A SLIMMER YET MORE POWERFUL MOBILE.

Deliver a truly superior user experience faster than anyone else with Samsung’s comprehensive state-of-the-art technologies.
Executive Summary

Always on, always connected

- Increasing demand for multi-tasking with heavier applications
- Extended battery life is paramount
- Smartphones are getting slimmer and diversified
- Time to market is critical in the smartphone industry

Differentiate your smartphone with Samsung’s state-of-the-art mobile technologies

- Deliver enriched user experiences through superior performance
- Provide long-lasting, yet immersive multi-app mobile experiences
- Enable unlimited design flexibility
- Introduce innovative products before others

▶ Read on to learn more …
Always on, always connected.

TV is no longer the first screen. The mobile, along with online has overtaken TV since 2013, with nearly 5 hours day.

Average time spent per day with smartphone in U.S. (2010-2013)

Increasing demand for multi-tasking with heavier applications.

High computing power, especially for entertainment purposes, is expected as users today multi-task.

- **Smartphone application usage**
  - Entertainment: 59%
  - Web Browsing: 11.9%
  - Lifestyle: 11%
  - Productivity: 10.3%
  - Social: 5.7%
  - Other: 2.3%

- **Most frequently used entertainment apps**
  - Video: 59%
  - Game: 52%
  - Music: 40%

- Entertainment apps are driving the most usage
- 59% of entertainment app users playing at least one game

Extended battery life is paramount.

Mobile device innovations are being introduced at unprecedented speeds. But, battery performance is not keeping up at all.

Battery performance is the least satisfying aspect of mobile devices. Customer complaint call about battery power have quadrupled since 2008. 71% of users believe the best way to improve a smartphone is to have a longer battery life.

- x20 Increase in cellular speed
- x30 Increase in WiFi bandwidth
- x34 Increase in video resolution

Customer complaint call about battery power have quadrupled since 2008.

Battery performance will only see CAGR of 5% from 2010 to 2020.

71% of users believe the best way to improve a smartphone is to have a longer battery life.

71% of users believe the best way to improve a smartphone is to have a longer battery life.

---

Smartphones are getting slimmer.

Form factors can be diversified in the future since technology allows for thinner devices.

Smartphones are getting slimmer

Smartphones are getting diversified.

The display size of each smartphone varies to meet diverse customer needs, with the average screen size increasing to enhance usability and functionality.

Smartphone screen size over time ¹

¹ Accenture Insights (2015)
Time to market is critical in the smartphone industry.

Smartphone makers can achieve business sustainability in today’s highly competitive market only by reducing time to market.

Smartphone (GSM) models released

Proud solutions to support the manufacturing of more powerful smartphones with a fast speed-to-market.

Today’s smartphones are smarter than ever and the demands vary to meet diverse customer needs. To support the time-to-market of our partners, Samsung provides design flexibility for your smartphone in terms of performance, power consumption and form factor size.
Samsung can deliver on the promise of a powerful mobile experience. We are confident that our technology offers users an experience no competitor can easily match.

Mobile DRAM, eMMC/UFS supports each component in a smartphone to perform at its best through improved speed and density.

Exynos solutions are designed to deliver superior experience with powerful performance, energy efficiency and fast internet connection through Octa core CPU, GPU and LTE Modem.

Mobile CIS opens the door for manufacturers to provide clear photos even in low light or backlight conditions with its ISOCELL technology.

Samsung’s stunning WQHD MDDI displays every pixel in stunning brilliance with Mobile Image Compression (MIC) technology.
Featuring lower power consumption with improved performance, you can more easily surf the web to experience uninterrupted streaming of movies and instantly capture high-resolution images.

Millions of bytes are read and stored on the fly by our industry-leading eMMC 5.1 and UFS 2.0, which shows about 80% power saving compared to the lowest power consuming SSD. Samsung’s cutting-edge LPDDR4 boasts 37% power efficiency over LPDDR3.

Samsung’s brand new Exynos Application Processor consumes 35% less power and performs 20% better than its predecessors.

Samsung PMIC offers better efficiency and accuracy in power control by employing the advanced 130nm BCD process technology, while conventional competitors still use 180-200nm.
Enable unlimited product design flexibility.

With Samsung’s small footprint components, product design flexibility can be greatly increased for manufacturers, meaning thinner smartphones with a large-size and high-resolution screen can be achieved.

