G32U1T9R / G32U3T8R / G32U7T6R
SATA 2.5" Industrial Enterprise SSD PX Series

Greenliant®

Features

- **Capacity**
  - 1.92TB, 3.84TB, 7.68TB (formatted)
- **Industry Standard SATA Host Interface**
  - SATA 1.5Gb/s, 3Gb/s and 6Gb/s
  - SATA Revision 3.2
  - Native Command Queuing (NCQ)
  - Boot support
  - Hot pluggable
- **Performance**[1]
  - Sequential Read (128KB): up to 560MB/s
  - Sequential Write (128KB): up to 530MB/s
  - Random Read (4KB): up to 80K IOPS
  - Random Write (4KB): up to 23K IOPS
- **Performance Consistency**
  - Read/Write: up to 90%/90% (99.9%)
  - Consistent latency and IOPS performance
  - Excellent sustained performance across industrial temperature range
  - On-board DRAM for enhanced performance
- **Latency**[2]
  - Sequential Read/Write: 80µs/30µs (typical)
  - Random Read/Write: 150µs/40µs (typical)
- **Quality of Service (QoS)**
  - Read/Write: 300µs/200µs (99.0%)
  - Read/Write: 300µs/800µs (99.99%)
- **Power Specifications**
  - 5V power supply
  - Active mode: 3.8W (typical)[3]
- **Operating System Compatibility**
  - CentOS 6.5 / 7.0/7.4/7.5 64-bit
  - RHEL 6.5/7.0/7.4/7.5 64-bit
  - MS Windows Server 2008/2012/2016 64-bit
  - VMware ESXi 6.0/6.5/7.0
  - NeoKylin
  - Deepin
- **Data Retention**
  - 10 years at <10% of SSD endurance used
  - 1 year at 100% of SSD endurance used

- **Endurance**
  - 2 Drive Writes Per Day (DWPD) for 5 years
  - 1.92TB: 6,900 TBW (TeraBytes Written) / 3.84TB: 13,800 TBW / 7.68TB: 27,600 TBW
- **Reliability**
  - Mean Time Between Failures (MTBF): 2 million hours[4]
  - Static and dynamic wear leveling
  - On-Chip Adaptive RAID protects data from block or die failure and provides reliable failover
  - Unrecoverable Bit Error Rate (UBER): < 1 sector per 10^{27} bits read, enhanced by RAID
  - End-to-end data path protection (local CRC) ensures high data integrity
  - Read-only mode support when there is not enough reserved drive space
  - Self-monitoring, analysis and reporting technology (SMART) command set
- **Enhanced Power Loss Data Protection**
  - On-board power loss protection (PLP) circuitry
- **Data Security**
  - Hardware-based AES-256 encryption
  - Secure erase / Crypto erase support
- **Industrial 3D TLC NAND Flash**
- **Operating Temperature Range**[5]
  - Industrial: -40°C to +85°C
- **2.5-inch Form Factor**
  - 100.45mm x 69.85mm x 9.50mm
- **CE and FCC Certifications**
- **RoHS Compliant**

1. Performance values may differ based on system configuration, workload and SSD capacity
2. Average latency values (iodepth=1, jobs=1)
3. Active average power measured during sequential read operations for the 1.92TB SSD
4. Calculated based on the Telcordia SR-322 standard for the reliability prediction of electronic equipment
5. Operating temperature is case temperature

Product Description

The G3200 Industrial Enterprise SATA 2.5" PX Series (referred to as "2.5" Industrial Enterprise SSD" in this datasheet) are high-performance, high-reliability solid state drives, built with NAND flash memory, DRAM and an advanced Serial ATA (SATA) controller in a standard 2.5-inch form factor housing.

Greenliant's advanced SATA SSD controller with intelligent NAND management firmware communicates with the host through the standard SATA protocol. The firmware effectively optimizes the use of NAND flash memory's program/erase (P/E) cycles, improves endurance, enhances data security and minimizes write amplification, extending the lifespan of aging NAND and achieving the longest device lifetime possible.

Greenliant's On-Chip Adaptive RAID technology helps seamless data recovery when NAND page, block, or die failure is encountered. Greenliant's NAND management technology combines robust 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. 2.5" Industrial Enterprise SSDs are ideal for high-reliability datacenter, industrial, video, networking, transportation and aerospace applications.

