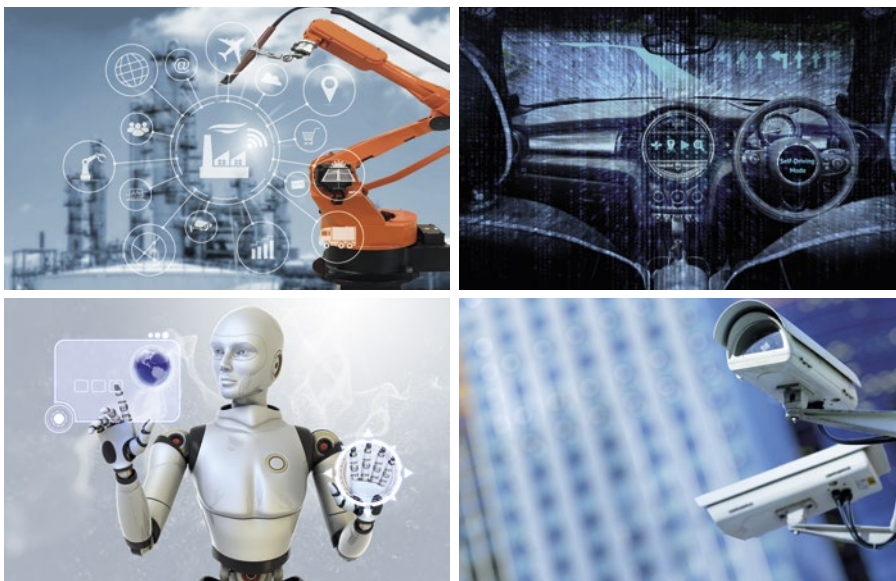


# Memory Guide

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.

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## 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.

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

# Arrow Memory

## Ready for the Future

### Components – EMEA

#### Content

##### Arrow

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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 <sup>2</sup> 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	ON Semiconductor, STMicro, Microchip	Everspin, Infineon (Cypress), STMicro	Infineon (Cypress), ISSI, Macronix, Micron, Microchip	Dialog (Adesto), 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	2 MB – 2 Gbit	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 and 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, ON Semiconductor	Infineon (Cypress), ISSI, ON Semiconductor	Infineon (Cypress)	Infineon (Cypress)

Parametric Data									
Density	64 Mbit – 512 Mbit	64 Mbit – 2 Gbit	1 Gbit – 4 8Gbit	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 and 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 applications.	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 256GB 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://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.



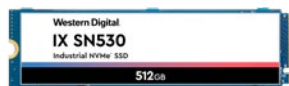
### Features and Benefits

- 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

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

## 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)

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



## 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

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

## 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.



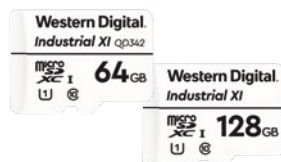
### Features and Benefits

- 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

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

## 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.



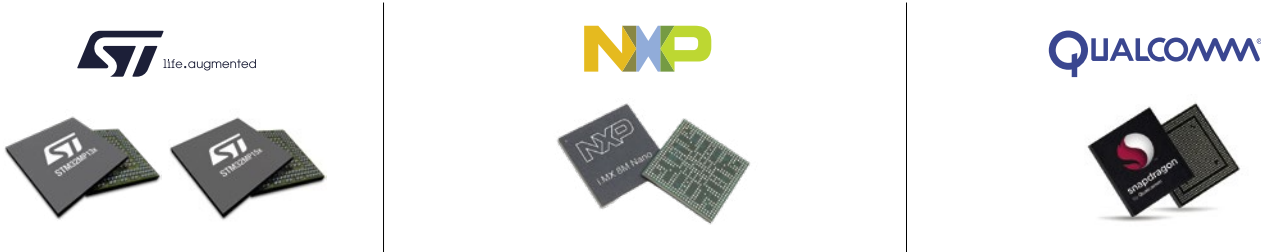
### Features and Benefits

- 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://arrow.com)

