Greenliant®

ASTUTE
Global Component Distribution

Product Guide

www.Greenliant.com | astute.global

By leveraging more than 25 years of solid state storage design expertise, Greenliant is dedicated to developing durable, reliable and secure storage solutions for embedded systems and enterprise datacenters. The company is headquartered in Silicon Valley with product development centers in Santa Clara, Beijing, Shanghai, Xiamen and Hsinchu.

Durability		**Longevity**
	**Reliability**	
Quality		**Security**

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Focus Markets

Automotive		• Black-box data recorder • Driver information system • GPS and telematics • Hands-free communications • In-vehicle infotainment
Communications & Networking		• Base station • Network firewall • Router / Switch • Server • VoIP gateway / PBX
Defense & Aerospace		• Black-box data recorder • Flight instrumentation • Imaging • Radar / Sonar
Industrial		• Factory automation system • Industrial panel PC • Single-board computer • Test & measurement instrumentation • Transportation system
Medical		• Data logger • Defibrillator • MRI and CAT scanner • Patient monitoring system • Ultrasound imaging
Video		• Digital signage • Internet TV • Set-top box • Video conferencing • Video surveillance
Security		• ATM / Banking • Point-of-Sale (POS) • Network security • Biometrics • Surveillance
Enterprise & Datacenter		• Big data analytics • Cloud computing system • High performance database • Online transaction processing • Virtual desktop infrastructure

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Greenliant was founded with a focus on providing industrial solid state storage solutions that meet the demands of long life embedded and enterprise applications in extreme environments. The company's first SSD controllers were developed at Silicon Storage Technology (SST) in the early 1990s, which Greenliant spun off from in May 2010. The company also pioneered the industry's first BGA SSD with a PATA interface in 2006. The original NANDrive™ BGA SSDs and ArmourDrive™ removable SSDs, based on planar NAND, were designed to serve the managed NAND requirements of the industrial, networking and automotive market segments.

With the introduction of 3D NAND, solid state storage devices are reaching higher reliability, performance and capacities that were not previously possible. To address different budgets, new markets and emerging applications, Greenliant has expanded its NANDrive and ArmourDrive lineup with a series of products based on 3D NAND. These new products include the value PX Series with 3D TLC NAND, the MX Series for customers who prefer higher endurance of 3D MLC NAND, and the premium EX Series with 3D SLC NAND for ultra-robust data retention and highest endurance. Rugged and reliable, the new NANDrive and ArmourDrive series provide a broad range of capacities and features to give customers more flexibility and control when selecting their data storage solutions.

New product series of removable and BGA SSDs with advanced, high reliability NAND controllers and next generation 3D NAND

EX	MX	PX	PX	PX
EX Series	**MX Series**	**PX Series**	**PX Series**	**PX Series**
I-temp SLC	I-temp MLC	I-temp TLC	C-temp TLC	D-temp TLC

Industrial (I-temp): -40°C to +85°C • Commercial (C-temp): 0°C to +70°C • Datacenter (D-temp): 0°C to +55°C

