IMMERSE GAMERS WITH PHENOMENAL GRAPHICS.

Stay at the forefront of the market equipped with Samsung’s dashing graphic memory solution.
Executive Summary

Evolution of video game
• Playing and sharing gaming moments in high definition are rising in demand
• Using more power than necessary

Enabling game console as the hub of home entertainment
• Empower superior graphics performance and sharing
• Present an extensive energy-efficient experience

▶ Read on to learn more ...
Playing and sharing gaming moments in high definition are rising in demand

Gamers are increasingly embracing graphics-intensive games and are also sharing their gameplay.

Next-generation of video games

1. Accenture, Internal research and analysis (2015)

Rich, high-fidelity graphics
Ultra-fast GDDR5 memory chip increases the graphics richness of 4K UHD.

Shared game experience
Simply scan through the last few minutes of gameplay, tag it, and return to the game—the video uploads as you play.
Using more power than necessary

The energy consumption of America’s game consoles will cost consumers $1 billion in electricity bills, topping at 10 billion kWh annually.

Projected video game console energy consumption in U.S. ¹

Begin a new era in gaming with Samsung’s stunning graphics solutions designed to stay ahead.

As the population across all ages starts to endorse 4K TVs, seamless gameplay in high definition is an unavoidable, yet difficult, challenge. Samsung proudly offers high speed GDDR5 chips that can seamlessly support 4K-resolution gaming.
Empower superior graphics performance and sharing.

With the higher processing capabilities of our graphics DRAM combined with the fast read and write performance of eMMC, manufacturers can offer a richer experience in high-definition gameplay and sharing.

Our GDDR5 memory provides ultrafast peak bandwidths that are more than 3 times faster than that of the GDDR3. Such improvements lead to seamless support for 4K resolution gaming.

Samsung eMMC 5.1 provides a faster R/W speed in both random and sequential modes over its predecessors and also a better sustained performance.
Present an extensive energy-efficient experience.

With our power-efficient graphics DRAM, consumers can enjoy energy-friendly consoles that consume less power than conventional products.

Samsung GDDR5 supports low-power modes with an operating voltage of 1.35V, which is a 25% reduction in power consumption compared to that of GDDR3.
Tailored for your business.

Explore products, solutions and resources that cater to your Game Console.
Featured Product Overview

Game Console

- **Graphic DRAM**: Supreme graphics at dashing speed
- **eMMC**: Faster R/W performance with power efficiency
- **Consumer DRAM**: Best fit memory for your diverse needs
Graphic DRAM

Market demand is high for a graphic DRAM that seamlessly supports high-definition contents and graphic-intensive applications. Samsung is dedicated to deliver the ultra-fast, yet power efficient graphic memory products. Samsung graphic DRAM, born to boost GPU capabilities, delivers unprecedented graphic performance, giving your devices the ultimate desirability.
Faster speed and bandwidth

GDDR5 provides 3.8 times faster data speed than GDDR3.

Samsung GDDR5 can achieve data rate of up to 10Gb/s per pin which translates to 40GB/s for the complete memory chip. This is 3.8x faster than GDDR3’s 2.6Gb/s per pin and 10.4GB/s.
Graphic DRAM

GDDR5 consumes less power than GDDR3.

Low power consumption

<table>
<thead>
<tr>
<th>VDD/VDDQ</th>
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</thead>
<tbody>
<tr>
<td>GDDR3</td>
</tr>
<tr>
<td>GDDR5</td>
</tr>
<tr>
<td>1.8V/1.8V</td>
</tr>
<tr>
<td>1.5V/1.5V (1.35V/1.35V)</td>
</tr>
</tbody>
</table>

With GDDR5’s 25% decreased VDD/VDDQ compared to GDDR3, Samsung has achieved low power consumption for its Graphic DRAM. Manufacturers can now provide energy-efficient graphic products to the end customers.
Today’s mobile-connected world expects mobile devices to deliver seamless and long-lasting performance. Samsung expertise in flash storage gives you complete freedom to design smartphones, tablets and other mobile devices that boast faster speed and better power efficiency.
eMMC

Samsung eMMC provides better sustained performance compared to competitors.

