Samsung Memory DDR4 SDRAM

The new generation of high-performance, power-efficient memory that delivers great reliability for enterprise applications

Manage a range of enterprise workloads with greater reliability, doubled bandwidth and reduced power consumption

Designed with advanced system circuit architecture, Samsung DDR4 supports a wide range of server memory needs by delivering higher performance and reduced power consumption with increased reliability. By taking advantage of the advanced features of Samsung DDR4, companies can achieve greater performance at a lower TCO.

**Samsung DDR4 SDRAM**

Provide greater reliability, availability and serviceability (RAS)

DDR4 modules provide only one RAS feature, their error-correcting code (ECC) capability. Compared to DDR3, Samsung DDR4 provides more robust RAS features, such as Cyclic Redundancy Check (CRC), Parity and Gear Down Mode. Enhanced reliability and improved S/I for mission-critical enterprise applications are directly attributable to Samsung DDR4’s significant advancements with the following RAS features:

1. Cyclic Redundancy Check (CRC) for improved data reliability
   
   CRC is error-detecting code that detects accidental changes to raw data of DRAM’s DQ. CRC confirms 100% detection of random 1- to 2-bit errors by enabling error detection capability for data transfer.

2. On-chip parity detection for the integrity of Command/Address
   
   Parity for Command/Address (CMD/ADD) provides a method of verifying the integrity of command and address transfers over a link.

3. Per DRAM Addressability for enhanced signal integrity
   
   Samsung DDR4 can control module components and enhance signal integrity by controlling the ODT of Vref levels.

4. Gear Down Mode for improved signal integrity
   
   DDR4 Gear Down Mode allows a high speed of DQ to be maintained while decreasing the high speed of CMD/ADD.

Fault-tolerant, higher RAS systems supported by DDR4 SDRAM can remain available for considerably longer periods of time without failure.

**DDR3 and DDR4 Specifications and features comparison**

<table>
<thead>
<tr>
<th>Feature</th>
<th>DDR3</th>
<th>DDR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component density, speed</td>
<td>512 Mb - 4 Gb, 0.8 – 1.6 Gbps</td>
<td>4 Gb - 16 Gb, 1.6 - 3.2 Gbps</td>
</tr>
<tr>
<td>Module density</td>
<td>1, 2, 4, 8, 16, 32 and 64 GB</td>
<td>8, 16, 32, 64 and 256 GB</td>
</tr>
<tr>
<td>Interface</td>
<td>Voltage (VDD, VDDQ, VPP) NA (1.35V, 1.35V, NA)</td>
<td>1.2 V, 1.2 V, 2.5 V</td>
</tr>
<tr>
<td></td>
<td>External Vref (VDD, 2) Internal Vref (need training)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Center Tab Termination (CTT) (34 ohm) POD (34 ohm)</td>
<td></td>
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<tr>
<td></td>
<td>CTT</td>
<td>CTT</td>
</tr>
<tr>
<td></td>
<td>Bi-dir, diff</td>
<td>Bi-dir, diff</td>
</tr>
<tr>
<td>Core architecture</td>
<td>Number of banks</td>
<td>8 banks</td>
</tr>
<tr>
<td></td>
<td>Page size (X4, 8, 16)</td>
<td>1 KB, 1 KB, 2 KB</td>
</tr>
<tr>
<td></td>
<td>Number of prefetch</td>
<td>8 bits</td>
</tr>
<tr>
<td></td>
<td>Added functions</td>
<td>RESET, ZQ, Dynamic ODT, Data Bus Inversion (DBI), Multiple preamble</td>
</tr>
<tr>
<td>Physical</td>
<td>Package type, balls X4, 8, X16, 78, 96 BGA</td>
<td>78, 96 BGA</td>
</tr>
<tr>
<td></td>
<td>DIMM type</td>
<td>R, LR, U, (ECC/nECC) R, 3DS R, LR, (ECC/nECC) U/SoDIMM</td>
</tr>
<tr>
<td></td>
<td>DIMM pins</td>
<td>240 (R, LR, U), 204 (So)</td>
</tr>
</tbody>
</table>

Fault-tolerance of random 1- to 2-bit errors

For more information

For more information about Samsung DDR4 SDRAM, visit www.samsung.com/semiconductor

Legal and additional information

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For more information

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Meet diverse enterprise workload demands, while enhancing client performance and battery life with higher bandwidth and reduced power consumption

Accelerated adoption of cloud computing, virtualization and high-performance computing (HPC) technologies has made higher-performing, higher-density memory a key factor for optimal server operations. Highly virtualized environments enable companies to run numerous applications on a single server instead of multiple servers. A single server with more virtual machines (VMs) requires not only a higher processor speed, but also higher memory density.

