Industry | Healthcare & Wellness

24/7 PERSONAL CARE BY YOUR SIDE.

Deliver a truly rich quantified-self solution to your customers with Samsung’s latest technology.
Executive Summary

From monitoring and episodic response to prevention and continuous care

• Increasing interest of personal wellness/fitness
• Driving the need of fitness monitoring devices in various forms
• Unauthorized access to health data is a serious concern
• Consuming low power to be always on

Pamper your customers with highly-efficient and highly-secure devices

• Leverage a compact Bio-Processor handling various fitness data
• Provide military-grade security to protect customer’s bio-data
• Create innovative fitness monitors of all forms

► Read on to learn more …
Increasing interest in tracking personal wellness/fitness (1/2).

Consumers are more and more concerned about their health and are willing to purchase a device to monitor their health or fitness.

Increasing interests on personal health/fitness monitoring device

- 69+%: “Of adults track at least one health indicator for themselves or a loved one”
- 54%: “Of adults willing to purchase an application or a device to monitor their health outcomes”
- 52%: “Of adults willing to purchase an application or a device to monitor their fitness outcomes”

Increasing interest in tracking personal wellness/fitness (2/2).

Wearable fitness monitoring devices are becoming widely recognized as important contributors to personal health.

“Wearable fitness monitoring devices can effectively satisfy health management needs”

76% of patients say health management technology has the potential to improve their health

85% of doctors say the use of wearable health devices helps their patients stay engaged in personal health management

Driving the need for fitness monitoring devices in various forms.

Demand is growing for wearable fitness monitoring devices that can offer versatile and specific health tracking.

1. **Orange, Wearable Tech Boom in Healthcare**

   - **Smart Contact Lenses**
     
     Able to measure glucose levels in tears

   - **Electronic Sensor Tattoos**
     
     Able to monitor skin hydration, temperature and any electric signals from muscle and brain activity

   - **Smart Fitness Bands**
     
     Able to measure a range of activities, from steps walked to hours slept

   - **Wearable Pain Relief Patch**
     
     Able to manage and track pain

   - **Smart Watches**
     
     Able to monitor heart rate and calories burnt daily

   - **Smart Socks**
     
     Able to coach users on their running techniques in real time and monitor heart rate
Unauthorized access to health data is a serious concern.

The risk of a breach in personal security can be the one of the biggest concerns on wearable healthcare devices, which can outweigh all benefits.

“If people won’t use the technology because of data breaches, we run the risk of losing the benefits of these technologies”

Robert B. McCray, president and CEO of the Wireless-Life Sciences Alliance

50% say they have data privacy concerns and data privacy is a barrier to wearable technology adoption.

55% say that they do not want their information to be shared with third parties.

1. The Economist, Power to the patient: How mobile technology is transforming healthcare (2015)
Consuming low power to be always on.

Amongst all the features related to hardware in wearable fitness monitoring devices, long battery life is the most critical purchase driver.

Fitness monitor purchase drivers

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of Use</td>
<td>35</td>
</tr>
<tr>
<td>Features and Functionality</td>
<td>32</td>
</tr>
<tr>
<td>Trusted Brand</td>
<td>26</td>
</tr>
<tr>
<td>Long Battery Life</td>
<td>23</td>
</tr>
<tr>
<td>Design Look and Feel</td>
<td>21</td>
</tr>
<tr>
<td>Compatibility with Existing Devices</td>
<td>17</td>
</tr>
</tbody>
</table>

Realizing 24/7 wearable fitness monitors with secure access to personal health information.

Consumers look for a variety of different features and form factors in fitness monitors. Samsung can help meet your consumer’s demand for convenient and natural-looking wearable devices that monitor personal fitness data at all times, while guaranteeing the security that is essential for such devices.
Capturing multiple forms of bio-data, from heart rate to electrodermal activity, normally requires more than one monitoring device. Samsung Bio-Processor integrates many fitness monitoring features into a single small chip, hence enabling manufacturers to offer low power devices without developing a complex fitness data interface.

Samsung Bio-Processor measures 5 types of bio-data including PPG, ECG, Skin Temperature, GSR and Body Fat using a single chip. The bleeding-edge technology achieved tremendous size reduction even after integrating MCU, DSP, AFE, PMIC and security units in the chip, enabling efficient use of board space in fitness monitoring devices.

