



Controller IC For NAND Type Flash Memory To 8G Bytes, GBDriver® RA4

Conforming to RoHS Directive

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GBDriver supports "CF+ and CompactFlash Specification Version 2.1" (maximum transmission speed: 16.6MB/s), the latest CompactFlash standard.

Offering an actual transfer rate that's more than 1.8 times faster when reading and about 1.4 times faster when writing.

Supporting PIO-Mode4 with a maximum transfer rate of 16.6M byte/s, much faster than that of the conventional host interface(PIO-mode2), which was the bottleneck in attaining the potential of accelerated NAND flash memories. Compared to the conventional RA3 which supports PIO-Mode2, a read performance that's more than 1.8 times faster and a write performance that's about 1.4 times faster can be achieved.

With embedded systems, such as operating systems and data systems, the boot-up time or loading time of the kernels or application programs can be greatly reduced. Also, for devices where capability is determined directly by the speed of data transfer, such as high-resolution single-lens reflex digital cameras, for which faster activation and continuous shooting are required, RA4 offers performance that overcomes conventional limitations.

With one chip, a maximum of 8G bytes can be controlled, easily supporting the next-generation high-capacity memory chips.

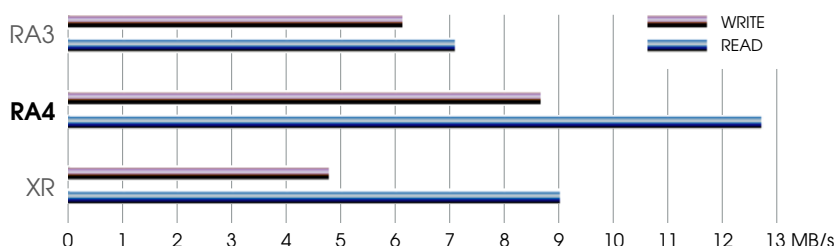
One chip can control up to four (up to 8G bytes) NAND flash memories (1G-16G bits products). This device also supports up to 2pcs of most advanced 32G bit NAND flash memory being released in middle of 2007, which brings the fastest path to the most cost effective silicon storage.

As of July 2006, NAND flash memory is available for purchase in up to 16G bit. It is expected that 32G bit products will be launched by manufacturers in the middle of 2007 or later.

Comparative example of 256-sector burst write/read speed with those of other products

Time to become DRDY after issuing a WRITE and READ command (The average value after measuring 1000 times)

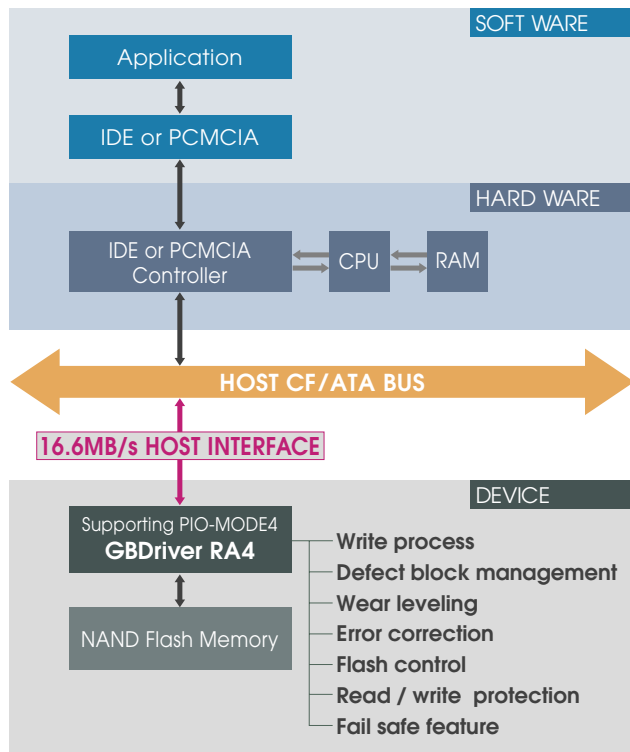
RA3: PIO-Mode1(8.3MB/s) supporting products XR: Versatile SRAM-BUS supporting products



Advanced features have been incorporated in the RA4, with the goal to provide superior reliability in flash memory control. The GBDriver RA4 brings you an "All-in-one one-chip solution" which significantly exceeds the existing control standard.

Complied with ATA/IDE interfaces. Because no special drivers are required, high-speed NAND flash memory can be used as storage for system applications without burdening system application programs.