# MPU Memory Solution Guide

## Volatile and Non-Volatile



### Memories matching MPUs from Qualcomm Technologies, Inc.\*

MPU	Volatile Memory Suppliers		Typical density	Non-Volatile Memory Suppliers	
		DRAM			Storage
QCS405	ISSI IS43LDxxx – Micron MT42Lxxx – Winbond W97xHx Micron MT52Lxxx – Winbond W63xHx ISSI IS43TRxxx – Micron MT41Kxxx – Winbond W63xxx	LPDDR2 – 32 bit – 533 MHz – 1066 MTPS LPDDR3 – 32 bit – 933 MHz – 1866 MTPS DDR3L – 16 bit – 933 MHz – 1866 MTPS	2 Gb – 8 Gb	Kioxia THGBMxxx – Macronix MX52LMxxx – Micron MTFCxxx – WesternDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia TC58N TC58B (BENAND) – Micron MT29Fxxxx	eMMC 5.1 2ports SDC 4/8-bit SLC NAND (parallel)
QCS410/610	Micron MT53xxx	LPDDR4 – 32 bit (dual channel) – 2133 MHz – 4267 MTPS	8 Gb – 16 Gb	Kioxia THGBMxxx – Macronix MX52LMxxx – Micron MTFCxxx – WesternDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia THGAxxx – Micron MTFCxxxx	eMMC 5.1 2port SDC 4/8-bit 1x UFS 2.1 gear 3 1-lane
SDA845	Micron MT53xxx	LPDDR4 – 64 bit – 1866MHz – 4267 MTPS – 366ball POP	32 Gb – 64 Gb	Micron i200/300 – WesternDigital IX QDxxx Kioxia THGAxxx – Micron MTFCxxxx	2 Ports SDC 4-bit 2x UFS 2.1 gear3 1/2-Lane
SDA660	Micron MT53xxx	LPDDR4 – 32 bit (dual channel) – 1866 MHz – 4267 MTPS	24 Gb – 64 Gb	Kioxia THGBMxxx – Macronix MX52LMxxx – Micron MTFCxxx – WesternDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia THGAxxx – Micron MTFCxxxx	eMMC 5.1 2port SDC 4/8-bit 1x UFS 2.1 gear 3 1-lane

### Memories matching MPUs from NXP

MPU	Volatile Memory Suppliers		Typical density	Non-Volatile Memory Suppliers	
		DRAM			Storage
i.MX 8M Mini/ Nano/Plus	Micron MT53xxx ISSI IS43TRxxx – Micron MT41Kxxx – Winbond W63xxx Micron MT40Axxx	LPDDR4 – 16/32 bit – 1866 MHz – 4267 MTPS DDR4 – 16/32 bit – 1600 MHz – 3200 MTPS** DDR3L – 16/32 bit – 933 MHz – 1866 MTPS	4 Gb – 32 Gb	Infineon FL-S FS-S – Micron MT25Qxxx – Winbond W25Qxxx Kioxia THGBMxxx – Micron MTFCxxx – Macronix MX52LMxxx – WesternDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia TC58N TC58B (BENAND) – Micron MT29Fxxxx	Flex/Quad SPI 2x eMMC 5.1 3ports SDC 4/8-bit RAW MLC/SLC NAND
i.MX8	Micron MT53xxx	LPDDR4 – 64 bit – 1866 MHz – 4267 MTPS	32 Gb – 64 Gb	Infineon FL-S FS-S – Micron MT25Qxxx – Micron MT35Xxxx – Winbond W25Qxxx - Kioxia THGBMxxx – Macronix MX52LMxxx – Micron MTFCxxx – WesternDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia TC58N TC58B (BENAND) – Micron MT29Fxxxx	Quad/Octal FlexSPI eMMC 5.1 2ports SDC 4/8-bit RAW NAND
i.MX8X	Micron MT53xxx ISSI IS43TRxxx – Micron MT41Kxxx – Winbond W63xxx	LPDDR4 – 16 bit – 1866 MHz – 4267 MTPS DDR3L – 16 bit – 933 MHz – 1866 MTPS	8 Gb – 32 Gb	Infineon FL-S FS-S – Micron MT25Qxxx – Micron MT35Xxxx – Winbond W25Qxxx Kioxia THGBMxxx – Macronix MX52LMxxx – Micron MTFCxxx – WesternDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia TC58N TC58B (BENAND) – Micron MT29Fxxxx	Quad/Octal FlexSPI eMMC 5.1 2ports SDC 4/8-bit RAW NAND

