

The logo for goodram, featuring the word "goodram" in a white, lowercase, sans-serif font on a dark blue rectangular background.

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# GOODRAM Industrial microSD Memory Card MLC DATASHEET

Version: 1.3

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Micro SD Card for Industrial Applications

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## REVISION HISTORY

VERSION	CHANGES	DATE
1.0	Initial release	22.01.2019
1.1	Added 4GB capacity	28.02.2020
1.2	Added 16GB capacity, logo amendment	05.05.2020
1.3	P/N Toshiba/Kioxia amendment	14.08.2020

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## PRODUCT OVERVIEW

<ul style="list-style-type: none"> <li>• <b>Capacity:</b> <ul style="list-style-type: none"> <li>○ MLC: 4-16GB</li> </ul> </li> <li>• <b>Flash Type</b> <ul style="list-style-type: none"> <li>○ Kioxia 15nm MLC</li> </ul> </li> <li>• <b>Controller</b> <ul style="list-style-type: none"> <li>○ Phison PS8210</li> </ul> </li> <li>• <b>Bus Speed Mode</b> <ul style="list-style-type: none"> <li>○ UHS-I</li> </ul> </li> <li>• <b>Power Consumption <sup>Note1</sup></b> <ul style="list-style-type: none"> <li>○ Power Up Current &lt; 250uA</li> <li>○ Standby Current &lt; 1000uA</li> <li>○ Read Current &lt; 400mA</li> <li>○ Write Current &lt; 400mA</li> </ul> </li> <li>• <b>Performance</b> <ul style="list-style-type: none"> <li>○ Read: Up to 95MB/s</li> <li>○ Write: Up to 45MB/s</li> </ul> </li> <li>• <b>MTBF</b> <ul style="list-style-type: none"> <li>○ More than 3 000 000 hours</li> </ul> </li> <li>• <b>Support SD system specification version 3.0</b></li> <li>• <b>The Command List supports: “Part 1 Physical Layer Specification Ver 3.01 Final definition”.</b></li> <li>• <b>Support CPRM</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Endurance</b> <ul style="list-style-type: none"> <li>○ 3000 erase/program cycles in whole capacity</li> <li>○ Data retention over 10 years in room temperature (25<sup>o</sup>C) <sup>Note2</sup></li> </ul> </li> <li>• <b>Copyrights Protection Mechanisms – Complies with highest security CPRM standard</b></li> <li>• <b>Built-In write protection features (permanent and temporary)</b></li> <li>• <b>Support SD SPI mode</b></li> <li>• <b>Advanced Flash Management</b> <ul style="list-style-type: none"> <li>○ Static and Dynamic Wear Levelling</li> <li>○ Bad Block Management</li> <li>○ SMART Function <sup>Note3</sup></li> <li>○ Auto-Read Refresh</li> <li>○ Data Clone System (DCS)</li> <li>○ Embedded Mode</li> </ul> </li> <li>• <b>Operating Voltage range</b> <ul style="list-style-type: none"> <li>○ 2.7 – 3.6 V</li> </ul> </li> <li>• <b>Temperature Range <sup>Note4</sup></b> <ul style="list-style-type: none"> <li>○ Operation 0 ~ +70°C</li> <li>○ Storage: -40C ~ +85°C</li> </ul> </li> <li>• <b>RoHS compliant</b></li> </ul>
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**Notes:**

1. Please see “Power Consumption” for details.
2. In new product
3. This function is enabled by customer requirement.
4. According to IEC-60068-2-1/2/14/38 standard.

