Apacer
For Industrial

The Most **Reliable**
Storage and Memory
For Industries

Gaming Solutions

industrial.apacer.com

Index

What Sets Apacer Apart?

Professional Technique

- Strong HW/FW engineering know-how
- Customized design with a variety of solutions
- State-of-the-art technology

Quality Assurance

- **100% reliable & compliant**
  - Wide temperature test
  - Thermal shock test
  - Strict ORT (Ongoing Reliability Test)
  - Power cycle test
  - Humidity test
  - Altitude test
  - Reliability test (Vibration/Shock)

Extensive Experience

- Tier 1 industrial SSD & memory supplier; delivered over 135 million units
- Comprehensive experience in product customization (across industries)

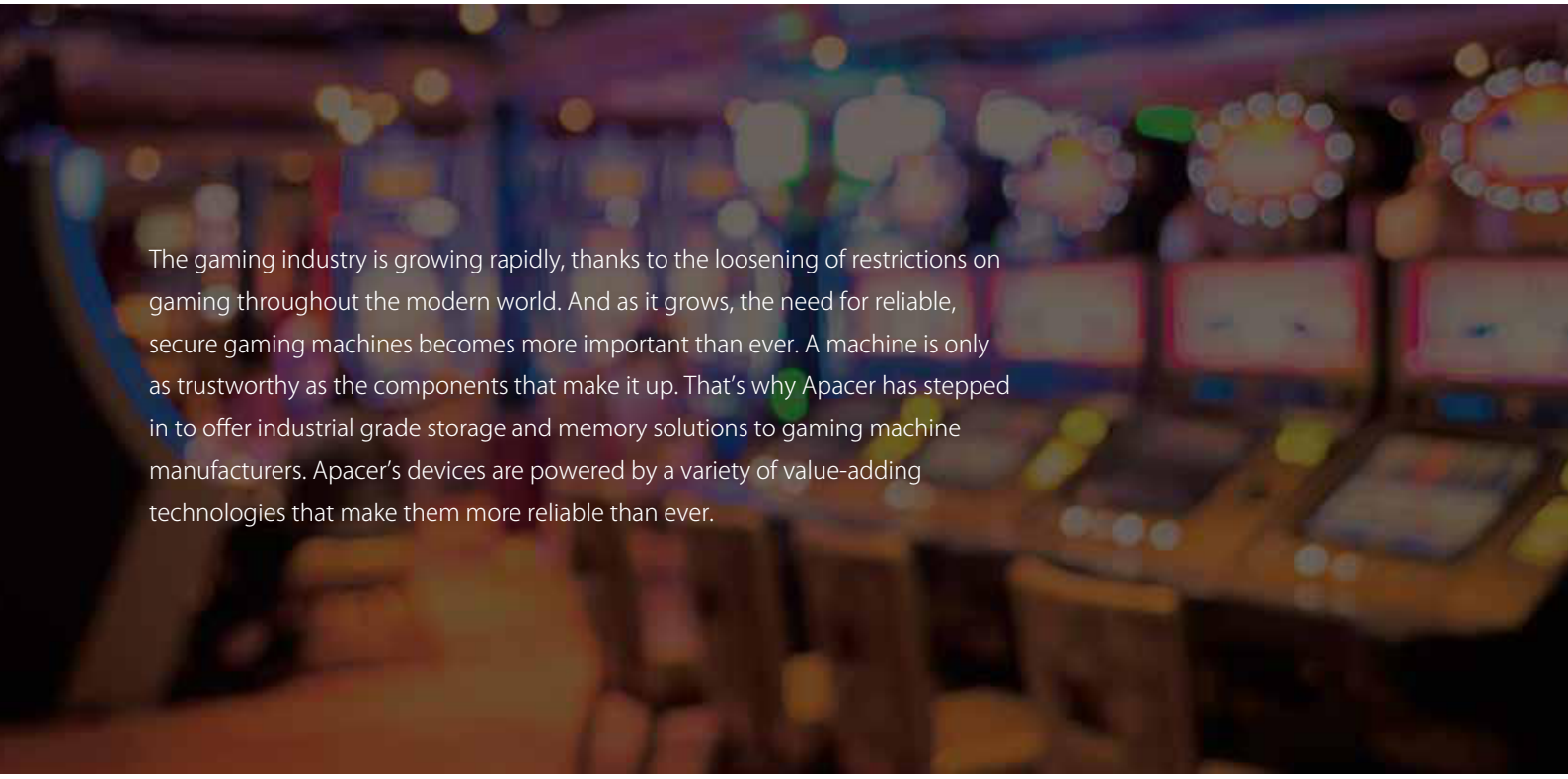
Reliable Service

- Fixed BOM solution
- Longevity of supply, EOL & LTB notice
- Manufacturing in Taiwan protects IP

Trustworthy Supplier

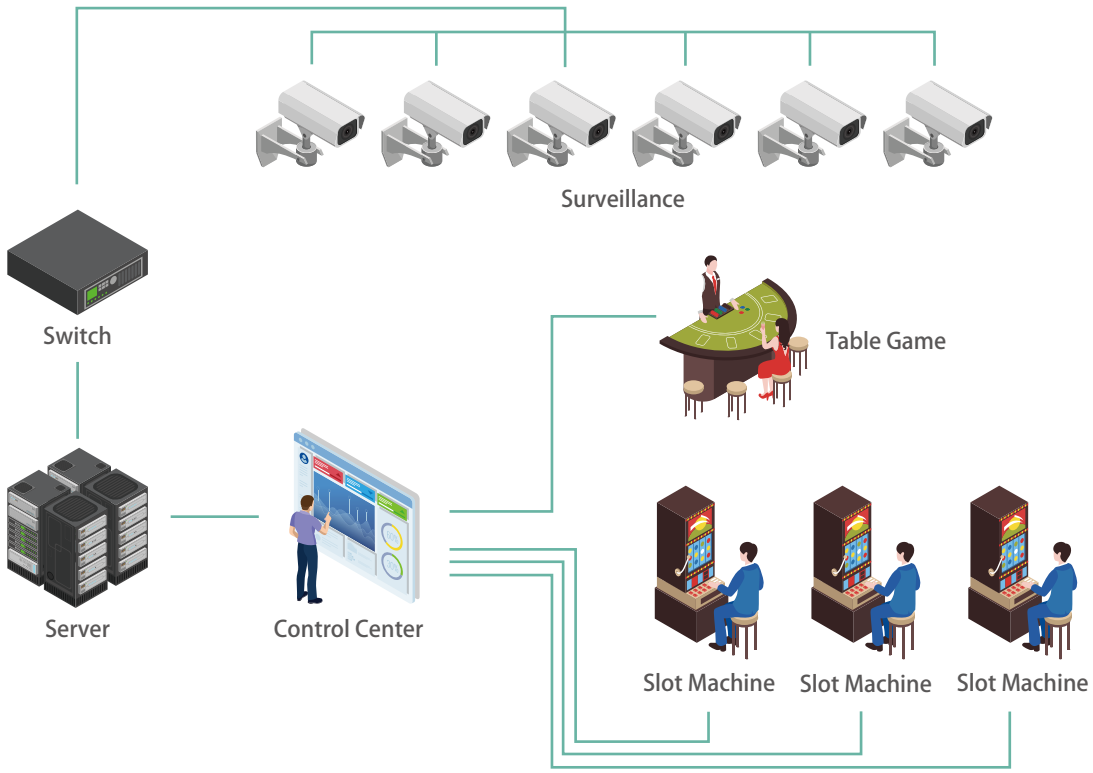
- A global-scale service and maintenance system
- Responsive local FAE technical support
- 24/7 flexible and quick delivery service
- Complete RMA system

