Panasonic SD Memory Offers the High Reliability Demanded for Industrial/automotive Use
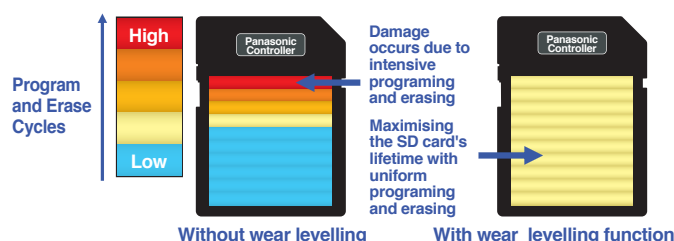
High Reliability and Panasonic Controller Technology

■ Data Programming and Erase Endurance

Wear Levelling

● Maximising SD Memory Life

Static wear levelling controls written data, including fixed data. Various use cases eliminate intensive data writing and maximise the lifetime of the SD card.

Program and Erase Cycles — High / Low

Without wear levelling | With wear levelling function

Damage occurs due to intensive programing and erasing

Maximising the SD card's lifetime with uniform programing and erasing

Intelligent Data Writing

● Dispersion of Writing Stress to NAND Flash Memory

Intelligent data writing disperses the writing stress to NAND flash memory, to reduce program disturbances.

■ Secure Storage

Bit Error Auto Refresh

● Withstanding Repeated Reading Operations

Automatically refreshes the bit errors that accumulate over time, before they exceed the threshold. (Accumulated bit errors are detected from read data.)

* This function does not guarantee permanent data retention.

x: Correctable error bits

Refresh

Detects and corrects bit errors, and automatically rewrites data.
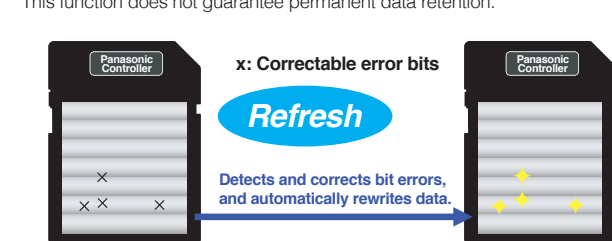
■ Power Failure Robustness

Recovery

● Protects saved data and device

Unique Panasonic algorithms minimise data damage in the event of a power interruption. Even in the event that an error is generated, the controller recovers the data, restoring it to the condition prior to the error, and preventing errors from reaching the entire SD memory area.

* Power Fail Robustness Mode firmware also available for more robust MLC system

Durable Performance

Panasonic SD memory features high endurance against static electricity, magnetism, and X-rays.

Temperature Resistance

Operation is assured even under harsh temperature conditions.

A usable temperature range of -40 ˚C to 85 ˚C maintains stable performance everywhere, from extremely cold to intensely hot climates.

Electrostatic Resistance

ICE 61000-4-2 compliance: Clears Electrostatic Discharge Immunity Tests of 150-pF energy storage capacitance, 15-kV aerial discharge, and 330-Ω discharge resistance.

Impact Resistance

High endurance against bending and twisting.

| Bending load resistance | 20 N (Newton) min. (SD standard: 10 N) |
| Twisting torque resistance | 0.3 N•m (Newton meter) min. (SD standard: 0.15 N•m) |

Magnetic Resistance

Minimal damage from magnetic forces.

Operable after being set onto a 1,000-gauss DC magnetic field for approx. 1 minute.

X-Ray Resistance

Data is protected from X-rays.

ISO 7816-1 compliance: Operable after 0.1 Gy (gray) of X-ray irradiation.

Water Resistance

JIS IPX7 compliance: Operable after submerging the product in water (tap water, 1-m depth) for 30 minutes.

