

Flash Memory



Flash Memory

Toshiba, the inventor of Flash Memory, blazed the trail to a world we can all carry data, music and videos with us, wherever we go. Now, Flash Memory is playing a major role in driving the evolution of automobiles and industrial equipment that is essential for realizing an environmentally friendly society. Behind the scenes, Flash Memory supports the world's continuing transformation to a better tomorrow.



Back in 1984, Toshiba developed a new semiconductor memory, Flash Memory, and by doing led the industry, and its competitors, into the next generation.

Today the international de facto standard, Flash Memories have realized an immense range of applications that include Memory Cards, Solid-State Drives (SSDs), and even industrial equipment. As the total volume of information continues its exponential growth, demand for storage units using Flash Memories will grow with it. In order to meet these market needs, Toshiba has made major investments in plant and equipment at its Yokkaichi memory fab, and is resolutely committed to develop new products. This brochure highlights Toshiba's Flash Memory and other Memory Solutions.

Toshiba's Leading Technology Areas

- ▶ Process
- ▶ Multi-Level Cell (MLC)
- ▶ Controller
- ▶ Die stacking
- ▶ Packaging

Features of Toshiba's Flash Memory

- ▶ Fast storage of large files
- ▶ Fast write and erase rates
- ▶ Low per-bit cost
- ▶ Easily extendable using the NAND Flash Memory interface
- ▶ Extensive product portfolio to meet diverse needs
 - Products with the standard HS-MMC interface
 - Offers products with the high-speed UHS-I and UHS-II SD bus interfaces
 - Available as SD Memory Cards with unique features

**Toshiba's Flash Memory and controller technologies
have found a wide range of applications.**

**By exploiting its outstanding technologies to the full, Toshiba endeavors to respond to
market needs and create products and services offering new levels of
comfort and convenience to everyday life.**



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SLC: Single Level Cell. A memory cell that can store a single bit of information.

* BENAND™ (Built-in-Error Correction Code NAND), EXCERIA™, FlashAir™ and TransMemory™ are trademark of Toshiba Corporation.

* e-MMC™ is a trademark of JEDEC/MMCA.

* SeeQVault and the SeeQVault logo are trademarks of NSM initiatives LLC.

* TransferJet™ and TransferJet™ logos are licensed by the TransferJet Consortium.

▶ SLC NAND Flash Memory

MEMORY STORAGE DEVICES

To meet diverse customers' application needs, Toshiba offers SLC NAND flash memory products with a wide range of capacity points and multiple packaging options. The high read/write performance and write endurance of the Toshiba SLC NAND make it a superb choice for a broad spectrum of commercial and industrial applications. SLC NAND also provides a significant cost advantage compared with NOR flash memory.

Toshiba, the inventor of flash memory, has led the world in using successive generations of fabrication processes to steadily enhance its performance. Toshiba also offers BENAND™ that incorporates error checking and correction (ECC) and Serial Interface NAND that provides a serial peripheral interface for NAND flash interfacing. Thus, you can select the optimal SLC NAND according to your host ECC and memory interface requirements.

■ SLC NAND Flash Memory Lineup

The Toshiba SLC NAND lineup includes three categories of products.

You can choose a product that best fits your needs accordingly to the ECC capability and the memory interface of the host chipset.

▶ SLC NAND

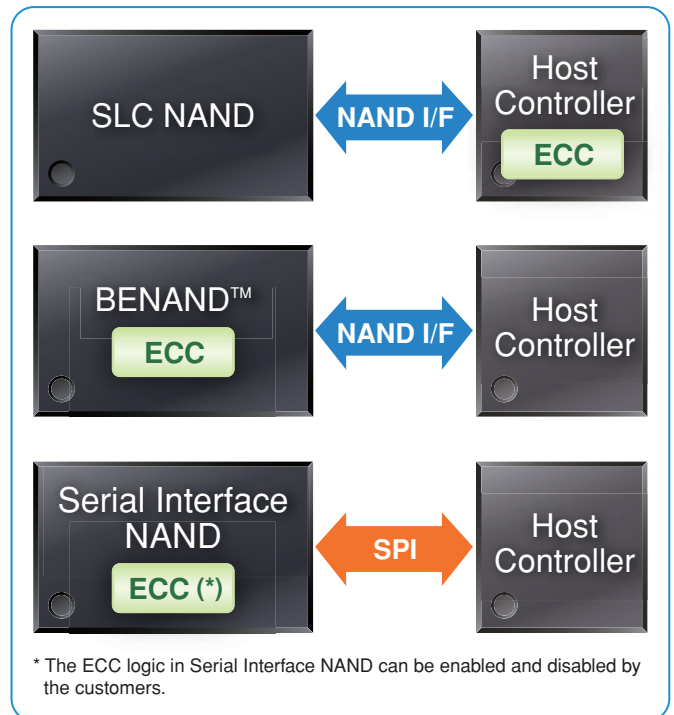
The high read/write performance and write endurance of the Toshiba SLC NAND make it a superb choice for a broad spectrum of commercial and industrial applications.

▶ BENAND™

BENAND™ is a NAND flash memory that incorporates ECC logic. BENAND™ eliminates the need for a host processor to perform ECC, making it possible to utilize the latest 24-nm SLC NAND regardless of whether the host processor has an adequate ECC capability.

▶ Serial Interface NAND

Serial Interface NAND provides a commonly used six-pin Serial Peripheral Interface (SPI) for flash memory interfacing and is offered in small WSON and SOP packages.



■ SLC NAND Flash Memory Line-up

■ Low Capacity (Small Block Size)

| Capacity | Part Number | Page Size (byte) | Block Size (byte) | Power Supply (V) | Operating Temperature (°C) | Package |
|-----------|-----------------|------------------|-------------------|------------------|----------------------------|-------------|
| 512 Mbits | TC58DVM92A5TA00 | 512 | 16 K | 2.7 to 3.6 | 0 to 70 | 48 pin TSOP |
| | TC58DVM92A5TAI0 | | | | -40 to 85 | 63 Ball BGA |
| | TC58DVM92A5BAJ3 | | | | | |

SLC NAND Flash Memories in BGA packages are also available with a supply voltage of 1.8 V. For details, contact your Toshiba sales representative.

■ Small to Mid Capacity (Large Block Size)

| Capacity | Part Number | Page Size (bytes) | Block Size (bytes) | Power Supply (V) | Operating Temperature (°C) | Package |
|----------|-----------------|-------------------|--------------------|------------------|----------------------------|------------|
| 1 Gbits | TC58NVG0S3HTA00 | 2 K | 128 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58NVG0S3HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TC58NVG0S3HBAI6 | | | | | 63Ball BGA |
| | TC58NVG0S3HBAI4 | | | | | |
| 2 Gbits | TC58NVG1S3HTA00 | 2 K | 128 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58NVG1S3HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TC58NVG1S3HBAI6 | | | | | 63Ball BGA |
| | TC58NVG1S3HBAI4 | | | | | |
| 4 Gbits | TC58NVG2S0HTA00 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58NVG2S0HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TC58NVG2S0HBAI6 | | | | | 63Ball BGA |
| | TC58NVG2S0HBAI4 | | | | | |
| 8 Gbits | TC58NVG3S0FTA00 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58NVG3S0FTAI0 | | | | -40 to 85 | 63Ball BGA |
| | TC58NVG3S0FBAID | | | | | |
| | TH58NVG3S0HTA00 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TH58NVG3S0HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TH58NVG3S0HBAI6 | | | | | 63Ball BGA |
| 16 Gbits | TH58NVG4S0FTA20 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TH58NVG4S0FTAK0 | | | | -40 to 85 | 63Ball BGA |
| | TH58NVG4S0FBAID | | | | | |
| 32 Gbits | TH58NVG5S0FTA20 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TH58NVG5S0FTAK0 | | | | -40 to 85 | |

SLC NAND Flash Memories in BGA packages are also available with a supply voltage of 1.8 V. For details, contact your Toshiba sales representative.