ECG: Electrocardiogram  
PPG: Photoplethysmogram  
GSR: Electrodermal Activity  
MCU: Microcontroller Unit  
DSP: Digital Signal Processor  
PMIC: Power Management IC  
AFE: Analog Front End
More and more fitness bands and other fitness devices containing personal information are being connected to the internet. Samsung Smart Card provides unparalleled security technology for manufacturers to secure sensitive bio-data.

Samsung Smart Card can help implement secure patient identification methods. In addition to conforming with global security standards in data storing, Samsung ensures secure data wiping when tampering is detected.

With its embedded flash memory, NFC’s firmware supports the latest industrial specifications to ensure greater security, and is compatible with various types of contactless communication technology.
Create innovative fitness monitors of all forms.

Samsung has a wide range of technologies to give high flexibility to manufacturers when designing fitness monitors. With Samsung’s small footprint components and unchallenged stacking technology, thinner and lighter fitness monitoring devices are within your reach.

Samsung has merged five different sensors into a single chip, achieving a significant space reduction and hence opening up space for other components.

We provide smart cards in various densities with a diverse range of security features, helping manufacturers to pick the best-fit card for their specific needs.

Samsung ePoP uses approximately 60% less space than the combined size of AP, mobile DRAM and eMMC. The remaining space can be used for other components as the manufacturer desires.
Tailored for your business.

Explore products, solutions and resources that cater to your fitness monitors.
Featured Product Overview

- **eMCP**
  - High SNR solution with unimaginable power efficiency
  - Integrated memory solution

- **Bio-Processor**
  - Rich fitness-monitoring experience

- **ePOP**
  - Single-package of eMCP and AP for small footprint
  - Extreme quality media contents on screens

- **NFC**
  - Customized for efficiency and accuracy

- **Mobile DDI**
  - Extreme quality media contents on screens

- **Touch Controller**
  - Universal compatibility with top-notch security

Healthcare & Wellness
ALL-IN-ONE QUANTIFIED-SELF SOLUTION IS FINALLY HERE.

Samsung’s monolithic Bio-Processor, translating the body’s complex messages into a rich fitness-monitoring experience.
Bio-Processor

Samsung Bio-Processor merges five different sensors in a single chip, empowering manufacturers to provide an in-depth monitoring of the human body.

Providing a variety of fitness data

- **Body Fat**
  - Body Fat Percentage
  - Samsung Bio-Processor can even measure body fat in a single chip.
  - %

- **PPG**
  - Photoplethysmogram
  - PPG sensors can monitor heart rate, cardiac cycle, respiration and hypo/hyper-volemia.
  - %
  - 99%

- **ECG**
  - Electrocardiogram
  - Electrocardiogram readings measure heart rate and heart rhythm, testing general heart health.
  - 68bpm

- **Skin Temp.**
  - Skin Temperature
  - Temperature sensors measure skin temperature to obtain overall body temperature.
  - 37°C

- **EDA(GSR)**
  - Galvanic Skin Response
  - Galvanic Skin Response (also called EDA) readings measure stress levels and depth of hypnosis.
  - 0.05µS
Bio-Processor

Five health functions are implemented within the Samsung BP which also secures sensitive sensor data using H/W based encryption.

Space efficiency by an integrated monolithic solution

Samsung Bio-Processor saves board space by integrating all the core components including health functions and MCU into a single chip. When compared to the discrete chips, Samsung BP significantly saves the board space.

Unparalled security technology

Samsung Bio-Processor has a security module inside it to ensure secure encryption of sensitive data from health functions. Unlike software encryption, Samsung BP uses H/W based encryption which greatly improves the integrity and confidentiality of data.
Bio-Processor

Use of a single optimized Bio-Processor reduces the power consumed by health functions, making Samsung BP the ideal option for wearable devices.

Health functions design for low power consumption

<table>
<thead>
<tr>
<th>Health Functions</th>
<th>Discrete Chips</th>
<th>Samsung BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPG</td>
<td>3.5 mW</td>
<td>1.5 mW</td>
</tr>
<tr>
<td>ECG</td>
<td>2.5 mW</td>
<td>1.0 mW</td>
</tr>
<tr>
<td>Body Fat</td>
<td>1.5 mW</td>
<td>0.5 mW</td>
</tr>
</tbody>
</table>

Samsung Bio-Processor uses less power than discrete chips in reading data from various health functions including PPG, ECG and body fat.

