

## Features

- **Industry Standard Embedded MultiMediaCard (eMMC) Host Interface**
  - JEDEC/MMC Standard Version 4.4 JESD84-A44 compliant
  - Backward compatible with eMMC 4.3
- **Performance**
  - eMMC clock speed: Up to 52MHz (Support x1/x4/x8 bus and Dual Data Rate mode)
  - Sequential data read:  
Up to 60 MByte/sec \*
  - Sequential data write:  
Up to 30 MByte/sec \*

\* measured using 128 Kbyte transfer size
- **Power Management**
  - 3.3V power supply
  - 3.3V or 1.8V eMMC IO voltage
  - Immediate disabling of unused circuitry without Host intervention
- **Power Specifications**
  - Active mode  
180mA typical (GLS85VM1032A)  
150mA typical (GLS85VM1016A)  
120mA typical (GLS85VM1008A)  
120mA typical (GLS85VM1004A)
  - Sleep mode  
200µA typical
- **Expanded Data Protection**
  - Hardware Write Protection pin
- **Latency Management**
  - Reduce latencies due to background operation during time critical read/write operations
- **Integrated Voltage Detector**
  - Detects supply voltage fluctuations and generates reset during power-up and power-down to prevent inadvertent writes
- **Robust Built-in ECC**
- **NAND Configuration**
  - 2 bits per cell (MLC)
- **Temperature Range**
  - Industrial: -40°C to 85°C
- **100-ball LBG Package**
  - 14.0 mm x 18.0 mm x 1.40 mm, 100-ball, 1.0 mm ball pitch, LFWE (GLS85VM1004A/8A/16A/32A)
- **All Devices are RoHS Compliant**

## Product Description

The GLS85VM1004A / 1008A / VM1016A / VM1032A eMMC NANDrive™ devices (referred to as “eMMC NANDrive” in this datasheet) are fully integrated solid state drives. They combine an advanced Greenliant NAND controller and 4, 8, 16 or 32 GByte of NAND flash memory in a multi-chip package. These products are ideal for solid state mass storage in embedded and portable applications that require small form-factor, energy efficient and reliable data storage.

eMMC solid state drives are widely used in GPS and telematics, in-vehicle infotainment, portable and industrial computers, handheld data collection scanners, point-of-sale terminals, networking and telecommunications equipment, robotics, audio and video recorders, monitoring devices and set-top boxes.

eMMC NANDrive provides complete eMMC solid state drive (SSD) functionality and compatibility in a 14mm x 18mm BGA package for easy, space saving mounting to a system motherboard. With its small size, low power consumption, strong security, reliability and ruggedness, eMMC NANDrive surpasses removable storage and discrete NAND-based products.

The integrated NAND flash controller with built-in advanced NAND management firmware communicates with the Host through the standard eMMC protocol. It does not require any additional or proprietary software such as the Flash File System (FFS) and Memory Technology Driver (MTD).

eMMC NANDrive's advanced NAND management technology enhances data security, improves endurance and accurately tracks the usage of the NAND flash. This innovative technology combines robust error correction capabilities with advanced wear-leveling algorithms and bad block management to extend the life of the product.

eMMC NANDrive supports Dual Data Rate (DDR) mode, boot, multiple partitions, permanent and partial write protect, Replay Protected Memory Block (RPMB) access, Secure erase and TRIM, hardware reset and other features detailed in the eMMC 4.4 standard specification. It is fully backward compatible with the eMMC 4.3 standard.

## **1.0 GENERAL DESCRIPTION**

Each eMMC NANDrive contains an integrated eMMC NAND flash memory controller and NAND flash die in a BGA package. Refer to Figure 2-1 for the eMMC NANDrive block diagram.

### **1.1 Optimized eMMC NANDrive**

The heart of the eMMC NANDrive is the eMMC NAND flash memory controller, which translates standard eMMC signals into flash media data and control signals. The following components contribute to the eMMC NANDrive's operation.