■ High Capacity (Large Block Size)
Legacy Interface

| Capacity | Part Number | Page Size (bytes) | Block Size (bytes) | Power Supply (V) | Operating Temperature (°C) | Package |
|-----------|-----------------|-------------------|--------------------|------------------|----------------------------|------------|
| 32 Gbits | TC58NVG5H2HTA00 | 8 K | 1 M | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58NVG5H2HTAI0 | | | | -40 to 85 | |
| 64 Gbits | TH58NVG6H2HTA20 | 8 K | 1 M | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TH58NVG6H2HTAK0 | | | | -40 to 85 | |
| 128 Gbits | TH58NVG7H2HTA20 | 8 K | 1 M | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TH58NVG7H2HTAK0 | | | | -40 to 85 | |

Toggle Interface

| Capacity | Part Number | Page Size (bytes) | Block Size (bytes) | Power Supply | | Operating Temperature (°C) | Package |
|-----------|-----------------|-------------------|--------------------|--------------|--------------|----------------------------|-------------|
| | | | | Vcc(V) | VccQ (V) | | |
| 64 Gbits | TH58TEG6H2HBA4C | 8 K | 1 M | 2.7 to 3.6 | 2.7 to 3.6 | 0 to 70 | 132Ball BGA |
| | TH58TEG6H2HBAMC | | | | 1.70 to 1.95 | -40 to 85 | |
| 128 Gbits | TH58TEG7H2HBA8C | 8 K | 1 M | 2.7 to 3.6 | 2.7 to 3.6 | 0 to 70 | 132Ball BGA |
| | TH58TEG7H2HBASC | | | | 1.70 to 1.95 | -40 to 85 | |
| 256 Gbits | TH58TEG8H2HBA89 | 8 K | 1 M | 2.7 to 3.6 | 2.7 to 3.6 | 0 to 70 | 132Ball BGA |
| | TH58TEG8H2HBAS9 | | | | 1.70 to 1.95 | -40 to 85 | |

BENAND™



BENAND™ is an SLC NAND Flash Memory Solution with embedded ECC(Error Correction Code), ending the burden of ECC on the host processor. Use of a common NAND Flash Memory interface ensures BENAND™ maintains compatibility with general SLC NAND Flash Memory in terms of the command set, device operation, packaging, pin configuration, etc., allowing the latest BENAND™ to easily replace a general SLC NAND Flash Memory, free of concerns about ECC.

BENAND™ Lineup

| Capacity | Part Number | Page Size (bytes) | Block Size (bytes) | Power Supply (V) | Operating Temperature (°C) | Package |
|----------|-----------------|-------------------|--------------------|------------------|----------------------------|------------|
| 1 Gbits | TC58BVG0S3HTA00 | 2 K | 128 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58BVG0S3HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TC58BVG0S3HBAI6 | | | | | 63Ball BGA |
| | TC58BVG0S3HBAI4 | | | | | |
| 2 Gbits | TC58BVG1S3HTA00 | 2 K | 128 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58BVG1S3HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TC58BVG1S3HBAI6 | | | | | 63Ball BGA |
| | TC58BVG1S3HBAI4 | | | | | |
| 4 Gbits | TC58BVG2S0HTA00 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TC58BVG2S0HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TC58BVG2S0HBAI6 | | | | | 63Ball BGA |
| | TC58BVG2S0HBAI4 | | | | | |
| 8 Gbits | TH58BVG3S0HTA00 | 4 K | 256 K | 2.7 to 3.6 | 0 to 70 | 48pin TSOP |
| | TH58BVG3S0HTAI0 | | | | -40 to 85 | 67Ball BGA |
| | TH58BVG3S0HBAI6 | | | | | 63Ball BGA |
| | TH58BVG3S0HBAI4 | | | | | |

Toshiba also offers SLC NAND Flash Memories in BGA packages that operate at a 1.8-V supply voltage. For details, contact your Toshiba sales representative.

Serial Interface NAND

Serial Interface NAND is a NAND Flash Memory with an interface compatible with a commonly used six-pin Serial Peripheral Interface (SPI). Toshiba offers high-capacity, low-pin-count Serial Interface NAND in small packages.



Serial Interface NAND Lineup

| Capacity | Part Number | Access Time Serial cycle(min)(ns) | Page Size (bytes) | Block Size (bytes) | Power Supply (V) | Operating Temperature(°C) | Package |
|----------|-------------------|-----------------------------------|-------------------|--------------------|------------------|---------------------------|-----------|
| 1 Gbits | TC58CVG0S3HQAIE * | 9.6 | 2 K | 128 K | 2.7 to 3.6 | -40 to 85 | 16pin SOP |
| | TC58CVG0S3HRAIF * | 9.6 | | | | | 8pin WSON |
| | TC58CYG0S3HQAIE * | 9.6 | | | 1.70 to 1.95 | | 16pin SOP |
| | TC58CYG0S3HRAIF * | 9.6 | | | | | 8pin WSON |
| 2 Gbits | TC58CVG1S3HQAIE * | 9.6 | 2 K | 128 K | 2.7 to 3.6 | -40 to 85 | 16pin SOP |
| | TC58CVG1S3HRAIF * | 9.6 | | | | | 8pin WSON |
| | TC58CYG1S3HQAIE * | 9.6 | | | 1.70 to 1.95 | | 16pin SOP |
| | TC58CYG1S3HRAIF * | 9.6 | | | | | 8pin WSON |
| 4 Gbits | TC58CVG2S0HQAIE * | 9.6 | 4 K | 256 K | 2.7 to 3.6 | -40 to 85 | 16pin SOP |
| | TC58CVG2S0HRAIF * | 9.6 | | | | | 8pin WSON |
| | TC58CYG2S0HQAIE * | 9.6 | | | 1.70 to 1.95 | | 16pin SOP |
| | TC58CYG2S0HRAIF * | 9.6 | | | | | 8pin WSON |

*: New Product

Packages

Serial Interface NAND is available in WSON and SOP packages. These packages and their pin assignments are compatible with those of usual serial flash memories.

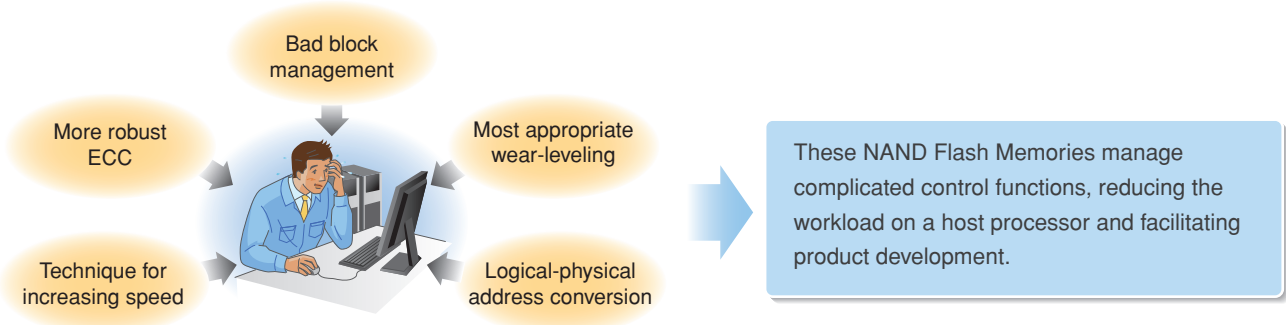
| Package | Package Specifications | | | Power Supply (V) | Capacity | | |
|---------|---|------------|------------------|------------------|----------|---------|---------|
| | Appearance | Size (mm) | Pin Count (Pins) | | 1 Gbits | 2 Gbits | 3 Gbits |
| WSON |  | 6 x 8 | 8 | 1.70 to 1.95 | ● | ● | ● |
| | | | | 2.7 to 3.6 | ● | ● | ● |
| SOP |  | 10.3 x 7.5 | 16 | 1.70 to 1.95 | ● | ● | ● |
| | | | | 2.7 to 3.6 | ● | ● | ● |

NAND Flash Memories with an Integrated Controller

MEMORY STORAGE DEVICES

If you opt for raw NAND(NAND Flash Memory) chips, ECC(Error Correction Code), bad-block management, logical-to-physical address conversion, wear leveling (a technique for distributing re-writes evenly across a memory array) and other control functions must be implemented on the host side. With evolving NAND manufacturing processes, ECC is becoming notably more sophisticated, imposing heavier burdens on the host processor, especially for large-capacity NAND.