Discrete chips have multiple components that need to be placed on a PCB. This creates a routing that's too complicated and an oversized PCB. Samsung BP avoids this problem by having an optimized PMIC.

PMIC for power management

Discrete

1.1V
0.7V
0.5V

Samsung BP
Bio-Processor

Implementation of a separate DSP allows simultaneous processing of workloads that a MCU would have processed sequentially, hence reducing peak power consumption several times over.

Samsung Bio-Processor incorporates a DSP that is actively used when heavy work such as data from health functions need to be processed. Conventional Bio-Processors, however, only use MCU to do the same job. This gives Samsung BP significant power savings when doing heavy work. Samsung BP does this by having MCU and DSP work simultaneously, hence considerably reducing time needed for heavy work.
STORE EVERYTHING, USE IT ANYWHERE.

Samsung delivers universal compatibility for myriad of applications, covered by top-notch security.
Smart Card

Samsung Smart Card understands the importance of international standards and at the same time, excels by using advanced process technology.

**Advanced process technology for high density**

<table>
<thead>
<tr>
<th>SIM</th>
<th>Banking/ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>45nm</td>
<td>80nm</td>
</tr>
</tbody>
</table>

**Ensuring security and compatibility through standards**

<table>
<thead>
<tr>
<th>EAL5+</th>
<th>EAL7</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIM</td>
<td>Banking/ID</td>
</tr>
<tr>
<td>ISO/IEC 7816 (SIM &amp; Banking/ID)</td>
<td>ISO 14443</td>
</tr>
<tr>
<td>102 221 102 613</td>
<td></td>
</tr>
</tbody>
</table>

**Process Technology**

- Samsung’s premium SIM Smart Cards are made using 45nm process technology and carry up to 2 MB of NVM. Our banking/ID products use 80nm process technology and offer a maximum NVM density of 500 KB.

**NVM Density**

- Samsung Smart Cards provide fast and stable data transmission through compliance with international standards. Furthermore, our products are CC EAL 7-certified to provide first-rate security.
Smart Card

Samsung Smart Card ensures the top of the line security with various mechanisms in effect that can effectively fend off attackers.

Unparalleled security technology

- **Smart Shield**  
  Custom Random Layout, Memory Encryption  
  - 100% secure solution against reverse engineering  
  - Able to actively defeat new attacks

- **Smart Sensor**  
  Light Sensor Network, Digital Fault Detection  
  - Protection against fault injection attacks  
  - Secure solution for managing software security

- **Smart Core**  
  Secure Crypto Engines & RISC CPU  
  - Secure CPU with dedicated protection against fault attack  
  - TORNADO™ H/W Crypto Engine

Samsung Smart Cards offer countless benefits. Smart Core’s TORNADO™ H/W Crypto Engine ensures secure encryptions (T-DES, AES, RSA, ECC). Smart Sensor detects any tampering attempts and ensures data integrity. Other integrity solutions include flash permanent write protection. Finally, Samsung secure Reduced Instruction Set CPU (RISC) supports both normal and secure instructions.
Smart Card

Samsung offers a full range of Smart Cards, from basic models to high-security, from low to high-density Smart Cards.

Supporting all relevant standards with design flexibility (Banking/ID)

<table>
<thead>
<tr>
<th>Dual Interface (Contact &amp; Contactless)</th>
<th>DDA</th>
<th>SDA</th>
<th>90nm NVM</th>
<th>80nm NVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>264k / 232k / 212k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144k / 80k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40k / 20k / 12k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single Interface (Contact)</th>
<th>DDA</th>
<th>SDA</th>
<th>90nm NVM</th>
<th>80nm NVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>80k / 40k / 20k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>90nm</th>
<th>80nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>72k / 40k</td>
<td>160k / 136k</td>
</tr>
<tr>
<td>120k</td>
<td>200k</td>
</tr>
<tr>
<td>136k / 160k</td>
<td>304k / 264k / 232k</td>
</tr>
<tr>
<td>500k / 420k / 320k</td>
<td>264k / 232k / 212k</td>
</tr>
<tr>
<td>160k / 136k</td>
<td>200k</td>
</tr>
<tr>
<td>120k</td>
<td>136k / 160k</td>
</tr>
<tr>
<td>90nm EEPROM</td>
<td>90nm NVM</td>
</tr>
</tbody>
</table>