### Memories matching MPUs from ST

MPU	Volatile Memory Suppliers		Typical density	Non-Volatile Memory Suppliers	
		DRAM			Storage
STM32MP1	ISSI IS43LDxxx – Micron MT42Lxxx – Winbond W97xHx Micron MT52Lxxx – Winbond W63xHx ISSI IS43TRxxx – Micron MT41Kxxx – Winbond W63xxx	LPDDR2 – 32 bit – 533 MHz – 1066 MTPS LPDDR3 – 32 bit – 933 MHz – 2133 MTPS DDR3L – 16 bit – 933 MHz – 1866 MTPS	1Gb – 8Gb	Infineon FL-S FS-S – Micron MT25Qxxx – Winbond W25Qxxx - Kioxia THGBMxxx – Macronix MX52LMxxx – Micron MTFCxxx – WesterDigital SDINBDA6xxx Micron i200/300 – WesternDigital IX QDxxx Kioxia TC58N TC58B (BENAND) – Micron MT29Fxxxx	Dual/Quad SPI eMMC 4.51 3ports SDC 4/8-bit SLC NAND 8-bit ECC

Please note available devices with higher speed grade backward compatible with lower speed grade requirements.  
\* Qualcomm SDA845, Qualcomm SDA660, Qualcomm QCS405, Qualcomm QCS610 and Qualcomm QCS410 are products of Qualcomm Technologies, Inc. and/or its subsidiaries.  
\*\* I.mx8M Nano supports 16bit only QCS410 are products of Qualcomm Technologies, Inc. and/or its subsidiaries.



# Flash – Forward into the Future



Macronix delivers high quality, innovative and performance driven products, ideal for diverse applications from computing, consumer, networking, and industrial, to mobile, embedded, automotive, and Internet of Things (IoT).

## **NOR Product Range**

Comprehensive Serial NOR Flash memory portfolio meets the requirements of high performance, reliable quality, low pin count and small form factor. Parallel NOR Flash provides customers with cost-effective, high performance and reliable products that offer low-power consumption, high endurance and reliability.

- Serial NOR 3 V, 2.5 V and 1.8 V from 512 KB to 2 GB  
Features: Hi performance Multi I/O and Duplex (DTR) family
- Parallel NOR 5 V, 3 V and 1.8 V from 2 MB to 1 GB.

## **SLC NAND Product Range**

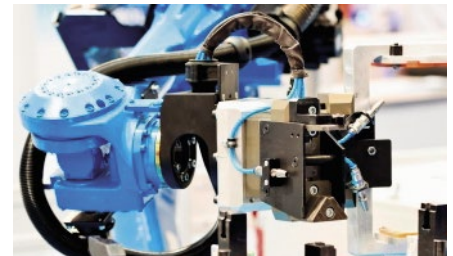
Macronix SLC NAND Flash complements its world-leading Serial and Parallel NOR Flash offerings. Our rigorous quality management system ensures that Macronix SLC NAND is one of the most robust and reliable NAND devices in the market.

- MX30LF/MX60LF family of 3 V parallel SLC NAND, ranging in densities from 512 MB to 8 GB;
- MX30UF family of 1.8 V SLC NAND, offered in densities from 1 GB to 4 GB.

## **eMMC Product Range**

Macronix integrates its MLC NAND Flash and controller in a BGA package with a standard interface to the host system. The e•MMC™ memory is ideal for various applications, such as digital TV, set-top boxes, infotainment, industrial and networking applications. It is also available in the 11x10 mm BGA package for wearable applications.

