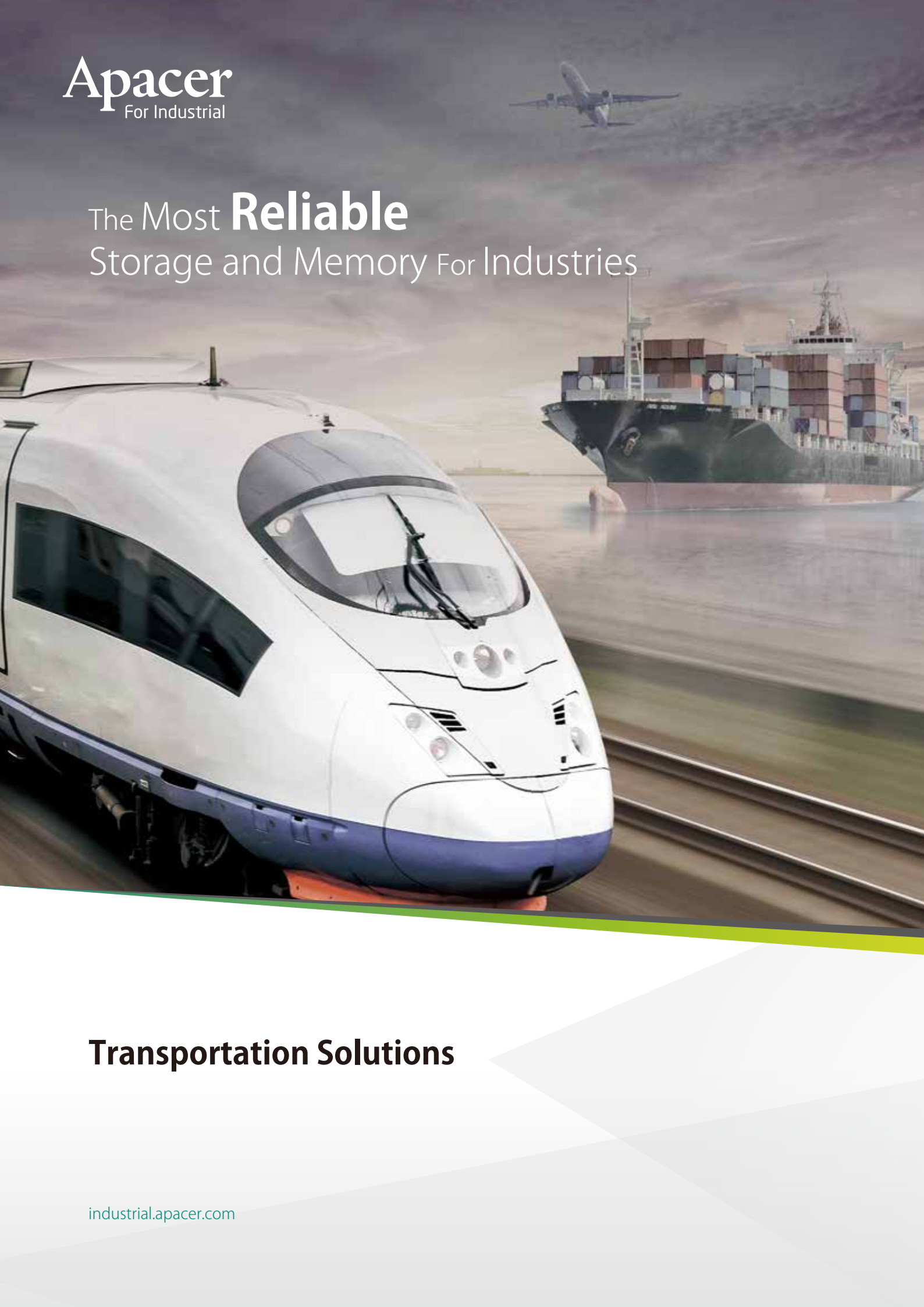


The background of the entire page is a composite image. In the foreground, a white and blue high-speed train is moving rapidly from left to right, with motion blur on the tracks. In the background, a large cargo ship filled with colorful shipping containers is on the water. Above the ship, a commercial airplane is flying in a cloudy sky. The overall theme is transportation and industry.

**Apacer**  
For Industrial

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

**Transportation Solutions**

[industrial.apacer.com](http://industrial.apacer.com)

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# What Sets Apacer Apart?

## 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

## Professional Technique

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



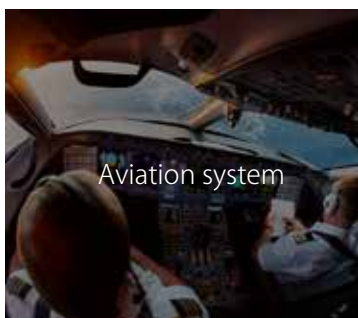
## Trustworthy Supplier

- 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 Transportation Applications

In recent years, SSDs have found homes in a wide variety of transportation-related products. From entertainment and navigation systems in vehicles to surveillance and traffic control systems outdoors, SSDs are tasked with reliably reading and writing data. Apacer's industrial SSD solutions are the result of years of experience making and customizing these devices. And with self-driving vehicles just over the horizon, applications for Apacer's reliable storage solutions are sure to grow.