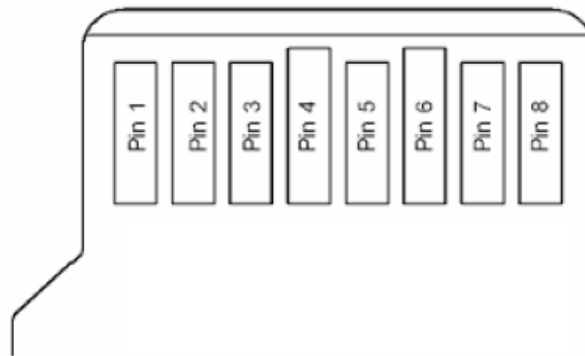
## PRODUCT DETAILS

### GENERAL DESCRIPTION

The Micro Secure Digital (microSD) card version 3.0 is fully compliant to the specification released by SD Card Association. The Command List supports [Part 1 Physical Layer Specification Ver3.01 Final] definitions. Card Capacity of Non-secure Area, Secure Area Supports [Part 3 Security Specification Ver3.0 Final] Specifications.

The microSD 3.0 card is based on 8-pin interface, designed to operate at a maximum operating frequency of 50MHz or 100MHz. It can alternate communication protocol between the SD mode and SPI mode. It performs data error detection and correction with very low power consumption.

### PIN ASSIGNMENT MICROSD CARD



PIN	SD MODE			SPI MODE		
	NAME	TYPE	DESCRIPTION	NAME	TYPE	DESCRIPTION
1	DAT2	I/O/PP	Data Line [bit2]	RSV		
2	CD/DAT3	I/O/PP	Card Detect/ Data Line [bit3]	CS	I	Chip Select (neg true)
3	CMD	PP	Command/Response	DI	I	Data In
4	VDD	S	Supply Voltage	VDD	S	Supply voltage
5	CLK	I	Clock	SCLK	I	Clock
6	VSS	S	Supply voltage ground	VSS	S	Supply voltage ground
7	DAT0	I/O/PP	Data Line [bit0]	DO	O/PP	Data Out
8	DAT1	I/O/PP	Data Line [bit1]	RSV		

## FLASH MANAGEMENT

GOODRAM microSD card utilizes all the state of art technologies to ensure full reliability until the specified NAND Flash program/erase cycles parameter is reached. These technologies include but are not limited to:

### Error Correction Code (ECC)

Flash memory cells will deteriorate with use, which may generate random bit errors in the stored data. To ensure the highest reliability, GOODRAM microSD card applies the BCH ECC Algorithm, which can detect and correct errors that occur during read process, to ensure data is read correctly, as well as protected from corruption.

### Wear Leveling

Storage devices based on NAND flash memory, can only undergo a limited number of program/erase cycles, and due to various usage scenarios, data may not be distributed evenly between NAND flash chips. If a certain area gets updated more frequently than others, the lifetime of the device will be reduced significantly. Wear Leveling algorithm used in GOODRAM microSD cards is used to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the whole storage area. Moreover, by utilizing both dynamic and static Wear Leveling algorithms, the life expectancy of GOODRAM microSD cards can meet the listed specification.

### Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as "Initial Bad Blocks". Bad blocks that are developed during the lifespan of the flash are named "Later Bad Blocks". GOODRAM microSD card uses an efficient bad block management algorithm to detect all types of bad blocks, which further prevents data being stored into them and improves the data reliability.

### SMART Function

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is a special function that allows a memory device automatically monitor its health.

### Auto-Read Refresh

Auto-Read Refresh is especially applied on devices that read data mostly but rarely write data. When blocks are continuously read, then the device cannot activate wear leveling since it can only be applied while writing data. Thus, errors will accumulate and become uncorrectable. Accordingly, to avoid errors exceed the amount ECC can correct and blocks turn bad, firmware will automatically refresh the bit errors when the error number in one block approaches the threshold, ex. 24 bits.

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**Data Clone System (DCS)**

DCS is a function which minimizes the chance of data lost in the event of sudden power lost. When power lost occurred during writing, there will always be a chance where the data become corrupted. To counter this, firmware will perform extra writing of data to a buffer block. In the event of a sudden power loss, during the next power up, ECC will be checked on the original target block. If ECC was discovered, firmware will copy the same data from the buffer block and replace the corrupted data in the original target block. This will greatly reduce the chance of the corrupted data being used continuously.

