

## Features

- **Industry Standard Serial ATA (SATA) Host Interface**
    - SATA 1.5Gb/s <sup>1)</sup>
    - ATA/ATAPI-8 compliant
    - Supports 48-bit address feature set
  - **Performance**
    - Sequential data read:  
Up to 70 MByte/sec\*
    - Sequential data write:  
Up to 60 MByte/sec\*
    - \* measured using 128 KByte transfer size
  - **Power Management**
    - 3.3V and 1.2V power supply
    - Host SATA interface power management
    - Immediate disabling of unused circuitry without host intervention
  - **Power Specifications** <sup>2)</sup>
    - Active mode:  
750mW typical (GLS85LS1008P)  
560mW typical (GLS85LS1004P)  
450mW typical (GLS85LS1002P)
    - Idle / Standby mode: 210mW typical
    - Sleep mode: 70mW typical
  - **Integrated Voltage Detector**
    - Detects supply voltage fluctuations and generates reset during power-up and power-down to prevent inadvertent writes
  - **Supports SMART Commands**
  - **Expanded Data Protection**
    - Added data security through user-selectable protection zones
  - **20-Byte Serial Number**
    - Factory pre-programmed 10-Byte unique ID
    - User-programmable 10-Byte ID
  - **Robust Built-in ECC**
  - **NAND Configuration**
    - 1 bit per cell (SLC)
  - **Industrial Temperature Range**
    - -40°C to 85°C
  - **FBGA package**
    - 14.0 mm x 24.0 mm x 1.95 mm, 145-ball, 1.0 mm ball pitch, FZJE
  - **All Devices are RoHS Compliant**
- <sup>1)</sup> Current product revision supports SATA Revision 1.x with host transfer rate of up to 1.5 Gb/s (i.e. SATA 1.5Gb/s).  
<sup>2)</sup> For management of the Sleep Mode, refer to "SATA NANDrive Application Design Guide."

## Product Description

The GLS85LS1002P / 1004P / 1008P Industrial Grade SATA NANDrive™ devices (referred to as "SATA NANDrive" in this factsheet) are fully integrated solid state drives. They combine an advanced Greenliant NAND controller and 2, 4 or 8 GByte of NAND flash in a multi-chip package. These products are ideal for embedded and portable applications that require smaller form-factor and more reliable data storage.

SATA-interface solid state mass storage technology is widely used in portable and industrial computers, set-top boxes, multi-functional printers, point-of-sales terminals, video and audio recorders, medical instruments and car infotainment systems.

SATA NANDrive is a single device, solid state drive (SSD) that provides the functionality and compatibility of a complete SATA hard disk drive (HDD) in a 14 mm x 24 mm BGA package for easy, space saving mounting to a system motherboard. These products surpass traditional storage in their small size, security, reliability, ruggedness and low power consumption.

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

SATA NANDrive is pre-programmed with a 10-Byte unique serial ID and has the option of programming an additional 10-Byte serial ID for even greater system security.

SATA NANDrive's advanced NAND management technology enhances data reliability and security, improves endurance and accurately estimates the remaining life of the NAND flash devices. This innovative technology combines robust NAND controller hardware error correction capabilities with advanced wear-leveling algorithms and bad block management to significantly extend the life of the product.

SATA NANDrive devices are offered in a 145-ball BGA, 1 mm ball pitch package.

## **1.0 GENERAL DESCRIPTION**

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

### **1.1 Optimized SATA NANDrive**

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

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

The MCU translates SATA commands into data and control signals required for flash media operation.

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

SATA 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 SATA NANDrive. The PMU dramatically reduces the power consumption of SATA NANDrive by putting the part of the circuitry that is not in operation into sleep mode.<sup>3)</sup>

The Flash File System handles inadvertent power interrupts and has auto-recovery capability to ensure SATA NANDrive firmware integrity. For regular power management, the host must send a STANDBY\_IMMEDIATE (E0h), IDLE\_IMMEDIATE (E1h), STANDBY (E2h) or IDLE (E3h) command and wait for command ready before powering down SATA NANDrive.

<sup>3)</sup> For management of the Sleep Mode, refer to "SATA NANDrive Application Design Guide."

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

The embedded flash file system is an integral part of SATA 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 the flash writes across all memory address space to increase the longevity of flash media
3. Keeps track of data file structures
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 SATA 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 SATA NANDrive after the reflow process.

