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SAMSUNG SYSTEM LSI



Investor Presentation

2018

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BUSINESS UPDATE

MARKET OPPORTUNITIES

SAMSUNG STRATEGY

KEY TAKEAWAYS

FINANCIAL HIGHLIGHTS

At the Heart of Mobile Innovation



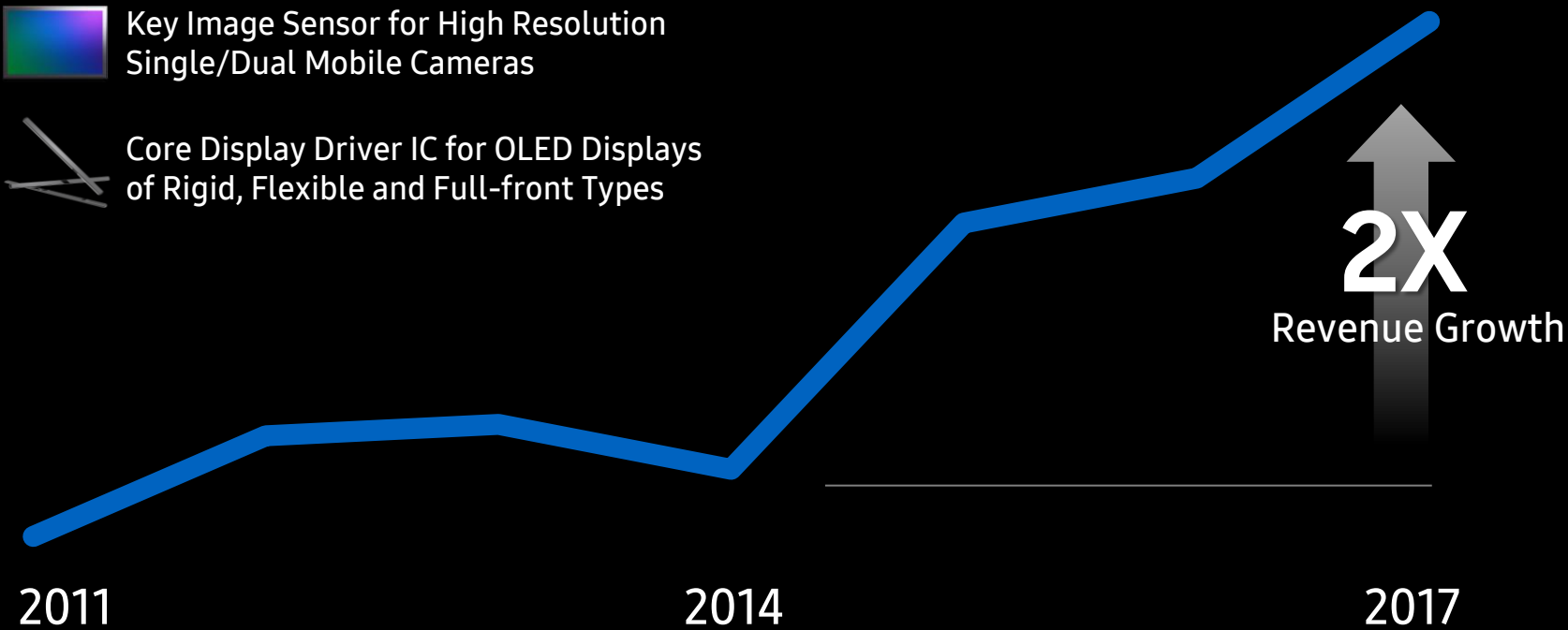
Exynos SOC's for Premium and Volume Zone Smartphones



Key Image Sensor for High Resolution Single/Dual Mobile Cameras



Core Display Driver IC for OLED Displays of Rigid, Flexible and Full-front Types

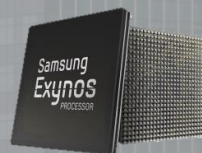


1/3 Global Smartphones Used ISOCELL Image Sensors

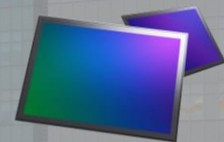
4.6 Out of 10 Chinese Smartphones Used ISOCELL Image Sensors

4.6 Out of 10 Global Mobile Displays Used System LSI's Driver ICs

Business Portfolio



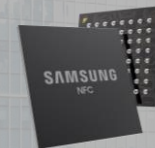
Exynos Processor
Modem/RF/Connectivity



ISOCELL
CMOS Image Sensor



Mobile DDI
Touch Controller



NFC/eSE
Fingerprint Sensor



SIM/eSIM
Banking/ID



Power
Management IC

Communication Devices



Internet of Things



Automotive

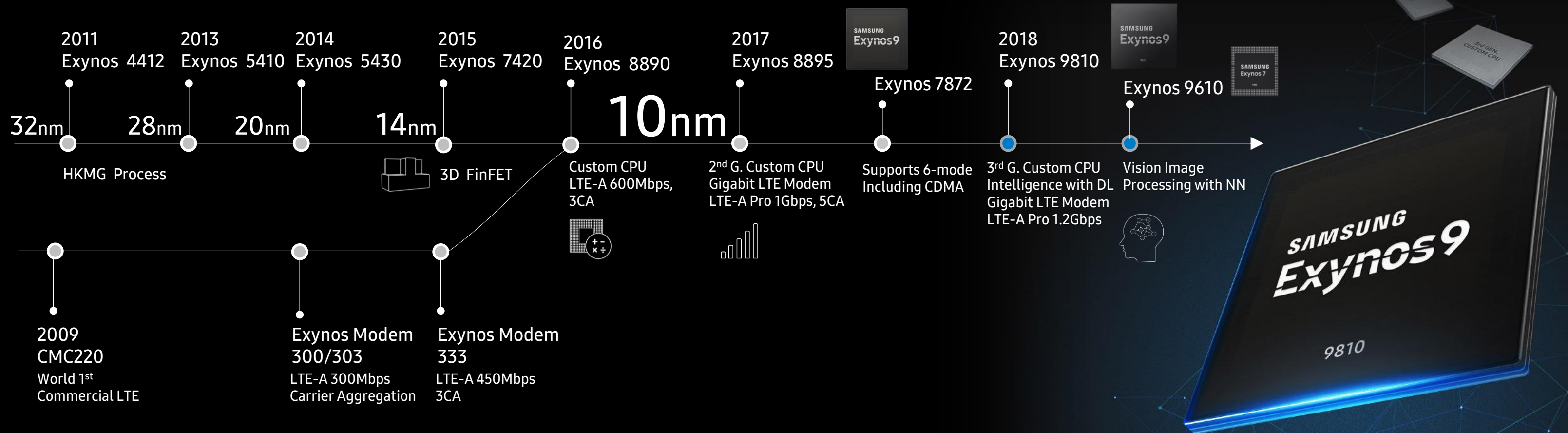


Consumer Devices



EXYNOS PROCESSOR

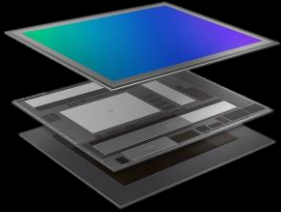
Path of the Innovation



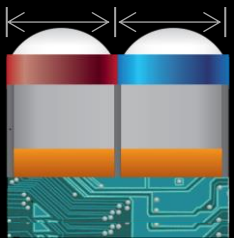
ISOCELL IMAGE SENSOR

SAMSUNG ISOCELL

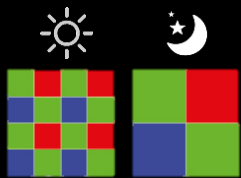
Technologies that Redefine Mobile Camera



