

## Features

- **Industry Standard PCIe Host Interface**
  - PCIe Gen3x4
  - PCI Express Base Revision 3.1 compliant
  - NVMe 1.4c compliant
- **Performance**
  - Sequential data read: Up to 2,400 MB/s
  - Sequential data write: Up to 1,480 MB/s (measured using 128KB transfer size)
- **Power Management**
  - 3 power supplies (PWR\_1/2/3 = 3.3V/1.8V/0.9V)
  - Autonomous power state transition (APST)
  - Active state power management (ASPM)
  - Supports L1.2 link state
- **Power Consumption**
  - Active mode (typical):
    - 160GB: 2,698 mW
    - 80GB: 2,630 mW
    - 40GB: 1,645 mW
    - 20GB: 1,278 mW
  - Idle/Slumber mode (typical): 108 mW/57 mW
  - Sleep mode (typical): 3.84 mW (160GB)
- **Data Protection**
  - End-to-end data path protection
  - AES-256 encryption engine
  - Hardware Crypto Erase (HCE)
  - Secure erase / Data sanitization
  - Host Controlled Thermal Management (HCTM)
  - Thermal throttling
- **Supports up to 4 Namespaces**
- **Boot Partition**
- **Replay Protected Memory Block (RPMB)**
- **Host Memory Buffer (HMB)**
- **Volatile Write Cache (VWC)**
- **Field Firmware Update (FFU)**
- **Supports SMART and TRIM Commands**
- **Power Loss Notification**
- **Command Queuing**
  - 1 Admin queue and 8 IO queues supporting up to 128 commands per queue
- **Dynamic and Static Wear-Leveling**
- **Bad Block Management**
- **Built-in ECC**
  - Uses advanced LDPC bit error detection and correction optimized for 3D NAND
- **NAND Configuration**
  - 1 bit per cell (SLC)
  - Designed with Greenliant's advanced EnduroSLC™ Technology
- **High Endurance**
  - GLS85LE1xxxG  
P/E cycles: 75K, TBW (160GB): 6,700
  - GLS85LE1xxxQ  
P/E cycles: 150K, TBW (160GB): 13,400
- **Operating Temperature Range**
  - Industrial: -40°C to 95°C (Tc)
- **BGA Package**
  - 16.0 mm x 20.0 mm x 1.40 mm, 291-ball, 0.8 mm ball pitch, LTE (LFBGA)
  - 16.0 mm x 20.0 mm x 1.85 mm, 291-ball, 0.8 mm ball pitch, F1TE (FBGA)
- **All Devices are RoHS Compliant**

- Notes:
1. User capacity: 1GB = 1 billion bytes
  2. PCIe = Peripheral Component Interconnect Express
  3. NVMe = Non-Volatile Memory Express
  4. P/E cycles = NAND Program/Erase cycles
  5. TBW = TeraBytes Written
  6. Tc = Case surface temperature

## Product Description

The GLS85LE1xxxG / 85LE1xxxQ Industrial Grade NVMe NANDrive™ EX Series (referred to as "NVMe NANDrive" in this datasheet) are high-performance, high-reliability solid state drives (SSDs). They combine an advanced Greenliant NAND controller with 20, 40, 80 or 160 GBytes of NAND flash memory in a multi-chip package.

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

memory's program/erase (P/E) cycles and minimizes write amplification.

NVMe NANDrive's advanced NAND management technology improves endurance, enhances data security and helps prevent data corruption during unexpected power failure events. This innovative technology combines robust NAND controller hardware error correction capabilities with advanced wear-leveling algorithms and bad block management to improve data reliability and significantly extend the life of the product. NVMe NANDrive is ideal for high-reliability industrial and networking systems which need low latency and fast performance.

## 1.0 GENERAL DESCRIPTION

Each NVMe NANDrive module integrates an NVMe PCIe NAND flash memory controller with discrete NAND flash die in a BGA package. Refer to Figure 2-1 for the NVMe NANDrive block diagram.

### 1.1 Optimized NVMe NANDrive

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

#### 1.1.1 Microcontroller Unit (MCU)

The MCU translates PCIe / NVMe commands into data and control signals required for flash media operation.

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

NVMe 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 NVMe NANDrive. The PMU dramatically reduces the power consumption of NVMe 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 NVMe NANDrive firmware integrity.

#### 1.1.4 Embedded Flash File System

The embedded flash file system is an integral part of NVMe 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

#### 1.1.5 Error Checking and Correction (ECC)

The ECC technology uses advanced LDPC algorithms to detect and correct errors, ensuring data integrity and extending the SSD lifespan.

