Biwin
Storage Technology

Embedded Storage Solutions



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Version 6.09

INFINITE STORAGE
UNLIMITED SOLUTIONS

BIWIN Storage Technology Co., Ltd. (SSE STAR Market 688525) produces high quality flash storage and is now known in embedded, consumer, corporate and industrial segments for its independent development capabilities in hardware, software, firmware, and storage algorithms.

BIWIN's experience in production (along with its complete packaging, testing, and production lines) ensures BIWIN products are superior in performance, earning BIWIN many awards and a reputation for providing global customers with high-quality storage products.

BIWIN recently opened its latest 110,000 m^2 facility, Greater Bay Advanced Technology Co., Ltd., with state-of-the-art R&D and production.

Our founders started in the flash storage business in Shenzhen, China in 1995, embracing the "WIN-WIN" business philosophy that would later become the hallmark for BIWIN. In 2009 they made a key decision for the business: to add IC encapsulation (or IC packaging) process into the factory. A remarkable milestone that the vast majority of competing companies still don't have (they outsource the process or buy the packaged IC). This successful step led to the 2010 creation of the company we know today, BIWIN Storage Technology Company Limited.

BIWIN Advantages

Storage Algorithms & Firmware Development

Two expert R&D teams at BIWIN work on the latest firmware development. Each core team member has at least ten years of experience in firmware development and a rich experience in the mass production of self-developed firmware.

Outstanding Customization, Fast Response

BIWIN's track record demonstrates our extraordinary customized R&D capabilities and our fast response to our customers' needs. With our experience, we can readily meet the embedded requirements for projects including wearables, smart devices, 5G, IoT, smart industry, smart city, and vehicle networks.

Full-range Product Testing Capability

BIWIN continually develops memory chip testing algorithms and automation equipment. We lead the industries with our impressive test coverage and automation. Every product from us undergoes DVT and PVT.

Advanced Packaging & Testing

With the leading multi-chip and SiP packaging technology, BIWIN can process wafers as thin as 25 μm, support the mass production of 16-layer die stacking, and achieve the smallest packages in the industry.

Market Requirements in Embedded Storage

High Performance:
Rapid execution of required tasks and hardcore applications.

Low Power Consumption:
Prolonged standby and usage, minimizing device heating.

Small Size:
The trend continues for smaller and lighter terminal devices; usually requiring better user experiences despite smaller sizes.

Large Capacity:
The rapid introduction of AI applications creates the need for increased capacities for both RAM and ROM.

Long Lifespan:
Increasingly longer replacement cycles for smart devices create higher requirements for the lifespan of storage chips.



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eMMC

Features



- High-Quality 3D TLC NAND Flash Memory
- HS400 Mode and Field Firmware Update (FFU)
- Full Disk Scan
- Built-In LDPC ECC (Low-Density Parity-Check Error Correction) Codes, Supports TRIM Commands
- Product Health Monitoring and Automatic Sleep Mode to Reduce Power Consumption

Specifications

Interface	eMMC 5.1
Capacity	4 GB / 8 GB / 16 GB / 32 GB / 64 GB / 128 GB / 256 GB / 512 GB
Sequential Read (Up to)	300 MB/s
Sequential Write (Up to)	250 MB/s
Operating Voltage	V_{cc}=2.7 V - 3.6 V V_{ccq}=1.7 V - 1.95 V / 2.7 V - 3.6 V
Dimensions	7.10 x 7.10 mm, 8.00 x 7.50 mm, 11.50 x 13.00 mm
Package	FBGA 153 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Warranty	3-Year Limited
Supported Platforms	Allwinner, Amlogic, ASR, BES, Eeasytech, Gokemicro, HiSilicon, Ingenic, JQL, MediaTek, Qualcomm, Rockchip, SiFli, UNISOC, Horizon

Applications



UFS 2.2

Features

- FFU (Field Firmware Update)
- Write Booster and HPB (Host Performance Booster)
- High-Quality 3D TLC / QLC NAND Flash
- Complies with JEDEC Standards
- Full Disk Scan
- Product Health Monitoring