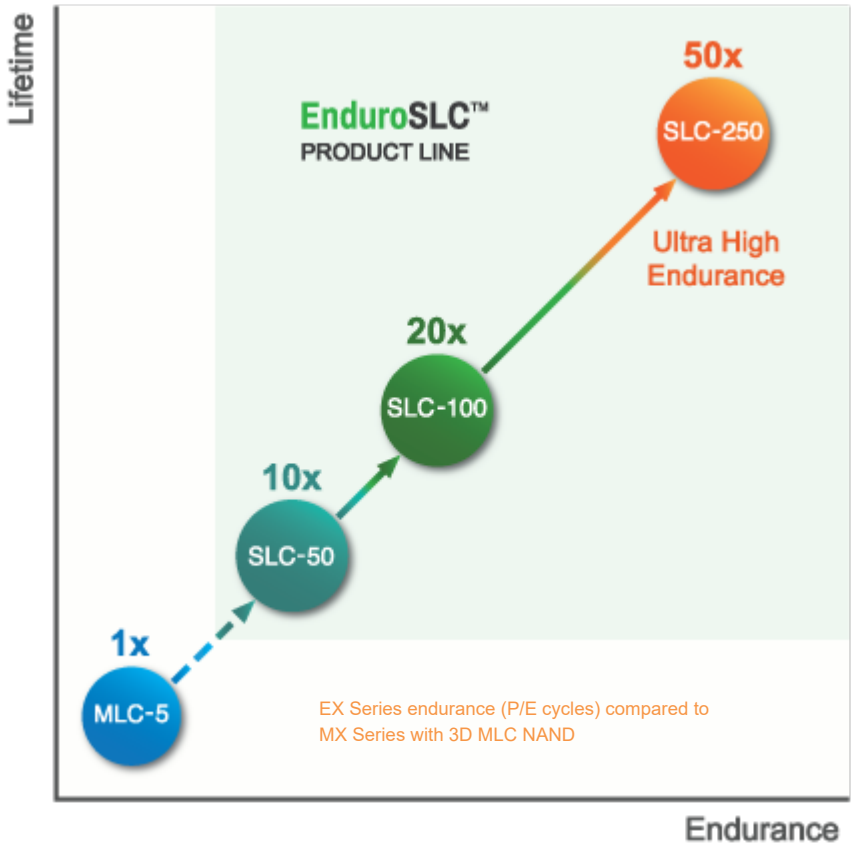
EnduroSLC™ Technology

Superior Data Retention and Endurance

EnduroSLC™ is a proprietary 3D NAND management technology developed by Greenliant for high reliability applications requiring superior data retention and endurance in extreme temperature, high stress environments. With advanced hardware ECC capabilities and NAND flash management algorithms, EnduroSLC Technology significantly extends the write endurance of 1-bit-per-cell (SLC) SSDs reaching industry leading 250K+ program-erase (P/E) cycles. EnduroSLC enabled products meet robust data retention requirements under complex temperature conditions and support wide cross-temperature ranges between data programming and reading. Due to its substantially lower bit error rate, an EnduroSLC SSD provides better consistency in read/write performance throughout product lifetime.

To address the most demanding longevity requirements, Greenliant offers high endurance EX Series NANDrive, Enterprise and ArmourDrive product lines with EnduroSLC Technology. The EX Series SSDs are available in industry standard M.2, mSATA, CFast, 2.5", U.2 and BGA form factors with various endurance specifications—50K, 100K and 250K+ P/E cycles (ultra-high endurance of 300K and above is available upon request).

Endurance Comparison



NAND Flash Configuration	Endurance P/E Cycles
MLC-5	5K
SLC-50	50K
SLC-100	100K
SLC-250	250K

NAND Controllers

NAND flash memory controllers used in Greenliant's solid state drives and memory cards resolve the inherent deficiencies of NAND flash through intelligent wear leveling, bad block management and power interrupt data protection. Their advanced functionality is critical for achieving prolonged product life and superior data integrity in data storage systems. An advanced Error Checking and Correction (ECC) engine ensures support of current and future NAND flash ECC requirements. Embedded reconfigurable firmware enables easy field updates at any stage of the product life cycle to address ever-evolving NAND flash technology.

With a focus on high reliability features, Greenliant maintains a leadership position in NAND controller know-how and SSD technology. Trusted for demanding embedded applications, NANDrive™ and ArmourDrive™ SSDs are available with SLC, MLC and TLC NAND to meet a wide range of system requirements for lifespan, capacity, performance and endurance. Committed to customers with long-life applications, Greenliant offers extended support through its Long-Term Availability (LTA) program.

Note: Greenliant uses best-in-class internally and externally developed controller IPs

NANDrive™ BGA SSDs

Available in three different interfaces (eMMC, PATA, SATA), Greenliant's NANDrive portfolio offers the broadest range of ball grid array (BGA) form factor SSDs for automotive, communications and networking, defense and aerospace, industrial, medical, security and video applications. As an integrated single-chip solution, NANDrive eliminates the need for long qualification cycles when there is a change of NAND flash technology. Customers need only qualify NANDrive as a mass storage subsystem.

NANDrive SSDs have the same ball print across all capacities in each device family for backward compatibility. Based on Greenliant's industrial grade NAND controllers, these versatile managed NAND devices enable compact, embedded systems that require rugged and reliable data storage. Greenliant offers both planar NAND and 3D NAND based NANDrive SSDs with 2-bit-per-cell (MLC) and 1-bit-per-cell (SLC) configurations. NANDrive EX Series products include eMMC 5.1 and SATA 6Gb/s SSDs with EnduroSLC Technology for ultra-robust data retention and ultra-high endurance, from 50K and 100K to market leading 250K+ program-erase cycles (endurance of 300K and above is available upon request).