Our cutting-edge product leaves space for competitive and unique designs. Samsung eMCP saves 30-40% of space by stacking mobile DRAM and eMMC, allowing the saved board space for other components.

Samsung has achieved 1.0 micron pixel size with industry-first ISOCELL technology, providing 23% thickness reduction in the 16MP sensor.

Mobile DDI for flexible OLED display enables a new shapes of design for smartphone and wearable devices.

Samsung’s touch algorithm reflects human touch input as accurately as possible, offering the finest touch recognition and an overall UI performance improvement.
Samsung provides customized solutions for today’s competitive market trends. Because Samsung manufactures most of the major hardware components used in the smartphone, most of the issues with compatibility or customization can be avoided. Thanks to the simplicity and convenience of our latest process and stacking technology, manufacturers can achieve business sustainability while rapidly launching state-of-the-art smartphones.
Tailored for your business.

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

Superior intelligence

Capture valuable moments, day and night

Multiband, Multimode support

ModemRF

High SNR solution with unimaginable power efficiency

Integrated memory solution

Best of both worlds: SSD and eMMC

Highly power efficient performance

Faster R/W performance with power efficiency

Extreme quality media contents on screens

Customized for efficiency and accuracy

Globally compatible and highly reliable

Combining intelligence with network capability

UFS

Mobile DRAM

Mobile DDI

eMMC

eMCP

Touch Controller

NFC

PMIC

ModemAP

Highly power efficient

Capture valuable moments, day and night

High SNR solution with unimaginable power efficiency

Global compatibility and highly reliable

Multiband, Multimode support

Combined intelligence with network capability

Extreme quality media contents on screens

Smartphone
THE ULTIMATE BLEND OF PERFORMANCE AND POWER EFFICIENCY.

Superior intelligence leading the future of mobile through cutting-edge technology.
Exynos Application Processor

Samsung’s advanced 14nm FinFET process technology is the key to both performance and power efficiency increases for the latest Exynos AP.

World 1’st 14nm leading process technology – FinFET

Using 3D transistors, Samsung overcame limitations of conventional planar technology. In the 14nm FinFET cells, the vertical structure creates more conducting channels, and the increased channels enable better current flow and substantially reduce current leakage.
Exynos Application Processor

Samsung Exynos AP provides top-class performance to empower manufacturers while ensuring a longer battery life at the same time.

Superior computing performance

- 20% performance improvement

By implementing the 3D FinFET technology, the 14nm Exynos AP shows a 20% overall performance improvement over the previous generation’s 20nm processor.

Low power consumption

- 35% of power can be saved due to the most advanced process technology.

The latest Exynos AP consumes up to 35% less power than its predecessor by using Samsung’s advanced 14nm process technology.
Exynos Application Processor

Samsung helps reduce time to market by supporting the most advanced standards and by testing interoperability of core components with Exynos AP.

64-bit CPU offering a whole new world of power

Tested compatibility with critical components

Samsung’s new Exynos AP supports the 64-bit architecture used by many popular mobile operating systems. The most notable being the latest Android OS, which has a runtime optimized for 64-bit processors.

Exynos AP is well compatible with the various modules in a device. Device makers can create their devices easily with the verified components through the AP’s compatibility test with a wide range of components such as PMIC, NFC, CIS and modem.
Exynos Application Processor

Performance has improved significantly, especially when it comes WQHD high resolution gaming.

Octa-core GPU for superior graphics

By adding two more cores to the SoC’s GPU, Samsung Exynos AP offers an Octa-core GPU. This represents a significant performance improvement, especially when it comes WQHD high resolution gaming.
Exynos Application Processor

Samsung provides a complete in-house premium solution that will greatly shorten time to market for customers.

Leading solution provider from design to packaging

**AP, ModAP only IDM**
- A stable supply system for all demands
- Vertical integration of the manufacturing process

**Proven Premium Solution**
- Powering the best selling premium smartphones
- A complete product line-up

**Technology Leadership**
- Future process technology
- Leading LTE-Advanced modem revolution
- In-house ARM v8 CPU architecture

Samsung, being an Integrated Device Manufacturer (IDM), provides a stable vertical integration of the manufacturing process from design to packaging. As a result, Samsung Exynos AP is the solution of choice for many major premium smartphone manufacturers.
MAKE YOUR OUTSTANDING MOBILE DEVICE SHINE.