Sequential read performance

Random read performance
eMMC 5.1 is faster than eMMC 5.0.

With its Command Queue feature, eMMC improved cache and data streaming. Samsung eMMC 5.1 provides faster speed in both random read and write compared to eMMC 5.0.
eMMC

1znm eMMC is faster than 16nm eMMC.

Faster speed of 1znm eMMC (32/64GB)

<table>
<thead>
<tr>
<th></th>
<th>Sequential Read</th>
<th>Sequential Write</th>
<th>Random Read</th>
<th>Random Write</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(MB/s)</td>
<td>(MB/s)</td>
<td>(IOPS)</td>
<td>(IOPS)</td>
</tr>
<tr>
<td>16nm eMMC</td>
<td>260</td>
<td>140</td>
<td>6.8K</td>
<td>12K</td>
</tr>
<tr>
<td>1znm eMMC</td>
<td>300</td>
<td>140</td>
<td>9K</td>
<td>12K</td>
</tr>
</tbody>
</table>

1znm MLC eMMC is faster than 16nm MLC eMMC in both sequential and random speed.
eMMC

eMMC consumes 80% less power than SSD.

Low power consumption

eMMC (128GB) consumes 0.5 watt which is 80% lower than the SSD with lowest power consumption (256GB) in random read test.

Watt is based on active typical power.
SSD with the Lowest Power Consumption: 256GB, eMMC: 128GB.
We know exactly what you need. Discover why Samsung is a long-standing, unparalleled partner in today’s consumer electronics market. Whether the requirement is for blistering speed, or for extended temperature ranges, our exceptional range of DRAM products and expertise make us the preferred memory supplier for worldwide commercial and industrial OEM markets.
Consumer DRAM

DDR4 has higher power efficiency.

High power efficiency

Samsung DDR4 consumes less power with its unique 2nm technology. Samsung 2nm DDR4 operating at 1.2V achieves 26% higher performance/watt compared to 2nm DDR3 operating at 1.5V.
**Consumer DRAM**

Samsung offers a wide range of DRAM component products.

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**Diverse component product portfolio**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Density</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR2</td>
<td>x8 x16</td>
<td>512Mb - 1Gb</td>
</tr>
<tr>
<td>DDR3</td>
<td>x8 x16</td>
<td>1Gb - 8Gb</td>
</tr>
<tr>
<td>LPDDR3</td>
<td>x32 x64</td>
<td>8Gb - 32Gb</td>
</tr>
<tr>
<td>DDR4</td>
<td>x8 x16</td>
<td>4Gb - 8Gb</td>
</tr>
<tr>
<td>LPDDR4</td>
<td>x32 x64</td>
<td>16Gb - 32Gb</td>
</tr>
</tbody>
</table>
Rediscover the wonder of technology with our latest breakthroughs, products, and solution as we continue to push limits of innovation.
Leading the industry with technological innovation

Samsung's semiconductor business remains at the forefront of the market by constantly pushing the limits on innovation through sustained investment in R&D and corporate citizenship.

Technology Leader Making Global Contributions

1. Market Leadership
   - Samsung's semiconductor business has been the memory leader for over 20 years, and is rapidly moving to the head of the LSI market.

2. Technology Innovations
   - Samsung has made numerous technological innovations in the semiconductor industry since 1983, when we developed the world's 1st 64Kb DRAM.

3. Company Capability
   - Samsung's semiconductor business never stops innovating within its comprehensive product portfolios, from semiconductors to end-products, and makes massive investments in R&D.

4. Corporate Citizenship
   - Samsung's semiconductor business puts great value in our social responsibilities toward customers and partners, and in maintaining a green planet.
Market Leadership | A comprehensive view

Samsung's semiconductor business has held the 2nd largest global market share for over 12 years and it continues to grow its presence in the industry.

