

INDUSTRIAL MEMORY SOLUTIONS



**goodram
industrial**

PRODUCT CATALOGUE

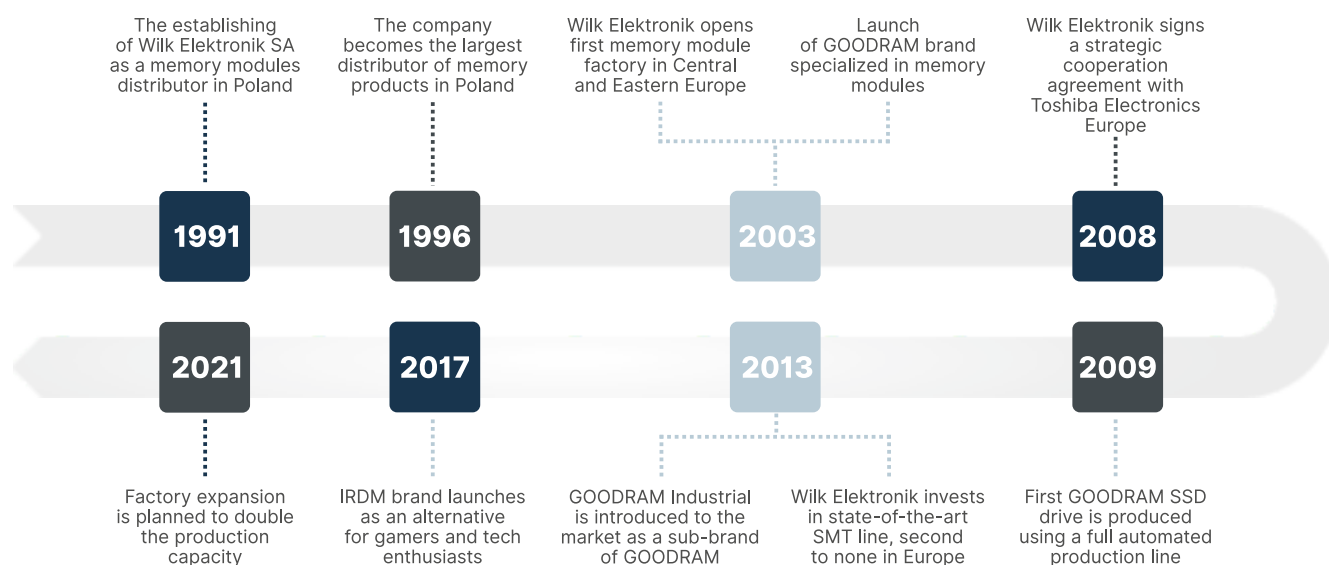


About Company

GOODRAM Industrial is a brand of Wilk Elektronik SA – Polish memory manufacturer and distributor with nearly 30 years of experience in the memory business.

Known for its strict quality policy, flexibility and post-sales support, GOODRAM is the only European memory manufacturer with its own lab, R&D department, state-of-the-art production site, test field and support team. All in-house, under one roof.

GOODRAM stands for quality, reliability and support – we believe that the industry needs customized solutions for very specific needs. Designing our own testing procedures ensures that the modules we produce are tailored to match our customers needs perfectly. Add low MOQ's, fixed BOM and long-term post-sales support to the mix to achieve the highest possible quality of customer service. It all boils down to guaranteeing our partners the highest reliability possible throughout the module's lifetime.



How we work

To put it brief and simple – we take your needs and do everything we can to provide you with the perfect product to do the job. Every case is a different story of meeting very specific needs with a dedicated, customized and reliable solution. And in our minds “solution” is not only the final module or memory card your company uses. The solution is everything that happens before, in the midst of and after sales.

Services

Every customer brings different needs and expectations to the table. It's in our company's DNA to react to those dynamically changing variables. We provide services that go far beyond a simple sale process:

- pre-sales support, which includes meticulous interviews with the customer, giving us a greater understanding of our partner's needs;
 - complex customer service throughout the sales process, which means making sure we have a specific solution available for you over a long period of time among other things;
 - post-sales support such as diagnostics, consulting and training.
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Quality assurance

Everything we do is oriented towards providing products of the highest quality. Quality, as we understand it, means complete reliability and satisfaction of the customer's requirements throughout the product's lifetime. It's the reason why we continuously invest in more advanced machinery, diagnostic equipment and people, who create our LAB, R&D and QC departments. The more complicated cases we solve and issues we resolve through our design and production processes, the harder we believe this is the right course to take. Constant growth and evolution is the key to our success.





THERE ARE FOUR SIMPLE STEPS WE TAKE IN EVERY PROJECTS WE ARE INVOLVED IN:

1. SUPPORT

AFTER-SALES
SUPPORT,
IN-DEPTH
CONSULTING
AND TRAINING

2. IN-DEPTH ANALYSIS

WE TAKE A LOOK
AT THE SCOPE OF WORKS
AND POSSIBLE SOLUTIONS

3. EVALUATION

WE RUN FURTHER TEST,
QUALITY CHECKS
AND ON-FIELD
EVALUATION IF NEEDED

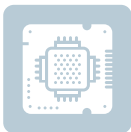
4. EXECUTION

WE DO TEST-RUNS,
QUALITY CHECKS
AND MANUFACTURE
THE FINAL PRODUCT

CORE FEATURES

PCN AND EOL MANAGEMENT

FIXED BILL OF MATERIAL



EXTENDED TEMPERATURE
RANGE

HIGH QUALITY
PRODUCTS

LONG TERM SUPPORT



Applications of GOODRAM Industrial solutions



VIDEO SECURITY SYSTEMS

The use of CCTV systems is more and more popular in all fields of human activity. Whole cities, events and large production plants are being monitored and those videos are recorded for safety measures - which creates the need for faster, more reliable and durable storage.