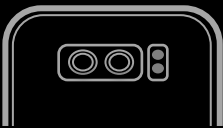
3-stack Fast Readout Sensor
960 frame Super Slow Motion
with Integrated LPDDR4



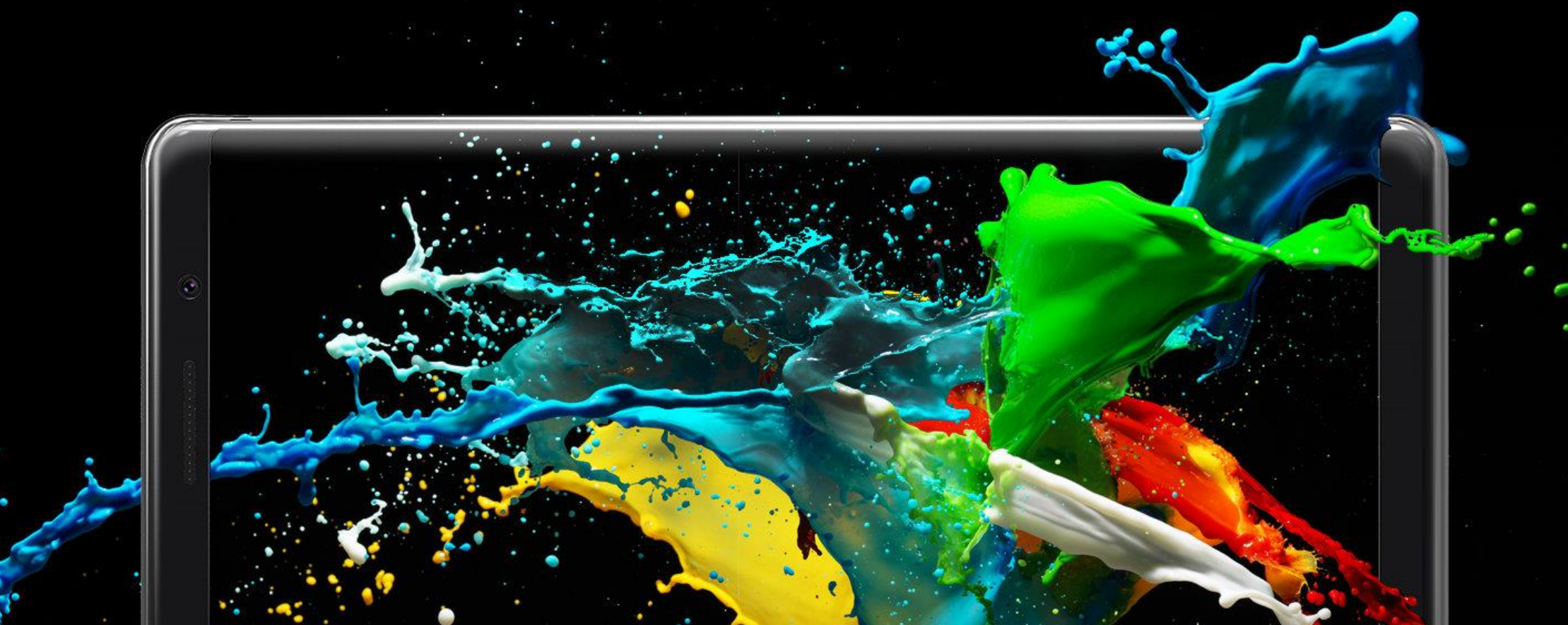
Sub-micron Small Pixel
0.9um 24Mega Pixel
Small but High Resolution Sensor



Hybrid Pixel Conversion
Tetracell – Remosaic Technology
Clear and Bright Images Any Time