NANDrive FAQs: www.greenliant.com/nandrive-faqs
Evaluation Boards: www.greenliant.com/nandrive-eval-boards
Long-Term Availability: www.greenliant.com/support/#LTA-program

eMMC NANDrive

Part Number	GLS85VM1xxxB	GLS85VM1xxxE/G/Q	GLS85VM1xxxC
Interface	eMMC 4.4	eMMC 5.1	
Product Series	85VM	EX	MX
NAND Configuration	MLC	EnduroSLC™	MLC (3D NAND)
Capacity	16GB, 32G, 64GB	2GB, 4GB (100b) 2GB, 4GB, 8GB, 16GB, 32GB (153b)	8GB (100b) 8GB, 16GB, 32G, 64GB (153b)
Voltage	3.3V		
Operating Temperature	Industrial: -40°C to +85°C		
Storage Temperature	-40°C to +85°C		
Endurance	5K P/E cycles	50K, 100K, 250K P/E cycles*	5K P/E cycles
Data Retention	10 years / 1 year at end of device life		
Max Sequential Read/Write (MB/s)	70 / 30	130 / 80	125 / 60
Package Type / Dimensions (mm)	100-ball LBGA / 14 x 18 x 1.40	100-ball LBGA / 14 x 18 x 1.40 153-ball LFBGA / 11.5 x 13 x 1.35	
Features	High performance: DDR52 (eMMC 4.4), HS200 / HS400 (eMMC 5.1) Advanced global and group wear leveling SSD lifespan monitoring (SMART) Enhanced power interrupt data protection Data sanitization and RPMB Write protection		

Note: eMMC NANDrive's sequential read / write performance is measured in 52MHz clock speed DDR mode for eMMC 4.4, and HS400 DDR mode for eMMC 5.1, using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
*100b eMMC 5.1: 250K endurance – 2GB; 50K/100K endurance – 4GB. 153b eMMC 5.1: 250K endurance – 2/4/8/16GB; 50K/100K endurance – 4/8/16/32GB.

SATA NANDrive

Part Number	GLS85LS1xxxP	GLS85LS1xxxE/G/Q	GLS85LS1xxxC
Interface	SATA 1.5Gb/s	SATA 6Gb/s	
Product Series	85LS	EX	MX
NAND Configuration	SLC	EnduroSLC™	MLC (3D NAND)
Capacity	2GB, 4GB, 8GB, 16GB, 32GB	2GB, 4GB, 8GB, 16GB, 32GB, 64GB, 128GB	8GB, 16GB, 32G, 64GB, 128GB
Voltage	1.2V and 3.3V	1.0V and 3.3V	
Operating Temperature	Industrial: -40°C to +85°C		
Storage Temperature	-40°C to +85°C		
Endurance	60K P/E cycles	50K, 100K, 250K P/E cycles*	5K P/E cycles
Data Retention	10 years / 1 year at end of device life		
Max Sequential Read/Write (MB/s)	120 / 80	470 / 340	410 / 115
Package Type / Dimensions (mm)	145-ball FBGA / 14 x 24 x 1.95	145-ball LBGA /14 x 24 x 1.40 145-ball FBGA / 14 x 24 x 1.95 (128GB MLC)	
Features	Secure erase and purge commands User-selectable protection zones SSD lifespan monitoring (SMART) Enhanced power interrupt data protection Bad block management 1mm ball spacing		

NANDrive FAQs: www.greenliant.com/nandrive-faqs

Evaluation Boards: www.greenliant.com/nandrive-eval-boards

Long-Term Availability: www.greenliant.com/support/#LTA-program

Note: SATA NANDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
*250K endurance – 2/4/8/16/32/64GB; 50K/100K endurance – 4/8/16/32/64/128GB