Challenges and Requirements for Gaming Applications



The gaming industry is growing rapidly, thanks to the loosening of restrictions on gaming throughout the modern world. And as it grows, the need for reliable, secure gaming machines becomes more important than ever. A machine is only as trustworthy as the components that make it up. That's why Apacer has stepped in to offer industrial grade storage and memory solutions to gaming machine manufacturers. Apacer's devices are powered by a variety of value-adding technologies that make them more reliable than ever.

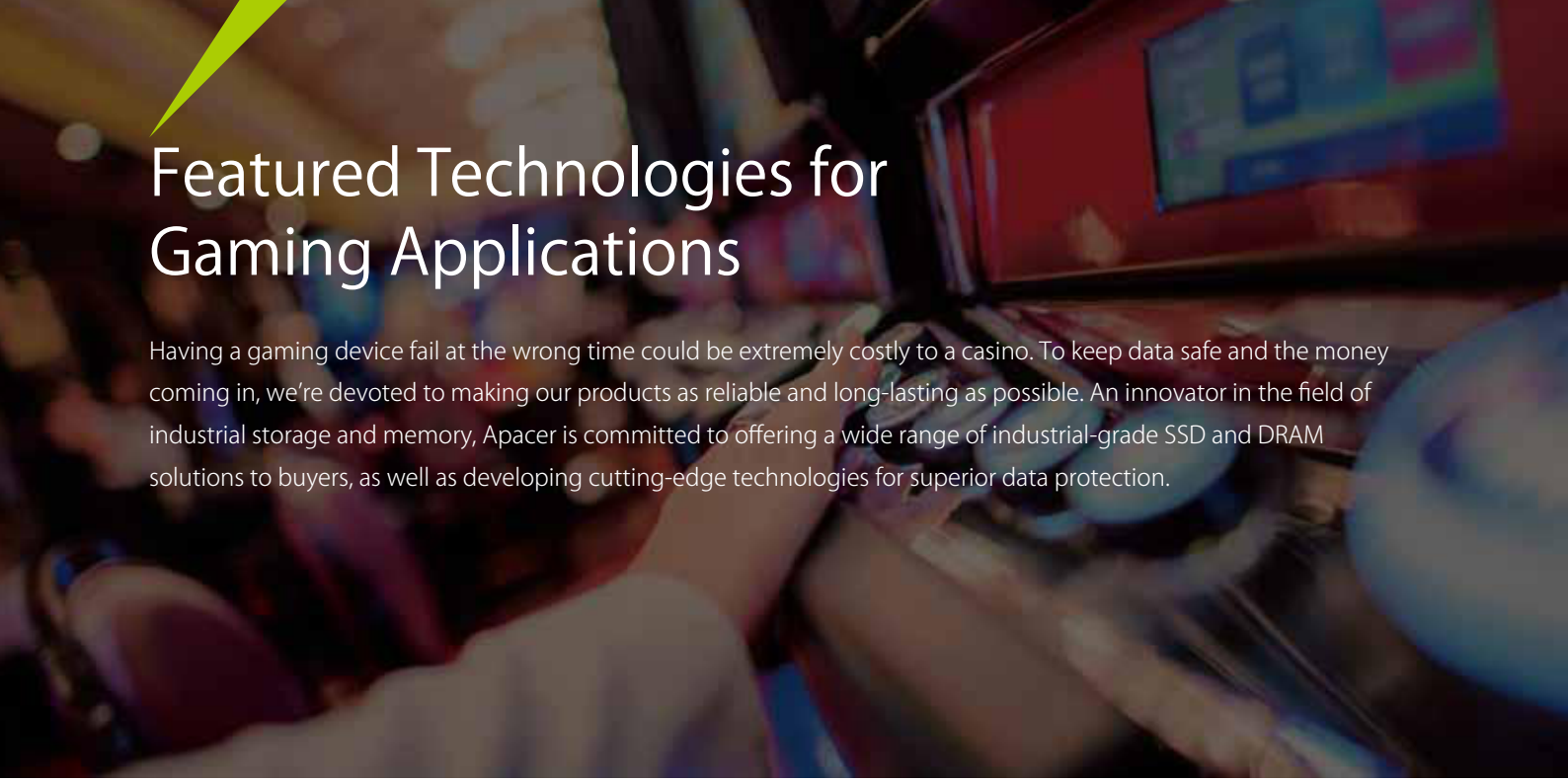
Gaming Applications



Challenges and Requirements

Security is clearly a major concern for manufacturers of gaming machines. Precautions must be taken so that hardware remains invulnerable to hacking or other unauthorized access to prevent theft or misuse. That's why Apacer's industrial-grade products support the strongest encryption protocols, including TCG Opal 2.0 and AES-256.

Reliability is also a crucial selling point for gaming machines, since many of them will be operating 24/7 without much downtime for maintenance. Gaming machines often also require read-intensive operations. With both of these challenges in mind, Apacer developed the Smart Read Refresh™ technology. This prevents the accumulation of read-disturb errors from harming hardware operation and extends the operational lifetime of devices as a result.



Featured Technologies for Gaming Applications

Having a gaming device fail at the wrong time could be extremely costly to a casino. To keep data safe and the money coming in, we're devoted to making our products as reliable and long-lasting as possible. An innovator in the field of industrial storage and memory, Apacer is committed to offering a wide range of industrial-grade SSD and DRAM solutions to buyers, as well as developing cutting-edge technologies for superior data protection.

Security

- AES 256-bit Encryption
- TCG Opal 2.0
- Write Protect
- Signed Firmware

Reliability & Endurance

- Over-provisioning
- DataDefender™
- CorePower
- SLC-lite
- SLC-liteX
- Wide Temperature
- Thermal Throttling
- Page Mapping
- Multi-PowerPath

Data Integrity

- Smart Read Refresh™
- DataRAID™

Longevity

- Fixed BOM
- 6+6 PCN/EOL Policy
- Double-barreled Solution
  - CoreAnalyzer2
  - SSDWidget 2.0

Security

Hardware-based AES Encryption

AES 256-bit encryption is an extremely high encryption standard. To brute-force it would take literally millions of years, so it has been adopted by many governments and defense contractors over recent years.