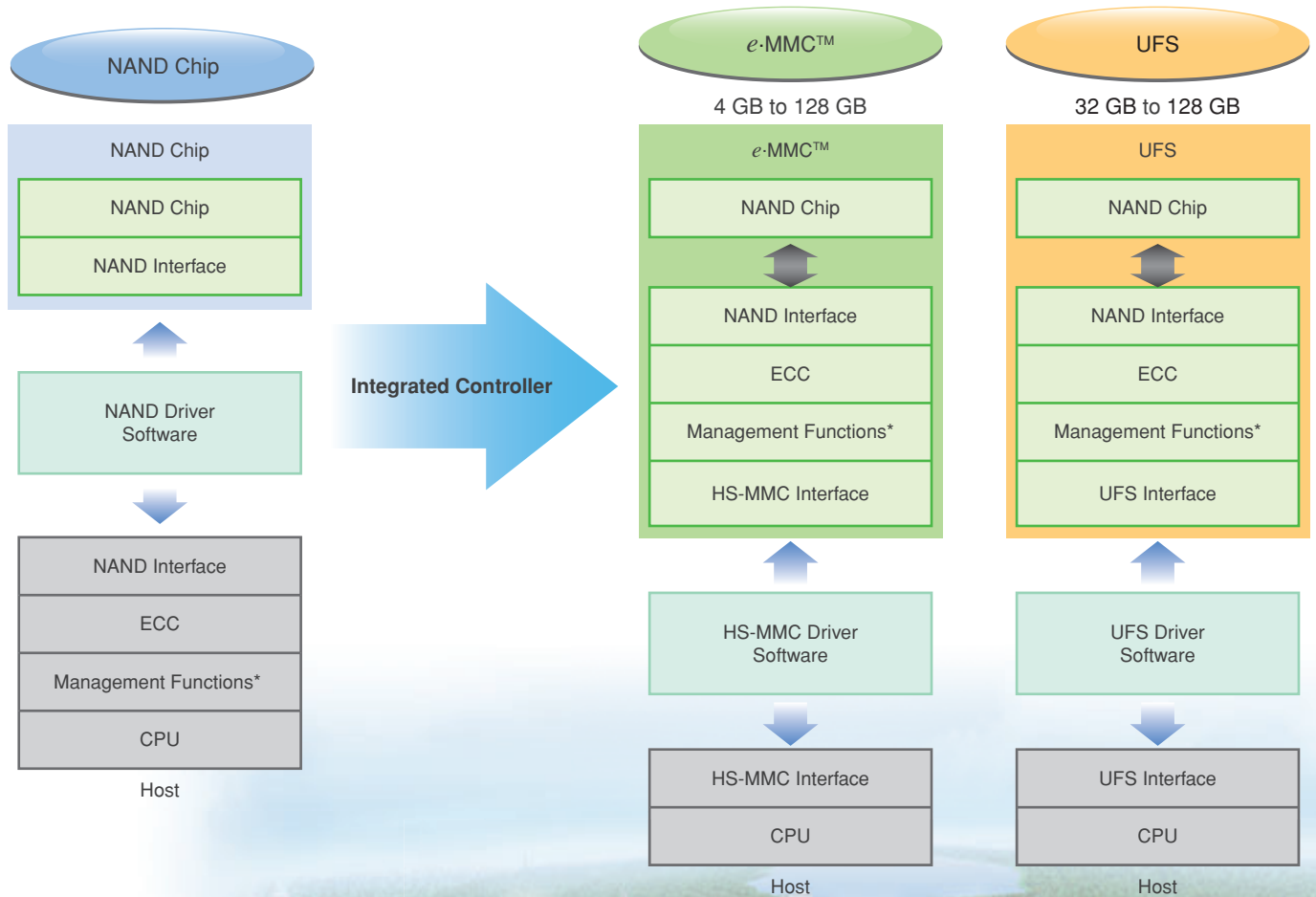
In response to customer needs, Toshiba offers NAND Flash Memories that integrate a controller in the same package. These are Toshiba's recommendation for high-capacity NAND Flash Memories.



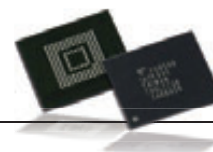
■ Features of NAND Flash Memories with an Integrated Controller

Toshiba offers *e*-MMC™ and UFS, a family of high-capacity NAND Flash Memories that integrates a controller in one package. These NAND solutions provide ECC and other control functions, optimized by Toshiba for each NAND technology generation.

e-MMC™ and UFS reduce the workload on the host processor, simplify product development, shorten time-to-market and increase ease of use of memory products.



*Management functions: wear leveling, bad-block management, garbage collection, etc.

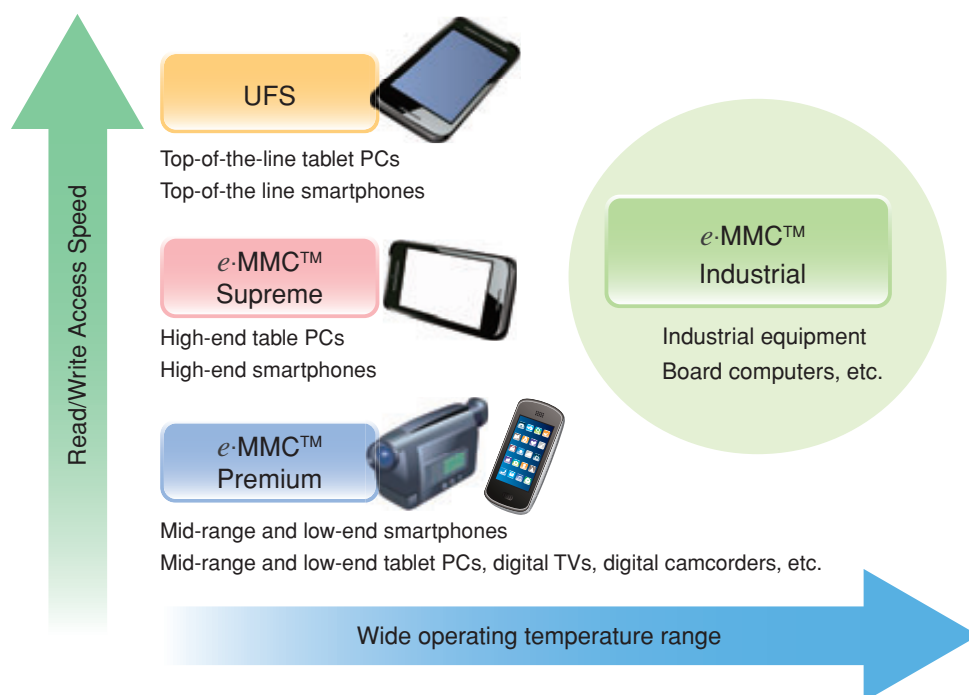


e-MMC™

e-MMC™ is a family of NAND Flash Memories with controller functionality covering ECC(Error Correction Code), wear leveling and bad-block management. e-MMC™ also provides a high-speed memory card interface compliant with JEDEC/MMCA Version 5.0/5.1, eliminating concerns about directly controlling NAND Flash Memories. e-MMC™ can easily be used as an embedded storage device.

e-MMC™ Families

Toshiba offers e-MMC™ in three classes of products: Supreme, Premium and Industrial. The Supreme family features a high data transfer rate, ideal for high-end mobile and other applications requiring high performance. The Premium family is suitable for general low-end and mid-range applications. The Industrial family (shown as "I-Ver" in the following table) provides guaranteed device operation at low temperature, making it highly suited to industrial applications.

