
- e.MMC with internal NAND management for simplifying development
- 1TB uSD removable storage

Multichip Packages (MCPs)

- Broad range of NAND MCP, e.MCP density combinations
- Low 1.8V power; small package size/ball count solutions
- Vertical stacking at die level; minimize BOM for simplified manufacturing and cost savings

Industrial- and Automotive-Grade Storage

- Micron 2100AI, 2100AT 3D TLC SSDs
- SLC partitioning; Trusted Computing Group (TCG) Opal self-encrypting drives (SED)-compliant
- 64 GB-1 TB densities, BGA and M.2 form factors:
 - 2100AI: Tcase -40 °C to 95 °C operating temperature
 - 2100AT: Tcase -40 °C to 105 °C operating temperature

Security and Trust

- Authenta Technology adds secure element functionality into standard flash memory providing code and data integrity through memory protection and attestation.
- The Authenta Cloud Platform enables simple activation credentials and identities based on Trusted Computing Group standards.
- Features support zero-touch onboarding, secure boot in flash, and secure OTA update process for device management.

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High-Performance Memories for Embedded Systems

Infineon's differentiated portfolio of volatile and non-volatile memories features: the SEMPER™ family of safe, secure, and reliable NOR Flash, the EXCELRON™ family of ultra-low power, high-performance, reliable F-RAM products, and our HYPERBUS™ interface-based HYPERFLASH™ NOR Flash and HYPERRAM™ pSRAM memories.

Infineon introduced the first random access memory in 1982, and have grown from that auspicious beginning to a broad range of products spanning NOR Flash, pSRAM, SRAM, nvSRAM, and F-RAM with densities ranging from 4 Kbit to 4 Gbit.

Non-Volatile Memory			Volatile Memory		Others
NOR Flash 8 Mb – 4 Gb	F-RAM 4 Kb – 16 Mb	nvSRAM 64 Kb – 16 Mb	pSRAM 64 Mb – 512 Mb	SRAM 256 Kb – 64 Mb	Solutions
– SEMPER™ NOR – HYPERFLASH™ – Standard Serial NOR – Standard Parallel NOR – Burst Parallel NOR	– EXCELRON™ F-RAM – EXCELRON™ LP – EXCELRON™ Auto – EXCELRON™ Ultra – Standard Serial F-RAM – Standard Parallel F-RAM	– Serial nvSRAM – Parallel nvSRAM	– HYPERRAM™ Gen 1.0 – Gen 2.0 – Octal xSPI RAM	– Async SRAM – Fast Micropower ECC SRAMs – Sync SRAM – Standard Sync NoBL – QDR-II/III+/Xtreme – QDR-IV	– HYPERBUS™ MCP – KGD/Wafer Solutions – Radiation Hardened Products
Applications					
Industrial, Medical, Aerospace & Defense		Automotive		Consumer & Internet of Things	
– Industry Automation – Smart Healthcare – Smart Grid – Office Automation		– Instrument Cluster – Body and Comfort – Infotainment – ADAS		– Wearables – Smart Home – Personal Electronics – Remote Controls	

HYPERRAM™ PSRAM (Pseudostatic RAM) memory

Infineon's HYPERRAM™ are high-speed, low pin-count, and power efficient self-refreshing Dynamic RAM (DRAM) memories providing high throughput to maximize system

performance. HYPERRAM™ is ideal for enhancing system performance and ease of design, as well as reducing system cost.

Family		Density	Data bus width	Interface	Voltage	Speed	Throughput
Hyper Bus	HYPERRAM™ 2.0	64 Mb 128 Mb	8-bit	HyperBus (x8)	1.8 V 3.0 V	200 MHz	400 MBps
		256 Mb 512 Mb			1.8 V		
Octal xSPI	Octal xSPI RAM	64 Mb 128 Mb	8-bit	HyperBus (x8)	1.8 V 3.0 V	200 MHz	400 MBps
		256 Mb 512 Mb			1.8 V		
Applications							
HyperBus				Octal xSPI			
Wearable devices, IoT devices, HMI Systems, Industrial Machine Vision and Automotive Instruments Clusters				Smart Home, industrial and medical HMI displays			
Use Cases: Expansion memory for scratchpad or buffering purposes				Use cases: Expansion memory			

EXCELON™ F-RAM (Ferroelectric RAM) memory

EXCELON™, Infineon's next generation Ferroelectric RAM (F-RAM) memory, delivers the industry's lowest-power nonvolatile memory for mission-critical datalogging.

When system failure is not an option, choose EXCELON™ - the industry's reliable and energy efficient nonvolatile memory.

Family		Density	Interface	Voltage	Frequency	Temperature grade	Endurance (R/W cycles)	Data retention (@ max temp)
Serial	EXCELON™ Ultra	2 Mb 4 Mb 8 Mb 16 Mb	QSPI	1.8 V to 3.6 V 1.71 V to 1.89 V	108 MHz	Industrial	1014 cycles	10 years @ 85 °C
	EXCELON™ Auto	2 Mb	SPI	1.8 V to 3.6 V 1.71 V to 1.89 V	50 MHz	Automotive Grade 1	10 ¹³ cycles	11,000h @ 125 °C
		4 Mb			Automotive Grade 3	10 ¹⁴ cycles	10 years @ 85 °C	
		16 Mb	108 MHz				Automotive Grade 2	11 years @ 105 °C
		EXCELON™ LP	8 Mb 16 Mb		QSPI	1.8 V to 3.6 V 1.71 V to 1.89 V	50 MHz	Industrial
	4 Mb		SPI	20, 50 MHz	Commercial Industrial			
	8 Mb			20, 40 MHz	Industrial Plus		10 years @ 105 °C	
	16 Mb		50 MHz	Industrial	10 years @ 85 °C			
			40 MHz	Commercial	141 years @ 70 °C			
			20 MHz					
	Applications							
EXCELON™ Ultra				EXCELON™ Auto			EXCELON™ LP	
High-performance, low-pin-count nonvolatile memory Industrial automation, test and measurement, motor controls, smart meters, Programmable Logic Controllers				AEC-Q100 qualified high-reliability, instant write nonvolatile memory Camera and sensor data capture for ADAS vision systems, event data recorders, infotainment			Ultra-low-power, small form factor nonvolatile memory	
Use cases: Mission-critical datalogging, Instant data capture on power loss				Use cases: Datalogging, last second data capture			Use cases: Mission-critical datalogging	
							Portable medical devices, wearable and IoT devices	