- 2 GB to 8 GB eMMC products using Macronix NAND and eMMC controllers.

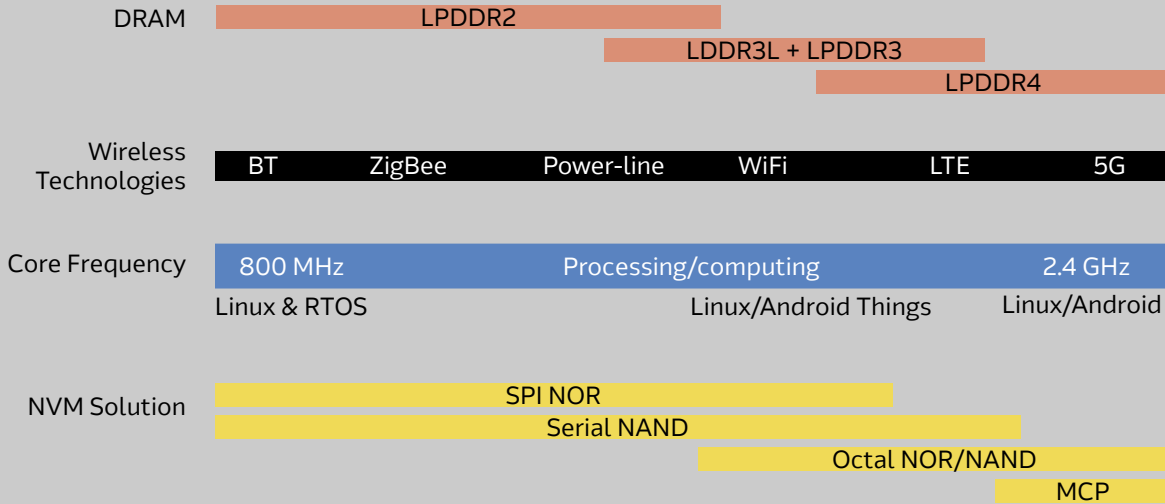



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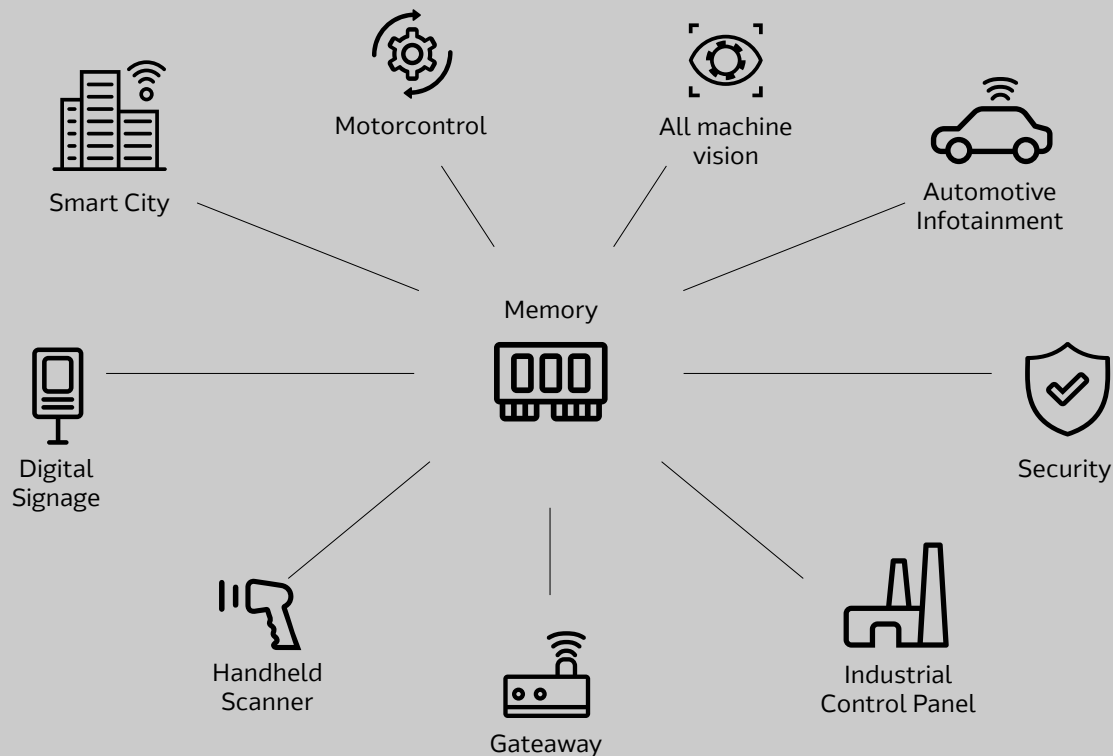
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## MPU Technology Coverage and Memory Landscape



