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BUSINESS UPDATE
MARKET OPPORTUNITIES
SAMSUNG STRATEGY
KEY TAKEAWAYS
At the Heart of Mobile Innovation

Financial Highlights

Global Smartphones Powered by ISOCELL Image Sensors
1/3
*TSR, Dec. '19

Leading Provider of 5G Modem & 5G Mobile SOC
5G
1/2

60% of Global Mobile Displays Featured with System LSI's OLED Driver ICs
60%
* IHS, 2019

Revenue Growth
2.6X

2019

2011

2014
Contents

BUSINESS UPDATE
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SAMSUNG STRATEGY
KEY TAKEAWAYS
Technologies for the Next Decade

5G Network
On-device Intelligence
Mobile Camera
Smart Mobility
toward Intelligent Connectivity
5G Network

5G for Everyone

3GPP Rel-15
Rel-15 NSA Freeze

3GPP Rel-16
Rel-16 Study
Rel-16 Development
Rel-16 Freeze

2018
2019

5G Phase 1
- Commercial service rollout
- Non standalone network
- Combination of 4G LTE and 5G NR

5G Phase 2
- Mass Market 5G devices with various 5G chipsets
- Standalone network deployment
- Global adoption of mmWave
- NR-V2X, Industrial IoT

2020
2021
2022
Intelligence on the Devices

Smarter Future Powered by AI

Artificial Intelligence (AI) is playing an increasingly prominent role in our day to day lives and it promises to transform the technological landscape. Complex algorithms and processes, such as machine learning and deep learning, are driving the transformation, boosting the need for more powerful on-device AI solutions.
Mobile Camera

**Mobile Camera Technical Trend**

- **Ultra-high Resolution**
  64 and 108Mp mobile image sensors

- **Small and Slim**
  Packs in ultrafine ~0.7um sized pixels

- **Intelligent Camera**
  Scene-Adaptive HDR Processing, Face Detection/Recognition, Fast AF

- **Multiple Cameras**
  More front and rear facing cameras

- **DSLR-like Performance**
  High light sensitivity, super zoom, slow-mo

- **3D Depth Sensing**
  DVS, ToF for Game/VR/AR

*DVS: Dynamic Vision Sensor*  
*ToF: Time-of-Flight*
Smart Mobility with IC Technology

Innovation in Automotive Industry

Various semiconductor components including processor, connectivity, image sensor and memory power future driving experience.
Cameras, Displays and Security Systems for the Future Mobility

Cameras for ADAS/Autonomous Driving

Displays and Security Systems for Driving, System Control and In-vehicle Entertainment

Enriched Systems in Future Mobility
Strategy for the Growth

Innovation to Bring Ideas to Life

Total Solution
Integrated, extended portfolio
Hardware & software capability

Technical Leadership
Leading technologies for 5G/AI/Sensor
Technology on leading-edge process

Market Shaper
Close collaboration with ecosystem partners
Pioneering future market
Solutions for Mobile Devices

Advanced IC Portfolio for Mobile Innovation

ISOCELL Image Sensor
- Super resolution, sub-micron sensors for front / rear cameras
- Motion & depth sensor

Exynos Processor
- Mobile processors
- LTE/5G modems & RF ICs
- Connectivity
- Supply modulator

Power Management IC
- PMIC for mobile processor, UFS memory, OLED display, Wireless charger, USB Type-C PDIC

NFC / Secure Element
- Mobile payment
- Data security solution

Touch Controller
- Low power, high sensitive

OLED Display Driver IC
- Bezel-less full screen

Fingerprint Sensor
- Fingerprint sensor on display

Reference Designs
- Optimized platform design
Transforming the Driving Experience with IC Technologies

**Exynos Auto**
Processors and modem solution for infotainment, telematics and ADAS system

**ISOCELL Auto**
High sensitive, high resolution image sensors with embedded security

**Security**
Safe and highly reliable security solutions to protect personal data and privacy

**Display**
Display driver ICs, Touch Controllers for integrated cockpit system

*S-C-V2X: Cellular Vehicle-to-Everything*
Unlocking the future of 5G with Exynos

- Hyper-fast: Up to 7.35Gbps* (Based on FR2 (mmWave))
- Compliant with 3GPP 5G NR Rel-15
- Global spectrum covers FRI & FR2
- Ready for 5G Phase 2 supporting NSA & SA
- Technologies for speed: 256 QAM, 4x4 MIMO, EN-DC
- Full 5G chipset: Modem, RF IC, ET, PMIC
Making 5G into a Reality