Specifications

Interface	UFS 2.2
Capacity	64 GB / 128 GB / 256 GB / 512 GB
Sequential Read (Up to)	1000 MB/s
Sequential Write (Up to)	800 MB/s
Operating Voltage	V_{cc}=2.7 V - 3.6 V V_{ccq}=1.7 V - 1.95 V
Dimensions	11.50 x 13.00 mm
Package	FBGA 153 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	MediaTek, UNISOC, Qualcomm, HiSilicon, Samsung, Allwinner
Warranty	3-Year Limited

Applications



UFS 3.1

Features

- HS-Gear4, 2-Lane
- FFU (Field Firmware Update)
- Write Booster and HPB (Host Performance Booster)
- Full Disk Scan
- Product Health Monitoring
- Automatic Sleep Mode to Reduce Power Consumption

Specifications

Interface	UFS 3.1
Capacity	128 GB / 256 GB / 512 GB
Sequential Read (Up to)	2000 MB/s
Sequential Write (Up to)	1800 MB/s
Operating Voltage	V_{cc}=2.4 V - 2.7 V V_{ccq}=1.14 V - 1.26 V
Dimensions	11.50 x 13.00 mm
Package	FBGA 153 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	Mediatek, UNISOC, Qualcomm, HiSilicon, Samsung, Allwinner
Warranty	3-Year Limited

Applications



LPDDR4/4X

Features

- Data Rate Up to 4266 Mbps
- Transfer Bandwidth Up to 17 GB/s
- Low Power Consumption with High Performance
- Backward Compatible with LPDDR4 Protocols and Interfaces

Specifications

Interface	LPDDR4/4X
Data Rate	Up to 4266 Mbps
Capacity	Up to 64 Gb
Channel	1x16-bit / 2x16-bit
Voltage	V_{DD1}=1.7 V - 1.95 V V_{DD2}=1.06 V - 1.17 V V_{DDQ}=0.57 V - 0.65 V / 1.06 V - 1.17 V
Dimensions	10.00 x 14.50 mm, 10.00 x 15.00 mm
Package	FBGA 200 Ball
Operating Temperature	-25 °C to + 85 °C
Supported Platforms	Mediatek,Qualcomm, Rockchip, Spreadtrum, Allwinner

Applications



LPDDR5/5X

Features

- Delivers data rates up to 8533 Mb/s and a maximum bandwidth of 17.06 GB/s per channel, meeting the data-processing demands of high-performance mobile and smart devices.
- Features ultra-low-voltage core and I/O power supplies, with enhanced dynamic voltage and frequency scaling (DVFSC) for an optimal balance between performance and power efficiency.
- Supports dual-channel operation, 16-bit/32-bit prefetch architectures, and both Bank Group and 16-bank operating modes.
- Supports programmable on-die termination (ODT), non-target ODT, and per-byte/per-pin DFE to improve signal integrity during high-speed transmission.
- Supports optional link ECC, background ZQ calibration, partial-array self-refresh (PASR), and partial-array auto-refresh (PARC).
- Supports an operating temperature range of -25°C to +85°C.

Specifications

Interface	LPDDR5/5X
Data Rate	Up to 8533Mbps
Capacity	Up to 128 Gb
Channel	2x16-bit / 4x16-bit
Voltage	V_{DD1}=1.7 V - 1.95 V V_{DD2H}=1.01 V- 1.12 V V_{DD2L}=0.87 V - 0.97 V V_{DDQ}=0.5 V NOM or 0.3 V NOM (ODT off)
Dimensions	8.2x12.4 mm/12.4 x 15.0 mm / 14.0x12.4 mm
Package	FBGA 245Ball/FBGA 315 Ball/FBGA 496Ball
Operating Temperature	-25 °C to +85 °C
Application Platforms	Mediatek, Qualcomm, Intel, AMD, Rockchip

Applications



eMCP (eMMC 5.1 + LPDDR4X)

Features



- High-Performance eMMC 5.1 + LPDDR4X
- Frequency Up to 4266 MT/s
- Compact Size: 11.50 x 13.00 mm
- LDPC ECC (Low-Density Parity-Check Error Correction) Codes
- Standard 254 Ball BGA Package