## Storage and Memory Solutions in the Transportation Industry



Aviation system



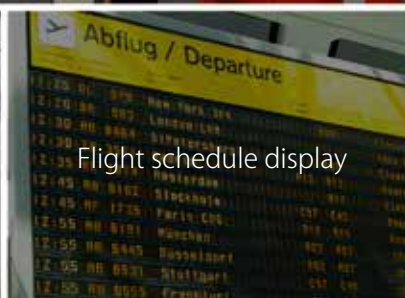
Ticket Machine



Ship navigation system



Railway Intelligent Security System



Flight schedule display



Operation Control Center



Shipping Industry



Ticket Gate System



Surveillance System



Electronic Signage



## Challenges and Requirements

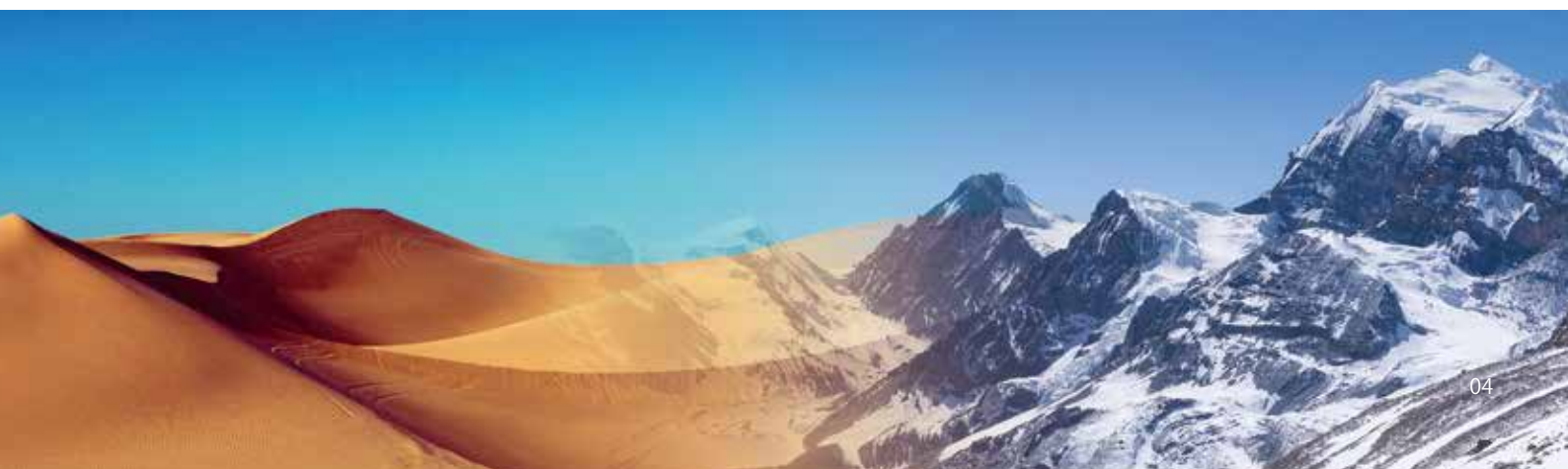
### Tough Enough To Survive Anywhere In The World

More than perhaps any other industry, the transportation industry has to develop vehicles and systems that will be used in a variety of harsh environments. From bitterly cold conditions to burning desert landscapes, transportation technology has to resist the extremes of temperature, humidity, dust and vibration. And natural weather systems aren't the end of it. Many parts of the world where vehicles need to travel are badly polluted.

Luckily, Apacer's engineers are seasoned professionals at creating storage solutions that can resist even the most challenging conditions.

### Voltage Instability Is No Longer A Problem

Especially in developing countries or remote areas, voltage supply can sometimes be compromised. That's why Apacer has created storage solutions that can mitigate and offset the effects of voltage instability. Thanks to our innovative protection systems, storage solutions will still maintain data integrity if voltage instability issues occur.



# Featured Technologies for Transportation Applications

In the transportation industry, manufacturers have to consider the varied and punishing environments where their products will be used. Apacer stays ahead of its competitors because of its focus on stability, longevity, durability and reliability. And what's more, we also offer assistance with SSD optimization and monitoring with our value-added technology.

## Power Stability



- CorePower
- DataDefender™

## Longevity



- Over-Provisioning
- SLC-lite
- SLC-liteX
- Fixed BOM
- 6+6 PCN/EOL Policy

## Survivability



- Anti-Sulfuration
- Nano Coating (IP57)
- Underfill
- 30μ Gold Finger
- Conformal Coating
- Sidefill
- Wide Temperature

## Value-Added Application



- Double-barreled Solution
- CoreAnalyzer2
- SSDWidget 2.0

## ⚡ Power Stability



### 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



Detect



Backup Power



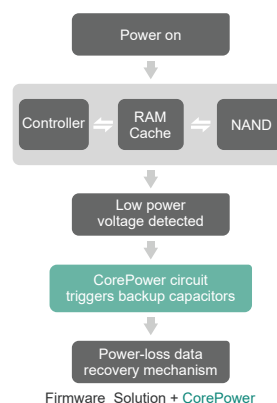
CorePower Circuit



### 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.



## 🕒 Longevity



### Over-Provisioning

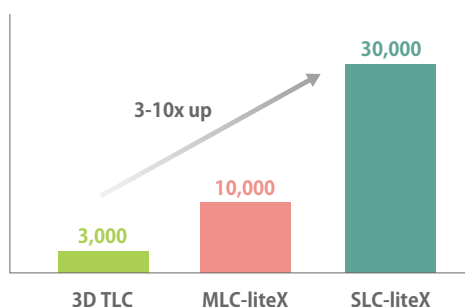
To reduce write amplification and increase endurance and performance, Apacer's SSDs support over-provisioning. The SSDs set aside a certain portion of the physical capacity of the memory to carry out garbage collection, wear-leveling and bad block mapping operations. The end result is a longer operating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

SLC  
liteX

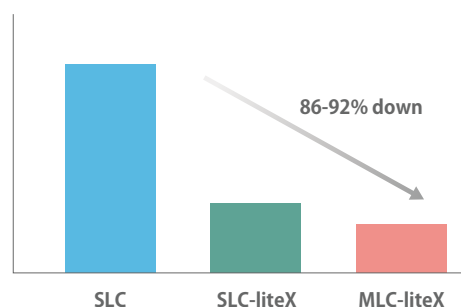
### SLC-liteX

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.

Endurance



Cost





## 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.



## Survivability

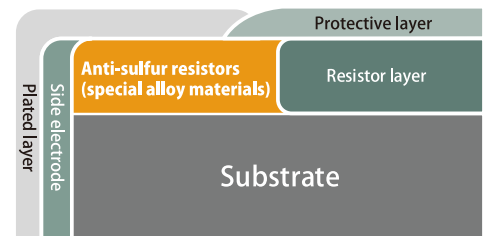


### Anti-Sulfuration

Apacer's world's first patented anti-sulfuration DRAM modules and anti-sulfuration SSDs with the industry's highest level of anti-corrosion ANSI/ISA 71.04 G3 Certification can meet the needs of industrial products facing harsh environments.