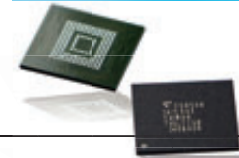


e-MMC™ Lineup

| Capacity | Part Number | Class | e-MMC Version | Max Data Rate (MB/s) | Power Supply | | Operating Temperature (°C) | Package | |
|------------|------------------|---------|---------------|----------------------|--------------|----------------------------|----------------------------|------------|-------------------|
| | | | | | Vcc (V) | VccQ (V) | | Type | Size (mm) |
| 4 Gbytes | THGBMDG5D1LBAIT* | Premium | 5.0 | 400 | 2.7 to 3.6 | 1.70 to 1.95 2.7 to 3.6 | -25 to 85 | P-WFBGA153 | 11.0 x 10.0 x 0.8 |
| | THGBMDG5D1LBAIL* | Premium | 5.0 | 400 | | | -25 to 85 | P-WFBGA153 | 11.5 x 13.0 x 0.8 |
| 8 Gbytes | THGBMHG6C1LBAIL | Premium | 5.1*1 | 400 | | | -25 to 85 | P-WFBGA153 | 11.5 x 13.0 x 0.8 |
| | THGBMHG6C1LBAWL* | I-Ver | 5.1*1 | 400 | | | -40 to 85 | P-WFBGA153 | 11.5 x 13.0 x 0.8 |
| 16 Gbytes | THGBMHG7C2LBAIL | Supreme | 5.1*1 | 400 | | | -25 to 85 | P-WFBGA153 | 11.5 x 13.0 x 0.8 |
| | THGBMHG7C1LBAIL | Premium | 5.1*1 | 400 | | | -25 to 85 | P-WFBGA153 | 11.5 x 13.0 x 0.8 |
| | THGBMHG7C2LBAWR* | I-Ver | 5.1*1 | 400 | | | -40 to 85 | P-VFBGA169 | 11.5x 13.0 x 1.0 |
| 32 Gbytes | THGBMHG8C4LBAIR | Supreme | 5.1*1 | 400 | | | -25 to 85 | P-VFBGA169 | 11.5 x 13.0 x 1.0 |
| | THGBMHG8C2LBAIL | Premium | 5.1*1 | 400 | | | -25 to 85 | P-WFBGA153 | 11.5 x 13.0 x 0.8 |
| | THGBMHG8C4LBAWR* | I-Ver | 5.1*1 | 400 | | | -40 to 85 | P-VFBGA169 | 11.5 x 13.0 x 1.0 |
| 64 Gbytes | THGBMHG9C4LBAIR | Supreme | 5.1*1 | 400 | | | -25 to 85 | P-VFBGA153 | 11.5 x 13.0 x 1.0 |
| | THGBMGG9U4LBAIR | Premium | 5.1 | 400 | | | -25 to 85 | P-VFBGA153 | 11.5 x 13.0 x 1.0 |
| | THGBMHG9C8LBAWG* | I-Ver | 5.1*1 | 400 | -40 to 85 | P-TFBGA153 | 11.5 x 13.0 x 1.2 | | |
| 128 Gbytes | THGBMHT0C8LBAIG | Supreme | 5.1*1 | 400 | -25 to 85 | P-TFBGA153 | 11.5 x 13.0 x 1.2 | | |
| | THGBMGT0U8LBAIG | Premium | 5.1 | 400 | -25 to 85 | P-TFBGA153 | 11.5 x 13.0 x 1.2 | | |

*1 Compliant with the optional command queuing features of JEDEC e-MMC Version 5.1

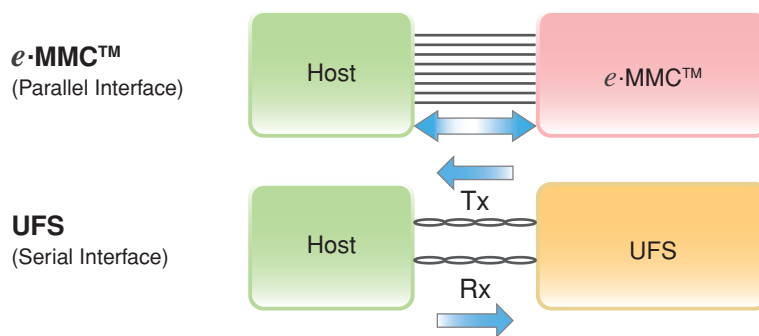
*: New product



UFS

Universal Flash Storage (UFS), the successor to *e*-MMC™, is the latest flash memory to feature an ultra-high-speed data rate compliant with the JEDEC/UFS standard. Like *e*-MMC™, UFS integrates a controller that supports ECC, wear leveling, bad-block management and other control functions. UFS also provides an interface compliant with JEDEC/UFS Version 2.0, eliminating concerns about directly controlling NAND Flash Memories. UFS can easily be used as an embedded storage device.

Because of its high-speed data rate, UFS reduces boot times for smartphone and tablet apps, create embedded cameras with a high-speed consecutive shooting function, and cut the time needed to record large video and music files, and so delivers an enhanced user experience.



While *e*-MMC™ has a parallel interface, UFS has a high-speed serial interface. Free from the restrictions imposed by a parallel interface, UFS makes it possible to further improve data rates.

UFS Lineup

| Capacity | Part Number | UFS Version | Max Data Rate (MB/s) | Power Supply (V) | | | Operating Temperature (°C) | Package | |
|------------|------------------|-------------|----------------------|------------------|------------|--------------|----------------------------|------------|--------------------|
| | | | | Vcc | VccQ | VccQ2 | | Type | Size (mm) |
| 32 Gbytes | THGBF7G8K4LBATR* | 2.0 | 1166 | 2.7 to 3.6 | 1.1 to 1.3 | 1.70 to 1.95 | -25 to 85 | P-VFBGA153 | 11.5 x 13.0 x 1.0 |
| 64 Gbytes | THGBF7G9L4LBATR* | | | | | | | P-VFBGA153 | 11.5 x 13.0 x 1.0 |
| 128 Gbytes | THGBF7T0L8LBATA* | | | | | | | P-TFBGA153 | 11.5 x 13.0 x 1.04 |

*: New product



Media Cards

MEMORY STORAGE DEVICES

All Toshiba memory cards are manufactured by Toshiba, a NAND flash vendor, using its own NAND flash memories. In addition to standard SD and microSD memory cards, Toshiba offers value-added memory cards such as FlashAir™, SeeQVault™, NFC-enabled and TransferJet™ memory cards in order to meet the requirements for increasingly diverse portable media.