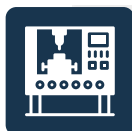
POINT-OF-SALE (POS)

A point-of-sale terminal is an essential part of every modern store. In many cases, to conform with local law, transactions are recorded in the terminal's memory. More and more POS are equipped with NAND flash storage.



INTERNET OF THINGS

The "Internet of Things" is the future that we are just entering. Continuous and seamless communication of devices around us creates new demand within storage and data transfer technologies.



INDUSTRIAL COMPUTING

Supervising production processes is no longer exclusively a human domain. They can be successfully controlled by intelligent computer systems that make them more efficient.



HOME AUTOMATION

Home automation systems are innovative technologies that are getting more popular every day. Setting up your own way to operate within and shape the environment you live in creates more and more need for memory products.



HUMAN-MACHINE INTERFACES

These interface devices enable human operators to communicate with machines, and collect data from monitored processes. Modern interfaces feature a touch screen, and offer a visual display that makes it easy to control processes and receive alerts in case of potential dangers.



WIRELESS SYSTEMS

Digitalization of our everyday life requires introduction of new means of communication. They include wireless data transfer systems which enable global access to the resources we all create.



PUBLIC COMMUNICATION

People commute every day, usually to work or school. New technologies can now make means of public transportation faster, more efficient and safer.



AUTOMOTIVE SOLUTIONS

The car is no longer just a simple means of transport. Today, it is expected that the vehicle is equipped with a multimedia system and navigation.



INDUSTRIAL AUTOMATION

Arduous and precise production processes are now performed by automated devices and robots. Their operations are controlled by advanced computer systems.

Flash core features

FLASH MEMORY

NAND Flash based memory devices form a distinct group of products with a range of different interfaces and applications. Depending on the type of NAND flash used, these products differ in terms of durability, speed and capacity. All of them, however, have advanced mechanisms to ensure data integrity. We currently offer solutions based on SLC, pSLC, MLC and 3D TLC NAND Flash.

NAND FLASH MANAGEMENT

GOODRAM Industrial storage products utilize the latest technologies to ensure complete reliability up to the specified TBW (Total Bytes Written) value. These technologies include:

ECC (ERROR CORRECTION CODE)

NAND Flash memory cells are subject to wear, potentially causing random errors in the stored data. GOODRAM Industrial implements advanced error detection and correction algorithms (LDPC/BCH) appropriate for the used technology. This guarantees a high level of data security up to the specified TBW.

WEAR LEVELLING

NAND Flash memories have a limited number of program/erase cycles. To ensure product longevity, data must be evenly distributed between the memory blocks. GOODRAM Industrial memories implement advanced wear leveling algorithms for this purpose. This means that the fixed flash blocks will not wear out due to repeated writing to a particular address location.

DAMAGED BLOCK MANAGEMENT

In NAND Flash memory units, certain memory blocks may be rendered unusable. This occurs during manufacturing of the devices and during their subsequent use, for instance as a result of wear. Such blocks must be excluded from use. Methods of fault prediction and exclusion of unusable memory blocks are implemented in all GOODRAM Industrial Flash products.

SMART

SMART (Self-Monitoring Analysis and Reporting Technology) is a technology for self-diagnosis and reporting oriented towards the prediction and detection of basic faults. In the case of SSDs, the self-diagnosis results and wear statistics can be accessed via a standardised interface. In the case of memory cards, such as SD, access to this data requires the use of special software.

TRIM

TRIM is a command defined by the ATA standard, enabling the operating system to inform the SSD controller which sectors contain expired data, so that the flash wear levelling algorithm does not transfer expired data between blocks. It can significantly increase the lifetime of SSD.

OVER-PROVISIONING

This term refers to the memory capacity not available to the user. Thanks to the limit on available capacity, mechanisms used for organizing the stored data are used less frequently, leading to increased operations per second (IOPS) and reduction in write amplification. This results in faster write speeds and longer device lifetime.

DIPM/HIPM/DevSLEEP MODE

The SATA interface utilizes two reduced power modes: partial and slumber. In partial mode the power consumed by the interface is limited to a few tens of mW and the wake-up time is not more than 10 μ s. In slumber mode the power consumption is further reduced and the wake-up time may be up to 10 ms. Partial and slumber modes may be initiated by the host computer (HIPM) or by the storage device (DIPM). SSDs may also offer a DevSleep mode, resulting drive to go into a deep "device sleep" significantly reducing power consumption. Reduced power modes enable mobile devices to operate for longer without recharging.

Compact Flash

Compact Flash memory card has a PATA interface and a housing conforming to the PCMCIA I and II standards. Since it is compliant with the IDE interface, it may be used a system drive in all applications which require low power consumption, low heat emission and resistance to mechanical vibration. Performance may be expressed in MB/s or in accordance with the UDMA standard.