PATA NANDrive

Part Number	GLS85LDxxxxT	GLS85LPxxxxP
Interface	ATA / IDE	
Product Series	85LD	85LP
NAND Configuration	SLC	
Capacity	512MB, 1GB	1GB, 2GB, 4GB, 8GB
Voltage	3.3V or 5.0V	3.3V
Operating Temperature	Industrial: -40°C to +85°C	
Storage Temperature	-55°C to +125°C	-40°C to +85°C
Endurance	100K P/E cycles	60K P/E cycles
Data Retention	10 years / 1 year at end of device life	
Max Sequential Read/Write (MB/s)	30 / 10	50 / 35
Package Type / Dimensions (mm)	91-ball LBGA / 12 x 24 x 1.40	91-ball BGA / 12 x 24 x 1.90 (1GB) 91-ball BGA / 14 x 24 x 1.90
Features	Connect to standard memory bus (for devices without ATA interface) Secure erase and purge commands User-selectable protection zones SSD lifespan monitoring (SMART) Enhanced power interrupt data protection Bad block management 1mm ball spacing	

Note: PATA NANDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.

Industrial Enterprise Storage

Greenliant's high-capacity Industrial Enterprise SSDs are designed for primary storage applications that require ultra-high reliability with sustainable low-latency and high IOPS performance. These SATA 2.5" and NVMe U.2 SSDs surpass traditional HDDs in their performance, security and ruggedness. Greenliant's flagship EX Series SSDs designed with EnduroSLC™ Technology provide ultra-robust data retention and can reach ultra-high write endurance of 30 DWPD for 5 years operating over a wide range of temperatures from -40°C to +85°C.

Greenliant's industrial enterprise storage products support AES-256 hardware encryption to protect sensitive user data and include power interrupt data protection to help prevent data loss during unexpected power failure events. EX Series (and select PX Series) SSDs also implement on-chip adaptive RAID for the highest levels of data integrity. With advanced features and outstanding quality of service, Greenliant's industrial enterprise storage products are ideal for mission critical, I/O intensive applications in defense, aerospace, transportation, energy, power, communications, industrial control, cloud computing and big data.

SATA 2.5” Enterprise SSD

Part Number	G32UxxxP	G32UxxxR	G31UxxxR
Interface	SATA 6Gb/s		
Product Series	EX	PX	PX
NAND Configuration	EnduroSLC™	TLC (3D NAND)	
Capacity	800GB, 960GB, 1.6TB, 1.92TB	960GB, 1.92TB, 3.84TB	480GB, 960GB, 1.92TB, 3.84TB
DRAM	Yes		
Voltage	5V		
Operating Temperature	Industrial: -40°C to +85°C	Datacenter: 0°C to +55°C	
Storage Temperature	-55°C to +110°C	-40°C to +85°C	
Endurance	30 DWPD for 5 years	1 DWPD for 5 years	1.3 DWPD for 3 years
Data Retention	10 years / 1 year at end of device life		
Max Sequential Read/Write (MB/s)	530 / 520		
Form Factor / Dimensions (mm)	2.5-inch / 100.5 x 69.85 x 9.5		2.5-inch / 100 x 69.85 x 7
Features	On-chip adaptive RAID for reliable failover (G3200) Dedicated power interrupt data protection Advanced ECC for 3D NAND Data purge / instant erase (G3200) AES 256-bit encryption		

NVMe U.2 Enterprise SSD

Part Number	G72UxxxP	G72UxxxR
Interface	PCIe Gen3x4	
Product Series	EX	PX
NAND Configuration	EnduroSLC™	TLC (3D NAND)
Capacity	800GB, 960GB, 1.6TB, 1.92TB	960GB, 1.92TB, 3.84TB
DRAM	Yes	
Voltage	12V	
Operating Temperature	Industrial: -40°C to +85°C	Datacenter: 0°C to +55°C
Storage Temperature	-55°C to +110°C	-40°C to +85°C
Endurance	30 DWPD for 5 years	1 DWPD for 5 years
Data Retention	10 years / 1 year at end of device life	
Max Sequential Read/Write (MB/s)	2,600 / 1,900	
Form Factor / Dimensions (mm)	2.5-inch / 100.5 x 69.85 x 9.5	
Features	On-chip adaptive RAID for reliable failover Dedicated power interrupt data protection Advanced ECC for 3D NAND Data purge / instant erase AES 256-bit encryption	

Built in industry standard M.2, mSATA, 2.5” and U.2 form factors, Greenliant’s ArmourDrive SSD portfolio is ideal for demanding industrial, networking, security, video and imaging applications that require reliable removable data storage. Tested for shock and vibration, and operating at extended temperature ranges, ArmourDrive industrial SSDs are able to withstand extreme environments. ArmourDrive SSDs are offered in a variety of interfaces (NVMe PCIe, SATA) and NAND configurations (SLC, MLC, TLC) to meet different customer requirements for performance, endurance and lifespan.