Dual Camera Solution
Total Solution for Out-focus, Low Light Shooting



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TECHNOLOGIES FOR THE NEXT



AI / Deep Learning

Machine Intelligence
on Various Devices

5G Network

High Speed, Low Latency,
Massive Number of Connections

Smart Mobility

Autonomous Driving
Cars, Drones and more

INTELLIGENCE ON THE DEVICES

AI/Deep Learning for Wide Industries

Realized by Semiconductor Technologies

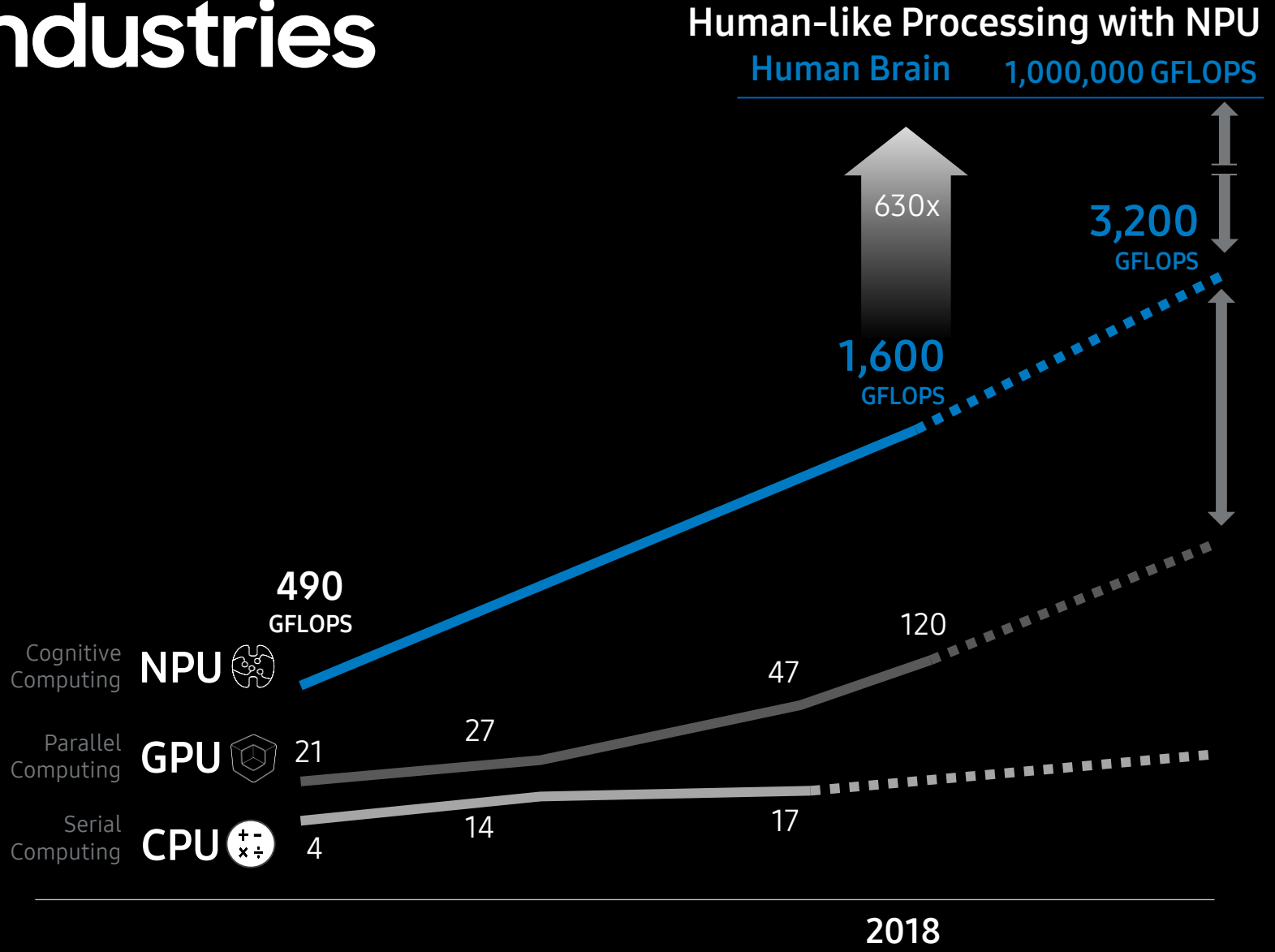
Technologies

- Intelligent Image Processing
- Face/Voice Recognition
- Natural Language Processing
- Personal Assistance
- Pedestrian/Object Detection & Recognition
- Autonomous Operation based on Deep Learning



Requirement

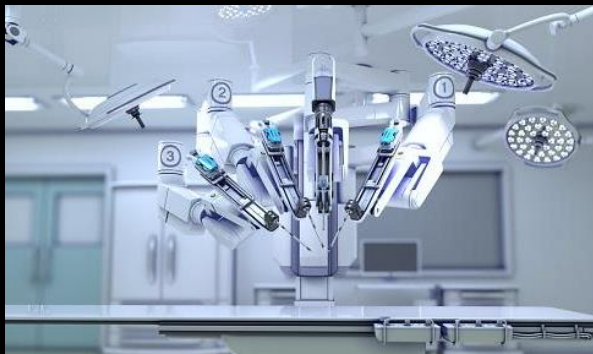
- Huge Data Processing
- High Speed, Low Latency
- Low Power Consumption
- Optimized Learning Algorithm
- High Resolution Sensors



5G NETWORK

The Mass Connected Era

Inspires creativity to all connected dots



5G

Enhanced Mobile Broadband
Ultra Reliable & Low Latency
Massive Machine Type Communication



5G Mobile Subscriptions to Reach 1 Billion by 2023

(Ericsson Mobility Report, Nov.2017)

AUTONOMOUS MOBILITY

The Future Mobility is Near

Powerful Processing

◀ **10TOPS**
ADAS Level 2
Simple Driving Support



100TOPS+
ADAS Level 5
Autonomous Driving

Low Latency with 5G Connection

◀ **50ms**
4G LTE



1ms
5G NR

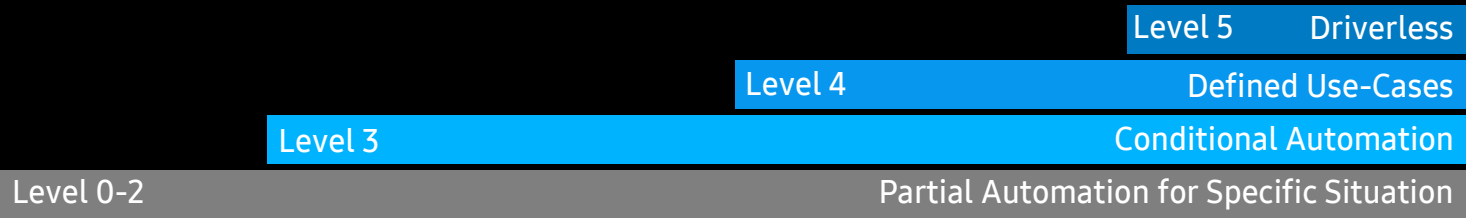
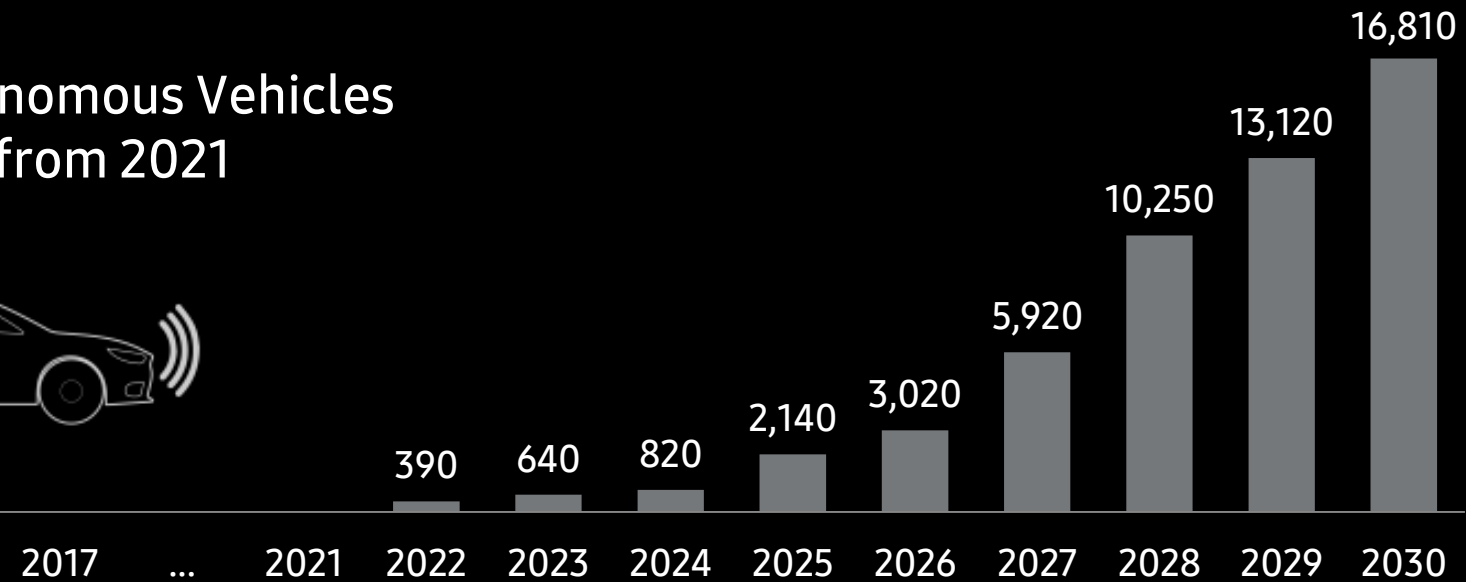
Higher Level Security

Biometric Authentication and Data Encryption
Systems and Supply Chain Data Protection

Level 3 Autonomous Vehicles
on the Road from 2021



Autonomous Vehicle Market
(K units)



(Experts interview, BCG analysis)

Diagram illustrating the locations of various cameras on a car:

- Front View Camera (located at the front of the car)
- Viewing Camera (located on the side of the car, near the front door)
- Driver Monitoring (located inside the car, near the driver's seat)
- Front Sensing Camera (located at the front of the car, above the hood)
- Rear View Camera (located at the rear of the car)