Samsung helps you confidently meet the market demands for slimmer and diverse device sizes in smartphones, tablets, and various other mobile devices. Leverage Samsung mobile DRAM, built specifically for devices to thrive in various package densities and size portfolios with an extended battery life.
Mobile DRAM

Mobile DRAM is becoming more power efficient.

LPDDR4 is more power efficient than LPDDR3 and LPDDR2. LPDDR4 has 37% improved energy efficiency than LPDDR3, and LPDDR3 has 10% improved energy efficiency than LPDDR2.
Mobile DRAM

LPDDR4 has doubled bandwidth of LPDDR3.

High bandwidth

Samsung is ready to be a timely provider of Ultra HD, large-screen mobile devices through its 2nm LPDDR4 that enables smartphones with 3,200 Mbps bandwidth. LPDDR4’s increased memory bandwidth allows faster communication between memory and AP.
THE DAWN OF UFS ERA HAS COME.

The mobile market craves a new and better-performing storage solution. The unprecedented speed and energy usage level that mobile users have yearned for is at hand. Walk with Samsung leadership in advanced storage solutions to the future of mobile devices.
UFS

UFS is faster than eMMC.

High speed of UFS 2.0

UFS, the latest mobile storage technology, replaces the common eMMC 5.0/5.1 used in previous generation mobile devices. It is designed for faster reading and writing from internal storage, simultaneous read/write processes, and prioritizing incoming commands to execute them as quickly as possible.
UFS

UFS consumes less power than eMMC.

Energy efficient when active

When eMMC is used (with AP and DRAM)

Active

Stand-by

Current

-10%

UFS

When UFS is used (with AP and DRAM)

Active

Stand-by

Current

-35%

Using less total system power

While providing higher performance than eMMC, UFS has higher energy efficiency consuming low energy of 0.5watt. UFS alone consumes 10% less energy than eMMC in active mode, and saves 35% of total system power in daily workload performance.
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 smart phones, tablets and other mobile devices that boast faster speed and better power efficiency.
eMMC

Samsung eMMC provides better sustained performance compared to competitors.
eMMC 5.1 is faster than eMMC 5.0.

**High speed of eMMC 5.1**

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

eMMC consumes 80% less power than SSD.

**Low power consumption**

<table>
<thead>
<tr>
<th>Watt</th>
<th>SSD with the Lowest Power Consumption</th>
<th>eMMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3</td>
<td>---</td>
<td>0.5</td>
</tr>
</tbody>
</table>

-80%

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.
**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.
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 reduces 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.
Low power consumption of mobile DRAM

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

Low power consumption of eMMC

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.
Mobile CIS

SUPERIOR IMAGE CAPTURE DESIGNED FOR MOBILE.

Help your customers capture valuable moments in astonishing quality - day and night.
Mobile CIS

Samsung ISOCELL technology offers crystal-clear photos even in low-light or backlighting conditions.

ISOCELL pixels offer roughly 30% less crosstalk than BSI pixels, resulting in the sharpness and richness of higher color fidelity and a 30% increase in Full Well Capacity (FWC), bringing greater dynamic range.

The new RWB color pattern further enhances light sensitivity, offering an improvement of over 3 dB in SNR (Signal to Noise Ratio) in low-light and backlight conditions.
Mobile CIS

Samsung mobile CIS opens the door for manufacturers to provide professional quality photos.

ISOCELL pixel for high resolution power

Multiple additional benefits

- **Accurate PDAF**: High contrast for faster and accurate auto focus
- **Smart WDR**: Preventing inter-pixel blooming

<table>
<thead>
<tr>
<th>Year</th>
<th>Sensitivity-Wise</th>
<th>Crosstalk-Wise</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1.4 μm</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>1.1 μm</td>
<td>1.0 μm</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Backside (BSI) → ISOCELL”

To meet market demands for better camera resolution and image quality in smaller devices, Samsung has shrunk pixel size while increasing vibrancy.

Samsung ISOCELL technology allows many differentiations by offering key features valued by end-users.

*PDAF: Phase Detection Auto Focus, WDR: Wide Dynamic Range
Mobile CIS

Samsung mobile CIS allows for a Long Lasting UX along with the design flexibility to enable stylish Slim Form Factor.