NOR Flash Memory

Infineon NOR Flash products provide safety, reliability and security, and are backed by long-term supply commitments, a zero-defects policy, and resources

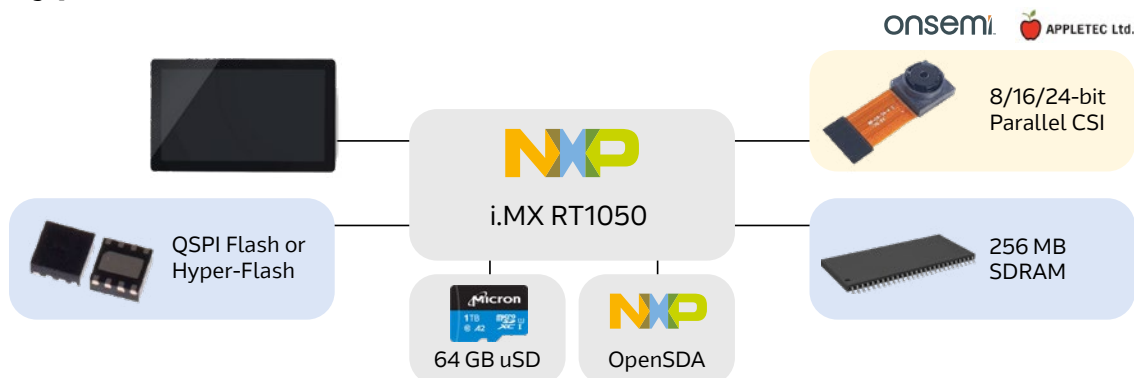
to simplify your design. When failure is not an option, depend on our broad portfolio of solutions to give you a competitive advantage.

		Interface	Voltage	Density	Speed	Process
Serial	SEMPER™ Integrated functional safety	Q-SPI Octal HYPERBUS™	3.0 V 1.8 V	256 Mb – 4 Gb	Up to 400 MB/s	45 nm
	HYPERFLASH™ High performance	HYPERBUS™	3.0 V 1.8 V	128 Mb – 512 Mb	Up to 333 MB/s	65 nm
	Standard SPI Broad portfolio	Q-SPI Dual Q-SPI	3.0 V 1.8 V	64 Mb – 1 Gb	Up to 204 MB/s	65 nm
Parallel	Standard 16/8-bit wide Page mode	16/8-bit page	3.0 V	64 Mb – 2 Gb	Down to 70 ns / 15 ns	45 nm 65 nm 90 nm
	Legacy 8-bit wide Page and burst modes	8-bit page & burst	3.0 V 1.8 V	8 Mb – 128 Mb	Down to 55 ns / 20 ns	110 nm
Applications						
SEMPER™ Integrated functional safety		HYPERFLASH™ High performance	Standard SPI Broad portfolio	Standard 16/8-bit wide Page mode	Legacy 8-bit wide Page and burst modes	
Architected and designed for functional safety Where safety and reliability meet, e.g., PLC, motor drive, factory robotics, ADAS		High throughput with HYPER-BUS™ interface For systems tailored to the HYPERBUS™ interface, e.g., HMI, digital signage	Wide range of industry-proven solutions Standard memory for industrial, communications and automotive, e.g., IoT edge devices, medical electronics	Dependable memory with parallel interfaces Scales to high density and performance for traditional designs, e.g., network switches, climate control	Long-term support for legacy designs Applications: Continued support for your mature products, e.g., test and measurement, patient monitoring systems	
Use cases: Execute-in-place, fast boot, instant-on systems, safety-critical storage		Use cases: Execute-in-place, fast boot, instant-on systems	Use cases: Boot device, data-logging, FPGA configuration	Use cases: Code, parameter and data storage	Use cases: Code, parameter and data storage	



Scan QR-Code for more information.

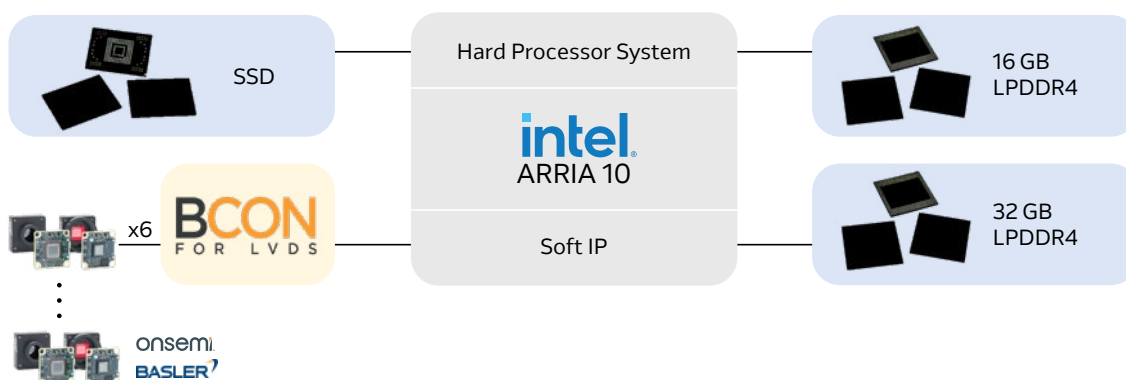
Typical MCU-based vision solution



RT1050 matching Memories

Technology	Supplier	Part number	Description
QSPI NOR	Micron	MT25QL128ABA1ESE-OSIT	serial NOR 128 Mbit 3.3 V
QSPI NOR	Infineon	S25FL127SABMFI100	serial NOR 128 Mbit 3.3 V
QSPI NOR	ISSI	IS25LP064A-JBLE	serial NOR 64 Mbit 3.3 V
Hyper-Flash	Infineon	S26KS512SDPBHI020	Hyper NOR Flash 512 Mbit 1.8 V
SDRAM	Micron	MT48LC16M16A2P-6A IT:G	SDRAM 256 Mbit 16Mx16 3.3 V
SDRAM	Winbond	W9825G6KH-6I/REEL	SDRAM 256 Mbit 16Mx16 3.3 V

