



Redefining Flash Storage Solution

For Infinite Scale and Hyper-Efficiency

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PRODUCT SELECTION GUIDE

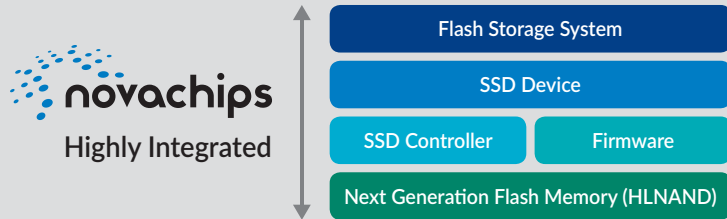


Holistic Approach to Redefine Flash Storage

Novachips is a leading provider of a broad range of Flash storage processors and storage drives with breakthrough capacity and scalability. We reimagined Flash storage from the inside out and offer the SSD (Solid State Drive) industry's most advanced capabilities with high storage capacity for enterprise-class storage applications. Novachips products are built upon the company's innovative Flash memory architecture, which significantly outpaces the scalability, performance and reliability of SSDs that use NAND Flash.

Why Integration Matters-Three key components in SSD systems

- Flash Memory: HLNAND Flash (Next Generation Flash Memory)
 - Controller: SSD/HLSSD controller
 - Firmware: customized firmware based on workload
- Full control over Flash memory, controller and firmware to maximize performance and reliability.



Technical Innovation

1. Reliability

- DRAM ECC** : In Novachips SSD, all data path are protected by CRC, ECC, and EDC, so it can maintain high reliability, even at very high altitude environment where radiation can cause "Single Event Upset" issue.
- SPOR** : On-board power capacitor can sustain required time for SSD internal back-up to minimize data loss and guarantee stable operation even at sudden power off case.
- Constant performance** : Guarantees stable write performance at any kind of data pattern.
- Wide Temperature** : even Large capacity is stable operation at wide temperature.

2. Security

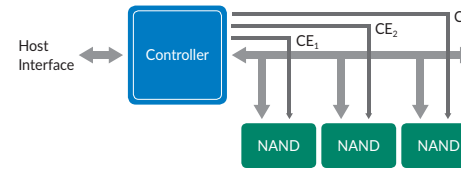
- FIPS 197 certified AES-256 hardware engine**
- TCG Enterprise** : security option for Server or RAID system
- TCG OPAL** : security option for Laptop or PC
- Host Key Encryption** : security option for portable storage
- Hardware Function Trigger** : Dedicated hardware jumper can support various functions which is required at military, industrial or other mission-critical application.

3. Customization

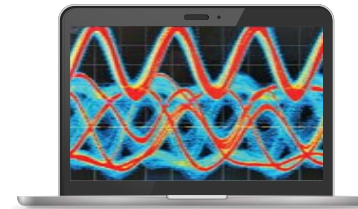
- In-house Firmware development** : Optimizing performance and power, New function command support
- Software Tool support** : Various type of software tools for diagnose, security, encryption
- In-house PCB/Enclosure design** : Customized Form Factor Design Support
- Longer Life cycle guarantee & Locking BOM**

Today's problem to drive high density NAND flash

Multi-drop Bus Topology in Conventional NAND

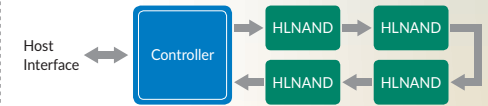


SSD capacity is limited at conventional NAND interface, because they're sharing data line as bus topology and drive strength is limited. RAID or FPGA solution will consumer higher power at larger foot print. And also not good from reliability perspective.

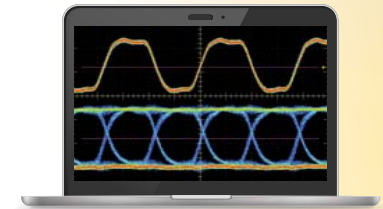


Driving 8 dies per channel at 333MT/s

Point-to-point Ring Topology in HLNAND



Exclusive Hyper-Link NAND interface is serially point-to-point connected, and increase SSD capacity without physical limitation. Currently supporting up to 16TB by single SSD controller.