## **1.3 Advanced NAND Management**

SATA 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

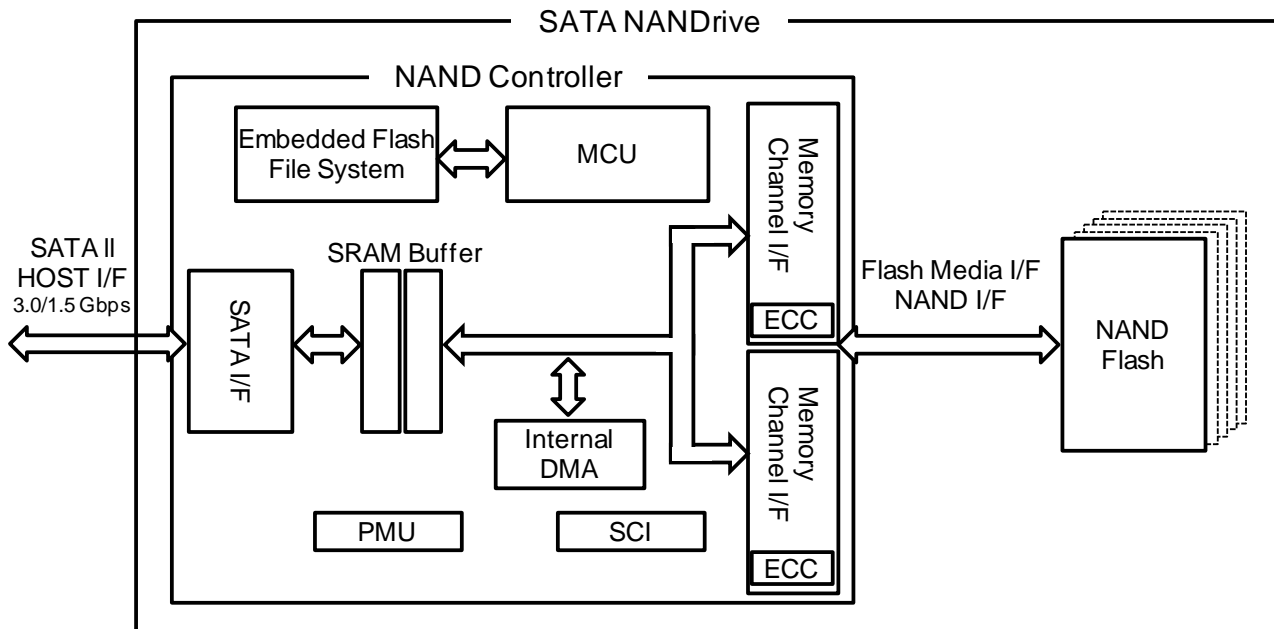
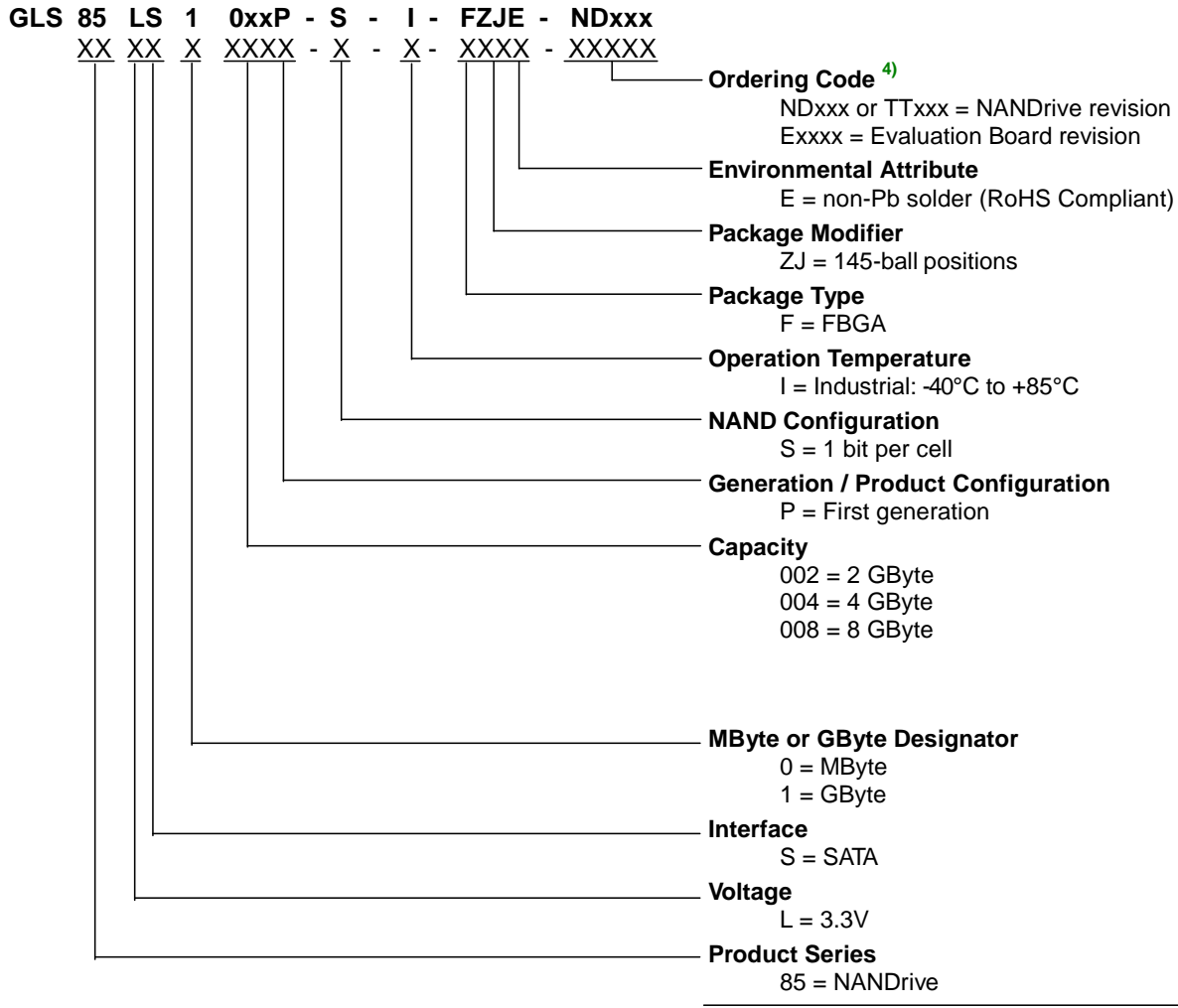


