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Industry's First 7.2 Gbps 512GB DDR5 Module

Samsung Electronics Co., Ltd.

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A Promising Memory Solution for Next-Gen Servers

Text Abstract

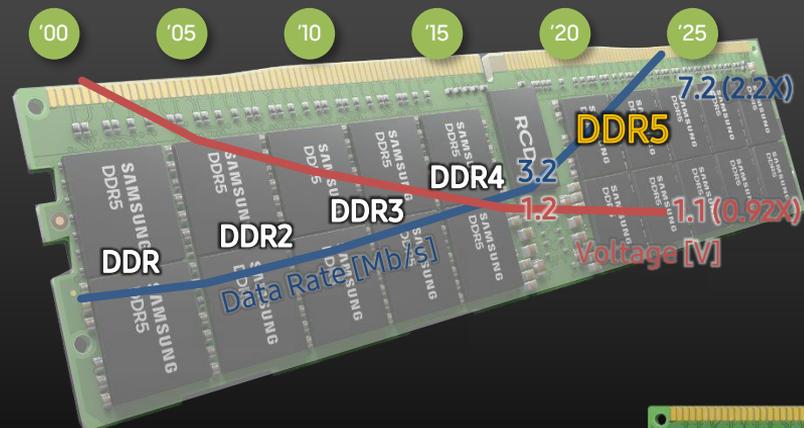
Spurred by the increasing market needs for big data and cloud services, global server suppliers and hyper-scalers are looking to adopt high-speed and large-capacity memory modules. To fulfill this trend, the brand-new low-voltage operable [DDR5](#) (double data rate 5th generation) memory can be an appropriate solution, with the highest speed of [7.2 Gbps](#) and the largest capacity of [512 GB](#).

However, some critical obstacles, such as increased capacity and high-speed I/O requirements, unstable power noise occurrences, high power consumption, and increase in operating temperature, must be overcome. This poster will cover various technical pathfinding solutions for world's first DDR5 512 GB module with an [advanced DRAM process and I/O schemes, package technology, and module architecture](#) regarding improvements in the following four aspects: [performance, speed, capacity, and power](#).

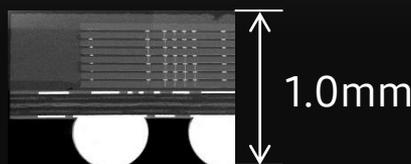
This will unveil the industry's first high-performance and large-capacity memory product with 8-stacked DDR5 DRAMs. Samsung believes that this product will pave the way for achieving both higher bandwidth and lower power consumption to inaugurate the era of terabyte DRAM modules for next-gen servers.

Graphic Abstract

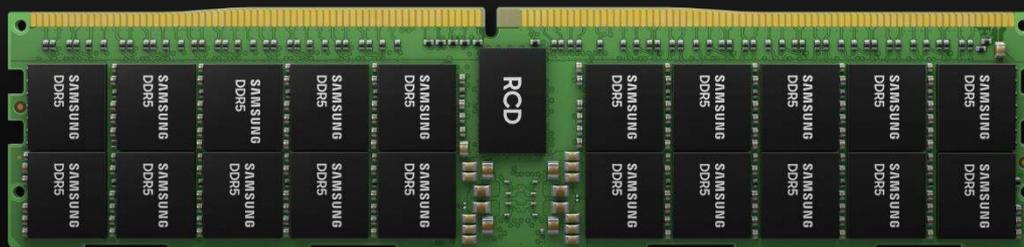
Advances in Performance, Bandwidth, Capacity, and Voltage



Performance	Speed	Capacity	Voltage
1.4x	2.2x	2x	0.92x



8H TSV



Manufactured 512GB module with 8-stacked DRAMs

Data Center Trend

Growth for Cloud, AI demands on faster and bigger memory

Forbes

Feb 22, 2021, 12:18am EST

The 4 Biggest Trends In Big Data And Analytics Right For 2021

Self-driving cars, lifelike robots, and [autonomous delivery drones](#) are the sexy, headline-grabbing face of the digital transformation that we see all around us today.