* micro SD – Excluding SD adaptor use.
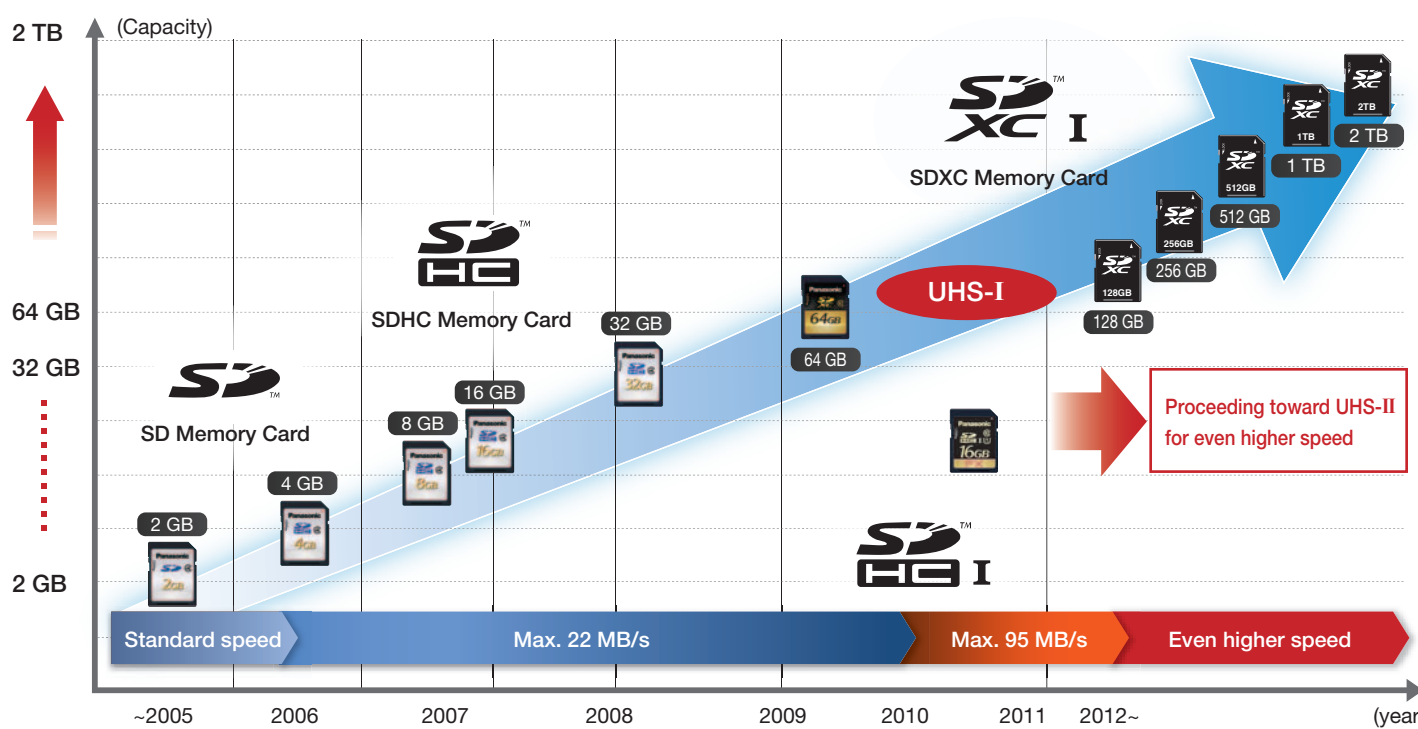* Card only.

Built-in Fuse

The internal card fuse protects against excess current and abnormal heating. Even if excess current or abnormal heating were to occur due to internal card damage caused by the device being used or the environment, the built-in fuse will operate to prevent the SD Memory Card from overheating or igniting.

■ Applications by Model

	Data Protection*				Card Endurance						
	Wear Levelling	Intelligent Data Writing	Refresh	Recovery	Temperature Resistance	Electrostatic Resistance	Impact Resistance	Magnetic Resistance	X-Ray Resistance	Water Resistance	Fuse
FX Series	●	●	●	●	–40 ˚C to +85 ˚C	●	●	●	●	—	●
P Series	●	●	●	●		●	●	●	●	—	●
microSD/ KC Series	●	●	●	●		●	●	●	●	●	●
microSD/JC Series	●	●	●	●		●	●	●	●	●	●
eSD (Flexible connection type)	●	●	●	●		●	●	●	●	—	—
eSD (Semiconductor mounting type)	●	●	●	●		●	●	●	●	—	—

* Based on Panasonic test results. Protection may not be possible in certain usage environments. The data stored inside a card cannot be guaranteed.