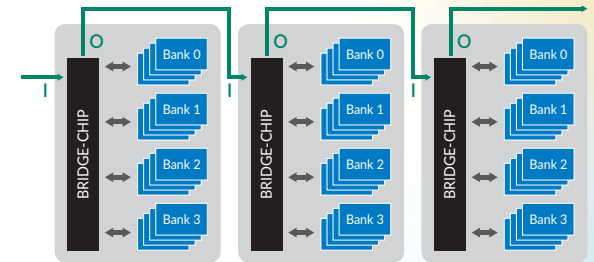
Driving 128 dies per channel at 533MT/s

* Legacy result is based on 8dies per channel (F16 1Tb PKG 2Ch x 4CE x 2dies)

HL^TNAND on Board

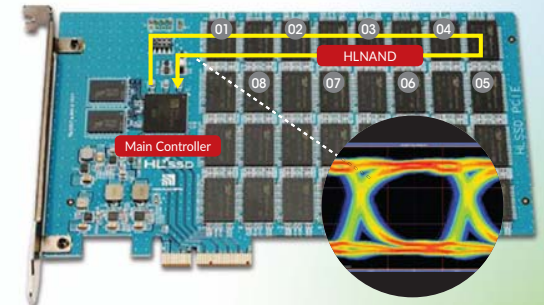
HLNAND

Point to point ring topology implemented for flash
 Unlimited number of devices per channel
 DDR-533/667/800
 Up to 16-die stack
 Up to 256Gb NAND Die
 Up to 4Tb MCP
 Support SLC, MLC, eMLC, TLC in 2x, 1x, 1y Process Technology

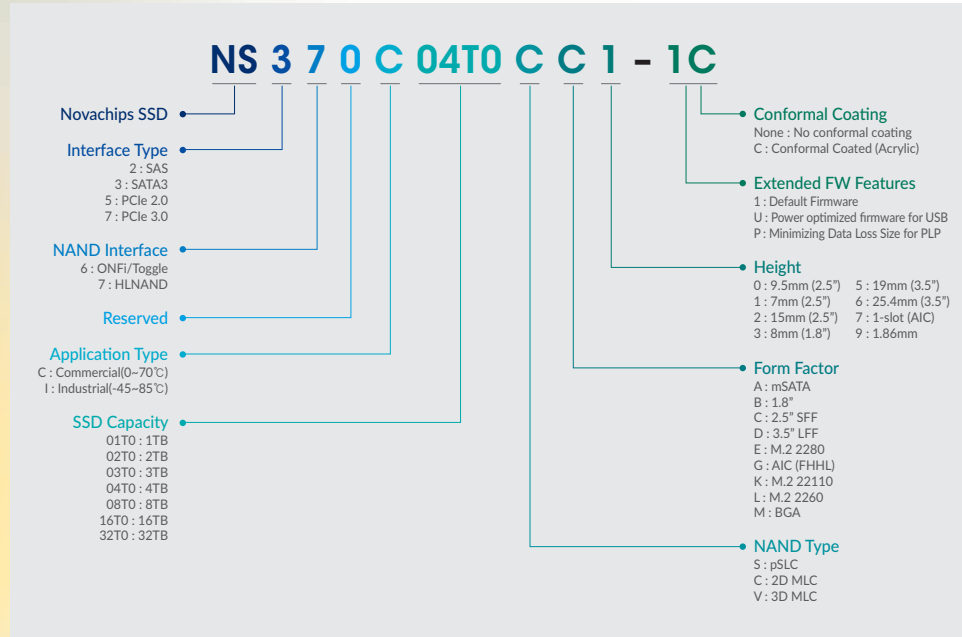


Main SSD Controller

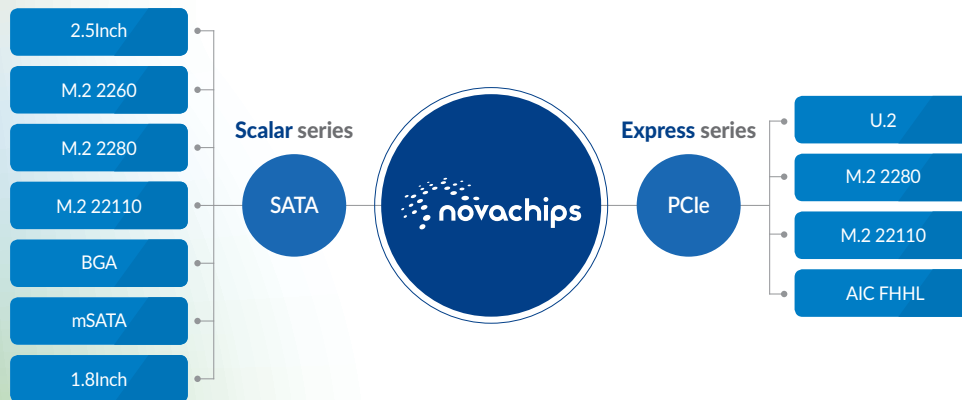
SATA 6.0Gb/s, 3.0Gb/s and 1.5Gb/s support
 PCIe Gen2 4-lane support / NVMe support
 HLNAND Interface with up to DDR-533
 Low Power Design HW Controlled IO/
 Low Clock & MCU/HW Read-retry/28nm Process