ArmourDrive’s advanced features include robust power interrupt data protection, hardware encryption, secure erase and lifespan monitoring. Available in a wide range of capacities, from 4 GByte to 8 TByte, ArmourDrive industrial SSDs surpass traditional storage with their superior functionality and reliability. In addition to 3D MLC NAND based MX Series and 3D TLC NAND based PX Series, Greenliant offers ArmourDrive EX Series with EnduroSLC Technology for ultra-robust data retention and ultra-high endurance, from 50K and 100K to market leading 250K+ P/E cycles (endurance of 300K and above is available upon request).

SATA M.2 2242 ArmourDrive

Part Number	GLS87CAxxxGx	GLS87CAxxxG2	GLS87DPxxxG3	GLS87DPxxxG3
Interface	SATA 6Gb/s			
Product Series	EX	MX	PX	PX
NAND Configuration	EnduroSLC™	MLC (3D NAND)	TLC (3D NAND)	
Capacity	8GB, 16GB, 32GB, 64GB, 128GB	16GB, 32GB, 64GB	32GB, 64GB, 128GB, 256GB, 512GB	32GB, 64GB, 128GB, 256GB, 512GB
Voltage	3.3V			
Operating Temperature	Industrial: -40°C to +85°C			Commercial: 0°C to +70°C
Storage Temperature	-40°C to +85°C			
Endurance	50K, 100K, 250K P/E cycles*	5K P/E cycles	3K P/E cycles	
Data Retention	10 years / 1 year at end of device life			
Max Sequential Read/Write (MB/s)	470 / 340	410 / 115	550 / 500	
Form Factor / Dimensions (mm)	M.2 2242 SS‡ B+M key / 22 x 42 x 2.38 (Max)		M.2 2242 DS‡ B+M key / 22 x 42 x 3.58 (Max)	
Features	Power management (HIPM / DIPM) MTBF more than 2 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND NCQ up to 32 commands Enhanced power interrupt data protection			

ArmourDrive FAQs: www.greenliant.com/armourdrive-faqs

Long-Term Availability: www.greenliant.com/support/#LTA-program

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
‡ Single-sided (SS); Double-sided (DS) *250K, or higher, endurance offered from 8GB to 64GB

SATA M.2 2280 ArmourDrive

Part Number	GLS87AAxxxGx	GLS87BPxxxx3	GLS87BPxxxx3	GLS87BQxxxx3
Interface	SATA 6Gb/s			
Product Series	EX	PX	PX	PX
NAND Configuration	EnduroSLC™	TLC (3D NAND)		
Capacity	8GB, 16GB, 32GB, 64GB, 128GB	32GB, 64GB, 128GB, 256GB, 512GB, 1TB	32GB, 64GB, 128GB, 256GB, 512GB, 1TB	240GB, 480GB, 960GB, 1.92TB
DRAM	No			Yes
Voltage	3.3V			
Operating Temperature	Industrial: -40°C to +85°C		Commercial: 0°C to +70°C	Industrial: -40°C to +85°C
Storage Temperature	-40°C to +85°C			
Endurance	50K, 100K, 250K P/E cycles*	3K P/E cycles		
Data Retention	10 years / 1 year at end of device life			
Max Sequential Read/Write (MB/s)	470 / 340	550 / 500		
Form Factor / Dimensions (mm)	M.2 2280 SS‡ B+M key / 22 x 80 x 2.38 (Max)	M.2 2280 DS‡ B+M key / 22 x 80 x 3.58 (Max)		
Features	Power management (HIPM / DIPM) MTBF more than 2 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND NCQ up to 32 commands Enhanced power interrupt data protection AES 256-bit encryption / OPAL 2.0 (select models)			

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.