#### Apacer's anti-sulfuration technology

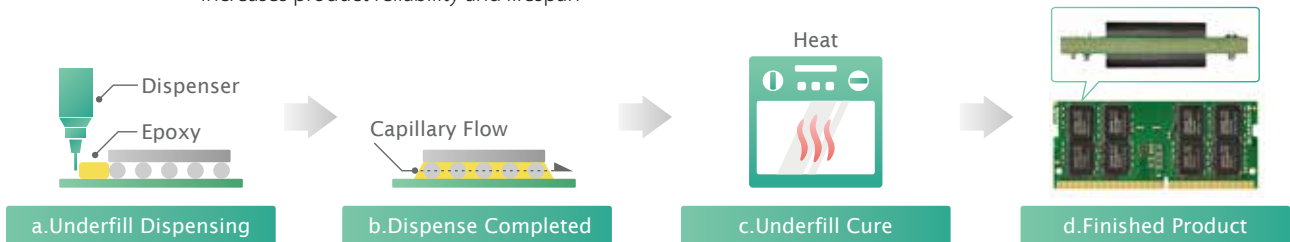
Resistor construction



### Underfill

Apacer provides underfill technology to increase product reliability and resistance to various thermal and mechanical shocks.

- Strengthens the solder joints between solder balls and printed circuit board
- Increases the product's resistance against shock and vibration
- Reduces thermal stress damage
- Complies with MIL-STD-810G shock and vibration requirements
- Increases product reliability and lifespan



### Sidefill

Apacer's Sidefill technology strengthens the connections between solder joints and their board, making them more robust and vibration-resistant. It also allows for heat dissipation to offset thermal damage.

30μ

### 30μ Gold Finger

With 30μ gold plating, the connector interface is more reliable and can withstand potential damage that can arise in industrial applications.



## Conformal Coating

Enhances reliability of products by applying coatings on the surface of printed circuit boards. The protective film can safeguard devices from dust ingress and liquid immersion.

- Uses automated spraying to maintain precise coating thickness
- Enhances product reliability
- Prolongs SSD and DRAM modules lifespan

IP57

## Nano Coating

The IP57 waterproof and dustproof Nano Coating (parylene conformal coating) solution is especially ideal for SSD modules as it provides invulnerable protection for the components on the devices.

|                      | Conformal Coating                 | Nano Coating                              |
|----------------------|-----------------------------------|-------------------------------------------|
| <b>Protection</b>    | Dust, moisture, fungus, corrosion | Dust, moisture, fungus, corrosion<br>IP57 |
| <b>Cost</b>          | \$                                | \$\$\$                                    |
| <b>Additional LT</b> | 14 Working-days                   | 14 Working-days                           |



## Wide Temperature

Apacer insists on using industrial-grade chips from original manufacturers to ensure operation reliability in extreme temperatures ranging from -40°C to 85°C.



## Value-Added Application

### 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

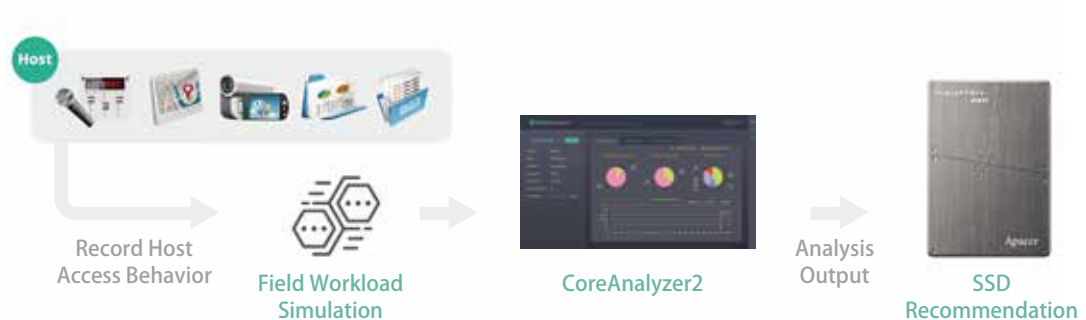
Anticipate and mitigate SSD failures remotely

Longer-lasting SSDs



### CoreAnalyzer2

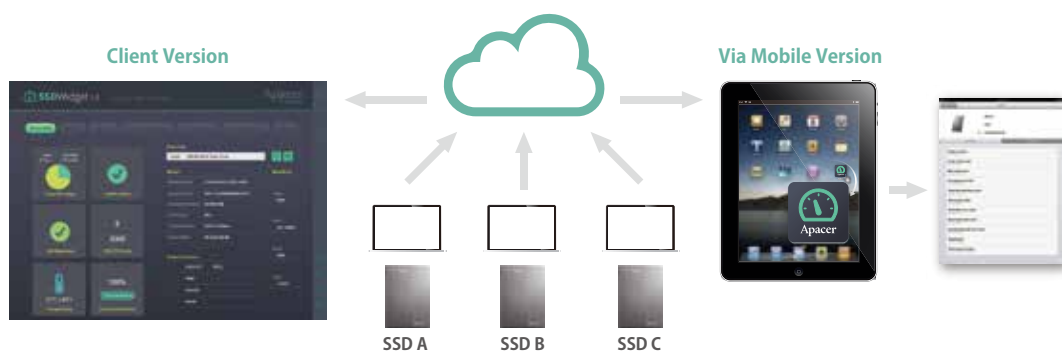
CoreAnalyzer is an exclusive, analytic data-behavior technology integrated with Apacer's SSD products. By collecting and analyzing data from a customer's host system, it can help customers analyze their usage behavior so they can choose the best-suited SSD for their application.