**Slimmer solution**

- Enabling ‘slim’ solution while maintaining 16MP resolution

- Samsung’s new 16MP sensors feature a pixel size of 1.0 μm and thickness of 5.0 mm, allowing for a 23% or 1.5 mm thinner camera module.

**Low power consumption**

- The logic processor is made using the most advanced process technology, allowing mobile CIS to become slimmer. The combination of logic processor and smaller pixel consumes less power.

- The 1/2.6” 16MP (1.12 μm) sensor consumes 255 mW (65nm), while the 1/2.6” 20MP (1.0 μm) sensor consumes <200 mW (65/28nm).
Mobile DDI

A CINEMA-LEVEL DISPLAY AT YOUR FINGERTIPS.

The solution for extreme quality media contents designed for mobile screens.
Mobile DDI

The Samsung MDDI provides a flawless transition from low-quality to high-resolution pictures with a minimum of loss by maximizing the full potential of every pixel.

SCOPE

Up-scaling technology is applied to transform HD720 or FHD image into WQHD image. SCOPE allows device makers to get WQHD image without WQHD AP and enjoy cost-efficient image enhancement.

SMIES is the world’s most advanced image enhancing IP package, an image enhancement tool independent from AP. Up-scaled image by SCOPE can be enhanced by SMIES.

Samsung Mobile Image Enhancement System (SMIES)

- Sharpness Enhancement
- Color Gamut Control
- Hue & Saturation Control
- Adaptive Power Saving
- Contents Adaptive Brightness Control

Featured Products
Mobile DDI

Samsung MDDI’s image enhancement and upscaling solutions guarantee unforgettable visual experiences.

**Samsung MDDI for high quality display**

WQHD image can be realized efficiently through Samsung mobile DDI, thanks to Samsung’s advanced image enhancement technology. SCOPE is utilized to scale the image up and SMIES is utilized to enhance the quality of up-scaled image.
Mobile DDI

The Samsung MDDI supports numerous image compression algorithms from major APs to reduce power consumption while maintaining the same high level of image quality.

Compression of mass data for low power consumption

Power saving for mass data handling improves Mobile Industry Processor Interface (MIPI) power saving by up to 27%

1/2 data compression in 4 lane
(or 1/3 data compression in 8 lane)

* DSI: Display Serial Interface, MIC: Mobile Image Compression, FBC: Frame Buffer Compression, UFO: Universal Frame Optimization
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 provides high accuracy and high SNR solution, with unimaginable power efficiency for mobile devices.
Touch Controller

Samsung touch controller offers ultimate performance through excellence in precise touch recognition.

**Accurate touch recognition**

**Fast response time**
Reduce touch panel latency to coordinate output from Touch Controller.

**Excellent finger separation**
Separate two fingers as close as ~2mm.

**Enhanced drawing quality**
Improve the accuracy within a range of 0.05mm~0.1mm.

**Higher SNR**
High TX voltage & multi-drive technology, variable bandwidth filtering technology.

Samsung 1-phi algorithm detects a 1-phi stylus while also reflecting human touch input as accurately as possible, offering the finest touch recognition and an overall UI performance improvement.
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>Mode</th>
<th>Conventional (%)</th>
<th>Samsung (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>100</td>
<td>25.3</td>
</tr>
<tr>
<td>Idle</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

<table>
<thead>
<tr>
<th>Electromagnetic Interference ↓ (%)</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.
Touch Controller

Samsung touch controller can discharge high current safely and clamp pad voltage to a sufficient low level.

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.
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.

System power optimization and dedicated process technology for PMIC

- Efficiency: **Securing over 89%** (buck converter)
- Accuracy: ±1.5% (undershoot <40mV)

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

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)
Experience unprecedented performance with a total solution combining two core capabilities.

SUPERCHARGED INTELLIGENCE, CONNECTED.
Exynos ModAP

A single package combining AP and modem for space efficiency is available at Samsung.

Small form factor of ModAP compared to traditional AP + Modem

Prior to integrating AP and modem in one chip, the board space required to insert an AP and a modem was around 279mm². With a chip size of 227mm², the Samsung Exynos ModAP is vastly smaller. Such space efficiency makes Exynos ModAP the preferred choice for high-end smartphones requiring competitive designs.
Exynos ModAP

With AP + modem, Samsung excels by offering the advantage of more space.