‡ Single-sided (SS); Double-sided (DS) *250K, or higher, endurance offered from 8GB to 64GB

mSATA ArmourDrive

Part Number	GLS86FA0xxG1	GLS86FCxxxGx	GLS86FCxxxG2	GLS86FPxxxx3	GLS86FPxxxx3
Interface	SATA 1.5Gb/s	SATA 6Gb/s			
Product Series	86	EX	MX	PX	PX
NAND Configuration	SLC	EnduroSLC™	MLC (3D NAND)	TLC (3D NAND)	
Capacity	8GB, 16GB, 32GB	4GB, 8GB, 16GB, 32GB, 64GB, 128GB	16GB, 32GB, 64GB, 128GB	32GB, 64GB, 128GB, 256GB, 512GB, 1TB	
Voltage	3.3V				
Operating Temperature	Industrial: -40°C to +85°C			Industrial: -40°C to +85°C	Commercial: 0°C to +70°C
Storage Temperature	-40°C to +85°C				
Endurance	60K P/E cycles	50K, 100K, 250K P/E cycles*	5K P/E cycles	3K P/E cycles	
Data Retention	10 years / 1 year at end of device life				
Max Sequential Read/Write (MB/s)	120 / 80	470 / 340	410 / 115	550 / 500	
Form Factor / Dimensions (mm)	JEDEC MO-300 / 29.85 x 50.80 x 4.85				
Features	Advanced global and group wear leveling Secure erase, TRIM and SMART Bad block management Enhanced power interrupt data protection Power management				

ArmourDrive FAQs: www.greenliant.com/armourdrive-faqs

Long-Term Availability: www.greenliant.com/support/#LTA-program

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
*250K, or higher, endurance offered from 4GB to 64GB

SATA 2.5” ArmourDrive

Part Number	GLS89SAxxxGx	GLS89SAxxxG2	GLS89SPxxxx3	GLS89SQxxxx3	GLS89SQxxxx3
Interface	SATA 6Gb/s				
Product Series	EX	MX	PX		PX
NAND Configuration	EnduroSLC™	MLC (3D NAND)	TLC (3D NAND)		
Capacity	16GB, 32GB, 64GB, 128GB	32GB, 64GB, 128GB	32GB, 64GB, 128GB, 256GB, 512GB, 1TB	240GB, 480GB, 960GB, 1.92TB, 3.84TB	128GB, 256GB, 512GB, 1TB, 2TB
DRAM	No			Yes	
Voltage	5V				
Operating Temperature	Industrial: -40°C to +85°C				Commercial: 0°C to +70°C
Storage Temperature	-40°C to +85°C				
Endurance	50K, 100K, 250K P/E cycles*	5K P/E cycles	3K P/E cycles		
Data Retention	10 years / 1 year at end of device life				
Max Sequential Read/Write (MB/s)	470 / 340	410 / 115	550 / 500	550 / 530	560 / 540
Form Factor / Dimensions (mm)	2.5-inch / 100 x 69.85 x 7.00				
Features	Power management (HIPM / DIPM) MTBF more than 2 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND NCQ up to 32 commands Enhanced power interrupt data protection AES 256-bit encryption / OPAL 2.0 (select models)				

Note: ArmourDrive’s sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
*250K, or higher, endurance offered from 16GB to 64GB

NVMe M.2 ArmourDrive

Part Number	GLS88BPxxxx3	GLS88ARxxx3	GLS88DQxxxG3
Interface	PCIe Gen3x4		PCIe Gen3x2
Product Series	PX	PX	PX
NAND Configuration	TLC (3D NAND)		
Capacity	240GB, 480GB, 960GB, 1.92TB	128GB, 256GB, 512GB, 1TB, 2TB	64GB, 128GB, 256GB, 512GB
DRAM	Yes	No	
Voltage	3.3V		
Operating Temperature	Industrial: -40°C to +85°C	Commercial: 0°C to +70°C	Industrial: -40°C to +85°C
Storage Temperature	-40°C to +85°C		
Endurance	3K P/E cycles		
Data Retention	10 years / 1 year at end of device life		
Max Sequential Read/Write (MB/s)	3,000 / 1,000	2,500 / 2,100	1,550 / 950
Form Factor / Dimensions (mm)	M.2 2280 DS‡ M key / 22 x 80 x 3.58 (Max)	M.2 2280 SS‡ M key / 22 x 80 x 2.23 (Max)	M.2 2242 DS‡ B+M key / 22 x 42 x 3.58 (Max)
Features	Power management: APST / ASPM (select models) MTBF 2 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND AES 256-bit encryption / OPAL 2.0 / Pyrite (select models)		

ArmourDrive FAQs: www.greenliant.com/armourdrive-faqs

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
‡ Single-sided (SS); Double-sided (DS)