Example of an applied system



Reliability-reinforcing features are fully integrated, based on TDK's original flash control architecture, such as wear leveling, avoiding writing to blocks that were not completely erased or blocks with high risk of reading error, and the "Write & Verify" command which verifies read errors on every write.

In addition to the high-speed host interface enhanced flash management system embedded in RA4 has improved its robustness against the sudden power fail during the operation. Thanks to this reliability feature, customer can concentrate on designing your own added value.

Basic characteristics / Rating

Host interface	120ns (BUS cycle)	
Flash interface	60ns	
Power supply	Host I/F	4.5 to 5.5V or 3.0 to 3.6V
	Core	3.0 to 3.6V
System clock	Flash I/F	3.0 to 3.6V
	33.33 MHz	
Operating temperature range	-40 to +85°C	

GBDriver® RA4

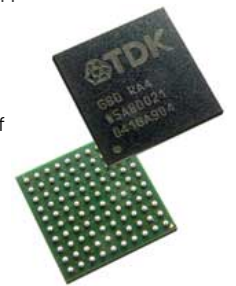


Small VFGA package and low current consumption with industry's lowest level.

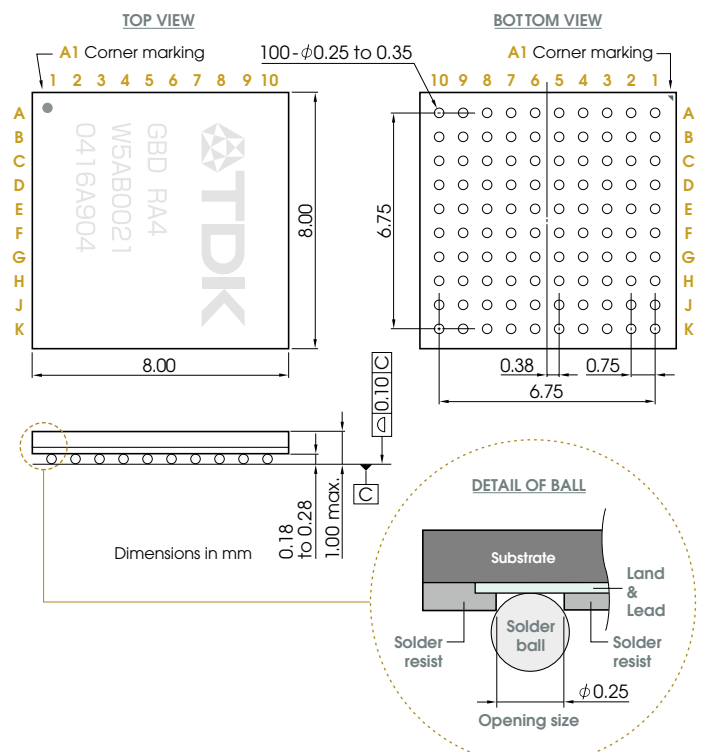
RA4 is provided by low profile small VFBGA 100 package (8mm square) so that any application requiring small form factor can utilize the NAND flash memory as a reliable storage system. Adding to the small package, current consumption* at the lowest level in the industry allows it embeddable in the dramatically downsized devices such as portable information devices, high-resolution digital single-lens reflex cameras, 3G cellular phones with cameras, and memory audio players, saving battery life.

* Example of actual measurement of current consumption

When reading 256 sectors : 48mA
When writing 256 sectors : 47mA



Shapes and dimensions



Every function required for controlling NAND flash memories is incorporated. The data protection feature at power down has been reinforced and the high-speed controller issue has been solved.

Data reliability

To counteract flash memory's time-lapse degradation, TDK's original, accurate control methods, which have proven their quality in the GBDriver series, have been applied. For improved reliability in data writing to flash memories, features relating to the memory control method, such as detecting defective cells, are integrated.

A dynamic verification function is also integrated when a potentially defective physical block is detected, so realizing the high-reliability required for NAND flash memories for embedded systems.

Avoiding concentration of writing to specific blocks

In case of rewriting of FAT, or directory areas, TDK's proprietary technology implemented in RA4 can offer dynamic block allocation feature, which can disperse the frequently rewritten address range into wide range of flash memory blocks.

Avoiding writing to blocks that were not completely erased

Writing to flash memories is performed only in "blocks where all memory cells are completely erased". Although it doesn't sound specific matter, controller needs to care many things which can occur in the normal usage by users. One case is to avoid writing to "blocks with the possibility of read error" caused by power failures during writing or erasing processes. The other case is to avoid writing to "blocks where one or more memory cell(s) has been incompletely erased" caused by time-lapse degradation of flash memory cells.