TCG Opal 2.0

Advanced encryption mechanism for data security

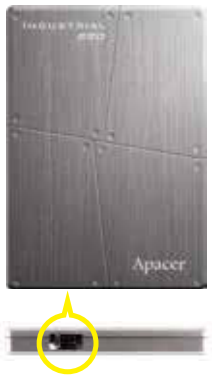
Apacer has stepped in with TCG Opal-compliant SSDs as the demand for more invincible data security solutions gives self-encrypting drives (SEDs) a strong foothold in the industrial SSD market.

- AES 256-bit encryption
- 100 % hardware encryption
- Fast data encryption
- Pre-boot authentication
- LBA range assignment

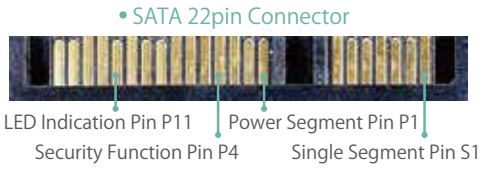
Write Protect

Write Protect can prevent drives from unauthorized data write via a hardware switch/pin or vendor software command.

a. Pin Header



b. Pin Configuration



c. Slide Switch

Signed Firmware

A digital signature that works inside firmware which can ensure the firmware comes from a trusted device and avoid malicious attacks.

Reliability & Endurance

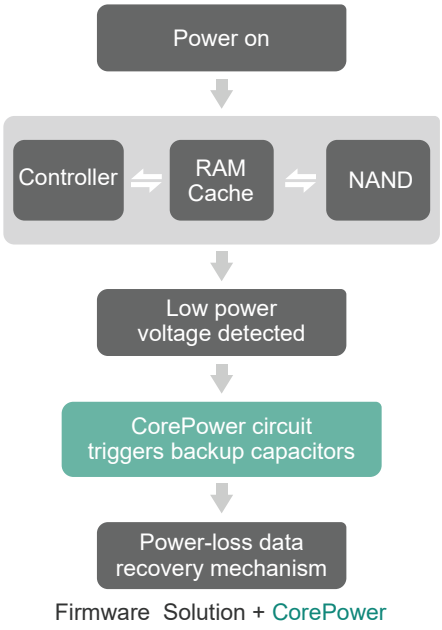
Over-provisioning

To reduce write amplification and increase endurance and performance, Apacer's SSDs support over-provisioning. The SSDs set aside a certain portion of the physical capacity of the memory to carry out garbage collection, wear-leveling and bad block mapping operations. The end result is a longer operating lifetime for our SSDs.

DataDefender™

Apacer DataDefender™ combines both firmware and hardware mechanisms to ensure data integrity.

When power disruption occurs, the hardware mechanism will notice and trigger the controller to run multiple write-to-flash cycles to store data. Then the firmware will check that the data was correctly written to the NAND flash after the power disruption, preventing data loss.



CorePower

Apacer's hardware-based technology is designed to prevent data loss and ensure the stability of data transmission during a power outage by implementing backup power supply that allows sufficient time to move all cached data to NAND flash.

- SSD will stop receiving host commands
- Detect IC will inform controller to move all the cached data into NAND
- Capacitors start working - backup power supply

SLC-liteX

Apacer's 3D NAND SLC-liteX technology breaks through the limitations of existing technology and provides up to 30,000 P/E cycles, which is 10 times more than MLC or industrial 3D TLC.

SLC-lite

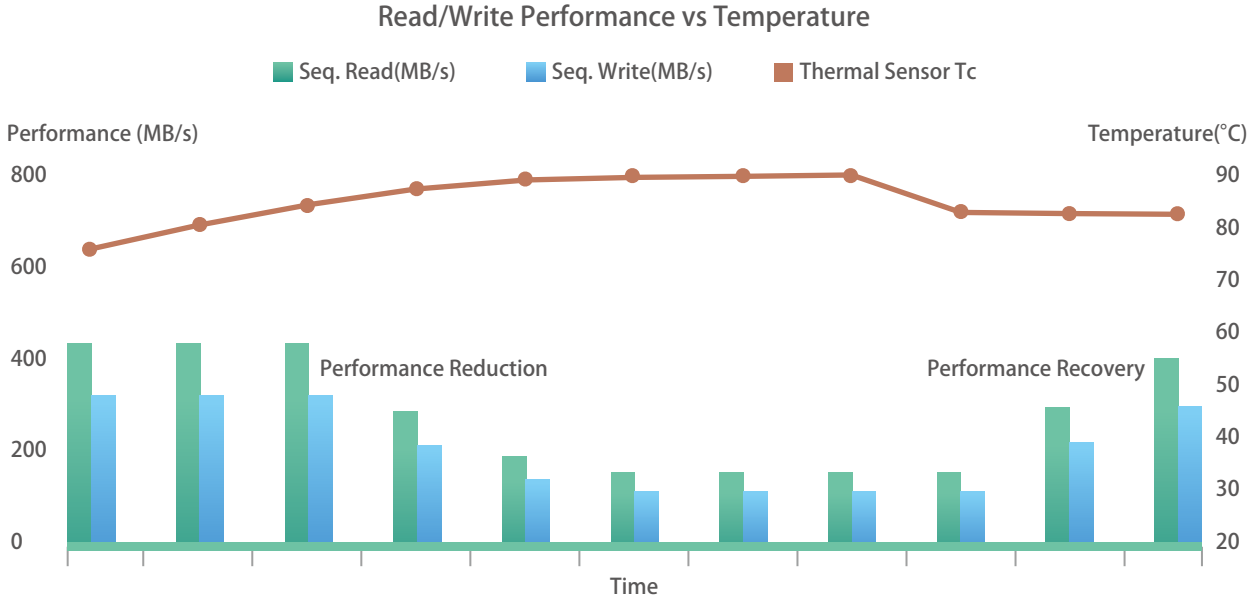
SLC-lite is Apacer's proprietary technology that strikes a cost-performance balance between MLC and SLC flash types, making it an ideal alternative solution for mission-critical embedded or industrial applications.

Wide Temperature

Apacer's products are designed with wide temperature support to ensure reliable operation in extreme temperatures ranging from -40ºC to 85ºC.

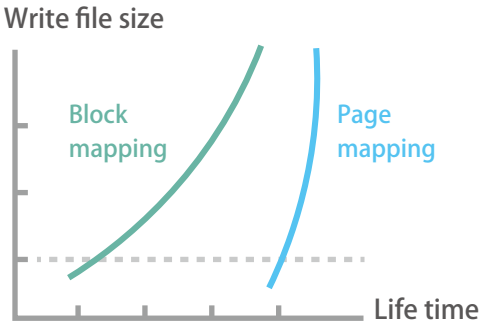
Thermal Throttling

To prevent overheating, Apacer equips SSD products with a built-in thermal sensor to monitor the temperature of the SSD via S.M.A.R.T commands and configures the drive with firmware deployment of thermal throttling to manage the device temperature when responding to increased temperature conditions.