Specifications

Interface	eMMC 5.1 + LPDDR4X
Capacity	Up to 128 GB + 64 Gb
Performance	**eMMC 5.1:** Sequential Read: Up to 300 MB/s Sequential Write: Up to 250 MB/s **LPDDR4X:** Up to 4266 MT/s
Operating Voltage	**eMMC 5.1:** V_{cc}=3.3 V V_{ccq}=1.8 V **LPDDR4X:** V_{dd1}=1.70 V - 1.95 V V_{dd2}=1.06 V - 1.17 V V_{ddq}=0.57 V - 0.65 V
Dimensions	11.50 x 13.00 mm
Package	FBGA 254 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	Rockchip, UNISOC, MediaTek, Qualcomm
Warranty	3-Year Limited

Applications



uMCP (UFS 2.2 + LPDDR4X)

Features

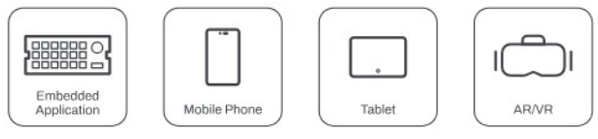


- Enhanced Write Booster
- High-Performance UFS 2.2 + LPDDR4X
- Compact Size: 11.50 x 13.00 mm
- Full Disk Scan
- Product Health Monitoring

Specifications

Interface	UFS 2.2 + LPDDR4X
Capacity	Up to 512 GB + 64 Gb
Performance	**UFS 2.2:** Sequential Read: Up to 1000 MB/s Sequential Write: Up to 800 MB/s **LPDDR4X:** Up to 4266 MT/s
Operating Voltage	**UFS 2.2:** V_{cc}=3.3 V V_{ccq}=1.8 V **LPDDR4X:** V_{dd1}=1.8 V V_{dd2}=1.1 V V_{ddq}=0.6 V
Dimensions	11.50 x 13.00 mm
Package	FBGA 254 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	MediaTek, Qualcomm, UNISOC
Warranty	3-Year Limited

Applications



uMCP (UFS 3.1 + LPDDR5X)

Features

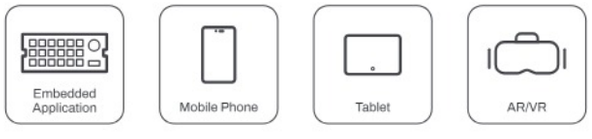
- Enhanced Write Booster
- High-Performance UFS 3.1 + LPDDR5X
- Compact Size: 11.50 x 13.00 mm
- Full Disk Scan
- Product Health Monitoring



Specifications

Interface	UFS 3.1 + LPDDR5X
Capacity	Up to 512 GB + 64 Gb
Performance	**UFS 3.1:** Sequential Read: Up to 2000 MB/s Sequential Write: Up to 1800 MB/s **LPDDR5X:** Up to 8533 MT/s
Operating Voltage	**UFS 3.1:** V_{CC}=3.3 V V_{CCQ}=1.2 V **LPDDR5X:** V_{DD1}=1.8 V V_{DD2H}=1.05 V V_{DD2L}=0.9 V V_{DDQ}=0.3 V / 0.5 V
Dimensions	11.50 x 13.00 mm
Package	FBGA 297 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	HiSilicon, MediaTek, Qualcomm, Samsung
Warranty	3-Year Limited

Applications



ePoP (eMMC 5.1 + LPDDR4X)

Features

- High-performance eMMC 5.1 + LPDDR4X
- High Frequency up to 4266 MT/s
- FFU (Field Firmware Update)
- Compact Size of 8.00 x 9.50 mm
- Certified by Leading Wearable Platforms Including SW5100



Specifications

Interface	eMMC 5.1 + LPDDR4X
Capacity	Up to 64 GB + 32 Gb
Performance	**eMMC 5.1:** Sequential Read: Up to 290 MB/s Sequential Write: Up to 150 MB/s **LPDDR4X:** Up to 4266 MT/s
Operating Voltage	**eMMC 5.1:** V_{CC}=3.3 V V_{CCQ}=1.8 V **LPDDR4X:** V_{DD1}=1.8 V V_{DD2}=1.1 V V_{DDQ}=0.6 V
Dimensions	8.00 x 9.50 mm, 8.60 x 10.40 mm, 10.00 x 10.00 mm
Package	ePoP 144 Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	Ingenic, Qualcomm, UNISOC
Warranty	3-Year Limited

Applications



ePoP (eMMC 5.1 + LPDDR5X)