Two new protection features

To satisfy the market needs for the protect feature, RA4 supports several modes of data protection feature, where the flash memory system can be set as "read protect mode" or write protect mode. (Please contact TDK for details of command configuration).

GBDriver® RA4



Perfect tolerance against power failure during high-speed writing processes

Even if the power fails while data is being written, the system will prevent losing the data that's not stored in the just written area.

Error correction/restoration

For bit-error phenomenon during the read access, which must be treated correctly by system design in embedded application, a feature is integrated to correct such errors upon detection of correctable bit-error and to transfer the data in the block to safe one. This provides adequate reliability for operating system of embedded devices where the read access occurs frequently.

TDK proprietary NAND management algorithm: detection and verification of unstable blocks and refraining from making too many defective blocks

A feature is implemented to detect and check unstable blocks of flash memories. To reduce the risk of writing to the unstable blocks can contribute not only to decrease the risk of reading error, but also to prolong the storage life. TDK's proprietary flash memory control technology reduces the risk of future unreadable incidents due to writing to incompletely erased blocks and averts reduction of memory capacity due to increased correctable defective blocks.

Detailed verification by the "Write & Verify" command ensures further advanced reliability

The "Write & Verify" command, which verifies existence of the read error at each write, is fully supported. Adding to the feature that GBDriver only writes to completely erased blocks, usage of this command can provide higher level of reliability with the system.

Although NAND flash memories were originally designed for the file systems and memory cards of consumers, their application in recent years has extended to storage of system OS, user data, and system data. Continuous increase of additional features is creating the market such as small information devices, digital AV systems, IT home appliances, car-navigation systems, ITS, business terminal devices, and so forth.

TDK's GBDriver series, with its own designed architecture providing the most advanced product in the industry, has received high recognition and been widely used both in consumer and embedded market. GBDriver RA4 is an innovative device with all functions required for the outstandingly reliable employment of NAND flash memory integrated into one chip.

**3G Cellular phone / PDA / Electronic organizer / Printer / Scanner / Projector
Broadband router / Access point / Network storage / Multimedia device
Digital camera / Digital video camera / Digital audio system
Memory audio player / USB memory / Portable DVD player
Home information appliance / Home theater system / Set-top box / Plasma TV
Wide liquid crystal TV / DVD-HDD recorder / Car-navigation system
GPS system / ITS / Diverse security systems / Monitoring system / Handy terminal
POS register / Mobile terminal for business / FA control device / Industrial robot
Measuring device / Medical device**

Information on related products

Controller IC For NAND Type Flash Memory To 16G Bytes, GBDriver® XR

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It supports - a world first - general-purpose SRAM interfaces, and read/write performance has been further improved. The NAND flash memory can be controlled through a direct connection to the CPU bus, allowing systems without interfaces for hard disks, such as ATA/IDE, to use high-capacity, low-priced NAND flash memories for storing system OS, system work areas, user data, and so forth.

One chip can control up to eight (up to 16G bytes) NAND flash memories (64M bit - 16G bit products). It permits simple attainment of low-cost systems based on the next-generation 8G bit and 16G bit high-capacity memory.

GBDriver® RA4



INFORMATION

Customization / Consultation contact

Customization needs for parameters such as CIS information or Identify-Drive information will be provided. Read/write protection features for increased security can be implemented according to specific needs.

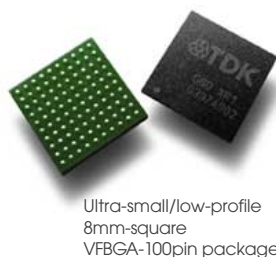
Also, there are demands for embedded applications that are peculiar to system usage.

Therefore, for memory controllers, a basic design that can deal with each requirement of embedded systems flexibly and accurately is vital. For each system, the gist of advanced system design is to utilize the control technologies that memory controllers support. For optimized performance of GBDriver, TDK has reinforced each support system by offering services such as system design guidelines for embedded applications, and vendor command specifications for flash memory diagnostics.

If consultations are needed, or requests concerning the use of NAND flash memories are of interest, please feel free to contact the representative below.

Flash memory application
device group

Representative: Shunichi Hanafusa
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Ultra-small/low-profile
8mm-square
VF8GA-100pin package