Figure 2-1: SATA NANDrive Block Diagram

**3.0 PRODUCT ORDERING INFORMATION**



4) 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: SATA NANDrive Product Valid Ordering Numbers**

Capacity	Operating Temperature	Part Number	Package
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-FZJE	FZJE, 14x24x1.95mm
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-FZJE-ND104	FZJE, 14x24x1.95mm
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-FZJE-TT095*	FZJE, 14x24x1.95mm
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-FZJE	FZJE, 14x24x1.95mm
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-FZJE-ND104	FZJE, 14x24x1.95mm
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-FZJE-TT095*	FZJE, 14x24x1.95mm
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-FZJE	FZJE, 14x24x1.95mm
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-FZJE-ND101	FZJE, 14x24x1.95mm
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-FZJE-ND104	FZJE, 14x24x1.95mm
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-FZJE-TT095*	FZJE, 14x24x1.95mm

\* TT095 products include enhanced support for TRIM command and power management in Windows environments.

**Table 3-2: SATA NANDrive Evaluation Board Valid Ordering Numbers**

Capacity	Operating Temperature	Part Number	Form Factor
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1S-K	Module with SATA connector
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1S-ED104	Module with SATA connector
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1S-ET095	Module with SATA connector
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1S-K	Module with SATA connector
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1S-ED104	Module with SATA connector
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1S-ET095	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-K	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-ED101	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-ED104	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-ET095	Module with SATA connector
Capacity	Operating Temperature	Part Number	Form Factor
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1S-K	Module with SATA connector
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1S-ED104	Module with SATA connector
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1S-ET095	Module with SATA connector
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1S-K	Module with SATA connector
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1S-ED104	Module with SATA connector
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1S-ET095	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-K	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-ED101	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-ED104	Module with SATA connector
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1S-ET095	Module with SATA connector

**Table 3-3: SATA NANDrive miniSATA Evaluation Board Valid Ordering Numbers**

Capacity	Operating Temperature	Part Number	Form Factor
2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1MS-K	JEDEC MO-300

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Industrial Grade **SATA NANDrive™**



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2GB	Industrial (-40°C to 85°C)	GLS85LS1002P-S-I-1MS-ED104	JEDEC MO-300
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1MS-K	JEDEC MO-300
4GB	Industrial (-40°C to 85°C)	GLS85LS1004P-S-I-1MS-ED104	JEDEC MO-300
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1MS-K	JEDEC MO-300
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1MS-ED101	JEDEC MO-300
8GB	Industrial (-40°C to 85°C)	GLS85LS1008P-S-I-1MS-ED104	JEDEC MO-300