Legend
- 90nm EEPROM
- 90nm NVM
- 80nm NVM
- EMVCo
- CC EAL 5+
- CC EAL 6+
- CC EAL 7

New generation products (65/45nm) are under planning (Multi-eID, Banking)

DDA: Dynamic Data Authentication
SDA: Static Data Authentication
Smart Card

Samsung’s extensive experience in the Smart Card market has led to our participation in projects all over the world.
SAFE CONTACTLESS COMMUNICATION.

Samsung’s latest NFC products can provide globally compatible and highly reliable solutions.
Unparalleled security technology

Samsung has applied its experience and knowledge of security technology to NFC.

Samsung NFC utilizes the most advanced multi-application embedded Secure Element which can offer large memory. It allows easy deployment of secure NFC payment, strong authentication, transit, access and loyalty applications.

Moreover, it has several features to be compatible with various payment technologies such as Host-based Card Emulation (HCE). Samsung has also optimized the NFC firmware and its middleware to facilitate data exchange between the software of the smartphone and NFC. The firmware supports the latest industrial specification due to its e-Flash memory, resulting in greater security.
NFC

Samsung’s advanced process technology enables power savings in NFC.

High density

Industry's First NFC IC using 45nm Embedded Flash Process

Low power consumption

25% reduced power consumption compared to Samsung's second most recent product

45nm Embedded Flash Process reduces power requirements by approximately 25 percent compared to Samsung's second most recent NFC product. This is enabled by Samsung’s newly optimized Low Power Sensing (LPS) technology.

Samsung offers several NFC solutions, including embedded secure element, along with high-density flash chips with the capacity to store various user details. Thus, Samsung is the preferred NFC chip supplier for OEMs worldwide.
NFC

Samsung NFC excels in performance, and complies with international standards.

Design flexibility

Universal compatibility for faster time-to-market

30% smaller antenna
while enhancing the RF performance

ISO 14443 / ISO 15693 / ISO 18092
NFC Tag Type I/II/III/IV

Samsung enhanced RF performance was with a 30% smaller ‘Smart Antenna’ that made room for other specifications while consuming less power.

Samsung has obtained NFC certifications for ISO 14443 A/B, ISO 15693, ISO 18092 and all NFC Tag types. Samsung has received awards from reputable organizations. Seamless user experience can be ensured through universal compatibility.
ePoP

ALL-IN-ONE SOLUTION, FOR THE ULTRA MINI.

Samsung ePoP has solved the dilemma of wearables that must be sleek in design and enjoy long unplugged life. The industry’s first ePoP combines the advanced and power efficient Mobile DRAM, eMMC and Application Processor in a single package, achieving extreme compactness for wearable devices.
ePoP provides tremendous space savings for mobile AP, eMMC and mobile DRAM.

Samsung ePoP requires the board space only the same as a conventional mobile AP, and is thinner than 1.4mm. When compared to using each component separately, Samsung ePoP decreases over 60% of the total memory & AP space by stacking one over another. The remaining device space can be used for any other function required, such as an extra battery.
## ePoP

AP, mobile DRAM and eMMC is a more power efficient combination all together.

### Low power consumption of mobile DRAM

<table>
<thead>
<tr>
<th></th>
<th>LPDDR2 1.2V/800 Mbps</th>
<th>LPDDR3 1.2V/1,600 Mbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption</td>
<td></td>
<td>10%</td>
</tr>
</tbody>
</table>

LPDDR3 is more power efficient than LPDDR2. LPDDR3 has 10% improved power efficiency than LPDDR2.

### Low power consumption of eMMC

<table>
<thead>
<tr>
<th></th>
<th>NVMe BGA SSD</th>
<th>eMMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption</td>
<td>2.3 (Watt)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Embedded Multi-Media Controller (eMMC, 128GB) consumes 0.5 watt which is 80% lower than the SSD with lowest power consumption (256GB). Watt is based on active typical power.
SINGLE TOUCH, FEEL THE DIFFERENCE.