Page Mapping

Page mapping is an advanced flash management technology which distributes the data into flash pages to allow the data to be evenly written. This way, random access speed will be increased. Also, it reduces the block erasing frequency.



Multi-PowerPath

While a traditional 7-pin miniature SSD requires an external power supply, Apacer offers an alternative. Our patented plug-and-play Multi-PowerPath supplies power through two power connectors (7+2) on the side or through the 7th pin. This allows an SSD to operate without an external power supply, giving it the dual advantages of signal integrity and flexible configuration on the motherboard.

Data Integrity

SMART Read Refresh™

Apacer Smart Read Refresh™ plays a proactive role in avoiding read disturb errors from occurring to ensure health status of all blocks of NAND flash. Developed for read-intensive applications in particular, Smart Read Refresh™ is employed to make sure that during read operations, when the read operation threshold is reached, the data is refreshed by re-writing it to a different block for subsequent use.

DataRAID™

Apacer's DataRAID™ algorithm applies an additional level of protection and error-checking. Using this algorithm, a certain amount of space is given over to aggregating and resaving the existing parity data used for error checking. So, in the event that data becomes corrupted, the parity data can be compared to the existing uncorrupted data and the content of the corrupted data can be rebuilt.

Longevity

Double-barreled Solution

Apacer's Double-barreled Solution extends SSD lifespans, and is comprised of CoreAnalyzer2 and SSDWidget 2.0. CoreAnalyzer2 helps determine which SSD and firmware are most suitable for a customer's application, and SSDWidget 2.0 allows for customers to remotely monitor SSD status in real-time on smartphones or other connected devices, via their private server.

Step 1

CoreAnalyzer2 – Know your application

Choose the most suitable F/W for SSD

Step 2

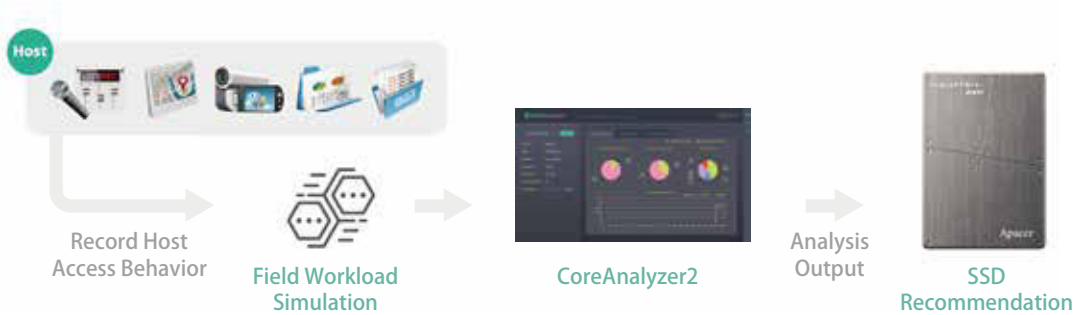
SSDWidget 2.0 – Monitor your SSD Status

Anticipate and mitigate SSD failures remotely

Longer-lasting SSDs

CoreAnalyzer2

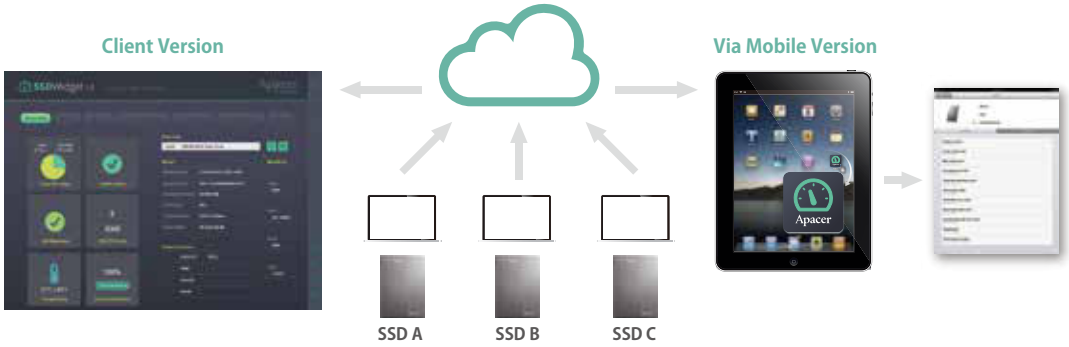
CoreAnalyzer is an exclusive, analytic data-behavior technology integrated with Apacer's SSD products. By collecting and analyzing data from a customer's host system, it can help customers analyze their usage behavior so they can choose the best-suited SSD for their application.