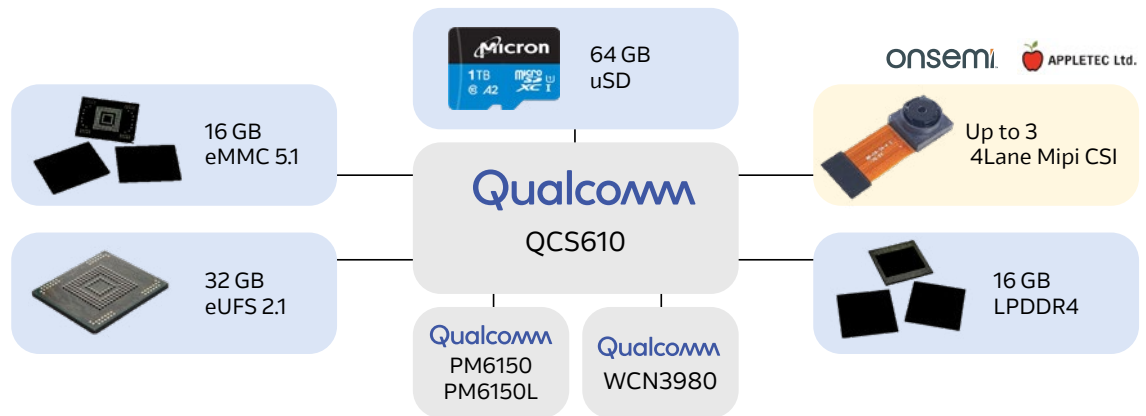
Typical MPU-based vision solution



ARRIA 10 matching Memories

Technology	Supplier	Part number	Description
SSD	Micron	MTFDHBA1T0QFD-1AX15ABYY	2210 – 1 TB PCIe Gen3 NVMe 1.3 – M.2 2280 QLC
SSD	Micron	MTFDHBA960TDF-1AW1ZABYY	7300 – 960 GB PCIe Gen3 NVMe 1.1 – M.2 2280 TLC
SSD	Western Digital	SDBPNPZ-1T00-XI	IX SN530 – 1 TB PCIe Gen3 x4 NVMe 1.4 – M.2 2280 TLC
LPDDR4	Micron	MT53E512M32D1ZW-046 IT:B	16 Gbit x32 4266 Mbps Z42M SDP
LPDDR4	Micron	MT53E512M32D2FW-046 AIT:D	16 Gbit x32 4266 Mbps Z11M DDP
LPDDR4	Micron	MT53E1G32D2FW-046 IT:B	32 Gbit 1Gx32 4266 Mbps Z42M DDP
LPDDR4	ISSI	IS43LQ32256A-062BLI	8 Gbit x32 3200 Mbps

Typical MPU-based vision solution



QCS610 matching Memories			
Technology	Supplier	Part number	Description
eMMC	Western Digital	SDINBDG4-16G-I2	16 GB MLC eMMC v5.1 3.3 V
eMMC	Western Digital	SDINBDA6-16G-I1	16 GB 3D BiCS eMMC v5.1 3.3 V
eMMC	Kioxia	THGAMRG7T13BAIL_TRAY	16 GB 3D BiCS eMMC v5.1 3.3 V
eUFS	Micron	MTFC32GASAONS-IT	UFS 2.1 32 GB 3.3 V
eUFS	Kioxia	THGAF8G8T23BAIL_TRAY	UFS 2.1 32 GB 3.3 V
LPDDR4	Micron	MT53E512M32D1ZW-046 IT:B	16 Gbit x32 4266 Mbps Z42M SDP
LPDDR4	Micron	MT53E512M32D2FW-046 AIT:D	16 Gbit x32 4266 Mbps Z11M DDP
LPDDR4	ISSI	IS43LQ32256A-062BLI	8 Gbit x32 3200 Mbps
uSD Card	Micron	MTSD064AHC6MS-1WT	i200 - 3D TLC NAND 64 GB
uSD Card	Western Digital	SDSDQED-064G-XI	uSD Card IX QD334 SLC 64 GB



Appletec Camera Modules

With the increase in resolution and moving to 4K and 8K there will be further need for increase in memory capacity. Depending on the processor you will use, the technology could be SDRAM through to the latest DDR5 for DRAM.

With an increase in data speed transactions you may need to move from Standard SPI to QSPI. As the level of video storage increases the standard SLC NAND will not be enough so you will need to look at eMMC up to 256GB or Micro SD cards from Micron up to 1TB. With more storage required you would have to look at 9TB SSD.



Arrow Compact Camera Module (CCM)

Offerings for Small Form-Factor Applications

Arrow Electronics is introducing a family of plug-and-play camera modules based on sensor technology from onsemi. The modules provide original equipment manufacturers (OEMs) with a simple and cost-effective path to incorporating a wide range of camera functionalities in their products. All camera modules comply with onsemi IAS standard and have the same connector and pinout, providing compatibility with the popular 96boards development ecosystem. Arrow has partnered with Timesys for Linux drivers.