#### **1.1.1 Microcontroller Unit (MCU)**

The MCU transfers the eMMC commands into data and control signals required for flash media operation.

#### **1.1.2 Internal Direct Memory Access (DMA)**

The eMMC NANDrive uses internal DMA allowing instant data transfer from/to buffer to/from flash media. This implementation eliminates microcontroller overhead associated with the traditional, firmware-based approach, thereby increasing the data transfer rate.

#### **1.1.3 Power Management Unit (PMU)**

The PMU controls the power consumption of the eMMC NANDrive. The PMU dramatically reduces the power consumption of the eMMC NANDrive by putting the part of the circuitry that is not in operation into sleep mode.

The Flash File System handles inadvertent power interrupts and has auto-recovery capability to ensure the eMMC NANDrive's data integrity.

#### **1.1.4 Embedded Flash File System**

The embedded flash file system is an integral part of the eMMC NANDrive. It contains MCU firmware that performs the following tasks:

1. Translates host side signals into flash media writes and reads
2. Provides flash media wear leveling to spread flash writes across all memory address space to increase the longevity of flash media
3. Keeps track of the data file structure
4. Manages system security for the selected protection zones

#### **1.1.5 Error Correction Code (ECC)**

High performance is achieved through optimized hardware error detection and correction.

#### **1.1.6 Serial Communication Interface (SCI)**

The Serial Communication Interface (SCI) is designed for error reporting. During the product development stage, it is recommended to provide the SCI port on the PCB to aid in design validation.

#### **1.1.7 Multi-tasking Interface**

The multi-tasking interface enables fast, sequential write performance by allowing concurrent Read, Program and Erase operations to multiple flash media.

## **1.2 SMT Reflow Consideration**

The eMMC NANDrive family utilizes standard NAND flash for data storage. Because the high temperature in a surface-mount soldering reflow process may alter the content on NAND flash, it is recommended to program the eMMC NANDrive after the reflow process.

## **1.3 Advanced NAND Management**

The eMMC NANDrive's integrated controller uses advanced wear-leveling algorithms to substantially increase the longevity of NAND flash media. Wear caused by data writes is evenly distributed in all or select blocks in the device that prevents "hot spots" in locations that are programmed and erased extensively. This effective wear-leveling technique results in optimized device endurance, enhanced data retention and higher reliability required by long-life applications.