	COMPACT FLASH			
Flash Type	3D TLC	MLC	pSLC	SLC
Program/Erase cycles	3000	3000	20000	60000
Capacity	32GB ÷ 256GB	4GB ÷ 128GB	2GB ÷ 64GB	128MB ÷ 64GB
Interface	PCMCIA/IDE			
Key Features	Static and Dynamic Wear Leveling Bad Block Management Power Sleep Mode			
Operating Temperature (°C)	Carbon grade: 0 ÷ 70	Silver grade: 0 ÷ 70 Diamond grade: -40 ÷ 85		
Storage Temperature (°C)	-40 ÷ 85			
Maximum transfer speed (MB/s)	Read: Up to 160 MB/s Write: Up to 145 MB/s	Read: Up to 100 MB/s Write: Up to 80 MB/s	Read: Up to 110 MB/s Write: Up to 100 MB/s	Read: Up to 80 MB/s Write: Up to 80 MB/s
Maximum Power Consumption	< 650mW	< 945 mW		< 710 mW
MTBF	> 2 000 000	> 1 000 000		
Environmental Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (1.1m) Torque (1.3N/m, 30 sec / 5 times) Bending (>50N for 1 min / 5 times) Contact ESD (+/-4KV contact)			
Dimensions (LxWxH/mm)	42,8 x 36,4 x 3,3			

CFast

CFast cards are compliant with the PCMCIA I or II standards with SATA interface. The card's controller, which is functionally compliant with typical SATA SSD controllers, offers low power consumption and data transfer rates of up to 550 MB/s. Other features include S.M.A.R.T., advanced power management methods and a DRAM cache. CFast is available with 3D TLC, SLC, pSLC and MLC NAND and its capacity may depend on the technology used. It's small size and housing suited for mutiple applications make CFast a good solution form many mobile applications.



	CFAST			
Flash Type	3D TLC	MLC	pSLC	SLC
Program/Erase cycles	3000	3000	20000	60000
Capacity	64GB ÷ 256GB	32GB ÷ 128GB	16GB ÷ 64GB	8GB ÷ 32GB
Interface	SATA III			
Key Features	Static and Dynamic Wear Leveling Bad Block Management TRIM S.M.A.R.T. NCQ Over-Provisioning Low Power Management			
Operating Temperature (°C)	Carbon grade: 0 ÷ 70	Silver grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85		Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85
Storage Temperature (°C)	-40 ÷ 85			
Maximum transfer speed (MB/s)	Read: Up to 550 MB/s Write: Up to 490 MB/s	Read: Up to 555 MB/s Write: Up to 465 MB/s		Read: Up to 540 MB/s Write: Up to 305 MB/s
Maximum Power Consumption	< 1440 mW	< 1475 mW		< 1420 mW
MTBF	> 2 000 000			
Environmental Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (0.8m) Torque (1.3N/m, 30 sec / 5 times) Bending (>50N for 1 min / 5 times) Contact ESD (+/-4KV contact)			
Dimensions (LxWxH/mm)	42,8 x 36,4 x 3,3			

microSD/SD

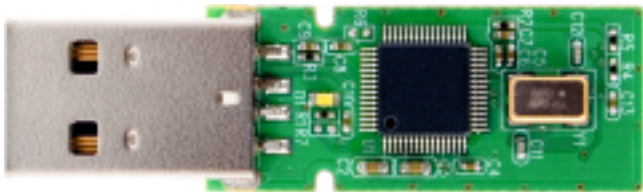
MicroSD and SD cards are available in three capacity standards: SDSC (Standard Capacity), SDHC (High Capacity) and SDXC (extended Capacity) and with bus up to UHS-I. Selected models have an additional SPI interface. Small dimensions, low power consumption and wide range of available capacities (from 128MB to 256GB) and wide selection of NAND types (3D TLC, SLC, pSLC, MLC) make microSD and SD cards a go-to storage solution for many industrial designers.



	microSD				SD			
Flash Type	3D TLC	MLC	pSLC	SLC	3D TLC	MLC	pSLC	SLC
Program/Erase cycles	3000	3000	20000	60000	to be confirmed	3000	20000	60000
Capacity	16GB ÷ 256GB	4GB ÷ 128GB	2GB ÷ 64GB	128MB ÷ 4GB	32GB ÷ 256GB	4GB ÷ 128GB	2GB ÷ 64GB	128MB ÷ 32GB
Interface	UHS-I			High Speed	UHS-I			128MB ÷ 2GB High Speed 4GB ÷ 32GB UHS-I
Key Features	Static and Dynamic Wear Leveling Bad Block Management S.M.A.R.T.	Static and Dynamic Wear Leveling Bad Block Management S.M.A.R.T. Auto-Read Refresh Data Clone System Embedded Mode			Static and Dynamic Wear Leveling Bad Block Management S.M.A.R.T.	Static and Dynamic Wear Leveling Bad Block Management S.M.A.R.T. Auto-Read Refresh Data Clone System Embedded Mode		
Operating Temperature (°C)	Carbon grade: 0 ÷ 70	Carbon grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85			Carbon grade: 0 ÷ 70	Carbon grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85		
Storage Temperature (°C)	-40 ÷ 85							
Maximum transfer speed (MB/s)	Read: Up to 95 MB/s Write: Up to 85 MB/s	Read: Up to 95 MB/s Write: Up to 90 MB/s		Read: Up to 20 MB/s Write: Up to 20 MB/s	Read: Up to 95 MB/s Write: Up to 85 MB/s	Read: Up to 95 MB/s Write: Up to 90 MB/s		Read: Up to 65 MB/s Write: Up to 55 MB/s
Maximum Power Consumption	< 400 mA							
MTBF	to be confirmed	> 3 000 000			to be confirmed	> 3 000 000		
Environmental Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock(1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (1.5m) Torque (0.1N/m, 30 sec / 5 times) Bending (>10N for 1 min / 5 times) Salt Spray (3% NaCl, 35°C / 24 h) Waterproof (IPX7, 1m immersion for 30 minutes) X-Ray (70÷140 keV for 30 minutes) Switch Cycle (0.4÷0.5 N / 1000 times) Durability test (EIA 364-13 10000 times) Contact ESD (+/-4KV contact 25 times, +/- 8KV air 10 times)				High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock(1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (1.5m) Torque (0.1N/m, 30 sec / 5 times) Bending (>10N for 1 min / 5 times) Salt Spray (3% NaCl, 35°C / 24 h) Waterproof (IPX7, 1m immersion for 30 minutes) X-Ray (70÷140 keV for 30 minutes) Switch Cycle (0.4÷0.5 N / 1000 times) Durability test (EIA 364-13 10000 times) Contact ESD (+/-4KV contact 25 times, +/- 8KV air 10 times)			
Dimensions (LxWxH/mm)	15 x 11 x 1				32 x 24 x 2,1			