### 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

- SSD is sometimes not detected by host PC
- Detection failure happens during boot process

## Solutions

- ADC4 SLC
- CF6

## Value-added technologies

- **Hardware:**  
Standard Apacer SSD fine-tuned with additional resistors and power IC for greater voltage over- and under-protection

## The Customer and the Application: High-speed Rail Transportation Systems

Our customer is an experienced transportation system integrator in the high-speed rail industry. The customer is currently in the process of implementing high-speed rail solutions that cover large parts of China.



## Challenges

The customer told us about a certain problem they had discovered. Whenever a train booted up its transportation system, there was a chance that the host PC would have trouble detecting the SSD. This didn't happen all of the time, but it happened enough times that the client realized there was the potential for a serious problem.

However, the client knew that Apacer could help them investigate the issue and perhaps come up with a solution. They were right, and after an exhaustive discussion of the issues online and via telephone, an Apacer engineer was en route to the demonstration train that was already undergoing early tests. He gathered data on location, and then reported back to the Apacer headquarters so that our team could begin the analysis process.

## Solutions and Technologies

Analysis of the data that the engineer brought back revealed the source of the issue. We discovered that the voltage supplied to the SSD could become unstable when the transportation system booted up. After initializing, the SSD should be supplied a minimum operating voltage within a certain fixed period of time. But in certain cases, the actual supplied voltage took longer to meet the threshold, so the SSD did not power up. In other cases, the supplied voltage might meet the threshold in time, but then dip below it for a few moments.

After some discussion, our hardware team modified the resistor structure in our standard SSD. These allowed the SSD to filter out unsuitable operating voltages, and in most cases these resistors would be enough. But in this case, we also added a redundant power IC to monitor and report on voltage instability. Together, these two powerful protection mechanisms extend the practical operating lifespan of the SSD, no matter how unpredictable the voltage supply might be.

## Results and Benefits

After these modifications, our customer was pleased to discover that the SSD functioned much more smoothly. Now, as they continue to expand their operations in China, they keep coming back to us for customized SSDs for their transportation systems. And we've incorporated what we've learned from this case into other systems that can function smoothly even when voltage supplies are unstable.

## 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  
transportation applications

## Rugged and robust design

Compliant with MIL-STD-810G  
(shock and vibration),  
Test Method 503.5 (temperature shock)  
Test Method 500.6 Low Pressure (altitude)  
and FIPS 140-2 certified (security)

## 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: VehiclePro™

## A Tailor-Made Technology Set for Transportation Applications

Apacer has developed a tailor-made technology set, "VehiclePro™", to meet the multi-faceted requirements of transportation applications and help customers find the right solutions, further simplifying the process of implementation.

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

## VehiclePro™

**Supreme**

Customized power stabilization  
CorePower  
Nano Coating (IP57)

**Upgrade**

Anti-Sulfuration  
Conformal Coating  
SLC-lite / SLC-liteX  
Underfill / Sidefill  
30μ Gold Finger

**Select**

DataDefender™  
Double-barreled Solution  
Over-provisioning  
Wide Temperature

# 2.5" SSD



| Model                                       | SV170-25                                                                                                                                      | SV250-25                                 | SM130-25                                                         | SM210-25<br>SM21P-25*                                            |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|
| <b>Interface</b>                            | SATA3.0 (6Gb/s)                                                                                                                               | SATA3.0 (6Gb/s)                          | SATA 3.0 (6Gb/s)                                                 | SATA 3.0 (6Gb/s)                                                 |
| <b>Connector</b>                            | (7+15) pin male                                                                                                                               | (7+15) pin male                          | (7+15) pin male                                                  | (7+15) pin male                                                  |
| <b>Form Factor</b>                          | 2.5"                                                                                                                                          | 2.5"                                     | 2.5"                                                             | 2.5"                                                             |
| <b>NAND Flash Type</b>                      | 3D TLC                                                                                                                                        | 3D TLC                                   | MLC                                                              | MLC                                                              |
| <b>Capacity</b>                             | 60GB ~960GB                                                                                                                                   | 30GB~480GB                               | 512GB~2TB                                                        | 32GB~512GB                                                       |
| <b>External DRAM</b>                        | No                                                                                                                                            | No                                       | Yes                                                              | Yes                                                              |
| <b>Sustained Read Performance (MB/sec)</b>  | Up to 560                                                                                                                                     | Up to 560                                | Up to 530                                                        | Up to 510                                                        |
| <b>Sustained Write Performance (MB/sec)</b> | Up to 510                                                                                                                                     | Up to 520                                | Up to 510                                                        | Up to 380                                                        |
| <b>ECC Engine</b>                           | Low-Density Parity-Check (LDPC) Code                                                                                                          | Low-Density Parity-Check (LDPC) Code     | Built-in up to 120-bit per 2K bytes BCH ECC                      | Built-in 40-bit per 1K bytes BCH ECC                             |
| <b>IOPs (4K Random Write)</b>               | 85K                                                                                                                                           | 74K                                      | 89K                                                              | 79K                                                              |
| <b>Standard Operating Temperature (°C)</b>  | 0 ~ + 70                                                                                                                                      | 0 ~ + 70                                 | 0 ~ + 70                                                         | 0 ~ + 70                                                         |
| <b>Wide Temperature(°C)</b>                 | -40 ~ + 85                                                                                                                                    | -40 ~ + 85                               | -40 ~ + 85                                                       | -40 ~ + 85                                                       |
| <b>Storage Temperature (°C)</b>             | -40 ~ + 100                                                                                                                                   | -40 ~ + 100                              | -40 ~ + 100                                                      | -40 ~ + 100                                                      |
| <b>Thermal Sensor</b>                       | Yes                                                                                                                                           | Yes                                      | Optional                                                         | Optional                                                         |
| <b>Shock</b>                                | Operation: 50G/11ms (compliant with MIL-STD-202G)<br>Non-operation: 1500G/0.5ms (compliant with MIL-STD-883K)                                 |                                          |                                                                  |                                                                  |
| <b>Vibration</b>                            | Operation: 7.69 Grms,20~2000 Hz/random (compliant with MIL-STD-810G)<br>Non-operation:4.02 Grms, 15~2000 Hz/sine(compliant with MIL-STD-810G) |                                          |                                                                  |                                                                  |
| <b>Operating Voltage</b>                    | 5.0 V ± 10%                                                                                                                                   | 5.0 V ± 10%                              | 5.0 V ± 5%                                                       | 5.0 V ± 5%                                                       |
| <b>Power Consumption</b>                    | Active mode: 525 mA<br>Idle mode: 90 mA                                                                                                       | Active mode: 385 mA<br>Idle mode: 100 mA | Active mode: 1,040 mA<br>& Idle mode: 80 mA                      | Active mode: 680 mA<br>& Idle mode: 60 mA                        |
| <b>Dimension (mm)</b>                       | 100.00 x 69.85 x 6.90                                                                                                                         | 100.00 x 69.85 x 6.90                    | 7mm:<br>100.00 x 69.85 x 6.90<br>9.5mm:<br>100.00 x 69.85 x 9.30 | 7mm:<br>100.00 x 69.85 x 6.90<br>9.5mm:<br>100.00 x 69.84 x 9.30 |
| <b>MTBF (hours)</b>                         | >1,000,000                                                                                                                                    | >1,000,000                               | >1,000,000                                                       | >1,000,000                                                       |