Requirements for memory become more diverse when supporting a wide range of enterprise server applications, from less critical workloads to mission-critical workloads. Enterprise-level workloads, such as database or transaction processing, have high-bandwidth memory requirements that need to be met for optimal server operations. Highly virtualized environments can achieve a higher utilization ratio, in turn, increasing the total power consumption of the server. As a result, CPU and server companies are focusing more on the development of next-generation G5 servers.

An optimized memory for enterprise-level workloads and client

Samsung DDR4 SDRAM provide an optimized solution for enterprise applications

Samsung DDR4 is an optimized solution for highly virtualized environments, high-performance computing and networking as well as PC clients. Samsung DDR4-based modules are designed with a new system-on-chip architecture to deliver higher performance with lower power requirements than previously available memory products.

The portfolio includes the following modules:

- **Density:** 4 GB, 8 GB, 16 GB, 32 GB
- **Type:** Registered (RDIMM), Load-Reduced (LRDIMM), UDIMM

The memory supports next-generation, green IT systems that need to reduce the diverse demands of enterprise workloads with higher performance, increased density, improved reliability and memory power consumption.

- **As system resolution increases up to 8K UHD, more memory bandwidth is also needed for client applications. Adopting higher bandwidth memory, users can better experience the more natural and smoother texture inherent in high-resolution screens. Also, one of the most important factors in portable PCs is battery life. By reducing memory power consumption, users can take advantage of their portable PCs longer with extended battery life.**

- **Increased performance for higher bandwidth**

- **Low - power memory consumption with higher capacity and performance**

- **Meet diverse enterprise workload demands, while enhancing client performance and battery life with higher bandwidth and reduced power consumption**

- **An optimized memory for enterprise-level workloads and client**

- **Leverage the expertise of a technology leader in innovation**

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**Samsung Memory 3DS TSV DRAM Package**

The Samsung portfolio of DDR4-based modules using 20 nm-class process technology includes registered dual inline memory modules (RDIMM), load-reduced DIMMs (LRDIMM) for servers and unregistered DIMMs (UDIMM), and small outline DIMMs (SO DIMM) for workstations and PCs. These memory modules are available with initial speeds up to 2667 Mbps, increasing to the Joint Electron Device Engineering Council (JEDEC) defined 3200 Mbps.

**Increased performance for higher bandwidth**

Samsung DDR4 delivers higher performance at higher speeds than DDR3. DDR4 can achieve up to 2.5 Gbps bandwidth. Compared to DDR3 (low power DDR3), Samsung DDR4 shows overall performance improvements in every DIMM and over 45% better performance at 32 GB per channel.

**Low - power memory consumption with higher capacity and performance**

- **Lower power consumption for greener, lower-cost computing**

- **A major decrease in voltage and the improved (8X) power efficiency of DDR4 synchronous dynamic RAM (SDRAM) translates to significant cost savings. According to Samsung internal testing, DDR4 boasts a continuous operating voltage of 1.5 V, a voltage that is 11% lower than the 1.65 V consumed by DDR3. It also has a faster Open Drain (OD) interface to reduce US power consumption and increase power savings by 56% compared to DDR3. Overall DDR4 shows a higher performance/watt of over 20%**

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**Power efficiency**

- **Doubled bandwidth, along with reduced voltage and dramatically lower power consumption, improve performance and optimize the total cost of ownership (TCO). Samsung DDR4's enhanced scalability, reliability, availability and serviceability (RAS) features provide the total cost of ownership (TCO). Samsung DDR4's enhanced RAS features provide the lowest TCO for data centers.**

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**Reduced power usage for greener, lower-cost computing**

- **Efficient Power (Watt/Performance) of DDR4 and DDR3**

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