Samsung provides high accuracy and high SNR solution, with unimaginable power efficiency for mobile devices.
Touch Controller

Samsung touch controller delivers efficiency in both Power and Bill of Materials by solving the problem from the source.

Ultra low-energy for longer use

Up to 90% of energy is saved compared to competing products in Idle mode.

<table>
<thead>
<tr>
<th></th>
<th>Active</th>
<th>Idle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>100</td>
<td>25.3</td>
</tr>
<tr>
<td>Samsung</td>
<td>100</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Samsung Touch Controller saves up to 90% of power compared to competing products. This can help deliver longer battery life.

Ultra low-EMI for minimizing effects on RF

Electromagnetic Interference ↓

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Samsung</th>
</tr>
</thead>
<tbody>
<tr>
<td>(%)</td>
<td>-100</td>
<td>-117</td>
</tr>
</tbody>
</table>

Samsung Touch Controller can solve electronic interference problem from the source. The ultra low EMI Touch Controller removes the need for an EMI shield, enhancing power efficiency.
High ESD immunity

**Electrostatic discharge**

2.3X

more capable of electrostatic discharging in average

Samsung Touch Controller is capable of discharging up to 8 and 6 kilovolts in interface and up to 6 kilovolts in channel modes respectively. This is a significant improvement compared to conventional products that discharge around 3 kilovolts in both modes.
eMCP

SINGLE PACKAGE ALIGNED WITH YOUR DESIGN VISION.

Samsung eMCP enables hand-held devices to thrive in the rapidly-evolving mobile market that demands slimmer design while maintaining performance. Take advantage of the reduced memory space, only made possible thanks to the in-house expertise in both mobile DRAM and eMMC. Samsung eMCP will also help your customers to enjoy longer battery life.
eMCP

MCP saves total memory space by nearly 30~40%.

Space efficiency

30 ~ 40% savings in total memory space

Through stacking, Samsung can develop an MCP that reduce the required board space and is also extremely thin as less than 1 mm. Samsung MCP offers device makers more space by combining the two key elements into a single package reducing the total memory space by 30~40 percent.
Mobile DRAM and eMMC is a more power efficient combination together.

Low power consumption of mobile DRAM

LPDDR2
1.2W/800 Mbps

LPDDR3
1.2V/1.600 Mbps

LPDDR3 is more power efficient than LPDDR2. LPDDR3 has 10% improved power efficiency than LPDDR2.

Low power consumption of eMMC

NVMe BGA SSD
2.3

eMMC
0.5

Embedded Multi-Media Controller (eMMC, 128GB) consumes 0.5 watt which is 80% lower than the SSD with lowest power consumption (256GB). Watt is based on active typical power.
A CINEMA-LEVEL DISPLAY AT YOUR FINGERTIPS.

The solution for extreme quality media contents designed for mobile screens.
The Samsung MDDI supports numerous image compression algorithms from major APs to reduce power consumption while maintaining the same high level of image quality.
Mobile DDI

The Samsung MDDI saves power by only using the minimum amount of resources required.

DDI-embedded up-scaler for low power system

Samsung DDI supports seamless resolution adjustments

WQHD AP

WQHD AP

FHD mode

WQHD mode

6.4Gbps

3.6Gbps

AP can save power

Frame Buffer

SCOPE

Display Driver

WQHD Panel

WQHD Panel

Samsung DDI supports seamless resolution adjustments

WQHD AP

FHD mode

6.4Gbps

3.6Gbps

AP can save power

Frame Buffer

SCOPE

Display Driver

WQHD Panel

WQHD Panel
Power Management IC

AN ENORMOUSLY EFFICIENT POWER CONTROL.

The most compelling power management solution customized for efficiency and accuracy of each component in a mobile device.
Power Management IC

Long battery life is achieved through Samsung’s persistence in fine tuning and our ability to rethink the way that a product works to bring true innovation.

The advancement of PMIC manufacturing technology enables device makers to optimize system power and enhance efficiency and accuracy of power control. Samsung has developed state-of-the-art cell technology for an efficient and effective power management IC. The amount of power consumption can be reduced by 5% annually through continuous power reduction.
Power Management IC

Samsung OLED PMIC ensures low power consumption by employing the most advanced process technology.