\*Includes CorePower technology.

# M.2 2280 / mSATA (MO-300) / SSD Module



| Model                                | SV170-M280                                                                                                                                       | SV250-280                               | SM210-M280<br>SM21P-M280*                                                    | SV170-300                               | SV250-300                               | SM230-300<br>SM23P-300*                  | SDM5A                                   |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|------------------------------------------|-----------------------------------------|
| Interface                            | SATA3.0 (6Gb/s)                                                                                                                                  | SATA3.0 (6Gb/s)                         | SATA 3.0 (6Gb/s)                                                             | SATA3.0 (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                           | 52-pin                                   | 7-pin                                   |
| Form Factor                          | M.2 2280                                                                                                                                         | M.2 2280                                | M.2 2280                                                                     | MO-300                                  | MO-300                                  | MO-300                                   | SATA Disk Module                        |
| NAND Flash Type                      | 3D TLC                                                                                                                                           | 3D TLC                                  | MLC                                                                          | 3D TLC                                  | 3D TLC                                  | MLC                                      | SLC                                     |
| Capacity                             | 30GB~960GB                                                                                                                                       | 30GB~960GB                              | 32GB~256GB                                                                   | 30GB - 960GB                            | 30GB - 480GB                            | 32GB~512GB                               | 8GB~32GB                                |
| External DRAM                        | No                                                                                                                                               | No                                      | Yes                                                                          | No                                      | No                                      | No                                       | No                                      |
| Sustained Read Performance (MB/sec)  | Up to 560                                                                                                                                        | Up to 560                               | Up to 510                                                                    | Up to 560                               | Up to 560                               | Up to 560                                | Up to 435                               |
| Sustained Write Performance (MB/sec) | Up to 515                                                                                                                                        | Up to 525                               | Up to 475                                                                    | Up to 510                               | Up to 520                               | Up to 510                                | Up to 215                               |
| ECC Engine                           | Low-Density Parity-Check (LDPC) Code                                                                                                             | Low-Density Parity-Check (LDPC) Code    | Built-in up to 40-bit per 1K bytes BCH ECC                                   | Low-Density Parity-Check (LDPC) Code    | Low-Density Parity-Check (LDPC) Code    | Built-in 40-bit per 1K bytes BCH ECC     | Built-in 40-bit per 1K bytes BCH ECC    |
| IOPs (4K Random Write)               | 87K                                                                                                                                              | 75K                                     | 45K                                                                          | 87K                                     | 74K                                     | 58K                                      | 47K                                     |
| Standard Operating Temperature (°C ) | 0 ~ + 70                                                                                                                                         | 0 ~ + 70                                | 0 ~ + 70                                                                     | 0 ~ + 70                                | 0 ~ + 70                                | 0 ~ + 70                                 | 0 ~ + 70                                |
| Wide Temperature(°C )                | -40 ~ + 85                                                                                                                                       | -40 ~ + 85                              | -40 ~ + 85                                                                   | -40 ~ + 85                              | -40 ~ + 85                              | -40 ~ + 85                               | -40 ~ + 85                              |
| Storage Temperature (°C )            | -40 ~ + 100                                                                                                                                      | -40 ~ + 100                             | -40 ~ + 100                                                                  | -40 ~ + 100                             | -40 ~ + 100                             | -40 ~ + 100                              | -40 ~ + 100                             |
| Thermal Sensor                       | Yes                                                                                                                                              | Yes                                     | Optional                                                                     | Yes                                     | Yes                                     | Optional                                 | Optional                                |
| Shock                                | Operation: 50G/11ms (compliant with MIL-STD-202G)<br>Non-operation: 1500G/0.5ms (compliant with MIL-STD-883K)                                    |                                         |                                                                              |                                         |                                         |                                          |                                         |
| Vibration                            | Operation: 7.69 Grms, 20~2000 Hz/random (compliant with MIL-STD-810G)<br>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%                              | 5.0 V ± 5%                               | 5.0 V ± 5%                              |
| Power Consumption                    | Active mode: 540 mA<br>Idle mode: 95 mA                                                                                                          | Active mode: 455 mA<br>Idle mode: 80 mA | Active mode: 745 mA<br>Idle mode: 75 mA                                      | Active mode: 540 mA<br>Idle mode: 90 mA | Active mode: 400 mA<br>Idle mode: 60 mA | Active mode: 925 mA<br>Idle mode: 125 mA | Active mode: 260 mA<br>Idle mode: 60 mA |
| Dimension (mm)                       | 80.00 x 22.00 x 3.58                                                                                                                             | 80.00 x 22.00 x 3.58                    | Single side:<br>80.00 x 22.00 x 2.23<br>Double side:<br>80.00 x 22.00 x 3.58 | 50.80 x 29.85 x 4.85                    | 50.80 x 29.85 x 4.85                    | 50.80 x 29.85 x 3.80                     | 33.0 x 29.3 x 8.85                      |
| MTBF (hours)                         | >1,000,000                                                                                                                                       | >1,000,000                              | >1,000,000                                                                   | >1,000,000                              | >1,000,000                              | >1,000,000                               | >2,000,000                              |