None of these would be possible, though, without data – the oil of the [fourth industrial revolution](#) – and the analytic technology we've built to allow us to interpret and understand it.

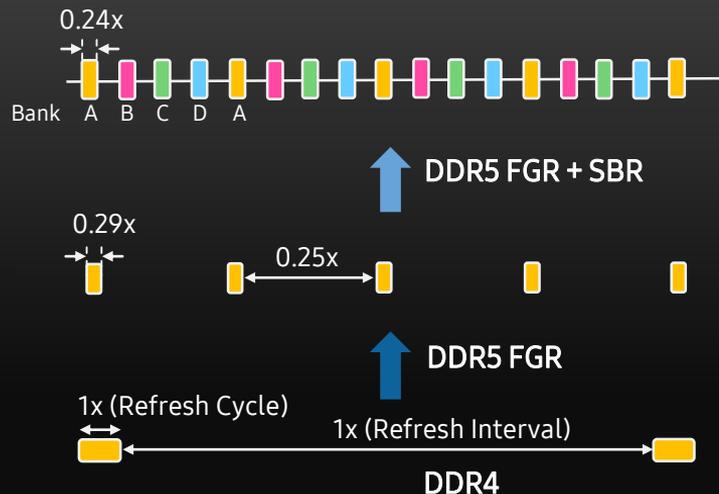
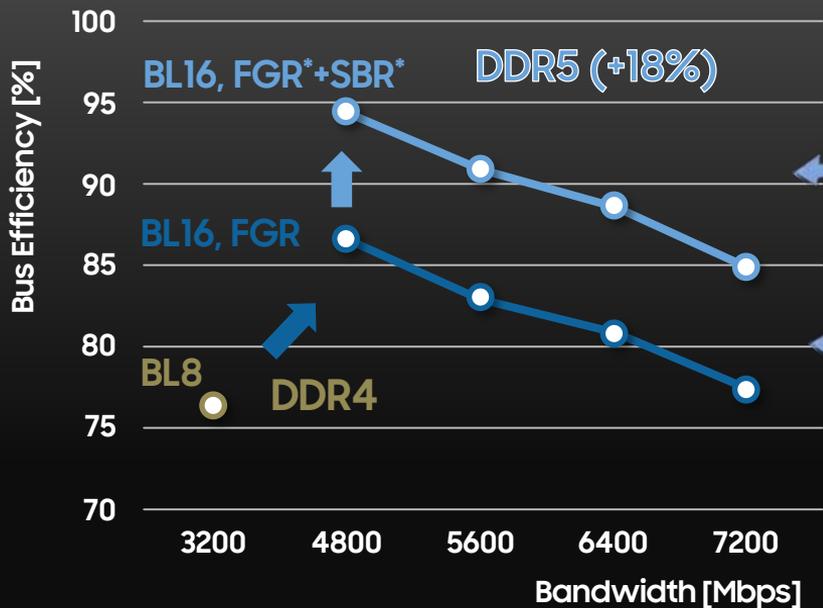
4th Industrial Revolution