In-vehicle Systems
Data Protection
Driver Authentication

ADAS System
Device Authentication
System Attack Protection
Data Security

Supply Chain
Copy Protection

Side eMirror

Control

Control

Sub IVI

Rear View Mirror

Center IVI

HUD

Center Control

Cluster

Rear Entertainment Systems

System Control

Control

Control

Side eMirror

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

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KEY TAKEAWAYS

STRATEGY FOR GROWTH

Innovation to Bring Ideas to Life

Total Solution

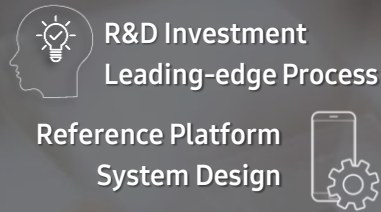
Integrated and
Extended Portfolio



Hardware Software

Technical Leadership

Advanced Technologies
for Components & Platform

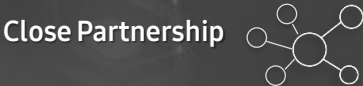


R&D Investment
Leading-edge Process

Reference Platform
System Design

Leading Market

Collaboration
with Ecosystem

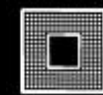


Close Partnership

Future Market &
Technical Research

TOTAL SOLUTION PROVIDER

**Samsung's advanced component
solutions for mobile innovation**



Exynos SOC



OLED Display Driver IC



Touch Controller



Envelope Tracker



Power Management IC



Front Camera

ISOCELL Bright
ISOCELL Slim



Main Camera

ISOCELL Fast
ISOCELL Dual



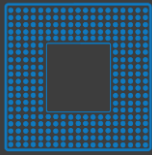
Iris Recognition







NFC

EXYNOS FOR DEVICE INTELLIGENCE

Brainy Unit that Makes a Difference






CPU GPU DSP NNE

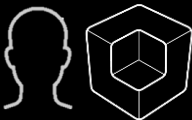
High Performance,
Low Power Processing


Flexible and Scalable
Architecture

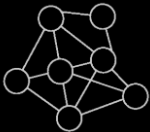
Enhance DSP +Programmable NNE


Android NN API,
Caffe2, Tensorflow-lite

- 

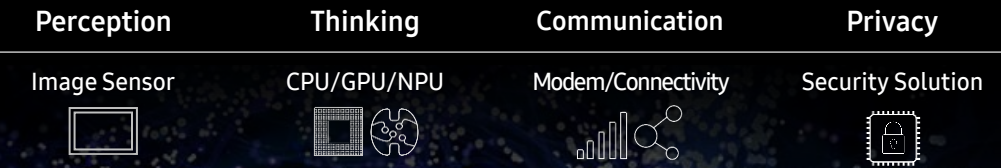
Vision Image Processing
Enhanced Low Light Sensitivity
De-hazing / Super Resolution
Single Image Bokeh / Depth Sensing
- 

Detection and Recognition
Objects/Face/Voice
Humans and Animals
- 

Autonomous Driving
Pedestrian/Object Recognition
Navigation, Driving Control
- 

IoT with Machine Learning
- 

**Augmented Reality
Mixed Reality**



* NNE (Neural Network Engine)

EXYNOS FOR 5G ERA

Making 5G NR a Reality



MOBILE CAMERA SOLUTIONS

SAMSUNG ISOCELL

Image Sensors Capturing Moments
Anytime and Anywhere through
Unique Pixel Technologies

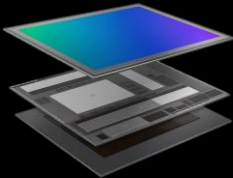


Bright



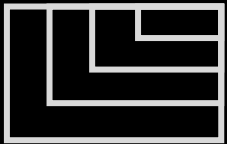
Tetracell
Smart WDR

Fast



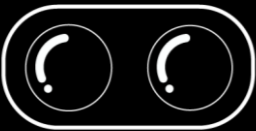
DUAL PIXEL
Fast Readout Sensor

Slim



Sub-micron
Small Pixel

Dual



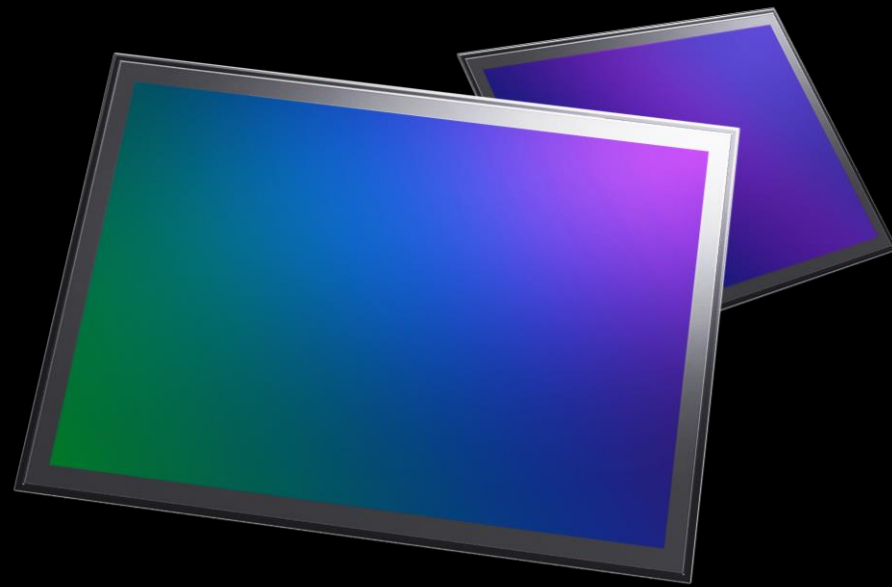
Dual Camera Solutions
for Zoom, Depth Sensing, LLS



* WDR (Wide Dynamic Range), LLS (Low Light Shooting)