USB Flash Drive

USB Flash Drives are available in many housing options and with wide selection of NAND types (3D TLC, SLC, pSLC, MLC). As the USB 3.0 interface is supported by nearly all personal computers and embedded applications, these devices are used as storage media for operating systems, data and application keys. Backwards compatibility with USB 2.0 and USB 1.1 provides flexibility for designers and administrators.

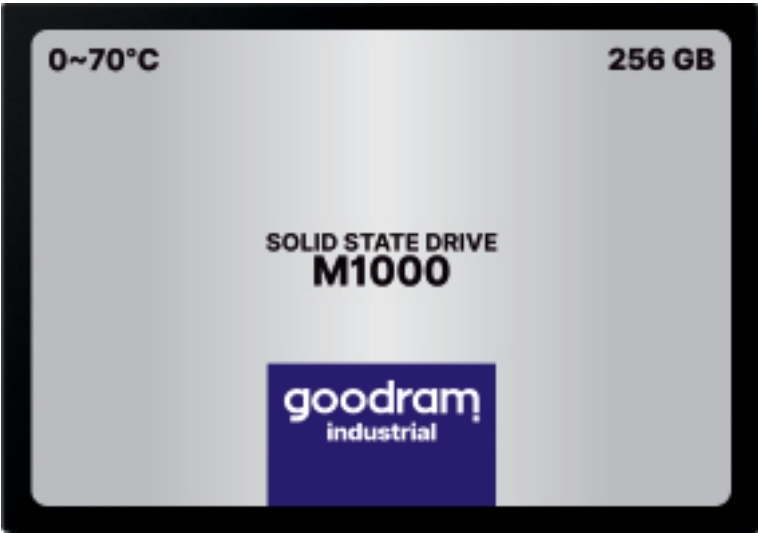


	Industrial USB Flash Drive			
Flash Type	3D TLC	MLC	pSLC	SLC
Capacity (uCOB)	16-512GB	4-32GB	2-16GB	128MB-8GB
Capacity (PCBA)	32GB ÷ 256GB	4GB ÷ 256GB	2GB ÷ 128GB	128MB ÷ 32GB
Program/Erase cycles	3000	3000	20000	60000
Interface	USB 2.0 / USB 3.0 (USB 1.1 / USB 2.0 compatible)			
Key Features	Wear Leveling Bad Block Management ECC			
Operating Temperature (°C)	Carbon grade: 0 ÷ 70 Silver grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85			
Storage Temperature (°C)	-40 ÷ 85			
Maximum transfer speed (MB/s) (PCBA)	Read: Up to 265 MB/s Write: Up to 175 MB/s	Read: Up to 190 MB/s Write: Up to 130 MB/s	Read: Up to 150 MB/s Write: Up to 125 MB/s	Read: Up to 170 MB/s Write: Up to 120 MB/s
Maximum Power Consumption (PCBA)	< 220 mA	< 210 mA		< 120 mA
Maximum transfer speed (MB/s) (uCOB)	Read: Up to 220 MB/s Write: Up to 100 MB/s	Read: Up to 190 MB/s Write: Up to 85 MB/s	Read: Up to 140 MB/s Write: Up to 100 MB/s	Read: Up to 65 MB/s Write: Up to 50 MB/s
Maximum Power Consumption (uCOB)	<187 mA	< 130 mA		< 90 mA
MTBF	> 2 000 000			
Environmental Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (1.1m) Torque (0.5N/m, 30 sec / 5 times) Bending (>50N for 1 min / 5 times) Durability test (Extraction/Insertion 5000 times) Contact ESD (+/-4KV contact 25 times)			
Dimensions (LxWxH/mm)	55.8 x 18.6 x 9.6*			

*Dimensions for standard housing. Wide selection of housings is available.

