GOODRAM Industrial
microSD Memory Card SLC type
Gold/Diamond
DATASHEET

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Micro SD Card for Industrial Applications

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REVISION HISTORY

VERSION	CHANGES	DATE
1.0	Initial release	26.10.2016
1.1	Correction of PN	24.07.2017
1.2	Logo amendment	17.01.2018

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PRODUCT OVERVIEW

- Capacity:
  - SLC: 128MB – 4GB

- Flash Type
  - Toshiba 24nm SLC

- Bus Speed Mode
  - 128MB-4GB: up to UHS 104

- Power Consumption [Note1]
  - Power Up Current < 0.25mA
  - Standby Current < 1mA
  - Read Current < 400mA
  - Write Current < 400mA

- Performance
  - Read: Up to 20MB/s
  - Write: Up to 20MB/s

- MTBF
  - More than 3 000 000 hours

- Support SD system specification version 3.0

- The Command List supports: "Part 1 Physical Layer Specification Ver 3.01 Final definition".

- RoHS compliant

- Copyrights Protection Mechanisms – Complies with highest security CPRM standard

- Support CPRM

- Support SD SPI mode

- Endurance
  - Up to 100000 erase/program cycles in whole capacity
  - Data retention over 10 years in room temperature (25^0C) [Note2]

- Advanced Flash Management
  - Static and Dynamic Wear Levelling
  - Bad Block Management
  - SMART Function [Note3]
  - Auto-Read Refresh
  - Embedded Mode [Note3]

- Operating Voltage range
  - 2.7 – 3.6 V

- Temperature Range [Note4]
  - Operation
    - Gold: -25°C ~ +85°C
    - Diamond: -40°C ~ +85°C
  - Storage: -40C ~ +85°C

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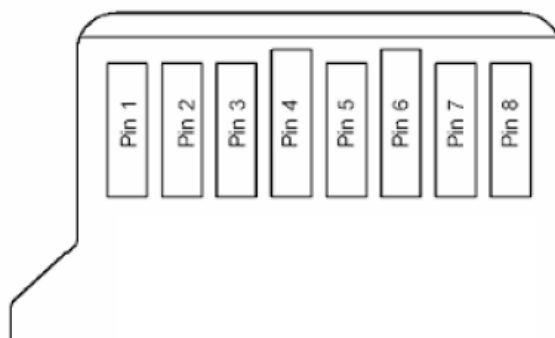
PIN	SD MODE			SPI MODE		
	NAME	TYPE	DESCRIPTION	NAME	TYPE	DESCRIPTION
1	DAT2	I/IO/PP	Data Line [bit2]	RSV		
2	CD/DAT3	I/O/PP	Card Detect/ Data Line [bit3]	CS	I	Chip Select (neg true)
3	CMD	PP	Command/Response	DI	I	Data In
4	VDD	S	Supply Voltage	VDD	S	Supply voltage
5	CLK	I	Clock	SCLK	I	Clock
6	VSS	S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

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 Levelling 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 Levelling 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 levelling 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.

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 levelling mechanism will be affected or even disabled in some cases. With embedded mode activated, wear levelling 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)

PERFORMANCE AND POWER CONSUMPTION

Process	Capacity	Mode	Flash Structure	Performance		Max Power Consumption		
				TestMetrix Test @500MB		Read (mA)	Write (mA)	Standby (mA)
				Read (MB/s)	Write (MB/s)			
24nm	128MB	Non-UHS	128MB x 1	16	4	400	400	1
	256MB		256MB x 1	16	10	400	400	1
	512MB		512MB x 1	16	10	400	400	1
	1GB		512MB x 2	18	10	400	400	1
	2GB		512MB x 4	20	20	400	400	1
	4GB	UHS-104	512MB x 8	35	20	400	400	1

NOTE:
1. Data transfer mode is single channel.