SD Memory Card Roadmap

(Capacity)

2 TB / 64 GB / 32 GB / 2 GB

SDXC Memory Card — 2 TB, 1 TB, 512 GB, 256 GB, 128 GB
UHS-I
SDHC Memory Card — 32 GB, 16 GB, 8 GB
SD Memory Card — 2 GB, 4 GB

Proceeding toward UHS-II for even higher speed

Standard speed | Max. 22 MB/s | Max. 95 MB/s | Even higher speed

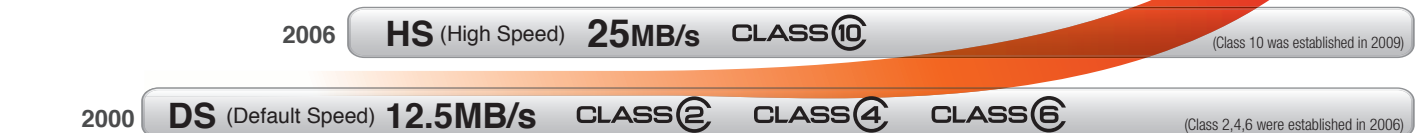~2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012~ (year)

What is UHS-I?

UHS-I (Ultra High Speed I) is a speed specification for SD Memory Cards that was established in 2010. Its features include a maximum bus interface speed of up to 104 MB/s. It utilizes conventional SD design assests and offers enhanced speeds. Three different modes (DDR50, SDR50 and SDR104) have been standardized for the UHS-I based on the application and objective.

■ Speed Specification and Performance of SD Memory Cards

(Years indicate the year that the standard was established.)

2010 — UHS-I (Ultra High Speed) 104MB/s — UHS Speed Class 1

2006 — HS (High Speed) 25MB/s — CLASS 10 (Class 10 was established in 2009)

2000 — DS (Default Speed) 12.5MB/s — CLASS 2 CLASS 4 CLASS 6 (Class 2,4,6 were established in 2006)

Bus Interface Standard	Conventional	UHS-I		
Mode	HS	DDR50	SDR50	SDR104
Signal Amplitude	3.3 V Amplitude	1.8 V Amplitude		
Clock Frequency	50 MHz	50 MHz	100 MHz	208 MHz
Data Frequency	50 MHz	100 MHz	100 MHz	208 MHz
Logic Performance (Bus Speed)	25 MB/s	50 MB/s	50 MB/s	104 MB/s

Product Precautions

• SDHC memory cards can be used with SDHC and SDXC host products. SDHC memory cards cannot be used with products that are solely compliant with SD memory cards.

• SDXC memory cards can be used only with SDXC host products. SDXC memory cards cannot be used with SD and SDHC host products. Check if the device has an SDXC logo, or refer to the device's instruction manual or other manufacturer's information
* Please note that using an SDXC Memory Card in a non-compatible computer or device may cause card compatibility problems or loss of data.

• The SD Memory Card is intended for ordinary use in for home or professional devices and embedded systems. Consult with Panasonic in advance about uses for applications that require a high degree of reliability (uses that may have a serious impact on human lives, such as in nuclear power or social infrastructure applications.)

— For more information —

http://panasonic.net/avc/sdcard/industrial_sd/

Panasonic
ideas for life

Industrial/Automotive SD Memory

Extended Temperature | Power Failure Robustness | Program/Erase Endurance

• Specifications for industrial/automotive applications demanding high reliability.
• Various customization to meet customer requirements.
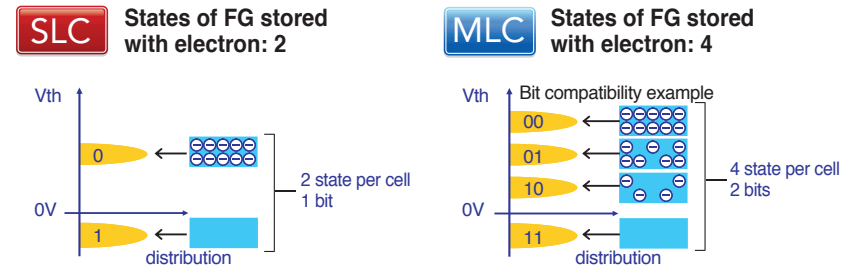• B-to-B specialised support provided.