2.5" SATA Solid State Drive

2.5" SATA is the most common form factor of Solid State Drives. All SSDs can be configured with 3D TLC, SLC, pSLC and MLC NAND Flash. They provide up to 550 MB/s of fast data transfer, low power consumption and advanced power management modes. With ruggedness resulting from absence of moving parts and low power consumption, Solid State Drives are optimal for both desktop and mobile applications.



	2.5" SATA Solid State Drive			
Flash Type	3D TLC	MLC	pSLC	SLC
Program/Erase cycles	3000	3000	20000	60000
Capacity	32GB ÷ 1TB	4GB ÷ 512GB	2GB ÷ 256GB	8GB ÷ 128GB
Interface	SATA III			
Key Features	Static and Dynamic Wear Leveling Bad Block Management TRIM S.M.A.R.T. NCQ Over-provisioning Low Power Management			
Operating Temperature (°C)	Carbon grade: 0 ÷ 70	Silver grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85		
Storage Temperature (°C)	-40 ÷ 85			
Maximum transfer speed (MB/s)	Read: Up to 550 MB/s Write: Up to 500 MB/s	Read: Up to 550 MB/s Write: Up to 490 MB/s		
Maximum Power Consumption	< 1750 mW	< 2650 mW		
MTBF	> 2 000 000			
Environmental Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (0.8m) Torque (0.1N/m, 30 sec / 5 times) Bending (>20N for 1 min / 5 times) Contact ESD (+/-4KV contact 25 times)			
Dimensions (LxWxH/mm)	100 x 69.85 x 7			

mSATA Solid State Drive

SSD mSATA is a type of Flash memory that can be installed directly on the motherboard, occupying a small amount of space – it is 80% smaller than the 2.5". Compatibility with the SATA I, II and III standards means that these devices can be installed in any device having an mSATA port. As with the entire range of SSD memories, the absence of moving parts and low power consumption make it an optimum choice of data storage medium in mobile systems.



	mSATA Solid State Drive			
Flash Type	3D TLC	MLC	pSLC	SLC
Program/Erase cycles	3000	3000	20000	60000
Capacity	32GB ÷ 1TB	4GB ÷ 512GB	8GB ÷ 256GB	8GB ÷ 128GB
Interface	SATA III			
Key Features	Static and Dynamic Wear Leveling Bad Block Management TRIM S.M.A.R.T. NCQ Over-Provisioning Low Power Management			
Work Temperature (°C)	Carbon grade: 0 ÷ 70	Silver grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85		
Storage Temperature (°C)	-40 ÷ 85			
Maximum R/W (MB/sec)	Read: Up to 550 MB/s Write: Up to 500 MB/s	Read: Up to 550 MB/s Write: Up to 490 MB/s		
Maximum Power Consumption	< 1620 mW	< 2690 mW		
MTBF	> 2 000 000			
Environment Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (0.8m) Torque (0.1N/m, 30 sec / 5 times) Bending (>20N for 1 min / 5 times) Contact ESD (+/-4KV contact 25 times)			
Dimension (LxWxH/mm)	50.8 x 29.85 x 4			

M.2 SATA Solid State Drive

M.2 is another type of SSD with SATA interface. It provides up to 550 MB/s data transfer speeds. M.2 SATA Solid State Drive can be installed directly onto motherboard. It can be configured with pSLC and MLC NAND and PCBA can be delivered in two sizes: 42 x 22 mm and 80 x 22 mm. Small footprint, lack of moving parts and low power consumption make M.2 SATA SSD a great solution for mobile applications. Other form factors (2260, 22110) available upon request.



	M.2 Solid State Drive							
Form factor	M.2 2242				M.2 2280			
Flash Type	3D TLC	MLC	pSLC	SLC	3D TLC	MLC	pSLC	SLC
Program/Erase cycles	3000	3000	20000	60000	3000	3000	20000	60000
Capacity	16GB ÷ 512GB	4GB ÷ 512GB	2GB ÷ 256GB	8GB ÷ 64GB	32GB ÷ 1TB	4GB ÷ 512GB	2GB ÷ 256GB	8GB ÷ 128GB
Interface	SATA III							
Key Features	Static and Dynamic Wear Leveling Bad Block Management TRIM S.M.A.R.T. NCQ Over-provisioning Low Power Management							
Operating Temperature (°C)	Carbon grade: 0 ÷ 70	Silver grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85			Commercial grade: 0 ÷ 70	Silver grade: 0 ÷ 70 Gold grade: -25 ÷ 85 Diamond grade: -40 ÷ 85		
Storage Temperature (°C)	-40 ÷ 85							
Maximum transfer speed (MB/s)	Read: Up to 550 MB/s Write: Up to 490 MB/s				Read: Up to 550 MB/s Write: Up to 500 MB/s	Read: Up to 550 MB/s Write: Up to 490 MB/s		
Maximum Power Consumption	< 1520 mW	< 1740 mW			< 1620 mW	< 2650 mW		
MTBF	> 2 000 000							
Environmental Tests Resistance	High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (0.8m) Torque (0.1N/m, 30 sec / 5 times) Bending (>20N for 1 min / 5 times) Contact ESD (+/-4KV contact 25 times)				High/Low temperature High Humidity (55, 95% RH) Temperature Cycle (30 min, 20 cycles) Shock (1500G, Half Sin Pulse) Vibration (80Hz÷2000Hz/20G in 3 Axis) Free Fall (0.8m) Torque (0.1N/m, 30 sec / 5 times) Bending (>20N for 1 min / 5 times) Contact ESD (+/-4KV contact 25 times)			
Dimensions (LxWxH/mm)	42 x 22 x 3.8				80 x 22 x 3.8			