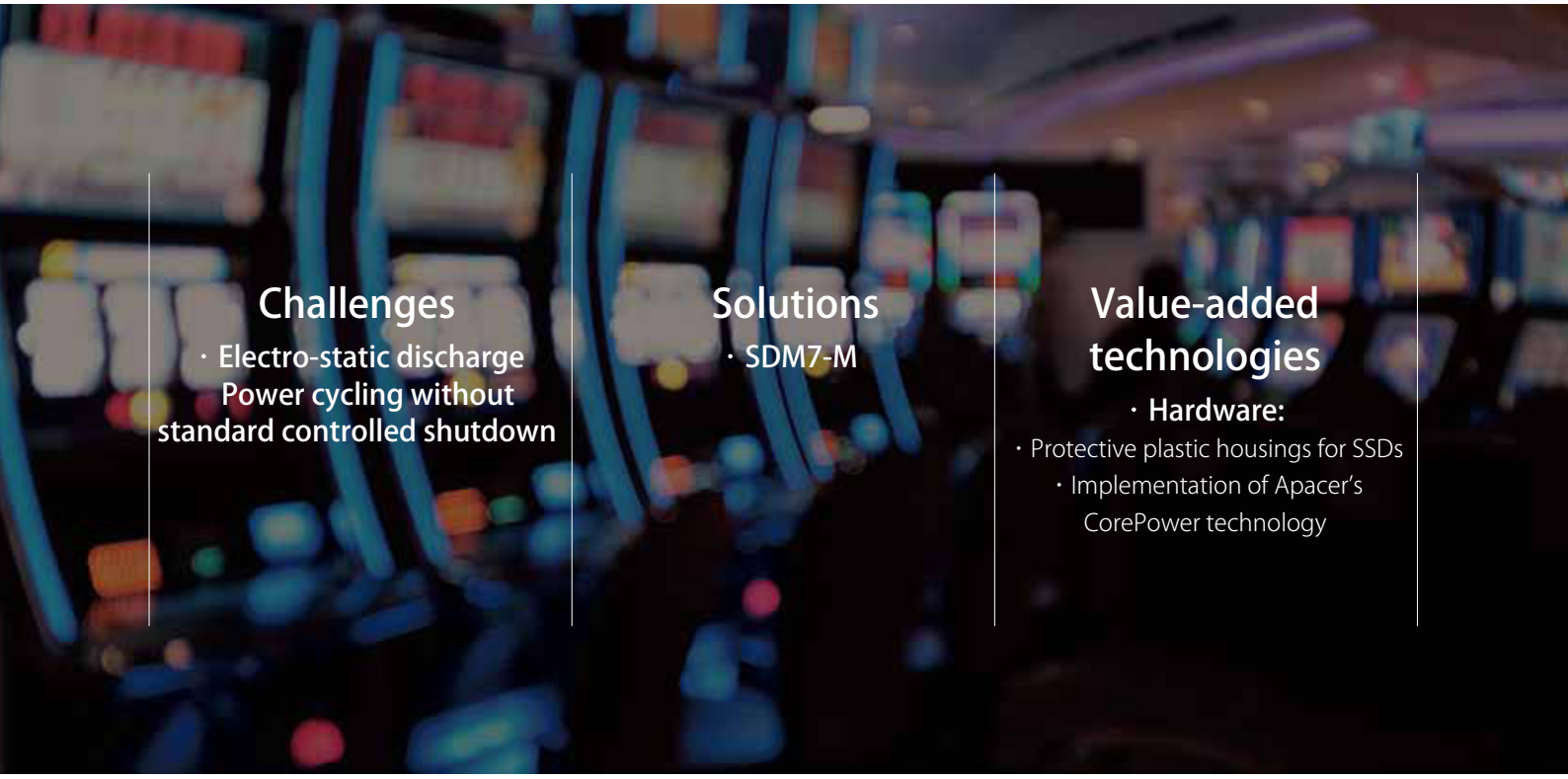
SSDWidget 2.0

Intelligent and comprehensive monitoring and maintaining software

This program features advanced monitoring that allows users to get more detailed read and write records for further use-behavior analysis. The SSD self-test and performance optimization are also included.



Success Story - They Chose Apacer



Challenges

・Electro-static discharge
Power cycling without standard controlled shutdown

Solutions

・SDM7-M

Value-added technologies

・**Hardware:**

・Protective plastic housings for SSDs

・Implementation of Apacer's CorePower technology

The Customer and the Application: Gaming Machines

Our customer is an industry leader in the world of gaming machine manufacturing. Their systems are popular in high-end casinos around the world, so they demand only the finest components. But when they had a problem with their original supplier, they turned to Apacer to help them find a solution.

Challenges

The customer sent Apacer's engineering team a batch of SSDs they had purchased from another supplier. All of the SSDs were damaged beyond repair, yet they had only been in use for six months or less. The customer had approached their original supplier and asked them to figure out the causes of the failures, but the original supplier could not come to any finite conclusions. Frustrated with this lack of practical feedback, the customer called Apacer, since they knew we were a veteran supplier of industrial-grade storage solutions with extensive experience in the gaming industry.

Having received the batch of damaged SSDs in the mail, Apacer's squad of engineers set to work to find out the root cause of the problem.

Solutions and Technologies

Apacer's engineering team first determined that the SSDs had been damaged by electro-static discharge (ESD). This is a common phenomenon within complex electronic devices – static electricity builds up over time, and when it finally discharges, it's powerful enough to cause fatal damage to sensitive unprotected circuits.

Apacer's design team offered the customer a simple solution to this problem. They suggested encasing each SSD in a plastic housing to protect their circuits from ESD, and also to strengthen all the components of the PCB and upgrade certain converters and power ICs. This cost-effective approach could effectively ensure the SSDs would remain safe and operate without interruption.

There was an another issue that Apacer's engineering team identified, in addition to ESD. They determined that in many cases, the customer's gaming machines were being power cycled without being shut down first. In other words, the end-users would not take the time to power down each machine individually. Rather, to save time, at the end of the working day, the power supply to multiple machines would be cut off without warning. Since a controlled shut down is an important part of prolonging a computing device's lifetime, repeated power cycling was taking an early toll on the customer's machines.

To combat this phenomenon, our team suggested that the customer incorporate Apacer's CorePower technology into their designs. This hardware- and firmware-based technology is designed to prevent data loss and ensure the stability of data transmission when power supply is unexpectedly cut off. The capacitor circuit design ensures sufficient time to move all cached data to NAND flash. The customer couldn't control how its end-users power-cycled their gaming machines, but with this technology in place, damage from power cycling would be completely eliminated.

Results and Benefits:

The customer was very impressed with how Apacer's engineering team was able to quickly identify the problems that were plaguing their machines and to offer practical, affordable solutions to those problems. They started to design-in and phase in Apacer's SSDs to replace their previous supplier. They recognized that Apacer's extensive experience in the industry could help overcome any challenge they might encounter.

Additional Support

Longevity

Fixed BOM solution,
EOL & LTB notice

Strong customization capabilities

Strong HW/FW
engineering know-how

Service

Real-time and responsive
after-sales service

Apacer's Strengths

Industrial solutions for gaming applications

ISO 13486 CE FC MIL-STD 810G RoHS REACH

Longevity

Fixed BOM support
6+6 PCN/EOL Policy
Unique S/N for RMA tracking

Strong R&D and customization capabilities

Apacer's Premium Package: CasinoPro™

A Tailor-made Technology Set for Casino Applications

Apacer has developed a tailor-made technology set, CasinoPro™, to meet the multi-faceted requirements of gaming applications and help customers find the right solutions for their circumstances, further simplifying the process of implementation.

CasinoPro™ is classified into three levels based on customers' requirements and Apacer's strong industry background.