#### 1.1.6 Multi-tasking Interface

The multi-tasking interface enables concurrent Read, Program and Erase operations to multiple NAND flash media.

### 1.2 EnduroSLC™ Technology

EnduroSLC™ is a proprietary 3D NAND management technology developed by Greenliant for high reliability applications requiring ultra-high endurance and superior data retention. Using 1-bit-per-cell (SLC) NAND configuration, EnduroSLC enabled SSDs are ideal for write-intensive applications used in extreme temperature, high stress environments. EnduroSLC enabled solid state drives offer a high reliability flash storage solution with ultra-high write endurance that exceeds capabilities of legacy, planar SLC NAND based products.

### 1.3 SMT Reflow Consideration

Preprogrammed NAND devices have temperature limits due to data retention. The EnduroSLC NVMe NANDrive family can withstand multiple passes of SMT high temperature process without losing data. Using Greenliant's recommended reflow profile during production will help prevent damage to the device and ensure better retention of any preprogrammed data through the surface-mount soldering process. See the relevant datasheet section describing the recommended reflow temperature limits.

### 1.4 Advanced NAND Management

NVMe NANDrive's 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.

### 1.5 Advanced Data Security

Advanced data security measures include end-to-end data path protection, data sanitization (Secure Erase) support and Hardware cryptographic erase. Secure Erase is an effective method to quickly wipe all data from a PCIe-based SSD using the NVMe protocol (Format NVM). NVMe NANDrive's controller supports industrial standard AES-256 encryption to protect sensitive user data. Hardware Cryptographic Erase resets the cryptographic keys of the NVMe NANDrive SSD, making all encrypted user data useless.