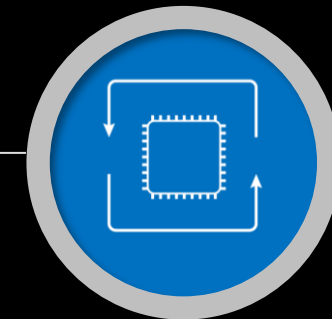
PROCESS / SERVICE COMPETENCY

Stunning Mobile Images with ISOCELL



Advanced Node

28nm based Image Sensors



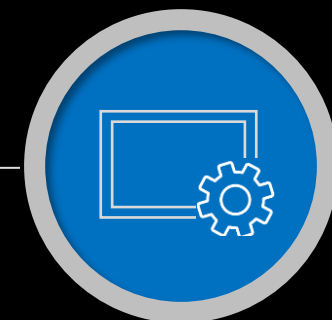
ISOCELL Pixel Technology

Superior Image Quality with Small Pixel
Unique Pixel Technologies



Design Service

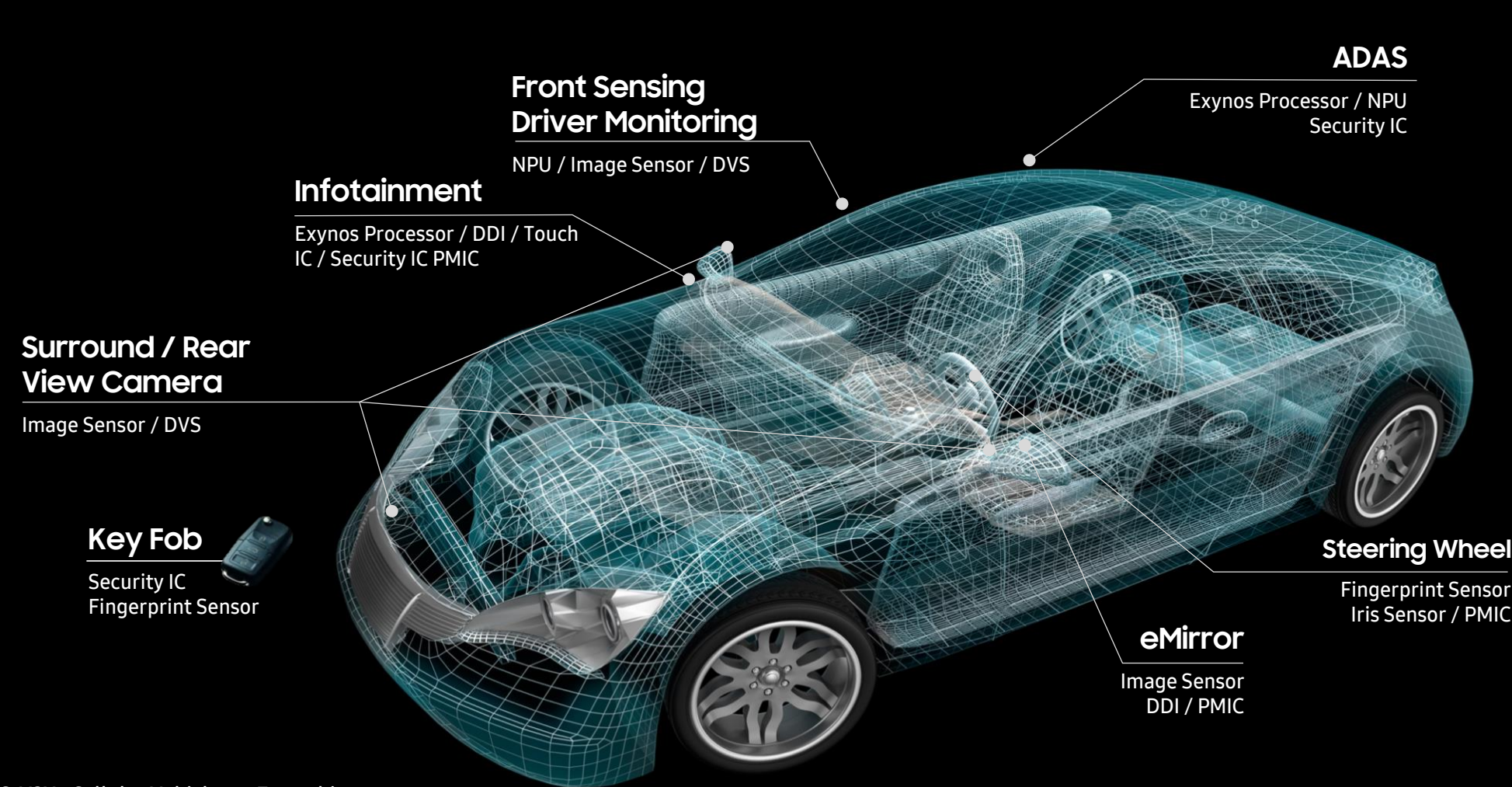
Hardware and Software Integrated Solution
Custom Sensor Design



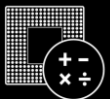
SOLUTION FOR MOBILITY

Transforming the Driving Experience with IC Technologies

ADAS, Infotainment System, Telematics and Autonomous Driving Solutions



ExynosAuto



Processors and NPUs for IVI, Cluster, ADAS System
Modems for Telematics System

ISOCELL



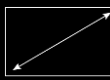
High Sensitive and High Resolution Image Sensors
with Embedded Security

Security



Safe and Reliable Security Solutions for
Automotive Systems and Personal Information

Display



Display Driver ICs, Touch Controllers

* C-V2X : Cellular Vehicle-to-Everything

SOLUTION FOR IOT

IoT Platforms with Enhanced Performance and Security

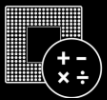
SAMSUNG Exynos i
T200
Enhanced Security

Exynos i T200
WiFi Integrated IoT Processors
On-chip Security Sub-System and PUF

SAMSUNG eSE
Enhanced Security

Secure Element
Embedded Crypto Engine and
Hacking Protection Circuit with Security Software

Exynos i



IoT Processors with On-chip Security Solution
and Connectivity

ISOCELL



Image Sensor Solution for Sensing and Recognition
Dynamic Vision Sensor

Security



NFCs, Secure Elements for Data Protection of IoT Systems
Secure Storage of Key & Credentials, Authentication
and Crypto Operation

* PUF : Physically Unclonable Functions

Samsung System LSI

Possibilities Beyond Components

SAMSUNG

Integrated
Solutions

Silicon
Technologies

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KEY TAKEAWAYS

KEY TAKEAWAYS

- ✓ 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 System LSI is a provider of integrated total solution for mobile. On top of that, System LSI is now on the path to be a key player for 5G and autonomous mobility, and is investing for future device intelligence.

SAMSUNG

Follow System LSI

- | | |
|--|--|
|  www.samsung.com/semiconductor |  www.youtube.com/SamsungExynos |
|  www.samsung.com/Exynos |  www.instagram.com/SamsungExynos |
|  www.facebook.com/SamsungExynos |  www.weibo.com/SamsungExynos |
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SAMSUNG FOUNDRY



Investor Presentation

2018

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Samsung Foundry

Started as a new business unit in 2017 for better customer support

The Most Trusted Foundry
providing creative solutions for customers' innovation needs