Product Code Information



Form Factor Line up



Hardware Trigger
* I-grade only

Form Factor	2.5Inch(C1)			
Grade	C-grade	E-grade	I-grade	
Host interface	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	
NAND type	MLC	MLC	MLC	
Capacity	7mm height	125GB/250GB/500GB 1TB/2TB/4TB	100GB/200GB/400GB/800GB/ 1.6TB/3.2TB : DWPD3 480GB/960GB/1.92TB/3.84TB : DWPD1	32GB/64GB/125GB/250GB/500GB 1TB/2TB/4TB
	9.5mm height	8TB	6.4TB : DWPD3 7.68TB : DWPD1	8TB
	15mm height	16TB/32TB(3D)	12.8TB(15mm) : DWPD3 15.3TB(15mm) : DWPD1	16TB
Speed (Sequential Read/Write, MB/s, Max)	520/500	520/500	520/500	
Speed (Random 4KB Read/Write, MB/s, Max)	70K/70K	70K/70K	70K/70K	
Power consumption (Active)	6W	8W	6W	
Warranty	5year	5year	5year	
Shock/Vibration (Operating)	2.17 GRMS (5-700 Hz)	2.17 GRMS (5-700 Hz)	16.3 GRMS (10-2,000 Hz)	
Operating Temp	0°C~70°C	0°C~70°C	-40°C~85°C	
DRAM ECC	X	Optional	O	
Encryption mode	X	TCG enterprise(optional)	O	
Hardware Secure erase /Write protection	X	X	O	
Military Secure Erase protocol	X	X	O	



M.2 2260(L7)



M.2 2280(E7)

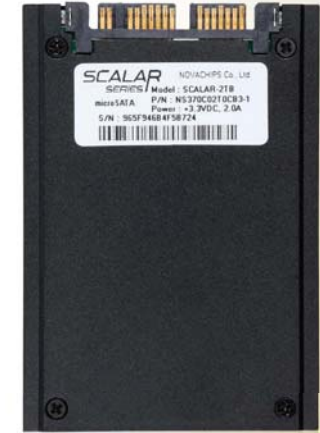


M.2 22110(K7)

Form Factor	M.2 2260(L7)		M.2 2280(E7)		M.2 22110(K7)		
Grade	C-grade	C-grade	I-grade		C-grade	I-grade	
Host interface	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps
NAND type	MLC	MLC	MLC	pSLC	MLC	MLC	pSLC
Capacity	1TB /2TB(3D)	125GB /250GB /500GB /1TB	64GB /125GB /250GB /500GB/1TB	32GB/64GB /125GB /250GB /500GB	2TB /4TB(3D)	2TB	1TB
Speed (Sequential Read/Write, MB/s, Max)	500/300	500/300	500/300	500/500	500/500	500/500	500/500
Speed (Random 4KB Read/Write, MB/s, Max)	50K/50K	50K/50K	50K/50K	50K/50K	70K/70K	70K/70K	70K/70K
Power consumption (Active)	5.2W	5W	5W	4W	6W	6W	4.8W
Warranty	5year	5year	5year	5year	5year	5year	5year
Operating Temp	0°C~70°C	0°C~70°C	-40°C~85°C	-40°C~85°C	0°C~70°C	-40°C~85°C	-40°C~85°C
DRAM ECC	X	X	O	O	X	O	O
Encryption mode	X	X	O	O	X	O	O
Hardware Secure erase /Write protection	X	X	X	X	X	X	X
Military Secure Erase protocol	X	X	O	O	X	O	O



1.8Inch(B3)



mSATA(A7)



BGA_2024(M9)



Form Factor	BGA_2024(M9)
Host interface	SATA 6Gbps
NAND type	MLC
Capacity	32GB/64GB
Speed (Sequential Read/Write, MB/s, Max)	350/100
Speed (Random 4KB Read/Write, MB/s, Max)	30K/24K
Operating Temp	-40°C~85°C
Power consumption (Active)	1.3W
Warranty	5years
Encryption mode	X
Hardware Secure erase /Write protection	X
Military Secure Erase protocol	O
EMI shield package	Overall 20dB noise reduction (30KHz ~ 8.5GHz)