## 2.0 FUNCTIONAL BLOCKS

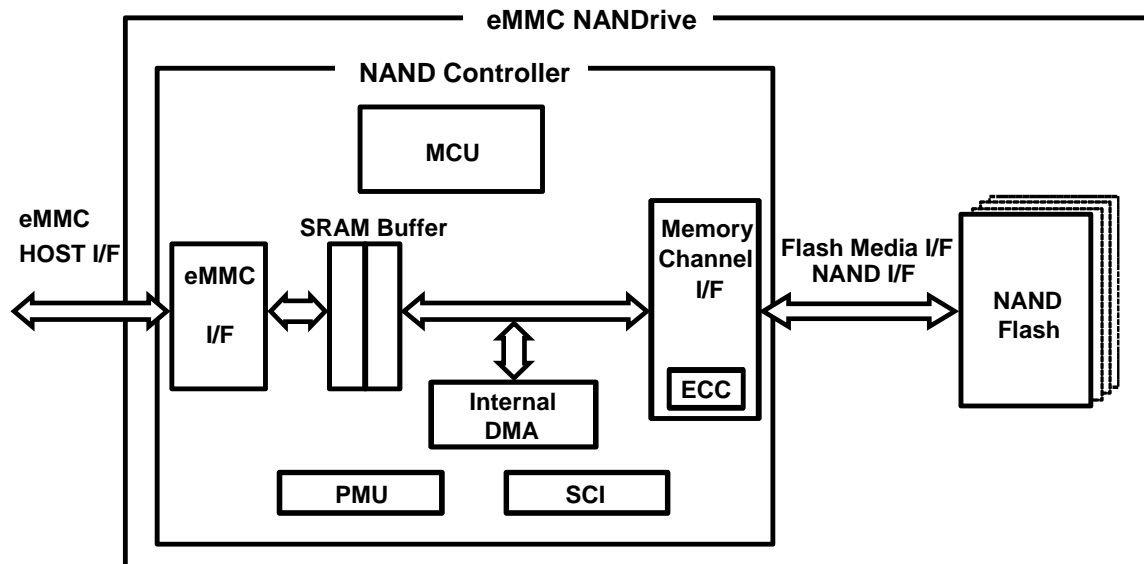
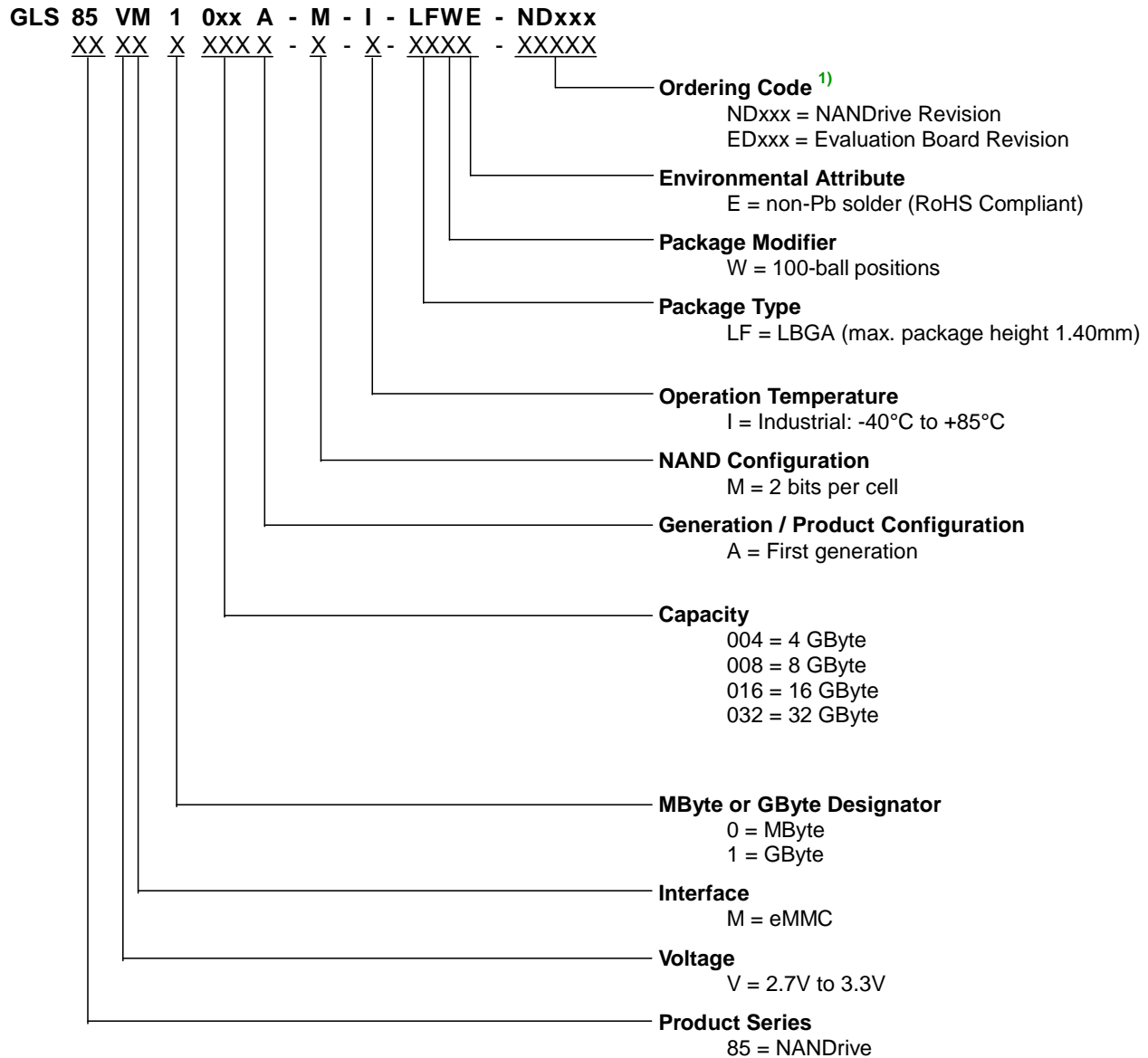