NVMe U.2 ArmourDrive

Part Number	GLS90UPxxxx3	GLS90UPxxxx3
Interface	PCIe Gen3x4	
Product Series	PX	PX
NAND Configuration	TLC (3D NAND)	
Capacity	480GB, 960GB, 1.92TB, 3.84TB, 7.68TB	512GB, 1TB, 2TB, 4TB, 8TB
DRAM	Yes	
Voltage	5V	
Operating Temperature	Industrial: -40°C to +85°C	Commercial: 0°C to +70°C
Storage Temperature	-40°C to +85°C	
Endurance	3K P/E cycles	
Data Retention	10 years / 1 year at end of device life	
Max Sequential Read/Write (MB/s)	3,200 / 1,000	3,300 / 3,000
Form Factor / Dimensions (mm)	2.5-inch / 100 x 69.85 x 7.00	
Features	Power management: APST / ASPM MTBF 1.5 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND AES 256-bit encryption / OPAL 2.0	

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
NVMe U.2 planned for production in 2Q21

ArmourDrive™ Memory Cards

Greenliant's ArmourDrive industrial memory cards are available in industry standard CFast, CFexpress, SD and microSD form factors. Tested for shock and vibration, and operating at industrial temperatures (-40°C to +85°C), rugged and reliable ArmourDrive memory cards are able to withstand demanding environments. They implement advanced NAND flash management technology to preserve data integrity and extend memory card lifespan.

ArmourDrive industrial memory cards meet a wide range of performance requirements from Class 10 SD / microSD cards to fast SATA 6Gb/s CFast cards to ultrafast NVMe PCIe Gen3 CFexpress cards. Offered in various 3D NAND configurations (SLC, MLC, TLC) and endurance specifications, ArmourDrive memory cards give industrial, medical, security, gaming, video and imaging customers added flexibility when selecting high quality, removable solid state storage for space-constrained, embedded systems.

ArmourDrive FAQs: www.greenliant.com/armourdrive-faqs

Long-Term Availability: www.greenliant.com/support/#LTA-program

Part Number	GLS93SP0xxG1	GLS93SPxxxG3	GLS93MP0xxG1	GLS93MPxxxG3
Interface	SD Specification Version 6.10			
Product Series	EX	PX	EX	PX
NAND Configuration	SLC (3D NAND)	TLC (3D NAND)	SLC (3D NAND)	TLC (3D NAND)
Capacity	8GB, 16GB, 32GB, 64GB	32GB, 64GB, 128GB, 256GB	8GB, 16GB, 32GB, 64GB	32GB, 64GB, 128GB, 256GB
Voltage	3.3V			
Operating Temperature	Industrial: -40°C to +85°C			
Storage Temperature	-40°C to +85°C			
Endurance	30K P/E cycles	3K P/E cycles	30K P/E cycles	3K P/E cycles
Data Retention	10 years / 1 year at end of device life			
Max Sequential Read/Write (MB/s)	95 / 85			
Form Factor / Dimensions (mm)	SD / 24 x 32 x 2.10		microSD / 11 x 15 x 1.00	
Features	SSD lifespan monitoring (SMART) Static and Dynamic Wear Leveling MTBF more than 3 million hours Advanced ECC for 3D NAND Password protection (optional) Write protection / Lock switch (SD cards) Waterproof			

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.

CFast ArmourDrive

Part Number	GLS91CAxxxGx	GLS91CAxxxG2	GLS91CPxxxG3
Interface	SATA 6Gb/s		
Product Series	EX	MX	PX
NAND Configuration	EnduroSLC™	MLC (3D NAND)	TLC (3D NAND)
Capacity	8GB, 16GB, 32GB, 64GB, 128GB	16GB, 32GB, 64GB	64GB, 128GB, 256GB
Voltage	3.3V		
Operating Temperature	Industrial: -40°C to +85°C		
Storage Temperature	-40°C to +85°C		
Endurance	50K, 100K, 250K P/E cycles*	5K P/E cycles	3K P/E cycles
Data Retention	10 years / 1 year at end of device life		
Max Sequential Read/Write (MB/s)	470 / 340	410 / 115	550 / 490
Form Factor / Dimensions (mm)	CFast / 36.40 x 42.85 x 3.30		
Features	Power management (HIPM / DIPM) MTBF more than 2 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND NCQ up to 32 commands Enhanced power interrupt data protection		