Small form factor of ModAP compared to the previous generation and the conventional

An AP + modem combination is typically around 12x14mm, whereas Samsung Exynos ModAP is 14% smaller at 12x12mm. Samsung goes further by offering 15% more space efficiency than previous generation ModAPs.
Exynos ModAP

Samsung offers the best of both components to deliver unmatched synergy.

High performance of Exynos ModAP

S/W Compatibility
- Reducing Dev. Resource & time by using same protocol stack with S333 Modem

Focusing on Market Need
- Supporting 5-mode
- TD-LTE/TD/SCDMA/Dual SIM
- CA53 Octa SMP 1.6Ghz

Additional Values
- High Quality ISP with 16+ 5MP@30fps
- Integrated Audio Codec with Ultra High Quality Audio (UHQA)
- H/W Flash Memory Protector (FMP)
Samsung Modem/RF is a footstep ahead of the global mobile modem industry, supporting a wide variety of bands and modes.
Modem/RF

With Samsung modem, you can provide a user experience featuring constant connectivity with the latest mobile networks around the globe, while consuming minimal power.

**High speed and joint CA**

Category 10 LTE Modem

- **LTE-Advanced 3 Band Carrier Aggregation (CA)**

  - Download speed: ~ 450 Mbps
  - Upload speed: ~ 100 Mbps

Exynos Modem 333 series is the world's first commercialization of a modem to support LTE 3CA with LTE-A, WCDMA/HSPA, TD-SCDMA/TD-HSPA and GSM/GPRS/EDGE through one RFIC.

**Low power consumption**

- **30% reduced power consumption compared to Samsung’s second most recent product**

  - Exynos Modem 303
  - Exynos Modem 333

Featuring extended operating time for data services through hierarchical clock gating based on operating scenarios, deep power reductions enhanced Micro-Sleep functionality, and enhanced, highly efficient RF Power Reduction Technology.
Modem/RF

Samsung can provide responsive worldwide support and strong collaboration through a global network of subsidiaries spread throughout the globe.

Faster time to market

Samsung has been at the forefront of the LTE industry ever since 2009 and has become the global leader in the 4G LTE market. As part of our effort to always deliver the best quality products on the market, Samsung invests in R&D globally, operating in various countries including US, China and India.
Modem/RF

Samsung modem solution is no experiment. It has been tested, certified and commercialized all over the world.

Mainly commercialized in major markets

17+ operators around the globe

17+ operators around the globe

and also in South East Asia, Oceania etc...

Certified by major carriers worldwide

<table>
<thead>
<tr>
<th></th>
<th>CMC 221</th>
<th>CMC 222</th>
<th>S222</th>
<th>Exynos 3470</th>
<th>S300</th>
<th>S303</th>
<th>S333</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>T-Mobile</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Deutsche Telekom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dōcomo</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Samsung has successfully commercialized through major network operators in the EU, America and Asia. A total of 34 different devices have been commercialized with Samsung modem as a result of collaboration with major operators.

Samsung modem has been certified with major mobile carriers worldwide including some of the biggest ones in the world.
SAFE CONTACTLESS COMMUNICATION.

Samsung's latest NFC products can provide globally compatible and highly reliable solutions.
Unreachable Security achieved with Samsung’s obsession for perfection empowers Samsung NFC modules.

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

45nm

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

Previous Gen.

90nm

Latest Gen.

45nm

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

30% smaller antenna
while enhancing the RF performance

Universal compatibility for faster time-to-market

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.
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 Semiconductor 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 Semiconductor 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 Semiconductor never stops innovating within its comprehensive product portfolios, from semiconductors to end-products, and makes massive investments in R&D.

4. **Corporate Citizenship**
   ✓ Samsung Semiconductor puts great value in our social responsibilities toward customers and partners, and in maintaining a green planet.
Market Leadership | A comprehensive view

Samsung Semiconductor has held the 2nd greatest global market share for over 12 years, yet it continues to grow while making gains on the leading company.