Features

- High-performance eMMC 5.1 + LPDDR5X
- High Frequency up to 8533 MT/s
- FFU (Field Firmware Update)
- Compact Size of 8.00 x 9.50 × 0.64 mm
- Compatible with Platform Qualcomm 6100 & AR2 Gen2S



Specifications

Interface	eMMC 5.1 + LPDDR5X
Capacity	Up to 64 GB + 32 Gb
Performance	**eMMC 5.1:** Sequential Read: Up to 290 MB/s Sequential Write: Up to 150 MB/s **LPDDR5X:** Up to 8533 MT/s
Operating Voltage	**eMMC 5.1:** V_{CC}=3.3 V V_{CCQ}=1.8 V **LPDDR5X:** V_{DD1}=1.8 V V_{DD2H}=1.05 V V_{DD2L}=0.9 V V_{DDQ}=0.5 V or 0.3 V
Dimensions	8.00 x 9.50 x 0.64 mm
Package	ePoP 201Ball
Operating Temperature	-25 °C to + 85 °C
Storage Temperature	-40 °C to + 85 °C
Supported Platforms	Qualcomm
Warranty	3-Year Limited

Applications



BGA SSD

Features

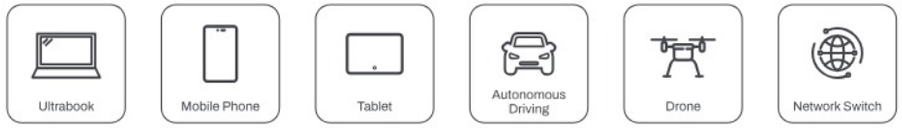
- High-Performance Storage
- Efficient Thermal Management
- Low Power Consumption
- Comprehensive Technology Support
- Premium Quality Assurance



Specifications

Model Name	EP410	EP420	EP401
Interface	PCIe Gen4 x4	PCIe Gen4 x4	PCIe Gen4 x2
Capacity	Up to 2 TB	Up to 2 TB	Up to 1 TB
Dimensions	16.0 x 20.0 x 1.6 mm (Max.)	16.0 x 20.0 x 1.4 mm (Max.)	11.50 x 13.00 x 1.35 mm (Max.)
Package	FBGA 291 Ball	FBGA 291 Ball	FBGA 345 Ball
NAND Type	3D TLC	3D TLC	3D TLC
DRAM Cache	DRAM-less	DRAM-less	DRAM-less
Sequential Read (Up to)	7300 MB/s	7400 MB/s	3700 MB/s
Sequential Write (Up to)	6600 MB/s	6800 MB/s	3450 MB/s
4K Read (Up to)	930K	1300K	850K
4K Write (Up to)	850K	1500K	650K
Read/Write Power Consumption (Avg.)	< 5 W	< 4.5 W	< 3 W
Operating Temperature	0 °C to 70 °C	-25 °C to 85 °C	0 °C to 70 °C
MTBF	1,500,000 hours	1,500,000 hours	1,500,000 hours

Applications



Applications





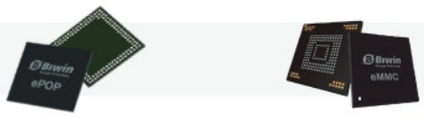
Smart Wearables

As applications for wearable devices continue to grow, the market for smart wearables is expanding faster than other consumer electronics. These devices now cover many fields (including fitness, health, and entertainment), driving a strong demand for ultra-small, ultra-thin, and long-lasting storage solutions.

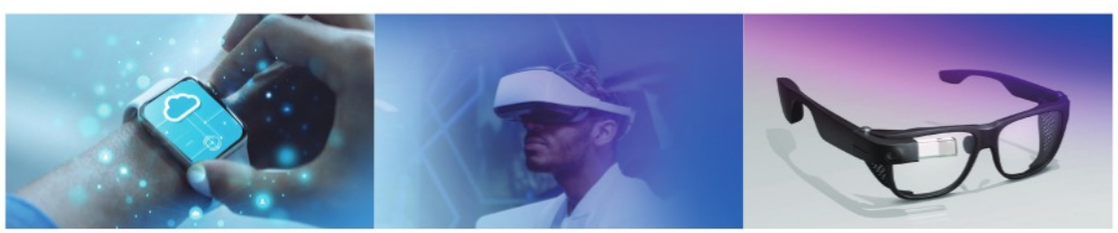
Storage Requirements for Smart Wearables:

- Low Power Consumption and Long Battery Life: Battery life is crucial for wearable devices which often remain in sleep mode for extended periods.
- Ultra-thin and Compact Size: Wearables design requires a sleek, compact form factor that allows for mobility, style and fashion considerations.
- High-performance Small I/O Operations: Wearable devices frequently handle small I/O data read/write tasks, requiring fast processing of these small data transactions.
- Low Latency: Faster responsiveness is highly important in AI-driven applications as well as AR/VR.