Technology

Operation

Service

Business Milestones



Global Manufacturing Sites

Advanced 300mm Fabs, Matured 200mm Fab, Test/Package Facilities

in 3 Locations in Korea and US

in Korea

in Korea and China



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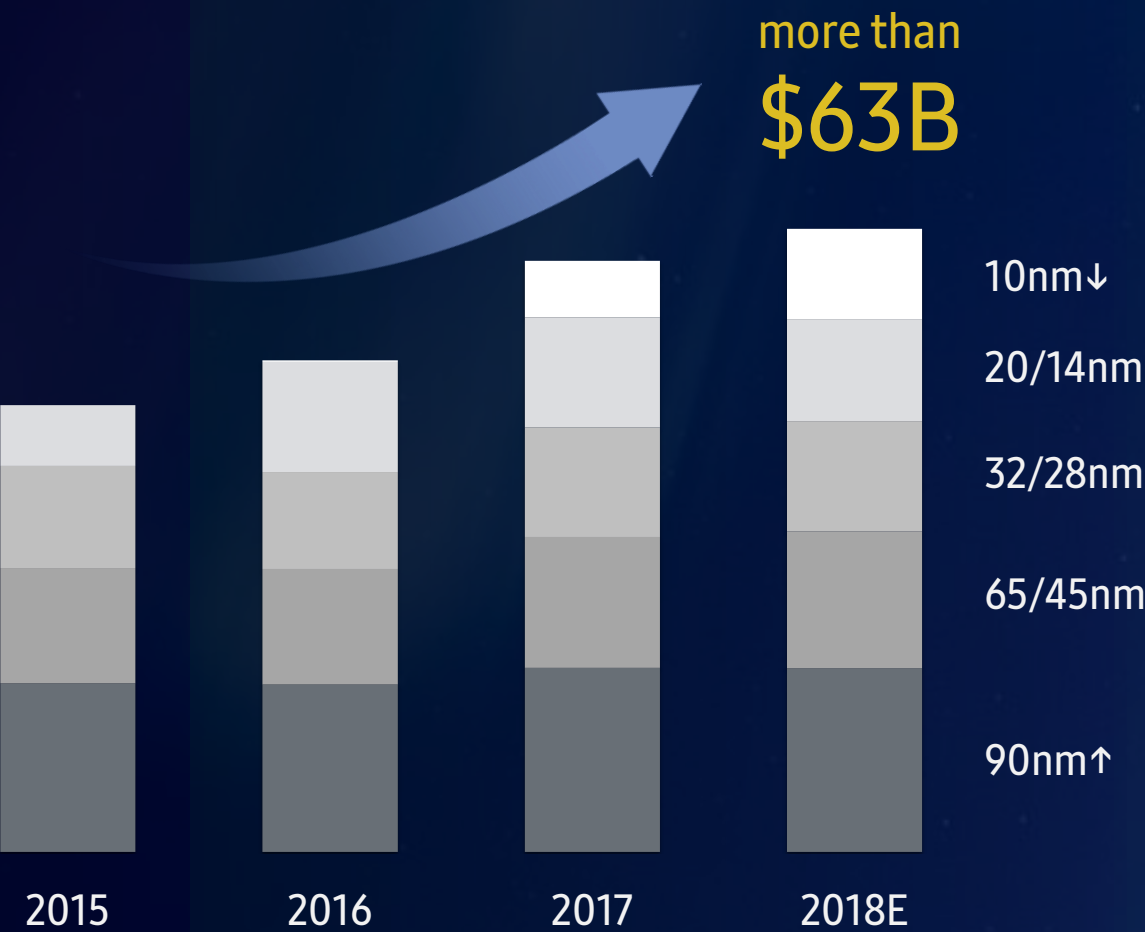
SAMSUNG STRATEGY

KEY TAKEAWAYS

Market Opportunities

Foundry Market by Node

Expected to grow more than 5% in 2018



of Foundry Providers by Node

Now only 3 companies, including Samsung, provide leading-edge foundry services



Samsung in Foundry Industry

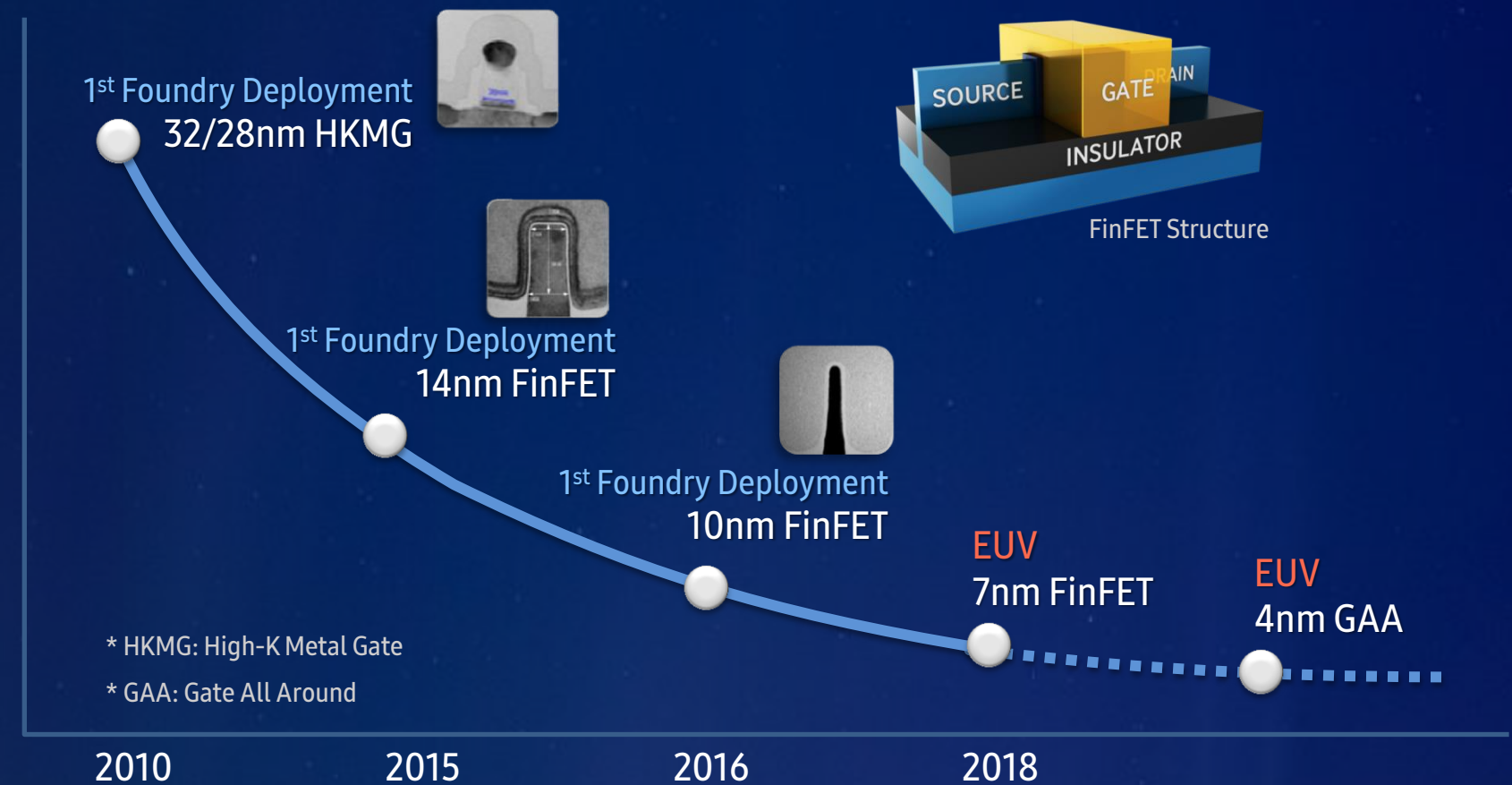
Company Revenue 2017

Samsung is aiming to be a strong no. 2 player in the foundry market



Firm Technology Leadership at Advanced Nodes

Samsung is ready to support a wide variety of customers and applications



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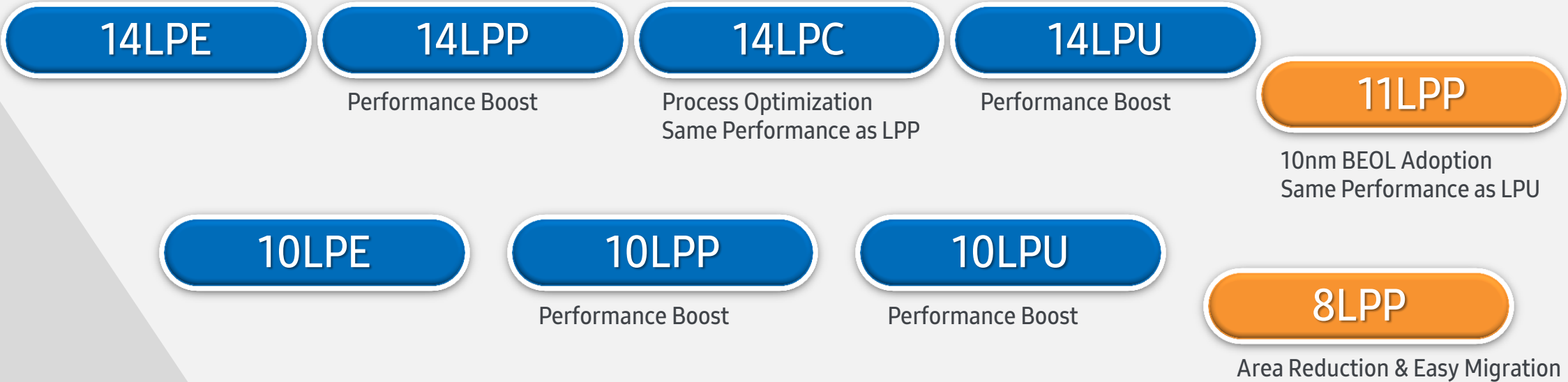
SAMSUNG STRATEGY