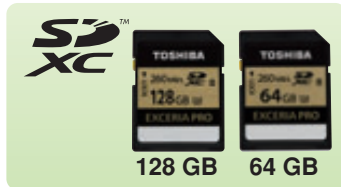
SD Memory Cards

High-Speed Card Series: EXCERIA™

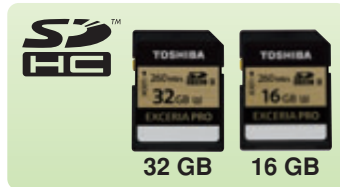
UHS-II cards deliver the maximum data rate*1 when they are used with devices compliant with the UHS-II high-speed bus interface with the HD312 speed mode. UHS-I cards deliver the maximum data rate*1 when they are used with devices compliant with the UHS-I high-speed bus interface with the SDR104 speed mode.

SDXC/SDHC Memory Cards

EXCERIA PRO™ (Read 260 MB/s, Write 240 MB/s)



SDHC UHS-II
UHS Speed Class3 [3]



SDHC UHS-II
UHS Speed Class3 [3]

EXCERIA™ (Read 95 MB/s, Write 60 MB/s)



SDXC⁽²⁾ UHS-I
UHS Speed Class3 [3]



SDHC UHS-I
UHS Speed Class3 [3]

microSDXC/microSDHC Memory Cards

EXCERIA™ (Read 95 MB/s, Write 60 MB/s)



microSDHC UHS-I
UHS Speed Class3 [3]



microSDHC UHS-I
UHS Speed Class3 [3]

Compatibility Considerations

*1: Maximum data transfer speeds can be achieved on devices supporting the high-speed SD bus interface UHS-II (312 MB/s) or UHS-I (104 MB/s).

*2: SDXC memory cards exceeding 32 GB in capacity employ a new file system called exFAT and cannot be used on devices that support SD and SDHC memory cards. These memory cards can only be used on devices compliant with the SDXC specifications.

Standard Series

The support for the high-speed UHS-I (with SDR50 bus speed mode and a maximum read speed of 48 MB/s) and/or 25-MB/s bus interfaces makes the Standard series suitable for various applications.

SDXC⁽²⁾/SDHC Memory Cards, microSDXC⁽²⁾/microSDHC Memory Cards



64 GB



32 GB



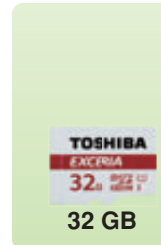
16 GB



8 GB



64 GB



32 GB



16 GB



8 GB

UHS-I, UHS Speed Class1 [1], SD Speed Class [10]

SDHC Memory Cards, microSDHC Memory Cards



32 GB

16 GB

8 GB

4 GB



32 GB

16 GB

8 GB

4 GB

SD Speed Class [4]

▶ SD and microSD Memory Cards for Automotive Infotainment Applications

- ▶ Extended operating temperature range
- ▶ New features, including power interruption tolerance, data refreshing and reliability test commands

| Capacity | Part Number | SD Physical Layer version | Maximum Data Rate [MB/s] | Power Supply Vcc[V] | Operating Temperature Range (°C) | Card Type |
|----------|----------------|---------------------------|--------------------------|---------------------|----------------------------------|-----------|
| 32 GB | THNSR032GBA5KC | 3.01 | 45 | 2.7 to 3.6 | -30 to 85 | SD |
| | THNSR032GBB5KG | | | | | microSD |
| 16 GB | THNSR016GBA5KB | | | | | SD |
| | THNSR016GBB5KF | | | | | microSD |
| 8 GB | THNSR008GBA5KA | | | | | SD |
| | THNSR008GBB5KE | | | | | microSD |

▶ Industrial SD memory card

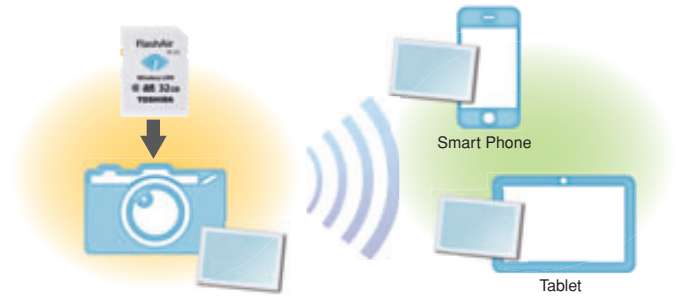
- ▶ Extended operating temperature range
- ▶ These memory cards allow users to check the remaining life, making them suitable for applications with frequent writes such as event data recorders and surveillance cameras.
- ▶ Power interruption tolerance

| Capacity | Part Number | SD Physical Layer version | Maximum Data Rate [MB/s] | Power Supply Vcc[V] | Operating Temperature Range (°C) | Card Type |
|----------|----------------|---------------------------|--------------------------|---------------------|----------------------------------|-----------|
| 32 GB | THNSQ032GBB5KG | 3.01 | 45 | 2.7 to 3.6 | -30 to 85 | microSD |
| 16 GB | THNSQ016GBB5KF | | | | | microSD |
| 8 GB | THNSQ008GBB5KE | | | | | microSD |



Wireless LAN Memory Cards FlashAir™

FlashAir™ is an SDHC memory card with wireless LAN functionality that allows it to function as a wireless LAN access point. This makes it possible for tablet PCs, smartphones and other external wireless LAN devices to access photos and other files stored in the card. FlashAir™ expands the possibilities for communication through photos.

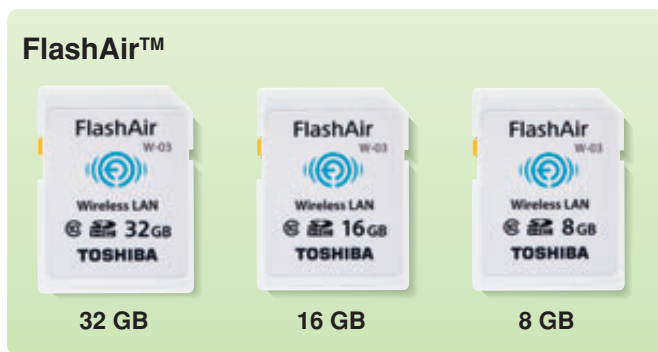


Five Features of FlashAir™

| | | | | |
|--------------------------------------|---------------------------------------|--|---|-------------------------------|
| 1 Connects various devices | 2 On-the-spot photo sharing | 3 Usable over various networks | 4 Supports various file formats | 5 Future provisions |
| | | | | |

Product Outline

- ▶ Compliant with the SD memory card standard.
- ▶ SDHC Speed Class 10
- ▶ Capacity: 8 GB, 16GB, 32 GB
- ▶ Compliant with IEEE802.11b/g/n.
- ▶ Supports HTTP/HTTPS protocols to enable interactions with web applications from a standard browser.
- ▶ Allows access from PCs and smartphones using server functions.
- ▶ Offers application software for smartphones and tablets.



Wireless LAN Specifications

| | |
|-----------------------|---|
| Compliant standard | IEEE802.11b/g/n (2.4 GHz SISO, 20 MHz) |
| Modulation | DSSS/CCK (1, 2, 5.5, 11 Mbps), OFDM(6 to 72.2 Mbps) |
| Wireless LAN security | WEP, TKIP, AES (WPA/WPA2) |
| Wireless QoS | EDCA (WMM) |
| Others | Infrastructure-STA, Infrastructure-AP, WPS-enrollee |

Networking Specifications

| | |
|----------------------|--------------------------|
| Supported protocol | TCP/IP (IPv4) |
| Server functionality | HTTP Server, DHCP Server |
| Client functionality | HTTP, DHCP, DNS, NETBIOS |

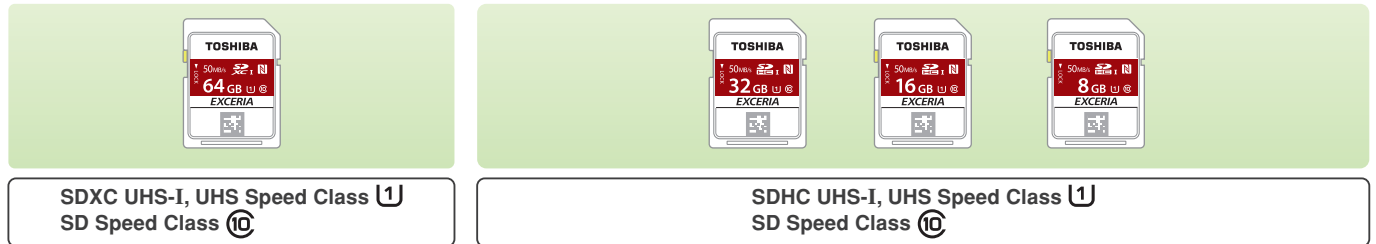
Toshiba has a website designed to support developers of applications and devices for FlashAir.