SD Memory

SLC and MLC

The NAND flash memory that is used in SD Memory Cards has Single Level Cells (SLC), which each store 1 bit of data, and Multi Level Cells (MLC), which each store 2 bits. The FX Series use SLCs to provide superior data retention and reliability.

SLC States of FG stored with electron: 2

Vth | 0 | 2 state per cell 1 bit
0V | 1 | distribution

MLC States of FG stored with electron: 4

Bit compatibility example
Vth | 00 / 01 / 10 / 11 | 4 state per cell 2 bits
0V | distribution

SLC FX Series

* 128MB/512MB SLC line-up also available

SDHC UHS-I
UHS Speed Class 1

RP-SDF02G   RP-SDF04G   RP-SDF08G   RP-SDF16G*

Performance Specifications

Model		RP-SDF02G	RP-SDF04G	RP-SDF08G	RP-SDF16G
Capacity*1		2 GB	4 GB	8 GB	16 GB
Flash Memory	Type	Single-Level Cell (SLC) NAND Flash Memory			
SD Physical Specification		Ver.3.01 (No UHS-I Compliant)	Ver. 3.01 (UHS-I Compliant)		
Speed Class		SD Speed Class 6	SD Speed Class10, UHS Speed Class 1		
Transfer Rate (Max)*2	Read	22 MB/s	90 MB/s	95 MB/s	
	Write	20 MB/s	40 MB/s	80 MB/s	
Operating Temperature		-40 to +85 ˚C by Panasonic			
Controller	Functions	Static Wear Levelling, Intelligent Data Writing, Recovery Function from Power Failure, Refresh Function			
Size		32.0 x 24.0 mm			

★ Release date under consideration   *1: SD Memory utilise a portion of the memory for copy protection and other purposes. Therefore Usable capacity will be less.   *2: Speed performance is subject to change.

MLC P Series

GD Series

RP-SDP04G   RP-SDP08G   RP-SDP16G   RP-SDGD32G*   RP-SDGD64G*

Performance Specifications

Model		RP-SDP04G	RP-SDP08G	RP-SDP16G
Capacity*1		4 GB	8 GB	16 GB
Flash Memory	Type	Multi-Level Cell (MLC) NAND Flash Memory		
SD Physical Specification		Ver.3.01 (No UHS-I Compliant)		
Speed Class		SD Speed Class 4		
Transfer Rate (Max)*2	Read	22 MB/s		
Operating Temperature		-40 to +85 ˚C by Panasonic		
Controller	Functions	Static Wear Levelling, Intelligent Data Writing, Recovery Function from Power Failure, Refresh Function		
Size		32.0 x 24.0 mm		

★ Release date under consideration   *1: SD Memory utilise a portion of the memory for copy protection and other purposes. Therefore Usable capacity will be less.
*2: Speed performance is subject to change.

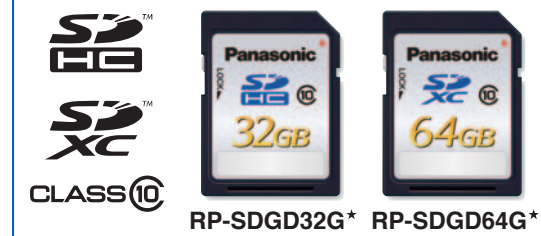## MLC KC Series

microSDHC UHS-I
UHS Speed Class 1

RP-SMKC04   RP-SMKC08   RP-SMKC16

Performance Specifications

Model		RP-SMKC04	RP-SMKC08	RP-SMKC16
Capacity*1		4 GB	8 GB	16 GB
Flash Memory	Type	Multi-Level Cell (MLC) NAND Flash Memory		
SD Physical Specification		Ver. 3.01 (UHS-I Compliant)		
Speed Class		SD Speed Class 10, UHS Speed Class 1		
Transfer Rate (Max)*2	Read	45 MB/s		
	Write	12 MB/s		
Operating Temperature		-40 to +85 ˚C by Panasonic		
Controller	Functions	Static Wear Levelling, Intelligent Data Writing, Recovery Function from Power Failure, Refresh Function		
Size		15.0 x 11.0 mm (Max)		

*1: SD Memory utilise a portion of the memory for copy protection and other purposes. Therefore Usable capacity will be less. *2: Speed performance is subject to change.