BIWIN Storage Solutions for Smart Wearables



Specifications	136 ball ePOP3: 10 x 10 mm Max → 4 GB + 4 Gb to 32 GB + 8 Gb
	144 ball ePoP4X: 8 x 9.5 mm Max → 32 GB + 16 Gb to 64 GB + 32 Gb
	201 ball ePoP5X: 8 x 9.5 mm Max → 64 GB + 16 Gb to 64 GB + 32 Gb
	153 ball eMMC: 8 x 7.5 mm Max → 4 GB to 64 GB
Features	Low-power firmware, high-density design, ultra-compact/thin ePoP integrated with SoC for optimal compactness



Smartwatches | AR/VR Headsets | AI Glasses

Wireless Communication

Wireless communication modules are essential for network connectivity, enabling devices to send and receive data and commands. Without these modules, devices become “information islands,” unable to transmit and receive data or commands. As such, these modules require data storage solutions to play their crucial role in information transmission.

Storage Requirements for Wireless Communication:

- High Integration: Designed for embedded applications, these modules maximize space efficiency and meet strict chip size requirements.
- 24/7 Continuous Operation: Ensures high reliability and stability, preventing data loss and maintaining system operation.
- High-Quality Standards: Comprehensive hardware and software design ensures consistent performance in demanding environments.
- Durability and Longevity: Supports frequent write operations to extend storage lifespan, meeting the high-frequency data recording demands of communication modules.

BIWIN Storage Solutions for Wireless Communication



Specifications	153 ball eMMC: 4 GB to 512 GB
	153 ball UFS: 64 GB to 512 GB
	200 ball / 245 ball / 315 ball / 496 ball LPDDR: 16 Gb to 128 Gb
	221 ball / 254 ball eMCP: 4 GB + 4 Gb to 128 GB + 64 Gb
	254 ball / 297 ball uMCP: 64 GB + 32 Gb to 512 GB + 64 Gb
Features	High integration, reliability and stability, low PPM for quality assurance



NB-IoT Modules | 4G Modules | 5G Modules | WiFi Modules | Bluetooth Modules

Commercial Displays

With the developing digital transformation across industries and new infrastructure trends, commercial displays (digital signage) are increasingly in demand. These customizable high-definition multimedia products are widely used across hotels, real estate, retail, conferencing, education, and healthcare, and in settings like malls, classrooms, airports, and train stations. The trend toward larger, smarter, interactive, and customized commercial displays brings higher performance and stability requirements for storage solutions.

Storage Requirements for Commercial Displays:

Commercial displays are used in business environments, requiring long-term, high-intensity and stable operation.
—High reliability to prevent data loss and damage, ensuring the continuous operation of commercial displays.
Expanding application scenarios for commercial displays, such as HD video playback, big data processing, AI-driven digital signage, and remote conferencing.
—Greater storage capacity.
Commercial displays need to connect and communicate with various devices and systems, such as computers, smartphones, and projectors.
—Broad compatibility to support connectivity with diverse devices and systems.
Stored data on commercial displays may include sensitive information, such as customer details and meeting records.
—Robust data protection features to prevent data leaks and unauthorized access.
Used in public areas or retail environments, commercial displays need to ensure data protection.

Solutions

BIWIN offers eMMC embedded storage solutions ranging from 4 GB to 512 GB, depending upon the need. These solutions support operating temperatures from -25 °C to 85 °C and undergo rigorous end-to-end testing to ensure stability and optimal performance. BIWIN's firmware provides power-loss protection, wear-leveling, FFU upgrade support, error checking, and correction (ECC) functions to ensure data integrity.





Robotic Vacuums

Robotic vacuums are now widely used in homes, offices, hotels, and hospitals, providing convenience across various settings. BIWIN provides customized high-quality storage solutions tailored to ensure long-term reliable device operation.