Global semiconductor market share

- Company A: 14.6% in 2009, 13.9% in 2010, 16.5% in 2011, 16.4% in 2012, 15.4% in 2013, 15.4% in 2014.
- Samsung: 7.7% in 2009, 9.0% in 2010, 9.0% in 2011, 9.5% in 2012, 9.7% in 2013, 10.2% in 2014.
- Company B: 2.8% in 2009, 3.2% in 2010, 4.4% in 2011, 5.5% in 2012, 5.7% in 2013, 5.7% in 2014.
- Company C: Not shown.
- Company D: Not shown.

1. Gartner
Samsung has been the leader of the total memory market for 22 years running since 1993.

Memory market leadership (2014)

- Memory: 35% for 22 years since 1993
- DRAM: 41% for 23 years since 1992
- NAND Flash: 31% for 13 years since 2002

1. Gartner
Market Leadership | System LSI business

Samsung's semiconductor business took the DDI market lead in 2003 and never looked back, expanding to a leadership position for smart cards, CIS and other products.

Market leadership in the LSI business (2014)

- **DDI**: 23%
- **Smart Card**: 37%
- **Mobile CIS**: 27%
- **CIS**: 14%

for **12 years** since 2003

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1. Samsung Internal Forecast '15
Samsung has achieved numerous technological innovations in the memory field on an almost annual basis since first developing 64Kb DRAM in 1983.
Samsung system LSI has grown significantly since its inception in 2001, making several technological innovations for each of its products.
Samsung's semiconductor business offers nearly 25 memory and system LSI product portfolios that are essential in today’s electronic appliances.

Samsung’s 9 product categories

- **Memory**
  - DRAM
  - Flash Storage
    - V-NAND
    - SSD
  - MCP
  - eMMC

- **System LSI**
  - Exynos Solution
    - Application Processor
    - Modem/RF
    - ModAP
  - Display Solution
    - Mobile DDI
    - Panel DDI
    - Touch Controller
  - CMOS Image Sensor
    - Mobile CIS
    - Camera CIS
    - Industry CIS
  - Security Solution
    - Smart Card
    - NFC
  - Power IC
    - Bio Processor
Samsung's semiconductor business operates in 18 international locations to better serve and collaborate with customers around the world.
Global professionals as a core value

- **300,000+** talented employees in 80 countries around the world
- **36,900** Doctorate/Masters degrees
- **63,000** R&D Staff
- **1,700** Designers

Striving rigorously for innovation

- **$14.6 B** R&D investments in 2014
- **6%** Net Sales
- **$209 Billion**

Leading patent holder

<table>
<thead>
<tr>
<th>SAMSUNG</th>
<th>Number of patents 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 100,000</td>
<td>Globally</td>
</tr>
<tr>
<td>No.2 in Europe (2,366)</td>
<td>No.2 in the US (5,072) since 2006</td>
</tr>
</tbody>
</table>

Why Samsung

Our global business experts and continued R&D investments position us to provide the market with cutting-edge technology to maintain our leadership position.
Company Capabilities | Global recognition

Samsung has also been widely acclaimed for our reputability and innovative spirit.

Global recognition

7th **TOP BRAND VALUE** company (Interbrand)

15th most **REPUTABLE** company (Forbes)

13th **TOP GLOBAL** company (Fortune)

5th most **INNOVATIVE** company (BCG)

3rd top global **INNOVATOR** (Thomson Reuters)

most **REPUTABLE** company (Forbes)

**TOP GLOBAL** company (Fortune)
Corporate Citizenship

Samsung constantly strives to resolve community challenges, protect nature, create safe and healthy workplaces and share growth with our employees, partners and customers.

Corporate citizenship of Samsung

- Social Contributions
  - Sharing and Volunteering to Foster New Hope

- Green Management
  - Green Management that Protects the Planet

- Health and Safety
  - Creating Safe and Healthy Workplaces

- Sharing Growth
  - Success Built on Helping and Dreaming Together
4 Corporate Citizenship | Social contributions

Samsung has initiated 5 key programs for social contributions to address the leading social issues around the globe, including education, healthcare and employment.