MLC eSD (Flexible Connection Type)

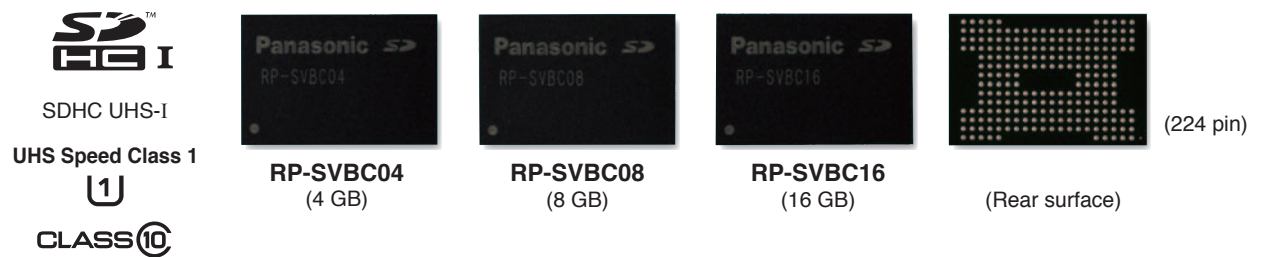Products converted to SLC are also available on demand. Form factor of module can be customized.

RP-SD04GP (4 GB)   RP-SD08GP (8 GB)   RP-SD16GP (16 GB)   (Rear surface)

Performance Specifications

Model		RP-SD04GP	RP-SD08GP	RP-SD16GP
Capacity*1		4 GB	8 GB	16 GB
Flash Memory	Type	Multi-Level Cell (MLC) NAND Flash Memory		
SD Physical Specification		Ver. 3.01 (No UHS-I Compliant)		
Speed Class		SD Speed Class 4		
Transfer Rate (Max)*2	Read	22 MB/s		
Operating Temperature		-40 to +85 ˚C by Panasonic		
Controller	Functions	Static Wear Levelling, Intelligent Data Writing, Recovery Function from Power Failure, Refresh Function		
Size		30.0 x 24.0 mm		

*1: SD Memory utilise a portion of the memory for copy protection and other purposes. Therefore Usable capacity will be less. *2: Speed performance is subject to change.

MLC eSD (Semiconductor Mounting Type)

SDHC UHS-I
UHS Speed Class 1

RP-SVBC04 (4 GB)   RP-SVBC08 (8 GB)   RP-SVBC16 (16 GB)   (Rear surface) (224 pin)

Performance Specifications

Model		RP-SVBC04	RP-SVBC08	RP-SVBC16
Capacity*1		4 GB	8 GB	16 GB
Flash Memory	Type	Multi-Level Cell (MLC) NAND Flash Memory		
SD Physical Specification		Ver. 3.01 (UHS-I Compliant)		
Speed Class		SD Speed Class 10, UHS Speed Class 1		
Transfer Rate (Max)*2	Read	90 MB/s		
	Write	12 MB/s		
Operating Temperature		-40 to +85 ˚C by Panasonic		
Controller	Functions	Static Wear Levelling, Intelligent Data Writing, Recovery Function from Power Failure, Refresh Function		
Size		18.0 x 12.2 mm		

*1: SD Memory utilise a portion of the memory for copy protection and other purposes. Therefore Usable capacity will be less. *2: Speed performance is subject to change.

Environmental Specifications (Common to all models)

Temperature	(Operating)	-40 to +85 ˚C	Vibration	15 Gp-p
	(Non-operating)	-40 to +85 ˚C (1,000 h)	Shock	1,000 G
Humidity		5 to 95 % (No condensation)	RoHS Directive Compatibility	

Applicable EMC Standards
1) VCCI Class B (Option B)
2) FCC Part 15 Class B (Verification)
3) EC Directive 89/336/EEC
   EN55022: 2006 Class B
   EN55024: 1998 +A1: 2001 +A2: 2003
4) AS/NZS CISPR Pub22: 2006

• Panasonic industrial/automotive use SD memory has a unique Panasonic function that reports data such as bad blocks, writing cycles, and the SD memory internal connection status.
• A special B to B support system also allows Panasonic to offer consultation concerning customisation upon customer request.

For details, consult a salesperson.

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