**Embedded Mode**

Embedded mode is a function specially designed for operating systems that not utilize FAT. Often under non Windows OS, for example Linux or customized host, wear leveling mechanism will be affected or even disabled in some cases. With embedded mode activated, wear leveling mechanism can operate normally to keep the usage of blocks even throughout the card's life cycle.

**COMPARING SD3.0 AND SD3.0 SDHC**

	SD3.0 Standard (Backward compatible to 2.0 host)	SD3.0 SDHC (Backward compatible to 2.0 host)
Addressing Mode	Byte (1 byte unit)	Block (512 byte unit)
HCS/CCS bits of ACMD41	Support	Support
CMD8 (SEND_IF_COND)	Support	Support
CMD16 (SET_BLOCKLEN)	Support	Support (Only CMD42)
Partial Read	Support	Not Support
Lock/Unlock Function	Mandatory	Mandatory
Write Protect Groups	Optional	Not Support
Supply Voltage 2.0v – 2.7v (for initialization)	Not Support	Not Support
Total Bus Capacitance for each signal line	40pF	40pF
CSD Version (CSD_STRUCTURE Value)	1.0 (0x0)	2.0 (0x1)
Speed Class	Optional	Mandatory (Class 2/4/6/10)



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**PERFORMANCE AND POWER CONSUMPTION**

Capacity	Flash Structure	Performance		Max Power Consumption		
		TestMetrix Test @500MB		Read (mA)	Write (mA)	Stand by (mA)
		Read (MB/s)	Write (MB/s)			
4GB	TSB 4GB x 1, SIP	90	10	400	400	1
8GB	TSB 8GB x 1, SIP	95	20	400	400	1
16GB	TSB 8GB x 2, SIP	95	45	400	400	1

Note:

1. Performance may vary from flash configuration and platform.
2. The table above is for your reference only. The criteria for mass production and for accepting goods shall be discussed based on different flash configuration.

PARAMETER	RATING
Operating voltage	2.7 – 3.6V +/- 5%

**TEMPERATURE SPECIFICATION**

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
T <sub>a</sub>	Operating Temperature	0	+70	°C
T <sub>st</sub>	Storage Temperature	-40	+85	°C