Global semiconductor market share

- Samsung
  - 2009: 7.7%
  - 2010: 9.0%
  - 2011: 9.0%
  - 2012: 9.5%
  - 2013: 9.7%
  - 2014: 10.2%

- Company A
  - 2009: 14.6%
  - 2010: 13.9%
  - 2011: 16.5%
  - 2012: 16.4%
  - 2013: 15.4%
  - 2014: 15.4%

- Company B
  - 2009: 2.8%
  - 2010: 3.2%
  - 2011: 4.4%
  - 2012: 5.5%
  - 2013: 5.7%
  - 2014: 5.7%

- Company C
  - 2009: 2.7%

- Company D
  - 2009: 

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%
- from 13 years since 2002

1. Gartner
Market Leadership | System LSI business

Samsung Semiconductor 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% for 12 years since 2003
- **Smart Card**: 37%
- **Mobile CIS**: 27%
- **CIS**: 14%

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 has an extensive business portfolio, from device solutions to consumer electronics and IT & mobile communications, leading the market in many of these areas.

The 9 business divisions of Samsung Electronics

**Consumer Electronics**
- Digital Appliances
  - Washing Machine
  - Refrigerator
- Printing Solutions
  - LCD Monitor
  - LED Monitor
- Visual Display
  - UHD LCD Monitor
  - LED Monitor
- Device Solutions
  - Health & Medical Equipment
    - Medical Imaging Solution
  - IT & Mobile Communications
    - Smartphone
    - Wearable
  - Integrated Antenna Unit
  - WLAN
  - Network
  - System LSI
    - CIS
    - DDI
  - Memory
    - DRAM
    - NAND Flash
  - Storage
    - SSD
    - UFS
  - Memory
    - DRAM
    - NAND Flash
  - LED
    - LED Module
    - LED Package
  - Application processor
  - LED
  - DDI
  - System LSI
Samsung Semiconductor offers nearly 25 memory and system LSI product portfolios that are essential in today’s electronic appliances.

Samsung’s 9 product categories

- Memory
  - DRAM
  - MCP
  - eMCP
  - ePOP

- Flash Storage
  - V-NAND
  - SSD
  - eMMC
  - UFS

- System LSI
  - Exynos Solution
    - Application Processor
    - Modem/RF
    - ModAP
  - Display Solution
    - Mobile DDI
    - Panel DDI
    - Touch Controller
  - Power IC
  - CMOS Image Sensor
    - Mobile CIS
    - Camera CIS
    - Industry CIS
  - Security Solution
    - Smart Card
    - NFC
  - Bio Processor

Why Samsung
Company Capabilities | Global presence (1/2)

Operating in 220 locations around the world, Samsung Electronics is fully capable of effectively responding to both consumer and market requirements.
Samsung Semiconductor 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 84 countries around the world

6,700 Doctorates

75,000 R&D Staff

1,700 Designers

Striving rigorously for innovation

$14.6 B R&D investments in 2013

6% Net Sales

$209 Billion

Leading patent holder

SAMSUNG

Number of patents 2014

106,707 Globally

No. 1 in Europe (14,834)

No. 2 in the US (35,718) for 9 consecutive years
Company Capabilities | Global recognition

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

Global recognition

7th TOP BRAND VALUE company

Interbrand

2nd most INNOVATIVE company

booz&co.

10th most REPUTABLE company

Forbes

3rd most INNOVATIVE company

BCG

13th TOP GLOBAL company

FORTUNE

3rd top global INNOVATOR

THOMSON REUTERS
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
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\(^1\) skills

---

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.
Corporate Citizenship | Health and safety

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.

**Mutual Growth Academy**

- **Education Center**
  - Business management/Leadership/Specialized job areas

- **Professors Council**
  - Counseling on education content development

**Establishment of the Mutual Growth Academy**

- **Consultation Center**
  - Counseling on business management, technical guidelines

- **Mutual Benefit Research Center**
  - Case studies strategy formulation

- **Youth Employment Center**
  - Employment counseling consultation

**Mutual Growth Fund for 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.

Samsung Electronics set up the mutual Growth Academy in June 2013 to provide comprehensive and systematic support for its primary and secondary suppliers.
A SLIMMER YET MORE POWERFUL MOBILE.

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

About Samsung Semiconductor

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.

Copyright © 2015 Samsung Electronics Co. Ltd. All rights reserved. Samsung is a registered trademark of Samsung Electronics Co. Ltd. Specifications and designs are subject to change without notice. Non-metric weights and measurements are approximate. All data were deemed correct at the time of creation. Samsung is not liable for errors or omissions. All brand, product, and service names and logos are trademarks and/or registered trademarks of their respective owners and are hereby recognized and acknowledged.

For more information

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

2015-08