

**PHISON**

The Future of Gaming  
**Starts with Phison**



# AGENDA

## Phison Corporate Updates Product Showcase

- PS5026-E26
- PS5021-E21T
- PS5021-E21T BGA
- PS7101 PCIe 5.0 Redriver

## Technology Showcase

- Next Generation Gaming Workload
- NVMe Redefines Mobile Gaming

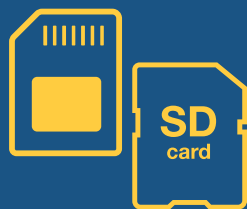
# 1 Phison Corporate Updates



# Phison the Storage Technology Leader

## Removable

- U17/U18 first high speed native USB3.2 controller- improve cost and performance in a smaller dimensions
- SD 7.0 Express card available up to 870 MB/s, new applications and market...



## Gaming

- 1<sup>st</sup> Gen PCIe Gen4 E16 was only solution up until 4Q 2020, now E18 paves the way to a new generation of performance for gaming
- E18 is the best performance Gen4 with B47R setting many performance world records



## PC/Mobile

- E13T BGA followed by future E21T BGA leads us to the future for mobile NVMe performance in the smallest form factor for NVMe
- Dramless Gen3 NVMe and Gen4 for cost sensitive demands, both E13T and E19T have major design wins



## Enterprise

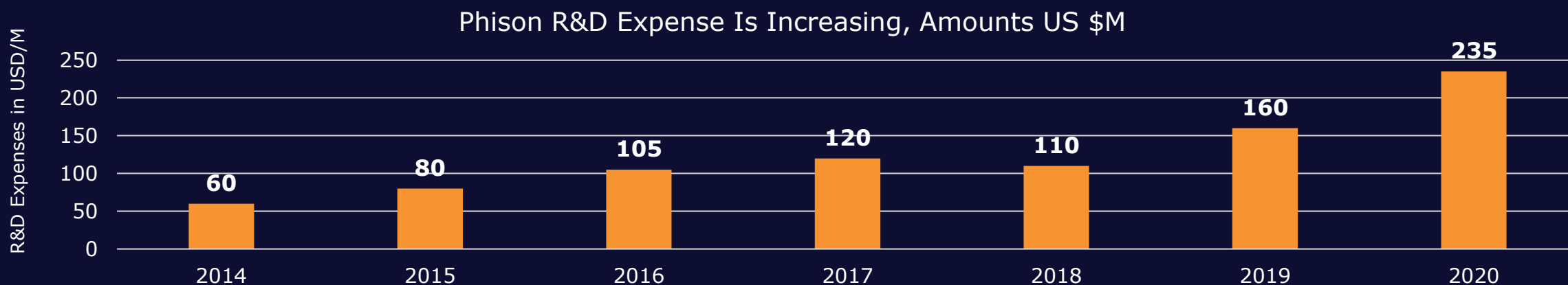
- Phison offering SSD solutions with FIPS 140-2 certification... as we lead the way for future security
- Future Gen4 and Gen5 solutions advancing through development



# Tier-1 OEMs Depend on Phison's Engineering

- Phison engineering teams enable time to market, industry leading storage products
- Phison is increasing our R&D spending to deliver exceptional products and technologies:

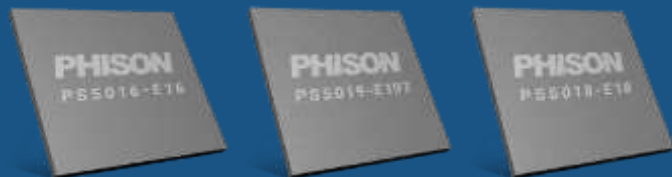
Category	2014	2015	2016	2017	2018	2019	2020
<b>R&amp;D Headcount</b>	530	674	809	942	1,112	1,450	1,531
<b>R&amp;D Exp. / Revenue (%)</b>	5%	6%	7%	9%	9%	11%	14%
<b>R&amp;D Exp. / Operating Exp.</b>	65%	71%	73%	78%	79%	59%	81%



# World's First PCIe Gen4 SSD, Repeating Success with Gen5

## PCIe Gen4

- Phison SSD and AMD Ryzen Motherboard teams worked closely together to launch PCIe Gen4 SSDs
- Phison invested \$20M in R&D, 150 engineers, 9 mo.
- **Result:** Phison & AMD ship the world's first Gen4 SSD solution in 2019!



## PCIe Gen5

- Goal: to ship the world's first Gen5 SSD in 2022!
- 1st Gen5 test chip at TSMC fully validated in 2020, an incredible feat!
- Close engineering collaboration with both Intel and AMD motherboard teams
- Phison will set the industry's standard for Gen5!