## 2.0 FUNCTIONAL BLOCKS

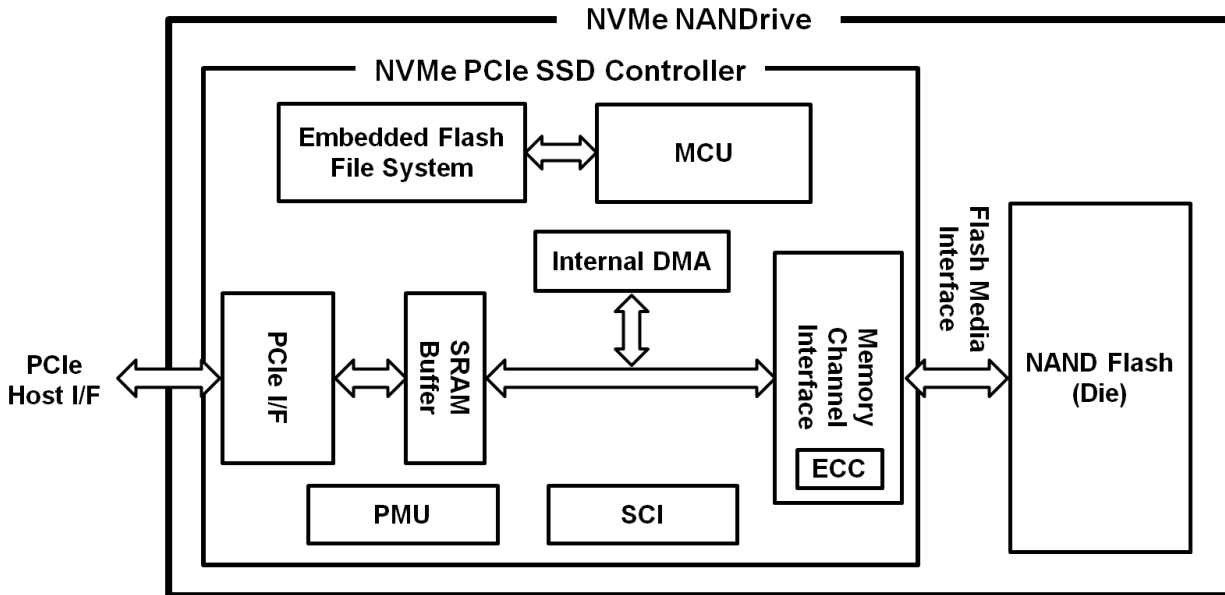
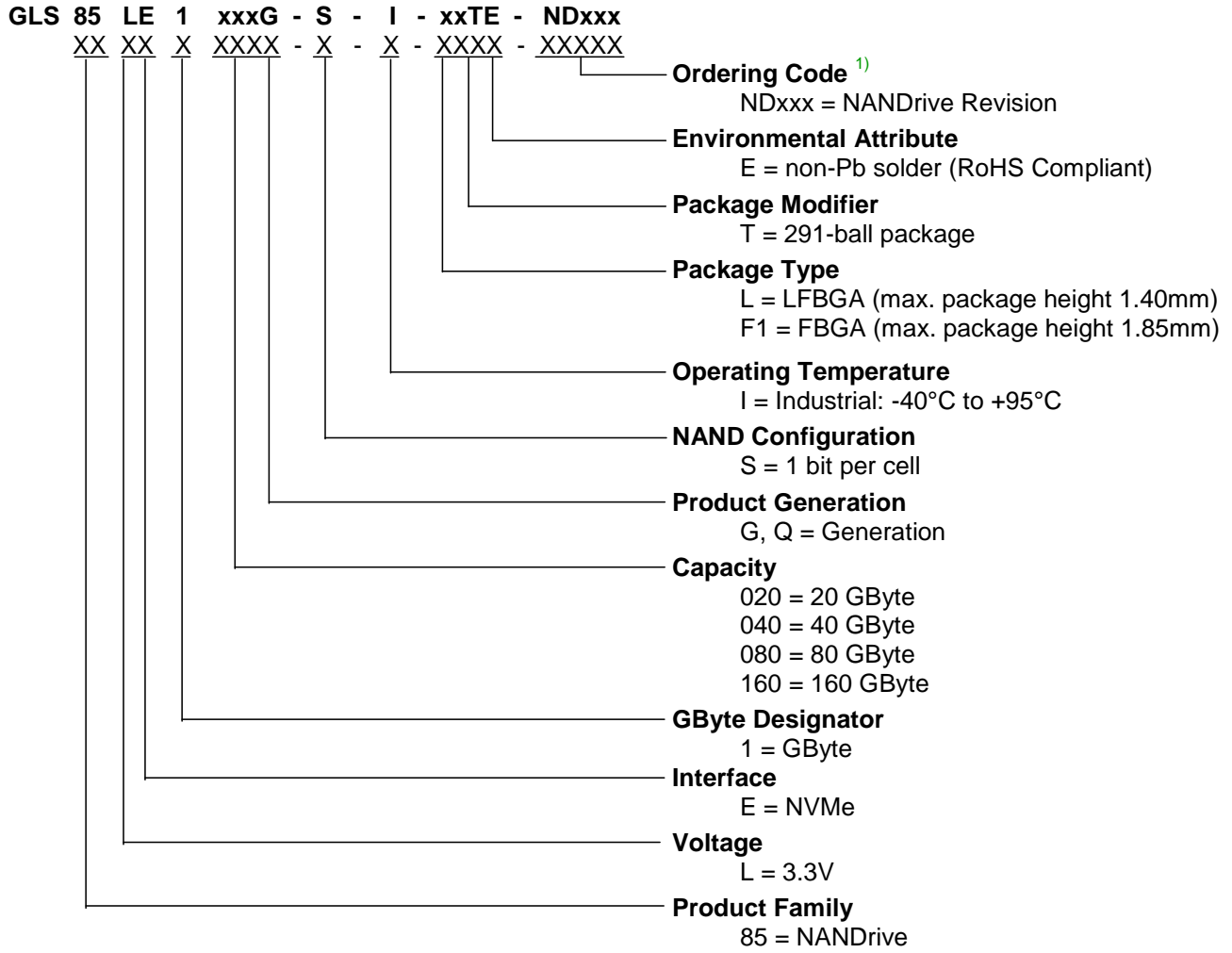


Figure 2-1: NVMe NANDrive Block Diagram

### 3.0 Product Ordering Information



1) Note that the top side marking on the package typically does not include ordering codes (e.g. NDxxx), unless it is a special custom specification (C-SPEC) 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: NVMe NANDrive Product Valid Ordering Numbers**

Capacity	Operating Temperature	Part Number	Package
20GB	Industrial (Tc = -40°C to 95°C)	GLS85LE1020G-S-I-LTE-ND301	LTE, 16x20x1.40mm
		GLS85LE1020Q-S-I-LTE-ND302	
40GB	Industrial (Tc = -40°C to 95°C)	GLS85LE1040G-S-I-LTE-ND301	LTE, 16x20x1.40mm
		GLS85LE1040Q-S-I-LTE-ND302	
80GB	Industrial (Tc = -40°C to 95°C)	GLS85LE1080G-S-I-LTE-ND301	LTE, 16x20x1.40mm
		GLS85LE1080Q-S-I-LTE-ND302	
160GB	Industrial (Tc = -40°C to 95°C)	GLS85LE1160G-S-I-F1TE-ND301	F1TE, 16x20x1.85mm
		GLS85LE1160Q-S-I-F1TE-ND302	