<https://flashair-developers.com/ja/>

NFC-Enabled SDHC and SDXC Memory Cards

NFC-enabled SDHC and SDXC memory cards provide Near Field Communication (NFC) functionality. These memory cards consist of a Flash Memory used as a typical SD memory card and a read/write user area for NFC tags. Thumbnails of several photos stored in the Flash Memory and card usage information are written to the user's NFC tag area. This makes it possible to check the contents of the memory card just by touching it with an NFC-enabled device such as an Android™ smartphone.

NFC-Enabled SDHC/SDXC Memory Cards: EXCERIA™ (Reed 50 MB/s)



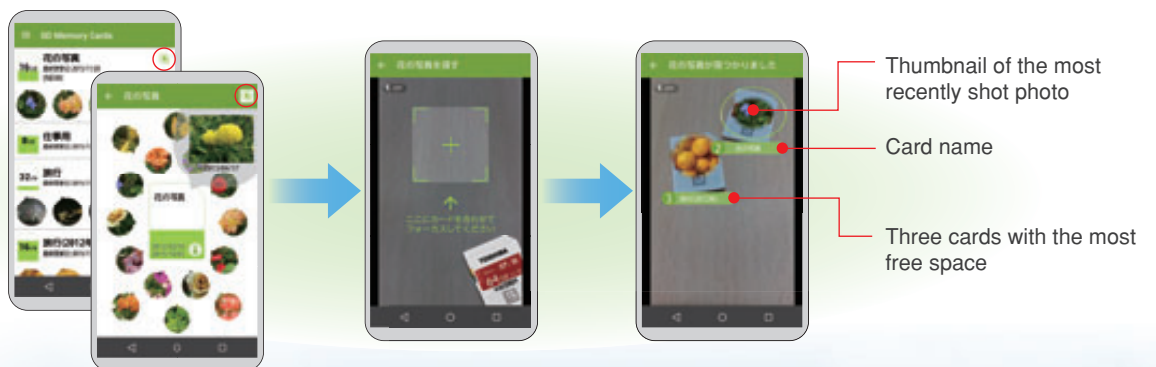
Preview function for displaying the contents of a memory card

Just by touching an NFC-enabled memory card with a smartphone, you can display the free space of the card and up to 16 thumbnails of the photos stored in the card.



Augmented reality (AR) function that allows you to quickly find a card you are looking for

NFC-enabled SDHCV/SDXC cards bear a two-dimensional (2D) barcode. By having a smartphone camera recognize 2D barcodes, you can quickly find cards that are registered with an app.



Specifications

| | |
|--------------------------|--|
| Product name | NFC-enabled SDHC/SDXC memory card |
| Interfacing | SD interface standard UHS-I |
| Speed class | UHS Speed Class: 1U SD Speed Class: CLASS10 |
| Card standard compliance | SD memory card standards |
| NFC standard compliance | NFC Forum Type 3 Tag |
| Frequency | 13.56 MHz |
| Supply voltage | 2.7 to 3.6 V |

Developers Website

Toshiba has a website designed to support developers of applications and devices for NFC-enabled SD memory cards.

<https://flashair-developers.com/ja/nfc/>

Android is a trademark of Google Inc.

TransferJet™ Memory Card



Toshiba offers SDHC memory card with embedded TransferJet™ functionality, a close proximity wireless technology.

TransferJet™ allows you to transfer videos and photos shot with a camera to a peer device such as a Windows® PC, a tablet or a smartphone without removing a memory card from the camera. All you need to do is to just bring the camera close to the coupler (or an external adapter) of the peer device.

TransferJet™ makes your photo-sharing experience more convenient.



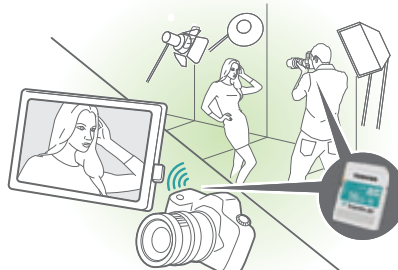
Use Cases

TransferJet™ SDHC memory cards allow you to share and back up videos and photos easily.

You can easily copy your backup files to a Windows® PC.



You can check out your photos with a tablet immediately after shooting them.



You can share your photos immediately after shooting them.



Product Overview

- ▶ Compliant with the SD memory card standard
- ▶ Capacity: 16 GB
- ▶ Compliant with SDHC Class 10
- ▶ TransferJet™ transmit mode

Incremental Data Transfer mode

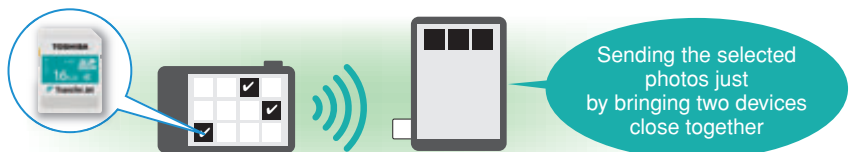
In this mode, all the videos and photos that have yet to be transferred are automatically transferred in batch only once.

This mode is useful when you want to back up videos and photos.

Selected Data Transfer mode

In this mode, you can selectively transfer photos (in JPEG format) using the DPOF* function of a digital camera.

Since this mode allows you to send the same photos any number of times, it is useful when you want to share photos with your friends.



(*DPOF(Digital Print Order Format)

DPOF is a format that allows the user of a digital camera to specify which captured images on a memory card are to be printed, together with other information such as the number of copies and date imprinting. A DPOF file is often called a print ordering file. For details, see the owner's manual that accompanies your digital camera.