AP-Vision-ARX3A0-55

- onsemi ARX3A0 sensor
- 1/10.3" 560 x 560 Mono +NIR
- 0.3 Mp @ 360 fps
- Fixed focus 49°FOV
- F# 2.0
- Length: 21.95 mm



Target Applications

- IoT Applications
- Super Low Power Applications
- Machine Vision
- Artificial Intelligence
- Eye tracking



Click here or scan the QR-Code for more information.

AP-Vision-AR0430-54

- onsemi AR0430 sensor
- 1/3.2" 2316 x 1746 Color
- 4 Mp @ 120 fps
- fixed focus 81.5°FOV
- F# 2.4
- Length: 23.5 mm



Target Applications

- Consumer Devices
- Door Camera
- Dual Camera
- Robotics
- Drone Camera



Click here or scan the QR-Code for more information.

AP-Vision-AR1335-74

- onsemi AR1335 sensor
- 1/3.2" 4208 x 3120 Color
- 13 Mp @ 30 fps
- Auto focus 64° FOV
- F# 2.0
- Length: TBD mm



Target Applications

- Digital Still Cameras
- Drone Cameras
- AI Vision
- Body Camera
- Sports Camera

Available in Q1 2022

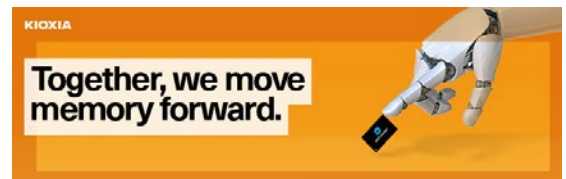
In Partnership with:

onsemi

APPLETEC Ltd.

Flash Memory & Flash Storage Solutions

From the invention of flash memory in 1984 to today's groundbreaking BiCS FLASH™ 3D flash memory technology. KIOXIA is moving the industry forward with innovative memory solutions and services that enrich people's lives and expand society's horizons. KIOXIA's mission is to uplift the world with "memory". By evolving "memory", KIOXIA creates uplifting experience and changes the world.



Solid State Drives (SSDs)

KIOXIA provides high-end Solid State Drives (SSDs) for Enterprise-, Data Center- and Client-applications.

Enterprise SSD

Enterprise SSDs offer high reliability, data protection incorporating power-loss-protection (PLP) and encryption technology to support enterprise environments and applications. The light weight and low power consumption features will make the systems more energy efficient. The SSDs are available as Read Intensive, Mixed Use and Write Intensive.

- CM6 (PCIe 4.0 / NVMe)
- PM6 (SAS-4 24G)

Data Center SSD

KIOXIA's Data Center SSDs are optimized for a balance of performance, low latency and power efficiency. They also provide power-loss-protection (PLP) and data security options to increase safety and security. The SSDs are suitable for low-end servers, cloud computing, databases and content delivery networks and media streaming.

- CD6 (PCIe 4.0 / NVMe)
- XD6 (PCIe 4.0 / NVMe)

Client SSD

The SSDs deliver storage competence with their large capacities, small size and low power consumption. They also support fast transfer rates as well as high durability against shock and vibration. The SSDs are suitable for high-performance workstations, desktops and mobile computing.

- BG4 (PCIe 3.0 / NVMe)
- XG6/XG6-P (PCIe 3.0 / NVMe)

Embedded Flash Memory

KIOXIA offers a wide range of advanced Flash Memory technologies for all kinds of applications like consumer electronics, mobile technology and industrial applications such as robotics.

Raw NAND

Raw NANDs like SLC NAND, BENAND™ and Serial NAND deliver high endurance and data retention for sensitive or frequently used data.

Managed NAND

Managed NAND like e-MMC and UFS are the preferred solutions for efficient and easy to integrate storage systems. Both solutions offer broadly accepted standard interfaces and packages. In combination with high-speed interfaces, they are the optimal selection for many applications in the industrial, mobile and automotive market.

More information



KIOXIA introduces a new family of e-MMC with the leading-edge 3D BiCS Flash.



Key Reasons That KIOXIA NVMe SSDs Boost PCIe® 4.0 Performance.

Non-Volatile Memory Technology								
Sub-Technology	Serial Eeprom	NV-RAM	Parallel Nor Flash	Serial Nor Flash	NAND Flash	NAND Cards	eMMC – UFS	SSD
Application	Used in many boot-up applications, parameter storage, and as support memory for low density storage applications.	Anywhere that RAM product needs to retain memory when the power is turned off. POS Terminals, Power Meters, Industrial Control.	Work memory, used in code storage and most embedded applications.	Code and parameter storage. Leading volume replacement parallel NOR Flash. Used in boards with limited space.	Storage Memory chips used when there's a need for high densities for data storage, not used to execution of data.	Removeable Storage Memory for Security, Camera and image storage, industrial control, Test instrumentation, Medical and many other applications requiring removeable storage.	Embedded Memory Card. Non Removable memory card solution, suitable for internal storage.	High end data storage applications, server, data centre, robotics, video surveillance, Industrial machine, AI edge storage.
Features	Low Power, low voltage, low densities, low cost, space-savers. Three industry standard serial buses: I ² C, SPI and Microwire.	STMicro has battery backed up products. Infineon uses capacitor to route contents into on-board, also FRAM technology. Everspin uses magnetic solution.	High read speeds, high bit reliability, parallel read, mature technology and production processes.	Low pin count, smaller packages, increased densities range, reads serially.	Slower read speed, but faster writes. Not as high data integrity as NOR, supplies now on longevity programs suitable for industrial customers.	Dominant types are Micro SD cards Class 10 offers best speed and endurance, we can offer CF and SD cards but are lower densities and expensive	Emmc now using standard NAND wafer and new 3D NAND which can be stacked to 96 layer and increasing . Densities continue to increase as the die technology changes.	Low power consumption compare to HDD technology. Faster performance, densities continue to grow giving you more storage for simliare cost.
Arrow Suppliers	onsemi, STMicro, Microchip	Everspin, Infineon (Cypress), STMicro	Infineon (Cypress), ISSI, Macronix, Micron, Microchip	Infineon (Cypress), ISSI, Macronix, Micron, Microchip, Winbond	ISSI, Kioxia, Macronix, Micron, Samsung, SkyHigh, Winbond	Kioxia, Micron, Panasonic, TDK, Western Digital, Virtium	ISSI, Kioxia, Macronix, Micron, Samsung, SkyHigh, Western Digital	Intel, Kioxia, Micron, Panasonic, Samsung, TDK, Western Digital, Virtium

