# Samsung OneNAND™ Flash
Fusion Memory Featuring High-Density
NAND Flash with a NOR Interface
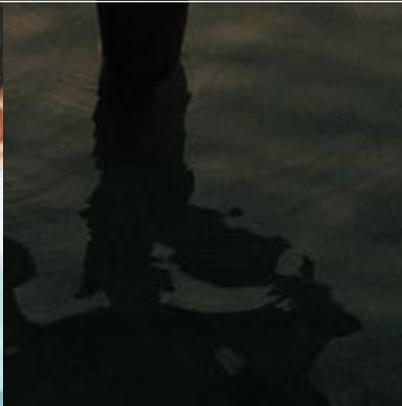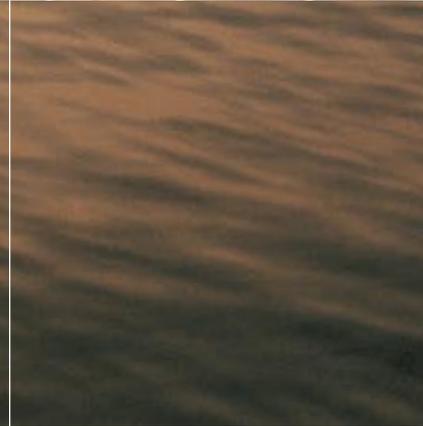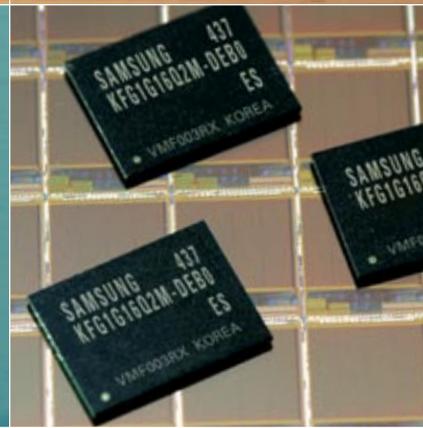
# Samsung OneNAND™ Flash

## What is OneNAND?

Samsung's OneNAND meets the memory-hungry needs of next-generation devices by providing a single-chip flash that offers the ultra-high density of NAND with the simplified interface of NOR at very attractive price points. OneNAND can achieve up to 108MB/s read performance to optimize application functionality. It is available in densities from 256Mb to 8Gb.

With OneNAND, designers can use their existing chipset's NOR interface to communicate directly with the NAND flash memory, obviating the need for a separate NAND device. In addition, OneNAND's fast write speed increases performance, which is extremely difficult to attain with NOR flash alone.

OneNAND's compact size and range of features make it the ideal choice for:

- Handsets
- Digital cameras
- Embedded solutions
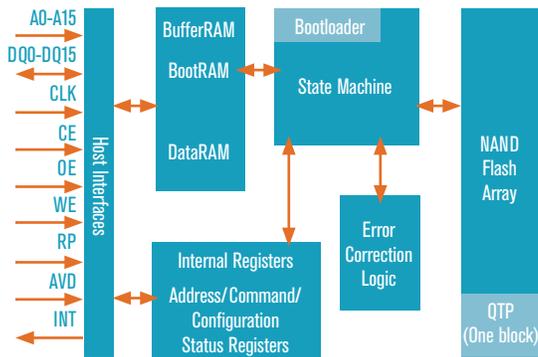


Samsung OneNAND Flash includes NAND flash memory, controller logic, up to 5kB of buffer RAM and hardware ECC on a single chip. It supports high-resolution digital images, video and memory-hungry applications.

## OneNAND for Handsets

Next-generation smart phones require increased memory to store digital images and support advanced multimedia functionality. This presents a challenge for designers looking to transform traditional architectures to support media-rich functionality. OneNAND's feature set enables:

- Up to 50 times faster click-to-click rate for sequential photos (based on 3- megapixel-resolution image capture)

- Instant availability; no more missing pictures

- Lower voltage & lower power for extended battery life

- Reduces costs up to 40% vs. traditional NOR
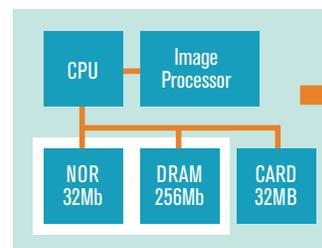


Historic Architecture     OneNAND Architecture
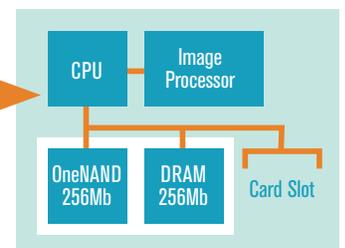
## Why OneNAND?