## 2 Product Showcase



# Phison PS5026-E26 First in Class, Best in Performance

Phison's first PCIe Gen5 solution uses our outstanding architecture as a customizable solution to balance power, unique features, and class-leading performance. The E26 charges into the new year to meet the high demands from emerging workloads designed to take advantage of Gen5 hardware.

## Specifications

- PCIe 5.0 x4 (128GT/s)
- NVMe 2.0
- 2x ARM Cortex-R5 and 3x Proprietary IP CoXProcessor
- TSMC 12nm Process Technology
- 8-Channels with 32 Chip Enables
- 2,400MT/s Flash Transfer Rates
- Up to 32TB Capacity

## Performance

- Sequential Read up to 12GB/s
- Sequential Write up to 11GB/s
- 4K Random Read up to 1,500K IOPS
- 4K Random Write up to 2,000K IOPS





# Phison PS5026-E26 First in Class, Best in Performance

	Read [MB/s]	Write [MB/s]
SEQ1M Q16T1	13815.38	12727.24
SEQ1M Q1T1	0.00	0.00
RND4K Q32T16	0.00	0.00
RND4K Q1T1	0.00	0.00

Phison E26 PCIE Gen5

E26 development is well underway. We have passed the hardware phase and are in the process of building firmware to incorporate features and tune performance.



# Phison PS5021-E21T Cost Efficient Gen4 Performance

A PCIe Gen4 user experience in a low power M.2 form factor. The E21T allows for all-day computing in a mobile environment while meeting the performance needs of gamers, office workers, and business travelers.

## Specifications

- PCIe 4.0 x4 (64GT/s)
- NVMe 1.4
- Single CPU Architecture
- TSMC 12nm Process Technology
- 4-Channels with 16 Chip Enables
- 1,600MT/s Flash Transfer Rates
- Up to 4TB Capacity

## Performance

- Sequential Read up to 4,800MB/s
- Sequential Write up to 4,500MB/s
- 4K Random Read up to 550K IOPS
- 4K Random Write up to 600K IOPS



Product	S-Company	PS5021-E21T	PS5019-E19T	PS5013-E13T
Max Capacity	Up to 1TB	Up to 4TB	Up to 2TB	Up to 2TB
Controller	Pablo	Phison E21T	Phison E19T	Phison E13T
Technology	14nm	12nm TSMC	28nm TSMC	28nm TSMC
Interface / Protocol	PCIe 3.0 x4 / NVMe 1.4	PCIe 4.0 x4 / NVMe 1.4	PCIe 4.0 x4 / NVMe 1.3	PCIe 3.0 x4 / NVMe 1.2
Channel / CE	4-Channel, 16 CE	4-Channel, 16 CE	4-Channel, 16 CE	4-Channel, 16 CE
Memory Bus	1200MT/s	1600MT/s	1200MT/s	800MT/s
Sequential Read	3,500 MB/s	4,800 MB/s	3,750 MB/s	2,500 MB/s
Sequential Write	3,000 MB/s	4500 MB/s	3,750 MB/s	2,100 MB/s
Random Read	500,000 IOPS	780,000 IOPS	440,000 IOPS	230,000 IOPS
Random Read QD1	17,000 IOPS	20,300 IOPS*		
Random Write	480,000 IOPS	800,000 IOPS	500,000 IOPS	400,000 IOPS
Random Write QD1	54,000 IOPS	77,200 IOPS*		

\*As measured in CrystalDiskMark 8.1

E21T is Phison second-generation PCIe Gen4 mainstream solution ready to storm the battlefield in 2022.

# Phison PS5021-E21T BGA Coin-Sized Storage

The new E21T BGA takes smart device storage to new heights with a 1.65mm Z-height and a massive 1TB capacity. This 11.5mm x 13mm package will power diverse workloads with the ability to make you a gaming champion.

## Specifications

- PCIe 4.0 x2 (32GT/s)
- NVMe 1.4
- Single CPU Architecture
- TSMC 12nm Process Technology
- 4-Channels with 16 Chip Enables
- 1,600MT/s Flash Transfer Rates
- Up to 1TB Capacity

## Performance

- Sequential Read up to 3,600MB/s
- Sequential Write up to 3,000MB/s
- 4K Random Read up to 500K IOPS
- 4K Random Write up to 280K IOPS





# Phison PS7101 PCIe 5.0 Redriver

Phison's redriver comes with a patented Auto Tuning Software package. It can automatically set different gain parameters in the redriver for the customer's motherboard design and trace lengths, collect the results of the signal, and use AI technology to optimize and find the best parameters for the strongest transmission signals.

## Specifications

- PCIe 5.0 (Compatible with 4.0 and 3.0)
- Global Foundries SiGe BiCMOS 8XP Process Technology

## Performance

- Signal Adjustment Flexibility
- Transparent to Link Training
- Rate and Coding Agnostic
- Automatic Receiver Detect
- 4-Level I/O EQ and Gain



## 3 Technology Showcase



# Next Generation Gaming Workload

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Game developers will rely on NVMe storage to deliver a consistent data stream to the GPU in 2022. This model will come to market through DirectX 12 Ultimate® to reduce game load times and expand virtual worlds.