PCIe




Model	PV310-M280	PV120-M280	PV130-M242	PV130-CFX
Interface	PCIe Gen3 x4	PCIe Gen3 x2	PCIe Gen3 x2	PCIe Gen3 x2
Connector	M.2 M key	M.2 B & M key	M.2 B & M key	21-pin male
Form Factor	M.2 2280	M.2 2280	M.2 2242	CFX Type B Card
NAND Flash Type	3D TLC	3D TLC	3D TLC	3D TLC
Capacity	120GB~960GB	120GB~960GB	60GB~480GB	120GB~480GB
DRAM Solution	Yes	Yes	No	No
Sustained Read Performance (MB/sec)	UP to 3,290	UP to 1,700	UP to 1,600	Up to 1550
Sustained Write Performance (MB/sec)	UP to 2,470	UP to 1,000	UP to 1,000	Up t.o 950
ECC Engine	Low-Density Parity-Check (LDPC) Code	Low-Density Parity-Check (LDPC) Code	Low-Density Parity-Check (LDPC) Code	Low-Density Parity-Check (LDPC) Code
IOPS (4K Random Write)	158K	182K	181K	170K
Standard Operating Temperature (°C)	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temperature (°C)	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85
Storage Temperature (°C)	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100
Thermal Sensor	Yes	Yes	Yes	-
Shock	Operation: 50G/11ms (compliant with MIL-STD-202G) Non-operation: 1500G/0.5ms (compliant with MIL-STD-883K)			
Vibration	Operation: 7.69 Grms, 20~2000 Hz/random (compliant with MIL-STD-810G) Non-operation: 4.02 Grms, 15 ~ 2000 Hz/sine (compliant with MIL-STD-810G)			
Operating Voltage	3.3 V ± 5%	3.3 V ± 5%	3.3 V ± 5%	3.3V ± 5%
Power Consumption	Active mode: 2,120 mA Idle mode: 255 mA	Active mode: 1,040 mA Idle mode: 140 mA	Active mode: 785 mA Idle mode: 135 mA	Active mode: 970 mA Idle mode: 135 mA
Dimension (mm)	80.00 x 22.00 x 3.88	Single side: 80.00 x 22.00 x 2.38 Double side: 80.00 x 22.00 x 3.88	Single side: 42.00 x 22.00 x 2.38 Double side: 42.00 x 22.00 x 3.88	29.6 x 38.5 x 3.8
MTBF (hours)	>1,000,000	>1,000,000	>1,000,000	>1,000,000

2.5 SSD





Model	SV250-25	SM230-25	SM210-25	SM21P-25	SU210-25
Interface	SATA3.0(6Gb/s)	SATA 3.1 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)
Connector	(7+15)pin male	(7+15)pin male	(7+15) pin male	(7+15) pin male	(7+15) pin male
Form Factor	2.5"	2.5"	2.5"	2.5"	2.5"
NAND Flash Type	3D TLC	MLC	MLC	MLC	MLC
Capacity	30GB~480GB	With AES 256 support: 32GB~1TB With TCG Opal 2.0 support: 32GB~512GB	32GB~512GB	32GB~512GB	16GB~256GB
DRAM Solution	No	No	Yes	Yes	Yes
Sustained Read Performance (MB/sec)	UP to 560	Up to 530	Up to 510	Up to 505	Up to 545
Sustained Write Performance (MB/sec)	UP to 520	Up to 520	Up to 380	Up to 470	Up to 450
ECC Engine	Low-Density Parity-Check (LDPC) Code	Built-in 40-bit per 1K bytes BCH ECC	Built-in 40-bit per 1K bytes BCH ECC	Built-in 40-bit per 1K bytes BCH ECC	Built-in 40-bit per 1K bytes BCH ECC
IOPS (4K Random Write)	73K	65K	79K	81K	80K
Standard Operating Temperature (°C)	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temperature (°C)	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85
Storage Temperature (°C)	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100
Thermal Sensor	Yes	Yes	Yes	Optional	Yes
Shock	Operating:50G/11ms,(compliant with MIL-STD-202G) Non-operating: 1500G/0.5ms,(compliant with MIL-STD-883K)				
Vibration	Operating: 7.69 GRMS, 20~2000Hz/random,(compliant with MIL-STD-810G) Non-operating: 4.02Grms,, 15~2000Hz/sine, (compliant with MIL-STD-810G)				
Operating Voltage	5.0 V ± 10%	5.0 V ± 5%	5.0 V ± 5%	5.0 V ± 5%	5.0 V ± 5%
Power Consumption	Active mode: 385 mA Idle mode: 100 mA	Active mode: 500 mA Idle mode: 95 mA	Active mode: 680 mA Idle mode: 60 mA	Active mode: 1100 mA Idle mode: 120 mA	Active mode: 560 mA Idle mode: 75 mA
Dimension (mm)	7mm: 100.00 x 69.85 x 6.90 9.5mm: 100.00 x 69.85 x 9.30	7mm: 100.00 x 69.85 x 6.90	7mm: 100.00 x 69.85 x 6.90 9.5mm: 100.00 x 69.85 x 9.30	9.5mm: 100.00 x 69.85 x 9.30	7mm: 100.00 x 69.85 x 6.90 9.5mm: 100.00 x 69.85 x 9.30
MTBF (hours)	>1,000,000	>1,200,000	>1,000,000	>1,000,000	>1,000,000

M.2





Model	SV250-M242	SM230-M242	SV250-M280	SM230-M280 SM23P-M280	SU230-M280
Interface	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA3.0(6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)
Connector	M.2 B & M key	M.2 B & M key	M.2 B & M key	M.2 B & M key	M.2 B & M key
Form Factor	M.2 2242	M.2 2242	M.2 2280	M.2 2280	M.2 2280
NAND Flash Type	3D TLC	MLC	3D TLC	MLC	MLC
Capacity	30GB~480GB	8GB~256GB	30GB~960GB	With AES 256 support: 32GB~1TB	32GB ~ 128GB
DRAM Solution	No	No	No	No	No
Sustained Read Performance (MB/sec)	Up to 560	Up to 525	UP to 560	Up to 560	Up to 560
Sustained Write Performance (MB/sec)	Up to 520	Up to 355	UP to 525	Up to 510	Up to 470
ECC Engine	Low-Density Parity-Check (LDPC) Code	Built-in up to 72-bit per 1K bytes BCH ECC	Low-Density Parity-Check (LDPC) Code	Built-in up to 72-bit per 1K bytes BCH ECC	Built-in up to 72-bit per 1K bytes BCH ECC
IOPS (4K Random Write)	75K	40K	75K	63K	57K
Standard Operating Temperature (°C)	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temperature (°C)	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85
Storage Temperature (°C)	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100
Thermal Sensor	Yes	Yes	Yes	Yes	Yes
Shock	Operation: 50G/11ms (compliant with MIL-STD-202G) Non-operation: 1500G/0.5ms (compliant with MIL-STD-883K)				
Vibration	Operation: 7.69 Grms, 20~2000 Hz/random (compliant with MIL-STD-810G) Non-operation: 4.02 Grms, 15 ~ 2000 Hz/sine (compliant with MIL-STD-810G)				
Operating Voltage	3.3 V ± 5%	3.3 V ± 5%	3.3 V ± 5%	3.3 V ± 5%	3.3 V ± 5%
Power Consumption	Active mode: 405mA Idle mode: 70 mA	Active mode: 695mA Idle mode: 135 mA	Active mode: 455 mA Idle mode: 80 mA	Active mode: 695mA Idle mode: 135 mA	Active mode: 740mA Idle mode: 145 mA
Dimension (mm)	42.00 x 22.00 x 3.80	42.00 x 22.00 x 3.80	80.00 x 22.00 x 3.58	80.00 x 22.00 x 2.23	80.00 x 22.00 x 2.33
MTBF (hours)	>1,000,000	>1,000,000	>1,000,000	>1,000,000	>1,000,000