ELECTRICAL SPECIFICATIONS

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

Temperature specification

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
T_a	Operating Temperature Gold	-25	+85	°C
T_a	Operating Temperature Diamond	-40	+85	°C
T_{st}	Storage Temperature	-40	+85	°C

PHYSICAL DIMENSION

Dimensions: 15mm (L) * 11mm (W) * 1mm (H)
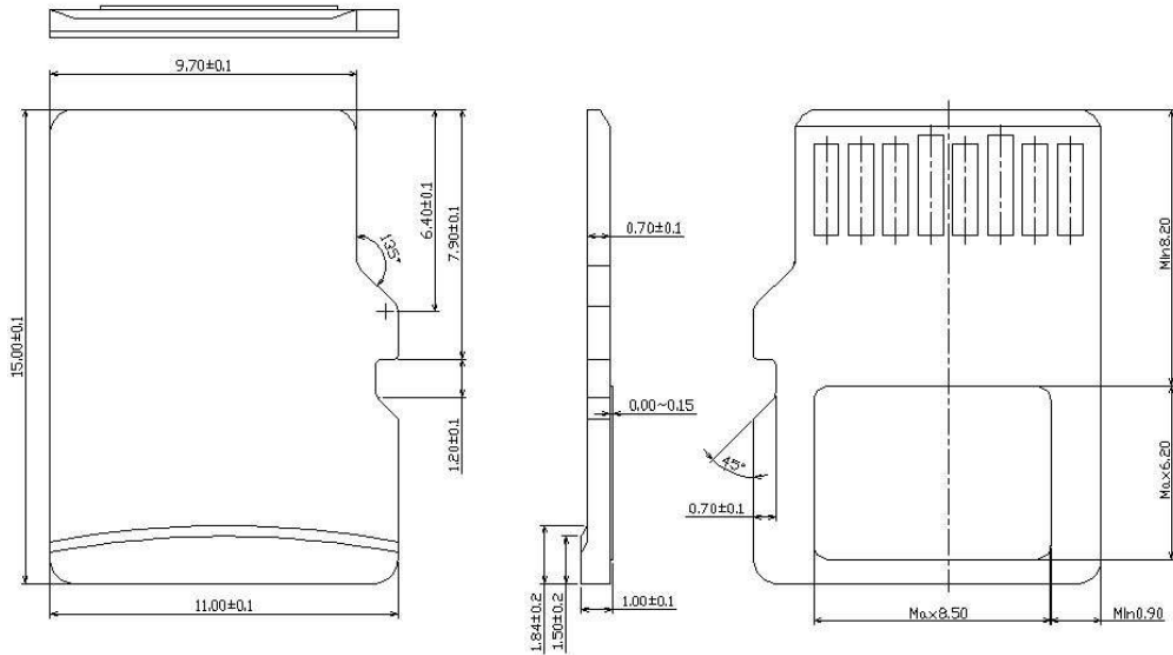
PRODUCT ORDERING INFORMATION

PN	Type	Capacity	Technology	Temp range	Grade
SDU128MGSGRB	microSD	128MB	SLC	-25~85°C	gold
SDU256MGSGRB	microSD	256MB	SLC	-25~85°C	gold
SDU512MGSGRB	microSD	512MB	SLC	-25~85°C	gold
SDU1GGSGRB	microSD	1 GB	SLC	-25~85°C	gold
SDU2GGSGRB	microSD	2 GB	SLC	-25~85°C	gold
SDU4GGSGRB	microSD	4 GB	SLC	-25~85°C	gold
SDU128MDSGRB	microSD	128MB	SLC	-40~85°C	diamond
SDU256MDSGRB	microSD	256MB	SLC	-40~85°C	diamond
SDU512MDSGRB	microSD	512MB	SLC	-40~85°C	diamond
SDU1GDSGRB	microSD	1 GB	SLC	-40~85°C	diamond
SDU2GDSGRB	microSD	2 GB	SLC	-40~85°C	diamond
SDU4GDSGRB	microSD	4 GB	SLC	-40~85°C	diamond

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	http://www.sdcard.org
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 non-volatile 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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