Continuous Increase in the Number of Data Centers

Higher Performance

By increased BL* and refresh granularity

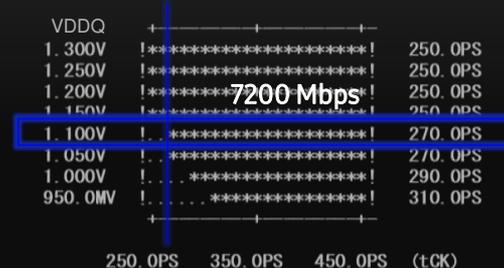
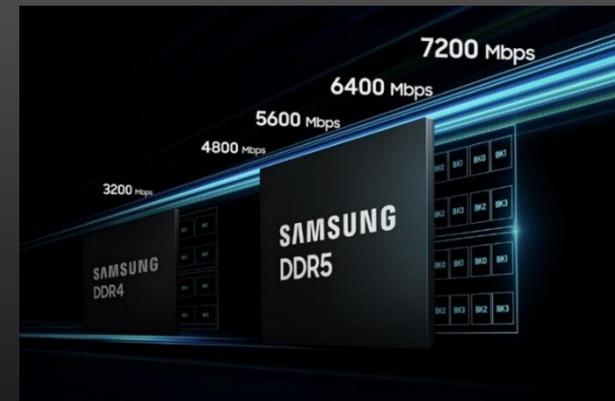
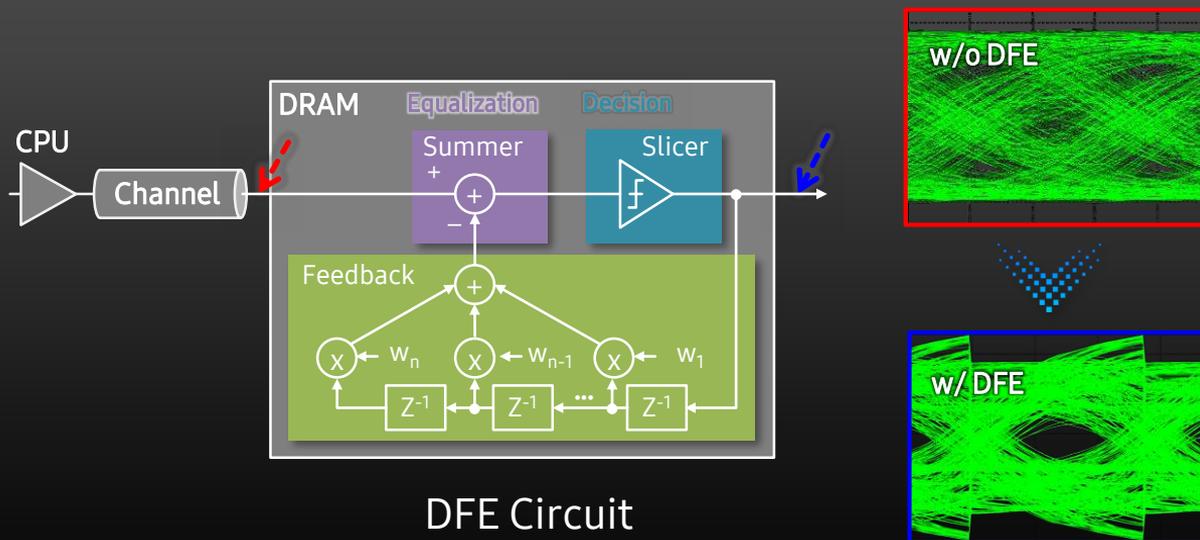


Fine Granularity Refresh

* BL: Burst Length, FGR: Fine Granularity Refresh, SBR: Same Bank Refresh

Faster Transfer Speed

By newly adopted equalization schemes



Test Result

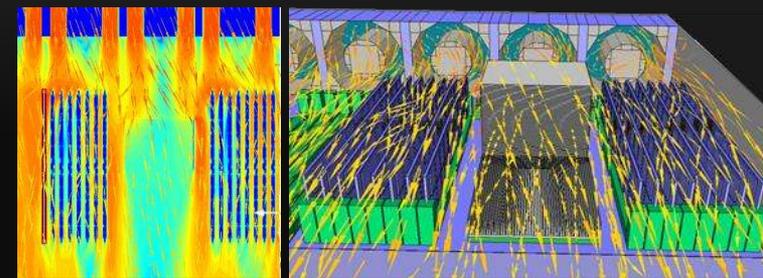
- Decision feedback equalizer (DFE) with loop-unrolling
- Shortened data path with un-matched data and strobe (DQ-DQS)
- Equalizer scheme with per-pin VrefDQ calibration

Larger Capacity

By the thinnest eight-stacked package



- Reduced gap between dies by ~40%
- Thin wafer handling techniques
- Error-free TSV interconnect technology
- Better cooling capability with lower airflow impedance