CFast

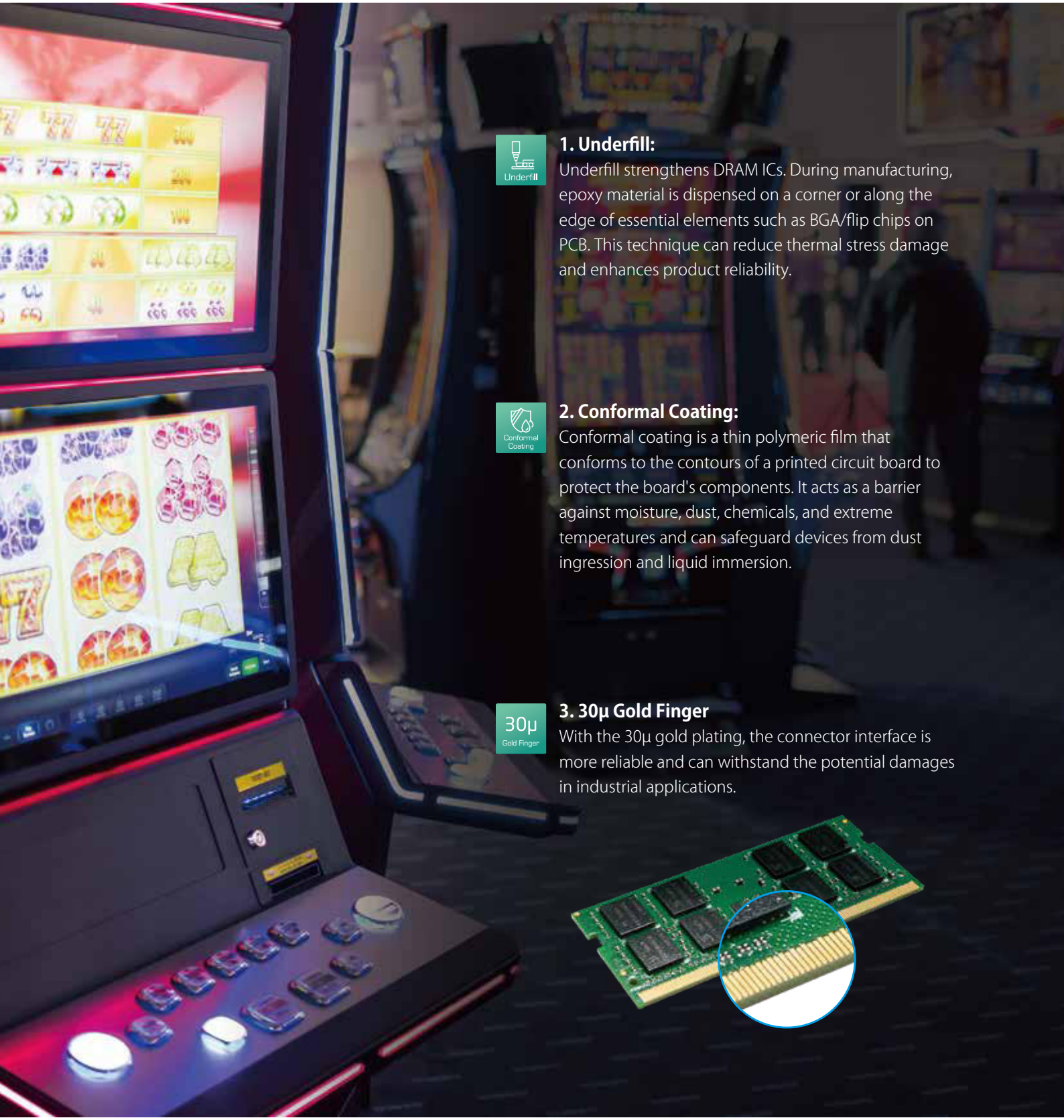
Model	SV170-CFast	SM230-CFast	SM22P-CFast	SU230-CFast
Interface	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)
Connector	(7+17) pin male	(7+17) pin male	(7+17) pin male	(7+17) pin male
Form Factor	CFast	CFast	CFast	CFast
NAND Flash Type	3D TLC	MLC	MLC	MLC
Capacity	30GB~480GB	8GB~256GB	8GB~128GB	8GB ~ 128GB
DRAM Solution	No	No	Yes	No
Sustained Read Performance (MB/sec)	Up to 560	Up to 560	Up to 475	Up to 555
Sustained Write Performance (MB/sec)	Up to 520	Up to 465	Up to 85	Up to 475
ECC Engine	Low-Density Parity-Check (LDPC) Code	Built-in up to 72-bit per 1K bytes BCH ECC	Built-in 72-bit per 1K bytes BCH ECC	Built-in up to 72-bit per 1K bytes BCH ECC
IOPS (4K Random Write)	84K	41K	16K	58K
Standard Operating Temperature (°C)	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temperature (°C)	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85
Storage Temperature (°C)	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100
H/W Write Protect	Yes	Yes	-	Yes
Thermal Sensor	Yes	Yes	Optional	Yes
Shock	Operation: 50G/11ms (compliant with MIL-STD-202G) Non-operation: 1500G/0.5ms (compliant with MIL-STD-883K)			
Vibration	Operation: 7.69 Grms, 20~2000 Hz/random (compliant with MIL-STD-810G) Non-operation: 4.02 Grms, 15 ~ 2000 Hz/sine (compliant with MIL-STD-810G)			
Operating Voltage	3.3 V ± 5%	3.3 V ± 5%	3.3 V ± 5%	3.3 V ± 5%
Power Consumption	Active mode: 355 mA Idle mode: 90 mA	Active mode: 645 mA Idle mode: 135 mA	Active mode: 610 mA Idle mode: 140 mA	Active mode: 645 mA Idle mode: 120 mA
Dimension (mm)	42.80 x 36.45 x 3.60	42.80 x 36.45 x 3.60	36.4 x 42.8 x 3.60	42.80 x 36.45 x 3.60
MTBF (hours)	>1,000,000	>1,000,000	>1,000,000	>1,000,000

