G7101/G7102
G-card™ (Greenliant PCIe flash card)

Fact Sheet 01.000
December 2014

Features

- **Industry Standard PCI Express (PCIe) Interface**
  - Compliant with PCIe 2.0
  - Compatible with NVM Express (NVMe) 1.0d
- **User Capacity (Raw)**
  - **G7101**: 900 GB (1.37 TB)
  - **G7102**: 1.8 TB (2.75 TB)
- **Form Factor**
  - PCI Express 2.0 x4 flash card
  - Full Height, Half Length (FHHL)
- **Sequential Performance**
  - Read: 875 MB/sec (typical)
  - Write: 850 MB/sec (typical)
- **Random Performance**
  - Read (4KB): 130K IOPS
  - Write (4KB): 65K IOPS
- **Concurrent Sequential Read and Write**
  - 900MB/s (typical)
- **Latency**
  - Sequential Read/Write: 80µs/20µs (typical)
  - Random Read/Write: 130µs/22µs (typical)
- **Host Interface**
  - PCI Express x4 (fits into any x4, x8 and x16 non-graphics card slot)
- **Supports SMART Commands**
- **Built-in Hardware RAID**
- **Dedicated Power Interrupt Data Protection**
- **Power Specifications**
  - 12V supply rail
  - Active mode: 25W (typical)
  - Idle mode: 12W (typical)
- **Operating Temperature Range**
  - 0°C to 55°C with 200 Linear Feet per Minute (LFM) airflow
- **Operating System Compatibility**
  - MS Windows Server 2008 R2 64-bit
  - MS Windows Server 2012 R2 64-bit
  - CentOS 5.5/ 5.8/ 5.10 64-bit
  - CentOS 6.3/ 6.4/ 6.5 / 7.0 64-bit
  - RHEL 6.0/6.1/6.2/6.3/6.4/6.5 64-bit
  - RHEL 7.0 64-bit
  - Oracle Linux Server 6.5 64-bit
- **Lifetime Endurance**
  - Up to 10 Drive Writes Per Day (DWPD) for 5 years
- **Unrecoverable Bit Error Rate (UBER)**
  - 1 sector per 10^{28} bits read
- **RoHS Compliant**
- **Certifications**
  - CE
  - FCC

Product Description

The G7101 and G7102 Greenliant PCIe flash cards (referred to as "G-card" in this data sheet) are high-reliability solid state storage solutions designed for demanding enterprise and Internet datacenter applications. They combine Greenliant's advanced G-card Controller and an array of forty (40) NANDrive™ ball grid array (BGA) solid state drives (SSDs) organized in eight (8) RAID groups on a printed circuit board (PCB) with built-in power interrupt data protection.

G-card products surpass traditional storage in their high performance and are ideal for mission critical I/O intensive applications that require sustainable low latency, large capacity data storage in a PCIe form factor.

For added flexibility, G-card user capacity can be configured depending on the application's performance and capacity requirements.

The G-card Controller's advanced architecture supports concurrent read and write operations with consistently low latency, bringing a sustained, predictable performance experience to cloud computing, server virtualization, big data and virtual desktop infrastructure (VDI). By utilizing on-board buffer DRAM memory and a power interrupt data protection circuit, G-card can commit host write operations without risk of data loss.

Greenliant's industry leading NANDrive technology is incorporated in G-card products to offer the highest reliability and rich functionality. NANDrive is equipped with advanced NAND management algorithms that enhance data reliability, improve endurance and accurately estimate the remaining life of the NAND flash devices.

In addition to the Error Correction Code (ECC) engine inside NANDrive, G-card is equipped with built-in hardware RAID, which provides a higher level of protection against uncorrectable errors (UNC).

The G7101 and G7102 G-card products are offered in full-height, half-length PCIe x4 form factor. Refer to Figure 6-1 for G-card dimensions.

1.0 GENERAL DESCRIPTION

Each G7100 series G-card product contains Greenliant's advanced G-card Controller, an array of forty (40) NANDrive SSDs organized in eight (8) RAID groups and power interrupt data protection. The industry standard PCI Express form factor, sustained performance and high reliability enable G-card to be the ideal storage solution for enterprise applications that require high responsiveness, sustained throughput and superior reliability. Refer to Figure 2-1 for the G-card block diagram.