Parametric Data								
Density	1 kbit – 2 Mbit	4 Kbit – 32 Mbit	2Mb – 2Gbit	256 kbit – 4 Gbit	128 Mbit – 128 Gbit	8 GB – 1 TB	2 GB – 1 TB	40 GB – 9 TB
Density Sweet Spot	64 k – 256 k	1 Mbit	256 Mbit – 512 Mbit	8 Mb and 128 Mb	1 Gbit + 4 Gbit	16 GB	8 GB – 64 GB	256 GB
Major Packages	SO8N, TSSOP8, DFN2X3, DFN5, WLCSP and bare die packages.	SOIC, SSOP, PDIP, EIAJ8, TDFN8 and bare die	TSOP, FBGA, LFBGA	8-SOP, 8-USON, 8-WSON, 24-TFBGA.WLSCP and bare die	TSOP, FBGA	Cards - various form factors including Secure Digital, Mini-SD, Compact Flash	100 ball BGA and 153 BGA, 100 TFBGA	2.5 inch SATA, PCIe M.2, U2, mSATA, BGA
What you need to know	Low cost entry level boot and execute solution used where limited memory capacity is required.	Non-Volatile SRAMs are expensive and can generate high NSB if the design requires this product, FRAM and magentic RAM are a more cost effective solution.	Legacy NOR flash not recommend for new design all new processors have no parallel interface.	Low pin count, small packages make Serial Flash a space saver. All new processors and FPGA use Serial and standard interface	Enter level NAND solution, used in application for local storage.	A wide variety of solutions for removeable storage needs, replacement for EOL and support leading edge technology.	Small embedded form factor allows for maximum storage in minimal space. Higher density storage than SLC NAND good support for IOT-AI applications . All leading edge manufactures moving away from 2.5 inch SATA .	SSD will continue to increase density, more and more data will be used therefore more storage will be required. Intel, Kioixia, Micron, Western digital moving away from 2.5 inch SATA, to other form factors. Not recommend for new design

Note: Kioxia formerly Toshiba, Western Digital formerly SanDisk, Dialog formerly Adesto, Infineon formerly Cypress

Volatile Memory Technology

Volatile Memory Technology									
Sub-Technology	DRAM	DRAM	DRAM	DRAM	SRAM	SRAM	SRAM	Specialty Memory	Specialty Memory
Specific Type	SDRAM - LPSDRAM	DDR1/DDR2 – LPDDR1/2	DDR3/DDR4 – LPDDR3/4	DDR5 – LPDD5	Synchronous	Asynchronous	Micropower	FIFO	Multi-Port
Application	Used in mature markets low technology factory automation, medical.	DDR1 used in mature Networking/ Telecom legacy product, DDR2 replacement for DDR one used on older processor.	Surveillance, Drones, AI, IOT, SOM, SBC, Transportation, Factory automation, Medical, Robotics will use this DRAM technology.	New DRAM technology high end servers, 5G application, future SBC subject to correct processor avaiability	Telecom, Networking, Speed and Bandwidth critical applications.	Applications where speed is most critical (like CPU cache and router buffers).	Battery powered applications that require memory.	Data buffering and flow control as well as rate and bus matching.	DSP circuits, synch and asynch applications.
Features	"Synchronous" DRAM	DDR = "Double Data Rate" gives two reads per cycle	Multiple packages and speeds to support the requirements of the up to date processors	Increase performance and bandwith. Lower power consumption improves voltage margins	Highest densities, fastest speeds. Latest SRAM technology.	Conventional SRAM: has high speed, but high power require-ments and limited density.	Used where high performance and speed are necessary but power requirements are low.	Organizes data reads.	Used for simultaneously reading multiple processors.
Arrow Suppliers	ISSI, Micron, Winbond	ISSI, Micron, Samsung, Winbond	ISSI, Micron, Samsung, Winbond	Micron, Samsung	Infineon (Cypress), ISSI	Infineon (Cypress), ISSI, onsemi	Infineon (Cypress), ISSI, onsemi	Infineon (Cypress)	Infineon (Cypress)

Parametric Data									
Density	64 Mbit – 512 Mbit	64 Mbit – 2 Gbit	1 Gbit – 48 Gbit	8 Gbit – 64 Gbit	1 Mbit – 288 Mbit	4 Kbit – 64 Mbit	64 Kbit – 64 Mbit	2 Kbit – 1 Mbit	8 Kbit – 36 Mbit
Density Sweet Spot	256 Mbit - 512 Mbit	512 Mbit	4 Gbit – 16 Gbit	32 Gbit	18 Mbit	4 Mbit	8 Mbit	1 Mbit	4 Mbit, 9 Mbit
Speed Sweet Spot	166 Mhz	200 Mhz – 400 Mhz	800 Mhz, 933 Mhz, 1866 Mhz, 2133 Mhz, 3000 Mhz	3200 Mhz – 6400 Mhz	250 Mhz – 400 Mhz	10 ns	55 ns	166 Mhz	166 Mhz
Major Packages	TSOP, VFBGA	TSOP, FBGA, TFBGA	FBGA, TFBGA, VFBGA, WFBGA	FBGA, TFBGA, VFBGA, WFBGA	BGA, TQFP	FBGA, TSOP, SOJ	VFBGA, TSOP, SOIC	PLCC, TQFP, BGA	TQFP, FBGA, PBGA
What you need to know	Mature DRAM technology: Look for applications that use low technology FPGAs or legacy processors.	DDR2 leads the two technologies, still used on most older industrial, medical and automotive appli-cations.	DDR3 is the current industrial DRAM technology used on most processor, DDR4 works with iMX8 processor.	DDR5 – LPDD5 limited application in the industrial sector. Will be available for mass market 2022	Market moving to QDR (Quad Data Rate) due to need for higher speeds and densities.	Non growth market with limited supplier base.	Will go head-to-head with Pseudo Statics, but has the advantage in power consumption.	Specialty Memory: Design work needed and rewarded – DW programs.	Variety of features offered depending on part/supplier.

