SAMSUNG GREEN DDR3

Energy-efficient, High-Performance Memory
for Today's Computing Platforms

SAMSUNG'S GREEN DDR3 DELIVERS MAJOR ENERGY SAVINGS

The evolution of green memory continues with a new generation of low-power, high-performance DDR3.

Dual-core and multi-core CPUs for multi-tasking activities, 64-bit operating systems and compute-intensive applications such as virtualization, 3D, gaming and photo/video editing are accelerating the need for higher-performance memory with reduced power consumption. From PCs to servers, Samsung's 30 nanometer (nm)-class Green DDR3 provides designers with the key to creating the most energy-efficient, high-performance computing platforms available today.

Samsung 30nm Green DDR3 Benefits Server Platforms

Memory's contribution to system efficiency and power consumption is highly significant. Therefore, the need for optimizing the use of memory has become extremely important.

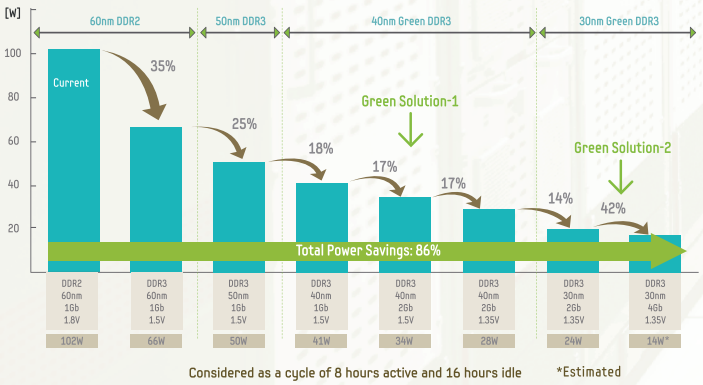
Samsung 30nm-class, 4Gb DDR3, which delivers bandwidth up to 1.6Gbps, consumes significantly less power than DDR2 and operates with voltage as low as 1.35V. This provides the best performance-to-power efficiency ratio on the market.

Switching to Samsung's 30nm-class Green DDR3 provides an 86 percent power savings over a 60nm-class-equivalent, 1.8V DDR2 memory chip.

RAW DATA WITH KEY FACTORS

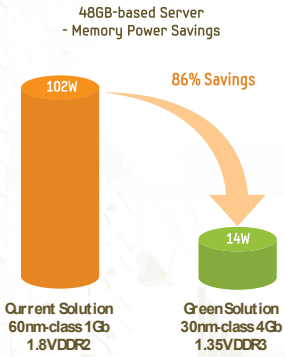
- **30nm-class 4Gb-based DDR3 can cut power consumption by 86% compared to a common current server solution**

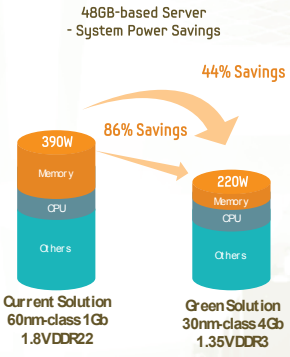
Power Consumption of Memory in 48GB server



Considered as a cycle of 8 hours active and 16 hours idle *Estimated

Moreover, these improvements translate into a 44 percent power savings at the server level. Higher density servers will achieve even greater power savings.



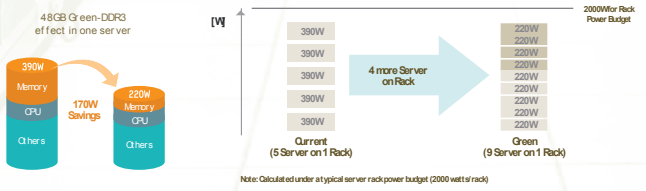


Lowering The Total Cost of IT Ownership

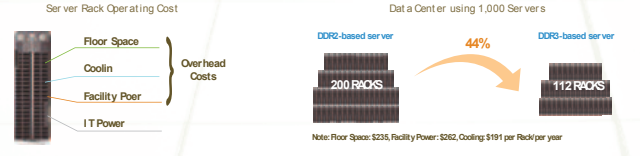
Samsung 30nm-class Green DDR3 is designed to put the brakes on energy waste. It provides a server system-level power savings of about 44 percent (from 390 to just 220 watts). The 44 percent savings at the server level equates to significant Total Cost of Ownership (TCO) benefits in the enterprise space. Through the use of Samsung Green DDR3, a data center manager can increase its server resources 86 percent without needing to increase its power budget. As this example shows, in a 2K Watt power envelope, Samsung Green DDR3 allows for placing nine servers on a single rack instead of five. The savings become even more significant when operating costs are factored. For example, in a 1000-server farm, only 112 racks would be needed instead of 200, cutting overhead costs proportionately by more than $60K.