### 3.1 Package Diagrams

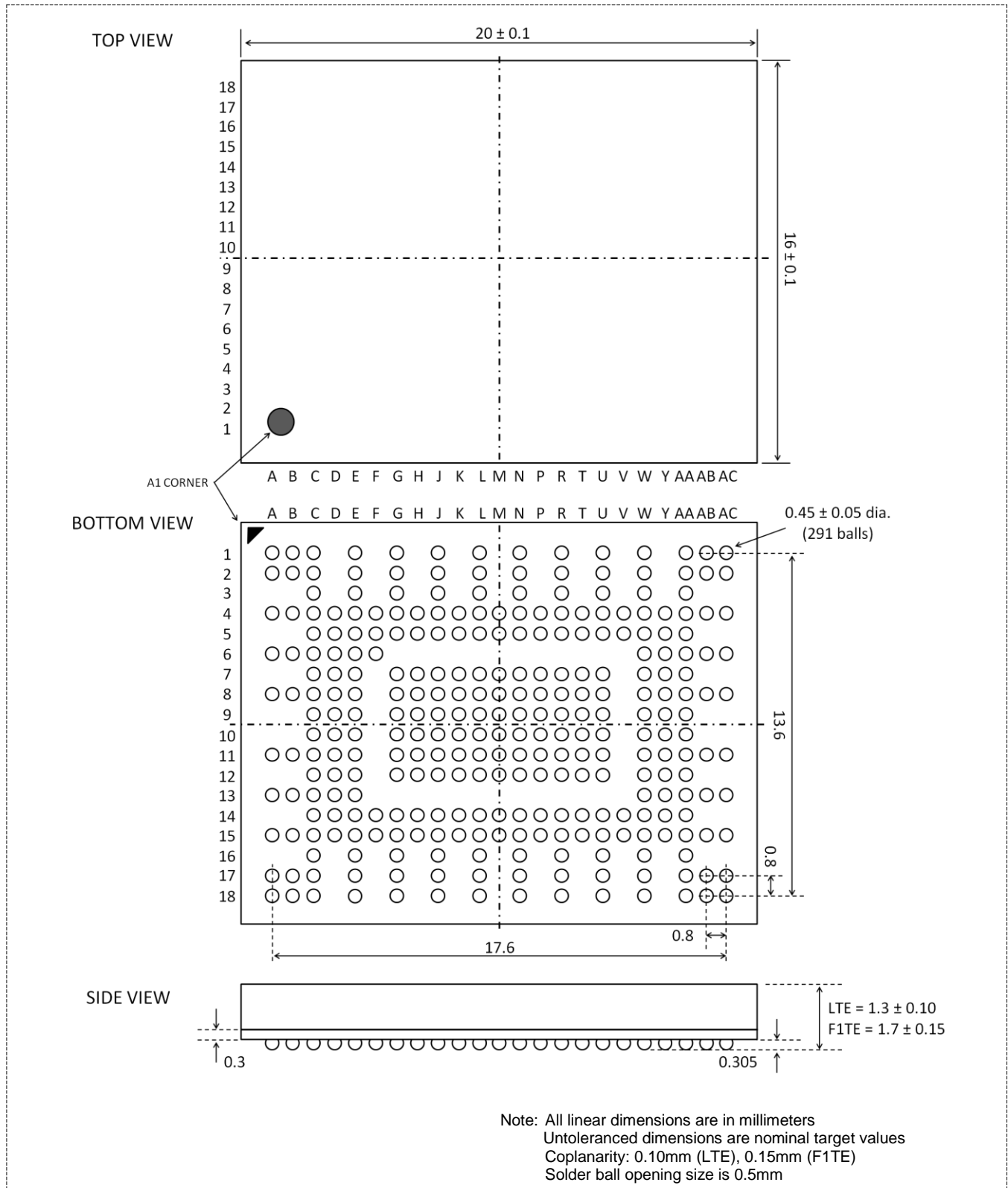


Figure 3-2: NVMe NANDrive 291-Ball, Ball Grid Array (BGA)

## Revision History

Number	Description	Date
00.100	Initial Release as Advance Factsheet	January 26, 2024
00.101	Updated Idle and Sleep mode on page 1	March 22, 2024

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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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