Note: Infineon formerly Cypress

Industrial and IoT Storage Solutions

e.MMC Embedded Flash Drives

iNAND® IX EM122 and EM132 e.MMC 5.1 storage solutions offer dependable and robust embedded storage options to system designers in the Industrial and IoT market. The EM132 is the first 256 GB and 3D NAND-based e.MMC in the Industrial and IoT market.

Features and Benefits

- e.MMC 5.1 interface
- 8 GB to 256 GB in small form factor
- Wide temperature range: -25 °C to 85 °C (I) and -40 °C to 85 °C (XI)
- Auto and manual refresh, enhanced health status, smart partitioning



Orderable at [arrow.com](https://www.arrow.com)

UFS Embedded Flash Drive

iNAND IX EM312 the industrial-grade UFS version 2.1 based on 3D NAND technology, delivers higher capacities and up to 2.5 times the performance of e.MMC-based products.

Features and Benefits

- UFS 2.1 interface for high data speeds
- 16GB to 256 GB in small form factor
- Wide temperature range: -25 °C to 85 °C (I) and -40 °C to 85 °C (XI)
- Fast boot, auto refresh, manual refresh, enhanced health status



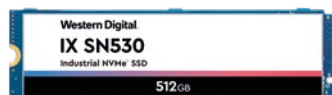
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PCIe SSD

Western Digital IX SN530, PC SN530, CL SN720, CL SN520, and PC SN730 NVMe™ SSDs are designed to capture massive amounts of sensor and imaging (video) data from POS, delivery robots, factory automation, industrial PCs and laptops and gaming devices – some generating terabytes of data per day.

Features and Benefits

- PCIe Gen3x4 NVMe 1.4
 - M.2 2280, M.2 2242 and
 - M.2. 2230 form factors
- High capacities up to 2TB
- TLC and SLC configurations for higher endurance of up to 24 PBW (IX SN530)
- Temperature range:
 - -40 °C to 85 °C (IX SN530)
 - 0 °C to 85 °C (CL series)
 - 0 °C to 70 °C (PC SN730 & PC SN530)



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SATA SSD

Western Digital PC SA530 and SanDisk X600 SATA SSDs deliver leadingedge performance, high capacity, and enhanced endurance. In capacities of up to 1 TB, the PC SA530 3D NAND SATA SSD is optimized for the demanding power management requirements of ultra-thin and small form factor products.

Features and Benefits

- X600 – 128 GB
- PC SA530 – 256 GB to 1 TB
- 2.5" and M.2 2280 form factors
- Sequential R/W up to 560/530 MB/s
- Random R/W up to 95 K/84 K IOPS



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SD Cards

Industrial SD Card IX LD332 and LD342 are ideal for Industrial and IoT applications that require a removable storage media like drones, drive recorder, digital signage, aviation, and body and dash cams.

Features and Benefits

- 8 GB – 512 GB
- High endurance (3K P/E Cycle)
- Wide temperature range: -25 °C to 85 °C (I) and -40 °C to 85°C (XI)
- BOM control
- Extended longevity



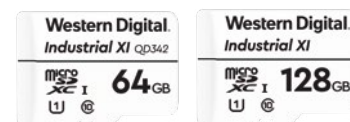
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microSD™ Cards

Industrial microSD Card IX QD332, QD334 and QD342 offer industrialgrade extended temperature flexibility to support customers that not only want a removable solution but also a small form factor with extreme endurance. SLC, MLC, and TLC solutions are available.

Features and Benefits

- 8 GB to 256 GB
- Wide temperature range:
 - -25 °C to 85 °C (I) and -40 °C to 85 °C (XI)
- Extreme endurance (Up to 30 K P/E cycle)
- Longevity
- BOM control
- Auto/manual refresh, health status, host lock



Orderable at [arrow.com](https://www.arrow.com)



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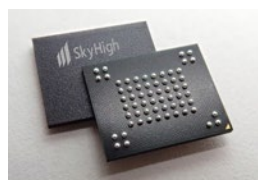
SkyHigh Memory

Founded in 2019, SkyHigh Memory is the leader in advanced embedded system solutions for the world's most innovative automotive, industrial, home automation and appliances, consumer electronics and medical products. SkyHigh Memory reliable, high-performance memories help engineers design differentiated products and get them to market first. SkyHigh Memory is committed to providing customers with the best support and engineering resources, enabling innovators and out-of-the-box thinkers to disrupt markets and create new product categories in record time.



All SkyHigh Memory's products are backed by SkyHigh Memory's world-class customer support and commitment of supply longevity.

SLC NAND Flash Memory



SkyHigh Memory SLC NAND products offer a high-density memory solution optimized for embedded systems. The SkyHigh SLC NAND product family include differentiated features such as operating temperature support up to 105 °C, AEC-Q100 qualification for automotive applications and packages as small as 52 mm² for ONFI1.0 parallel interface and 48 mm² for Serial Parallel Interface.