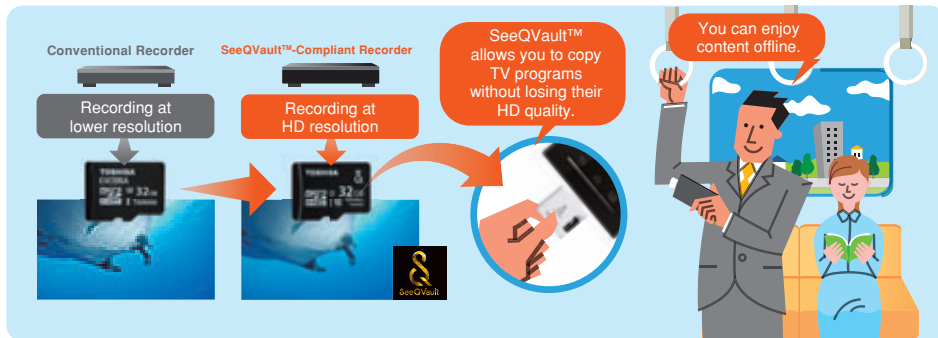
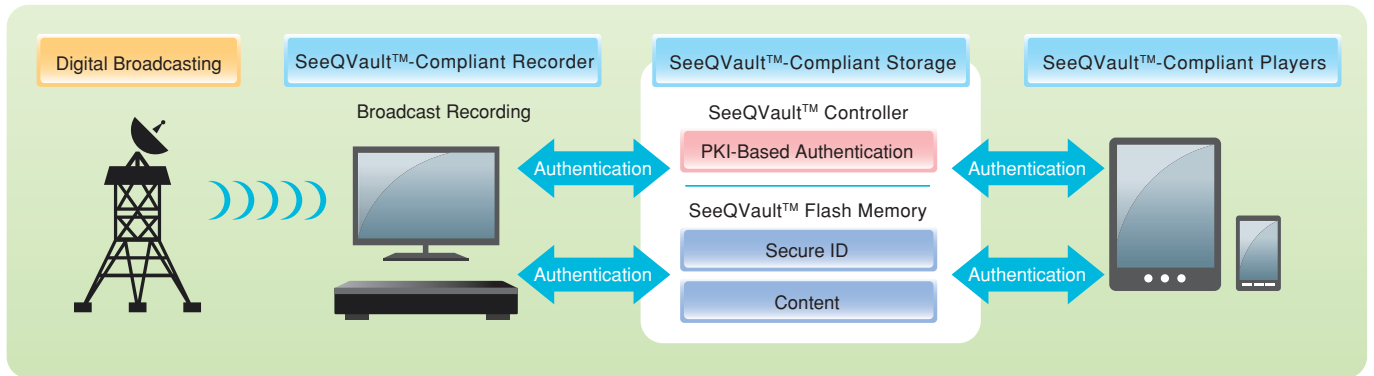
- Microsoft, Windows, Windows Vista and ReadyBoost are trademarks or registered trademarks of Microsoft Corporation in the U.S. and other countries.
- DPOF denotes compliance with Digital Print Order Format. DPOF is a trademark of Canon Inc., Eastman Kodak Company, Fujifilm Corporation and Matsushita Electric Industrial Co., Ltd.
- Other company and product names mentioned herein may be trademarks or registered trademarks of respective companies or organizations.

Content Protection Technology SeeQVault™



SeeQVault™ is a content protection technology that provides robust security and protected content playback on any compliant devices. SeeQVault™ has independent double security layers for the controller and flash memory to realize device authentication and anti-cloning (protection against unauthorized reproduction of content on an SD memory card). These features allow enjoyment digital content on the desired device in a highly secure environment via a SeeQVault™-compliant SD memory card or external hard disk. From now on, SeeQVault™ will support the content industry in developing a broad array of business models, including online purchases, rentals, members-only subscriptions, machine vending and over-the-counter sales of premium videos, games, electronic textbooks and more.

Recording protected digital data to a storage device to prevent unauthorized copying



SeeQVault-Compliant microSDHC Memory Cards
MSV-RW Limited production / **MU-SV** Series
 * TV programs cannot be recorded directly to an SD card.

- 32GB** MSV-RW32GA/MU-SV032G
- 16GB** MSV-RW16GA/MU-SV016G



Accessible anytime

Once you have transferred the recorded programs to a memory card, you can enjoy them on a mobile device with a SeeQVault™ app at your leisure. You can watch your backlog programs in a spare time.

Viewing anywhere

You can comfortably watch video content anywhere offline. SeeQVault™ is stress-free because you do not need to connect to network in locations where your mobile device is out of service or has a weak signal such as on trains and airplanes.

HD picture quality

SeeQVault™ allows HD content to be transferred to a mobile device without any loss of picture quality. Enjoy powerful videos with no concerns about illegible subtitles.

| | MSV-RW Series | MU-SV Series |
|---|--|----------------------------|
| Maximum data rate* | Read 40 MB/s | |
| Interface | UHS-I Interface, SD Interface | |
| Speed Class | UHS Speed Class: U1 SD Speed Class: CLASS10 | UHS Speed Class: U1 |
| SeeQVault-compliant microSD card reader | Included | - |
| Accessory | microSD to SD adapter | |

Video Recording Capacities of microSD Memory Cards

* TV programs cannot be recorded directly to an SD card.

| | Terrestrial Digital Broadcasting (17 Mbps) | BS & 110-Degree CS (24 Mbps) | AVC AF (x 2 Mode) | AVC AS (x 4 Mode) | AVC AE (x 12 Mode) |
|-------|--|------------------------------|-----------------------|------------------------|------------------------|
| 32 GB | Approx. 4 hr. 6 min. | Approx. 2 hr. 54 min. | Approx. 5 hr. 24 min. | Approx. 11 hr. 34 min. | Approx. 34 hr. 18 min. |
| 16 GB | Approx. 2 hr. 2 min. | Approx. 1 hr. 26 min. | Approx. 2 hr. 41 min. | Approx. 5 hr. 46 min. | Approx. 17 hr. 3 min. |

* Based on Toshiba's test results. Actual read and write speeds depend upon the device in use and the size of the file. * MB per second is calculated as 1,000,000 bytes per second. * The recording capacities shown above are provided only as estimates and are not guaranteed to be accurate. * SeeQVault and the SeeQVault logo are trademarks of NSM Initiatives LLC. * Android is a trademark of Google Inc. Other company and product names mentioned herein may be trademarks or registered trademarks of respective companies or organizations.

See the website of Toshiba Semiconductor & Storage Products Company for a list of compatible devices.



http://www.toshiba-personalstorage.net/compati/microsd/sqv_microsd_list.htm



SeeQVault-Compliant Content Player App

Android™ app: SeeQVault player (PIXELA CORPORATION)

The SeeQVault player allows you to view the HD-quality TV programs stored in a SeeQVault microSD memory card on your Android™ device.

Read the terms of use before downloading the app.



View PIXELA's website for a description of the SeeQVault player and the supported devices.

http://www.pixela.co.jp/products/mobile/seeqvault_player/

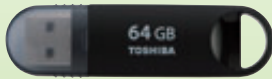
▶ USB Flash Memory *TransMemory™*

MEMORY STORAGE DEVICES

USB flash drives are compact memory devices designed to meet the user needs for portability. They provide a convenient means of transferring data at offices and for sharing photos among friends. A USB flash drive is recognized automatically when you plug it into a USB port on a PC, etc.

■ USB 3.0 TransMemory-MX™

Offers a sequential read speed of 70 MB/s due to the use of a USB 3.0 port, allowing users to transfer large amounts of data quickly.



| | 64 GB | 32 GB | 16 GB | 8 GB |
|-------|-------|-------|-------|------|
| Black | ○ | ○ | ○ | ○ |
| White | | ○ | ○ | |

■ USB 3.0 TransMemory™

Rigid and Durable. Standard USB 3.0 drive with a cap. Variations in capacity from 16 GB to 64 GB.



| | 64 GB | 32 GB | 16 GB |
|----------|-------|-------|-------|
| Capacity | ○ | ○ | ○ |

■ USB 2.0 TransMemory™

Rigid and Durable. Standard USB 2.0 drive with a cap. Variations in capacity from 8 GB to 128 GB.



| | 128 GB | 64 GB | 32 GB | 16 GB | 8 GB |
|-------|--------|-------|-------|-------|------|
| White | ○ | ○ | ○ | ○ | ○ |
| Blue | | | | ○ | ○ |

■ USB 3.1 Type-C TransMemory-EX™

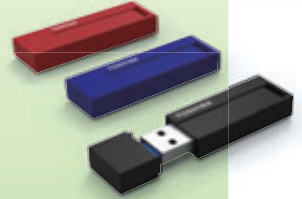
USB Type-A and Type-C Dual Port. Suitable for Type-C ports on Smartphone and Tablets.



| | 32 GB |
|----------|-------|
| Capacity | ○ |

■ USB 3.0 TransMemory™

Easy data management by Body color and Tacking Label.



| | 128 GB | 64 GB | 32 GB | 16 GB | 8 GB |
|-------|--------|-------|-------|-------|------|
| Black | ○ | ○ | ○ | ○ | ○ |
| Blue | | ○ | ○ | ○ | |
| Red | | ○ | ○ | ○ | |

■ USB 3.0 TransMemory™

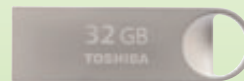
Small, cute USB 3.0 Drive.



| | 64 GB | 32 GB | 16 GB |
|----------|-------|-------|-------|
| Capacity | ○ | ○ | ○ |

■ USB 2.0 TransMemory™

USB memory in a stylish metal body.