BENEFIT: LESS INFRASTRUCTURE + REDUCED COST

- **Using Samsung Green DDR3, a data center can increase its server resources by 80% without having to upgrade its overall infrastructure**

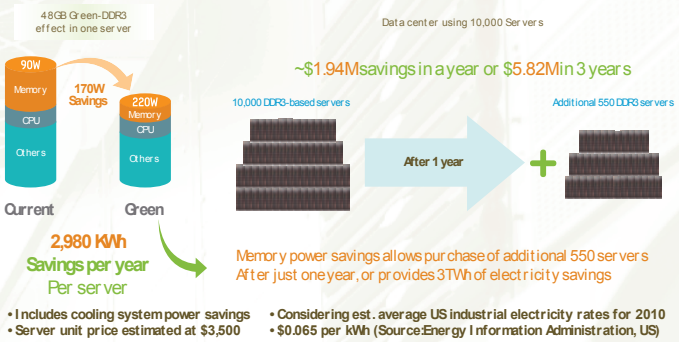


- **Data center using Samsung Green DDR3 can reduce its overhead costs by 44%**



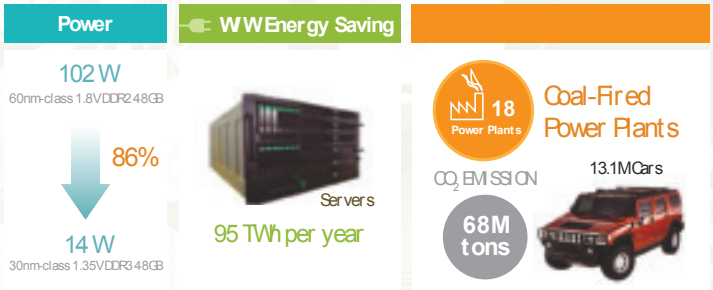
TRANSLATING POWER SAVINGS INTO DOLLAR SAVINGS

- **86% of server's memory power reduction gained by using 30nm-class 4Gb DDR3 can save 2.9MWh of energy per year per server**



- Includes cooling system power savings
- Server unit price estimated at $3,500
- Considering est. average US industrial electricity rates for 2010
- $0.065 per kWh (Source:Energy Information Administration, US)

By 2010, the number of servers worldwide should reach 32 million. Replacing them with new servers that house Samsung's Green DDR3 memory technology can save about 95 terawatt-hours (TWh) of power per year, amounting to billions of dollars in savings globally. This equates to eliminating gas emissions from more than 13 million cars, or preventing the release of more than 68 million tons of CO_2 emissions. As the number one memory supplier, we can help you build the best generation of green computing platforms by aligning our state-of-the-art, green memory solutions with your commitment to the utmost in data center efficiency.

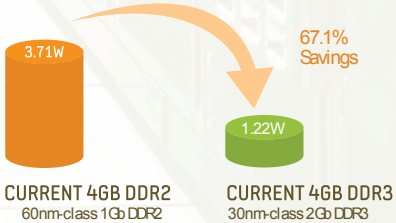


Green DDR3 in Windows 7

Building Low-Power PC Platforms With Green DDR3

Reducing energy costs for PCs and monitors is just as important as doing so for servers and data centers. By 2015, the total number of PCs will reach 2.25 billion units. Therefore, finding ways to reduce overall power consumption and CO_2 emissions on the client side is becoming as important as on the enterprise side. Studies show that replacing a 4GB SODIMM that is based on 60nm-class, 1Gb DDR2 technology with a 4GB SODIMM built with Samsung's 30nm-class, 2Gb Green DDR3 technology can save as much as 67 percent of a PC's power consumption at the module level. For more information about Samsung's energy-efficient technology for Green PCs, specifically Windows 7 and DDR3, visit: www.samsung.com/greenmemory.

MEMORY POWER COMPARISON

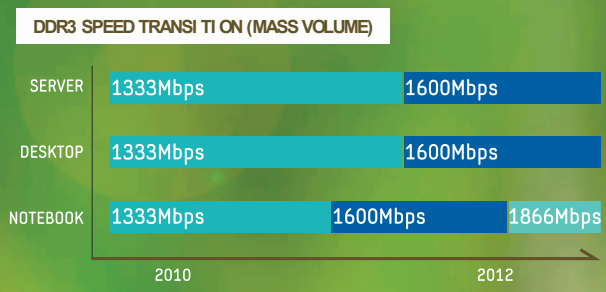


Through the use of Samsung Green DDR3, a data center manager can increase its server resources 86 percent without needing to increase its power budget.