# microSD / SD / CF



| Model                                       | Industrial microSD R1                                                                                                                            | Industrial SD R1                        | CS710-CF                                                                                                                                           | Industrial CF6A                                                                                                                                    |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Interface</b>                            | SD 3.0                                                                                                                                           | SD 3.0                                  | PC Card Memory Mode;<br>PC Card I/O Mode;<br>True IDE Mode                                                                                         | PC Card Memory Mode;<br>PC Card I/O Mode;<br>True IDE Mode                                                                                         |
| <b>Form Factor</b>                          | microSD                                                                                                                                          | SD                                      | CompactFlash Type I                                                                                                                                | CompactFlash Type I                                                                                                                                |
| <b>NAND Flash Type</b>                      | SLC                                                                                                                                              | SLC                                     | SLC                                                                                                                                                | SLC                                                                                                                                                |
| <b>Capacity</b>                             | SD: 1GB~2GB<br>SDHC: 4~8GB                                                                                                                       | SD: 1GB~2GB;<br>SDHC: 4~16GB            | 128MB~64GB                                                                                                                                         | 256MB~32GB                                                                                                                                         |
| <b>Sustained Read Performance (MB/sec)</b>  | Up to 34                                                                                                                                         | Up to 43                                | Up to 55                                                                                                                                           | Up to 60                                                                                                                                           |
| <b>Sustained Write Performance (MB/sec)</b> | Up to 28                                                                                                                                         | Up to 41                                | Up to 55                                                                                                                                           | Up to 65                                                                                                                                           |
| <b>ECC Engine</b>                           | Built-in 43-bit per 1K bytes BCH ECC                                                                                                             | Built-in 43-bit per 1K bytes BCH ECC    | Built-in BCH ECC capable of correcting up to 96 bits in 1KB data                                                                                   | Built-in 72-bit per 1K bytes BCH ECC                                                                                                               |
| <b>Wide Temperature ( °C )</b>              | -40 ~ + 85                                                                                                                                       | -40 ~ + 85                              | -40 ~ + 85                                                                                                                                         | -40 ~ + 85                                                                                                                                         |
| <b>Storage Temperature ( °C )</b>           | -40 ~ + 100                                                                                                                                      | -40 ~ + 100                             | -40 ~ + 100                                                                                                                                        | -40 ~ + 85                                                                                                                                         |
| <b>Shock</b>                                | Operation: 50G/11ms(compliant with MIL-STD-202G)<br>Non-operation: 1500G/0.5ms(compliant with MIL-STD-883K)                                      |                                         |                                                                                                                                                    |                                                                                                                                                    |
| <b>Vibration</b>                            | Operation: 7.69 Grms, 20~2000 Hz/random (compliant with MIL-STD-810G)<br>Non-operation: 4.02 Grms, 15~2000 Hz/sine (compliant with MIL-STD-810G) |                                         |                                                                                                                                                    |                                                                                                                                                    |
| <b>Operating Voltage</b>                    | 3.3 V ± 5%                                                                                                                                       | 3.3 V ± 5%                              | 3.3 V / 5.0 V ± 5%                                                                                                                                 | 3.3 V / 5.0 V ± 5%                                                                                                                                 |
| <b>Power Consumption</b>                    | Active mode: 50 mA & Idle mode: 265mA                                                                                                            | Active mode: 120 mA & Idle mode: 260 mA | Operating Voltage: 3.3V<br>Active mode: 145 mA<br>Standby mode: 10 mA<br><br>Operating Voltage: 5.0V<br>Active mode: 145 mA<br>Standby mode: 10 mA | Operating Voltage: 3.3V<br>Active mode: 165 mA<br>Standby mode: 10 mA<br><br>Operating Voltage: 5.0V<br>Active mode: 230 mA<br>Standby mode: 10 mA |
| <b>Dimension (mm)</b>                       | 15 x 11 x 1.0                                                                                                                                    | 32 x 24 x 2.1                           | 36.4 x 42.8 x 3.3                                                                                                                                  | 36.4 x 42.8 x 3.3                                                                                                                                  |
| <b>MTBF (hours)</b>                         | >3,000,000                                                                                                                                       | >3,000,000                              | >2,000,000                                                                                                                                         | >2,000,000                                                                                                                                         |