Challenges and Requirements

Complex Environments
— Fast read/write speeds for quick data processing.
Continuous Data Recording
— Multi-stream write capabilities for stable, long-term operation.
The battery life of a robotic vacuum directly affects its work efficiency
— Low power consumption.

Solutions and Benefits

LPDDR is a low-power dynamic random-access memory widely used in mobile, embedded, and IoT devices.
LPDDR4X operates under temperature ranges from **-25 °C to 85 °C** with speeds up to 4266 MT/s, enabling fast data handling. With **ECC, PASR**, and other features, LPDDR4X ensures long-term system stability and security, while its **low power consumption** significantly enhances vacuum battery life.



Smartphones

Smartphones are integral to everyday life, enabling communication, work, payments, and entertainment. To support diverse mobile applications, BIWIN provides high-performance LPDDR solutions.

Challenges and Requirements

Seamless Entertainment
— Fast processing speed.
Extended Standby
— Low power consumption.
Stable Performance with Minimal Crashes and Reboots
— Ultra-low PPM.

Solutions and Benefits

Smartphone storage chips directly impact performance, storage capacity, and user experience. To meet varying user needs, BIWIN offers LPDDR5X (128 Gb) with an 8533 MT/s data rate for enhanced multitasking.

This product features DVFS, which enables low-voltage operation under low loads, greatly reducing power consumption. To maintain product quality and reduce PPM, BIWIN built an SLT testing platform for pre-application testing, ensuring risk control with the PPM below 300.



Tablets

The tablet market is highly competitive, with various brands and companies vying for market share. Brands continuously launch new products, optimize user experiences, and adjust pricing to attract customers. High-resolution displays, high refresh rates, and AI capabilities enhance the tablet experience, boosting performance and expanding usage scenarios. Storage solutions face challenges in terms of technology, cost, user requirements, and market trends.

Challenges and Requirements

The rise of HD video, large games, and multimedia content and smooth experience of interactive products
— Real-time feedback with fast and stable read/write speeds.
The trend toward thinner and lighter devices while maintaining high performance.
— This increases the design complexity and manufacturing costs of storage chips and solutions.
Diverse user demands for tablet storage capacity and experience
— Highly customizable and compatible storage solutions.

Solutions

Speed - BIWIN UFS storage solution uses advanced serial data transfer and low-voltage differential signal interfaces, achieving significantly faster data transfer speeds. Compared to traditional eMMC, UFS read/write speeds are nearly four times higher, greatly improving device responsiveness and overall performance. This high-speed data transfer allows users to download apps, browse the web, and play HD videos faster, delivering a smoother experience.
Capacity - BIWIN UFS storage adopts multi-layer stacking technology, enabling greater storage capacity within the same chip area. This provides more storage space for mobile devices, meeting users' demands for large media files and applications.
Reliability - BIWIN UFS storage includes data logging and write protection features, ensuring data reliability and security.



BGA SSD Storage Solutions

Challenges and Requirements

- Compact Design: BGA SSDs are 30% smaller than traditional modular SSDs in dimensions, ideal for ultra-slim devices like 2-in-1 laptops, ultrabooks, and tablets.
- High Capacity, High Performance: Fast data read/write speeds for real-time processing, up to 4x faster than UFS.
- Low Power Consumption, Advanced Heat Dissipation: Ultra-low power (as low as 2 mW in PS4) and advanced thermal management for efficient heat distribution.
- Comprehensive Technologies: ATA encryption, end-to-end data protection, S.M.A.R.T., garbage collection, TRIM, wear leveling, in-drive RAID, bad block management, inspection technology, SLC caching, intelligent thermal tuning, ESD protection, and firmware updates.

BIWIN BGA SSD

		
Model Name	EP401	EP410
Capacity	256 GB to 1 TB	256 GB to 2 TB
Dimensions	11.50 × 13.00 × 1.35 mm	16.00 × 12.00 × 1.60 mm (Max.)
Interface	PCIe Gen4 ×2	PCIe Gen4 ×4
R/W (Up to)	3700 / 3450 MB/s	7300 / 6600 MB/s



ARM Cloud Servers



High-End Switches



Educational Tablets



2-in-1 Laptops

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