ULLtraDIMM™ SSDs

High performance solid state storage with extremely low latency at memory speeds.

Features
- < 5 μsec Write Latency
- Fits into existing memory slots
- 10 Full Random Drive Writes/Day
- FlashGuard - Enhances Flash Endurance
- DataGuard - Ensures Data Integrity
- EverGuard - Reliable 24x7 operation

Write-intensive Application Workloads
- Indexing
- High Performance Computing (HPC)
- Media Editing

Mixed-Use Application Workloads
- On-Line Transaction Processing (OLTP) Databases
- Big Data Analytics
- High-Frequency Trading (HFT)
- In-Memory Compute
- Virtualization
- Virtual Desktop
- Database acceleration

The ULLtraDIMM SSD closes the last latency gap in current storage solutions by placing flash as close as possible to the CPU and applications. Powered by Diablo Technologies Memory Channel Storage (MCS), the ULLtraDIMM SSDs innovative design connects flash storage to the memory channel using an industry standard DIMM form factor enabling it to be fully interoperable with RDIMM’s in any server or blade found in the data center today. The ULLtraDIMM SSD is ideally suited for large enterprise customers in application environments where high performance at deterministic ultra-low latency is required.

Ultra-low Latency and Scalable I/O Performance

The ULLtraDIMM SSD provides less than 5 μsec write latency. The ULLtraDIMM SSD achieves random read/write performance up to 150K/65K IOPS, and data transfer rates up to 1 GB/s/760MB/s** sequential read/write, enabling I/O performance to scale while maintaining a low latency. Additional DIMM modules can be added to scale I/O performance, while keeping latency low. The ULLtraDIMM SSD is available in capacities of 200GB and 400GB* and scales linearly, allowing it to meet the capacity requirements of any enterprise application.

Guardian Technology™ Platform

The ULLtraDIMM SSD is powered by SanDisk’s proprietary Guardian Technology Platform, a comprehensive suite of innovative flash management and enterprise features comprised of FlashGuard™, DataGuard™, and EverGuard™ technologies, enabling the ULLtraDIMM SSD to reach 10 DWPD.

FlashGuard Technology combines Aggregated Flash Management, which treats all flash elements as a single system, and Advanced Signal Processing, which dynamically adjusts flash parameters throughout the life of the SSD, to reliably extract significantly more life from MLC flash, making it suitable for write-intensive and mixed-use application workloads.

DataGuard Technology features full data path protection, safeguarding user data from corruption along all data paths in the ULLtraDIMM SSD.

EverGuard Technology protects against loss of user data in the event of unexpected power interruptions using a 3rd generation backup power circuit design and high-reliability discrete capacitors.
### ULLtraDIMM™ DDR3 SSDs

**Preliminary Specifications subject to change**

#### Performance

<table>
<thead>
<tr>
<th>Interface</th>
<th>DDR3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Latency</td>
<td>150 µsec</td>
</tr>
<tr>
<td>Write Latency</td>
<td>&lt; 5 µsec</td>
</tr>
<tr>
<td>Random Read (IOPS)</td>
<td>150K IOPS&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Random Write (IOPS)</td>
<td>65K IOPS&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sequential Read (GB/s)&lt;sup&gt;**&lt;/sup&gt;</td>
<td>1GB/s</td>
</tr>
<tr>
<td>Sequential Write (MB/s)&lt;sup&gt;**&lt;/sup&gt;</td>
<td>760MB/s</td>
</tr>
</tbody>
</table>

#### Capacity

- **19nm MLC User Capacities**
  - 200GB-400GB
  - Scalable across multiple memory slots

#### Reliability

- **Data Reliability (BER)**
  - 1 unrecoverable error in 10<sup>17</sup> bits read
- **MTBF**<sup>***</sup>
  - 2.5M hours
- **DWPD**<sup>****</sup>
  - 10/25 DWPD (random/sequential)
- **Data Fail Recovery**
  - F.R.A.M.E. (Flexible Redundant Array of Memory Elements)
- **Power Fail Recovery**
  - EverGuard: Backup Power Circuitry
- **Data Path Protection**
  - DataGuard
- **Warranty**<sup>****</sup>
  - 5 Year

#### Power

- Vcc
  - 1.35/1.5V
- Active (Typ)
  - TBD
- Idle
  - TBD

#### Environmental

- **Shock**
  - 200g half-sine, 10msec, 1 shock along each axis, X, Y, Z, in each direction
- **Vibration**
  - 2.17 g rms, 7-800 Hz
- **Operating Temperature**
  - 0 °C to 70 °C (Internal)
- **Storage Temperature**
  - -40 °C to 90 °C
- **Humidity**
  - 5% to 95%, non-condensing, relative humidity<sup>2</sup>
- **Altitude**
  - 5486.4 m [18,000 ft]

#### Dimensions

- **Thickness**
  - 8.5 mm
- **Width**
  - 133.35 mm
- **Height**
  - 30 mm

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**At SanDisk, we’re expanding the possibilities of data storage. For more than 25 years, SanDisk’s ideas have helped transform the industry, delivering next generation storage solutions for consumers and businesses around the globe.**

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