2.0 FUNCTIONAL BLOCKS

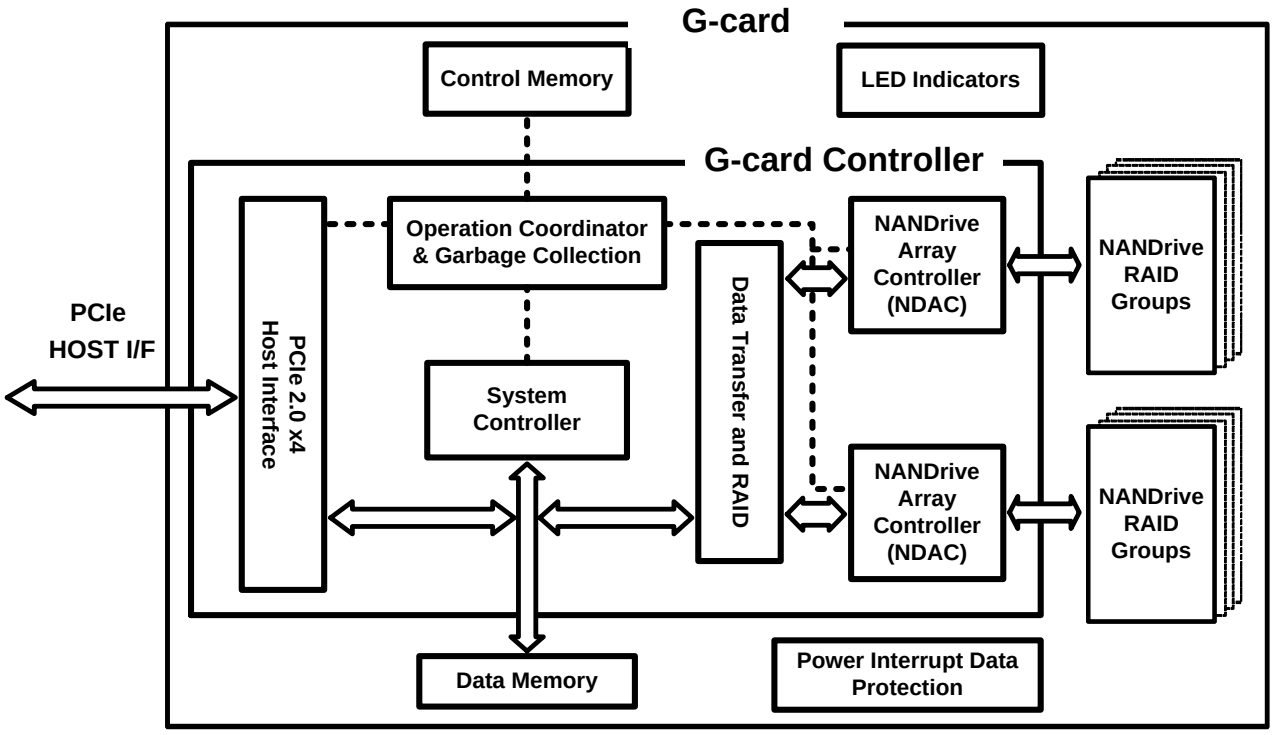


Figure 2-1: G-card Block Diagram

2.1 G-card Features

The heart of G-card is the G-card Controller, which receives and executes IO and administrative commands from the host, and manages data transfer with built-in RAID and onboard NANDrive RAID groups. The following components contribute to G-card's operation.

2.1.1 G-card Controller

The G-card Controller translates NVMe commands into control commands required for flash media operations. The G-card Controller is an integral part of G-card that performs the following tasks:

1. Translates host side commands into internal data writes and reads.
2. Coordinates operations and garbage collection to maximize performance while offering high reliability and prolonging product life.
3. Performs hosts administrative commands
4. Manages data transfers to achieve sustained low read and write latency.
5. Efficiently manages the address space.

2.1.2 Built-in RAID Functionality and NANDrive RAID Groups

The G-card Controller is equipped with hardware RAID that controls an array of forty NANDrive SSDs organized in eight RAID groups. The built-in RAID substantially improves protection against uncorrectable errors.

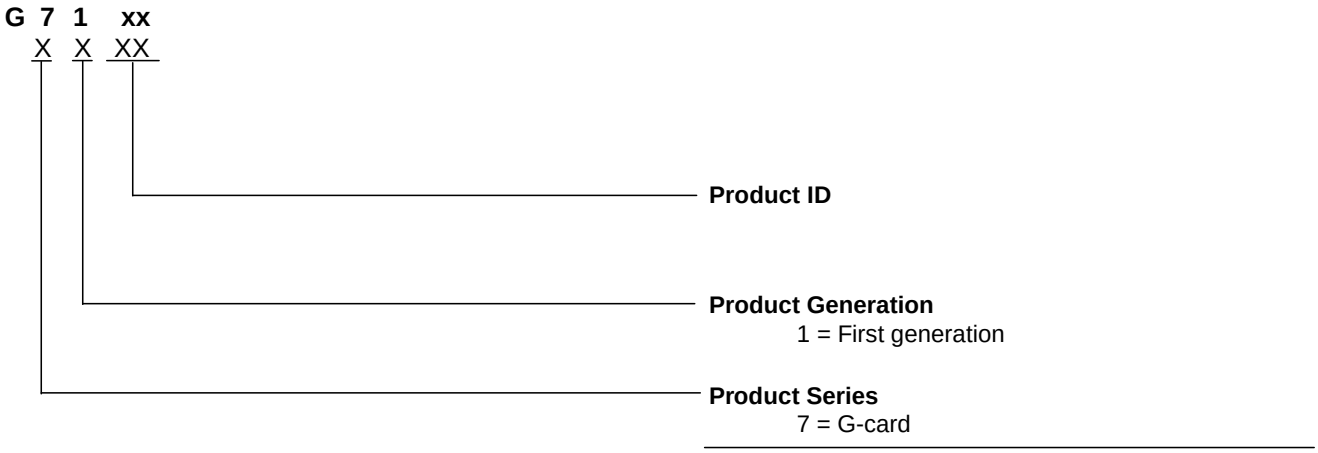
2.1.3 Control Memory and Cache

Control memory and cache are used during data transfer and background operations. By allowing write coalescing, G-card optimizes performance and supports low write latency.