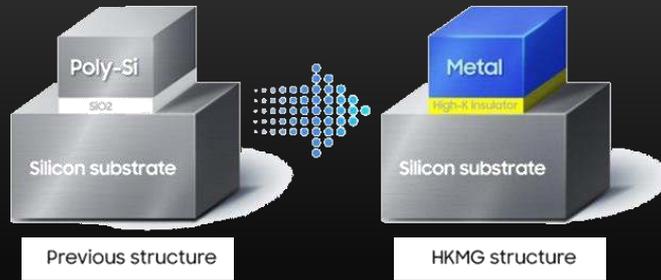


Increased Air Flow in CFM* (+16%)

* Cubic feet per minute

Lower Power

By reduced voltage and new process

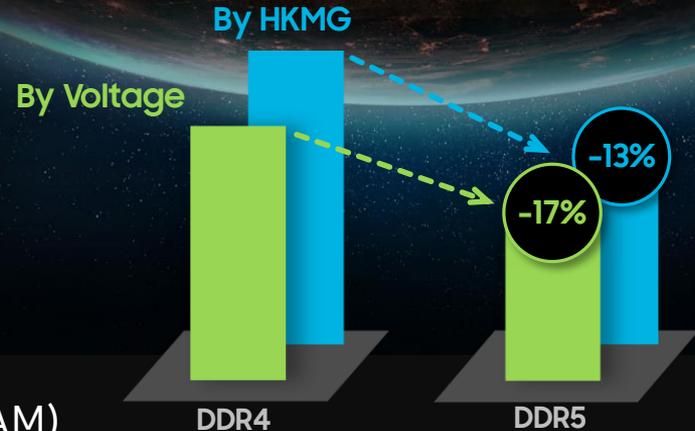


- High-efficiency PMIC (1st for DRAM module)
- Reduced noise for low voltage operation
- High-K Metal Gate (HKMG) process (1st for EDP* DRAM)