Figure 2-1: eMMC NANDrive Block Diagram

### 3.0 PRODUCT ORDERING INFORMATION



<sup>1)</sup> Note that the top side marking on the package typically does not include ordering codes (e.g. NDxxx), unless it is a special C-SPEC (custom specification) which is required by the end-customer to be marked on the device.

## Valid Combinations

Valid product combinations are those that are in the mass production or will be in the mass production. Consult your Greenliant sales representative to confirm availability of the valid combinations and to determine availability of new product combinations.

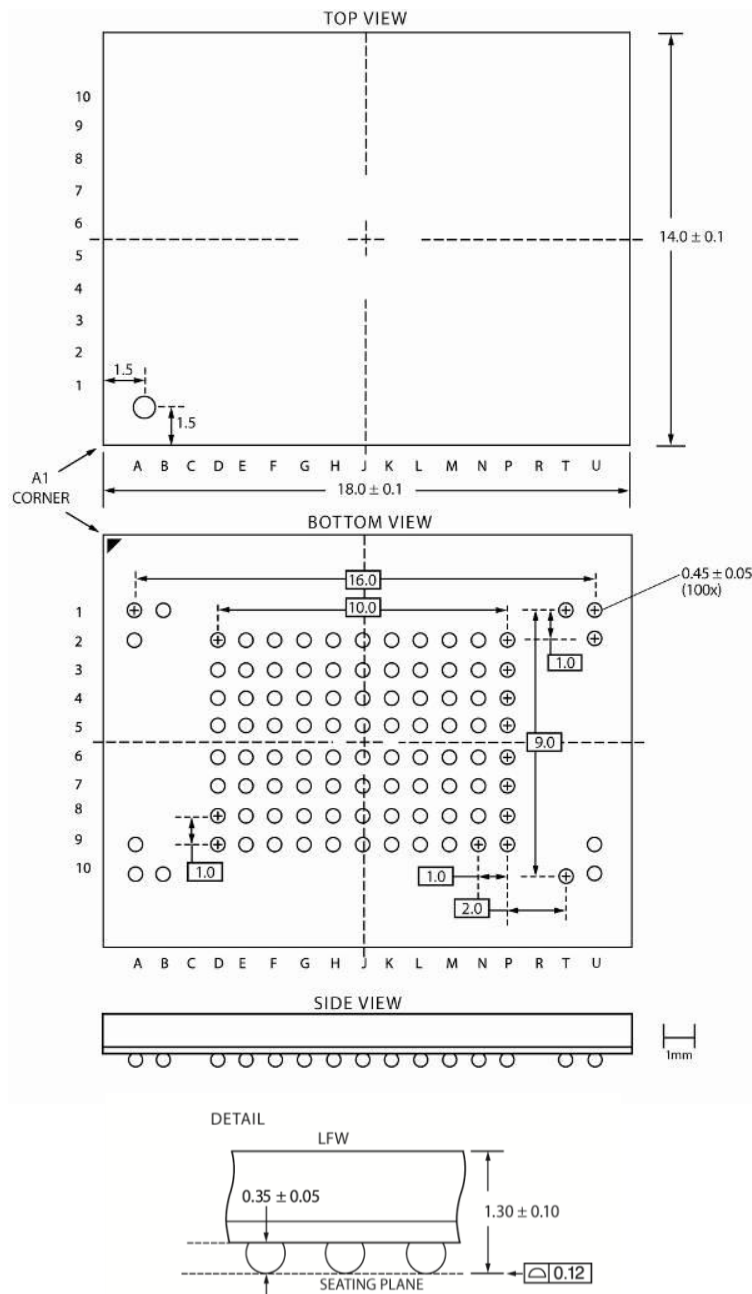
**Table 3-1: eMMC NANDrive Product Valid Ordering Numbers**