- Simplifies system architecture
- Increases system performance, decreases footprint
- Reduces parts inventory and BOM costs

## OneNAND for Digital Cameras

The key issues for designers involve storage, click-to-click speeds and capacity vs. cost. However, choosing OneNAND helps in simplifying design while increasing features and controlling costs. OneNAND enables:

- Up to 50 times faster click-to-click rates for sequential photos (based on 3- megapixel-resolution image capture)
- On-board memory for image storage eliminates the need to bundle additional cards
- Lower voltage & lower power for extended battery life
- Reduces costs up to 40% vs. traditional NOR

## OneNAND for Hybrid Hard Drive

The Hybrid Hard Drive developed by Samsung and Microsoft for Vista PCs is a next-generation approach to storage that offers faster boot and resume times, increased battery life and greater reliability compared to traditional magnetic media technology. The Hybrid Hard Drive includes a NAND flash cache with the hard drive; performance gains are directly related to the speed of that cache. Thus OneNAND Flash is the device of choice for the Hybrid Hard Drive. The OneNAND cache performs two functions:

1. As a write cache, it saves power and increases drive reliability while it keeps the mechanical portion of the disk spun down.
   - The result is up to 30 minutes longer battery life and up to 5x reliability improvement.

2. As a read cache, it enables faster bootup & resume and allows specific applications to be cached for quick-start functions in Vista such as SideShow, Hot-Start, Media Player and others.
   - The result is up to a 50% reduction in boot and resume times and near-intant launch of pinned applications.

**Historic Architecture**

**NOR + NAND + DRAM**

Processor

NOR Code | NAND | DRAM

Data

**OneNAND Architecture**

**OneNAND + DRAM**

Processor

OneNAND Code Data | DRAM
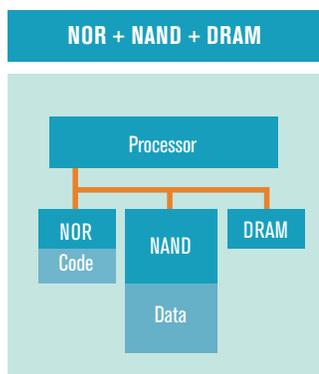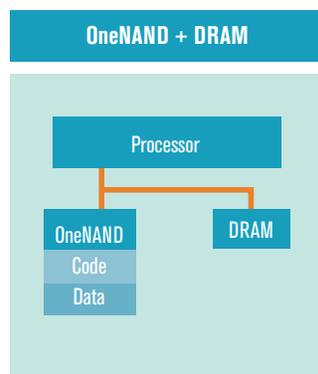
**OneNAND Flash Caching Solution for HHD**

SATA → SATA interface ↔ SoC ↔ platters

OneNAND Flash cache

hard disk
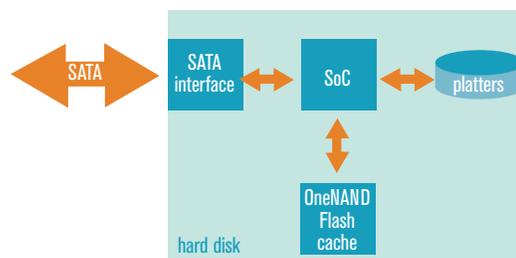
The OneNAND Flash-based write cache within the Hybrid Hard Drive allows the platters to be kept idle 99% of the time; they spin briefly when this cache is full and the data is then automatically saved to the disc. Besides reducing power and increasing reliability, the inclusion of solid-state memory in the drive significantly cuts boot and resume times.

OneNAND Flash is the ideal NOR replacement. Not only does it plug directly into an existing NOR interface with minimal hardware redesign, but it's less expensive and provides higher performance than NOR.

## OneNAND Features

- Host interface:
  - Synchronous burst read
  - Asynchronous write
- Internal boot loader (1kB boot block)
- Internal NAND flash controller
- Internal data buffer: (4kB SRAM-512Mb/2kB SRAM-256Mb)
- Hardware ECC (2-bit EDC/1-bit ECC)
- Single Layer Cell (SLC) NAND technology
- Sustained read performance: 108MB/s
- Sustained write performance: up to 17MB/s
- Voltage supply: 1.8, 2.5, 3.3v
- Density: 256Mb - 8Gb
- Packaging: 63-ball, 9.5mm x 12mm x 1mm, .8mm ball pitch FBGA
- Software support for all major mobile operating systems:
  - Flash drivers & file systems for Symbian, PocketPC, Linux, Nucleus, etc.
  - Extended Sector Remapper (XSR) for OS with file system
  - Transactional File System (TFS) for OS without file system

## Samsung OneNAND Products

| Density | Org | Operating Voltage | Speed | Package |
|---------|-----|-------------------|----------|----------|
| 256Mb | x16 | 1.8/2.7/3.3V | 50MHz | TSOP/BGA |
| 512Mb | x16 | 1.8/2.7/3.3V | 50MHz | BGA |
| 1Gb | x16 | 1.8V | 50/83MHz | BGA |
| 2Gb | x16 | 1.8V | 50/83MHz | BGA |
| 4Gb | x16 | 1.8V | 50/83MHz | BGA |
| 8Gb | x16 | 1.8V | 50/83MHz | BGA |

For more information on Samsung OneNAND, visit our website: www.usa.samsungsemi.com, or email your questions and requests to "Dr. NAND" at dr.nand@ssi.samsung.com.