## Target Memory and Controller Markets and Application



# IS25LP/IS25WP Flash Devices



## Industry Standard Serial Interface

- IS25LP(WP)01G: 1G-bit/128M-byte
- IS25LP(WP)512M: 512M-bit/64M-byte
- IS25LP(WP)256E: 256M-bit/32M-byte
- IS25LP(WP)128/128F: 128M-bit/16M-byte
- IS25LP(WP)064A/064D: 64M-bit/8M-byte
- IS25LP(WP)032D: 32M-bit/4M-byte
- IS25LP(WP)016D: 16M-bit/2M-byte
- IS25LP(WP)080D: 8M-bit/1M-byte
- IS25LP040E: 4M-bit/512K-byte
- IS25LP020E: 2M-bit/256K-byte
- IS25LP010E: 1M-bit/128K-byte

Orderable at [arrow.com](http://arrow.com)

ISSI introduces its new Family of IS25LP (2.5/3 V) and IS25 WP (1.8 V) series of flash devices. The family builds upon the success of ISSI's IS25LQ (2.5/3 V) and IS25WQ (1.8 V) family by introducing leading edge features such as double data rate (DTR/DDR) interface modes, SFDP support, and the popular 2 cycle instruction input (QPI mode). All ISSI SPI flash come with the long lifecycles and stability customers have come to expect from ISSI.

The new product family offers read speeds up to 166 MHz in Single/Dual/Quad I/O and 80 MHz in double data rate (DTR/DDR) modes, delivering up to 664 MB/s (equivalent 83 MB/sec) of read throughput (IS25LP256E).

ISSI's SPI NOR Flash are ideal for a broad range of applications, such as Automotive, Industrial, Medical, Communications, Networking, Smart Meters, FPGA, Digital Cameras, Printers, Bluetooth, and IOT. The family is also ideal for code shadowing, execute in place (XIP), and data storage operations.

## Applications

- |                         |                                |
|-------------------------|--------------------------------|
| – Instrument Clusters   | – Medical Devices              |
| – Infotainment consoles | – Military & Aerospace         |
| – Telematics            | – Wireless Access Points       |
| – Safety Systems (ADAS) | – 4G LTE Base Stations         |
| – Smart TV STB          | – Routers & Switches           |
| – HDD                   | – Home Networking              |
| – Printers              | – Energy Smart Grid Management |
| – Gaming                |                                |
| – Industrial Controls   |                                |

# Uplifting the world with “Memory”



KIOXIA delivers flash-based products for next-generation storage applications. Having invented NAND flash over 30 years ago, KIOXIA is now one of the world's largest flash memory suppliers – and continues to move the technology forward.

## BiCS FLASH – The Future of High-Density Flash Memory

With BiCS FLASH 3D, a three-dimensional vertical flash memory cell structure, KIOXIA focuses on innovation, quality and reliability. This structure is an important component in almost all electronic devices where data need to be stored and enables it to surpass the capacity of mainstream 2D (planar) flash memory.

KIOXIA's TLC 3-bit-per-cell 512 GB (64 GB) BiCS FLASH enhances the reliability of write/erase endurance while boosting write speeds. The company also offers a 1.33 TB BiCS FLASH device that features 4-bit-per-cell, quadruple-level-cell (QLC), technology.