KEY TAKEAWAYS

Advanced Technology

Continuous Evolution to Provide Even More Benefits for a Long Lifetime

- Multiple derivative performance and cost variations for a wide range of applications
- Most competitive process nodes before full EUV adoption



Competitive in Power and Performance, Scaling with EUV Lithography Technology

* Extreme Ultraviolet



Adopting New Architecture, GAA

* Gate All Around



Differentiated Platform, FD-SOI

28/18FDS, Samsung's Differentiated Solution for IoT and Automotive

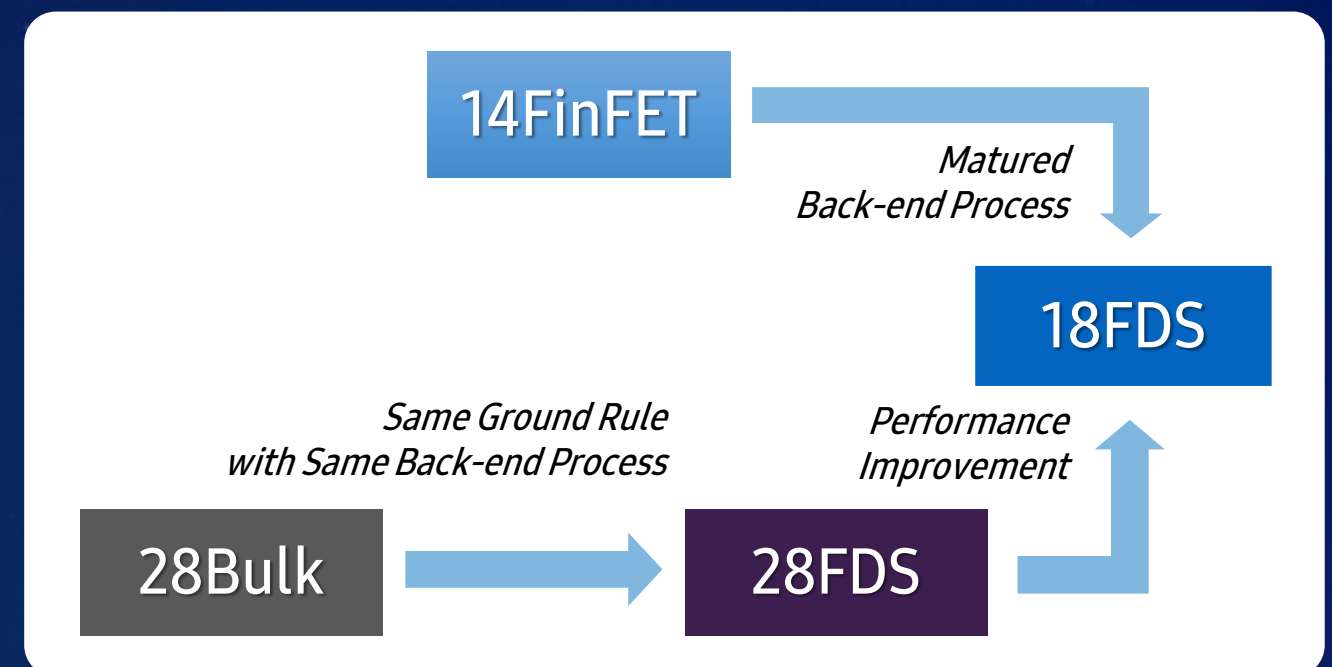
- RF : Supports 100GHz and mmWave
- eMRAM : Extremely small bitcell, superior write speed and endurance time

FDS Technology Offering

	Logic	RF	eMRAM
28FDS	●	●	●
18FDS	○	○	○

● Available ○ Under Development

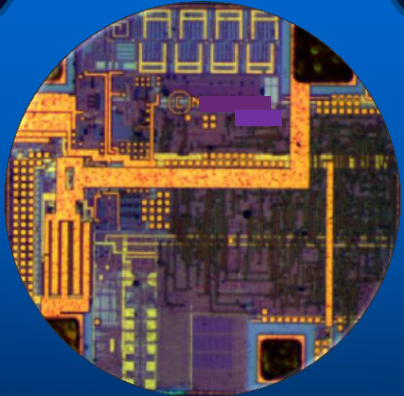
Next Generation FDS Strategy



8-inch Value Added Offerings

Expanding Portfolio from eFlash, Power, DDI, CIS to RF/IoT and Fingerprint Sensor