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1.0 GENERAL DESCRIPTION

Each 2.5" Industrial Enterprise SSD integrates a SATA SSD controller with NAND flash multi-chip packages, DRAM, on-chip adaptive RAID and hardware-based power loss protection circuitry in a standard 2.5-inch form factor housing.

1.1 2.5" Industrial Enterprise SSD

The heart of the 2.5" Industrial Enterprise SSD is the SSD controller, which translates standard SATA signals into flash media data and control signals. The following components contribute to the 2.5" Industrial Enterprise SSD's operation.

1.1.1 Industrial Enterprise SSD Controller

The 2.5" Industrial Enterprise SSD's controller is an advanced ASIC which has been built for high-capacity drives with sustained high performance and consistent, low latency operations.

1.1.2 Internal Direct Memory Access (DMA)

The 2.5" Industrial Enterprise SSD uses internal DMA allowing instant data transfer from/to buffer to/from flash media.

1.1.3 Power Management Unit (PMU)

The PMU controls the power consumption of the 2.5" Industrial Enterprise SSD. The Flash File System handles inadvertent power interrupts and has auto-recovery capability to ensure the 2.5" Industrial Enterprise SSD's user data integrity. For regular power management, the host must send an IDLE_IMMEDIATE command and wait for command ready before powering down the drive.

1.1.4 Embedded Flash File System

The embedded flash file system is an integral part of the 2.5" Industrial Enterprise SSD. 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 On-Chip Adaptive RAID

By default, the 2.5" Industrial Enterprise SSD uses 15+1 RAID. When an uncorrectable read error occurs in one NAND die, the SSD will quickly reconstruct the affected data from the data on the other 15 NAND die in the same RAID group. This RAID group will be seamlessly reconfigured to ensure continuous data loss protection, without affecting the user capacity.

1.1.6 Power Interrupt Data Protection

Power Interrupt Data Protection is a mechanism to help prevent data corruption during unexpected power failure events. Enhanced data integrity is supported by the on-board power loss protection (PLP) circuitry with power hold-up capacitors and the SSD controller's advanced firmware. The controller also proactively optimizes the amount and stay time of the "in-flight" data residing in the cache.

1.1.7 Error Checking and Correction (ECC)

The 2.5" Industrial Enterprise SSD uses advanced ECC technology to detect and correct errors, ensuring data integrity and extending the SSD lifespan.

1.1.8 Multi-tasking Interface

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

1.2 Intelligent NAND Management

The 2.5" Industrial Enterprise SSD's SATA 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, superior data retention and higher reliability required by long-life applications.

1.3 Advanced Data Security

Advanced data security measures include end-to-end data path protection, data sanitization (Secure Erase) and hardware-based data encryption. Secure Erase is an effective method to quickly wipe all data from a SATA-based SSD using the SATA protocol. Cryptographic erase (Crypto Scramble) resets the cryptographic key making all encrypted user data useless. The 2.5" Industrial Enterprise SSD's controller supports industry standard AES-256 encryption to protect sensitive user data.