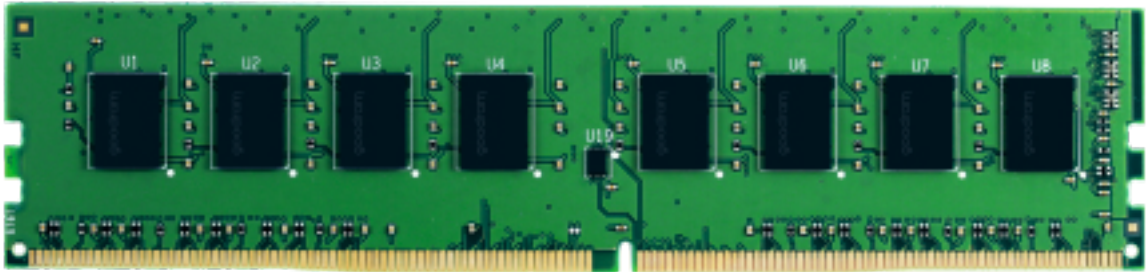
DRAM

DDR1 SDRAM – the first memory in the DDR family has a synchronous interface, active on both edges of the clock signal. A DDR1 interface enables data transfer rates up to 3200 MB/s via a 64-bit bus.

DDR2 SDRAM – the second generation of DDR memory operates with reduced supply voltage and power consumption. The lower voltage allows the maximum clock rate to be increased to 800 MHz, leading to transfer rates up to 6400 MB/s (with a 64-bit interface).

DDR3 SDRAM – currently it's the most commonly used DRAM type. Lower power consumption and high capacity make it suitable for a wide range of industrial applications. With the use of a “fly-by” bus, DDR3 may run with a clock rate of up to 1866 MHz.

DDR4 SDRAM – the latest generation of memory in the DDR family. It features a POD12 (Pseudo Open Drain 1.2 V) interface, CRC (Cyclic Redundancy Check) on the data bus, parity control on the address bus, and a DBI (Data Bus Inversion) function. The new features of the DDR4 interface enable memory clock rates above 2400 MHz, making it an ideal solution for high-performance industrial systems.



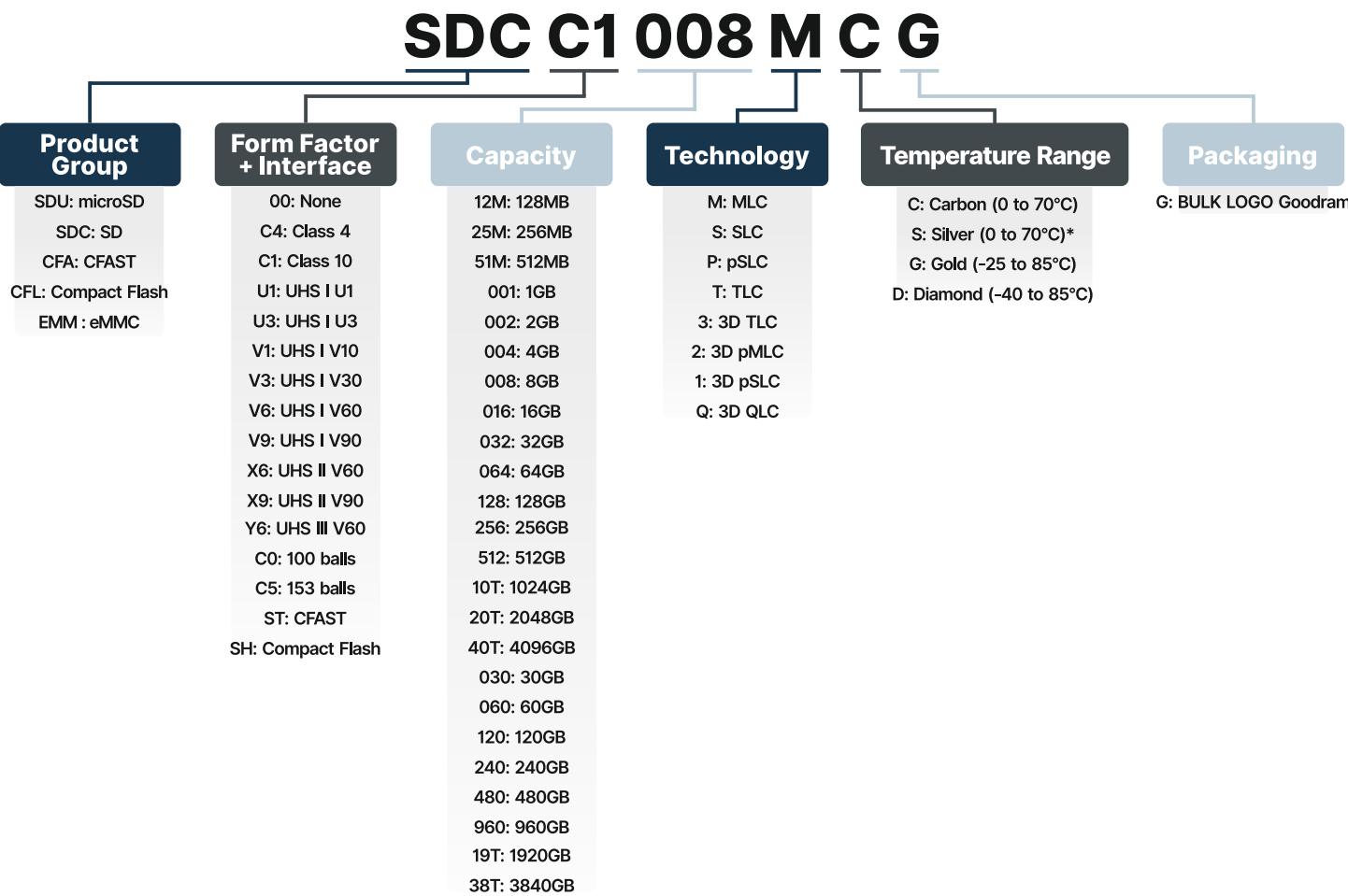
	DRAM Memory Modules			
Type	DDR1*	DDR2	DDR3	DDR4
Form Factors	184-pin DIMM 200-pin SO-DIMM	240-pin DIMM 200-pin SO-DIMM	240-pin DIMM 204-pin SO-DIMM	288-pin DIMM 260-pin SO-DIMM
Capacity	512MB ÷ 1GB	1GB ÷ 2GB	1GB ÷ 8GB	4GB ÷ 16GB
Peak transfer rate (MB/s)	Up to 3200	Up to 6400	Up to 14900	Up to 25600 (3200MHz)
Voltage (V)	2.5	1.8	1.5 / 1.35	1.2
ECC option	YES			
Operating Temperature (°C)	Standard grade: 0 ÷ 70 Industrial grade: -40 ÷ 85	Standard grade: 0 ÷ 85 Industrial grade: -40 ÷ 85		
Storage Temperature (°C)	-40 ÷ 85			
Key Features & Options	Single/Double Rank configuration DDR3/4 Very Low Profile size 100% functional tests High/Low temempartaure testing Build from major IC grades Long lifetime project support FIX BOM option PCN and EOL notification			