5G Smartphones powered by Exynos

- Dec. 2018: 5G Commercial Service Launch
- Feb. 2019: The 1st 5G Smartphone
- Aug. 2019: Galaxy Note10+
- Dec. 2019: Vivo X30/Pro
- Feb. 2020: Galaxy S20
Exynos for Device Intelligence

An Intelligent Powerhouse

Powerful hardware architecture
Integrated hardware & software design
Efficient deep learning algorithms

Neural Processing SDK

Deep learning frameworks
TensorFlow | Caffe | Caffe2 | PyTorch | Android NN API | ONNX

Software architecture & tools
Compiler | Conversion tools | Pre-trained models | Library
Exynos Auto for Mobility

Driving the Future of Mobility

In-vehicle Infotainment
Exynos Auto V
Powerful Processor for Intelligent Multi-screen Infotainment Platform

ADAS System
Exynos Auto A
Intelligent Processor for ADAS System

Telematics
Exynos Auto T
LTE & 5G Modems for Telematics System
Low Latency, C-V2X

Exynos Auto V9
A Processor to Power the Next Generation In-vehicle Infotainment System
Supports 6 Displays & 12 Cameras in 1 Chip
Embedded NPU
Tri-cluster GPU
Safety System
ISOCELL Image Sensor

Super Resolution Sub-micron Pixel
0.7um & 0.8um Fine Pixels to Integrate up to 108 Megapixel

Hybrid Pixel Algorithm
Tetracell / Nonacell Technology
Hybrid pixel algorithms to enable clear and bright photos at any time

Smart ISO
Intelligent ISO level selections depending on light environment

Image sensors to redefine mobile photography

ISOCELL Plus
Upgraded Pixel Isolation Technology
Better Low Light Sensitivity, Higher Color Fidelity
Fit for Realizing High-resolution with Sub-micron Pixel
Remarkable color accuracy and balance

An advanced pixel isolation technology that minimizes optical loss and cross-talk by placing a barrier around each pixel
Super Resolution, Sub-micron Pixel

Super resolution in a tiny sensor enabled by ISOCELL Plus pixel technology

- ISOCELL
  - 1.12um (2013)
  - 1.0um (2014)
  - 0.9um (2017)

- World's 1st Mass Production

- ISOCELL PLUS
  - 0.8um (2019)
  - 0.7um (2020)

- World's 1st Mass Production

- 8Mp, 16Mp, 24Mp, 48Mp, 64Mp, 108Mp
Advanced Image Sensor Technologies

Merge Four Neighboring Pixels
Brighter Images with Big-pixel like Performance

Re-mosaic Algorithm
More Details with Super Resolution

Small pixels for detail
big pixels for brightness

Tetracell and Nonacell technologies
Hybrid pixel merging and remosaic solutions that enable bright photos in low-light and detailed photos in day light
Advanced Image Sensor Technologies

Smart-ISO
Intelligent ISO caters to variable environments

Low ISO in bright environments

High ISO for low-lit settings
Stunning Mobile Images with ISOCELL

- **Advanced Node**: 28nm based Image Sensors
- **Unique Pixel Technology**: Various Pixel Technologies and Algorithm for Superior Image Quality with Small Pixel
- **Design Service**: Hardware and Software Integrated Solution, Custom Sensor Design
Samsung has maintained the position as a key supplier of mobile processors, image sensors and display driver ICs.

Innovations in semiconductor technologies will be the key driver in various new applications that adopts AI/Deep Learning, 5G NR network, and smart mobility.

Samsung’s System LSI business provides integrated total solutions for mobile, and is now on the path to be a key player in the field of 5G, autonomous mobility, and device intelligence.
Possibilities Beyond Components

Meet Samsung System LSI