Capacity	Operating Temperature	Part Number	Package
4GB	Industrial (-40°C to 85°C)	GLS85VM1004A-M-I-LFWE-ND206	LFWE, 14x18x1.40mm
4GB	Industrial (-40°C to 85°C)	GLS85VM1004A-M-I-LFWE-ND209	LFWE, 14x18x1.40mm
4GB	Industrial (-40°C to 85°C)	GLS85VM1004A-M-I-LFWE-ND214	LFWE, 14x18x1.40mm
8GB	Industrial (-40°C to 85°C)	GLS85VM1008A-M-I-LFWE-ND206	LFWE, 14x18x1.40mm
8GB	Industrial (-40°C to 85°C)	GLS85VM1008A-M-I-LFWE-ND209	LFWE, 14x18x1.40mm
8GB	Industrial (-40°C to 85°C)	GLS85VM1008A-M-I-LFWE-ND214	LFWE, 14x18x1.40mm
16GB	Industrial (-40°C to 85°C)	GLS85VM1016A-M-I-LFWE-ND206	LFWE, 14x18x1.40mm
16GB	Industrial (-40°C to 85°C)	GLS85VM1016A-M-I-LFWE-ND209	LFWE, 14x18x1.40mm
16GB	Industrial (-40°C to 85°C)	GLS85VM1016A-M-I-LFWE-ND214	LFWE, 14x18x1.40mm
32GB	Industrial (-40°C to 85°C)	GLS85VM1032A-M-I-LFWE-ND206	LFWE, 14x18x1.40mm
32GB	Industrial (-40°C to 85°C)	GLS85VM1032A-M-I-LFWE-ND209	LFWE, 14x18x1.40mm
32GB	Industrial (-40°C to 85°C)	GLS85VM1032A-M-I-LFWE-ND214	LFWE, 14x18x1.40mm

**Table 3-2: eMMC Evaluation Board Valid Ordering Numbers**

Capacity	Operating Temperature	Part Number	Form Factor
4GB	Industrial (-40°C to 85°C)	GLS85VM1004A-M-I-E2-ED214	JEDEC MO-277
8GB	Industrial (-40°C to 85°C)	GLS85VM1008A-M-I-E2-ED214	JEDEC MO-277
16GB	Industrial (-40°C to 85°C)	GLS85VM1016A-M-I-E2-ED214	JEDEC MO-277
32GB	Industrial (-40°C to 85°C)	GLS85VM1032A-M-I-E2-ED214	JEDEC MO-277

### 3.1 Package Diagram



Note: All linear dimensions are in millimeters.  
Untoleranced dimensions are nominal target values.  
Coplanarity: 0.12 mm  
Ball diameter is 0.45 mm (± 0.05 mm)  
Ball opening size is 0.38 mm (± 0.05 mm), SMD type

**Figure 3-1: eMMC NANDrive 100-Ball, Ball Grid Array (BGA) Greenliant Package Code: LFWE**

## Revision History

Number	Description	Date
01.000	Initial release as Fact Sheet	March 22, 2013
02.000	Added GLS85VM1004A-M-I-LFWE	August 26, 2013
03.000	Added Ordering Codes ND206/ND209/ED209, Removed ND202	June 15, 2016
04.000	Added Ordering Codes ND214, ED214, Removed ED209	March 9, 2017

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Specifications are subject to change without notice. Memory sizes denote raw storage capacity; actual usable capacity may be less.

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