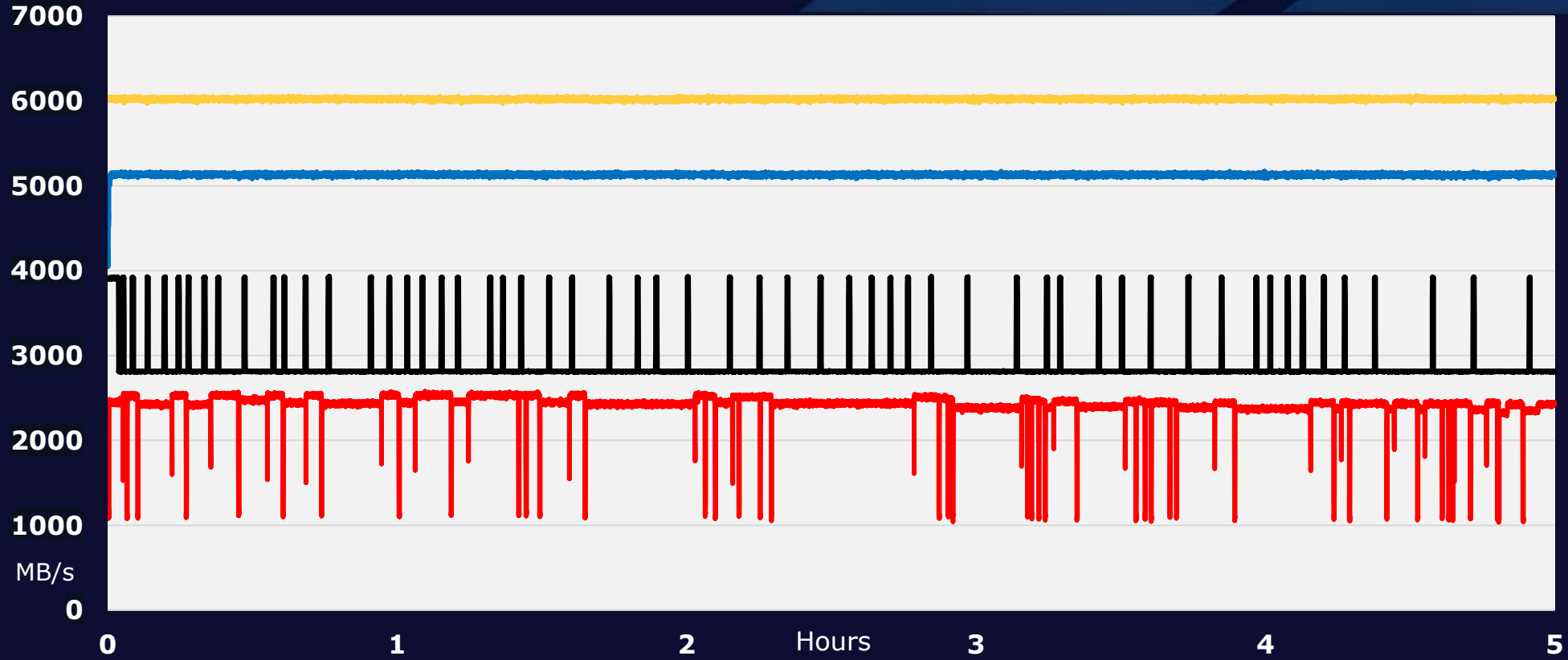
Phison is leading in the development of this upcoming technology to meet the challenging requirements of both high performance and performance consistency.

The future of gaming starts at the storage sub-system. The new gaming technology changes the workload model. High queue depth random read performance at 32KB and 64KB block sizes becomes an essential performance test going forward.

# Next Generation Gaming Workload

**PHISON**

Streaming Data Over Time - Higher is Better



— Phison E18 Gaming FW — A-Company — S-Company — W-Company

Iometer 1.1.0 - 75% Full, 100GB LBA Range, 32KB Block Size, 100% Random Read, 5 Hour Test



# NVMe Redefines Mobile Gaming - First BGA SSD Smart Phone

In March 2021, Xiaomi released the Black Shark 4 mobile gaming phone. The gaming high-performance gaming device features a **Phison PS5013-E13T BGA NVMe SSD** delivering up to 3GB/s performance. This is nearly a 3x increase in bandwidth compared to previously released mobile gaming platforms.

Phison is developing the **PS5021-E21T BGA NVMe SSD** to succeed the E13T BGA for next-generation mobile gaming platforms.





**PHISON**

**THANK YOU!**

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