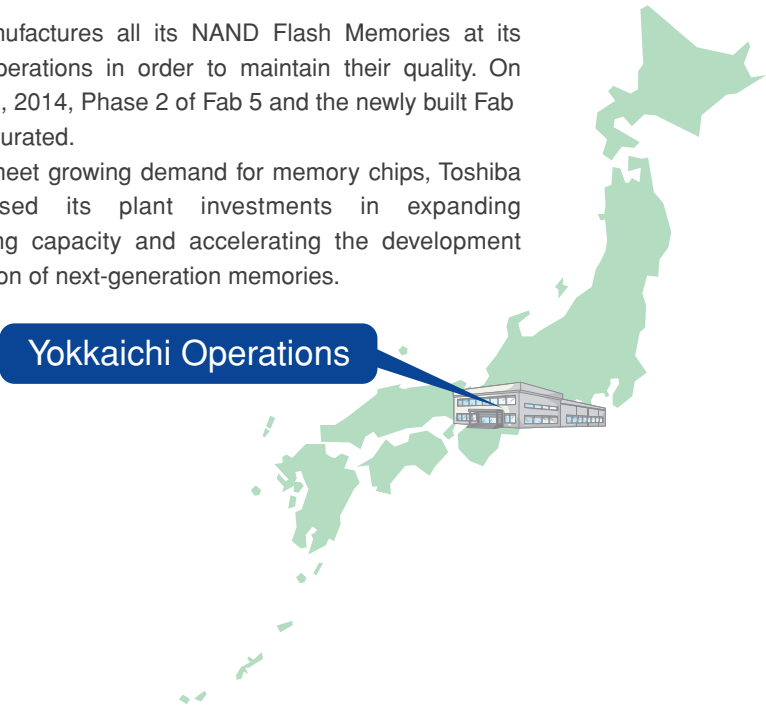


| | 32 GB | 16 GB | 8 GB |
|----------|-------|-------|------|
| Capacity | ○ | ○ | ○ |

Yokkaichi Operations, the manufacturing site for Flash Memories

Toshiba manufactures all its NAND Flash Memories at its Yokkaichi Operations in order to maintain their quality. On September 9, 2014, Phase 2 of Fab 5 and the newly built Fab 2 were inaugurated.

In order to meet growing demand for memory chips, Toshiba has increased its plant investments in expanding manufacturing capacity and accelerating the development and production of next-generation memories.



Yokkaichi Operations

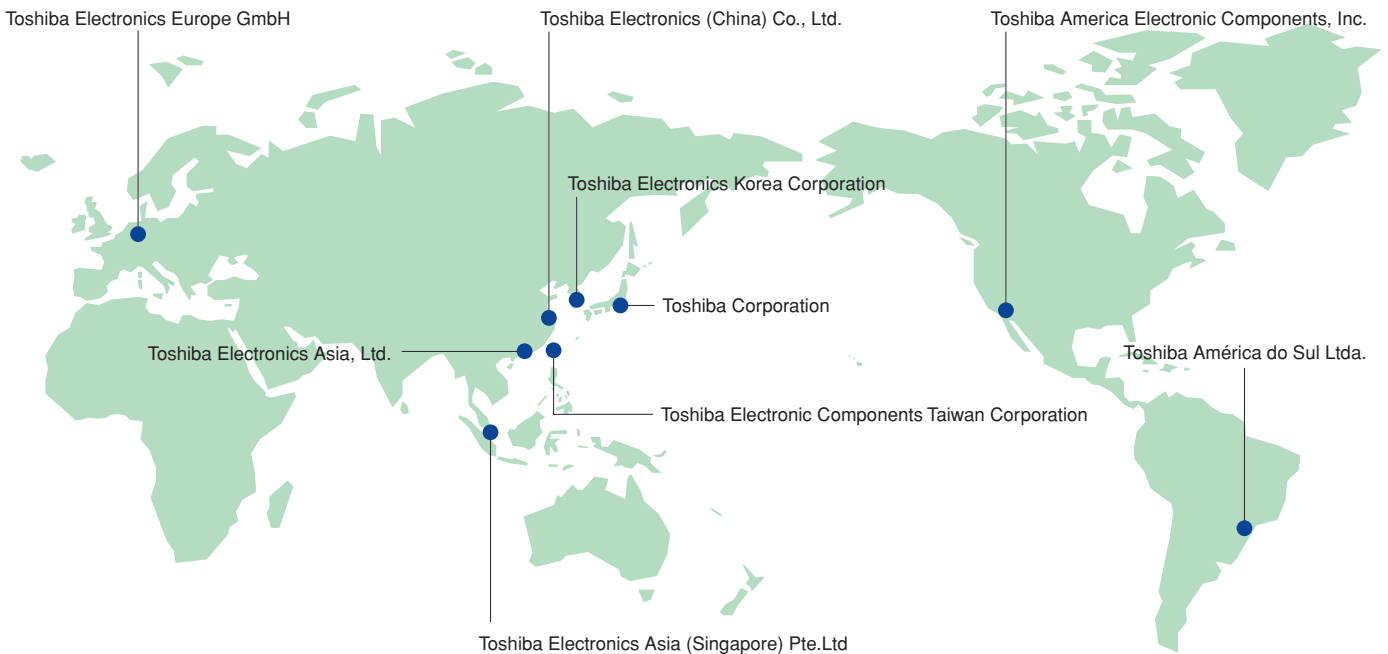


Fab 5



Cleanroom

Overseas Sales Offices



Notes on Memory Capacities

- All memory capacities shown herein represent the actual total capacity of a flash array. Note that not the entire capacity is available as the user area.
- A small amount of the flash array is used as management and other areas. For usable capacities, see the respective product specifications.
(One gigabyte is 1,073,741,824 bytes.)

Note on Data Rates

- The read and write speeds are calculated based on the decimal number system, i.e., 1 MB/s = 1,000,000 bytes/s.



Flash Memory for your life

Toshiba contributes to its customers and society as a whole through its Flash Memory and other Memory Solutions.



1984: Invent Flash Memory

1987: Publish a paper on NAND Flash Memory

1991: Disclose the specification for NAND Flash Memory

2016: Mass-produce Flash Memories with up to 256Gb chip

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<http://toshiba.semicon-storage.com/>



Use the search box for product search.



Your smartphone will automatically take you to the mobile site.

Mobile Site

It has become easier to run a product search, and view new topics as well as information about individual products with a smartphone.



Use a QR reader on your smartphone.



Our official SNS sites provide detailed information about our products and events in real time.

NEW!!



Twitter

Our Twitter account dispatches information about new products, trade shows and seminars in a timely manner.



https://twitter.com/ToshibaSemi_EN



Facebook

Our Facebook page delivers information about microcontroller products and seminars.



https://www.facebook.com/ToshibaMicrocontroller/info?tab=page_info



YouTube

Video clips introducing our latest products and technologies are posted on YouTube.



<https://www.youtube.com/user/TOSHIBASandSOOfficial>

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