- Technologies extensively optimized through many years of product manufacturing



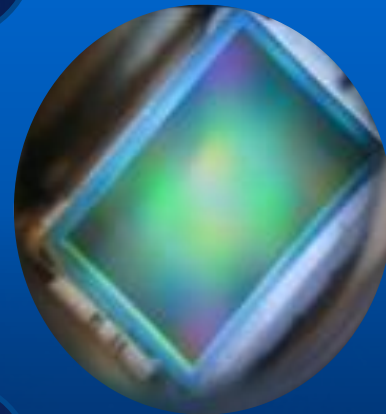
eFlash



Power



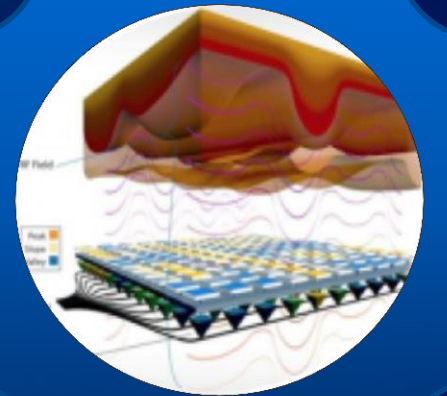
Display Driver IC



CMOS Image Sensor



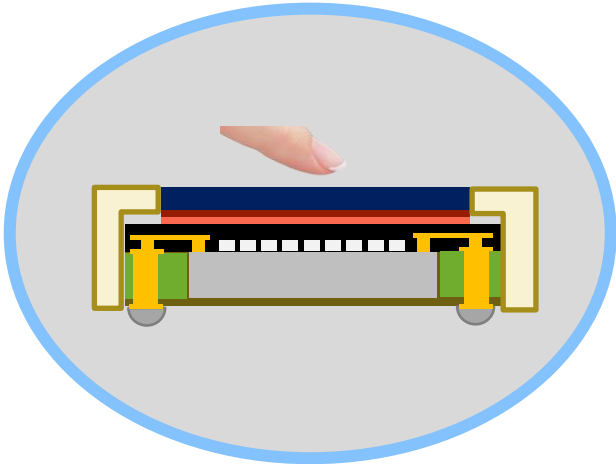
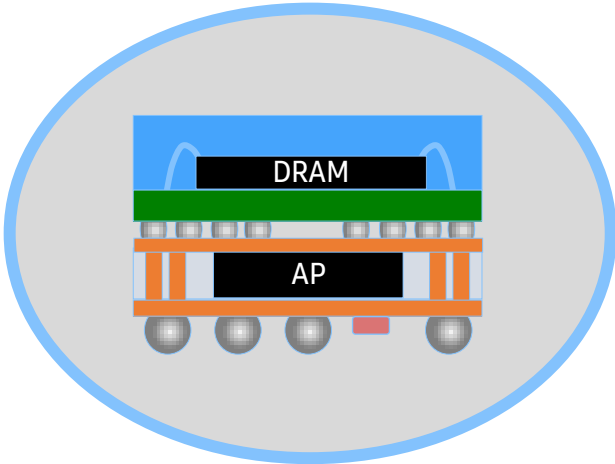
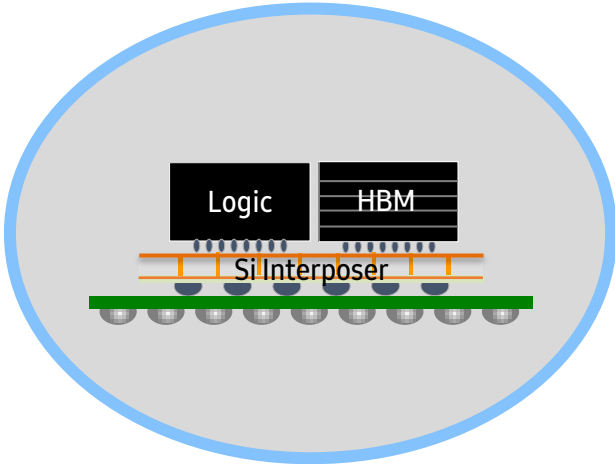
RF/IoT



Fingerprint

Value Added Package Solutions

Advanced Package Technology Drives System Level Performance Improvement by Enabling More Integration and Better Performance

Application	Fingerprint Sensor	Mobile	Server & Network
Structure			
Features	<p>Fan-out type for Fingerprint Sensor</p> <p>Shorter sensing distance supporting higher sensitivity</p>	<p>Fan-out type Package on Package</p> <p>For thinner chip and better performance</p>	<p>I-Cube™</p> <p>HBM and interposer solutions addressing higher bandwidth needs</p> <p><small>* HBM : High Bandwidth Memory</small></p>

Foundry One-Stop-Shop

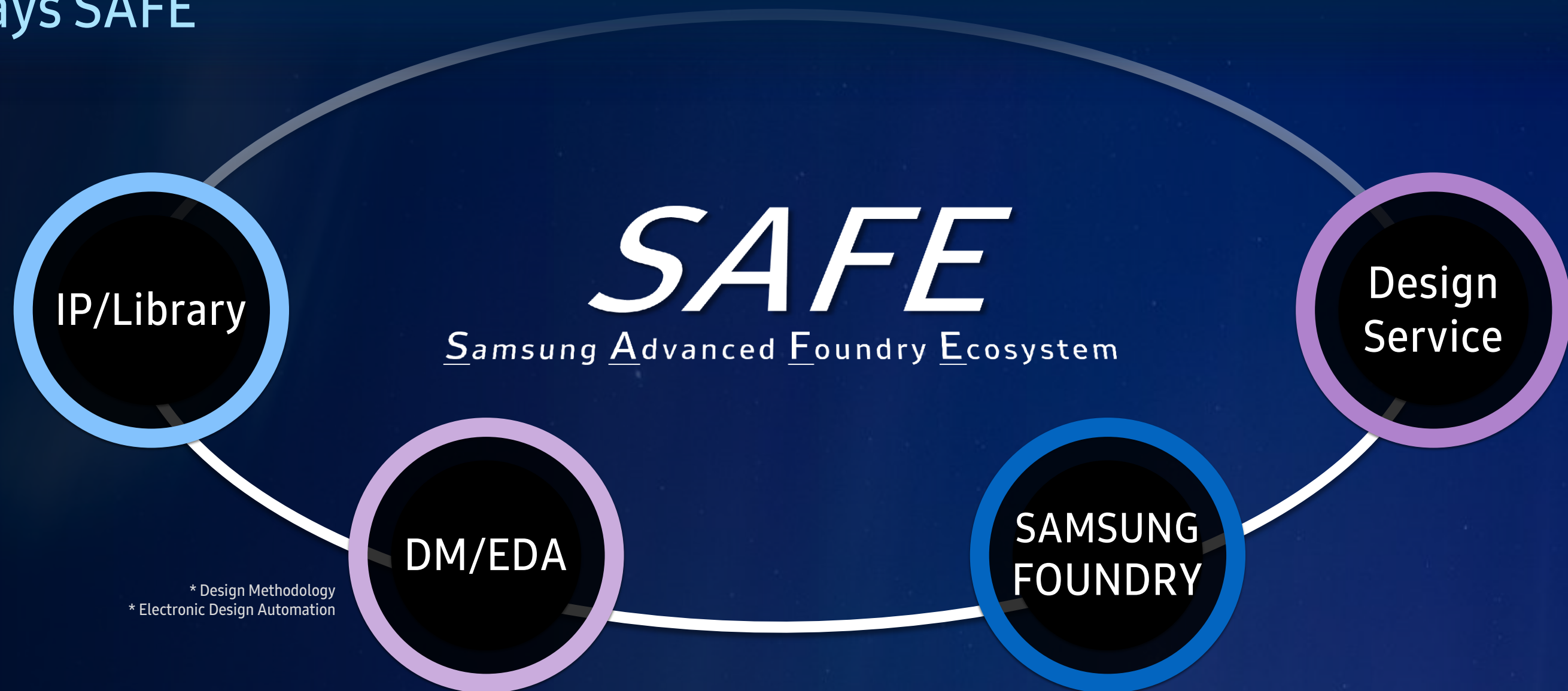
Offering Complete Turn-key Foundry Solution, Simplifying Customers' Supply Chain



Efficient Supply Chain Management is Possible at Samsung

Foundry Ecosystem

'SAFE', the Ecosystem that Samsung Foundry has Built with its Partners,
is Always SAFE



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Key Takeaways

- ✓ Maintain firm leadership in cutting-edge technology
- ✓ Provide various technology offerings and solutions to serve as a "one-stop-shop"
- ✓ Maintain state-of-the-art operations to satisfy customers' needs
- ✓ Provide best products and services to enable customers' success

To be the most trusted foundry,

providing creative solutions for customers' innovation needs

Technology

- Unrivalled process Technology
- Customer-friendly design infrastructure
- Semiconductor 'One-stop-shop'

Operation

- Flawless supply chain management
- Unparalleled execution to deliver our commitment
- Highest level of visibility and flexibility

Service

- Service beyond expectation
- Deep knowledge and expertise to solve customer challenges
- Agile collaboration for customers' success

SAMSUNG FOUNDRY

SAMSUNG

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