SSD Module




Model	SV250-7LP2	SDM7-M 7P/180D LP2(H)	SDM5A-M 7P/90D LP(H)	SDM5A-M 7P/180D LP5(H)	SDM5A 7P/270D N1
Interface	SATA3.0(6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)	SATA 3.0 (6Gb/s)
Connector	7-pin	7-pin	7-pin	7-pin	7-pin
Form Factor	SATA Disk Module: 7-pin/180 degree	SATA Disk Module	SATA Disk Module	SATA Disk Module	SATA Disk Module
NAND Flash Type	3D TLC	MLC	MLC	MLC	SLC
Capacity	60GB~240GB	8GB ~ 64GB	4GB~32GB	16GB ~ 64GB	2GB~32GB
DRAM Solution	No	No	No	Yes	No
Sustained Read Performance (MB/sec)	UP to 560	UP to 135	Up to 120	Up to 435	Up to 65
Sustained Write Performance (MB/sec)	UP to 510	UP to 90	Up to 40	Up to 80	Up to 105
ECC Engine	Low-Density Parity-Check (LDPC) Code	Built-in 72-bit per 1K bytes BCH ECC	Built-in 40-bit per 1K bytes BCH ECC	Built-in 40-bit per 1K bytes BCH ECC	Built-in 40-bit per 1K bytes BCH ECC
IOPS (4K Random Write)	75K	22K	-	-	-
Standard Operating Temperature (°C)	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temperature (°C)	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85	-40 ~ + 85
Storage Temperature (°C)	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100	-40 ~ + 100
Housing	No	Optional	Optional	Optional	No
H/W Write Protect	Optional	Optional	No	Optional	Optional
Screw Hole	No	No	No	No	Yes
Cable-less Solution	Muti-PowerPath	Muti-PowerPath	Optional (7+2 pin)	Muti-PowerPath	Optional (7+2 pin)
Thermal Sensor	Yes	Yes	-	No	-
Shock	Operation: 50G/11ms (compliant with MIL-STD-202G) Non-operation: 1500G/0.5ms (compliant with MIL-STD-883K)				
Vibration	Operation: 7.69 Grms, 20~2000 Hz/random (compliant with MIL-STD-810G) Non-operation: 4.02 Grms, 15 ~ 2000 Hz/sine (compliant with MIL-STD-810G)				
Operating Voltage	5 V ± 5%	5.0 V ± 5%	5.0 V ± 5%	5.0 V ± 5%	5.0 V ± 5%
Power Consumption	Active mode: 455 mA Idle mode: 80 mA	Active mode: 215 mA Idle mode: 105 mA	Active mode: 160 mA Idle mode: 65 mA	Active mode: 225 mA Idle mode: 70 mA	Active mode: 205 mA Idle mode: 85 mA
Dimension (mm)	33.00 x 29.30 x 8.85	Without housing: 35.2 x 30.4 x 9.25 With housing: 33.0 x 29.3 x 88.5	Without housing: 30.0 x 20 x 15.2 With housing: 32.5 x 23.13 x 17.8	Without housing: 35.2 x 30.4 x 9.25 With housing: 33.0 x 29.3 x 88.5	52.5 x 23.0 x 15.2
MTBF (hours)	>1,000,000	>1,000,000	>1,000,000	>1,000,000	>2,000,000

Rugged DRAM Modules



Underfill

1. Underfill:
Underfill strengthens DRAM ICs. During manufacturing, epoxy material is dispensed on a corner or along the edge of essential elements such as BGA/flip chips on PCB. This technique can reduce thermal stress damage and enhances product reliability.

Conformal Coating

2. Conformal Coating:
Conformal coating is a thin polymeric film that conforms to the contours of a printed circuit board to protect the board's components. It acts as a barrier against moisture, dust, chemicals, and extreme temperatures and can safeguard devices from dust ingression and liquid immersion.

30µ
Gold Finger

3. 30µ Gold Finger
With the 30µ gold plating, the connector interface is more reliable and can withstand the potential damages in industrial applications.

Wide Temp. UDIMM / SODIMM




Model	DDR4 Wide Temp. UDIMM	DDR3 Wide Temp. UDIMM	DDR4 Wide Temp. SODIMM	DDR3 Wide Temp. SODIMM
Module Type	Wide Temperature UDIMM	Wide Temperature UDIMM	Wide Temperature SODIMM	Wide Temperature SODIMM
Memory Technology	DDR4	DDR3	DDR4	DDR3
Frequency	2133/2400/2666	1066/1333/1600	2133/2400/2666	1066/1333/1600
Density	4G/8G/16G	1G/2G/4G/8G	4G/8G/16G	1G/2G/4G/8G
Voltage	1.2v	1.5v/1.35v	1.2v	1.5v/1.35v
Pin Count	288-Pin	240-Pin	260-Pin	204-Pin
Width	64-Bit	64-Bit	64-Bit	64-Bit
PCB Height	1.23	1.18	1.18	1.18
Operation Temperature	TC=-40℃ to 85℃	TC=-40℃ to 85℃	TC=-40℃ to 85℃	TC=-40℃ to 85℃
Value-Added	Wide Temperature, 30μ	Wide Temperature, 30μ	Wide Temperature, 30μ	Wide Temperature, 30μ

Wide Temp. ECC UDIMM / ECC SDIMM




Model	DDR4 Wide Temp. ECC UDIMM	DDR3 Wide Temp. ECC UDIMM	DDR4 Wide Temp. ECC SODIMM	DDR3 Wide Temp. ECC SODIMM
Module Type	Wide Temperature ECC UDIMM	Wide Temperature ECC UDIMM	Wide Temperature ECC SODIMM	Wide Temperature ECC SODIMM
Memory Technology	DDR4	DDR3	DDR4	DDR3
Frequency	2133/2400/2666	1066/1333/1600	2133/2400/2666	1066/1333/1600
Density	4G/8G/16G	1G/2G/4G/8G	4G/8G/16G	2G/4G/8G
Voltage	1.2v	1.5v/1.35v	1.2v	1.5v/1.35v
Pin Count	288-Pin	240-Pin	260-Pin	204-Pin
Width	72-Bit	72-Bit	72-Bit	72-Bit
PCB Height	1.23	1.18	1.18	1.18
Operation Temperature	TC=-40℃ to 85℃	TC=-40℃ to 85℃	TC=-40℃ to 85℃	TC=-40℃ to 85℃
Value-Added	Wide Temperature, 30μ, Thermal Sensor	Wide Temperature, 30μ, Thermal Sensor	Wide Temperature, 30μ, Thermal Sensor	Wide Temperature, 30μ, Thermal Sensor

About Apacer

Apacer is a global leader in digital storage solutions devoted to innovative storage technology and services. After 20 years in the industry, we remain dedicated to our belief in "persistence in doing the right things." Our core values, as always, continue to revolve around reliability and innovation.

The company focuses on embedded applications for a variety of vertical markets, including military, medical, gaming, and industrial, and has become an integration expert in digital storage, innovative applications, and value-added services. Apacer is known for its advanced technologies and product quality and was ranked by Gartner as the top industrial SSD supplier for five consecutive years, from 2012 to 2016. In addition, Apacer is committed to making a positive impact on societal issues and has joined the **Responsible Business Alliance (RBA)**, which is formerly known as Electronic Industry Citizenship Coalition (EICC), a coalition promoting **corporate social responsibility (CSR)** within the global electronics supply chain. We believe that the success of a corporation is marked not by profit but by how we benefit others, whether by caring for the environment or making contributions to society.

Compliance and Associations

ISO 9001:2015 | ISO 14001:2015 | OHSAS 18001:2015 | IECQ CQ80000