*DDR1 modules only for special request

Part number decoder

Flash Memory (Memory Cards)

(SD, microSD, Compact Flash, CFAST, eMMC)

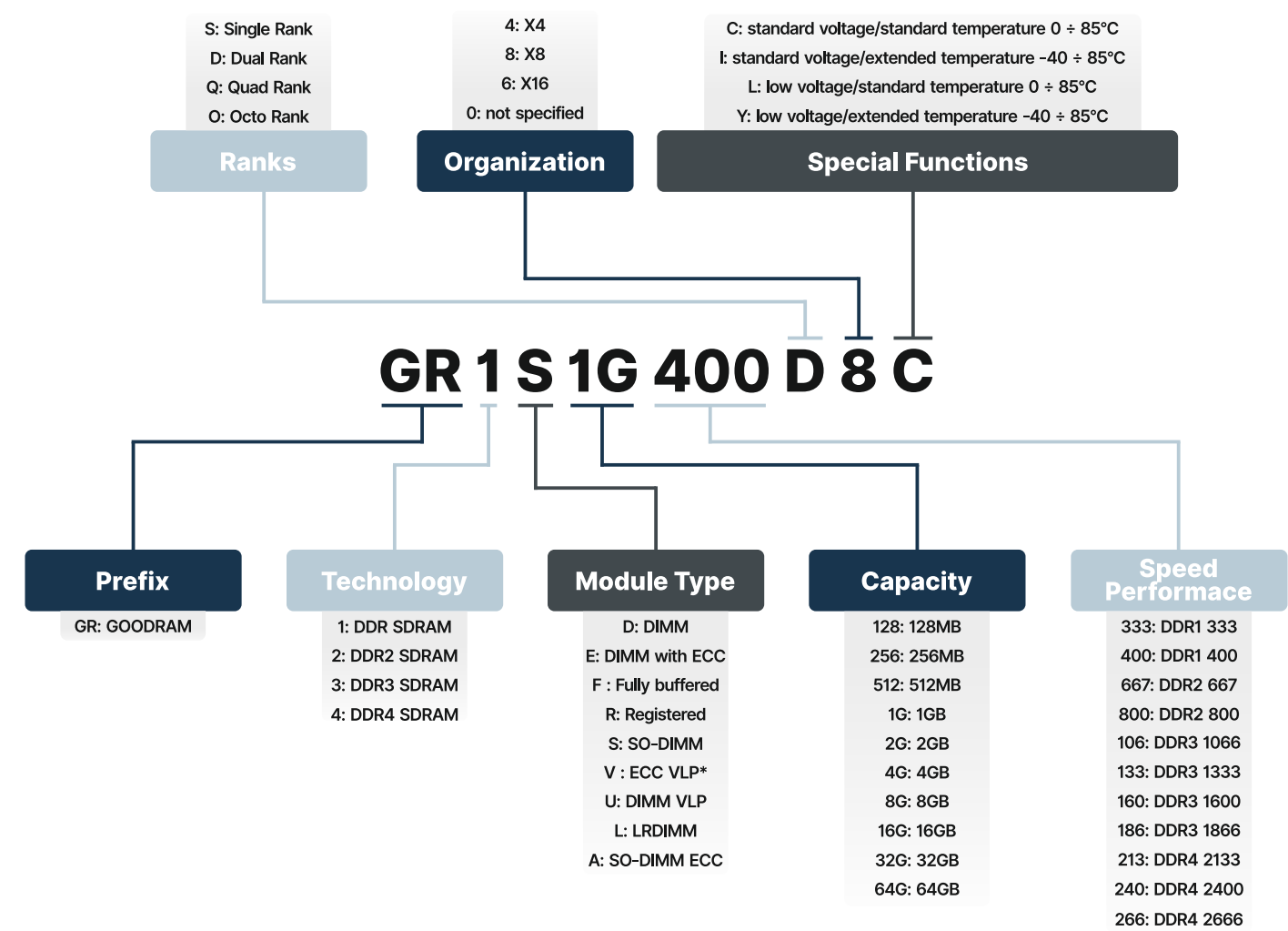


* - Carbon grade available upon request (C: carbon (0-70°C))

Part number decoder

DRAM Memory

(UDIMM, SODIMM)

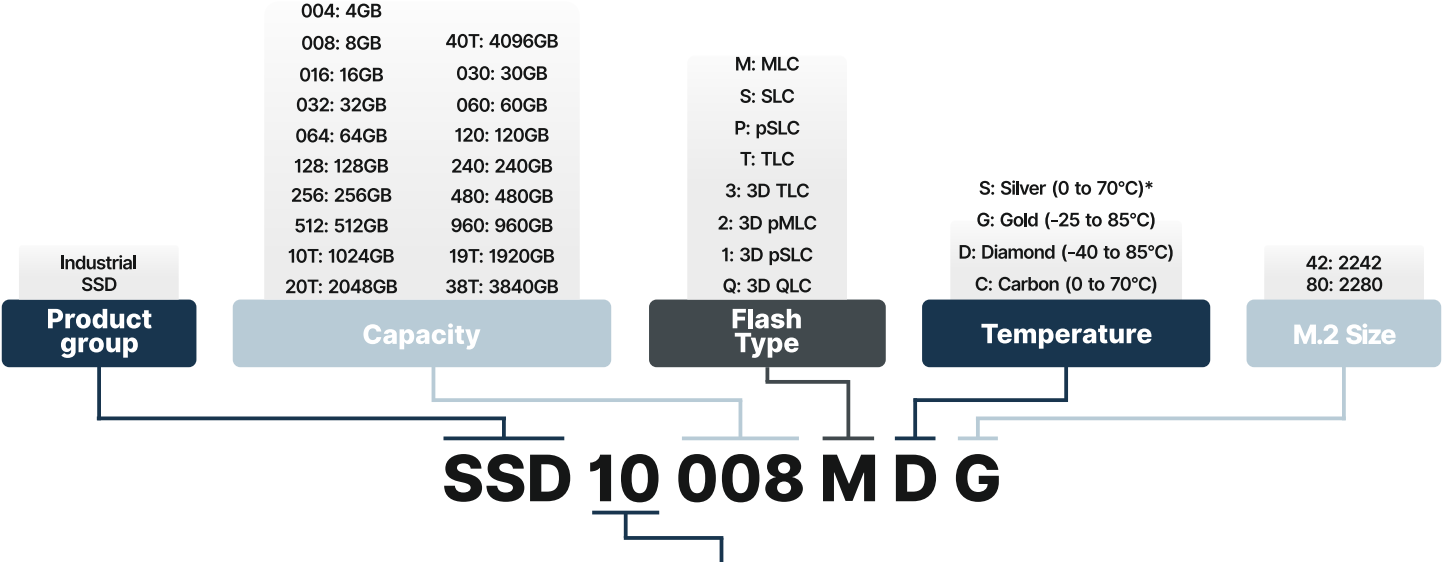


* VLP - Very Low Profile

Part number decoder

Flash Memory (SSD)

(2,5" SATA, mSATA, M.2 SATA SSD)



Form Factor + Interface			
10: 2,5" SATA 7MM SSD*	53: SATA DOM (type 3)	76: M.2 PCIE NVMe gen3 x2 2260	93: M.2 PCIE NVMe gen4 x4 2230
20: ATA Flash Module 40 PIN	63: M.2 SATA 2230	78: M.2 PCIE NVMe gen3 x2 2280	94: M.2 PCIE NVMe gen4 x4 2240
21: ATA Flash Module 44 PIN	64: M.2 SATA 2242	71: M.2 PCIE NVMe gen3 x2 22110	96: M.2 PCIE NVMe gen4 x4 2260
30: Half-Slim (MO297)	66: M.2 SATA 2260	83: M.2 PCIE NVMe gen3 x4 2230	98: M.2 PCIE NVMe gen4 x4 2280
40: mSATA	68: M.2 SATA 2280	84: M.2 PCIE NVMe gen3 x4 2240	91: M.2 PCIE NVMe gen4 x4 22110
41: mini mSATA	61: 63: M.2 SATA 22110	86: M.2 PCIE NVMe gen3 x4 2260	
51: SATA DOM (type 1)	73: M.2 PCIE NVMe gen3 x2 2230	88: M.2 PCIE NVMe gen3 x4 2280	
52: SATA DOM (type 2)	74: M.2 PCIE NVMe gen3 x2 2240	81: M.2 PCIE NVMe gen3 x4 22110	

* - 1,8" available upon special request



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