For applications where security is a priority, SkyHigh Memory offers the SL-2 SecureNAND™ and ML-3 product family which provides enhanced protection features. SkyHigh Memory SLC NAND products are available in densities ranging from 1 Gb to 16 Gb.

ONFI1.0 SLC NAND: Featured Product Families							
Technology	Densities	Voltages	Reliability	ECC	Temperature	Package	Security
ML-1/MS-1	1 Gb to 8 Gb	3 V and 1.8 V options	100,000 P/E Cycles 10-year Data Retention	1-bit ECC	-40 to +85 °C -40 to +105 °C	48-pin TSOP 12 x 20 x 1.2 mm 63-ball BGA 9 x 11 x 1.0 mm	
ML-2/MS-2	1 Gb to 16 Gb	3 V and 1.8 V options	100,000 P/E Cycles 10-year Data Retention	4-bit ECC	-40 to +85 °C -40 to +105 °C	48-pin TSOP 12 x 20 x 1.2 mm 63-ball BGA 9 x 11 x 1.0 mm 67-ball BGA 8 x 6.5 x 1.0 mm	
ML-3	1 Gb to 8 Gb	3 V	80,000 P/E Cycles 10-year Data Retention	0-bit ECC, Support 1/4/8-bit ECC SoC	-40 to +85 °C -40 to +105 °C	48-pin TSOP 12 x 20 x 1.2 mm 63-ball BGA 9 x 11 x 1.0 mm	Enhanced Protection Features
SL-2	1 Gb to 4 Gb	3 V	100,000 P/E Cycles 10-year Data Retention	4-bit ECC	-40 to +85 °C -40 to +105 °C	63-ball BGA 9 x 11 x 1.0 mm	Enhanced Protection Features

SPI SLC NAND: Featured Product Families							
ML-3	1 Gb to 4 Gb	3 V	80,000 P/E Cycles 10-year Data Retention	0-bit ECC Support 1/4/8-bit ECC SoC	-40 to +85 °C -40 to +105 °C	8-pin LGA 6x8x0.75 mm	Enhanced Protection Features

Key Applications

- Automotive Instrument Clusters and Infotainment Systems
- Communication Equipment
- Wearables
- Consumer Electronics
- Industrial Automation



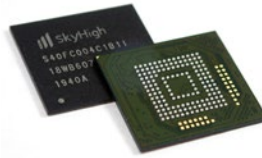
eMMC Flash Memory

SkyHigh eMMC incorporates a mature interface standardized by JEDEC, and key functionality that yields strong operating life cycle, power management and performance optimization. SkyHigh Memory eMMC products are available in 2 GB and 4 GB density for now and offered in JEDEC compliant 153-ball BGA standard and 153-ball BGA small packages for application requiring a small memory footprint.

Featured Product Families						
Technology	Densities	Interface	Reliability	Temperature	Package	Monitoring
S40	2 GB to 4 GB	eMMC 5.1	3K+ P/E Cycles (MLC mode) 30K+ P/E Cycles (pSLC mode) 10-year Data Retention	-25°C to 85 °C -40 to 85 °C	153-ball BGA 11.5x13x 0.8 mm 153-ball BGA 9x7.5x 0.8 mm	Enhanced health status

Key Applications

- Communication Equipment
- Wearables
- Consumer Electronics
- Industrial Automation



MCP LPDDR4X + SLC NAND

The SkyHigh Memory S6 MCP family, provides an integrated solution by stacking in one package SLC NAND and LPDRAM4x Memory components. The SkyHigh Memory S6 family are designed for applications that need high reliability and performance with lower power consumption within small form factor. SkyHigh Memory MCP products are available in densities of 4Gb SLC NAND +4Gb LPDDR4x and 8Gb SLC NAND +8Gb LPDDR4x and offered in small JEDEC compliant 149-ball BGA packages.

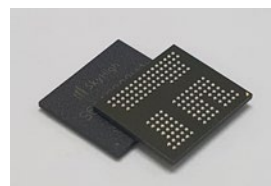
SLC NAND Features			
Error Correction	Supply Voltage	Architecture	Power
4-bit ECC	1.8 V (1.70 to 1.95)	x8 IO Width 4 KB page (4/8 Gb NAND)	Read/Program/Erase: 35 mA (max) Standby: 100 uA (max)

LPDDR4x SDRAM Features				
Speed	Supply Voltage	Architecture	Performance	Reliability
2133 MHz (4 Gb/8 Gb LPDDR4x)	VDD1 = 1.8 V (1.70 to 1.95) VDD2 = 1.1 V (1.06 to 1.17) VDDQ = 0.6 V (0.57 to 0.65 V)	x16 IO Width 8 internal banks of 16 Mb 16n (256 bit) prefetch DDR	Programmable RL (Read Latency) and WL (Write Latency) Burst length: – 16 (def.), 32 and On-the-fly – On the fly mode is enabled by Mode Register	Auto refresh and self-refresh supported All bank auto refresh and directed per bank auto refresh supported Auto TCSR PASR by Bank Mask and Segment Mask