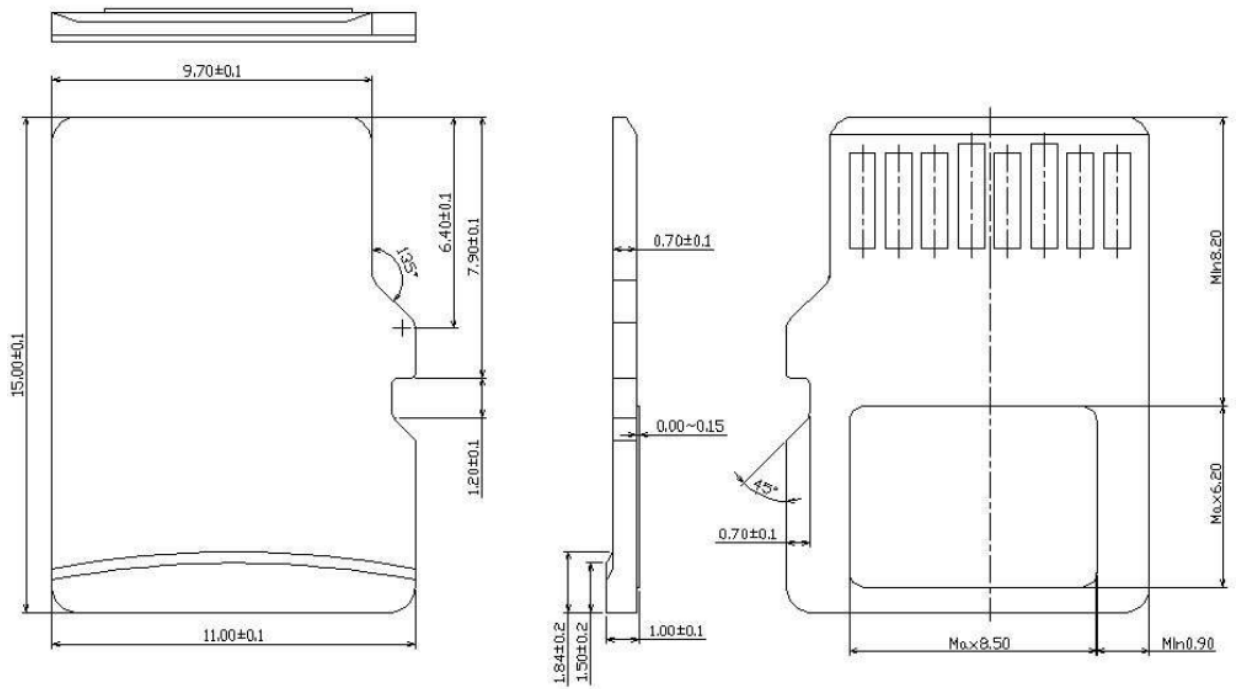
**PRODUCT ORDERING INFORMATION**

PN	Type	Capacity	Technology	Temp range
RUSDUM004U1SB-P8EKI5	microSD	4 GB	MLC	0 ~ +70°C
RUSDUM008U1SB-P8EKI5	microSD	8 GB	MLC	0 ~ +70°C
RUSDUM016U1SB-P8EKI5	microSD	16 GB	MLC	0 ~ +70°C

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**PHYSICAL DIMENSION**

Dimensions: 15mm (L) \* 11mm (W) \* 1mm (H)



## STANDARDS & REFERENCES

The following table is to list out the standards that have been adopted for designing the product.

STANDARD USED	ACRONYM/SOURCE
RoHS	Restriction of Hazardous Substances Directive
SD specification	<a href="http://www.sdcard.org">http://www.sdcard.org</a>
CE	Consumer electronics certification; please contact us for further information.

## SAFETY PRECAUTIONS

Do not bend, crush, drop, or place heavy objects on top of the Product. Do not use tweezers, pliers or similar items that could damage the Product. Take particular care when inserting or removing the Product. Stop using the Product when the Product does not work properly. Failure to follow these instructions could result in fire, damage to the Product and/or other property and/or personal injury including burns and electric shock.

Keep out of reach of small children. Accidental swallowing may cause suffocation or injury. Contact a doctor immediately if you suspect a child has swallowed the Product.

Do not directly touch the interface pins, put them in contact with metal, strike them with hard objects or cause them to short. Do not expose to static electricity.

Do not disassemble or modify the Product. This may cause electric shock, damage to the Product or fire.

## NOTES ON USAGE

The Product contains nonvolatile semiconductor memory. Do not use the Product in accordance with a method of usage other than that written in the manual. This may cause the destruction or loss of data.

To protect against accidental data loss, you should back up your data frequently on more than one type of storage media. Wilk Elektronik S.A. assumes no liability for destruction or loss of data recorded on the Card for any reason.

When used over a long period of time or repeatedly, the reading, writing and deleting capabilities of the Product will eventually fail, and the performance speed of the Product may decrease below the original speed specific to the Product's applicable class.

If the Product is to be transferred or destroyed, note that the data it contained may still be recoverable unless it is permanently deleted by third-party deletion software or similar means beforehand.

Product is intended for use in general electronics applications and selected industrial applications and any other specific applications as expressly stated in this document. Product is neither intended nor warranted for use in equipment or systems where failure may cause loss of human life, bodily injury, serious property damage or serious public impact ("Unintended Use"). Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment or equipment used to control combustions or explosions. Do not use Product for Unintended Use unless specifically permitted in this document.

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