2.1.4 Power Interrupt Data Protection

Dedicated power failure detection and backup power circuitry is built-in to prevent data integrity issues due to sudden power interruptions. To ensure the on-board backup power circuitry is fully discharged, it is recommended to wait for at least three minutes to power up G-card again after a power failure or a power down.

3.0 PRODUCT ORDERING INFORMATION

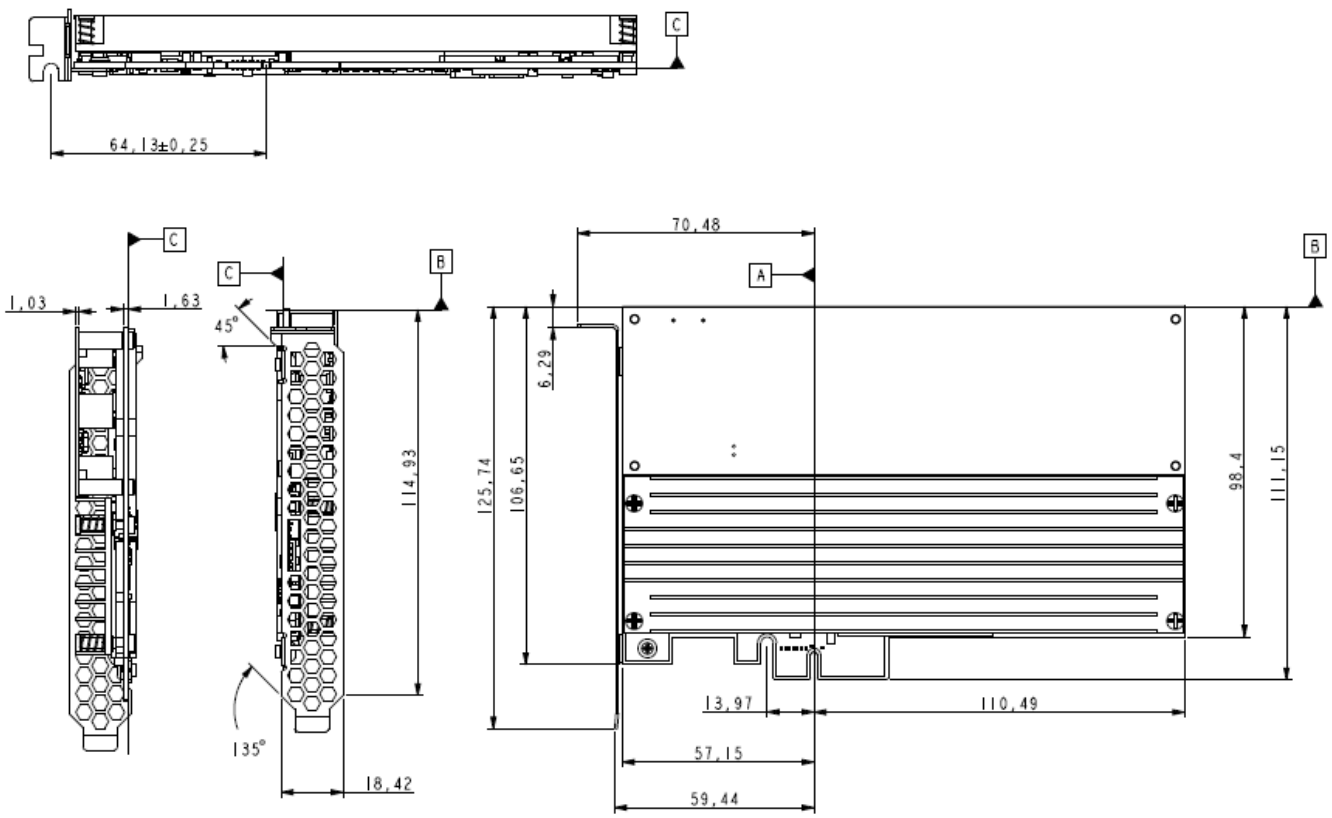


Valid Combinations
Valid product combinations are those that are in the mass production or will be in the mass production. Consult your Greenliant sales representative to confirm availability of the valid combinations and to determine availability of new product combinations.

Table 3-1: G-card Product Valid Ordering Numbers

Capacity	Operating Temperature	Part Number	Form Factor
1.37 TB	0°C to 55°C	G7101	PCI Express x4 (Full Height, Half Length)
2.75 TB	0°C to 55°C	G7102	PCI Express x4 (Full Height, Half Length)

3.1 Board Diagram



Note: All linear dimensions are in millimeters.
Tolerances on all dimensions are ± 0.15 mm, unless otherwise specified.

Figure 3-1: G-card Dimensions

4.0 REVISION HISTORY

Number	Description	Date
01.000	Initial release as Fact Sheet	December 23, 2014

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