* Electronic data processing

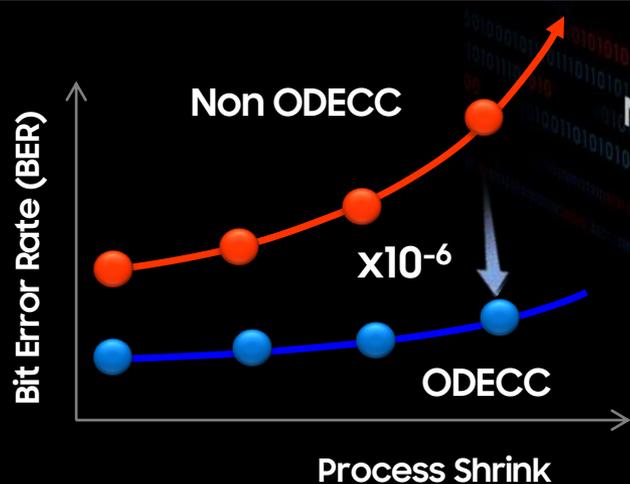
SAMSUNG

Power efficiency
30%



More Reliable Data

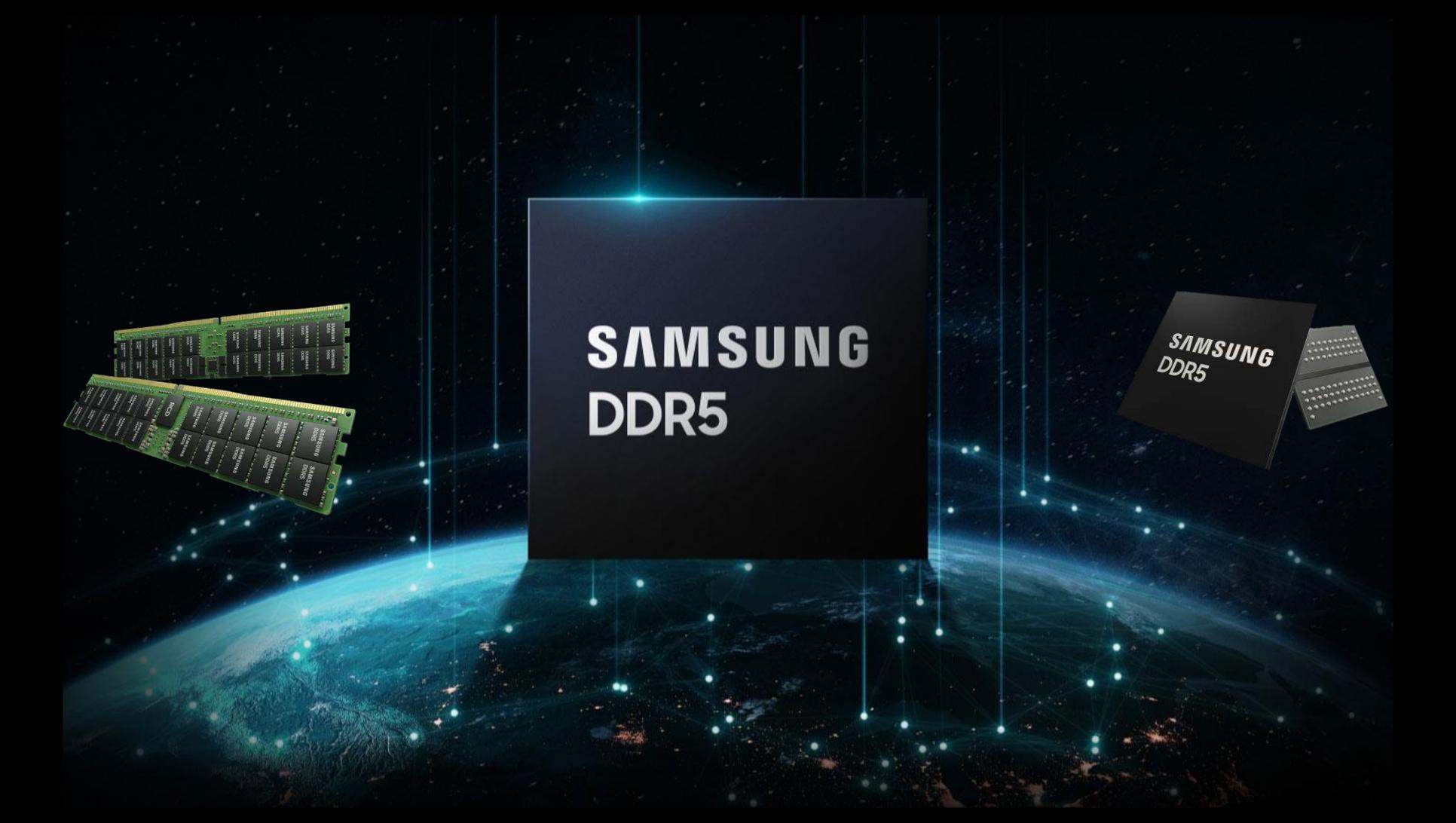
By enhanced error correction capability



- On-Die Error-Correction Code (ODECC)
- Improved (10^{-6} times) bit error rate (BER)
- More reliable and secure data

Summary & Future Plan

- AI and cloud technologies drive demand for high-performance and large-capacity memory
- Samsung developed industry's first 7.2 Gbps 512GB DDR5 module
- Ready for mass production of 512GB by the end of year 2021
- DDR5 to be the main stream of computing memory (DDR5 cross over expected in '23-'24)
- New era of terabyte DRAM for next-gen servers at post-pandemic
- Samsung to provide total memory solutions for industry

The background of the advertisement features a dark, starry space scene with a glowing blue horizon line, possibly representing Earth from space. Vertical lines of light and a network of glowing nodes are scattered across the scene, creating a futuristic, digital atmosphere.

SAMSUNG DDR5