Ensuring lower power with cutting-edge process technology

<table>
<thead>
<tr>
<th>Year</th>
<th>Samsung</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>90nm</td>
<td>130/110nm</td>
</tr>
<tr>
<td>2012</td>
<td>70nm</td>
<td>90nm</td>
</tr>
<tr>
<td>2013</td>
<td>45nm</td>
<td>55nm</td>
</tr>
<tr>
<td>2015</td>
<td>32nm</td>
<td></td>
</tr>
</tbody>
</table>

14% of power can be saved due to the most advanced process technology

45nm @ 1.1V → 32nm @ 1.0V

The amount of power consumption can be reduced by 10-15%, whenever the process technology is upgraded.
Power Management IC

Samsung PMIC is made using the most advanced process technology and continuously evolves through the integration of multiple modules into one.

Design efficiency through space savings

The power management unit is integrated with other modules to optimize power usage. For example, Sub PMIC and Application Specific (AS) PMIC can all be integrated into a single component. This ultimately allows for a smaller chip size by up to 10% annually.
Power Management IC

Samsung PMIC can deliver rapid customization like no other through years of experience in mass production and in-house infrastructure.

Faster time to market

- **Fuel Gauge** (Voltage/Current Detection)
- **Controller/Converter** (Buck/Boost/LDO)
- **Charger** (Liner & Switching)
- **Custom Design** (e-MIC (USB Type-C) | USB3.0 Controller | Heimdall (I/F IC))
- **Wireless Power Transfer**
- **Display Power** (LCD/OLED Panel)
- **Haptic Driver Flash LED Driver Display**

**High reliability**
(Mass production experience with Tier-1)

**Quick response**
(On-site technical support)

**Fast turnaround**
(Delivering 1st sample within 4 months)
Wearable Platform

SUPPORTING FAST INTEGRATION OF ADVANCED FEATURES.

Samsung Bio-Processor has a number of advanced features and the most unique among them is its ability to integrate with the Samsung IoT platform.
Wearable Platform

Samsung products allow manufacturers to launch faster without having to develop and test each device for fitness monitoring.

Freedom of design with advanced technology

Fast integration of advanced features

Samsung Bio-Processor has advanced features, including its security module and multiple AFEs. Most unique among them is its ability to integrate with the Samsung IoT platform.

Through Samsung Bio Processor, manufacturers can easily gain additional healthcare functionality without having to develop a complex, large-scale health data interface conforming to all legal requirements. They simply need to use Samsung IoT Platform providing a simple interface for using sensors and storing data in a local DB.
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.

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

1. Gartner
Market Leadership | Memory business

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

Memory market leadership (2014)

Memory
- Samsung has been the leader for 22 years since 1993 (35%)

DRAM
- Samsung has been the leader for 23 years since 1992 (41%)

NAND Flash
- Samsung has been the leader for 13 years since 2002 (31%)

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.

* Note: 10nm-class denotes a process technology node somewhere between 10 and 19 nanometers
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
- MCP
- eMCP
- ePOP

**System LSI**
- Exynos Solution
  - Application Processor
  - Modem/RF
  - ModAP
- Display Solution
  - Mobile DDI
  - Panel DDI
  - Touch Controller
- Security Solution
  - CMOS Image Sensor
  - Mobile CIS
  - Camera CIS
  - Industry CIS
- Power IC
  - Bio Processor
  - Smart Card
  - NFC
- Bio Processor
  - Power IC
Samsung's semiconductor business operates in 18 international locations to better serve and collaborate with customers around the world.
Our global business experts and continued R&D investments position us to provide the market with cutting-edge technology to maintain our leadership position.

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
- $14.6B R&D investments in 2014
- 6% of Net Sales

Leading patent holder
- SAMSUNG
  - Over 100,000 globally
  - No.2 in Europe (2,366)
  - No.2 in the US (5,072)
  - Since 2006
Company Capabilities | Global recognition

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

Global recognition

7th **TOP BRAND VALUE** company

15th most **REPUTABLE** company

13th **TOP GLOBAL** company

5th most **INNOVATIVE** company

3rd top global **INNOVATOR**
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
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 in Africa
  - 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 STEM\textsuperscript{1} skills

1. STEM: Science, Technology, Engineering, Mathematics
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 to 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.

For more information

For more information, visit [www.samsung.com/semiconductor](http://www.samsung.com/semiconductor).

2016-04-08