### 3.1 Package Diagram

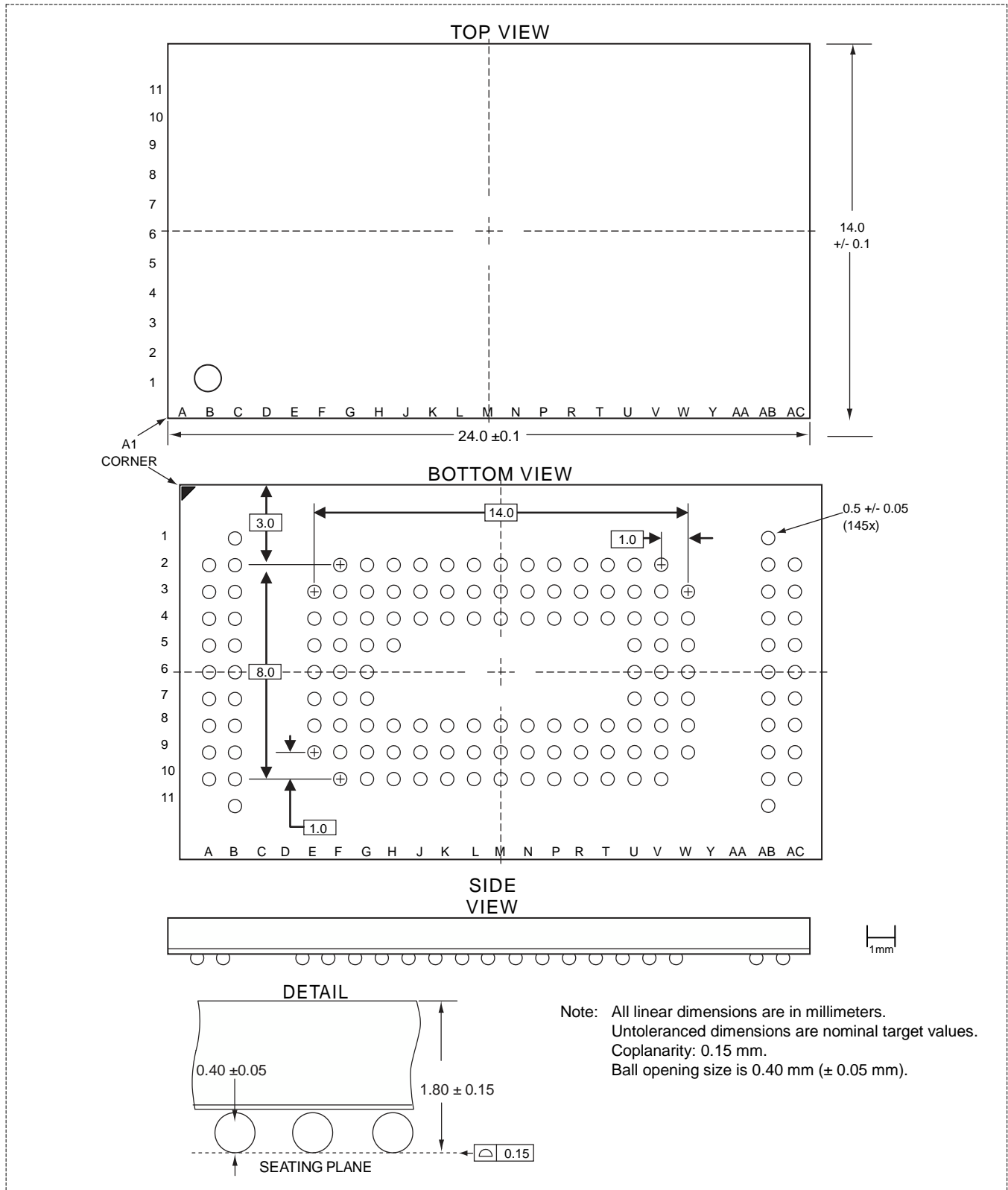


Figure 3-1: SATA NANDrive 145-Ball, Ball Grid Array (BGA) Greenliant Package Code: FZJ

## Revision History

Revision	Description	Date
01.000	Initial release of Fact Sheet for GLS85LS1002P/1004P/1008P	October 17, 2011
01.001	Updated Table 3-1	December 22, 2011
01.002	Corrected typo in Table 3-1	March 12, 2012
02.000	Added part numbers GLS85LS1016P/1032P and updated Section 1.2	April 9, 2012
02.100	Separated part numbers GLS85LS1016P/1032P to document S71445-F Updated Table 3-1 and Section 4.0	January 18, 2013
02.101	Removed Table 3-1	April 17, 2013
02.200	Updated Power Specifications Added information for part number GLS85LS1008P-S-I-FZJE-ND104	November 21, 2013
03.000	Added information for part numbers GLS85LS1002P-S-I-FZJE-ND104 and GLS85LS1004P-S-I-FZJE-ND104	February 25, 2014
03.001	Updated Section 1.1.3	May 09, 2014
04.000	Added GLS85LS1002P/1004P/1008P part numbers with the TT095 suffix	October 19, 2016
04.100	Added Evaluation Board part numbers with the ET095 suffix	July 10, 2018

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