2.0   APPENDIX
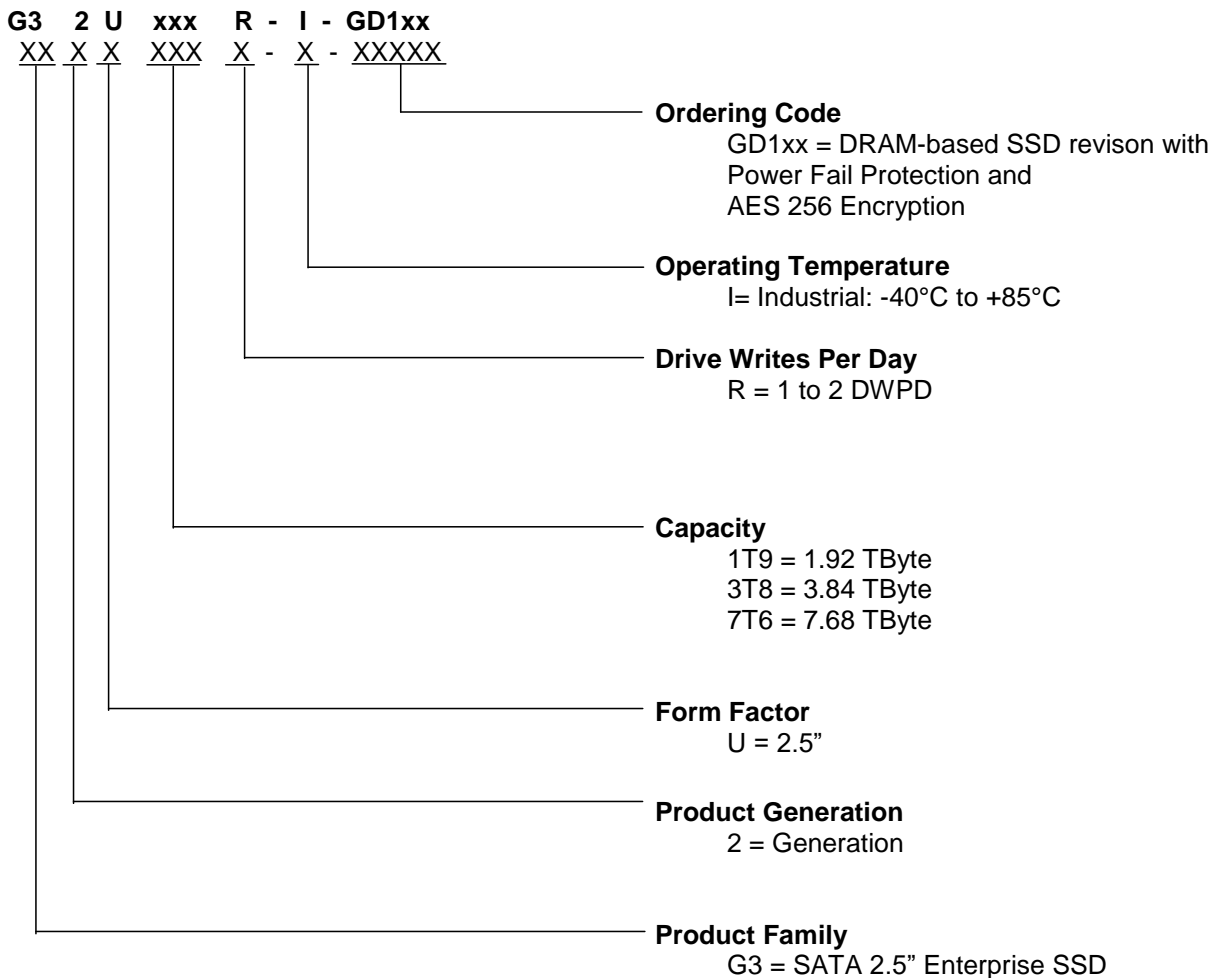
2.1   Product Ordering Information

```
G3   2 U   xxx   R - I - GD1xx
XX   X X   XXX   X - X - XXXXX
```

Ordering Code
GD1xx = DRAM-based SSD revison with
Power Fail Protection and
AES 256 Encryption

Operating Temperature
I= Industrial: -40°C to +85°C

Drive Writes Per Day
R = 1 to 2 DWPD

Capacity
1T9 = 1.92 TByte
3T8 = 3.84 TByte
7T6 = 7.68 TByte

Form Factor
U = 2.5"

Product Generation
2 = Generation

Product Family
G3 = SATA 2.5" Enterprise SSD

Table 2-1: 2.5" Industrial Enterprise SSD Product Valid Ordering Numbers

| Capacity	Operating Temperature	Part Number	Form Factor
1.92TB	Industrial (-40°C to 85°C)	G32U1T9R-I-GD130	2.5-inch
	Industrial (-40°C to 85°C)	G32U1T9R-I-GD133	2.5-inch
3.84TB	Industrial (-40°C to 85°C)	G32U3T8R-I-GD130	2.5-inch
	Industrial (-40°C to 85°C)	G32U3T8R-I-GD133	2.5-inch
7.68TB	Industrial (-40°C to 85°C)	G32U7T6R-I-GD130	2.5-inch
	Industrial (-40°C to 85°C)	G32U7T6R-I-GD133	2.5-inch