## SLC NAND – Reliable, High-Performing, Low-Density NAND

Single-level cell (SLC) NAND flash memory is the original NAND architecture. A 1-bit-per-cell, non-volatile memory, SLC provides the high endurance that makes it ideally suited for a variety of consumer and industrial applications where longevity of supply is important.

KIOXIA's SLC NAND product family includes two interface options: PARALLEL and SERIAL.

### Parallel Interface

Available as raw SLC NAND or as BENAND (Built-in ECC NAND). BENAND is SLC NAND with an internal hardware error correction code (ECC) engine, which removes the burden of ECC from the host processor.

### Serial Interface

KIOXIA's Serial NAND is SLC NAND with a serial peripheral interface (SPI). SPI is an industry standard inter-chip interface that is used in NOR flash and supported by most microprocessors and microcontrollers.



## e-MMC – Highly-efficient Storage

e-MMC is a family of advanced and highly efficient NAND flash memory with an integrated controller for enhanced memory management. Based on an interface standardized by JEDEC, KIOXIA's e-MMC offers the optimal solution for applications where higher data volumes need to be stored in an efficient way.



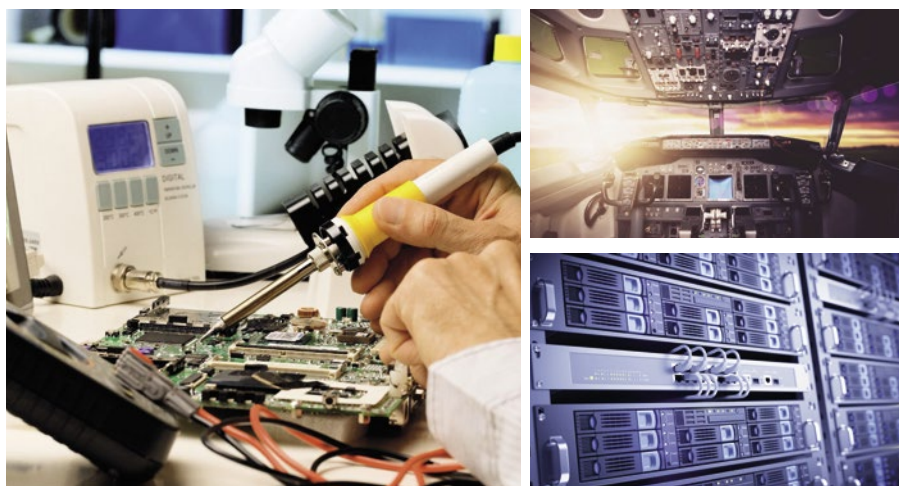
## UFS – High-Performance Storage

UFS (Universal Flash Storage) is a JEDEC-standard, non-volatile managed flash device. It was developed to be the high-performance replacement to e-MMC for embedded memory solutions. When compared to e-MMC, UFS delivers a faster interface, higher performance for reads and writes, higher density, better power efficiency and support for full duplexing.

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

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# Micron® Industry-Validated Memory Solutions



## Key Partners Validating Micron Memory

- ADI
- Allwinner
- Ambarella
- AMD
- Amlogic
- Broadcom
- Hisilicon
- Infineon
- Intel
- Lattice
- Mediatek
- Microchip
- NVIDIA
- NXP
- Qualcomm
- Realtek
- Renesas
- STMicroelectronics
- Synaptics
- Telechips
- Texas Instruments
- Xilinx