ArmourDrive FAQs: www.greenliant.com/armourdrive-faqs

Long-Term Availability: www.greenliant.com/support/#LTA-program

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
*250K, or higher, endurance offered from 8GB to 64GB

CFexpress ArmourDrive

Part Number	GLS92EPxxxG3
Interface	PCIe Gen3x4
Product Series	PX
NAND Configuration	TLC (3D NAND)
Capacity	128GB, 256GB, 512GB
Voltage	3.3V
Operating Temperature	Industrial: -40°C to +85°C
Storage Temperature	-40°C to +85°C
Endurance	3K P/E cycles
Data Retention	10 years / 1 year at end of device life
Max Sequential Read/Write (MB/s)	1,600 / 1,000
Form Factor / Dimensions (mm)	CFexpress / 38.50 x 29.60 x 3.80
Features	Power management (APST / ASPM) MTBF more than 2 million hours Secure erase, TRIM and SMART Advanced ECC for 3D NAND Enhanced power interrupt data protection

Note: ArmourDrive's sequential read / write performance is measured using 128KB transfer size. Faster performance can be achieved with larger data transfer sizes.
CFexpress planned for production in 2Q21

Specialty NOR Flash Memory

TSOP-32 TFBGA-48 PLCC-32

Greenliant's specialty NOR flash memory portfolio includes the CSF™ (Concurrent SuperFlash™), MTP (Many-Time Programmable) and SSF™ (Small-Sector Flash™) product families. They provide high reliability of more than 100 years data retention and endurance up to 100,000 cycles, low power consumption and a small footprint, making them ideal for code storage applications and space-constrained systems. Offered in industry-standard packages, Greenliant's specialty NOR flash memory products are designed to meet the stringent quality and long-term support requirements of embedded applications.

Many-Time Programmable Flash				
Part Number	GLS27SF512	GLS27SF010	GLS27SF020	GLS37VF010
Type	64K x8 Many-Time Programmable	128K x8 Many-Time Programmable	256K x8 Many-Time Programmable	128K x8 Many-Time Programmable
Density	512Kbit	1Mbit	2Mbit	1Mbit
Voltage	4.5V – 5.5V			2.7V – 3.6V
Operating Temperature	Commercial: 0°C to +70°C			
Storage Temperature	-65°C to +150°C			
Read Access Speed (ns)	70			
Package Type / Dimensions (mm)	PLCC-32 / 13 x 15 x 2.8	PLCC-32 / 13 x 15 x 2.8		PLCC-32 / 13 x 15 x 2.8 TSOP-32 / 8 x 14 x 1.2

Small-Sector Flash		
Part Number	GLS29EExxx	
Type	64K x8 Page-Write EEPROM, 128 Bytes per Page	
Density	512Kbit	1Mbit
Voltage	4.5V – 5.5V	
Operating Temperature	Industrial: -40°C to +85°C Commercial: 0°C to +70°C	
Storage Temperature	-65°C to +150°C	
Read Access Speed (ns)	70	
Package Type / Dimensions (mm)	PLCC-32 / 13 x 15 x 2.8 TSOP-32 / 8 x 20 x 1.2	

Concurrent SuperFlash			
Part Number	GLS36VF1601G	GLS36VF320x	
Type	16 Mbit (x8/x16) Concurrent SuperFlash, Bottom Boot	32 Mbit (x8/x16) Concurrent SuperFlash, Bottom Boot	32 Mbit (x8/x16) Concurrent SuperFlash, Top Boot
Density	1 Mbit x16 or 2 Mbit x8	4 Mbit x8 or 2 Mbit x16	
Voltage	2.7V – 3.6V		
Operating Temperature	Industrial: -40°C to +85°C	Extended: -20°C to +85°C	Industrial: -40°C to +85°C
Storage Temperature	-65°C to +150°C		
Read Access Speed (ns)	70		
Package Type / Dimensions (mm)	TSOP-48 / 12 x 20 x 1.2 TFBGA-48 / 6 x 8 x 1.1	TFBGA-48 / 6 x 8 x 1.1	TSOP-48 / 12 x 20 x 1.2

Microchip (Atmel) Cross-Reference: www.greenliant.com/products/flash-memory.dot

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