2.2 Mechanical Diagrams
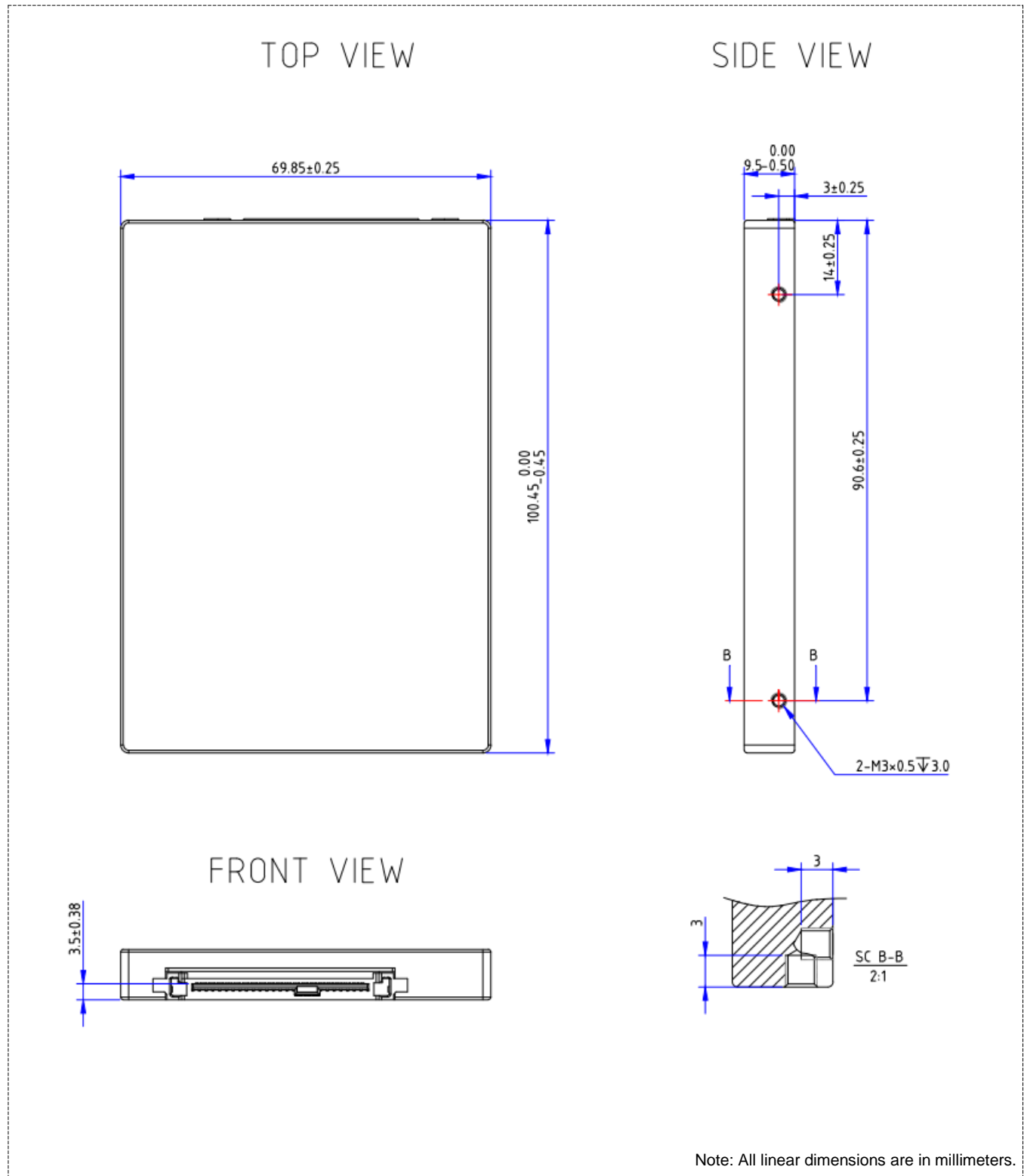
Figure 2-1: 2.5" Industrial Enterprise SSD Dimensions

2.3 Revision History

Revision	Description	Date
01.000	Initial release as factsheet	March 17, 2023

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