# PATA SSD



| Model                                        | ADC4                                                                       | ADM5S                                                                      | AFD257-M                                                                   |
|----------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <b>Interface</b>                             | Standard ATA/IDE                                                           | Standard ATA/IDE                                                           | Standard ATA/IDE                                                           |
| <b>Connector</b>                             | 32-pin                                                                     | 44-pin                                                                     | 44-pin                                                                     |
| <b>Operation Mode</b>                        | PIO Mode up to 4/<br>Multiword DMA Mode up to 2/<br>Ultra DMA Mode up to 6 | PIO Mode up to 4/<br>Multiword DMA Mode up to 2/<br>Ultra DMA Mode up to 6 | PIO Mode up to 4/<br>Multiword DMA Mode up to 2/<br>Ultra DMA Mode up to 6 |
| <b>Form Factor</b>                           | PATA Disk Chip                                                             | PATA DOM                                                                   | 2.5"                                                                       |
| <b>NAND Flash Type</b>                       | SLC                                                                        | SLC                                                                        | MLC                                                                        |
| <b>Capacity</b>                              | 128MB~16GB                                                                 | 128MB~64GB                                                                 | 32GB~256GB                                                                 |
| <b>External DRAM</b>                         | No                                                                         | No                                                                         | No                                                                         |
| <b>Sustained Read Performance (MB/sec)</b>   | Up to 41                                                                   | Up to 75                                                                   | Up to 100                                                                  |
| <b>Sustained Write Performance (MB/sec)</b>  | Up to 35                                                                   | Up to 65                                                                   | Up to 90                                                                   |
| <b>ECC Engine</b>                            | Built-in 72-bit per 1K bytes BCH ECC                                       | Built-in 72-bit per 1K bytes BCH ECC                                       | Built-in 72-bit per 1K bytes BCH ECC                                       |
| <b>Standard Operating Temperature ( °C )</b> | 0 ~ + 70                                                                   | 0 ~ + 70                                                                   | 0 ~ + 70                                                                   |
| <b>Wide Temperature ( °C )</b>               | -40 ~ + 85                                                                 | -40 ~ + 85                                                                 | -40 ~ + 85                                                                 |
| <b>Storage Temperature ( °C )</b>            | -40 ~ + 100                                                                | -40 ~ + 100                                                                | -40 ~ + 100                                                                |
| <b>Housing</b>                               | Yes                                                                        | No                                                                         | Yes                                                                        |
| <b>H/W Write Protect</b>                     | No                                                                         | No                                                                         | No                                                                         |
| <b>Screw Hole</b>                            | No                                                                         | Yes                                                                        | No                                                                         |
| <b>Shock</b>                                 | Half sine wave,<br>Peak acceleration 50 G, 11 ms                           | 1500G<br>(complied with MIL-STD810)                                        | 1500G<br>(complied with MIL-STD810)                                        |
| <b>Vibration</b>                             | Sine wave : 10~2000Hz, 15G                                                 | 15G (complied with MIL-STD810)                                             | 15G (complied with MIL-STD810)                                             |
| <b>Operating Voltage</b>                     | 3.3 V ± 5% / 5 V ± 5%                                                      | 3.3 V ± 5% / 5 V ± 5%                                                      | 5 V ± 5%                                                                   |
| <b>Power Consumption</b>                     | Active mode: 170 mA &<br>Idle mode: 3 mA                                   | Active mode: 265 mA &<br>Idle mode: 5 mA                                   | Active mode: 400 mA &<br>Idle mode: 20 mA                                  |
| <b>Dimension (mm)</b>                        | 42.60 x 19.30 x 5.90                                                       | 45.00 x 28.00 x 6.85                                                       | 100.00 x 69.80 x 9.30                                                      |
| <b>MTBF (hours)</b>                          | >2,000,000                                                                 | >2,000,000                                                                 | >1,000,000                                                                 |

# Anti-Sulfuration DRAM Modules



| Model                 | DDR4 Anti-Sulfuration UDIMM | DDR3 Anti-Sulfuration UDIMM | DDR4 Anti-Sulfuration SODIMM   | DDR3 Anti-Sulfuration SODIMM   |
|-----------------------|-----------------------------|-----------------------------|--------------------------------|--------------------------------|
| Module Type           | Anti-Sulfuration UDIMM      | Anti-Sulfuration UDIMM      | Anti-Sulfuration SODIMM        | Anti-Sulfuration 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                        | 1.35v/1.5v                  | 1.2v                           | 1.35v/1.5v                     |
| 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=0°C to 85°C              | TC=0°C to 85°C              | TC=0°C to 85°C / -40°C to 85°C | TC=0°C to 85°C / -40°C to 85°C |
| Value-Added           |                             |                             |                                |                                |

# Wide Temperature DRAM Modules



| Model                 | DDR4 Wide Temp. SODIMM  | DDR3 Wide Temp. SODIMM  | DDR4 Wide Temp. UDIMM  | DDR3 Wide Temp. UDIMM  |
|-----------------------|-------------------------|-------------------------|------------------------|------------------------|
| Module Type           | Wide Temperature SODIMM | Wide Temperature SODIMM | Wide Temperature UDIMM | Wide Temperature UDIMM |
| 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             | 4GB/8GB/16GB           | 1G/2G/4G/8G            |
| Voltage               | 1.2v                    | 1.5v/1.35v              | 1.2v                   | 1.5v/1.35v             |
| Pin Count             | 260-Pin                 | 204-Pin                 | 288-Pin                | 240-Pin                |
| Width                 | 64-Bit                  | 64-Bit                  | 64-Bit                 | 64-Bit                 |
| PCB Height            | 1.18                    | 1.18                    | 1.23                   | 1.18                   |
| Operation Temperature | TC=-40°C to 85°C        | TC=-40°C to 85°C        | TC=-40°C to 85°C       | TC=-40°C to 85°C       |
| Value-Added           |                         |                         |                        |                        |

# VLP DIMM DRAM Modules



| Model                        | DDR4 VLP UDIMM                                                                                                                                                        | DDR3 VLP UDIMM                                                                                                                                                        | DDR4 VLP SODIMM                                                                                                                                                               | DDR4 VLP ECC SODIMM                                                                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Type</b>           | VLP UDIMM                                                                                                                                                             | VLP UDIMM                                                                                                                                                             | VLP SODIMM                                                                                                                                                                    | VLP ECC SODIMM                                                                                                                                                                |
| <b>Memory Technology</b>     | DDR4                                                                                                                                                                  | DDR3                                                                                                                                                                  | DDR4                                                                                                                                                                          | DDR4                                                                                                                                                                          |
| <b>Frequency</b>             | 2133/2400/2666                                                                                                                                                        | 1066/1333/1600                                                                                                                                                        | 2133/2400/2666                                                                                                                                                                | 2133/2400/2666                                                                                                                                                                |
| <b>Density</b>               | 4G/8G/16G                                                                                                                                                             | 1G/2G/4G/8G                                                                                                                                                           | 4G/8G                                                                                                                                                                         | 4G/8G                                                                                                                                                                         |
| <b>Voltage</b>               | 1.2v                                                                                                                                                                  | 1.5v/1.35v                                                                                                                                                            | 1.2V                                                                                                                                                                          | 1.2V                                                                                                                                                                          |
| <b>Pin Count</b>             | 288-Pin                                                                                                                                                               | 240-Pin                                                                                                                                                               | 260-Pin                                                                                                                                                                       | 260-Pin                                                                                                                                                                       |
| <b>Width</b>                 | 64-Bit                                                                                                                                                                | 64-Bit                                                                                                                                                                | 64-Bit                                                                                                                                                                        | 72-Bit                                                                                                                                                                        |
| <b>PCB Height</b>            | 0.738                                                                                                                                                                 | 0.738                                                                                                                                                                 | 0.709                                                                                                                                                                         | 0.7                                                                                                                                                                           |
| <b>Operation Temperature</b> | TC=0°C to 85°C                                                                                                                                                        | TC=0°C to 85°C                                                                                                                                                        | TC=0°C to 85°C                                                                                                                                                                | TC=0°C to 85°C                                                                                                                                                                |
| <b>Value-Added</b>           |   |   | 30μ   | 30μ   |