BENEFITS OF SAMSUNG GREEN DDR3

Higher Performance with Lower Power Consumption

- Up to 1.86Gbps data rate
- More than 86% power savings at 2x the performance of DDR2
- 1.5V/1.35V VDD & VDDQ to support low-voltage platforms
- Higher density with 4Gb technology
- DQ shielding, self calibration and fly-by topology for better signal control
- Halogen-free and RoHS-compliant materials and components



Feature Comparison: DDR3 vs. DDR2

	DDR3 SDRAM	DDR2 SDRAM
I/O width	x4/x8/x16	x4/x8/x16
Prefetch bit width	8 bits	4 bits
Clock input	Differential clock	Differential clock
Burst length	4 (Burst chop), 8	4, 8
Data strobe	Differential data strobe	Differential data strobe
Supply voltage	1.5V/1.35V	1.8V/1.55V
Interface	SSTL_15	SSTL_18
CAS latency (CL)	6, 7, 8, 9, 10, 11 clock	3, 4, 5, 6 clock
On-die termination (ODT)	Dynamic ODT	Static ODT
Component package	FBGA	FBGA
Lead free	Yes	Yes
Halogen free	Yes	Optional
DRAM density	1Gb/2Gb/4Gb	512Mb/1Gb/2Gb
Module types	UDIMM, SODIMM, RDIMM	UDIMM, SODIMM, FBDIMM, RDIMM
Module densities	UDIMM: 1GB to 8GB	UDIMM: 512MB to 4GB
	SODIMM: 1GB to 8GB	SODIMM: 256MB to 4GB
	RDIMM: 1GB/4GB/8GB/16GB/32GB	RDIMM/FBDIMM: 512MB to 8GB

Note: All modules are RoHS compliant and halogen free.
Modules operate at 1.5V.

*Available in 1.5V and 1.35V versions
**1600MHz Customer Samples are Now Available

For more information, visit
www.samsung.com/GreenMemory
or scan the QR code.

SAMSUNG DDR3 PRODUCTS

DDR3 SDRAM Unbuffered Modules

Density	Speed (Mbps)	Rank	Composition
1GB	1066/1333/1600**	1	1Gb (128M x8) *8
2GB	1066/1333/1600**	2	1Gb (128M x8) *16
4GB	1066/1333/1600**	2	2Gb (256M x8) *16
8GB	1066/1333	2	4Gb (512M x8) *16

DDR3 SDRAM Unbuffered Modules (ECC)*

Density	Speed (Mbps)	Rank	Composition
1GB	1066/1333/1600**	1	1Gb (128M x8) *9
2GB	1066/1333/1600**	2	1Gb (128M x8) *18
4GB	1066/1333/1600**	2	2Gb (256M x8) *18
8GB	1066/1333	2	4Gb (512M x8) *18

DDR3 SDRAM Registered Modules*

Density	Speed (Mbps)	Rank	Composition
1GB	1066/1333/1600**	1	1Gb (128M x8) *9
2GB	1066/1333/1600**	2	1Gb (128M x8) *18
2GB		1	1Gb (256M x4) *18
4GB	1066/1333/1600**	2	1Gb (256M x4) *36
4GB		1	2Gb (256M x8) *18
4GB		1	2Gb (512M x4) *18
8GB	1066/1333/1600**	4	2Gb (256M x8) *36
8GB		2	2Gb (512M x4) *36
8GB	1066/1333	2	4Gb (512M x8) *18
8GB		1	4Gb (1024M x4) *18
16GB	1066/1333/1600**	4	2Gb (DDP 1G x4) *36
16GB	1066/1333	4	4Gb (512M x8) *36
16GB		2	4Gb (1024M x4) *36
32GB	1066/1033	4	4Gb (DDP 2G x4) *36

DDR3 SDRAM SODIMMs*

Density	Speed (Mbps)	Rank	Composition
1GB	1066/1033/1600**	1	1Gb (128M x8) *8
2GB	1066/1033/1600**	2	1Gb (128M x8) *16
4GB	1066/1033/1600**	2	2Gb (256M x8) *16
8GB	1066/1033	2	4Gb (512M x8) *16

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