## 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](https://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

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

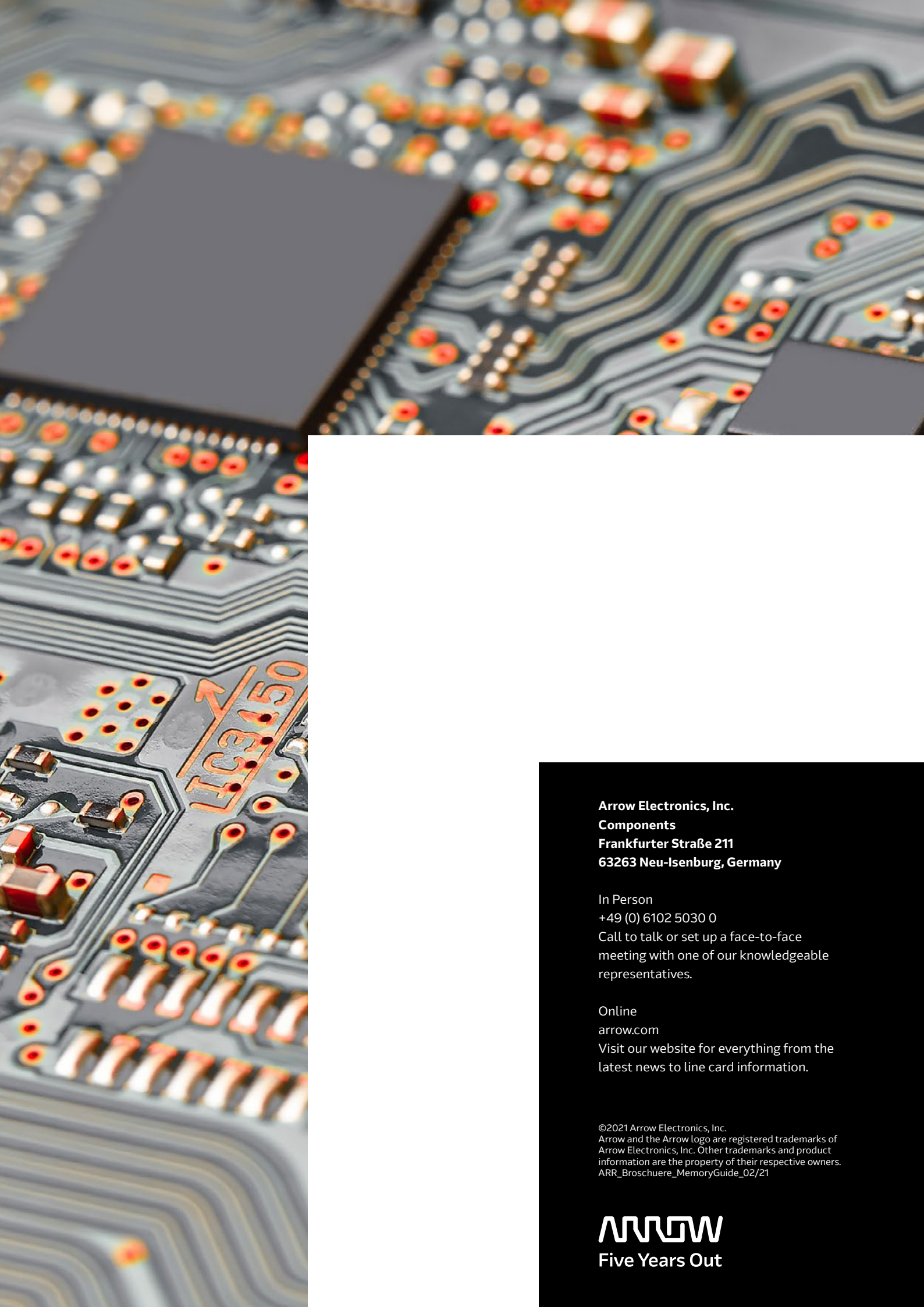


	Dialog (former Adesto)	Everspin	Infineon (former Cypress)	Intel	ISSI	Kioxia	Macronix	Microchip	Micron	ON Semiconductor	Panasonic	Samsung	SkyHigh Memory	STMicroelectronics	TDK	Virtium	Western Digital	Winbond
SRAM			•		•			•										
DRAM / SDRAM																		
SDRAM					•				•									•
DDR / LPDDR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

\* Industrial Temperature Grade available

## Our Partners for Memories





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**Five Years Out**