Form Factor	mSATA(A7)		1.8Inch(B3)		
Grade	I-grade		C-grade	I-grade	
Host interface	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps	SATA 6Gbps
NAND type	MLC	pSLC	MLC	MLC	pSLC
Capacity	125GB/250GB /500GB	60GB/125GB /250GB	1TB/2TB	1TB/2TB	500GB/1TB
Speed (Sequential Read/Write, MB/s, Max)	500/300	500/500	500/500	500/500	500/500
Speed (Random 4KB Read/Write, MB/s, Max)	50K/50K	50K/50K	70K/70K	70K/70K	70K/70K
Power consumption (Active)	5.1W	4.08W	5.6W	5.6W	4.48W
Warranty	5year	5year	5year	5year	5year
Shock/Vibration	1.000 G/0.5ms 2.17 GRMS (5-700 Hz)				
Operating Temp	-40°C~85°C	-40°C~85°C	0°C~70°C	-40°C~85°C	-40°C~85°C
DRAM ECC	O	O	X	O	O
Encryption mode	O	O	X	O	O
Hardware Secure erase /Write protection	X	X	X	O	O
Military Secure Erase protocol	O	O	X	O	O



Hardware Trigger
* I-grade only

Form Factor	2.5Inch U.2(C0)					
Grade	C-grade		E-grade		I-grade	
Host interface	PCIe Gen2x4		PCIe Gen2x4		PCIe Gen2x4	
NAND type	MLC	pSLC	MLC	pSLC	MLC	pSLC
Capacity	2TB/4TB/8TB	1TB/2TB/4TB	1.6TB/3.2TB/6.4TB	800GB /1.6TB/3.2TB	2TB/4TB/8TB	1TB/2TB/4TB
Speed (Sequential Read/Write, MB/s, Max)	1000/1000	1200/1200	1000/1000	1200/1200	1000/1000	1200/1200
Speed (Random 4KB Read/Write, MB/s, Max)	90K/80K	90K/80K	90K/80K	90K/80K	90K/80K	90K/80K
Power consumption (Active)	7W	6.8W	7W	6.8W	7W	6.8W
Warranty	5year	5year	5year	5year	5year	5year
Operating Temp	0°C~70°C	0°C~70°C	0°C~70°C	0°C~70°C	-40°C~85°C	-40°C~85°C
DRAM ECC	X	X	O	O	O	O
Shock/Vibration (Operating)	2.17 GRMS (5-700 Hz)	2.17 GRMS (5-700 Hz)	2.17 GRMS (5-700 Hz)	2.17 GRMS (5-700 Hz)	16.3 GRMS (10-2,000 Hz)	16.3 GRMS (10-2,000 Hz)
Encryption mode	X	X	X	X	O	O
Hardware Secure erase /Write protection	X	X	X	X	O	O
Military Secure Erase protocol	X	X	X	X	O	O



M.2 2280(E7)



M.2 22110(K7)

Form Factor	M.2 2280(E7)			M.2 22110(K7)		
Grade	C-grade	I-grade		C-grade	I-grade	
Host interface	PCIe Gen2x4	PCIe Gen2x4	PCIe Gen2x4	PCIe Gen2x4	PCIe Gen2x4	PCIe Gen2x4
NAND type	MLC	MLC	pSLC	MLC	MLC	pSLC
Capacity	250GB/500GB	250GB/500GB	125GB/250GB	2TB	2TB	1TB
Speed (Sequential Read/Write, MB/s, Max)	500/300	500/300	500/500	800/600	800/600	1200/1200
Speed (Random 4KB Read/Write, MB/s, Max)	50K/50K	50K/50K	50K/50K	70K/70K	70K/70K	70K/70K
Power consumption (Active)	5.2W	5.2W	4.16W	6W	6W	4.8W
Warranty	5year	5year	5year	5year	5year	5year
Operating Temp	0°C~70°C	-40°C~85°C	-40°C~85°C	0°C~70°C	-40°C~85°C	-40°C~85°C
DRAM ECC	X	O	O	X	O	O
Encryption mode	X	O	O	X	O	O
Hardware Secure erase /Write protection	X	X	X	X	X	X
Military Secure Erase protocol	X	O	O	X	O	O



Form Factor	AIC_FHHL-Full-Height Half-Length(G3)	
Grade	E-grade	
Host interface	PCIe Gen2x4	PCIe Gen2x4
NAND type	MLC	pSLC
Capacity	12TB/24TB(3D)	6TB
Speed (Sequential Read/Write, MB/s, Max)	1200/1000	1200/1200
Speed (Random 4KB Read/Write, MB/s, Max)	100K/90K	100K/90K
Operating Temp	0°C~70°C	0°C~70°C
Power consumption (Active)	12W	9.6W
Warranty	5year	5year
DRAM ECC	0	0

Fast Speed
Sudden Power Off Protection
Customizing firmware

Industrial



Enterprise
Stable speed
Stable latency time speed
Strong endurance
Data encryption



Military

Write protection
Data encryption
Security erase
Operation temperature

Performance optimization
Low price NAND
Low power mode
Benchmark
WHCK certification

Commercial

Automotive

Data retention
Operation temperature
Update library