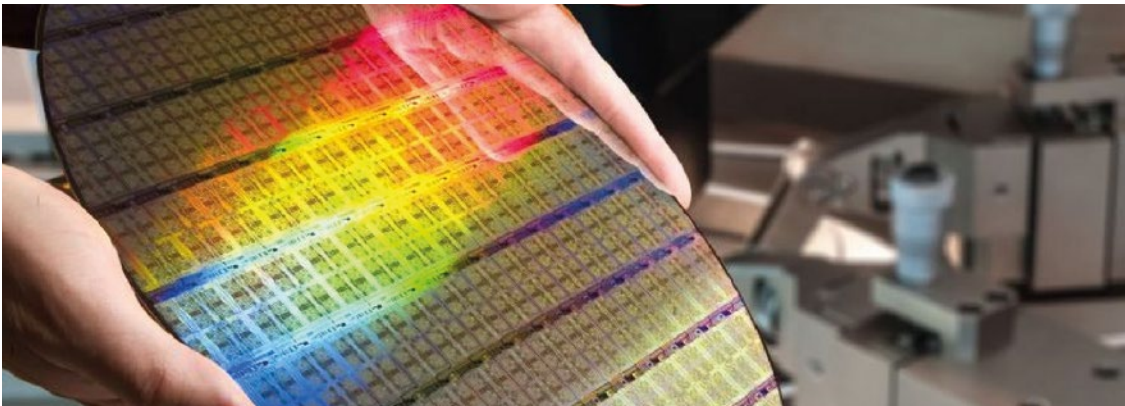
MCP Features	
Temperature Range	Packages (Pb-free)
Industrial (-40 °C to +85 °C) Industrial Plus (-40 °C to +105 °C) Automotive AEC-Q100 Grade 3 (-40 °C to +85 °C) Automotive AEC-Q100 Grade 2 (-40 °C to +105 °C)	149-ball WFBGA (9.5 x 8 x 0.7 mm)

Key Applications

- Automotive Telematics Systems
- Communication Equipment
- Industrial Automation



Advanced Memory Solutions Provider



Mobile & Specialty DRAM

DRAM memory is an essential component of new AI systems and technology. New Winbond DRAM products save space and cost and reduce power consumption, while providing super-fast performance up to 4.26 Gbps.

HyperRAM

An ultra-low power with just 13 signal pins is a space saving solution for simple AI applications such as keyword recognition and SD image processing. Available in densities up to 512 Mb, standby power consumption as low as 35 μ W, these products are ideal for use in battery-powered and energy-saving devices.

SDRAM / LPDDR, DDR / LPDDR, DDR2 / LPDDR2, and DDR3 / LPDDR3

Data rate options up to 2.13 Gbps support advanced microprocessors which run a Linux® operating system. Ideal for applications involving FHD video processing, face recognition or object detection, especially for 1 Gb LPDDR3.

LPDDR4

Supports high-bandwidth operation for 4K and even 8K video processing at a data rate up to 4.26 Gbps. Available in densities from 1 Gb to 4 Gb DDP, LPDDR4 are suitable for advanced applications such as autonomous driving.

Code Storage Flash Memory

High Speed

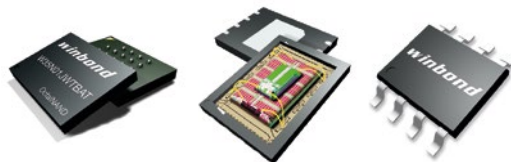
The latest OctalNAND Flash products feature fast Write speed and ultra-fast Continuous Read performance up to 240 MB/s.

Low Power

Winbond was the first SPI NOR Flash manufacturer to supply the market with a portfolio of 1.2 V devices.

Small Board Footprint

Winbond can stack NOR+NOR, NOR+NAND or NAND+NAND die combinations in a standard package outline. SpiStack® gives the flexibility to modify a design's specifications without changing the board layout.



Click here or scan the QR-Code for more information.



	Everspin	Infineon (former Cypress)	Intel	ISSI	Kioxia	Macronix	Microchip	Micron	onsemi	Panasonic	Samsung	SkyHigh Memory	STMicroelectronics	TDK	Virtium	Western Digital	Winbond
SRAM		•		•			•										
DRAM / SDRAM																	
SDRAM				•				•									•
DDR / LPDDR				•				•									•
DDR2 / LPDDR2				•				•			•						•
DDR3 / LPDDR3				•				•			•						•
DDR4 / LPDDR4				•				•			•						•
DDR5 / LPDDR5								•			•						
Memory Modules								•			•				•		
MRAM / FRAM / nvSRAM	•	•					•						•				
NOR Flash																	
Serial		•		•		•	•	•	•								•
Parallel		•		•		•	•	•									
EPROM / E ² PROM							•		•				•				
NAND Flash																	
SLC NAND				•	•	•		•				•					•
eMMC				•	•	•		•			•	•				•	
UFS					•			•			•					•	
SD Cards								•		•				•	•	•	
MicroSD Card								•		•				•	•	•	
Compact Flash / CFast														•	•		
Solid-State Drives Memory			•		•			•*			•			•*	•*	•	

* Industrial Temperature Grade available



Click here or scan the QR-Code for more information.

Industry-Validated Memory Solutions



Micron System Enablement

Your system relies on more than high-performance memory solutions to succeed. That's why we work with system and segment experts – both internal and external to Micron – to develop memory solutions that meet the requirements of your entire system.

Speed Time to Market

With Validated Memory Solutions To give you a head start on your design, we've collaborated with 70+ semiconductor design teams and solutions providers to validate your NOR, NAND and DRAM memory devices for use with key platforms, including:

- Microcontrollers
- Processors
- ASICs and custom SoCs
- Programmable logic solutions (e.g., FPGAs, SoCs, CPLDs)
- Supporting hardware and software

The prevalidation can minimize your time and costs spent investigating memory compatibility so you can take your design to market faster.

Start exploring our industry-validated memory solutions for your design at micron.com/ecosystem.

Reap the Benefits of Our Industry Collaborations

Through our relationships with preferred partners and key enablers, we're building an ecosystem that not only delivers validated memory solutions, but also promotes collaboration efforts between industry-leading technology experts, which can benefit your systems in big ways:

- Fully optimized, leading-edge solutions
- Better performance, reliability and compatibility
- Simplified system designs
- Reduced engineering costs
- Proven, preferred partners

Key Partners Validating Micron Memory

- | | |
|-------------|-------------|
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| – Allwinner | – Microchip |
| – Ambarella | – NVIDIA |
| – AMD | – NXP |
| – Amlogic | – Qualcomm |
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| – Intel | |
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