5 global social contribution activities

SMART School
- 384 schools under operation worldwide
- Supporting the development of creative talents in a smart education environment
- Resolving regional education gaps

Samsung Tech Institute
- 23 institutes under operation worldwide
- Offering systematic vocational training & local employment
- Laying the foundation for financial independence

Samsung Care Drive
- 8 programs under operation worldwide
- Offering a Smart Healthcare System accessible anywhere at any time
- Promoting better health and lifestyles of local citizens

Nanum Village
- 2 digital villages under operation worldwide
- Providing healthcare and education support to low-income countries
- Offering citizens the chance to contribute to local communities

Solve for Tomorrow
- +2,300 participants in the 2014 competition
- Explored innovative ideas, putting them to practice in partnership with local communities
- Resolved local pending issues using STEM¹ skills

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1. STEM: Science, Technology, Engineering, Mathematics
Corporate Citizenship | Green management

Samsung has launched a wide range of innovative eco-conscious products in an effort to protect the environment for all of us.

Certified green products

100% of products achieved Good Eco-Product ratings

3,027 products certified green by global institutes

Globally recognized for the eco-friendliness of its products, Samsung received green certifications for a total of 3,027 product models from 11 nations including Korea, the US, China and European countries by the end of 2014.

Resource reuse and recycling (2014)

92% of waste recycled

19,403 tons of recycled plastics reused

354,599 tons of electronic waste recycled globally

37,594 mil. tons of water reused worldwide

Samsung reduces environmentally hazardous elements by reusing and recycling resources such as recycled plastic throughout the life cycle of products, from the manufacturing of parts and products, to their distribution, use and disposal.
Samsung promotes and complies with safety regulations to establish a proactive culture of safety, both inside and outside worksites.

### Health and safety management system

100% global certification for all of Samsung's health and safety management systems

Samsung complies with **OHSAS 18001**, a global standard for occupational health and safety management systems, in each of its workplaces around the world, striving to maintain on-site safety and protect employee health.

### Employee healthcare and safety enhancement

39,968 employees participated in hands-on environmental and safety education programs in 2014

Program to teach emergency CPR

CPR: Cardiopulmonary Resuscitation

Samsung is committed to **improving employee healthcare and safety** by developing ergonomic adaptations in the workplace environment, prohibiting business trips to regions with a high risk of infectious disease and supporting employee medical checkups.
Samsung has taken part in various shared-growth activities to create a mutually beneficial business ecosystem with its suppliers.

Samsung Electronics set up the mutual Growth Academy in June 2013 to provide comprehensive and systematic support for its primary and secondary suppliers.

Samsung created a supplier support fund of **USD $1 billion**, known as the ‘**Mutual Growth Fund**’ in collaboration with various financial institutes to support both primary and secondary suppliers.
ENABLING THE FUTURE OF LIFELOGGING.

Let’s Get Started...
Samsung as a trusted partner

About Samsung's semiconductor business

The component businesses of Samsung Electronics come together under the title Device Solutions. As a leading company in the global electronics industry, Samsung Electronics has one of the widest range of products for its key component businesses Memory and System LSI, which are core elements of the company's well-balanced business portfolio.

Samsung initiated its semiconductor operations in 1974, mostly developing and producing ICs and peripherals for consumer electronics. The pivotal turning point in our evolution into a leading semiconductor manufacturer was the successful development of the 64Kb DRAM in 1983.

Samsung achieved and has maintained its market leadership position in the memory industry since 1993. Along with its success in the memory sector, the company signaled a long commitment to logic and analog chip development in 2001 with the expansion of its System LSI organization and the opening of its SoC Research Lab. Since then, Samsung's System LSI Business has scaled significantly upward, and is now one of the major players in the sector and also the largest provider in many product categories.

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For more information

For more information, visit www.samsung.com/semiconductor.

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