## 32-Bit SODIMM



| Model                        | DDR4 32-Bit SODIMM                                                                                                                                                      | DDR3 32-Bit SODIMM                                                                                                                                                          |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Type</b>           | 32-Bit SODIMM                                                                                                                                                           | 32-Bit SODIMM                                                                                                                                                               |
| <b>Memory Technology</b>     | DDR4                                                                                                                                                                    | DDR3                                                                                                                                                                        |
| <b>Frequency</b>             | 2133/2400/2666                                                                                                                                                          | 800/1066/1333                                                                                                                                                               |
| <b>Density</b>               | 2G/4G/8G                                                                                                                                                                | 1G/2G/4G                                                                                                                                                                    |
| <b>Voltage</b>               | 1.2v                                                                                                                                                                    | 1.5v                                                                                                                                                                        |
| <b>Pin Count</b>             | 260-Pin                                                                                                                                                                 | 204-Pin                                                                                                                                                                     |
| <b>Width</b>                 | 32-Bit                                                                                                                                                                  | 32-Bit                                                                                                                                                                      |
| <b>PCB Height</b>            | 1.18                                                                                                                                                                    | 1.18                                                                                                                                                                        |
| <b>Operation Temperature</b> | TC=0°C to 85°C                                                                                                                                                          | TC=0°C to 85°C                                                                                                                                                              |
| <b>Value-Added</b>           |   |   |

# XR-DIMM

- Innovative board-to-board connector design
- Adopts highly durable 300-pin connector and mounting holes to improve the anti-vibration and anti-shock reliability
- Supports multiple protection technologies and value-added applications



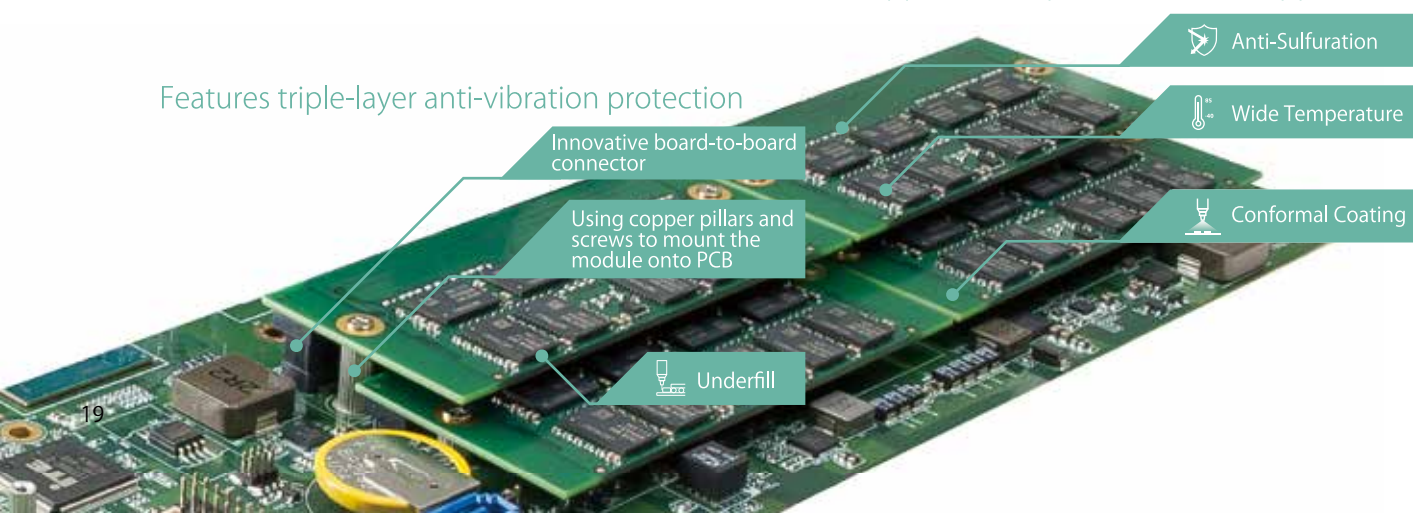
| Model                 | DDR4 XR-DIMM                                                                                                                        |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Module Type           | XR-DIMM                                                                                                                             |
| Memory Technology     | DDR4                                                                                                                                |
| Frequency             | 2133/2400                                                                                                                           |
| Density               | 8G/16G                                                                                                                              |
| Voltage               | 1.2v                                                                                                                                |
| Pin Count             | 300-Pin                                                                                                                             |
| Width                 | 72-Bit                                                                                                                              |
| PCB Height            | 1.466                                                                                                                               |
| Operation Temperature | TC=-40°C to 85°C                                                                                                                    |
| Value-Added           | <div>Wide Temperature</div> <div>Thermal Sensor</div> <div>Anti-Sulfuration</div> <div>Underfill</div> <div>Conformal Coating</div> |

## Rugged Memory Comparison

|                                     | XR-DIMM Rugged Memory | Onboard memory           |
|-------------------------------------|-----------------------|--------------------------|
| Anti-shock & anti-vibration ability | Great                 | Great                    |
| Memory upgradability                | Yes                   | No                       |
| Repair difficulty                   | Easy                  | Difficult                |
| RMA cost                            | Low                   | High                     |
| Stackable design                    | Yes                   | No                       |
| Motherboard space usage             | Flexible              | Uniformed and inflexible |

Supports multiple value-added applications

Features triple-layer anti-vibration protection





## 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





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Storage and Memory  
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